COPYRIGHT STATEMENT

Copyright and Moral rights arising from original work in this thesis and (where relevant), any accompanying data, rests with the Author unless stated otherwise[1].

Re-use of the work is allowed under fair dealing exceptions outlined in the Copyright, Designs and Patents Act 1988 (amended)[2], and the terms of the copyright licence assigned to the thesis by the Author.

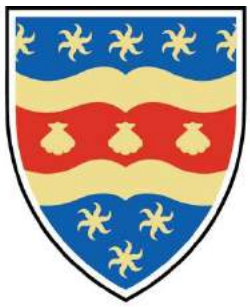
In practice, and unless the copyright licence assigned by the author allows for more permissive use, this means,

- that any content or accompanying data cannot be extensively quoted, reproduced or changed without the written permission of the author / rights holder; and
- that the work in whole or part may not be sold commercially in any format or medium without the written permission of the author/rights holder.

Any third-party copyright material in this thesis remains the property of the original owner. Such third-party copyright work included in the thesis will be clearly marked and attributed, and the original licence under which it was released will be specified. This material is not covered by the licence or terms assigned to the wider thesis and must be used in accordance with the original licence; or separate permission must be sought from the copyright holder.

The author assigns certain rights to the University of Plymouth including the right to make the thesis accessible and discoverable via the British Library's Electronic Thesis Online Service (EThOS) and the University research repository, and to undertake activities to migrate, preserve and maintain the medium, format and integrity of the deposited file for future discovery and use.

[1] *E.g.* in the example of third-party copyright materials reused in the thesis.
[2] In accordance with best practice principles such as, *Marking/Creators/Marking third party content* (2013). Available from: https://wiki.creativecommons.org/wiki/Marking/Creators/Marking_third_party_content [accessed 28th February 2022]



UNIVERSITY OF PLYMOUTH

A Performative Framework for Exploring Traditional Whirling Dervish Movement and Flamenco Dance through Augmented Digital Media and Wearable Technology

by

HEDY HURBAN

A thesis submitted to the University of Plymouth in partial fulfilment for the degree of

DOCTOR OF PHILOSOPHY

School of Art Design and Architecture

April 2024

Acknowledgements

The last 6 years of my life can be described as tumultuous, exhilarating, frustrating, rewarding, illuminating and blissful. Above all, it has been the single most difficult thing I have done in my life apart from being a mother. But it has been worth every moment.

There are a number of people who I have to acknowledge here - none of whom I could have completed this without. Firstly, thank you to my Director of Studies Mike Phillips for understanding my vision and for putting up with my many emails and texts in the last leg of this thesis. Your insight has been invaluable into how I have shaped this work. Secondly to Edward Braund who no matter what happened would always say: “you’re gonna be fine, it’s all gonna be fine”. Thank you to David Jenkins for helping with prototyping ideas on how to build my devices. To Eduardo R. Miranda, thanks for initiating me back into the world of academia and computer music. Thank you to my colleagues at i-DAT especially: Christopher Booth and Dawn Melville - you are true friends. To Stewart Starbuck for the time and effort he spent building and refining code and for helping design the Soundrop. To Andy Banks for help with experimentation in the motion capture suite at the Immersive Media Lab at Plymouth University. To Andrew Norris for building the latest prototype of the Soundrop - you got the thing working well in the end! To all the other colleagues at i-DAT with whom I have worked in various capacities: Andrew Prior, Christiana Kazakou, Rafael Arrivabene, George Simms, James Sweeting, Joel Hodges, and Diego Zamora. To my friends and family across continents, in Canada, USA, Hungary, Türkiye and India, I appreciate you.

I am fortunate for knowing some of the most amazing people that I have ever met in my life. I would like to thank my soul sister, Anna Dobrisan - you were there for me in my darkest moments during this process always pushing me to keep going even when I felt like giving up. Divine intervention surely placed us on the same street so that we could run in and out of each other’s houses cooking, philosophizing and debating! Te iubesc, te pup. To my dear sis Feyza Özdes who has supported me in my second home of Türkiye

with wisdom, prayers, and love - your help on this project is invaluable - Allah senden razı olsun canım, seni seviyorum. To my dear friend Christine Eckert who always picked up the phone, no matter the time difference and told me “you got this!” – your love and support is genuine. To my amazing performers from Spain muchas gracias and especially Sercan Çelik for working on this project and seeing it come to life over the last 7 years, and for finally helping to make my vision come true - çok teşekkür ederim.

With deepest love and gratitude, I thank the following people: To my dear mother-in-law Elizabeth Rahman whose continued love and support for me has been unconditional. You are my second Mom and you have helped me in so many ways that you can’t imagine. I am blessed to have you in my life – je t'aime profondément. To Sara Rahman, the best sister-in-law ever, you are inspiring, kind and have the biggest heart. To Eva Szabó, my dear cousin, your gentle heart is always with me, no matter how far we are from each other. Thank you to my father Ted Hurban - even though you are thousands of miles away, anytime we would talk it’s like you were right there with me. To my brother Tibor Hurban who is a man of few words but still loves his big sis.

I thank my children Zamir Rahman and Dalia Rahman who were inspirations for this thesis. You are smart and amazing, and I know you will do wonderful things in your lives. To Mayez Rahman, my sweet boy, my first born. How can I thank you? There are not enough words and no way to truly express my love and gratitude for your work on this thesis. Without you, this project would be incomplete. I have been tough, and I asked a lot of you, but you are my Dervish through and through. Thank you for doing this - you may not want to whirl again for a while, but you will propel yourself into incredible endeavors in your future because you are brilliant. I love you all with every ounce of my being.

To my mother Eva Baranyai Hurban. Édes drága Mamikám, no matter how many times a day I would call you, you would pick up the phone and listen to me going on about my worries. You would always tell me that I am fine and that just got me through my day. I know you don’t always understand what I am doing or what crazy ideas I have but you

have always supported me in every way possible. I am thankful for all that you have done throughout my life, nagyon szerettlek. I hope I have made you proud.

Lastly, to my soulmate, my endearing husband Kaz Rahman: you are the director of the village that made this project happen with your advice, support and love. I know I can be demanding and difficult, but you know that I always get the job done and your patience with me is unmatched. Thank you for your beautiful films, for editing, producing, stage design, managing and being the best husband and father to our kids that I could ever have dreamed of. You are the love of my life, my partner, my confidante and my shoulder. I will love you forever.

Author's Declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University without prior agreement of the Doctoral College Quality Sub-Committee.

Work submitted for this research degree at the University of Plymouth has not formed part of any other degree either at the University of Plymouth or at another establishment.

Word count of main body of thesis: 55,828

Signed .....

Date.....April 15, 2024.....

Abstract

Hedy Hurban

A Performative Framework for Exploring Traditional Whirling Dervish Movement and Flamenco Dance through augmented digital media and wearable technology

The thesis establishes a comprehensive framework that facilitates an in-depth exploration of the intricate traditional movements of the Whirling Dervishes of Turkey and the passionate expressions of Spanish Flamenco dance. This exploration is facilitated by leveraging augmented digital media and wearable technology. By integrating these modern tools into the realms of these historically rich art forms, the thesis endeavors to uncover new dimensions and possibilities within the dance practices. This convergence transcends the boundaries of conventional performance, offering a heightened sensory experience for both performers and audiences alike. At its core, the performative framework involves a harmonious synergy between the physicality of the dancers, the artistic essence of the movements, and the digital enhancements provided by augmented media. This unique approach allows for the creation of immersive experiences that bridge the gap between tradition and innovation, opening doors to novel avenues of creative expression and enriching the appreciation of these captivating dance forms.

The research in this thesis is led by developing a wearable musical body instrument device using existing sensors that can be embedded or attached to clothing or the body via a removable mechanism. This device tracks gestures and movements to which sounds, and haptic vibrations are attributed. The body movement practices of the Mevlevi Dervishes of Turkey and Andalucían Spanish Flamenco have been examined as two case studies in developing this work. The objective is to cultivate a practice that connects Dervish and Flamenco practices using this digital body instrument - the Soundrop - that communicates a language through sound and movement. The contrasts and parallels between the two traditions have been emphasized in a few different theatrical

performances that combine the use of the Soundrop with film, music and dance. Soundrop provides an interface for performers to use by enhancing certain aspects of their performance. 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. A Dervish and a Flamenco dancer use their costumes as extensions of their body in performance. The Soundrop is an added layer that complements this by further augmentation of movement.

The contribution to new knowledge examines how two musical/dance forms with cultural and geographical historical links (Ottoman Turkish *Dervish* and Andalucían *Flamenco*) can be morphed with wearable technology to create a new and immersive audio-visual experience. The potential implications can lead to the preservation of cultural heritage by digitizing these movements, as well as cultivating new performance works. Along with the development of the Soundrop (which has electronic sound samples programmed into it) a complete musical soundscape has been composed as an output of this research - they are a reflection, fusion and electronic interpretation of these traditions.

Table of Contents

Acknowledgements i

Author's Declaration iv

Abstract v

List of Figures xi

List of Tables xviii

Glossary of Terms xix

1. Introduction 1

1.1. Research Context and Essential Concepts 2

1.2 Research Questions and Aims 5

1.3 Methodological Approach; a practice-based investigation 9

1.4 Thesis Overview 16

1.5 Ethical considerations 16

1.6 Contribution to New Knowledge 17

2. The Wearing of Technology on the Body 19

2. Wearing Technology 19

2.1 Developments in Wearable Technology; Past, Present and Future 20

2.1.1 Wearable technology and the Internet of Things 22

2.2 Wearable Technology Applications 23

2.2.1 Commercial Devices 24

2.2.2 Virtual and Augmented Reality Wearables 25

2.3 Wearable Technology in Fashion, Costume and Film 27

2.3.1 Art and Fashion Technology 30

2.4 New Wearable Digital Musical Instruments for Performance 32

Chapter Summary 38

3. Dance, Body Movement and Wearable Technology 39

3. Body Movement in Art History 39
3.1 Dance, Costume and Technology 44
3.2 Digital Body Movement and Performance 50
3.2.1 Experiments with Motion Capture Technology 55
3.3 The Body as Instrument 59
3.3.1 Haptics and sensory exploration 61
3.4 Augmenting Traditional Dance Forms with Technology 62
Chapter Summary 69

4. Decoding the links between Dervish Whirling and Flamenco Dance 71
4. Contrasts and Parallels 72
4.1 *Dhikr* and *Duende*; decoding the metaphysical and the spirited 78
4.2 The Music and Dance of Dervish and Flamenco performance 86
4.3 Costume; an Extension of the Body 95
4.4 Dervish and Flamenco; a fusion of music, movement and wearable technology 99
Chapter Summary 106

5. The Soundrop: A Digital Musical Body Instrument 107
5. Digital Sound Devices 107
5.1 Design And Development 109
5.2 Hardware Assembly and Prototyping 111
5.3 Proof of Concept 117
5.3.1 Software and programming 123
5.3.2 Soundrop Webapp 126
5.4 The Soundrop – A New Digital Musical Body Instrument 127
5.4.1 Proprioception and capturing bodily movement 132
5.4.2 Soundrop sounds 133
5.5 Testing and building choreography - the Soundrop in practice 134
Chapter Summary 144

6. An analysis of *Digital Dervish + Flamenco Sonic*;
A Multimedia, Immersive, Interactive Performance **146**
6. *Digital Dervish + Flamenco Sonic*: a multi-media performance work 146
6.1 *Digital Dervish + Flamenco Sonic*; Musical Score and Composition and Choreography Analysis 149
6.2 *Digital Dervish + Flamenco Sonic*: *Immersive Sky;* Market Hall, Plymouth, UK May 6th, and 7th 2022*;* Venue: Market Hall Dome theatre, Plymouth, UK 150
6.3 Digital *Dervish + Flamenco Sonic: Life Circle* Market Hall Theatre/Public Energy, Peterborough, Canada, September 9th, and 10th, 2022; Venue: Market Hall Theatre, Peterborough, Canada 167
6.4 *Digital Dervish + Flamenco Sonic: Dream Chamber;* Theatre of Digital Art, Dubai, United Arab Emirates, December 16th, and 17th, 2022*; Venue: Theatre of Digital Arts (ToDA)* Dubai, UAE. 175
6.5 *Digital Dervish + Flamenco Sonic*; augmenting traditional dance with wearable technology 188
Chapter Summary 194

7. Conclusions **195**
7. Summary 195
7.1 Research Questions and Aims 195
7.2 Research outcomes 197
7.3 Contribution to new knowledge 199
7.4 *Digital Dervish + Flamenco Sonic*; a multimedia performance work 200
7.5 Reflection on Opportunities and Challenges 203
7.6 Future work and research 204

References **207**
References of Videos/Films **233**

Appendix I: *Digital Dervish* + *Flamenco Sonic*: the film **237**
Appendix II: Information Sheet and Consent Form **244**
Appendix III: Interviews with Performers **247**
Appendix IV: Press Releases for Performances **266**
Appendix V: Visual Storyboard for *Digital Dervish* + *Flamenco Sonic* and *Digital Dervish* (ToDA performances) with time code and translation **273**
Appendix VI: Synopsis and bios for performances of *Digital Dervish* + *Flamenco Sonic* (Plymouth, Peterborough, and Dubai) **288**
Appendix VII: Promotional posters and website advertising for performances of *Digital Dervish* + *Flamenco Sonic* **293**
Appendix VIII: Exhibitions/Performances **299**
Appendix IX: Raw Data Samples from Device Recordings **300**
Appendix X Sound Files **304**
Appendix XI Links to Code **305**
Appendix XII: Excerpts from Q&A's/Audience comments from performances **306**
Grants received **310**
Publications **311**
Conferences **312**
Reviews on *Digital Dervish* + *Flamenco Sonic* **313**

List of Figures

Figure 1.1: Mayez Rahman as *Digital Dervish* at the Market Hall Theatre, Plymouth, UK May 6, 2022 (image from Russell, 2022) 13

Figure 1.2: Mayez Rahman and Carolina Loyola-Garcia in *Digital Dervish + Flamenco Sonic* at the Market Hall Theatre in Peterborough, Canada, September 9, 2022 (image from Charminar Films, 2022) 14

Figure 1.3: Sercan Çelik and Pepa Sanz in *Digital Dervish + Flamenco* Sonic at ToDa, Dubai, December 16, 2022 (image from Charminar Films, 2022) 14

Figure 2.1: *Iridescence* by Behnaz Ferahi 2019 (image courtesy of artist) 31

Figure 2.2: Yamaha's *Miburi* 1995 (screenshot by author) 33

Figure 2.3: Laetitia Sonami performing at NIME 2014 with 'Lady's Glove' (screenshot by author) 34

Figure 2.4: Dervish Sound Dress, (Hurban, April 2019) 36

Figure 3.1: Marcel Duchamp, *Nude Descending a Staircase (No. 2)*, 1912, oil on canvas, 57 7/8 x 35 1/8 (151.8 x 93.3 cm) (Philadelphia Museum of Art) 41

Figure 3.2: Eadweard James Muybridge, *Woman Walking Down Steps*, photograph, 1887 (Public Domain) 42

Figure 3.3: Gustave Trouvé, Electrical Diadems, 1884 45

Figure 3.4: *Loie Fuller Dancing with her Veil* (1897) Isaiah West Taber (Aristotype mounted on card). Musée d'Orsay, Paris, France 47

Figure 3.5: *Spiral Costume*, from the *Triadic Ballet*, 1926, The J. Paul Getty Museum, Los Angeles, Karl Grill, Gelatin silver print, Image: 22.5 × 16.2 cm (8 7/8 × 6 3/8 in.) 49

Figure 3.6: Using Vicon's MOCAP system to perform tests of choreography (Hurban, 2021) 56

Figure 3.7: Choreographing dance using Vicon's metahuman (Hurban, 2021) 57

Figure 3.8: Mayez Rahman testing choreography alongside virtually recorded dance (Hurban, 2021) 58

Figure 3.9: Research methodology 65

Figure 3.10: A map outlining possible gestures and movements to be tracked with Soundrop for Dervish 67

Figure 3.11: A map outlining possible gestures and movements to be tracked with Soundrop for Flamenco. 69

Figure 4.1: Sercan Çelik performing in 2019 (image from Sercan Çelik) 93

Figure 4.2: Pepa Sanz (image from Pepa Sanz, 2020) 94

Figure 4.3: A tourist venue Flamenco performance in Barcelona (Hurban, 2022) 98

Figure 4.4: Sercan Çelik performing as *Digital Dervish* at ToDA, Dubai, December 2022 (image from Charminar Films, 2022) 102

Figure 4.5: Figure 4.5: Mayez Rahman performing as *Digital Dervish*, Plymouth, UK May 6th, 2022 (image from Charminar Films, 2022) 103

Figure 4.6: Carolina Loyola-Garcia performing as *Flamenco Sonic*, Peterborough, Canada, September 9th, 2022 (image from Charminar Films, 2022) 104

Figure 5.1: Soundrop Design Process (Hurban, 2023) 110

Figure 5.2: Assembly of components of ‘Sound Device’ with LED ring switched on (Hurban, 2021) 114

Figure 5.3: Prototype Design Version 1.0 (Hurban, 2021) 115

Figure 5.4: Soft sewn tulip shape enclosure for *Sound Device* (Hurban, 2021) 116

Figure 5.5: 3D printed casings with various sizes and openings (Hurban, 2021) 118

Figure 5.6: Version 1.0 with components inside 3D printed casing (Hurban, 2021) 119

Figure 5.7: Clear/transparent resin for 3D printed casing (Hurban, 2021) 120

Figure 5.8: Soundrop version 2.0 (Hurban, 2022) 121

Figure 5.9: Soundrop Version 2.0 (Hurban, 2022) 122

Figure 5.10: Algorithmic Flow Chart of Soundrop (Hurban, 2023) 125

Figure 5.11: Soundrop web application interface (Hurban, 2022) 126

Figure 5.12: A comparison of the current Soundrop in casing and early

‘tulip’ version (Hurban, 2022) 128

Figure 5.13: Soundrop in new casing mid-movement (Hurban, 2022) 129

Figure 5.14: Soundrop without casing mounted on belting with Velcro (Hurban, 2022) 130

Figure 5.15: Soundrop devices embedded into fabric bands (Hurban,2022) 131

Figure 5.16: Sketch of Mayez Rahman as Digital Dervish with Soundrop placement (Hurban, 2022) 135

Figure 5.17: Mercedes Romero testing the Soundrop (Hurban, 2022) 136

Figure 5.18: Fuse Jam at Barbican Theatre, Plymouth with Mercedes Romero (Hurban, 2022) 137

Figure 5.19: Testing with Mayez Rahman and Mercedes Romero with finalized version of Soundrop, May 5, 2022, Plymouth, UK (Hurban, 2022) 138

Figure 5.20: Carolina Loyola-Garcia testing Soundrop, March 2022, (Hurban, 2022) 139

Figure 5.21: Sercan Çelik testing Soundrop in Istanbul, July 2022 (Hurban, 2022) 140

Figure 5.22: Sketch of Sercan Çelik with placement of Soundrop on wrists (Hurban, 2022) 141

Figure 5.23: Sketch of *Flamenco Sonic* with Soundrop on wrist and ankle (Hurban, 2022) 142

Figure 5.24: Student trialing Soundrop at University of Tennessee, Knoxville, USA. October 19, 2022 (Hurban, 2022) 144

Figure 6.1: *Digital Dervish + Flamenco Sonic* score in spectrograph with areas of ambient silence and peak sound, (Hurban 2022) 150

Figure 6.2: A still from *Digital Dervish + Flamenco Sonic: Immersive Sky* featuring Mayez Rahman and Mercedes Romero, Market Hall, Plymouth, UK (image from Russell, 2022) 152

Figure 6.3: Visual choreography storyboard for DDFS 2021 part 1 (Hurban, 2021) 153

Figure 6.4: Visual choreography storyboard for DDFS 2021 part 2

(Hurban, 2021) 154

Figure 6.5: Side-by-side visualization of *DDFS* score and performance, May 7, 2022, Market Hall, Plymouth, UK (image from Charminar Films, 2022) 156

Figure 6.6: Mayez using Soundrop at 07:03 in musical score (image from Charminar Films, 2022) 157

Figure 6.7: 'Hurricane/whirling' section where device is continuously triggering, May 6, 2022, Market Hall, Plymouth, UK (image from Charminar Films, 2022) 159

Figure 6.8: Mayez Rahman in 'hurricane/whirling' section May 6, 2022 (Hurban, 2023) 160

Figure 6.9 Mayez Rahman in 'hurricane/whirling' section May 6, 2022 (Hurban, 2023) 160

Figure 6.10: *Flamenco Sonic* entering stage at 17:53, May 6th, 2022, Market Hall, Plymouth, UK (image from Charminar Films, 2022) 162

Figure 6.11: Mercedes using Castanet sound at 17:53 (Hurban, 2023) 163

Figure 6.12: Mercedes using Soundrop with digital guitar sound, Market Hall, Plymouth, UK (image from Charminar Films,2022) 164

Figure 6.13: Mercedes using Soundrop on wrist and ankle at 22:17 in performance (Hurban, 2023) 165

Figure 6.14: *Digital Dervish* and *Flamenco Sonic* whirling in unison, Market Hall, Plymouth, UK (image from Russell, 2022) 166

Figure 6.15: Mercedes and Mayez data while whirling together (Hurban, 2023) 167

Figure 6.16: Mayez Rahman as *Digital Dervish* with hurricane, Market Hall, Peterborough, Canada, September 9th,2022 (image from Charminar Films, 2022) 169

Figure 6.17: Carolina using castanets at 17:58 during ambient transition, Market Hall, Peterborough, Canada, September 9th, 2022 (image from Charminar Films, 2022) 171

Figure 6.18: Carolina in 'guitar section' 23:17 of *DDFS*, Market Hall, Peterborough, Canada, September 9, 2022 (Hurban, 2023) 172

Figure 6.19: Carolina initiating Soundrop on wrist and ankle with Mayez in foreground, Market Hall, Peterborough, Canada, September 9, 2022

(image from Charminar Films 2022) 172

Figure 6.20: Carolina and Mayez bowing to each other before whirling, Market Hall, Peterborough, Canada, September 9, 2022 (image from Charminar Films, 2022) 173

Figure 6.21: Carolina and Mayez whirling in unison, Market Hall, Peterborough, Canada, September 9, 2022 (image from Charminar Films, 2022) 174

Figure 6.22: Mayez and Carolina in final whirling scene, September 9, 2022 (Hurban, 2023) 175

Figure 6.23: Sercan Çelik as *Digital Dervish* in Part 1, Theatre of Digital Art, Dubai, UAE. December 16, 2022 (image from Charminar Films, 2022) 178

Figure 6.24: Data from Part 1 of Sercan whirling solo, December 17, 2022 (Hurban, 2023) 179

Figure 6.25: Sercan Çelik as *Digital Dervish* in Part 1, Theatre of Digital Art, Dubai, UAE. (image from Charminar Films, 2022) 179

Figure 6.26: Opening scene at ToDA, December 16, 2022 (image from Charminar Films, 2022) 180

Figure 6.27: Sercan in opening scene using Soundrop, December 17, 2022 (Hurban, 2023) 181

Figure 6.28: Sercan Çelik in ‘hurricane’ scene, Theatre of Digital Art, Dubai, UAE. December 17, 2022 (image from Charminar Films, 2022) 182

Figure 6.29: Whirling scene with Sercan, December 17, 2022 (Hurban, 2023) 183

Figure 6.30: Pepa using Soundrop on wrist Theatre of Digital Art, Dubai, UAE. December 17, 2022 (image from Charminar Films, 2022) 184

Figure 6.31: Pepa in first scene using wrist and ankle Soundrop, December 17, 2022 (Hurban, 2023) 185

Figure 6.32: Sercan and Pepa bow to each other, Theatre of Digital Art, Dubai, UAE. December 17, 2022 (image from Charminar Films, 2022) 186

Figure 6.33: Sercan and Pepa whirl together, Theatre of Digital Art, Dubai, UAE. December 17, 2022 (image from Charminar Films, 2022) 187

Figure 6.34: Sercan and Pepa in final scene, December 17, 2022 (Hurban, 2023) 187

Figure 7.1: Mercedes Romero and Mayez Rahman in *Digital Dervish + Flamenco Sonic*, May 6, 2022, Plymouth, UK (image from Russell, 2022) 206

Figure I.1: Mayez begin whirling at underwater scene (image from Charminar Films, 2022) 238

Figure I.2: Mayez whirling during hurricane scene (image from Charminar Films, 2022) 238

Figure I.3: Flamenco Sonic (Mercedes) in solo scene (image from Charminar Films, 2022) 239

Figure I.4: Mercedes and Mayez in final whirling scene (image from Charminar Films, 2022) 240

Figure I.5: Mayez whirling (image from Charminar Films, 2022) 241

Figure I.6: Sercan in seated position at ToDA (image from Charminar Films, 2022) 243

Figure III.1: Interview with Sercan Çelik in Dubai, December 17, 2022 (image from Rahman, 2022) 259

Figure III. 2: Rehearsing in Dubai with Sercan and Pepa December 15th, 2022 (image from Rahman,2022) 259

Figure III.3: Interview with Pepa Sanz in Dubai December 17, 2022 (image from Rahman, 2022) 262

Figure III.4: Mayez Rahman backstage at Market Hall, Plymouth, UK, May 6th, 2022 (image from Rahman, 2022) 265

Figure V.1: Sitting/swaying position DDFS (image from Charminar Films, 2022) 273

Figure V.2: Child's pose position DDFS (image from Charminar Films, 2022) 274

Figure V.3: Arms raised position DDFS (image from Charminar Films, 2022) 275

Figure V.4: Raising up on one knee position DDFS (image from Charminar Films, 2022) 276

Figure V.5: Initiating device DDFS (image from Charminar Films, 2022) 276

Figure V.6: Bowing position DDFS (image from Charminar Films, 2022) 277

Figure V.7: Begin whirling position DDFS (image from Charminar Films, 2022) 278

Figure V.8: Whirling position DDFS (image from Charminar Films, 2022) 279

Figure V.9: Initiate castanet sound DDFS (image from Charminar Films, 2022) 280

Figure V.10: Communicate with Soundrops DDFS (image from Charminar Films, 2022) 281

Figure V.11: Whirling together DDFS (image from Charminar Films, 2022) 282

Figure V.12: Dervish seated position DD (Hurban, 2022) 283

Figure V.13: Standing position DD (Hurban, 2022) 284

Figure V.14: Begin whirling DD (Hurban, 2022) 285

Figure V.15: Begin removal of skirt DD (Hurban, 2022) 286

Figure V.16: Removal of skirt DD (Hurban, 2022) 287

List of Tables

Table 4.1: Outline of comparisons and contrasts 76
Table 5.1: Detailed description of each sensor unit on *Digital Dervish* 133
Table 5.2: Detailed description of each sensor unit on *Flamenco Sonic* 133
Table 6.1: List of performers, roles, shows, venues, and locations (Hurban, 2023) 148

Glossary of terms

Ahwāl	A state of heightened awareness
Alegrías	The most common form of lively Flamenco dance
Baile	To dance in Spanish
Bata de cola	Long ruffled ‘train dress’ used in Flamenco
Bulerías	A type of Flamenco dance that involves banter and shouting with dance
Café Cantantes	A place where Flamenco singers and dancers would perform
Cante	Song or to sing in Spanish
Cante Jondo	‘deep song’ or profoundly sad, tragic song style in Flamenco
Cimbalom	A stringed instrument resembling a dulcimer that is mounted on a table and used with soft mallets
Compás	The rhythmic cycle and foundation for all Flamenco dance/song
Dervish	A Muslim who strives to seek a closer path to the Divine through meditation and prayer
Dhikr	Meaning ‘remembrance’; a form of prayer that is repeated
Duende	A spirit, or an overwhelming feeling of passion and elation while performing Flamenco
Escobillo	A quick turn made with a train dress
Flamenco	An all-encompassing word for the Spanish traditional dance, song and guitar music
Florea	An action done using the wrists and hands in Flamenco - it refers to the hand being held and turned delicately like a flower
Gitana/Gitano	Spanish word for Gypsy or people of Romani origin
Juergas	A wild party involving song and dance
Mantilla	A laced veil which covers the head and is worn over the *peineta* - it is often associated with religious symbolism
Mantón	A large, fringed shawl usually embroidered, worn by a Flamenco dancer

Maqam	A musical mode derived from Arabic musical styles
Ney	A reed flute used in *sema* ceremonies
Olé	An exclamation
Oud Or Ud	A stringed instrument with a large wooden base
Palmas	Hand clapping in Flamenco
Palos	Literally means a stick but also style of Flamenco dance/song
Payos	A non-gypsy Spaniard
Peineta	A decorative comb that is usually worn under the *mantilla* in the hair; it is sometimes adorned with flowers
Qawwali	A genre of music typically performed in the sub-continent
Sema	A sacred ceremony usually performed by Turkish Dervishes which involved whirling in circles to music and poetry
Semahane	The place or venue where a *sema* would take place
Semazen	The Turkish word for a Dervish or one who performs the *sema*
Semazenbaşı	The leader of the *sema* who directs the other Dervishes
Sikke	A long conical hat made of wool worn by *semazen*
Soleá	One of the many Flamenco *palos,* it is generally a song style that is more serious or somber.
Sufi	The term for those who practice a more esoteric branch of Islam, but not separate from it
Sunnah	The ways or traditions of the Prophet Muhammed (p.b.u.h.) that all Muslims should follow
Sünnet	A circumcision ceremony usually done in Turkey although it may be practiced in other Central Asian countries
Tablao	The theatre venue or space where Flamenco is performed
Tanoura	A North African (usually Egyptian) variation of the Turkish costume that is used for whirling consisting of a large colorful skirt
Tekke	A Dervish lodge where the *semahane* would also be
Tennure	The skirt portion of a Dervish costume – usually white for *sema* ceremonies

Traje	The costume of a Flamenco dancer
Wajd	Similar to ahwāl, it is the state of total annihilation of self and intense emotional feeling of connectedness to the Divine Creator
Zapateado	The complex patterns of footwork created by Flamenco dance

Chapter 1

Introduction

1. Introduction

My practice-based research explores the intersection of the traditional performance practices of the Whirling Dervishes of Turkey and Spanish Andalucían Flamenco using wearable technology by investigating how a new digital musical body instrument - the Soundrop, can enhance a performer's movement experience in an immersive performance that unites the two practices. This thesis has cultivated a performative paradigm necessitating my multifaceted engagement as a designer of costumes, architect of bespoke wearable technological body instruments, producer of performance pieces, choreographer, and composer of music. The overarching objective has been to inaugurate the evolution of this endeavor, integrating these interdisciplinary modalities, thereby producing an exhibition or performance piece that has also employed a collaboration between a filmmaker, dancers, and technicians who have contributed to its realization. As an interdisciplinary artist working with various forms of mediums alongside digital art and wearable technology, I developed the production of this work from its inception several years ago to the present which has been a culmination of trials, experimentation and iterations to executing not only a written account of these ventures but also producing a new performance work that encapsulates these mediums. Part of this performative framework emphasizes the act of the performance as a central element of my artistic work being presented and analyzed. The creation and presentation of this project is guided by utilizing and exploring interactive and technology-driven elements. Some questions that arose out of this research are as follows: how can the advances in the performing arts made through the incorporation of wearable and performative technologies enhance already established centuries-old dance/body movement traditions? Also, can these devices contribute to creating new explorations in traditional dance forms? The study uses existing technology to create a new experience for wearers

that may use these devices in their performance practices that could alter or enhance their form, using additional electronics that track gestures and movements while emitting musical sounds. I have developed a performance whereby technology, sound, music, animation and dance collide in a narrative composition, morphing two distinct and culturally notable body movement practices. This dissertation draws inspiration from a range of multidisciplinary practices and concepts including sound and music, digital technology, costume design, body movement and performance practices, as well as traditional forms of folk or cultural practices and sacred ceremonial movement rituals.

Throughout this work, an emphasis on performance and documentation of performances are analyzed as one of the key driving forces for this investigation. Engagement and interaction play a role in determining how the performers interpret their use of the Soundrop while also considering the temporal and spatial dimensions that are utilized to enhance the performers' and audience's experiences. The theoretical underpinning also explores concepts that are related to how users/performers interact with or embody the use of a digital component into their practice where they may have otherwise not considered employing wearable technology into their performance styles. Through iterative testing, development and refinement of the Soundrop as well as choreographing, rehearsing and presenting performances globally, a new digital artwork has been created which after analysis are documented through digital recordings and reveal invisible entities that are transformative and intriguing.

1.1. Research Context and Essential Concepts

The origins of this research began with work that I had done previously while building the *Dervish Sound Dress*, a prototype wearable tech performance garment that was inspired by the Whirling Dervishes of Turkey[3]. More specifically, the concept for this project developed from traveling to and living in Turkey and Spain where my interest in

[3] The Whirling Dervishes of Turkey/Türkiye are the founders of the tradition of whirling in the region; a practice that dates back to the 13th century. Throughout the dissertation, this particular Dervish order is referenced upon which the research is based. Though recently changed to 'Türkiye' as the official spelling of the country's name, the word 'Turkey' will be used for ease throughout this document and/or Türkiye where appropriate/necessary.

developing a link between ancient forms of traditional dance and contemporary dance practices that use technology was initiated. I was curious about building more costumes or garments that were outfitted with sensors and had some function, whether it was emitting sounds or other variables. The impracticality of the first prototype led to the question of whether another piece of wearable technology could be built that was interactive, intuitive, as well as functional. There was an intrigue in connecting sensors to a Dervish to see what would happen to the data while they moved. This concept started to evolve, but it needed a more thorough and deeper insight into the meaningful relationship between the Dervish and their movement. There is a lineage and a broadly rooted history surrounding the Ottoman traditions in the fine arts and culture. Devising a way of capturing this practice in a contemporary performance using multidisciplinary digital media is an essential concept of this work. The circular patterns that are created when a Dervish moves are mesmerizing. The continuous and laborious effort of spinning without so much as flinching or coming out of balance, even when the spinning winds down, is fascinating and exhilarating. There is deep meaning attached to whirling and why Dervishes have whirled for centuries. The potential to design a new interpretation of the ancient practice was promising. The initial challenge was finding the right people to work with, as most Dervish orders in Turkey/Türkiye still practice in the original form which has been unaltered for several hundred years. There are many contemporary ‘turners’ or ‘whirlers’, yet there is a gap in those who are inclined to revitalize the practice into the mainstream while retaining the essence of it with respect to the cultural and metaphysical associations. There was no interest from any of the traditionally performing Dervishes that were approached in the UK and in Turkey to even attempt to try the Soundrop, as they were quite strict in observing the original form of the performance. Following this, a performance artist/Dervish was contacted via social media who was enthusiastic about testing the Soundrop in his practice. The possibility of aligning the Dervish with another traditional dance practice was also appealing. If the Dervish could somehow connect to another performer through the use of a musical device, the possibility of creating a narrative between the two would be intriguing.

Apart from the research already underway with Dervish whirling, there were some initial conversations with a dancer in Pittsburgh, USA who practices classic Flamenco[4]. Her dance studio offers workshops and classes in Flamenco that were observed and recorded visually as a reference. There were discussions about how Flamenco could be further augmented with the use of wearable technology and to take the dance of Flamenco to another level. Flamenco is another practice that has centuries of development, oppression, resistance and revitalization with complex sets of movements and intricately detailed gestures that form a dance unlike any other on the planet. It is distinctly Spanish, and its underlying roots and structure are a result of the intertwining of language, dance and form that it is known for globally. These roots are embedded in the geographical wanderings of the Gitanos or Romani Gypsy populations that have traveled across continents and absorbed various cultural practices before creating their own version of Flamenco.

The intrigue of Flamenco which differs from a Whirling Dervish is that the movements and gestures are quite animated and expressive - a fairly broad contrast to the minimal continuous spinning of a Dervish. Some of these movements include wrist-rolling to clapping, hands on hips, arms in the air, slapping the thighs or legs and, most importantly, the legwork/footwork. How then could these movements and gestures be captured with a digital wearable device and what would be the outcome of this data?

After some research it became clear that there were in fact many contradictions to the practice of the Whirling Dervishes of Turkey with Spanish Flamenco - but there were also incredible, expansive and obliterated links that could be uncovered between the two, which would ultimately connect the two practices in a finalized performance piece using the Soundrop.

The initial stages of development involved becoming immersed in both practices to gain a deeper understanding of the driving forces behind how to turn for a length of time and

[4] The practice of Spanish Flamenco is discussed in-depth in this thesis with an emphasis on traditional or classic Flamenco from southern Andalucían Spain.

also how to engage in the arduous process of learning complex foot movements. The level of difficulty of both is intense and not for the faint of heart - they require strength, agility and stamina on a scale that cannot be reduced to simple trials. A sense of the tremendous power involved in executing Flamenco movements takes years of training, as does the baffling spinning of a Dervish that can last up to thirty minutes at a time. Both practices cultivate stories with their bodies, whether with arm/hand movements or gestures, using facial expressions, torso movements, balancing and foot movements that may look simple to the untrained eye, but are extremely sophisticated and beguiling. Part of the formula for both the Dervish and Flamenco dance uses music and sound, without which neither would make much sense. A Dervish can whirl in almost any situation, but the highlight of the whirling is emphasized through recitation and musical accompaniment. Similarly, Flamenco dance is almost always associated with song and dance, as these factors are inseparable as well as fundamental. Thus the next phase in the research was to create a bridge between these traditions by using technology that can be manipulated by the moving body to create sounds. This sound exchange would create a new way of performing both Flamenco and the *sema* (Dervish whirling ceremony) simultaneously. Investigating the possible connections between the two impervious practices that have not really changed in terms of form over many centuries and combining them together in a contemporary interpretation using a digital musical body instrument, the Soundrop, is the focus of this research.

1.2 Research Questions and Aims

My work gathers many different threads that form a cohesive study in using wearable technology to elevate the practices of the Whirling Dervishes of Turkey and Spanish Flamenco while also connecting the sociological, geographical and historical traits of these traditions using examples from music, dance and culture that interlink them. These channels are not arbitrary - in fact the evidence dates back to the 8th century when the Spanish Moors ruled Southern Spain as a flourishing Islamic society. It is a topic that is loaded with political discord amongst Spaniards who undoubtedly reflect the past, even in the present day, but who relinquish any associations with the Islamic rule of that time.

Orientalists will continue to defy these associations, but it is nonetheless part of the fabric of Spanish society as this brand of colonial dominion set the precedent for modern Spanish culture and traditional discourse. Flamencologists, musicologists and anthropologists agree for the most part that certain rhythms and forms in the music of ancient Arab poetry and songs have been absorbed into the Gitano/Gypsy vernacular over the centuries since the conquest of the Southern Spanish peninsula, and that these forms are the result of what is known as Flamenco to this day (Hayes, 2009).

These similarities, as well as contrasts, between the two practices are pronounced throughout this thesis to demonstrate that through music, dance, costume and performance a link is made using a digital musical body instrument that emits sounds when it is moved. The Soundrop highlights the performative layers of a Dervish and a Flamenco dancer in a performance that reflects cultural heritage, while also examining the subtle nuances of their body movements.

My aim is to explore how I can elevate the practice of Dervish whirling and Flamenco dance without appropriating, altering or exploiting the essence of the original forms. While living in Turkey for 2 ½ years and studying Turkish culture, and also traveling to Spain to observe Flamenco dance while becoming immersed in Flamenco guitar music, song and poetry the project began to take shape and the concept of juxtaposing these two traditions became more certain . This work expands on previous prototypes and designs that are inspired by these traditions that aim to digitally preserve or archive movements using wearable technology to create new immersive experiences for performers. Part of the invisible language between the two practices reveals that a Dervish can interpret most sounds, beats or even silence into a whirling state of continuous - sometimes ecstatic – motion, while a Flamenco performer can move to potentially the same tempo, beat, song or instrument for lengthy periods which submit them into a similarly euphoric state. A Dervish’s whirling depends upon the metaphysical state they attain while hurling themselves endlessly in circular motions, whereas a Flamenco dancer relies upon the music and song to drive their emotions which are often outwardly expressed using passion and intensity. There are patterns that have been discovered between the two

practices that reveal the intricacies of the movements and gestures made by a Dervish and a Flamenco dancer. The streets of Granada, Spain are filled with Flamenco performers ready to pounce on their flat boards in the squares to the delight of tourists and onlookers. Their accompanying singers belt out cries that are reminiscent of a muezzin who vocalizes the call to prayer in any given Arabic-speaking or Muslim majority country. These cross-cultural overlaps between the Romani Gypsies hailing from Northern Indian, through the Middle East and into Southern Europe, tell a story of a journey of intermingling cultures, languages and lifestyles. The parallels can surface by interlacing these traditions that have several centuries worth of historical tradition, through designing a piece of work that brings the Dervish and Flamenco in a collective study of sound, dance and performance using a piece of wearable technology.

Currently, in the age of the Internet of Things (or IoT) and data output and retrieval, humans are dependent on technology in a way that is becoming an essential and inevitable part of the social fabric. Everything is interconnected and so are the bodies of humans without even consciously being aware of it. Dance and performance have in recent years begun to make use of incorporating technological elements into contemporary works. Wearable technology can be used as an extension or an added limb that can control certain parameters or variables in a performance which seeks to emphasize or augment movements and gestures, creating a novel way of performing/dancing. Creating, composing and making music has taken on a whole new meaning in the age of the Internet of Things and the wide-ranging available applications that even the most untrained amateur aspiring pop star can get their hands on. Anyone can download software and start making beats from the comfort of their own bedroom. Slade (2007) remarks that it is now even more exciting and accessible for people to be able to go online and create their own playlists, find bands or music to be inspired from and tinker with electronics and tools from which to create music - all within the space of their own surroundings. Having the freedom to control and create sounds by using the body has endless possibilities. It can allow for creation to happen instantaneously, rather than requiring rigorous training and high level of skill. Devices that are created as digital musical instruments can promote the interdisciplinary production of sounds that may be

created by, for example, a dancer rather than a live guitar player. This can lead to new expressions of sound that may not necessarily be generated by traditional means. Capturing movements to which sounds are attributed can formulate new relationships with how performers express and interpret sound.

Therefore this research connects the historical, cultural, musical and performative links between the traditional turning practice of the Whirling Dervishes of Turkey and Spanish Andalucían Flamenco dance by using existing technology to create a device that augments the movements made by these two dance styles. The two practices seem to be 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 gestures that can be interpreted in numerous ways. This investigation is showcased in a performance where the two forms of movement morph together with sound, a visual spectacle and dance. I have choreographed a narrative between the Dervish and the Flamenco dancer which is augmented using the Soundrop that tracks body movements or gestures that are specific to each practice. These body instrument devices contribute layers of sounds to a composed piece of music by triggering sounds based on the movements and gestures of the performers.

The questions provoked in this research can be summarized as:

- What are the similarities or links between the practices of Dervish whirling and Flamenco dance through the respective cultural heritages that can be explored using sound/music and technology? How then can these amplified elements be used to establish a new hybrid form of performance practice?

- What specific meaningful movements/gestures of a Dervish and Flamenco dancer can be augmented and captured using a digital wearable musical body instrument?

- What tools and sensor systems are needed to create wearable body instrument devices that are safe for wear close to the body for a wearer in performance settings such as theatre, opera, and dance?

The main aims of this research can therefore be defined as:

- To create a digital musical body instrument device that is interactive and immersive which emits musical sounds

- To create a contemporary, experimental performance piece that examines links both in terms of sound and movement between the Mevlevi Dervish 'turning' ritual of the *sema* and traditional Spanish Flamenco dance practices using a digital musical body instrument
- To evaluate and analyze recorded digital data that reveals information about how a Dervish and a Flamenco dancer moves

- To create a performative framework to coherently contain and instrumentalize these elements

1.3 Methodological Approach; a practice-based investigation

The methodological framework for the research undertaken in this thesis is led by practice, observation, experimentation, engagement and empirical analysis. This practice-based inquiry is constructed by observing and reviewing literature on wearable technology while designing and prototyping a tangible artefact. As defined by Skains (2018), within the field of arts and humanities, a practice-based or practice-led approach to research, 'the creative act is an experiment' where the process and the product are of equal importance. The approach is multi-disciplinary: the intent is to observe how the movements of the body can trigger sounds via a wearable device and how the wearer can create a composition with these sounds. This combined with my interest in the cultural heritage of traditions from which inspiration is drawn, defines the direction of this thesis. It is a study in combining wearable technology, sound and music, performance, digital art

and human-to-computer interaction with rich traditions of the Spanish flamenco dance and the Whirling or Mevlevi Dervishes of Turkey.

The *Dervish Sound Dress* was a study in drawing inspiration from the sacred performance of the *sema* performed by the Whirling Dervishes of Turkey, where a prototype body instrument costume was built and test-performed using layers of wiring and microcontrollers which, although effective, were cumbersome and bulky. The dress was outfitted with sensors that were mapped to various sound samples and when gestures were initiated such as bending elbows or touching capacitive touch buttons made of conductive thread on the bodice, sounds would be emitted. Following this, several design options for embedding sensors into other traditional dance costumes were developed to decipher how or why those performers move in a particular way and how those movements can be attached to sounds.

One of the major components of this practice-led research has been to experiment with using sound as a way to amplify and sonify[5] movement. The act of sonifying movement can be described as "mapping movement parameters to sound in order to create novel perceptual streams congruent to the time course of kinematic or dynamic movement parameters" (Effenberg, 2005). Further to this, using sound as an extension of the body can elevate and emphasize movements or gestures which can serve to communicate more information about a dance, an emotion, or highlighting specific climatic features during a dance performance. When sound is controlled by the dancer themselves, the interaction and advanced sense of expression becomes a more embodied experience, regardless of whether the dancer/performer is a trained musician - the goal is to add an additional emphasis to the movement to create new ways of conveying sound. Representing sound through movement enables performers to use their interpretative methods of dance choreography to alter the perception of their movements. Misgeld et al (2022) mention that if dance movements can be 'sounded' - whether traditional folk dance

[5] According to the Merriam-Webster (n.d.) definition of sonification, or to sonify, means the act or process of producing sound. In terms of computer music applications, sonification is used to visualize sensor data, hence data sonification.

or otherwise - an entanglement between musicians and dancers appears which can generate new ways of artistic expression.

Through testing and analysis using various methods of attaching sensors onto fabrics, developing conductive materials, using different programming languages and development environments, and testing different hardware components, a hand-held detachable device - the Soundrop - has been developed with a singular purpose: to track gestures based on the velocity of movement to which sounds, and haptic vibrations are mapped. The importance of the user being able to feel the subtle tactile vibrations is key to this device, in that it assists the user in understanding that an action has been completed. These vibrations are a key feature of any electronic device that is worn close to the body as it can trigger sensations that are reminiscent of using acoustic instruments. The reverberation from any acoustic instrument such as a piano, guitar or reed instrument is the result of injecting mechanical force and energy through velocity and displacements such as plucking, striking or pressing (Papetti & Saitis, 2018). Designing digital musical instruments[6] require the functionality of implementing haptics as a tangible component in relaying real-time action from device to performer. DMIs are becoming increasingly more sophisticated and powerful in emulating acoustic instruments and by integrating multimodal feedback and haptics, DMIs can not only produce limitless opportunities for sound design and interaction but can allow more control and expression (Miranda & Wanderley, 2006). The Soundrop is equipped with an LED ring as its purpose is multifold: when it is initiated with movement, a color is displayed which adds a visual element signifying that a piece of technology is affected by movement, while also signaling when it is turned on or off. The sounds that are mapped to it are interchangeable - a bank of sounds is created that are used during a performance which complement the musical composition and are electronic sound manipulations of instruments or sounds associated with Dervish whirling and Flamenco music. This detachable device, which can be worn on the wrist or the ankles, has also been tested using a visual output, and the possibilities of using it in VR settings are also potentially viable.

[6] The acronym 'DMI' is accepted and widely used abbreviation of Digital Musical Instruments.

There are two main streams of methods used for amalgamating concepts in this thesis: defining the cultural, historical and musical links and distinctions between the centuries-old traditions of the Whirling Dervishes of Turkey and Spanish Andalucían Flamenco dance, and using the design thinking process to develop a digital musical body instrument that augments these practices in a final showcase where the performers dance together onstage using the Soundrop set to an experimental film and a musical composition. The contrasts and similarities are evident as the lines of technology, costumes, dance, music, culture and movement become blurred but also harmonious. The research undertaken for this project evolved into building the practice component of this thesis by producing a performance piece where the interface for the Soundrop was designed, tested and developed, music was composed for the performance piece, dancers from different parts of the globe were instructed through rehearsals and given choreography to use and interpret with their own movement styles, and two immersive films that I commissioned by a filmmaker who translated the music and the story into a visual spectacles. These collaborative elements resulted in the production of six performances in total. These performances have been showcased globally in the UK, Canada and Dubai, UAE. Stills from each performance can be seen in Figures 1.1, 1.2 and 1.3. Each venue was distinct from the other: the first used a 360 projection of a film creating an immersive experience for the performers and the audience, the second a traditional theatre with two circular screens that mirrored one another and the third, a fully immersive space with 12 reflective screens.



Figure 1.1: Mayez Rahman as *Digital Dervish* at the Market Hall Theatre, Plymouth, UK May 6, 2022 (image from Russell, 2022)



Figure 1.2: Mayez Rahman and Carolina Loyola-Garcia in *Digital Dervish + Flamenco Sonic* at the Market Hall Theatre in Peterborough, Canada, September 9, 2022 (image from Charminar Films, 2022)



Figure 1.3: Sercan Çelik and Pepa Sanz in *Digital Dervish + Flamenco* Sonic at ToDa, Dubai, December 16, 2022 (image from Charminar Films, 2022)

The primary method of knowledge development in this research examines the histories and oral traditions of both the Whirling Dervishes of Turkey and Spanish Andalucían Flamenco through contextual analysis and theoretical approach of underpinning the essential historically relatable links and subtleties that define each tradition. The secondary route of the methodology of this practice-based research is led by prototyping and iterating using the universal system of the design thinking process. This process which generally consists of five or six key steps which are empathizing, defining, ideation, prototyping, testing and implementation (Dam, 2022). The Soundrop has evolved from an initial concept to a functioning, interactive artefact that is used to enhance dance movements. The various iterations have gone from embedding sensors into fabric to designing a bespoke multi-sensor device that is wireless and detachable from the body. Initially this process involved setting a precedent for understanding or empathizing with potential users and how this human-to-computer interaction can be sensible and an effective tool for sound generation. Creating a DMI/gestural controller that is focused on capturing a dancer's movements defined the direction of this inquiry. Following this, a range of concepts and designs were iterated to determine the best possible solution for a variety of parameters including size, practical wear, real-time sound generation and placement on the body. After several iterations and prototypes built with testing various forms of coding and microcontrollers, a robust design has been constructed and tested with performers. The testing phase using different prototypes aided in deciphering which iteration would work best and be the most effective at delivering sound, leaving less latency between a gesture and sound emission.

Different performers use the devices in different ways depending on their interpretation of their dance form - all have remarked that using technology can enhance their conventional way of performing while contributing to the outcome of their dance expression.

1.4 Thesis Overview

This thesis is structured in a narrative way, wherein each chapter follows the other in familiarity and relevance. The second chapter examines the field of wearable technology in terms of its applications, uses and notable designers/creators/musicians/fashion designers/performers who use wearable technology and digital art in their work. This sets a precedent for creating a digital wearable body instrument that can be used as an extension of the body for performance in music, dance, theatre or other performing arts areas. The third chapter analyzes how technology in the performing arts is being used and applied and how the relationship with the body and sound can be further elevated with technology. Chapter 4 explores the parallels and contrasts between Dervish turning and Flamenco and how, through links and variations, a multi-media immersive and interactive performance piece bring the two practices together with choreography, an audio-visual backdrop and an interchangeable language using a digital musical body instrument. Chapter 5 further outlines the practice of this research with the development of a digital musical body instrument: the Soundrop. The methodology, trials and testing and experimentations with the device are discussed. Finally in Chapter 6, the culmination of the performative framework of this research is presented through the practice in the formulation of the performance work *Digital Dervish + Flamenco Sonic* through visual and data analysis. Appendices A and B offer an in-depth analysis into the histories and practices of the Whirling Dervishes of Turkey and Spanish Andalucían Flamenco dance, and how a wearable digital musical body instrument (the Soundrop) can augment these forms of dance/movement. The work here also serves to illustrate the motivation behind examining these two forms of traditional dance.

1.5 Ethical considerations

This practice-led research is concerned with observing dance and body movement forms of Dervish whirling and Flamenco dance. A considerable factor in this observance is testing electronical components with and on live performers whose feedback was instrumental in the development of the Soundrop. Therefore testing, iterating, prototyping

and designing is reliant upon how performers could use the Soundrop in their practice considering several points: is the Soundrop user friendly/easy to operate, is it comfortable, does it interfere with the dance/movement, does it contribute to the movements/gestures when emitted sounds and vibrations, does it feel like an extension of the body or a body instrument, can it elevate the dance in a new or different way? These considerations and questions are key details throughout this research and are tested extensively on various subjects which include the dancers who play a role in the performance of *Digital Dervish + Flamenco Sonic*. The pertinent factor in this research is to also observe these traditions from a bird's eye perspective so as to not deter, appropriate, alter or interfere with the pure forms of these practices. Rather the objective is to augment the forms with electronics and sound.

Ethical approval was secured for this project through the University of Plymouth for engaging in testing and interviewing performers who are involved in this project and how their use of experimenting with the Soundrop contribute to the design process. Informed consent about this project was given to all parties involved as information about their experiences were collected through a series of videos of the performances as well as participating in interviews and candid moments while testing and using the device.

1.6 Contribution to New Knowledge

This thesis provides an insight into how audio-visual, sonic art and wearable technology can be intertwined with links made between contemporary forms of Whirling Dervish turning practices and traditional Spanish Flamenco dance. A new performance has been created interlacing these two richly diverse, culturally and historically significant practices using sound and wearable technology to emphasize meaningful gestures using bespoke sensor systems to be worn on the body. There is a definable mechanism that reveals a clear connection that has been sanctioned for centuries through politics, conflict and socio-economical boundaries. These links are made clearer through this analysis which further emphasizes connections that are made through a digital arts practice which are an essential element of the performative framework.

Specifically, this research aims to:

- To draw comprehensive links between the Dervish whirling practice from Turkey and Spanish Andalucían Flamenco dance in terms of musical traditions, body movements and gestures, and significant socio-political/historical links

- To create digital musical body instrument devices that can be used for interactive on-stage performance by capturing significant movements and augmenting them to emphasize meaningful gestures

- To create a new performance work that combines digital art, dance, sound, film and wearable technology inspired by the movements of Dervishes and Flamenco dance

- To observe the nuances in data flow from the movement of a Dervish and Flamenco dancer through uncovering and visualizing the invisible relationship between device and performer

Chapter 2

The Wearing of Technology on the Body

This chapter analyzes the field of wearable technology with a focus on developments in commercialized wearables as well as experimental wearable digital musical instruments. Historical examples are presented of how the concept of wearing technology has evolved over centuries and how wearable technology is currently being classified. Modern applications and uses for wearable technology are discussed and how it continues to be implemented in the areas of fashion, costume, music and the performing arts. This research positions itself within the oeuvre of digital art.

2. Wearing Technology

In the post-modern contemporary world, humans have found themselves in a position where technology is becoming deeply integrated with most everyday human functions. These functions are being completed by another mechanism that delivers and gathers information. The mechanism is the result of how developments in technology have been integrated into mankind's existence. The idea of "wearable technology" is not new; what has changed over time is the way humans perceive the technology that they wear on their bodies. This "wearing" of technology has more intricate implications that humans are yet to discover. Where humans are becoming more drawn to augmenting aspects of their lives and even their bodies with technology, the question of how this concept will serve humans in the future is well worth investigating. This research is therefore concerned with investigating how the wearing of technology for the purpose of highlighting movements of dancers through musical sound can augment their dance practices. The examples shown in this chapter outline how wearing technology and specifically those developments play an important role in the broader research for this work.

2.1 Developments in Wearable Technology

The word *wearable* can mean anything such as a piece of cloth or object that can be worn over, on or around the human body in one way or another. Dominique and Crego (2019) interpret the term by suggesting that using the word 'wearable' derived from the verb 'to wear' is in fact archaic, since everything that humans place on their bodies is worn. The wearing of things on the human body has existed since the beginning of man, therefore what makes something 'wearable' is in itself a contradiction. In the present day however, the word 'wearables' has come to be associated more with the wearing of devices that are connected to electronics on the body, rather than a piece of clothing that is simply 'worn'. It may be that the correct term if referring to a wearable product that is embedded somehow with technological capabilities should be defined as 'wearable computing', which would make more sense since 'wearables' are in fact devices that use computing on or embedded into fabrics or devices that are worn on the body. Dominique and Crego (2019) go on to suggest that referring to wearables as 'connected wearables' seems to make more sense since it encompasses a wide variety of objects that are somehow linked to the internet via a means of communication such as wireless or Bluetooth. McCann and Bryson (2009, pp.4) define wearable computing in these terms:

"A wearable computer is a computing device assembled in a way which allows it to be worn or carried on the body while still having the user interface ready for use at all times. By constructing it to be body-worn, a wearable computer makes computing possible in situations where even a laptop would be too cumbersome to open up, boot up and intercede; a wearable computer can be used all the time, wherever the user goes."

To refer to the term 'wearable technology' with ease throughout this document, the shorthand WT will be used where appropriate. WT can be defined as a category of electronical devices that are attached to the body, embedded into textiles and fabrics, or even implanted onto the human skin (Watkins & Dunne, 2015 pp. 123). Seymour (2009) states that fashionable technology or WT also has a purposeful function such as delivering computational data, while creating meaningful design that is aesthetically

pleasing. Sazonov (2014) further describes WT 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. 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. Ultimately, any device that can be attached, implanted, or somehow worn and incorporated onto the body through fabric or other materials, serves a purpose to transmit information with ease, speed, portability and hands-free access to computers and electronics. Ryan's (2014) commentary on how WT is defined serves a more philosophical explanation: that there are also cultural dimensions of technology that are defined in the way humans dress. Moreover, enhancing a garment with technology advances the language of dress that is also embedded in social behavior (Ryan, 2014).

The idea of human augmentation has been incremental over the last few decades, but it is now becoming more of a reality. Some regard Steve Mann as the founder of wearable computing. He has called himself the first 'cyborg' and his innovations such as the wireless webcam and wearable technology eyeglasses, among many others, have positioned him as one of the great innovators of WT (Guler et al, 2016). Raisamo et al (2019) comment that human augmentation is a means by which technology is somehow integrated through the use of wearables, especially as a way to enhance human capabilities or productivity. These wearables may include devices that are attached to the body in some way through textiles or 3D printed mechanisms, implanted devices, augmented reality (AR) or virtual reality (VR) devices such as headsets or full-body suits; all with the purpose of allowing the wearer to engage in an immersive and interactive experience with technology. It is arguable that humans have already augmented themselves to a certain degree by using and carrying portable devices such as smartphones and smartwatches that transmit and deliver information at the touch of a button (Balanganur, 2020). For centuries, humans have been seeking ways of adding to or extending what is already on their bodies in an effort to minimize human labor, but also to adorn themselves with useful gadgets and devices that enhance their daily lives. Some of these inventions include the wrist or pocket watch, eyeglasses and so forth. Therefore,

delving into the past to understand how civilizations have developed WT over time, is worthy of exploration. This also relates to how the concept of wearable technology can potentially enhance historically rich traditions such as ancient dance forms and how this can be done in such a way that upholds the historical importance of these traditions with the addition of technological enhancements.

2.1.1 Wearable technology and the Internet of Things

According to McCann and Bryson (2009), what spawned the surge of interest and development in WT was the military and health sectors' interest in using computing on clothing and technology in the medical field, the fact that computer scientists and electronics engineers were 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. It was around this time that people began to explore finding ways to customize accessories or garments by attaching computing, without realizing the impact this experimentation would have in the near future.

The *Internet of Things* or IoT can basically be described as physical objects or devices that can be connected to the internet through the use of software or sensors. Burgess (2018) describes the *Internet of Things* as any object that can communicate or 'talk' with other whether it be a smart toaster or a smartphone. Therefore, these objects that can range from simple wearables such as fitness trackers or smart watches to devices that generate playlists based on music preferences that one listens to frequently, can communicate with other devices so that they are all connected and perform a function. This function, such as outputting data for the purpose of tracking a person's movements and locations, can then be used to create algorithms. Some argue that this type of data collection could be useful in time saving, while others say it is invasive and evades a person's privacy by unknowingly delivering information about themselves.

2.2 Wearable Technology Applications

Wearable technology roughly falls under these main categories: consumer devices, wearables for the health sector and health-related applications, wearables for the military and textiles that have been integrated with technology in some way. Advancements in the health sector have provided the bulk of research being done in WT but consumer products are increasingly becoming in higher demand with a market that is now flooded with a gadget for almost any need or purpose. Just about anything that can be attached to the body whether it is a ring, a hearing aid, glasses, socks, a watch, footwear or jewelry, can be connected wirelessly through Bluetooth to feed data to a source.

Perhaps the most practical of wearables are in the health and wellness industries where devices can now detect more about the human body than was ever conceivable. Whether it is analyzing blood oxygen levels, blood pressure, heart rate, body temperature and all of the other usual vitals, wearable devices can detect for certain anomalies in the human body that could provide integral information in predicting illness and disease.

Wearables are expanding into several different markets such as healthcare, sports/fitness, military, security and defence, gaming, smart homes, as well as crowd sensing/interaction. With these areas targeting consumers that are not just for a niche market such as high fashion, the possibilities of integrating technology into clothing is inevitable. However, the above-mentioned applications and much of the research and reviews surrounding wearable technology have a focus on the garment industry and are less to do with the performing arts. Therefore, the interest in this research is to develop and apply technology to clothing that provides an enhanced or augmented experience in the performing arts by integrating technology seamlessly onto garments.

WT in the 21st century has now become synonymous with wearing computing on the body. This can be in the form of a wristwatch, armband, earpiece, ring, necklace but also includes wearing garments that are embedded in some way with electro-connective wiring that can somehow transmit data using a wireless output. These smart garments are

beginning to shape not only the future of fashion and technology, but also technology and how it can be used in the performing arts.

2.2.1 Commercial Devices

With the advent of the internet and the development of the Internet of Things wearable devices have been flooding the market of wearable consumables for the past few decades. To be more precise, since the highly marketable Sony Walkman was introduced in 1979 in Japan, wearable computing devices have morphed into a field that can now include anything from an Apple iPod to Google Glass, and numerous iterations of smartwatches, headsets and even jewelry (Ikuo, 2019). Some examples of WT designed for consumer consumption can include portable and wireless devices such as earpieces that receive and deliver phone calls via Bluetooth to a phone app, various fitness-related wearables that encompass health and motion trackers, and devices that can be embedded into clothing to improve or enhance fitness performance. Augmented and virtual reality headsets for gaming and other applications as well as AI earpieces or hearing aids (also known as *hearables*) that have the capability of filtering out unwanted noise which can also perform a variety of functions such as audio streaming, tracking fitness and voice translation are also on the market (Wigmore, 2019).

There are a number of WT devices that have exploded on the consumer market but perhaps none more so than those that are worn on the wrist or arm. Devices such as the iWatch revolutionized how the regular consumer could feel connected to the world just by touching a sleek and colorful little screen on their wrist. When its creator Steve Jobs unveiled the technological marvel, he promised that it would 'work like magic' – a promise which truly delivered (Campbell & Pastina, 2011). Commercial wearables for fitness and health tracking include the popular elegant and pricey Oura[7] ring. It can measure and monitor the wearer's vital signs as well as track movement, heart rate and calorie burn. With several built-in sensors that fit into a tiny space on the inner band of the ring, the Oura is outfitted with a 3D accelerometer, gyroscope, and 2 LED infrared sensors that

[7] https://ouraring.com

monitor thermal body temperature (So, 2020). The ring was used in early 2020 to detect the COVID-19 virus in healthcare workers before they became symptomatic (So, 2020).

The latest in WT trends for the year 2021 and going forward have surfaced due to the COVID-19 coronavirus pandemic which started late 2019. Designers have sought ways to invent devices that could detect information about the wearer's health such as in many fitness trackers now having oxygen saturation and ECG monitors as standard functions. But perhaps the most adventurous of designs that have been cropping up are smart masks for protecting people against the virus and other diseases. Several companies globally have already begun to market their inventions with companies such as Donut Robotics[8] in Japan. The company created a smart mask that attaches to any ordinary mask and is connected with a wireless router over Bluetooth to a smartphone app. The wearer can answer phone calls and dictate text without having to touch their phones (Chandler, 2020). The "C-Mask" is an example of how the growing anticipation of persistent waves of infection of the virus can change social interactions amongst humans requiring a way of re-entering the pre-COVID life that most humans yearn for.

These commercial devices have served as an inspiration to the conception of a design that amalgamates the wearing of technology in the context of the performing arts. The following examples illustrate the various modes and categories of WT and the possibilities of exploring these for use in the realm of digital performance art.

2.2.2 Virtual and Augmented Reality Wearables

By its very nature, the word 'virtual'[9] means something that is not entirely real or experienced in the real world. The definition lends itself to meaning something that is created through the use of software to simulate an existing environment. These virtual or augmented worlds are being created in the areas of gaming, industrial design, fashion, healthcare and education as well as in the entertainment industries such as in films. The

[8] https://en.donutrobotics.com/c-mask
[9] https://www.merriam-webster.com/dictionary/virtual

applications and possibilities of AR and VR are endless and are gaining momentum in these and other fields of research.

Wearable devices such as the Oculus[10], which is a product under Facebook Technologies, offers intense virtual reality user experiences for gaming and virtual environments that are worn as a headset with separate handles and controllers for both hands (Jerdan et al, 2018). The Oculus and its various iterations (Oculus Go, Quest, Rift among others) provide users with high-quality, fast processing, stand-alone functionality for the ultimate virtual reality gaming experience (Greenwald, 2020). Although using the VR headset for gaming can garner an amazing and unique virtual experience, the downside for some is VR-related motion sickness due to a loss of spatial awareness (Fagan, 2018).

Devices such as Apple's Vision Pro[11] are also challenging the notions of how advancements in WT that encompass virtual and augmented realities can enhance and change the way in which humans communicate, work, perform tasks, use entertainment and build virtual settings for design and creation. However for a hefty price tag, this concept of 'spatial computing' is not for all consumers and although can be beneficial to users, it poses some ethical or philosophical questions such as, do users really want to be looking through a virtual setting than real life for extended periods of time? (Patel, 2024)

While many AR/VR systems have been designed for the purpose of developing gaming environments, the use of motion capture to create avatars with such as characters for gaming can use further exploration. Many games are designed using live performers in motion capture suits whose movements are recorded for characters in games. However, the possibilities of using motion capture for alternative purposes are endless. For this research, motion capture technology was also used as a means of experimentation with

[10] https://www.oculus.com
[11] https://www.apple.com/apple-vision-pro/?afid=p238%7CsTHXpRf18-dc_mtid_%5Btracker_id%5D_pcrid_689653239346_pgrid_150826790596_pexid__&cid=wwa-us-kwgo-VisionPro-slid---productid--Brand-Avalanche-Avail-

virtual worlds. The concept was to explore how a metahuman in a virtual space could be used as a tool for recording dance movements. This is further explained in Chapter 3. Added short para on how VR/AR relates to work

2.3 Wearable Technology in Fashion

At the inception of this work, experiments with integrating sensor systems into garments or fabrics was part of the process of inquiry which eventually led to encasing sensors that were separate from but attached to the body. The works of many designers especially in the field of fashion technology were investigated in terms of how sensor systems could communicate something or record and output data. Essentially, wearable technology could not only enhance a garment or a costume, but it could serve as an instrument that the wearer could manipulate. The works of the following designers are revered as the platform from which part of this work originates.

Explorations in using WT in fashion/clothing/costume are becoming more experimental but also functional. This collaboration between clothing designers and scientists have catapulted WT into a new era of discovery at the intersection of art and science. In 2006, Philips Design created along with fashion tech designer Nancy Tilbury, the *Skin Probe* project for which they designed two dresses: the *Bubelle Dress* and the *Frisson Dress*. Both dresses were an exploration into sensing using the body to project information or emotion onto a fabric using biometric sensors (Weir, 2007). Antic (2011) describes the project as Philips Design's prototype to test its viability in the future mainstream market of clothing that could be integrated with technology. The *Bubelle Dress* in particular was made up of biometric sensors that detect the wearers heart rate which could then be translated as a color in the form of a bubble shape displayed by LEDs. This interplay and interaction of how wearers might conceive of using technology to relay information to their surroundings was an experiment that began to set the world of just couture fashion apart from fashion that had a function or purpose hence, wearable technology.

Costumes and fashion pieces that have been created for the stage for performing arts practice such as musical theatre, rock and pop stage shows or spectacles, circus performance among others have all begun to test the possibilities of how technology can be used to enhance garments in this area. Schneegass & Amft (2017) explain that in the last two decades, pop star performers and celebrities have been looking to enhance their on-stage performances with technology, whether it be in the form of flashy LED lit costumes or perhaps even controlling certain aspects of the show's spectacle such as lighting or sound.

There are several crossovers in fashion technology and the sciences such as designers who were trained as engineers or scientists who have collaborated with fashion designers to develop new ways of implementing technology into clothing, while others are focused more on the performative or entertainment aspect of using technology in clothing, costume, or fashion.

Fashion designers have for the most part, over the last three decades, embraced technology in one form or another, whether implementing technology in aspects of the fashion show such as lighting, projections, illusions, sound, and other effects, as well as using technology as a medium in which to create fashionable garments. Some of the contemporary fashion designers working at the intersection of fashion and technology include Hussein Chalayan, Iris Van Herpen, Annouk Wipprecht and wearable-tech duo Ryan Genz and Francesca Rosella of CuteCircuit. The work being done by these designers is for the most part inaccessible for the ordinary fashionista, however some of the innovations that are being created seem to be trickling down into the consumer market where it will soon be possible for the average tech-savvy fashion fanatic to adorn bits of wearable computing that is functional and transmits data in one way or another.

Seymour (2009) remarks in her book *Fashion Technology* that the ideal partnership of scientists/engineers and fashion designers can result in creating truly functional and aesthetically beautiful wearable computing. Fashion designers are not necessarily proficient in programming tech for use in their fashion tech design pieces, therefore this

union of fields is not only crucial to the output of truly operative smart garments but is also inevitable. Perhaps it was the work of Turkish-born Hussein Chalayan[12] that in the early 2000's broke ground in this area of fashion tech with his wildly innovative designs in his Spring/Summer collection of 2000, where 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.

Iris Van Herpen's[13] work, in contrast to Chalayan's, uses technology with which to craft cloth. Herpen's designs are often reflections of organic beings such as sea creatures, patterns in nature, or exotic plants and flowers. Her Spring/Summer 2021 couture collection entitled 'Roots of Rebirth' is inspired by the pleated gills of mushrooms and the interconnected web of fungus that branches out far and wide underground (Borrelli-Persson, 2021). As with many of her previous collections, Herpen makes extensive use of 3D printing as a method for constructing her garments, rather than embedding technology directly into the cloth. The garments move through space as though they are becoming a part of the wearer and not separate from it, which is why Herpen's work is so often referred to as 'post-human fashion design' or the interconnections across species (Smelik, 2020).

Annouk Wipprecht's[14] 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. Wipprecht went on to create further iterations of the *Spider* dress, partnering with Intel Systems and Audi to design garments that border on organic robotics in the shape of sleek automobiles.

[12] https://chalayan.com
[13] https://www.irisvanherpen.com
[14] http://www.anoukwipprecht.nl

CuteCircuit is a company founded by Francesca Rosella and Ryan Ganz out of London, UK. The pair met at the Interaction Design Institute in Italy and their company has now undoubtedly become one of the leaders in interactive fashionable technology. Their work has been adorned by celebrities for onstage performances as well as red carpet events. Many of CuteCircuit's designs have now become synonymous with wearable tech pop - fashion. Their brand of functional wearables has gained notoriety amongst WT designers. The Sound Shirt[15] is an immersive garment that uses haptics. It was created as a piece of clothing that could replicate the vibrations of instruments being played for the hearing impaired during a concert or performance. Rather than being able to listen to music, the wearer senses the vibrations on the body as it is being fed through sensors from a live orchestral performance. The shirt is totally without any wires or visible cables, it is lightweight and provides subtle vibrations from 28 high resolution haptic actuators. The haptics provide and immersive experience for the wearer, whether or not they are hearing impaired, making it a uniquely innovative design. This particular work which deals with sound by emphasizing haptic vibrations propelled the concept for using and integrating sensors in the Soundrop to activate reverberations made by real-time gestures and movements. The impact of feeling tactile sensations on the body further augments the experience of the user to where the user interaction is enriched.

