

Algorithmic cinema and collective memory

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Abstract: The Pixeldust project is a contributory, interactive video/audio/text engine that can be output to many different forms of exhibition. It is conceived of as a form of algorithmic filmmaking, that blends the aesthetics and visual power of cinema with the flexibility and mutability of computer programming. Written in the Processing language, the Pixeldust engine accepts photographic portraits, disassembles them into component pixels and particles that lie like dust in the bottom of the projected screen, then dramatically sweeps them up and crystallizes them into a complete portrait accompanied by the spoken word attributed to the portrayed person. Pixeldust is a platform that encourages individuals and communities to share their own examples of inspirational people.

Keywords: Digital Art; Collective Memory; Algorithmic Filmmaking; Processing.

Cinema algorítmico e memória coletiva

Resumo: O projeto Pixeldust é um mecanismo interativo de vídeo/áudio/texto que pode ser distribuído em diversas formas de exibição. É concebido como uma forma de cinema algorítmico, que combina a estética e o poder visual do cinema com a flexibilidade e a mutabilidade da programação de computadores. Escrito na linguagem de processamento, o mecanismo Pixeldust aceita retratos fotográficos, desmonta-os em pixels e partículas componentes que ficam como poeira na parte inferior da tela projetada, depois os varre dramaticamente e os cristaliza em um retrato completo acompanhado pela palavra falada atribuída para a pessoa retratada. Pixeldust é uma plataforma que incentiva indivíduos e comunidades a compartilhar seus próprios exemplos de pessoas inspiradas.

Palavras-chave: Arte Digital; Memória Coletiva; Produção de Filmes Algorítmicos; Processamento.

Introduction

We live in troubling times – in a period of human rights abuses, economic disparity, migration crises, contagions, and the threat of global warming. Despite these challenges, courageous individuals and dynamic grassroots movements have stepped forward to respond to our crises. Climate change scientists have become more vocal, publicly raising awareness of the danger of global warming. Young people have emerged as active challengers of the perpetrators of our global problems. Women and people of color are entering the electoral arena by margins never seen before. The March for Science brought hundreds of thousands of defenders of science into the streets. Women's Marches for equality and against sexual violence have taken place in Mexico, Chile, India and all over the globe. Popular uprisings and public expressions for peace, equality, independence, justice, indigenous rights, and human rights have spread rapidly, despite the rise of authoritarian regimes in many parts of the world. Art and technology are not separate or apart from these major social shifts in the world, nor should they be.



Figure 1. Screen capture sequence of Nelson Mandela progression from blurred pixeldust to focused pixeldust

Description

Our visual artist/programmer team sought to produce a work that would prove inspirational during these trying times. Many people find inspiration in those who have faced challenging times in their lives, yet managed to maintain their resilience, and ultimately emerged stronger, powerful and victorious. We asked ourselves how can we use our skills to inspire people from these historical lessons? Our inquiry led us to consider people we admired and to understand how they faced challenging and dark moments in their life. Curiosity led us into libraries in pursuit of personal letters, diaries and autobiographies of inspirational figures, searching for personal statements where our subjects expressed their fears and failures, and often questioned themselves, considered giving up, or concluded that they would ultimately be failures. These personal thoughts were not easy to find, as famous people are remembered more from their words from their positions of power and influence, not from their weaknesses and despair. We wanted to find statements written from their own hands, and not from the position of a once or twice-removed biographer. We sought words that expressed the oftentimes banality of their doubts and misgivings, to remind us that all people face everyday trials and tribulations. Famous women's rights activist Susan B. Anthony, for example, wrote how she was destitute from her life of activism and loathed having to borrow money from her family to survive (HARPER, 1898). We gathered these quotes of obstacles and shortcomings to gain strength from people who kept faith and persevered to move forward to make an enormous impact in the world.

