Flow: An Interactive Public Artwork

Fiona Bowie
Artist

fionabowiestudio@gmail.com

Sidney Fels
Dept. of Electrical and Computer
Engineering
University of British Columbia
+1 604-822-5338

ssfels@ece.ubc.ca

Morgan Hibbert
Engineering Physics
University of British
Columbia

mhibbert8@gmail.com

ABSTRACT

This paper describes the conceptual, aesthetic, hardware, and software design of Flow, a photo/media-based permanent public interactive artwork in Vancouver, Canada. The work is located at street level in a new local community centre at one of the city's oldest intersections. In addition to the community centre location, it has a related interactive web component. It involves the animation and projection of continually recombining photographic images onto a large, interactive 4x4 array of electronically controlled switch glass windows. Over the course of the day and night, these photographic tableaux appear on the glass in combinations that depend upon image-to-image relationships, time of day, season and weather. In addition, lighting elements including water effect gobos are integrated at selected times of day. Images disappear when viewers inside the building come within close proximity to the work: the interactive windows respond to movement by changing from translucent to clear. In the daytime, when the projected image is off at the site, the work continues on the project's website, offering the visitor an interaction with the work. The work aims to provide an experience of the flux of people, animals, landscape and urban environment over time. It addresses the way landscape has transformed in response to colonialism, capital and local pressures, where change is rapid and histories are lost and rewritten.

Categories and Subject Descriptors

J.5 [Arts and Humanities]: Arts, fine and performing; H.5 [Information Interfaces and Presentation]: Animation.

General Terms

Algorithms, Design

Keywords

Public artwork, animation, hardware, interactive art, photography, transitions, superimposition, Portraiture, Landscape, post-human, dystopia.

Figure 1: *Flow*- at night photographed from across the street The switch glass is the 4x4 matrix of windows in the centre. (image F. Bowie © 2009).

1.INTRODUCTION

Flow is Vancouver's first photo/media-based permanent public art work. Commissioned by the *something* of *somewhere*, the work is situated at street level at 1 Kingsway, a new civic centre housing a library, community centre, residences and a games room (where the work is installed). It can also be found online at flow1kingsway.com. The piece is expected to run for 10 years or more. Figure 1 shows an image of the work at night from outside.

Over the course of the day and night, *Flow* shifts between live and constructed theatrical tableaus. During daylight hours, *Flow's* dynamic glass projection surface creates viewing portals: framing details the activity inside and provides individuals inside with shifting views and details of the street (these views change according to their proximity to the glass surface).

During the early morning and after dusk, *Flow* at 1 Kingsway transforms into a continuously changing tableau in which hundreds of photographic portraits and landscapes, shot by F. Bowie over the last few years, are blended and projected onto the changing surface. The scenes change every two to four minutes. The transitions from one scene to another are so slow that a face is sometimes barely discernable over a background - prompting several people to characterize this aspect of work as having a dream like or hallucinatory quality.

During this time, the special projection material causes portions of the imagery to disappear as the projection surface switches from translucent to clear, fragmenting the image and frustrating its coherence.

Our custom-designed software allows figures shot at different times to appear as if they simultaneously present, with a core group of these figures or actors recurring in a manner that implicitly suggests they're part of a larger narrative. Images that are linked (or 'friended' to each other) embrace unlikely combinations: disparate F-stops combine the blurred edges of portraits upon clear backgrounds and purposefully contrary lighting schemes.

The host of characters have been arranged into social groups: a core of main characters appear more often than most and more often with other main characters. Because of varying likelihood of appearance, some will become more familiar than others over the months and years to regular visitors to 1 Kingsway. The core group have more focused (willful) countenances than the general population: they were shot as if engaged in dialogue/interaction. The general population are often far more candid in nature.

In the daytime, when the projected image is off at the site and continues on the project's website, the glass at 1 Kingsway becomes the focus. The projection surface, made up of computer controlled glass, creates portals into and out of the building. When translucent, the glass blocks the view, and when clear - provides a view. In the morning and after dusk the opposite occurs: the translucent surface holds the image, the clearing of it fragments the image.

The online component of *Flow* allows viewers to see the work unfold during the day when the site image projectors are off and the site glass is the active component. Visitors are encouraged to engage with the work, play with dialogue and attribute phrases to characters pictured within the work. The viewer may capture an image and choose from a number of phrases penned by F. Bowie and excerpts of lyrics by The Residents, The New Pornographers, Spores, SLickerslacker and Chopper. This collection of phrases is dynamic and will be added to over time.

Images may be saved without dialogue or with one or two 'subtitles'. After choosing the phrase(s), it will be saved and be permanently attached to the uploaded image in the *Flow* archive.

The archive is available to visitors to the site so that the work builds meaning over time. The technical aspects of the interactive web component will be discussed in Section 3.2.2.3.