2.3.1 Art and Fashion Technology

In the last decade or so there has been an upsurge of speculative fashion tech designers who are working at the intersections of art, architecture, interactive technologies, wearable tech, and design. The work has been surfacing on social media sites such as Instagram, as well as in curated gallery settings that display their creations alongside other designers in the field. More notable designers such as Behnaz Ferahi[16] have cultivated a practice that is a unique blend of art, fashion and technology and has packaged it in such a way that makes the viewer consider how technology and fashion can be merged to create experimental works that offer new perspectives on how humans

[15] https://cutecircuit.com/soundshirt/
[16] http://behnazfarahi.com/Iridescence/

integrate their clothing with technology. Ferahi is a critical thinker and a technologist, but also interested in deriving inspiration from living objects that can be emulated using advanced computational technologies. One of her recent works as seen in Figure 2.1, *Iridescence* (2019), Ferahi explores the behavior of hummingbirds by creating a collar that is attached to the wearer's shoulders and reacts using a facial tracking camera to activate the two hundred 'quills' that change color and flutter like that of a bird.



Figure 2.1: *Iridescence* by Behnaz Ferahi 2019 (Image courtesy of artist)

Other notable artists and makers in the field of fashion technology include Melissa Coleman[17], Camille Baker[18] and Joanna Berzowska[19]. Coleman's work explores the interactions between electronics and the body in various sensory projects. Baker's work is based on sensory experiences that also involve the use of VR technologies for performance and participatory engagement. Berzowska runs a research and design lab at Concordia University in Montreal where the work focuses on innovations in the field of electronic textiles, tangible computing, and interaction design. The work in this research is closely related to this field in that the investigative and exploratory nature of using sensors to create experiences with sounds for the wearer that revolve around

[17] https://melissacoleman.nl
[18] https://camillebaker.me/media/
[19] https://www.concordia.ca/faculty/joanna-berzowska.html

performance, costume and sound art engage with the possibilities of digital spaces, time, body movement, music, costume, and interaction.

2.4 New Wearable Digital Musical Instruments for Performance

There are several notable artists/musicians working in the field of developing digital wearable instruments that push the boundaries of exploration with sound, body and human to computer interaction which are at the intersection of science, art, fashion, music and performance. A few examples of these musicians/artists who have contributed to this field are detailed here.

Michel Waisvisz's *The Hand* was an experimental gestural MIDI controller that he developed at STEIM; a center for research and development of new musical instruments in Amsterdam, alongside several other conceptual designs and digital instruments in the late 1980's through the 1990's. As an electronic music composer, he developed *The Hands* as a tool for generating electronic sounds using an interface assembled with hand-mounted sensors (Krefeld & Waisvisz, 1990). Waisvisz remarked that he considered the hands to be an extension of the brain and the physicality of playing an instrument with the hands and creating real-time sounds transmitted by MIDI allowed him to make immediate sounds rather than following a formal structure (Krefeld & Waisvisz, 1990).

Yamaha's Miburi (Figure 2.2) was a conceptual digital musical instrument; it was composed of a suit or jacket that had sensors that could be attached to it. The Miburi was never marketed outside of Japan or developed further. The detachable sensors would be activated as the wearer would move and the intended use was for dancers/performers.



Figure 2.2: Yamaha's *Miburi* 1995 (screenshot by author)

The *Sonalog Gypsy MIDI* by UK based game developer company Animazoo was a motion capture MIDI suit (now discontinued) that could transmit MIDI and used with a bespoke software Exo, could take raw controller data from the Gypsy MID and turn it into actual musical notes and tones (Rothwell, 2006). The development of this suit led to the potential for performers to create with motion capture technology at home or onstage (Maragos, 2006). However, there were some issues that halted development such as the fact that the suit was bulky and uncomfortable for performers or dancers to wear, as it limited movement and calibration was not always accurate, and some latency would occur in transmission (Rothwell, 2006).

Laetitia Sonami is a sound artist and electronic musician who developed the 'Lady's Glove' (Figure 2.3) in 1991 and has been refining, building upon it and performing with it since then (Mainsbridge, 2022). The gloves are an extension of her anatomy and she

‘plays’ them onstage in real-time with sounds that are stored in a program generated by Max/MSP software (Mainsbridge, 2022). Innovations by artists/performers such as these have laid the groundwork for new explorations in digital musical interfaces that are fast becoming more accessible, commercially available, and technologically sophisticated. Digital Musical Instruments or DMI’s (sometimes called Electronic Digital Instruments) are a branch of wearable electronics for the use of creating sounds or music with the body. In the last several decades and with the inception of specialized conferences on digital musical interfaces such as New Interfaces for Musical Expression (NIME), DMI’s have seen an upsurge in innovation for the development of gestural interfaces. Mainsbridge (2022) writes:

“For live electronic musicians seeking richer modes of expression, gestural interfaces offer opportunities to incorporate greater physicality in their performance.”



Figure 2.3: Laetitia Sonami performing at NIME 2014 with ‘Lady’s Glove’ (Screenshot by author)

Recent gestural controllers such as the *Mi.Mu.*[20] *Gloves* (2011) designed in partnership with singer/musician Imogen Heap, are outfitted with several sensors including gyroscopes and flex sensors. The gloves (potentially influenced by the 'Lady's Glove') function as external body instruments that Heap herself uses on stage. The gloves control various parameters and are mapped to gestures such as turning the volume up or down or changing the pitch, while also mimicking sounds such as the drums or a guitar.

In the current climate of digital wearables, most devices are connected through the use of a smartphone or computer via an application with software created specifically for use with a device. These devices and apps communicate through WIFI or Bluetooth and are relatively reliable, easy to use, and provide a decent range between the source and the device with little to no latency. Recent inventions that connect devices via an app include the MicTic[21] 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.

As a prequel to this research, a prototype wearable tech costume was constructed in 2018 where embedded sensors into the garment of a Whirling Dervish served to track various parameters such as speed of a turning skirt in circular motions, the bending of sensors at the elbows and touch capacitive conductive thread buttons on the bodice. Each of these sensors would release a sound when the sensor was triggered. The *Dervish Sound Dress* was first trialed on Mayez Rahman (author's son) and later on performance artist and Dervish, Sercan Çelik who has been working on the project since 2018. Although neither Mayez nor Sercan actually performed with the dress on stage, the experiments led to new questions and discoveries about how sensors that can activate data flow from the body movement can become significant. Birringer (2015) writes that the body and its movements become the instrument that is like a tool or extension of one's

[20] https://mimugloves.com
[21] https://mictic.com/pages/faq#collapse2

own sensorial/corporal technics. He goes on to say that gestural interfaces in digital art media can serve as controllers for dancers/performers to capture movement in real-time so that in effect, the performer dances as the instrument and the accuracy of that data becomes significant when they transmute something in the audiovisual-kinematic-choreosonic environment (Birringer, 2015).



Figure 2.4: *Dervish Sound Dress*, (Hurban, April 2019)

The goal of this research is to therefore connect the threads of previous work to develop a new, more streamlined artefact of wearable technology that can be used by performers (dancers, musicians etc.) to augment their performance. One of the inspirations for intermingling this technology with performance will emerge from the practice of the Whirling Dervishes of Turkey.

The *Dervish Sound Dress* was a catalyst for experimentations with wearable technology, cultural dance practices, sound art, and musical composition. This research strives to harmoniously blend the use of wearable technology with the rich historical traditional practices of the Whirling Dervishes of Turkey and Spanish Flamenco dance. The goal is

not to deter from the inherent essence of these practices whether or not it is interpreted in a more contemporary form or more traditional – rather, it is to experiment with new ways of decoding the movements of Dervishes as they spin or Flamenco dancers as their feet pound the floor and to connect digital artefacts that accentuate the form of movement. This experimentation is put into practice culminating in an exploration of how a Dervish and a Flamenco dancer can use wearable devices that enhance their body movements to create a narrative performance that combines digital art, film, dance, music, costume, and culture.

These examples are used as inspiration but also represent the scope of work that has been done in the field of musical digital wearables. WT encompasses a wide variety of digital electronics, as the aim of this work uses digital technology to enhance performing art practices with electronic sounds generated by movements and gestures; specifically, traditional dance practices that are centuries old with a great body of research surrounding them. This work contributes to how within the domains of wearables in fashion, fashion tech and digital body instruments, it encompasses several areas that draw from these disciplines while also investigating further possibilities of using wearable technology on the body to create musical sounds with. This research thus focuses on the development of a digital musical body instrument that is used in a performance between two dancers: a Whirling Dervish from Turkey and a Spanish Flamenco dancer. This device, the Soundrop, reacts to the dancers' movements by emitting sounds and subtle haptic vibrations on the wearer's skin. It is a device that combines sensors which perform certain functions such as triggering sounds based on defined movements or using touch sensors to initiate actions. The use of gestural systems for performance are further discussed in Chapter 3. The choreography of movement between the two dancers considers the movement and use of their costumes, the dynamism and interaction of the dancer's with the device, and their engagement with an audio-visual composition. A wearable digital musical body instrument is a piece of technology that can be used by performers, musicians, and creators as a tool for experimenting with sounds by using body motion or gestures. The goal is to examine how the device is used by performers who are practicing historically significant dance practices by augmenting them using a

wearable digital musical body instrument and bridging these practices through the use of a wearable device. It is a new integration of dance between two different cultures that make links with each other on stage using their costumes and Soundrop devices as an extension of their body movement.

Chapter Summary

This chapter analyzes developments in wearable technology (WT) over time with an emphasis on designers, makers, creators, and artists who are integrating WT into their work. The many applications of WT include medical/health sector, military, fashion, costume, and sound or digital/electronic wearable musical devices. The following chapter investigates innovations in WT that are applied to the performing arts in areas including dance, theatre and musical, with a focus on how WT can be used effectively as a tool for music/sound generation to emphasize or augment dance and performing arts practices. In the subsequent chapters, the work also examines the body movement practices of the Whirling Dervishes of Turkey and Spanish Andalucían Flamenco as case studies in identifying how a digital musical body instrument is used to enhance their performance practices. Within this realm of WT, the Soundrop is a playful, interactive gestural device that tracks movements and attributes sounds to them while also being an experimental tool for dance performance expression. The examples discussed here all use a method of recording and receiving data while synchronously outputting feedback whether in the form of tactile sensations, auditory impulses or visual stimulus. The Soundrop employs all of these elements and can be used interchangeably across performative arts disciplines.

Chapter 3
Dance, Body Movement and Wearable Technology

"Many forms of artistic media will eventually be absorbed into the digital medium, either through digitization or through the use of computers in a specific aspect of processing or production" (Paul, 2008)

This chapter analyzes dance and body movement with historical references to works and dance/body movement practices that have employed some form of technology. The goal is to illustrate how, over time, technology has been used to augment the expressive body and how this contributes to the development of new body movement practices and how these practices galvanize the development of using wearable technology to emphasize movements of a Whirling Dervish and a Flamenco dancer. There is also an analysis of how humans reveal emotion and meaning through gestures, and what this means within the context of cultural dance practices and how they can be highlighted with a digital musical body instrument.

3. Body Movement in Art History

Human bodies are in constant motion; changing shape and position, constantly finding new shapes and positions with which to move and articulate gestures. The incorporation of electronics or other forms of mechanical and digital technology has evolved from a distant past. Capturing the motion and gestures of humans has been a point of fascination since the first photograph was taken in 1827 (Phillips, 2016). Since then, artists and filmmakers have been finding new and innovative techniques in capturing motion. This notion of disentangling space and time by observing subtle movements of the body within

a variety of situations is fascinating. Mundane day-to-day movements, expressive dance movements, body movements that symbolize or signify a narrative or historical accounting of events past, communicating with the body, and the language of the moving body all have a certain value attached to them. Clarke (1981) writes that humans have been communicating language, expressing emotion and telling stories that has always been a part of human life and always will be. Body movement, or in this case dance, is usually propelled by sound, a beat and music.

Costume is an essential tool for conveying different features in a performing art piece; it can emphasize the wearer's character, highlight drama and emotional expression, and contribute to the overall visual aspect of the performance. Clothing or costume can also contribute to how the body moves by adding sounds and visual effects, and exaggerating movements to convey something.

This exploration of movement in a two-dimensional space is seen in Eadweard Muybridge's photographic plates and figure studies of the 1880's. These studies of the human body and animals were among the first to examine how motion was captured using time-lapsed photography. Muybridge amassed a collection of over 100,000 photographic plates between 1883 and 1886 studying the movement of various animals and human in different and sometimes absurd positions (Mileaf, 2002). Mileaf (2002) also discusses that Muybridge used a more scientific approach to using the medium of photographic film in his studies of the human figure (Figure 3.1). It was a departure from obvious and static portraiture at the time, by which Muybridge offered a new and fascinating view of the human body. By aligning several cameras at a time, Muybridge was able to invent a clockwork mechanism by which to activate the cameras automatically (Jensenius, 2013).

In Marcel Duchamp's painting *Nude Descending a Staircase* (1912) (Figure 3.2), a departure from his Cubist contemporaries such as Braque and Picasso and arguably influenced by Muybridge, became obvious as the artist envisioned abstracted objects moving through time and space, rather than shapes and angles that remained stationary

and unchanged. Though his work is often attributed to being more in the Dadaist realm than Cubist following his often-controversial sculptures of found materials and objects, Duchamp's work pointed towards an investigation of disabling societal norms in the art world. His unique approach to Cubism, with its fragmented but discernable shapes, was received with widespread criticism which provoked negative reactions from spectators and critics alike when presented at the Armory Show exhibition in 1913, for viewers struggled to locate a nude amongst the jagged and incomprehensible lines (Taylor, 2012).

These early examples of studying bodies in motion clearly had an impact upon artists working in mediums other than photography and certainly within burgeoning art movements only a few decades later. Perhaps it was Duchamp's painting of a nude descending a staircase, totally abstracted in form, that opened the possibilities for explorations in how the human body is perceived in motion via a two-dimensional medium that seemed to become activated, and therefore perceived, as three-dimensional on canvas.

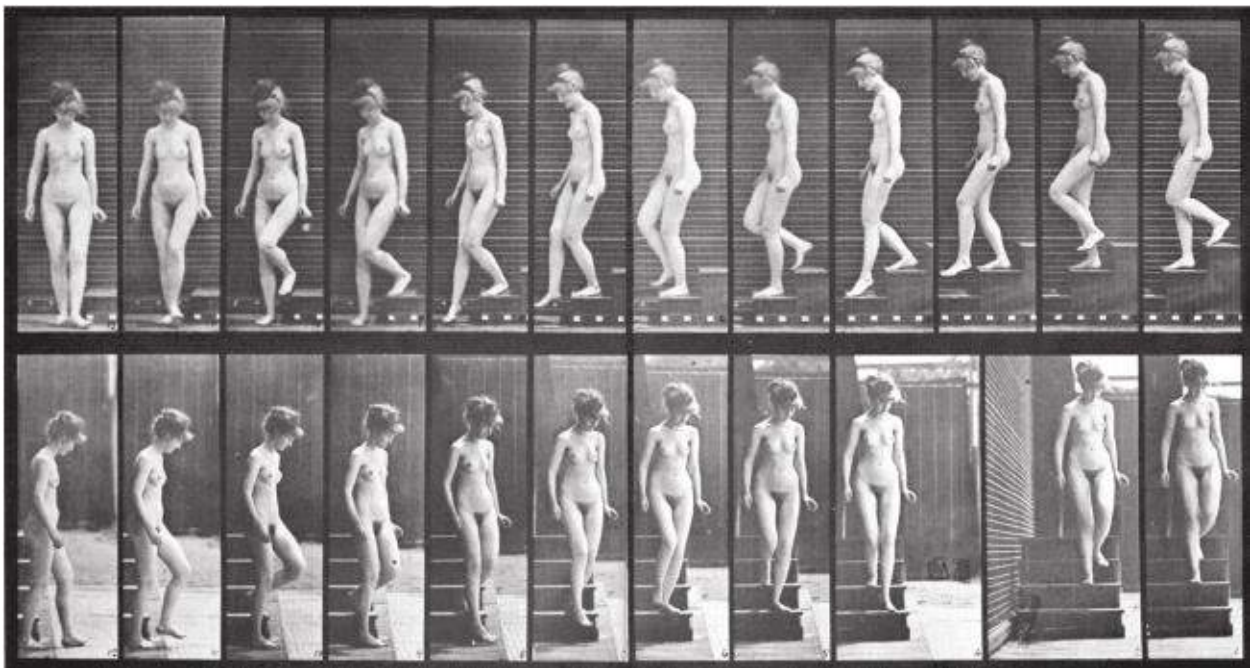


Figure 3.1: Eadweard James Muybridge, *Woman Walking Down Steps*, photograph, 1887(Public Domain)



Figure 3.2: Marcel Duchamp, *Nude Descending a Staircase (No. 2)*, 1912,
oil on canvas, 57 7/8 x 35 1/8 (151.8 x 93.3 cm) (Philadelphia Museum of Art)

These examples of capturing motion serve to deconstruct movement in different dimensions. The ultimate goal in this work is to achieve the same process whilst attaching sound to fragments of movement captured in real-time. The movements and gestures specific to how Whirling Dervishes and Flamenco dancers move are captured in time and are highlighted through the use of sounds that emphasize these movements. The process of examining how this can be done has been through the observation of historical works that involve the use of dance and sound with an emphasis on how technology can be used to augment historical dance practices.

Dixon (2007) 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 early 1910's Europe. 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. As an example, Gino Severini painted several works with dancers as the subject matter. In his 1912 painting *Blue Dancer*, it is difficult to decipher where the dancer begins and where they are going – the movement that is captured through what looks like a kaleidoscopic perspective of different stages of movement reflects moments of energy moving through time. His other works, including *Dancer (Ballerina and Sea)* 1914 and *Sea = Dancer (Mare = Ballerina)* 1914, are even more abstracted and show a dynamism of movement that resemble feverish fluidity of motion.

The relationship between the body and the space in which it is moving is a naturally occurring, repetitive and subconscious process that all humans do in their daily lives. The space in which a body is in motion becomes significant when those movements being performed express meaningful information. This information can have an impact on how humans perceive movements when it is led by technological tools. Birringer (2002) expresses 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.

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.

3.1 Dance, Costume and Technology

Gray (1989) writes that dance is not technologically inclined; rather, the art of human movement is self-sufficient. However, dance and technology have coexisted for centuries and are only now beginning to implement electronics and ways of using computer mechanisms to document choreography and use technology as a means for enhancing dance (Gray, 1989). Using wearable electronics in dance is not a novel concept – it can be traced back to the late 19th century. As the Industrial revolution soared across Europe and America, the curiosity for using electricity in adventurous and inventive ways saw its applications in many areas including illuminating the world's performing arts stages, with dancers and performers wearing elaborate costumes equipped with electrical components. Fashionable wearable computing, as it is known today, may have started with the wearing by ballet dancers of electrical diadems (Figure 3.3) created by Gustav Trouvé for a dance performance in 1883 of 'La Farandole' in Paris (N.A., 1884). Trouvé may have developed one of the first electrical interfaces for dance performance - an example of wearable technology used in performances on stage (Sjuve, 2008). These illuminated headbands were a key innovation of their time and paved the way to incorporating small-scale electronics by integrating them into clothing or for use on the body and in the performing arts milieu (Hughes-Riley et al, 2018). Apart from inventing the pocket battery which powered the diadems, Trouvé also created jewelry that illuminated at the push of a button (Soth, 2022). These early trinkets and gadgets may have been bulky and restricting to wear on the body, but the concept to augment dance (gestures and movement) with electronic parts that transmitted a function (lights) were at the forefront of experimenting with body movement and technology.

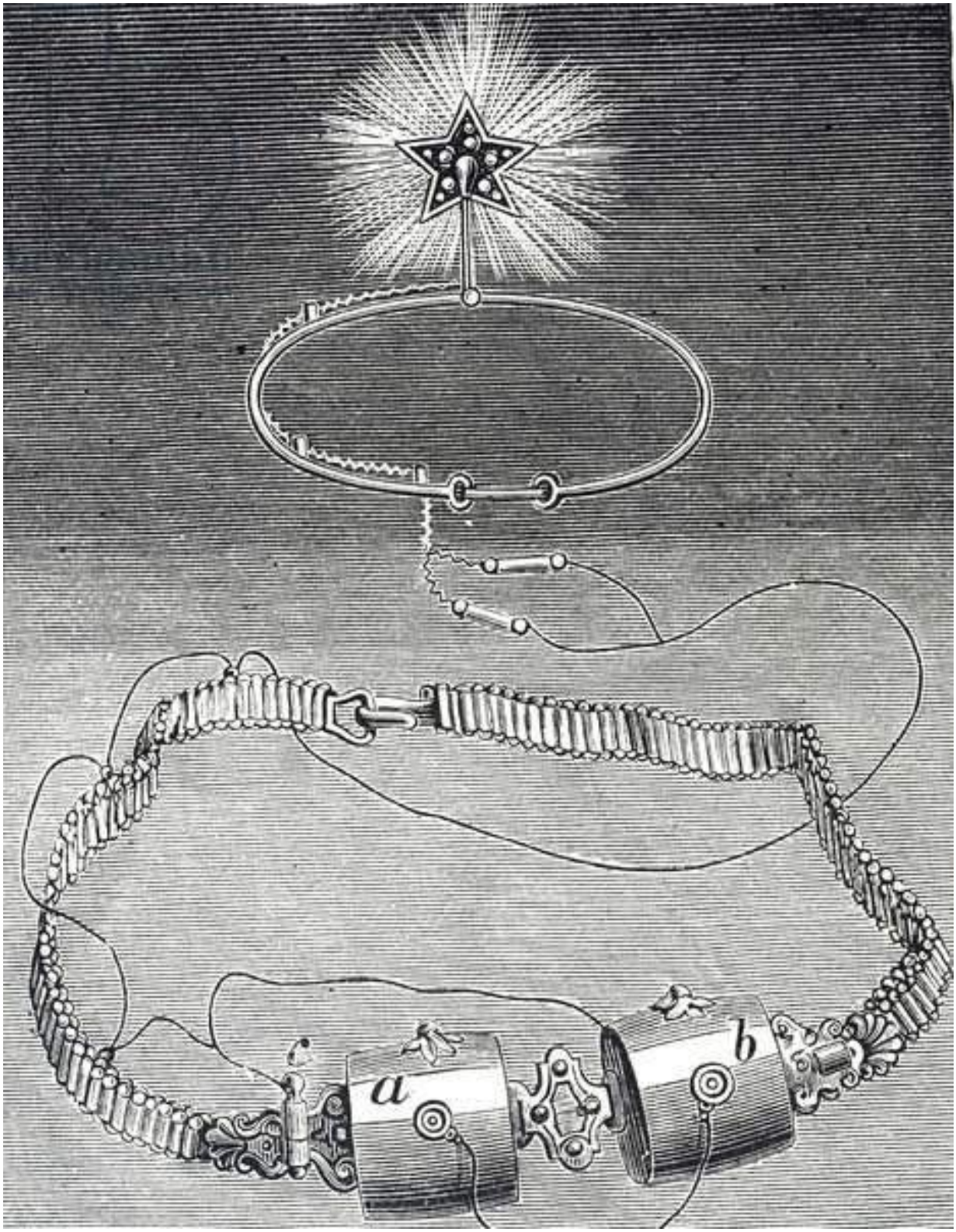


Figure 3.3: Gustave Trouvé, Electrical Diadems, 1884

Trouvé's electric diadems were a turning point in the cross section of electronic inventions with the world of dance and the performing arts. This particular piece was so rudimentary, yet the simplicity of the design and its purpose was impactful. It was early examples such as these that marked a time in which artists and inventors were looking to thrill audiences with innovative discoveries on the live stage.

Loïe Fuller (Figure 3.4), who was a dancer, choreographer, and a designer of costumes in the late 1800's, was one of the first dancers to incorporate her own vision of dance and technology using colored lighting on stage to create moving shadows from her large swathes of fabric that she hurled around her body in various shapes (Gunning, 2003). Her genius was not developing any particular technology for dance, rather it was the impression of animated movements that she created from her choreography and her use of her costumes as an extension of her body that was the spectacle.

Her famous *Serpentine Dance,* which debuted at Le Folies Bergère in 1892, made use of the drapery effect of her fabrics that seemed to make her look like she was floating in clouds (Gunning, 2003). Fuller's modernist approach to stagecraft, music, dance and scenic design had an impact on her contemporaries and future greats such as Martha Graham and Isadora Duncan (Sommer, 1981). Fuller's explorations with her costume and lighting, which created an independent, animated chromo-luminous mechanism from rhythmic moving shapes, were noted by artists in the Italian Futurist groups who referenced her work as radical and influential in the field of innovations in dance (Veroli, 2009).

These inquires such as Fuller's work laid some of the groundwork for this research as a significant part of this thesis delves into using costumes or garments as part of the extension of the body in a dance performance. This work expands upon these concepts by adding other layers such as digital technology to initiate other features such as sound.



Figure 3.4: *Loie Fuller Dancing with her Veil* (1897) Isaiah West Taber (Aristotype mounted on card). Musée d'Orsay, Paris, France.

In other related work, Oscar Schlemmer's *Triadic Ballet* (1926) is best known for its geometric interpretations of the human body into shapes and forms that moved and functioned with the dancer. Schlemmer contributed to the Bauhaus's creative collective in terms of design, choreography and painting with his eclectic, modernist approach to the human body and form. The *Triadic Ballet* featured several costumes that Schlemmer designed, in particular the *Spiral Costume* (Figure 3.5) which was constructed using several metal wire cylinders fashioned onto the waist area of the wearer (Mead, 2022). Many of the costumes were constructed with heavy and unusual materials and were fantastical representations of machinery and science. These costumes also created sounds that were the cause of how the mechanisms were constructed onto them. Michèle Danjoux (2019) uses the example of the *Triadic Ballet* costumes as "choreosonic wearables" in that the costumes are designed to create sound from movement. There are several features of these costumes that make them responsive to sound through movement which are formed by their amplified, multi-sensory, tactile qualities (Danjoux, 2019). Birringer (2013) writes that Schlemmer's work was arguably the first of its kind in the context of modern digital art and performance with the costumes in the *Triadic Ballet* in particular resembling the oscillations of sound that are activated and performed by the dancers manipulating the movements of the costumes.

Dance performances in the present day seek to include technology in inventive and curious ways. Cirque du Soleil created dozens of robot-inspired costumes for their *Immortal* show (2015) where dancers wore costumes that were covered in tiny flat-screen displays which lit up with images or symbols during a performance (de Saint Phalle, 2016). Dance wearables such as the E-Trace ballet slippers developed in 2014 use sensors on a dancer's shoes which are connected to an app and traces their movements in elegant lines and shapes, as though drawing with the finger (Mateo, 2014). These new forms of using digital technology to enhance dance performance are becoming more prevalent as choreographers are using technological tools and advancements to design new and innovative work that also archive and preserve dance performances for reference for future generations to come.



Figure 3.5: *Spiral Costume*, from the *Triadic Ballet*, 1926, The J. Paul Getty Museum, Los Angeles, Karl Grill, Gelatin silver print, Image: 22.5 × 16.2 cm (8 7/8 × 6 3/8 in.)

3.2 Digital Body Movement and Performance

With the advent of the computer age in the mid 1950's, the obsession with the future and new improved technologies generated a significant paradigm shift in fashion, architecture, art, film, music, dance and performance. Groups like *Fluxus,* which experimented with intermedia performance, used technology in novel ways to explore how humans and machines can coexist seen in the works of Nam June Paik, John Cage and George Maciunas, to name a few (Lushetich, 2011).

One of the main concerns for scholars of dance and for practitioners is the preservation of dance practices. As most dance forms from across time are generally associated with the development of oral culture, there has been no adequate means for recording and preserving dance masterpieces in a comprehensive tangible manner (Savage & Officer, 1978).

These pioneers of modern dance, among many others, shifted the classical notions of dance which consequentially led to further explorations of dance that became multi-disciplinary, as in the work of Merce Cunningham[22] whose choreography acknowledged the greats from the past but nurtured a style of body movement that was unpredictable and radical (Clarke, 1981). Cunningham created closely with his contemporaries such as electroacoustic musician John Cage, and artist Franck Stella, and although not directly linked to work being done with the Fluxus group of artists, was more than likely inspired by them (Clarke, 1981). Throughout Cunningham's career, the discovery of 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, was of utmost importance (Clarke, 1981). Cunningham's works from the 1970's to the 1990's and through to the early 2000's brought his work to the forefront of contemporary dance. His interest in intermingling technology with dance began in the late 1980's and early 1990's, whereupon Cunningham began experimenting with a computer software program: *Life Forms* (Celant, 1999). This animation software allowed the user to dictate and notate a wide

[22] https://www.mercecunningham.org

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 (Copeland, 1999). The software is a graphical interface that can be used by choreographers to design concepts and movements.

The use of this technology culminated in the choreographed piece *Trackers* with the help of *Life Forms* (now known as Dance Forms). This piece allowed Cunningham to create compositions and movements by manipulating the human body on the computer. In his later work *Biped* (1999) Jacobs (2020) remarks that Cunningham relied heavily on *Life Forms* but also used motion tracking technology as a way to add more intensive drama to the stage. Jacobs (2020) also states that while speaking with Cunningham in 1995, he said that computers will be the future of dance. In *Biped,* the dancers seem to weave in and out of the stage so that the observer is unsure of whether they are on the stage or in an illusion. The motion capture that was used transformed the dancer's movements into animations that were projected onto the stage in the form of dots, lines or human figures (Roy, 2000). This early work also serves to inspire this thesis in that using technology in innovative ways to capture body movement and to record those movements with digital tools are essential to the underpinning of this research and investigating how to capture the movements of a Whirling Dervish and Flamenco dancer to which sounds are then attributed. Cunningham's work set the stage for other artists, dancers, choreographers and musicians to use innovative and ground-breaking techniques for creating a symbiotic relationship between human and computer through movement of the body. The Merce Cunningham Trust or Cunningham Dance Foundation has also developed a digital 'Dance Capsule' on their website where eighty-six of Cunningham's works have been preserved digitally so that future generations of dancers can learn his techniques and movements. This includes video, sound, costume and other methods of documentation that can be viewed or accessed. This form of digital preservation is vital to maintaining the essence of the work that is produced by ground-breaking artists working in this field of performing arts to educate upcoming performers in practices that, if not recorded in some way, would otherwise be lost in history.

Perhaps motivated by the work of Merce Cunningham, in the last several decades dance companies and practitioners in the field of movement and performing arts have embraced the use of technology as a way to preserve choreographed pieces that may otherwise become diluted or lost completely (Young Reed, 2018). 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 (2018) 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. Dance notation has a place here in that it has also been used as a tool for recording and annotating dance movements visually. One of the most recognizable was Hungarian dancer and theorist Rudolf Laban's system of characterizing the choreography of dance movements and gestures that was collated into a body of scores called Labanotation – similar to how musical notes are scored but using symbols and/or shapes to represent gestures and dance movements (Lu, 2009).

However, 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 traditional folk practices from around the globe have become obsolete due to lack of notation or preservation in some way. The reason for this is that many of these practices have been passed down through generations, whether by memory or orally. 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 (2002) 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.

Dance interaction using VR or Virtual Reality environments have been shaped by concepts created by the likes of Merce Cunningham and others including Morton Heilig, who invented one of the first multimodal experience with his *Sensorama* in 1956 (Craig et al, 2009). The simulator was equipped with sensory stimulators that a person could view on a screen and was outfitted with sensors that produced sound, smell, wind and vibrations (Craig et al, 2009). Myron Krueger's *Videoplace* from 1975 was an artificial reality laboratory of exploration that used responsive video projections which mapped users' movements in real-time (Krueger & Wilson, 1985). The system provided a way to capture movements in a digital field while also enabling interactivity between the projected (virtual) image and the participant.

The work of Yacov Sharir is a valuable contribution to the evolvement of digital and virtual art. His *Dancing with a Digital Dervish* (which coincidentally does not involve a Dervish at all) is one of the first immersive VR art experiments he choreographed alongside Diane Gromala which explores dancers and the audience interacting with a virtual reality environment in real time (Pinkston, 1994).

Virtual spaces offer a level of immersion through an alternate reality and dancers are experimenting with ways of using VR to create new experiences virtually. Microsoft's Kinect system, which was usable alongside the gaming console Xbox One, was a motion sensing system launched in November of 2010 (Lee, 2023). The system was built with RGB cameras and infrared projectors that detected motion by mapping depth, which in turn captured motion in real-time (Lee, 2023). But the product essentially failed as there were not enough games that were developed with the system, and the accuracy rate of real-time motion sensing was not 100% (Weinberger, 2018). Other iterations have come and gone, however there are newer generations that have higher accuracy and advanced depth sensors powered by AI.

Artist and interaction designer Maziar Ghaderi created the work: *Dissolving Self: Wearable Technology + Contemporary Dance*[23] in 2013 through the Ontario College of

[23] https://maziart.ca/dissolving-self

Art (OCAD). This work embodies some of the concepts that surround this project in that it fuses the traditional, culturally sacred practice of the Whirling Dervishes by combining it with a contemporary form of dance and body movement. The piece also involves the sole performer/dancer interacting with a rotating orb on a screen that is initiated by her lateral movements through a Microsoft Kinect module. The sensors embedded into the costume are an accelerometer that controls the speed of rotation of the orb as she turns and moves. The piece is relevant to the inspiration of this project in that it unfolds the areas of wearable technology with motion capture technology in a very simplistic way without over-complicating the process.

Artists and creators have made considerable use of projection mapping technology, such as the work of Adrien M and Claire B[24] who combine live dance, musicians and projection mapping. Their projects have captivated audiences with their impossible and mesmerizing visuals with which dancers interact. One of their earlier pieces *Pixel* (2014) features several dancers interacting with a digital environment that makes it difficult for the viewer to determine whether they are in a virtual space or in reality. *The Movement of Air* show in 2015 features what resembles a Dervish whirling inside of a digital tornado - the elegance and sophistication of their work is sleek and polished where the dancer truly engages with the digital world that surrounds them.

There are several dance and body movement companies that have formulated their work on the basis of combining dance and technology. Troika Ranch[25] is a dance company established 1989. Its artistic director Mark Coniglio developed a system of sensors that were attached to dancers' bodies from which data was streamed to software in which the gestures and movements created wireless MIDI signals that translated these movements into sounds (Dixon, 2007).

[24] https://www.am-cb.net
[25] https://troikaranch.org/technology.html

Wayne McGregor[26] is a British dancer and choreographer who has engaged in the research and development of art, dance and science with technology partners. His work *No one is an Island* (2021) explores how artificial intelligence can sense subtle body movements as dancers weave through a sculpture that becomes animated as the dancers move and interact with it. This seamless relationship between human and machine that combines sound feedback, a light installation with the movement of dancers is an example of the voyage that creators are exploring with simulating the emotional and visceral reactions between the body and technology.

The works of these artists/dancers/creators have shaped the direction in which the potential for elevating body movement digitally can be explorative and playful, while also capturing data from body movement and gestures that can be archived and further analyzed. Experiments using motion capture technology also expand the way in which human bodies perceive spaces virtually.

3.2.1 Experiments with Motion Capture Technology

Using motion capture (MOCAP) as a tool in conducting experiments with body movement can be advantageous and practical. With new systems constantly changing with increased upgrading and sophistication, the possibilities for use are boundless. Capturing motion digitally can give insight into more precise and nuanced movements and gestures made by humans. As part of the methodology for this research, a motion capture system was used to test and record the choreography of dance movements – in particular, observing and recording movements of the dance of Whirling Dervishes and Flamenco dance. A choreographed dance was performed to a musical composition to which a metahuman was mapped in a virtual field using Vicon's Motion Capture system (Figure 3.6 and Figure 3.7). This process shadows the work that Cunningham did over 25 years ago and has been found as a useful mechanism to view and record body movement in real-time.

[26] https://waynemcgregor.com/productions/no-one-is-an-island/



Figure 3.6: Using Vicon's MOCAP system to perform tests of choreography (Hurban, 2021)

This process was intuitive and useful in that the data of movements were available after the dance was completed and could be used and deciphered later to correct any issues, change movements, and to better understand the relationship of the digital and physical space. The experiment also evolved to create a virtual keyboard where a grid of eight squares were mapped to sounds. This enabled the dancer to move in and out of the blocks, creating their own musical soundscape with pre-programmed sounds. This playful experimentation can lead to new ways of using motion capture as a gestural controller - to let the entire body play as an instrument in a virtual environment. Dancing with an avatar can capture improvisational movements digitally and record them to be used for analysis as a tool for choreographers (Strutt & Cisneros, 2021).

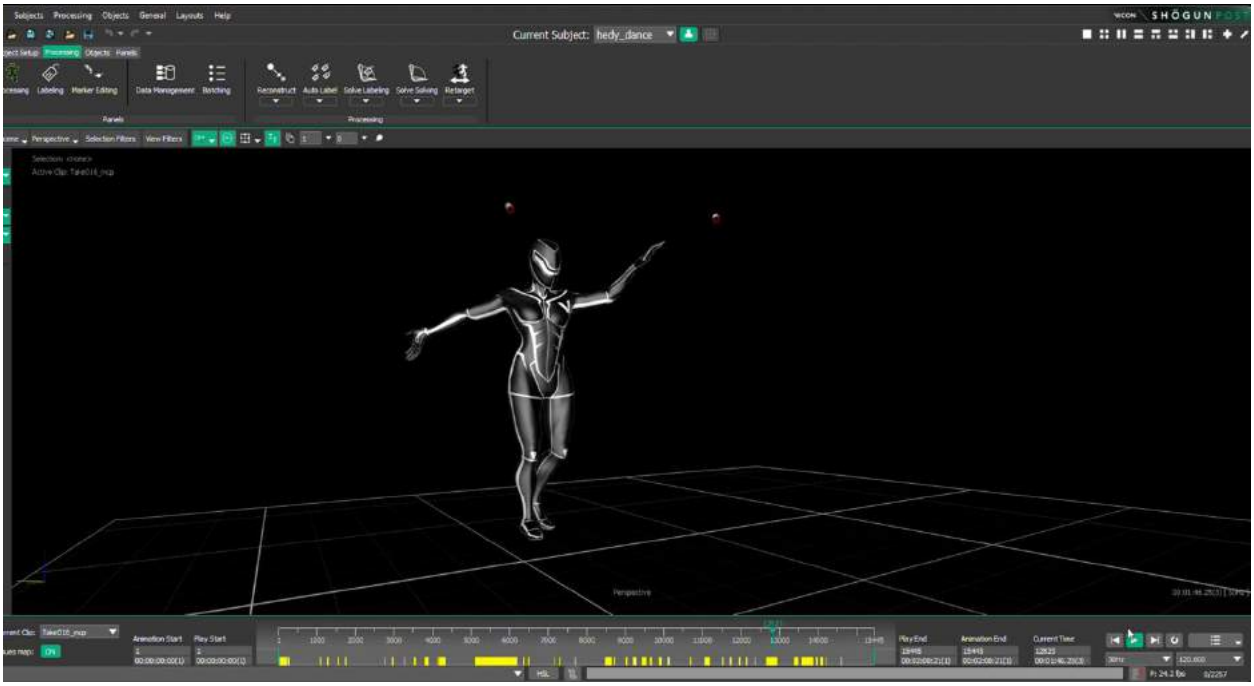


Figure 3.7: Choreographing dance using Vicon's metahuman (Hurban, 2021)

Using motion capture to not only track movements and gestures, but to acquire valuable data on a person's gait and performance stamina, can be useful. Several companies are developing detachable motion capture sensor systems such as XSENS[27]'s motion capture sensors. The sensors can not only accurately track motion in real time, but also provide sensing capabilities for detection of a wearer's position and performance.

Apart from well-established dance companies experimenting in the field of digital tech, many performers in dance, theatre and others have also implemented the use of digital tools for augmenting performance practices. Some of these tools that are available on the consumer market such as XSENS. The company has developed wearable devices that can track the movements of a wearer wirelessly via a suit outfitted with optical sensors that are individually attached to the wearer. The suit or the attachable motion capture attachments can be used in a number of settings whether for gaming, tracking fitness performance or for digital artists looking to use these devices in creative ways. Motion capture is a critical tool in analyzing body movement in a virtual environment that provides accurate real-time data. It is another avenue of exploration in capturing significant

[27] https://www.movella.com/products/xsens

gestures and movements in traditional folk performance practices and preserving those dance/body movement traditions digitally. Figure 3.8 demonstrates how the Dervish movements that were choreographed virtually were translated into live movement. The experiment was useful in recording movements which could be used to analyze choreography.



Figure 3.8: Mayez Rahman testing choreography alongside virtually recorded dance (Hurban, 2021)

3.3 The Body as Instrument

The development a new digital musical body instrument has been crafted partially through the culmination of observing the capturing of movement practices through film and art history and how the evolution of sound and the body has been established for centuries. Humans have long used their own bodies to create sounds; from clapping to kicking, snapping fingers, tapping, or slapping parts of the body which in turn creates resonance or vibrations while performing these gestures. These tactile cues allow performers to create rhythm and enhance their performance. Some examples of performance practices that use the body to create sounds with include beatboxing, tap dancing, the American hambone (slapping the body from the leg to the chest), Eastern European finger snapping-boot-clicking dance, *palmas* used in Flamenco (the clapping of hands to the rhythm or beat of the guitar), and South African gumboot dancing (mine workers hum and stomp boots in caves) (Consorte, 2012).

Johannes Birringer's pioneering work in combining wearable technology and the performing arts alongside Michele Danjoux of DAP Labs in Nottingham, have resulted in experiments that shared embodiment with the perception and proprioception of the wearer (Birringer, 2009). Birringer and Danjoux's *Telematic* costumes (2005) are constructed where sound, dance and wearable technology combine to create multi-sensory spaces where bodies communicate with each other through sound over space and time (Birringer, 2009). Birringer discusses the concept of Kinaesonics in much of his work and the interactive experiences between costume, the body and sound. *Speaker Veil* is an example of Danjoux's fusion of clothing and sound where the performer embodies the kinesthetic potentials of expression (Birringer, 2016). The performer manipulates the veil, creating sounds and shapes with lighting that is transformed through the movement of the fabric in an encounter that involves the auditory, tactile and visual senses by changing the performing space (Birringer, 2016).

The concept of using wearables to create embodied sound experiences and deeper interactivity with the body forges a relationship between the performer and technology in

a less organic way than with a physical musical instrument but has the potential to exponentially increase the multiple sensory functions through computer processing (Bokowiec & Bokowiec, 2006). Essentially, Kinaesonics is the physicalization of sound or the mapping of sound to bodily movements (Bokowiec & Bokowiec, 2006).

Perhaps the work of Di Mainstone[28] also comes to mind; her work as an artist and filmmaker has led her to create projects that revolve around digital art, sound and performance have put her at the forefront of creators in this field of multi-disciplinary work. Her work in wearable instruments – specifically her *Human Harp* (2009), is an example of human to musical instrument relationship. Although it is not a digital or virtual instrument, the mechanism is attached to the body of the wearer via a bespoke vest constructed as a latch to which wires are clipped onto existing parts of bridges. The wearer then plucks these wires and 'plays' the bridge by receiving reverberations from the wires (Heathman, 2016). This work is an example of a body musical instrument moving with the body, creating sound, and essentially performing as an extension of the body in a similar way that the Soundrop intends to be used.

The work of Atau Tanaka also explores the use of gestural interfaces for experimenting with the concept of Kinaesonics. Tanaka's work draws on internal physiological muscle-sensing data to illustrate how the body can perform as an instrument, whether it includes the use of external hardware or sensor systems attached to the body or by using the body through gesture/motion capture to map sounds with (Mainsbridge, 2022). Tanaka made use of Thalmic Lab's Myo armband before it was discontinued which records electrical muscle impulses - the recorded gestures could be mapped to sounds using machine learning software (Mainsbridge, 2022). Mainsbridge (2022) goes on to remark that through the development of DMI's, the styles and movement vocabularies of dancers/performers reveal a more personalized interpretation of sounds when used in performance. The gathering of data output from using gestural controllers can be used to further explore how movement while using a DMI can be recorded, manipulated and viewed as a separate entity.

[28] https://dimainstone.com/portfolio/human-harp/

In a sense, these mechanisms for experimenting with generating sounds with the body are essentially interfaces which Chatzichristodolou et al (2009) refer to as interfaces which allow interaction between two entities that could otherwise not communicate with each other in the same way. Adapting interfaces that can create new paradigms of emergent practices and discourse is appealing from many angles as the scope for utilizing technology to enhance bodily actions is imminent as it is necessary (Charzichristodolou et al, 2009).

3.3.1 Haptics and sensory exploration

Haptics or haptic feedback from digital devices provide a sensory layer to the human body that creates a tactile sensation or cue that a wearer becomes aware of. Most digital devices nowadays are equipped with haptics which gives the user/wearer cues or alerts without making sounds but also contributes to more immersive experiences. Gaming consoles and VR/AR systems also provide haptics for the user/wearer to feel the experience. Subtle vibrations diversify the wearer's experience and expand new media beyond the ocular and oral modes (Boucher, 2011). The importance of incorporating haptic sensors into the Soundrop which is further outlined in Chapter 5 stemmed from the research explored in earlier examples of wearables and the use of feedback as in the Sound Shirt or the Miburi body instrument. Creating tactile sensations on the body is a crucial component to the holistic approach of embedding sensor systems onto or near the skin and body. In this sense, the overall interaction is experienced in a three-dimensional way as opposed to simply through visuals or sound.

The complexities of relaying the sensations of reverberations, as an organic instrument would, through to the body are intricate. Papetti et al (2018) say that digital musical instruments (or DMIs) fall short of providing a natural experience for the performer, even though many DMIs offer touch-mediated interaction. The experience of plucking a guitar or blowing into a reed instrument is organic, in that the sensory stimulus activates not only the auditory and visual perception but the tactile/physical sensation is also generated - an experience that is difficult to replicate with a DMI in real-time. Although there are

challenges in initiating these vibrotactile cues, haptic musical devices that are computer driven offer the potential to increase in accuracy and sophistication in new advanced DMIs that are on the current market (Papetti et al, 2018). The study of body movement while using, playing, or interacting with an instrument has been examined extensively.

The gestures that one makes while using an instrument which could include the hands, arms, head, torso, legs and the feet, can in fact produce physiological changes in the way the user interacts with an instrument. The tangible artefact that is developed as part of the practice for this research is reliant on haptics as part of the 'kinaesonic' experience felt by performers using the device. This is discussed in further detail in Chapter 5. Haptics contribute to vital sensory cues when using technology/electronics close to the body or on the body, which in the case of physical instruments are felt inherently. The temporal relationship between device and body is crucial to developing a lucid transfer of interaction and expression.

3.4 Augmenting Traditional Dance Forms with Technology

Layson & Lansdale (1994) write that the body of knowledge of dance history, which encompasses global dance traditions, can be categorized into different types of dances against dance through time. In their model, the history of dance falls under the communal, educational, recreational, religious, social, theatrical, therapeutic, and the traditional context (Layson & Lansdale, 1994). Every culture in the world has at some point or another cultivated a practice that reflects their traditions, language and means of expressing sentiments. Dance practices have especially contributed to the way in which historians understand ethnic differences (Nadal & Strauss, 2003). As different global cultures have developed varying dance practices whether for artistic, social, folkloric, theatrical or educational purposes, so did the other components that coincide with a particular dance such as music, costumes and props.

This work is therefore concerned with investigating how the traditional practices of the Whirling Dervishes of Turkey/Türkiye who perform the sacred ritual of the *sema*[29] and Spanish Andalucían Flamenco can be augmented with wearable technology in a contemporary performance work. These traditions are further analyzed in Chapter 4 where an emphasis on the historical movement or dance which is born out of religious, cultural and political heritages are examined. Examples of performers who are currently exploring these traditional practices by interpreting them with either novel technologies or by revitalizing them are plentiful. Some of the more prominent figures in current contemporary art circles globally who practice versions of the *sema* include performance artist Ziya Azazi[30], 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 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 (Choksi, 2015). His prominent work *Dervish in Progress* has been performed numerous times worldwide. The work is an expression of body movement entangled with turning at a vigorous pace.

Contemporary Flamenco dancer Israel Galván uses the practice to innovate and enhance movements using extraordinary locations, new materials for which to perform on and musical accompaniments that move away from the traditional *guitarra flamenca*. Born into a Gypsy/Gitano family, he is considered by many as one of the greatest Flamenco dancers of all time and he has won several awards for his excellence and contribution to Flamenco from around the globe (Mackrell, 2015).

The intrigue of experimenting with Flamenco as with Dervish whirling practices, is that the concept of revitalizing (but not reinventing) the traditional dance forms, provides the opportunity to create new contemporary art practices on a more atypical level.

[29] The *sema* and its meaning is further analyzed in Chapter 4
[30] https://dervishinprogress.com

Contemporary forms of both Flamenco and Dervish body movement are fascinating and exciting, and they offer progressive contributions to future generations while considering the origins and vast histories that are associated with them.

At a glance, both of these culturally rich traditions need no alterations as they are established and rooted in their histories which have been practiced for centuries. Thus, through theoretical research an investigation of the geographical, historical, cultural, political, metaphysical/spiritual and musical parallels are uncovered. This is the defining feature that links the two practices together while also observing contrasts and particularities. This work does not exploit or deter the origins of the movement practices or try to change them – it seeks to add a layer onto each form of body movement to digitally capture movement in a novel way with an instrument/device that releases sounds as the wearer moves or gestures in their particular fashion. By doing this, new insights can be uncovered into how and why specific movements are executed and if these movements emphasize various factors such as: climatic/dramatic peaks in performance, moments of silence or less movement, or gestures that may symbolize aspects of the practice that are meaningful and significant. As a way to track and categorize which movements are of particular interest, a map showing common and consequential gestures are drawn out as a way to decipher how to decode these movements with a wearable device. Revitalizing the practice of Whirling Dervishes and Flamenco dance is appropriate in the current climate of digital art and performance. There are many ways of observing and digitizing the movement of both without compromising or interfering with the original form and authenticity of these practices. The body movement of a Dervish who performs the sacred turning ritual of the *sema* and a dancer trained in classical Spanish Andalucían Flamenco dance are investigated with the use of a new wearable musical body instrument – the Soundrop. The motivation behind examining these two dance practices is further explained in Chapter 4. The two performing practices culminate to form a new digital art performance piece that combines music, wearable technology, immersive film and dance.

The methodology for this work can be defined in the following diagram which outlines the process of research and design development, to experimentation, testing, and finally a functioning artifact (Figure 3.9). The particular areas of interest in examining the dance or body movement styles of a Whirling Dervish and a Flamenco dancer are observed through an analysis of the historical traditions that are attached to both, and deciphering which movements or gestures are the defining features of each. For example, a Dervish moves in continuous circles - however this is a simplification. To understand how a Dervish moves and why in a certain way, years of observing foot movements, arm and hand positions, torso rotations and head position have been analyzed. To each of these positions meanings may be attached or they may symbolize something significant about the dance. Similarly, a Flamenco dancer uses a wide vocabulary of gestures and movements with all parts of the body, however some are more meaningful and expressive than others, depending on the type of dance being performed.

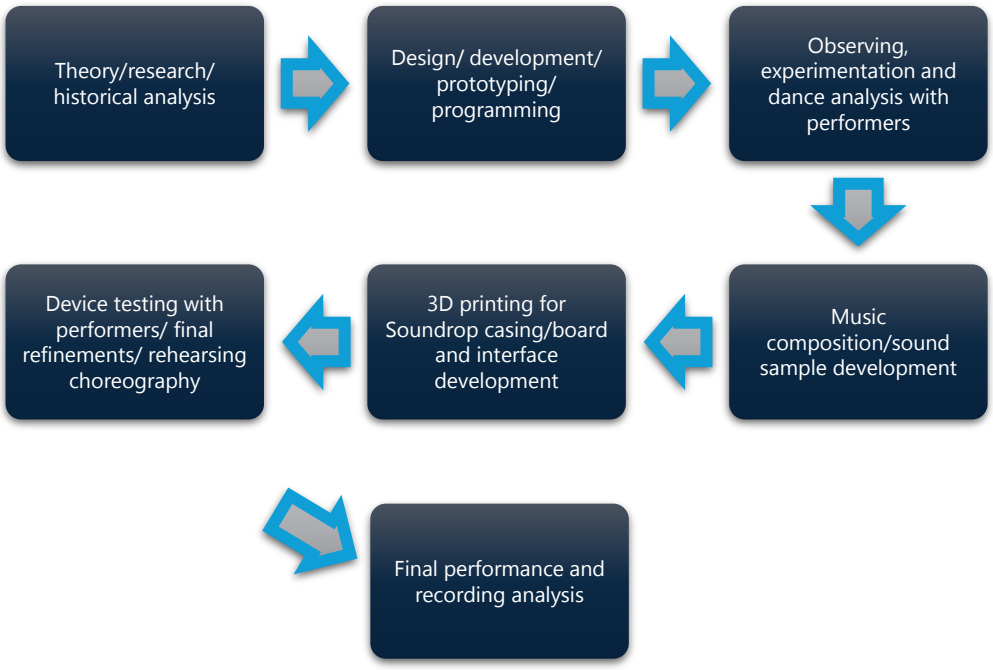


Figure 3.9: Research methodology

For this research, an analysis is made of four to five movements between both practices to which sounds are attributed with the wearable musical body instrument, the Soundrop. This device (which is discussed at length in Chapter 5) is created to track the velocity of movement to which sounds are mapped in real-time. These sounds are reflections or are inspired by sounds that are associated with both practices, whether Flamenco guitar sounds or Turkish instruments that are electronically manipulated. The purpose is to create a work that is contemporary, led by digital art investigations, and highlight specific movements and gestures of these two performance practices which ultimately culminate in a live performance piece.

Dancers use various tools for augmenting their own body movements, whether it is stage lighting, props, or costumes. In the case of a Whirling Dervish, the costume generates a visual momentum while the arms draw outwards and upwards towards the heavens. This position is ideal for monitoring and recording movement digitally while also attaching a device that senses movement and speed from which a sound, lights and tactile vibrations are emitted. Initially, this work investigated using electronic textiles or sensors embedded into fabric to initiate sounds and haptics. However, a small wearable device has been developed of which two are worn by a Dervish and two by a Flamenco dancer. Through experimentation, several devices were attached to various parts of the body (wrists, ankles, torso) but it was found that accurate data analysis and sound attribution was excessive. The sound is used as an extension of the body, as is the costume. In a Dervish ceremony, the various parts that are required for a complete performance include music, prayer/recitation and costume. The movements of a Dervish play an integral role in the outcome of a performance and are highlighted here with a wearable musical body instrument. These gestures and movements are outlined further in Figure 3.10. The notation for these movements is formulated through the observation of basic gestures and are described in the diagram, however the dancers are free to use their own improvisation as they see fit according to the tone of the performance. The gesture maps are used in collaboration with the performers so that they are aware of how to use the Soundrop and also to use the device with these particular gestures/movements.

A further analysis of these movements and gestures is made through visualizing the data flow from the Soundrop of each performer as they use them in performance. This is presented in greater detail in Chapter 6. There are moments that are highlighted which offer a glimpse using the data into how the performers responded to the device. These moments are compared from one performer to the other which describes and gives insight into how the performers used the instrument which is reflected in the data. Particular sections of the performance are analyzed to detect this, as analyzing the data is one of the many components to uncovering relationships between performers, and between the performers and the Soundrop which is essential to this performative framework.

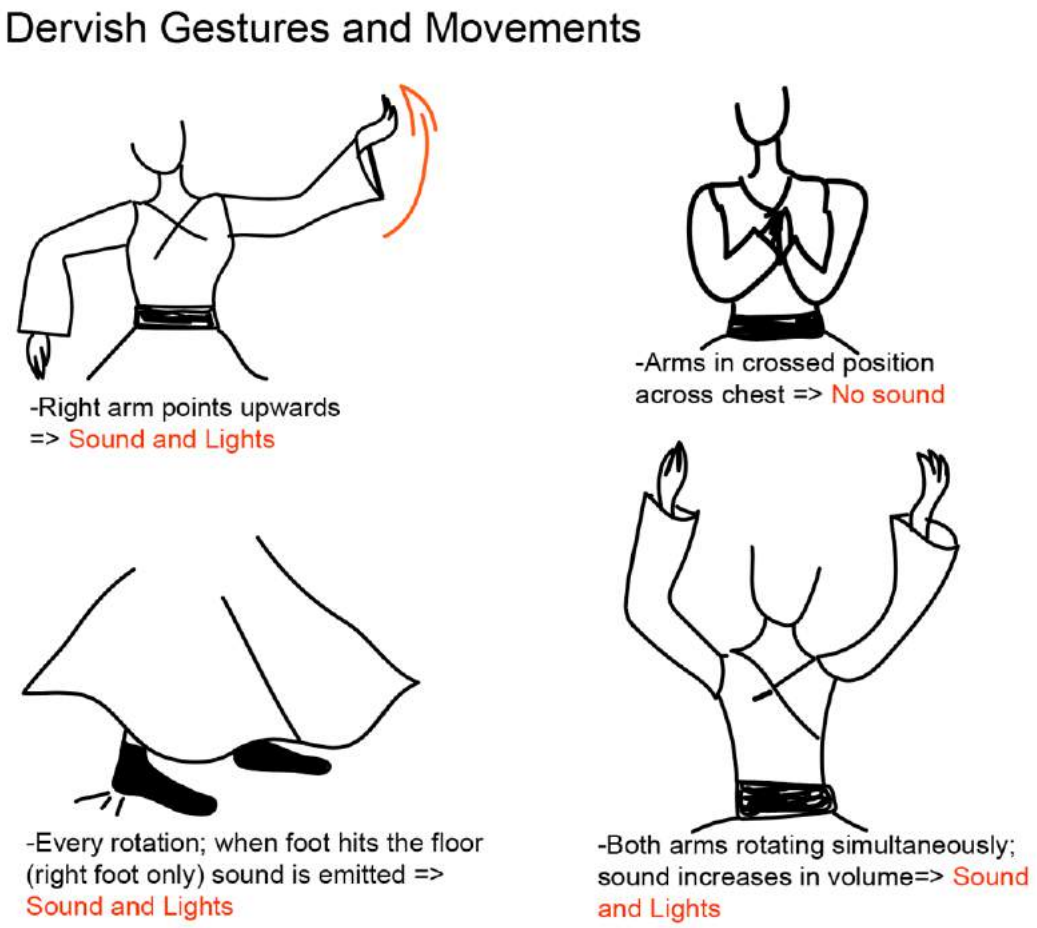


Figure 3.10: A map outlining possible gestures and movements to be tracked with Soundrop for Dervish.

A Flamenco dancer uses various parts of their body – whether male or female, the classical style of Flamenco is interchangeable between the sexes for the most part. It is an expressive, passionate, fiery and at times emotional experience to watch. The foot movements of a Flamenco dancer are especially intriguing, for there are so many variations in the way a dancer moves. There are also numerous styles of Flamenco that require different time signatures, tempo and movement. In Flamenco dance, the different parts of the body have different roles which all connect to form a whole. By deconstructing these parts, a clearer understanding of how certain movements are made and why become evident while using a digital device. Particular gestures and movements that are observed in Flamenco dance are wrist rolling/gestures, arm positions, hand clapping and footwork as outlined in Figure 3.11.

Overall, the movements and gestures of Whirling Dervishes and Flamenco dancers are observed through documentation, sketching, analyzing and deciphering and determining how a digital musical device can augment particular movements and gestures that emphasize them, without relying on the device to overshadow the complete and well-established practices of both. The goal is to capture these movements/moments and coordinate them in a new, contemporary performance art piece as the practice component of this research. The following chapter demonstrates distinctive links between the movement, music, costume and the spiritual/metaphysical elements that reveal the possibilities of how the two forms can be augmented with a digital wearable musical body instrument.

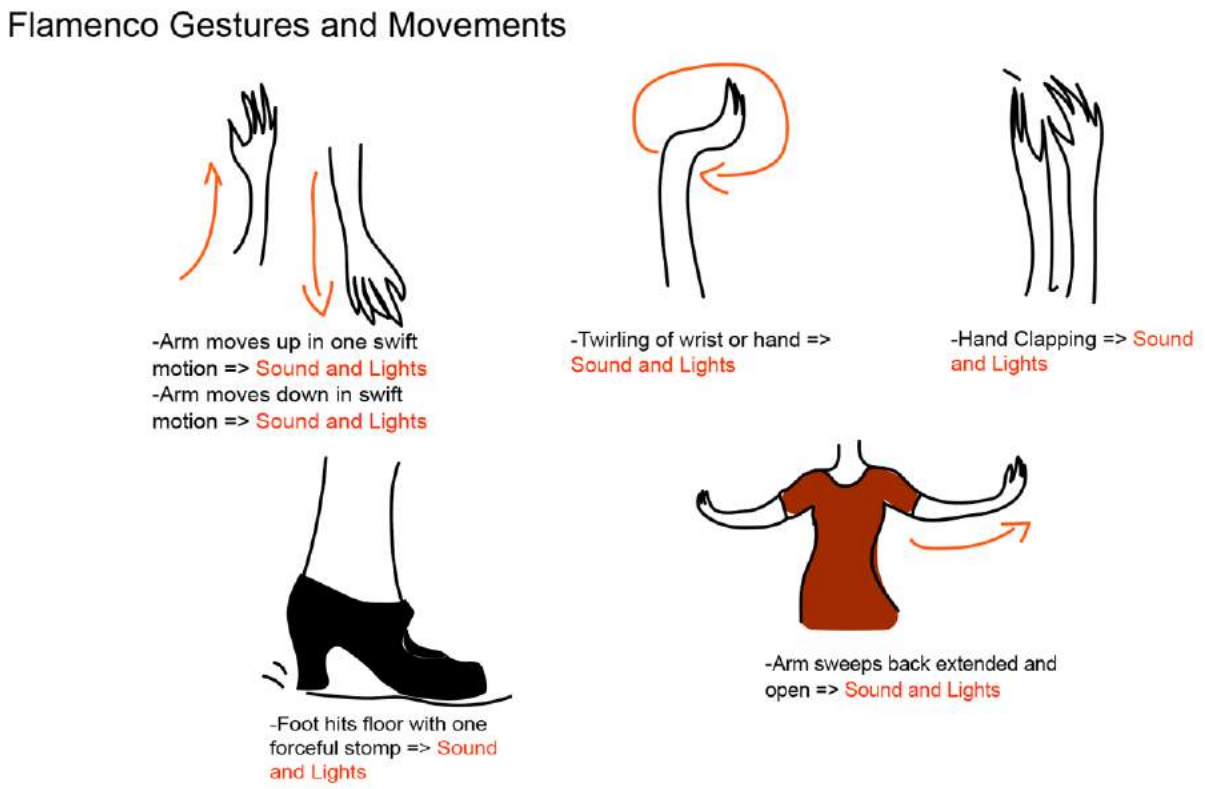


Figure 3.11: A map outlining possible gestures and movements to be tracked with Soundrop for Flamenco.

Chapter summary

This chapter evaluates human body and movement through time with a focus on the performing arts, dance and contemporary dance practices that infuse technology. The following chapter discuss how the practice of the Whirling Dervishes of Turkey and Spanish Andalucían Flamenco are interconnected and are used as a study in augmenting these traditional dance forms with a wearable musical digital body instrument. The impetus for this work is to highlight the comparative aspects of the two practices via the transfer and recording of data from a digital musical body instrument: the Soundrop. Emphasizing these connections by analyzing the traditions behind Dervish whirling and Flamenco dance will provide a clearer insight into how they are intrinsically linked. The two practices are coalesced in a performance piece where they harmonize through music, cultural history, film, dance, and wearable technology. The following chapter examines

these links by using parallels in history, geography, politics, music and dance to decipher the underlying qualities that are used to inspire the production of a performance piece that unites the two traditional forms with an interactive digital musical body instrument.

If I look like I am a gypsy, I sing bulerías
And the bells ring
They have entered that garden
Four men at will
and without compassion they have taken
the rose that I wanted
and then they have despised it
how my heart trembled alone on the street

-Lole Montoya, 1994

Chapter 4
Decoding the links between Dervish Whirling and Flamenco Dance

This chapter is an intense exploration of the lineages as well as the parallels and contradictions between the practices of Dervish whirling and Flamenco dance forms. The purpose here is to illustrate that the two movement practices are linked through geo-political histories, musical traditions, modes and genres, and complexities in movement. Dervish whirling and Flamenco dance have had tumultuous pasts with significant ordeals involving oppression, dissipation, resistance, and disaccord. However, both practices have also seen a revitalization in new and contemporary forms as well as being celebrated by the chronicling of the movements in an effort to archive and preserve the intangible cultural heritage through scholars and ethnographers. The two forms are unpicked through various criteria and are analyzed as to how a Dervish and Flamenco performer can use digital wearable musical body instruments to augment specific movements and gestures. These findings lead into the next chapter which details the development of a wearable musical body instrument that is worn as part of a performance piece that intertwines both a Dervish and a Flamenco dancer.

4. Contrasts and Parallels

When beginning this research, the intention was to study several different dance forms; alongside a deep interest in Dervish whirling or the sacred practice of the *sema* performance and Flamenco dance, there was an enthusiasm for other cultural dance forms such as the Maasai tribal dance or Hungarian *csárdas* dance among many others. The attempt to find meaningful links between a variety of dance forms across the globe became challenging; the purpose was to place them next to each other in a performance space in a composition that unified them with a digital wearable musical device. *Gypsies and Flamenco* (1994) by Bernard Leblon is a book that reveals a lineage that traces the heritage and wanderings of Gypsies across the Middle East to Europe and Spain where the same roads were traveled by Sufis, mystics and possibly even Dervishes. The organic experiences of these civilizations that meandered and wove in and out of time with each other is a relationship that can be further explored in terms of music, costume, art history, film, dance and cultural heritage.

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 performances/spiritual practices in the world and has recently been proclaimed an intangible cultural heritage of humanity in 2005 through UNESCO[31]. The *sema* performance or ritual dance that is performed by followers of Mevlana who was known as a Sufi mystic, poet and scholar founded the practice of whirling which dates back to 13th century Anatolia once known as Rum within the Turko-Persian Seljuk state (Lewis, 1963 p.14). This is also why Mevlana has been known as 'Rumi' and has come to be associated with Western philosophies on meditation and spiritual poetic practices. It is deeply rooted in Sufi mysticism which focuses on the complete annihilation of one's ego and self-centeredness to receive God's glory and exaltations. It is said to have been born out of Mevlana Celaluddin's (sometimes spelled *Jalâluddîn*) meetings with Shams al-Din Tabrizi, a wandering dervish and friend of Mevlana's who exposed Mevlana to the wonders of combining music and poetry with

[31] https://ich.unesco.org/en/RL/mevlevi-sema-ceremony-00100

the ecstasy of sacred recitation which is also known as *dhikr*[32] or *zhkir* (Uyar & Besiroğlu, 2012). The word 'sema' or sometimes spelled 'săma' has different meanings but is usually referred to as being a 'spiritual concert' or a 'metaphysical audition' however, it can also mean 'to listen' (Lewis, 2000, pp. 309). It is the spiritual embodiment of everything that is surrounding the Dervish in a moment of contemplation or prayer that is emphasized by the music and often Qur'anic recitations that accompany a *sema*.

The most formative element in the way a Dervish moves adheres to the epithet that they ascribe to, whirling or turning. The movement during a *sema* of continuous spheres sometimes for an hour, is the physical embodiment of the metaphysical connection between the 'dancer' and the Almighty Creator (Clarke, 1981). It is the abandonment of all worldly attachments, and it is focused upon annihilating the temporal self through the recitation of *dhikr* or *zikr* (Pietrobruno, 2019). Basak (2017) writes that the *sema* is not a dance per se; it is the remembrance of God and a form of submission to the divine through prayer and contemplation which is propelled by movement, recitation and also music.

Flamenco also has a vast and significant history that has helped to shape this research in understanding the background of the tradition and how over the centuries, Flamenco has evolved to where it has now become one of the most recognizable dance forms in the world. The lineage spans continents and its closet relations through Arabic Moorish[33] rule have a major role to play in the development of the direction of the genre (Leblon, 1994). According to Accombo (2016) 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. Totton (2003) suggests that the dance developed from the melting pot of cultures and descendants of Greek colonists, Sephardic Jews, Christians and Phoenicians. The music and form of narrative or storytelling began developing among

[32] The word 'Dhikr' literally translates from the Arabic to 'remembrance' or the remembering of God (Allah) the Almighty. It is often used repetitively in prayer, continuously reciting the name of Allah or Qur'anic verses over and over again until the worshipper finds themselves in a meditative state based on the holy word(s). The *sema* is an example of the use of *dhikr* in that each time a Dervish steps on the ground whilst turning, they quietly whisper 'Allah' in continuous patterns.

[33] The word 'Moor' is derived from the Latin word 'Mauri' which identifies most of the 'dark-skinned' people who arrived in Northern Africa from Mauritania to Algeria, Tunisia, and Morocco and eventually through to Spain. It is a widely accepted term, but it also comes with negative and derogatory connotations as being an all-encompassing word for describing all people of colour from those regions (Barbour, 1970).

these various cultures and the Gypsies who would perform with and amongst the Moors and the Jews shaped what Flamenco music is today (Accombo, 2016).

Flamenco is generally known to have originated from the Romani Gypsies of Andalusian Spain (Alonso, 2019). Although the practice of Flamenco has also been recognized by UNESCO as an intangible cultural heritage of humanity in 2010[34], for many Spaniards, Flamenco has no effect on their daily existence; if anything, it has garnered negative associations for being a relic of the past marketed for tourism and a hindrance in Spain's advancement as a modern, European state (Machin-Autenrieth, 2017). This prejudice against Spanish Gypsies has been prevalent for ages; the (non-Gypsy) Spaniards have brazenly displayed their suspicions of Gypsies and have viewed them as immoral and uneducated people (Schreiner et al., 1990).

Several questions about taking the traditional practice of Flamenco to create a new digital experience arose from cultural crossovers through the author's experiences in Turkey/Türkiye with Whirling Dervishes as well as in Spain through observing the practice of Flamenco. Some of these questions consisted of how and why a Flamenco dancer moves the way they do, and how do they do it? How can this research develop ways of attributing digital sounds to the movements of dancers performing Flamenco? There is profoundly long story behind Flamenco that has been dissected by many writers, musicologists and dancers in the past and this journey with Flamenco would be a very different one. To begin with, Flamenco is not just a 'dance' – it is a language, a song, a story and above all, a mystery. It is the pride of the Romani Gypsies who cultivated the practice and claimed it for their own centuries ago by way of wandering across continents to the Iberian Peninsula.

There is no distinct or exact 'similarity' between a Dervish and a Flamenco dancer. The purpose of this research is not to outright compare the two, but to investigate the lineages to formulate the possibility of a language between the two. From a cursory glance, they look nothing alike; the costumes or garments seem vastly unrelated, the mannerisms of

[34] https://ich.unesco.org/en/RL/flamenco-00363

a Dervish performer compared to a Flamenco dancer are also clashing, and yet, there is something that from a distance, even to the untrained ears or eyes, invokes interchangeable potential.

The generational overlaps and cross-pollination of cultures and traditions become more evident here as the links in terms of music, bodily gestures and expression, emotional mannerisms and communication are examined. The histories of the Turkish Mevlevi or Whirling Dervishes and the dance of Flamenco in Andalucían Spain are vast and have been delved into with fervor wherein the inspiration behind creating this practice stems from. The parallels and contrasts between Dervish whirling and Flamenco are evident in their expansive histories. Both the practice of whirling and Flamenco date back several centuries: the origins of Dervish practices date from 13th century and the beginnings of Flamenco musical traditions from around the 8th century. They have seen oppression under dictatorships, such as in Spain under Franco's regime (1936 – 1975) or in Turkey under Atatürk's rule (1925 – 1953).

The traditions have both been threatened with disintegration over time due to conflict or inaccurate record-keeping, but they have also seen revivals over the last 50 or so years. The practice of the Whirling Dervishes is a sacred, metaphysical Islamic meditative practice while Flamenco draws from passion, anguish, tragedy and love. The intermingling of cultures, traditions, religions and people with the conquest of the Visigoths of Spain by the Muslim Moors from North Africa in the 8th century are elements that have been embedded in the Spanish psyche for centuries (Catlos, 2018). The starting point for the invisible links between the two begins with the winding roads that have led Sufi mystics through Spain, and to the poetry and search for spiritual fulfillment by wandering Dervishes of ancient Anatolia.

A closer look at the essential elements that pertain to this research, a breakdown in Table 4.1, outlines how this chapter is structured. This table also illustrates the particular aspects of both practices that are considered in developing the production with attention to each category: spiritual/metaphysical, music/dance and costume. It is a way to outline

the comparisons and the contrasts that are particular to both practices. This framework contributes to the features that are augmented/highlighted with a digital musical body instrument of both the Dervish and Flamenco performers that shaped the production of a multi-media immersive performance piece.

