

Algorithmic Montage

- A Frame by Frame Approach to Experimental Documentary

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Abstract

A thirteen-part volume of Web-based experiments are presented within the larger context of an investigation into the ontology of photographic, cinematic and internet specific media with particular emphasis upon on their unique temporal modalities. A code-specific approach to the assembly and animation of digital still photographs is introduced as 'algorithmic montage.' New methods for extending the practice of 'preloading' content are presented as a means of delivering high-resolution, low-bandwidth motion graphics.

The central questions of the investigation are: 1. How can digital stills be transformed into compelling, low-bandwidth motion pictures using code? 2. How can the expressive power of gesture be captured and amplified in frame-specific animations? 3. How does algorithmic montage relate to traditional editing strategies such as American montage, Soviet montage, and mise-en-scène?

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Introduction

1.1 Back to the Future

Within the larger societal shift that occurred in the late 1990s, and predicated upon vast resources directed towards integrating personal computers and the internet into the basic fabric of our society, the confluence of art and technology was widely heralded and accompanied by the establishment of an array of new genres generally falling under the larger rubric of New Media art. These emerging art forms received a good deal of institutional support and validation as they were both a product and symbol of a larger culture deeply immersed in the throws of an information revolution with a second, biotechnological revolution following close behind.

The burst of the information technology bubble in 2000 brought an end to the era of unbridled optimism that gave birth to New Media art as a widespread (read institutionalized) practice and galleries and museums have since become more stringent about measuring their return on investment in this area. While this chain of events should not be given any more significance than the exorbitant hype surrounding New Media art in the late 1990s, it does warrant reflection upon the relationship between theory and practice, as New Media art tends to fall short of the promise suggested by the cumulative power of the disciplines brought to bear upon its realization (no less than art *and* technology). With such a powerful array of resources to draw from, why do we find such a gap between rhetoric and reality?

As the institutionalized merger of art and technology is still in its infancy, its practitioners are still for the most part descendants of one or the other fields of practice (art or science). This has created something of a vacuum in which well-intentioned theorists have offered to consummate the marriage for us. To highlight this point, imagine if one were confronted with a printed panel describing an artwork that was physically larger than the artwork itself (this is analogous to the manner in which some net art is presented). In so far as theory has outpaced practice, this would explain both the grandiosity of our expectations and the disappointment of many approaching New Media art from the outside.

While this introduction may suggest that the author is skeptical about the prospects of a successful integration of art and technology in New Media art, this is not the case. Rather the radical proposition contained herein is one of subtlety. The fusion of art and technology will continue to flourish to the degree to which artists, technologists, and theorists commit themselves to (1) remaining open to and aware of their biases and vigilant about perpetually broadening their frame of reference and (2) are capable of striking a balance between the dichotomies that arose in the midst of a Modern culture of specialization. It is in this spirit that I have engaged in the body of research outlined below.

1.2 Stop Motion Studies

In this thesis, I will present a body of work collectively entitled the *Stop Motion Studies*. Presented in a series of thirteen installments, these Web-based documentaries use the historical framework outlined in the second section of this thesis (Background) as context for investigation. The experiments explore areas including the ontology of the networked digital image, the nature of media and memory, the language of cinematic montage and its relationship to spectacle, the practice of documentary and conceptual photography, and perhaps most importantly, the ways in which art and technology can intersect in service of mining the space still to be explored between the still and the moving image.

In concrete terms, the *Stop Motion Studies* are a series of experimental documentaries that chronicle my interaction with subway passengers in cities around the world with one of the most tangible aims of the project being to create an international character study based on the aspects of identity that emerge. The project extends my long standing interest in narrative and, in particular, looks at the subway as a stage upon which social dynamics and individual behavior are increasingly mediated by digital technology. As one of the most vibrant and egalitarian networks in our cities, subways bring people from a wide range of social and cultural backgrounds into close contact with each other. This process plays a significant role in shaping both the character of a city and our individual identities.

By celebrating both public transportation and the internet, the *Stop Motion Studies* draw a parallel between the two and posit them as inclusive technologies in opposition to more exclusive forms of transportation (automobiles) and media (television). In doing so, the project brings real life and the internet together in as far as it models each system -- the subway and the internet -- in relation to the other and celebrates the inclusive spirit of both networks. By tapping into and representing the information superhighway of the subway, the project arrests time and allows

users to analyze events which are often otherwise only experienced subliminally. Ultimately, everything is such that it invites prolonged reflection.

While the animated sequences that comprise the project paint portraits and tell stories by documenting the interaction between passengers themselves, the most powerful moments are those in which a passenger enters into an exchange with the photographer, an exchange based solely on visual cues and body language and one which reveals something about each other's identity and character. In doing so, the project probes the "scripts" that we live by in our day-to-day interactions with strangers.

In the mid-seventies at Yale in our work on designing programs that understand English, or natural language processing, we invented the concept of a script. A script is a set of expectations about what will happen next in a well-understood situation. In a sense, many situations in life have the people who participate in them seemingly reading their roles in a kind of play. The waitress reads from the waitress part in the restaurant script, and the customer reads the lines of the customer. Life experience means quite often knowing how to act and how others will act in given stereotypical situations. That knowledge is called a script [1]. –Roger Schank

My intervention in the form of taking photographs creates a type of crisis for those passengers aware of the activity and some enjoy the novelty of the situation while others are disturbed by it. Ultimately though, it is the group as a whole -- one which is diverse and pluralistic -- that is responsible for mediating this crisis. This is all to say that I am able to take the risks that the project requires because of my belief in the ethics of this diverse and pluralistic community.

1.2 Thesis Structure

Introduction: A point of view on the intersection of art and technology in general is followed by a summation of the experiments detailed in sections 3-5.

Background: The conceptual model of a 'televisual horizon' is introduced as frame or reference through which to reconsider the connections between media technologies and temporal relationships. This is followed by an account of Vannevar Bush's 1945 musings on the 'Memex,' as it constitutes a precursor to the Web browser. Next is a description of the birth of cinema followed by a section on media as it relates to Situationsm, montage, and mise-en-scène filmmaking. Moving back into history, the work of three photographers and two chronophotographers are explored with an emphasis upon investigating the space that exists between the still and the moving image.

Experiments: General theoretical principles and precepts are outlined with an emphasis upon related contemporary work in the visual and time-based arts. This is followed by a detailed analysis of process as it relates to production and post-production of the *Stop Motion Studies*. Central questions of the investigation are: 1. How can digital stills be transformed into compelling, low-bandwidth motion pictures using code? 2. How can the expressive power of gesture be captured and amplified in frame-specific animations? 3. How does algorithmic montage relate to traditional editing strategies such as American montage, Soviet montage, and mise-en-scène?

Algorithmic Montage: The code used to drive the animations in the experiments is introduced as ‘algorithmic montage,’ followed by a analysis of ‘preloading’ as both a practical tool for network distribution and creative framework for delivering high-resolution, low-bandwidth motion graphics.

Survey of Installments: On an installment-by-installment basis, a detailed account of challenges and solutions to formal and theoretical questions is provided.

Conclusions and Discussion: A discourse for relating the research to a broader social and cultural context is suggested. Next, questions raised from the results of the experiments are used as a starting point to consider alternative methodologies and future directions in research.

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Background

2.1 The Televisual Horizon

The very word "globalization" is a fake. There is no such thing as globalization, there is only virtualization. What is being effectively globalized by instantaneity is time. Everything now happens within the perspective of real time: henceforth we are deemed to live in a "one-time-system." [2]
–Paul Virilio

For the past ten years, Paul Virilio has been warning us about the dangers of what he calls the "generalized accident." With hyperbolic flair, he continually asks his readers to consider the implications of the present and unprecedented shift in the relationship between time and space (as mediated by technology) that we are undergoing. This phenomenon is fundamentally a question of media and one which Marshall McLuhan has detailed at length:

Whether the light is being used for brain surgery or night baseball is a matter of indifference. It could be argued that these activities are in some way the "content" of the electric light, since they could not exist without the electric light. This fact merely underlines the point that "the medium is the message" because it is the medium that shapes and controls the scale and form of human association and action [3].

Using McLuhan's statement as a pretext, one could say that telepresence is the content of the internet. From Virilio's standpoint, the natural physical horizon and the sense of a present moment that it affords us as we wake and sleep in synchronicity with it has been overshadowed by the two-dimensional horizon of the screen. "The televisual horizon is thus uniquely that of the present of the real-time emission and reception of the televised interview [4]." For Virilio, the interactive screens of the Web do not just represent a spatial displacement, but more importantly, a temporal one:

How can we really live if there is no more here and everything is now? How can we survive the instantaneous telescoping of reality that has become ubiquitous, breaking up into two orders of time, each as real as the other: that of presence here and now, and that of telepresence at a distance, beyond the horizon of tangible appearances [5]?

At the end of this thesis, I will argue that it is our changing relationship to media that is at the heart of some of our most pressing questions as a culture and society. As a subset of this argument, I will also suggest that the projection of temporal relationships within the media itself constitute an important point of investigation, for these represent an encoding which prescribe both our way of relating to media and ultimately to each other.

The theme of temporal relationships is explored in the *Stop Motion Studies* to the extent that an experimental form of montage, what I will henceforth refer to 'algorithmic montage,' mediates the temporal relationships within the animations. In particular, time does not flow in a linear or cyclical fashion, forward or backward, but rather rhythmically stutters in such a way as to suggest that viewers inhabit an unexplored form of temporal space, one which is deeply mediated by a technology of interruption. This technology is that of the internet with its implicit content of telepresence, a form of perpetual temporal interruption that is mimicked by the pseudo real-time transmissions of the *Stop Motion Studies*.

Because we are such highly visual beings, screens have become the interface through which this phenomenon is mediated and as such, our present condition can be succinctly summarized via Virilio's conceptual model of the televisual horizon. This theory was given a palpable dramatic image in Wim Wenders' 1991 film, *Until the End of the World*.

2.2 The Memex

During World War II, following a post a dean of engineering at MIT, Vannevar Bush oversaw the development of the first atomic bomb while acting as head of the US Office of Scientific Research and Development. Surprisingly, this same man published an essay in the *Atlantic Monthly* in 1945 calling for scientists to use their powers of reason and creation for purposes other than that of bomb-building. The essay was titled *As We May Think* [7], and it was so prescient in predicting (if not prescribing) the inter-workings of the internet and Web browser that one might call Vannevar Bush clairvoyant.

In particular, he speculates about the invention of a device called a 'Memex,' "which could, by a process of binary coding, photocells, and instant photography, make and follow cross-references among microfilm documents [6]." Vannevar Bush first points out the increasing need for people

whom Bill Gates would later call 'knowledge workers,' to be both generalists and specialists at the same time:

There is a growing mountain of research. But there is increased evidence that we are being bogged down today as specialization extends. The investigator is staggered by the findings and conclusions of thousands of other workers -- conclusions which he cannot find time to grasp, much less to remember as they appear. Yet specialization becomes increasingly necessary for progress, and the effort to bridge between disciplines is correspondingly superficial [7].

This is a problem both created and solved by information technology and the internet depending upon one's level of skill. Vannevar Bush goes on to clarify that the problem is not one of too much information, but rather an inefficient means of digesting it:

The difficulty seems to be, not so much that we publish unduly in view of the extent and variety of present day interests, but rather that publication has been extended far beyond our present ability to make real use of that record. The summation of human experience is being expanded at a prodigious rate, and the means we use for threading through the consequent maze to the momentarily important item is the same we used in the days of square-rigged ships [7].

It is noteworthy that in speculating about our capabilities to address this crisis, Vannevar Bush writes at length about instant photography and speculates about a head-mounted camera whose functionality strangely mirrors that of an experimental apparatus used by photographer Walker Evans (see section 2.5.1) a few years prior to the publication of *As We May Think*:

The cord which trips its shutter may reach down a man's sleeve within easy reach of his fingers. A quick squeeze, and the picture is taken. On a pair of ordinary glasses is a square of fine lines near the top of one lens, where it is out of the way of ordinary vision. When an object appears in the square, it is lined up for its picture. As the scientist of the future moves about the laboratory or the field, every time he looks at something worthy of record, he trips the shutter and in it goes, without even an audible click. Is all this fantastic? The only fantastic thing about it is the idea of making as many pictures as would result from its use [7].

In proposing the Memex, Vannevar Bush proposes something of a personal memory aid, or a memory (Mem), which is mechanical (mex). The concept of a Memex relates to the *Stop Motion Studies* in that they are a collection of documentary style animations meant to be experienced via a Web browser. As they are internet-specific and documentary in nature, the *SMS* exist as something of what McLuhan defines as an 'anti-environment' (see section 2.5.3) to mainstream Hollywood cinema.

2.3 The Birth of Cinema

Last night I was in the Kingdom of Shadows....It is terrifying to see, but it is the movement of shadows, only of shadows....Suddenly something clicks, everything vanishes and a train appears on the screen. It speeds straight at you -- watch out! It seems as though it will plunge into the darkness in which you sit, turning you into a ripped sack full of lacerated flesh and splintered bones, and crushing into dust and into broken fragments this hall and this building, so full of women, wine, music and vice. But this, too, is but a train of shadows [8]. –Maxim Gorky

So concluded Maxim Gorky after attending the Moscow screening of the first films of the Lumière brothers (August and Louis) in 1896. While most film historians ascribe significance to the Lumière brothers by nature of the fact that they were the inventors of cinema -- via the creation of a device called the 'cinématographe,' which acted as both camera and projector -- it is probably more meaningful within the context of an investigation into the relationships between art and technology to consider them as presiding over a liminal moment in which the technology of film, the process of technological invention, gave way to the art and craft of what we consider to be filmmaking today.



1. August and Louis Lumière, *L'Arrivée d'un train en gare de la Ciotat* (1895)

One well-known story is that during the projection of *L'Arrivée d'un train en gare de la Ciotat* (The Arrival of a train at La Ciotat Station) (fig. 1) at the Grand Cafe in Paris on December 28, 1895, viewers actually ran out of the screening for fear of being hit by the train. What is perhaps less well documented is the fact that viewers were equally awed by the difference between the spontaneity they saw in these mini-documentaries and the affected sensibilities of the theater at that time. The historic twenty-five minute screening of ten of the films produced by the Lumière brothers using the cinématographe also included a documentary of a mother feeding her baby, *Le Déjeuner de Bébé*. The date of this screening (December 28, 1895) along with the date that they first used their invention to shoot workers leaving the Lumière and Sons factory in Lyon (March 19, 1895) are commonly used as reference points for the birth of cinema.

From 1895 to 1897 they produced over 1,500 short films which they called “actualities.” These were typically 50 seconds long and were produced in one set-up using a tripod. Initially, their subjects were close at hand, but over time they employed cameramen to journey as far away as Australia, Japan, Mexico, and Russia to make documents. While they would state that their goal was to represent life as it actually was (hence the label “actualities”) their skill in craft (Louis was an experienced photographer) meant that their reductive approach was not without aesthetic criteria such as lighting and composition. While one could argue that the Lumière brothers had to approach filmmaking from the standpoint of *mise-en-scène* due to technical limitations, this should not lessen the validity of the observation that the power of their films is greatly derived from their interest in Realism (see section 2.4.4) as approach to the moving image.

The early films of the Lumière brothers are charged with a power not unlike that of a child opening his or her eyes for the first time. While they are predicated on the sequential juxtaposition of images at 16 frames per second -- something which looks very conventional to us now -- one can feel a palpable sense of wonder and possibility in these films. Furthermore, one can easily see that these films combine an interest in the unmediated representation of their subjects with a fascination for the ontology of the images produced by this new technology. As such, I would classify the Lumière brothers as the first cinematic Realists. It is in exactly this spirit (Realist and ontological) that I approached the production of the *Stop Motion Studies*.

2.4 Spectacle, Montage, and *Mise-en-scène*

Below is an inventory of essential schools of motion picture editing including theories of montage (a word meaning “assembly” in French) that have become codified in our present media landscape. For the time being, it is sufficient to say that the dominant form of montage, what could be referred to as the American school of D.W. Griffith and now Hollywood, has come to dominate the world’s media.

With the syntax of cinema and then television being shaped to support fiction as the preferred form of content, it is not surprising that certain members of society began to become uncomfortable with what they experienced as an erosion of the very texture of reality. This is not to say that myth and drama are not capable of compelling individuals to invest new (post-cathartic) meaning into reality. However, in the hands of a culture industry, this tool (montage in support of illusionistic fiction) tends to be used in service less aspirational goals, such as advertising.

2.4.1 Guy Debord

If one were to identify one cultural movement which called this phenomenon into question most clearly, it would be Guy Debord's Situationist International. In general, the Situationists felt that society was sleep-walking through its existence as the result of its unquestioning absorption of commodity:

More directly, situationist thinking began in Paris in the early 1950s, when Guy Debord and a few other members of the Lettrist International -- a group, known mostly to itself, which had split off from the lettrists, a tiny, postwar neo-dada movement of anti-art intellectuals and students -- devoted themselves to *dérives*: to drifting through the city for days, weeks, even months at a time, looking for what they called the city's psychogeography. They meant to find signs of what lettrist Ivan Chtcheglov called "forgotten desires" -- images of play, eccentricity, sweet rebellion, creativity, and negation. That led them into the Paris catacombs, where they sometimes spend the night. They looked for images of refusal, or for images society had itself refused, hidden suppressed, or "recuperated" -- images of refusal, nihilism, or freedom that society had taken back into itself, coopted or rehabilitated, isolated or discredited [9]. --Greil Marcus

Debord and the Situationists saw images as cultural objects which mediated what he would refer to in his famously titled book, *The Society of the Spectacle* (1967) [10]. This volume serves as something of a nexus for Situationist theory and practice and outlines Debord's perceptions of a society which had succumbed to the opiate of television and to a degree that it had lost its creative and aspirational bearings. This condition was simply referred to as the "spectacle" and Debord's ruminations on its properties are pertinent to our further examination of montage:

The spectacle is not a collection of images; rather, it is a social relationship between people that is mediated by images [10]. --Guy Debord

He wrote this in 1967, just three years after the publication of McLuhan's *Understanding Media* [3]. Debord was also a filmmaker and as such was involved with montage on a materialist level. In an essay about Debord's films, in which he seeks to establish ties between cinema and history, Giorgio Agamben writes:

A definition of man from our specific viewpoint could be that man is moviegoing animal. He is interested in images after he has recognized that they are not real beings. The other point as Gilles Deleuze has shown, the image in cinema -- and not only in cinema, but in modern times generally -- is no longer something immobile. It is not an archetype, but nor is it something outside history: rather, it is a cut which itself is mobile, an image-movement, charged as such with a dynamic tension. This dynamic charge can be clearly seen in the photos of Étienne-Jules Marey and Eadweard Muybridge which are at the origins of cinema, images charged with movement. It was a

force of this kind that Benjamin saw in what he called the “dialectical image,” which he conceived as the very element of historical experience. Historical experience is obtained by the image, and the images are themselves are charged with history [11].

