

GESTURECLOUD: GESTURE, SURPLUS VALUE AND COLLABORATIVE ART EXCHANGE

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Abstract

GestureCloud is an art collaboration founded by Beijing-based artist Fei Jun and Toronto-based artist Judith Doyle. At the ISEA2013 Creators Session, GestureCloud discussed its collaborative research-creation methodology and gave a demonstration of its Xbox Kinect 3D depth camera modified for motion capture. In addition to describing past and current artistic projects, this text expands on the theoretical concerns raised at GestureCloud's ISEA presentation, such as embodiment in the post-digital present and the changing status of labour. Particular attention is paid to networked installations that harness gesture to trigger physical effects between locations. Different types of value (economic, documentary, social) that may be attributed to gesture are also considered.

Keywords: China-Canada exchange, gesture, labour, visual art, motion capture, Kinect.

Introduction

GestureCloud was initiated in 2010 by Beijing-based artist Fei Jun and Toronto-based artist Judith Doyle, alongside artist-programmers Jim Ruxton, Ken Leung and Ian Murray [1]. The collaboration was sparked by a shared interest in the accelerating proliferation of virtual labour. In their initial assessments of the flow of labour between China and North America, the collaborators distinguished between traditional factory labour and emerging virtual workforces such as those in SecondLife (an online virtual world) and Mechanical Turk (a web service offered through Amazon) [2]. The name GestureCloud was chosen to signal the collaborators' long-term goal of developing a cloud-based gesture dictionary including an inventory of gestural language.

Gesture is considered as a meeting point of discourses and embodied experiences where meaning can be identified and generated. Different aspects of gesture are highlighted, such as its relation to embodiment and forms of labour that are increasingly detached



Fig 1. Wall of gesture animations at the entrance to GestureCloud's interactive installation at China Museum of Digital Art, CMoDA, Beijing, AV@AR 2.0 exhibition, 2013. (© GestureCloud. Photo © Fei Jun.)

from the body. The imbrication of the Internet with everyday life has enacted a number of shifts in the way we understand gesture and embodiment. GestureCloud analyzes, assesses, and seeks to intervene in the future of these shifts. The collaborators have long artistic and professional trajectories working with emerging technologies including early teleculture, fax, and net art. By studying and experimenting with emerging technologies whose meanings, functions and regulations are not yet fully fixed, the collaborators seek to affect how these technologies unfold and network in the future.

Initially, GestureCloud engaged with emerging forms of virtual labour by connecting them to physical ones. As virtual forms of labour emerge, gesture as a by-product of physical labour becomes an important consideration. For example, gestures associated with physical labour hold archival value; they function as traces of work that goes unacknowledged due to its outsourcing to overseas factories or anonymous workers online.

The collaborators adopt a research-creation process. Research-creation is understood to engage a flexible array of studio-based creation practices that both derive from and contribute to new research methodologies. Research-creation activities have included long-distance collaboration that utilizes online and virtual studios, residency-exchanges in both universities, small community

workshops, collaborations with other artist-researchers and students, and networked exhibitions.

Distinct from a continuous flow of movement, GestureCloud identifies gesture in intervals with a beginning, middle and end. These intervals are edited from within the flow of captured motion (input). Once isolated, gestures can be stored, notated and arranged in meaningful sequences (output). The collaborators select from these gestures to create prints. GestureCloud also makes interactive projects including installations, performance events, and art-creation tools. Recently, the collaborators have used 3D depth cameras adapted for motion capture to record gesture on-location and in the studio.

Documenting factory work and re-enacting gestures for motion capture

In January 2010 in Toronto, the collaborators identified a central research question: can labour be transposed via gesture across virtual locations to trigger material effects elsewhere in the world? For example, could the surplus value of gesture generated from factory labour in China activate events in virtual settings, accruing value that would return to the real-world factory workers?

An initial research-creation residency took place in Summer 2010 at the media lab of the Central Academy of Fine Arts (CAFA) in Beijing. The residency

provided an opportunity to prototype an artwork to be installed simultaneously in Beijing and Toronto galleries, linked by sensors that would send data through the SecondLife virtual environment [3].

The collaborators captured gesture data from physical labour in various locations in Beijing (restaurants, factories, construction sites). This included video and audio documentation of sewing, assembly lines, noodle-making, tai chi, and recycling of waste. Gesture research also took place in the Artron Factory in Beijing, a printing factory that produces fine art books. Fei Jun has worked at Artron as a graphic designer. GestureCloud collected video and audio documentation of workers at the factory. The collaborators analyzed this footage and identified a set of gestures that together comprise a factory labour system of actions, including lifting, stacking, trimming, conveying, shredding waste, and taking smoke breaks. The collaborators also sourced Beijing's Zhongguancun Electronics Market, finding parts to build a prototype of a robotic tripod head that could mount camera or projector, to be controlled across networks using gesture.