2. RELATED WORK
Our work generally fits within the context of installations such as *Slip/host* [3][4][12] and interactive video based large display works such as Krueger's *Videoplace* [13], Rozin's various mirror installations such as *Snowmirror* [16] and Iamascope [8], however our interaction comes from the use of motion detectors. It also is intended to be an ambient piece leveraging off slow technology concepts [10]. We originally planned to include a video camera interaction mode, but decided to exclude that element in contrast to other interactive installation artworks. A significant technical difference with our work from others is that instead of a usual projection surface, we use a large array of computer switched glass that spans 20x10 feet of an exterior wall allowing our imagery to disappear and reappear, spill onto the street or stay contained. This type of glass has been used successfully in other installations [15]. With this medium we are able to explore themes relevant to the context of the piece situated in a community centre.

Three previous works informed the initial conception of *Flow* presented in Section 2.1. There are also works that will be discussed that will serve as context and contrast for landscapes

and image transitions of *Flow*. This will be discussed in Section 2.3.

2.1. Work informing the inception and development of Flow and it's imagery.
Phenotypes (Fiona Bowie, 2001), a 360º immersive installation, had a formal and conceptual influence on the inception of *Flow*. This work set video vignettes into a largely lifeless, suburban cul-de-sac. The work, while created in 2001 continues to evolve. New narrative vignettes (superimposed into the windows of the 360º photographic projection of the cul-de-sac) are added to or replace older vignettes, creating a flux of people over time that seem to variously occupy the homes of *Phenotypes*. The landscape of *Phenotypes* has aesthetic and socio-political relationships to those pictured in *Flow*. It's cul-de-sac, retaining nothing of what was in the landscape previously, essentially a clean and bereft slate, provided impetuous to photograph landscapes that were in a state of transition from one for *Flow*: capturing the moment after the lands history has erased and before anything has been built in its place.

Figure 2 Barren landscape of Phenotypes (2001-ongoing)

Another work that informed the basic structure of *Flow* was *Slip/host* (Fiona Bowie, 2006). In 2004, the script and installation for *Slip/host* was developed. For this immersive multimedia work, characters (shot in video) are superimposed (like Phenotypes) upon their (photographic) 360º projected settings, creating an immersive narrative that focused on the nature of capital, it's impact on natural and social processes, it's pathologies of gluttony and the extinction of species.

In this work, the dialogue, context and content of characters shot at different times are seamlessly integrated upon a common background, creating a cohesive tableau out of multiple, disparate image/layers and sculptural elements.

Figure 3 Slip/host showing 3 views of 360º installation

Candice Hopkins, curator of Western Front Gallery, 2007 writes:

"An eccentric host of characters in Slip/host includes the The Big Lump, the Gargantuan Head and Two-Headed Moon.

In author's installation the dystopia and brown drudgery of the Big Lump's world, called "Host", is countered with "Slip", a quirky cartoon-like molecular environment, which resides in the body of the The Big Lump, a character whose habitual routines are undertaken relentlessly. The Big Lump, whose limited daily routine is internalized through his thoughts which seemingly only cycle from gluttonous desires for food to paperwork and back again, works out of a nameless warehouse in an industrial park.

Through gurgles and flabberwacks, The Big Lump's presence is audibly felt throughout the environs of the other characters. The sage narrator, Gargantuan Head, looms large as he floats in the sky of Slip. The Gargantuan Head weaves a tale of cause and effect and references the actions and nature of both realms.

Slip/host plays with conventions of media, narrative, and scale and draws on the reciprocities between two disparate worlds to reconsider notions of consciousness, consumption, beauty and oblivion".

The interplay of characters, the flow of *Slip/host's* installation from one scene to another and it's focus on contemporary consumption and dissolution played a large part in the development of the landscapes, the concepts of disappearance and superimposition of images in *Flow* [1]. As Heibert says [11],

"... the constitution of delirium and the awareness of disappearance, Slip/host is a paradoxically candy-coated dystopia, ...

One must add reality to the list of creatures rendered extinct by technology, slipped out of the projected future, for only delusion can be properly hosted. But this is what happens anyways when the screens emerge – for only screens are capable of representing that which otherwise exists only in the privacy of our own heads. We have come full circle from screened stages to screened worlds, a digital universe that has made its way into our molecular flesh".

In 1995, a work entitled *Nature Morte* (Fiona Bowie 2005-6), expanded on the aspects of *Slip/host*, but also explored the aesthetic embellishment of its subject by creating images that were tenuous in terms of their readability over time. These images transitioned from one to another over a seemingly very long time: so that at times the work would be barely visible to the viewer.

Figure 4: ***Nature Morte*** **(2005-6) showing beginning of transition and fade out at 17 of a 21 second fade.**

The transitions lasted up to thirty seconds: a period antithetical to temporal conventions of cinema. This transition style was directly implemented into *Flow*. *Nature Morte* focused on seasonal and yearly changes of a young tree, the inter-relationship of natural and social forces and perception.