If we accept that images (whether figurative or literal) constitute an essential component of our historical framework and thus our collective memory as a culture and society, why does the 20th Century bring such a proliferation of images which would seem to do nothing but obfuscate the very texture of direct experience? While it is tempting to approach this question solely from the standpoint of content (fiction versus non-fiction), it is perhaps more fruitful to look at the question as a matter of form. In other words, the capacity of montage to divest images of their historical referents cannot be understated. This line of thinking constitutes a thread between the montage of interruptions found in the *Stop Motion Studies* and the refusal of the Situationists to become complicit in their own self-anesthesia within a culture of commodity based upon image-based representations, or a montage of forgetting.

2.4.2 D.W. Griffith

Montage as a practice can be delineated into what was referred to as the American school above and the Soviet school of Sergei Eisenstein. D.W. Griffith was the father of many of the film techniques which survive today in Hollywood cinema, having worked on over 450 pictures between 1908 and 1913. However, unlike his Soviet or French counterparts, Griffith was “not an innovator. Instead, he was an intuitive refiner and extender of existing cinematic methods, which he combined with the conventions of Victorian art, literature and drama in order to tell stories in the most effective way [12].” This statement resonates with McLuhan’s belief that the subject of any new medium becomes the media which preceded it. In this sense, cinema is the subject of television and television the subject of the internet. However, here in lie the seeds of an intense cultural and societal conflict. If the power of global media becomes such that it can permanently alter the phenomenological texture of reality and that alteration can become something of a Trojan Horse for conventions of “Victorian art, literature, and drama,” does this not effectively put a stranglehold on non-Western ways of thought? Again, we tend to think of these issues in terms of content, but they are primarily a factor of formal relationships.

Despite the enormous impact of Griffith’s techniques, or the refinement thereof, his legacy has been perpetually warped due to his favorable portrayal of the Ku Klux Klan in his 1915 epic, *The Birth of a Nation*. Griffith’s montage and the stories he portrayed were calculated for maximum physiological impact in his viewers, in that he wanted his movies to provide the audience with a thrilling ride:

The American school...makes an effort to keep the tempo of the picture in tune with the average human heartbeat, which, of course, increases in rapidity under such influences as excitement, and may almost stop in moments of pregnant suspense [13]. –D.W. Griffith

Thus he saw the challenge of this new medium of cinema as one of using his burgeoning techniques of what could be called convergent montage (multiple storylines and organic shot sequences) in service of creating the path of least resistance between the “stimulation” of Victorian content and his enraptured audience. In a statement which reminds one of the emotional depths of the most banal of Spielberg’s efforts, Griffith would comment: “For a quick, keen estimate of a motion picture, give me a boy of ten and a girl of fifteen -- the boy for action, the girl for romance. Few things have happened in their lives to affect their natural reactions [13].” As masterful as the montage of Griffith was, it was not one of reflection, but of reaction. One cannot help but wonder if the constant state of alert which has gripped the American psychology is not somehow related to a steady diet of this entertainment of stimulation.

2.4.3 Sergei Eisenstein and Dziga Vertov

In a direct parallel to the balance of superpowers that would characterize the cold war, the opposing school of montage would come from the Soviet Union. Working in the mid 1920s, Sergei Eisenstein developed an approach to the juxtaposition of images based not on seamlessness or continuity, but rather on opposition. His most famous film, *Battleship Potemkin* (1925), serves as the embodiment of his theories on montage. Eisenstein was not unlike Griffith in that he perfected techniques gleaned from others to great effect. The most notable example of this would be something known as the ‘Kuleshov effect.’ (e.g. [14]) This term is derived from an experiment conducted by Lev Kuleshov, who along with Eisenstein and a filmmaker named Dziga Vertov, came to define the principles and techniques of the Soviet school.

The Kuleshov effect was discovered in an experiment where the unexpressive face of an actor (Ivan Mozhukin) was cut together with footage of a bowl of soup, a corpse in a coffin, and a child with a toy bear. While the footage of the actor’s face was identical each time, the emotional effect created with each successive montage was unique (soup = hunger, coffin = grief, child = joy). This approach to montage is closely related to the Japanese concept of an ideogram in which the juxtaposition of two characters creates a third meaning (bird + mouth = sing).

Eisenstein combined this logic with a penchant for dramatizing social conflict in developing his own theory of montage, one consisting of a taxonomy of five different types: metric, rhythmic, tonal, and overtone, “However, Sergei Eisenstein was most preoccupied with the fifth method, ‘intellectual’ montage, the linkage of the contrasting shots to make ideological statements or express abstract ideas, such as the comparison of the massacred workers in Strike with the

slaughtered cattle [12].” However, it was not until Vertov’s 1929 classic, *The Man with the Movie Camera*, that the logic of Soviet montage was pursued to its most inventive conclusions.

Vertov began his film career making newsreels for the state in 1917. As part of the Soviet propaganda machine, he worked on a train car specifically designed for the mobile production and projection of films. In 1922, Vertov founded the Kino-Pravda or “film truth” series. These newsreel style documentaries were focused on socio-political issues and eschewed any dalliance with narrative, which he saw as a corruption of filmmaking’s true social potential. Vertov produced twenty-three installments over a period of three years, and became increasingly inventive in his formal approach (to the point that critics began to ridicule him). In 1929 he further indulged in his experimental tendencies and went on to make one of the most influential films in history (fig. 2).



2. Dziga Vertov, *The Man with the Movie Camera* (1929)

Vertov’s piece remains an unparalleled masterwork that would go to influence generations of filmmakers working in both the Formalist and Realist traditions. In summary, we find the American school with its emphasis upon seamless montage and narrative and the Soviet school with an emphasis on conflict and reflection.

2.4.4 André Bazin

If there is one figure with whom to contrast both Griffith and Eisenstein it would be André Bazin. Bazin co-founded the French magazine, *Cahiers du Cinéma* in 1951 and became the progenitor of a movement known as the French New Wave. He was very prolific as a critic, publishing extensively between the years 1944 and 1958, with the majority of his writings being published in a four volume French compendium and an annotated two volume English translation entitled, *What is Cinema?* [15]. As the champion of the ‘mise-en-scène’ (a phrase meaning “to put on stage” in French) approach to filmmaking, Bazin favored shots of long duration and deep focus. Fundamentally, he believed in the ontological (their relationship to reality) power of images in themselves and favored a more “hands-off” approach to editing than was employed by practitioners of either the American or Soviet schools. Bazin believed that a mise-en-scène

approach had the power (albeit understated) to eclipse both the expressionistic might of the American school's narrative continuity and the intellectual rigor of Soviet montage:

Montage as used by Kuleshov, Sergei Eisenstein, or Gance did not show us the event; it alluded to it [15]. –André Bazin

While most of the discourse surrounding theories of Soviet montage accepted the photographic image as an unquestioned starting point in order to focus upon questions pertaining to the juxtaposition of images, Bazin challenged filmmakers to reconsider the meaning (in the broadest sense) of a single frame.

In filmmaking vernacular, *mise-en-scène* is a term carrying with it a chain of associations that could be summarized as refusing to privilege the abstract relationships between shots over the concrete relationships which the shots share with reality. In other words, *mise-en-scène* favors spatial realism over temporal abstraction in that it compels viewers to have greater level of investment in their experience (as realism brings with it choice and contradictions). A concrete example of this would be that in a long shot with deep focus, one's eye is free to roam over a number of characters and thus subject to the responsibility of exercising free will.

While *mise-en-scène* is generally thought of as something of a polar opposite to montage in theory, it would be an exaggeration to say that in practice editors employ strictly one or the other technique. In fact, the approaches enjoy a harmonic relationship in most cinematographic productions, and in some cases it is difficult to distinguish which technique is being employed at any given moment. One example would be the Hollywood convention of an 'eyeline match' or "cutting on a look." It could be argued, that such practice uses the cutting technique of montage (which is time-centric) and the ontological framework of *mise-en-scène* (which is space-centric) to create a psychological space, if not a haptic one.



3. Orson Welles, *Citizen Kane* (1941)

While we could refer to Eisenstein and Vertov as Formalists and to Bazin's critical approach as implemented by filmmakers such as Jean Renoir and Orson Welles (fig. 3) as being a Realist approach, one could also say that the former were primarily concerned with image, while the later were focused upon reality:

All the arts are based on the presence of man, only photography derives an advantage from his absence. Photography affects us like a phenomenon in nature, like a flower or a snowflake whose vegetable or earthly origins are an inseparable part of their beauty [15]. –André Bazin

While Bazin's ideas have fallen out of fashion -- or perhaps it would be better to say contextualized -- in contemporary film theory as failing to take into account the degree to which reality itself is a construction of language, his theoretical impact remains vast. Bazin's basic provocation that filmmakers should eschew formal devices in favor paying homage to the ontology of the image itself (its relationship to reality) is a line of thinking which leads us to another central figure in this thesis, Walker Evans.

2.5 Between the Still and Moving Image

"I would like to be able to state flatly," he continued, "that sixty-two people came unconsciously into range before an impersonal and fixed recording machine during a certain time period, and that *all* these individuals who came into the film frame were photographed, and photographed without any human selection for the moment of lens exposure [16]." –Walker Evans

2.5.1 Walker Evans and Bruce Davidson

Working between 1938 and 1941 in the New York City subway, Walker Evans produced an extensive study of its subterranean inhabitants (fig. 4). His work was literally underground for a number of years and was finally published in 1966 as *Many Are Called* [17] and was exhibited that same year exhibited at MOMA as *Walker Evans' Subway*. He was among a number of American artists working in the 1930s who were inspired by Honoré Daumier's 1863-65, *The Third Class Carriage* (fig. 5) and 19th Century Realist art in general.



4. Walker Evans, *Subway Portrait* (1938-41)



5. Honoré Daumier, *The Third Class Carriage* (1863-65)

In terms of methodology, Evans worked with a camera hidden beneath his topcoat, with a shutter release running down his sleeve and into his hand (see Vannevar Bush's quote in section 2.2). His subjects were unaware that they were being photographed. Evans wanted to rebel against studio portraiture and as such, sought to push himself (as the photographer) out of the way, allowing himself no interaction with the subject (see Bazin's quote in section 2.4.4). One could say that his combination of a strict theoretical framework and a process-oriented abdication of control make Evans an early Conceptual artist.

Both Evans and photographer Bruce Davidson spoke of being obsessed with the act of taking pictures on the subway. In 1986, twenty years after Evans published *Many Are Called*, Davidson published *Subway* [18]. Of the project, Davidson said:

I wanted to transform the subway from its dark, degrading, and impersonal reality into images that open up our experience again to the color, sensuality, and vitality of the individual souls that ride it each day [18].

It was his first extensive series in color and he described the tones as "an iridescence like that I had seen in photographs of deep-sea fish [18]." In the late 1980s the New York City subway system was a particularly hostile environment and during the course of shooting the project, Davidson would eventually lose his camera at knife-point.

2.5.2 Cindy Sherman

From 1977 to 1980, American photographer Cindy Sherman produced a series of sixty-nine photographs collectively entitled, *Untitled Film Stills*. What is remarkable about the scope of her vision is the degree to which she deconstructed the entire semiotic apparatus of the moving image as it related to the representation of women in film.

She did this by taking on the roles of various characters who posed for the viewer in the recreation of an inventory of clichés ranging from seductive librarians (fig. 6) to vacationing starlets (fig. 7). On a formal level, Sherman's genius lies in her 'détournement,' (a Situationist practice that translates to "turning around" in French) of the ready-made visual vocabulary of the publicity film still. These artifacts are of course still images which are used to sell moving images. She is said to have ceased production of the *Untitled Film Stills* series when she ran out of clichés. In 1997 Sherman directed a feature length horror film entitled *Office Killer*.



6. Cindy Sherman, *Untitled Film Still #13* (1978)



7. Cindy Sherman, *Untitled Film Still #7* (1978)

Another lens through which to examine Sherman's art practice is a conceptual model developed by McLuhan called an 'anti-environment.' McLuhan considered himself to be a media ecologist

and for him an anti-environment delineated a context that inverted the figure/ground relationship inherent in any techno-cultural construct. In other words, in order to see what is happening within a (media) landscape, one must step outside of it in order to gain some type of meaningful vantage point:

As our proliferating technologies created a whole series of new environments, men have become aware of the arts as 'anti-environments' or 'counter-environments' that provide us with the means of perceiving the environment itself [3]. –Marshall McLuhan

By using still images as an anti-environment to the cinema, Sherman was able to shed light on the power of cinema as a spectacle that shaped identity through the projection of role models and codes of behavior.

2.5.3 Étienne-Jules Marey and Eadweard Muybridge

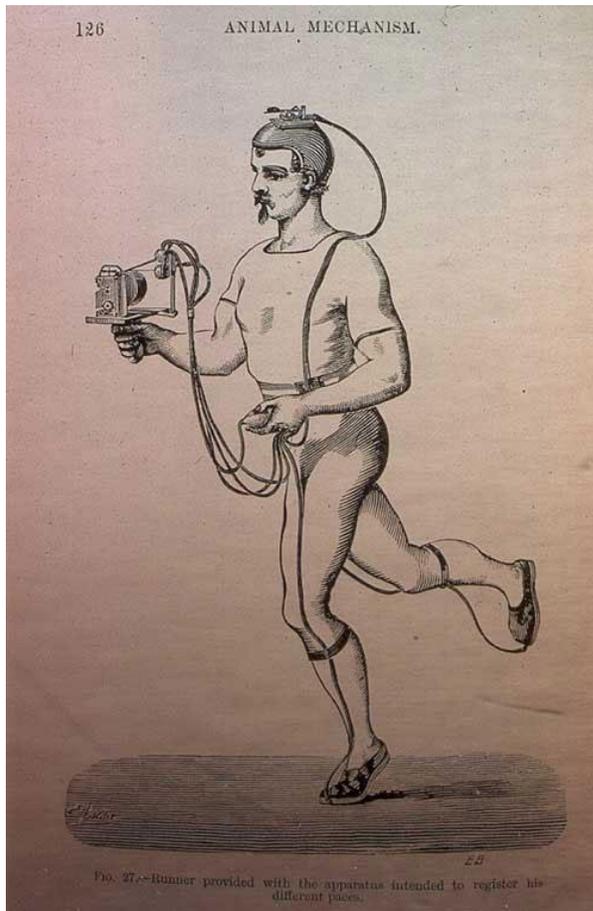
Traces of this aesthetic and constructional morphology are found in the work of a precursor of Marey, Leonardo da Vinci, who was likewise a passionate enthusiast of machines, movement, running and flight [19]. –Francois Dagognet

Étienne-Jules Marey was a French physiologist who traversed the realms of both art and technology in pursuit of recording motion. He began by inventing devices to record the processes of internal organs such as the heart and lungs and moved on to recording animal and human locomotion. Marey's interests in motion studies found him at the crux of a number of socio-cultural shifts which took place in both art and science at the end of the 1800s. Like Bazin, Marey was a Realist in that he was fundamentally interested in what could be uncovered with recording devices, this in relation to both medicine and a photographic method he invented to study motion called "chronophotography."

I do not know what vital phenomenon are; I recognize only two kinds of manifestations of life; those that are intelligible to us, which are all of a physical or chemical order, and those that are not. In the latter case, it is better to admit our ignorance than to dress it up in pretended explanations [20].
–Étienne-Jules Marey

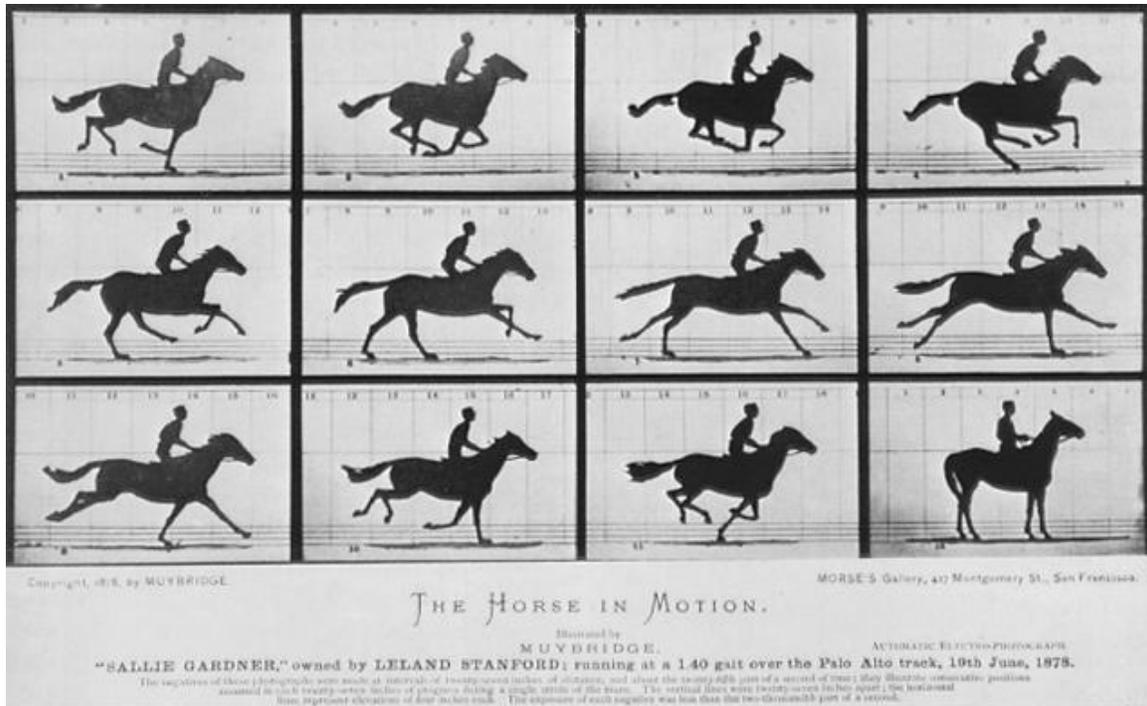
Like Bazin, Marey was a scientist who sought to use images as a means of probing a reality which was deeper than we could perceive with the naked eye. Both men advocated the value of asking simple questions persistently, and both saw imagery and its sequential juxtaposition (for Marey this was chronophotography, for Bazin it was cinematography) as a means answering these questions. For Bazin, the question was: "What is the relationship between the artifact of a

photograph as the basic unit of filmmaking and reality?” For Marey, this question was: “How can a sequential arrangement of images unlock nature’s secrets in relation to motion?”



8. Étienne-Jules Marey, *Animal Mechanism* (1873)

Marey’s landmark book, *Animal Mechanism* (fig. 8) [21], was published in 1873 and featured images of people, horses, birds, fish, insects, and even microscopic life. This book made its way into the hands of Leland Stanford, a railway tycoon in California with a stable of racehorses. Stanford’s interest in Marey’s work led him to commission photographer Eadweard Muybridge to further study the motion of horses. In particular, Stanford sought to resolve a dispute as to whether all four legs of a horse actually left the ground during a gallop (which they do). Muybridge wrote a letter in 1879 that read as follows: “Reading [Étienne-Jules Marey’s] famous work on *Animal Mechanism* inspired Governor Stanford’s first thoughts on the possibility of solving the problem of locomotion with the help of photography (30 cameras obscura with electric shutters placed 12 inches from each other) [22].”