	Practice	
Criteria	**Dervish Whirling**	**Flamenco Dance**
Spiritual/ Metaphysical	▪ Meditative ▪ Prayer ▪ Oneness with God	▪ Expressive ▪ *Duende* ▪ No direct spiritual/religious links
Music/Dance	▪ Maqam mode ▪ Some poetic recitation in Turkish ▪ Qur'anic recitation ▪ Limited instrumentation ▪ Complex footwork ▪ Arms help propel Dervish in circles ▪ Movements are linked to music and sound of repetitive recitation	▪ Using Arabic maqam mode in compositions ▪ Poetic songs in various forms/traditions ▪ Guitar only accompaniment ▪ Complex footwork and body work ▪ Dance is linked to music and rhythm of guitar or handclapping
Costume	▪ Minimal silhouette consisting of jacket, shirt, weighted skirt, and headgear ▪ Dervishes use the costume to emphasize whirling ▪ Costumes have specific meaning attached to them ▪ Minimal to no color	▪ Early Flamenco clothing was worn by Gypsies/Gitanos as a part of their folk dress ▪ Later became more distinctive consisting of more elaborate skirts for women, shawls, and head/hair ornaments – simple shirt and trousers for men ▪ Colorful patterns and fabrics

Table 4.1: Outline of comparisons and contrasts

The esoteric and transcendental human connections with either the Divine or within the realm of incomprehensible emotional sincerity are both integral to a Dervish and a Flamenco dancer. Without these rudimentary foundations, neither practice would be as effective, emotionally dependent or profound. The other component of these practices is the musicality that is associated with them and how music and sound are integral to the culmination of intensity that is expressed through movement. Music is a force that drives both practices in a way that delivers a channel between the musician and the performer to the point of involving audiences to experience the spectacle internally as well as externally.

The body movements of a Dervish and a Flamenco dancer are as distinct as the music that accompanies them. Each are unlike the other at first glance however the momentum that arises during a performance can amaze and fascinate audiences with regard to the skill and technical dynamism that is exerted. One of the key similarities between Flamenco and Dervish whirling is the emphasis on the physicality of the performance. Both styles involve intense and often improvised movements that require a high level of skill and training. In Flamenco, the dancer's feet are the primary instrument, with intricate footwork patterns that create complex rhythms and syncopations. Similarly, in Dervish whirling the dancer spins continuously in a clockwise direction, creating a sense of whirling movement that is both mesmerizing and meditative. Another shared element between these two styles is the importance of improvisation. In Flamenco, dancers often improvise movements and steps in response to the music, creating a unique performance every time. Similarly, in Dervish whirling the speed and direction of the spinning can be adjusted in response to the music or the spiritual state of the practitioner. This improvisation allows for a deeper connection between the performer and the audience, creating a sense of spontaneity and authenticity.

Finally, the costumes associated with both practices are at the forefront of a performance. It is the visual that is the most impressive and the most well-understood. As the Dervish and Flamenco come together in the performance, the visual connection between the costumes becomes apparent and are morphed in a way that separates them while

simultaneously uniting them. All aspects of the costumes are discussed; the colors, fabrics, symbolisms, and the fact that the costumes play an integral role in becoming extensions of the body that the performers use as tools to create their movement spaces while also initiating the use of a wearable musical instrument.

The breakdown of how the practices of Dervishes and Flamenco dancers relate follows a criterion based on the most pertinent contrasts and parallels. These five sections demonstrate the DNA that links or divides the two which ultimately lead to the practice of composing a performance piece that connect the two forms while also highlighting the variations and contradictions.

4.1 *Dhikr* and *Duende*; decoding the metaphysical and the spirited

The deepest historical link between a Dervish and Spain (or Flamenco) is the presence of the Arab (Moorish) people from the early 8th century until the Reconquista of 1492 when Christian Spanish forces re-took control of the territories of Spain from the Islamic rulers (MacGuire & Stewart, 2017). Though the sometimes-merciless Inquisition which disbanded in the early 1800's sought to expunge much of Spain's Islamic history, the period from the early 8th century to the late 15th century saw the development of cultures and religions (Jews, Muslims, Christians) that brought about a flourishing of ideologies and knowledge including art, architecture, spirituality/metaphysics, philosophy and music to name a few (García, 2023). While people lived in relative harmony, exchanges between traditions of those of different faith groups and cultures were made. Though Spain is not at all associated with having a Muslim population nowadays where Spain's Muslims are just under 2%, the Islamic past and the impression it has left in Spain is unquestionable (McGuire & Stewart, 2017). It is possible that even the Gitanos[35] of Spanish Gypsies were not oblivious to this; in fact, they absorbed it, practiced it and created from it.

[35] The word 'Gitanos' refers to Spanish gypsies.

The Sufi[36] mystic, poet, philosopher, and scholar Ibn Arabi (or Ibn El-Arabi) made his presence felt in Andalucía in the mid 12th century (Nightingale, 2015). His book, *The Sufis of Andalusia* is an account of his travels which led him on a path of learning, searching and philosophizing (Nightingale, 2015). His poetry and sayings were inspired by his life and wanderings in the region where Sufism and the practice of *dhikr* were common (Irwin, 2004). Whether or not there was transmission amongst the other civilians (including Gitanos) who were exposed to these and other religious practices or traditions, it is clear that the amalgamation of cultures played an important role in the formation of song and music where the influences between them crossed paths.

The manifestation of emotions that are physically expressed when a performer/dancer moves to music or to a rhythm and their state of heightened nature during a performance are unexplainable on a tangible level. It is impossible to fully comprehend what one experiences in their mind and body when they outwardly express gestures, song or movement. The physical actions, gestures, movement and vocals of a performer are conveyed depending on how the performer interprets (in the case of musical performance) music, sound and rhythm. However, the connection between the mind and body is nevertheless unmistakable and the two rely on each other for this level of corporal/mental communication. Audiences can sense a glimpse of what a performer may be feeling on stage as they are involved to some degree in that shared experience to a degree. It is the performer's skill in conveying these emotions through physicality that merges the art form with the emotion.

Katan (2016) writes that the expressionist feature of a dancer communicates meaning or emotion through gestures which are part of a perceptual process. This process materializes as a performer uses their body to focus and become completely and wholly absorbed in the meaning they are conveying about their relationship with the act whether this manifests as facial expressions, gestures, vocal utterances or in other ways. As an example, a member of the audience watching an opera performance of *Madame Butterfly*

[36] Sufism is a branch of Islam but not separate from it; it is the mystical tradition that was born out of the foundations of the Whirling Dervishes from Jalal-Uddin Rumi or Mevlana.

by Puccini may be moved emotionally by the musicality of the song and the drama that is created between performers, but the same audience member cannot fully understand how the performer feels internally when conveying meaningful words and phrases about the subject matter (in this case love, tragedy and loss). Similarly, an audience member can observe the mesmerizing whirling of a Dervish performer and the expressive song or dance of Flamenco and become emotionally moved but the mystery of how or why these heightened phases occur are only known to the performers themselves and will always be ambiguous. *Dhikr* and *Duende* are emotional, physical and mental states that are internalized and expressed during performance by a Dervish and Flamenco performer. They are phases lived in an intangible realm but are an integral component to the overall authenticity of each practice. The source of these metaphysical or expressive modes are not analogous, but similar themes are associated with both.

Dervishes perform *dhikr* as they are whirling or are in a prayer circle with others. *Dhikr* refers to the repetition of sacred prayers or words that glorify God. This process or structure of *dhikr* is an essential element in how a Dervish achieves their goal of becoming united with their Creator. This is a part of a 'mystical path' that Schimmel (1975) describes as the ultimate state of consciousness of God that is like a ladder leading a Dervish there through moments of 'ecstatic rapture' that comes with the experience of practicing *dhikr* and ultimately more so with the physical form of body movement. In the early times of Sufi-related meetings of scholars and 'spiritual masters' men would gather in circles to discuss God-consciousness and deeper explorations of Islam to the point where the esoteric side of the religion could out-weigh the liturgical practice (Friedlander, 2003). Needless to say, the goal of achieving a highly mystical state and becoming closer to God has become the essential factor upon which Dervishes plant their feet and turn repetitively.

There have been many articles and books written on Jalâluddîn Rumi/Mevlana who was essentially the founder of the tradition of the Dervishes in Turkey, that talk about how Rumi was often 'drunk on the Divine' – a phrase that does not bode well with staunch scholars that observe the authentic writings of Mevlana. Many of Mevlana's poems that

have been translated into various languages from the original Persian and his writings incorporate Qur'anic verses or concepts throughout (Ali, 2017). However, this has been greatly over-looked by Western new age enthusiasts since associating Islam with Rumi is less than desirable when one is simply looking for a phrase or adulterated quote drawn from his many texts to use as a mantra or daily affirmation (Ali, 2017). Nevertheless, in the case of Dervishes including Mevlana, the holistic intention of whirling was to create an emotional, physical and elevated metaphysical experience that is brought on by creating continuous circular patterns and by reciting sacred text. This is a state that can be referred to as *wajd,* or an intense feeling of emotional energy that is released when the body, mind and heart are overcome with the love of the Creator (Kharkovi, 2018). Referring to Dervishes as 'being in a state of ecstasy' while they are whirling is also a disputed and disparaging remark that does not translate well into English (Kharkovi, 2018). To be in an 'ecstatic' state or to experience ecstasy according to an online entomology site[37], means to be 'enraptured' or 'taken over' by something where the prefix from the Latin 'ex' means 'out of' or 'deprived of' and the suffix 'sta' meaning 'a solid state' or 'to stand'. However, to refer to a Dervish as they are whirling in 'ecstasy' is a simplification in that their experience can also be a part of the physical realm more so than the religious or metaphysical. Ecstasy as a term also refers to a state of loss of self-control which is quite the opposite of what Dervishes experience in that they are fully controlling their movements and actions while performing *sema* (Kharkovi, 2018). The practice of the *sema* which is the word for the sacred ritual that the Mevlevi order practice in their 'turning' performances, has rarely changed over the past several hundred years. To some staunch practitioners, it is not considered to be a 'dance' in the formal sense, rather it is considered to be movement to the rhythm and sounds that magnify God. This practice is still done to this day and for some, performing it as authentically as possible is a great honor which holds esteem from generational Dervish practitioners. Dervishes are not inclusive to Turkey even though they are synonymous with Turkish culture; many other countries in the Middle Eastern and North African regions have developed their own variations whether by chance or through cultural exchanges over the centuries. The term *ahwāl* may also be used which in Arabic translates to a 'spiritual state' where *wajd* or

[37] https://www.etymonline.com/word/ecstasy

ahwāl can be described as: “states of heightened awareness or spiritual intoxication including the pain and ecstasy or love” (Frishkopf & Spinetti, 2018). Perhaps therefore, the term *wajd* may be more appropriate here as it encompasses more of the meaning of the state of mind and body that relates to the physical and mental aspects of Dervish whirling rather than reducing it by referring to it as ‘ecstasy’ which implies wild loss of control or mental instability.

To further decode this state of euphoria that contributes to the emotional/temporal expression while a Dervish is whirling, one must also consider the roots of this state which are the music, and the recitation of poetry or sacred text. The articulation of bodily movement is propelled by the musical accompaniment in which in most cases is the reed flute (*ney*), the kettle drum (*kudum*) and the *ilahi* which is a musical term meaning a type of song that is sung during *dhikr* of a *sema* (Lifchez, 1992). These *ilahi* are normally performed in 4/4-time structure and are comprised of fixed rhythmic cycles (Lifchez, 1992). The *ilahi* is sung where the repetition of phrases that are part of the liturgical/ceremonial canon are repeated such as ‘La ilaha il Allah’ (there is no God but God) which fits perfectly into the 4/4-time structure (Lifchez, 1992). This may be repeated throughout the *sema* or exclusively with instrumentation. While the Dervish is turning, they repeat these phrases which are sung by other Dervish singers during a *sema* or may repeat other phrases to themselves (such as ‘Allah’) with each turn landing of the foot on the fourth beat. Therefore, there is a rhythmic construct while performing which leads the Dervish to become further invested in the objective of achieving a devotional position by repeating sacred words/phrases thereby exuding a state of elation.

This elation has also been described by many Flamenco performers over centuries and was recently compartmentalized into a single word: *duende*. Flamenco is an expression of song, story, dance and instrumental music usually accompanied by a Spanish guitar (*toque*), vocals (*cante*) and dance (*baile*) (Washabaugh, 1996). Matteo & Goya (2003) write that Flamenco is a communal event, a way of life; the performer is not separated from the audience - rather there is participation on their part. 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. Upon hearing the voice of a Flamenco singer, one might be taken aback by the extreme dramatic quality that exemplifies the enormous inner tension and inner struggle which becomes intensified as the faces of singers become overwhelmed with contortions that feel soul-shattering and profoundly other-worldly (Schreiner et. Al, 1990). This wailing through even the hoarsest of voices epitomizes the deep anguish of tales of the past and is felt as a mythical intensity that could be described as *duende*. It is difficult to describe what *duende* means; in the broadest sense, it means the 'soul' of Flamenco or a state of mind that emanates from the emotional energy created while performing Flamenco whether it be through song, dance, or playing an instrument (Matteo & Goya, 2003). It is also suggested that *duende* can describe something magical like an elf or fairy or that the spirit of the performer becomes possessed by the *duende* while they are performing (Matteo & Goya, 2003).

Federico García Lorca wrote many poems that describe the concept of *duende* using symbols such as the wind that symbolized a malevolent spirit (Stone, 2004). Stone (2004) states that the embodiment of *duende* is provoked by the fatalistic legends and beliefs of Flamenco culture. Stone (2004) goes on to say that in Gypsy culture, the manifestation of *duende* in a performance is brought on by a heightened spiritual experience and a release of intense emotional passion. While this may not be the case for all Flamenco performers, it is a concept that bears a close resemblance to the *wajd* experienced by Dervishes.

In some texts, *duende* simply explains a state of intoxication during Flamenco *juergas* or wild parties that would play out from dusk until dawn (Haas & Edwards, 2003). This may explain the theory to an extent since many performances (that may have been recorded by audio or text or verbal accounts) during the late 1800's that were held in *café cantantes*, where performers would gather for hours consuming considerable amounts of alcohol, would use the opportunity to belt out their most deeply emotional, tragic and profound songs (or *cante jondo*). This can equally be the case for a singer or a dancer, as well as a musician, as the triad of these elements belong together. To further attempt to unravel the mystery that is *duende*, one might look at certain performers through time

who have been said to have exhibited this ‘other-worldly’ or ‘spiritually heightened’ experience. When one listens to the voice of Manuel Torre for example, it is as though he is weeping from the inside outwards. His voice cuts the silence like a razor blade and is formed by the deeply rooted narrative of his Gitano origins. Manuel de Falla once commented upon hearing Torre’s voice that ‘whatever has black sounds has *duende*’ (Haas & Edwards, 2003). These ‘black sounds’ have been referred to by Lorca as something magical or like a power or spirit that climbs inside the performers’ throat and produces an inspired performance (Haas & Edwards, 2003). Haas & Edwards (2003) write that there were legendary accounts of Torre’s performances where if he was infused with the spirit of *duende*, he would invoke a similar feeling in his audience to the point where they would rip their shirts off or smash their chairs in a flood of passion.

A different experience from that of a Dervish - a contrast which is nevertheless significant to mention in terms of the nature of each practice and the powerful effect it has on those who perform it. Whether with gestures, actions or words, the atmosphere that a performer creates when attempting to convey their own feeling can result in exaggerating the dynamism of emotion to present their physical, mental and emotional struggle, fear, love, grief or anger (Landborn, 2015). Landborn (2015) writes that the expectations of *duende* are also similar in Spanish bullfighting, and that all the elements contribute to these expectations of exhibiting *duende* which are the formal elements (of Flamenco and/or bullfighting), colorful costumes and the display of talent and energy, and lastly the transcendent experience of the performer that is conveyed through passion and physical expression. The *wajd* or performing of *dhikr* and *duende* exhibit similar explanations of transcendental qualities that are signature characteristics of both practices. Washabaugh (1996) refers to *duende* as being a ‘spiritual practice which appeals to contemplative faculties’. Flamenco dancers/singers, whether contemporary or otherwise, may or may not identify their practice as being something that exudes qualities of mysticism however, the ‘ferocious sincerity’ of the *duende* requires that the performer have a profound sense of human inspiration that is elemental in Flamenco and without it the authenticity is merely a watered-down version of the pure form of the practice (Washabaugh, 1996).

Other similarities are present in this line of discovery in terms of the song style of both a *sema* performance and a Flamenco *cante*[38]. When a Dervish turns, as previously mentioned, a mantra is repeated that revolves on the mouths of Dervishes as they turn in continuous motion. Usually this would be 'Allah', meaning God in Arabic. This word or phrase may be used by the singers that accompany a *sema* as well or as a combination of words or phrases. The repetition of a word that exemplifies God greatly increases the likelihood of attaining a sensation of transcendent love for the Divine Creator. One of the driving forces behind a Flamenco performance is an utterance that is proclaimed by other singers to propel or motivate and even address a singer or dancer to further excite the drama and climatic appeal. This word is *olé* and is often used repeatedly during Flamenco performances as a vocal expression meaning 'bravo!' or 'to God!'. The etymology of the word comes from the Arabic 'Allah' since thousands of words were used and taken from Arabic and infused into Spanish (Echevarria, 2009). The traces left behind by the Moorish rulers of Spain definitely had an impact in the development of certain words that are still used in the Spanish vocabulary today (Echevarria, 2009). When a Flamenco singer/singers exclaim *Olé!* it signifies praise for the performance; a common cheer that is also heard during a bullfight. According to Kaye (2005), the etymology runs even deeper since the presence of Arabs and the Arabic language in Spain from 711 A.D. onwards where phrases such as the Arabic '*Ya Allah*' or 'Oh Lord/God' and '*Wallahi*' or 'Praise God' were probably used and emulated by *payos* to create a similar meaning of praise, appreciation and cheer. This could especially have been the case when witnessing or participating in a Flamenco performance where the possibility of the Arabic word origin was Hispanicized to mean 'bravo!' as in, 'well done!' hence, 'olé!'. However, staunch linguists and anthropologists continue to dispute that the two words or phrases have anything to do with one another as a way to deny any association of Spain's Islamic past.

As a way to connect the traditions of Dervish and Flamenco song and body movement, these attributes to each practice are nevertheless defining features and are integral to the authenticity of the performance. Whether or not a Flamenco singer, dancer or musician

[38] *Cante* generally refers to song, or the singer/vocalist in Spanish but it also refers to a group of song or song styles which are *palos*.

achieves a feeling of *duende* during a performance is entirely dependent on their circumstance, which includes several factors: the venue, context, audience and the marriage of the three main components of Flamenco which is song, dance and music. Similarly, a Dervish *sema* requires certain factors to place a Dervish in a position where they may feel moved by a metaphysical experience.

4.2 The Music and Dance of Dervish and Flamenco performance

The paths that intersected with philosophical poems, songs of pain, suffering, beauty, loss and the outward expression of an internal force that presents itself as a visual spectacle through song and body movement, have also formed the musical traditions of the practice of the Whirling Dervishes and Spanish Flamenco. There are clear parallels between the source of music that is played during a Dervish *sema* or Turkish classical music that are equally aligned with the music of Al Andalus (Arabic for Andalucía) or Flamenco music. The sources are generally agreed to be based on the Arabic notation and rhythmic musical modes known as *maqam*. There are many examples of this that exist in contemporary music, and one does not need to go back very far to see the analogous themes in Turkish/Middle Eastern musical traditions and Flamenco music. The interpretation of musical modes in Flamenco music that have been clearly derived from Arabic influences span decades, and centuries of musical development. There are many examples of these instances of crossovers which will be examined here. The purpose for this examination is to highlight these parallels which inform the musical composition for a performance piece that morphs a Dervish and Flamenco dancer with music and sound that are ambiguously blended with both musical traditions.

In a lecture on music in Andalucía by author, scholar and academic Shaykh Hamza Yusuf[39] he mentions the singer, composer and *oud* player Ziyrab (active in the region towards the late 8th century) who essentially improved upon the *oud* by adding a 5th string, making it more recognizable as a modern-day guitar. Ziyrab also introduced the Arabic *maqam* style in Southern Spain which is a mode or melody type that was said to have

[39] https://www.youtube.com/watch?v=CBcySL09c8A

healing properties on those who listened to it (Pohren, 1962). Flamenco musical styles were heavily influenced by the Arabic *maqam* tradition and framework of specifically *hijaz* musical modes (Thompson, 1985). This resonance or vibrational effects of this style of music is said to have soothed the soul and to have created an inner passion and emotional motivation for performing music. Perhaps this is why early song styles in Andalucía that were absorbed by the Gitanos along with their own brand of singing styles had such a profound effect on the listeners and audience. Flamenco guitar playing can be magical and can showcase the extraordinary talent and skill of a guitarist. According to Flamenco historians, the use of the guitar did not become standard in Flamenco until around the mid 1800's (Coelho, 2003). Between 1920 and 1949, some of the notable aficionados and skilled guitarists such as Ramón Montoya may have refined the modern Flamenco guitar style by producing intricate arpeggios and fast passages (Coelho, 2003). The use of Phrygian[40] tonality in Flamenco guitar is the common mode, with many of the chord tones originating from E major where the common chord progression is A minor, G major, F major to E major (Coelho, 2003). This distinctly reflects the Arab heritage in Andalucía, in particular with the *maqam* modes that are distinctly of Middle Eastern origins (Coelho, 2003).

Essentially, Flamenco guitar compositions have their own voice; with or without dance and song, the guitar can embody much of the tone and direction of a performance to where the melodic rhythms are capable of evoking passion and emotion. According to Pohren (1962), the guitarist should work in cohesion with the *bailaor* (dancer) to determine their mood and the movements that they will make. This will result in a better relationship and communication between the dancer and musician. The guitarist should also be in tune with the tempo, beat, rhythm or *compás* of the performance – more often than not, a guitar solo can also conjure feelings of emotion and awe in their audiences with or without song and dance. The skill and technical integrity of a Flamenco guitarist is part of the main attraction of a performance. This also provides the opportunity for

[40] The Phrygian mode is the fifth mode of the harmonic minor scale and is used in Flamenco guitar. It is based upon Arabic maqam musical mode where the use of whole tones and semi tones or micro tones are often produced to exemplify improvisation.

melodic variations and improvisations called *falseta* which as Pohren (1962) describes as a moment that the guitarist can use to allow the singer or dancer to rest or pause.

Washabaugh (1996) alludes to this theory in particular with the 'orientalization' of Flamenco music having been derived from North African (Moorish) variations of musical modes. As an example, Washabaugh (1996) discusses how famed singer Lole Montoya (a Gitana/Romani by birth) uses Arab vocal stylings in her songs. In a video of her and her mother known as 'La Negra' performing, Lole begins singing in Arabic with phrases such as 'Ya Habibi' (my love) and a variation on 'La Ilaha Il Allah' (the Islamic declaration of 'there is only one God') - are a clear fusion of not only musical styles but cultural practices (Xikorif, 2011). On her 1994 album *Nuevo día*, the closing track *Sangre gitana soy mora*, Lole sings entirely in Arabic or what could be a variation of Romani language intermixed with Arabic. Some of her songs sound somewhat like *fado* - a popular Portuguese song style which sounds as mournful and passionate as Flamenco. Another renowned Flamenco singer and Romani/Gitano Juan Peña Fernández, also known as El Lebrijano, was known for his interpretation of the *cante jondo* and he has also said that Flamenco and the music of North Africa are essentially the same (Cantor-Navas, 2016). His album *Encuentro* which translates to 'meeting' is a collaboration with an Andalucían orchestra in Morocco. The interplay and fusion of Arabic and Spanish musical styles as songs sung in both languages, is a seamless integration of the two heritages.

The vocal styles of Flamenco have also developed from the same melodic modes that are characteristic of melismatic vocal styles of Arabic music (Manuel, 1989). These melodic modes are seen/heard through much of Flamenco dance, song and guitar playing. As an example, Classical Turkish singer Hafiz Burhan and Flamenco singer Camarón de la Isla are juxtaposed. Hafiz Burhan was a singer of Classical Ottoman Turkish music in the early 1900's until his death in 1943 (Yilmaz, 2010). His voice could reach extreme high pitches and he sang with the characteristic style of classical Arabic *maqam* micro and semitonal harmonies. This similar style of microtonal qualities can also be heard in the vocal stylings of Camarón de la Isla. His vocal range was also astounding and he was known for his *afinacion,* or tuning which is the ability to use impeccable pitch

but not in the standard Western scale (Contreras, 2011). These microtonal intervals are what define both Arabic maqam mode and Flamenco song style. The intonations are also similar where the emphasis is usually on drawing out a particular syllable or stanza in a song.

Another example is the singer Aziz Balouch whose work is lesser known but is unusual and intriguing. Balouch's music (of which recordings are rare and few) is another example of fusing different traditional musical styles that form a comprehensive and solid merger into a non-conforming genre. Balouch was a singer of Qawwali music from Pakistan, and in the early 1930's traveled to Spain where he first encountered Flamenco (Currin, 2020). He played guitar in the style of Flamenco while singing Flamenco in Urdu, and he called himself a "Sufi-Hispano-Pakistani" (Currin, 2020). The song style is identical to the typical Flamenco and Arabic *maqam* musical modes but sung in another language entirely. His songs were generally of the *soleá* (or serious/somber song form of palos) where the accompaniment is solo guitar.

When a Flamenco is performed as a *bulerías,* the song can be expressive and emotional often with elongated and drawn-out stanzas that carry on into exaggerated trills. Similarly, many Mediterranean/Arabic song styles are performed using improvisational *maqam*, whether reciting Islamic prayers or poems, the melodic musical style is often interpreted as the musicians perform invented melodies that are adapted to pre-existing rhythms (Touma, 1971). 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 that 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. Some famous masters of *nasheed* include Qawwali singer Nusrat Fateh Ali Khan and the Sabri

Brothers. Other religious traditions use similar vocal techniques when reciting religious texts or devotional poems. Mizrahi Jews[41] also recite the Torah in a similar way, which to the untrained ear can sound remarkably like *nasheed* using the form of *maqam*.

While musical modes and styles have cross-pollinated, the dance of Flamenco and the Dervish whirling are more abstract when adjacent to each other. However, there have been several obscure performances all over the globe that fuse Flamenco and Arabic music together using various instruments such as *oud*, *ney*, guitar and a selection of percussion instruments (tambourine, hand drum) as well as dance. Leidse Schouwburg's - *From Sufi To Flamenco*[42] from 2009 showcases a Flamenco dancer with a traditionally dressed Whirling Dervish. The performance is quite minimal and shows the dancers moving to the music of Flamenco guitar, a *cimbalom*, *oud* and *ney* with both Spanish and Arab singers. There are other lesser-known performances where a version or variation of whirling intermingles with Flamenco dance as well as bands and groups globally that experiment with fusion and are plentiful on social media sites.

The dance and body movement of a Dervish and a Flamenco dancer are distinguishable and have their own distinct identities. However the roots of both practices follow a lineage that branch out from regions that encompass India, the Middle East, Ancient Anatolia, Eastern/Southern Europe, Spain and North Africa. Schreiner et al (1990) make an interesting point about the origins of movement of Flamenco dancing of which the scholarship and study has been less than extensive. The extended wanderings of Gypsies throughout Northern Africa into Andalucía even before the Moors began to rule there in 711 A.D., were heavily influenced by regional Indian Hindu dances that they presented at large festivals in which they would entertain the local population (Schreiner et al, 1990). These dances which focused upon the upper torso portion of the body and the feet, were also influenced by Arabic music and are easily heard in the *cante jondo* (Schreiner et al, 1990). Schreiner et al (1990) go on to note that:

[41] https://www.youtube.com/watch?v=ulEoW5eCNOU
[42] https://www.youtube.com/watch?v=Y7jz6jm4bR8&t=519s

“In the case of the baile, the concentration on movements of the upper body – hands, arms and hips – as well as on footwork, probably goes back to Arabic sources as well, since the Koran, not to mention the moral code of the Gypsies, forbade a woman to show her legs.”

In terms of Flamenco choreography, these areas such as the hands, torso and feet are most accentuated. The hand/wrist movement is multi-dimensional in Flamenco performance. Hands are used for keeping time and rhythm but also as an essential ‘third’ instrument – the other two being Spanish guitar and, in most cases, vocals not sung by the performer themselves but by other singers/performers. The hands express an incredible amount of information and narrative.

While a Dervish is performing, their hands and arms are in a position that have more of a symbolic aspect to how they use those limbs. The feet are also coordinating with each step much like a Flamenco dancer does when the feet are stepping to rhythmic beats. This can be said for almost any dance practice, however in both the Dervish and Flamenco the beats and musical modes such as *maqam* mode that they dance to are more or less derived from ancient Arabic dance forms.

A Dervish whirls for the sake of God and uses their body to launch themselves into continuous spheres. The torso remains static, while the hands point upward to the heavens and downward to the Earth as the feet step one after another, driving the endless spins. Each turn is made on the pulse of the beat, and although traditional whirling ceremonies will use classical Ottoman-style (sacred) music, contemporary Dervish turning can also be seen with new forms of music such as electronic dance music. Sercan Çelik (Figure 4.1) often performs to a variety of musical styles. His interpretation of the *sema* uses a blend of the sacred style of turning in the lower portion of his body while his arms, head and torso are often much more expressive and animated. His involvement in this project is further discussed in 4.4.

Flamenco 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. Flamenco dancer Pepa Sanz (Figure 4.2) is a classically trained dancer specializing in Flamenco. Her performances also use elements of other genres and styles of dance that fuse with Flamenco. Her approach is a modern interpretation of dance with a strong foundation of Flamenco.



Figure 4.1: Sercan Çelik performing in 2019 (image from Sercan Çelik).

Flamenco dance has several components that contribute to a performance in terms of the dance. The type of dance depends on the *palos*[43] being performed which determines how the dance will play out. *Palos* are like the building blocks of Flamenco music and dance, and they provide a framework for improvisation and expression. There is plenty of room for improvisation in Flamenco dance, but certain features are almost always present such as hand gestures, arm movements, torso rotations, twirls, footwork and clapping.



Figure 4.2: Pepa Sanz (image from Pepa Sanz, 2020)

The dance is directed by the sound – the tone of the music defines the momentum of the dance. Flamenco dancers will often also create drama by stepping into a character that

[43] "Palos" in Flamenco refer to specific musical styles or forms within the Flamenco genre. Each *palo* has its own unique rhythm, melody, and emotional character. Examples of palos include "soleá," "bulerías," "Alegrías," "fandango," and many more.

they embody to further emphasize the movement that is driven by the music. Despite the stereotypes of Flamenco as being an overtly sensuous style of dance, it is actually quite articulated and passionate rather than provocative. There are facets of Flamenco that present this way, particularly in the tourist venues, and may have been so in the *juergas* or *tablaos* of the 18th and 19th centuries, however Flamenco is an expression of extraordinary skill and expertise. The emotional and impassioned narrative that is told through song, music and dance are communicated with a fervor that is singular and unique in terms of global dance traditions. These accents or climatic moments are further elevated by using an electronic musical device that can be activated at moments of peak intensity during a performance.

4.3 Costume; an Extension of the Body

Throughout this research, the concept of combining/juxtaposing the movement of a Dervish with a Flamenco dancer took shape from the connections that were made through familiar histories, musical traditions and the significance of cultural heritage. The two practices are deeply ingrained in the social fabric of both Turkey and Spain and play an integral role in the cultural identity of both countries and its people. The goal of this research is not to change the forms of the practices but rather to augment certain aspects of each and to create a unique digital art spectacle by placing the forms beside each other. With the advancements in modern technology, dance forms are benefitting from the use of digital tools to enhance their performance. It is a different case when handling well-established and critically historic practices that do not need altering or reinventing. Although many practitioners of Flamenco and Dervishes are not necessarily opposed to using technology to augment their performance, this study shows that making use of the integral aspects of each practice while subtly integrating technology can have an interactive and more immersive experience for both the wearer and the audience.

One of these aspects is the costume of a Whirling Dervish and a Flamenco dancer. From a distance, the visual of a Dervish and Flamenco costume are very different. There are, however, points of interest in unpicking the visual connection between the two costume

types. A Dervish uses their costume in a different manner than a Flamenco dancer. The conical shape of a Dervish *tennure*[44] (the large circular skirt worn by Dervishes) when in a fully turned position resembles the structure of a tornado or hurricane flipped upside down. The momentum that creates this force isn't necessarily intense and yet the velocity is enough to achieve this shape which gives it the recognizable trait of a rotating conical shape. The appeal of a Dervish whirling ceremony is the fact that there are often at least 6 Dervishes turning in simultaneously. The spectacle becomes heightened as the white skirts all hurl in unison and create patterns that resemble planets spinning around in orbit. The skirt is weighted at the bottom in order to help maintain the conical shape while it is being turned.

When the *sema* begins, the Dervishes are typically cloaked with another layer of clothing on top of the white *tennure*. As they make their procession, they resemble tombstones in their black cloaks with their tall brown caps (*sikke*) on their heads. This is the intention of the ritual; to represent the death and then the renewal of life unto God when they shed their cloaks to reveal the white garments underneath (Kılınç, 2011). Dervishes use their costumes as an extension of their bodies by the way the costumes are layered, and by how the costume is revealed and then spun until it is fully opened. The fabric is usually made out of a polyester blend which helps to ensure less creasing and weight, as opposed to using natural fibers.

Contemporary versions of whirling that can be seen extensively on social media have different interpretations of the way the *tennure* or skirt portion of a Dervish costume is used. The *tanoura* dancers of Egypt and Libya use their costumes as a spectacle which involves attaching lighting or electroluminescent wires that outline the shape of the skirt. They will often use a double layer of skirt where the inside layer may be lined with LEDs and the top layer is used to spin overhead with the arms creating a double skirt-turning effect. These tanoura are also usually embroidered with colorful patterns and shapes, and are typically made from heavier-weight fabrics such as cotton or poly-cotton blends.

[44] The *tennure* and the traditional Dervish costume consisting of a circular skirt, trousers, vest and open jacket.

Apart from using the castanets or *palmas* as a way to accentuate or highlight/contribute to certain performative aspects of Flamenco performance, the Flamenco style of dress (more so for female dancers) is an integral component to the practice. In Figure 4.3, two Flamenco dancers can be seen wearing elaborate skirts also known as *batá de cola,* or 'ruffled train dress' which is characteristically used in *soleá* or *soleares* dances (Matteo & Goya, 2003). The *soleá* is a dance that highlights the feminine qualities of a female dancer and is more sensual but also restrained and introspective (Matteo & Goya, 2003). The dancer uses the train to emphasize steps as the dress is thrown in the air and around the back of the dancer to create tension and intrigue, and to articulate passionate expression. This is one of the more dramatic of the Flamenco *palos* and is danced with less fervor than perhaps an *Alegrías* but equally as dramatic and exaggerated. The *batá de cola* can be used to dramatically interpret the music which is done by carrying the train over different parts of the body such as the head; the visual effect of the dress is further emphasized by the massive weight, texture and style of the dress (Matteo & Goya, 2003). One movement in particular that is executed with this style of dress is called *escobillo*, or the turn that is made while heaving the dress back and forth in quick movements (Matteo & Goya, 2003). The fabrication for dresses made for Flamenco dance vary greatly but are more often than not they are made using synthetic fibers because they are much easier to move in than natural textiles such as cotton or linen. The draping of polyester or viscose fabrics are often used to emphasize that body shape (especially for female dancers) and the colors vary greatly, however red is the color that is most often associated with Flamenco dancewear/costume.

While red is often associated with Flamenco costume, polka dots have also become synonymous with the style. The use of polka dots (usually white with surrounding red color) is said to have come from the use of small, mirrored glass that was a customary detailed sewn onto clothing or housewares by Gypsies/Indians in Rajasthan dating back to the 11th century (Chandrashekhar, 2024). Although this may be folklore, it may have some legitimacy in explaining the reason for the use of polka dots in costume. These small mirrors or *lunares* in Spanish (as they resemble small moon) were worn by Rajasthani women as an auspicious tool to ward off evil spirits, and they have carried

through to the style of dress and accessories worn by Gypsies that migrated from there (Chopra, 2019). Typically, the style of wearing red and white polka-dotted costumes is very common in modern-day *tablao* (Flamenco dance venue) performance settings – mostly for the tourist crowds – but street performers will also dress in this manner, although not as elaborately. More often than not, a simple flowered skirt and blouse for females, and for males, a silk/poly shirt (with patterns or typically black) and trousers are worn.



Figure 4.3: A tourist venue Flamenco performance in Barcelona (Hurban, 2022)

Another tool that a Flamenco dancer (female) traditionally uses is the *mantón* or the shawl usually made of silk. The use of the scarf dates back probably to the mid 1500's through trade from China to the Philippines through to Spain, which is why it is sometimes referred to as *mantón de Manila* (Benjamin, 2022). This is not only an accessory but is also used to emphasize movement, whether arm movements as the scarf can wrap around the arms, or in an open position where the shawl twirls in the air held on either end by the dancer. This technique that is very often incorporated into a dance can achieve more dramatic effects than without a *mantón.* The *mantón* has its own choreography that becomes an integral part of the dance. Working with a *mantón* can be difficult as the size

is often quite large with long-hanging fringes and are often as large as the dress that a Flamenco (female) dancer wears. The *mantón* may come in a contrasting color to the dress and is often intricately embroidered.

Both a Whirling Dervish and a Flamenco use their costumes as an extension of their body. Like any costume used for performance, this is essential in creating drama, tension and entertainment while also capturing the audience in an experience that is memorable and perhaps awe-inspiring. A Flamenco dancer's *mantón* moves with the dancer's body and is a part of the costume until it becomes a separate entity and at times even a prop. A Dervish uses their *tennure* to create giant circular patterns that spin endlessly – a feature that may not be as intriguing if the Dervish was not wearing a *tennure*. These aspects of both performing practices are also used as inspiration in tracking movement and gestures using a digital musical body instrument by creating another layer onto the existing layers of costumes that the performers use to augment their dance. The next section will discuss how this and the visual connection between the two performance practices are highlighted in a showcase that morphs the two together.

4.4 Dervish and Flamenco; a fusion of music, movement and wearable technology

A deep, historical connection is uncovered between the Whirling Dervishes of Turkey and various forms of Spanish Flamenco in this research by which a connection is made using the Soundrop: a digital musical body instrument and a multimedia performance work that blends the musical traditions, costume and dance style/movements. The Soundrop and its development is discussed in greater detail in Chapter 5. The Soundrop is a small device slightly larger than a smartwatch which can be worn on the wrist or the ankle and emits sounds and subtle haptic vibrations based on the velocity of movement and the position of the wearer's arms or legs/feet. This work elevates the performance of the Dervishes and Flamenco dance without obstructing the original forms and fosters a fluid communication between two performers who use the devices as a way to create a new performing experience for both the wearers and the audience. This concept is further

developing how technology can be used to complement, enhance, and contribute to existing rich dance practices.

As music is an essential component to the sacred practice of the *sema* and a vital limb that belongs to Flamenco, this research has in part been comprised of observing, experimenting and developing a digital musical body instrument, but also by building a practice that involves the composition of a musical score that accompanies a performance piece totaling 50 minutes. The key elements that inform the performative framework in this work are comprised of the different areas of research in this thesis including the historical background, musical traditions/styles and movements of a Dervish and a Flamenco dancer. These aspects are combined in a choreographed work that is set to the backdrop of two separate films that coincide with the mood, tone and characteristics of a Dervish and a Flamenco dancer. The sounds that are used with the Soundrop also emulate distinctive sounds that are associated with the musical traditions of Dervish *sema* ceremonies and classic Flamenco guitar performance. The musical composition for this performance piece follows a narrative that draws upon the historical traditions of both Turkish Classical music and Flamenco guitar music. The piece is comprised of two parts: the first part is a solo act with the Dervish performing for 20 minutes. In the second part which is 30 minutes in length, the Dervish and Flamenco dancer meet towards the middle of the performance and merge their movements and sounds that they initiate with their devices.

Digital Dervish + Flamenco Sonic is a multimedia performance work that combines the rich historical traditions of dance, music and movement of the Whirling Dervishes of Turkey with Spanish Andalucían Flamenco dance with immersive film, sound, and wearable technology in the form of the Soundrop. The performances of *Digital Dervish + Flamenco Sonic* are discussed at length in Chapter 6 but are introduced here to provide evidence of the methodological framework for this research. In terms of how the two practices are amalgamated, a few examples are presented here including the use of movement, costume, music and sound.

From a distance a Dervish and a Flamenco dancer feel foreign to each other however, the various pieces that contribute to the composition integrates elements of both dance traditions which amplify their historical connections, but also reveal the contradictions between the two. Finding performance artists/dancers to work on the project was arduous but invaluable. Many contemporary performers have rediscovered and even revisited the *sema* and integrated it into their own practice, while still keeping the essence and meaningful custom of the *sema*. There are many groups of performers that practice individually or as troupes that have made names for themselves through the medium of social media. Sercan Çelik is a contemporary Dervish and practitioner of the *sema* using his own personal style. Sercan Çelik has been performing as a Dervish since the age of 12 both in the more traditional sense and now working as a performance artist in the contemporary dance world in Turkey. Çelik's style derives from the classic movement of the traditional *sema* but he uses his own interpretation which embodies a much more expressive movement style.

To bring the practice into the contemporary art world, a contemporary Dervish would have to be who willing to experiment with their practice. Sercan Çelik agreed to take part the prototype testing of *Dervish Sound Dress* in Istanbul in October of 2018. He used the dress in a staged 'test performance' at the Fatih Kültür Merkezi which is one of many cultural centers in Istanbul. Çelik's performance style involves 'turning' or whirling invoking the traditional practice in congruence with the physical demands of constant circular motion, but he also uses more of his upper torso and arms and head to express how he embodies his version of a *sema*. Unlike a more static shape that turns continuously as in a traditional Dervish *sema* while in ecstatic metaphysical contemplation, Çelik's whole body becomes enveloped in an almost transcendentally emotional state (Figure 4.4).

Çelik has also performed the more 'classical' Dervish ceremony; however his training in Turkish folk dances have led him to performances throughout Turkey, performing various dances from different regions. He commented in an interview about the possibilities of working with wearable technology in his line of performance which could help him achieve

a more controlled environment where the feeling of initiating sounds based on his gestures are sensational. He has since been committed to seeing this project come to fruition and his input has been invaluable in the process.



Figure 4.4: Sercan Çelik performing as *Digital Dervish* at ToDA, Dubai, December 2022 (image from Charminar Films, 2022).

Apart from working with Çelik to do testing, Mayez Rahman (author's son) became an integral part of this research. While at times logistically impossible to do experiments with Sercan, Mayez (who has performed previously in the *Dervish Sound Dress*) became a major component of testing with the Soundrop. His input helped shape the development of the artefact in terms of its size, placement on the body, and user experience. Figure 4.5 shows Mayez as *Digital Dervish* in the first performance at the Market Hall Dome theatre in Plymouth, UK where an original 360 film was produced using hand-drawn animation and live-action images. Mayez uses two devices; one on his wrist, the other on his foot which are choreographed as part of the composition. He initiates the wrist device at the beginning of the performance to introduce the device to the audience while 'playing' it alongside the musical composition as an extra voice or layer. He then later uses the Soundrop at peak climatic points in the performance where his foot movement during turning become more prominent and the continuous circular motions become more

repetitive and endless. Mayez performed four shows; two in Plymouth, UK and two in Peterborough, Canada at two very different venues which are further analyzed in Chapter 6.



Figure 4.5: Mayez Rahman performing as *Digital Dervish*, Plymouth, UK May 6th, 2022 (image from Charminar Films, 2022)

The key features that are highlighted with a wearable musical body instrument of a Whirling Dervish are the arm/hand movements and placement, and the foot work as they step one after another on the beat of the music to further mobilize and drive themselves into perpetual spheres. The sounds that are emitted while the devices are active are electronic versions of classical Turkish instruments and tones that are used in traditional the *sema*.

Similar features are also highlighted with *Flamenco Sonic*, a part that is played by three different Flamenco dancers: Mercedes Romero from Plymouth, UK (originally from Madrid, Spain), Carolina Loyola-Garcia (Figure 4.6) from Pittsburgh, USA (originally from Santiago, Chile) and Pepa Sanz from Madrid, Spain. When Mercedes was approached in August 2021 about the project, she agreed to have a rehearsal with the musical composition to which she could also bring her classical Flamenco elements.



Figure 4.6: Carolina Loyola-Garcia performing as *Flamenco Sonic* Peterborough, Canada, September 9th, 2022 (image from Charminar Films, 2022)

Initially, she was insecure about using an electronic device to dance with, but she quickly began to incorporate it into her choreography. Carolina has extensive experience working in multimedia projects and is also an accomplished documentary filmmaker and Flamenco dancer from Chile. The Soundrop was first trialed with her in March 2022 and her feedback during experimentation was critical in terms of her approach to using the device with her dance. She was concerned about the live element of Flamenco which is how classic Flamenco is performed (with a live singer and guitarist), and that using the Soundrop may interfere with the live quality of the performance. After several trials, she was able to incorporate the use of the device into her movements although they were more abstract and experimental. Pepa Sanz has had deeper involvement in contemporary Flamenco movement and although also classically trained, her use of the Soundrop was much more intuitive and instantaneous. These featured movements and gestures are further examined by demonstrating the data flow in detail in Chapter 6.

The song styles of Flamenco and Arabic *maqam* musical modes inspired part of the composition for the performance piece that morphs a Dervish performer's movement and

sound with a Flamenco dancer in *Digital Dervish + Flamenco Sonic*. The keys in which the score is composed follow the classic Flamenco chord progression: A minor, G major, F major to E major. The composition is a collection of organic sound samples from nature i.e.: birds in the forest, ocean waves, traffic sounds, people's voices, which are all blurred or electronically manipulated with effects and distortions. The keys in which the composition sits shifts from A major to C minor in the start of Part II with ambient sounds of birds and shifts again to Flamenco chord progression for the rest of the piece. Within the composition is a song in Spanish that is inspired by a *soleá* - a melancholic poem with four verses in the style of the *cante jondo*. The lyrics are as follows in both English and Spanish:

I am crying for you.	*Estoy llorando por ti.*
Please awaken now	*por favor despierta ahora*
Dream about your life	*Sueña con tu vida*
Time is passing, your love is the earth	*El tiempo pasa, tu amor es la tierra*

For the first part of the performance the ambience is darker starting with a D minor to F major chord progression. Instruments used for this part are electronic versions of traditional Turkish instruments alongside ambient drones and increasing arpeggios that meld into an 'arabesque' style beat. This part is more ambiguous and solemn as the narrative follows the Dervish who is alone with his thoughts and pondering his connection with the earth and his place in it. As with many *sema* ceremonies, the poetry of Mevlana may be recited or other forms of recitation. There is obscured repetition akin to *dhikr* during a *sema*. Following this section, a passage from Book 1 (verse 2759) of the Masnavi by Jalâluddîn Rumi is recited repeatedly (in Turkish) until it fades out into an electronic atmosphere bringing a feeling of positivity (with a chord change into B major). The poem occurs at a heightened stage of whirling where the Dervish activates his devices and turns for a length of 15 minutes. The passage is as follows:

A person who is in love with his own image and his own delusion, will he be one of those who are blessed by Allah? If that delusional lover is faithful in love, his figurative love brings it to reality.	*Kendi tasvirine, kendi vehmine âsik olan, nereden nimetler sahibi Allah âsuklarindan olacak? O vehmin asigi, askinda sadik olursa, onun mecazi ask onu gerçege çeker.*

This passage was chosen in particular as it reflected the tone and narrative of the piece which is important to the flow between the two parts. The use of a digital musical body instrument has been presented in a performance work that elevates the dance of a whirling Dervish and a Flamenco dancer. The Soundrop is a device that is used as a tool for experimentation and playful, exploratory interactive sound creation.

Chapter Summary

This chapter provides a discussion into the parallels and contrasts between the rich and historical traditions of Turkish Dervish whirling and Spanish Flamenco. The musical style, dance and geographical histories place the two practices in close proximity and are juxtaposed in a performance piece that brings the sacred and the expressive into the artistic realm while acknowledging and dignifying the essence of the traditions by augmenting them with a digital musical body instrument. The following chapter discusses the development design process of the Soundrop and its intended use in performance practices. The links between the Dervish and Flamenco performers are also highlighted by using the devices during a performance to emphasize how these movements relate to each tradition, as well as how these movements are augmented with a digital gestural musical device - the Soundrop.

Chapter 5
The Soundrop: A Digital Musical Body Instrument

This chapter documents the development of a new wearable digital musical body instrument, the Soundrop. From conception to ideation and design process, testing and finally the use of the Soundrop in performance, an analysis based on primarily the methodology and the application of the device is discussed. Following this chapter, an analysis of how the Soundrop is used in performance is presented.

5. Digital Sound Devices

The focus of this work has been to develop a wearable device which incorporates several sensors into a unique, exploratory and playful digital instrument that can be used to enhance the performance of dancers or performers. This device can be interpreted in different ways: an extension of the body, a detachable musical instrument that makes sounds, or a mechanism for tracking and analyzing movements of performers. Farion (2022) refers to this system as a 'hyper-body system' which initiates more than one of the five basic human senses, in this case, touch, sight and hearing and mentions the Soundrop as a system which is a multi-sensory device. For the purpose of this research, the relationship between a Dervish and Flamenco dancer is studied using the Soundrop in a performance entitled: *Digital Dervish + Flamenco Sonic*. The engagement between humans and technology throughout this research has been thought-provoking and one of the questions that arose several times during this process was why does a dancer need to enhance their dance style or performance with a digital musical device? What does this add to their performance? The answers to these questions have become clear and more refined over time through experimentation and the practice of observing the interaction of performers with a wearable technology Soundrop on stage. In the performing arts, wearable technology can be used to track the movement and physical activity of performers, providing insights into their overall fitness, and helping to prevent injuries. For example, dancers can use wearable sensors to monitor their movements and identify

areas where they may be overexerting themselves or using improper form. Wearable devices can also be used to enhance the overall experience for both performers and audiences in more nuanced and creative ways which use the expression of the performer in a way that highlights their movement. Performers can use wearable devices to create interactive performances where the audience's movements triggers sound or light effects. Wearable devices can also be used to enhance the visual effects of a performance, such as using LED lights embedded in costumes to create stunning light displays. Wearable devices are becoming increasingly important tools for performers, providing real-time data and insights into their physical and emotional states, as well as creating new possibilities for interactive and immersive performances.

Tanaka and Donnarumma (2018) write in their book, *The Body as Musical Instrument,* that whole-body interaction with musical instruments are a part of a humans' visceral dimension and that the connection between sound and body is inherently intuitive. There is a relationship that develops between the musician and the instrument in that the two become dependent upon each other; one for initiating sound or noise, and the other for delivering it. This corporeal communication between human and object which results in a cause and effect of producing sound and therefore releasing it, is intrinsically linked to the way humans desire to express their actions. The obvious form is to execute an action and the result should be something that evidences that action. For example, a pianist playing a piano expects to be satisfied with melodies and chord changes as a result of their rigorous plunking of keys, while a guitarist relies on reverberation to 'feel' the instrument that they have just plucked. Echard (2006) says that instruments are a means to actualize music as sound and that there are other components to this:

Music is Sound
Sound becomes music
The subject becomes a musician
Movement becomes music
Music becomes movement…

The Soundrop is an extension of the body and can be used to make musical sounds whether by a professional musician, dancer, performing artist or otherwise. The key functions of the Soundrop are to:

1. Be practical, comfortable, and intuitive to use
2. Provide vibro-tactile sensations and visual indicators (via LEDs that light up when device is triggered)
3. Perform as an extension of the body
4. Produce sounds when the Soundrop is moved using gestures

The following analyzes the various stages of development and conclude with how the Soundrop is used and tested by the participants involved in the research – in this case, the Dervish and Flamenco performers. This device - the Soundrop is developed by incorporating a variety of sensor systems and programming to achieve a tangible artefact that can be used to create sounds with; essentially, it is a new digital musical body instrument. This leads into the next chapter which examines the entirety of the performances using the Soundrop.

5.1 Design And Development

Initial development for the Soundrop (with previous versions referred to as the ‘Sound Tulip’ and the ‘Sound Drop’) began in April of 2021 at the University of Plymouth with the aid of departmental technicians. In the early stages of this research, it was thought that integrating sensors onto costumes would be the path that would lead to creating ‘Sonic Dresses’. These dresses or costumes would be outfitted with sensors that would have various functions. The first iterations of the design revolved around testing various sensors and combinations of sensors to be embedded into fabric which could then be manipulated by the user. In the beginning stages of development many other techniques were experimented with, such as screen-printing conductive material onto different fabrics or sewing conductive threads and attaching sensors to them, similar to how the *Dervish Sound Dress* was created. This part of the methodology was about deciphering which

approach would work best in developing a digital musical body instrument that could be worn on the body. It was later determined that embedding sensor systems into fabric would not be beneficial to advancing the research, as it was already trialed and found to be a less-sophisticated approach to designing a digital wearable musical body instrument. Figure 5.1 describes the design process and the various elements that have dictated the methodology for developing the Soundrop.

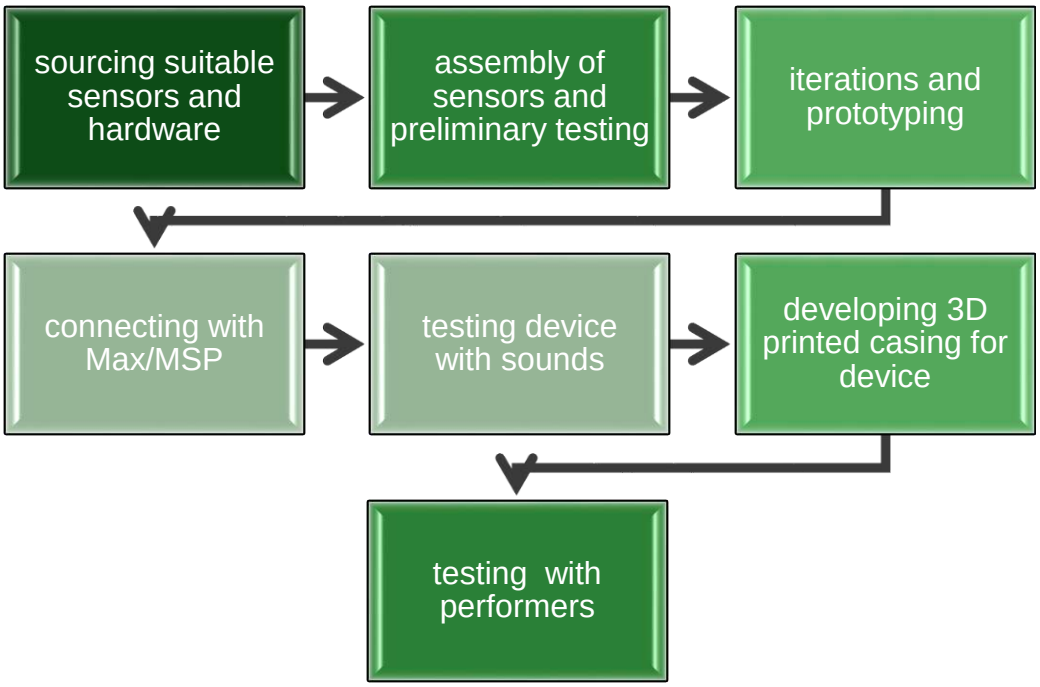


Figure 5.1: Soundrop Design Process (Hurban, 2023)

After many trials, the decision to make a stand-alone device became the best option. Connecting circuitry to fabric is a field of research unto itself - electronic textiles or e-textiles (as previously discussed in Chapter 2) would have changed the scope of this research a great deal. Lee et al (2010) write that smart clothing or e-garments require a great deal of design implementation with engineers as well as clothing/fashion designers and that some of the considerations for embedding electronics into clothing require electrical safety and physical comfort among others. For this reason, revisiting the idea of working with sewing conductive materials and sensors into clothing was abandoned. These preliminary tests using carbon nanotube polymers (which was a substance that

was incredibly impractical and difficult to work with) steered the direction of the methodology for testing and experimentation. It was later concluded that although the possibilities for developing refined e-textiles using conductive polymers was intriguing, the project evolved into the area of building a device that could be attached to the body or to clothing. The use of conductive materials is a field of research that is heavily embedded in civil engineering. Some success in powering garments with similar materials such as carbon nanotubes and graphene are seen with CuteCircuit's *Graphene Dress* as previously mentioned in Chapter 2.

5.2 Hardware Assembly and Prototyping

Part of the experimentation with different coding platforms, sensors and microcontrollers proved to be useful in determining which system would be appropriate for building a digital musical device. Some of these tests were made with Raspberry Pi to test sensors and to get these sensors working with Sonic Pi; a live coding environment meant for code-based music creation. The early tests determined which sensors or systems would work best to a) create real-time sounds b) determine which sensors were most practical to use and c) which programming environment and language would be suitable for further prototyping.

Several iterations of the prototype were made with various components to test the best use of available sensors for the desired capturing of gestures, obtaining real-time data and attributing sounds to. For the first iteration or 'Version 1.0', an Adafruit Circuit Playground[45] which is a small wearable device that can be programmed using the Arduino platform and easily sewn into fabric was tested. It is a handy system that has many capabilities and built-in sensors such as neo-pixels, accelerometer/gyroscope, mini speakers, touch and temperature sensors. The initial prototype was abandoned due to the fact that the Circuit Playground could not connect to the Bluetooth module without using a Microsoft app or an app that the designer would develop themselves. This limited the use of the Circuit Playground to being connected only via this app, thus rendering it unusable. Although it worked well by programming the module to initiate sounds via

[45] https://learn.adafruit.com/introducing-circuit-playground/overview

Max/MSP, there were limitations on the device itself with respect to its wireless capabilities.

The sensor parts and microcontroller unit needed some sort of enclosure and the concept for developing a casing for these parts would lead to designing a bespoke carrier for the parts. The casing would protect the electronic components while also safely placed close to the skin. The question was with what type of material, how to attach it and also how could it be made so that it looked like a part of the clothing not like wearing a small computer on the body? And it had to be aesthetically pleasing. The other issue was wearability- could it be easily taken on and off the body? Or detached somehow? Moreover, later questions developed as to where these sensor parts should be worn to capture movements of the wearer; movements that had meaning in terms of the dance practice. Both a Flamenco dancer and a Dervish use their arms and feet continuously during their dance so it was thought that a device that could be attached to the wrists or ankles would be the best approach. A prototype was designed in June of 2021 where the casing had watch-like characteristics with a top and bottom face as well as straps that stuck together with Velcro and could be attached at the wrist or ankle. The wrist/leg band device would be encased in a 3D printed casing with loopholes for Velcro straps to fit through for easy size fitting and comfort in wear. This initial prototype design never came into development but was later revisited as a possibility for creating a robust casing with straps.

A collection of sensors and parts for the ‘Sound device’ were assembled and tested extensively. It was decided that the unit needed to have separate components that worked together exclusively, without relying on any wiring that may have to be attached on the body. The goal was to experiment with different components to determine which ones worked best for the purpose of prototyping. These prototyped parts would lead to the final assembly in the current version of the Soundrop. The next phase of prototyping involved using an Arduino nano (with built-in accelerometer), a Bluetooth unit, touch sensor, small circular LED ring, one small haptic motor, a gyroscope, a power boost for Lithium-Ion battery and a Lithium battery. The exact specifications and components list

are as follows: Arduino Nano (with Accelerometer included), Nano pixel 12 ring LED, Power boost 500, Gyroscope, HC-06 Bluetooth, Power switch, Lithium Ion Battery 3.7volts and Adafruit Touch capacitive sensor. The Bluetooth module provides good range and can be used at a distance of up to 12 meters. The Arduino Nano is small and powerful, the touch capacitive sensor is quite sensitive and responsive while the lithium battery and the power boost charger are convenient and easy to use. The initial findings with experiments using these modules/units/pouches is that although each separate unit was wireless using Bluetooth to communicate with a source (via laptop) the wiring was unreliable and fragile.

The assembled components are pictured in Figure 5.2. This crude construction gave a basis for testing several features: the touch sensor which was placed in the center of the LED ring and would be the device's primary access point for turning it on and off. Having the LEDs exposed have a few functional purposes: a) to be used to indicate when the device has been turned on (LED ring flashes green) b) to indicate when it is turned off and not transmitting data (LED ring flashes blue) c) to indicate if the device has connected to Bluetooth or WI-FI (LED ring flashes white) d) to indicate if the device cannot connect to Bluetooth or WI-FI (LED flashes red) e) to differentiate between devices (Blue LEDs light up when used by Dervish, Red LEDs light up when used by Flamenco) and f) to indicate to both the performer and to the audience that the action has been completed thereby emphasizing that the movement triggers lights as well as sound.

The concept for re-designing the sound garments and to create a stand-alone compact device that could be inserted into a pocket or pouch on a costume or attached to the body using Velcro fasteners, came out of a need to make a device that could be easily removable and interchangeable and have an interface that was simple to use and be intuitive for the user. The initial approach was to encase the various sensors and the Arduino Nano into a unit that encompassed all of the parts. Various trials were tested to determine how the units could be packaged together to become streamlined devices that could either be attached to the body via Velcro strap attachments or directly sewn into the fabric of the costume. In preliminary testing with performers the concept was to sew a

pouch made of fabric that contained the unit of sensors to different parts of the costume worn by the Dervish performer and Flamenco dancer.

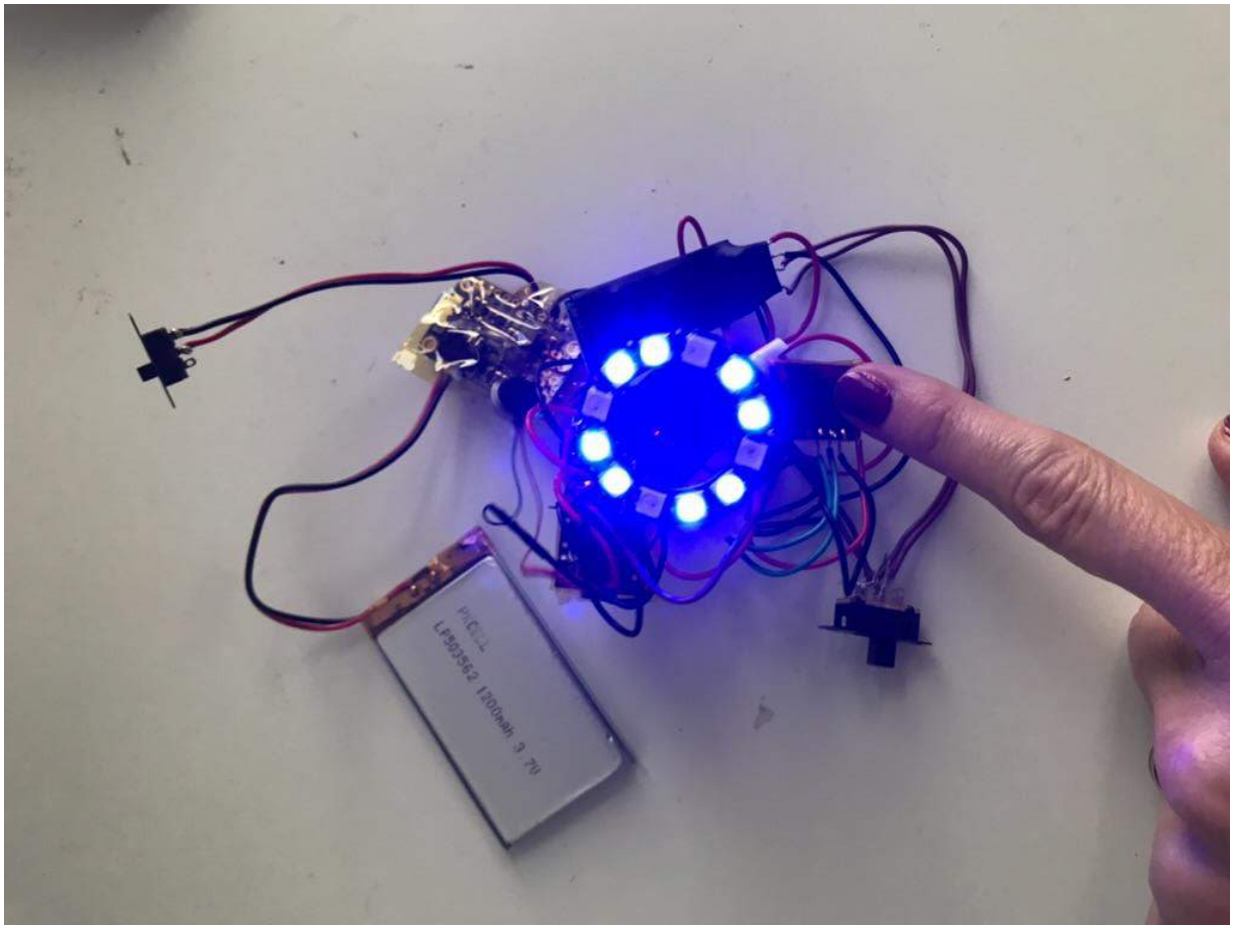


Figure 5.2: Assembly of components of ‘Sound Device’ with LED ring switched on (Hurban, 2021)

In the first prototype, the wires were too long and needed to be cut down to fit well into the pouch that was designed to hold all of the components together. The pouch (Figure 5.3) was clunky and awkward and did not adhere to the aesthetic concept of the overall look of the costumes. All of the components fit into the pouch; however it was not practical for use on a garment or attached elsewhere on the body.

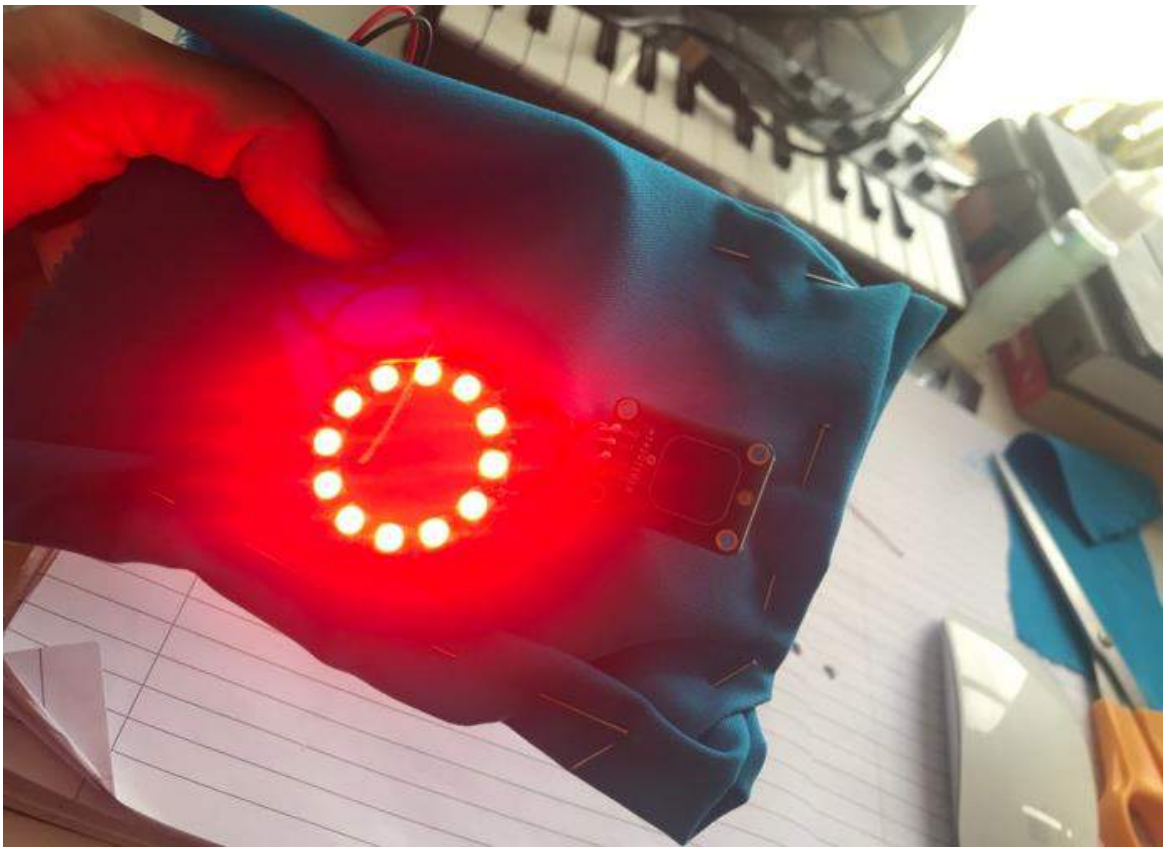


Figure 5.3: Prototype Design Version 1.0 (Hurban, 2021)

Following the first attempts at assembling a fabric-based enclosure to contain the various components and wires, a set of tulip-shaped cut-outs of fabric were made and sewn together with Velcro closures. This was also problematic due to the fact that the wires were lumpy inside the fabric enclosure and were not intact enough to support the components. The enclosure was also not easily accessible as it had to be opened from the top portion to gain access to the power boost and the Arduino Nano. As seen in Figure 5.4, the tulip shape of the design is a reference to Turkish culture and Ottoman historical decorative arts and crafts. The tulip has long had significance in Turkish culture since well before the 14th century, when various Sultans had them cultivated in Turkish lands and gardens.



Figure 5.4: Soft sewn tulip shape enclosure/casing for *Sound Device* (Hurban, 2021)

Tulip motifs adorned clothing, fabrics, carpets, mosques, and tombstones as well as weapons (Tüfkeçi, 2021). Tüfkeçi (2021) writes that tulips even influenced poetry and Turkish classical music during the early 18th century when new *makam* names were written for the tulip. The tulip had been used during this time as a metaphor for peace as it is often known as the 'Tulip period' when the Ottoman Empire began to look to Europe as commercial allies (Salzmann, 2000). The shape of a tulip not yet in full bloom also resembles other flowers such as a rose bud. The design is slightly ambiguous and abstract in that it can be interpreted as a flower bud, a leaf or perhaps even a drop of water (this is how the name 'Soundrop' came to be finalized). However, this shape makes an essential reference to developing the links between the cultural aspects of the costume and the device that is inhabiting it. In a broader sense, it is a design detail that reflects the overall aesthetic of the Dervish's costume so that the links between technology and culture can be more apparent. Flowers are also prominent in Flamenco dance and are often used in performance. The folds of a red carnation are reminiscent of the ruffles on a traditional *bata de cola* and are also used to adorn the *peineta* which is a hair ornament under a *mantilla* - the lace veil that is sometimes worn which covers the head. The rose or rose bud is often used and placed in the hair, behind the ear or in the *peineta*. The

concept around constructing a casing for a device which reflected both of these traditions was to honor them but also to integrate the wearable technology elements into the overall costume in a subtle unassuming way. However, these findings revealed that the components would be better placed in a hard enclosure/case which would be robust, practical, and accessible. One of the key features and objectives in the design of the Soundrop was to add tactile sensations. For this reason the idea of being able to wear it close to the skin where it could be felt when sound was initiated was a main priority. The concept of a device that reverberates on the body and transmits information through tactile sensations, like those of an Apple Watch[46], meant that the device would enable the performer or wearer to understand that their action or gesture had a consequence – in this case, sound.

Haptics have long had important usage in wearables since their first appearance. Tactile sensations can act as a marker for understanding that a cue has been issued. For the most part these actions that involve tactile sensations through daily interactions are innately intuitive. Therefore, replicating this using technology should be subtle yet effective in transmitting a sensation that is understood by the wearer that the action they have done has been completed. This is not the only factor in why the Soundrop has a haptic motor, it is because when the wearer initiates sound, it is the closet sensation that mimics using an acoustic, naturally reverberating instrument.

5.3 Proof of Concept

While the idea of having sensors embedded into clothing or with fabric was still on the table, it became more apparent that using small-scale electronics that were placed within a hard casing and designed to be attached to the body was more pragmatic and logical. Sensors and electronic components are very sensitive and fragile to exposed environments leading to short-circuiting. The components would have to be protected by electrical tape or in a shrink-wrapped coating so that the wires would not be exposed and also the various sensors would not touch each other accidentally resulting in the short-

[46] https://www.apple.com/apple-watch-series-8/

circuiting of sensors which was a factor in early prototyping and assembly. Eliminating all potential hazards including electric shock or burns on the skin through fabric would be the safest and most efficient course of development. The first designs reflected the tulip concept as the shape itself was ergonomic, soft and convenient or comfortable to hold in the palms of the hand, therefore several iterations with various polymers were tested. Figure 5.5 shows technical drawings for the first iterations of 3D printed casings. The goal was to leave a circular center through which the LED ring would fit while also giving access to the touch button sensor that was placed underneath the ring. This design allowed the Soundrop to be easily switched on and off when the Soundrop was being used and was the operating interface for the entire unit. Version 1.0 had two switches - one to turn the unit on and off and the other to turn the Bluetooth module on and off for programming. Therefore two holes had to be cut on the side of the casing to make room for the switches. The final assembly for Version 1.0 with the 3D printed casing in a polylactic acid (PLA) are stacked and fitted to place the LED and touch sensor at the top inside the circle cut-out while the rest of the sensors and switched are taped into place.