During the residency, GestureCloud created material and virtual components for its networked installations, considering aspects of exchange, value, embodiment, and automation. The collaborators set out to find how gestures produced during the course of factory work could be translated into data feeds to drive actions in virtual worlds (ie. SecondLife). These could potentially return value to the workers. The focus was on how real-world labour could be captured as gesture, cached, and loaded into SecondLife in the form of avatar animation files. GestureCloud's hypothesis was that these animations could be used to earn Linden dollars (SecondLife currency) to be converted to other virtual currencies, American dollars, or corporate shares. For example, workers manufacturing mobile phones for Motorola could generate Lindens by transforming their labour "force" into Second Life "camping" (a form of virtual labour in which avatars spend time on a site, thus increasing its traffic and position in search results). The compensation in Lindens for camping would trade for American dollars that could trade again for Motorola shares.

The collaborators had access to a traditional motion capture studio at CAFA in Beijing. They used this studio

to re-enact the set of factory gestures recorded at the Artron printing factory, wearing special suits and gear. The intent was to build a cache including video, audio, and motion capture data that could be organized into a searchable repository of gesture files for digital applications. The motion capture data was converted to BVH file format by Tian Yue, who was also responsible for operating the motion capture recording software during the session. A standard in Maya and other 3D animation software, BVH expresses the relation between skeletal joints over time and is most immediately useful for animating 3D characters. The data can be applied to other outputs including instructions to devices.

The BVH files were imported into the inventory of a specialized SecondLife avatar named Gesture Warden. Working with virtual artist-fabricators – avatars Desdemona Enright and Ian Ah - factory materials and machines were created in SecondLife for Gesture Warden's inventory. These were used as props to demonstrate gesture (a bag of paper shreds to "stomp" on, a box for "stacking," a conveyor belt, etc.).

From materials produced during the residency, GestureCloud made two projects.

Concurrent media installations in Toronto and Beijing

A residency in RMB City included the artists Yam Lau, Adrian Blackwell, and the GestureCloud team. The exhibition, which was curated by Yan Wu, took place at the Japanese Canadian Cultural Centre in Toronto, and subsequently in the SecondLife online virtual world. The exhibition was conceived as a virtual residency entwined with a gallery manifestation. At Gendai, GestureCloud created a media installation. A montage of animations and documentary video footage of factory workers was projected on the gallery walls. A micro-projector attached to a robotic tripod head was used. Virtual factory workers appeared in different zones, evoking a virtual factory space. Fei Jun used an identical installation kit for his exhibition "Stranger: Fei Jun Works" at offiCina Beijing, in the 798 gallery district, curated by Feng Boyi. The two installations in Toronto and China ran concurrently. Gendai was also the site of a curatorial discussion conducted via SecondLife with real-world participants located in Toronto and Beijing. The

value that returns to factory workers in this pair of joint exhibitions is symbolic, given to the workers through their expanded presence in both galleries [4].

A gesture vending machine in the SecondLife online virtual world

After the gallery exhibitions in Toronto and in Beijing, the participating artists created a virtual installation in RMB City, the extensive Second Life sim and curatorial project of Beijing-based artist Cao Fei. Named after the official currency of China, the Renminbi, RMB City literally translates as "Money City." The virtual architecture and art projects there reference the accelerated demolition and construction in Beijing around the time of the 2008 Olympic Games.

In RMB City, the GestureCloud vending machine was framed by expository signage with video of the Artron factory workers to the left and video of the gesture animations to the right. These didactic panels revealed the documentary origins of the gestures. From the vending machine, SecondLife avatars could test and buy animations with Lindens, the in-world currency. The avatar Gesture Warden holds the accumulated Lindens in its inventory. Anyone with access to SecondLife can log on using Gesture Warden's password, and collect Lindens from the sale of gestures from the vending machine. However, the exchange rate for Lindens is extremely low when traded for American dollars or Chinese yuan. The greatest exchange value is within the online virtual world itself.

Similar to the exchange rates of different currencies, the physical and the virtual cannot be made to mirror each other equally. Subsequently, GestureCloud ascertained that generating value that could accrue for factory workers would require more sustained and meaningful connections between physical workplaces and virtual ones. The next phase of research would consider how to record gesture on location, and how to link media installations that could work as portals.