In this work, still photographic images made up the entire narrative of the video: a subject would be paired with an object or landscape element (tree) and each of the pair or channel would fade independently.

In one scene for example a branch bud on a newly planted tree photographed several times over one year, fails to bloom, suggesting an arrest of development, a stunting of growth.

The subjects and shooting regimen of *Nature Morte* had a profound impact on the landscapes shot for Flow and also the timing of the transitions of one image to another.

The themes interrelatedness, of disappearance, contingency of life on capital and the tenuous nature of media runs through these works. In particular, adapted from these works for *Flow*, is how the presence or disappearance of an image might act as metaphorical content for the underlying subject of a work. This served as initial impetuous for the possibility of creating a work where it's content would both physically disappear before the viewer, but also suggest disappearance through the particular settings and transitions of them.

The interactive components were driven by Bowie's interest in visualizing disappearance and adapted from Fels's work in developing aesthetics of interaction where the four main elements are being used to form the connection between the viewer and work. These elements include response, control, reflection and belonging [7] which have been shown to influence participants experience of interactive artworks [5]. Specifically, the immediate disappearance of the window panes when movement is detected provides a strong control aesthetic while the imagery maintains a reflection aesthetic. The inclusion of the community images and the selection of flow as one of the core concepts brings the residents and users of the community centre into focus in the piece providing a sense of belonging, though, the interactive elements are not timed to reinforce this. The response aesthetic is intentionally not included as no instructions or visible interactive means are made available. This provides a sense of surprise when a viewer discovers this, however, is not core to the piece.

2.2. Transitions and Landscapes of Flow In relation to Contemporary Vancouver Photography

Contemporary landscape traditions in the Vancouver School such as Jeff Wall [14][12] and Roy Arden [2] have represented liminal landscapes that are in a state of transition from one thing to another [3][4][6]. Their tableaus differ from the landscapes in *Flow* in part due to the fact they are photographic prints – objects – and as such hold onto certain conventions of landscape photography (and indeed landscape painting) and the notion of the vista. The materiality of the photograph creates a sense of presence and enduring to-be-gazed-at-ness. In contrast, the landscapes in Flow are as fleeting as their particular states of being when photographed: in between history and new manifestation. The rates of transition, the mixing and remixing of images, their disappearing and reappearance later with different characters and thus context stands in contrast to other contemporary Vancouver photo based works. Here, the very veracity of the image/photograph is challenged.

3. FLOW: Image Content, Aesthetics and Design

The main design of *Flow* is to have a continuously changing tableau in a constant state of flux using hundreds of photographic portraits and landscapes blended variously into scenes and projected onto the changing surface from people's interaction with it. These scenes change every two to four minutes. We describe the artistic elements that comprise the piece in Section 3.1. The implementation and design of the piece is covered in Section 3.2.

3.1. Artistic Imagery, Aesthetic and Design

Flow has eight main artistic elements that contribute to the aesthetic structure of the work. They include: disappearance, temporal flow, character development, landscapes, water, birds, context within the community centre (1 Kingsway) and online that are discussed next.

3.1.1. Concept of Disappearance

A major component of the inception of *Flow* was that its images would disappear before the viewer, creating an unstable, contingent image and by extension a seemingly unstable artwork (much like the fragility of the image and subjects of *Nature Morte*). This core component also refers to the images' content as having a tenuous, contingent and entirely interdependent existence.

Figure 6 *Flow* **showing a slow fade of superimposed foreground character over background. The transitions last up to 20 seconds (photo: F. Bowie)**

The slowness of the transitions also reflect the general temporal flow of *Flow*: it is a slow piece. Viewers typically spend short periods of time viewing art, thus due to it's slowness, the acquisition of the content of *Flow* happens over repeated visits and is most available to individuals that either go by 1 Kingsway on a regular basis or visit the website on a regular basis.

This slowness is in contrast to popular media that changes and progresses in seconds rather than the minutes it takes Flow to change from one scene to the next.

3.1.3. Flow's Character Development, Superimposition and Integration

Flow's imagery has been conceived and designed to provide superimposition of segmented images on top of a background that fade in and fade out over time providing a complex composition over time. These images were photographed using blue screen techniques and tagged with their content along with probabilities associated with how likely they should appear with other images and time of day as described in Section 3.2. While doing the dailies (reviews of images after completion of blue screen shoots of the portraits that make up *Flow*), it became apparent that certain individuals were particularly dynamic, enigmatic or animated in gesture, making them prospects for being cast as main characters.

As Fiona Bowie spent time creating pairings to see how individuals played against each other, the concept of 'friending' by tagging the images that are particularly relevant to each other and adapting the software was a logical way to build a diegesis within *Flow*.