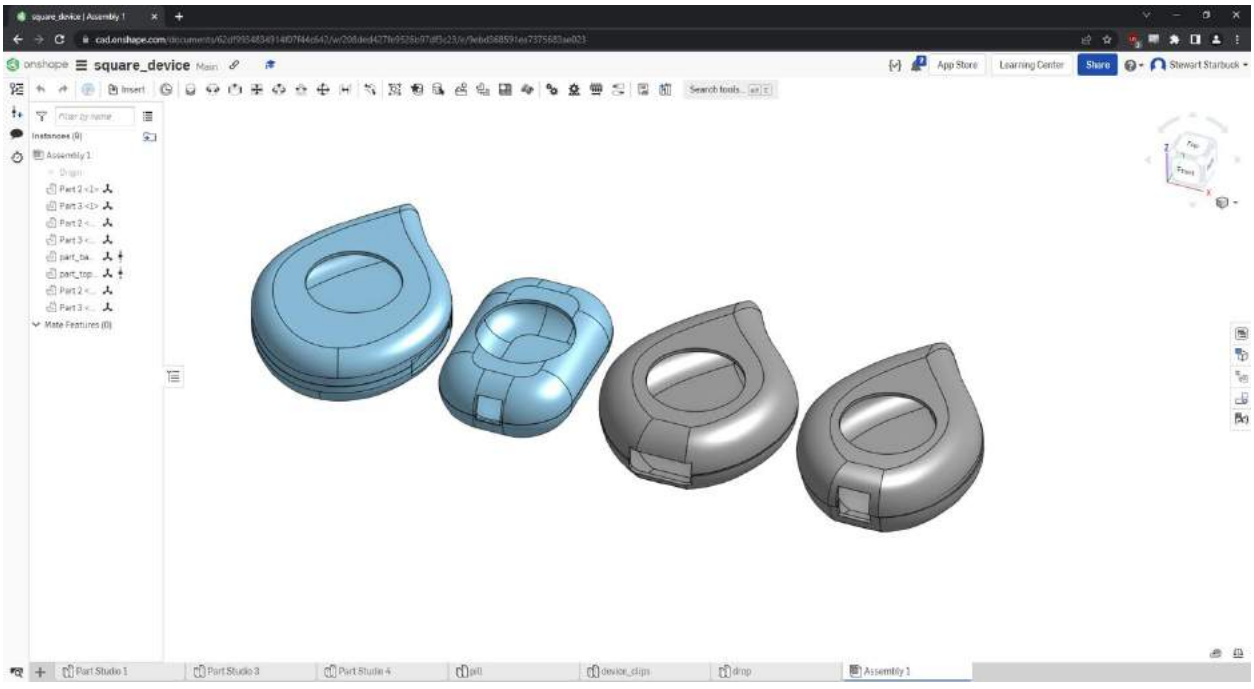


Figure 5.5: 3D printed casings with various sizes and openings (Hurban, 2021)

The PLA material was excellent for prototyping with but as a final usable device it would have been too brittle as it was fragile, thin, and cracked easily. The overall shape was slightly sharp-edged therefore further shaping was needed to make the casing more curved with softer edges. The various components fit snuggly into the case, with two rectangular openings for an on/off switch and access to the Arduino Nano and the power boost battery charger. This iteration was used to do initial movement testing and interaction testing with the LEDs that would light up when movement was initiated. The haptic motor was placed on the bottom right-hand side of the casing. Reverberations were felt subtly on the hand while using the device and little adjustments were made to the code in terms of the intensity of pulse sensations. The issues with this casing iteration were that, although it was an interesting shape and it concealed the sensors inside, the placement of the LED ring and touch sensor beneath it (Figure 5.6) was not proper and would often shift out of place when using the device.



Figure 5.6: Version 1.0 with components inside 3D printed casing (Hurban, 2021)

It was also too large to place onto the body as a brooch or on the wrist or ankle as a digital ornament. Further iterations of the 3D printed casing were made in different colors while also testing the quality of a different polymers and were printed in an ABS-like 3D Resin (Acrylonitrile butadiene styrene). The concern with this resin was that it may be even more fragile than the PLA version. After some testing in the field, the finished resin (when polished and cured) felt more robust and less brittle than using PLA but tended to crack and break in places. The final version was made using ABS-like photopolymer resin due to its robust quality, slight pliability, soft texture, aesthetic and durability. A clear resin (Figure 5.7) was used and when polished and cured resulted in a glass-like look which exposed the sensors and components. The transparent quality of this version used with or on the body was an intriguing interplay of using technology on the body and it contributed to the development of the final version. In the early stages of this research, the intention was to embed sensors or devices into/onto garments or costumes. Ideally, these sensor systems would need to be protected against the skin but also if costumes would need washing, the practicality of having embedded sensors would be less appealing.



Figure 5.7: Clear/transparent resin for 3D printed casing (Hurban, 2021)

Constructing stand-alone devices that were more functional which could be worn in various ways on the body after developing Version 1.0, became the main objective in creating a digital musical body instrument. Prototype Version 2.0 is a more compact unit using similar components to Version 1.0. This unit was developed starting in January of 2022. The unit is comprised of an Adafruit Huzzah with built-in WI-FI connectivity, an accelerometer/gyroscope, a touch sensor, 3.7-volt Lithium-ion battery, a haptic motor and twelve neo-pixel LED ring sensor; these are seen in Figure 5.8 This version is far more compact and lightweight and eliminates the need for a Bluetooth module which had limitations in terms of its connectivity with Max/MSP which is used as the software that gathers the data from the unit. The software and programming are discussed in detail in the next section.

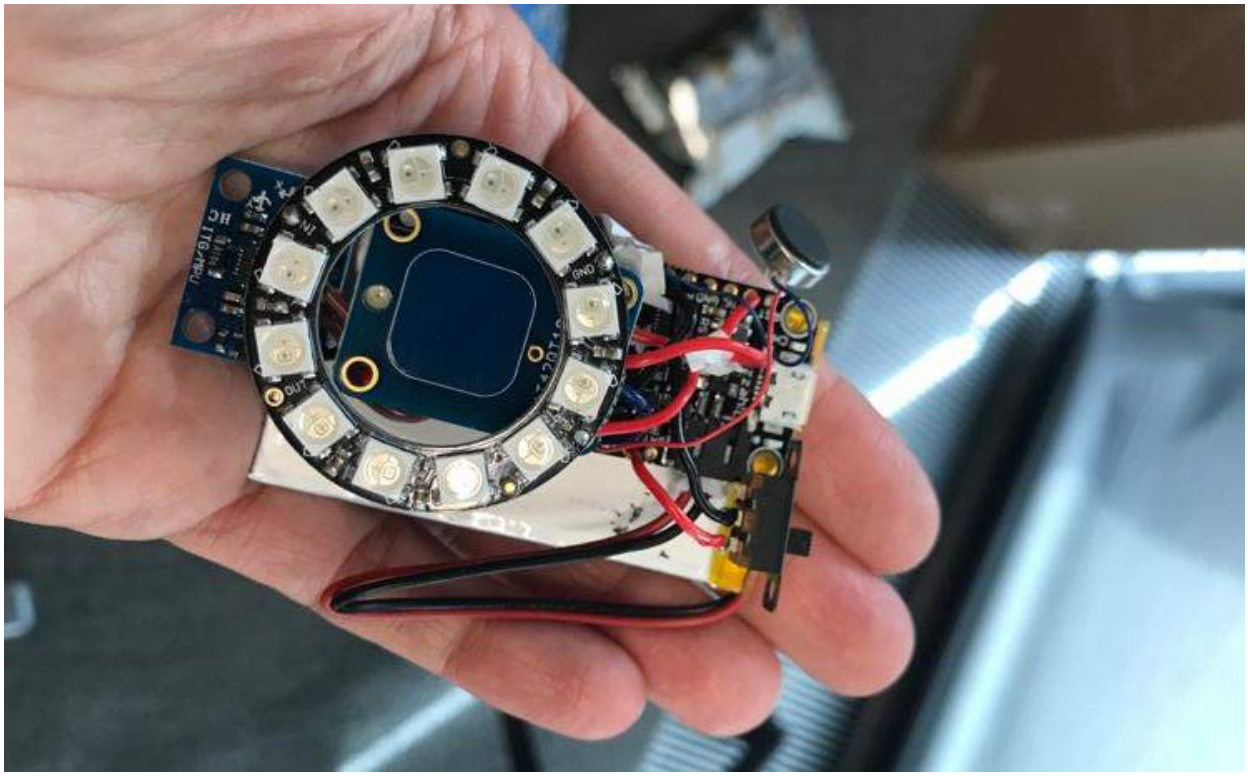


Figure 5.8: Soundrop version 2.0 (Hurban, 2022)

This version was used in testing with the performers and was the foundation for the final version in terms of components and sensors. Using a WI-FI module (TP Link) that was connected directly to the device/unit proved to be more accurate and resulted in less droppage of connection than using Bluetooth. The overall size and weight were a factor

in re-designing the casing to make it even more compact and wearable on the body. In Figure 5.9, the completed version using the clear/transparent resin as a casing is attached to a band that fits onto the wrist and the ankle using Velcro as a fastener. The components fit better into the casing and are not shuffled around due to negative space.



Figure 5.9: Soundrop Version 2.0 (Hurban, 2022)

The choreography and testing were all done using this version with the performers to determine accuracy, responsiveness, real-time movement to sound generation and wearability. The word ‘Soundrop’ (excluding the ‘d’ in ‘sound’ is part of the branding for the Soundrop) was thus finalized at the completion of this version as the casing had developed to form a pill/drop-like shape but was also much smaller than the first prototype. The Soundrop has since been developed further to seamlessly integrate sensors on a single small, circular board that was half the size of Version 2.0.

5.3.1 Software and programming

Once the hardware for the Soundrop had been established, defining how the Soundrop would work based on how a wearer would use it was the next phase in the development. The Soundrop is connected via Bluetooth to a laptop through OSC (Open Sound Control) and finally to Max/MSP where within a patch, sound samples could be mapped to the Soundrop. The project code is written in an Arduino IDE (Integrated Development Environment) and integrates a gyroscope and accelerometer module (MPU6050), a motor, and an RGB LED ring controlled by a Wi-Fi network via OSC (Open Sound Control) messages. The code also includes touchpad inputs for toggling the Soundrop on and off, as well as reconnecting to Wi-Fi in case of disconnection. Since the Soundrop has no visual interface, changing Wi-Fi servers by referring back to the code depending on location and availability was unreliable. Therefore, a stand-alone Wi-Fi networking device (TP-Link) was installed so that the Soundrop can always connect to the TP Link's address.

There are several variables that can be changed to customize the Soundrop, such as the device name, the feedback color, and the sensitivity of the gyroscope. Essentially, the code is designed to control the Soundrop's speed based on the movement detected by a MPU6050 which is an accelerometer/gyroscope sensor. The code sends the data to a computer running Max/MSP via OSC protocol. The data is then used to output sound. The code also includes a touchpad that allows the user to start and stop the motor and reconnect to the Wi-Fi network if disconnected. Another feature is that the code can be changed to include whether it is connected to Max/MSP or to a sketch done in Processing which visualizes the movement as repeating circles. Using Processing to experiment with visualizing the data is another way to use the Soundrop which enables the wearer to interact with visuals that respond to their movements. The maximum value from the gyroscope is a measurement from the device's rotation around the XYZ axis which are added together to produce a value which is proportional to the degrees of the axis being used by the system. The data essentially aids in visualizing the choreography of movement against the score (these are further described in Chapter 6). Future

experiments will consist of developing this concept further with the potential to implement virtual effects using the Soundrop.

An algorhythmic flowchart of the process of the Soundrop can be seen in Figure 5.10. Max/MSP is a software program by Cycling'74[47] and is used for visual programming of music and multimedia applications. The patch for this project contains various parameters to which the Soundrop is mapped. For instance, a buffer section is created to store sound samples (previously recorded) and can be interchanged while the Soundrop is in use or uploaded at any time. The samples will trigger when the "UDPreceive" function acquires data through OSC from the Soundrop. The sound is then triggered whereupon the volume is scaled depending on the velocity of the movement: the faster the movement, the louder the volume of the sound. No movement equals little to no sound and when the Soundrop is turned off, Max/MSP does not receive any messages therefore no data is coming in and sounds are not triggered. The volume can also be controlled manually in the patcher so that during performance, the volume of the sound from the Soundrops can offset the sound coming from the background musical composition or it can be increased to emphasize that a sound has been triggered from movement. At the moment, four Soundrops can operate simultaneously, and each Soundrop is mapped to a performer's wrist or ankle. The patcher is also equipped with a data recording system which records all incoming data from the Soundrops in real-time. This data is then saved as a text file which is later analyzed in terms of when the wearer uses the device in which moments during the performance in comparison to the musical composition. The signal processing is done in Max/MSP, and it contains buffers for where sounds can be uploaded which are then played on a looping mechanism once the movement has been triggered. The instance of looping is set to a parameter of one second so that the effect of real-time sound generation is dynamic rather than lagging in time. All links to the Arduino code and Max/MSP patcher are found in Appendix XI.

[47] https://cycling74.com

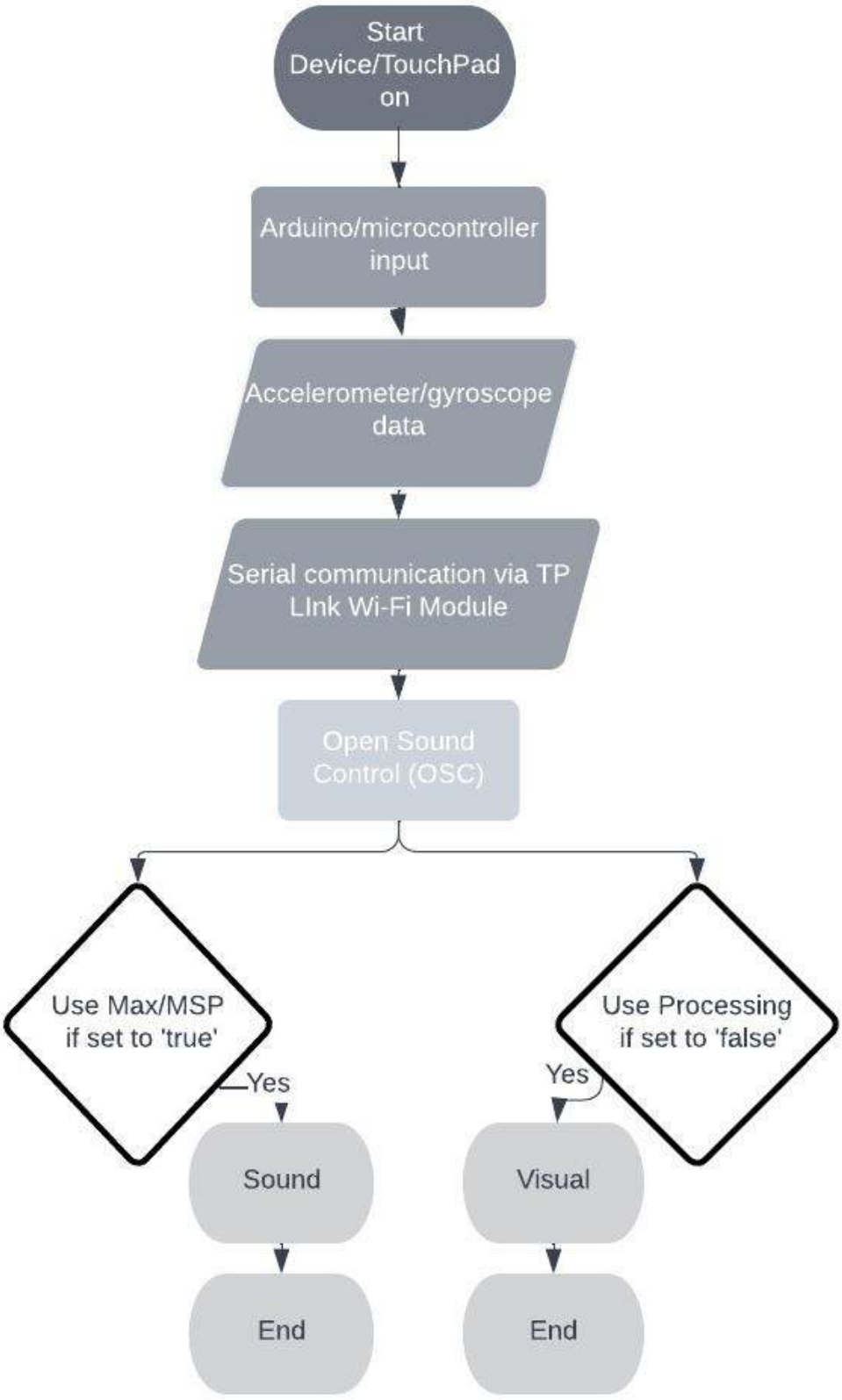


Figure 5.10: Algorithmic Flow Chart of Soundrop (Hurban, 2023)

5.3.2 Soundrop Webapp

A web application has also been created for the Soundrop as another alternative for using the Soundrop. The goal for this branch in the project is to eventually create an application that can be accessed via mobile devices with a simple, interactive interface that can be controlled via any Wi-Fi network. The webapp uses the same parameters as the Max/MSP patch in that the Soundrop works by using velocity to generate sound and increase volume (Figure 5.11). The webapp (which is currently available to a local network only) is an experimental prototype which has many possibilities. It can store hundreds of pre-programmed sound samples which can be interchanged in real-time as the wearer is using the Soundrop. The sensors track the velocity of movement to which sound samples and volume control are mapped; the faster the Soundrop is put in motion, a sound is emitted on a continuous loop and the louder the sound becomes. When the wearer stops moving the Soundrop, there is no sound – the wearer can also press the center of the Soundrop once to turn it off where the LED ring flashes blue or turn it on when it flashes green.

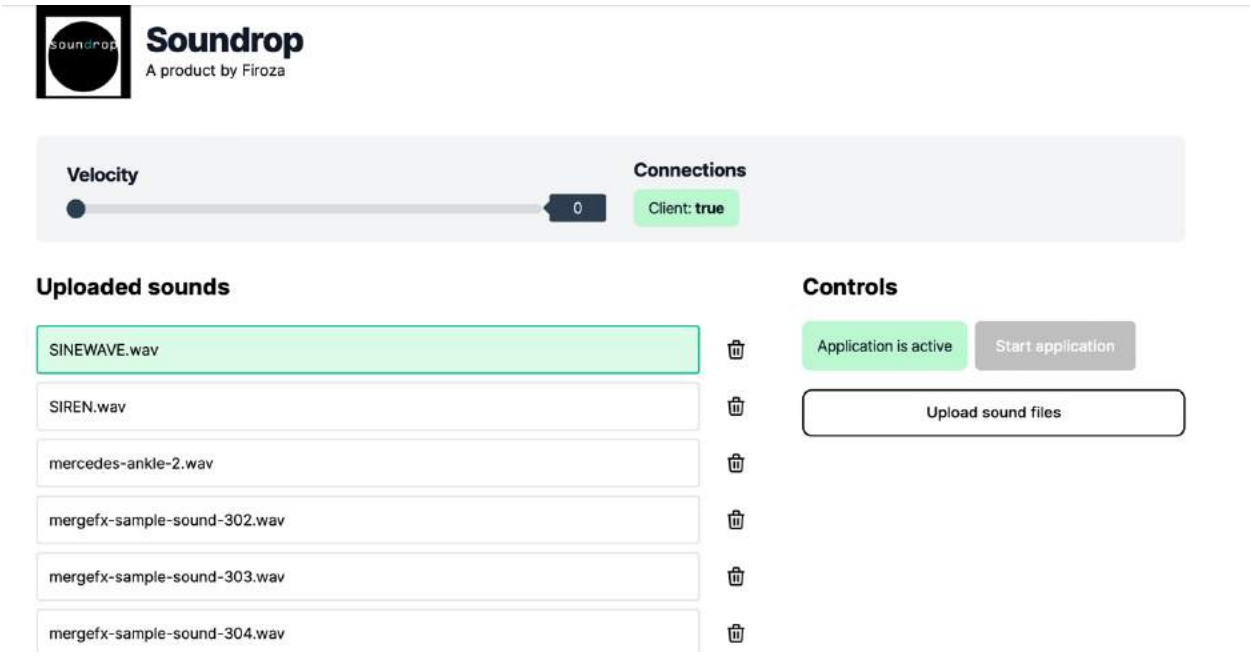


Figure 5.11: Soundrop web application interface (Hurban, 2022)

5.4 The Soundrop – A New Digital Musical Body Instrument

The Soundrop is a digital musical body instrument. It is a small device that fits in the palm of the hand and can be worn on the body with attached straps. This is the latest iteration (Version 3.0), developed from a series of prototypes that has been in use as the current final version. The Soundrop also gently vibrates so that these subtle tactile sensations can be felt by the wearer to alert them that their action has been completed. A comparison of the 3D printed casing for the original iteration of the 'Sound Device' or the 'Tulip' compared to the current Soundrop can be seen in Figure 5.12.

The Soundrop was developed to accompany performers whether dancers or musicians - and to function as an extension of the body while also using the data to represent movements as another dimension of the device. The practice of the Whirling Dervishes of Turkey and Spanish Flamenco dance are analyzed to discover how the Soundrop can be used as a tool to augment or add layers to the existing performance traditions much like other aspects of the practices such as the costumes are used as extensions of the body. The data reveals that by focusing on specific sections or moments in the performance of *Digital Dervish + Flamenco Sonic*, these moments become illuminated as the Soundrop gives some insight into how the performers felt about wearing the device. The Soundrop is a digital device that executes an output in a way an acoustic instrument does not - the data recorded in the Max patcher captures the invisible moments that are not apparent to the audience or the performer at the time but are valuable pieces of information. The fluctuations in the data output from all performers demonstrates how they interpret the use of the Soundrop while they perform to the choreographed piece, but they also reveal how at certain points in the performance, the morphing between a Dervish and Flamenco dancer becomes intrinsically linked. Therefore, these deeper connections between the two practices are not only paralleled through historical associations but also through digital data. Chapter 6 further details the analysis of how the data is used and examined.

The latest version was developed using the same components which were compressed into a single PCB (Printed Circuit Board) which is 43.28mm in diameter. The finalized circuit board encompasses the accelerometer, gyroscope, touch button, Wi-Fi module, micro switches and LEDs. The haptic motor is connected separate from the board as is the Lithium-Ion battery. A circuit board of this size is more practical for wearing on the body and allows for more spatial interactivity than the previous models which were far bigger and bulkier.

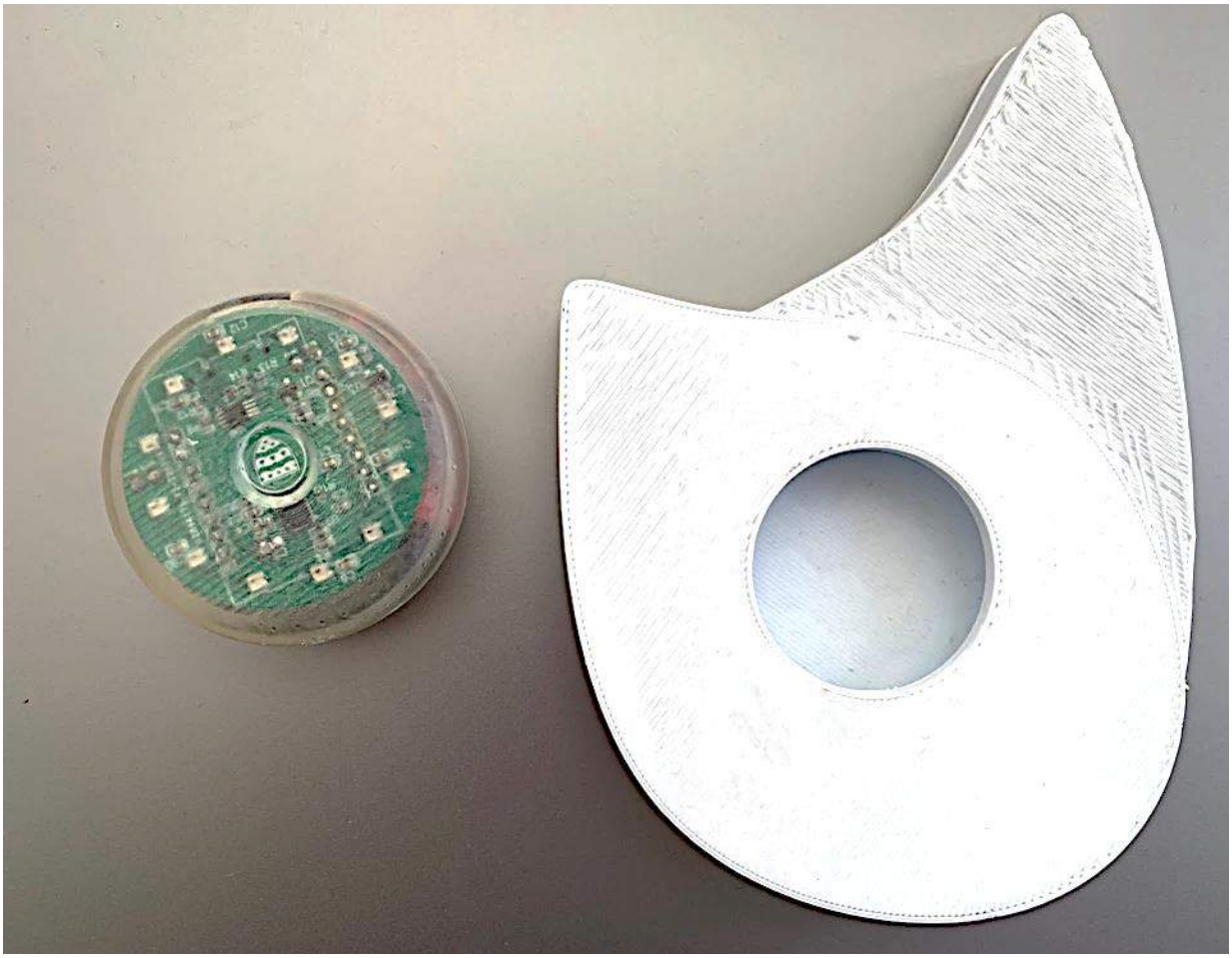


Figure 5.12: A comparison of the current Soundrop (Version 3.0) in casing and early 'tulip' version (Hurban, 2022)

This prototype is much smaller, more lightweight, and compact than the previous versions. The shape considers the placement of the LEDs which is the prominent design feature of the Soundrop wherein the components are built around the LED ring. Figure 5.13 shows the Soundrop in mid-movement with the LED ring lighting up in red. The

components and the PCB are visible through the casing, which is a part of the design aesthetic. The casing uses the same clear ABS-like resin and when cured and sanded, is transparent enough to reveal the board inside. The board is now fully encased rather than having components or sensors exposed, which resulted in short-circuiting of previous versions which experienced a malfunction due to wire placement and shifting of unsecure components. Figure 5.13 demonstrates the new casing features and indented middle section of Version 3.0 that, when pressed, turns the Soundrop on and off. This feature allows the board to be securely mounted within the casing without the danger of it coming in contact with the skin. The casing also snaps together and has an opening to allow the micro-USB jack access for charging as well as access to turning the units on and off.



Figure 5.13: Soundrop in new casing mid-movement (Hurban, 2022)

There are two switches at the top edge of the board: the first is to turn the unit off and on completely and the second is to be turned on when charging the Soundrop and for programming. The code can also be adjusted to account for battery usage when dormant and while in use. Figure 5.14 shows the Soundrop PCB mounted via Velcro taping onto belting that was measured to the width of an average wrist size and was also made to be adjustable in length. This was done to determine the position and overall bulk and weight once the PCB was encapsulated in the casing. The entire unit is roughly the size of a large wristwatch and weighs 5.5 ounces. This lightweight design is far more suitable for wearing interchangeably on the wrist and the ankle. A lip extension on the casing was designed to fasten a band or in this case belting so that Velcro would not be necessary as a fastener. However it added to the bulk of the design and was not developed further.

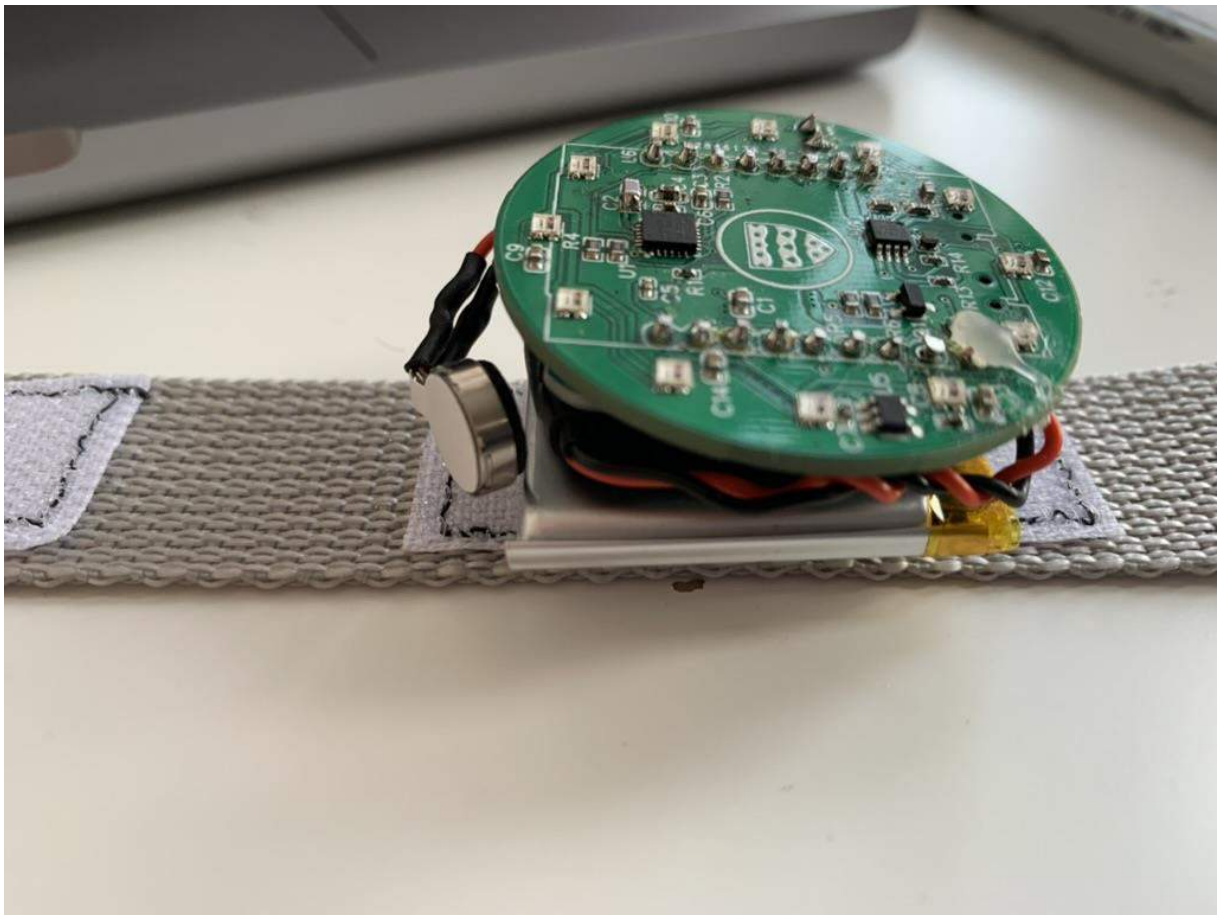


Figure 5.14: Soundrop without casing mounted on belting with Velcro (Hurban, 2022)

For the performances however, (which are detailed at length in Chapter 6) the Soundrops were sewn into strips of fabric to coordinate with the performers' costume and also to be more convenient for attaching to their wrists and ankles. Figure 5.15 shows the devices sewn into knit/stretch fabrics that are easily tied to the performer's wrists and ankles. The goal of the Soundrop is to emphasize not only particular movements but also improvisational movements that are highlighted through the performative aspects of a Dervish and Flamenco dancer.



Figure 5.15: Soundrop devices embedded into fabric bands (Hurban, 2022)

5.4.1 Proprioception and capturing bodily movement

Birringer (2003) writes about how proprioception of a dancer using computer-generated wearable devices or interfaces that are created for interactivity can result in physical sensing that is more pronounced and can position the body with deeper temporal awareness. This spatial awareness is evident when a Dervish turns and when a Flamenco dancer uses their body to shift into different positions. Proprioception is the sense of the body's position and movement in space, and it plays a crucial role in dance (Taylor, 2009). For dancers, proprioception helps maintain their balance, control their movements, and execute choreography with more precision and accuracy. Through proprioception, dancers are able to sense the position of their body parts and how they relate to each other, even without visual feedback. It is possible for a dancer to close their eyes and still understand where the position of their arms, legs and torso, are and can move them in a coordinated manner. Some of the findings of this research include feedback from performers using the Soundrop which enabled them to be more aware of their gestures and bodily movements as the device aides in reinforcing the outcome of movements through visuals and haptic sensations. In particular, specific choreographed gestures were recorded of each unit/device that was worn on the performers and the result was that each performer had a different interpretation of the choreographed gestures. However, the performers used their style of dance/movement to initiate gestures that were specific to each tradition and by using the Soundrop, became more aware of how the devices accentuated those movements.

The following two tables illustrate which movements are being tracked with the Soundrop and what sound samples are being mapped to these movements during the performance of *Digital Dervish + Flamenco Sonic*. Table 5.1 describes Dervish movements and Table 5.2 Flamenco movements. Each unit or apparatus is used in more or less the same way on each performer; tracking of the wrist/arm movements as well as foot/ankle movements are the key gestures that are of interest. The Soundrop can further emphasize the wearer’s proprioceptive awareness due to the sensory feedback it provides including vibrotactile sensations, auditory and visual effects.

Performer	Unit 2	Unit 3
Digital Dervish	• Tracks arm/wrist and /or foot movement • Touch sensors turns unit on and off • LED lights up when the action is completed • Haptics are triggered when movement is initiated • Emits variations of electronic sounds of Turkish *tambur* instrument	• Tracks arm/wrist and/or foot movement • Longer, ambient soundscapes (electronic manipulations of organic instruments or arpeggiated chords) • Touch sensors turns unit on and off • Haptics are triggered when movement is initiated • LED lights up when the action is completed

Table 5.1: Detailed description of each sensor unit on *Digital Dervish*

Performer	Unit 1	Unit 4
Flamenco Sonic	• Tracks arm/wrist and /or foot movement • Emits (electronic) castanet sounds • LED lights up when action is completed • Haptics are triggered when movement is initiated • Touch sensors turns unit on and off	• Tracks arm/wrist, and/or foot movement • LED lights up when action is completed • Emits (electronic) chords or Flamenco guitar sounds (variable) • Haptics are triggered when movement is initiated • Touch sensors turns unit on and off

Table 5.2: Detailed description of each sensor unit on *Flamenco Sonic*

5.4.2 Soundrop sounds

Although the Dervish and Flamenco dancers are aware of their movements in spatial dimensions, they are not accustomed to creating their own musical sounds. Classic Flamenco dance is accompanied by guitar playing, singing and hand clapping, while Dervish whirling is accompanied by the sounds of recitation and the instrumental music of the *ney, oud, tambur* or *kudum* (drum). The focus and purpose of their performance is to visualize the music using dance and movement and physical/emotional expression.

Adding another element to the dance by imparting a layer of control to their physical performance by extending their movement through music, is a choreographic challenge and unique experience. When trials first began, the performers were curious about the Soundrop and its capabilities, but also uncertain of how they could incorporate a digital device into their dance practice. The sounds created for the Soundrop are closely affiliated with the musical traditions of Dervish whirling performance and Flamenco music. For example, the Dervish performer wears Soundrops that are mapped to electronic ambient sounds resembling an *oud* while the Flamenco dancer wears Soundrops which are mapped to electronically manipulated sounds of castanets or guitar. These sounds accompany the musical score written for the performance and are interchangeable with a bank of several sounds to choose from. The sounds can also be changed while the performers are dancing in the Max/MSP patcher, where certain sounds accentuate climatic moments in the score.

After testing with the performers, some feedback from them included using short length sounds that when looped would feel more responsive. The Dervish performer (Sercan Çelik) was interested in using deep bass sounds on one Soundrop with higher pitched arpeggiated chords on the other. The castanet sounds for the Flamenco performers worked well in response to their movements - all sounds are one second or one and a half seconds, which coincides with the smoothing code for the Soundrop and gives the sensation that although the sounds are looped each time, they are responding to each movement in real-time. The links to all of the sound files used in performance can be found in Appendix X.

5.5 Testing and building choreography - the Soundrop in practice

Testing with the Soundrop began in February of 2022, three months before the premiere of *Digital Dervish + Flamenco Sonic*. Figure 5.16 shows a sketch of Mayez Rahman with the finalized placement of the Soundrop - one on the wrist and one on the ankle. The use of the Soundrop is detailed in Chapter 6 in terms of how and when the Soundrop should be used during the performance. These sketches and a storyboard outlining the

performance aide the performers in understanding their position on stage as well as when to interact with the Soundrops. Mayez initially tested the *Dervish Sound Dress* in 2018 extensively and his feedback on the design of the dress and its development was beneficial. The cumbersome use of wires that were embedded into the dress made it difficult to attach components and sensors and the entire system was not practical for wear during a lengthy performance. His input in the early stages of development of the Soundrop was also invaluable in that tests using different materials, shapes, sizes and wearability were all tested with Mayez.



Figure 5.16: Sketch of Mayez Rahman as Digital Dervish with Soundrop placement (Hurban, 2022)

Mercedes Romero who is one of the Flamenco dancers on the project can be seen in Figure 5.17 testing the Soundrop in the Immersive Media Lab at University of Plymouth.

After an initial tutorial, Mercedes was quick to incorporate the Soundrop with her movements. Her feedback after using the Soundrop was that it was interesting and exciting to use as she had never considered how a piece of wearable technology could be used in Flamenco dance. The wrist device is mapped to the electronic castanets sound and the ankle device is a guitar chord that is triggered when she moves with it. The wrist Soundrop seemed to be more responsive to her movements as she was able to adapt her choreography to the nature of the Soundrop. For example, when performing wrist or upper arm rotations, the Soundrop would loop continuously and then stop emitting sounds when she finished her movement. Incorporating the ankle Soundrop to coordinate with her syncopated foot movements was more challenging however, after some practice, the foot movements also made sense to the sound being emitted from the device.



Figure 5.17: Mercedes Romero testing the Soundrop (Hurban, 2022)

As part of the rehearsal for the performance, the Soundrop was also premiered in a ‘test performance’ at Plymouth’s Barbican Theatre on February 12, 2022. Mercedes wore the Soundrop devices (Figure 5.18), and she danced to a short seven-minute Flamenco guitar piece was danced to. This was an opportunity to trial the devices on stage with the

performer and to engage with audience members to determine if what they were experiencing made sense in terms of Mercedes' movements and the sound being generated from the tech on her body. The volume can be adjusted depending on the audio levels of the background music so that neither the Soundrop nor the music drown the other or that one system's volume is greater than the others. It was also a useful event to showcase the devices to audience members and let them trial and engage with the devices to determine how the Soundrop is perceived outside of the context of dance.



Figure 5.18: Fuse Jam at Barbican Theatre, Plymouth with Mercedes Romero (Hurban, 2022)

In several discussions during rehearsals and testing with the Soundrop Mercedes expressed that she had never thought of using any kind of technology in her dance before. Using the Soundrop gave her some autonomous control of the sound that became an addition to her dance. In this sense, she felt that by using the Soundrop, it could highlight moments of her gestures with greater emphasis that may otherwise be lost to the audience. These and other comments regarding how the Soundrop had the potential to add dimension to her dance are further described in an interview in Appendix III.

Following this presentation, rehearsals began for the premiere of *Digital Dervish + Flamenco Sonic* at Plymouth UK's Market Hall Full Dome Theatre in March 2022. Mayez Rahman who plays *Digital Dervish,* rehearsed with Mercedes (*Flamenco Sonic*) several times before the shows (Figure 5.19). The relationship between the two performers grew in a short time despite the fact that neither had any experience or much knowledge of working with the other's traditional practices. The Dome is the largest of its kind in Europe having opened in July 2021, and boasts a diameter of 15 meters and a height of 9.8 meters. This project was the first to present live performance with wearable technology and an original 360-camera film. The performers used the perimeter of the space, and the movements were choreographed to include the circular shape of the dome. The arrows in the image indicate the direction in which the movements are flowing with the Soundrops. These are some of the specific movements that are being captured and recorded and the gestures/movements to which the sounds of the Soundrop are emitted and emphasized - the continuous circular motion of the arms/hands and feet of the Dervish and the upwards and downwards motions of the Flamenco dancer's wrist and the accentuated foot stomps.



Figure 5.19: Testing with Mayez Rahman and Mercedes Romero with finalized version of Soundrop, May 5, 2022, Plymouth, UK (Hurban, 2022)

In March of 2022, the Soundrop was also tested with another Flamenco dancer - Carolina Loyola-Garcia, USA at Robert Morris University in Pittsburgh (Figure 5.20). Carolina's input in terms of how she wanted to use the Soundrops were useful in that her style of Flamenco dance varied greatly from Mercedes' dance style. Her instinct was to use the Soundrop's sounds as a compliment to her movements by incorporating background Flamenco music with hand/wrist gestures and by accentuating certain beats in time made by her ankle Soundrop. This made Carolina aware of the sensation of creating sound with her movement and enabled her to create her movements in a different way than she would without a Soundrop. The movements with the Soundrop became more organic and during her performance as *Flamenco Sonic* in Canada, the interaction between her movements and the sounds were seamless.



Figure 5.20: Carolina Loyola-Garcia testing Soundrop, March 2022, (Hurban, 2022)

In July of 2022 after the first performance of *Digital Dervish* + *Flamenco Sonic*, Sercan Çelik (pronounced 'Ser-jaan Chelik') tested the Soundrop in Istanbul, Türkiye where he also rehearsed for his role as *Digital Dervish* for the upcoming performance in Dubai, UAE. (December of 2022). As an experienced performer/dancer his interpretation of using the Soundrop was also unique in that he was interested in the development of

sounds that were emitted with the Soundrop. His role in the project has been ongoing for five years therefore he was eager to incorporate wearable technology into his dance. Moreover, when Sercan (Figure 5.21) first trialed the *Dervish Sound Dress* in 2018, he was excited about how using electronic components on the body could change his choreography in that the sounds can also lead the movement or influence it. Sercan's interpretation was to use the Soundrops on both of his wrists instead of his ankle since his movement style was more expressive with his arms and hands, as seen in a sketch in Figure 5.22. This resulted in some interesting findings as the two Soundrops on either wrist played off of one another as he used them to augment his arm/wrist gestures. The Processing sketch using the Soundrop was also tested to see how visualizing the data from the Soundrops would look like on a screen. This testing will be further explored as the possibilities of using more sophisticated visual effects such as 3D visualizations rather than 2D, would be more vivid and immersive for the dancer and audience. This exploration will require further investigation into using gaming engines such as Unity or Unreal Engine to communicate with the Soundrop and create visuals based on movements.

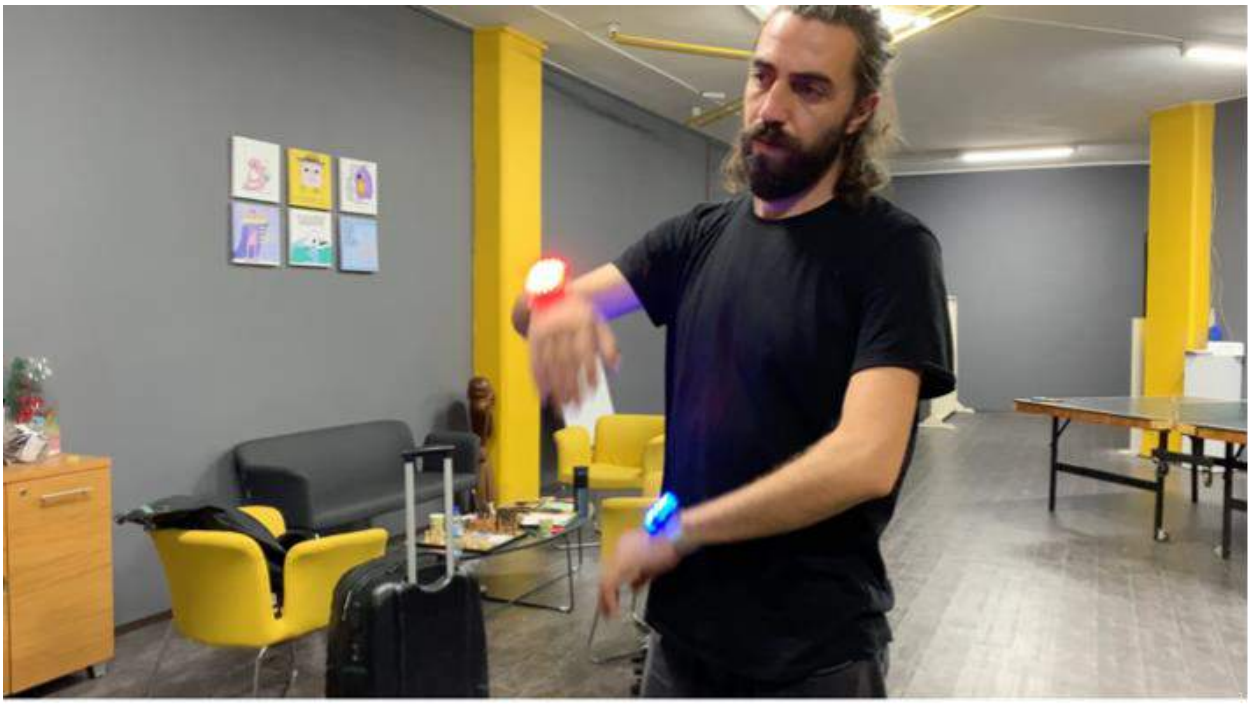


Figure 5.21: Sercan Çelik testing Soundrop in Istanbul, July 2022 (Hurban, 2022)



Figure 5.22: Sketch of Sercan Çelik with placement of Soundrop on wrists (Hurban, 2022)

Several discussions with Sercan (of which parts are recorded in interviews in Appendix III) revealed that his interest in elevating his whirling style with a piece of wearable technology could contribute to new forms and expressions of the traditional sema. He

also mentions that the Soundrop contributes holistically to the whole process and that using technology as a tool to enhance the quality of dance is a significant leap in dance performance.

Pepa Sanz is the third Flamenco performer to be involved in the project and her style of Flamenco dance, although in the same tradition of classical Flamenco training, is based on more contemporary, avant-garde interpretations of Flamenco. She used the Soundrop intuitively. Her movements reflected the outcome of the sounds and emphasized her gestures succinctly. Her foot movements became fluid with the Soundrop on her ankle and she made several pauses to emphasize the sound that was coming from her foot. The sketch in Figure 5.23 shows the placement of Soundrop on the dancer's wrist and ankle.



Figure 5.23: Sketch of *Flamenco Sonic* with Soundrop on wrist and ankle (Hurban, 2022)

Pepa also expressed an interest in modifying her Flamenco practice with wearable technology and sound. In an interview while discussing how she could integrate the Soundrop into her performance (recorded in Appendix III) Pepa remarked that she feels that having control over something else other than her body is unique because it can offer the audience more than just her movements.

As part of an ongoing search for alternative uses and applications for the Soundrop, the devices were trialed during an invited lecture at the University of Tennessee in Knoxville with the Time-Based Art students within the School of Art in October of 2022 (Figure 5.24). This lecture/workshop was a great way to experiment with the device even further and to gain insight on further uses for the Soundrop outside the scope of this research and beyond using it for a single purpose (for dancers/performers). The students were tasked with creating their own organic sounds during the workshop and creating a narrative with them. As they are film students, they used the devices to develop simple stories or sketches that depended on the Soundrop to emphasize something whether it was an action corresponding to a sharp blasting sound or sounds from nature that communicated something about the environment, or a quirky skit involving slapstick humor with sounds of slaps and punches or short abrupt vocalizations or phrases.

These tests were invaluable and added to the validity of the development of the Soundrop in that the goal has been to use the Soundrop to bridge a connection between a Dervish and a Flamenco dancer through technology and sound but also to explore how the device can be used to create original sounds with for education, expression, interaction, and music/sound execution.



Figure 5.24: Student trialing Soundrop at University of Tennessee, Knoxville, USA. October 19, 2022 (Hurban, 2022)

Chapter Summary

The development of the Soundrop digital musical body instrument has been arduous however, the artefact in its current form is a functional, playful, interactive tool that can be experimented with for performers, musicians, dancers or others to create unique sounds by using body movement and gestures. The devices are small gestural controllers that emit sounds when movements are triggered. The velocity of the devices changes the level of volume so that it is more responsive and natural to sudden subtle movements. These sounds (of which one can be uploaded to a device at a time) are currently looped to start and stop when movement begins and ends, and they are interchangeable. The sounds are currently used to emphasize musical sounds or instruments related to the practice of the Whirling Dervishes and Spanish Flamenco dance. The main component of the performative framework is captured and delineated in Chapter 6 where the six performances of *Digital Dervish + Flamenco Sonic* are analyzed in terms of the different

locations where it was showcased, how the data flow from the devices demonstrate the invisible elements that are transmitted by the performers and the overall experience of the users that experimented with the device.

Chapter 6

An analysis of *Digital Dervish + Flamenco Sonic*; A Multimedia, Immersive, Interactive Performance

Digital Dervish + Flamenco Sonic is a performance work that combines traditional dance, music, film, costumes and wearable technology into a story that brings a Dervish and a Flamenco dancer together on stage. This work is the culmination of the research set forth in this thesis and the practice component of the dissertation. Although much of the practical work has been steadily on-going from the initial beginnings of this research in 2019, the actual trials, prototyping, sound recording, music composition, filmmaking, editing, garment/costume construction, fittings for costumes, choreography, rehearsals, marketing, website development, coordinating with venues, and performances took place from August of 2021 to December 2022. This chapter focuses on the entirety of the performances and are divided into sections according to performers and the different venues that the show was exhibited in.

6. *Digital Dervish + Flamenco Sonic*: a multi-media performance work

Over the last two years, the planning for these performances (of which there were six in total) has been arduous but rewarding. The most challenging aspect of developing a show of this nature was acquiring the right performers to work with. A relationship had already developed with Sercan Çelik and he was enthusiastic to work on the project after having trialed the *Dervish Sound Dress* several years before. There were logistical constraints in testing and rehearsing with Sercan due to travel and visa restrictions to the UK however, after being awarded a grant from the Canada Council for the Arts to further develop and execute this production, the options for expanding on global performances possibilities opened. Filmmaker Kaz Rahman collaborated on this project as filmmaker of a 29-minute film shot on 360-degree camera to be screened on a dome screen format and a 20-minute

film for screening at a multi-screen immersive theatre as well as acting as production designer for all performances. His contribution to this project is unprecedented. Most of the images in this chapter are stills from the films and/or performances that he recorded. A detailed description of the films and how they exemplified the overall performances as an integral component to the work including the concept, stage design for each venue and how the films align with the musical score and the performers' movements is described in Appendix I.

Initially, Mayez Rahman tested the *Dervish Sound Dress* in 2018 which is when he began performing as a Dervish and became familiar with the cultural history and the metaphysical importance of performing the *sema*. Though not formally trained, Mayez's movements were incredible to watch, and his demeanor fit the character of the *Digital Dervish*. As Mayez is not Turkish or from Turkey/Türkiye, his inside knowledge and attachments to the practice were different than Sercan's for obvious reasons. However, as a Muslim, he is well aware of *dhikr*, recitation and Turkish culture having lived there for 2 ½ years as a pre-teen. After some initial chorographical testing and run-throughs of the musical score (which he had listened to several times) he perfected his version of whirling which became solid and true to the practice.

The Flamenco dancers of which there are three, were also from different backgrounds with similar knowledge and training in Flamenco dance but with varying opinions and versions of the dance. Some were more traditionally inclined, while others were open to experimentation with a digital musical wearable body instrument.

This chapter breaks down the performance of *Digital Dervish + Flamenco Sonic* (shortened to 'DDFS' where necessary) by examining the venues and the performers (of which there are five in total) in three different countries. The way in which each performer uses and interprets the Soundrop is also analyzed as a way to distinguish how or why they use the devices in the way that they do alongside the overall structure of the choreography, based on their interpretation of the musical score and their added improvisational elements. There were six shows in total in three different countries with a

total of five different performers. A breakdown of the performances and performers can be seen in Table 6.1:

Performer	Role	Show	Venue	Location
Mayez Rahman	Digital Dervish	*Immersive Sky*	Market Hall Dome Theatre	Plymouth, United Kingdom
Mercedes Romero	Flamenco Sonic	*Immersive Sky*	Market Hall Dome Theatre	Plymouth, United Kingdom
Mayez Rahman	Digital Dervish	*Life Circle*	Market Hall, Public Energy	Peterborough, Canada
Carolina Loyola-Garcia	Flamenco Sonic	*Life Circle*	Market Hall, Public Energy	Peterborough, Canada
Sercan Çelik	Digital Dervish	*Dream Chamber*	Theatre of Digital Arts	Dubai, UAE.
Pepa Sanz	Flamenco Sonic	*Dream Chamber*	Theatre of Digital Arts	Dubai, UAE.

Table 6.1: List of performers, roles, shows, venues, and locations (Hurban, 2023)

Each performance was set across two nights; May 6th and 7th 2022 in Plymouth, September 9th and 10th in Peterborough and December 16th and 17th in Dubai to sold-out or nearly sold-out crowds. The performances have evolved on several different levels and will all be examined in this chapter and unpacked according to each performance and showcase of the production. The storyboards outline the piece in its entirety with commentary on how the performers should use the space and when to initiate their Soundrops. Most of the visual materials including full-length videos of all six performances, promotional posters and marketing of the performances, a link to *Firoza*[48] website (a website created for the creation of contemporary works in film, painting, photography, installations and video art with an underlying theme of curating new approaches to contemporary Islamic Art) raw data and graphs are presented in the Appendices following the main body of the thesis.

[48] https://www.firoza.co.uk

6.1 *Digital Dervish + Flamenco Sonic*; Musical Score and Composition and Choreography Analysis

The composition and score for *Digital Dervish + Flamenco Sonic* completed in February of 2022 contains several elements that directly connect the two performers through music and sound. These layers are built up of several concepts that had been developing for some time and were composed through inspirations from both traditional Turkish instruments used during a *sema* as well as musical modes and instrumentation used in Flamenco performances. The approach was to use a mix of traditional styles of music and electronic sounds. All the sounds that were produced were manipulated in audio editing software (Audacity or Audition) to achieve more blurred sounds that were reminiscent of a Spanish guitar or an *oud* for example.

In Figure 6.1, the entire score of *Digital Dervish + Flamenco Sonic* shows a spectrograph where elements such as areas of transitional silence (indicated with yellow arrows) where the performers were choreographed to introduce their individual Soundrop onstage and peaks in sound where the music and narrative are at a climax (indicated with blue arrows). The entire piece is 29 minutes and 42 seconds in length. This spectrograph is used alongside image clips from the performances to illustrate how the choreography coincided with the music. It also demonstrates at which crucial moments in the piece the performers use their devices to present them to the audience and to 'play' their digital musical body instrument along with the score. Furthermore, a comparison between the various performers is analyzed in terms of their use and interpretation of the devices according to the choreography as well as graphic analysis of peak moments of use. These are illustrated as graphs that reveal the data output. It was essential to grant the performers the flexibility of using the devices outside the confines of the set choreography, as this ultimately validated the fact that they used the Soundrop to enhance their performance in a more organic way. This explains the previous point on how the costumes take on an essential role in how the performers execute their movements and that the Soundrop is another extension of this. Moreover, the data that is collected from the Soundrop presents the peaks and low points - the fluctuations are representative of each performers' interpretation of their use of the Soundrop in those particular moments that are highlighted

in the musical score. This demonstrates how the performers respond to the device in a graphical sense. This analysis gives a deeper insight and illuminates the access that the performers have to the Soundrop through visualizing the data by also revealing the 'invisible' moments that are captured by recording the movement data.

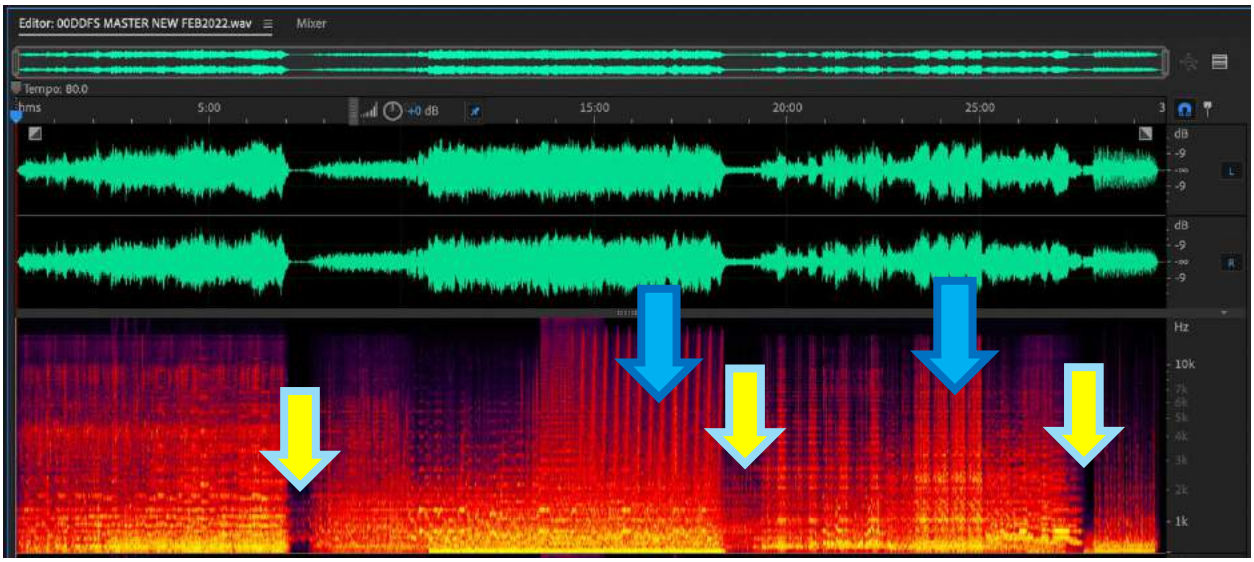


Figure 6.1: *Digital Dervish + Flamenco Sonic* score in spectrograph with areas of ambient silence and peak sound, (Hurban 2022)

6.2 *Digital Dervish + Flamenco Sonic: Immersive Sky*, Market Hall, Plymouth, UK May 6th, and 7th 2022
Venue: Market Hall Dome theatre, Plymouth, UK

The first venue at the Market Hall Dome Theatre in Plymouth, UK was entitled *Immersive Sky* as it features a 29-minute film by filmmaker Kaz Rahman who created the original 360 film and bringing the score to life with visuals interpreting how the movements (based on the story board) of the performers would interact with the space, the available light in the space (as there were no theatre lights available) and the music composition. The piece had already been mapped out in terms of how the performers should move in the space - in a circular pattern. The intention was to create endless spheres on the stage emphasizing the movements of both the Dervish and the Flamenco dancer which coincided with the narrative. The initial challenge of producing a show for the Dome at Plymouth's Market Hall was that a show of this kind had not been done before – the floor size was massive and choreographing the performers in such a large space while the

audience would also be simultaneously watching the film above and around them, meant that the shots had to coordinate with the movements of the performers so that one element did not outweigh the other. The interesting aspect of this production was that there was room to be creative and free, and to experiment in a large space. As far as it is known, this is the only performance that brings a Dervish and a Flamenco dancer together in a 360-degree space (Figure 6.2). Figures 6.3 and 6.4 show a hand drawn visual choreography storyboards for *DDFS*. Through initial visits to the Market Hall in Plymouth, it became clearer on how the performance would be developed in terms of the space and where the dancers would move, how the visuals would look and where the tech set-up would be for the shows. These visual storyboards were also given to all performers (including for the other shows) as a reference and guide outlining the time code in the music and visuals that would be shown in the background. Staging the Market Hall shows required a more minimalist approach to the production design in that there were no theatre lights other than the house lights around the perimeter of the Dome which could be dimmed, turned on and off.

This storyboard/visual choreography was used as a basis for the performers to learn the music and understand their cues. It was also a representation of significant moments that were to be highlighted with the Soundrop. The full storyboard with visuals is available in Appendix V. Apart from Mercedes' own choreography and style of movement, her Flamenco dancing coincided with the structure of the piece's choreography and with Mayez's movements. The performing space was the inner circular space on which the perimeter was seating for the audience. There was no other lighting design for the performers - the dancers were lit with the surrounding film and with the devices. The storyboard was given to all performers for each performance. This helped the performers to understand their cues and what visuals to expect since many of them had not had in-person rehearsals on stage until days before the shows began.



Figure 6.2: A still from *Digital Dervish + Flamenco Sonic: Immersive Sky* featuring Mayez Rahman and Mercedes Romero, Market Hall Plymouth, UK (image from Russell, 2022)

The storyboard/visual choreography demonstrates the key moments in the piece that are significant to this research and are the moments that reveal the ancestral traits between the two practices. Describing these moments as visual drawings help to steer the performers in a particular direction so that they are able to learn the movements but have room for improvisation. It also became a crucial and well-used document during rehearsals. Therefore, the moments of interest in this piece fall on certain time codes or sections that emphasize something significant about how a Dervish moves, and how a Flamenco dancer dances. Each of these moments are recorded in Max/MSP and later converted into text files and viewed as graphs based on the time code of the score and the maximum level of data output.

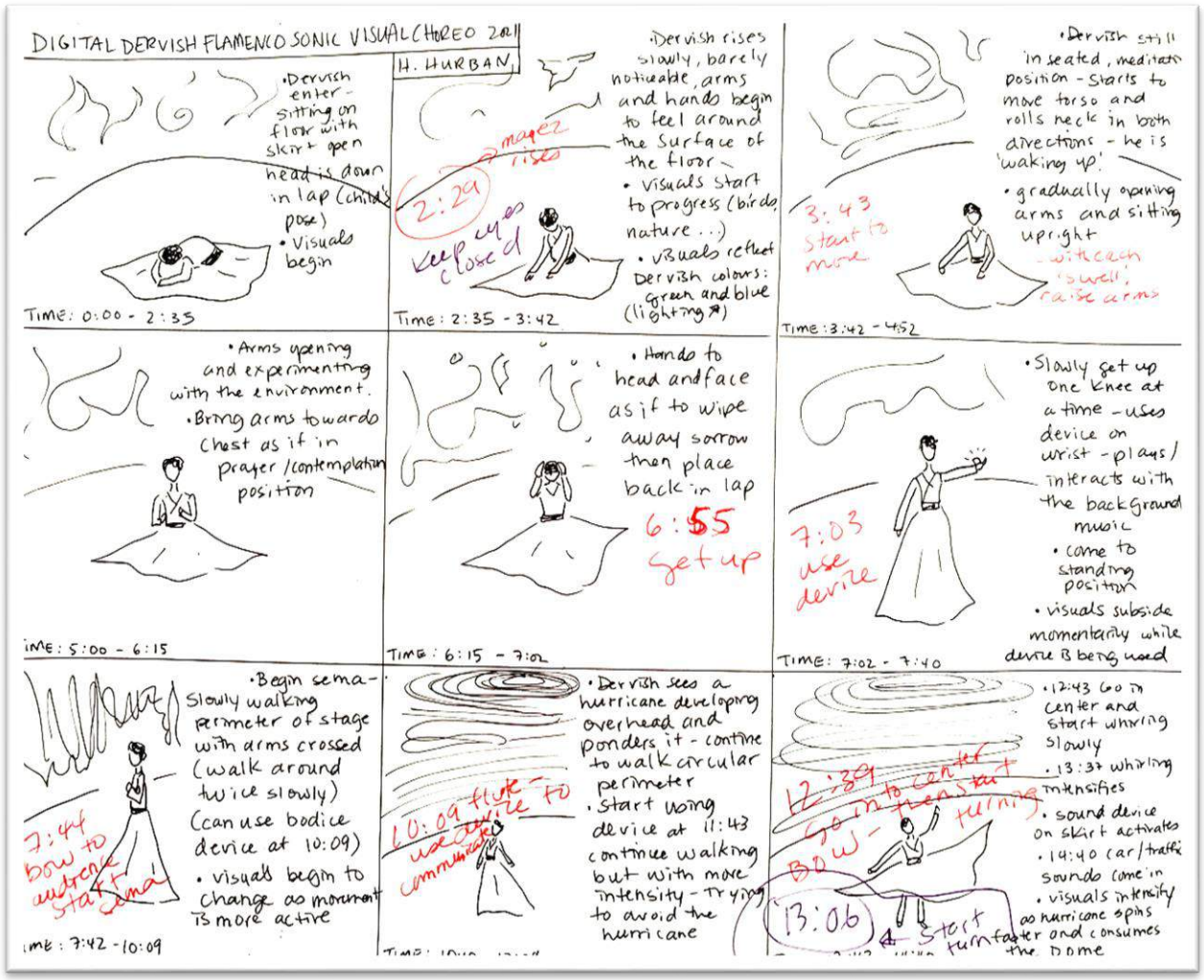


Figure 6.3: Visual choreography storyboard for DDFS 2021 part 1 (Hurban, 2021)

The Soundrop devices are numbered for ease to differentiate them between the performers, therefore the assignment of devices are as follows for all six performances (which are described in the graphs to follow):

Mayez Rahman: device 2 and device 3 (blue and yellow data)

Mercedes Romero: device 1 and device 5 (light green and dark green data)

Carolina Loyola-Garcia: device 1 and device 5 (light green and dark green data)

Sercan Çelik: device 2 and device 3 (blue and yellow data)

Pepa Sanz: device 1 and device 4 (light green and dark green data)

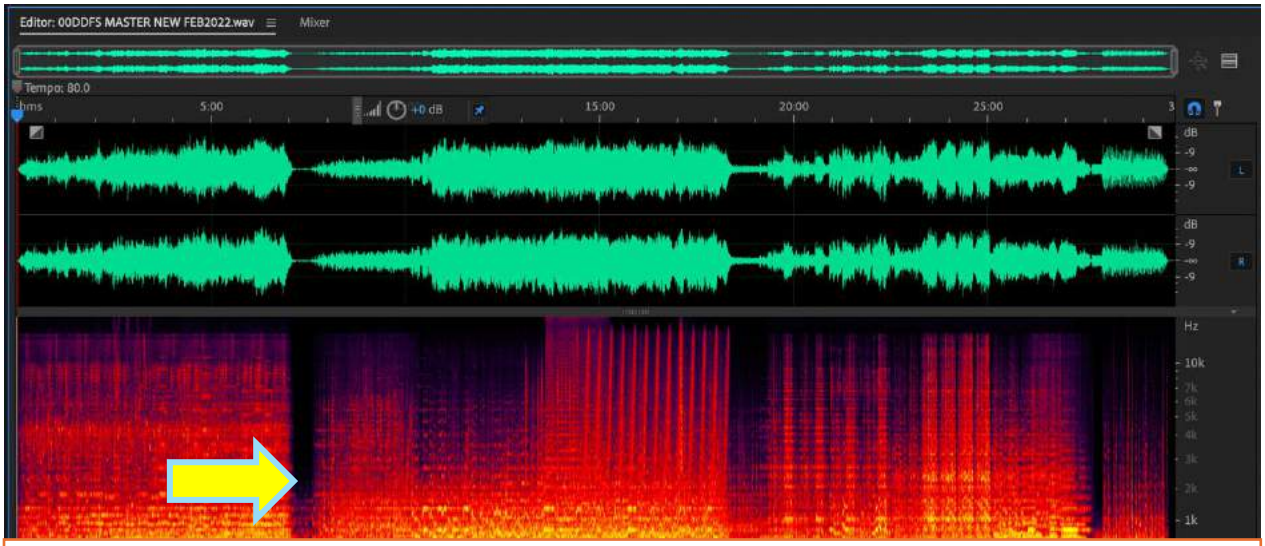
Essentially, the Dervish performers use devices 2 and 3 only, and the Flamenco dancers use devices 1 and 4 only.



Figure 6.4: Visual choreography storyboard for DDFS 2021part 2 (Hurban, 2021)

Digital Dervish – Mayez Rahman

Figure 6.5 shows how when compared to the score, the performer (in this case the Dervish is played by Mayez Rahman) begins to use his Soundrop. The purpose of these moments of ambient silence (with little melodic instrumentation) is to allow the performer time to initiate their device and to begin introducing the device to the audience, while adding layers of sound to the composition. The yellow arrow indicates the moment in time when the performer begins to use the device. In this scene of the performance, the sound that is being used with the Soundrop is a one second sound sample of an *oud*-like instrument which is reminiscent of an *oud* that might be played during a *sema*. It is a chord that has been arpeggiated electronically using a DAW (Logic X Pro). Some of the previous sounds that were experimented with were actual recordings of *oud* or *tambur* instruments, but it was found that using an electronic-sounding instrument would result in the same effect; the audience knows that the sound is being generated by the performer. Where the yellow arrow in Figure 6.5 points to this section and shows virtually little to no sound, Mayez uses the Soundrop to initiate his first sound which is an arpeggiated chord in E minor using electronic manipulation of an *oud* instrument. The graph in Figure 6.6 represents Mayez using the Soundrop at 07:03 in the time code of the musical score in a moment which is approximately 38 - 40 seconds in length. The graph illustrates an abundance of activity happening after the 600 mark in time which represents Mayez's motions. The data shows that Mayez follows the choreography by raising his arm/wrist upwards and downwards in slow movements. The sound fades in and out in volume as the velocity of his movement increases and decreases in time. Mayez uses the Soundrop in short bursts and sparingly.



This section is 38 seconds in length where the Dervish introduces his Soundrop at time code 07:03.



Figure 6.5: Side-by-side visualization of *DDFS* score and performance, Market Hall, Plymouth, UK, May 7, 2022 (image from Charminar Films, 2022)

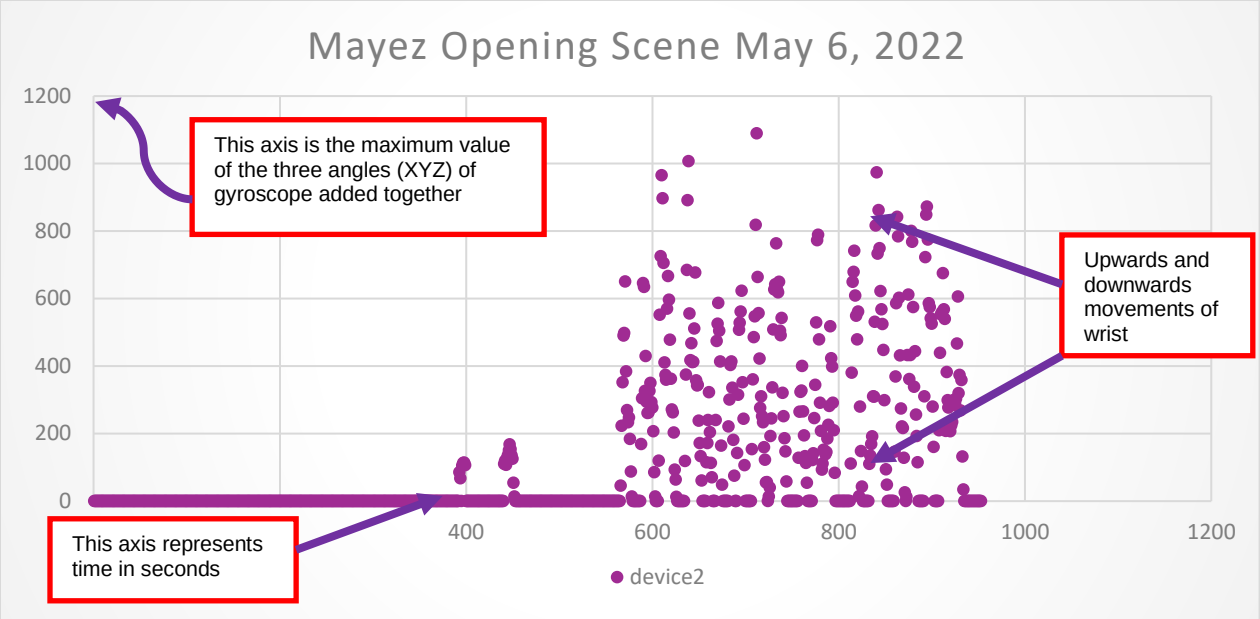


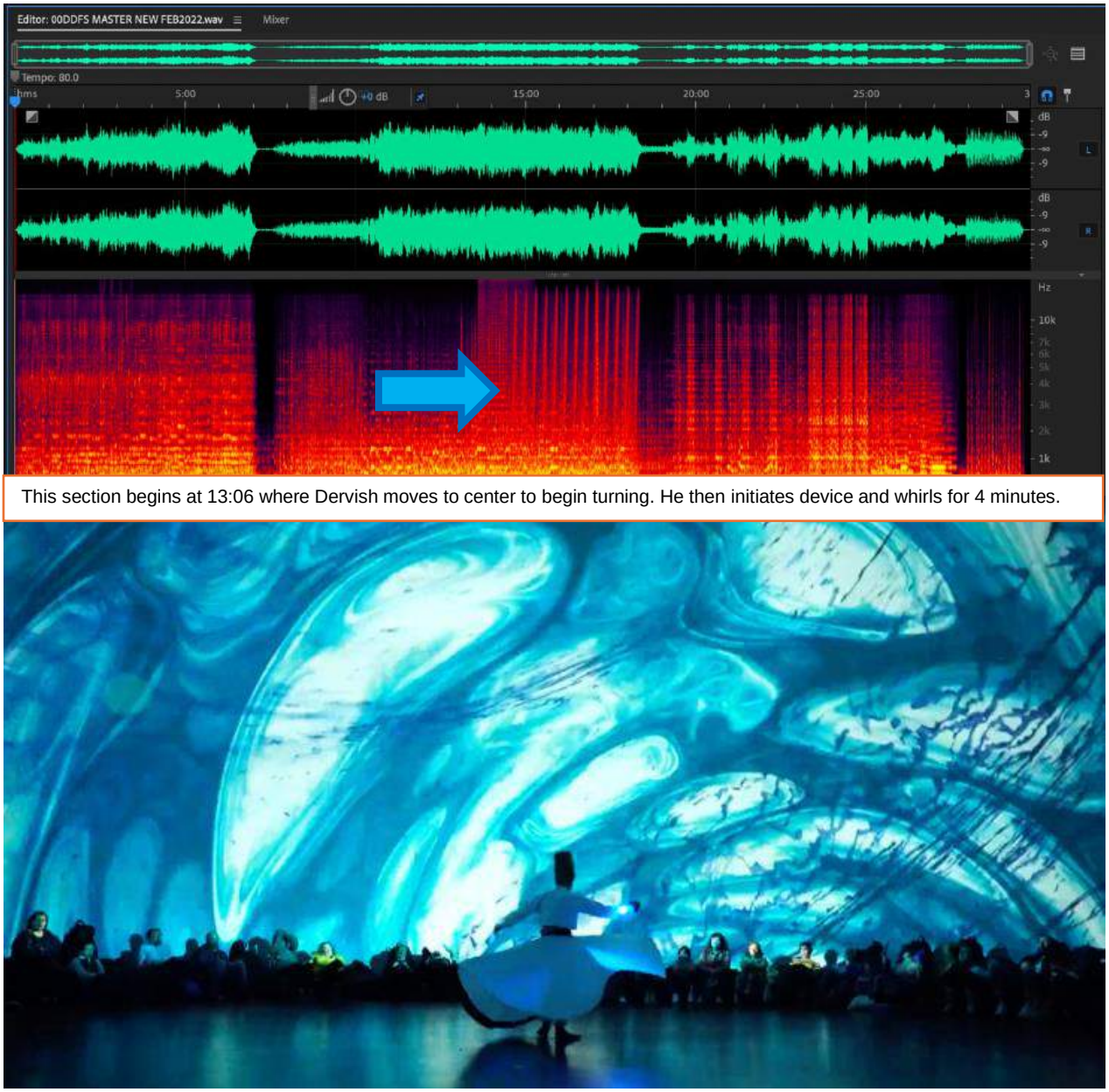
Figure 6.6: Mayez using Soundrop at 07:03 in musical score (Hurban, 2023)

The Dervish (Mayez) then moves into the next scene where he initiates his sound on his wrist device. He is accompanying the *ney* (Turkish reed instrument) or 'flute' sound with the arpeggiated sound that he triggers. This added layer places emphasis on this section which not only builds tension for the next scene but also gives the audience a chance to understand that his action has an effect and that he is using his instrument along with the music that surrounds him. This is also an example of how contemporary Dervish whirling can interpret an experimental digital art performance piece using a digital musical body instrument. While the movements may not be common for a Dervish to do during a traditional *sema*, this slight variation still has an impact as it is used sparingly and at just the pivotal moment to demonstrate to the audience that something other than his costume is connected to his body. His costume is an essential formal element in the dance, as it is used to extend and amplify his whirling - the Soundrop acts as another layer to further accentuate this.