9. Eadward Muybridge, *The Horse in Motion* (1878)

While Muybridge is generally perceived as being the father of chronophotography, it is in fact Marey who set the chain of events in motion which led to Muybridge's publication (fig. 9) of *The Horse in Motion* (1878) [23], *The Attitudes of Animals in Motion* (1881) [24], and finally, *The Human Figure in Motion* (1901) [25]. This is not to say that Muybridge's recognition in history is undeserved, but that Marey's contribution is too often underrepresented.

On a formal level, and in relation to montage, Marey's chronophotographs flourished in the tiny space between the still and the moving image. If his succession of images overlapped too much, they successfully conveyed motion in general but lacked the specificity communicated by clear points of reference. On the other hand, these points of reference needed to be close enough together (fractions of a second) in order to arrest persistence of vision and break a complex human or animal movement into a number of distinct geometries. Another way of saying this would be that "Camera and technique had to find a place between fusion and fragmentation [19]."

Both Marey and Muybridge sought to use the camera as a means revealing something unseen. The artifacts they created hovered between the still and the moving image and embodied forms of Realist spatial montage which can be seen as the direct antithesis of the style of montage employed by filmmakers working in the tradition of the American school, such as Griffith, who were primarily interested in using the cinema as something of a Trojan Horse capable of delivering an old (dramatic) product in a new and enticing form. If any approach to the moving

image was to dovetail with the Realist experiments of Marey and Muybridge it would be the *mise-en-scène* of Bazin.

The conclusion of this line of reasoning is that the Realist enterprise embodied in the work of Marey and Bazin in particular speaks to a fundamentally different set of concerns in terms of the relationship between sequences of photographic images and time as a phenomenon. While Eisenstein and Vertov may have explored this relationship in their Formalist approach, they share with Griffith and by extension Hollywood, little concern for the ontology of the image itself and the reality from which it extracts information. Put another way, the work of Bazin and Marey compels us to open up, inhabit, and reconsider the density and wonder of the natural world by nature of its interpretation and interpolation of time. When held up against the spectacles of Griffith or Eisenstein, the quiet ruminations of Marey's chronophotographs or the films of the Bazin inspired French New Wave may seem calm, but they possess a depth that allows for repeated reconsideration. For these reasons among others, I conducted a body of experiments in the spirit of the latter.

Experiments

3.1 Principles and Precepts

3.1.1 Into the year 2020

Given the difficulty of using the rather brittle material of still images and a Web browser to create animations, one might ask why anyone would seek to do things in such a difficult manner. We will begin by looking briefly into a future as predicted by futurologist, Ray Kurzweil:

...it is reasonable to estimate that a \$1,000 personal computer will match the computing speed and capacity of the human brain by around the year 2020, particularly for neuron-connection calculation, which appears to comprise the bulk of the computation in the human brain...After human capacity in a \$1,000 personal computer achieved around the year 2020, our thinking machines will improve the cost performance of their computing by a factor of two every twelve months. That means that the capacity of computing will double ten times every decade, which is a factor of one thousand (2^{10}) every ten years. So your personal computer will be able to simulate the power of a small village by the year 2030, the entire population of the United States by 2048, and a trillion human brains by 2060 [26].

Kurzweil reaches astounding conclusions about the future by translating Moore's law [27] into concrete terms. It gives one pause to reflect on the fact that Tim Berners-Lee established the protocols underlying the World Wide Web just over ten ago (e.g. [28]) and its impact has already been such that it has already shifted the context of large portions of our society and culture and by extension the research detailed in this thesis.

While someone analyzing these experiments from outside the context of art and technology as a discipline might conclude that the work detailed here constitutes a dramatic departure from the theories and practices employed by analog photographers and filmmakers for the past hundred

years, this would be an incorrect conclusion to draw. The work of this thesis just begins to scratch the surface of a line of inquiry (how processors and networks will change montage) which will likely change the face of what we call 'movies' and 'television' profoundly.

That being said, I would characterize the principles and precepts underlying this body of experiments as being quite conservative (technologically speaking). However, it is likely that a certain disregard for the use of technology for its own sake is useful in maintaining a balance between art and technology in a cultural context which is increasingly so biased towards the latter that it is becoming unnecessary to affix the words "digital, computerized, or technological" to a description of anything, as it can be assumed that technology is woven into the fabric of the entire environment we live in.

On the other hand, it may in fact be necessary to use language in the form of labels such as 'transgenic art' in order to keep pace with the revolution which we are in the midst of. This revolution is in essence an evolution of what could be loosely described as 'silicon based life.' It would be beyond the scope of this thesis to extrapolate, but a number of researchers have concluded that our evolutionary role looks increasingly tied to fostering forms of intelligence and/or life that will in many ways exceed our present human capabilities (e.g. [29]). With such profound changes occurring beneath our feet, changes predicated on processors and networks, I have a vested interest in understanding and possibly shaping how these changes will affect a particular 20th Century language that I am fascinated by, that of motion pictures and in particular, montage.

3.1.2 Presence and Telepresence

Those who have watched Godfrey Reggio's *Koyaanisqatsi*, are likely to immediately see the influence that this film has had on both the form and content of the *Stop Motion Studies*. *Koyaanisqatsi* was released in 1983 and is essentially an experimental narrative driven entirely through the juxtaposition of lyrical cinematography and a musical score. There are no actors or dialogue, but one could say that the earth or more specifically, the natural environment, is a protagonist in relation to the pollution of industry (Virilio would read this as what he deems temporal pollution, not just environmental). Time has a unique role in the film, which is carried from form to content via the juxtaposition of frantic stop motion sequences and foreboding slow motion cinematography.

As mentioned above, the score (composed by minimalist musical pioneer, Philip Glass) is as central to the power of the film as any of its visual components. Glass is one of a handful of composers whose reductive minimalist compositions could be interpreted as being algorithmic in

spirit. The compositions of Glass circulate through repetitions of musical phrases with slight changes of emphasis over time. The effect could be described as being hypnotic, but I will argue that is in fact the opposite. In an essay entitled "Glass and Snow" in which he draws parallels between the reiterated manipulations of Glass and experimental filmmaker Michael Snow, Richard Forman writes:

As is Glass's music, Snow is working in these films not to re-create the image of an intuited or sensed reality that is normally unavailable to consciousness; rather he is taking the material (the view in the room, in Glass's case the musical phrase) and subjecting it to a series of reiterated manipulations in which the elements are held in unchanging relation (there is no cutting in the camera motion, the notes from the phrase are not rearranged). The changes that are slowly introduced respect the integrity of the found image or structure and are specifically designed to show how they sustain themselves under the impact of *time*. Going back and forth over the image or the musical, time is a heavy truck knocking them a little this way, a little that way...repeatedly impressing a bit of dirt from the road...The new time-art of Glass and Snow, because it does go on in time and because the drift of regular change built into the work keeps us from settling back to use the work as a mere reflecting-glass (useful as that might be in itself) opens a new dimension in art. No longer images and relics brought back by artists from the spiritual "beyond," it is the building of a house within which the spectator, in order simply to *notice* the work itself, *must* replace himself so that he is no longer confronting an object, but putting "himself-as-self" elsewhere, so that naked presence is the mode and matter of the artistic experience [30].

There are of course parallels between Forman's formal analysis and the provocations of Virilio regarding what could be called the absence of telepresence (see section 2.1). The *Stop Motion Studies* bear a relationship to the work of Glass and Snow in that they compel viewers to accept process (algorithmic montage) as a rule for composition and perception. As such, the reiterated manipulations of these online animations function like spatial visual art in that they do not develop linearly in time so much as they do semantically. In the *Stop Motion Studies*, the confrontation that is elicited is one between presence and telepresence or between being present and being in transit.



10. Damien Hirst, *Isolated Elements Swimming in the Same Direction for the Purposes of Understanding* (1991)

The experiments described below reflect upon the mediation of the human body via networks, including both the subway and the internet. One way of interpreting their content is to see them as growing semantically out of the overlap of these two systems (subway and internet), with their implicit similarities and differences. In a larger art historical framework it could be said that this investigation into the relationship between the body (animal or human) and an increasingly powerful techno-scientific context is one pioneered in the last ten years by artists such as Damien Hirst (his segmented animals echo the work of Marey and Muybridge) (fig. 10) and Eduardo Kac [31]. Artists such as Vanessa Beecroft and Cindy Sherman (see section 2.5.2) pick up this investigation as it pertains to the (female) body, performance, and documentation within the spectacle of both art galleries and the media in general. In terms of motion pictures and montage, filmmaker Martin Arnold (fig. 11) and video artist Paul Pfeiffer look at how the body moves within the frame. The *Stop Motion Studies* share concerns with the artists noted above and extend this larger discourse -- one which could be described as revolving around systems of thought (art and science), and their modes of discourse (presentation, representation, simulacra) and mediation within a spectacular culture -- into the realm of the body within the context of networks.



11. Martin Arnold, *Alone. Life Wastes Laurel and Hardy* (1998)

In response to the online publication of *SMS 2*, the following post appeared on the blog of New York artist, Witold Riedel on November 23, 2002:

David Crawford's new *Stop Motion Studies - Series 2* (SMS) let us zoom in on microscopic time sequences recorded by the artist in London England between October 12 and October 15, 2002. Crawford seems to do to pictures to pictures what Phillip Glass would do to sound. As the 20 sequences taken in points of human travel through physical and information space expand our perception of time, we can look at subtleties in human expression that would have otherwise only been visible to our still surviving subconscious instincts. Crawford manages to translate non verbal communication into very aware poetic strings of information without the use of words. The camera in the sequences is a quiet observer, part of the hardware of the environment. The "observed" become the software of the short video sequences. All actors are strangers, reacting to being photographed by a stranger. Their reactions repeated over and over by the intelligently edited micro-sequences slowly turn them into familiar acquaintances as we become more and more familiar with their individual body language. The distance between the observer and the observed is slowly reduced through the intensity of observation. By focusing on subtle non verbal expression Crawford reminds us the 90% of human communication which has been "optimized away" by the very media he uses for his work [32].

3.1.3 Conceptualism and its Documentation

Among the ironies of Conceptualist art practice was that while it ascribed to the dematerialization of what could be called the formal preoccupations of Modernism as prescribed by Clement Greenberg [33], it also occurred during a period in history marked by an explosion of media. In this regard, it is not surprising that artist Joseph Kosuth would comment that Conceptual Art was "the art of the Vietnam war era" [34] considering that the Vietnam War itself was thought of as the "television war." While the larger society was grappling with what it meant to see the horrors of war on screens in their living rooms, artists at this time were also grappling with the power of documentation.

One could argue that while Conceptualism is generally considered to be the least material of all recent, post-modern approaches to art. Ironically, its dematerialization is predicated upon its reliance on documentation, a process which involves a great deal of material capital if not technology in particular. This irony parallels one found in the more contemporary meme of technology as it relates to mobility and “freedom.” While it is true that laptops and cell phones increase our mobility by allowing us to communicate wirelessly, they are also just as threatening to what one might call freedom, in that they require various other forms of submission on the part of their users in exchange for the benefits which they offer. One example would be the inability to be truly away from one’s desk because of the unrelenting telepresence of the mobile phone.

All of this bears relation to the experiments of this thesis in that they are both rooted in conceptualist practice by nature of their procedural framework and highly technological in their use of digital photography, animation software and Web-based distribution. One way of framing this practice in conceptualist terms is that it is actually the documentation of a performance. In an essay entitled “Photography and Performance,” Arthur C. Danto writes about Sherman’s *Untitled Film Stills* (see section 2.5.2):

Sherman’s art belongs at the cross-point between the artistic appropriation of the working photograph as one line, and the use by performance artists, especially women, of the photograph as a document of a performance, as the other. In the stills, the use of photography is more integral to the performance than a photographic record of what took place, and it is important to work this out in order to get a deep and true understanding of why they are so powerful. Their uniqueness is due to their being simultaneously and inseparably photographs and performances [35].

In a Situationist act of ‘détournement’ (a word meaning “or turning-around” in French), Sherman uses the medium of photography to deconstruct both itself and the closely related medium of film. Within this context, it can be argued that the *Stop Motion Studies* pursue a related set of questions in that they seek to deconstruct both our collective online scopophilia as well the audio-visual networks used by contemporary surveillance states to record all manner of human activity (large unbeknownst to us). Using the logic of Raymond Kurzweil, it not hard to imagine the creation of databases so vast in scale and high in resolution that they would dwarf their original subjects, namely ourselves.

3.3 Production

When I first began to shoot on the train I approached the challenge much like an analog photographer, carefully selecting subjects and obsessing about technical parameters such as exposure time and shutter speed. At a certain point I realized that as a digital image-maker there was really a new set of rules that been created through the use of digital technology. First and

foremost, image-makers now have unprecedented power at their fingertips in terms of the amount of visual data they can capture and the speed with which they can capture it. While there are still hurdles to creating high-resolution, print quality images with digital cameras, there are enormous advantages for those willing to sacrifice resolution for speed. What resulted in terms of a production style was really something of a hybrid between the way one might be accustomed to shooting still versus moving images.

The process of collecting footage became an expansive one. The following table details the approximate number of shots taken during the first six installments:

- SMS 1* - Göteborg (12,000 images)
- SMS 2* - London (3,000 images)
- SMS 3* - Paris (12,000 images)
- SMS 4* - Boston (6,000 images)
- SMS 5* - New York (3,000 images)
- SMS 6* - New York (3,000 images)

The seventh installment was a remix of footage taken from these shoots and thus did not involve any additional photography. In the course of shooting material for a series of installments grouped under the title *SMS-Tokyo*, over 18,000 images were taken. The bulk of these have been edited into *SMS-Tokyo* which is comprised of series 8 through 12.

3.2.1 Hardware

The Canon PowerShot A40 stores data on removable CompactFlash cards. This removable memory utilizes memory chips which work in a similar fashion to those used in computer RAM. They are different in one important aspect however, namely that they use what's called 'non-volatile' RAM. In essence, this means that the data is not erased when a user removes the card; instead the memory cells retain the data for later use. Below is a table (fig. 12) detailing the storage capacity of various cards:

Menu Selection	File Size (KB)	Resolution (pixels)	8MB	16MB	32MB	64MB	128MB
Large / SuperFine	957	1,600 x 1,200	7	15	31	64	128
Large / Fine	611	1,600 x 1,200	11	24	49	100	200
Large / Normal	302	1,600 x 1,200	24	48	99	200	401
Medium / SuperFine	450	1,024 x 768	16	32	67	135	271
Medium / Fine	294	1,024 x 768	24	49	102	205	412
Medium / Normal	155	1,024 x 768	46	92	189	379	760
Small / SuperFine	208	640 x 480	35	70	143	288	577
Small / Fine	141	640 x 480	50	99	206	415	831
Small / Normal	79	640 x 480	87	172	353	707	1,417

12. Table correlating picture quality, file size, and resolution for various CompactFlash cards [36].

As I knew that I would be presenting the images in an online environment, there was no need to use a resolution greater than 640 x 480 as this already takes up the entire screen of some Web users with smaller monitors. As is shown in the table above, using this low-resolution (640 x 480) setting yields up to 1,417 images on a 128 Mb card. While these cards are available in sizes greater than 128 Mb (256 Mb, 1 Gb) I have found that 64 Mb is optimal. This has to do with a trade-off between price, storage capacity, and what might be called “risk management.” After buying a 128 Mb card, filling it with data and then experiencing the CompactFlash version of a crash in which I lost the data, it became evident that 64 Mb was the maximal amount of data I was prepared to lose in a crash.

By utilizing production tools in a modular fashion (700+ images per card, 3-12 cards per shoot) the whole process scales in a way which allows for flexibility in the face of new circumstances. For instance, while in Paris I was able to acquire extra cards from a supplier just above the subway without creating a significant interruption to the shoot. There is also another benefit to utilizing the tools in this modular fashion, namely that the cards can themselves serve as something of a blank canvas in that the goal for a day’s shooting can be to fill a 64 Mb card. This is an approach to media that I learned in film school when we were asked to make a film “in camera,” with no post-production. While digital tools provide a seemingly limitless amount of flexibility, it is often advantageous to have a limiting structure to work against. Reductionism is found on the tool level in that the most basic unit of memory storage (a CompactFlash card) serves as a blank canvas while a minimalist approach finds the camera set to the lowest resolution possible.

A common aim during production was to set out with the day’s goal defined in terms of volume. In the earliest installments, CompactFlash cards were scarce so shooting and editing occurred at the same time, with clearly unsuccessful sequences being deleted as the shoot progressed. This

approach became increasingly problematic in that it became difficult to distinguish the order in which the shots were taken and this undermined the documentary aspect of the work.

Increasingly, CompactFlash cards became a useful constraint to work against. The adoption of this framework allowed for a degree of pacing to be applied to production (half a clip in the morning, the second half in the afternoon) and also created surprisingly favorable conditions under which some of the most striking sequences of the entire body of experiments were produced. Specifically, this came as the result of a shift of modality away from “doing my job” and towards one of simply experimenting. In concrete terms, the last 100 shots of a clip present a unique opportunity to improvise (provided the day’s production was favorable) with much lower stakes than at the start of a shoot.

3.2.2 Social Engineering

When I first started trying to point a camera at people it was terribly uncomfortable, and in truth it still is. If there are two rules of thumb which I have followed, they are to project the image that I am simply “doing my job” (which I am in fact doing) and secondly, to not hesitate. There is an enormous difference between looking for 24 shots versus 240 shots. The process of shooting in a subway car is one of moving through the cars of a train looking for cinematographic moments which are happening or just about to happen. This may have to do with a particular character or group of characters or it may have to do with a quality of light or a random word spray-painted on a car door. In the ideal scenario, a number of elements coalesce and suggest that it is a worthwhile moment to shoot. As it pertains to hesitation, this process of hunting for ideal scenarios is not one which allows for lengthy deliberation, with the obvious implication that these scenarios are constantly in flux.

Hesitation is problematic for two reasons. First, experience has shown that my first impression of a scenario is almost always the most lucid. Secondly, it makes people quite nervous if you seem hesitant, agitated, or otherwise confused when you are pointing a camera in their direction. In making presentation of the work, I usually liken this to what I call “dog psychology” in that if you act afraid of a dog it will often become aggressive towards you. It goes without saying that going to the other extreme of being particularly aggressive would produce equally problematic results. The best results in these experiments have come from encounters in which I have eye contact with a subject and they are aware that their image is being recorded, but are either curious or ambivalent. When a subject becomes angry the footage becomes less multi-dimensional and this, combined with the more obvious downside that I am upsetting a complete stranger prompts me to stop shooting in most cases.

3.2.3 In the Field

Shooting proceeds as a matter of controlled chaos in which the train lines that have been scouted become the terrain for a *derivé* based on the psychogeography of the particular subway line and city (see section 2.4.1). The billing system for a city's subway network often plays a role here, as it is important not to have to pay repeated fares, if only not to lose inertia waiting in line to pay. In most cases, there is some type of day pass available in which I am able to pay for some type of unrestricted access, a broadband connection to the subway if you will. From here, the heart of the task is to shoot and move as fast as possible. If I am experiencing good results on a particular line I will move from car to car as that line runs its route, snapping shots along the way. It is common to change to alternate lines at large interchanges along with the bulk of the commuters. Occasionally however, the trains are so crowded that it is important to actually get away from the largest pockets of people. Otherwise, there simply may not be room to get enough distance from the subjects in order to photograph them. This was a primary component of my experience in Tokyo.

