# BODY GRAFFITI: EXPRESSIVE WEARABLE ART THROUGH BODILY PERFORMANCE

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A wearable art itself can be an expressive media platform and when it is worn by a performer, it elevates expression of body language combining two forms of media that have been so close to art and technology - wearable and performance. This paper introduces “Body Graffiti”, a performance wearable art project that uses the illusion of POV (persistence of vision) technology to create ephemeral graffiti via bodily movement.

*Fig 1. Body Graffiti Performance with B-Boy Crew, Last For One, HCI Korea 2010, Younghui Kim*

*Fig 2. Body Graffiti(Testing Prototype, hand sewn electronic circuit with LilyPad Arduino), 2009, Younghui Kim*

*Fig 3. Body Graffiti v.2, The Swing Boots, 2011, Younghui Kim*

## Introduction

Like many fine artists with technological background, modern & experimental dancers in the age of digital media have been early adopters of wearable technology. It seems obvious as the wearable itself can be an expressive media platform and at the same time, worn by a performer, it elevates expression of body language as creating a stronger media platform combining two forms of media that have been so close to art and technology - wearable and performance. This paper introduces “Body Graffiti”, a performance wearable art project that uses the illusion of POV (persistence of vision) technology to create ephemeral graffiti via bodily movement. The artist creates and utilizes this newly developed wearable platform in order to express and communicate her contextual messages and suggests the significance of creating a "wearing" technology art project by presenting the creative development process, as well as future variations of “Body Graffiti.”

## Background

About a few decades ago when wearable technology was introduced as a new form of human-computer interaction, a small group of media artists with technology background paid a great attention to it as a new form of expressive media to explore.  Today, wearable technology has become more accessible to designers and artists and wearable has become a new subject of research for its abilities to transform physical interface of information technology into clothes to wear. While they were in search for innovative new flexible technology solutions, many found out that wearable computing facilitates a new form of human-computer interaction because the user can compute by one's body while wearing it. Furthermore, interaction can be operated by simple bodily gestures or its surrounding elements such as noises, temperature and WIFI signals while walking or doing various activities.

There have been great interests by artists in wearable as a form of new media art since it brought out innovative significance in communicative art. Especially in interactive dance or performance like N.I.M.E. (New Interface for Musical Expression) artists can take full advantage of expressive choreographies of wearable technology media. Diverse experimental wearable projects have been showcased at the international exhibitions like ACM SIGGRAPH Cyber Fashion Shows, FutureFashion Event, Seamless, Social Fabrics and more during 2000s.

At a glance, Interactive wearable computing seems to be a natural adaptation of physical computing as clothing is ubiquitous with physical interface. In a comparison with portable devices like mobile phones, one can see obvious behavioral difference between being 'wearable' and 'portable.' The computer being wearable introduces drastic changes in how we communicate and compute. Further more, fashioning element enhanced with interactive technology creates a new form of computing media that is more responsive and expressive for both creators and wearers. This shows that not only wearable media brings the new condition of wearing an actual computer on body but it also introduces significant changes in ways a user computes using one's body whether its a gesture or a temperature body emits. Therefore wearable art can be investigated for being a powerful means for expressionism of everyday life activities and performances through interaction.

## Body Graffiti

The "Body Graffiti" projects started with a simple idea for a new performable digital media public art that doesn't require a stage set or a big screen in urban streets. Performers like B-boys(Breaking dancers) are originated from street art scene just like graffiti artists, and they can be defined as public art performers. There is no simple definition of street art yet, here is how the online publication; Art Radar Asia defines 'street art'.

With anti-capitalist and rebellious undertones, it is a democratic form of popular public art probably best understood by seeing it in situ.  It is not limited to the gallery nor easily collected or possessed by those who may turn art into a trophy. Considered by some a nuisance, for others street art is a tool for communicating views of dissent, asking difficult questions and expressing political concerns. [1]

Graffiti arts are drawn in urban public space to communicate messages whether they mean political or not. You can find tap dancers or b-boys in public streets or parks in urban cities like Seoul or New York City, performing outside of structured theatrical environments. Combining elements of strong graphic message with the street performing art, the POV driven technological platform for "Body Graffiti" was invented in a wearable format using basic electronic technology with a microcontroller embedded hardware, Arduino. [2]

Observing the performers like B-boys who express in their fierce body language, the idea of enhancing their bodily expression using wearable media reacting to their dancing motion, was conceived in 2007 when the artist moved to Seoul to teach and research further in interactive art.  She had been looking for new collaborators to experiment POV technology on wearable costume for dancers to test on POV displays with their movements.

