

An Exploration of Sound, Digital Art, Performance, and Wearable Technology Inspired by Traditional Whirling Dervish Movement and Flamenco Dance

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Abstract

Humans have been augmenting their bodies with accessories and gadgets for centuries. In recent decades, these accessories have included electronic devices such as smart watches or smart jewelry or wearable computing mechanisms which are attached to the body or integrated into clothing. Wearable technology has also been incrementally shaping the future of the performing and fine arts. With a growing demand for digital systems that contribute to the overall production of a performance, more artists are using immersive and interactive platforms as a means of expression and exploration. This study is interested in analyzing the use of wearable technology to augment existing performance practices, specifically traditional heritage

dance/movement practices. A route to unpicking this relationship between the wearer's movement and the data that it outputs is by developing a bespoke device that tracks and captures certain gestures that the performer/wearer enacts. The rich traditions of Spanish Flamenco dance and the turning ritual of Whirling Dervishes of Turkey are examined in a fusion of sound, movement and digital technology. These dance and movement styles have specific historical links that will be investigated ultimately culminating in a morphing of the two traditions in a performance setting. The devices will track specific movements associated with these styles and will emit sounds that can be layered onto existing musical compositions as an accompaniment to a score. The device acts as a wearable musical instrument, or an extension of the body.

1. Introduction

Wearable technology is incrementally changing the landscape of innovative designs in the fields of robotics engineering, medical and healthcare sectors, the military, commercial devices, and the performing arts. Applying technology to clothing for performative purpose opens the possibilities for speculative exploration. This could be

using electronic circuits that operate on the body as mechanisms for producing a number of actions including emitting sounds by attributing gestures to them, controlling other factors such as lighting on stage, and transmitting tactile cues that inform the wearer that they have initiated an action. Haptic mechanisms contribute to the sensory experience where the performer initiates sound that provide feedback. These vibrations also mimic the reverberations felt when using physical instruments close to the body. Birringer indicates that in order for wearable computing to have meaningful interactions with humans, the construction and integration between machine and man should go beyond hard-wired sensors to include more tactile and purposeful sensory qualities [1]. Quinn also remarks that textiles or clothing that have been integrated with tangible devices and sensors should not only process data to be captured and analyzed but to communicate more neural actions between computer and human [2].

Sensor systems that can react with the wearer in real-time can have more meaningful and engaging possibilities. An early example of linking the human and electronic medium in a performance setting is Atsuko Tanaka's *Electric Dress*, 1956. The dress was comprised of several tubular colorfully hand painted electric bulbs that were placed or worn on the artist and was an exploration of interaction between the body and the electronic juxtaposing herself within two- and three-dimensional spaces [3]. A few decades later, Turkish-born fashion designer Hussein Chalayan¹ created a piece for his 2002 Spring/Summer collection where one of the dresses would change shape as the model

walked down the runway using shape memory alloy powered by a larger car battery [4]. The intention was to house the electrical parts within the garment but the technology had not yet been developed.

Although much of the focus in developments in wearable technology over the last several decades have been in the fields of robotics, space exploration, health and medical and the military, wearable technology has seen an increase in innovation throughout the performing arts.

The main focus of this research is to explore using existing technologies by developing systems or devices that can be embedded or attached to clothing which track and capture movements of the wearer and emit sounds. This amalgamation between science, technology and art combines the fluid, organic and at times abstract characteristics of the performing arts with the physical, tangible circuitry of hardware and computing. The inspiration for a performance piece using these sound costumes/devices are acquired from the rich cultural traditions of the Mevlevi Dervishes of Turkey and Andalusian Spanish Flamenco. These two practices have had centuries-long traditions that have been deeply rooted and developed by merging and absorbing cultures to hone distinct practices that are recognizable the world over. The forms have historical links both culturally and geographically which will be explored by morphing them to create a new digital, audio-visual wearable technology immersive experience. The potential implications can lead to the preservation of cultural heritage by digitizing these movements and cultivating new performance works as well as developing more streamlined systems that can be

¹ <https://chalayan.com>

integrated into clothing in a sustainable and practical way.

Flamenco and Dervish seem to be polar opposites from a distance, but viewed through a closer lens, the similarities become apparent through an investigation of cultural origins, musical styles and rhythm, and emphasis on capturing meaningful.