Our Pixeldust team chose ten public figures known around the world by their recognizable silhouettes and the acknowledgement that there was no doubt that they had an enormous impact on world. We realized some of the initial figures we chose could be controversial to some, knowing that one person's hero/heroine is not necessarily another person's hero/heroine, but our choices left no doubt that personal trials and tribulations were overcome to achieve ultimate vindication. Nelson Mandela, for example, described how he questioned his sanity by talking with the cockroaches in his jail cell where he lived for over 25 years, yet he emerged to become President of South Africa, and one of the most admired people on the planet (MANDELA, 1994).

We wanted to bring this wisdom back to life, where from our contemporary historical vantage point we have the luxury of knowing how these human beings became the icons we recognize them as today. We wondered how we could use our video, audio, research and programming skills to do that. In selecting the first group of people we wanted to highlight, we recognized that we all have our own inspirational figures who loom large in our lives, and we aimed to build a platform whereby others could also share their own inspirations from other parts of the world, from other regions and cultures. We conceived a future engine whereby people around the world could contribute to this pool of wisdom. This required not a static repository but a digital engine that would ultimately drive this collective memory machine.



Figure 2. Installation view of Susan B. Anthony final frame as pixeldust begins to fall to the bottom of the screen.

Pixeldust 1.1

The experience we wanted to create was a personal one, a one-on-one or small group experience, akin to a confessional box (known well by several of us!) where the viewer was alone with their own thoughts and the thoughts of the figure. We built our initial vision in our studio at Verge Center for the Arts in Sacramento, California, and invited the public to experience it during an open studios weekend event. The participant entered the darkened space of the black box (roughly 12 feet long by 8 feet wide) by parting black velvet curtains. On the wall facing the viewer was a gently rolling layer of "dust" particles that swished slowly back and forth at the bottom of the wall. There was a slight sound of wind. As the viewer's eyes started to adjust to the darkness, they were confronted by the only object

in the room, a glowing blue hand towards the center of the room. The hand beckoned the viewer to extend their own hand towards it, and when they did, the wind noise kicked up, and the “dust” on the wall began to swirl into the air. A voice began, and the viewer listened to the quote that was chosen from our research. While the pixel “dust” swirled as the voice began, much in the manner of a murmuration of birds, the “specks” periodically flocked together to dynamically form images that illustrated certain emphasized key words from the speech, and then dissipate once again into murmuration. The viewer still had no idea who was speaking, as the speaker was never identified, and when the quote was almost finished, the pixel “dust” began to flock together again to form the image of a face. At the very conclusion of the quote the dust moved into position to form the icon of the person who said the quote, revealing the speakers identity. The image held for a second, and then the specks of “pixeldust” dropped back down to the floor, where they once more gently swirled around waiting for another human trigger from the blue glowing hand.

Process

The Pixeldust engine was designed to input a recorded sound file narrated and recorded from an extracted segment from a personal text found in archival material. The recording process itself was an integral part of the project, and a means to integrate public involvement into the project. Once a text was chosen from an individual we wanted to highlight, we would approach a person in the community who might have some personal connection to the story we were telling. The recording process would progress in the exact same order each time. The recordist would meet the person who agreed to narrate a section for the project, but the content and subject would not be given in advance. The community volunteer would be given the quote on a piece of paper and asked to read it into the microphone a few times. After the initial takes, the recordist would ask the person if they knew who the quote was from. In only one instance did someone guess correctly. Afterward, we revealed who the quote originated from, and then with that knowledge, they would be asked to record the quote a few more times, to see if they recited the quote differently or not. In all of these cases, it was a very meaningful event for both the narrator and the recordist.

These are the quotes that were recorded and integrated into the Pixeldust engine:

Nelson Mandela:

I was locked up for twenty three hours a day, with thirty minutes of exercise in the morning and again in the afternoon. I had never been in isolation before, and every hour seemed like a year. There was no natural light in my cell; a single bulb burned overhead twenty-four hours a day. I had nothing to read, nothing to write on or with, no one to talk to. The mind begins to turn in on itself, and one desperately wants something outside of oneself on which to fix one's attention. After a time in solitary, I relished the company even of the insects in my cell, and found myself on the verge of initiating conversations with a cockroach.