The portraits were then arranged into social groups so that this core of main characters would appear more often than most and more often with other main characters. After developing this strategy, the photo shoots became more focused: some individuals would be photographed in higher volume - in varying framings, as close ups and then again as back-grounded (full body), so that these main characters would appear varied in spite of their more frequent appearance within the work. Because of this strategy, some will become more familiar than others over the months and years to regular visitors to 1 Kingsway. The core group generally have more focused (willful) countenances than the others: they were shot as if engaged in dialogue/interaction. This becomes an important aspect directing the dialogue that is added to the portrait pairings at the project website. In addition to tagging, the appearance of these individual images were determined also by doubling, copying or mirroring them. Due to the mirroring and

Figure 5 Flow at 1 Kingway showing portions of the image dissapearing as people inside the building engage the work. (photo F. Bowie)

During this time, the software governing the special projection material, switch glass, causes portions of the imagery to disappear as the projection surface switches from translucent to clear, fragmenting the image and frustrating its coherence. This disappearance is a direct result of the viewer moving closer to the scene, thereby making the viewer responsible for wiping out the image[1]. The interactive nature of this particular element– that the image disappears when the viewer comes within close proximity to it –relates to the interaction aesthetics of response, control without a strong element of belonging [7].

3.1.2. Flow and the experience of time

The transitions from one scene to another are so slow that a face is sometimes barely discernable over a background - prompting several people to characterize this aspect of work as having a dream like or hallucinatory quality.[2] These transitions or fade in / fade outs can last up to twenty seconds so that for a brief moment, the image is barely visible to the viewer.

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[2] One viewer who was sitting across the street from 1 Kingsway, reported that she called a friend distressed that she was having a visual hallucination, to which the friend who knew the work, (Carol Sawyer) replied: "oh, don't worry it's just art."

repetition of some images within *Flow's* image library, there is a chance that some characters may be twinned within one scene, creating the potential to suggest time or create absurd or overtly fabricated tableaus.

Because of the frequency of their appearance within the work, the core group of these figures or actors recur in a manner that implicitly suggests they're part of a larger narrative. Images that are linked (or 'friended' to each other) embrace unlikely combinations: disparate F-stops combine the blurred edges of portraits upon clear backgrounds and purposefully contrary lighting schemes. This was a conscious strategy of shooting the portraits to make the image look more or less convincing from scene to scene: sometimes the integration of images would appear seamless, while other times, the integration of images would seem overtly fabricated – fraudulent.

The characters of *Flow* were photographed as subjects in a state of *seeing*: they are often looking outside the *frame,* their gaze fixed on something that is not visible to the viewer. Whether they seem to be in an act of looking or an act of reflection is dependent in part on the context of the particular *mise-en-scene[3]* and it's other character (or lack thereof).

Individual images reappear over time into different scenes with different people, birds or animals creating differing contexts for anyone particular image. Because of the scaling component as described in Section 3.2, any image may also reappear changed in scale, providing additional variation in the experience of *Flow* over time.

3.1.4.Landscapes of Flow
At the inception of the work, the landscapes were to represent the neighbourhood where *Flow* at 1 Kingsway is situated. However, over the course of shooting the work and doing research at the Vancouver Archives where key images were selected from the 19th and early 20th centuries of the area's forests razed and burned to make way for colonial builds, focus was turned to landscapes that were in a period of transition from one state to another.

Figure 7 example of an Archive image typical of the thematic of Flow's landscapes, circa 1885 (© City of Vancouver Archive)

In many of these archival images, the history of the site as marked by indigenous civilization has been erased but its new use had not yet manifest. While histories lost and rewritten was a core theme for the creation of *Flow*, these images in particular directed and focused the strategy for photographing landscapes for *Flow.* Thus the thematic of the image became the main impetuous rather than the local of any particular landscape. The geographical location then broadened greatly after production started from the area in and around the site of 1 Kingsway to other locals.

The landscapes as subjects are for the most part razed, fallow, destroyed by inclement weather events, others flattened and leveled, awaiting new builds. Others are blurred, unfixed, or chaotic (such as the social scenes). As a collection, they are manifestations of will, of potential and systems. These captured moments of marked change have a very different resonance today than they had for the generations of last century: the stakes have become much higher.

Figure 8 Flow showing example of landscape typical of dystopic themes.

3.1.5.Water of Flow
During a brief time in the early hours of the day (between 2:30 a.m. and 3:30 a.m. , Gobo lights are employed to project water-like images when the main image projectors are off. These water images directly reference the stream long buried into a culvert below the site of 1 Kingsway.

3.1.6.Crow/Bird imagery of Flow
At dusk and dawn, crow imagery is favoured. The crow times reflect that everyday the crows of Vancouver migrate to their daily feeding and mating areas from their roost at Willingdon Rd. and Lougheed Hwy [10]. One of the migration paths is over the 1 Kingsway building.