2. Wearable Technology

Wearable technology can be defined as a category of electrical devices that are attached to the body, embedded into textiles and fabrics or even implanted onto the human skin. Seymour states that fashionable technology or wearable technology also has a purposeful function such as delivering computational data while creating meaningful design that is aesthetically pleasing [5]. Sazonov further describes the term as having components such as small computers that provide feedback to the user through various ways of communication such as sensing and processing that information through to an application [6]. These small devices that are worn on the body are developing at a rapid pace in order to meet the new and changing demands that humans are expecting micro-computers to produce.

According to McCann and Bryson what spawned the surge of interest and development in wearable technology was due to the military and health sectors interest in using computing on clothing and technology in the medical field, computer scientists and electronics engineers designing automated systems that were more compact and portable, as well as the advent of the World Wide Web in the late 1980's and beyond [7]. It was around this time that people began to tinker with finding ways to customize accessories or garments by attaching

computing without realizing the impact this experimentation would have in the near future.

Recalling more of Hussein Chalayan's work from the early 2000's, in his Spring/Summer collection of 2000 he debuted his *Remote-Control Dress*. Sometimes referred to as the 'airplane dress' *Remote-Control* is a manifestation of Chalayan's concepts of combining architectural structures with the human body with moving electronic parts [5].

Canadian designer Ying Gao also works with the interplay of subtle emotions that are sensed by clothing from the wearer to express new shapes controlled either by electroluminescent wires embedded within the garment or by mechanisms that change the actual structure of clothing [5].

Anouk Wipprecht's² work has also challenged boundaries of fashion and technology in that her work embodies the idea of coalescing machine and human. In the case of Wipprecht's work, the human activates the machine on the body and in turn the machine offers a function or purpose such as protecting the wearer (the *Spider Dress* 2013) or blowing smoke at an individual when they come in close contact as a way of camouflaging the wearer.

As materials become smaller and the technology cleverer and more accurate, the newer generations of textiles and how wearable technology will shape the future of what humans will wear, the possibilities will be endless.

2.1 New Digital Musical

² <http://www.anoukwipprecht.nl>

Instruments and Wearable Technology

Digital Musical Instruments or DMI's have become progressively more interactive and innovative. The Mi.Mu³ Gloves are an example how wearable technology can be used to create music for composition and performance. The gloves use gesture recognition with which to create sounds using dedicated software (Glover) that is designed to allow the user to program each gesture according to how they want to map sounds to them. The gloves are outfitted with several sensors including gyroscopes and 10 flex sensors with an IMU (Inertial Measurement Unit) compactly tucked into a pocket with a wireless rechargeable battery pack. The gloves have gone through several prototypes and iterations and are now available to order from the company's website [8]. Singer/songwriter Imogen Heap had a hand in the design of the gloves and frequently uses them on stage for her performances.

Sound artist Di Mainstone has also contributed to the craft of musical wearables by using the body to create musical sounds with. In one of her many iterations of using the human body as a platform to make music, she constructed a garment – the *Human Harp*, that can be attached magnetically to cables and structures of a bridge which the wearer then plucks to create sounds with [9].

MicTic⁴ is another portable wearable device which is a wristband resembling a bracelet. The wristband connects to an app via Bluetooth and the output can be through headphones or speakers. It allows the user to choose from a range of

musical styles or genres such as jazz, piano, EDM and others and through the use of gestures, the sounds that are available from the sound bank can be manipulated any way the wearer desires. The product has yet to be released and it is too early to gauge how truly immersive it is as the manufacturers claim it to be.

These wearable musical devices can lend to shaping new performances that use the body or gestures to create sounds with as a unique way to enhance body movement practices or as a way to make music with gestures.

3. The Performative Body

Dixon has argued that much of what is currently significant in digital performance is owed in large part to the ideologies, conceptualizations and works of artists and creators during the Futurist movement in the early 1910's Europe [10]. The breadth of work done during this period and forward had a significant impact on how technology would come to be envisioned by later generations. Other movements such as Dadaism and Surrealism also had their visions of the future that seemed to intertwine with the musings of Futurist works.