Each city presents layer after layer of unique characteristics which play themselves out in terms of the artifacts created. While it is natural to assume that one might encounter differences when taking pictures in a culture such as that of Japan versus taking pictures in New York City, a great deal of the flavor of the images produced actually has to do with the design of the subway cars in which production occurs. One of the first conclusions reached in the process of animating the *Stop Motion Studies*, was that there was a trade-off between the strength of a particular image and the degree to which it could be naturally offset (in x and y pixel coordinates, due to camera instability) from the images appearing directly before or after it. No matter how strong a particular image might be as a still photograph, if its removal improves the overall effect of the resulting montage, then it is worth removing. While users have commented that the shaking of the camera adds to the texture of the animations, it also produces the side-effect of distancing the viewer by calling attention to the artifice and thus away from the content. In looking at the entire body of experiments, one will notice that the earliest installments (*SMS 1*, *SMS 2*, *SMS 3*) are more reflexive for this reason.

The degree to which the camera shakes has everything to do with the physical construction of the subway cars in which shooting takes place. In some cities the cars are very narrow (Paris) while in others, they are quite wide (Boston). A host of other variables, including car length, seat alignment, handrail configuration, window size and position, and lighting scheme add to the list of unknowns in an environment which is perpetually dynamic and unpredictable. A plausible solution would be to affix the camera to a tripod, but my few attempts at using one have led to more frustration than anything else. As mentioned above, the speed with which production takes place

is of vital importance, with a typical shot being 'set-up' (an interesting subject is identified along with a stable position from which to photograph) and executed in less than two minutes. By its very nature, this improvisational process requires a great deal of mobility and fluidity in order to work. Also, the presence of a tripod as an accessory makes the act of framing a shot more aggressive from the eyes of the subject and this tends to result in unfavorable results for the reasons cited in section 3.2.2. The solution arrived at for working without a tripod while still maintaining enough stability in the camera body to yield favorable results was to ballast the camera against objects within the subway car itself. In fact, the railing configurations used in most cars have proven to provide the best make-shift tripods. In some cases, I have been able to ballast the camera so well against a hand-railing that I have no doubt that it provided greater stability than even a conventional tripod.

At the end of the day, what you have in production is a form of highly controlled improvisation. Variables such as the scope of the shoot (how many CompactFlash cards), time of day, and train line are predetermined while almost everything else involves a process of mediation between constantly shifting circumstances (many of which are entirely unforeseen) and well-practiced, intuitive methodologies.

Having employed the same core production processes with slight adjustments over of the last two years of shooting the *Stop Motion Studies*, the methodology has become quite specific. The contingent variables are minimized as much as possible through a reductive process in pre-production so that the experience of the subway at a particular moment can be further reduced and recorded as a short sequence of images. All of this aims towards opening a window in time and space in which I am able to shoot in an efficient and fluid manner:

When you perform a task repeatedly, it tends to become easier to do. Juggling, table tennis, and playing piano are everyday examples in my life; they all seemed impossible when I first attempted them. Walking is a more widely practiced example. With repetition, or *practice*, your competence becomes *habitual*, and you can do the task without having to think about it [37]. –Jef Raskin

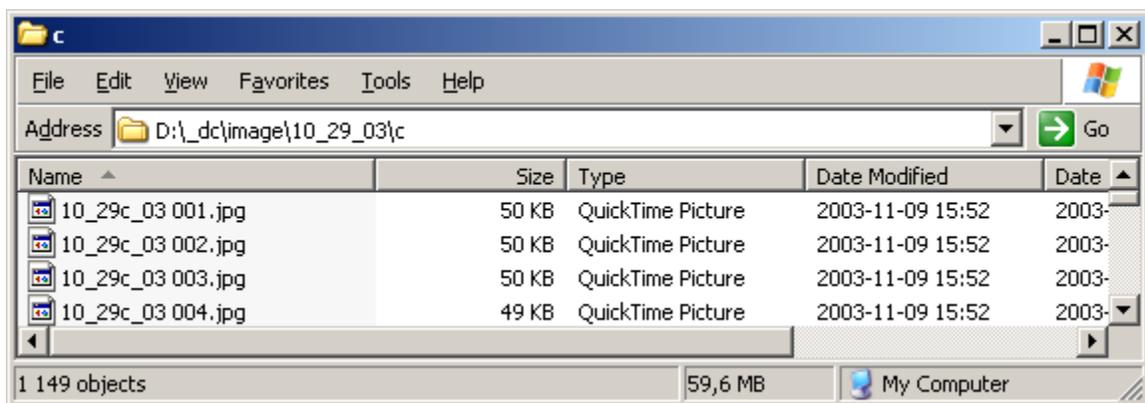
As mentioned earlier, the goal is maximizing the yield of the entire process and valuing that process over the singularity of any one image or sequence.

3.3 Post-production

3.3.1 Process

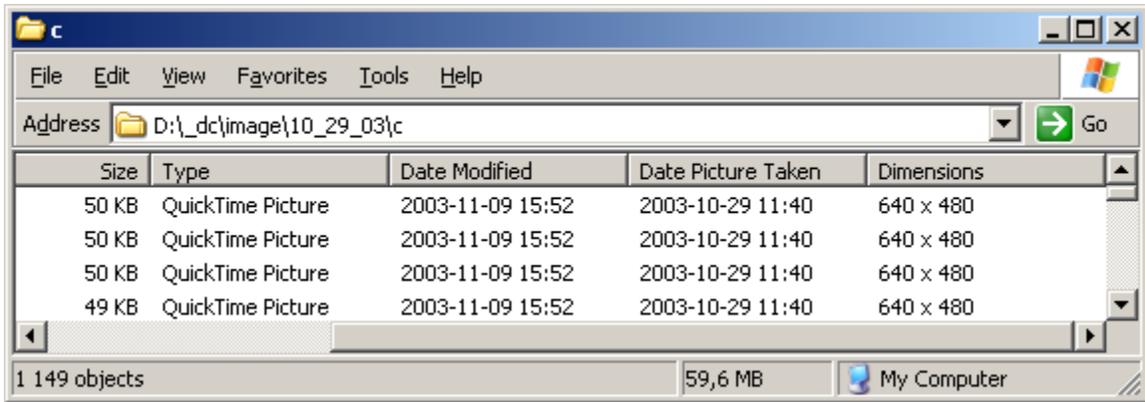
Post-production of the *Stop Motion Studies* actually begins in production whereby the management of the CompactFlash cards (see section 3.2.1) became the first step in transposing the improvisational endeavor of production (shooting) into the organizational challenge of post-production (editing). In this way, an awareness of the context of the computer as a creative environment began early.

Once a card or series of cards were filled during production, the material was downloaded from the PowerShot A40 to an IBM A31 laptop in the form of thousands of still images. Below is a screenshot (fig. 13) showing an example of the file structure of the raw data after it was first transferred to hard disk.



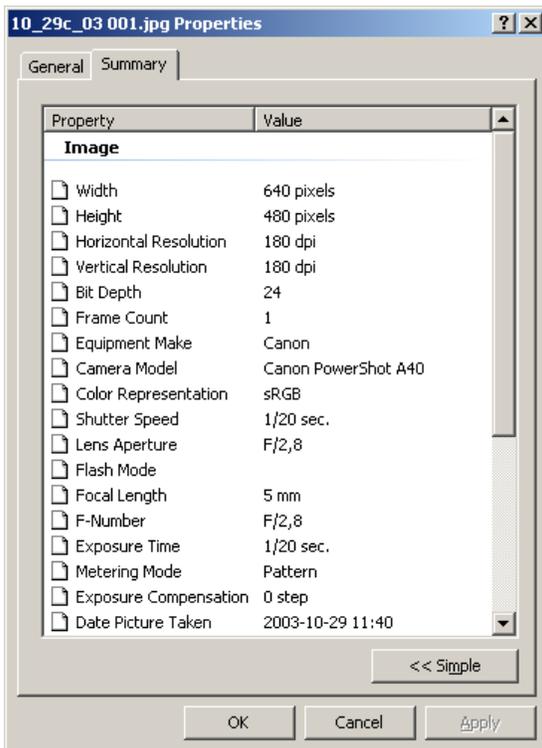
13. Screenshot of SMS source material showing nomenclature for individual photos.

One can see that within the directory "c," there are 1,149 objects. Images are denoted by the name given to the data downloaded from the card, in this case "10_29c_03," plus a sequential reference number "001" and declaration of file format "jpg." One can see that the file size is estimated at either 49 Kb or 50 Kb (kilobytes) for the images which appear in the window. Further inspection reveals that a full range of file sizes runs from 18 Kb up to 76 Kb. The next screenshot (fig. 14) assumes that the window above has been scrolled to the right.



14. Screenshot of SMS source material showing record of “Date Picture Taken.”

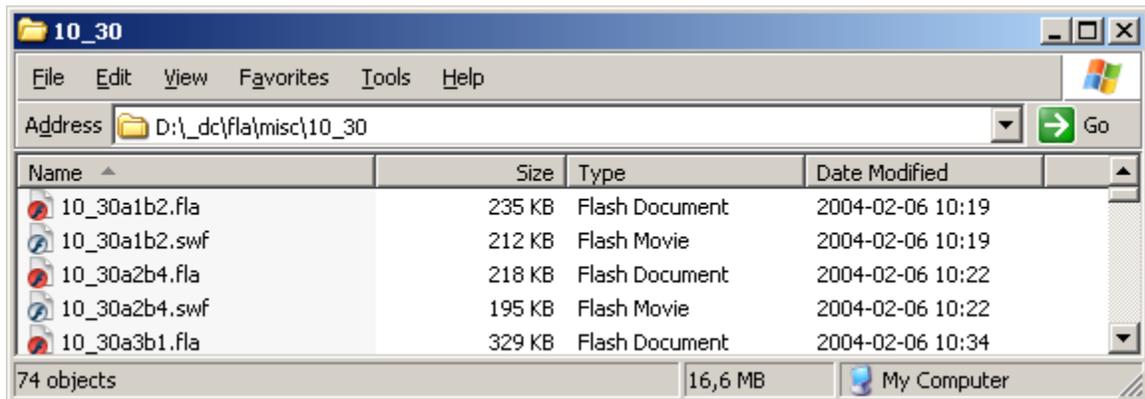
Here one can see the additional columns added to the window by the operating system as it has read the meta-data of the files and determined that they are digital photos. The data falling under the column “Date Picture Taken” was particularly useful in an effort to use date of production as an organizing principle. If a single file was to be selected and probed by the operating system for additional information, the following would be displayed (fig. 15).



15. Screenshot of SMS source material showing a complete summary of the photo’s meta-data.

The data displayed in this window describes the technology used and the particulars of its application (Shutter Speed, Lens Aperture, F-Number, and Exposure Time). This figure gives a

flavor for the power of the computer as post-production tool. While the approaches to post-production detailed in this thesis have only capitalized on one of these particulars (Date Picture Taken), the granularity with which an editor is allowed to probe the data would be unthinkable within an analog context. From here, the images were organized into further subgroups based on content and were imported in the software, Macromedia Flash MX to be animated.

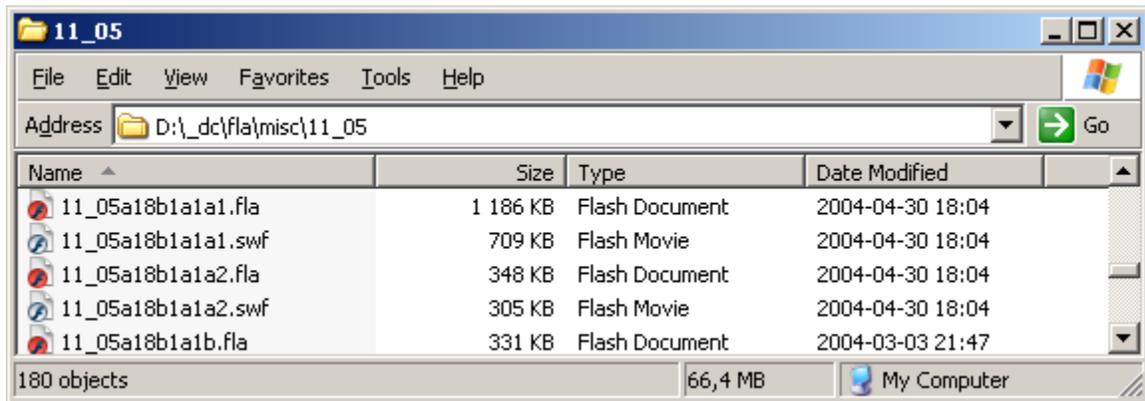


16. Screenshot of SMS post-production files highlighting nomenclature.

Here (fig. 16) we see that the Flash files alternate between two types of formats, '.fla' and '.swf'. An .fla file denotes a development file which has all the necessary information to publish an online file (the .swf file) in addition to the raw materials necessary to change this file. Having been divested of all but the most vital information, the .swf file is much smaller in file size than the .fla file and cannot be modified once it has been created (see below). The file naming conventions for the .fla and .swf files are similar to those used for image files with the exception that the digits denoting year have been omitted and the number demarcating date of production is followed by an alphanumeric string (for example "a1b2") which uses an alternating sequence of letters and numbers to map a tree structure into the file name itself.

Since the final character denoting the date of production is a number, card reference was denoted with a letter. Thus, if there were four cards shot on October 30, they would be named 10_30a, 10_30b, 10_30c, and 10_30d. After a series of images from a card were identified as originating from the same set-up, these images were first earmarked using a number, so the first number following the letter signifying card identity refers to set-up number. In the window above we see evidence of 3 out of 37 total set-ups (the Status Bar at the bottom of the window lists 74 objects, since there are two files for every sequence this number is simply divided by two). This information (set-up number) is garnered from the 1, 2, and 3 which appear respectively following the date and card identifier. Following these numbers denoting set-up is another letter which refers to a subdivision of that particular set-up.

In the window above (fig. 14) this letter is always “b.” This means that while there was an “a” at one point (the first subdivision) it was deleted after it was clear that the second subdivision, “b” was a stronger sequence. This letter is followed by another number which refers to a further subdivision. In the files shown in fig. 14, the first subdivision of “10_30a1b” (“10_30a1b1”) was deleted, thus we are left with “10_30a1b2” as a starting point. If this file needed to be further subdivided, it would do so by having another letter added to it and so on. While adhering to system of nomenclature at this level of detail may seem unnecessary, it was in fact a crucial component of the post-production process, in that it allowed for large bodies of data to be distilled down to tightly isolated selections while retaining traces of their lineage automatically. This meant that editing decisions could be reconsidered quickly and easily and data was logically classified and archived during post-production. The file names seen below will serve as an extreme example of this mitosis in action.



17. Screenshot of SMS post-production files highlighting nomenclature.

Here (fig. 17) we see two files named “11_05a18b1a1a1.” This syntax means that these files were shot on November 5 as a part of memory card “a” and came from the 18th set-up on that day. Furthermore, the file name tells us that the sequence was subdivided (usually this means frames have been removed) 6 times, for the number demarcating set-up (18) is followed by six alphanumeric characters. While it is common practice to delete unwanted subdivisions, the work discarded is always archived should a sequence need to be traced or revived. Directories such as the one shown above (fig. 17) can be easily duplicated providing an iterative framework for post-production.

All of the *Stop Motion Studies* are distributed online in the Macromedia Flash MX format (.swf). Each of these sequences is delivered inside of an ‘.html’ file that serves as a wrapper. In general, each sequence is then the product of a combination of the two files (.swf and .html). While the

.html file does little other than provide a Web page in which the .swf file is shown, it does serve two important functions. First the .html files contain a list of parameters which are applied to the .swf files in order to control various properties such as their size, position, and background color. Secondly, each .html file creates a distinct Web page which includes navigation to other sequences in that series and can be indexed by search engines such as Google.

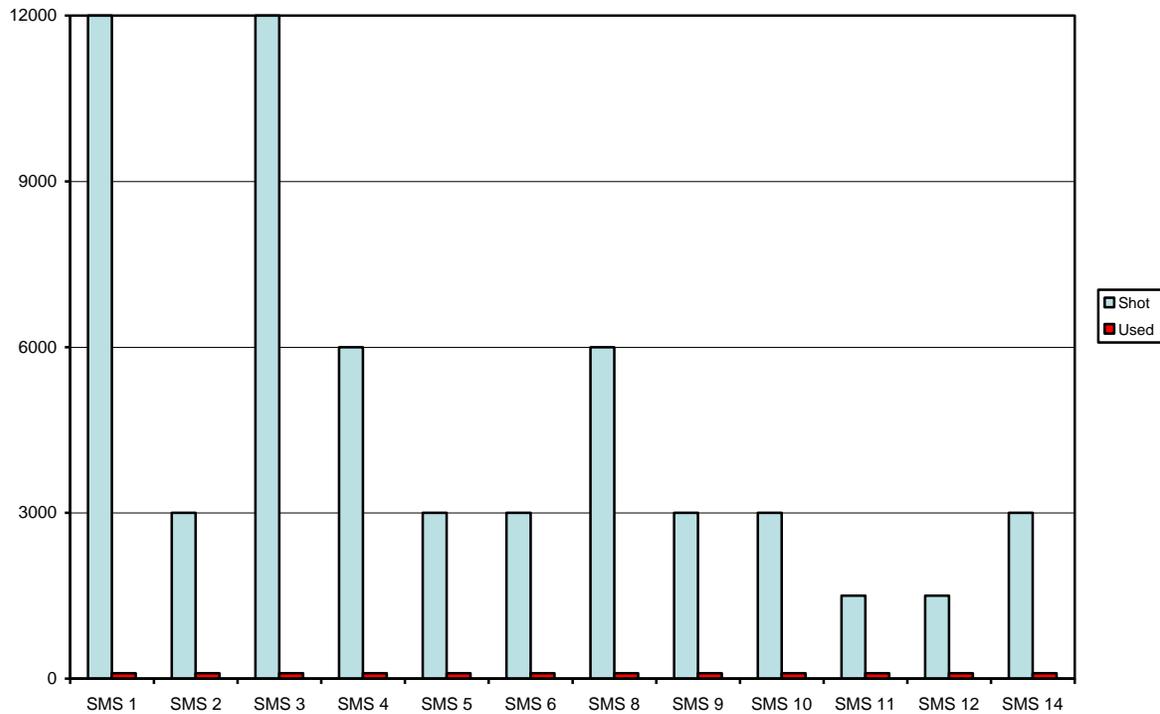
3.3.2 Product

Another lens through which to look at post-production is from the standpoint of images shot versus images used in the final animations. The table below provides a quick overview of the former:

SMS 1 - Göteborg (12,000 images)
SMS 2 - London (3,000 images)
SMS 3 - Paris (12,000 images)
SMS 4 - Boston (6,000 images)
SMS 5 - New York (3,000 images)
SMS 6 - New York (3,000 images)
SMS 7 - Remix (0 images)
SMS 8 - Tokyo (6,000 images)
SMS 9 - Tokyo (3,000 images)
SMS 10 - Tokyo (3,000 images)
SMS 11 - Tokyo (1,500 images)
SMS 12 - Tokyo (1,500 images)
SMS 13 - Remix (0 images)
*SMS 14** - Tokyo (3,000 images)

*Installment forthcoming

In total, there were approximately 57,000 images shot, and of these, there are approximately 100 unique images used in each installment. This calculation is derived from the observation that the average sequence contains 5 frames in its “photo” movie clip. By extrapolating this data, one can conclude that (not including the two installments which are remixes) the ratio of imagery used to imagery shot is approximately 1,200 divided by 57,000, or roughly 2%. The chart below (fig. 18) visualizes this data, total images shot versus the number of images used in each installment.