3.1.7.Flow during the day at 1 Kingsway
During the day at 1 Kingsway, *Flow* shifts from the constructed or theatrical tableaus to live ones: inadvertently employing occupants within and outside the building as subjects. During daylight hours, when the projected image is off at the site and continues on the project's website, the glass at 1 Kingsway becomes the focus. *Flow*'s dynamic glass projection surface creates viewing portals into and out of the building. When translucent, the glass blocks the view, and when clear - provides a view. Individuals can momentarily see activity inside as the occupants can see details and shifting views of the street. These views are dependent on and change according to the viewers' proximity to the wall of glass. The gaze is frustrated by the dynamic nature of the glass – views are fleeting and seemingly random though based on a Poisson distribution model. This and technical aspects related to this will be discussed in section 3.2.

3.1.8.Online Flow
The online component of *Flow* mirrors the work onsite but also allows viewers to see the work unfold during the day when the site image projectors are off and the site glass is the active component. Visitors to the website will see the work continue to unfold day and night – therefore when the projectors are off during daylight hours, the work remains continuous.

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[3] *mise-en-scene,* or *to place within the scene,* refers to how the particular individuals 'characters' and landscapes were chosen, shot and 'friended' by Bowie to compile into scenes.

The online component also offers enhancement of the imagery of Flow, providing phrases to visitors to add as subtitled dialogue to images they choose or "grab" from the *Flow* continuum.

Figure 9 image/dialogue pairing created by visitor to website (phrase: Where are you. Where are you. where are you?)

When a particular image/moment appeals to a visitor to the site, they may save it to an archive. Visitors engage the work in this manner by clicking on the "Put words in our mouths" link to play with the dialogue choices and create narrative vignettes. They may also examine previous contributions in the *Flow* archive and use those images with new dialogue if they so choose. Thus far on the *Flow* web component, some images have been captured by visitors when they are in a state of transition, so that this online component, even though not fully animated, successfully represents the thematic of disappearance. These particular saved images are in a ghost-like state, tenuous and sometime barely legible. One visitor humourously captured a fully grey transition as their contribution to the archive.

Once an image is chosen by the viewer, they can then attribute dialogue to the characters captured within the mis-en-scene. This dialogue will be available to them in the form of pull down menus. Images may be saved without dialogue or with one or two 'subtitles'. After choosing the image and phrase(s), they will be integrated, saved and permanently attached to the image in the *Flow* archive.

The archive is available to visitors to the site to view so that the work builds meaning over days, months and years.

Figure 10 image/dialogue pairing by visitor to website. (phrase: The New Pornographers)

The available phrases are excerpts of lyrics by The Residents, The New Pornographers, Spores, SLickerslacker and Chopper and phrases by author.

The phrases were chosen based on their adaptive possibilities to different contexts; on their potential to enhance the thematics of landscape settings and characters and their potential when paired other phrases to create surreality or absurdity. The embrace of absurdity is a playful gesture but also intended to disrupt a sense the order and logic typical of conventional narrative. This collection of phrases is dynamic and will be added to over time.

3.2. Technical Design

Flow consists of a both hardware components and software design that implement the work. The main components are shown in figure 10 and described next.

3.2.1. Hardware design

The hardware consists of five main modules as follows:

1. Windows and window controller: the windows are arranged in a 4x4 array of Polyvision switch glass. Each pane is approximately 59" wide by 26.5" high. We connect the windows to a Light-o-Rama Triac (MC-TB08) lighting controller to allow us to switch a 65V regulated supply on and off by the computer that turns the glass on and off. We use a 0/0/16 Phidget board to control the lighting controller from the computer connected by a USB cable. When *on,* a window is clear and when *off,* it is translucent and provides a video projection screen that is viewable from both sides. The 4x4 switchable array is within a 6x5 array of glass with the perimeter panes being part of the projection but not switchable. This can be seen in Figure 1, where the switchable glass is the 4x4 array in the centre.

2. Motion detectors and controller: we use 4 Phidget motion detectors connected to a Phidget 8/8/8 input/output board to detect movement in front of the windows on the inside of the building. We mounted the 2cmx2cm detectors inside a light fixture to blend into the décor of the room so that they look like small pot lights. Each detector is mounted on the ceiling over a single column of windows and targeted so that each responds within the width of the column it is placed over.

3. Video projectors: we use two Panasonic Sanyo PLCXF46N video projectors. These projectors were a compromise between brightness and cost. We used cat-5 based extenders so that we could locate the computer in a communication closet near the work and run cable lengths around 50' to the projectors. We also required serial cables to be run from the computer to the video projectors to allow them to be controlled by our software.

4. Gobo light and controller: we control a gobo light using the Light-o-rama lighting controller (120VAC) controlled by a Phidget 16/0/0 output board. The gobo light is set to project a watery texture and turns on late at night prior to the work shutting down in the early morning.

5. Computer and disk: we use an Intel Dual core, Power Mac with a 1TB disk for image storage. The computer has a NVIDIA GeForce 9400M graphics card with 4GB of memory to speed up the rendering of the projected images. We designed custom software to run on it.

