Extruding the Body with Light to Make Visible the Spatial Relationships inherent in Gesture and Posture

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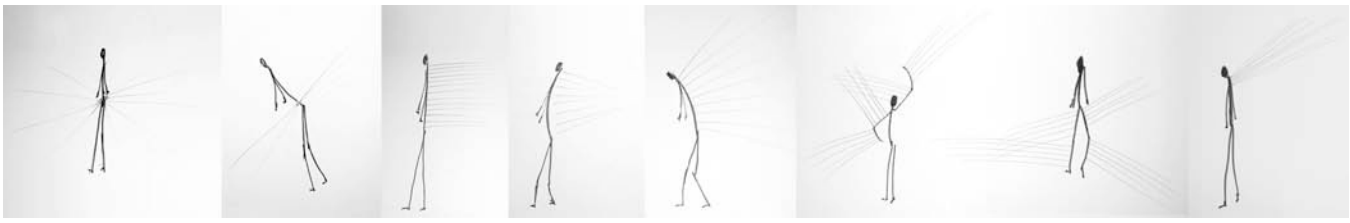

Figure 1: sketches of light-based planar extrusions originating at the hips, spine, arms, legs and shoulder blades.

ABSTRACT

This proposal describes a modular system for creating light-based planar body extrusions that make visible the spatial relationships inherent in gestures and postures.

The aim of the system is to afford clearer insight into the dynamics of gesture, and the spatial interplay between body parts, a person and their surroundings. Two different forms of light-extrusions are proposed.

The system is envisioned to be of use to designers of tangible and embedded interactive systems, bio-mechanists, theatre and performance artists, costume designers, architects, and any who desire to broaden their understanding of the body's dynamic structure and function.

Keywords

light, spatial relationships, gesture, posture, extrusion

INTRODUCTION

The motion of the human body is complex and dynamic. Gaining insight and understanding of the inherent and resulting spatial relationships can prove a rich resource for creating works of art, or with which to inform the design of body-centric interfaces, irrespective of medium or context.

Physically extruding the body allows us to magnify and draw focus to the relative position of different body parts. It also allows us to consider how postures and gestures might impact surrounding space. If the extrusions are realized with light they would not constrict the body, hinder movement, or otherwise affect the wearer or their surroundings, except to inform both wearer and observer of dynamic changes in the resulting spatial relationships. Light, therefore, seems an ideal medium for this purpose.

The proposed system consists of strips of LEDs that can be placed directly on the body. Two different iterations are mooted. The first allows wearer and observer to see points of light at the outer limits of the room – on the floor, walls and ceiling. The second incorporates sufficient artificial smoke to make visible the entire beam of light emitted by each LED, from its origin at the body to the extremities of the room.

By making visible body position and inter-relationships, through magnification and extrusion, the hope is to gain insight into the mechanics as well as the spatial and experiential impact of gesture and posture.

BACKGROUND AND RELATED WORK

Work by the Author

I am currently engaged in an investigation into how technology can be paired with the body to poeticise experience. The research is motivated by the idea that we can access deeper, unfiltered experiences than we normally allow ourselves or access in everyday life, if we engage in full- or core-body actuation and control of sonic and other interfaces. A guiding premise is that through thoughtful, playful, poetic applications of technology to the body we can shift our relationship to our bodies and to technology. Related projects share the aim, with the proposed wearable light arrays, of drawing focus to body position and stimulating movement.

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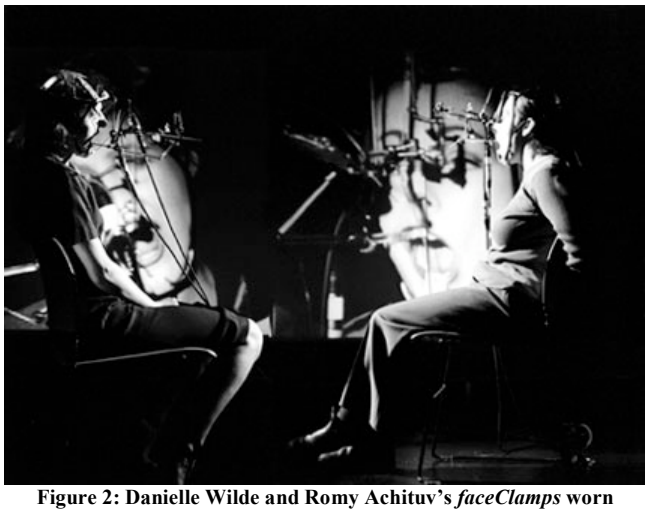

Figure 2: Danielle Wilde and Romy Achituv's *faceClamps* worn here by Yasmeen Godder (left) and Danielle Wilde (right)

*faceClamp*s [1] (fig. 2) precedes the current research project by ten years, but provides a clear example of an interface that affords insight into movement by extruding the body into space. The *faceClamps* physically extrude the face in order to measure the opening and closing of the mouth to control sound. The interface mechanically magnifies the subtle movements of the mouth, so affords both increased visual and higher resolution mechanical reading of the movement than would be available without this extrusion. Additionally, the reading of the movement is augmented through the application of the resulting data to real-time manipulation of sound.

hipDisk [8] (fig. 3) is a self-contained wearable system for performance and play that augments the body with instrumental capabilities. The interface extrudes the body on two horizontal planes, one at the hip and one above the waist. The wearer of *hipDisk* can trigger simple musical tones within a one-octave chromatic scale by tilting their hip and torso towards each other until the two disks touch. Through repetition of this action on different angles, tunes and melodies incorporating any of the twelve notes of the chromatic scale may be performed.