18. Bar chart contrasting shots taken versus shots used.

Given the amount of data extracted, one can conclude that a tenet of the editing strategy in these experiments was to capitalize on the absence of frames. One can think of the face as a series of data points with the eyes, nose, and mouth as geometric structures which are capable of projecting an infinite number of emotive expressions based upon their configuration. In a film or video where the apparent motion perceived by someone viewing either 24 or 30 frames per second (film versus video) (e.g. [38]) serves as a proxy for real-time vision, the geometric facial data changes very smoothly and tends to recede into the milieu of visual information. With fewer frames that appear and reappear as is the case in the *Stop Motion Studies*, the geometric facial data tends to get arrested and amplified. Also, because viewers are not looking at contiguous frames their juxtaposition tends to accentuate their differences and further pronounce the emotional cues communicated. Overall, one could say that one of the defining characteristics of these experiments is that they contain a high density of facial geometry and thus are data-rich, making them interesting to viewers. While on several occasions comments from users have expressed curiosity about why the animations are so interesting to them, it would seem that on a purely formal level, the visual density of facial geometry provides an explanation. In other words, the expressive power of gesture has been captured and amplified.

Using these conclusions as a starting point, *Stop Motion Studies - Series 13* takes these a step further by exploring the implications of combining multiple sequences. As mentioned above, 28 clips were selected from over 220 sequences from cities around the world. The initial line of investigation in this experiment was to determine whether a collection of clips which were not shot with continuity strictly in mind could be assembled in a manner consistent with the conventions of American montage.

After numerous attempts at working within this framework it became clear that the animations were too dissimilar to utilize continuity as an organizing principle. At this point, the approach to juxtaposing the material had to be reassessed and it was decided to use contrast rather than concord as a means of stitching the clips together. Initially, *SMS 13* was to be comprised solely of footage shot for *SMS-Tokyo* as numerous cut-aways had been shot (outdoor shots and interior long shots) in order to serve as something of a glue to create continuity in a linear construction comprised of disparate elements. Despite the extensive library of material to draw from (there were 300 odd clips used as source material during the first cut of *SMS 13*), the footage would not coalesce in a satisfactory way. Another way of describing the change of approach in terms of editing strategy would be to say that it increasingly moved away from the convergent continuity of the American school (which was the initial challenge of the experiment) and towards what could be called an algorithmic interpretation of both the Soviet school as well the Realist principles of *mise-en-scène*.

SMS 13 was ultimately constructed using a cascading series of *mise-en-scène* style shots contrasting subway riders in different cities. One way of interpreting the editing structure would be to say that the long-take, *mise-en-scène* style of the building blocks is actually built on top of and nested within tactics which are more easily ascribed to the Soviet school. If one dissects the structure of each clip, it becomes clear that while they are presented in a very straightforward, *mise-en-scène* style, they are in fact predicated on the contrast of their highly edited constituent parts. Thus, while the individual clips may read semantically as a Realist, documentary style, *mise-en-scène*, their texture is that of Soviet montage by nature of the process used to construct them. Zooming out a level, it becomes clear that when a sequence of a man in New York City is juxtaposed against a sequence of a woman in Tokyo, there is an underlying play of contrasts which suggests a Soviet approach. However, with the exception of two or three particularly dissimilar combinations, the methodology is not one which could be called intellectual montage (see section 2.4.3).

Instead, the effect of Soviet montage (one frame algorithmically contrasted against another) are nested within a *mise-en-scène* style presentation at the shot level (the sequences still read as

one long take) which are again nested within a Soviet style representation of the sequences at the highest level of organization (the linear assemblage), as they are ultimately juxtaposed against each other, thus self-reflexively emphasizing their contrast as units. *SMS 13* represents a hybrid form arrived at via the technology of the operating system as an organizational tool and the computer processor as a programmable projector. It is not purely Soviet or Realist in its underlying framework, but instead mixes these approaches via an object-oriented nesting of its constituent parts. The resulting animation constitutes a unique mix of Formalism and Realism and suggests that the power of algorithmic montage as an approach lies not defining an entirely new (programmatic) school of editing, but rather in capitalizing on the specificity, speed, and burgeoning intelligence of interactive systems to explore the grey areas between existing schools.

Algorithmic Montage

The experiments detailed in the next section are predicated upon a process consisting of three primary components. First, a stop motion stream of images is recorded in one camera set-up. Second, these images are carefully distilled down to a handful of frames which are chosen based on number of factors including their strength as individual photographs as well as their value within the context of a short sequence. Finally, these frames are stochastically re-animated by means of a short script. The cumulative effect of this process is one of minimizing file sizes while maximizing the staying power of the sequence in question.

In writing about the relationship between algorithms and computer games, Lev Manovich notes that part of what makes games compelling for players is that they seek to discover the underlying algorithm of the game itself [39]. In this instance, Manovich is using the word 'algorithm' as a metaphor for the underlying story or rule set, rather than the specific equations used. While a small number of players may be interested in the actual code, any player who becomes proficient at a game has invested considerable energy in understanding the rules of the world in which they are playing:

For instance, in a first person shooter such as Quake the player may eventually notice that, under such and such conditions, the enemies will appear on the left, that is, she will literally reconstruct a part of the algorithm responsible for the game play [39].

Implicit in this argument is that the player derives pleasure from the problem-solving activity of decoding the construct. This is a process central to how we, particularly as children, come to understand the parameters or rules sets of our environment (its algorithm) through a process of trial and error. These points regarding algorithms and computer games are relevant to the third part of the process outlined above in that code is used to alter what would otherwise be a simple cyclical algorithm (3 or 4 frames looping) in favor of something more complex and captivating.

A common shortcoming of computer generated animations involves the movement of living beings. Here, the weaknesses of the algorithms used to simulate organic motion are often readily apparent. While motion capture processes in which actors map their body movements onto computer generated models have become common, there is still a good deal of character animation in which the evenness of the movement draws attention to the simplicity of the algorithm being used, thus breaking the suspension of disbelief.

Since the movements of living beings are highly complex in their geometry and these movements are encoded within layers upon layers of semantics related to our survival, it is natural that we are fascinated by the movement of living beings. The use of a stochastic algorithm in the *Stop Motion Studies* mimics the texture of this complexity and results in animations which are both naturalistic and cybernetic at the same time. People shake and jerk as if afflicted by a disease which has scrambled the time and space which they inhabit, and in this sense the animations are Formalist constructions with an element of science fiction in them. Conversely, the implicit frame of reference is both non-fiction and Realist.

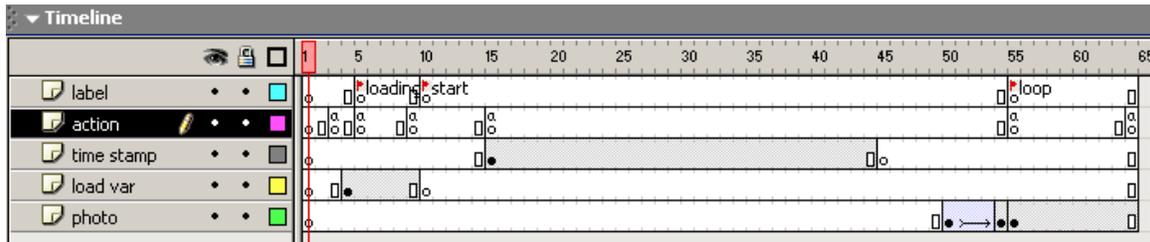
Implicit in the statement above is something which Richard Forman makes explicit in his analysis of the work of Glass and Snow (see section 3.1.2). Here he remarks that their works:

...baffle our attempt to derive pleasure in the name of that characterological configuration which is "myself." Rather than creating images which of an "elsewhere" that asks our emotional self to wake up and go for a moment to its frontier, their art makes its process rather than its resultant object into the mode of "being-present." The reiteration of process is always in the now, and we do not confront its occurring in the same way that we confront an object. We rather test ourselves, our own consciousness continuing in time against the piece's continuing in the same shared time. The only object that is "elsewhere" is the self which experiments with creating different modes of its own problem of "doing something with the attention" as it confronts the on-going structure of the work [34].

The use of algorithmic montage in the *Stop Motion Studies* mediates an experience in which users are suspended between mise-en-scène and montage on the level of form and between presence versus telepresence on the level of theory. These strands are woven together in a process mediated by the computer, one which both draws attention to the underlying algorithm (not the code, but the story) while simultaneously burying it within a Realist framework which puts constraints on its reflexivity. The result is a hybrid form, one which aims to split the difference between people and machines to the extent that users are invited to perceive themselves, perceiving themselves as machines.

4.1 Practice

Within the .swf files themselves there are actually two algorithms used. Below is a screenshot (fig. 19) of a timeline from an .fla file which has been used as a template in these experiments.



19. Screenshot of timeline of SMS post-production file (.fla) highlighting organization of timeline.

In it are 5 layers of a data stacked upon each other along the z-axis (background to foreground) with the layer “photo” in the background and the layer “load var” appearing on top of that layer and so on. The top two layers contain meta-information about the file, with the “action” layer housing object-oriented scripts written in the Flash scripting language (ActionScript) and the “label” layer providing an internal directory for these scripts to mediate the flow of control of the .swf file as it executes.

Most of the markers set in the timeline in the “label” layer are dedicated to orchestrating the process of the .swf file loading into a user’s Web browser. All of the frames preceding frame 55 are solely dedicated to the process of preloading the .swf into memory. Preloading will be examined in depth. If one looks at frame 55 of the action layer, one will see a lowercase “a” standing on top of an empty circle. This “a” signifies the presence of a string of ActionScript. When the playback head seen in the first frame of the diagram above reaches the 55th frame during playback, the script placed on that particular frame is executed. Here is the code.

```
x = random(y)+1;
photo.gotoAndStop(x);
gotoAndPlay(random(10)+55);
```

The first line is responsible for instantiating two variables, x and y. Variable x refers to the position of the playback head in the movie clip which contains the photos used in any given animation. Movie clips are defined in the Macromedia Flash MX help files as follows:

A movie clip is like a mini-movie in Macromedia Flash MX: it has its own Timeline and properties. A movie clip symbol in the library can be used multiple times in a Flash document; each use is called

an instance of the movie clip. To distinguish instances from each other, you must assign each instance a name. Movie clip instances can be nested inside each other to create a hierarchy.

So, in essence the movie clip is a timeline nested inside of the main timeline (fig 16). In terms of its conceptual framework as a piece of software, this is probably the most inventive leap made by the Macromedia Flash MX software designers. This program contains many ground-breaking features (its inventor Jonathan Gay actually received an honorary mention at Prix Ars Electronica in 2002 in the Net Vision category), but the movie clip remains the crown jewel of the application. The power of the movie clip lies in its clarity as a conceptual model for multithreaded object-oriented programming. For many Web designers, this basic tenet of computer science was beyond the scope of their everyday tools prior to the widespread adoption of Flash as a design and development tool for the Web.

To summarize, a conceptual model is a story. It doesn't have to discuss the actual mechanisms of the operation. But it does have to pull the actions together into a coherent whole that allows the user to feel in control, to feel there is a reason for the way things are structured, to feel that, when necessary, it's possible to invent special variations to get out of trouble and, in general, feel mastery over the device [40]. –Donald Norman

Getting back to the morphology of the code above, the second line begins with the word "photo." This is the name of the movie clip which contains the photos. ActionScript follows 'dot syntax' where the code to right of the dot refers to procedures applied to the object named on the left of the dot. This is similar to the address on a letter with the exceptions that the line breaks in the address are the equivalent of the dots and that the hierarchy of information goes from the general to the specific, rather than the other way around. The movie clip "photo" has the action gotoAndStop() applied to it, which simply tells the playback head to stop at the frame number specified within the parenthesis that follow. In this case, the parenthesis contains a variable x, the same variable which is instantiated on the first line of the script. So in the first line,

```
x = random(y)+1;
```

x is set equal to the product of the expression random(y)+1. The function random(y) is a random number generator which selects a whole number between 0 and y-1. In a real implementation of the script, y would correspond to the actual number of photographs which are contained in the movie clip named "photo." For instance, if the sequence being animated was made up of 5 different images, the first line would read:

```
x = random(5)+1;
```

Thus for every animation, *y* is a unique value determined by how many photos are contained in the movie clip named “photo.” This number could range from 2 to 30 frames -- anything over 30 frames creates an unwieldy file size for Web distribution -- depending upon the material chosen for a particular sequence. The 1 that is added to this value ensures that the value of *x* is never 0. This is necessary since the `random(y)` function chooses a value starting at 0 and there is no frame 0, with all timelines starting at frame 1. So to review the purpose of the first two lines in this script, we’ll replace *y* with a “hard-coded” value of 5.

```
x = random(5)+1;  
photo.gotoAndStop(x);
```

The first line returns a value between 1 and 5 to *x*, which is then passed to the `gotoAndStop()` action telling movie clip “photo” to stop at frame *x*. These first two lines work as a unit, with the third line below directing the Flash movie in a different manner.

```
gotoAndPlay(random(10)+55);
```

In this line, the `gotoAndPlay()` action is not preceded by the name of a movie clip or another Flash object using the dot syntax mentioned above. The absence of a declared object means that the action is to be applied to the ‘parent movie’ or main timeline. This is reminiscent of the convention of omitting the name of the country to which a letter is sent if it is also the country of origin. Therefore, using the `gotoAndPlay()` action, this line of code directs the main timeline to play a frame which is defined as `random(10)+55`. Applying the `gotoAndPlay()` action to the expression `random(10)+55` sets the playback head in the main timeline to a number ranging between 55 and 64. This range results from the fact that the `random()` function begins counting at 0, so that with an argument of 10 the function can return 10 possible values ranging from 0 to 9. A returned random value of 0 plus 55 sends the playback head to frame 55 at which point the function is called again (this is the frame where our script is located), while a returned value of 1 plus 55 sends the movie to frame 56, and so on, up to a returned value of 9 which send the playback head to frame 64. This small bit of code creates fascinating effects by nature of the fact that two things are always changing at once, namely the frame being displayed (the first two lines of code) and the duration of that frame (the third line of code).

First, the initial two lines of code direct the “photo” movie clip to jump to a random frame, with each frame containing a different image. Next, the more complex line of code directs the playback of the main timeline (as opposed to the “photo” timeline, which is placed inside the main timeline) to jump to any of one of 10 frames including the one it is already on. What makes this third line of

code more complex is that the playback head on the main timeline is running forward at 30 frames per second, while the “photo” timeline is not. In essence, this means that the frequency with which the whole statement (all three lines of code) is executed depends upon how many frames the playback head traverses before reaching the end of main timeline. When it does this, in other words when it reaches frame 64, another line of code (note the small “a” in that frame) directs the playback head of the main timeline back to frame 55, or back to the frame named “loop” in the label layer

```
gotoAndPlay("loop");
```

and at this point the process is repeated from the beginning. This structure means that any given image may remain on screen for anywhere between 1 and 9 frames while it is also 20% more likely that the duration will be 1 frame rather than 2-9 frames. This is due to the fact that both a returned value of 55 and a returned value of 64 have essentially the same result (remember that frame 64 immediately directs the playback head back to frame 55). As the main timeline is a moving target in that its playback head is constantly in flux, there are a range of durations which are produced. The table below outlines the range of possible durations for the display of any one frame/image.

1 frame	= 0.033 seconds
2 frames	= 0.067 seconds
3 frames	= 0.100 seconds
4 frames	= 0.133 seconds
5 frames	= 0.167 seconds
6 frames	= 0.200 seconds
7 frames	= 0.233 seconds
8 frames	= 0.267 seconds
9 frames	= 0.300 seconds

In theory, for any given cycle an image will appear for anywhere between 0.033 seconds and 0.300 seconds. In practice, there are significant differences between the speed of various processors and even a very fast processor will struggle to animate large bitmaps at precisely the intervals detailed above. In any case, these numbers do serve as an accurate model of the proportional relationships which are generated when the .swf file executes. As the file loops -- remember that the action on frame 64 returns the playback head to frame 55 where the bulk of the ActionScript is called again -- the number of cycles seen in a given animation is ultimately the product of how long a user chooses to remain on that .swf's corresponding .html page. In

other words, this stochastic animation will play forever without repeating itself over an extended series of cycles.

If we assume that a sequence is comprised of 5 different photos and there are 9 possible durations, a calculation of possible outcomes for one cycle of animation -- photo (x) multiplied by duration (y) -- would result in 45 possible outcomes. If a user were to let an animation cycle 5 times, the number of possible permutations produced would be 45 to the power of 5 or 184,528,125 possible montages. In theory, this amount of complexity would arise in no more than 1.5 seconds -- the duration created by a series of 5 durations of 9 frames each, or $5 * 0.3$ seconds. In practice, the speed of this process is ultimately mediated by the speed of the processor, and as such it is uncertain whether 5 frames of bitmapped animation would in fact be displayed in less than 3 seconds. Still, if we simply double the calculations in order to take the reality of processor speed into account, this represents an exponentially number of possibilities, where there are 34,050,628,916,015,625 (45 to the power of 10) possible montages over the course of just ten cycles, or 6 seconds using an adjusted estimate of actual processor speed (theoretical duration multiplied * 2).

4.2 Preloading

The convention of 'preloading' content on the World Wide Web allows for files which are large in terms of their file size (such as audio and video files) to be delivered and stored on a user's computer prior to playback. This process is also often used in conjunction with graphical menus using an image swapping strategy to provide additional user feedback in the form of 'rollovers.' Preloading as a practice can be quite simple or terribly complex depending upon the specificity with which the operation needs to be conducted. Most Web sites that make use of multimedia in any way will have a handful of strategies which they use to preload content.

As a widely adopted Web technology, Macromedia Flash MX has encouraged such extensive use of preloading that it can to some extent be credited (or blamed) for the increasingly televisual qualities of the Web. As preloading effectively neutralizes the uncertainty of whether a file can progress from "point a" to "point b," it allows for an array of linear possibilities which would otherwise be too unpredictable in the Web environment. The graphical language of preloading as represented on the Web borrows heavily from the vernacular of operating systems and it is often represented to the user in the form of horizontal bar (also called a "progress bar") such that they have a means of visualizing this otherwise invisible process.

The *Stop Motion Studies* employ another common means of representation, namely a "%" loaded variable. In this model, the amount of data loaded versus the total amount of data in the file is

simply represented to the user via an alphanumeric string. For example, a message will appear onscreen at first saying that a file is “10%” loaded. This number will climb in increments, with the number of increments displayed and speed with which the increments are refreshed being contingent upon the speed of the download. A slow preloading process would find this variable slowly climbing from “10%” to “11%” and so on, while a fast process might see the variable jump from a value of “50%” to “75%,” skipping the values in between.