Ho Chi Minh

The bedbugs are swarming round like army tanks on maneuvers,
While the mosquitoes form squadrons, attacking like fighter planes.
My heart travels a thousand li toward my native land.
My dream intertwines with sadness like a skein of a thousand threads.
Innocent, I have now endured a whole year in prison.
Using my tears for ink, I turn my thoughts into verses.
Misfortune is a test of people's fidelity.

Those who protest at injustice are people of true merit.
When the prison doors are opened, the real dragon will fly out.

Albert Einstein

I am truly a “lone traveler” and have never belonged to my country, my home, my friends, or even my immediate family, with my whole heart; in the face of all these ties, I have never lost a sense of distance and a need for solitude—feelings which increase with the years. How strange is the lot of us mortals! Each of us is here for a brief sojourn; for what purpose he knows not, though he sometimes thinks he senses it. But without deeper reflection one knows from daily life that one exists for other people—first of all for those upon whose smiles and well-being our own happiness is totally dependent, and then for the many, unknown to us, to whose destinies we are bound by the ties of sympathy.

Cesar Chavez

It all comes down to the question of what we are going to do on earth. Are we here to make money? Are we here just to get what we can for ourselves? Or are we here to do something for our brothers? You really can't help people unless you are willing to sacrifice yourself because first there are always greater demands upon your time than you can take care of and second, everything you do becomes controversial. So you have these attacks against you all the time. That is the sacrifice. Our lives are really all that belong to us. Only by giving our lives do we find life.

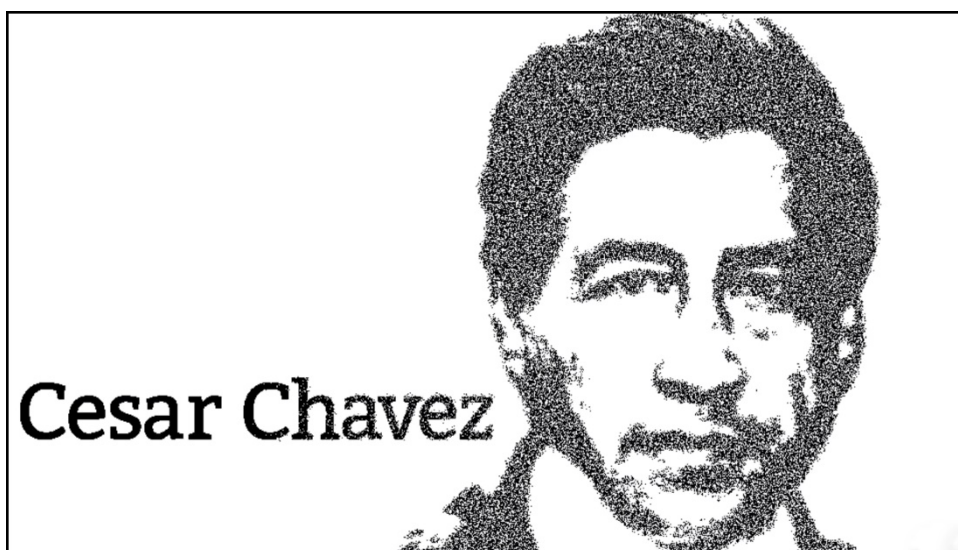


Figure 3. Still of time-based screen capture of Cesar Chavez.

Che Guevara

Full of inner life and nothing more. A collection of failures of every kind, and unchanging sources of hope. Decidedly I am one given to optimistic fatalism.

My studies are at a standstill: I read very little medicine and a little more literature, but I hardly ever write anything. As to public relations, they are more or less the same as before; I haven't made any really worthwhile friendship, either intellectual or sexual.

I had a project for my life which involved ten years of wandering, then some years of medical studies and, if any time was left, the great adventure of physics. Now that is all over. The only clear thing is that the ten years of wandering look like being more, but it will be very different from the kind I imagined.