A system for on-location motion capture

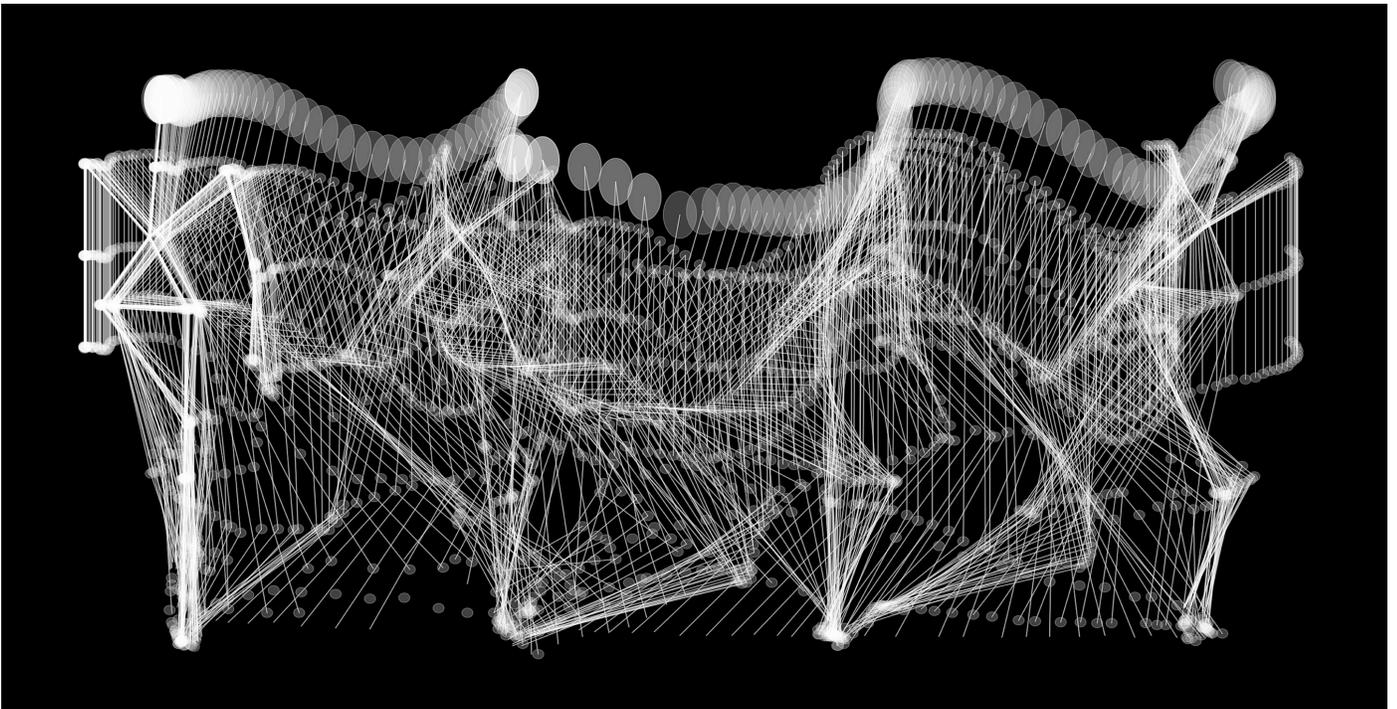


Fig. 2. Runtime, digital print, GestureCloud, 2012. The data for the print was captured using GestureCloud's Xbox Kinect-based 3D depth camera and applications for recording gesture on location. (© GestureCloud.)

During GestureCloud's second Beijing residency in 2011 the collaborators including Fei Jun, Judith Doyle, and Ken Leung developed a prototype system for on-location motion capture. The system includes the Xbox Kinect, open source code and Processing programming.

The unit included a laptop, an Xbox Kinect 3D depth camera, and a digital video camera. The two cameras were tethered to and powered by a car cigarette lighter-adaptor. This prototype was tested on location in a Beijing car wash and a family-run restaurant near the Great Wall of China.

Using this unit, the collaborators captured and encoded movement by workers on location, to be subsequently edited into gestural units. Benefits included lower cost and greater flexibility than performance in the cumbersome motion capture studio, and more direct worker participation. The disadvantages included much lower resolution data and the difficulties associated with capturing leg movement. Also, this system was too expensive to be installed and left as a dedicated unit on location; its drivers and software were complicated to install and troubleshoot.