Birringer expressed that technology has changed the way in which relationships between humans and machines interact with one another in spaces providing new bodily boundaries yet in turn using technological advances in the theatrical arts as a significant tool for creation [11]. These digital tools can provide the potential to create and design unique pieces of work. One of the underlying interests that are significant to digitizing body movements is the scope for recording, preserving and archiving them.

Kiko et al discuss that digitizing dance movements allow future generations to

³ <https://www.mimugloves.com/gloves/>

⁴ <https://mictic.com/pages/faq#collapse2>

observe practices that help to diversify global cultures [12]. Recording or attributing sensor data to movements whether by using motion capture technology or through a device that is specifically linked to meaningful and distinct movements such as in flamenco dance or the turning practice of Dervishes, can benefit by preserving the intangible cultural heritage of crafts that have for centuries been passed down mostly through memory or oral traditions.

There is some significance to preserving traditions which can be archived and used for historical reference much like works of art, writing, poetry, film and other fine arts have been preserved for centuries. Many folk traditional practices from around the globe have become obsolete due to lack of notation or preservation in some way. Artists and digital creators have begun to digitize and capture dance movement through various digital tools such as motion capture systems, video recording, and embedding or attaching sensor systems. Birringer had a vision of this in the late 1990's where dance performances will be generated by telematic interactions that are created by digital means; using computing that enables performances to be multi-media platforms where the ability to capture and intermingle technology with body movement will be how dance in the future will be performed [11].

The use of technology in performing arts practices has seen a rise over the last several decades. This has enabled dance companies and practitioners in the field of movement and performing arts to embrace technology as a way to preserve choreographed pieces that may otherwise become diluted or lost completely [13]. This trend towards documenting live performances by digital

recordings offers a new way of archiving movements in dance performance which unlike paintings or sculptures make them intangible. Young Reed goes on to discuss the fact that a growing debate among dance historians, practitioners and notators argue that digitizing performances devalues and objectifies the final outcome of a performance which would possibly categorize the work as reproducible rather than being appreciated for what the work intends to express in that present moment [13].

American choreographer Merce Cunningham discovered how the body could relate to not only the exterior sensory outputs of the dancer's movements but the interior or rather, embedded somatic senses were of utmost importance. Bevilacqua (et al) remark that Cunningham had begun to interject technology into dance performances as early as 1965 in a performance where dancers interacted with analog sound systems [14]. His interest in intermingling technology with dance began in the late 1980's early 1990's whereupon Cunningham began experimenting with a computer software program: *Life Forms*. This animation software allowed the user to dictate and notate a wide variety of variables as a choreographic tool to place dancers in certain areas, analyzing various body movements such as jumps and the flexing of joints as well as determining stage spacing among performers [15]. In his later work *Biped* (1999) Jacobs remarked that Cunningham relied heavily on *Life Forms* but also used motion tracking technology as a way to add more intensive drama to the stage [16].

Canadian media artist Thecla Schiphorst worked extensively with Cunningham to develop *Life Forms* and used it to create works such as *StillDancing* (1994) which

incorporates the whole body into a motion capture system resulting in an immersive participatory environment [17].

4. The practice of the Mevlevi Dervishes of Turkey

The Whirling Dervishes or Mevlevi Order of Turkey have had a long and ingrained history in Turkish culture for centuries. It is one of the oldest known dance/performance/spiritual practices in the world and has recently been proclaimed an intangible cultural heritage of humanity in 2005 through UNESCO⁵. The practice of the *sema* which is the word for the sacred and spiritual ritual glorifying the Almighty Creator that the Mevlevi order practice in their 'turning' performances, has rarely changed over the past several hundred years. It is about prayer, contemplation, and music which sends a Dervish into a repetitive state of continuous movement – their feet root them firmly to the ground while they rotate endlessly, the head tilted to one side and arms pointed upward and downward.

The practice itself dates back to 13th century Anatolia once known as Rum within the Turko-Persian Seljuk state [18]. The movement of a Dervish represents a planet turning on its axis or the orbital patterns of the earth and the moon that circumambulate endlessly, infinitely [19]. This pattern can be seen in many areas of Islamic art, including painting, architecture, sculpture, calligraphy and so forth. The circumambulation of the Ka'ba in Mecca is also reflective of this. As pilgrims converge on Islam's holiest site, the intention to circulate the Ka'ba while in and out of prayer times illustrates the same pattern of continuous circulation

while in meditative contemplation and prayer.