In 2009, the WCU Digital Media Public Art Research Lab [3] was founded with a support by the Ministry of Education, Science and Technology through the National Research Foundation of Korea. As a participating researcher, the artist was able to develop the newest prototype of "Body Graffiti" wearable project.

The wearable project requires to be designed with a great knowledge in both art and technology combined. Thus, it requires a long process of researching in various materials and technologies as well as developing an actual working prototype in a breadboard and then, clothing. Especially for dance performances, the wearable garments had to be comfortable and durable from fierce bodily movement. Additionally, unlike of the other physical computing applications such as installations and interactive objects, wearable computing applications force artists to de-construct the conventional 2-dimensional electronic circuit system and rewire into a flexible 3-dimensional electronic circuit system transforming it to be integrated seamlessly into soft clothing design with strong wearability. [4]

The Body Graffiti for the b-boy performance had been an on-going collaborative project from beginning. There had been multiple prototypes of "Body Graffiti" in collaboration with the world champion b-boy crew, 'Last for One. In this performance wearable project, the artist tested the POV system interacting with specific dancer's movement with a couple of small testing prototypes first.

POV, Persistence Of Vision is the phenomenon of the eye by which an afterimage is thought to persist for approximately one twenty-fifth of a second on the retina. A common application is a flipbook animation. POV display is a technology that composes an image by displaying one spatial portion at a time in rapid succession (for example, one column of pixels every few milliseconds). In the project, "Body Graffiti" has used 2D POV display technology accomplished by means of rapidly moving a single row of LEDs along a linear or circular path. The viewer can perceive the image as a whole as long as the entire path is completed during the visual persistence time of the human eye. A further effect is often to give the illusion of the image floating in mid-air. [5]

With a technical collaboration from the fellow researcher, Dan Mikesell, the artist made a jump rope using 8 LED pixels at first. The POV image was somewhat recognizable in bare eyes during the jump rope swings so, she moved to the next version using a LilyPad Arduino with 16 smaller red LED pixels and hand-sew the whole circuit using 2-ply conductive thread. When wearable computing projects are involved, the Lilypad Arduino, designed by the Sparklab [6] and Leah Beachley, [7] conductive thread or fabrics, metallic connectors like snap buttons, and light batteries are common ingredients. The second small prototype was sewn into a pair of sneakers where LEDs were embedded on the outer layer. However, after the first meeting and rehearsal with the b-boy team, it was soon realized that POV display on the sneakers limits the visibility of the graffiti message because of the breaking dancers' certain angle of movements.

The next sewn circuits with an Lilypad Arduino was purposely made on the small pieces of fabric in order to attach on different spots on the performer's body since wearable has to be designed according to dancer's speed and angle of movements; rotation such as head-spin in the case of break dance. After test-rehearsals with two b-boy dancers who specialize 'head spin' technique, the research team soon found the best suitable spots on the dancers' bodies to perform "Body Graffiti" – chest, back and from ankle to knee part of both sides of legs.

Once wearable forms are decided to be a vest and a pair of leg shields for the better visibility of graphic and textual message to be conveyed, the whole new system was developed quickly. The new system

was built with the custom PCB (Printed Circuit Board) where electronic parts were hand soldered to control 32 LEDs with an Arduino Nano. The electronic circuit and software had to be redesigned and reconfigured to support more number of LED pixels. With this new system, the very first finished version of "Body Graffiti" was developed successfully and performed during HCI Korea 2010. [8]

During the performance, two main b-boy dancers wore the Body Graffiti system embedded in the vests and leg shields and expressed visual graffiti drawn in air, with their body movements. As b-boy dancers perform head spins, windmills and flares, messages programmed in the custom designed LED POV system was displayed. The visual messages for the HCI Korea 2010 performance were graphical icons like a pointing finger and a heart beat with words such as – 'HCI 2010', 'Open Creativity', '창조', a noun meaning 'creativity' in Korean, to emphasize the main theme of the HCI event, "Open Creativity". Therefore, one can say that the performance of the Last For One dancers wearing the "Body Graffiti" was meaningful for its collaborative and creative effort.