While preloading is generally considered something of a necessary evil for those who wish to make use of the Web as a means of distributing multimedia content, many have developed sophisticated strategies for embedding content this process such that users are not simply stuck with the Web equivalent of “dead air,” but are instead engaged with content the moment a page begins to load. An example of this would a simple vector graphic game (such as Pong) which runs while additional media is being loaded in the background.

4.2.1 Practice: Basic Preloading

As mentioned above, the first 54 frames of the timeline template are solely dedicated to orchestrating the process of the .swf file loading into a user’s Web browser. As having all of the images available to the script we explored above is a prerequisite for its predictable functionality, ‘preloading’ becomes a crucial part of the process. This is achieved with a fairly conventional set of tactics. While somewhat pedestrian, they are worth going into as these techniques have recently become the basis for a more ambitious experiment, *SMS 13*.

By examining the layer stacked one level above the “photo” layer in the z-axis (background to foreground) one can see that the layer named “load var” lies on top of the “photo” layer. This layer contains keyframes on frame 4 through 9 which house the visual display (dynamic text on the “stage”) for a variable which calculates the percentage of a movie that has loaded versus its total file size. Directly on top of the “load var” layer is another layer named “time stamp.” The time stamp layer is responsible for dating the .swf file for the user in the format: mm.dd.yy. As with “load var,” the time stamp variable is instantiated via code in the action layer. The time stamp layer utilizes keyframes between frames 15 and 44 to display the date the images were shot. While it would be possible to combine, or merge the layers as they have mutually exclusive keyframes, it is actually easier to keep them on two separate layers, providing a more natural conceptual model of the forces at work in the file. Finally, before looking at the ActionScript in the action layer, a few notes about the layer named “label.” As we saw above, labels can be used to direct the playback to a particular location.

```
gotoAndPlay("loop");
```

This is especially useful when the proportion of keyframes changes during development. By using labels instead of “hard-coded” frames as markers, the timing of the elements in the Flash file (.fla) can be adjusted in the timeline using an intuitive graphical user interface (GUI) without losing the functionality that has been added in the scripts.

In frame 3 of the “action” layer is the following ActionScript statement:

```
if ((_framesloaded)>=(_totalframes)) {  
    gotoAndPlay ("start");  
}
```

This statement comes in the form of a ‘conditional,’ or to be more precise, an ‘if statement.’ This statement uses a ‘comparison operator’ (>=) to determine which of two values is larger. These values are stored in ‘properties’ (denoted by terms preceded with an underscore “_”) which are capable of instantly returning data pertinent to the .swf file. In this instance, the properties used are ‘_framesloaded’ and ‘_totalframes.’ The former returns a value which corresponds to the number of frames which have been loaded (from either an .swf file or movie clip) while the later denotes the total number of frames used. An ‘if statement’ is a straightforward construction in that it either executes the statements which are nested inside of it or it doesn’t, the deciding factor is whether the comparison of values made in the first line evaluates as true or false. If ‘_framesloaded’ is greater than or equal to ‘_totalframes,’ then the line of code which follows,

```
gotoAndPlay ("start");
```

is executed. This particular statement directs the playback head in the main timeline to locate the frame number which is currently indexed to the frame label “start,” and to begin playing at that frame. If ‘_framesloaded’ is not greater or equal to ‘_totalframes,’ then the statement above is not executed and the playback head continues moving forward through the timeline. This statement serves to avoid showing the user the “%” loaded message if the .swf file has already been loaded, as the “start” label marks the point at which the loading procedure ends and the preloaded animation begins.

When the playback head reaches frame 5, the frame named “loading” on the label layer, it reaches another block of code:

```
load_var1 = _root.getBytesLoaded( );  
load_var2 = _root.getBytesTotal( );
```

```

load_var3 = ((load_var1/load_var2)*100);
load_var4 = Math.round(load_var3);
load_var5 = load_var4+"%";

```

Here we find five lines which declare 5 variables: *load_var1*, *load_var2*, *load_var3*, *load_var4*, and *load_var5*. All five have to do with the display on the layer “load var” (mentioned above) which informs users about how much of the file has been transferred to their Web browser. The first line:

```

load_var1 = _root.getBytesLoaded( );

```

uses the ‘method’ (a method is a function associated with a specific object) “getBytesLoaded()” to set the variable *load_var1* to the total number of bytes loaded. The *load_var2* variable is set equal to the total file size (in bytes) of the .swf file that is being loaded using the *getBytesTotal()* method. When the first two variables have been assigned values, a third variable (*load_var3*) divides the amount of data loaded (*load_var1*) by the total amount of data expected (*load_var2*) and then multiplies this value by 100 in order to generate a percentage value. The next variable, *load_var4*, takes the number supplied by *load_var3* and uses the method *round()* in conjunction with the *Math* object to convert floating point values to whole numbers, i.e., 96.765 becomes 97. Finally, the last variable (*load_var5*) appends the number stored in *load_var4* with the “%” sign. This final variable is the one which is actually displayed onscreen in the “load_var” layer, showing users the real-time progress of the .swf file they are attempting to load into their Web browser. It is important to note that in order for these variables to be dynamic and to produce the animated information graphic which we as users associate with a “%” loaded message, they (the variables) need to be constantly repopulated with values while the loading process is taking place. This is achieved by directing the playback head -- itself a proxy for what computer scientists think of as ‘flow of control’ -- back to frame 5 (the “loading” frame) a number of times. How many times is simply a function of how fast the .swf loads. This process is managed through the code found on frame 9:

```

if ((_framesloaded)>=(_totalframes)) {
    gotoAndPlay ("start");
} else {
    gotoAndPlay ("loading");
}

```

Here we see the same code from frame 3 repeated, followed by an ‘else’ statement which sends the playback head back to the frame indexed to the “loading” label (frame 5) where the values for the five variables mentioned above (*load_var1-5*) are given fresh values. This looping process

enables the user to see a real time measurement of how much of the file is loaded and consequently, how long they should expect to wait before the animation begins. Once the file has loaded, the user will see this is onscreen via a message reading “100%,” and the playback head/flow of control will proceed to the frame indexed to the “start” label, in this case frame 10.

Between frames 10 and 14, one will notice that there are no elements on the stage (delineated by grey areas following black dots on the layers in the timeline), nor are there any actions to be executed (delineated by the presence of the letter “a” in a frame on the “action” later). This simply means that the user is given 4 frames or 0.133 seconds (not taking into account processor lag) of a black, empty screen. This absence is used to punctuate the end of the “%” loading message and prepare the user for the beginning of the time stamp. The time stamp occurs at frame 15 and lasts for 30 frames/1 full second. While the display is housed on the “time stamp” layer, the variable which populates this display is declared on the “action” layer as follows:

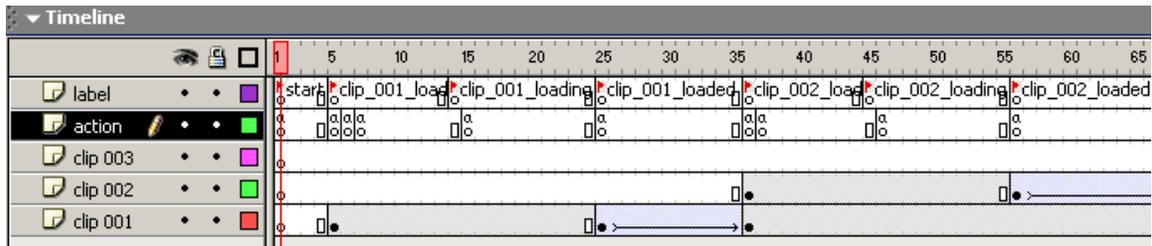
```
time_stamp = "09.18.02";
```

This methodology of separating form from content is one of the basic tenets of object-oriented thinking and can be seen in everything from low-level programming languages such as C++ and Java to the ISO specifications for Web-based mark-up languages such as HTML and CSS. While the display which shows the time stamp and the variable which declares it could be combined on one layer or the variable could even be dispensed with entirely and the “time stamp” display could be “hard-coded,” the abstraction of form and content in this timeline template allows it to serve as just that, a template which can be quickly and easily repopulated with new content without having to re-investigate formal solutions which have been previously addressed. In the line above, the value of variable “time_stamp” is set to “09.18.02”. This is the date that will be displayed prior to the animation fading-in, a date which ostensibly (and almost always) refers to the date on which the photos appearing in the forthcoming sequence were shot.

Taking a look at the timeline template again, one will see that there is again a punctuation of black or empty frames starting at frame 45 and continuing to frame 49. Using the table above, this would be the equivalence of 0.167 seconds of black (unadjusted for processor lag). At frame 50, a black dot surrounded by a light-blue field in the “photo” layer signifies the beginning of a 5 frame fading-in of the animation contained on the “photo” layer. When the playback head/flow of control reaches frame 55 or the frame indexed to the “loop” label, the show begins and events proceed as they are detailed at the outset of this section.

4.2.2 Advanced Preloading

The loading process outlined above forms the basis of the architecture used in the final experiment introduced below, *Stop Motion Studies - Series 13*. In *SMS 13*, a number of sequences from previous installments were composited into a linear animation. Twenty-eight different clips were chosen and arranged into a master timeline which was 7,830 frames long. All things considered (processor variation and download time), this constitutes approximately 6 minutes of Web-based animation. The technical innovation in this installment is that there is no visible loading strategy, as everything happens “behind the scenes,” so to speak. The screenshot of the timeline below (fig. 20) provides a condensed look at how the work was constructed.



20. Screenshot of timeline of *SMS 13* post-production file (.fla) highlighting organization of timeline.

In essence, the project is built as a series of ‘preloaders’ (a term referring to the entire set of operations pertinent to preloading a .swf file into memory), one on top of another. Each sequence preloads itself, runs for a specified number of frames (in most cases 120 frames or 4 seconds) and while it is being displayed, calls for the next animation to be loaded. While the preloader detailed above was concerned with loading itself into memory, the master file used in *SMS 13* is actually loading external .swf files in just the same manner. The thinking in this experiment was to take a well known technical component (in this case a preloader) and pursue its implications to a logical end. The resulting montage (in both senses of the word, spatial and linear) creates about 6 minutes of animation at a resolution of 640 x 480 and a total file size of 6.4 Mb. Thus, the entire technical framework constitutes something of video codec in and of itself. Because of the stuttering, start-and-stop style of animation that results, it’s debatable whether others would employ this solution based purely on its technical merits. In any case, this framework represents an unprecedented approach to the transformation of digital stills into low-bandwidth motion pictures using code.

Survey of Installments

5.1 Stop Motion Studies - Series 1-12

All installments have been published online (www.stopmotionstudies.net). Italicized copy denotes descriptive text originally accompanying the installments as they were published online from 2002 to 2004. The following statement has preceded each installment:

The camera used was a Canon PowerShot A40 -- a consumer grade still camera capable of taking roughly 64 low-resolution images per minute. The photos were then brought into Flash MX to be programmatically sequenced and formatted for the Web. There was been no cropping or retouching applied to the images.

5.1.1 SMS 1 - Göteborg

All imagery was shot in Göteborg, Sweden between September 18 and October 7, 2002.



21. David Crawford, *Stop Motion Studies - Series 1* (2002)

The first in the *Stop Motion Studies* series (fig. 21) was a period of broad experimentation. As is evidenced in the screenshot above, subject matter was not limited to the subway at this point. It was during the editing of this series that the subway emerged as a subject worthy of particular focus. Subject matter ranged from an alcoholic in the park to a deer at a zoo. During production of this installment it was determined that asking for subject's permission before taking photographs, generally led to uninteresting documents. On a formal level, the animations created at this point were significantly longer and larger in file size than the installments which follow, with the typical animation being comprised of 10 or more frames.

5.1.2 SMS 2 - London

All imagery was shot in London, England between October 12 and October 15, 2002.



22. David Crawford, *Stop Motion Studies - Series 2* (2002)

In the second installment (fig. 22), the subject matter was limited to travel (it includes sequences from both airplanes and airports) with a particular emphasis upon the subway. There were a number of significant aspects to this series. As the second installment, it would serve as the initial proof of concept in creating a serialized body of work. The idea was to separate form (the structures inherent to the .swf and .html files) and content (the images from different cities) in order to create artifacts which were consistent in both form and function, and did not require “reinventing the wheel” for each new piece of content created.

These principles figure predominantly in both computer programming and in the recent standards-based Web movement. This grass roots movement led by prominent Web professionals such as designer and author Jeffery Zeldman [41], takes its cues from the World

Wide Web Consortium (W3C) [42] in an effort to undertake a more disciplined and efficient approach to Web design and development. As the experiments progressed from a single installment to multiple installments, it became clear that *SMS 2* would benefit from the reuse of the .swf and .html files designed for *SMS 1* as standardized templates. By doing so, the post-production of *SMS 2* was a process that could be devoted almost entirely to the refinement of the form and content of the images themselves as opposed to their presentational structure.

Another important aspect to this series was the attempt at further developing a stringent, process oriented approach to production. This began with between one and two days of location scouting. In retrospect, this seems to be an incredibly short window in which to digest an unfamiliar city and its transit system. The London series also marked the beginning of the use of the CompactFlash cards as an underlying organizing principle during production. While this would seem perfectly logical, it was always tempting to erase large portions of the cards when they became filled with sequences which (judging from the in-camera display) were not going to turn out favorably. This was a natural means of evaluating progress and saving memory during the production of both *SMS 1* and *SMS 2*. Having returned from London however, it became clear that too much time was spent reassembling continuity (on which day a set-up occurred and at what time a particular sequence was shot) after the fact.

Finally, while cognizant of the degree to which the documentary structure of the work provided an implicit conceptual model for how to read it, up until this point I was pretty cynical about its function otherwise. In other words, I was aware that when I placed numeric hyperlinks to animations labeled “01, 02, 03” and so on up to the number “20,” people would instinctually perceive these as being linear sequence (temporally speaking) regardless of the order that they were actually recorded in. Filmmaker Peter Greenaway often uses numbers in his films (*Drowning by Numbers*) as a semantic device. This is not surprising, considering that learning to count is among one of the first things we are taught to do with language.

Furthermore, and perhaps more importantly, each sequence is initiated with the time stamp detailed in section 3.2.2. This explicitly reinforces the documentary veracity of the artifacts and works in conjunction with the implicit numerical structure at the meta-level to create a seamless conceptual model. In fact, if there were a way in which these experiments maintain a formal and thematic relationship to the American school of montage, it would be in their aim to render the interface invisible. This implies that there can be parallels drawn between the temporal montage of cinema, the spatial montage of information design, and the temporal montage of interaction design, the latter two disciplines being those brought to bear upon an analysis of interface design.

SMS 1 and *SMS 2* constitute experiments employing both the implicit power of sequential representation and the explicit power of a documentary frame of reference (as connoted via a time stamp) as constructs which function largely independently of content. All of this is to say that while most of the time stamps appearing in the first two installments are in fact accurate, some are not. In other words, a sequence purported to have been shot on “09.18.02” may have in fact been shot on another day entirely. At this stage in post-production, it was more important to maintain creative control over the sequencing of the animations while not puncturing the seamlessness of the conceptual model than it was to “tell the truth” so to speak. This represents an early attempt at grappling with the ontological power of conceptual models and cognitive frameworks as they relate to art practice, one which will resurface in *SMS 7*, and is likely to resurface in future experiments.

5.1.3 *SMS 3* - Paris

All imagery was shot in Paris, France between November 8 and November 11, 2002.



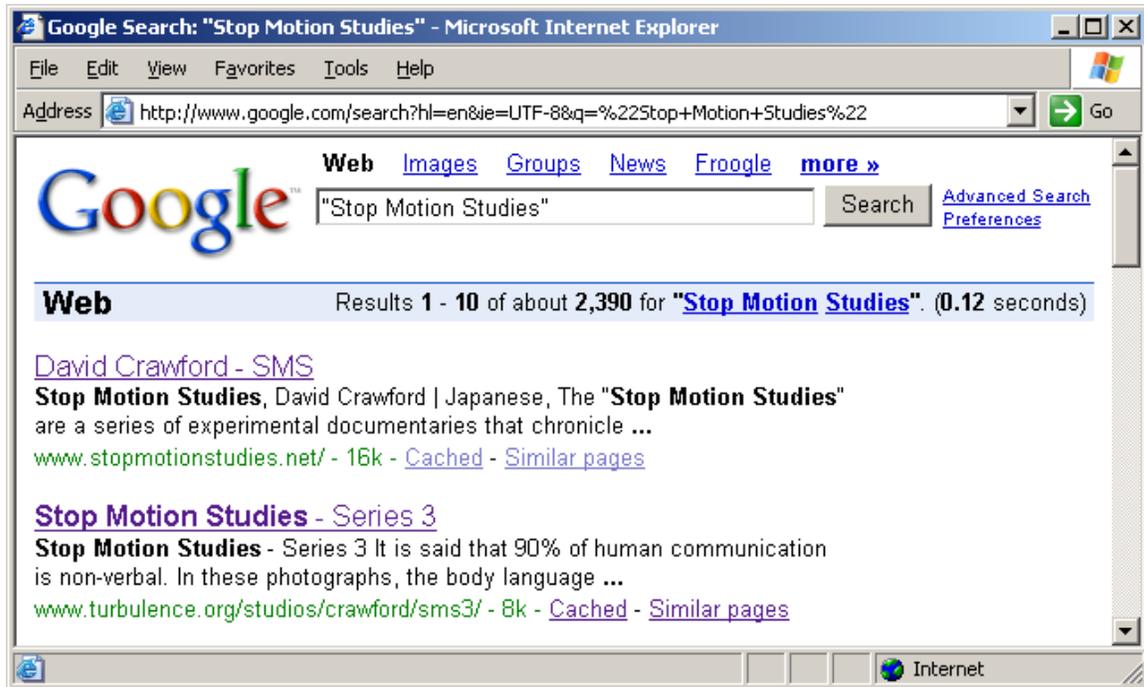
23. David Crawford, *Stop Motion Studies - Series 3* (2002)

Being the third in the series (fig. 23), the Paris installment provided a framework within which to definitively prove the viability of the *Stop Motion Studies* as a serialized art practice based on revisions and refinements to process that were suggested by the results of the first two installments. In short, the third installment would either provide a definitive proof of concept or would continue to embody what was perceived as shortcomings of the first two installments to the degree that it might undermine the rationale for continuing the experiments.

In particular, these shortcomings were primarily a lack of consistency in both subject matter and conceptual framework. In terms of the former, this meant the inclusion of non subway-related subjects as were prevalent in the first installment, and in particular those which included people and were not explicitly relevant to transportation as an overriding theme. In terms of the latter (concept) this meant making a decision to either embrace the documentary framework (in truth) or to further pursue the questions raised by employing this framework while at the same time working against it (a situation created by the use of fictional time stamps). To do this surreptitiously, seemed to be too cynical, thus I felt that this dichotomy either needed to become more pronounced and reflexive or should be minimized and/or eliminated.