Angela Davis

This cell was slightly larger than mine. The walls were painted the same drab gray, the concrete floors the same institutional rust-color. It contained bunk-beds—metal slabs extending from the wall, with a thin mattress like the one I slept on every night. There were a few other superficial differences between it and my cell—the toilet bowl was not attached to the sink, and there was a shower inside. But the only difference to me was the skylight above. By this time I was so starved for a bit of natural light that I rejoiced when I discovered that on occasion I would be able to tell whether it was light or dark outside. The skylight was translucent, rather than transparent, so I could not really see the sky, but I could hear airplanes passing above and on rainy days the monotony of my surroundings would be broken by the sound of raindrops. In my nighttime dream fantasies, I climbed through this skylight to freedom.

Mother Jones

I was put in the cellar under the courthouse. It was a cold, terrible place, without heat, damp and dark. I slept in my clothes by day, and at night I fought great sewer rats with a beer bottle. The hours dragged underground. Day was perpetual twilight and night was deep night. I watched people's feet from my cellar window; miners' feet in old shoes; soldiers' feet, well shod in government leather; the shoes of women with the heels run down; the dilapidated shoes of children; barefooted boys. The children would scrooch down and wave to me but the soldiers shooed them off. A red glare from the mills lighted the sky. It made me think of Hell. Injustice boils in men's hearts as does steel in its caldron, ready to pour, white hot, in the fullness of time. The producer, not the meek, shall inherit the earth. Not today perhaps, nor tomorrow, but over the rim of the years my old eyes can see the coming of another day.

Frida Kahlo

I am not dumb; my memory is very bad; and I am very sensitive. My health is the worst. I do not consider myself very weak, but I would like to be stronger. I would like others to think that I am useful; to give the impression of cleanliness and beauty; to come across as intelligent. One should fight with the strongest and with the weakest, to bring the strong one down to the level of the other, and to make the weak one stronger. Only some laws should be obeyed. I have broken many social norms. I have not regretted the things that I have done.

Susan B. Anthony

I never was so poor in purse and I fear to end another campaign with a heavy debt to still further encroach upon my small savings. I can not bear to make myself dependent upon relatives for the food I eat and the clothes I wear; I never have done it and hope I may never have to. Perhaps I may feel a renewed faith in myself and my work but the past years have brought me so much isolation and spiritual loneliness, although in the midst of crowds, that I confess to a longing to stay for awhile among my own people.

I have been as a hewer of wood and a drawer of water to this movement. I know nothing and have known nothing of oratory or rhetoric. Whatever I have done has been done because I wanted to see better conditions, better surroundings, better circumstances for women.

Rosa Luxemburg

I need company, I'm sad, and I want to make a confession. The last few days I've been angry and therefore unhappy and therefore sick. Or was the order reversed: was I sick and therefore unhappy and hence angry? I don't know

anymore. Now I'm well again, and I vow never, ever again to lend an ear to my inner demons. Can you blame me that I'm sometimes unhappy because I always have to see and hear from a distance those things that for me mean life and happiness? But yes, go ahead and scold me, I swear that from now on I will be patience and gentleness and gratitude itself. Good lord, don't I have reason enough to be grateful and joyful, since the sun is shining down on me so and the birds are singing their age-old song, whose meaning I have grasped so well?

The Algorithmic Engine

Scrawled on napkins, our early visions for Pixeldust described a system of algorithmically-generated cinematic events comprised of text, sound and image. Specific words within the audio files would trigger time-based changes when played. In essence, the audio file of the quotation would serve as a score triggering dramatic, murmuration-like formations of the pixeldust at key moments. The pixeldust would momentarily coalesce into an almost recognizable image (intermediary images) before the specks would dissipate quickly, intentionally creating a visual field of random and rhythmic movements, before coalescing into the next image and finally forming a portrait of the author of the quote at the end.

The visual research for the project included strategically selecting source images from the artist team's personal photographic archives and public domain collections. Visual unity was achieved by extracting images from their backgrounds and applying grayscale and threshold effects consistently across all images. The intention was to stylize the images while ensuring that they could maintain recognizability for a brief instant when created in real-time by the low-fi, monochromatic and somewhat unpredictable pixeldust. Audience recognition of the final image of the person associated with the quote was especially important.