The function of the melody in this section is used as a transition to the next scene where the Dervish will enter the center of the stage and begin whirling. Figure 6.7 shows how in this climatic section, there are several peaks in the music. These peaks are also cues to the performer to continue turning and where the visuals become more intense as the 'hurricane' develops, changes colors and the spinning/whirling become more electrifying

and heightened. The Dervish tends to use the wrist device in this section, emphasizing the effect of whirling as the sound continuously crescendos in and out as he moves his arms. These moments in the choreography and music act as cues for the performer to begin a new scene as well as trigger the Soundrop. Another integral feature is the visual backdrop; each section changes as the music and dance change, thereby emphasizing a shift in the story. This particular scene emphasizes the chaotic whirling that Mayez is performing; the 'hurricane' in the film mirrors the spinning of his body, which is further indicated with the Soundrop. Various iterations were tested on him, through which feedback into how intuitive it was using the device later resulted in fine-tuning the code to be more responsive and triggering in real-time. His input was critical to the development of this project.

It was interesting that, although Mayez performed similarly in all four shows, he did use some of his own interpretations on when to use the devices. The Soundrop was placed on his wrist to initiate sounds while he was turning but also as a layer to the music in moments of quiet ambience in the score, whereas the device placed on his ankle was meant to heighten the felling of momentous turning and vigorous whirling. The ankle device was to be initiated as he began his 4 – minute turning spectacle. During this time, the volume could be increased and decreased on the Max/MSP patch to avoid too much clash of sound during the whirling with the score. It would have been difficult to reach down to his ankle to deactivate the device while turning, however it was turned off at the moment he 'falls down' to the floor as the music and visuals change again to allow the Flamenco dancer to segue onto the stage.



This section begins at 13:06 where Dervish moves to center to begin turning. He then initiates device and whirls for 4 minutes.

Figure 6.7: 'Hurricane/whirling' section where device is continuously triggering, Market Hall, Plymouth, UK, May 6, 2022. (image from Charminar Films, 2022)

The data flow from this scene in Figures 6.8 and 6.9 demonstrate the position of the wrist Soundrop and the ankle Soundrop, while also revealing the consistent pattern of turning. The foot movement is consistent with the pattern of stepping one foot in front of the other while the hand is swaying upwards and downwards in larger open movements. The wrist device shows an oscillatory behavior where there is a spike in upwards and downwards movements in rhythmic activity. It also demonstrates that there is a quick sudden

movement in these spikes and a slow progressive movement. There is a clustering of data points recorded in the foot movements which shows that there were moments where one foot was stationary while the other turned around.

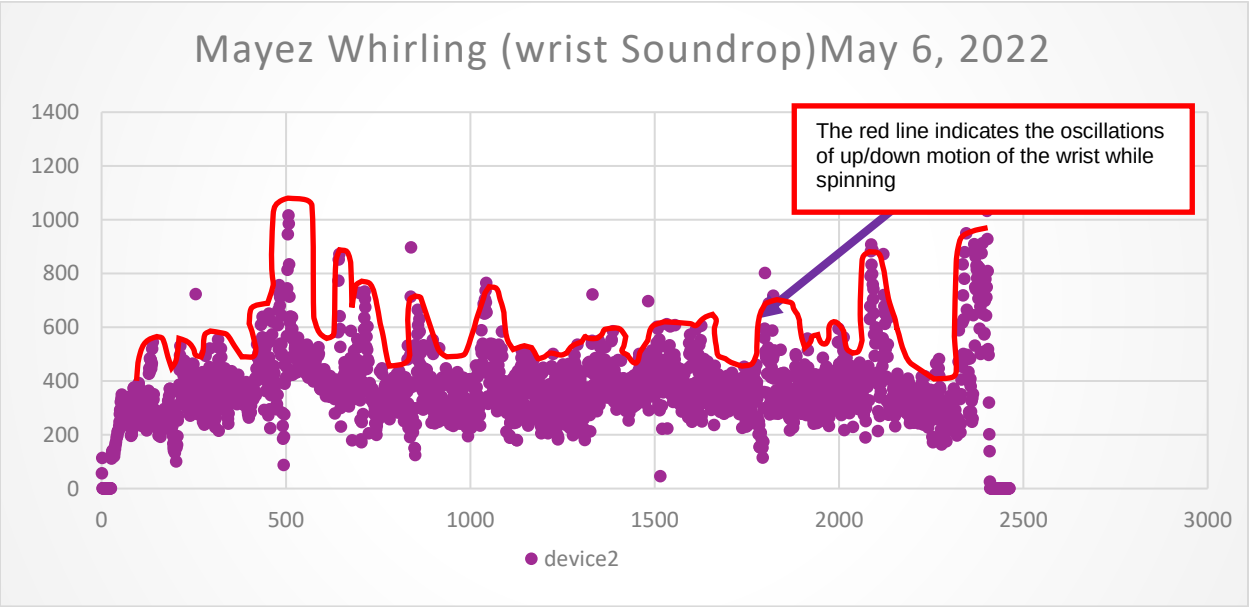


Figure 6.8: Mayez Rahman in 'hurricane/whirling' section May 6, 2022 (Hurban, 2023)

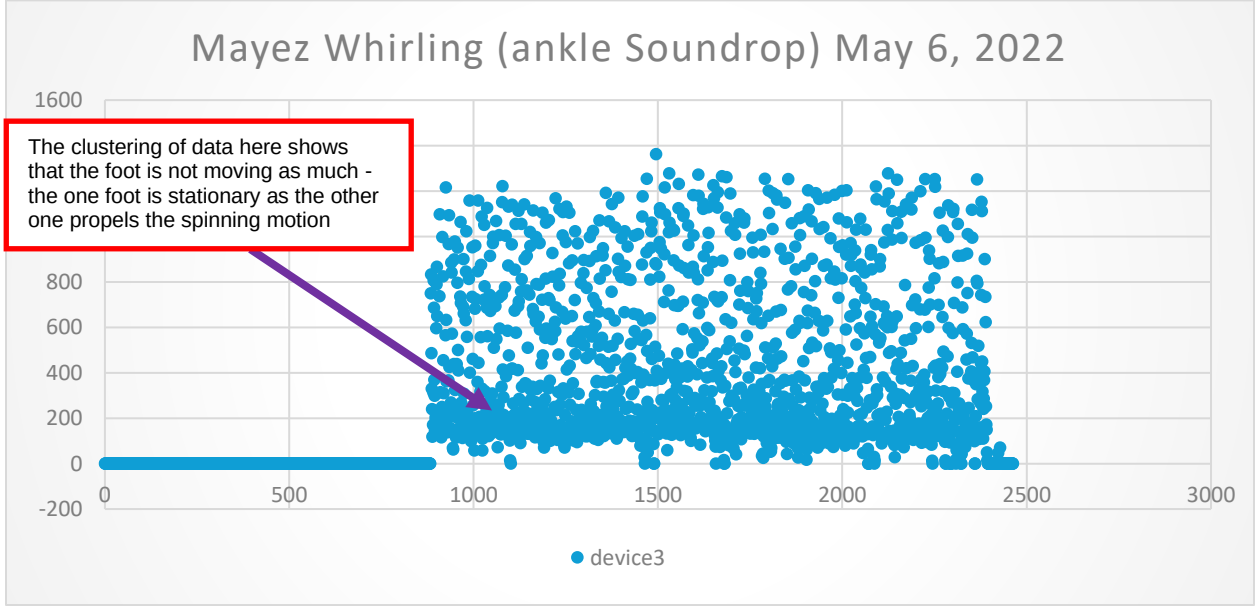
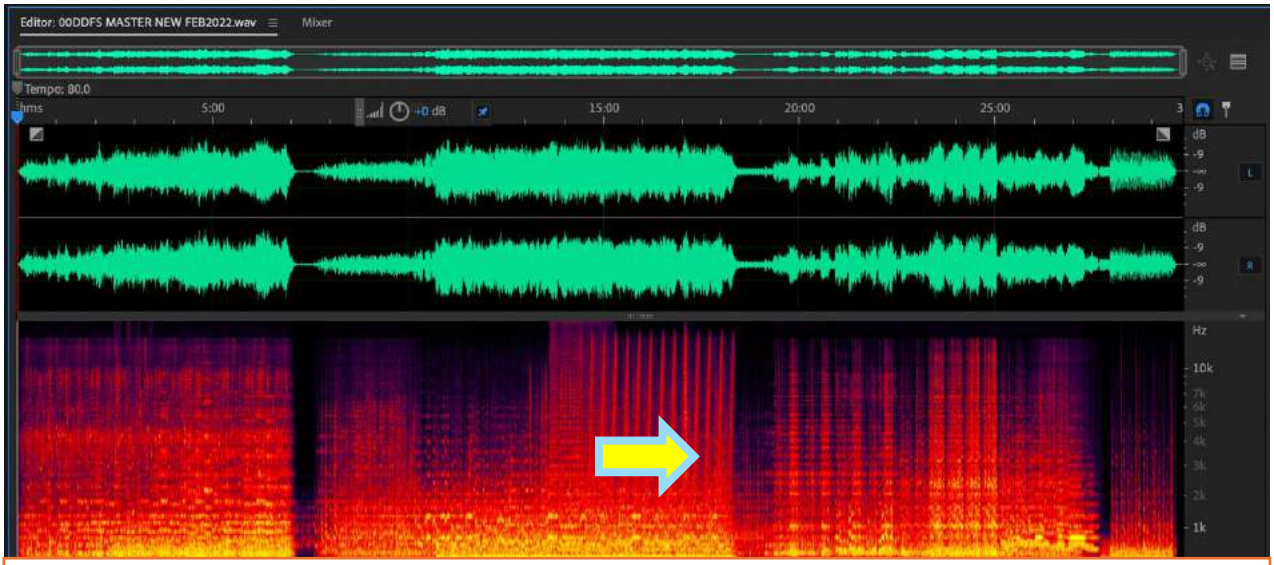


Figure 6.9 Mayez Rahman in 'hurricane/whirling' section May 6, 2022 (Hurban, 2023)

Flamenco Sonic – Mercedes Romero

A trained Flamenco dancer from a very young age, Mercedes came to the production of DDFS with enthusiasm and intrigue. She had previously performed in shows that were somewhat experimental in nature, but she had never used any other device than castanets on her wrists to accentuate or augment her dancing. Her role as *Flamenco Sonic* required her to adjust her formal classical training to embrace a new approach to her dancing. Although during rehearsals discussions revolved around the importance of maintaining pure Flamenco form, there was room for liberal improvisation especially while using the Soundrop. Figure 6.10 shows Mercedes entering the stage at the Dome theatre performance in Plymouth (May 6th, 2022). The change in tempo, transition to a new key and the film surrounding the performers (the Dervish is in the child-pose position in this scene) all contribute to introducing a new character and a new form of dance that the audience may otherwise have not been expecting. The *Flamenco Sonic* part of the performance was choreographed not only to the music but also to the visuals. In the scene where she arrives on the stage, there is a transition from the world of the Dervish to the world of the Flamenco; this is emphasized by the animated lines that are jumping over head. The abstract lines and shapes that are hand-drawn animations move to the tempo of the music and the performer moves to this. Adding another layer, the Flamenco dancer initiates the wrist Soundrop which is mapped to a digital castanets sound sample. This sample plays from the beginning in a loop when it is moved. Each time the dancer moves her wrist, the device triggers the sound of castanets. As she uses her *mantón* (shawl) to exaggerate her movements, the Soundrop triggers castanet sounds. The data from Mercedes' Soundrop shows that her movements were sporadic but consistent with her use of the 'digital castanets' (Figure 6.11). Her movement is reminiscent of slow waves that show a quick movement followed by a gentle pause as she is changing direction in position. This particular scene is just under two minutes in length and gives Mercedes the opportunity to introduce the Soundrop slowly and discreetly to the audience.



This section begins at 17:53. Mercedes initiates device and film changes; there is 1:45 of ambience where she 'plays' her device



Figure 6.10: *Flamenco Sonic* entering stage at 17:53, Market Hall, Plymouth, UK, May 6th, 2022, (image from Charminar Films, 2022)

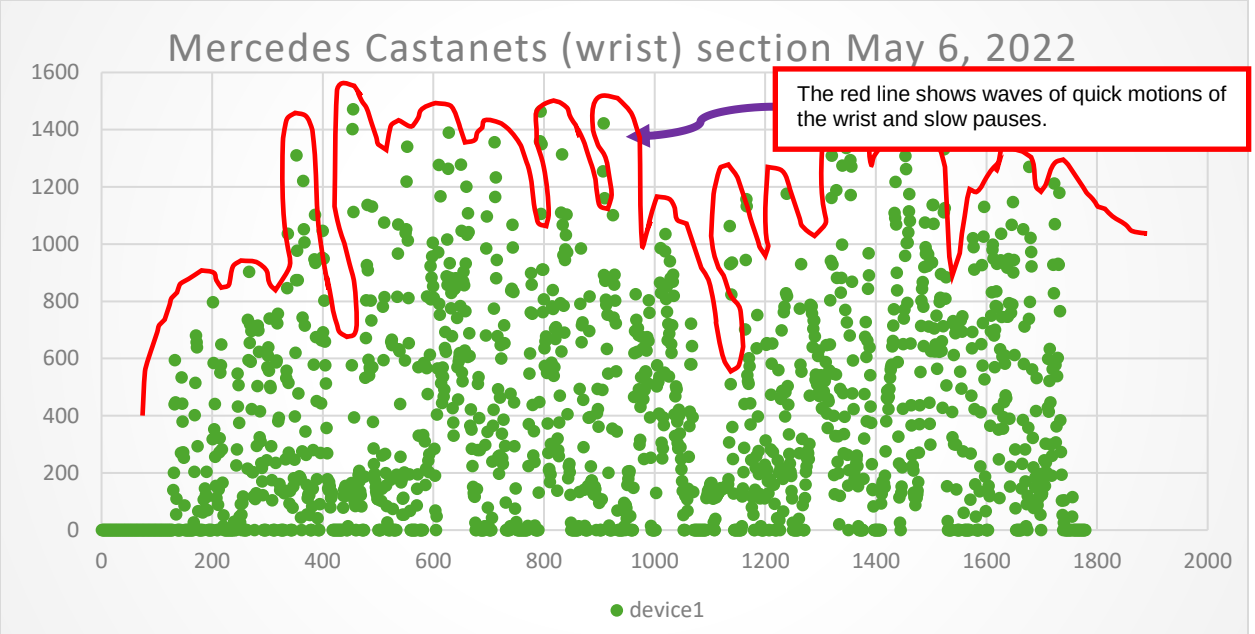
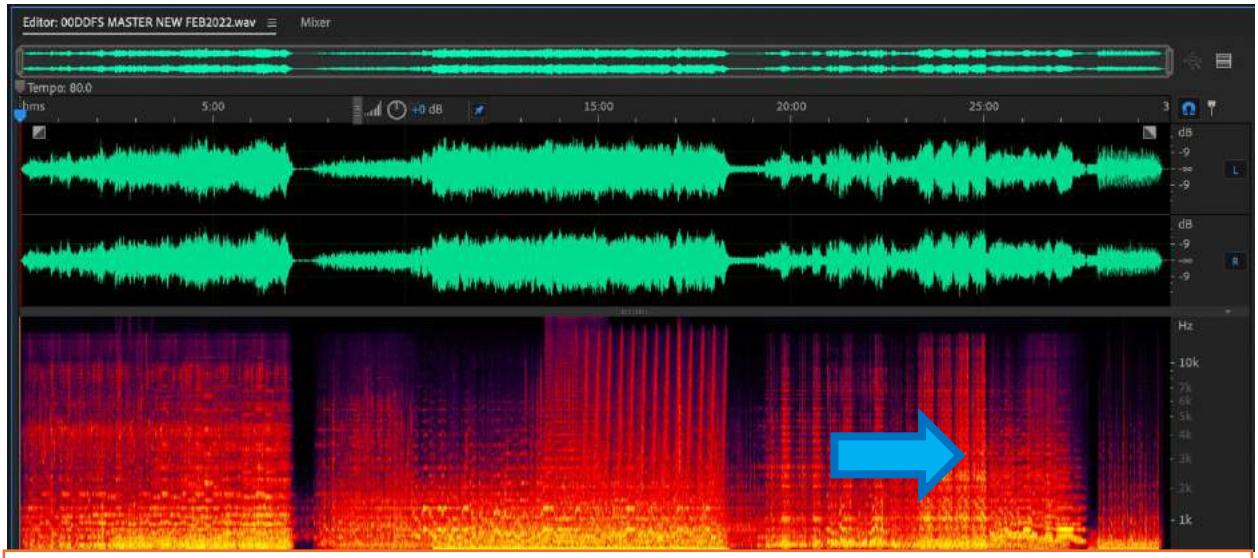


Figure 6.11: Mercedes using Castanet sound at 17:53 (Hurban, 2023)

At first, Mercedes had to learn and understand how to control the device, when to use it and when not to. It was decided early on in the rehearsal stage that if the device was used sparingly and focused on the moments that highlighted specific shifts in the music and tone of the performance, the Soundrop would not over-power the entire performance. This is why adding the ability to control the level of volume by slowing it down or not moving with it at all, contributed to the drama of the movement of the dancers. It was important to introduce the castanet sounds as she entered the stage so that the audience became aware that something else was happening in the performance other than the music, film and performers. The goal was to build some intrigue for the audience, but also to give control to the performers to activate their Soundrop when they felt they wanted to add another layer or emphasis to their movements. These crucial details solidified the fact that not only could the dancers be choreographed and directed to use the devices at certain peak points in the music but also as part of their expression. Figure 6.12 shows Mercedes using her Soundrop device on her wrist and ankle as she performs in her solo section. This 'guitar' section is inspired by solo guitar and Flamenco dancing and Mercedes uses both devices interchangeably.



Mercedes using ankle device at 22:17 during animated part in film and guitar song.



Figure 6.12: Mercedes using Soundrop with digital guitar sound, Market Hall, Plymouth, UK, (image from Charminar Films,2022)

Figure 6.13 demonstrates Mercedes' data using both the wrist and ankle devices. Her movements appear to be interchanging as she uses the castanets sounds intermittently with her ankle device which emits guitar sounds. She uses them together towards the finale. There are again peak moments in the data that reflect the velocity of her movement.

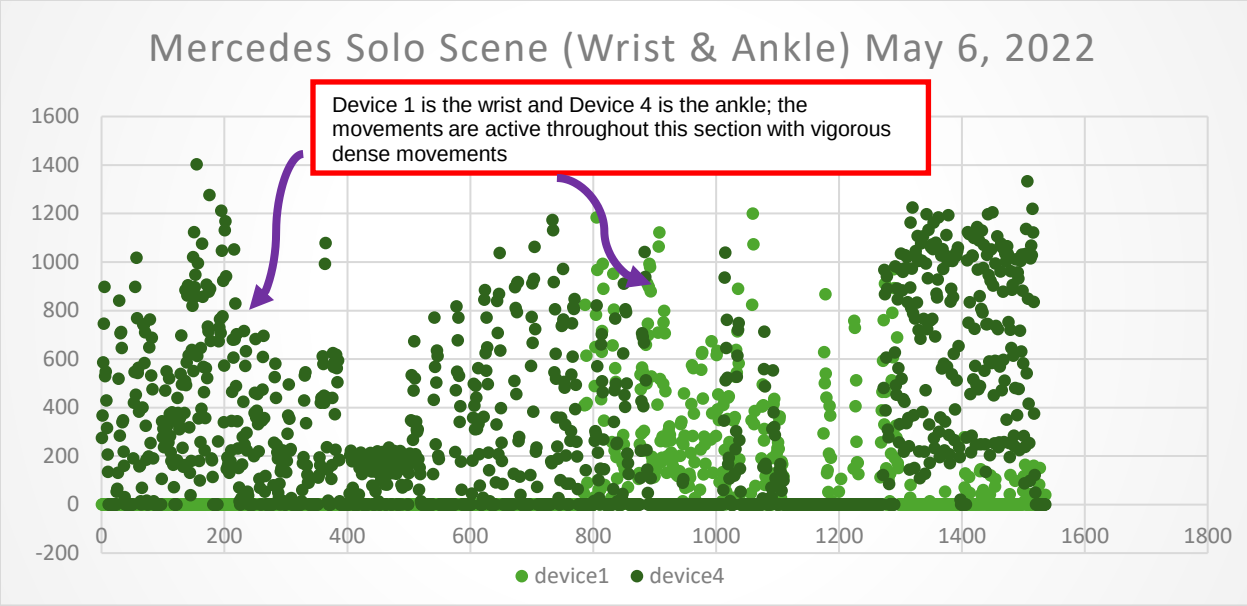
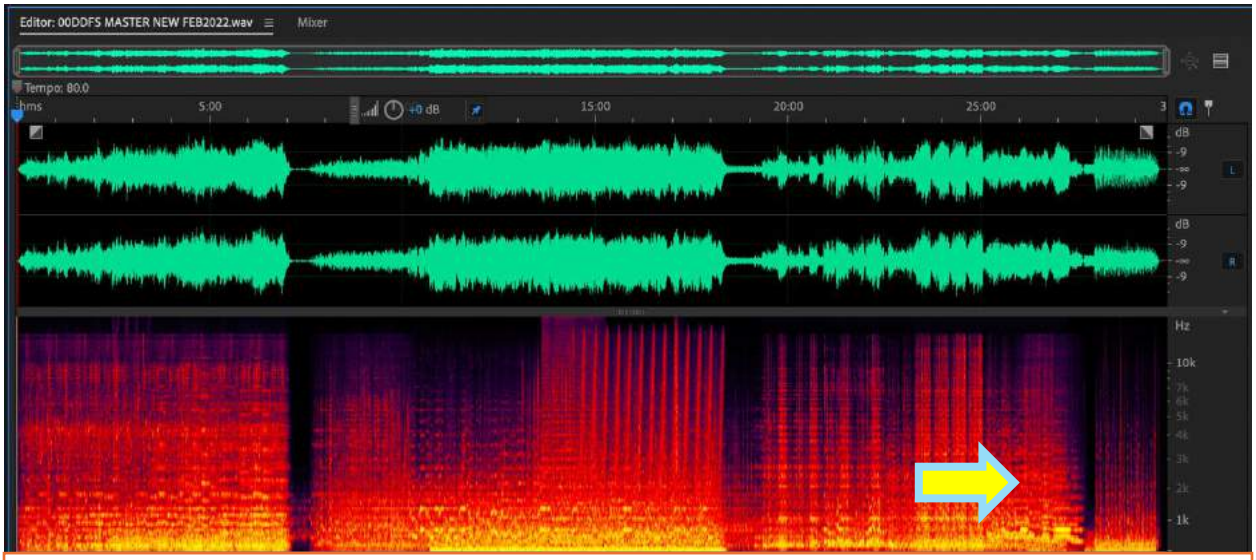


Figure 6.13: Mercedes using Soundrop on wrist and ankle at 22:17 in performance (Hurban, 2023)

Mercedes initiated her ankle device towards the middle of her performance. In this scene before the Dervish 'wakes up', the Flamenco dancer is creating circular patterns around the Dervish while using her ankle device and emphasizing her foot movements to the background music. Before the finale when the two performers whirl together, the Dervish and Flamenco bow towards each other with both bowing in the tradition of their respective practices; the Dervish with arms crossed at the chest, and the Flamenco using a deeper curtsy form of bowing towards the Dervish. At this moment in the performance, the relationship between the two traditions becomes the clearest.

Figure 6.14 show *Digital Dervish* and *Flamenco Sonic* whirling together in rhythmic turns. The end of the performance is the climatic point where the two distinct traditions are uniformly turning as their movements and sounds are combined alongside the visuals and music. This moment concludes the speculation over how the two are related or how they create their narrative overall - it is exhilarating to watch and a sensation of integrated completion of the story transpires.



Mercedes and Mayez whirl together at 25:30 in the score using all four Soundrop devices



Figure 6.14: *Digital Dervish* and *Flamenco Sonic* whirling in unison, Market Hall, Plymouth, UK, (image from Russell, 2022)

The data between Mayez and Mercedes (Figure 6.15) at the climatic whirling moment that the two performers share (from 25:50 to 27:30 in the time code) reveals that the ankle Soundrops for both performers had consistent movements while their wrist devices are also relatable and constant with the continuous whirling movement. The similarities

between the two are apparent as the movements seemingly overlap. The peak spikes in movement are outlined in purple squares.

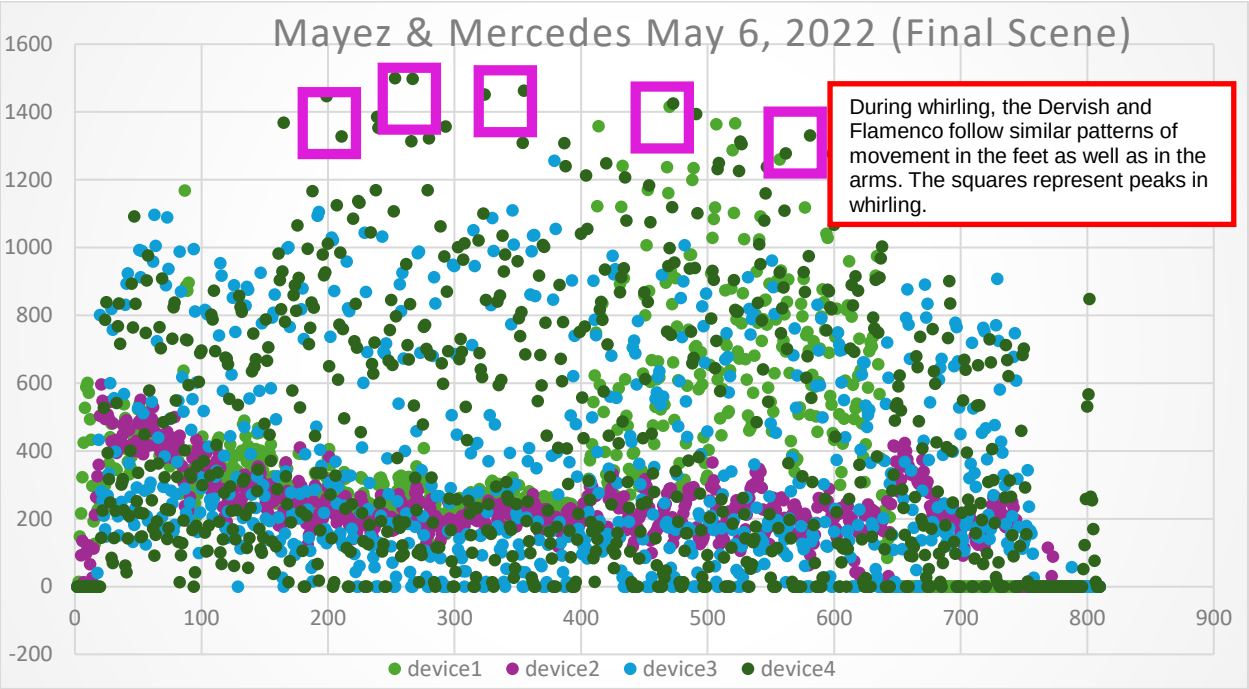


Figure 6.15: Mercedes and Mayez data while whirling together (Hurban, 2023)

6.3 *Digital Dervish + Flamenco Sonic: Life Circle*, Market Hall Theatre/Public Energy, Peterborough, Canada, September 9th, and 10th, 2022

Venue: Market Hall Theatre, Peterborough, Canada

The appeal of this performance work has been that it could be interchanged with different performers; many of whom are from different parts of the world. The show was also exhibited in Canada at the Market Hall Theatre in Peterborough, Ontario on September 9th, and 10th, 2022. Mayez Rahman reassumed the role of Digital Dervish while a new Flamenco dancer, Carolina Loyola-Garcia performed as Flamenco Sonic. The dynamics between the two performers were slightly different; Carolina is more concerned with the abstract interpretation of Flamenco and is familiar with performing different genres and interpretations of Flamenco. The language between Mayez and Carolina was stronger and more coherent. It may have been that the more intimate nature and size of the theatre

contributed to showcasing a more vivid connection between the two or that Carolina's interpretation of the role was more cohesive than Mercedes'.

The stage design for this show was very different from the Dome theatre in Plymouth in that it is a traditional performing arts theatre with a stage, backdrop screen and seating facing and at the sides of the stage. The art direction involved using the same circular pattern that was shown at the Dome theatre which is essential to the choreography. This emphasizes the circular movement of the Dervish while the Flamenco dancer dances in a circle on the perimeter of the Dervish's space. A white circular screen was constructed on the dance floor which acted as a mirror reflection to the back projection. The decision to screen the 360 film in a non-360 format was interesting in that there were now two circles: one behind the dancers and one on the floor. The Dervish (Mayez Rahman) remained mostly in the floor circle and performed his *sema* slightly on the perimeter of it. The Flamenco dancer (Carolina) performed on the perimeter of the circle and structured her choreography in a series of blocks that coincided with the changes in music and how she used her Soundrop devices. Essentially, there were three circles: one on the back projected screen, one on the floor and the skirt of the Dervish was also projected onto from the top-mounted projector. The lighting for the show was minimal; four side lights were used to project onto the performers as they walked around the perimeter of the circle, and the rest of the lighting came solely from the film itself.

Digital Dervish – Mayez Rahman

Mayez (Figure 6.16) resumed the role of Digital Dervish as Sercan Çelik was unable to travel to Canada due to visa restrictions. Mayez's performance was stronger this time; the space and venue were different but his confidence and being attuned to the music and the visuals were evident as he was bolder in his use of the Soundrop outside of choreographed instances. It was a chance for him to 'feel' the sound that he was playing rather than being overly structured. The discussions with all performers prior to the performances centered around this concept of using the Soundrop during particular moments in the performance but to also use it with improvisation. For example, too much use of the castanets sound would be over-powering and would drown out the background

music while also being too distracting from the essence of the performance. Therefore, the direction to the performers was to use it as they felt necessary to emphasize a moment, a gesture, a movement that they would see fit adding sound to. Therefore, while Mayez made use of the Soundrop in moments of silence in the musical score, he also used it to emphasize what he thought was important about his movement for example, using the wrist device for the entirety of his whirling scene which was approximately seven minutes.



Figure 6.16: Mayez Rahman as *Digital Dervish* with hurricane, Market Hall, Peterborough, Canada, September 9th, 2022 (image from Charminar Films, 2022)

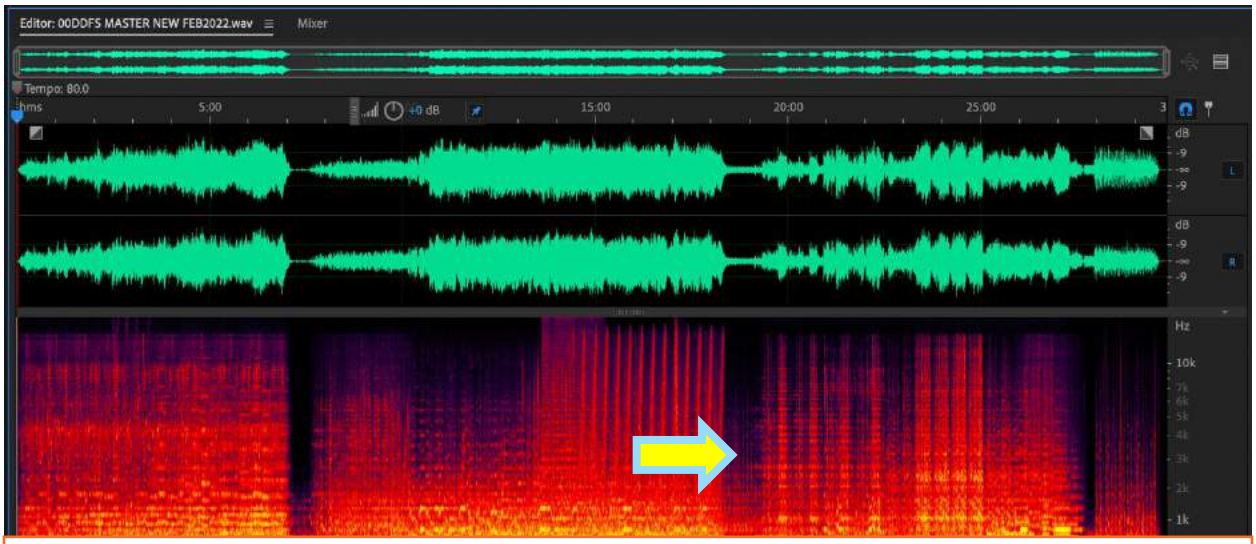
Flamenco Sonic – Carolina Loyola-Garcia

Carolina's role as *Flamenco Sonic* was a variation from Mercedes' character in that her style of Flamenco dance is more organic and introspective. Her main concerns with her movements were blocking patterns to learn and understand the choreography of the piece and also how to incorporate the Soundrop. Carolina has worked widely on-stage productions that involve dance as well as acting therefore, her approach to the choreography was about the story and telling the story with her movements as well as

emphasizing those movements with the Soundrop. As Carolina emerges from the back of the stage, at around 17:58 when the sequence of animated looping hurricane ends and dissolves into a dreamy cityscape, she begins to slowly use the Soundrop as she is lit gradually at the far upper-left corner of the stage. Her movements in this section are different from Mercedes' in that she focuses on the subtle wrist movement to which she initiates sounds of castanets (the same sounds used for Mercedes). Carolina is more aware of the device and interacts with it on a more visceral level. As seen in Figure 6.17, the same point in the audio composition is expressed however, the data that is recorded is slightly different from Mercedes' in terms of how the device is being used.

While the data from this performance of Mayez's movements is roughly similar to the UK performances, Carolina's data is strikingly different from Mercedes'. Figure 6.18 shows how Carolina made continuous use of both Soundrops and an interplay between the two devices is apparent. This moment is from the 'guitar section' where the film also transitions, and the Flamenco attempts to 'awaken' the sleeping Dervish. The time code is 23:17 and in this section, Carolina switches her ankle Soundrop on and dances in syncopated rhythms alternating between her castanets Soundrop and her ankle device.

Carolina also used her ankle device in an intuitive way; she would incorporate her movement to include switching the device on so that the action of turning it on was not awkward, but it flowed neatly into her movement as seen in Figure 6.19. Following this, the interaction between Mayez and Carolina was more tender and integrated as their movements became synchronized and more fluid. In the scene where Mayez 'awakens' to see Carolina dancing and then joins her, his actions are more responsive to hers and they communicate with their body movement as well as the Soundrops as they reach out to each other in harmony.



This section begins at 17:58. Carolina initiates device and film changes; there is 1:45 of ambience where she 'plays' her device

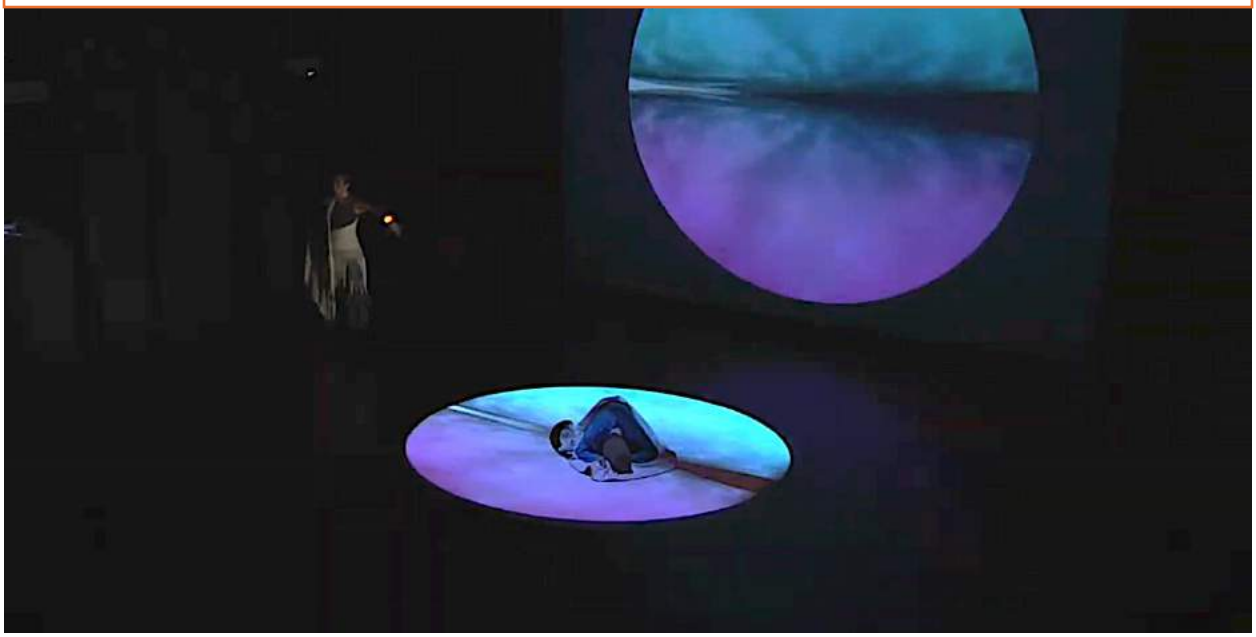


Figure 6.17: Carolina using castanets at 17:58 during ambient transition, Market Hall, Peterborough, Canada (image from Charminar Films, 2022)

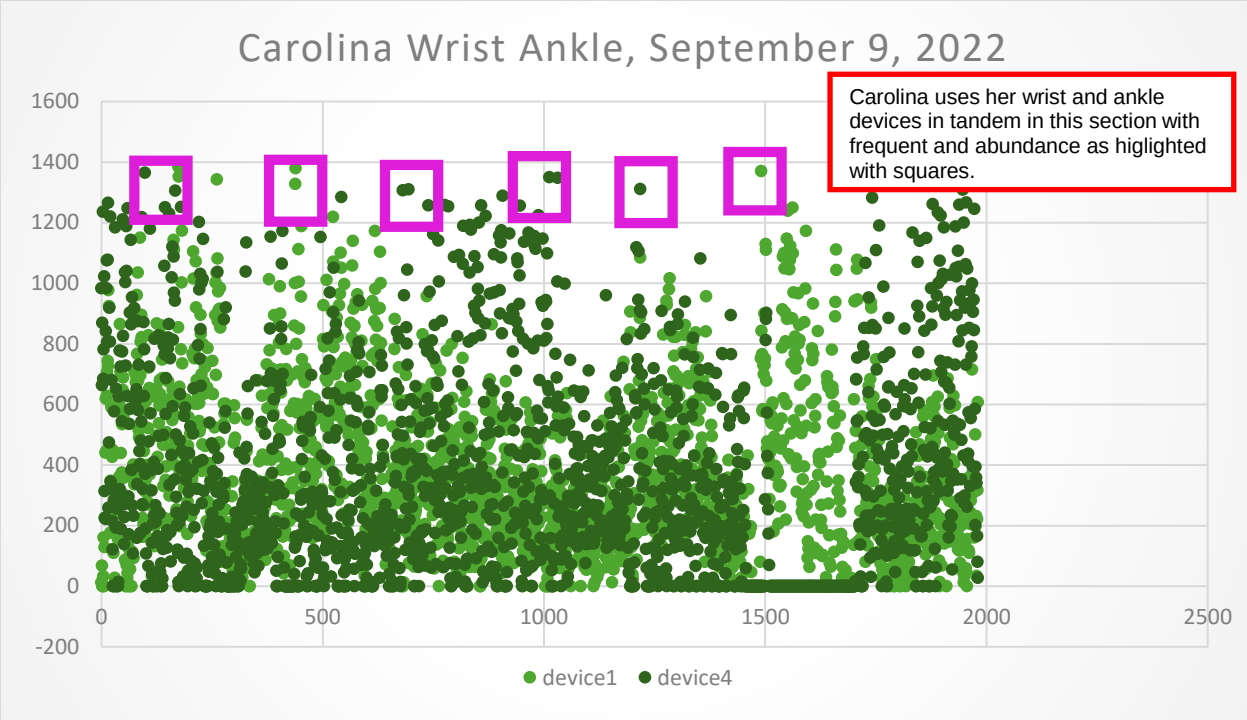


Figure 6.18: Carolina in 'guitar section' 23:17 of *DDFS*, September 9, 2022 (Hurban, 2023)



Figure 6.19: Carolina initiating Soundrop on wrist and ankle with Mayez in foreground, Market Hall, Peterborough, Canada, September 9, 2022 (image from Charminar Films, 2022)

The connection between the two performers during this scene was balanced and heartfelt - it was clear that the relationship between the Dervish and the Flamenco made sense to each other within the narrative and developed through these moments of exchange through sound and movement. As the final scene approached, the Dervish and Flamenco bow to each other and begin to whirl together (Figure 6.20).

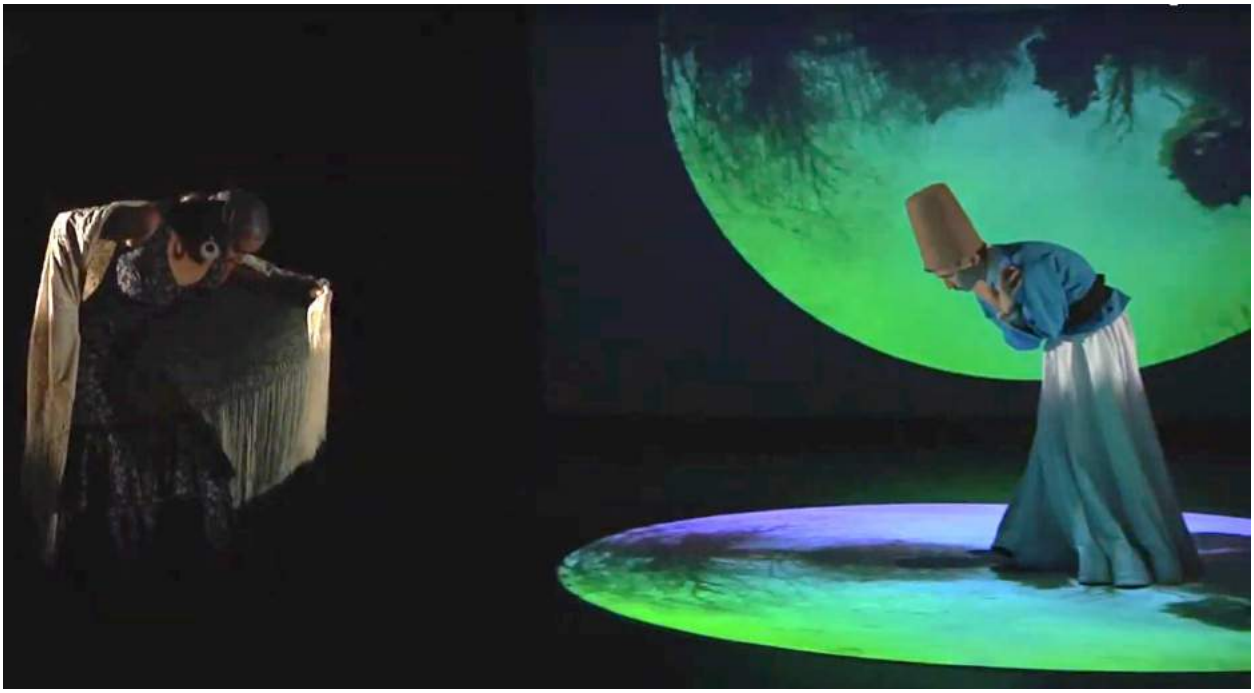


Figure 6.20: Carolina and Mayez bowing to each other before whirling, Market Hall, Peterborough, Canada ,September 9, 2022 (Still from Morritt, 2022)

The end of the performance marked the moment where the Dervish and Flamenco were to whirl together in unison after bowing to each other as the Dervish awakens to find himself in the presence of a new entity that he interacts with. The acknowledgement of each other in this particular moment solidifies their relationship. Since the venue was quite the opposite of the Dome theatre in Plymouth with respect to size and format, the Market Hall theatre in Peterborough was more intimate. The connection was different from the Dome shows in that even though the Soundrops were more or less used in the same manner according to the choreography, the improvisational element was sharper than the previous shows. In this case, Carolina was able to use the Soundrop more instinctively and organically, and she truly embodied the use of a wearable device in her practice.

Mayez's embodiment was also more apparent in these shows at the Market Hall in Peterborough, as he was more comfortable with using the Soundrop as an instrument to interact with and to demonstrate to the audience that there was another layer at work during the performance that initiated an auditory sensation. The speakers that output the sounds of the Soundrop were separate from the film audio and were placed towards the middle of the audience seating area, so that the sounds were understood to be coming out of the Soundrop as opposed to being a part of the background music. The sound design for the stage helped to emphasize the audio of the Soundrop to the audience and the volume of the devices were controlled separately through the Max/MSP patcher. Figure 6.21 shows Carolina and Mayez whirling in unison towards the end of the performance where all four of the Soundrops are turned on to emphasize the resounding looping sounds of continuous circular movement. Carolina used her *mantón* in a similar way to Mercedes with a wide-open stance that extended into a shape which reflected Mayez's turning *tennure*. They whirled outside of the perimeter of the circle on the floor which visually connected the two performers.

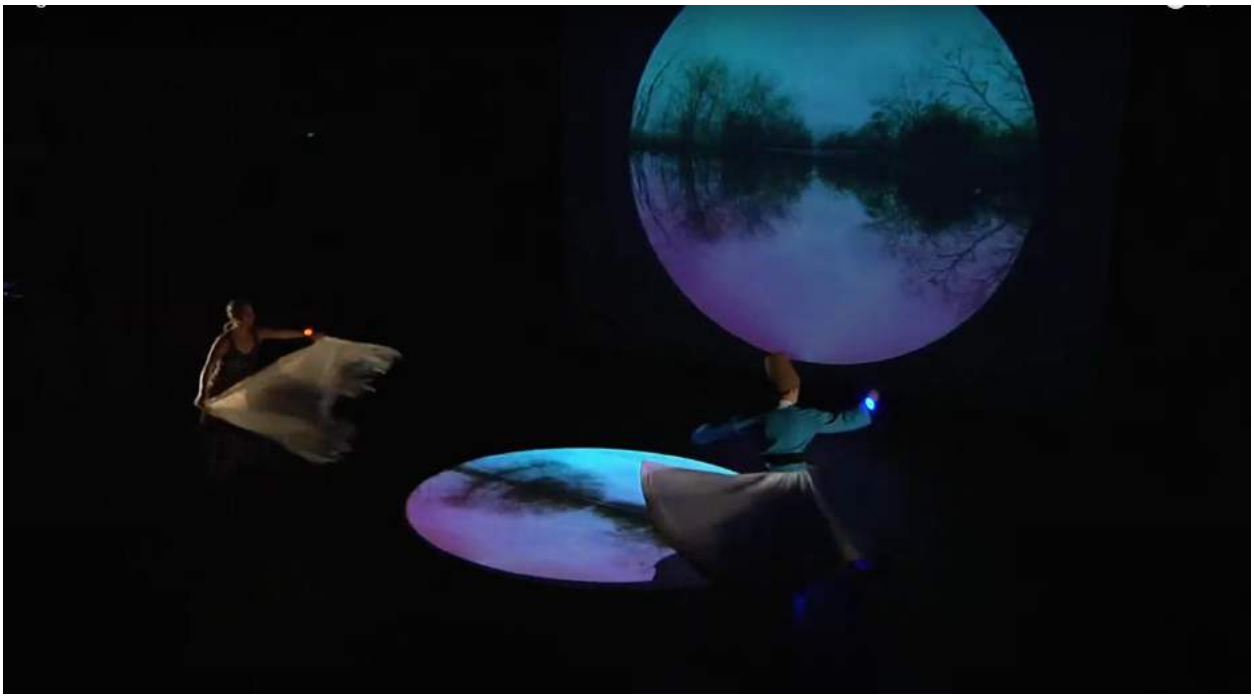


Figure 6.21: Carolina and Mayez whirling in unison, Market Hall, Peterborough, Canada, September 9, 2022 (Still from Morritt, 2022)

The data for this scene (Figure 6.22) reveals moments before Mayez and Carolina begin to whirl together and that the movements are again overlapping (indicated in purple arrows) as with Mercedes and Mayez previously. The peaks occur at each turn and the foot movements are also coinciding with each other.

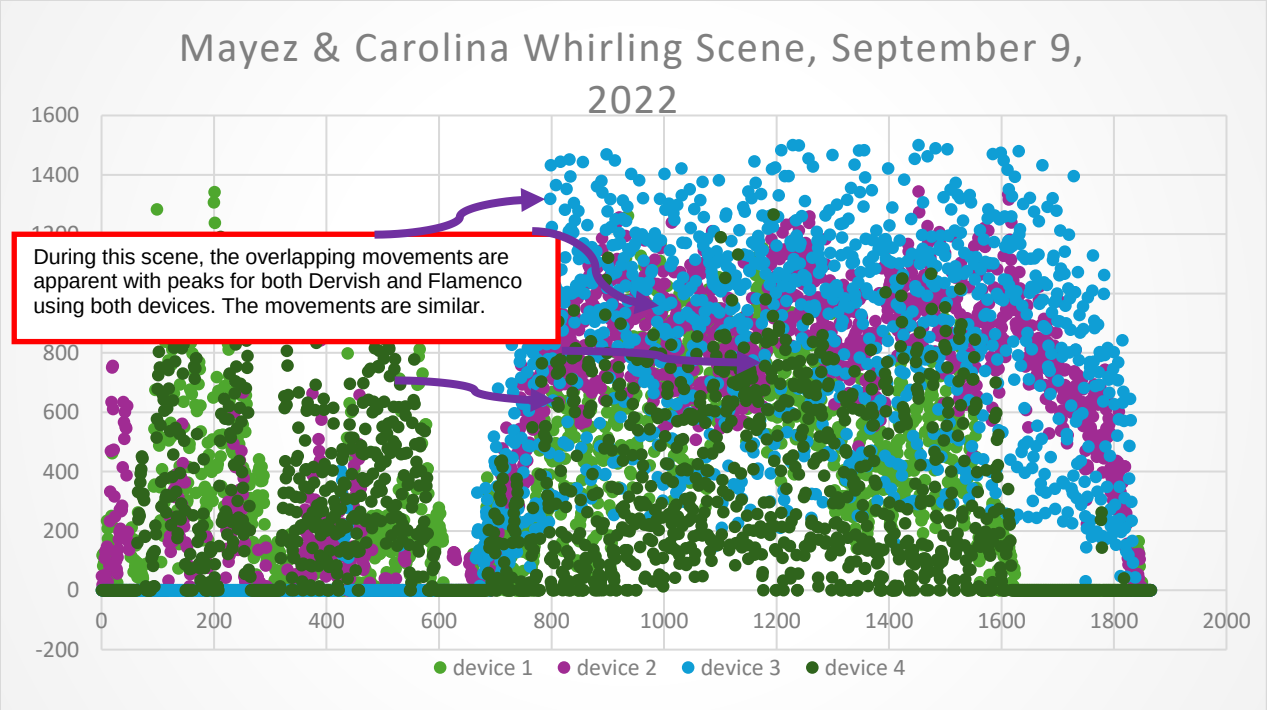


Figure 6.22: Mayez and Carolina in final whirling scene, September 9, 2022 (Hurban, 2023)

6.4 *Digital Dervish + Flamenco Sonic: Dream Chamber*, Theatre of Digital Art, Dubai, United Arab Emirates, December 16th, and 17th, 2022
Venue: Theatre of Digital Arts (ToDA) Dubai, UAE.

After several meetings and discussions with the programming team at the Theatre of Digital Art in Dubai (ToDA)[49], United Arab Emirates who invited this project to be shown in December of 2022, it was decided that the length of the program (only showing *DDFS*) was too short for paying audiences. ToDA is an incredible performing arts space in Dubai located in Souk Madinat in Jumeriah and boasts 12 massive screens with a reflective floor space. The space in the theatre is substantial with a large stage area and screens

[49] https://www.toda.ae/en/

on all sides and overhead. This creates a feeling of immersion as the films that are shown there are projected surrounding the audience and performers. The films that were projected for *DDFS* were a different format than for the previous shows at the Dome and Market Hall. Therefore, a second composition and a second film were produced which would be a prelude to *DDFS*. Sercan would play in two parts of the performance: the first part, *Digital Dervish* danced as a solo performance and the second part was danced with another Flamenco dancer, Pepa Sanz.

The first part of the show for ToDA is a 20-minute composition featuring a solo performance by Sercan Çelik who takes on the role of Digital Dervish from Mayez Rahman at ToDA. This part of the performance had some developments shortly after the May performances and was finalized by August of 2022. The narrative is a prelude to the second part featuring the Flamenco dancer as well and comes together as a whole production. This narrative follows the concept back to the original *Dervish Sound Dress* but is fully developed using the music and the Soundrop as well as the film as the driving forces for a full 15 minutes of continuous whirling by Sercan. This section threads a coherent continuum to the second part of the performance where the character is the same, but more meditative whereas in the first part he is adrift, troubled and unsettled. The following analyses Sercan's solo performance while investigating how he uses the Soundrop in the first part of the performance. The subsequent analysis observes his role in the second part of the performance as well as Pepa Sanz's dance against the audio of the composition and choreography.

Digital Dervish (Part 1, solo)– Sercan Çelik

Sercan (Figure 6.23) interpreted Part 1 as a meditation on the self - a discovering of the inner emotions and deep wanderings of the subconscious. His character for this part of the performance was darker, agitated and very emotional. The prelude was designed as a dream or a memory to Part 2 where he encounters the Flamenco character, and throughout the accompanying film, remnants of that vision or dream exist around him, such as Mevlevi Whirling Dervishes, the destruction of a mosque, Flamenco dancers

appear and disappear, and a younger version of himself (portrayed by Mayez in the film) circles as the beat of the rhythm becomes more intense as does Sercan's whirling. At first, he is waking up or awakening within a dream to chaos and uncertainty for which he has no other solution but to whirl. Sercan uses the momentum of his whirling which begins roughly five minutes into the 20-minute performance to activate his Soundrop devices which are both placed on the wrists. In rehearsals, Sercan insisted that he wanted to be able to control his sounds with his arms because it is the key hallmark of his whirling practice. His arm and torso movements are not static compared to Mayez's in that his upper body including his arms and head are active and animated and are constantly pulling the ambience of his surroundings down onto himself as if he were at one with the visuals. This interaction gives the overall perception of bodily awareness and total immersion with his setting. The Soundrops are programmed to chords that are part of the musical composition but are arpeggiated and exaggerated. As he turns, the sounds loop continuously which reinforces the momentum of his whirling. As he winds down, the sounds are softer and decreasing in volume. As the music changes, he turns the Soundrops off at which time different sounds are uploaded to reflect a change in key or tone of the music. In the first part of the piece, Sercan is whirling with intense velocity until the second section where the Mevlana poem (discussed in Chapter 5) is recited and repeated endlessly reflecting the endless turns of a Dervish. At this point, the melody changes to denote a more positive ambience and Sercan begins to remove a layer of his costume which unveils a white *tennure* underneath (Figure 6.25).

This removal of a layer of his costume symbolizes the burden he removes from himself and remembers his journey which goes from feelings of ambivalence to serenity in Part 2. This moment in the performance was dramatic and climactic - while also unexpected - since it is an interpretation of Dervish whirling which may be uncommon among the Mevlevi orders but could be a literal representation of the abandonment of the self to the Divine creator. Following this, Sercan fades into black as he continues to turn and the second part with the Flamenco dancer begins.



Figure 6.23: Sercan Çelik as *Digital Dervish* in Part 1, Theatre of Digital Art, Dubai, UAE. December 16, 2022 (image from Charminar Films, 2022)

The data in Figure 6.24 illustrates an insight into Sercan's whirling. This section is approximately 15 minutes in length of continuous whirling (the data represents approximately 3 minutes of this). The oscillations of upward downwards motions here are more apparent compared to Mayez's as it represents changes of pace as he is turning around but also shows that there is no clustering because his movement is in constant motion which is why there is a greater variation. The rate of change from the devices is higher as he is turning and moving his arms up and down. Having used both devices on his wrists, there is no conclusive data for his foot movements. However, when compared to the data flow of his performance in Part 2, the movement is much more exaggerated and animated. This 'invisibly visible' evidence discloses a few points about Sercan's contemporary style of whirling and the whirling he does in the tradition of the Mevlevi Dervishes: he uses his hands as his main instruments which are further extended through the use of the Soundrop which is continuously emitting sounds as he whirls - the sounds increase and decrease in a more dramatic way as he uses his arms with deeper vigorous gestures. As he whirls in Part 2, the data is similar but much more linear and with far

fewer fluctuations. This captures a particular essence of how traditional whirling is performed compared to more stylistic and contemporary versions.

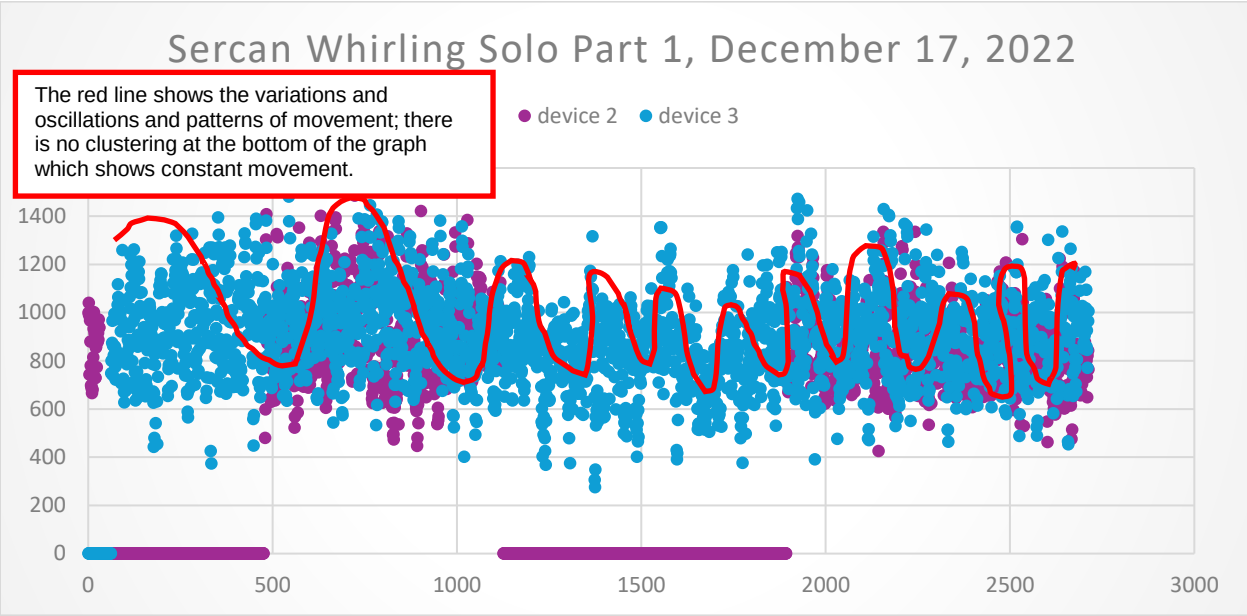
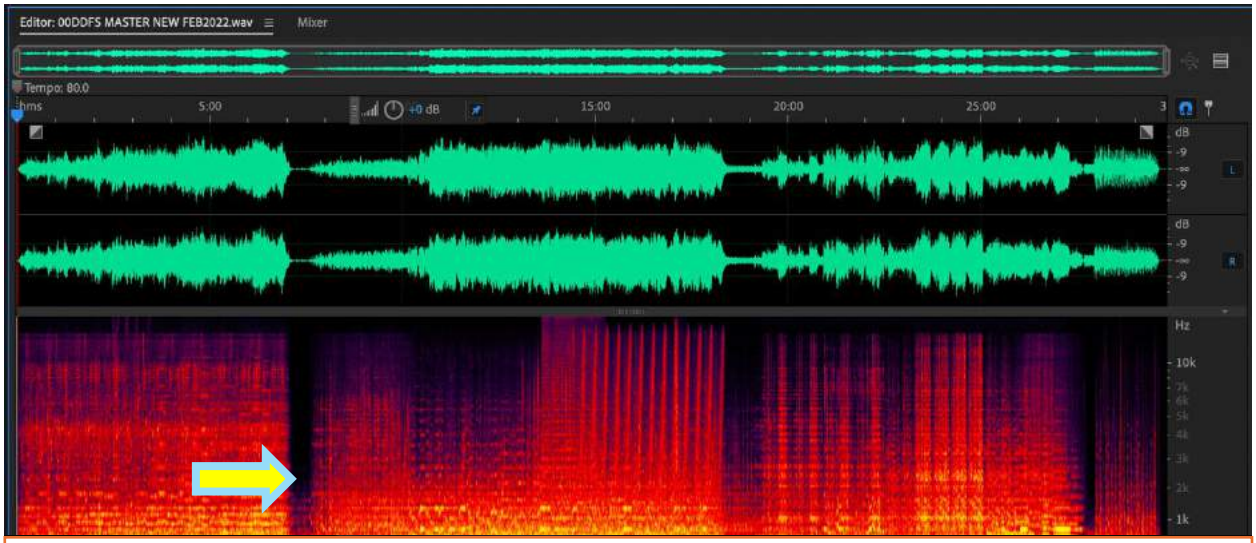


Figure 6.24: Data from Part 1 of Sercan whirling solo, December 17, 2022 (Hurban, 2023)


Figure 6.25: Sercan Çelik as *Digital Dervish* in Part 1, Theatre of Digital Art, Dubai, UAE. (image from Charminar Films, 2022)

Digital Dervish (Part 2)– Sercan Çelik

Sercan's role as *Digital Dervish* for the second part of DDFS proved to be quite different from Mayez's interpretation. The choreography began as Mayez's but evolved into more contemplative and serene movements. His costume has changed as he donned the traditional *sikke* and full white *tennure* in Classic Mevlevi *semazen* style (Figure 6.26).



Sercan using Soundrop in this section which is at 07:05. The section is 38 seconds in length

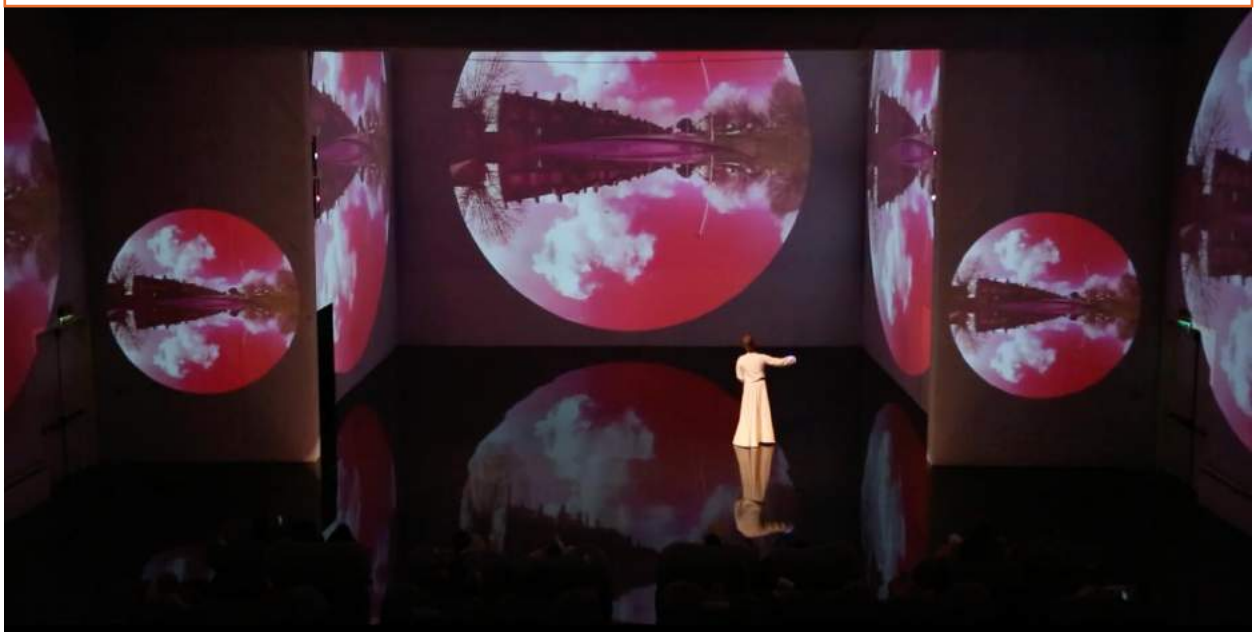


Figure 6.26: Opening scene, at ToDA, Dubai, December 16, 2022 (image from Charminar Films, 2022)

Sercan's demeanor was subdued, sleepy and less affected than in Part 1. He subtly sways to the sounds of birds as he begins to awaken again from a dream, into another dream perhaps, and he is more introspective than his previous version of himself. Sercan takes more time to articulate the music in his movements and this sense of tension building resumes as the audience wonders what he will do next. However, the tension is not as impassioned as it was in Part 1 - in fact, he is slowly, languidly performing *sema* around the perimeter of the stage where, this time, the circle on which the film is projected and repeated several times, is at the center and reflected on both sides and above him on the stage. Figure 6.27 shows Sercan at 07:12 minutes into the performance where he is using the Soundrop on his wrist (device 2). The moment in time correlates to the choreography and the quiet ambient section of the scene where there is little to no melody, allowing a chance to activate the Soundrop and being using it to create his own sounds.

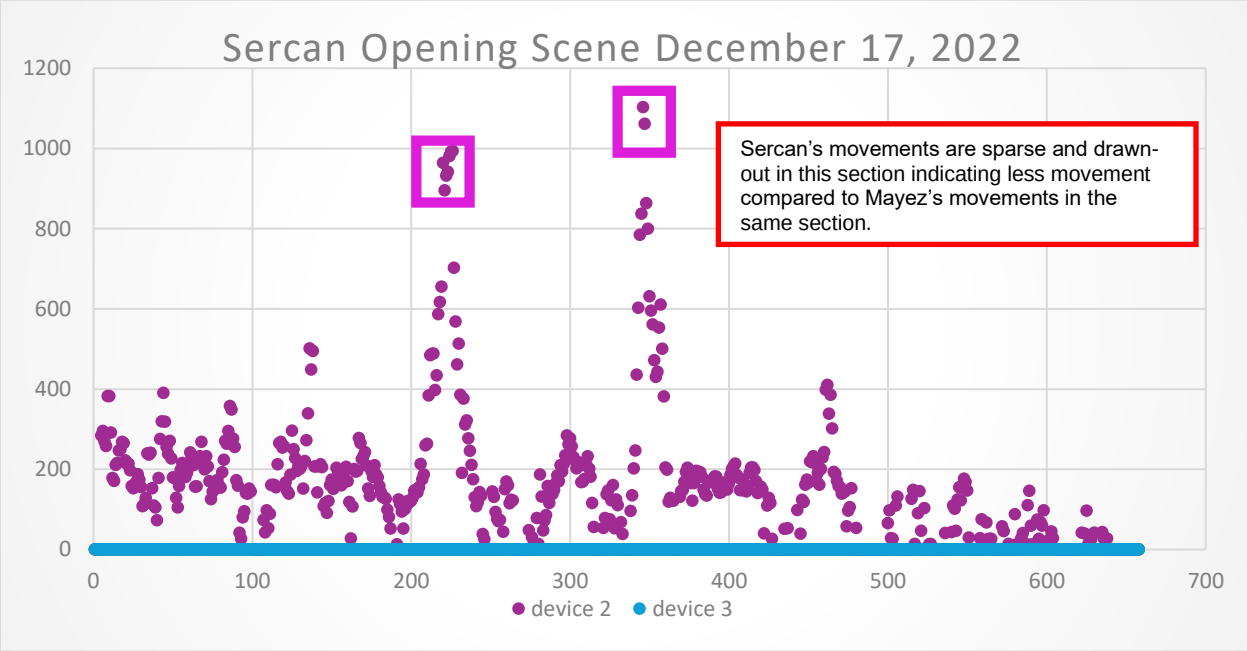


Figure 6.27: Sercan in opening scene using Soundrop, December 17, 2022 (Hurban, 2023)

When compared to Mayez's data in the same sequence within the scene, Sercan's movements are more subdued but also fragmented. The peak moments are indicated with purple squares on the graph, and they illustrated that the movement is much less

and more distributed over time. Mayez's movements are more abrupt and mechanical. This data shows that each performer interpreted the movements in slightly different ways, but the essence of the choreography is still present. As the piece continues, Sercan begins to turn slightly earlier than Mayez but with full momentum. Mayez's turning was less stationary than Sercan as his movements were not fully centered in the same spot - he would whirl while moving back and forth hurling his costume around the floor space while Sercan remained in one place repeatedly placing one foot in front of the other with ease and precision. His movement was more meditative than Part 1 and was more consistent with classical Dervish whirling, with one arm turned upwards and the other pointed downwards. His Soundrop devices were placed on both wrists and the sounds were interchanged during the performance according to the change in music. He whirled under the hurricane in Figure 6.28 with both arms in the air until he 'crashes' down and becomes dormant again which is where the Flamenco dancer (Pepa Sanz) appears.



Figure 6.28: Sercan Çelik in 'hurricane' scene, Theatre of Digital Art, Dubai, UAE. December 17, 2022 (image from Charminar Films, 2022)

As previously mentioned, the whirling data (Figure 6.29) shows the consistent patterns that Sercan creates in this scene similar to his solo performance in Part 1. These patterns

are reminiscent with how Sercan holds his arms in the same position with little variation for approximately 10 minutes. The range of the data is much lower than Sercan's solo data since he is not moving his hands - beforehand, there was a much bigger distribution and difference between the minimum and maximum than in this section as the hands are still. There are slight variations in the speed of rotation as opposed to where the arms were much more animated in Part 1.