The conical shape of the skirt portion of the costume has been compared to the force that governs hurricanes [20]. It is this distinct shape and structure that distinguishes the Mevlevi practice from all others and is the visual accompaniment to the other components of a *sema* such as the music and recitations. The skirt evolves as the *sema* progresses and remains in a static phase creating infinite celestial patterns. It is a practice that has remained unchanged over centuries and has been kept as a sacred ritual but has been progressed by new practicing performance artists who are also Dervishes in Turkey. There are many performers who whirl to contemporary electronic music and also use technology to inform the practice – an issue that has been met with some criticism amongst staunch practicing Dervishes.

Nowadays, many Dervish performances have been commissioned or used for purposes of entertaining wealthy families in function halls for various private celebration events, executive parties and so forth. In these cases, Dervishes put on a show of whirling for the less-than enthused audiences by whirling to Turkish pop music or sometimes accompanied by a vocalist and a band.

Some of the more prominent figures in current contemporary art circles globally who practice versions of the *sema* include performance artist Ziya Azazi⁶, Isha Kurun and Rana Gorgani who can easily be found on social media sites such as Instagram. Austrian based Turkish-born Ziya Azazi's work has stemmed from his passion for dance but also his interest in combining Sufi

⁵ <https://ich.unesco.org/en/RL/mevlevi-sema-ceremony-00100>

⁶ <https://dervishinprogress.com>

traditions with his contemporary dance form without necessarily relying entirely on the spiritual aspects of the *sema* for his practice. Azazi explores the repetitive nature of turning dervishes and concedes that there are not only mystical and meditative aspects to turning, but mental transformations that occur when one whirls [21].

4.2 The Flamenco of Spain

Traditional flamenco is an expression of song, story, dance, and instrumental music usually accompanied by a Spanish guitar (*toque*), vocals (*cante*) and dance (*baile*). The practice of flamenco has also been recognized by UNESCO⁷ as an intangible cultural heritage of humanity in 2010. Flamenco is a way of making the music a visual experience and in many cases, an emotional one for both the performer and the audience. In popular culture, some of the most well-known flamenco dancers such as Carmen Amaya have dazzled the globe and introduced flamenco as a generically Spanish tradition.

The traditional formal elements of flamenco can be broken down by examining the generational overlaps in cultural history. The origins of the practice are blurred; most flamenco is associated with the Andalusian region of Spain but it's roots may have come from further afield since the song traditions that influenced Gitano music in the Middle Ages were shaped by Islamic, Jewish and Christian traditions [22]. According to Akombo flamenco can be attributed to Gypsy culture which dates back eight centuries and specifically to the descendants of the Moors in that region of modern-day Spain [23]. Totton suggests that the dance developed from the melting pot of cultures and

descendants of Greek colonists, Sephardic Jews, Christians and Phoenicians [24]. The music and form of narrative or story-telling began developing among these various cultures and the Gypsies who would perform with and amongst the Moors and the Jews shaped what we know as flamenco music today [23]. As well as developments in song and body movements practices, musical instruments such as the *tambura*, a stringed instrument with a wide wooden base, the *cymbalom* (in Hungarian *cimbalom*), a stringed instrument played by using mallets, and the Persian *ney* or *nay* which is a reed instrument, were also experimented with throughout the Eastern and even Western European countries via the silk road [25].

Hayes writes that flamenco has become somewhat of a national identity of Spain and Spanish cultures but the Gypsies have also claimed it as a form of civil rights activism due to its origins [26]. Where it was once a performance that was traditionally held in underground music scenes in the 18th century and onwards, has now become somewhat of a tourist spectacle with many contemporary practitioners using the performance as a way to collect and earn a living rather than performing it in its traditional form.

The art of flamenco is intriguing and enticing in the way that it tells a story or reflects upon a moment in time, a romance, a tragedy or daily life. It is a recounting of memories and experiences that are told visually through music and dance. There exists a language that is expressed through the movement of the body from the tips of the performer's fingers to the base of their heels.

⁷ <https://ich.unesco.org/en/RL/flamenco-00363>

4.3 The Invisible links: Dervish and Flamenco

Throughout this research, interesting links and connections exist between the practice of the dervish and flamenco dance.