By physically extruding the body above and below the waist, the *hipDisk* draws the attention of both wearer and viewer to the relative position of hip and torso. The addition of sound serves to both accent and motivate the wearer's movement.

The *gesture≈sound* project, [2] (fig. 4) in contrast, has no visible physical interface. Yet, by tightly coupling movement with sound, the eye of the observer is focused

Figure 3: Danielle Wilde demonstrating the *hipDisk*

Figure 4: Ross Bencina, Danielle Wilde and Somaya Langley performing different *gesture ≈ sound* experiments

on body movement and posture, and extends them invisibly into the surrounding environment.

gesture≈sound explores how one might successfully mesh gestural/physical and sonic composition. The aim is to develop systems that support kinæsthetic-auditory synchresis, where human body motion is mapped into sound in such a way that sound production becomes an inherent and unavoidable consequence of moving the body. The intention is to engage both performer and audience in a fluid experience of the relation between performed sound and gesture. The resulting symbiosis between gesture and sound affords different ways of looking at the body in space.

hipThings, a proposed series of hip-controlled interfaces, is also relevant to this proposal. *hipThings* directly question and explore the impact of the choice of soft, hard, embedded or extended interface, and how this choice might inform our understanding of body mechanics and impact on experience.

Related Work by Other Artists and Researchers

An obvious connection can be made between the proposed project and the dresses from Hussein Chalayan's Spring/Summer 2008 Collection *Readings* [3] that incorporate servo-driven lasers and crystals (fig. 5).

In Chalayan's work the lights are driven by servo motors, to refract out from the body of the model into the space in

Figure 5: Hussein Chalayan, Spring/Summer 2008

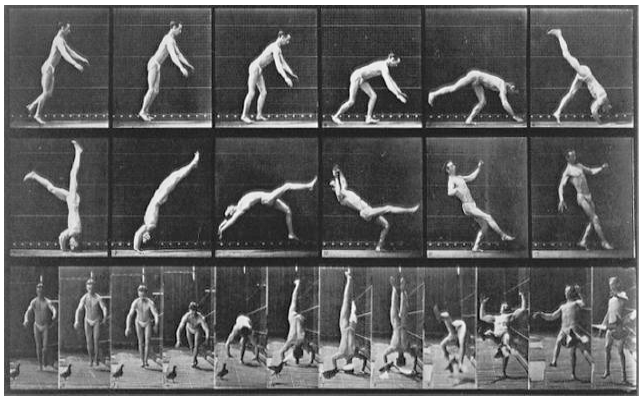

Figure 6: Eadweard Muybridge Headspring, a Flying Pidgeon Interfering. 1885

dynamically changing directions. While highly engaging, this does not extrude the body in relation to its underlying mechanics. My proposal uses the movement of the body alone to affect changes in direction of beams of light, so offers insight directly into the mechanics of the underlying movement.

The explorations into animal and human locomotion undertaken in the late 1800s by Etienne-Jules Marey, [5] in France and Eadweard Muybridge, [6] in the United States provided groundbreaking insight into body mechanics.

Through photography their work gives us insight into movement as it occurs over time and through space – presenting the body as an integrated whole comprised of linked parts and dynamically shifting relationships.

Muybridge used multiple cameras for his motion studies (fig. 6). Marey, on the other hand, invented chronophotography to capture cycles of movement through time in a single camera frame (fig. 7).