The computer was located in a communication closet that was about 50' from the room where the piece was installed with conduit installed between the two locations for the wiring. The windows face westward onto the street (Kingsway Ave) with the two projectors mounted on the ceilings and calibrated so that the seam between them falls on the centre mullion. We had fixed lenses requiring precise positioning of the projectors relative to the windows. Significant colour and brightness calibration was performed. The projectors each have 13,000 lumens output which is necessary as the switch glass material is not very effective as a
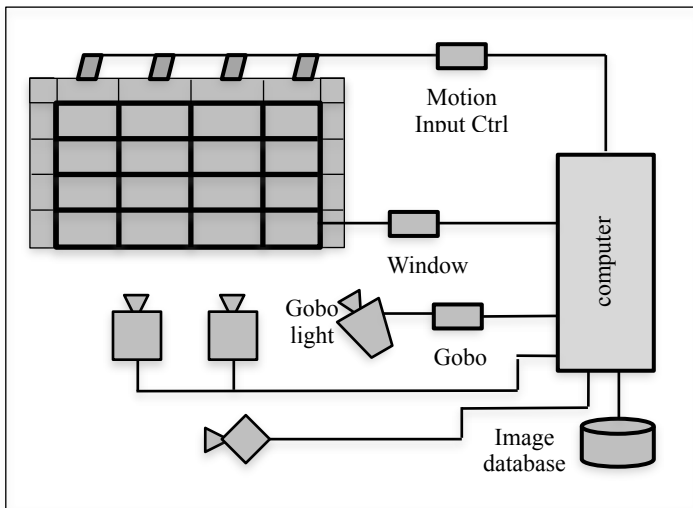
Figure 10: Block diagram of Flow: the 4x4 array of controlled windows are centred within a 6x5 glass array.

projection screen. While even higher lumens would make daytime projection marginally more legible, there was concern that going over 13,000 lumens might pose a hazard for occupants' eyesight. The architect and building project manager came onsite to approve the placement and brightness of the projectors with respect to safety considerations of the rooms occupants.

When the switch glass is translucent the projected image is seen on both sides but with significant reduction in brightness making it difficult to see when there is daylight. When the glass becomes clear, the projection passes through effectively and can be seen cast onto the sidewalk and street outside. The motion detectors appear as pot lights to the people in the room and thus are not noticed which makes the work feel a bit magical. Finally, the gobo light is mounted on the ceiling near the video projectors and is aimed at the wall beside the windows rather than directly at the windows. The wall provides an effective surface to view the watery imagery it produces. We chose white lighting. The pattern is viewable at night from inside the community centre and appears glowing from the outside. When a window pane becomes clear, it is also viewable from outside.

3.2.2. Software design

We designed the software to manage all the aesthetic elements of the piece. The main aspects it controlled are:

1. control of the timing of the flow of the piece
2. animation
3. control of the windows
4. logging and website upload

These are described next.

3.2.2.1. Flow Timing

Projector timing: The piece follows a scheduled set of activities over the course of a day. The variations in the timing depend upon sunset and sunrise times that vary over the course of a year. Within the schedule of the day, the projectors are turned on or off depending upon daylight since when it is light, the video projection brightness is insufficient to provide a good image. Thus, as sunrise in Vancouver ranges from 4:55am to 8:05am and sunset ranges from 4:14pm to 9:05pm, we need to adjust the off time of the projectors to be a set number of hours after sunrise and a set number of hours before sunset. The schedule is as follows:

1. 4:00am computer turns on
2. 120min before sunrise projectors turn on
3. 180min after sunrise projectors turn off

4. 120min before sunset projectors turn on
5. 480min after sunset projectors turns off
6. 480min after sunset gobo light turns on
7. 3:30am gobo light turns off
8. 3:30am computer turns off

These are adjustable parameters so they can be tuned if needed.

Window timing: The window panes are each computer controllable. The control software uses a combination of motion controller inputs as well as a probability distribution to determine when they turn off and on. There are three modes: 1. when the video projectors are on (morning and evening), 2 when they are off and the gobos are off (daytime) and 3. when only the gobos are on and the projectors are off (late night/early morning).

Projectors on mode: When the projectors are on in the morning and evening, the window panes respond to the motion detectors as well as a Poisson random process. Effectively, when motion is detected in front of a column of glass the entire column of four panes is activated to become clear (on). The caveat is that with a probability determined using a Poisson distribution, the panes scheduled to go clear will be deselected so they remain translucent. We set this likelihood to be quite small so that usually the panes will all go clear leading to a larger sense of intimacy with the piece through the interaction [Fels, 2005]. After the windows become clear, they are scheduled to turn off again using a Poisson distribution again with the interarrival rate (λ) set with a defined parameter. We use a value of $\lambda=16s$ plus a constant offset of 1s to ensure that a pane does not go clear and translucent in less than 1s which would have a blinking effect.

When the projectors are on, there is also another random process that selects whether a pane should go off independent of the motion detectors. This ensures that if there is no movement there will be some windows that turn on. We've set the random selection probability to be 5% that is checked every time interval at 8s. The probability of a pane turning on is set quite low since in this mode, it is expected that there will be quite a bit of motion, thus, that will be making the windows quite active. This is especially true in the evening when the room is heavily used.