## Future Projects

The "Body Graffiti" art projects continued to evolve in both contextually and esthetically after the performance with the b-boys. First, the system has been upgraded with more defined custom PCB design that has become thinner and more flexible with the doubled resolution of a vertical column of 64 LED pixels, where more detailed images can be displayed in the POV display. Also, newly designed PCB has become modular, so that each unit of 8 LEDs can be added up to 64 LEDs when connected together. Each unit can be connected with electronic wire or conductive thread through the connecting sewing holes on the PCB modules, in order to construct the electronic parts into a flexible wearable piece and also to fit better with 3-dimensional shape of human body.

The design variations of the "Body Graffiti" interface have been an on-going exploration. The second variation with the newly upgraded electric circuit system has become a pair of black boots with a column of 64 LEDs each, titled "Body Graffiti, The Swing Boots." The wearer can perform the POV graffiti display on the swing set like one that you see in the playground, or just swing her legs back and forth fast to display POV message. Contextually, it is still in an experimenting stage for the swing boots wearable project. During the exhibition at DALSMA 2011, an exit sign graphic following with a text of "RUN" was performed while swinging the boots. [9] On a swing set, the swinger wore the boots to display the POV graffiti images of a pair of wings on both legs along with a word, 'FLY.' One could imagine, when the "Body Graffiti" swing boots are made in multiple numbers, the wearers could be marching in a formation to demonstrate certain textual messages in public space as an urban performance.

For the newest variation of "Body Graffiti", the context of exchanging meaningful message matters heavily. The audience would catch the moment of movements of lights and remains of its prior existence; the existence of the brief visual text message created by blinking LEDs a brief moment ago. In this version, it is not actually a wearable for the performer but multiple numbers of objects that anyone can perform to throw – they are the "Body Graffiti" Frisbees, working titled as "Throw & Catch (Words)." Each disc will display two words when it is thrown up in the air to be caught. Words are carefully programmed and embedded into the "Body Graffiti" POV platform system by the artist. This project is to demonstrate the physical form of communication through bodily movement, throwing and catching certain words that briefly exist. The project, "Throw & Catch (Words)," was displayed, and performed at the Tukksom Han River public park in Seoul, Korea on the 21st of August, 2011 as a part of a group exhibition titled, "Media Circu(it)s." There were about twelve "Body Graffiti" discs laid out on the grass near

Han River and the public was invited to participate in throwing words around in the evening. The different texts in Korean meaning such as 'I'm better than you', 'I don't want to', 'I envy you' were POV displayed for participants to experience communicating in physical action of throwing and catching the briefly existing textual words that are commonly uneasy to speak out within Korean society, where this art project was exhibited. This new version is to be developed further in different languages in close future.

## Conclusion

'As a wearable communication platform, an electronic textile functions as a dynamic surface around the body that interconnects people and places.' [10] Often, wearable artists take great deals in displaying since the surface of the garment easily becomes visual interface to communicate. Lights are common form of visual expression in wearable technologies since it's easy to control their patterns and movements with micro-controllers.

In some sense, "Body Graffiti" performance with the b-boy crew, "Last For One" was a true form of hybrid art and collaborative creation among dancers and wearable art technology researchers. Like other performing wearable musical interfaces and/or real-time moving images that interact with wearable on performers, it reflects how performing art can be an ideal platform for the wearable media as it provides creative expression for both wearable artist and performers.

The fact that messages for the "Body Graffiti" projects can be reprogrammed easily through the software developed in Processing and Arduino makes "Body Graffiti" a wearable platform. The project wasn't originally created with a functionality of a wearable in mind. Rather, this new wearable display platform was created in the process of exploring context of words and graphic messages displayed through bodily movements of the wearer. Very often, new media artists have to create or reinvent a new technological platform in order to express in new ways and this was the case for the project, "Body Graffiti." Additionally, very expressive ability of the platform opened up new opportunities of creating many different variations of the "Body Graffiti" projects as a result.

"Body Graffiti" isn't just a new wearable platform. It is a statement the wearable creates through performer's bodily movement and the artist's conscious messages combined. Its fast movement and transformation leaves a brief story while blurring its surroundings for its audiences.

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