Addressing the first issue noted above (subject matter) was fairly straightforward and presented little difficulty with the exception that it ran the risk of instilling the production process with a certain degree of monotony. This was easily offset by using the freedoms afforded by the constraints of the CompactFlash cards (see section 3.2.1) to allow for instances of more broad experimentation as a card reached its full capacity. Addressing the second issue above (concept) in relation to the documentary framework was resolved through a decision to favor content (the thoughts and feelings provoked by the images themselves) over construct (an examination of frameworks themselves). This is a fork in the road which may very well be returned to at a later point in time, especially when and if the results stemming from a choice to favor content start to become unsatisfying. These challenges, combined with the uncertainty of working in a culture where I did not understand the language, as well as the unusual design of the subway cars in Paris, made this shoot particularly challenging.

While in Paris, over 12,000 images were shot over the course of 4 days and 3 nights, with the vast majority of the shots being taken in the first three days. As such, the Paris installment is the one compiled out of the most source material. While over 18,000 images were shot during the production of *SMS-Tokyo*, it yielded over 5 installments. Paris was special in this sense. In retrospect, it can be deduced from the Google listing of the query "Stop Motion Studies," (fig. 24) that *SMS 3* has been particularly successful as it has a higher ranking than any other installment.



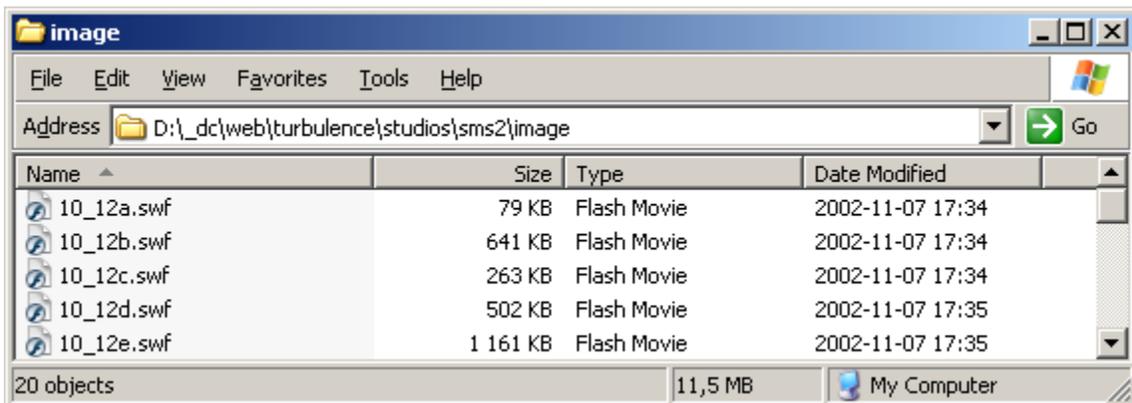
24. Screenshot displaying Google search query for "Stop Motion Studies".

Another important aspect of the Paris shoot which made itself manifest during post-production, was the shakiness of the footage. In both Göteborg and London, various solutions had been found for stabilizing the camera, leading to a large body of source material from which to draw when selecting sequences to refine (the issues related to the stability of the camera are detailed in section 3.1.3). While specific tactics are discussed above, suffice to say that in Paris the subway cars are simply not constructed in a manner which is conducive to improvisation in terms of ballasting a camera. While this was initially experienced as serious impediment, it created conditions under which I was compelled to maximize the power of the images as stills as it was clear that the shakiness of the footage in general would not allow for long sequences in which subtle differences became amplified over time. In other words, the construction of the Parisian subway cars pushed production closer to the realm of still photography. As such, I was primarily focused on controlling the active process of seeking out good subjects, much in the way that a photojournalist might shoot.

This can be contrasted with the more conceptual approach noted in relation to the approach used by Evans (see section 2.5.1) in that he decided to abdicate a certain degree of control, something that was and still is quite foreign to the culture of photography proper. Overall, the images that resulted from production in the Paris Metro had very 'handheld' quality to them, to speak in cinematographic terms.

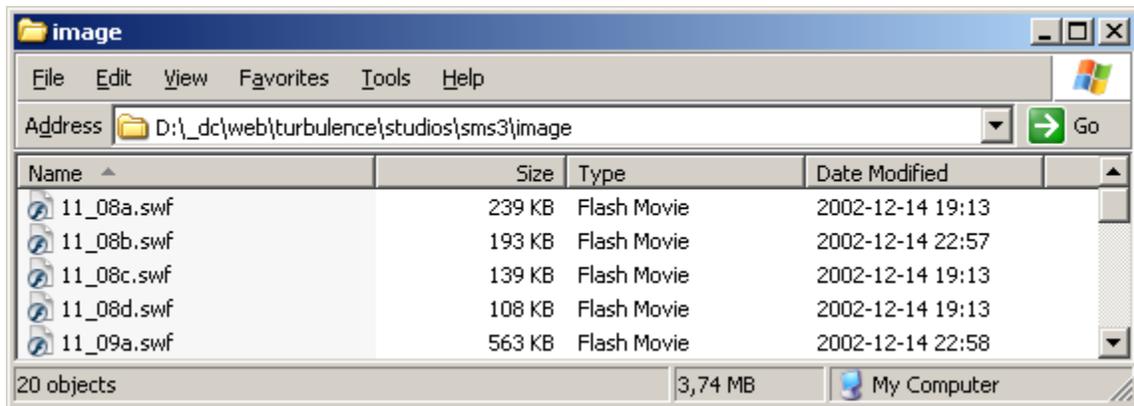
Having returned from Paris to begin post-production on *SMS 3*, it became immediately apparent that the lack of registration between successive shots was going to be a real problem. Out of the 12,000 images that were generated, it would be safe to say that the vast majority of them were eliminated from consideration purely due to the lack of registration between frames. This was of course enormously disappointing as it seemed that I had allowed myself to ignore a hard won lesson from the first two installments that despite any positive textural and/or reflexive qualities, a shaky camera produces animations which are self-conscious to the point of undermining their unique ontology as artifacts.

There is a fascinating continuum here though. If an image or series of images is captivating enough, the sequence which results from its animation can withstand a greater amount of shakiness without losing the interest of the viewer. In any case, the fact that the camera seemed to be “flying all over the place” as I had attempted to ballast it on various imperfect surfaces (such as a bag sitting on my lap) necessitated that I test the extremities of this theory in actual practice. In other words, I was cognizant of the fact that at the heart of the project there was a certain alchemy in realizing that fewer frames could actually produce better animations, but I wasn’t sure what the limits of this were because I had only pushed this logic so far. Most of the animations created for *SMS 1* and *SMS 2* were in the 5-to-10 frame range with some sequences containing as many as 25 or 30 frames. The screenshot below (fig. 25) shows the file sizes of the first five .swf files in *SMS 2*.



25. Screenshot displaying file sizes of *SMS 2*.

The sequences range from the very small (79 Kb) up to the quite large (1,161 Kb) with the entire set of sequences being 11.5 Mb in file size. This can be contrasted with the screenshot (fig. 26) from *SMS 3* below.



26. Screenshot displaying file sizes of SMS 3.

Here, the largest of the first five .swf files is 563 Kb, with the entire set of sequences being only 3.74 Mb in file size. This contrast illustrates the dramatic reduction in frames that took place between SMS 2 and SMS 3. While aware that the principle of reductionism was a central aspect of this practice, it was not until the source material from Paris was brought into post-production that the limits of this reductionism were actually tested. What I ended up with from Paris were animations of only 2 or 3 frames. Initially, I viewed this as a real shortcoming in that it just too reductive, too impoverished to be visually satisfying or compelling. Over time however, I came to see that with all its peculiarities, the Paris material is really among the strongest that has been produced.

This can possibly be ascribed to the tension at work behind the scenes in terms of both the thematic concerns mentioned above (content and concept) and the practical challenges that had be confronted in terms of the construction of the cars and the shaky footage which resulted. All in all, SMS 3 remains the installment which compelled me to test the limits of my theoretical and procedural dogma in practice. It would appear that this has infused the work a particular authenticity and authority within the greater body of experiments.

5.1.4 SMS 4 - Boston

All imagery was shot in Boston, USA between December 21 and December 22, 2002.



Intro 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20

27. David Crawford, *Stop Motion Studies - Series 4* (2003)

Having realized that an animation could be effectively constructed from just 2 or 3 frames, the Boston installment (fig. 27) was approached with a renewed belief that the minimalist and reductionist themes which had provided much of the foundation for the body of work. This, combined with an extensive knowledge of the location and culture that I was about to document (I had been a resident of Boston at various points in my life for a total of about five years) created almost ideal conditions under which to create *SMS 4*. In addition, the cars in Boston were particularly conducive to ballasting the camera which provided an opportunity to approach production in a much different way than had been done on Paris. Put in Situationist terms, it could be said that products of these *dérives* (see section 2.4.1) were largely contingent upon the psychogeography (if not industrial design) of the subway cars themselves.

Just as *SMS 3* found production occurring as a very active process, with associations to photojournalism, the production of *SMS 4* embodied a more conceptual approach. Again, this was largely predicated upon the design of the handrails, which were designed in an almost ideal configuration to support the camera. Under these conditions, it was possible to pursue the abdication of control mentioned in relation the practice of Evans, in an effort to see the work transcend the purely retinal (as Duchamp might characterize it). *SMS 4* represents an attempt at giving greater emphasis to the conceptual framework -- that these documents were produced within a given set of parameters -- and less about the notion of making individual images.

In practice, this meant letting subjects "come to me," rather than following the program of active pursuit that characterized the production of *SMS 3*. This is not to say that my aesthetic interest in form as it related to photography and cinematography was denigrated in *SMS 4*, but that I wanted to see what would happen if I made product a secondary concern to process. While the *SMS 3*

shoot entailed covering a large amount of territory each day (many different train lines and subway cars) actively scouting for photogenic subjects, the production style of *SMS 4* assumed that virtually everybody on the train was fascinating and that the challenge was more about placing oneself in conditions allowing for optimal coverage. This meant covering less territory and limiting the scope to only one train line and on that line, only a handful of stations.

This more conceptually-rooted approach dramatically increased the yield of images shot versus images used (see fig. 18). With an overhead of only 3,000 source images, *SMS 4* returned strong results and would seem to justify the precept of “finding without seeking.” Most surprisingly, this installment remains one of the strongest from a purely photographic standpoint. When examined within the context of the almost diametrically opposed production style of *SMS 3*, one can conclude that there is great value in both adapting tactics to suit the situation at hand as well as in varying one’s assumptions and approach when conducting a body of experiments.

5.1.5 SMS 5 - New York

All imagery was shot in New York City, USA on January 3, 2003.



28. David Crawford, *Stop Motion Studies - Series 5* (2003)

In terms of the production cycle of the experiments as a whole, *SMS 5* (fig. 28) and *SMS 6* were unique in that they were the only city where production took place prior to the post-production of the installment(s) from the previous location. In other words, *SMS 5* and *SMS 6* were shot before *SMS 4* had been edited, this being the product of practical circumstance as it related to travel schedules. Having not seen the footage from Boston, the New York installments were produced using identical tactics to those used in Boston. These were as follows: First, to place a great deal

of importance on ballasting the camera properly as to avoid large quantities of unused material. Second, to work within a limited territory -- meaning train lines and cars -- that (a) provided some type of outdoor view to downplay the sense on the part of subjects that they were being intruded upon and (b) were somewhat familiar to me. Finally, to let the subjects “come to me” rather than chasing after them. These tactics turned out to produce the same favorable results in New York as they had in Boston.

5.1.6 SMS 6 - New York

All imagery was shot in New York City, USA on January 4, 2003.



Intro 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20

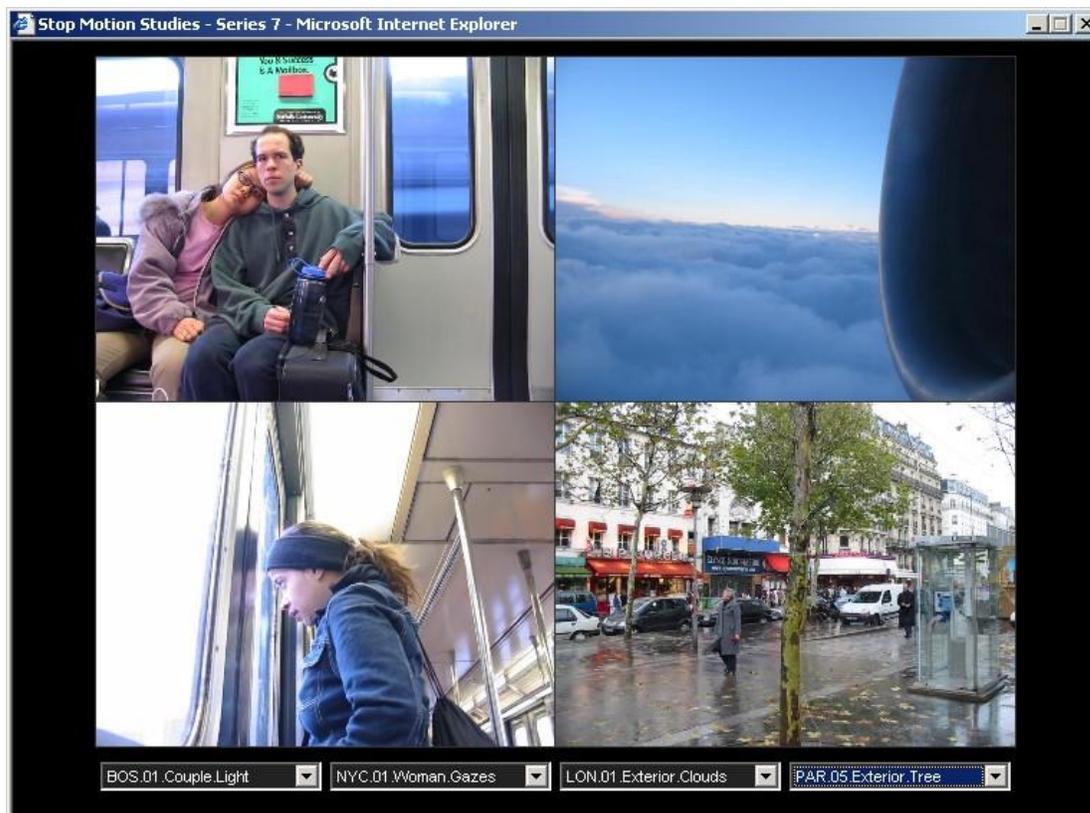
29. David Crawford, *Stop Motion Studies - Series 6* (2003)

SMS 5 and *SMS 6* (fig. 29) also represent something unique in terms of the larger post-production cycle in that they mark the first instance in which the resulting footage was sufficiently strong to support not just one, but two installments. While this had seemed to be a possibility in the past -- particularly in regard to the Paris and Boston footage -- when it actually came down to producing 40 rather than just 20 animated sequences from the source material it always somehow fell short. It should be explained that the process of editing in post-production is one of a process of elimination whereby 60 potential sequences become 50, which in turn become 40 and so on, until the prerequisite 20 clips (a number that is consistent with the space that has been allocated in the design template) have been chosen. During the course of this process, there comes a point (40 clips) when it is tempting to start to look at them all as being viable. Prior to the New York shoot this tipping point always veered in the direction of 39 good clips (which soon became 38, 37, 36, and so on) rather than holding firmly at 40.

While one may assume that the desire to double the rate of production is merely based on a desire to increase capital, it is also predicated on a belief that the act of transposing the real space of the subway into the virtual space of the screen is fundamentally a conceptual undertaking which mimics the real-time telepresence of the internet. As such, narrowing the intervals between what is shot and what is shown becomes attractive. The bifurcation of the New York footage represents a new interest in using pragmatic parameters, such as one day or one CompactFlash card, as a primary unit of measure and more importantly, structure.

5.1.7 SMS 7 - Remix

In this remix for the Whitney's Artport, I've taken previous material and added a meta-structure which allows users to apply database logic as a creative filter. The project's original sequential construct remains intact, but is now nested within a categorical hierarchy. The interface also supports a spatial montage in which sequences from four cities appear simultaneously. Users are invited to reconstruct mini-narratives based upon the paths they take through the data.

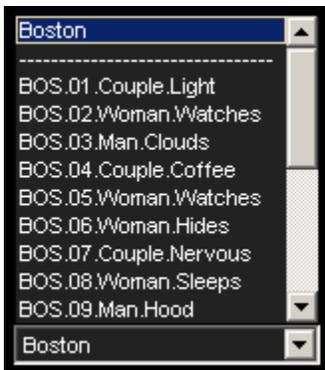


30. David Crawford, *Stop Motion Studies - Series 7* (2003)

SMS 7 (fig. 30) was an experiment in reinvestigating what could be done with the interface in relation to the source material. The form of the project came about as the result of an informal

chat between myself and Christiane Paul, the Adjunct Curator of New Media Arts at the Whitney Museum of American Art. I initially proposed doing what is called a “Gate Page” for the Whitney Museum based on the material shot in New York. This developed into a larger idea which involved creating a meta-structure in which to display sequences from various cities simultaneously. It was always discussed as something of a remix.

Unlike its supporting role in the installments created up until this point, the interface developed for SMS 7 was brought into the foreground as a main character of sorts. As there was no new material generated for this installment, the entire four week production cycle was devoted entirely to designing the interface through a series of rapid prototypes.



31. David Crawford, *Stop Motion Studies - Series 7 (Detail)*, 2003

In the larger of the two screenshots above, four “pull-down” menus appear beneath the grid of images. These four menus correspond to the sequences displayed in the four windows, one for each city which had served as the location for an installment up until this point (the first installment from Göteborg was excluded due to the inconsistency of its content and large file sizes). Thus, sequences from Boston, New York, London, and Paris are displayed, reading top-to-bottom (Boston, New York), left-to-right (London, Paris). Along the bottom of the panes run the menus which correspond to the cities listed above, running simply left-to-right (Boston, New York, London, Paris).

Users are able to toggle through a selection of sequences based on a syntax detailed below. From a design standpoint, these pull-down menus are central to both the mechanical and perceptual functionality of the piece. While the functional component is surely clear, there is an important phenomenological effect that is created by burying the data inside these menus. In short, this effect is one of metering the amount of data presented to a user at any one time in favor of reserving their attention for the animations themselves. The pull-down menus hold no less than 100 sequences, all of which are contextualized with a string of meta-information. The

effect of placing all of this data on the screen at one time -- as was the case in all of the previous installments of just 20 sequences -- would be like asking the user to both read a book and watch a video at the same time. One of the cardinal sins of interactive designers whether they are artists or not, is that they overestimate the amount of conscious attention they can expect to have from their users at any given time:

That people have a single locus of attention is not always a drawback. Magicians exploit this characteristic shamelessly. A good magician can fix the attention of the entire audience on one hand so that not a single spectator will see what the other hand is doing, although that hand is no way concealed. If we know where the user's attention is fixed, we can make changes in the system elsewhere, knowing that the changes will not distract the user [37]. --Jef Raskin

Opening the far left pull-down menu pictured in figure 30 above would reveal the text displayed in the figure 31. The syntax used resembles the same 'dot syntax' referred to section 3.2.1 and forms a basic component of object-oriented programming and scripting languages such as Java, JavaScript, and ActionScript. In general, these languages use dots to signify a subclass. One can use the conceptual model of a tree structure or more specifically a family tree to understand the meaning of 'subclassing' (an example being "GrandParent.Parent.Child"), in that each dot represents a fork in the path and denotes inheritance. In terms of using this syntax in SMS 7, the decision was driven primarily by a need to communicate the most amount of alphanumeric information possible in the smallest amount of space possible. In order for the textual component of this installment to work within its design constraints, there was little room in terms of pixel space to play with. By adopting the use of dot syntax I was able to meet the practical needs of the form while embedding a certain degree of reflexivity in the content.