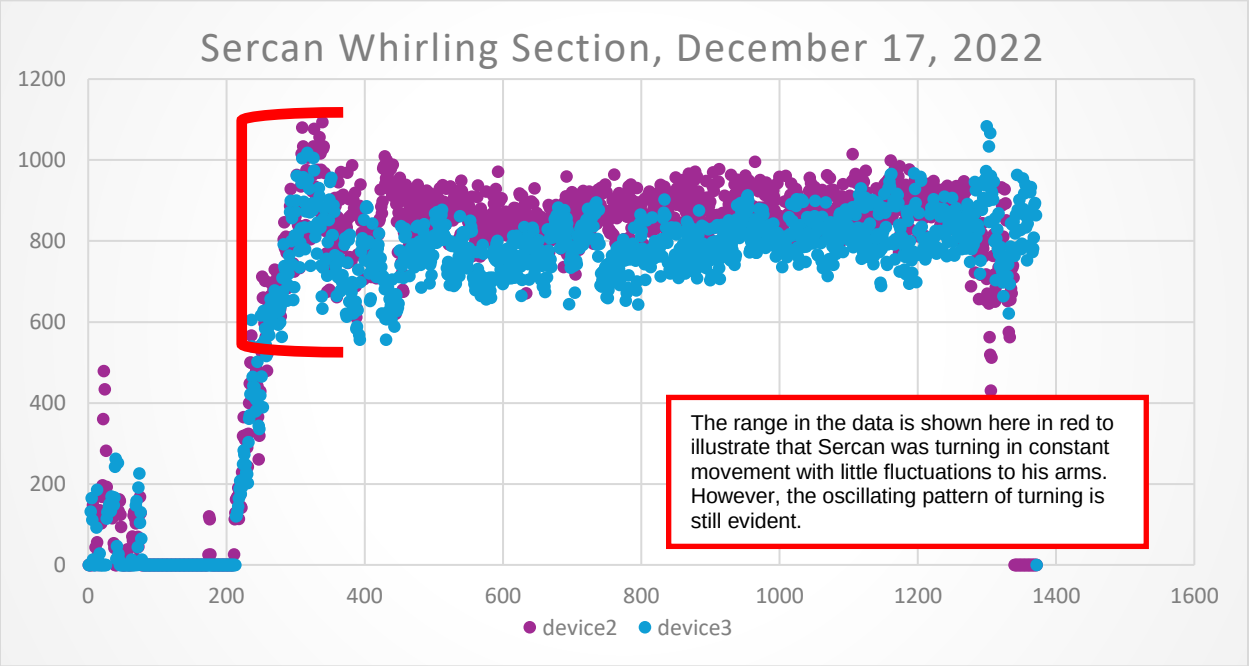


Figure 6.29: Whirling scene with Sercan, December 17, 2022 (Hurban, 2023)

Flamenco Sonic (Part 2) - Pepa Sanz

Pepa Sanz's entrance to the stage is gradual, but not as composed or as literal as Mercedes or as inconspicuous as Carolina. She immediately gravitates towards Sercan who is on the floor in the 'dormant' position, and her intention is to create her own space while moderately approaching Sercan in incremental steps. All three dancers use *mantón* or shawl as part of their costume which is also used as an extension of their body movements and often mirrors what their bodies are conveying. In Pepa's dance, the *mantón* envelopes the space while also emphasizing her turns, which is seen towards the end of the performance where she turns in unison with Sercan. In Figure 6.30 she initiates

her Soundrop to which the castanet sounds are uploaded, and her movements are a new variation compared to how the other Flamenco dancers use them. Her wrist twirls and rotations are more vibrant and rapid.



Figure 6.30: Pepa using Soundrop on wrist Theatre of Digital Art, Dubai, UAE. December 17, 2022 (image from Charminar Films, 2022)

As a performer, Pepa's dance style and quality is multifaceted and although she is quite small in stature, she commands power and agility onstage. Her interpretation of the piece brought a rhythmic accentuation of the guitar piece in the Flamenco solo section as she adds syncopated beats with her foot movements to the composition. Her foot device was not turned on for the entirety of the performance, rather she used it sparingly and preferred to emphasize her movements and arm/wrist gestures with the wrist device. Towards the end of her solo however, she initiates the ankle Soundrop which highlights the first beat of each bar (the score is in 4/4 time). In an interview with Pepa after the first show she recounts how the device made her feel more connected to what she was doing, and that this awareness was new for her as she was in control of emphasizing her actions in a way she hadn't experimented with before. She mentions that using the Soundrop helps her to integrate with all aspects of the performance rather than just on one level or layer. She feels that using a digital musical body instrument can contribute to dancers'

movements overall as it is another component and dimension that can be used for creativity and expression. Her data is also a variation of how both Mercedes and Carolina used the Soundrop on both their wrists and ankles. Figure 6.31 demonstrates the alternating patterns she uses in the first scene as she enters the stage and encounters the Dervish (light green for wrist and dark green for foot).

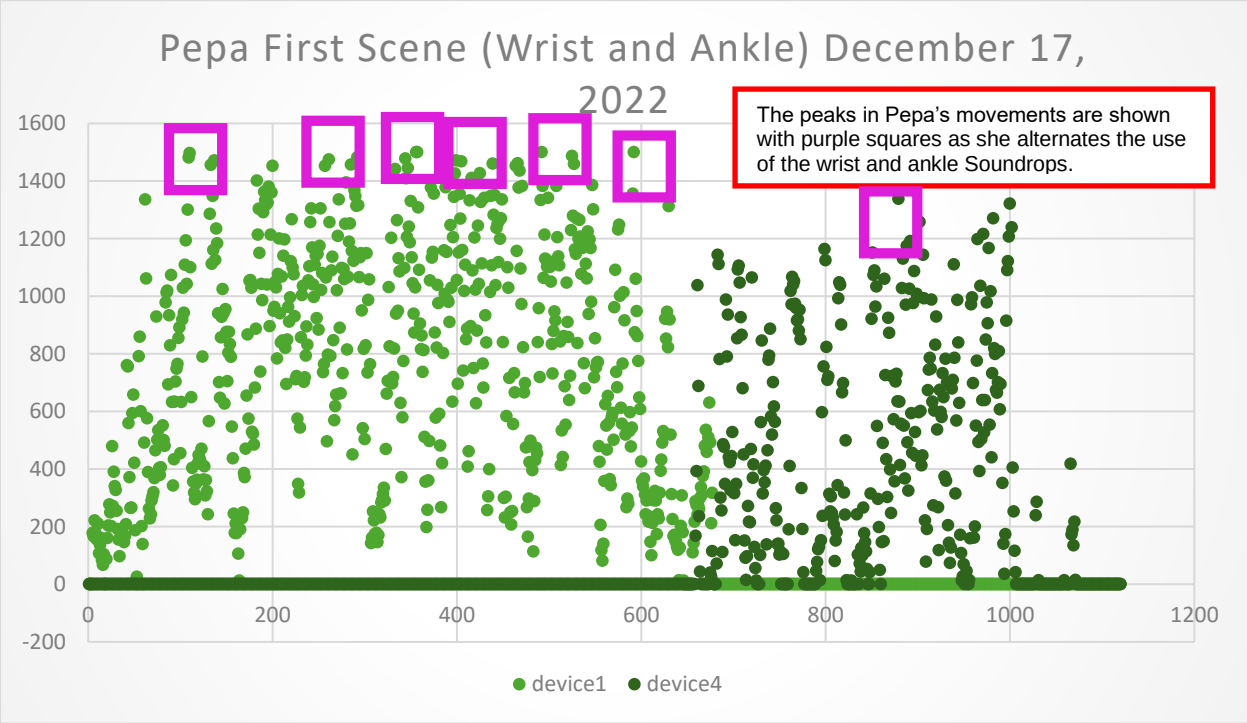


Figure 6.31: Pepa in first scene using wrist and ankle Soundrop, December 17, 2022 (Hurban, 2023)

Towards the end of the performance where the Dervish awakens to see the Flamenco dancer beckoning him to rise, the channel created between the two dancers is evident. The relationship between Sercan and Pepa exhibits a natural chemistry that is evident onstage. They understand each other, respect each other, and acknowledge each other's dance form while combing them with their own assigned sounds and similar movements. The union is complete as they bow and begin to whirl (Figure 6.32). In this final scene (Figure 6.33) as Sercan and Pepa whirl together before Flamenco Sonic closes the show in a brief two-and-a-half-minute dance, their Soundrops are turned on as they whirl. Pepa also uses her *mantón* to give prominence to her turning while also mirroring the spinning *tennure* of Sercan.



Figure 6.32: Sercan and Pepa bow to each other, Theatre of Digital Art, Dubai, UAE. December 17, 2022 (image from Charminar Films, 2022)

Sercan and Pepa's data reveal that Sercan's whirling is consistent with his solo whirling movements and that Pepa's turning reflects Sercan's movements in a similar sequence (Figure 6.34). The data for the Dervish performers (both Mayez and Sercan) have a similar sequence as well in that the movements consistently overlap with each other while the Flamenco performers in the final whirling scene also have a comparable order to them. These patterns reveal some interesting insight into how the performers responded to their Soundrop devices in terms of using them as an extension of their bodies with which to create sounds with, and also demonstrating that the data captured from the movements uncover how the unseen elements are being used in a virtual, digital realm that is otherwise lost. Having digitized these movements, theses nuances and improvisations become identified and unveiled.



Figure 6.33: Sercan and Pepa whirl together, Theatre of Digital Art, Dubai, UAE. December 17, 2022 (image from Charminar Films, 2022)

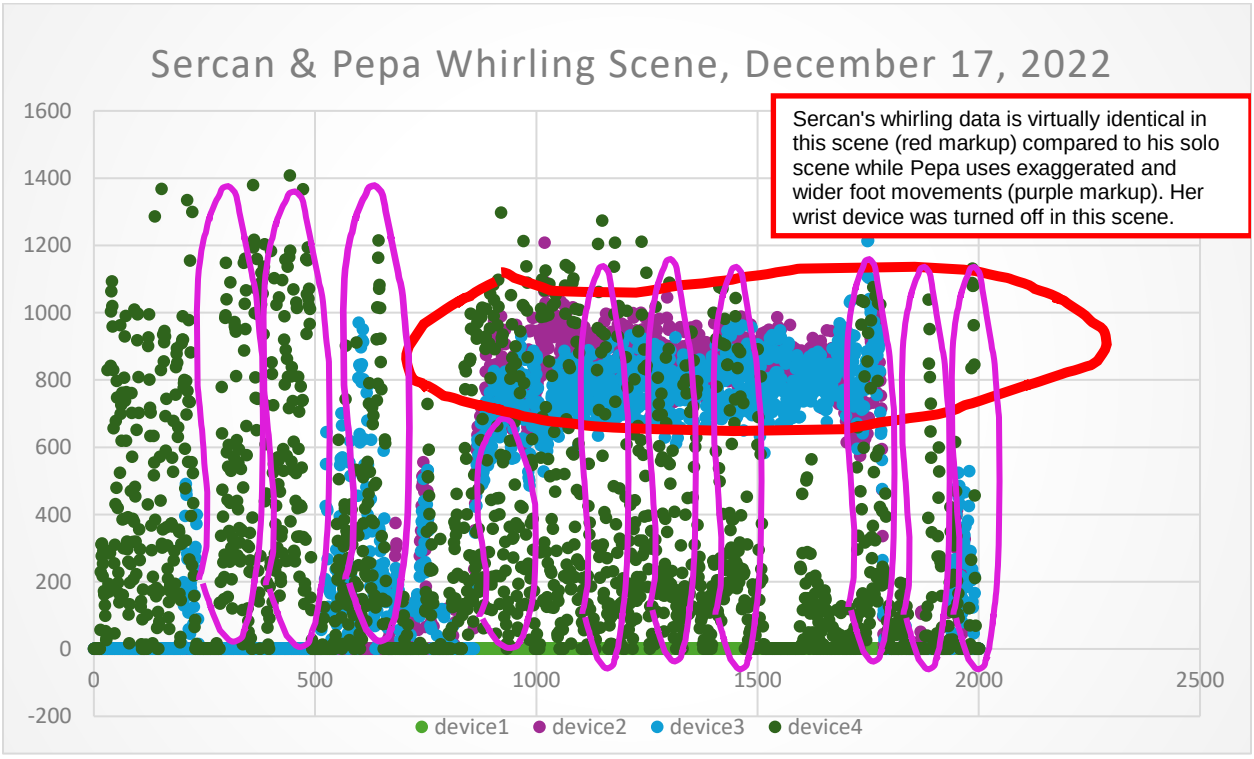


Figure 6.34: Sercan and Pepa in final scene, December 17, 2022 (Hurban, 2023)

6.5 *Digital Dervish + Flamenco Sonic*; augmenting traditional dance with wearable technology

The performances of *Digital Dervish + Flamenco Sonic* across the UK, Canada, and the UAE. were largely successful on many levels. When producing the shows, there was to be only two performers whereas in the end, all together five different dancers performed in the shows from all parts of the globe with different modes and styles or interpretations of their dance forms. The one constant was that using the Soundrop affected the outcome of their body movements, since they were given another layer or tool to work with as they were dancing, which further emphasized their improvisations and their most significant and/or symbolic gestures. These gestures or movements varied from performer to performer. As the choreography was set to include climatic moments of when the Soundrop should be used in accordance with the musical composition to give the audience a sense that this electronic mechanism was performing a function, the performers also embodied the use of the device to express other meaningful moments in their dance. To be able to incorporate a digital body instrument into a dance form that has seemingly remained unchanged or altered for centuries brings a new contemporary revitalization that can serve to form new insights on these traditions. An audience member cannot know what a dancer feels innately as they are expressing their movements with emotion, passion or devotion. However, this insight by using a digital body instrument can be a more profound experience for not only the audience, who can share in a deeper understanding of expression of the performer, but the performers themselves contribute to emphasizing their gestures with amplified sounds and subtle electronic visuals.

As an overall comparison between all of the performers using the Soundrop during the performances of *Digital Dervish + Flamenco Sonic,* the recorded data of movements presents variations that are consistent with each performers' style and interpretation of the choreography. Mayez's performance was more calculated and exact in the first two performances and freer flowing in the second set of performances. After acclimatizing with the Soundrop, Mayez understood that his motions had a cause and effect; the sound that he emitted from the Soundrop played a role in the piece as a secondary character that was a part of him, or an extension of him. He used this extension to highlight and

bring to the attention of the audience that there was in fact a piece of technology that he was using to create these sounds and that no two movements he made were the same. The effect of him manipulating the Soundrop resulted in adding a new layer of sound to the musical score. During the performances in Canada, Mayez made better use of the Soundrop by veering slightly from the choreographed moments and adding his own emphasis on movements that he felt were pivotal to express to the audience. He would initiate his ankle Soundrop towards the end of the performance as he begins to turn with Mercedes which further emphasizes his movements as the device lights up underneath his *tennure* and emits continuous looping sounds. During the hurricane section, Mayez uses both devices as well (wrist and ankle) to amplify his whirling. In his experience, he remarked that it made him feel as though he was in control of something, not just the dance and that this 'thing' helped propel him further into his whirling.

Mercedes controlled her Soundrop devices by using them as actual musical instruments. She interpreted the choreography to which she added her own style and technique, as a channel through which the Soundrop could convey her gestures. When initially rehearsing with the Soundrop, Mercedes was able to formulate a cohesive order to her dance and was conscious of implementing the Soundrop into her dance. During the two performances, she was keen to showcase the electronic attachment on her wrist and ankle to the audience in a way, displaying the fact that she had somehow become a 'futuristic' Flamenco dancer or a hybrid version of her organic self alongside a flashing, vibrating, sound-emitting apparatus. Her feedback after the performances were also valuable in that she commented that by using the Soundrop, she became more aware of her movements - more aware of the cause and effect, whereas without it, her movements or gestures become forgotten or disappear without leaving a trace behind her. In the data that followed her movements, it is evident that her usage of the Soundrop was literal in the sections of the piece that were meant to either introduce the device in ambient moments of silence or to emphasize climatic surges in other sections. Particular highlights from Mercedes' performance were using different *palos* or Flamenco styles that were adapted to the music to which she accommodated the use of the Soundrop. Towards the end of the performance, she accentuates the use of her ankle device by using *zapateado*

to stamp out every fourth beat which is further stressed with sounds emitted from the Soundrop. In the finale section where Mayez and Mercedes whirl together, both his and her devices are turned on and loop continuously, which aids in building the momentum between the two performers where the sounds merge and morph, creating a coalescence of sound, dance and spinning euphoria.

Mayez and Carolina's performances in Canada were again quite different to the UK performances. The venue was smaller, more intimate, and the set design was completely different. The performers had to adapt to the space and to create a mood that reflected the visuals and the music. As previously mentioned, Mayez's use of the Soundrop was more distinct and precise, but also more fluid. He was able to grasp a sense of ownership of the device which was the goal of this project from its very inception. The performers were all briefed on how to use the Soundrop well in advance in terms of its capability, functionality, and how it is meant to be used for this particular performance. However, there was even greater direction on using the device as they felt necessary, so as not to 'overuse' it and to employ it as they saw fit during their dance. The overall point of this research inquiry has been to deliver an external tool to a Dervish and a Flamenco dancer to determine how their actions are annunciated with a digital musical body instrument. Therefore, the improvisational and spontaneous handling of the device was imperative for evidencing the fact that a digital musical body instrument can in fact be used to augment traditional dance practices but can also be used in new explorations of contemporary dance forms. Carolina embodies this notion of how bodily gestures can be sonified with movement. While rehearsing with the Soundrop in March of 2022, Carolina made some interesting remarks and suggestions as to how she could incorporate a wearable device into her Flamenco dance. According to her, the arrangements of a classical Flamenco performance must include a live musician to preserve the traditional heritage of the practice. However, after trialing the Soundrop, it became clear to her that her sonic contribution to a performance could convey something more meaningful about her movements to herself and to viewing audiences that could not be amplified previously. Her role as Flamenco Sonic differed from Mercedes in that she was calculated, but also conscious about telling a story with the Soundrop and creating a deeper connection with

Mayez. The difference between Mayez and Mercedes may have been attributed to the sheer size of the performing space at the Dome in the UK, but the difference between Mercedes and Carolina was that Mercedes separated her role as Flamenco Sonic from Mayez, whereas Carolina used her role to correlate to Mayez on an expanded level. Carolina used her Soundrop devices sparingly and as a result, her data was less animated than that of Mercedes'. The castanet sounds of the wrist Soundrop were delivered with grace and elegance, as it seemed as though the electronic sounds were coming straight from this electronic accessory on her arm. She used her ankle Soundrop towards the end of the show to emphasize beats which illuminated under her skirt as she moved giving the audience a glimpse of a piece of technology on her leg. She truly absorbed the Soundrop as a part of her body which she controlled according to how she felt and how she wanted to communicate her sounds to Mayez and to the audience.

Following these performances, the Dubai shows were equally successful and also very different from the other shows. To begin with, the Dervish who was played by Sercan, who is much older than Mayez, a professional performance artist/dancer/Dervish who is more nuanced with his movements and style of dance. For Part 1 of the performance, Sercan's character was darker, brooding and contemplative as he embraced the idea of struggling with his own obstacles and how to overcome them. During his performances, the sounds emitted by the Soundrop were interchanged as the keys in the musical score changed resulting in a more varied selection of sounds as opposed to using just one continuous sound. Sercan preferred to use the devices on his wrists as the gestures from his arms were more animated than the lower half of his body. He wanted to use them interchangeably so that one sound would come after the other, emphasizing the upswings and turns of his arms/wrists as he was whirling. The recorded data shows that although Sercan was turning for roughly 15 minutes in Part 1, he would use the Soundrops towards the end more so than in the beginning of the performance, which added to the resounding momentum of the echoing arpeggios of the musical score which repeated endlessly. This part of *Digital Dervish + Flamenco Sonic* was powerful, expressive, mesmerizing and exhaustive to watch. As Sercan prepared for the second part which includes Flamenco Sonic, his character becomes more subdued and meditative. In comparison to Mayez,

Sercan also acts out his character even more, giving facial expressions and taking longer between movements by drawing them out - building tension, curiosity and intensity.

Sercan's interpretation of this part of *Digital Dervish + Flamenco Sonic* sees him drift for a while, mirroring actions and movements of Mevlevi Dervishes preparing to whirl in a *sema*, and then suddenly, effortlessly, his whirling begins. During the 'hurricane scene' where the intensity of the whirling is reflected by the intensity of the music and a visual representation of a whirling tornadic hurricane overhead and on either side of him, Sercan use the Soundrops on his wrist to emphasize this momentum. He gently moves his arms up and down, pointing them towards the heavens and remaining in a static whirling state before winding down and becoming 'dormant'. As Pepa enters the stage she reveals her Soundrop and uses it with clarity and ease during all key sections where the musical composition comes to a decrescendo, allowing Pepa to introduce and use her device. Her initial reaction to the Soundrop was that it is playful, unique and a possible tool to use in her performance. Pepa's background as mentioned previously, is centered upon a more avant-garde style of Flamenco which comes across in her performance. Her movements are swifter and dynamic and are further accentuated with the Soundrop. Compared to Mercedes and Carolina, her use of the Soundrop was also intuitive as she embodied the device as an external part of her body. Her data reflects that her use of the Soundrop was less than that of the other two Flamenco dancers, but it was used in key moments of the performance, such as in moments when she attempts to 'awaken' the Dervish or towards the end as she finishes the performance and gently walks off the stage flicking her wrist with the castanets Soundrop sounds as she fades into black.

Ultimately, the outcomes of this research have shown that each performer used the Soundrop in varying ways while also adhering to the choreography of the performance. The goal was to apply the Soundrop to the performers' bodies – specifically areas that resulted in a high concentration of movement such as the wrist and feet - to augment certain moments with particular sounds that highlighted these movements. In essence, the augmenting of their dance came in the form of modifying their existing dance movements using the Soundrop while also integrating the Soundrop into their costumes

and onto their bodies by seamlessly blending their dance traditions with a digital musical body instrument. The cultural implications for using a piece of technology to enhance a significantly historical tradition has not meant to deter from the cultural authenticity but to draw attention to and accentuate critical moments in the dance of Flamenco or Dervish whirling which harmoniously reminds the audience as well as the dancers that these moments are essential elements of the movements and of the meaningful, symbolic and compelling. This is done by using electronically modified sounds of instruments that belong specifically to each tradition that are emitted via the Soundrop when the Dervish raises his hands towards the heavens emphasizing the magnitude of his expression in that moment, or as the Flamenco dancer uses her digitized castanet sounds on her wrists to entice further curiosity about her hand and wrist movements.

Overall, the performers in *Digital Dervish + Flamenco Sonic* were able to incorporate and employ the use of a digital wearable musical body instrument, the Soundrop, without interfering with their movement, style or altering their practice. Essentially, the Soundrop provided a layer onto which the performers were able to build a language with the Soundrop that was communicated with their stage partners. This language was revealed through opposing sounds; the sound of digital castanets or digitized electronic *tambur*, facilitated the morphing of these two dance forms in a hybridized performance that was immersive, interactive, playful and poignant. The interviews with the performers which are outlined in Appendix III give an insight into how their experiences using the Soundrop changed how they view their own performance styles, and how integrating wearable technology could have a positive impact on their future work.

An anecdote from the May 6, 2022, performance at the Market Hall Dome Plymouth, UK post-show Q&A period where audience members asked the cast and crew questions:

Audience member (to Mayez): “How do you get your skirt to go up there like that?”
Mayez: “I spin…”

Chapter Summary

By analyzing the details of these performances, it is distinctly evident that by using the Soundrop, performers playing the roles of *Digital Dervish* and *Flamenco Sonic* can augment their dance movements and gestures in interpretative, improvised ways that highlight their bodily expression, emotion and meaningful choreographed moments in the performance of *Digital Dervish + Flamenco Sonic*. The culmination of this research reaches its pinnacle here and demonstrates that through the use of a digital musical body instrument between two distinct and contrasting performance traditions can be augmented by attributing sounds to movements and gestures digitally forming new expressions of dance with digital art. This analysis confirms that through the collection of data from the movements of the Dervish and Flamenco dancers, the patterns overlap and become synchronized. These observations soundly establish the links between the two using data from the Soundrop and visual recordings of the dancers which are consolidated through the sound composition, choreography and motion picture.

Chapter 7
Conclusions

Souls that are bound in bodies made of clay
Feel ecstasy when they can fly away,
They dance to songs of passionate, sacred love,
Expanding like the full moon high above,
Dancing inside as well as outwardly,
Whirling around their souls which we can't see

-Jalâluddîn Rumi, Masnavi Book 1, verse 1350

7. Summary

This work has focused on developing a robust link and connection between the sacred turning ritual of the Mevlevi Dervishes of Türkiye and Spanish Andalucían Flamenco with the use of a digital musical body instrument that augments the movements and gestures of these two practices in a performance piece. The research questions and aims are compared to those stated in Chapter 1. The outcomes of the research are also stated with points raised about how the overall practice was conducted, analyzed and presented. The main output for this work has been a series of performances that were showcased in three different countries featuring five different performers from Canada, Türkiye, Chile and Spain. This chapter concludes the concepts that were set forth and which have followed through to this culmination of outcomes.

7.1 Research Questions and Aims

What are the similarities or links between the practices of Dervish whirling and Flamenco dance through the respective cultural heritages that can be explored

using sound/music and technology? How then can these amplified elements be used to establish a new hybrid form of performance practice?

Although from a distance the practices of the Whirling Dervishes of Turkey and Spanish Andalucían Flamenco seem opposite and contradictory in a comparison, through a closer lens it is evident that, by investigating the geographical, historical and cultural heritages that are prevalent with both, significant links are made. These links also include music and sound as a way of communicating these connections through which the Soundrop - a digital musical body instrument - aids in highlighting them. The performance that developed through creating a narrative evolved organically from the research associated with these practices. The result has been formulating a new work that reflects these traditions by using digital art to emphasize them in a unique and innovative way.

What specific meaningful movements/gestures of a Dervish and Flamenco dancer can be augmented and captured using a digital wearable musical body instrument?

Throughout this work, the aim has been to develop an understanding of the various symbolic, mechanical, biological and fundamental movements and gestures that are the essence of how a Dervish whirls and how a Flamenco dancer performs. A Dervish uses gestures to connect to the Divine Creator by using their arms as channels through which they emanate their passion and love for the Sacred. These symbolic actions propel the Dervish into a state of euphoric whirling that translates into how they discover these connections. It is impossible to detect this in a literal sense, however these specific movements can be highlighted with wearable technology that can attribute sound to these movements. A Flamenco dancer also has an incredible vocabulary of gestures and movements that can be captured with a digital device which highlights these invisible moments. These moments can also be further digitized as a way of preserving or archiving them as the dance ends, where the evidence that it ever happened tends to disappear.

What tools and sensor systems are needed to create wearable body instrument devices that are safe for wear close to the body for a wearer in performance settings such as theatre, opera and dance?

After significant testing and iterating with different prototypes, it was found that creating a stand-alone detachable device would be the most suitable option for creating a digital musical body instrument rather than embedding sensors into fabrics and garments. These findings are described in detail in Chapter 5.

7.2 Research outcomes

The research aims described in 1.2 relate to how the research questions were explored. These outcomes have been addressed in the following ways:

<u>To create a digital musical body instrument device that is interactive and immersive which emits musical sounds</u>

The Soundrop was developed as a detachable digital musical body instrument that tracks the velocity of movement to which sound samples are mapped. The design and development are discussed at length in Chapter 5. The inspirations for developing this device come from several different threads of research as described in Chapter 2 where wearable technology and its developments over the centuries is discussed, as well as new developments in digital musical instruments (DMIs) which have contributed to the current climate of using wearable technology and gestural controllers to create digital sounds. Chapter 3 also observes how through historical references of connecting electronics to the body for the purpose of making sound and sound art with costumes, performances, musical and theatre, digital musical instruments can also be used to augment traditional dance practices such as the Whirling Dervishes of Turkey and Spanish Flamenco. Dance is an area in which wearable technology continues to explore new ground in integrating systems with the moving organic body.

To create a contemporary, experimental performance piece that examines links both in terms of sound and movement between the Mevlevi Dervish 'turning' ritual of the *sema* and traditional Spanish Flamenco dance practices using a digital musical body instrument

A great deal of research went into examining the histories of the Whirling Dervishes of Turkey/Türkiye and the Flamenco Dance of Andalucían Spain to uncover how two unaltered traditional forms of dance have a relationship to one another through music, body movement and the geographical nomadic trails of the Romani Gypsies/Gitanos. The bulk of this research into the historical background resides in Chapter 4 which serves to inform the overall context in which the Dervish and Flamenco are placed. There is evidence that the origins of Flamenco are deeply rooted in an amalgamation of traditions through the wanderings of Gypsies over the centuries with specific ties to the rule of the Andalucían Moors. This propelled a story between the two traditions that augment or revitalize the practices with a digital musical instrument. Both of these practices are then connected through similar musical traditions, styles and metaphysical/spiritual/expressive modes as described in Chapter 4. The costumes of both a Dervish and Flamenco dancer also act as an extension of their bodies in performance as the goal is to further emphasize these layers with a digital musical body instrument - the Soundrop. A new performance work has been created and showcased in the United Kingdom, Canada and the United Arab Emirates entitled *Digital Dervish + Flamenco Sonic* where five different performers danced to the backdrop of a 360 animated/experimental film using the Soundrop to emphasize their signature gestures and movements. The musical composition/score also refers to the links between Dervish and Flamenco through the music, poetry, similar musical modes, chords and tempo. The performance is described in greater detail in Chapter 6.

To evaluate and analyze recorded digital data that reveals information about how a Dervish and a Flamenco dancer move

During the performances of *Digital Dervish + Flamenco Sonic,* recordings of the data flow from the Soundrop were made in an effort to understand through a different lens or

dimension what the outcome of the performers' actions represented and what this conveys about how or why the performers move in a particular way which are discussed in Chapter 6. This invisible dimension reveals that patterns are made by the movements and gestures of both the Dervish and Flamenco dancer which are also reflected in how they interpretated the use of the Soundrop. All performers remarked that using the Soundrop contributed a different facet to their way of performing, and that having some control over the outcome of their actions by attributing sound to them was interesting, playful, explorative and effective. These findings have led to the conclusion that building a device that can record movements has been instrumental in demonstrating the links between the Dervish and Flamenco performers while also revealing a new component to analyzing data from the movements of dancers. The data shows consistent patterns between all the performers as certain sections are highlighted in the performance where they make interesting use of the Soundrop based on the choreography. Recording this data can have future implications in preventing the loss of these practices by archiving specific moments or features of these dance/body movements.

7.3 Contribution to new knowledge

This research has followed a line of enquiry that is presented in this thesis and which has led to the following of contribution to new knowledge:

- The research establishes a performative framework that explores traditional Whirling Dervish movement and Flamenco dance through augmented digital media and wearable technology

- Comprehensive links between the Dervish whirling practice from Turkey and Spanish Andalucían Flamenco dance are made in terms of musical traditions, body movements and gestures, and significant socio-political/historical links.

- A new digital musical body instrument device was developed which captures significant movements and gestures by tracking the velocity and angle of movement to which sounds are mapped. The Soundrop augments the movements

and gestures of a Whirling Dervish and a Flamenco Dancer who morph their heritages with each other in a performance piece through sound.

- *Digital Dervish + Flamenco Sonic* is an immersive, interactive performance piece that combines digital art with dance, sound and film in a work that has been exhibited at various venues internationally. The piece follows a narrative between a Dervish and a Flamenco dancer who use the Soundrop as a means to communicate sounds with one another while also extending their performance using a digital musical instrument.

- The data flow that is uncovered from recording the performances of *Digital Dervish + Flamenco Sonic* resulted in visualizing the invisible relationship between the device and the performer. This data presents how the performers move and how they respond to the Soundrop in real-time.

7.4 *Digital Dervish + Flamenco Sonic*; a multimedia performance work

The logistics of producing a show which has begun a global tour has been arduous, laborious and challenging at times. However despite these obstacles the performance has been a great success both personally and professionally. The difficulties were not in composing two musical scores - one 20 minutes in length the other 30 minutes, or developing the concept for the show, but were more in the area of administrative pitfalls that were sometime unavoidable. Needless to say, while coordinating performers across three time zones in three different countries was a major hurdle, the reward of witnessing a spectacle whose inception has been in the making for years was worthwhile.

After years of delays, the opportunity to work with performance artist Sercan Çelik was exciting as his style is professional, creative and mesmerizing to watch. Sercan has been very interested in augmenting his style of whirling since 2018 when he experimented with the *Dervish Sound Dress*. The performance of *Digital Dervish + Flamenco Sonic* was inspired by his style of movement but also with him as the main character in mind. His interpretation is wild yet meditative, aggressive but soothing.

As a contrast to Sercan's performance in *Digital Dervish + Flamenco Sonic,* Mayez Rahman who was 14 years old at the time of the performances in the UK and in Canada, is not a professional dancer or performer, but he learned the role for his character and embraced it using his knowledge, and the emotional and metaphysical affinity he has with the Islamic tradition of Dervish whirling. His input was valuable in a number of ways: as a teenager who is tech-savvy and interested in all the latest gadgets, games and wearable devices that are trending, Mayez made practical suggestions about the Soundrop and how he would make it more responsive to his movements. This was accomplished in revising and defining the code to smooth those actions made with the Soundrop, so that they were not only more responsive but lacked any latency. His performances were equally mesmerizing as Sercan's to watch - he embodied the role of Dervish and became unified with his Soundrop and used them as per the choreography, but also there were moments that he created for himself when he felt it was appropriate to use it.

All three Flamenco dancers were professional, talented and curious to implement a wearable device into their dance. Mercedes heavily promoted the Soundrop during interviews and rehearsals in the UK and commented many times that she felt that her Flamenco didn't change, it just became elevated in a way that she was not expecting or had ever experienced before. Carolina's version of Flamenco Sonic presented her blend of contemporary, experimental Flamenco with classical Flamenco dance and incorporated the Soundrop by articulating her movements to present the device as an extension of her body and her costume. Pepa, who had not rehearsed the show until prior to the first performance in Dubai, quickly became accustomed to using it. She also stated that the use of an electronic device on her body made her feel the movements she created as the device reverberated against her skin and also emitted lights and sounds.

Overall, the performances were a great success in many ways; apart from the complicated logistics of organizing and producing a show of this scale, the main goal of showcasing them in three different locations with different performers who used the Soundrop in their own unique way, was the highlight of this achievement. This cemented the research and the outcomes will influence future work based on these findings. Looking

back on the footage from all six shows, the contrasts and parallels between the different versions of Dervish and Flamenco are interesting and can be unpicked in many ways. Articles have been written about the shows which are available to view on the website and listed in the reviews following the Appendices. The reactions from the audience members of each show were overwhelmingly positive, as for many it was a new experience to see two unlikely traditions come together in a harmonious spectacle. Excerpts from the performances' Q&A's and candid comments/questions from the audience can be found in Appendix XII. The dynamics and chemistry between the performers should be noted: Mayez and Mercedes developed a tender relationship as Mercedes assumed her role of Flamenco Sonic, she was careful to be attentive to the Dervish as she helps him on his quest or journey. Carolina's relationship was more abstract in that at times, she may have overshadowed his minimalism with her own exuberance and Flamenco passion. However, in the end their whirling collaboration became an enlightened moment of peace and balance. Sercan offered a different perspective as the lonesome troubled Dervish who wanders with a heavy burden on his shoulders. He then emerges from a dream that is further uplifted by his Flamenco counterpart Pepa. There is a symmetry between the two which is fluid and homogenous.

Finally, the performances were an accomplished component to this research which without the visual collaboration with filmmaker Kaz Rahman, would not have been possible. Appendix III presents interviews with the performers in which their experiences are documented through the process of rehearsing to using the Soundrop on stage. These candid moments are captured in video recordings which reveal that using a new digital musical body instrument contributes a unique element to their dance performance. None of the performers felt that by using a wearable device would their practice be compromised in any way. Rather, they found that it behaved as an extension to their bodily movements and were pleasantly surprised at how functional it was to use them. These moments further cement the fact that, although the purity of Dervish whirling or Flamenco dancing need not be tampered with, augmenting them in a subtle way can create another dimension for creativity. The show will continue to tour and develop in other venues that showcase both traditional theatre settings and 360 projected screens.

7.5 Reflection on Opportunities and Challenges

The culmination of this research journey prompts a critical reflection on the potentials and challenges of the fusion of technology with traditional dance forms which are inherent in using the Soundrop - a digital musical body instrument. The work examined in this thesis illuminates the transformative possibilities of using wearable technology to enhance the sensory experience of a Whirling Dervish and Flamenco dancer. The Soundrop offers a novel avenue for dancers to express themselves, amplifying movements with mesmerizing soundscapes which relate to the musical traditions that they have evolved from. While the outcomes have been substantial and enlightening, it's essential to acknowledge the complexities and nuances encountered throughout this exploration.

One pivotal aspect to consider is the delicate balance between preserving the authenticity and essence of traditional dance forms while integrating innovative technological interventions. The process of augmenting movements and gestures with the Soundrop necessitated a profound understanding of the symbolic, cultural, and historical significance imbued within each motion. However, part of the consideration when delving into this project was to remain vigilant against diluting the intrinsic value of these ancient practices in the pursuit of novelty. When subsequently re-examining the performances, there were areas that could have been improved upon. As with any live performance there are discrepancies or moments that are unclear or can use revision. Some of these moments included adjusting the volume of the Soundrop against the musical composition to avoid one cancelling out the other. Another would have been fine-tuning the code for smoother output and modifying the sound samples uploaded to each device to coincide more appropriately with the dancers' movements. Ultimately, the Soundrop was an added feature to the performances which served to give the performers the liberty to move in a space using a digital device to contribute to the music composition and highlight certain moments in their movements. The future research will also explore how the potential for refining the Soundrop may lend to new opportunities for showcasing body movement with sound.

Navigating the logistical and technical challenges encountered during the research process underscores the need for continuous advancement and improvement. From optimizing the responsiveness of the Soundrop to addressing concerns around data privacy and user experience, there are ample opportunities for innovation and collaboration.

In parallel, the audience's perception after engaging and gathering feedback emerges as a central consideration. As spectators witnessed the marriage of tradition and technology on stage, their reception embodied a spectrum of responses. Some embraced the innovation and garnered an understanding of the symbolic or specific movements and gestures of the Dervish and Flamenco, reveling in the symbiotic relationship between dancer and digital instrument. Others may have had reservations regarding the potential commodification of cultural heritage in the pursuit of modernity. This divergence in perception necessitates a nuanced approach to audience engagement, one that cultivates dialogue, transparency, and mutual understanding while ensuring that the overall desire here is to innovate through respectively aligning with these particular historical traditions.

7.6 Future work and research

This work amalgamates the traditional dance practices of a whirling Dervish and Flamenco dancer with a digital musical body instrument - the Soundrop - through sound, culture, history, geography and musical traditions. While at the beginning of the research many other forms of traditional dance were investigated, the evident links between a Dervish and a Flamenco dancer were made using concrete sources and references that were also realized in real life during the performances of *Digital Dervish + Flamenco Sonic.* Although the Soundrop is a useful tool for adding layers to a dancer's performance which can give them control over the outcome of a sound, the device itself can be further iterated. An artefact was developed and can be further engineered as a more practical, logical mechanism that focuses in on the user's experience and outcome of sound generation. The results of testing with the Soundrop have been positive, but they have

limitations at this point. With further development, the Soundrop could include implementing the use of machine learning to train a system that is more responsive and produces real-time synthesized sounds. Using these algorithms, the diversity of sounds would be greater rather than relying on a bank of pre-programmed sounds. Creating a more autonomous gestural controller which is more sophisticated and refined would position the device more appropriately among current commercial digital musical instruments (DMIs). This would also lead to patenting and marketing the Soundrop as a commercial digital sound instrument that can be used not only by performers on stage, but also as a tool for learning new ways of creating music with gestures and the body. A truly immersive and interactive device can lead to explorations in sound creation that can be used by performers, musicians and by anyone wishing to use sound as a vehicle for experimentation, education and musical composition without the need for understanding complex music theory or notation. The Soundrop webapp is a current prototype for this exploration which can also be developed into a fully functioning digital application that can be accessed on a smart device such as a phone, tablet etc. Other features that can be further developed include a more sophisticated visual interface and sound selection/generation making the devices be more intuitive and interactive. While the current version has served an excellent purpose in highlighting significant aspects of a Dervish performer and a Flamenco dancer, the possibilities of further improving and advancing the system could be beneficial for use in other applications such as gaming engines, or virtual dance systems. Future research will also include the implementation of wearables to augment and elevate other digital performance practices by developing new innovative work that uses a multi-disciplinary approach. These endeavors may investigate the intersectionality of digital performance practices, leveraging wearables to unlock new dimensions of artistic expression. By embracing a multi-disciplinary approach and nurturing a spirit of experimentation, the possibilities of redefining the boundaries of traditional dance forms in the digital age are endless.

This project would not have been possible without all of the elements that brought it to its fruition including using film, sound design, dance, theatre, animation and digital art all of which contributed to the final piece. Through great adversity, struggle and perseverance,

the work will have a lasting impact as it is archived visually, digitally, and through the moments in time that recall how an unlikely pairing could be so closely intertwined with compassion, energy, memory and love.

“If you wish, O seeker of the way! To know your own soul, know that the blessed and glorious God created you of two things: the one is a visible body, and the other is something internal, that is called spirit and heart which can only be perceived by the mind.”

- Abu Hamid Muhammad ibn Muhammad al-Ghazali, 1104



Figure 7.1: Mercedes Romero and Mayez Rahman in *Digital Dervish + Flamenco Sonic*, May 6, 2022, Plymouth, UK (image from Russell, 2022)

References

Adams, R., Gibson, S. & Arisona, SM. (2008) *Transdisciplinary Digital Art: Sound, Vision, and the New Screen: Sound, Vision and the New Screen*, Springer, Berlin/Heidelberg. Available from: ProQuest Ebook Central. [1 March 2021].

Ali. R. (2017) *The Erasure of Islam from the Poetry of Rumi*, Available at: https://www.newyorker.com/books/page-turner/the-erasure-of-islam-from-the-poetry-of-rumi [Accessed: March 24, 2023]

Alonso, G. (2019) *Why does Rosalía cause so much controversy?* Available at: https://english.elpais.com/elpais/2019/11/15/inenglish/1573816503_062425.html [Accessed: March 2, 2023]

Andaluz, E.P. (2019) *Flamenco Dance: The Movement of Arms*, Available at: https://elflamencoensevilla.com/en/flamenco-dance-the-movement-of-arms/ [Accessed: October 22, 2020]

Antic, D. (2011) *Interface Criticism: Aesthetics Beyond the Buttons*, Aarhus University Press, Aarhus. Available from: ProQuest Ebook Central. [Accessed: February 2, 2021].

Azazi, Z. (2021) Ziya Azazi performing *Dervish in Progress*

Bacon, Roger & Bridges, John Henry (1897). *The Opus Majus of Roger Bacon*. Williams & Norgate.

Balaganur, S. (2020) *The Dawn Of New Technology – What Potential Does Human Augmentation Hold?* Available at: https://analyticsindiamag.com/the-dawn-of-new-technology-what-potential-does-human-augmentation-hold/ [Accessed: February 7, 2021]

Barbour, N., (1970) *The significance of the word Maurus, with its derivatives Moro and Moor, and of other terms used by medieval writers in Latin to describe the inhabitants of Muslim Spain*. *Biblos (Coimbra),* **46**, pp. 253.

Barber, X. T. (1986) *Four Interpretations of Mevlevi Dervish Dance, 1920-1929*. Dance Chronicle, 9(3), 328-355. Retrieved May 13, 2021, from http://www.jstor.org/stable/1567602

Bardakçı, M. (2010) *Hâlis Arap müziğini arabesk sanıyoruz*, Available at: https://www.haberturk.com/yazarlar/murat-bardakci/535227-halis-arap-muzigini-arabesk-saniyoruz [Accessed: May 11, 2023]

Barras, C. (2013) *Whirling dervish skirts are ruled by hurricane physics,* Available at: https://www.newscientist.com/article/dn24665-whirling-dervish-skirts-are-ruled-by-hurricane-physics/ [Accessed: March 25, 2023]

Bartal, Y. (2014) *Flamenco's Repression and Resistance in Southern Spain,* Available at: https://truthout.org/articles/flamenco-under-attack/ [Accessed: February 28, 2023]

Basak, R. (2017) *Secularization and Commercialization of Rumi*. Journal of Current Researches on Social Sciences. 7. 113-124. 10.26579/jocress-7.2.10.

Battison, A. (2022) Últmos Cursos del Año, [Image] @mysticalwhirling, https://www.instagram.com/p/Ck9XmtTOK4q/ [Accessed: May 25, 2022]

Beals, Jessie Tarbox (New York, N.Y.). (n.d. (circa 1928-1929)) *Two Spanish dancers, each holding castanets, posing "in position" while a man claps (right), possibly keeping time. An El Paseo building is behind them.* [Non-projected black and white photograph]. https://jstor.org/stable/community.12233934

Bell, L. (2019) *Meditation Tech: Muse 2 Brain-Sensing Wearable Review,* Available at: https://www.forbes.com/sites/leebelltech/2019/01/31/meditation-tech-muse-2-brain-sensing-wearable-review/ [Accessed: May 8, 2021]

Benjamin, T. (2022) *History of the Spanish Mantón: The Manila Shawl*, Available at: https://fromspain.com/history-of-the-spanish-monton-the-manila-shawl/ [Accessed: April 4, 2023]

Bennahum, N. (2016) *'Mercé y Luque, Antonia Rosa (Stage Name: La Argentina; b. 4 September 1888, Buenos Aires, Argentina; d. 18 July 1936, Bayonne, France)*' in Routledge Encyclopedia of Modernism, Taylor and Francis, viewed 27 February 2023, <https://www.rem.routledge.com/articles/merce-y-luque-antonia-rosa-stage-name-la-argentina-b-4-september-1888-buenos-aires-argentina-d-18-july-1936-bayonne-france>. doi:10.4324/0123456789-REM1780-1

Bennahum, N. (2000) *Antonia Merce,́ 'La Argentina': flamenco and the Spanish avant garde*. Hanover, N.H: University Press of New England.

Bianchi, R. (2018). *Istanbul sounding like revolution: The role of music in the Gezi Park Occupy movement*. Popular Music, 37(2), 212-236. doi:10.1017/S0261143018000016

Birringer, J. (2002) *Dance and Media Technologies*, PAJ: Journal of Performance and Art, Intelligent States: Digital Art and Performance, 24 (1), 84-93.

Birringer, J. (2003) *Dance and Interactivity*, Dance Research Journal, *35/36*, 88–112. http://www.jstor.org/stable/30045071

Birringer, J., Danjoux, M. (2009) *Wearable technology for the performing arts*, Editor(s): J. McCann, D. Bryson, In Woodhead Publishing Series in Textiles, Smart Clothes and Wearable Technology,Woodhead Publishing, Pages 388-419, ISBN 9781845693572, https://doi.org/10.1533/9781845695668.4.388.
(http://www.sciencedirect.com/science/article/pii/B9781845693572500204)

Birringer, J. (2013) *Bauhaus, Constructivism, Performance*. PAJ: A Journal of Performance and Art, 35(2), 39–52. https://www.jstor.org/stable/26376130

Birringer, J. (2015) *Gestural Materialities and the worn Dispositif*, In: Sutil, N. S. and Popat, S. (2015) *Digital Movement: Essays in Motion Technology and Performance*. Houndmills Basingstoke Hampshire: Palgrave Macmillan.

Birringer, J. (2016) *Kimospheres, or Shamans in the Blind Country*, Performance Paradigm 12. Retrieved from: http://performanceparadigm.net/index.php/journal/article/view/176 *(1) (PDF) Bio-medical Signals in Media Art*. Available from: https://www.researchgate.net/publication/318397455_Bio-medical_Signals_in_Media_Art [Accessed: April 19, 2023].

Borrelli-Persson, L. (2021) *Iris Van Herpen; Spring 2021 Couture,* Available at: https://www.vogue.com/fashion-shows/spring-2021-couture/iris-van-herpen [Accessed: April 11, 2021)

Borrelli-Persson, L. (2020) *Has Fashion Really Embraced Technology? We Chart the Ever-Evolving Relationship Between Maker and Machine*, Available at: https://www.vogue.com/article/has-fashion-really-embraced-technology-a-timeline-of-tech-and-fashion [Accessed: January 13, 2021]

Boucher, M. (2011) *Virtual dance and Motion-capture*, Contemporary Aesthetics. 9.

Brown, J. P. & Ross, H. A. (2008) *The Darvishes: or oriental spiritualism*. Abingdon, Oxon: Routledge.

Broudy,E. (1979) The Book of Looms, University Press of New England.

Buckley, C. D., & Boudot, E. (2017) *The evolution of an ancient technology.* Royal Society open science, 4(5), 170208. https://doi.org/10.1098/rsos.170208

Burgess, M. (2018) *What is the Internet of Things? WIRED explains,* Available at: https://www.wired.co.uk/article/internet-of-things-what-is-explained-iot [Accessed: December 2, 2020]

Burt, R. (2002) *Alien Bodies: Representations of Modernity, 'Race' and Nation in Early Modern Dance,* Taylor & Francis.

Burt, R. (1999) *Interpreting Jean Borlin's "Dervishes": Masculine Subjectivity and the Queer Male Dancing Body*. Dance Chronicle, 22(2), 223–238. http://www.jstor.org/stable/1567950

Butler, J. (2017) *Smoke Dress; Generative/AI Art, Bio Art, Robotic Art, Performance Art,* Available at: http://www.digiart21.org/art/smoke-dress [Accessed: April 11, 2021]

Caddy, B. (2018) Living with: Nadi X smart yoga pants; Can this pair of pulsing pants perfect my posture? Available at: https://www.wareable.com/health-and-wellbeing/wearable-x-nadi-x-smart-yoga-pants-review [Accessed: April 13, 2021]

Calvert, T. W., et al. (1993) *The evolution of an interface for choreographers*, Proceedings of the INTERACT '93 and CHI '93 Conference on Human Factors in Computing Systems. Amsterdam, The Netherlands, Association for Computing Machinery**:** 115–122.

Campbell, H. A. and La Pastina, A. C. (2010) *How the iPhone became divine: new media, religion and the intertextual circulation of meaning,* New Media & Society, 12(7), pp. 1191–1207. doi: 10.1177/1461444810362204.

Cantor-Navas, J. (2016*) El Lebrijano, Innovative Flamenco Singer, Dies at 75,* Available at: https://www.billboard.com/music/latin/el-lebrijano-dead-flamenco-7438217/ [Accessed: April 5, 2023]

Canonigo, J. (2018) *The Dazzling 'Electric Jewellery' of Gustave Trouvé (1879),* Available at: https://futurelapse.blogspot.com/2018/01/the-dazzling-electric-jewellery-of.html [Accessed: January 25, 2023]
Carter, C. L. (2000) *Improvisation in Dance*. The Journal of Aesthetics and Art Criticism, 58(2), 181–190. https://doi.org/10.2307/432097

Casellas, J. L.-P. (2017) *The politics of Flamenco: "La leyenda del tiempo" and ideology.* Popular Music, *36*(2), 196–215. http://www.jstor.org/stable/26358345

Catlos, B. A. (2018) *Kingdoms of faith: a new history of Islamic Spain.* First edition. New York, N.Y: Basic Books.

Çelebi, C. (N.D.) *Whirling Dervishes, Sema,* Available at: https://www.mevlana.net/sema.html [Accessed: February 25, 2023]

Chandler, S. (2020) *Coronavirus: Japanese Firm Unveils Smart Face Mask That Connects To Phones,* Available at: https://www.forbes.com/sites/simonchandler/2020/06/26/coronavirus-japanese-firm-unveils-smart-face-mask-that-connects-to-phones/?sh=38a73d233f3a [Accessed: April 13, 2021]

Chandrashekhar, M. (2024) Mirror Work Magic: The Sparkling World of Shisha Embroidery of Rajasthan, Available at: https://cultureandheritage.org/2024/02/mirror-work-magic-unveiling-the-sparkling-world-of-shisha-embroidery-of-rajasthan.html [Accessed: February 23, 2024]

Chatzichristodolou, M. et al (2009) Interfaces of Performance, MPG Books Group, London, UK

Chittenden, T. (2017) *Skin in the game: the use of sensing smart fabrics in tennis costume as a means of analyzing performance*. Fash Text **4,** 22. https://doi.org/10.1186/s40691-017-0107-z

Cho, G. (2010) *Smart clothing: technology and applications*. Boca Raton, FL: CRC Press.

Choksi, N. (2015) *Experience Sufism though this spinning dance form performed by Ziya Azazi*, Available at: https://www.hindustantimes.com/art-and-culture/experience-sufism-though-this-spinning-dance-form-performed-by-ziya-azizi/story-hweZQBxZYoMmVKGr299LaM.html [Accessed: May 15, 2021]

Chopra, Y. (2019) *Everything you need to know about the ancient craft of mirror work,* Available at: https://www.vogue.in/fashion/content/mirror-work-indian-craft-history-lehenga-designs [Accessed: April 4, 2023]
Chung, B. (2014) *13 Movies that Explore the Future of Technology*, Available at: https://www.vice.com/en/article/53wgp5/13-movies-that-explore-the-future-of-technology [Accessed: March 30, 2023]

Çiçek, M. (2015) *Wearable Technologies And Its Future Applications,* International Journal of Electrical, Electronics and Data Communication, ISSN: 2320-2084 Volume-3, Issue-4, April-2015 Available at: https://www.researchgate.net/publication/275580004_wearable_technologies_and_its_future_applications [Accessed Dec 03, 2020].

Çizmeci E. (2013) *Sufi Ceremonies in Private and Public*. In: Chambers C.M., du Toit S.W., Edelman J. (eds) Performing Religion in Public. Palgrave Macmillan, London. https://doi.org/10.1057/9781137338631_9

Clarke, M. & Crisp, C. (1981) *The History of Dance*. 1st ed. New York: Crown Publishers.

Coelho, V. (2003) *The Cambridge companion to the guitar*. Cambridge; Cambridge University Press.

Consorte, P. (2012) *Body Percussion as a music resource* Available at: https://pedroconsorte.wordpress.com/2012/04/18/quick-guide-to-body-body-percussion/ [Accessed: February 9, 2021]

Contreras, F. (2011) *Camarón De La Isla: The Voice Of Flamenco*, Available at: https://www.npr.org/2011/01/03/132450621/camaron-de-la-isla-the-voice-of-flamenco [Accessed: April 1, 2023]

Copeland, R. (1999) *Cunningham, Collage, and the computer*. PAJ: A Journal of Performance and Art*, 21*(3), 42-54. doi:10.2307/3245965

Craig, A. B., Sherman, W. R., Will, J. D. (2009) *Developing Virtual Reality Applications: Foundations of Effective Design.* Netherlands: Elsevier Science.

Cruise, N. (2020) *When Were Watches Invented?* Available at: https://jackmasonbrand.com/blogs/news/when-were-watches-invented [Accessed: March 31, 2021]

Culshaw, P. (2001) *Giving the dervish a whirl*, Available at: https://www.theguardian.com/books/2001/dec/01/classics.features [Accessed: May 20, 2021]
Currin, G. (2020) *The Mystery of Aziz Balouch, Who Fused Flamenco With Sufi Poetry,* Available at: https://daily.bandcamp.com/features/aziz-balouch-sufi-flamenco-feature [Accessed: January 20, 2021]

Dam, R.F. (2022) *The 5 Stages in the Design Thinking Process*, Available at: https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process [Accessed: May 10, 2023]

Danjoux, M. (2019) *Design-in-motion: sculpting choreosonic wearables*, Theatre and Performance Design, 5:1-2, 114-124, DOI: 10.1080/23322551.2019.1603340

Dias, T. (2015) *Electronic Textiles*, Woodhead Publishing, Page iv, ISBN 9780081002018, https://doi.org/10.1016/B978-0-08-100201-8.09988-4. (http://www.sciencedirect.com/science/article/pii/B9780081002018099884)

Dixon, S. (2007) *Digital performance: A history of new media in theater, dance, performance art, and installation*. ProQuest Ebook Central https://ebookcentral.proquest.com

Dominique, P., & Crego,P. (2019) *Wearables, Smart Textiles & Smart Apparel,* ISTE Press Ltd., London

Echard, W. (2006) *Sensible virtual selves: Bodies, instruments and the becoming-concrete of Music*, Contemporary Music Review, 25:1-2, 7-16, DOI: 10.1080/07494460600647386

Echevarria, M. (2009) *The Story of Olé*, Available at: https://www.altalang.com/beyond-words/the-story-of-ole/ [Accessed: March 27, 2023]

Fagan, K. (2018) *Here's what happens to your body when you've been in virtual reality for too long,* Available at: https://www.businessinsider.com/virtual-reality-vr-side-effects-2018-3?r=US&IR=T [Accessed: April 30, 2021]

Farion, C. (2022) *The Ultimate Guide to Informed Wearable Technology*, Packt, Birmingham.

Feldman, W. (2022) *From Rumi to the Whirling Dervishes: Music, Poetry, and Mysticism in the Ottoman Empire.* United Kingdom: Edinburgh University Press.

Feldman, W. (2022) *From Rumi to the Whirling Dervishes: Music, Poetry, and Mysticism in the Ottoman Empire*. Edinburgh University Press. http://www.jstor.org/stable/10.3366/j.ctv2dd4798

Feldman, W. (2019) *The Emergence of Ottoman Music and Local Modernity*, *YILLIK: Annual of Istanbul Studies*. **1** (1): 173–179. doi:10.53979/yillik.2019.10.

Fernández de Alba, F. & Garcés, M.T. (2021) *Fashioning Spain: From Mantillas to Rosalía*, United Kingdom: Bloomsbury Publishing.

Friedlander, S. et al. (2003) *Rumi and the whirling dervishes: being an account of the Sufi order known as the Mevlevis and its founder the poet and mystic Mevlana Jalaluʾddin Rumi.* 1st Parabola ed. New York: Parabola Books.

Frishkopf, M. A. & Spinetti, F. (2018) Music, sound, and architecture in Islam. First edition. Michael Aaron Frishkopf & Federico Spinetti (eds.). Austin: The University of Texas Press.

Fuller, L. (n.d.). *Photograph of Fuller in Her Costume*. 1862-1928 https://jstor.org/stable/community.13888407

García, S. (2023) *Virgin Mary, Sufism, and flamenco: Lost Muslim influences in Spain,* Available at: https://www.middleeasteye.net/discover/virgin-mary-sufism-flamenco-spain-catholic-muslim-influences [Accessed: March 31, 2023]
García Lorca, F. et al. (2008) *Romancero gitano*. 1st digital pbk. ed. Manchester: Manchester University Press.

Ghazzali. A.H.M. (1873) *The Alchemy of Happiness*, United States: J. Munsell.

Ghaderi, M. (2016) *Dissoving Self: Wearble Technology + Dance*, Available at: https://www.youtube.com/watch?v=llnSPaJdews [Accessed: April 23, 2021]

Godøy, R. I. & Leman, M. (2010) *Musical gestures: sound, movement, and meaning*. New York: Routledge.

Gottlieb, Harry (1895 – 1992) (American). (n.d.). *The Gypsies* [Chine-colle lithograph]. Binghamton University Art Museum, Binghamton, New York. https://jstor.org/stable/community.28149363

Greeley, J.A. (2022) *Sufi turning and the spirituality of sacred space,* Journal for the Study of Spirituality, 12:2, 108-119, DOI: 10.1080/20440243.2022.2126138

Greenwald, W. (2020) *Oculus Quest 2*, Available at: https://uk.pcmag.com/first-looks/128655/oculus-quest-2 [Accessed: April 30, 2021]

Grill, K. (1926) *Spiral Costume*, from the *Triadic Ballet*, 1926, The J. Paul Getty Museum, Los Angeles, Gelatin silver print, Image: 22.5 × 16.2 cm (8 7/8 × 6 3/8 in.)

Gunning, T. (2003) *Loïe Fuller and the Art of Motion: Body, Light, Electricity, and the Origins of Cinema.* In R. Allen & M. Turvey (Eds.), *Camera Obscura, Camera Lucida: Essays in Honor of Annette Michelson* (pp. 75–90). Amsterdam University Press. http://www.jstor.org/stable/j.ctt46n2cn.8

Haas, K. & Edwards, G. (2000) Flamenco! New York: Thames & Hudson.

Habibipour, A., Padyab, A.M., & Ståhlbröst, A. (2019). *Social, Ethical and Ecological Issues in Wearable Technologies. AMCIS*.

Hafiz, (1480) *Dancing Dervishes*, Folio from a Divan of Hafiz, Available at: https://www.metmuseum.org/art/collection/search/446892 [Accessed: March 17, 2023]

Hall, J. (2016) *Mary Wigman - Dancer, Choreographer and Pioneer of Expressionist Dance 3,* Available at: https://www.youtube.com/watch?v=37sEaUhFzpI&t=116s [Accessed: July 25, 2021]

Harlizius-Klück, E. (2017) *Weaving as Binary Art and the Algebra of Patterns*, TEXTILE, 15:2, 176-197, DOI: 10.1080/14759756.2017.1298239

Harss, M. (2020) *Flamenco Dancers who 'move between genders'*, Available at: https://www.nytimes.com/2020/03/17/arts/dance/queer-flamenco-viva-manuel-linan.html [Accessed: March 16, 2023]

Hartman, K. (2014). *Make: Wearable electronics: design, prototype, and wear your own interactive garments*. ProQuest Ebook Central, Available at: https://ebookcentral.proquest.com [Accessed: February 2, 2021]

Hayes, M.F. (2009) *Flamenco: Conflicting histories of the Dance*, MacFarland & Company, Inc. Publishers, Jefferson, North Carolina, and London

Heathman, A. (2016) *Human Harps, singing bridges and sensory sand: Di Mainstone pushes the boundaries of sound,* [Online] Available at: https://www.wired.co.uk/article/di-mainstone-sennheiser-bridge-harp [Accessed: February 3, 2023]

Holmes, T. (2020) *Electronic and Experimental Music: Technology, Music, and Culture,* Taylor & Francis Group, Milton. Available from: ProQuest Ebook Central. [8 February 2021].

Honauer M. (2017) *Designing (Inter)Active Costumes for Professional Stages.* In: Schneegass S., Amft O. (eds) Smart Textiles. Human–Computer Interaction Series. Springer, Cham. https://doi.org/10.1007/978-3-319-50124-6_13

Howrath, D. (2013) *(No)where (Now)here: Two Gaze-activated Dresses by Ying Gao,* Available at: https://www.dezeen.com/2013/06/24/nowhere-nowhere-two-gaze-activated-glow-in-the-dark-dresses-eye-tracking-ying-gao/ [Accessed: May 5, 2021]

Howarth, D. (2014) *Google enlists Diane von Furstenberg to turn Glass headsets into fashion accessories,* Available at: https://www.dezeen.com/2014/06/03/google-glass-diane-von-furstenberg-wearable-headsets/ [Accessed: February 3, 2021]

Howell, E. (2020) *New SpaceX spacesuits get five-star rating from NASA astronauts*, Available at: https://www.space.com/spacex-spacesuits-five-star-astronaut-review.html [Accessed: May 8, 2021]
Húder, P.C. (2022) *Rocío Molina, la reina lesbiana del flamenco explora los límites corporals,* Available at: https://www.eldiario.es/cultura/teatro/rocio-molina-reina-lesbiana-flamenco-explota-limites-corporales_1_9202378.html [Accessed: March 18, 2023]

Hurban, H. (2019) *Dervish Sound Dress; An Investigation of Wearable Technology Using Computer Music and Haptic Mechanisms for Live Performance,* http://hdl.handle.net/10026.1/14240

Ibn 'Arabi, M. (2007) *Sufis of Andalusia: The Ruh Al-Quds and Al-Durat Fakhirah.* United Kingdom: Routledge.

Ikuo, S. (2019) *Walkman Story: The Early Years of the Iconic Personal Cassette Player,* Available at: https://www.nippon.com/en/japan-topics/g00726/walkman-story-the-early-years-of-the-iconic-personal-cassette-player.html [Accessed: April 14, 2021]

Irwin, R. (2004) *The Alhambra*. London: Profile.

IshaKurun [@ishakurun]. (2021, February 18) *Binlerce yıldız var Sen güneş ol*, [video] Instagram. https://www.instagram.com/p/CLc695gCOH1/

Jacobs, E. (2020) *When Merce Cunningham Took On a New Collaborator: The Computer*, Available at: https://www.nytimes.com/2020/09/01/arts/dance/merce-cunningham-computer-LifeForms.html [Accessed: February 23, 2021]

Jalāl al-Dīn Rūmī et al. (2008) *Love's ripening: Rumi on the heart's journey*. 1st ed. Boston: Shambhala Publications.

Jalāl al-Dīn Rūmī & Nicholson, R. A. (1994) *Selected poems from the Dīvāni Shamsi Tabrīz*. Richmond, Surrey: Curzon Press.

Jensenius, A. (2013) *Some Video Abstraction Techniques for Displaying Body Movement in Analysis and Performance*. Leonardo, 46(1), 53-43. Retrieved March 22, 2021, from http://www.jstor.org/stable/23468117

Jerdan S., Grindle M., van Woerden H., Kamel Boulos M. (2018) *Head-Mounted Virtual Reality and Mental Health: Critical Review of Current Research*, JMIR Serious Games 2018;6(3):e14 URL: https://games.jmir.org/2018/3/e14, DOI: 10.2196/games.9226

Johnson, N. (2020) *Best Language Translation Devices in 2021*, Available at: https://www.imore.com/best-language-translation-devices [Accessed: February 3, 2021]
Jones, CL. (ed.) (2017) *Rethinking Modern Prostheses in Anglo-American Commodity Cultures, 1820-1939*, Manchester University Press, Manchester. Available from: ProQuest Ebook Central. [Accessed: April 12, 2021].

Kamath, A., (2021) *Sonam Kapoor Ahuja and Iris Van Herpen talk about couture, feminism, and sustainability*, Available at: https://www.vogue.in/magazine-story/sonam-kapoor-ahuja-and-iris-van-herpen-talk-about-couture-feminism-and-sustainability/ [Accessed: May 8, 2021]

Katan, E. (2016). *The Dancing Body as a Means of Expression.* In: Embodied Philosophy in Dance. Performance Philosophy. Palgrave Macmillan, London. https://doi.org/10.1057/978-1-137-60186-5_21

Kaye, A. S. (2005) *Two Alleged Arabic Etymologies*. Journal of Near Eastern Studies, 64(2), 109–111. https://doi.org/10.1086/431686

Kazanci, H. (2015) *Modern-day dervishes: Followers of Turkey's Rumi,* Available at: https://www.middleeasteye.net/features/modern-day-dervishes-followers-turkeys-rumi [Accessed: May 10, 2021]

Kenrick, D. (2007) *Historical Dictionary of the Gypsies (Romanies*). United States: Scarecrow Press.

Kew, C. (2012). *Mary Wigman's London Performances: A New Dance in Search of a New Audience.* Dance Research: The Journal of the Society for Dance Research, 30(1), 1-21. Retrieved May 17, 2021, from http://www.jstor.org/stable/23326514

Kılınç, N. (2011) *Mevlevi Sema Ritual Outfits And Their Mystical Meanings, ISSN:1306-3111 e-Journal of New World Sciences Academy 2011, Volume: 6, Number: 4, Article Number: 4C0123*

King, J. (2020) *5 Military Applications for Wearable Technology*, Available at: https://butlertechnologies.com/military-wearable-technology/ [Accessed January 13, 2021]

Krueger, M.W., & Wilson, M.W. (1985) *VIDEOPLACE: A Report from the ARTIFICIAL REALITY Laboratory*. Leonardo, 18, 145 - 151.

Koç, F., Koca, E. (2011) *The Clothing Culture of the Turks, and the Entari (Part 1: History).* Folk Life: Journal of Ethnological Studies, Vol. 49 No. 1. 2011, 10-29

Kozel, S. (2007) *Closer: performance, technologies, phenomenology*. Cambridge, Mass: MIT Press.

Krefeld, V., & Waisvisz, M. (1990). *The Hand in the Web: An Interview with Michel Waisvisz.* Computer Music Journal, *14*(2), 28–33. https://doi.org/10.2307/3679709

Kunimoto, N. (2013) *Tanaka Atsuko's "Electric Dress" and the Circuits of Subjectivity*. The Art Bulletin*, 95*(3), 465-483. Available at: http://www.jstor.org/stable/43188842 [Accessed: February 25, 2018].

Lafuente, R. (1955). *Los gitanos, el flamenco y los flamencos.* Editorial Barna.

Lamkin, P. (2014) *History of wearable technology*, Available at: https://www.raconteur.net/history-of-wearable-technology/ [Accessed: February 3, 2021]

Landborn, A. (2015). *Flamenco and Bullfighting: Movement, Passion and Risk in Two Spanish Traditions.* United States: McFarland, Incorporated, Publishers.

Layson, J. & Lansdale, J. (1994) *Dance history: an introduction. 2nd ed*. London; New York: Routledge.

Latulipe C., Wilson D., Huskey S., Word M., Carroll A., Carroll E., Gonzalez B., Singh V., Wirth M., and Lottridge, D. (2010) *Exploring the design space in technology-augmented dance*. In CHI '10 Extended Abstracts on Human Factors in Computing Systems (CHI EA '10). Association for Computing Machinery, New York, NY, USA, 2995–3000. DOI: https://doi.org/10.1145/1753846.1753904

Leblon, B. (1994) *Gypsies and Flamenco*, University of Hertfordshire Press, 2nd edition (2003)

Lee, H. A. (2023) *This is Why Microsoft Kinect was a Complete Failure*, Available at: https://www.svg.com/301470/this-is-why-microsoft-kinect-was-a-complete-failure/ [Accessed: April 13, 2023]

Lee, J., Cho, H.S., Lee, Y.J. and Cho, H.K. (2010) *Designing Technology for Smart Clothing* In: Cho, G. (2010) *Smart clothing: technology and applications*. Boca Raton, FL: CRC Press.

Lewis, B. (1963) *Istanbul and the Civilization of the Ottoman Empire*, University of Oklahoma Press. (pp.14-16)

Lewis, F. D. (2000) *Rumi: past and present, east, and west; the life, teachings and poetry of Jalâl al-Din Rumi*, (pp. 300-309) Oxford, Oxford: Oneworld.
Lewis, F. (2009) *Rumi's Masnavi, part 1: World figure or new age fad?* Available at: https://www.theguardian.com/commentisfree/belief/2009/nov/30/rumi-masnavi-muslim-poetry [Accessed: February 24, 2023]

Lewisohn, L. (1997) *The Sacred Music of Islam: Samā' in the Persian Sufi Tradition.* British Journal of Ethnomusicology, *6*, 1–33. http://www.jstor.org/stable/3060828

Lifchez, R. (1992) *The Dervish lodge: architecture, art, and Sufism in Ottoman Turkey,* Berkeley; Oxford, University of California Press.

Lolli, A. (2014) *A Fusion between Fashion & Science,* Available at: https://thefashionglobe.com/descience [Accessed, November 10, 2020]

Lu, M.C. (2009) *The Dance Notation Bureau*, Dance Chronicle, *32*(2), 291–301. http://www.jstor.org/stable/25598209

Lum, R. (2019) *A Brief History of Motion Tracking Technology and How it is Used Today*, [online] Available at: https://medium.com/@lumrachele/a-brief-history-of-motion-tracking-technology-and-how-it-is-used-today-44923087ef4c [Accessed: November 10, 2021]

Lushetich, N. (2011) *The Performance of Time in Fluxus Intermedia*, TDR (1988-), 55(4), 75–87. http://www.jstor.org/stable/41407108

MacGuire, E. & Stewart, A. (2017) *The Spaniards rediscovering their nation's long-lost Islamic heritage,* Available at: https://www.cnn.com/2017/07/21/middleeast/spain-islam-andalucia-influence/index.html [Accessed: March 31, 2023]

MacKrell, J. (2015) *Flamenco firebrand Israel Galván: 'I was probably dancing inside the womb,* Available at: https://www.theguardian.com/stage/2015/jul/12/israel-galvan-lo-real-dance-interview-edinburgh-festival [Accessed March 18, 2023]

MacKrell, J. (2014) *Torobaka review – Akram Khan and Israel Galván's duet is more like a duel,* Available at: https://www.theguardian.com/stage/2014/nov/04/torobaka-akram-khan-israel-galvan-sadlers-wells-review [Accessed: January 28, 2021]

Machin-Autenrieth, M. (2017) *Flamenco, regionalism, and musical heritage in southern Spain.* London; Routledge, Taylor & Francis Group.

Mainsbridge, M. (2022*) Body as instrument: performing with gestural systems in live electronic music.* New York: Bloomsbury Academic.

Manuel, P. (1989) *Andalusian, Gypsy, and Class Identity in the Contemporary Flamenco Complex.* Ethnomusicology, 33(1), 47–65. https://doi.org/10.2307/852169

Maragos, N. (2006) *Animazoo Launches Gypsy5 Motion Capture Systems,* Available at: https://www.gamedeveloper.com/pc/animazoo-launches-gypsy5-motion-capture-systems [Accessed: January 21, 2023]

Marr, B. (2021) *The Biggest Wearable Technology Trends In 2021*, Available at: https://www.forbes.com/sites/bernardmarr/2021/03/05/the-biggest-wearable-technology-trends-in-2021/?sh=6cdb12c13092 [Accessed: April 13, 2021]

Martinez, S., & Fouce, H. (Eds.). (2013*) Made in Spain: Studies in Popular Music (1st ed.)*. Routledge. https://doi.org/10.4324/9780203127032

Mateo, A. (2014) *Wearable Tech Device E-Trace Draws Ballet Dancers' Movements,* Available at: https://www.self.com/story/wearable-tech-device-e-trace-draws-ballet-dancers-movements [Accessed: April 14, 2023]

Matteo. & Goya, C. (2003) *The language of Spanish dance: a dictionary and reference manual.* 2nd ed. Hightstown, NJ: Princeton Book Co.