Social Media and Collaboration Lab (SMAClab) Toronto

Judith Doyle is the Principal Investigator at the Social Media and

Collaboration Lab (SMAClab) at OCAD University in Toronto. Since 2012, GestureCloud's research has been based in this lab. In Spring 2012, GestureCloud was awarded funding by the Federal Economic Development Agency for Southern Ontario (Fed Dev ARC 2) for activity based at the SMAClab. The Fed Dev project was intended to investigate gesture representation and generate art and art creation tools (software modifications, computer files, physical systems) incorporating motion capture and 3D depth cameras.

The collaborators developed a suite of applications using an Xbox Kinect and skeletal tracking for full-body gesture capture. The applications are intended for use as artist toolkits for sonic art installation, video compositing, character animation and figurative drawing.

GestureCloud investigated how to identify and organize gestural units. The focus was on how to record, store, and transfer gesture in a meaningful way for the creation of networked installations – specifically how gestures recorded by the Xbox Kinect could activate effects, such as turning on a light bulb, across countries.

GestureCloud's Xbox Kinect-based 3D depth camera uses a modified skeletal tracking system that calibrates the relative depth positions

of 20 joints in the shoulders, torso, arms and legs. This data is collected from full-body motion within the Kinect's field of view (roughly twelve feet wide). Data flows to drivers, activating Open NI / NITE (a proprietary 3D sensing software that is free to use). OSCeletion is an open source software that makes NITE data available to GestureCloud's processing software, presently in development. GestureCloud's own programming generates the PDF files and/or HDMI display. The Runtime print was made with a PDF from a five-second motion capture thus obtained. Viewers can also generate real-time displays of their own movements, for example, in sweeps of overlapping figures that refresh every five seconds [5].



Fig. 3. GestureCloud's 3D depth camera and projection unit, incorporating an Xbox Kinect, microcomputer and applications, housed in a 3D printed shell with a tripod mount (© GestureCloud.)

Art-historical antecedents

When cinematic technologies began to emerge, artist-inventors adopted these new tools, devising new approaches to portraying and organizing gesture. The motion 'study' as a durational unit or loop (a zoetrope-like visual structure) emerged in late nineteenth century research undertaken by Edward Muybridge and Étienne-Jules Marey. Marey and Muybridge used then-emerging, proto-cinematic technologies to shape understandings of embodiment, motion and time. Both Muybridge and Marey developed lab-studios that were optimized for capturing figurative images of people and animals using new techniques. The lab-studios also generated dissemination formats (prints and projections) that were presented to artists and collectors.

Muybridge's 781 motion studies (1884-1885) are widely understood as quantitatively obtained, scientific in both intent and methodology. Yet, elements of creative artifice enhanced the research results. Marta Braun deconstructs Muybridge's "tactics - insertion, expansion, contraction, substitution... to stage motion studies frame-by-frame for the camera" [6]. Marey adapted his laboratory and recording tools to capture useful images: "when Marey could not change an instrument any further to suit his subject, he would adapt the subject to suit the instrument" [7]. To capture high-contrast images, Marey photographed white animal subjects, added white lines to a black bodysuit and blackened the lab background. GestureCloud shares an interest with Marey and Muybridge in using emerging technologies to represent the subject of motion. This entails a process of creating new tools and outfitting specialized spaces, both of which combine elements of the laboratory with the art studio. Marey's graphic method distills overlapping frames into static time-lapse images – "chronophotographic" prints and sculptures that reveal gestural trajectories. GestureCloud adopted this chronophotographic method for its "Runtime" application.

Networked installations between Toronto and Beijing

In the Spring of 2013, GestureCloud exhibited interactive installations at CMoDA (China Museum of Digital Arts) and the Art Beijing International Art Fair. For the AV@AR 2.0 exhibition, GestureCloud converted a zone of CMoDA into a symbolic factory

floor where labour - stacking, pulling, stomping, and lifting - was performed by visitors and recorded with an onsite motion capture system. The visitors' efforts powered a light bulb on location in Toronto, across a twelve hour time zone difference.

At the entrance to GestureCloud's exhibit, a collection of flat screen displays showed the series of factory labour gestures developed for the vending machine in the SecondLife RMB City. There was also an audio component that consisted of machine sound recorded live on the Artron factory floor in Beijing. In the adjunct performance zone, participants tried to copy the factory labour gestures while observing themselves on the Runtime display interface. If they successfully triggered the gesture recognition software, a light was activated for ten seconds in Toronto, illuminating a large tree, or, at times, a live performance. There is a twelve hour time difference between Beijing and Toronto, and the illuminated scenes from Toronto were shown on a live Skype feed. Clear text was sent over port 80 (the standard HTTP port) from GestureCloud's dedicated server in Canada to China to avoid triggering automated filtering of other ports (the firewalls).