As the Pixeldust engine reads source images, it generates up to 500,000 tiny pixel objects. Each pixel object is defined with properties of its original location and grayscale level. The pixel object generates a set of dust objects and the pixel object shares its properties of location and grayscale with its associated dust objects. In addition, each dust object has its own properties of time, direction, speed and location. In other words, each pixel object has its own agency, and generates associated dust objects that also have agency. The dust objects can behave both individually, moving along their own random paths, and they can behave collectively, flocking together and breaking apart on cue, creating visually "alive" and fleeting qualities to the images. Not only do all dust objects know their starting locations, but they also intelligently determine time, direction and speed to move when assisting other dust objects to visually and cooperatively coordinate to assemble intermediary images. The dust objects magnetically attract to the darker areas of source images as they seek out their new locations and they know to move off screen when they are no longer needed. The Pixeldust engine orchestrates the events, from swirling specks of dust at the bottom of the frame, to the intermediary formations, to a final gravitational pull that forms the final portrait, all in synch with the recorded sound file.

An important added layer, the viewer ultimately conducts the start of the show. Whenever a viewer's hand reaches toward the glowing acrylic hand a raspberry Pi (a small microprocessor board) senses the interaction and sends a signal via wifi to the Pixeldust program running on a Mac Mini. The Mac Mini then sends data to a video projector mounted on the ceiling to trigger the pixels to start their journeys in synch with the audio. When the audio file of the quote ends, the pixeldust dramatically falls to the bottom of the screen and each dust object

defaults to their simple, random swirling behaviors, waiting for the next trigger of a hand.

As visual artists, our influences come mostly from our involvement in the independent documentary and experimental traditions. Our enthusiasm for building Pixeldust comes from our interest in expanding the practices of cinema and to integrate them into the computer-based environment in novel ways. Marshall McLuhan once said that new mediums often suffer from “rear view thinking” in that new technologies begin as new ways of reproducing old ways of doing things. In the spirit of moving away from “rear view thinking,” we wanted to consider computer code itself as a creative method of cinema rather than merely as a digitizing tool for traditional film and video. Our approach was to use code to create a visual experience that only algorithms could deliver. Pixeldust creates a different image every time and in real-time, when triggered by the user. In this way we create a novel cinematic experience with computer-based algorithms.

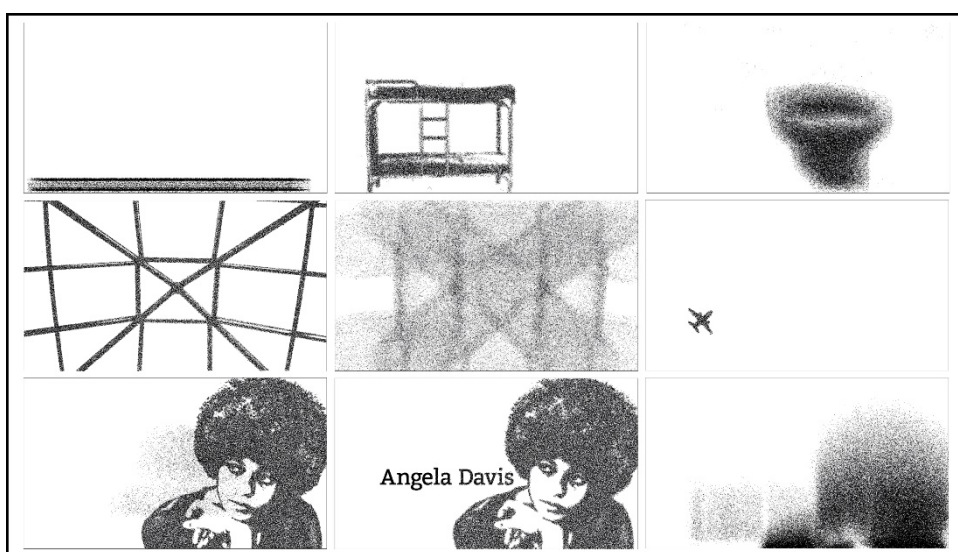


Figure 4. Still of time-based screen capture of Angela Davis sequence. See video here: <https://vimeo.com/258002805>, Password: pixeldust

Acknowledgements

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