Mayall, D. (2004*) Gypsy identities, 1500-2000: from Egyptians and moon-men to the ethnic Romany.* London; Routledge.

Max, T. (2021) *Top 10 Best Translator Devices in 2021 | World's Languages*, Available at: https://www.thetoppro10.com/best-translator-devices/ [Accessed: February 3, 2021]

McCann, J., & Bryson, D. (2009) *Textiles, Smart Clothes and Wearable Technology*, Woodhead Publishing, ISBN 9781845693572, https://doi.org/10.1016/B978-1-84569-357-2.50023-X.
(http://www.sciencedirect.com/science/article/pii/B978184569357250023X)

McClure, H. (2016) *The Whirling Sema Ritual and Performance Practitioners: Issues of Authenticity Change, and East–West Exchange*. Congress on Research in Dance Conference Proceedings, 2016, 251-259. doi:10.1017/cor.2016.34

McGarry, C. & Guy, N. (2022) *The Apple Watch Is the Best Smartwatch for iPhone Owners,* [Online] Available at: https://www.nytimes.com/wirecutter/reviews/best-smartwatch-iphone/ [Accessed: February 5, 2023]

Mead, D. (2022) *Strange and futuristic: 100 years of The Triadic Ballet,* Available at: https://www.seeingdance.com/the-triadic-ballet-220928/ [Accessed: April 7, 2023]

Meador, W.S., Rogers, T.J., O'Neal, K., and Cunningham, C. (2004) *Mixing dance realities: collaborative development of live-motion capture in a performing arts environment*. Comput. Enertain. 2, 2, 12-12.

Merriam-Webster. (n.d.). *Sonification*. In Merriam-Webster.com dictionary. Retrieved May 10, 2023, from https://www.merriam-webster.com/dictionary/sonification

Mileaf, J. (2002). *Poses for the Camera: Eadweard Muybridge's Studies of the Human Figure.* American Art, 16(3), 31-53. Retrieved March 22, 2021, from http://www.jstor.org/stable/3109424

Miranda, E. R. and Wanderley, M. (2006) *New Digital Musical Instruments: Control and Interaction Beyond The Keyboard*. A-R Editions

Misgeld, O., Lindetorp, H., AhlbÃ¤ck, S., & Holzapfel, A. (2022) *Exploring sonification as a tool for folk music-dance interactions.* Proceedings of the Second Symposium of the ICTM Study Group on Sound, Movement, and the Sciences (SoMoS). Presented at the SoMoS 2022 - The Second Symposium of the ICTM Study Group on Sound, Movement, and the Sciences. Retrieved from http://urn.kb.se/resolve?urn=urn:nbn:se:kmh:diva-4724

Mitchell, T. (Timothy J. (1994) *Flamenco deep song*. New Haven: Yale University Press.

Molina R. & Mairena A. (1971) *Mundo y Formas del Cante flamenco*. Libreria Al-Andalus.

Morritt, M. (2022) *Digital Dervish + Flamenco Sonic*, videographer for performances in Peterborough, Canada September 9th and 10th, 2022

Mower, S. (2006) *Chalayan Spring 2007 Ready-to-Wear*, Available at: https://www.vogue.com/fashion-shows/spring-2007-ready-to-wear/chalayan, [Accessed: April 10, 2021]

Mower, S. (2018) *Remembering the Potent Performance Art of Alexander McQueen's Collection No. 13—20 Years Later*, Available: https://www.vogue.com/article/alexander-mcqueen-no-13, [Accessed: December 1, 2020]

Mullis, E. (2013) *Dance, Interactive Technology, and the Device Paradigm*. Dance Research Journal, *45*(3), 111-123. Available at: http://www.jstor.org/stable/43966086 [Accessed: January 15, 2021]

N.A. (1884) *The Electric Diadems Of The New Ballet "La Farandole." Scientific American, 50*(11), 163-163. Retrieved May 31, 2021, from http://www.jstor.org/stable/26080765.

Nadel, M. H. & Strauss, M. (2003) *The dance experience: insights into history, culture, and creativity.* The all-new 2nd ed. Hightstown, NJ: Princeton Book Co.
Nicholas, L., Morris, G. (2018) *Rethinking Dance History: Issues and Methodologies*. Vol 2. Routledge. Available at: http://search.ebscohost.com.plymouth.idm.oclc.org/login.aspx?direct=true&AuthType=ip,url,shib&db=nlebk&AN=1543976&site=ehost-live [Accessed February 17, 2021]

Nightingale, S. (2015*) Granada: a pomegranate in the hand of God*. Berkeley, CA: Counterpoint.

Nutter, N. (2020) *The History of Flamenco*, Available at: https://www.visit-andalucia.com/one_post.php?id=783&title=the-history-of- flamenco [Accessed: July 3, 2021]

O'Connell, J. M. (2000*) Fine Art, Fine Music: Controlling Turkish Taste at the Fine Arts Academy in 1926*. *Yearbook for Traditional Music*. 32: 117–142. doi:10.2307/3185245. ISSN 0740-1558.

Olsen, S. (2017) *The dancing girls of Ancient Greece: performance, agency, and entertainment*. Clio. Women, Gender, History, 46, 20–41. https://www.jstor.org/stable/26795724

Olsson, T. (2012). *Arduino wearables*. ProQuest Ebook Central, Available at: https://ebookcentral.proquest.com [Accessed: February 2, 2021]

Orwell, G. (1952) *Homage to Catalonia. [1st American ed.].* New York: Harcourt, Brace.

Öztekin, N. (2020) *Kadın semazenler anlatıyor: Allah korkusu değil Allah aşkı var,* Available at: https://www.indyturk.com/node/271221/haber/kadın-semazenler-anlatıyor-allah-korkusu-değil-allah-aşkı-var [Accessed: February 26, 2023]

Pailes-Friedman, R. A. (2016) *Smart textiles for designers: inventing the future of fabrics*. (pp. 9-14) Lawrence King.

Papetti, S. & Saitis, C. (eds.) (2018) *Musical Haptics*, Springer Series on Touch and Haptic Systems, https://doi.org/10.1007/978-3-319-58316-7_1

Paret, D., & Crégo,P. (2019) *Wearables, Smart Textiles and Smart Apparel*, Elsevier, ISBN 9781785482939, https://doi.org/10.1016/B978-1-78548-293-9.50021-0. (http://www.sciencedirect.com/science/article/pii/B9781785482939500210)

Patel, N. (2024) Apple Vision Pro review: magic, until it's not, Available at: https://www.theverge.com/24054862/apple-vision-pro-review-vr-ar-headset-features-price [Accessed: February 5, 2024]

Paul, C. (2008) *Digital art*. 2nd ed. London; Thames & Hudson.

Pereira, S.R. (2020) *Japanese Fashion – History, Trends, Innovation and Sustainability* Available at: https://wtvox.com/fashion/japanese-fashion/ [Accessed: January 13, 2021]

Phillips, M. (2013*). Becoming the Floor / Breaking the Floor: Experiencing the Kathak-Flamenco Connection.* Ethnomusicology,57(3), 396-427. doi:10.5406/ethnomusicology.57.3.0396

Phillips, I. (2016) *The first photograph ever taken was almost lost to history*, Available at: https://www.businessinsider.com/first-photograph-in-history-2016-8 [Accessed: April 9, 2023]

Picasso, P. (1901) *Danseuse Espagnole*, Oil on board (49.5 x 33.6 cm.) 19 1/2 x 13 1/4 in. ©Helly Nahmad Gallery NY

Pietrobruno, S. (2019) *Algorithmic Choreographies Women whirling dervishes and dance heritage on YouTube*, The Routledge Companion to Dance Studies, 1st ed. Routledge, eBook ISBN 9781315306551

Pinkston, R. (1994) *Dancing with the Virtual Dervish: Virtual Bodies*. Virtual Reality Software And Technology - Proceedings of the VRST '94 Conference.

Piotrowska, A. G. (2013) *'Gypsy music' as music of the Other in European culture,* Patterns of Prejudice, 47:4-5, 395-408, DOI: 10.1080/0031322X.2013.846615

Plummer, L. (2014) *Wearables in Space; Out of this world tech*, Available at: https://www.wareable.com/features/wearables-in-space [Accessed: January 13, 2021]

Pohren, D. E. (1962) *The art of flamenco*. Jerez de la Frontera, Spain: Jerez Industrial.

Quance, R.A., (2011) *On the way to 'duende' (through Lorca's Elogio de Antonia Mercé, 'la Argentina', 1930)*, Journal of Iberian and Latin American Studies, 17:2-3, 181-194, DOI: 10.1080/14701847.2011.648920

Quinn, B. (2002) *A Note: Hussein Chalayan, Fashion and Technology*, Fashion Theory, 6:4, 359-368, DOI: 10.2752/136270402779615325 [Accessed: April 10, 2021]

Quinn, B. (2003) *The fashion of architecture*, Oxford, Berg.

Quinn, B. (2010) *Textile Futures; fashion, design, and technology*. New York, Berg.

Rabimov, S. (2017) *The New Beginning of Music: BodyRocks and Wearable Sound,* Available at: https://www.forbes.com/sites/stephanrabimov/2017/10/30/the-new-beginning-of-music-bodyrocks-wearable-sound/?sh=7560a5f73e9b [Accessed: December 4, 2020]

Rahman, K. (2017) *Islamic art and modernism: formal elements in painting, architecture, and film*. Istanbul: New East Foundation.

Raisamo, R., et al. (2019) *Human augmentation: Past, present, and future,* International Journal of Human-Computer Studies **131**: 131-143.

Ranagorgani [@instagram]. (2019, October 26) *Through the eyes of @didierperon. photography Simon Ghraichy's Concert @ Nuit Blanche Paris,* [photo] Instagram. https://www.instagram.com/p/B4FDL6sI8Km/

Redman, J. (2020) *The Oura Ring Is a $300 Sleep Tracker That Provides Tons of Data. But Is It Worth It?* Available at: https://www.nytimes.com/wirecutter/reviews/oura-ring-sleep-tracker/ [Accessed: November 10, 2020]

Riess, J. (2003) *Rumi and the Whirling Dervishes*, Publishers Weekly*, 250*(24), 67. https://www.proquest.com/trade-journals/rumi-whirling-dervishes/docview/197076838/se-2

Roberts, R. (2020) *The Flamenco Dresses of the Feria*, Available at: https://www.spain-holiday.com/Andalusia/articles/the-flamenco-dresses-of-the-feria [Accessed: March 16, 2023]

Romero, S. (2014) *10 frases célebres de Camarón de la Isla,* Available at: https://www.muyinteresante.es/curiosidades/29518.html [Accessed: May 11, 2023]

Rothwell, N. (2006) *Sonalog Gypsy MIDI; Motion Capture MIDI Controller Suit,* Available at: https://www.soundonsound.com/reviews/sonalog-gypsy-midi [Accessed: January 21, 2023]
Roy, S. (2000) *Merce Cunningham's Biped: where flesh meets form*, Available at: https://sanjoyroy.net/2000/10/merce-cunningham-biped-where-flesh-meets-form/ [Accessed: February 23, 2021]

Rumi, J. a. (2004). *The Masnavi, book one*. United Kingdom: Oxford University Press, UK.

Russell, L. (2022) *Digital Dervish + Flamenco Sonic*, still photography for performance rehearsal in Plymouth, UK May 5th, 2022.

Ryan, E.S., (2014) *Garments of Paradise: Wearable Discourse in the Digital Age*. Cambridge, MA: MIT Press.

Ryan, E.S., (2015) *Hyperdressing: Wearable Technology in the Time of Global Warming*. ISEA2015; Proceedings of the 21st International Symposium on Electric Art.

Ryan, M. (2022) *Spanish Traditional Flamenco Dress,* Available at: https://bellatory.com/clothing/Spanish-Traditional-Flamenco-Dress [Accessed: March 16, 2023]

Şahin, N.Ş. (2019) *Dervish on the Eurovision Stage Popular Music and the Heterogeneity of Power Interests in Contemporary Turkey,* Available at: https://www.degruyter.com/document/doi/10.14361/9783839443583-005/html [Accessed: May 15, 2021]

Salzmann, A. (2000) *The Age of Tulips Confluence and Conflict in Early Modern Consumer Culture (1550–1730)*. In Consumption Studies and the History of the Ottoman Empire, 1550–1922. Albany State University of New York Press, pp. 83–106.

Sanz, P (2018) *Pepa Sanz wearing Flamenco-style dress*.

Savage, G.J., Officer, J.M. (1978) *CHOREO: an interactive computer model for dance*, International Journal of Man-Machine Studies, Volume 10, Issue 3, Pages 233-250,ISSN 0020-7373,
https://doi.org/10.1016/S0020-7373(78)80042-X.

Sazonov, E. & Neuman, M.R. (2014) *Wearable Sensors; Fundamentals, Implementation and Applications*, Elsevier Inc. San Diego, CA, USA

Seymour, S. (2009) *Fashionable technology*: *the intersection of design, fashion, science, and technology*, Wien; London, Springer

Schaffer, M. (1977) *The Soundscape*, Destiny Books, Rochester

Schatzberg, E. (2006) *"Technik" Comes to America: Changing Meanings of "Technology" before 1930.* Technology and Culture*,* 47(3), 486-512. [Retrieved December 3, 2020, from http://www.jstor.org/stable/40061169]

Schimmel, A. (1975) *Mystical dimensions of Islam*, Chapel Hill; The University of North Carolina Press.

Schneegass, S. and Amft, O., (2017), *Smart Textiles: Fundamentals, Design, and Interaction*, Human-Computer Interaction Series, Springer. DOI: 10.1007/978-3-319-50124-6

Schreiner, C. et al. (1990*) Flamenco: gypsy dance and music from Andalusia*. Portland, Or: Amadeus Press.

Schuster, C. (2017) *Devil and the Deep 1932 360,* Available at: https://www.youtube.com/watch?v=jrXlLAINmV8 [Accessed: July 25, 2021]

Semazengözteri (2021) *Semazengözteri,* April 21, 2021, Instagram [Image] [Accessed: September 5, 2021] Available at: https://www.instagram.com/semazengosterisi/

Semenov, S. A. (1964) *Prehistoric technology; an experimental study of the oldest tools and artefacts from traces of manufacture and wear*. New York: Barnes & Noble.

Shafieh, C. (2019) *In Space, Movement, and the Technological Body, Bauhaus performance finds new context in contemporary technology*, Available at: https://www.gsd.harvard.edu/2019/05/in-space-movement-and-the-technological-body-bauhaus-performance-finds-new-context-in-contemporary-technology/ [Accessed: April 10, 2023]

Sharman, S. (2009) *Khwaja Mere Khwaja - Jodhaa Akbar*, Available at: https://www.youtube.com/watch?v=Pam8tXa6pkM [Accessed: May 15, 2021]

Skains R. L., (2018) *Creative Practice as Research: Discourse on Methodology*, Media Practice and Education, 19:1, 82-97, DOI: 10.1080/14682753.2017.1362175

Slade, N. (2007) *How to make Music in Your Bedroom*, Virgin Books ltd. London

Smelik, A. (2020) *Fractal Folds: The Posthuman Fashion of Iris van Herpen*, Fashion Theory, DOI: 10.1080/1362704X.2020.1850035

So, A. (2020) *Review: Oura Ring; No, you can't diagnose yourself for Covid-19 by wearing a ring. But it can tell me when my period is coming*. Available at: https://www.wired.com/review/oura-ring/ [Accessed: March 13, 2021]

Sommer, S. R. (1981) *Loie Fuller's Art of Music and Light.* Dance Chronicle, 4(4), 389–401. http://www.jstor.org/stable/1567418

Soth, A. (2022) *Electrical Fashions,* Available at: https://daily.jstor.org/electrical-fashions/ [Accessed: March 30, 2023]

Strutt, D. & Cisneros, R. (2021) *Virtual relationships: the dancer and the avatar*, Theatre and Performance Design, 7:1-2, 61-81, DOI: 10.1080/23322551.2021.1925468

Stone, R. (2004) *The flamenco tradition in the works of Federico García Lorca and Carlos Saura: the wounded throat*. Lewiston: E. Mellen Press.

Sutil, N. S. and Popat, S. (2015) *Digital Movement: Essays in Motion Technology and Performance*. Houndmills Basingstoke Hampshire: Palgrave Macmillan.

Taber, I.W. (1897) *Loie Fuller Dancing with her Veil* [Aristotype mounted on card]. Musée d'Orsay, Paris, France.

Tanaka, A. & Donnarumma, M. (2018) *The Body as Musical Instrument*; The Oxford Handbook of Music and the Body, Online Publication Date: July 2018 DOI:10.1093/oxfordhb/9780190636234.013.2

Tanman, M.B. (2023) *Galata Mevlevîhânesi*, TDV İslâm Ansiklopedisi, Available at: https://islamansiklopedisi.org.tr/galata-mevlevihanesi [Accessed: February 17, 2023]

Tariq, S. (2021) *From "Tanura" to "Dhamaal": A Legacy of Sufism*, Available at: https://matrixmag.com/from-tanura-to-dhamaal-a-legacy-of-sufism/ [Accessed: February 24, 2023]

Taylor, M. (2012). *Marcel Duchamp's Nude Descending a Staircase [No. 2] and The 1913 Armory Show Scandal Revisited.* Archives of American Art Journal, 51(3/4), 50-65. Retrieved March 22, 2021, from http://www.jstor.org/stable/43155387
Taylor, J.L. (2009) *Proprioception*, Encyclopedia of Neuroscience, Academic Press, Pages 1143-1149, ISBN 9780080450469, https://doi.org/10.1016/B978-008045046-9.01907-0.

Tekelioglu, O. (1996) *The rise of a spontaneous synthesis: The historical background of Turkish popular music. Middle Eastern Studies, 32*(2), 194. Retrieved from https://search-proquest-com.plymouth.idm.oclc.org/docview/203254611?accountid=14711

Tekelioğlu, O. (2001) *Modernizing Reforms and Turkish Music in the 1930s*, Turkish Studies, 2:1, 93-108, DOI: 10.1080/14683849.2001.11009175

TheHamzaYusufChannel, (2013) *Nine Hundred Years Reviving the Spirit of Andalusia*, Available at: https://www.youtube.com/watch?v=CBcySL09c8A [Accessed: March 10, 2023]

Thomas, H., & Prickett, S. (Eds.). (2019) The Routledge Companion to Dance Studies (1st ed.). Routledge. https://doi-org.plymouth.idm.oclc.org/10.4324/9781315306551

Thompson, B. (1985) *Flamenco: A Tradition in Evolution*, The World of Music, 27(3), 67–80. http://www.jstor.org/stable/43562714

Thrower, L. (2020) *Extinction Rebellion stages protest outside Angus Taylor's office,* Available at: https://www.goulburnpost.com.au/story/6824253/costumed-protesters-dance-in-streets-and-bag-out-gas/#slide=0 [Accessed: May 17, 2021]
Tong, D. (1998) *Gypsies: an interdisciplinary reader*. New York: Garland Pub.

Tong, R.K-Y, (2018) *Wearable Technology in Medicine and Healthcare*, Elsevier Inc., London

Torre, M.G.M.V, Lara, S.M, and Fuentes, J.M.A. (2016) *Análisis Del Flamenco Como Recurso Turístico En Andalucía,* Cuadernos De Turismo, no. 38 (2016): 301. doi:10.6018/TURISMO.38.1461.

Totton, R. (2003) *Song of the Outcasts: An Introduction to Flamenco*. Portland, OR: Amadeus *Wearable Technologies: Concepts, Methodologies, Tools, and Applications*, edited by Association, Information Resources Management, IGI Global, 2018. *ProQuest*

Ebook Central,
https://ebookcentral.proquest.com/lib/plymouth/detail.action?docID=5322287.

Touma, H. (1971). *The Maqam Phenomenon: An Improvisation Technique in the Music of the Middle East*. Ethnomusicology, 15(1), 38-48. doi:10.2307/850386

Tüfkeçi, A. (2021) *Tulip: The flower lending its name to an Ottoman period,* Available at: https://www.dailysabah.com/arts/tulip-the-flower-lending-its-name-to-an-ottoman-period/news [Accessed: July 25, 2021]

Umali, T. (2019) *Wearable tech allows people to feel music,* Available at: https://opengovasia.com/wearable-tech-allows-people-to-feel-music/ [Accessed: November 30, 2020]

Unknown. (1956). *Group of gypsies, outdoors, clapping around two dancers while a man plays guitar.* [Non-projected black and white photograph; mounted]. https://jstor.org/stable/community.12233427

Uyar, Y. M. and Besiroğlu, S. S. (2012). *Recent representations of the music of the Mevlevi Order of Sufism.* Journal of Interdisciplinary Music Studies, 6(2), 137-150.

Van Ede, Y. (2014) *Japanized flamenco: Sensory shifts in a transcultural relocation of a dance genre.* Journal of Dance & Somatic Practices. 6. 10.1386/jdsp.6.1.61_1.

Veroli, P. (2000). The Futurist Aesthetic and Dance. In G. Berghaus (Ed.), *International Futurism in Arts and Literature* (pp. 422-448). Berlin, Boston: De Gruyter. https://doi.org/10.1515/9783110804225.422

Veroli, P. (2009) *Loie Fuller's Serpentine Dance and Futurism: Electricity, Technological Imagination and the Myth of the Machine*. In *Futurism and the Technological Imagination*. Leiden, The Netherlands: Brill. doi: https://doi.org/10.1163/9789042027480_007

Walsh, J. R. (1960). *Yunus Emre: A 14th Century Turkish Hymnodist*. Numen, *7*(2), 172–188. https://doi.org/10.2307/3269433

Washabaugh, W. (1996) *Flamenco: Passion, Politics and Popular Culture,* Berg, Oxford.

Washabaugh, W. (1994). The flamenco body. *Popular Music, 13*(1), 75-90. doi:10.1017/S0261143000006851

Watkins, S. M. & Dunne, L. E. (2015) *Functional clothing design: from sportswear to spacesuits*. New York: Fairchild Books, an imprint of Bloomsbury Publishing Inc.

Webster, J. (2017) *Revealing Flamenco's Mystical Muslim Roots,* Available at: https://classicalguitarmagazine.com/flamenco-mystical-muslim-roots/ [Accessed: January 20, 2021]

Weinberger, M. (2018) *The rise and fall of Kinect: Why Microsoft gave up on its most promising product,* Available at: https://www.yahoo.com/news/downfall-kinect-why-microsoft-gave-183900710.html [Accessed: April 17, 2023]

Weir, J. (2007) *Bubelle Emotion Sensing Dress*, Available at: https://crunchwear.com/bubelle-emotion-sensing-dress/ [Accessed: February 2, 2021]

West Taber, I. (1897) *Loie Fuller Dancing with her Veil (Loïe Fuller dansant avec son voile)* [Aristotype mounted on card]. Musée d'Orsay, Paris, France. https://jstor.org/stable/community.10598298

Wheeler, B. (2002) *Between Orientalism and Fundamentalism: Problematizing the Teaching of Sufism.* Oxford, Oxford University Press.

Wigmore, I. (2019) *Wearable Technology*, Available at: https://searchmobilecomputing.techtarget.com/definition/wearable-technology [Accessed: April 13, 2021]

Wilson-Bokowiec, J. & Bokowiec, M.A., (2006) *Kinaesonics: The intertwining relationship of body and sound*, Contemporary Music Review, 25:1-2, 47-57, DOI: 10.1080/07494460600647436

Wilson, J.R. (2018) *Military wearable computing hits the mainstream*, Available at: https://www.militaryaerospace.com/unmanned/article/16707347/military-wearable-computing-hits-the-mainstream [Accessed: May 8, 2021]

Winchester, H. (2015) *A brief history of wearable gaming; Because strapping interactive devices to your body in the name of entertainment is nothing new,* Available at: https://www.wareable.com/features/the-history-of-wearable-gaming [Accessed: January 13, 2021]

Worth, S. (2014) Gitana Dress and Dress à la Gitana, Dress, 40:1, 31-45, DOI: 10.1179/0361211214Z.00000000022

Wood, M. (2014) No Longer Clashing, Wearable Tech Embraces Fashion, Available at: https://www.nytimes.com/2014/03/06/technology/personaltech/no-longer-clashing-wearable-tech-embraces-fashion.html [Accessed: January 24, 2021]

Yalman, N. (1969) *Islamic reform and the mystic tradition in eastern Turkey*. European Journal of Sociology*, 10*(1), 41-60. doi:10.1017/S0003975600001727

Yilmaz, E. (2010) *Hafiz Burhan*, Available at: https://www.last.fm/music/Hafız+Burhan/+wiki [Accessed: April 1, 2023]

Young Reed H. (2018) *In/Tangible: The Duality of Video Documentation in Dance.* In: Whatley S., Cisneros R., Sabiescu A. (eds) Digital Echoes. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-319-73817-8_12

References of Videos/Films

Rahman, K. (2022) *Digital Dervish + Flamenco Sonic: Dream Chamber* (2022- multimedia) Filmmaker and Production Designer for Live Performances at Theatre of Digital Art, Dubai (UAE)

Rahman, K. (2022) *Digital Dervish + Flamenco Sonic: Life Circle* (2022- multimedia) Filmmaker and Production Designer for Live Performances at Market Hall, Peterborough (Canada)

Rahman, K. (2022) *Digital Dervish + Flamenco Sonic: Immersive Sky* (2022- multimedia) 360 Filmmaker and Production Designer for Live Performances at Fulldome Market Hall, Plymouth (UK)

DERVISH RELATED

Dimos, I. (2014) *Flamenco & Sufi (Ya Madad) Ahmed Al Tuni*, Available at: https://www.youtube.com/watch?v=0ALIZcI_wIk [Accessed: January 25, 2023]

Hall, J. (2015) *Mary Wigman - Dancer, Choreographer and Pioneer of Expressionist Dance 3*, Available at: https://www.youtube.com/watch?v=37sEaUhFzpI [Accessed: May 17, 2021]

Karakoç, M. (2014) *Abdurrahman Önül - Döndüm Mevlana Gibi*, Available at: https://www.youtube.com/watch?v=vt898iphyi8 [Accessed: April 30, 2019]

kibrisulkuocaklari (2014) *Semazen Gösterisi*, Available at: https://www.youtube.com/watch?v=fib8EKDfpPs&t=1178s [Accessed: June 26, 2022]

Madison's Old Archive (2021) *(1932) Devil and The Deep,* Available at: https://www.youtube.com/watch?v=C91b7GEv5wM [Accessed: May 15, 2021]

Nurunyolcusu, (2012) *Hayko Cepkin - Demedim mi TRT 1 Sufi Klipler (2009) Ramazana Özel,* Available at: https://www.youtube.com/watch?v=oiowiaFDf2E [Accessed: May 19, 2021]

Semazen (2019) *Hz. Mevlana'nın 746. Vuslat Yıldönümü - Şeb-i Arus - Karciğar Mevlevî Ayin-i Şerifi*, Available at: https://www.youtube.com/watch?v=qFQviDV3MTA [Accessed: July 25, 2020]

Sheek, F. (2019) *Sufi Dance*, Available at: https://www.youtube.com/watch?v=OVmCGiNsX00 [Accessed: March 20, 2020]

TedxTalks (2017) *Dervish in Progress - Dans Gösterisi | Ziya Azazi | TEDxİKÜ*, Available at: https://www.youtube.com/watch?v=28lWyVV5f_4 [Accessed: January 18, 2020

Turkey Travel, (2022) *Rumi: Authentic Mevlana Whirling Sema Dervish Dance Complete Video in Konya Turkey,* Available at: https://www.youtube.com/watch?v=efgMJ5XD8oE [Accessed: February 28, 2023]

Gazette Duvar, (2020) *Kadın semazenler anlatıyor: Bildiğimiz yolda yürüdük,* Available at: https://www.youtube.com/watch?v=crBW3w13hUo [Accessed: May 6, 2022]

FLAMENCO RELATED

Baek, U. (2022) *Joaquin cortes -Gipsy passion, flamenco, 호아킨 코르테스 - 플라멩코 밴드,* Available at: https://www.youtube.com/watch?v=2qmA4LYe8ew [Accessed: March 2, 2023]

Clemente, N. d. N. J., (2009) *Carmen Amaya y su troupe por Bulerias – 1961,* Available at: https://www.youtube.com/watch?v=GP3Gho5qe4Y&t=123s [Accessed: May 2, 2022]

David-Teacher (2021) *Bodas de Sangre 1981 Español descargacineclasico com OREV,* Available at: https://www.youtube.com/watch?v=3YcgZI424Dc [Accessed: March 19, 2023]

De Flamenco TV (2022) *Manuela Carrasco 'Manuela' La Bienal de Flamenco de Sevilla,* Available at: https://www.youtube.com/watch?v=Go4xdE3f7-s [Accessed: September 9, 2022]

Great Big Story, (2020) *How a Japanese Dancer Made a Place for Herself in Flamenco,* Available at: https://www.youtube.com/watch?v=vCsOSgSmdO8 [Accessed: July 23, 2021]

Ling Daisly (2011) Flamenco Dance, Seville, Spain Available at: https://www.youtube.com/watch?v=XNhfV_53W7A [Accessed: November 3, 2020]

NYCityCenter (2016) *Ballet Flamenco Andalucia - Flamenco Festival at New York City Center*, Available at: https://www.youtube.com/watch?v=cm9IYSDxagc [Accessed: November 3, 2020]

Cortinas Negras (2018) *Macarena Ramírez. Festival flamenco de León.* Available at: https://www.youtube.com/watch?v=elPlcVOby-8 [Accessed: November 3, 2020]

Festimad2m (2018) *5 Macarena Ramírez Premio Baile Flamenco 2017*

Available at: https://www.youtube.com/watch?v=2pATRqvAmKU&t=72s [Accessed: November 2, 2020]
Corral de la Morería (2019) *Flamenco en Corral de la Morería: Macarena Ramírez por alegrías,* Available at: https://www.youtube.com/watch?v=F5UyT8oV_7A [Accessed: November 1, 2020]

CanalFlamenco (2011) *Joaquín Cortés en el Festival de la Guitarra de Córdoba - 'Calé'*, Available at: https://www.youtube.com/watch?v=dqyItsY-yck [Accessed: January 26, 2021]

Maralan51 (2006) *Flamenco, Bulerias - Antonio Canales (Spain),* Available at: https://www.youtube.com/watch?v=CY4AP2nKFR8 [Accessed: March 22, 2022]

Flamenco Biënnale NL (2021) *Rocío Molina, Al Fondo Riela | 7 Nov '21 Stadsschouwburg Utrecht,* Available at: https://www.youtube.com/watch?v=I4HR5s4-iEU [Accessed: March 19, 2023]

FlamencoBiennaleNL (2020) *Israel Galván | Flamenco Biënnale ON|OFF 2021*, Available at: https://www.youtube.com/watch?v=iBNA0gsOy7w [Accessed: January 26, 2021]

FlamencoBiennaleNL (2020) *La Fiesta - Israel Galván | VII Flamenco Biënnale 2019*, Available at: https://www.youtube.com/watch?v=5LG6x7Ia5OM [Accessed: January 26, 2021]

La Bienal de Flamenco de Sevilla (2018) ISRAEL GALVÁN ABRIÓ LA BIENAL CON UNA VERSIÓN EN 360º DE "ARENA", Available at: https://www.youtube.com/watch?v=RFrq-a2ba9s&t=228s [Accessed: January 28, 2021]

Maralan51 (2008) *The Legendary Carmen Amaya (1913-1963),* Flamenco Potpourri 1, Available at: https://www.youtube.com/watch?v=FCca6d2ceI0 [Accessed: January 26, 2021]

People of the Theatre – The Vlog for Theatregoers, (2021) *Sabores | SARA BARAS | Flamenco Dancer,* Available at: https://www.youtube.com/watch?v=Z-Z679y9VLw [Accessed: January 31, 2021]

Veronez, B. (2015) *TOROBAKA*, Available at: https://www.youtube.com/watch?v=8thZWACW5Gc [Accessed: January 28, 2021]

Xikorif (2011) *Flamenco verdadero: Lole y La Negra cantando en Espano-Arabe - YALLA HABIBI-* Available at: https://www.youtube.com/watch?v=JWF1IuxXp3Y&t=242s [Accessed: April 1, 2023]

FILMS ABOUT FLAMENCO:

Move: Flamenco (2020) Directed by Thierry Demaizière, Alban Teurlai, Availabled at: Netflix [Accessed: January 26, 2021]

WEARABLE TECHNOLOGY

Reuters, (2020) *Wearable Device Lets You Make Music With Movement*, Available at: https://www.youtube.com/watch?v=yNWmO4oZXxQ, [Accessed: November 30, 2020]

Tedx Talks, (2015) *Designing For The Augmented Body: Fashion And Wearable Technology* | *Amanda Parkes* | *Tedxfultonstreet*, November 11, 2015, Available at: https://www.youtube.com/watch?v=u109YbO4rn4, [Accessed: November 30, 2020]

Moore, B. (2011) *Video Alexander McQueen Savage Beauty The Metropolitan Museum of Art, New York*, Available at: https://www.youtube.com/watch?v=P13oZsD-t4s, [Accessed: December 1, 2020]

Steimtube (2009) Michel Waisvisz – 1993, Available at: https://www.youtube.com/watch?v=aaYE1TQGIvk [Accessed: December 13, 2022

DANCE PERFORMANCE

EMPAC | Experimental Media and Performing Arts Center at Rensselaer (2022) *William Forsythe, Improvisation Technologies***,** Available at: https://www.youtube.com/watch?v=Vx0fe9R1D7E&t=1464s [Accessed: Marc 20, 2023]

Patricia, D. (2013) *LifeForms*, Available at: https://www.youtube.com/watch?v=ROmTHBg8Nw0 [Accessed: February 23, 2021]
BAMorg, (2011) *Merce Cunningham Dance Company at BAM: BIPED*, Available at: https://www.youtube.com/watch?v=YHeoYdDMbLI [Accessed: February 23, 2021]

Appendix I: *Digital Dervish + Flamenco Sonic*: the film

Undeniably, half of the production for this performance is credited to the film that accompanies the musical score and the choreography of the performances. The performers for each show used a visual reference to learn from and understand their cues and gestures according to the time code as described briefly in Chapter 6 and outlined in greater detail in Appendix V. The director of the film(s) was also in tune with the tone of the piece and created the film(s) based on the musical composition and through discussions of how the performers would move in the space. Kaz Rahman shot an original film on a 360 camera for Plymouth UK's immersive full Dome theatre. Later, this film was projected onto a circular shape created for the Peterborough, Canada performances and formatted for screening on the 12 multi-screen venue at Dubai's Theatre of Digital Art.

The concept according to the synopsis (found in Appendix VI) revolved around the metaphysical and emotional journey of a Dervish as he winds through spaces and time. The beginning of the film is an awakening: as the Dervish is sleepily opening his eyes and embracing the sky above him, the visuals correspond to his movements. The changing landscapes in the film invoke a feeling of tranquility as the film moves through forests, buildings and into abstract spaces which immerse the dancer and the audiences. These images correspond to the sounds of birds and dynamic chord swells that are emphasized by the movements of the Dervish. The music changes which each scene which aligns with the dancers' movements and when they are cued to use their Soundrop devices. In the underwater-scape scene for example, the music changes in key and a sensation of intensity begins to build where curious creatures that blur the screen weave in and out of symmetrical domains as seen in Figure I.1. Suddenly the visuals become darker and more ominous as the Dervish traverses through a winding spectacle overhead resembling a hurricane. Initially, the concept was to animate a 3D model of a hurricane or tornado however, the image was too literal and did not compliment the aesthetic of Rahman's vision for the film. The hurricane scene is a pivotal moment in the piece as it dramatizes the whirling movements of the Dervish as seen in Figure I.2. In this scene, the

music also become more chaotic and intense as large hand-drawn swirls envelope the screen and seemingly shrouds the Dervish.



Figure I.1: Mayez begin whirling at underwater scene (image from Charminar Films, 2022)



Figure I.2: Mayez whirling during hurricane scene (image from Charminar Films, 2022)

The film's aesthetic also revolves around colors to which meanings could be associated and unpicked. In the beginning scene, the color tones are warm like a sunrise implying a peaceful serenity whereas in the more intense whirling scene, the colors are vivid and extreme conjuring feelings of turmoil.

When Flamenco Sonic appears on stage, the music again changes key and rhythm while the film also uses a mélange of city/streetscapes and obscure landscapes that meld into each other before changing again. When the Flamenco dancer begins their movements, the rhythm of the music (in this case a guitar piece mixed with ambient electronic chords/pads) the visuals turn to hand-drawn shapes and lines that move and bounce to the beat of the music and emphasize the dancer's movements as seen in Figure I.3.



Figure I.3: Flamenco Sonic (Mercedes) in solo scene (image from Charminar Films, 2022)

The syncopation of the backdrop of the film along with the dancer's movements and the music while the dancer uses the Soundrop all produce a harmonious element that allows the viewer to become absorbed into the entire experience.

The final scene as Digital Dervish and Flamenco Sonic perform their whirling or turning together unites the playful animated colors of the Flamenco sections with the serene minimal color tones of the Dervish's character as seen in Figure I.4. The film reflects the personalities of each performer which further emphasizes their role in the production and the overall tone of the piece as they join their music, movements and sounds that they convey with their Soundrops.



Figure I.4: Mercedes and Mayez in final whirling scene (image from Charminar Films, 2022)

The stage design for the performances in Peterborough, Canada which were described previously in Chapter 6, required an adjustment to the stage in that the theatre was a traditional venue with a stage and seating facing the stage, therefore it was impossible to recreate the full Dome experience at Plymouth's Market Hall. The solution to this challenge was to build a circular space on the floor of the stage as the film would be projected from above pointing downwards onto the white circular screen while the 360-format film was back projected as a circle mirroring the floor circle. This solved the issue of creating an immersive experience and in turn created a different atmosphere for the audience and performers. Since the dancers in Plymouth had a massive space to dance

in and the Market Hall theatre in Peterborough had a more limited space, the choreography had to be adjusted to focus on the center of the circle rather than overhead and all around. The film was then projected not only onto the circular screen on the floor but also onto the performer (in this case Mayez Rahman). This created a new dimension to his character as the projection of the film onto the costume made it seem as though he was fully intertwined with the visual landscape rather than being 'underneath' it as seen in Figure I.5. He remained within the perimeter of the circle for the duration of his role while the Flamenco dancer danced around the circle. Towards the end during the whirling scene between the two, both dancers whirled outside of the circle.



Figure I.5: Mayez whirling (image from Charminar Films, 2022)

The film for *Digital Dervish* which became a second part, was created especially for the ToDA Dubai performances. This film was a departure from the first film in that it related to the character of the Dervish (who performed solo in this piece). The premise for the film is a prequel to *Digital Dervish + Flamenco Sonic* as it is more reminiscent of the Dervish's past but also his future where there are insights or glimpses into his memory or his dreams. Rahman's concept was to use moving images and layering them to create a surreal dimension that tapped into the Dervish's inner world of struggle, passion,

motivation and love. The layering of colors is also present in this film as the subtitle of this piece is ‘Dream Chamber’ where certain color palettes invoke different emotions in the Dervish as he travels through a dreamscape of distorted images and swathes of colors that amalgamate as he whirls continuously. This film is 20 minutes in length and the choreography for this performance was centered around the Dervish’s uninterrupted whirling. Sercan Çelik took on the role of Dervish for the Dubai performances as his stamina for turning is far greater than Mayez’s. As mentioned previously in Chapter 6, the Theatre of Digital Arts in Dubai, UAE is a venue that comprises 12 large screens and a reflective floor thereby applying an immersive experience for the audience. The film was shot on an HD camera and was formatted to fit the screens so that there were repetitions of the film on all 12 screens. The beginning section of the film reveals images that may be inner thoughts of the Dervish or subconscious thoughts that he is not aware of. As the Dervish begins to move and whirl, the music intensifies with deep, arpeggiated chords that drive the whirling momentum into a chaotic spin. Rather than using hand-drawn animated shapes, Rahman relies on animating within the film itself by juxtaposing layers of moving images to emphasize the continuous movement and resonance of pounding electronic chords. In the beginning scene where Sercan is seated in meditative contemplation, the film is comprised of superimposed shots of and the destruction of a mosque and a *sema* ceremony with multiple dervishes as seen in Figure I.6.

The pacing of the film continues to build in tension and energy as the Dervish sets himself in motion against a surrounding backdrop of endless fragmentations of images. There are moments in the film where there is not only abstracted landscapes but stillness in nature that reverberates as the music resonates with each turn that the Dervish initiates. He uses his Soundrops to emphasize this in the movement as well and adds to visual ambience as he is whirling his arms in dynamic gestures. Towards the end of the piece where Sercan’s whirling becomes more intense with the removal of one of his *tennure* (skirt) the film cuts to blocks of color; sometimes red or green with a superimposed shot of another whirling Dervish which is Mayez. This emphasizes that he is in a dream state of some sort where he is possibly remembering himself as a child. These subtle indications into the narrative of his whirling are underscored by the shot selection which eventually

becomes more accelerated reiterating the propulsion of whirling as seen in Figure I.7. This image shows a shot of waves crashing on a shore and it begins to spin through the theatre in the same velocity as the Dervish.

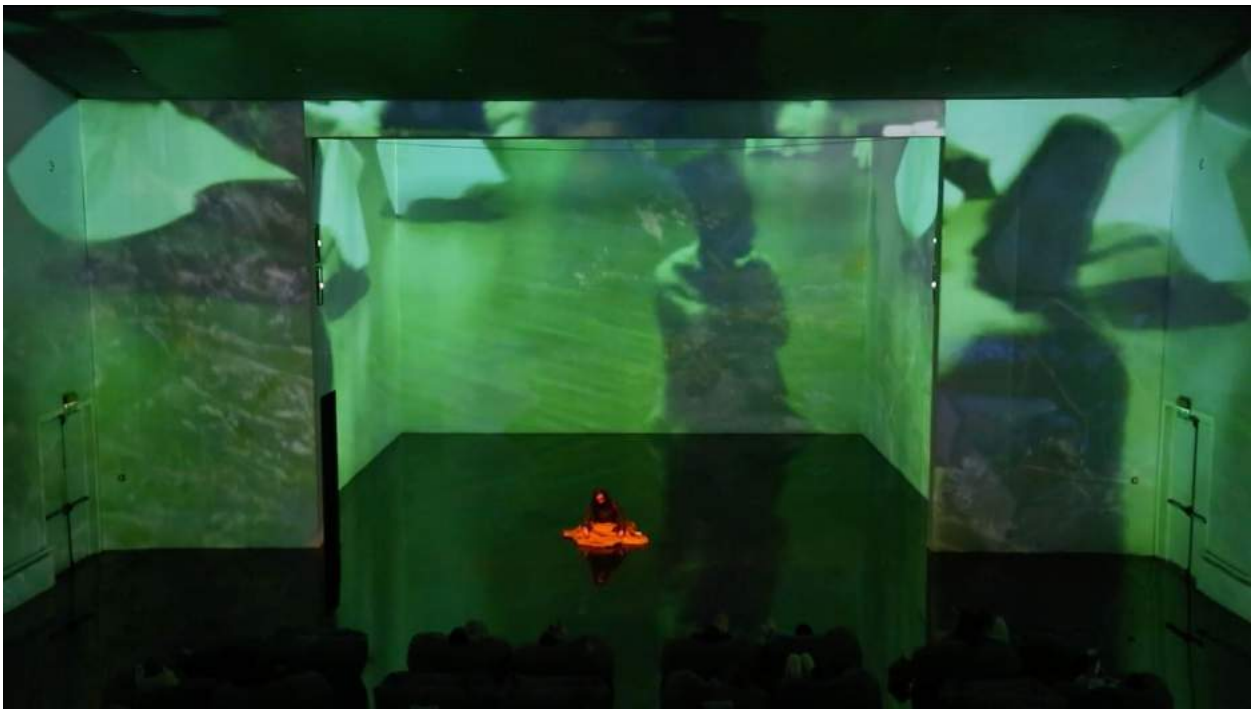


Figure I.6: Sercan in seated position at ToDA (image from Charminar Films, 2022)

In essence, the films delivered the dynamism and spectacle of the performances which without, would not have had the same compelling impact. In a traditional *sema* setting, the backdrop or venue would be the gathering place of the Mevlevi or *semazen* (those who perform the *sema*). This would be in a building or a space with no other visual elements other than the building itself. Similarly, a Flamenco show is normally presented at a theatre-like venue where there is a stage and an audience focusing their attention on the performers. The setting that is created with *Digital Dervish + Flamenco Sonic* is essentially the films which is a multi-media performance piece that places both a Dervish and a Flamenco dancer into a world of abstract moving images that tell a narrative which is augmented by the actions of the performers. These fundamental elements: the film, music, dance and the use of a digital wearable device are what make this production unique and anomalous.

Appendix II: Information Sheet and Consent Form

Exploring the Movements of the Whirling Dervishes of Turkey and Spanish Flamenco Dance with a New Wearable Musical Body Instrument – Digital Dervish Flamenco Sonic

You have been invited to be part of this research project as titled above, in its short form: Digital Dervish Flamenco Sonic. This is a research project for the fulfillment of a degree in Doctor of Philosophy in Digital Art and Technology by Hedy Hurban. Please read this information sheet to find out more about the research and why it is being done.

About the project

This research project involves creating a bespoke hand-held wearable technology device that emits sounds and vibrations to be used in performance practices such as dance, theatre, musicals etc.

What the research is about

The project aims to create a simple device that emits musical sounds to be worn on different areas of the body such as the wrists or ankles. The focus of the research is to examine traditional performance practices such as Spanish Andalusian flamenco and the movement practice of the Whirling Dervishes of Turkey by attributing wearable devices to performers in these traditions. The goal is to augment the performances using these devices to determine if the performer can incorporate these pieces of technology in their traditionally performed practices. Some meaningful movements or gestures are intended to be captured such as wrist rolling, foot stomping, or arms waving back and forth.

How information will be gathered

Several tests will be done to determine how the device works and feels against the body, attached to the wrist or ankles in terms of comfort and how it is worn. Information will be gathered by video and still image documentation so that tests of movement can be analyzed to best determine how sounds should be allocated to the device, what movements suit the sounds best, what other movements can be examined to generate sounds with. Information will also be gathered in the form of interviews that will involve a series of questions surrounding how you have come to engage with your practice and how you feel this device can be used to augment your movement practice. This information will help determine many factors in the development of the project. Some of these factors include the physical construction of the device, using different materials but also determining if using a wearable device on the body that augments cultural practices is sustainable, suitable and viable. You will also partake in performances in select venues in Plymouth, UK and/or Ontario, Canada. These performances will also be documented in the form of a short film for research purposes.

Confidentiality and anonymity

If you are happy to take part, please complete the consent form, making clear if there are any parts of the research you would prefer not to take part in. I may write about what I find out in reports, conference papers, journals and books. I will also share my findings with other people who arrange similar activities, as well as other researchers. It will not be possible to know who said what in anything made public unless you give your permission. You can ask for feedback about my findings if you would like.

Photographs and Videos

I may want to use photographs and videos in my research reports and other publications about the project. If you prefer us not to use photographs and videos of you, please indicate this in the consent form.

Right to withdraw

You have the right to stop taking part in the research at any time, including during the data collection or afterwards up to the point at which the data is analysed. You also have a right not to answer specific questions or to ask for audio and video recording to stop.

Thank you for taking the time to read this information sheet. I very much hope you will take part.

CONSENT FORM

I have read the information about your research project title. I am happy to take part and give my permission for:

*Please delete any of the statements below you do not want to give permission for

- The audio recording of conversation
- The use of photographs and videos for research purposes only (photographs and videos

with only be viewed by participants and researchers)

- The use of photographs and videos in reports and publications (photographs and videos

will be published and publicly available)

- Written records of the research and its findings being held by Your Organization for a period of 10 years (in which all participants will be anonymous, unidentifiable and unnamed)
- The use of this written research data for reports, presentations and publications
- Add any other use you may be planning

Signed.....Date..... Print name .....

Address.....

.....Postcode..... Telephone contact.....

Email contact.....
I would like a copy of the summary of the research sent to me at this email address
Please return one copy of this form to: Hedy Hurban
Please keep the other copy of this form and the information sheet for your own records.

THANK YOU VERY MUCH FOR YOUR TIME.

Appendix III: Interviews with Performers

Interview with Mercedes Romero
December 14, 2021
At University of Plymouth, UK

1. Where are you from originally?

I am from Madrid, Spain

2. How long have you been performing flamenco and were you trained through oral traditions or through a professional dance studio?

I have been dancing Flamenco since a very young age as well as other style of Latin dance such as salsa, but I mainly practice Flamenco. I was trained in Madrid and have performed in many places for the last few decades. I have also taught Flamenco for over 25 years, and I have performed in Spain, Mexico, France, Italy and England with various dance companies such as Ballet Teatro Español de Rafael Aguilar, Ballet Español y Flamenco Martin Vargas, Ballet de Carmen Mota, Ballet titular Teatro de la Zarzuela and Teatro de la Maestranza. I currently reside in Plymouth, UK where I perform at local venues and teach Flamenco to students of all ages.

3. What does Flamenco mean to you?

To me, Flamenco is an important part of my life. It is a part of who I am, and I use Flamenco in my everyday life one way or another. Flamenco is not just a dance, it is an expression of many things like emotion, love, tragedy, joy, anger and so forth. It is a lifestyle and also a way to express myself - I cannot imagine my life without Flamenco.

4. Who are some of your Flamenco heroes?

Oh, there are so many…over time there have been a great many performers but some of the best I think are Camarón de la Isla, Paco de Lucia, and the dancers are also many such as Carmen Amaya, Cristina Hoyos, Joaquín Cortés…

5. What are the most important movements for you to embody?

There are many movements that are important in dancing Flamenco, so it is not one or the other - it is more like the body is a unit but with several moving parts that each have a job. Like, my feet are in tune with the rhythm of the music and then my hands are also using the music to create movements and then the rest of my body like my hips, torso coordinate everything else. I think the zapateado is very important because it is the highlight of the performance, but other things can make the dance interesting as well such as the wrist movement and then using things like *mantón* which adds another element of excitement for me.

6. Do your movements and gestures have any specific meaning behind them in for example if you move your arms in a certain way or rolling wrists is there any symbolism associated with it or is it part of the dance?

Well, not exactly. I think about when I am moving my hands for example, it is like I am communicating something, so I guess that is the meaning in a way - but it is like *florea* which is the movement of the wrists that extend from the arm that resemble a flower. If the flower is not strong it becomes wilted so to make it look beautiful, there has to be strength in the wrists.

7. What does *duende* mean to you?

How can I explain it? I think it means like magic in Flamenco - and to have *duende* means to have a power or magic that comes across when you dance. It is something that is felt deep inside the soul and cannot really be explained.

8. What is your opinion on collaborating with different traditional dance practices?

I think it's amazing, I am very happy to do this. I have dance with other dance forms from different traditions and cultures before but never with a Dervish. I would have never realized that there could be a connection between the two.

9. How does having a device that you can control which makes sound based on your movements make feel to you physically and maybe emotionally?

It is really great - I never experienced this before! I feel like I have control over something else other than my body parts and it is really nice and unique. It makes me feel like I can give the audience more than just my movements. I can express something else as well that can make them understand more about my dance.

10. Do you think using technology to augment your dance practices could be useful to you in your performances?

Definitely, I can use it. If I learn how to bring it into my dance and use it in new ways, I think I can create some different types of choreography. I think it is a great invention that can be used by any kind of dancer.

Interview with Carolina Loyola-Garcia
March 26th, 2022
Robert Morris University
Pittsburgh, PA, USA

1. Where are you from originally?

I am from Santiago, Chile

2. How long have you been performing flamenco and were you trained through oral traditions or through a professional dance studio?

I started learning Flamenco when I was in college and I at a flamenco school in Chile and ever since I've continued to study in a variety of places I've taken classes from teachers in New York and San Francisco and Washington DC, Madrid, in Sevilla - I've been going to Spain for you know or a decade now every year well before the pandemic and to train so yeah I continue to train there.

3. What does Flamenco mean to you?

Flamenco has a become very much part of my identity and it is historically a tradition of a specific group of people and it is a clan in its in its history that became public at some time in the mid 19th century by chance a from there it started propagating and expanding but it's always being very guarded by the group the community that is sort of holds ownership of it. The origin of it it is rooted in what we know Spain today and so for me it has connected with my heritage. I have found over the decades that I've been learning a practicing Flamenco and number of connections with childhood stories and experiences of mine in my family of origin and that link back to my grandfathers in history who was an immigrant from Spain in Chile. So, as I said has become a big part of my identity of what I practice creatively it has become a big part of my sense of community as an immigrant in the United states it has become part of my creative practice. It brings me ultimately a lot of joy and a sense of tradition and belonging and space or placement in time.

4. Who are some of your Flamenco heroes?

This is not just my hero but it's everybody's hero so I have to mention him Camarón de la Isla was very important figure in the history of Flamenco, and he was one of the many people at the forefront back in the 70s pushing the envelope of what Flamenco could be because of the origin of Flamenco being belonging to a specific cultural group it has been very guarded. People that have tried to take Flamenco outside of this defining frame have been criticized over the decades and so Camarón was definitely one of them. Before him Carmen Amaya back in the 30s she - pushed the envelope for female dancers in the tradition by developing her technique in footwork which women did not do up until then and dressing in drag she took on the male outfit and started performing in drag with a lot of foot work phrases - she was possessed. I guess a lot of my heroes or people that I admire people that have pushed envelopes to expand it - another one contemporary figure that I admire is Israel Galvan who has done the same thing in the world of dance. Camarón did it in the music and Amaya did it in the dance area specifically for women and Galvan has pushed the envelope further out for all performers completely departing from its origin.

5. What are the most important movements for you to embody?

Well, when I am dancing because I I've had the fortune of dancing to live music for most of my life in Flamenco so the most important thing when dancing and moving in Flamenco is to stay in the compas - the beat that dictates any everything and anything you do so staying within the compas is the most important thing and then making the music visible that is the most important aspect of what I do. So, it is slightly being one with the music in the movement and the visual aspect of it and then while I am on that when I am able to be on that space then communicating to the audience being in that space of the emotional connection that you as a performer can have with them being there being present being open so that can flow and you can connect with them.

6. Do your movements and gestures have any specific meaning behind them in for example if you move your arms in a certain way or rolling wrists is there any symbolism associated with it or is it part of the dance?

Not really so like an Indian dance where hand movements have meaning even though arguably a there is some connection between flamenco and Indian culture because of the origin of gypsies. But in flamenco the movements that have specific meaning in general like women for example they had movement is called florea which means flowering so your hands are kind of like you know symbolizing flowers and, but they don't really mean anything in particular. What does have meaning is the specific rhythm that you're performing. Flamenco has a family of many rhythms - 40 something rhythms on each rhythm has its own history its own beat its own place of birth within southern Spain. Each of those then there's a lot of meaning because when you're dancing soleá for example, it's somber and intense and it's slow so the movement sort of has to carry that intention in a degree. The opposite like happy Alegrías from Cadiz and it's very graceful so your movement has to sort of carry that kind texture but other than that the movements themselves don't have any specific symbolism attached.

7. What does *duende* mean to you?

Duende is a term that means a magical spirit or creature and when there is *duende* for a performer it means that there is something magical or inspirational for the performer. When you are connected to spirit and you are channeling a divine connection, there is something that happens in a performance to a performer and the audience. It brings you to that moment of inspiration.

8. What is your opinion on collaborating with different traditional dance practices?
I would very much so like to perform with other cultural practices - early on in my career I used Flamenco as a form of movement, but I was taking it into installations. I have a lot of interest in bringing Flamenco into other forms of expression. I have done many adaptations with Flamenco and other theatrical productions playing different characters.

9. How does having a device that you can control which makes sound based on your movements make feel to you physically and maybe emotionally?

I think it's interesting it offers into an interesting possibility of exploration I would just like for the device to become somewhat invisible or not invisible like literally but really incorporated into the movement so that it's doesn't become a distraction, but it becomes embedded into what the performance is. I think ideally the device from a design perspective would also graduating to the other thing that would be like the perfect marriage of those two traditions or practices.

10. Do you think using technology to augment your dance practices could be useful to you in your performances?

I think that story telling is the most vital aspect of conveying a message. I think as long as it serves the data communication process then yes it can be an augmented.

Interview with Sercan Çelik
July 18, 2022
Istanbul, Türkiye

1. How did you start turning and why?

I started turning when I went to the winter Olympics in Türkiye as a dancer in 2011. My first *Sema*/*Sema*zen experience was the preparation for that. They were trying to form a group of 100 *semazen* but they missed out some people, so I joined in because I had been dancing since my childhood. That's how I had to learn *sema* when I was offered. There it was my first show. Until that time, I had no knowledge about *sema*. I didn't know what it is to be a *semazen*. I didn't know what the Mawlawi was about. At that time, it had just started for me as a show that I needed to participate in. But later I started loving it. So, I worked harder as well as learning the meaning of what it presents and have become who I am today. Soon I plan on writing a thesis on the Mawlawi and the *Semazen*. *Sema* literally drew me into itself, but I have never joined a *Sema* group. I have been moving forward with my own works and research. The *Sema* itself and being a *semazen* are a huge part of my life now. I would like to say that I'm not officially a *sema*zen and haven't received an education on it, I move forward myself, I'm taking the path alone, trying to exist on the path.

2. Do you experience and metaphysical effects when you are turning?

That does not happen during the shows. I mean that requires a considerable amount of time, from the beginning to its end you may not know how and where in this world you will find yourself. That's why you need to be both mentally and physically ready because it's highly possible within some circumstances, you may not be able to catch that. You may not be able to go through that transition. The status of your mind at that time, your thoughts or your experiences on that very day have an impact. These are why only after I provide the necessary conditions, there are times I can go into that transition and outside that dimension. However, what I have felt from the beginning is that whenever I go into

the stage, the stage itself, being in that stage, the audience, the music take me somewhere else to another dimension. So, what I feel when I dance to Turkish folk music for instance and the feeling I get when I do *sema* is actually the same. In both of them I can grasp the spiritual satisfaction. Each situation carries me to a state of comfort and getting rid of the self. So, what matters the most to me is the movements.

3. Do you feel that you are contemporizing Mevlevi whirling with your style of dancing?

The answer to that question has many layers in fact. I could give various answers for this one. I think I'm doing he most primordial version of it based on the research I have been doing. Rather than a modern dance, it is primal. What I do is just reflecting how I feel at that moment. I also don't care about how I look from the outside that is because I do whatever I feel like doing in my heart. I just transfer what my soul tries to say with my hands and my body. To me this is speaking a different type of language. But is this modern dance? I don't know much about that. Maybe it's the most primitive status of it. What I know based on the research is that this became a system after the son of Mawlana, a system that has reached today known as the Mawlawi situation. But for the times before him I have to say I have never found solid sources. However, it is known that Mawlana used to go into to the state of Vecd (the spiritual transition not ecstasy like its described in English) in the gatherings and the movements used to develop later on through that spiritual transition, that's how it came to the turning movements around himself. For the turning movement I can say one similarity to meditation somehow, the turning can rip you apart from this world easily. Because at that moment you only deal with the self and do not care about what's happening outside in the world. You don't see anything that take place. First it cleanses you from the vision and then it channels you to other points you should be. What we call seeing with the eye of the heart starts from there. You do not think about being in the world or not in such status. Just as it is told in the tasavvuf (which is not mysticism as described in English dictionaries but it's focusing on The Creator and creation with the eye of the heart only, developing a better understanding of the creation and The Creator) who is Allah. Recently, not only Muslims but also people from different

religions and ethnicities have been practicing the turning movement. Actually, the answer to this question goes so far as to why son of Adam has been sent to this world.

4. What do you think about current *semazen* shows at weddings and other special events (on TV shows, Sünnet etc.) - what is your opinion about that?

It is no surprising to see this happening in today's world because frankly it has been turned to being a show. Why? Because it attracts audience. The lights and all type of stuff is used. There is also this fact that all around the world even the groups that are kind of introverts started to worry about being liked and receiving the attention of the audience. They use lights and sound so to be heard and watched better. They receive audience and when there is audience there is no escape from something to be a show. That's already the beginning of how it all came down to this. Honestly, I don't care about the weddings and so on. If it was me doing an authentic *Sema*, I wouldn't let anybody watch me, nobody would be watching. An audience during such experience would be tedious because I would already be on my way to nothingness (nothingness means getting rid of the nafs/shaytan/any type of worldly issues or wishes and just focusing on the real meaning of existence). So why would I make a demonstration to the people while I try to journey to nothingness. We should ask the real *Sema* and the real dervishes like the ones in Konya hundreds of years ago, do such dervishes ever live now and raised into this? For example, we should take a look at when did the Şeb-I Aruz celebrations started to be held. In the 1940's for the Vuslat of Mawlana for example. There was nothing until then because in Türkiye in the past, they brought a law to close all the educational institutions that focused on religious studies and also all the places where religious orders gathered and practiced. That whole system was moved out of here. So, it should be known that there is no authentic *a* raising, *Semazen* lectures left. There are no people left who deprives himself/herself of the worldly needs for 1001 days, leave them unfulfilled with loyalty, and wait for the day of acceptance for days and so on. Why? Because we live in modern days and nobody gives up on the worldly needs, the luxury in this world and the showoff even. So, we should ask, are there any true dervishes, thus *sema* left. There are many thesis studies written regarding the way *sema* is used for the purpose of cultural

promotion or other types of entertainment environments. Many people do research, many people say something about this, but we miss a point. The religious orders like back in those days have been forbidden in our country. There is none like it. There is no religious, spiritual training like the way it should have been. Now it is just that Mawlana is a great value here and we respect him so much because the messages he gives out to the world is so right and positive. So, to sum up where else they do the *sema* is not my concern but what I do is I close myself with others who do this by heart and do it or I do it myself cause I don't need anybody for it.

5. Some *semazen* who I've approached did not want to mix technology with their practice - how do you feel about using technology in your practice?

I don't see myself as a traditional *sema*zen. They do not want the technology involvement due to the concern of critics. I might as well be criticized but what we do here is not contradictory or altering, we just take the running movement as our base and make a combination. This can either go spontaneously or choreography based but after all we use the raw *sema* (essence of the *sema*).

6. Do you think that using these devices could enhance/augment your performance practice?

I can comment on this one like this. In fact, it's like I'm holding the future on my wrists. I am one of the first representatives of this is what motivates me. Maybe a few years later, everyone will be using this thing. The good, the contribution that it does to me is I can really reflect what I feel with my body and hands and along the way if I can present what they mean with music, that's very exciting for me. All the feelings I have as a whole, the movements, the music maybe even vocals that I may add in the future, can be presented in a totally different level of show. That will be the most contributing factor for me. The way this tech is now enables me to put something from me into the music.

7. How do you feel using this device; how can you integrate this body instrument into your dance practice? How do you think technology can emphasize what you are trying to do?

In these times we have gone into a digital age, I think these kinds of things will be required for someone to exist as a dancer already. You can also make artificial intelligence and computers come up with movements but in the sense of movements with emotions, one searches for the augment there too, this would have a huge impact, to be a part of the tech world with the emotional movements of a dance is really something. Also, when I dance, it is good to know that I am able to take charge of also the things that I normally in current circumstances cannot control. To be able to contribute to the music is great and without that, it would lose its point already. This provides a holistic approach to the performance. It could also increase the sensible interaction with a musician who plays on the stage at that moment as well. It could give a totally different scene and feeling. It is true that we can provide this with dancing and musicians together but here we talk about a wearable device who contributes holistically to the whole process. Lastly, it is a privilege for me to use this in my dance. The moment I reflect my feelings through my body along with the device is huge.



Figure III.1: Interview with Sercan Çelik in Dubai, December 17, 2022 (image from Rahman, 2022)



Figure III. 2: Rehearsing in Dubai with Sercan and Pepa December 15th, 2022 (image from Rahman,2022)

Interview with Pepa Sanz
January 18, 2023 (online)

1. Where are you from originally?

I am from Madrid, Spain

2. How and why did you start dancing flamenco?

I started dancing flamenco when I was 7 years old. I really liked to dance, and I was enrolled in a dance school. In my beginnings I learned to dance all types of Spanish Dance and then I was specializing with professional studies.

3. How would you describe your style of flamenco?

In my personal style I think that all the years of learning with flamenco masters of different styles, all the experience of 35 years as a professional dancer collaborating with many artists from different disciplines, and of course all the personal experiences that inevitably are in my dance are reflected. All this background is present in my current way of dancing and in my choreographies. I think it has given rise to an "Open Flamenco", with a freer and more personal style. I look for strength and sensitivity, I try to develop the "technical" part in search of quality, rhythmic games, body work, leaving room for viscerality and improvisation. I believe that my dance is in constant evolution, always with a lot of respect and knowledge of the traditional language.

4. Who are some of your influences?

It is difficult, because there are many artists, masters and colleagues who have greatly influenced my professional career. In Madrid I studied in the emblematic studios of "Amor de Dios" with many artists and teachers, La China, Antonio Reyes, Adrián Galia, Manolete, Ciro, Tomás de Madrid, Belén Fernández, Belén Maya... In 1994 I was

selected to the beginning of the 1st “Ballet Andaluz”, under the direction of Mario Maya in Seville, and it meant a great change for me, when I came in contact with the "Escuela Sevillana", getting to know other styles and studying with masters like Mario Maya himself, Manolo Marín, Milagros Mengíbar, "La Tona", ..., having for colleagues Israel Galván, Rafaela Carrasco, Isabel Bayón,...Undoubtedly another of the most important influences was the period that I was part of the company "Flamenco XXI Danza" (1996-2004) directed by Ricardo Franco, in which I had the opportunity to share the stage with great flamenco figures such as Beatriz Martín, Belén Maya, Belén Fernández, Mar Vivó, Rafaela Carrasco, Antonio "El Pipa", Rafael de Carmen, Domingo Ortega, Alfonso Losa, ... as well as great guitarists and singers of the moment. It was a real learning each rehearsal and performance.

5. Do you feel that wearable technology could augment your dancing?

More than "improving" the dance itself, I believe that technology can enrich and complement the shows. You have to experiment and develop other ways to evolve, it's clear, but the bodily, the physical, the face-to-face and ephemeral aspects of dance are irreplaceable for me.

6. How did you feel when you danced with the Soundrop on stage in Dubai?

It was a very interesting experience for me. I had never danced with such a device, and I was very curious.

7. Did you feel that the Soundrop was easy to use, or did you have any difficulty?

The device is easy to use. At first, I was very aware of when to turn it on and off. I didn't have time to become aware of what was resulting from the outside. Then I was relaxing and letting more improvisation emerge.

8. Would you dance using the Soundrop again?

I hope we will have the opportunity to further develop this experience. I would like to experiment again, practice other ways of using it, and using other sounds.



Figure III.3: Interview with Pepa Sanz in Dubai December 17, 2022 (image from Rahman, 2022)

Interview with Mayez Rahman
January 18, 2023
Knoxville, TN, USA

1. Where are you from originally?

Peterborough, Canada but I have never lived there. I lived in Pittsburgh, Pennsylvania, Istanbul, Turkey, Plymouth, UK and now in Knoxville, Tennessee.

2. How long have you been practicing performing as a Dervish?

Since 2018 but I am not professionally trained. I do it occasionally.

3. How did you come to performing as *Digital Dervish*?

My mother asked me for a favor to perform in her production.

4. Do you find it difficult to spin for long periods?

Very long periods yes.

5. What are you thinking of when you are whirling?

I just think about the whirling but sometimes I think about random things. I try to focus on whirling.

6. Do you feel any spiritual euphoria when you are whirling?

It feels like a kind of prayer sometimes – I sometimes have a prayer going on in my head.

7. How does wearing a device that makes sounds when you move contribute to your whirling?

It makes the experience feel more real.

8. Do you feel that wearing technology can change how performers perform on stage?

Yes, it can – it is a new generation of performing because it stands out compared to how performing used to be and it also shows the development of technology in performing arts.

9. What was it like for you performing as *Digital Dervish* in the production *Digital Dervish + Flamenco Sonic?*

It felt strange and sometimes tiring. It was also a positive experience for me.

10. How easy or difficult was it to use the Soundrop musical wearable device?

It was very easy to use, and you can learn how to use it quickly.

11. Would you change anything about the device?

I think it is fine the way it is right now other than having a touchscreen or interface, smaller and more compact – mass-produced and patented.

12. Would you perform again using the Soundrop or would you use it for your own sound/music making?

I would prefer to use it for my own music making purposes.



Figure III.4: Mayez Rahman backstage at Market Hall, Plymouth, UK, May 6th, 2022 (image from Rahman, 2022)

Interview with Kaz Rahman and Hedy Hurban led by Bill Kimball of Public Energy in Peterborough, Canada September 6th, 2022:

https://www.youtube.com/watch?v=wUOpEh01sek

Appendix IV: Press Releases for Performances

REAL IDEAS PRESS RELEASE

WHIRLING DERVISHES INTERTWINE WITH FLAMENCO DANCERS TO CROSS CENTURIES, CULTURES AND TECHNOLOGY IN UNIQUE MULTIMEDIA PERFORMANCE

Plymouth is set to play host to a unique multi-media immersive dance performance that mixes the metaphysical 13th century Islamic tradition of the Whirling Dervishes of Turkey with the vibrant dance of traditional Spanish flamenco, all set against the reactive backdrop of Europe's only awe-inspiring 15 metre immersive dome. Entitled *Digital Dervish + Flamenco Sonic*, the performances will take place in Plymouth's Market Hall dome on Friday 6th and Saturday 7th May.

The multi-disciplinary, cross-cultural event is created by arts collective Firoza and produced by composer and designer Hedy Hurban with an original 360 film made by globally renowned artist/filmmaker Kaz Rahman and showcased by Community Interest Company Real Ideas. The two-night event forms part of the Firoza collectives' ambition to provide a fresh approach to contemporary Islamic Art that brings together new painting, photography, installation, multimedia, film and video art and performance works in curated projects around the world and online. Real Ideas' immersive dome is the first-of-its-kind in Europe and as such, the Plymouth location offers experiences at the cutting edge of immersive tech, as well as a backdrop for 'cultural and creative collisions' such as this global performance- variations of this project will also be showcased in Turkey and Canada.

Hedy Hurban is a designer of costumes and composer of electronic/electroacoustic music. Her interest in interlacing sonic and digital art with traditional folk performance practices led her to create a prototype body instrument inspired by the Whirling Dervishes of Turkey called *Dervish Sound Dress* (2018) that combines music, wearable body technology and live performance. She has since developed a wearable musical body instrument device called the *Sound Drop* which will be used by both dancers in the show. Hedy has a BFA in Visual Arts from York University (Toronto) and a ResM in Computer Music from the University of Plymouth and is currently associate lecturer in Digital Art and Technology. Kaz Rahman has worked extensively as Visual Artist, Filmmaker and Academic with both commercial and public institutions, festivals and broadcasters over the last 20 years. Rahman has an MFA in Media Arts (writing/directing) from City College (CUNY), New York City and has taught at universities and colleges around the world.

Hedy Hurban says, "The sema of the Dervish blurs the lines between dance and meditation while symbolically expressing the formation of the universe and

mans' transference of love and respect to God. This ritual turning practice of the Mevlevi Sufi Order dates back to the 13th century to Muhammed Celaleddin better known as Mevlana. The duende is the expression of the soul for a Flamenco dancer- a flame that is provoked when in a state of ecstatic movement. Duende is not a tangible concept but one that is felt throughout the body and conveyed through passionate and striking movements."

Hedy continues, "Digital Dervish and Flamenco Sonic is a story about a Dervish who is in a dream and wakes up to birds and the sounds of nature – he begins to meditate and perform his Sema. He becomes enveloped in a storm of chaos as he whirls wildly and then collapses where he becomes dormant again. A Flamenco dancer notices and begins to move in similar patterns attempting to awaken him. They exchange their sounds and movements until they become intertwined in whirling. This is a story about landscape, earth, love and life that encompasses music, imagery and physical movement."

Real Ideas' CEO Lindsey Hall says, "This is exactly the kind of cross-cultural, cross-platform, multi-art opportunity that gets us really excited. We have created Europe's only immersive dome of this size to be able to allow artists and performers like Hedy to fully realise their ambitions of combining traditional performance arts with ultra-cutting edge technology and to bring this all alive on the 360 stage, set within Market Hall.

Lindsey continues, "Within these performances Hedy's dancers are wearing the *Sound Drop* device, and the gestures which are specific to these Islamic and Spanish dance traditions are being highlighted and augmented onto our dome surrounds. The device tracks certain movements from the performer to which sounds and LED lights are mapped, meaning the device becomes an extension of the body- a musical instrument as such, that can provide layers to the separate pre-recorded music composition. All of this has never been experienced in the South West before and we are honoured to be bringing this innovative, cross-cultural showcase to Plymouth."