The morphology of each line is as follows: First, there is a three letter, capitalized abbreviation denoting the city in which the sequence was shot in (BOS, NYC, LON, PAR). This is followed by a two digit number which refers to the sequence's position within the original installment in which it was first published. Next, are two 'strings' (a series of letters, often in the form of a word, phrase, sentence, or paragraph) which say something about the content of the animation. These content categories were created with an eye for characteristics shared between more than one clip, the thinking being that this would allow users to construct semantic relationships more easily. In the figure above, we see that the first string to follow the numerical sequence number reference is always either Man, Woman, or Couple. Thus, nouns generally appear in the first string, while a combination of nouns, adjectives, and adverbs appear in the second string. This syntax suggests that the latter is a descriptor which can be applied to interpret the former.

5.1.8 SMS 8 - Tokyo

All imagery was shot in Tokyo, Japan on October 27, 2003.



32. David Crawford, *Stop Motion Studies - Series 8* (2003)

As part of *Stop Motion Studies - Tokyo*, the eighth installment (fig. 32) marked a return to production after a lengthy break (over nine months) from the shooting of *SMS 6* in New York in January 2004. This, coupled with the fact that I was about to work in the most foreign culture that I had endeavored to work in, suggested that it might be a rather difficult shoot.

I resolved to stick to the paradigm of simply “doing my job” and settled on a regular (and somewhat grueling) production schedule that would find me shooting two cards worth of material in the morning and two cards worth in the afternoon. This ritualized practice helped to offset my unease about working in a completely foreign culture as well as promising ample source material despite a suspicion that I might have become kind of rusty in my time away from production. It is important to remember that a year prior to this, things progressed at break-neck speed with production in a new city starting immediately after I had wrapped up post-production on an installment, in several cases uploading the final animations days or just hours before flying to a new location. The method to this madness was to cajole myself to into letting go of an overtly self-conscious methodology and instead to start to work more from the gut. This dynamic tends to occur when time is short and could be referred to working in a gestural manner.

Pre-production for *SMS-Tokyo* was the most extensive that has been performed thus far, with at least 2-to-3 days being totally devoted to getting myself familiar with Tokyo’s massive train system. Over this period, two subway lines were identified which seemed promising and they were further investigated in an effort to gauge what the experience of shooting on them might be like. Among the most poignant information coming out of pre-production was the realization that

the trains in Tokyo could easily get crowded to a point that shooting on them would become all but impossible. While cars would get full in London and New York, there were also ample opportunities to move to another car that was carrying fewer passengers. In Tokyo there were times (such as rush hour, obviously) when it would seem that every square foot of space both inside and outside of the cars was occupied by someone, with another waiting to take their place should any free space open up.

5.1.9 SMS 9 - Tokyo

All imagery was shot in Tokyo, Japan on the morning of October 28, 2003.



33. David Crawford, *Stop Motion Studies - Series 9* (2003)

Having come off of what seemed like it had been a promising day of shooting despite the challenges, the day which followed (10.28.03) afforded a bit more comfort in the sense that the pressure to get something recorded was a bit less intense. It was raining on this day (fig. 33), which provided a nice contrast to the installments shot on sunny days (*SMS 9* and *SMS 10*) which would bracket this material at the meta-level.

In terms of post-production, while the eighth installment was consistent with the yield achieved while shooting *SMS 5* and *SMS 6* in New York (one day's source material producing one installment), *SMS 9* marked the beginning of an even more aggressive approach in which more than one installment was produced out of source material shot on a single day. In retrospect, it would appear that this was pushing too hard and that while I do not regret having done this in order to discover the limits of efficiency and conceptual rigor, I suspect that a full day of

production is most likely to be the ideal constraint to work against in terms of producing an installment.

In its favor, one could argue that seeking to get two or more installments out of a day's production led to the creation of what Jo-Anne Green, Associate Director of New Radio and Performing Arts, Inc. (Turbulence.org) referred to as the "mini-series," in that I would publish two or three sequences shot during the same set-up. The screenshot above (fig. 31) is an example of this, as there are three different sequences of this young woman in *SMS 9*. The "mini-series" approach was the key to allowing more than one installment to be produced out of a day's production and also served as something of a precursor to the linear montage used in *SMS 13*. One way of justifying the use of the simple equation that one day of production becomes the source material for one installment comes from a comment I heard filmmaker Luther Price make. He was talking about the synergy between narrative structure and natural processes and he pointed that the "world ends every day."

5.1.10 SMS 10 - Tokyo

All imagery was shot in Tokyo, Japan on the afternoon of October 28, 2003.



34. David Crawford, *Stop Motion Studies - Series 10* (2003)

As mentioned above, the ninth installment represented a turning point in that it came from source material which was generated in less than one day. *SMS 10* (fig. 34) is comprised of footage shot during the second half of the same day (10.28.03). At this juncture in post-production, I became very interested in the idea that "practice makes perfect" or, in other words, that the strength of the source material was improving with each CompactFlash card that was shot. This, combined with

a sense a that a dramatic arc might be added to the installments by even further shortening the window in which the source material was drawn from, prompted the framework of the next two installments.

5.1.11 SMS - Series 11 - Tokyo

All imagery was shot in Tokyo, Japan between 8:50 AM and 10:10 AM on October 29, 2003.



35. David Crawford, *Stop Motion Studies - Series 11* (2004)

Despite misgivings about the tactics of producing more than one installment per production day, *SMS 11* (fig. 35) is clearly the strongest installment in *SMS-Tokyo* and it was shot in almost exactly one hour. In thinking back to the first installments produced, this means that production time was shortened from 3 weeks (Göteborg) to 4 days (Paris) to 2 days (Boston) to 1 day (New York) to ½ of a day (Tokyo) and finally to 1 hour (Tokyo). If the next installment (*SMS 12*) were stronger, one might conclude that future experiments should keep moving in this direction, but while there are some successful sequences in *SMS 12*, its just not of the same caliber as some of the earliest installments such as *SMS 3* and *SMS 4*, which were drawn from up to eight times* the amount of source material.

**SMS 3* was drawn from 12,000 images, *SMS 11* and *SMS 12* from just 1,500 each.

5.1.12 SMS 12 - Tokyo

All imagery was shot in Tokyo, Japan between 10:10 AM and 11:45 AM on October 29, 2003.



36. David Crawford, *Stop Motion Studies - Series 12* (2004)

As noted above, this installment (fig. 36) is not among my favorite. In particular, there is a “mini-series” at the end of the series of a young woman sleeping that is simply a direct quote from a similar, but much more powerful variation on this theme appearing in *SMS 11*. In looking back at *SMS 12*, it would seem to be a sign that post-production had (a) reached the limits of its efficiency and (b) that it was time to look back to earlier approaches to post-production in order to further define the ideal parameters for both production and post-production. As mentioned, my working conclusion at this point is that any future installments beyond what has already been shot* should be drawn from a full day of source material.

**SMS 14* will be based on footage shot during the second half of the day on 10.29.03 and is likely to be published prior to the end of 2004.

5.2 Stop Motion Studies - Series 13

In this remix of footage originally shot for previous installments in London, Paris, Boston, New York, and Tokyo, each installment's modular structure has provided a library of building blocks that have been edited into a linear animation approximately 5 minutes long. The algorithmic montage constituting each clip's DNA remains intact, while the individual sequences are now composited within a linear framework. The speed of the transitions is based on network connection speed.



37. David Crawford, *Stop Motion Studies - Series 13* (2004)

SMS 13 (fig. 37) represents both the culmination of the installments preceding it and also something of an aberration if one looks at the body of work from the Formalist (Eisenstein) versus Realist (Bazin) dichotomy outlined in section 2.4. That being said, this installment actually began as an attempt at applying criteria from the continuity style in hopes of stringing something together which actually approximated an experimental narrative. Having shot an enormous amount of coverage which included lots of outdoor shots and innumerable variations on the passengers and their environs, I had hoped to piece something together in the spirit of *Man with a Movie Camera*, whereby underlying semantic structures such as day versus night and interiors versus exteriors would allow for the city itself, or more specifically its subway system, to become something of a main character.

Although there was no new source material shot for this installment, it took up a great deal of time in post-production (3 months as compared with 2-4 weeks on all previous installments). There were literally hundreds of different rough cuts of the footage. Initially, these were based solely on footage generated in Tokyo, but over time it became clear that the subject or main character

needed to become the world's subway system, so to speak. As a result, footage from all previous installments was considered as source material.

One way of describing the change in tactics that occurred during this period would be to say that the approach shifted away from one based upon the notion that I was making a montage in the sense that I have used it for the bulk of this thesis:

1. **montage.** a. A relatively rapid succession of different shots in a movie. b. The juxtaposition of such successive shots as a cinematic technique [43].

and towards an alternate, albeit related definition:

2. **montage.** a. A single pictorial composition made by juxtaposing or superimposing many pictures or designs. b. The art or process of making such a composition [43].

This suggests that attempts at employing the methods of continuity editing as embodied by the American school of montage pioneered by Griffith (see section 2.4.2) asked the material to do things which it simply was not capable of doing. Put another way, I suspect that one of the reasons that people have reacted favorably to these experiments is that they approach them within the semantic construct of photographs and are thus happily surprised when they discover that they are in fact, something more than just stills. People approach the work from a familiar conceptual model of a photograph and feel that they are getting something extra in terms of the animation.

In starting to flirt with tactics employed by Hollywood, namely continuity style, I was changing the protocol for how viewers were compelled to approach the work. In this sense I was raising the level of expectation or rather changing the type of expectation that viewers would have in terms of how they implicitly directed to read the work. In showing the installment to a small test audience, it became clear that the conventions being used (those of continuity editing) were working against me in the sense that the continuity was not particularly fluid in itself, meanwhile it was suggesting that viewers read the piece in terms of continuity (which only exacerbated the problem). It would seem that introducing an amount of experimentalism into a narrative predicated on top of continuity reads easily (such as in a dream sequence) but things don't work so smoothly the other way around.

By postponing my ambitions of constructing a piece based primarily on temporal montage (definition 1 above) and instead opting to build the animation utilizing what Lev Manovich refers to as a 'spatialized montage' (definition 2 above), I began to understand how I could build enough

tension (what Eisenstein would call “conflict”) into the piece in order to give it its own sense of gravity. To put this another way, one can look at any piece of art as the embodiment of tension between certain dichotomies. In literature, theater, or film, these might be the protagonist versus the antagonist or the tension of physical action versus dialogue. In drawing or painting, one might talk of tension between light versus dark, figure versus ground, and the play of one color against its complement. Regardless of the medium and specific dichotomy, a certain play of opposites can be found at the heart of any compelling structure. Another way of expanding this perspective would be to suggest that an artifact (whether we are within the realm of art or design) can be analyzed in terms of the number of layers of concord and contrast which it contains.

Specifically in relation to *SMS 13*, it could be said that the play of opposites begins on a formal level with the use of various parts of the screen. This, in the sense that one solitary figure is often juxtaposed against another in succession by having them each occupy separate areas of the screen simultaneously. The realm in which this visual technique seems to be the most prevalent in our visual vernacular is in print advertisements for upcoming movies. Here one will typically see images of the protagonist and antagonist together with a handful of supporting characters (rendered at a smaller scale) with the overall effect resembling something like a family in crisis.

In *SMS 13*, the next element of conflict a viewer is likely to perceive is that the individual passengers are set in different locations around the world. While one might not immediately recognize that a passenger is in New York versus Boston, it is evident that the sequences culled from *SMS 3* (Paris) and *SMS-Tokyo* (Japan) were shot in different countries. Finally, there are the contrasts of the gender, age, race, and class of the subjects. If one looks at the full cast of characters, there is a fairly wide spectrum of people, and this speaks directly to the myriad of socio-cultural juxtapositions one experiences on the subway.

Conclusions and Discussion

6.1 Conclusions

The central questions stated at the outset of this thesis were as follows: 1. How can digital stills be transformed into compelling, low-bandwidth motion pictures using code? 2. How can the expressive power of gesture be captured and amplified in frame-specific animations? 3. How does algorithmic montage relate to traditional editing strategies such as American montage, Soviet montage, and *mise-en-scène*?

As it relates to the first of these three (How can digital stills be transformed into compelling, low-bandwidth motion pictures using code?), the use of what is introduced as 'algorithmic montage,' would seem to provide an ideal solution. At the heart of this solution as detailed at length in section 4 (Algorithmic Montage) is a strategy of getting the most compelling visual data out of the least amount of footage (stills) possible.

A more concrete way of looking at this would be through the lens of a 'codec,' or an algorithm used to both compress (co) and decompress (dec) data, to allow for minimal spatial requirements and maximal transportability. The distribution of audio and video files on the internet is predicated on codecs since processing power is cheaper than bandwidth. The *Stop Motion Studies* could be said to have been built on top of a simple codec that uses a few lines of ActionScript to expand or decompress the semantic range of small collection of stills, for they would not hold our attention the way that they do if they were to simply loop sequentially.

In terms of the second question (How can the expressive power of gesture be captured and amplified in frame-specific animations?), it would seem clear from the results of the experiments that "amplification of gesture" can be produced via a careful and deliberate removal of frames within a linear sequence. Capturing gesture proves to be something of another matter in that the camera itself was found to be such a highly charged cultural artifact. In section 3.2.2 it was stated

that the best results in the experiments came from encounters in which I had eye contact with subjects and they were aware that their image was being recorded, but were either curious or ambivalent. Less favorable results occurred when subjects became angry as the footage was less multi-dimensional. This speaks the power of the camera to influence the “expressive power of gesture” by nature of the wealth of associations we have with cameras and the way these associations are conveyed through our bodies and projected through our faces. For some, the camera is a novelty, for others it cultivates narcissism, and for many it is seen as no less than a weapon.

In section 2.5.1, the work of Evans was presented with details regarding his surreptitious use of the camera. While this minimizes the negative side-effects that can occur when subjects are aware of the presence of the camera, it speaks to the conceptual underpinnings of what Evans would refer to as a “documentary style” project, one with a highly Realist sensibility.

In contrast, the *Stop Motion Studies* are more reflexive in terms of their relationship to the camera as a cultural artifact. This is logical, as the camera has come to occupy a much greater part of our everyday cultural vernacular than it did when Evans shot in the New York subway between 1938 and 1941. On the other end of the continuum, many viewers ask whether the author speaks with subjects (in other words, asks for their permission) before taking photographs of them. In light of the performative nature of my activity as a photographer, I would offer the perspective that “asking permission” from subjects somehow dulls the edge of my performance and this can be read in the faces of the subjects.

In regard to the third question used to structure this body of research (How does algorithmic montage relate to traditional editing strategies such as American montage, Soviet montage, and mise-en-scène?), it would appear that (as with so many technological innovations) rather than anything being replaced, that the niches will simply subdivide. In other words, the PDA did not replace the cell phone or the PC, rather all three now inhabit a more diverse technological ecosystem where they each have their strengths and weaknesses. Much in the same way, the experiments detailed in this thesis suggest that American montage, Soviet montage, and mise-en-scène are not in any danger of being usurped by a new approach to montage predicated on algorithms, but that we are likely to see a proliferation of hybrids as this digital mitosis picks up speed.

6.2 Discussion

As it pertains to the first of the three questions in section 6.1, it is perhaps most important to point out both the shortcomings and future research agendas suggested by the experiments of this thesis. Theoretically, the labor-intensive decision making process employed in selecting 2 out of a 100 frames to be used in an animation could be augmented if not managed in a generative manner. As an example, using evolutionary algorithms [44], one could manage a set of parameters in service of automating, or rather growing editing solutions. This implies partially relegating creative control to the computer. It is perhaps best exemplified by Harold Cohen's, *Aaron* program [45], in which he allows a computer to generate solutions (paint) from which he then selects the works which he likes.

The question of control (something endlessly fascinating to us as political creatures) comes to the fore, as a dynamic worthy of inspection on all levels (artistic, technological, and theoretical). While it is fairly simple to imagine a Hollywood studio employing something akin to algorithmic montage to generatively produce hundreds if not thousands of variations of particular scenes or entire films in service of extending the hegemony of American montage, the more interesting questions would seem to stem from the abdication of control modeled by Evans (see section 2.5.1) as it pertains to both production *and* post-production. Indeed, if the networks of the future provide an unlimited array of real-time streams of image data (by way of wireless cameras so cheap that they are disposable) then this would seem to place more emphasis upon the value of the algorithms used to collate, categorize and represent this data (via montage).

In a chapter entitled "The Database Logic," from his book, *The Language of New Media* [39], Lev Manovich offers one of his most salient conceptual models for approaching new media art. Here he suggests that one of the fundamental properties of new media is that it exists as a database of elements which can be pivoted in terms of its representation through various interfaces. The separation of form and content is certainly one of the central architectural paradigms of programming and from an editing standpoint, Manovich's suggestion speaks to the malleability of new media and myriad of ways in which it allows content to be repurposed. While new media may seem impoverished when held up against literature, cinema, and or television as a narrative environment, it does provide an economy of means in terms of the mileage one can get out of it by repurposing content within varying frameworks and modes of representation.

Another lens through which to look at Manovich's dichotomy of database and interface is that of network architecture. In his book *Protocol: How Control Exists After Decentralization* [46], Alexander Galloway introduces readers to a survey of uses of network architecture in a wide range of contexts ranging from the military to the artistic. One of Galloway's central points in a chapter entitled "Tactical Media," is that networks constitute the most powerful contemporary

paradigm for any organization. He contrasts the network paradigm (clients, servers, redundant nodes that orchestrate communications laterally) with that of a central (often bureaucratic) authority that tends towards vertical lines of communication and command structures. Galloway aptly points out, as does Benjamin Barber in a book entitled *Jihad vs. McWorld* [47], that the networked organizational structures of multinational corporations and terrorist groups are virtually identical:

What I have called the forces of Jihad may seem then to be a throwback to premodern times: an attempt to recapture a world that existed prior to cosmopolitan capitalism and was defined by religious mysteries, hierarchical communities, spellbinding traditions, and historical torpor. As such, they may appear to be directly adversarial to the forces of McWorld. Yet Jihad stands not so much in stark opposition as in subtle counterpoint to McWorld and is itself a dialectical response to modernity whose features both reflect and reinforce the modern world's virtues and vices -- Jihad *via* McWorld rather than Jihad *versus* McWorld. The forces of Jihad are not only remembered and retrieved by the enemies of McWorld but imagined and contrived by its friends and proponents [47].
–Benjamin Barber

While Barber aims to show that it is in fact the penetration of the hand of capitalism (via various networks) into the society and culture of Islamic fundamentalists that has radicalized them so, Galloway would argue that the power of networks is not inherently good or bad, just more effective than any other organizational model. This is due to an inherent flexibility and redundancy based (ironically) on the weakness of the individual nodes. With this as a pretext I would offer the perspective that the *Stop Motion Studies*, are an attempt to explore new formal relationships within the area of montage, based upon the presence of a network as an underlying architectural and conceptual model.

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