The show at CMoDA led to an invitation to install at the Art Beijing International Art Fair. For the installation, the Runtime display application played on a large LED screen that visitors interacted with at the entrance into the art fair. Participation was lively and yielded lots of kinetic energy and PDF documentation. However, setting up the show required much technician time for installing software, drivers and programming. It became clear that for future projects, it was necessary to develop an affordable plug and play system that would not require complicated installation and maintenance.

At ISEA 2013 GestureCloud unveiled the first iteration of this 3D depth camera unit, including an Xbox Kinect, an inexpensive microcomputer with embedded programming, and a 3D printed shell with a tripod mount. The unit includes HDMI output interactive media installation. GestureCloud has begun customizing applications for differently-abled users, and field-testing the unit for on-location motion capture and interactive public art projects.

Conclusion

The formation of GestureCloud was spurred by changing forms of labour and embodiment as impacted upon by contemporary technology and digital conditions. What makes this subject matter so ripe for consideration, both artistic and otherwise, is its emergent, still-undefined nature. This allows for the possibility of intervention - changing the course of a still-developing process. Therefore, new technologies that have not yet been adapted or considered as art-making tools are ideal for attempting such interventions.

Most recently, this activity has taken the form of a portable motion capture system, the early iteration of which was shown in exhibitions in Beijing and at the ISEA 2013 conference. Since the camera-projector unit works for real-time, on-location motion capture and as a projector, it is an ideal tool for opening up "portals" between locations, such as a museum in Beijing and an art studio in Toronto. These portals, occurring in the context of networked installations, can be thought of as temporary allegiances that are context-specific and project-based. It opens up the possibility for portals to be initiated and maintained without extensive technical expertise. The system can also be used as a sustainable tool to facilitate art collaborations and small-scale



Fig. 4. Choreographer Spirit Synod testing GestureCloud software for wheelchair applicability at the Social Media and Collaboration Lab (SMAClab) OCAD University, Toronto, 2013. (Photo © Judith Doyle)

residencies. It could decrease the need for physical travel between countries, and even continents, to facilitate collaboration.

This system is inherently hybrid in nature; it is only activated through the simultaneous engagement of the physical realm and the virtual realm. The SecondLife project, for example, relied upon a continual process of “translation”, from documentary-recorded gestures that were re-performed and saved as BVH files, and traces of physical labour that were reconfigured and sold for use by online avatars. The currency attributed to a product made in a factory is not the same currency used to purchase virtual inventory including animations, clothing items and furniture in SecondLife. The physical and virtual cannot be separated into discrete realms, nor can they be made to mirror each other equally. The intent is for GestureCloud’s systems to function as reciprocal circuits, rather than virtual ones that supplant the physical.

Future GestureCloud projects will utilize this hybrid approach and take place in settings that engage local artists and working communities, particularly those whose forms of work, object-making, and craftsmanship are disappearing. Gesture is a form of cultural production that can be endangered and jeopardized, therefore location-based 3D imaging will have documentary and archival applications.

In January 2014, collaborator Judith Doyle will be teaching a workshop titled GestureLab at the National Institute of Design in Bangalore, India. The workshop will address the residency’s theme – the Moving Image in India. The project will begin with a workshop that identifies community-specific gestures of labour in factories or communities. These will then be recorded on location, with 3D depth cameras and digital video. The residency will culminate in an expanded cinema installation incorporating these documentary materials.

The goal of returning value to the workers who generated gesture prompted GestureCloud to experiment with hybrid forms of value, including self-representation and long-distance exchange. These issues will be explored in the upcoming residency in India, and in another new project - a site-specific installation to be mounted in a Beijing factory. In this work, GestureCloud intends to implement local community portals for collaboration. These will contribute to the editorial development

of a dictionary publication to organize and archive gesture.

References and Notes

1. The lead programmer during this residency was Jim Ruxton, working alongside technicians Ken Leung, Wang Liming, Tian Yue, and Ian Murray. The residency was funded by the Canada Council for the Arts.
2. Mechanical Turk users post jobs – what the service refers to as Human Intelligence Tasks – that are completed by remote workers, usually for very little pay. The service has produced a large and cheap workforce that functions in a decentralized manner.
3. For further details about this residency, see <http://www.readingpictures.com/gesturecloud/>.
4. For video documentation of GestureCloud's exhibition at Gendai Gallery, see: <http://vimeo.com/20168035>.
5. For video documentation of GestureCloud's interactive installation at Art Beijing, see: <http://vimeo.com/67425782>.
6. Marta Braun, *Picturing Time: The Work of Etienne-Jules Marey (1830-1904)* (Chicago: University of Chicago Press, 1994).
7. Braun [6].