Projectors off, gobo of mode: When the projectors are off in the daytime, the behaviour is similar to the projector on mode, however, the probability that a window pane will go off is changed to 75% so that the windows appear active even without movement.

Gobo on mode, projectors off mode: Finally, when the gobo light is on late at night the motion detectors are inactive and the window probability is also 75% as in the projector off mode. Normally, the room is closed during this late hour, so there would not be motion activity; however, conceptually, during the time when the gobo is on illuminating water imagery we do not want the image to disappear based on motion. The water imagery comes on last to represent the flow of the buried Brewery Creek that touched the corner of the lot where the building is.

3.2.2.2. Animation

We designed the flow of the visual animation based on two main concepts: 1. semantic layers and 2. transition probabilities and parameters for when and how an image should appear on the *stage* and with what likelihood it should appear with other images. The stage refers to the animation that is currently being projected on the windows. To do this, each image in our database has associated tags that provide semantic labels for what the content is in the image. Table 1 shows the tags we have. As well, there is an

array of probabilities associated with each image that indicates the likelihood that it should appear depending upon time of day, weather, and semantics of the other images on the stage and in a scene. In addition to the semantic tags, images have various points of interest (POI) identified to indicate where in the image are acceptable areas where the image can be centered and zoomed along with panning constraints. These values ensure that the automatic procedures displaying the image in a scene always produce interesting results. Additionally, orientation flags provide information about whether the images bleed to the left, right or are centered so that they could be positioned on the stage without disruptive artifacts. For example, if the image in the database is of a person's profile facing right with part of their head cut off the left side of the image, the image would be tagged "lve" (left vertical edge) so that it would always appear on the stage pinned to the left side. Figure 11 illustrates the POI meta-tags used for a typical image.

Tag:	Value(s)	Tag:	Value(s)
edges:	lve	friend:	_MG_3094.xmp
imagelayer:	background	line:	no
timeofday:	evening	version:	2.0
weather:	cloudy	poi:	1800_1200
season:	summer	window:	no

Table 1 Example listing of semantic image tags

Figure 11 Example of POI tag

We use three layers for our stage: background, inanimate, and animate. Once the images have been selected for the stage they are rendered using the order: background, inanimate and animate so that the top layers occlude the bottom layers for the superimposition. The temporal flow of the stage is coordinated into scenes where images are selected to appear over time in a particular scene which lasts around two minutes. Within a scene, images will appear and disappear based on fade in and out timing parameters also associated with the image itself. At the beginning of the scene, all the timing parameters are calculated using a uniform distribution to select values between the ranges specified for all the different values. A uniform distribution is used to resolve the transition probabilities and a Poisson distribution to resolve the timing between images for each layer. After a scene ends, the stage fades to grey while the process of selecting the next scene runs. All the parameters are set to ensure that the aesthetics of the piece are maintained as images appear and disappear from the stage. Table 2 illustrates what a schedule for a given scene might look like. Figure 1 shows a typical view in a scene that may appear on the stage at a given time.

Time (s)	Action
0	background, imagelayer1, imagelayer2
5	background begins to fade in and starts to pan
30	background visible, imagelayer1 begins to fade in
55	imagelayer2 begins to fade in
70	imagelayer1 visible
80	imagelayer2 visible
130	imagelayer2 begins to fade out
143	imagelayer1 begins to fade out
145	imagelayer2 no longer visible
151	imagelayer1 no longer visible
152	background begins to fade out
170	background no longer visible, faded to grey screen

Table 2 Example of timing sequence

The scheduling of scenes over the course of a day proceeds deterministically through modes with stochastic processes used within the modes to determine the scenes for the mode. The first scene uses a background that comes from archival footage showing an image we have of the area from 1885. After that scene, the piece adjusts the content likelihoods based on the time of day, image relationships and weather as it transitions between modes.

The most concrete example of daily cycles being pictured within Flow is the appearance of images of crows at dusk and dawn. As sunrise approaches we favour more bird imagery as we do during sunset to coincide with the daily migration of the crows from Vancouver to their roost in nearby Burnaby as discussed in Section 3.1.6. Figure 12 shows an example of such an image.

Figure 12 Crows dominate the imagery during dusk and dawn. (Photo: F. Bowie)

3.2.2.3. Website and Logging

The website shows the stage image that updates every 60 seconds. We have an internet connection to the Flow computer that allows us to upload stage shots regularly that then appear on the website. This allows remote visitors to see the unfolding tableaux dynamically.

The web application works as follows:

Flow's web site contains a small application, built with PHP, MySQL and the gd graphics library, which enables site visitors to contribute captioned images to an archive on the site. The images themselves are screen grabs from Flow's live presentation, which are automatically uploaded to the web server at two-minute intervals, and the captions are selected from a phrase library provided within the application.