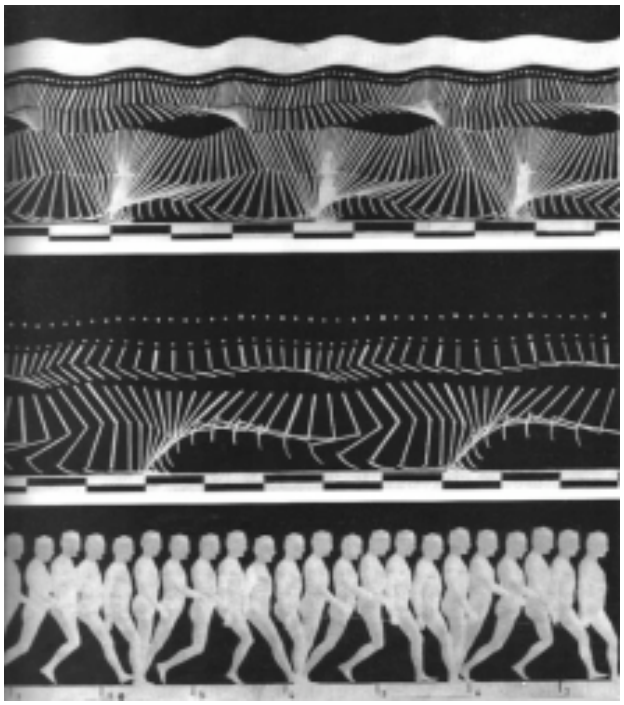

Figure 7 (a-c) : Etienne-Jules Marey. Man Running 1882

As shown in figure 7(a-b), for some of his experiments, Marey dressed his subjects in black and attached white ping pong balls and stripes to their clothing to expose the sine waves formed by their limb movements in space. The resulting abstraction relates clearly to this proposal, as well as to optical and magnetic motion capture systems, which use markers on the body to track movement; and mechanical motion capture systems that attach a kind of exoskeleton of straight metal pieces to the back of the performer. [4] The lines and dots resulting from the proposed LED arrays, though, will project out perpendicular to the body, or sit at the outer limits of the room, rather than sit against the body or reflect its form in parallel. This will afford a very different perspective to that offered by Muybridge, Marey and different motion capture systems.

Since as early as 1990, Merce Cunningham has worked with motion capture and movement synthesizing in his choreography. He has made extensive use of the Life Forms software program and was involved in the subsequent development of the Dance Forms choreographic software. Cunningham has been quoted as saying that Life Forms lets you "see movement in a way that was always there – but wasn't visible to the naked eye." [7] The proposed system clearly shares this aim, but is focused quite specifically on relationships – between the different parts of the body and its surroundings. It is not clear the role a consideration of these relationships might play in Dance Forms, but in most motion capture the interest in this is limited, if for no other reason than technical limitations. Also, in stark contrast to motion capture, the proposed system is a relatively low-tech, low-cost, light-based alternative aimed at providing inspiration and insight through real-time feedback, rather than quantifiable data. It is not, in any traditional sense, a technical tool. It can provide information, and hopefully inspiration, for an audience as well as a practitioner, but not hard data. Its use can also be a means and an end in and of itself, unlike motion capture, which is clearly a tool, no matter how artistic the application.

Finally, by extruding the body with light, the underlying movement and relationships can unfold dynamically before the eyes of both wearer and observer. The information is not broken down over time, or preserve for later referral, such as in the aforementioned systems and approaches. This difference is important.

PROPOSED IMPLEMENTATION

The proposal is to create strips of highly focused LEDs that can be attached to the body in a modular fashion. These LED arrays will be embedded in fabric so as to sit comfortably on the body. The method of attachment is still to be ascertained, but will most likely incorporate Velcro, press-studs or snaps, and some form of adjustable strap.

The system will be passive. It will not change over time or in response to any particular event, so will not require the inclusion of a microcontroller and will not need to be programmed to respond or behave in any way. The

electronic circuit will thus be simple, consisting of LEDs, resistors and a power supply.

Points and Beams of Light

The light output from the LED arrays will be visible as dots on a wall, or as beams of light when the air is fogged with artificial smoke, as outlined below. It is envisioned that both of these modes of viewing will be of interest – by offering different perspectives they will afford different insights.

Dots on the Wall

Single points of light corresponding to each LED will be visible on the walls at the edge of the space. This will allow shapes to be drawn, or rather suggested, as the eye of the observer "connects the dots" and connects the dots with the body part that is supporting the source of each point of light.

Extruding Light Beams

When smoke is added to the room, the entire beam of light from each LED will be visible, extending, literally, from the body to the outer limits of the space. This will magnify and extrude, so highlight, the position and tilt of each body part that supports an array.

Extruding the body with light in these ways will allow us to see and envision the different planar extensions that may not otherwise be apparent. It will thus allow us to examine the interactions and relationships between different body parts, as well as how our physical presence might impact on and interact with our environment.

The proposed system affords insight into the body by allowing wearer and observer:

(i) to examine the interplay between individual beams and points of light, as in the case of the spine or other parts of the body which can be curved or twisted – for example the hip, upper torso and waist area; and

(ii) to examine the interplay between different collections of beams or dots in the space, so the interrelation and spatial orientation of different parts of the body and how these might impact on the surrounding space.

CONCLUSION

The aim of the proposed system is to provide qualitative, rather than quantitative information about the body's underlying mechanics, and how our physical presence might impact on the surrounding space – to inspire as it informs.

The proposal is still in its conceptual stages and has not been extensively developed or tested. The desire is to open up the ideas for discussion with an interested audience, so provoke development in new and unexpected directions.

Figure 8: an excerpt from a Merce Cunningham dance work

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