When flamenco is performed as a Bulería, the song can be very expressive and emotional often with elongated and drawn out stanzas that carry on into exaggerated trills. It is the most fast-paced rhythmic form of flamenco using light-hearted banter, mockery, back and forth dialogue between singers, accompanied by *palmas* (hand clapping) and guitar [27]. Similarly, many Mediterranean/Arabic song styles are performed using improvisational maqam⁸, whether reciting Islamic prayers or poems, the melodic musical style is often interpreted as the musicians perform made up of invented melodies that are adapted to pre-existing rhythms [28]. The maqam, which is prevalent in many Middle Eastern and Eastern Mediterranean countries such as Egypt, Iran, Iraq, Afghanistan, and Turkey among many others, forms a style of music that is not organized in the way for example, traditional 'western style' European Romantic music is performed. It is highly dependent upon the communication between singer and musician – the interplay of question and response, echoing each other without any particular structure and particularly characterized by techniques of improvisation. When the Qur'an is recited, the intonations use maqam to draw out vowels sounds of words which are sung and are considered nasheed which is the melodic form of Qur'anic recitation or devotional affirmation of the Divine.

The possibilities of uniting the two practices of Dervish turning and Flamenco dance are exciting and invigorating. Two distinct cultural performance practices that have subtle similarities that can be interlinked by using technology as a ladder to connect them can result in discovering new ways of linking other performance practices in the future.

4.4 The *Duende* and the *Sema*

What defines the two practices are their distinct movements. A Dervish whirls or turns while a flamenco dancer propels themselves with their footwork and hand/arm movements. What are the features and characteristics that overlap between the two forms? On the one hand, the dervish performs for the purpose of repetitive or meditative contemplation on the divine Creator while on the other hand, flamenco contains narratives that are filled with grief, joy, tragedy, love, boredom or profound emotional questioning of religious morals and beliefs. From a distance, the two seem utterly separated from each other since the similarities are not obvious. The Roma gypsies intermingled with different cultures from which flamenco grew whereas the practice of the Dervish arose out of a collective love and appreciation for poetry and serving a metaphysical purpose by praising God through continuous circular movements.

The similarities and overlaps lie within the compositions: the music, the singing, and certain gestures or actions. A Dervish uses their hands to point either upwards or downwards to communicate a direction towards the heavens and the earth while their feet move continuously. Similarly, a flamenco dancer will use their arms and hands to communicate an expression of sound whether this may be

⁸ <https://www.britannica.com/art/maqam-music>

through clapping, finger clicking or wrist rolling. The hands provide a language as do the movements of the body. When a flamenco dancer is in the throes of a performance, the intensity becomes ecstatic much like the state that a dervish finds themselves in when they have been turning for lengthy periods of time. At a distance, one singing a bulería may sound like the call to prayer by a muezzin. Words have been used and played upon from the Arabic language to create non-sensical expressions such as 'olé' which has been said to have derived from the Arabic for 'Allah' meaning God.

Part of the invisible language between the two practices reveal that a Dervish can interpret most sounds, beats or even silence into a whirling state of continuous sometimes ecstatic motion whereas a flamenco performer can move to potentially the same tempo, beat, song or instrument for lengthy periods submitting them into a similarly euphoric state. There are patterns to be discovered between the two practices that can reveal the intricacies of the movements and gestures that a Dervish and a flamenco dancer make.

5. The *Sound Drop*; a wearable device for wearable performance

The goal of this work has been to use technology to augment performing arts practices, specifically, the practices of flamenco and the *sema* of the Whirling Dervishes of Turkey. To create this fusion and link between the two practices, a device has been developed to be used as a way to emphasize sounds that have been enacted by gestures and movements by two performers.

The links between the two distinct practices will become clearer when the two performers begin to make contact. A fusion of music and movement will result in a performative piece using a bespoke device created to augment these practices in a contemporary performance setting. Some of the experimentation that has surfaced while exploring these links between the patterns made by dervish and flamenco movements as well as music, have been examined through the use of motion capture technology. The possibility of integrating the physical device and the virtual space can inform how each mode of communication can exist together in a communal environment. Figure 2 shows how the same sound samples that are programmed to the *Sound Drop* can be used by taking a 3D model to explore sound creation in a virtual game engine using Unreal Engine and Vicon software. The goal is to create blocks of physical space that the virtual performer can enter which trigger sounds.