The original screen grabs are resized using gd, then renamed and stored. Captions are added to the image as a plain text overlay using CSS (in particular, the "opacity" attribute allows better presentation of the captions as subtitles). The initial screen of the application allows users to experiment with different captions by using Javascript and the Document Object Model to dynamically change the subtitles before the capture is committed to the database. Subsequent screens allow the user to confirm the submission, and then commit the selection of the image and captions to the database. A final step is performed by sending an e-mail to the user containing a URL for confirming the submission.

The submitted and confirmed contributions are presented in a paginated list. Each entry on the list links to a full-page presentation of the submission. From this list, it is possible to create a new submission based on one of the previously captured and submitted images, by adding new captions to that image. [Higgens, personal communication, 2010]:

We also log all the debugging information to files on the Flow computer so that if there is a crash of the program we will be able to determine what happened. This is important since at this point, the piece has not crashed in over 3 months, thus, if is does crash it will be difficult to replicate the problem. The logs are only kept for one week and then deleted so that disk space does not fill up.

4.DISCUSSION AND OBSERVATION

Flow has been running since Dec. 10, 2009. There were some technical problems at the start due to the serial port not working reliably, but that has been resolved and the piece has been running smoothly for over three months without any intervention needed. The opening night was on Dec. 10, 1009. During that time we have had a number of people viewing it, playing with it, talking about it and thinking about it. Some of the observations included:

- A Vancouver Curator noted how the disappearance of portions of the image contributed significantly to the reception and meaning of the images within the work. She observed that the image disappearing before the viewer was an interesting antithetical contrast to interactive results she observed in other works.

- People were captivated and puzzled by the switching action of the switch glass. The attendees walked back and forth with a distinct puzzled look while interacting with the switching glass to try and figure out what was going on. They would only become aware when it was pointed out to them that there were motion detectors above their heads. The interactive element that we were aiming for appears to have been achieved.

- Several individuals on opening night commented on the anti aesthetic nature of the landscapes (building sites, razed lands, fallen trees). Some comments included that they were not typical, that they countered the usual aesthetically pleasing tradition of landscape and this activated a narrative thematic within the work.

- Some viewers also noted that the population of portraits aptly represented the cosmopolitan cultural array of Vancouver.

We also check on it periodically and ask the staff how people are responding. The comments have ranged from they didn't notice it to people like it. There haven't been any negative responses that we are aware of.

One of the challenges of the pieces was to select projectors that were bright enough since the privacy glass does not provide as effective projection quality as high quality screen material. Thus, even with 13,000 lumens per projector, the image is not viewable during the day and is not bright inside the room due to ambient light.

The imagery is best seen at night from outside. However, the transitions of the glass provides a dynamic piece that provides surprise. Using a Poisson distribution for the scheduling of the glass to turn on and off also provides an organic feel to the changing glass. Likewise, the motion detectors dramatic impact on the windows capture attention of people passing by who look into the piece and also into the room where people are playing, providing a connection between the people inside and out.

The process of photographing the images for *Flow* focused and elaborated the core concepts of *Flow:* flow; histories lost and rewritten; and disappearance. It also brought new concepts to the work during production, such as the character strategies and development, the concept of 'friending' images and the interactive web component. These elements along with the core concepts, became central to the work.

The process of creating a collaborative artwork leads to many new ideas, artistic and technical developments and the need for discussions and mechanisms to resolve differences. Further, technical limitations also contributed to the final outcome for Flow. For example, we originally planned to have a small video camera capturing people as they moved around a particular hallway in the community centre. The person's silhouette would be extracted using computer vision methods, stored in a database and then used at different times in the scene in appropriately tagged locations. Limitation in the quality of the images and the effort to tag the image database prevented us from doing this. Another example is the interaction interpretation of the glass. From one perspective, images disappearing as viewers approach the glass provides an anti-reinforcement as they lose the image; however, from another, they can control the glass which provides its own aesthetic. This element can be seen either way and provides different interpretations for the participant even though the artists had different perspectives in mind. Other elements not under our control also required us to re-think some of our artistic and technical choices such as location of the work, cable runs, projector limitations, the use of video versus still imagery etc. For a project of this scale, these changes are expected and we regard this as an important lesson to be passed along to other artists planning large scale public installation work that is planned for extended durations.

5.CONCLUSIONS

Creating and producing *Flow* provided many challenges and many conceptual, aesthetic and technical discoveries. All of these circumstances culminated in the installation of a work that coalesced into a greatly enhanced manifestation of our original proposal to the competition for a public artwork at 1 Kingsway. While each of us worked independently on various aspects of *Flow,* the basic concepts that we outlined originally, while not

binding or restrictive, guided us to a common end. Changes to photography, concepts, software were constant over the 4 ½ year production. These changes were illustrative of creative process that adapts to deeper understanding of the work being produced. In the end, the community centre has a significant artwork that provides an identity for the building and their community.

6.ACKNOWLEDGMENTS

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