Figure 2: Experimenting with motion capture technology.

The wearable device– the *Sound Drop* is created as a tool for augmenting body movement performances. The concept was to build a contained device that was completely wireless and communicates to a computer system via Bluetooth.

There were several iterations of the device the first of which were compiling the components into sections and sewing them into fabric swatches to be then sewn as a patch onto a costume. It was found that after some testing, the sensors and battery within a fabric patch were inaccessible, awkward and not streamlined. Further testing proved that a small device could be built using the 3D printing of a casing that was designed to house all of the components which included an Arduino Nano, a gyroscope/accelerometer, touch sensor, 3.7-volt Lithium ion battery, a Bluetooth module and power boost charger as well as a haptic motor and twelve neo-pixel LED ring sensor. These are seen in Figure 3.

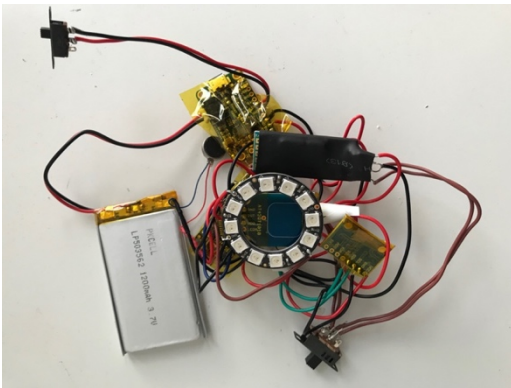


Figure 3: Components for *Sound Drop*

The *Sound Drop* fits inside the palm of the hand or onto other parts of the body via Velcro straps attached to the back of the casing. Various 3D printed versions using standard polyvinyl were created until an ABS-like resin was used to test the model. It was found that the resin prototype proved to be the most suitable and robust design due to its slight pliability and smooth texture after being cured.

The *Sound Drop* is programmed to react to movements or gestures of a performer. The device reacts when a threshold is met whereby the LED neo-pixel ring is initiated along with the haptic motor. It is turned on and off via a main control switch on the side of the device and can also be turned on or off via the touch pad sensor that lays underneath the neo pixel ring. The responsive interaction allows the performer to create subtle sounds that are programmed to each module thereby layering sounds that accompany a pre-composed piece of music. The device works by using Max/MSP to read the incoming Bluetooth data of the Arduino Nano and processes the data to create variations on the pre-programmed sounds. The sounds themselves are representative of Turkish instruments traditionally used in classical Turkish music as well as sound samples of Spanish guitar and other instruments that have been electronically manipulated and are heard through a loud-speaker system. The final design was printed in clear resin with the intention of having the components visible as a hybrid physical and digital object as seen in Figure 4.



Figure 4: Clear resin 3D print of *Sound Drop* casing.

The *Sound Drop* in its final form with the circular LED ring lit in the translucent resin can be seen in Figure 5.



Figure 4: The *Sound Drop*

Conclusion

This research has observed the developments in wearable technology over the last few decades and how these advancements contribute to the possibilities for use of wearable technology devices to enhance or augment performance practices. The study has also adapted the historically rich traditions of Flamenco and the Whirling Dervishes of Turkey by intertwining them into a performance setting where a narrative can be used to bring the two practices together in an immersive audio-visual work that augments the traditions by using bespoke devices that track certain movements or gestures to which sound is attributed. These intersections of cultural performance practices can be further explored by investigating other body movement/dance traditions globally. This study can also lead to the preservation of intangible cultural heritage by digitizing

and capturing meaningful and significant movements that are associated with traditional body movement practices globally.

Further work will investigate the use of the *Sound Drop* as a possible educational or therapeutic tool for learning and discovery by also integrating motion capture technology to develop interactive game engines. The device can be used as an extension of the body or a body instrument device that can accompany a live performance or pre-recorded piece of music. The prototype will be further developed to create a compact unit that can be more seamless and integrated into clothing/costumes or attached to various parts of the body. Future developments will explore machine learning to train a system that analyzes incoming sensor data of movements and gestures through which real-time sound synthesis can be generated.

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