Inspired by the Dervish, the award winning Hedgerow Hound will offer a vegan Turkish Mezze Bowl post performance. To book a performance and additional Turkish meal, please go to: https://realideas.ticketsolve.com/shows/1173624298

https://www.firoza.co.uk/event/digital-dervish-flamenco-sonic/

PUBLIC ENERGY PRESS RELEASE

PO Box 2319, Peterborough, ON K9J 7Y8 / Phone 705.745.1788 / Fax 705.749.3606 / www.publicenergy.ca

For Immediate Release August 24 ,2022

Photos available for download here.
https://publicenergy.ca/performance/firoza-uk-digital-dervish-flamenco-sonic/

Public Energy Performing Arts kicks off its 28th season with an international program of multi-media dance.

Digital Dervish and Flamenco Sonic

A multi-media performance created by Hedy Hurban

September 9 at 7:30pm

September 10 at 1pm

Market Hall Performing Arts Centre, 140 Charlotte St, Pboro, ON

Tickets are pick-a-price, starting as low as $5, available at the Market Hall box office here.

Featuring wildly imaginative projections and wearable body technology performed
by a dervish dancer and a Flamenco dancer.
https://publicenergy.ca/performance/firoza-uk-digital-dervish-flamenco-sonic/

Not ready to come to the theatre?
The Sept 10 show is being simultaneously streamed live and will be available for one week following the performance.
But you won't get the full effect of projections that immerse the dancers and their movements that influence the sound and lights vis wearable tech.

Combining original digital projections, live performance, and wearable technology, *Digital Dervish and Flamenco Sonic* features a whirling dervish and a flamenco dancer becoming intertwined as they relate a story of landscape, earth, love and life. It is created by **Hedy Hurban**, a UK-based electronic music composer, choreographer and costume designer who has developed her own unique wearable body technology for live performance. Collaborating with Hurban is her partner in life and work, filmmaker and production designer **Kaz Rahman**. Originally from Peterborough and now based in the UK,

Rahman -together with visual effects editor **Barış Çelik** - has created the dynamic projections that create a mesmerizing environment for the performance.

The story follows a dervish – performed by **Mayez Rahman** - who is in a dream and wakes up to birds and the sounds of nature: he begins to meditate and perform his *sema,* a dance and meditative ritual practiced for centuries by the Mevlevi Sufis in Turkey. He becomes enveloped in a storm of chaos as he whirls wildly and then collapses, where he becomes dormant again. A Flamenco dancer – performed by **Carolina Loyola-Garcia** - notices and begins to move in similar patterns, evoking her *duende* – a state reached through ecstatic movement that allows the body to express the soul - and attempting to awaken him. They exchange their sounds and movements until they become intertwined in a climactic whirling that encompasses music, imagery and physical movement.

The movements and gestures which are specific to these dance traditions are being highlighted and augmented with an original wearable device called the Soundrop*.* The dancers use the device as an extension of the body - a musical instrument that can provide layers to the separate pre-recorded music composition. The Soundrop has been developed by the creator of *Digital Dervish and Flamenco Sonic*, Hedy Hurban, a costume designer and composer of electronic/electroacoustic music who explores the interlacing of sonic and digital art with traditional folk performance practices.

- 30 -

Media contacts:
Eva Fisher, Marketing Director: eva@publicenergy.ca
Bill Kimball, Executive Director: bill@publicenergy.ca
Or call the Public Energy office: 705-745-1788.

More about the Soundrop
The Soundrop is a small wearable body instrument that is attached to the body via a strap on the wrist or ankle and tracks the speed of movement that a performer initiates. It emits sounds when it is moved; the greater the velocity of movement, the greater the volume of the sound being emitted from the device. It can be turned on or off by pressing a small sensor in the center of the device. LED lights also light up when the sound is emitted so that the wearer and the audience can understand that the action has been performed. It also gently vibrates on the skin providing a tactile cue. The devices are programmed with one sound each and are designed to add sound layers to a separate pre-recorded music composition. The dancer uses the device as an extension of the body.

More about *sema* and *duende*

The *sema* of the *Dervish* blurs the lines between dance and meditation while symbolically expressing the formation of the universe and man's transference of love and respect to God. This ritual turning practice of the Mevlevi Sufi Order dates back to the 13th century to Muhammed Celaleddin better known as *Mevlana*. The *duende* is the expression of the soul for a *Flamenco* dancer- a flame that is provoked when in a state of ecstatic movement. *Duende* is not a tangible concept but one that is felt throughout the body and conveyed through passionate and striking movements.

Bios for the artistic team

Hedy Hurban is a designer of costumes and composer of electronic/electroacoustic music. She showcased her collections at *DSYN O4* (Delhi, India) and has designed the costumes for the Operas *Lampedusa* (Plymouth, UK) and *The Mother of Fishes* (Pittsburgh, USA). Hedy is music composer for several short films such as *Dead Body*, *Grand Theatre and Picture Palace, Bees Mecanique*, the TV episode *Green and Blue* and the feature films *Salaat* and *Deccani Souls*. Her interest in interlacing sonic and digital art with traditional folk performance practices led her to create a prototype body instrument inspired by the Whirling Dervishes of Turkey called *Dervish Sound Dress* (2018) that combines music, wearable body technology and live performance. She has a ResM in Computer Music from the University of Plymouth and is currently associate lecturer in Digital Art and Technology.

Kaz Rahman has worked extensively as visual artist, filmmaker and academic with both commercial and public institutions, festivals, and broadcasters over the last 20 years. His work has played in film festivals and venues such as Anthology Film Archives (New York City), National Film Board of Canada (Toronto), India Habitat Centre (New Delhi), Salar Jung Museum (Hyderabad), Andy Warhol Museum (Pittsburgh), The San Jose Museum of Art (California), Bogazici Film Festival (Istanbul), SUFICINE Festival (Konya) and broadcast on TV24 (Turkey) and has been featured in publications such as The Times of India, The Hindu, The New Indian Express (India), Daily Sabah and Star Gazette (Turkey). His style explores themes such as time, memory, and narrative dreams as well as the convergence of fiction/documentary. Rahman has an MFA in Media Arts (writing/directing) from City College (CUNY), New York City and has taught at universities and colleges in Hyderabad, Pittsburgh, Istanbul, Plymouth, and Canterbury (UK).

Bariş Çelik's work in visual effects and as a colorist reflects his interest in graphic design and illustration. He has a BA in Cinema from Istanbul Sehir University and his work has been part of award-winning short films both within Turkey and internationally. He is one of the founding members of *Istanbul International Experimental Film Festival* and is currently lecturer in film editing/montage at Istanbul Medipol University. He is editor on *Green and Blue* and *Rebeldes Baseball*.

Carolina Loyola-Garcia is a multidisciplinary artist, filmmaker, and performer. She works primarily in media arts, including video art and installation, video design for theater, documentary and digital photography. She produced and directed the

documentary film *Sobre las Olas: A story of Flamenco in the U.S.* (2013), which offers a comprehensive view of the art of flamenco in the United States. She received her MFA from Carnegie Mellon University and is Professor of Media Arts at Robert Morris University. As a performer she has worked in theater productions, dance ensembles and as a flamenco artist. Loyola-Garcia has worked with Quantum Theatre in the productions of *The Red Shoes* (2007), *Maria de Buenos Aires* (2011), *Ainadamar* (2012), *Mnemonic* (2013), and *looking for Violeta* (2019) as well as Attack Theater's production of the *Rube Goldberg Variations* (2019). She is also lead dancer and singer with the ensemble *Alba Flamenca* and performs all through Western Pennsylvania, Eastern Ohio, and Western NY.

Mayez Rahman is a student at Lipson Co-operative Academy in Plymouth. He has lived in both Pittsburgh, USA and Istanbul, Turkey where he first encountered the traditions of the Whirling Dervishes. His interests include designing video games and all aspects of computer programming.

THEATRE OF DIGITAL ART DUBAI INVITATION LETTER

TODA
THEATRE OF DIGITAL ART

Dear Hedy Hurban,

Dubai's Theatre of Digital Art is pleased to inform you that we are happy to invite you to showcase your project 'Digital Dervish + Flamenco Sonic' for two nights this December 16th and 17th. We look forward to seeing the performance in our theatre and support this project which highlights music, dance, and wearable technology. This immersive experience will positively impact the Dubai creative scene and expand our horizons in partnerships with creatives outside of Dubai as you will be the first digital artist, we are physically bringing in ToDA.

Date: 03. 11. 2022

Signed:

Theatre of Digital Art
+971 4 277 4044 info@toda.ae www.toda.ae
Souk Madinat Jumeirah, Dubai, U.A.E., PO Box 239774

Appendix V: Visual Reference for *Digital Dervish + Flamenco Sonic* and *Digital Dervish* (ToDA performances) with time code and translation

All images are credited to Kaz Rahman for Digital Dervish + Flamenco Sonic, (2022)
All images for Sercan Çelik at green screen are created to the author (2022)

This document is a visual reference for the performances in Dubai on December 16th and 17th for the performers. It is a collection of images from the previous 4 performances which align with specific moments in the choreography and aids the performers (who did not have previous rehearsal time) in understanding (in their own respective languages) the visuals and the moments in which they would be cued to initiate their devices and certain actions/movements.

Türkçe
Español

Time: 0:00 – 2:35
Dervish enters stage sits down in 'child's pose' and bows head as though he is sleeping
Derviş sahneye girer 'çocuk pozu' ile oturur ve uyuyormuş gibi başını öne eğer.
Dervish entra al escenario y se sienta en "postura de niño" e inclina la cabeza como si estuviera durmiendo.


Figure V.1: Child's pose position DDFS (image from Charminar Films, 2022)

Time: 02:36 – 03:28

Dervish slowly gets up and eyes are closed, hands on knees, still sitting down

Derviş yavaşça kalkar ve gözleri kapanır, eller dizlerinin üzerinde, hala oturuyor

Dervish se levanta lentamente y cierra los ojos. manos en las rodillas, todavía sentado



Figure V.2: Sitting/swaying position DDFS (image from Charminar Films, 2022)

Time: 03:28 – 06:41

Dervish continues to sit and sway back and forth, moving very softly as though he was dreaming (eyes are closed still). Eyes open and notice everything above and around. When you hear a ‘swell’ in the music, raise arms to the sky as though you are embracing the world and all its glory. Start moving torso more back and forth.

Derviş oturmaya ve bir ileri bir geri sallanmaya devam eder, sanki rüyadaymış gibi çok yumuşak hareket eder (gözleri hala kapalıdır). Gözler açılır ve yukarıdaki ve etrafındaki her şeyi fark eder. Müzikte bir 'şişme' duyduğunuzda, dünyayı ve tüm ihtişamını kucaklıyormuş gibi kollarınızı gökyüzüne kaldırın. Gövdeyi ileri geri hareket ettirmeye başlayın.

Dervish continúa sentado y balanceándose de un lado a otro, moviéndose muy suavemente como si estuviera soñando (aún con los ojos cerrados). Los ojos se abren y notan todo lo que está arriba y alrededor. Cuando escuche un 'oleaje' en la música, levante los brazos hacia el cielo como si estuviera abrazando el mundo y toda su gloria. Comience a mover el torso más adelante y atrás.



Figure V.3: Arms raised position DDFS (image from Charminar Films, 2022)

Time: 06:45 – 07:42

Dervish gets up slowly, one knee at a time, when music fades and there is a slight silent part, start to turn on the device and interact with it (to show the audience that you are creating the sound with the device).

Derviş, her seferinde bir dizi olacak şekilde yavaşça ayağa kalkar, müzik kısıldığında ve hafif bir sessiz kısım olduğunda, cihazı açmaya ve onunla etkileşime girmeye başlayın (izleyiciye sesi cihazla yarattığınızı göstermek için).

Dervish se levanta lentamente, una rodilla a la vez, cuando la música se desvanece y hay una pequeña parte silenciosa, comienza a encender el dispositivo e interactúa con él (para mostrarle a la audiencia que estás creando el sonido con el dispositivo).



Figure V.4: Raising up on one knee position DDFS (image from Charminar Films, 2022)



Figure V.5: Initiating device DDFS (image from Charminar Films, 2022)

Time: 07:45 – 10:09

Dervish turns off device, bows to all sides of audience (in Toda it will be to the left, center and right). Then begin to walk (sema) around the perimeter of the space.

Derviş cihazı kapatır, seyircinin her tarafına eğilir (Toda'da sola, ortaya ve sağa olacaktır). Ardından mekanın çevresini dolaşmaya (sema) başlayın.

Dervish apaga el dispositivo, se inclina hacia todos los lados de la audiencia (en Toda será a la izquierda, centro y derecha). Luego comience a caminar (sema) alrededor del perímetro del espacio.



Figure V.6: Bowing position DDFS (image from Charminar Films, 2022)

Time: 10:11- 12:39

Dervish hears ‘flute’ sound at 10:09 and responds by activating device and communicating with the sound (this is the ‘fish’ scene). After this dervish continues to walk around perimeter of space.

Derviş, 10:09'da 'flüt' sesini duyar ve cihazı çalıştırarak ve sesle iletişim kurarak yanıt verir (bu 'balık' sahnesidir). Bu dervişten sonra uzayın çevresinde dolaşmaya devam eder.

Dervish escucha el sonido de la "flauta" a las 10:09 y responde activando el dispositivo y comunicándose con el sonido (esta es la escena del "pez"). Después de que este derviche continúa caminando alrededor del perímetro del espacio.

Time: 12:40 – 13:28

At 12:39, Dervish hears a slight ‘whooshing’ sound and slowly walks towards the center of the stage (or center of circle). Stay in the center for a few moments until the video changes again to a dark underwater scene. At 13:07 the sound of a cymbal crash can be heard here and it is where Dervish bows to the audience again, taking his time, slowly, and the begins to whirl after turning on wrist device.

12:39'da Derviş hafif bir 'vızıltı' sesi duyar ve yavaş yavaş sahnenin merkezine (veya dairenin merkezine) doğru yürür. Video tekrar karanlık bir sualtı sahnesine dönüşene kadar birkaç dakika merkezde kalın. 13:07'de burada bir zil sesi duyulur ve Derviş'in tekrar seyirciye selam verdiği yer, yavaş yavaş ve bilek cihazını açtıktan sonra dönmeye başlar.

A las 12:39, Dervish escucha un leve sonido de "silbido" y camina lentamente hacia el centro del escenario (o centro del círculo). Permanezca en el centro por unos

momentos hasta que el video cambie nuevamente a una escena submarina oscura. A las 13:07 se puede escuchar aquí el sonido de un platillo y es donde Dervish vuelve a hacer una reverencia a la audiencia, tomándose su tiempo, lentamente, y comienza a girar después de encender el dispositivo de muñeca.

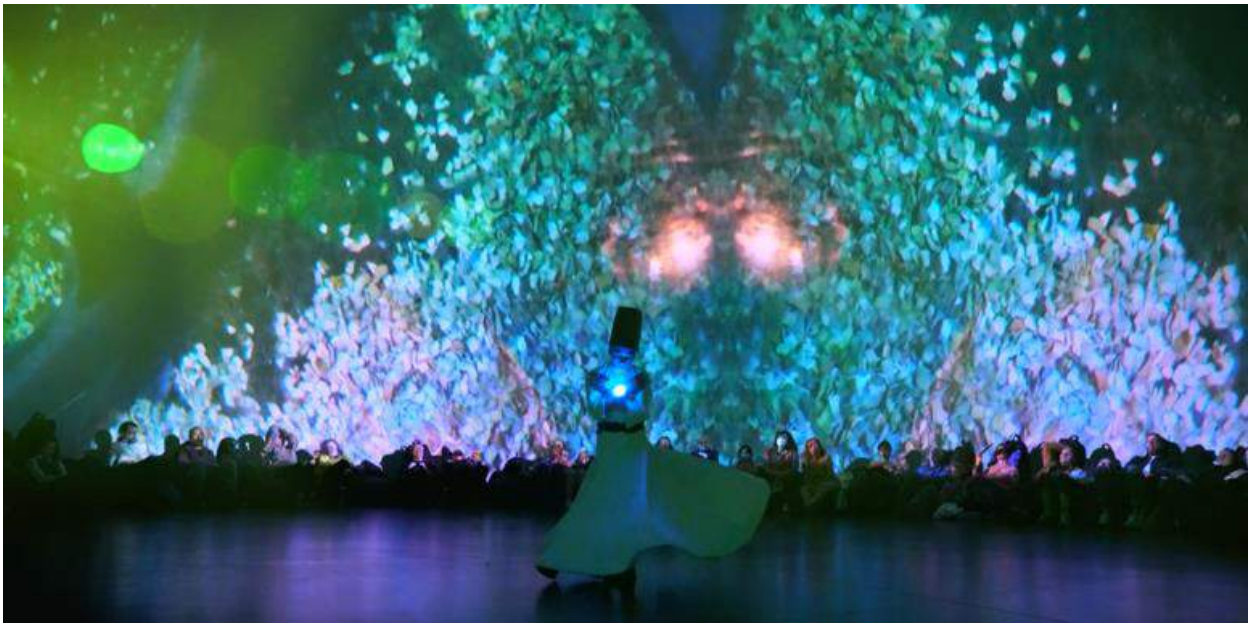


Figure V.7: Begin whirling position DDFS (image from Charminar Films, 2022)

Time: 13:30 – 17:04

Dervish continues to turn from 13:30 – until hearing the big ‘crash cymbal’ sound and then Dervish falls to the floor back into child’s pose. By this time, the sounds of traffic, music, chaos, and the whirling hurricane overhead are seen. The cymbal crash can be heard at 17:04. This is where the dervish ‘falls’ down and goes dormant in his dream state.

Derviş 13:30'dan büyük 'çarpma zili' sesini duyana kadar dönmeye devam eder ve ardından Derviş tekrar çocuk pozuna dönerek yere düşer. Bu zamana kadar trafik, müzik, kaos ve tepeden dönen kasırganın sesleri görülüyor. Zil sesi 17:04'te duyulabilir. Dervişin rüya halinde “düştüğü” ve uykuya daldığı yer burasıdır.

Dervish continúa girando desde las 13:30, hasta que escucha el gran sonido de 'platillo de choque' y luego Dervish cae al suelo y vuelve a la pose de niño. En ese momento, se ven los sonidos del tráfico, la música, el caos y el huracán que gira sobre su cabeza. El choque de platillos se puede escuchar a las 17:04. Aquí es donde el derviche 'cae' y se queda dormido en su estado de sueño.

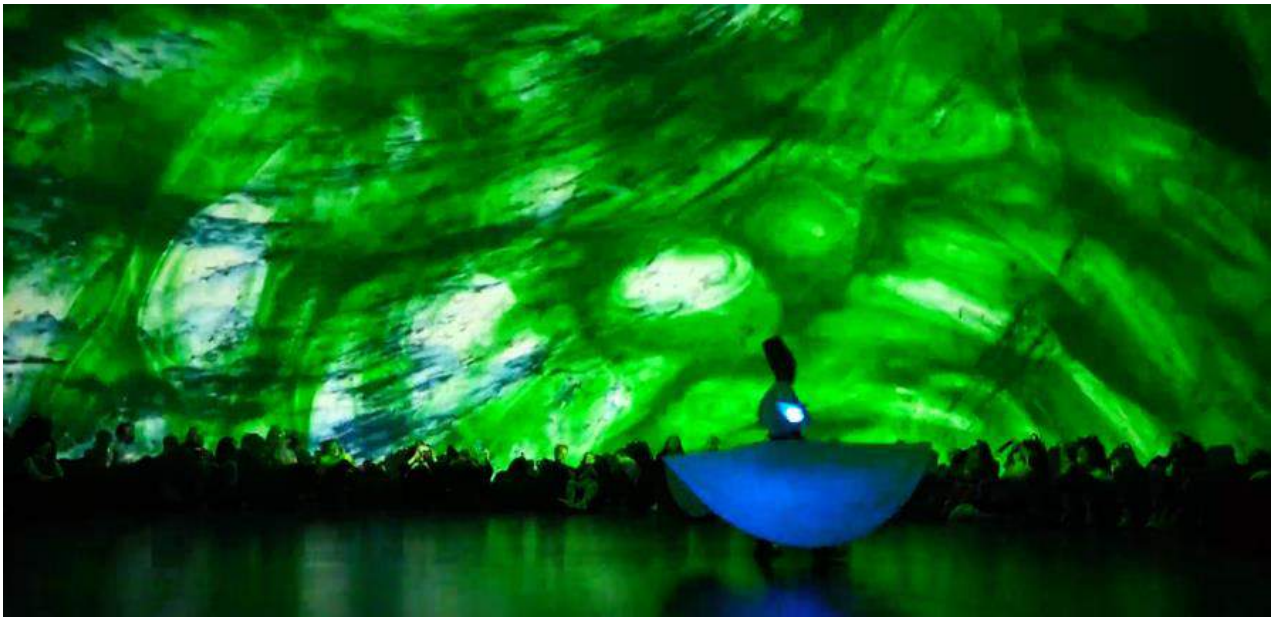


Figure V.8: Whirling position DDFS (image from Charminar Films, 2022)

Time: 17: 05 – 18:20

After Dervish crashes back down into his dream mode, Flamenco enters the stage very slowly (at 17:50). The visuals change as well as the music. Flamenco circles the perimeter for the stage and observes the Dervish on the floor. She uses her castanets sound on her wrist device at the beginning to introduce her device to the audience. This is at 18:18 but it can be used a little earlier. Flamenco continues to make her movements around Dervish forming a circular pattern. Flamenco may walk in with their shawl draped on their body and then put it on the floor when they will pick it up later.

Dervish rüya moduna geri döndükten sonra, Flamenko çok yavaş bir şekilde sahneye girer (17:50). Müzik kadar görseller de değişiyor. Flamenko, sahnenin çevresini çevreler ve yerdeki Dervişi gözlemler. Cihazını izleyicilere tanıtmak için başlangıçta bilek cihazındaki kastanyet sesini kullanıyor. Bu 18:18 ama biraz daha erken kullanılabilir. Flamenko, dervişin etrafında dairesel bir desen oluşturarak hareketlerini yapmaya devam ediyor. Flamenko, şallarını vücuduna sararak içeri girebilir ve daha sonra alacakları zaman yere serebilir.

Después de que Dervish vuelve a caer en su modo de sueño, Flamenco entra en escena muy lentamente (a las 17:50). Las imágenes cambian al igual que la música. Flamenco rodea el perímetro del escenario y observa al Derviche en el suelo. Ella usa el sonido de sus castañuelas en su dispositivo de muñeca al principio para presentar su dispositivo a la audiencia. Esto es a las 18:18 pero se puede usar un poco antes. Flamenco sigue haciendo sus movimientos alrededor de Dervish formando un patrón circular. Los flamencos pueden entrar con el mantón echado al cuerpo y luego ponerlo en el suelo cuando lo recogerán más tarde.


Figure V.9: Initiate castanet sound DDFS (image from Charminar Films, 2022)

Time: 18:22 – 22:28

Flamenco continues to dance around Dervish – the music becomes upbeat and positive after the chaos of the hurricane. She is expressing her movement using the wrist device (with castanets) but intermittently (don't use all the time, turn it on and off as you feel necessary for your choreography). The visuals also change and after voice song, Flamenco reaches down to ankle to turn on ankle device (time: 22:27 just before music changes again and Dervish starts to wake up).

Flamenko, Derviş'in etrafında dans etmeye devam ediyor - müzik, kasırganın kaosundan sonra iyimser ve pozitif hale geliyor. Bilek aletini kullanarak (kastanyetlerle) ancak aralıklı olarak hareketini ifade ediyor (her zaman kullanmayın, koreografiniz için gerekli olduğunu düşündüğünüzde açıp kapatın). Görüntüler de değişiyor ve sesli şarkıdan sonra Flamenko ayak bileğine uzanıp ayak bileği cihazını açıyor (saat 22:27 müzik tekrar değişip Derviş uyanmaya başlamadan hemen önce).

El flamenco continúa bailando alrededor de Dervish: la música se vuelve alegre y positiva después del caos del huracán. Ella está expresando su movimiento usando el dispositivo de muñeca (con castañuelas) pero de manera intermitente (no lo use todo el tiempo, enciéndalo y apáguelo según lo crea necesario para su coreografía). Las imágenes también cambian y después de la canción de voz, Flamenco se agacha hasta el tobillo para encender el dispositivo de tobillo (hora: 22:27 justo antes de que la música cambie nuevamente y Dervish comience a despertarse).


Figure V.10: Communicate with Soundrops DDFS (image from Charminar Films, 2022)

Time: 22:30 – 25:05

The music changes at 22:30 and the Flamenco dancer now moves closer to the Dervish. He slowly begins to wake up again and sits with his hands on his knees for a few moments. As Flamenco is dancing around him, he opens his eyes and the two exchange glances. The guitar music comes in and the two begin to communicate their sounds with each other. He follows her with his eyes and his arm which is activating the device. Before the music changes again, Flamenco should retrieve her shawl in preparation for whirling with Dervish. (24:55)

Müzik 22:30'da değişiyor ve Flamenko dansçısı şimdi Derviş'e yaklaşıyor. Yavaşça tekrar uyanmaya başlar ve birkaç dakika elleri dizlerinin üzerinde oturur. Flamenko etrafında dans ederken gözlerini açar ve ikisi birbirine bakar. Gitar müziği gelir ve ikisi seslerini birbirleriyle iletişim kurmaya başlar. Gözleri ve cihazı çalıştıran koluyla onu takip ediyor. Müzik tekrar değişmeden önce Flamenko, Derviş'le birlikte dönmeye hazırlanmak için şalını almalıdır. (24:55)

La música cambia a las 22:30 y el bailaor se acerca ahora al Derviche. Lentamente comienza a despertarse nuevamente y se sienta con las manos en las rodillas por unos momentos. Mientras baila flamenco a su alrededor, abre los ojos y los dos intercambian miradas. Entra la música de guitarra y los dos comienzan a comunicarse sus sonidos entre sí. Él la sigue con la mirada y el brazo que está activando el dispositivo. Antes de que la música cambie de nuevo, Flamenco debe recuperar su mantón en preparación para girar con Dervish. (24:55)


Figure V.11: Whirling together DDFS (image from Charminar Films, 2022)

Time: 25:05 – 29:48

Dervish stands up slowly as the music changes again, (he turns on his ankle device) and as the guitar slows down, Dervish and Flamenco bow to each other and begin to whirl (take a few moments with this from 25:04 to 25:50). Flamenco should whirl with the shawl to emphasize the effect of the circular pattern. The whirling/turning begins at 25:51. Whirling stops for both Flamenco and Dervish at 27:00 when both dancers face each other, bow to each other and Dervish leaves the stage. She acknowledges that he left and that he is ‘ok now’ and she continues her dance until the end when she dances off the stage. Fade to black and return to stage for bow and applause.

Müziğin tekrar değişmesiyle Dervish yavaşça ayağa kalkar (ayak bileğini açar) ve gitar yavaşlarken Dervish ve Flamenko birbirlerine eğilerek dönmeye başlarlar (25:04'ten 25'e kadar bununla birkaç dakikanızı ayırın: 50). Flamenko, dairesel desenin etkisini vurgulamak için şal ile dönmelidir. Dönme/dönüş 25:51'de başlıyor. Saat 27:00'de Flamenko ve Derviş için sema durur, dansçılar karşı karşıya gelir, selam verir ve Derviş sahneyi terk eder. Ayrıldığını ve 'şimdi' olduğunu kabul ediyor ve sahneden inerken sonuna kadar dansına devam ediyor. Siyaha dönün ve selam ve alkış için sahneye dönün.

Dervish se pone de pie lentamente mientras la música cambia de nuevo (enciende su dispositivo de tobillo) y mientras la guitarra se ralentiza, Dervish y Flamenco se saludan y comienzan a girar (tómese un momento con esto del 25:04 al 25: 50). El flamenco debe girar con el mantón para enfatizar el efecto del patrón circular. El torbellino/giro comienza a las 25:51. El torbellino se detiene tanto para Flamenco como para Dervish a las 27:00 cuando ambos bailarines se enfrentan, se saludan y Dervish abandona el escenario. Ella reconoce que él se fue y que él está "bien ahora" y continúa su baile

hasta el final cuando sale bailando del escenario. Fundido a negro y regreso al escenario para reverencia y aplauso

Digital Dervish Choreography and Time code

Time: 00:00 – 02:24
Dervish enters stage slowly and is in seated position. Dervish holds head is his hands, sways back and forth gently and maybe use tasbih.
Derviş yavaş yavaş sahneye girer ve oturur vaziyettedir. Derviş başını elleriyle tutar, hafifçe ileri geri sallanır ve belki tesbih kullanır.



Figure V.12: Dervish seated position DD (Hurban, 2022)

Time: 02:25 – 04:12
Dervish rises slowly and begins to pace around. Use the device on one wrist here to add to the background music. Dervish walks around more, building up some tension. Musical change at 04:12.
Derviş yavaşça ayağa kalkar ve volta atmaya başlar. Fon müziğine eklemek için cihazı bir bileğinizde kullanın. Derviş biraz daha dolaşarak biraz gerginlik yaratır. 04:12'de müzikal değişim.



Figure V.13: Standing position DD (Hurban, 2022)

Time: 04:13 – 07:36
Dervish waving arms around, walking in the perimeter of the stage slowly, capturing the surroundings in his arms. Use one device on wrist to accentuate music.
Derviş kollarını sallayarak, yavaş yavaş sahnenin çevresinde yürür, etrafı kollarına alır. Müziği vurgulamak için bileğinizde bir cihaz kullanın.

Time: 07:36 – 12:30
Music change at 07:36 – Dervish goes to center and bows to audience, begins to whirl.
07:36'da müzik değişimi – Derviş merkeze gider ve seyircinin önünde eğilir, dönmeye başlar.



Figure V.14: Begin whirling DD (Hurban, 2022)

Time: 12:31 – 15:00

Mevlana poem fades in – begin to whirl more furiously. At 13:35 begin to remove skirt (when the voice becomes more faded and distant). Remove skirt and fold it in arms, raise it upwards then toss it away from you.

Mevlana şiiri soluyor - daha hiddetle dönmeye başlıyor. 13:35'te eteği çıkarmaya başlayın (ses daha soluk ve uzaklaştığında). Eteği çıkarın ve kollara katlayın, yukarı kaldırın ve kendinizden uzağa fırlatın.



Figure V.15: Begin removal of skirt DD (Hurban, 2022)



Figure V.16: Removal of skirt DD (Hurban, 2022)

Time: 15:00 – 18:14

Musical change at 15:00 – activate other wrist device. Now two devices should be active while whirling. Turn off both devices before ending (19:00). Whirling is powerful and intense.

Saat 15:00'te müzik değişimi – diğer bilek cihazını etkinleştirin. Şimdi dönerken iki cihaz aktif olmalıdır. Bitirmeden (19:00) önce her iki cihazı da kapatın. Dönme güçlü ve yoğundur.

Time 18:14 – 20:42

Musical change at 18:14 – a large cymbal swell and beat will cue Dervish to change shape of turning and also to begin to slow down. Slow turning and stop at 19:55. Stop in center as music winds down and place hands in crossed position on chest. Fade to black. Exit stage. End first part of performance.

18:14'teki müzikal değişim – büyük bir zil sesi ve vuruşu Derviş'e dönüş şeklini değiştirmesini ve aynı zamanda yavaşlamaya başlamasını sağlayacaktır. Yavaş dönüş ve 19:55'te durun. Müzik yavaşlarken merkezde durun ve ellerinizi göğsünüzde çapraz şekilde yerleştirin. Siyaha solmak. Çıkış aşaması. Performansın ilk bölümünü sonlandırın.

Appendix VI: Synopsis and bios for performances of *Digital Dervish + Flamenco Sonic* (Plymouth, Peterborough, and Dubai)

Digital Dervish + Flamenco Sonic
A Multimedia Performance Work by Hedy Hurban

Market Hall Theatre Plymouth May 6th and 7th
Total run time: 30 minutes (Part 1 only)

Market Hall Peterborough by Public Energy September 9th and 10th
Total run time: 30 minutes (Part 1 only)

Theatre of Digital Art Dubai December 16th and 17th
Total run time: 50 minutes

The *sema* of the *Dervish* blurs the lines between dance and meditation while symbolically expressing the formation of the universe and mans' transference of love and respect to God. This ritual turning practice of the Mevlevi Sufi Order dates back to the 13th century to Muhammed Celaleddin better known as *Mevlana*. The *duende* is the expression of the soul for a *Flamenco* dancer- a flame that is provoked when in a state of ecstatic movement. *Duende* is not a tangible concept but one that is felt throughout the body and conveyed through passionate and striking movements.

The first part of the story introduces the viewers to the Dervish as he sits in quiet meditation. The destruction of a mosque envelopes him as a reminder of how the practice of whirling was repressed. The seasons carry him as he is somber and caught in a pool of memories or visions – darkness and uncertainty surround him. He moves slowly wading through a dream filled with heavy metaphors and a longing to reach to the Divine Creator. Premonitions of a dancer that he may encounter appear before him which are a reference to one of the first dance films ever made, *The Serpentine* 1895. He begins to perform *sema*. He remembers his youth when a flamenco dancer came to him and led him out of despair. His movements become more aggressive and powerful as he whirls uncontrollably through his journey until he reaches his climax and then fades into the darkness along with all the memories that hovered overhead.

The second part of the performance starts with Dervish who is again in a dream state in an abstract world and wakes up to birds and the sounds of nature- he begins to meditate and perform his *sema*. He becomes enveloped in a storm of chaos as he whirls wildly and then collapses where he becomes dormant again. A Flamenco dancer notices and begins to move in similar patterns attempting to awaken him and to led him out of his struggle. They exchange their sounds and movements until they become intertwined in whirling. The Dervish seems to 'remember' the flamenco dancer as they both have a positive encounter. This is a story about landscape, earth, love, and life that encompasses music, imagery, and physical movement. The movements and gestures which are specific to these dance traditions are being highlighted and augmented with an original wearable device called a Soundrop.

The Soundrop is a small device that is attached to the body via a strap on the wrist or ankle. It is designed to track certain movements from the performer to which sounds and LED lights are mapped. The dancer uses the device as an extension of the body- a musical instrument that can provide layers to the separate pre-recorded music composition.

Credits

Music Composer, Wearable Tech Designer and Choreographer: **Hedy Hurban**
Filmmaker and Production Designer: **Kaz Rahman**
Dervish: **Seyit Sercan Çelik (Dubai)**
Dervish performer: **Mayez Rahman (Plymouth & Peterborough)**
Flamenco Dancer(s): **Pepa Sanz (Dubai), Carolina Loyola-Garcia(Peterborough), Mercedes Romero (Plymouth)**
Visual Effects Editor: **Barış Çelik**

Website:

https://www.firoza.co.uk/project/digital-dervish/

Key people on project

Hedy Hurban bio (creator, wearable tech designer)

Hedy Hurban is a designer of costumes and composer of electronic/electroacoustic music. She showcased her collections at DSYN O4 (Delhi, India) and has designed the costumes for the Operas Lampedusa (Plymouth, UK) and The Mother of Fishes (Pittsburgh, USA). Hedy is music composer for several short films such as Dead Body, Grand Theatre and Picture Palace, Bees Mecanique, the TV episode Green and Blue and the feature films Salaat and Deccani Souls. Her interest in interlacing sonic and

digital art with traditional folk performance practices led her to create a prototype body instrument inspired by the Whirling Dervishes of Turkey called Dervish Sound Dress (2018) that combines music, wearable body technology and live performance. She has a BFA in Visual Arts from York University (Toronto) and a ResM in Computer Music from the University of Plymouth and is currently associate lecturer in Digital Art and Technology where she is completing her PhD.

Kaz Rahman bio (filmmaker)

Kaz Rahman has worked extensively as Visual Artist, Filmmaker and Academic with both commercial and public institutions, festivals, and broadcasters over the last 20 years. His work has played in film festivals and venues such as Anthology Film Archives (New York City), National Film Board of Canada (Toronto), India Habitat Centre (New Delhi), Salar Jung Museum (Hyderabad), Andy Warhol Museum (Pittsburgh), The San Jose Museum of Art (California), Bogazici Film Festival (Istanbul), SUFICINE Festival (Konya) and broadcast on TV24 (Turkey) and has been featured in publications such as The Times of India, The Hindu, The New Indian Express (India), Daily Sabah and Star Gazette (Turkey).

Seyit Sercan Çelik bio (Dervish)

Seyit Sercan Çelik is a contemporary Dervish from Istanbul who began performing Turkish Folkloric dance when he was 9. He is also grounded in the historical sacred traditions and rituals of the Turkish Mevlevi which he has been performing over the last decade. His own interpretations both with groups and solo have been performed extensively in Turkey, Eastern Europe, Russia, and the Balkans, as well as Spain, Japan, India, Malaysia, and Bangladesh. He has performed as a dancer in the opening and closing ceremonies of several major organisations through the International Olympic committee of Turkey. Çelik graduated from Sakarya University State Conservatory (Turkish Folk Dance) in 2014 and has conducted workshops in universities and conservatories in Turkey. This is his first performance in North America.

Mayez Rahman (Dervish performer)

Mayez Rahman is a student at Lipson Co-operative Academy in Plymouth. He has lived in both Pittsburgh, USA and Istanbul, Turkey where he first took encountered the traditions of the Whirling Dervishes. His interests include designing video games and all aspects of computer programming.

Pepa Sanz bio (flamenco dancer)

Versatile dancer and choreographer who in her extensive career has worked with directors and artists of various styles and disciplines. Awarded with the UNESCO Aschberg Bursary for Artist Programme and interpreter of several choreographies awarded in the Choreographic Contest of Madrid. She has been collaborating for more than two decades in pioneering, audacious and innovative projects in Spanish Dance and Flamenco, as a performer, assistant, and choreographer, creating her own creations with her company, Caminantes Danza, since 2010, together with dancer and choreographer José Merino. Her most outstanding pieces have been presented at festivals such as "Bangkok International Dance Festival" in Thailand, "Festival de Artes Escénicas Contemporáneas El Cruce", Argentina, "Festival Escenarios del Mundo", Ecuador, Quinzena de Dança de Almada, Portugal, or "Black Box International Theater and Dance Festival" in Bulgaria, among others. In 2022 he received the Award for Best Direction with José Merino for the play "Bendita Rutina", at the XVII Festival de Teatro y Danza Independiente de Santander, INDIFEST 2022.

Carolina Loyola-Garcia (flamenco dancer)

Carolina Loyola-Garcia is a multidisciplinary artist, filmmaker and performer. She works primarily in media arts, including video art and installation, video design for theater, documentary and digital photography. She produced and directed the documentary film *Sobre las Olas: A story of Flamenco in the U.S.* (2013), which offers a comprehensive view of the art of flamenco in the United States. She received her MFA from Carnegie Mellon University and is Professor of Media Arts at Robert Morris University. As a performer she has worked in theater productions, dance ensembles and as a flamenco artist. Loyola-Garcia has worked with Quantum Theatre in the productions of *The Red Shoes* (2007), *Maria de Buenos Aires* (2011), *Ainadamar* (2012), *Mnemonic* (2013), and *Looking for Violeta* (2019) as well as Attack Theater's production of the *Rube Goldberg Variations* (2019). She is also lead dancer and singer with the ensemble *Alba Flamenca* and performs all through Western Pennsylvania, Eastern Ohio and Western NY.

Mercedes Romero (flamenco dancer)

Mercedes Romero is a professional Flamenco dancer, teacher, and choreographer. She graduated from the Conservatory of Alicante, Spain (Spanish Dance and Flamenco and Classical Ballet). She has performed and taught for over 25 years in Spain, Mexico, France, Italy and England with various dance companies such as *Ballet Teatro Español de Rafael Aguilar, Ballet Español y Flamenco Martin Vargas*, *Ballet de Carmen Mota*, *Ballet titular Teatro de la Zarzuela* and *Teatro de la Maestranza*. She is based in

Plymouth and has performed at venues throughout the region with her group *Flamenco Vivo* as well as Flamenco *Amigos*.

Barış Çelik (visual effects editor)

Barış Çelik's work in visual effects and as a colourist reflects his interest in graphic design and illustration. He has a BA in Cinema from Istanbul Sehir University, and his work has been part of award-winning short films both within Turkey and internationally. He is currently Video Editor at *Bonte Digital* (Istanbul) and *Charminar Films* (Canada/UK) and is associate lecturer in film editing/montage at Istanbul Medipol University.

Appendix VII: Promotional posters and website advertising for performances of *Digital Dervish + Flamenco Sonic*

Market Hall
performing arts centre

Tickets Upcoming Events Rental Inquiries Support Us About

Members: Login | Get a Membership [membership activated instantly]
Membership Benefits: Purchase tickets at discounted price, purchase tickets before general public and much more.
See Membership Info

Tweet Share 94

Digital Dervish +Flamenco Sonic Presented by Public Energy

Friday, September 9 • 7:30 PM
Saturday, September 10 • 1 PM

(no performances)



Digital Dervish and Flamenco Sonic is a story about a Dervish who is in a dream and wakes up to birds and the sounds of nature- he begins to meditate and perform his Sema. He becomes enveloped in a storm of chaos as he whirls wildly and then collapses where he becomes dormant again. A Flamenco dancer notices and begins to move in similar patterns attempting to awaken him. They exchange their sounds and movements until they become intertwined in whirling. This is a story about landscape, earth, love and life that encompasses music, imagery and physical movement. The movements and gestures which are specific to these dance traditions are being highlighted and augmented with an original wearable device called the soundrop.

The soundrop is a small device that is attached to the body via a strap on the wrist or ankle. It is designed to track certain movements from the performer to which sounds and LED lights are mapped. The dancer uses the device as an extension of the body – a musical instrument that can provide layers to the separate pre-recorded music composition.

The sema of the Dervish blurs the lines between dance and meditation while symbolically expressing the formation of the universe and man's transference of love and respect to God. This ritual turning practice of the Mevlevi Sufi Order dates back to the 13th century to Muhammed Celaleddin better known as Mevlana. The duende is the expression of the soul for a Flamenco dancer- a flame that is provoked when in a state of ecstatic movement. Duende is not a tangible concept but one that is felt throughout the body and conveyed through passionate and striking movements.

boxof ce@markethall.org

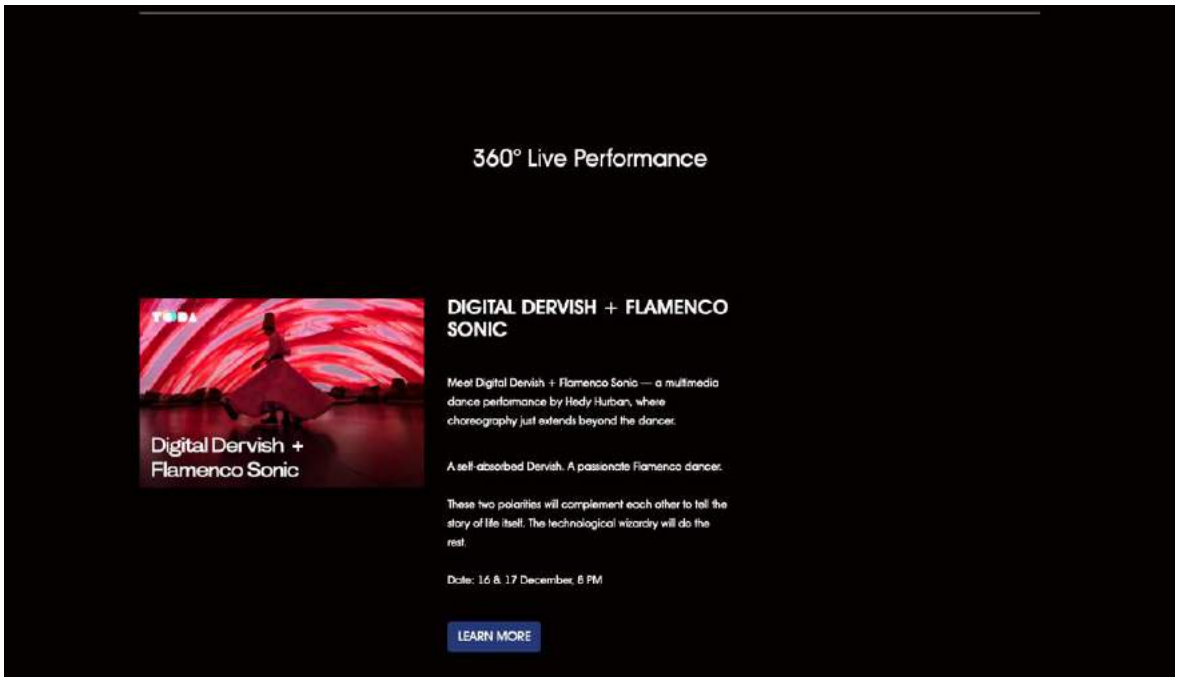
Copyright © 2022 Market Hall Performing Arts Centre Inc., All Rights Reserved. - Ticketing System by TicketWindow

Please read our Privacy Statement and Terms of Use.

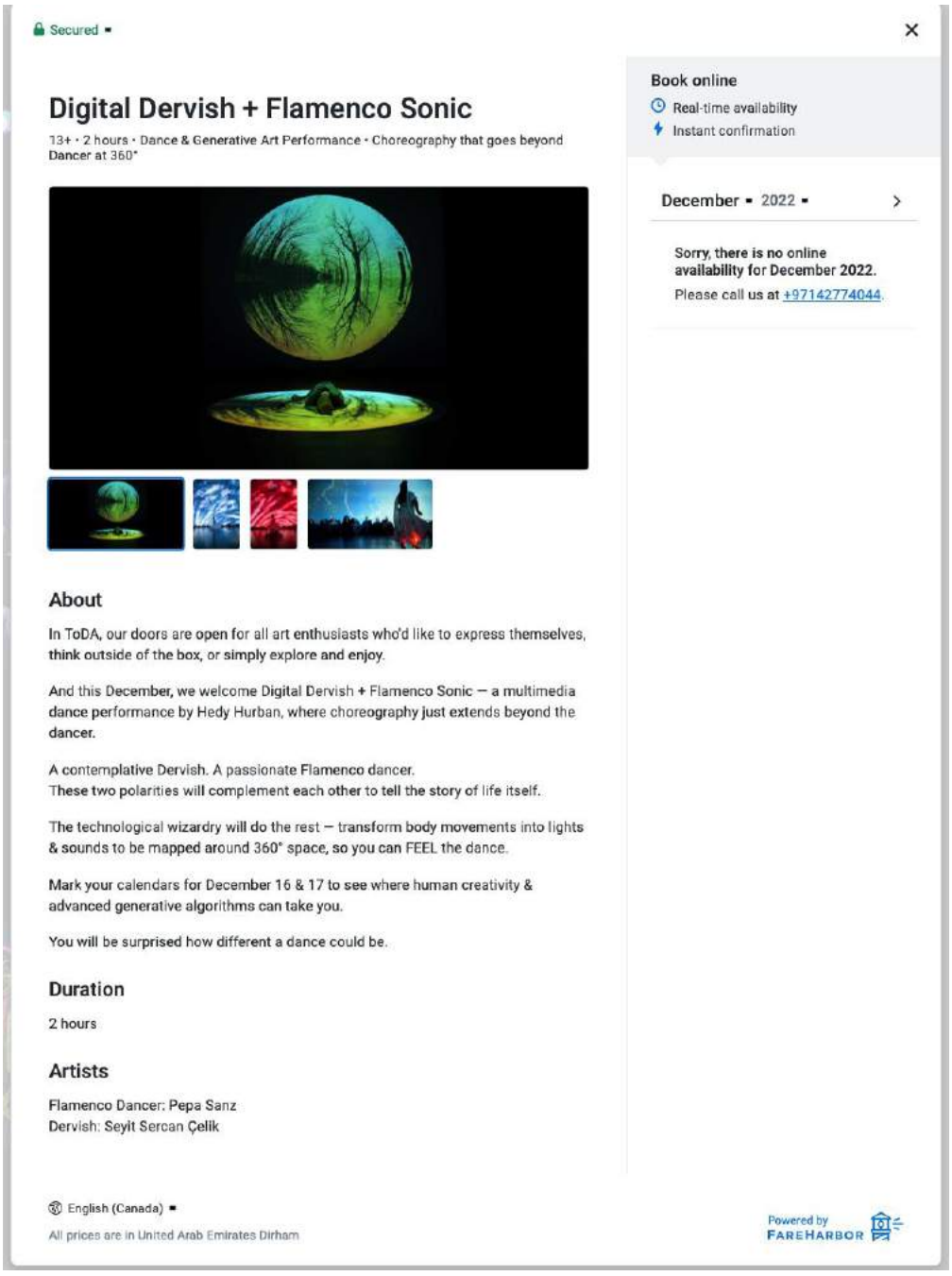
Website promotion for Market Hall performances, Peterborough, 2022.



Web poster for Digital Dervish + Flamenco Sonic



ToDA ticket promotion on website: www.toda.ae



ToDA website ticket booking, 2022



Poster for *Digital Dervish + Flamenco Sonic* for Market Hall, Peterborough, 2022





Story

Digital Dervish is a story about a Dervish who is in a dream and wakes up to birds and the sounds of nature- he begins to meditate and perform his Semo. He becomes enveloped in a storm of chaos as he whirls wildly and then collapses where he becomes dormant again until he eventually rises to embrace the mayhem. This is a story about landscape, earth, love and life that encompasses music, imagery and physical movement.

Digital Dervish is a performance art project that was inspired by live performances of Mevlevi Dervishes and their sacred turning practice called *semo* in Istanbul, Turkey. The *semo* of the *Dervish* blurs the lines between dance and meditation. This ritual turning practice of the Mevlevi Sufi Order dates back to the 13th century to Muhammed Celaleddin better known as *Mevlana*. *Digital Dervish* augments traditional movements that are specific to how a Dervish turns with sound and tactile vibrations- long established actions which are key features of the practice can be emphasised by attributing specific sounds to movements. *Digital Dervish* can also collaborate with other global performance styles that may have attributes and similarities such as motion and movement based on symbolism and metaphysical meaning. One current version of the performance work is linking Spanish Flamenco dance with the Dervish to create new movements, styles and ideas. The gestures which are specific to these dance traditions are being highlighted and augmented with an original wearable device called a *Sound Drop*.

The *Sound Drop* is a small device that is attached to the body via a strap on the wrist or ankle. It is designed to track certain movements from the performer to which sounds and LED lights are mapped. The dancer uses the device as an extension of the body- a musical instrument that can provide layers to the separate pre-recorded music composition.

Music Composer, Wearable Tech Designer and Choreographer: Hedy Hurban

Hedy Hurban is a designer of costumes and composer of electronic/electroacoustic music. She showcased her collections at DSYN 04 (Delhi, India) and has designed the costumes for the Operas *Lampedusa* (Plymouth, UK) and *The Mother of Fishes* (Pittsburgh, USA). Hedy is music composer for several short films such as *Dead Body, Grand Theatre and Picture Palace, Bees Mecanique*, the TV episode *Green and Blue* and the feature films *Solaat* and *Deccani Souls*. Her interest in interlacing sonic and digital art with traditional folk performance practices led her to create a prototype body instrument inspired by the Whirling Dervishes of Turkey called Dervish Sound Dress (2018) that combines music, wearable body technology and live performance. She has a ResM in Computer Music from the University of Plymouth and is currently associate lecturer in Digital Art and Technology.

Filmmaker and Production Designer: Kaz Rahman

Kaz Rahman is a Visual Artist and Filmmaker whose work has played in film festivals and venues such as Anthology Film Archives (New York City), National Film Board of Canada (Toronto), India Habitat Centre (New Delhi), Salar Jung Museum (Hyderabad), Andy Warhol Museum (Pittsburgh), The San Jose Museum of Art (California), Bogazici Film Festival (Istanbul), SUFICINE Festival (Konya) and broadcast on TV24 (Turkey) and has been featured in publications such as The Times of India, The Hindu, The New Indian Express (India), Daily Sabah and Star Gazette (Turkey). His style explores themes such as time, memory and narrative dreams as well as the convergence of fiction/documentary. Rahman has an MFA in Media Arts (writing/directing) from City College (CUNY), New York City and has taught at universities and colleges in Hyderabad, Pittsburgh, Istanbul, Plymouth and Canterbury (UK).

Dervish: Seyit Sercan Çelik

Seyit Sercan Çelik is a contemporary Dervish from Istanbul who began performing Turkish Folkloric dance when he was 9. He is also grounded in the historical sacred traditions and rituals of the Turkish Mevlevi which he has been performing over the last decade. His own interpretations both with groups and solo have been performed extensively in Turkey, Eastern Europe, Russia and the Balkans, as well as Spain, Japan, India, Malaysia, and Bangladesh. He has performed as a dancer in the opening and closing ceremonies of several major organisations through the International Olympic committee of Turkey. Çelik graduated from Sakarya University State Conservatory (Turkish Folk Dance) in 2014 and has conducted workshops in universities and conservatories in Turkey.

Flamenco Dancer: Mercedes Romero

Mercedes Romero is a professional Flamenco dancer, teacher and choreographer. She graduated from the Conservatory of Alicante, Spain (Spanish Dance and Flamenco and Classical Ballet). She has performed and taught for over 25 years in Spain, Mexico, France, Italy and England with various dance companies such as Ballet Teatro Español de Rafael Aguilar, Ballet Español y Flamenco Martin Vargas, Ballet de Carmen Mota, Ballet titular Teatro de la Zarzuela and Teatro de la Maestranza. She is based in Plymouth and has performed at venues throughout the region with her group Flamenco Vivo as well as Flamenco Amigos.

Dervish Performer: Mayez Rahman

Mayez Rahman is a student at Lipson Co-operative Academy in Plymouth. He has lived in both Pittsburgh, USA and Istanbul, Turkey where he first encountered the traditions of the Whirling Dervishes. His interests include designing video games and all aspects of computer programming.

Visual Effects Editor: Barış Çelik

Barış Çelik's work in visual effects and as a colourist reflects his interest in graphic design and illustration. He has a BA in Cinema from Istanbul Sehir University and his work has been part of award-winning short films both within Turkey and internationally. He is currently Video Editor at Bonte Digital (Istanbul) and Charminar Films (Canada/UK) and is associate lecturer in film editing/montage at Istanbul Medipol University.

Digital Dervish + Flamenco Sonic programs for Market Hall Dome, Plymouth, 2022

Appendix VIII: Exhibitions/Performances

Website: https://www.firoza.co.uk/project/digital-dervish/

***Digital Dervish + Flamenco Sonic*: *Immersive Sky* at the Market Hall hosted by Real Ideas on May 6th and 7th 2022, Plymouth, UK:**

May 6th screener:
https://vimeo.com/726031330/25174d8762

May 7th screener:
https://vimeo.com/712810813/dfa83c6b8f

***Digital Dervish + Flamenco Sonic: Life Circle* at the Market Hall hosted by Public Energy on September 9th and 10th 2022, Peterborough, Canada:**

Live stream with Q & A on September 10th, 2022:
https://vimeo.com/865176705/f1d67a3bee

***Digital Dervish + Flamenco Sonic: Dream Chamber* at Theatre of Digital Art Dubai on December 16th and 17th 2022, Dubai, UAE:**

December 16th screener:
https://vimeo.com/795008442/4455024af5

December 17th screener:
https://vimeo.com/795025239/64ca566055

Trailers for performances (also found on firoza.co.uk/project/digital-dervish/):

Trailer 1 for the Dome theatre at Market Hall, Plymouth, UK, 2022:
https://vimeo.com/681502330

Trailer 2 (360) for the Dome theatre at Market Hall, Plymouth UK 2022:
https://vimeo.com/manage/videos/701202043

Trailer for Market Hall theatre, Peterborough, Canada 2022:
https://vimeo.com/manage/videos/740018498

Trailer for Dubai performance, 2022:
https://vimeo.com/manage/videos/770911060

Digital Dervish + Flamenco Sonic Combined trailer, 2022:
https://vimeo.com/800670315

Appendix IX: Raw Data Samples from Device Recordings

Mayez and Mercedes whirling together May 6, 2022

index	device1	device2	device3	device4
2	-0.001694	0.000824	-0.001297	-0.002335
3	13.296341	0.000824	-0.001297	-0.002335
4	147.302841	0.000824	-0.001297	-0.002335
5	215.80336	92.53775	-0.001297	-0.002335
6	322.828583	134.926666	-0.001297	-0.002335
7	424.822113	12.604584	-0.001297	-0.002335
8	526.777588	97.758163	-0.001297	-0.002335
9	588.297241	97.435822	-0.001297	-0.002335
10	600.506348	117.817749	-0.001297	-0.002335
11	572.005005	121.533264	-0.001297	-0.002335
12	493.292603	65.199722	-0.001297	-0.002335
13	432.799072	0.000824	-0.001297	-0.002335
14	296.471313	25.688995	-0.001297	-0.002335
15	192.18895	112.088074	-0.001297	-0.002335
16	125.893326	210.774292	-0.001297	-0.002335
17	206.139297	264.021729	-0.001297	-0.002335
18	225.231857	325.550903	40.352478	-0.002335
19	230.26535	359.558899	433.216736	-0.002335
20	248.627396	503.632385	800.963013	-0.002335
21	278.681458	595.745789	280.411285	143.903305
22	308.039398	547.634888	254.187164	224.021484
23	272.167877	507.902893	209.038315	527.709595
24	299.048157	494.435059	168.163834	786.805786
25	325.155884	495.404022	148.100433	838.918335
26	320.10907	507.790283	269.026337	394.166534
27	363.354431	495.512695	333.340149	317.180206
28	440.262512	544.800537	599.665039	248.180023
29	480.490356	428.389343	819.38208	84.088913
30	397.430969	481.55481	757.961548	69.69606
31	402.125	418.743896	555.624268	142.921082
32	348.345398	431.715729	397.953247	223.130814
33	344.462036	394.177185	242.433777	541.688599
34	410.410583	403.765442	207.618942	768.409363
35	421.105103	406.718048	150.448074	835.321167
36	424.063446	431.278992	213.550797	716.157715
37	415.756958	426.056641	249.590179	300.372833
38	477.955566	448.260132	311.159424	316.375488
39	537.655579	473.822388	567.982056	224.876144

Carolina wrist movements September 9, 2022

index	device1	device2	device3	device4
0	12.843277	0	0	983.57489
1	67.143585	0	0	663.388306
2	0.008728	0	0	869.504089
3	0.008728	0	0	1236.157593
4	32.965805	0	0	684.993103
5	160.946991	0	0	781.216858
6	0.008728	0	0	1021.994812
7	129.058029	0	0	313.790436
8	226.481583	0	0	225.270447
9	440.123718	0	0	221.680817
10	619.183655	0	0	842.17749
11	446.780365	0	0	983.586426
12	628.838745	0	0	1075.097046
13	707.659973	0	0	805.855591
14	743.460815	0	0	1077.835938
15	726.498779	0	0	1265.448486
16	976.662964	0	0	258.641235
17	924.46637	0	0	474.709473
18	921.162842	0	0	919.354492
19	449.689087	0	0	807.43512
20	176.890533	0	0	1219.71814
21	347.272095	0	0	345.183441
22	598.32312	0	0	336.33905
23	589.650391	0	0	680.571716
24	427.100464	0	0	215.205353
25	450.268951	0	0	121.697586
26	247.967957	0	0	-0.000793
27	110.291718	0	0	-0.000793
28	251.561401	0	0	284.039673
29	235.244064	0	0	576.497253
30	27.404099	0	0	311.825867
31	0.00885	0	0	1184.64563
32	0.00885	0	0	193.512909
33	0.00885	0	0	652.262695
34	13.097076	0	0	288.683899
35	0.00885	0	0	255.089752
36	0.00885	0	0	195.170395
37	155.246048	0	0	-0.000961
38	188.761978	0	0	14.18399
39	344.865112	0	0	626.284607
40	361.638336	0	0	300.599182
41	596.768677	0	0	777.447876
42	865.269958	0	0	320.11142
43	707.766846	0	0	724.37207

Sercan solo performance Part 1, December 17, 2022

Index	Device 1	Device2	Device 3	Device 4
1	0	0	913.706116	0
2	0	823.822693	1091.854248	0
3	0	1105.663818	1029.037842	0
4	0	1071.999023	1030.477783	0
5	0	909.689636	1002.458923	0
6	0	703.291687	771.448547	0
7	0	670.462402	771.13385	0
8	0	802.208618	683.760254	0
9	0	809.151367	734.438477	0
10	0	876.349121	884.998901	0
11	0	896.015869	987.46167	0
12	0	886.948303	1053.955566	0
13	0	924.084351	1056.333984	0
14	0	909.721985	1069.054321	0
15	0	896.481079	1051.859375	0
16	0	894.651978	1051.148193	0
17	0	779.880981	1040.142578	0
18	0	751.06842	888.946838	0
19	0	739.24115	880.915161	0
20	0	708.269531	924.047974	0
21	0	701.220093	768.984436	0
22	0	792.031006	1065.283325	0
23	0	824.217407	927.906555	0
24	0	867.991089	1089.178467	0
25	0	929.262878	739.483093	0
26	0	977.459778	869.041748	0
27	0	1145.674438	641.044922	0
28	0	1246.329102	670.944519	0
28	0	1230.442871	746.301819	0
30	0	1153.527222	1180.473389	0
31	0	1021.574829	1433.082764	0
32	0	1317.641113	1471.576904	0
33	0	1270.565918	1388.568726	0
34	0	1127.229004	711.046082	0
35	0	1268.796143	1041.955811	0
36	0	1230.435425	1255.182251	0
37	0	793.831909	1459.247559	0
38	0	873.871826	1234.74707	0
39	0	819.989258	798.587952	0
40	0	744.75769	672.729736	0
41	0	826.932007	661.844482	0
42	0	856.121948	834.13916	0

Sercan and Pepa whirling together Part 1, December 17, 2022

Index	Device 1	Device 2	Device 3	Device 4
1	0	0	62.856964	-0.003922
2	0	91.746445	-0.001617	-0.003922
3	0	31.878586	-0.001617	-0.003922
4	0	0.002975	-0.001617	-0.003922
5	0	0.002975	-0.001617	-0.003922
6	0	47.146912	-0.001617	-0.003922
7	0	163.78891	-0.001617	-0.003922
8	0	0.002975	-0.001617	-0.003922
9	0	0.002975	-0.001617	-0.003922
10	0	0.002975	-0.001617	-0.003922
11	0	0.002975	-0.001617	-0.003922
12	0	0.002975	149.139694	-0.003922
13	0	0.002975	154.911331	-0.003922
14	0	14.208908	100.292496	-0.003922
15	0	150.000687	94.982437	-0.003922
16	0	199.883575	109.298996	-0.003922
17	0	179.932709	130.25885	-0.003922
18	0	276.690582	162.905029	-0.003922
19	0	373.931061	202.301315	-0.003922
20	0	299.700867	240.530304	-0.003922
21	0	313.189697	217.153839	-0.003922
22	0	198.229965	191.795639	-0.003922
23	0	160.931763	153.37973	-0.003922
24	0	188.124832	172.880463	-0.003922
25	0	165.454086	190.958313	-0.003922
26	0	103.934464	174.637131	-0.003922
27	0	0.003036	135.515503	-0.003922
28	0	0.003036	56.402496	-0.003922
29	0	0.003036	156.357101	-0.003922
30	0	0.003036	27.992538	-0.003922
31	0	0.003036	-0.001617	-0.003922
32	0	0.003036	-0.001617	-0.003922
33	0	0.003036	-0.001617	-0.003922
34	0	0.003036	-0.001617	-0.003922
35	0	0.003036	-0.001617	141.103638
36	0	0.003036	-0.001617	83.642853
37	0	0.003036	-0.001617	154.527557
38	0	0.003036	-0.001617	99.103821
39	0	0.003036	-0.001617	27.616394
40	0	0.003036	-0.001617	-0.003922
41	0	0.003036	-0.001617	13.757599
42	0	0.003036	-0.001617	-0.003922
43	0	0.003036	-0.001617	-0.003922

Appendix X Sound Files

All Soundrop sound files can be accessed through this private link on SoundCloud:

https://on.soundcloud.com/2LDz9

The following files can be found in the repository:

MAYEZ ANKLE 1
MAYEZ ANKLE 2
MAYEZ WRIST 1
MAYEZ WRIST 2
MERCEDES ANKLE 2
MERCEDES CASTANETS WRIST 1
MERCEDES EMAJ ANKLE 1
PEPA ANKLE 2
SERCAN WRIST 1 DDFS1 01
SERCAN WRIST 2DDFS2 02
SERCAN WRIST 3 DDFS 03
SERCAN DD Sound 1
SERCAN DD Sound 2
SERCAN DD Sound 3
SERCAN DD Sound 4
SERCAN DD Sound 5
SERCAN DD Sound 6
SERCAN DD Sound 7
SERCAN DD Sound 8
SERCAN DD Sound 9
SERCAN DD Sound 10

Appendix XI: Links to Code

The link to Arduino code for the Soundrop can be accessed here via GitHub:

https://github.com/hedih2022/Soundrop-Master

The link to the Max/MSP patcher can be accessed here via GitHub:

https://github.com/hedih2022/Volume-Control-Max-Patch.git

Both of these repositories are shared with the Creative Commons copyright licensing body.

Appendix XII: Excerpts from Q&A's/Audience comments from performances

Excerpts from Q&A and audience reactions from performance in Plymouth, UK May 6th, 2022, moderated by Dan Paolantonio

Dan: One thing that really struck me is just how effective the kind of internal relationship between technology performance and visual art can be felt, like what an incredible kind of intersection between film, sound, performance but the fact that we have this wearable tech and a live performance – it takes it completely out of the realm of traditional kind of cinema. When does that begin - where is the current thought process on something like we've just experienced?

Hedy: It's been a working progress for many years now and I've been so interested in the Dervish having spent time in Turkey and having lived in Turkey and also visiting Spain and just became enthralled with Flamenco. I wanted to create a piece that brought these two traditions together that kind of linked the sort of geographic and historical parts of both of these beautiful traditions but also, I wanted to augment them with technology in some way so to take those bits of Flamenco sound or music and have them on the dancer herself or on the Dervish. I wanted to put the technology on the dancer and then as well with Kaz's amazing film - he did it in such a way that it was choreographed to the music. It's a lot of choreographing all the different parts so not only did I compose the music, but I was also thinking about how I wanted the story between the Dervish and Flamenco using these wearable devices that I've developed at the university.

Dan: So, a couple of questions if that's OK - challenges of working as a filmmaker in 360 can you talk a little bit about this, I'm sure it was an interesting experience?

Kaz: The filmmaking is about pace and tone. I thought about the freest way to express something and drawing, or animation is quite freeing for me because I can express something without having to get those shots. In terms of the 360 I think that the challenge and there's a few technical challenges but the challenge was conceptually to get that rhythm going and to make it completely immersive so we wanted to use the space the Dome so that the viewer is not just seeing one side it's completely 360 and, in that sense, working in 360 can be quite freeing, quite interesting.

Dan to Mercedes: this must be a quite an unusual kind of environment for you - how does this differ from a traditional kind of Flamenco environment?

Mercedes: It has been from beginning to end tomorrow this amazing experience because I'm mixing my traditional Flamenco with some contemporary Flamenco with the digital graphics in a super beautiful stage really different amazing and also I have this lovely

devices here in my wrist and in my ankle that gives me an extra layer an addition to the movement to the sound that I can I do with my body like clapping or clicking fingers or another layer of movements. So, I'm very pleased and the sounds feel amazing – like another layer of expression. We just started experimenting with recording my castanets in the device a Flamenco guitar in the other device. Also, the device has gentle vibrations so when you are moving it feels just amazing completely different so it's experimental and I'm so happy to be a part of this.

Dan: How do you feel that a Dervish and a Flamenco dancer relate to each other?

Mercedes: well, there are some similarities: it is passionate and can be spiritual as well. There are a lot of turns that we do which has that connection. We have *duende*, which is the spiritual connection in the soul similar to the Dervish experience.

Patryk Swiatczak (camera/interviewer): What did you think about the show?

Audience member 1: Yeah, it was great very different - and great to see it in the Dome 360 – it took me a minute to orient myself with the theatre, but I think the dancers really complimented the circular space of the theatre with their movements.

Patryk: What did you think of the show?

Audience member 2: It was great – it was really immersive which may be an obvious thing to say but the whole 360 thing is something I've never seen before in cinema. I loved the Flamenco dance and the whole combination of the animation and different layers. It was a bit psychedelic!

Patryk: Can you tell me in general how did you enjoy the show?

Audience member 3: The show really pulls together that kind of cultural differences - well it's like the DNA inside those cultural differences and how the technology can inform both but also extract new meanings from those kinds of embedded complexities so in terms of the full Dome environment as well that coming together of all of these separate elements into a kind of coherent whole is exactly what films are about and wonderful demonstration of that cohesion.

Audience member 4 (to Mayez): Do you get dizzy when you spin around like that?

Mayez: No.

Patryk: What did you think of the show?

Audience member 5: Oh, it's really fantastic really immersive obviously had the Dome but there were so many parts coming together: the dance the movement the wearable technology on the costumes absolutely fantastic really cool. I'm super interested in the wearable fabrics and the wearable technologies and this sort of manipulation of the

sound. I tend to work in moving image and whatnot but that just for me opens up this whole new world of creativity and so that to me is the part that I'm most interested in but it's also it's the part that I know the least about so I'm sort of I'm tantalised by as it were.

Excerpts from Q&A in Peterborough, Canada, September 10th, 2022, moderated by Bill Kimball of Public Energy

Bill (question from audience member): The first question is explaining a bit about how the wearable technology works how does it trigger the sounds and the second question is when will it be available at Best Buy?

Hedy: Without getting too technical and research-y talk: so I a few years ago I started working with embedding sensors into clothing like E textiles - I was experimenting with putting sensors in different parts of the body because I was interested in capturing body movement with the use of sensors, but it was experimentation. I found it to be very cumbersome with wires sticking out everywhere and then of course there's the issue of wireless so I wanted to develop something that was easy for a performer to use and that that wasn't cumbersome. I've been working on getting it down to like a reasonably watch-sized piece but what essentially it does is it triggers a sound based on the velocity of movement and the faster the movement the louder the sound. So, I'm kind of playing with using different sounds and triggering them but essentially, they play one sound at a time, so it's meant to kind of be used like an added feature to the precomposed music. I'm not sure when it will be available at Best Buy!

Bill (question from audience member): the question is for Carolina: did the wearable technology change how you approached the movement?

Carolina: I tried incorporating it especially at the beginning of what I did tonight the awareness of the instrument and what it was doing both for me and my storytelling as well as to make it obvious to all of you and then from then on, I am aware of the sound that is creating. I'm trying to use it as much as possible in the choreography and so there is a marrying together in a fairly fluid way, but the instruments are not necessarily dictating what the movement is I am dancing more to the music and to the story that we're trying to tell.

Michael Morritt (camera/interviewer to audience member after the show): What did you think of the show?

Audience member: I think it was amazing – the way that the Dervish and the Flamenco dancer (you know that the Dervish is my brother…) they coordinated.

Michael (to audience member after the show): What did you think of the show?

Audience member: It was beautiful – there's a lot going on. I was compelled by the combination of the movements and the imagery, and I love the circular aspect of it. I love the idea of the two cultural traditions being brought together.

Excerpts from Q&A in Dubai, UAE at ToDA, December 17th, 2022

Audience member comment: First of all, thank you for such an amazing and beautiful performance. I was just wondering what made you come to this conclusion to make this fusion between a Sufi and a Flamenco dancer?

Hedy: Thank you very much thank you for your question. I lived in Istanbul for a few years, so I was very interested in the culture. As a Hungarian myself, my background is familiar with Turkish culture, and I was also very much interested in the beautiful mesmerizing practice of the Dervish. After watching performances, I did some research. My background is composing music and also working in costume design, so I wanted to find a way to bring this amazing beautiful traditional practice into a contemporary art setting. I also spent some time in Spain and realized that after watching Flamenco and many Flamenco performances that there is this cross-cultural connection between the two both geographically in terms of cultural history and musical history. I composed this piece of music to which I made a story that is an experience: an exchange between Dervish and Flamenco dancer and you begin to see some of their movements and patterns become similar so it's like a melting of two cultures together.

Audience member comment: The projection you showed when the Dervish was thinking, or meditating, if you close your eyes for two or three minutes you will see somewhat the same thing – the colors especially. It's like seeing dots and colors in your eyes when they are closed when you are in your imagination. That's what it reminded me of.

Grants received

Ideate Plymouth 5K Grant, February 10, 2022: £5000

Canada Council for the Arts grant for Concept to Realization; Explore and Create, October 2021: $60,000

Santander Scholarship Fund 2020/2021 for proposed research practice, April 2021: £750

School of Society and Culture Research and Travel Grant, December 2, 2021: £400

School of Humanities and Performing Arts Post Graduate Research Fund for Travel and Research, January 2020, University of Plymouth, UK: £350

Publications

Hurban, H. (2022) *Augmenting traditional performance practices with wearable body instruments* (paper) Musicology Symposium, Sarajevo, Bosnia Herzegovina, December 7-10, 2022.

Hurban, H. (2021) *An Exploration of Sound, Digital Art, Performance, and Wearable Technology Inspired by Traditional Whirling Dervish Movement and Flamenco Dance* (paper), Generative Art Conference, 24th Edition, Caligari, Italy, December 15-17, 2021.

Leonard, N., Way, A., Santune, F. (2020) *Web and Digital for Graphic Designers (Book)*, Bloomsbury Visual Art. (Contribution of my work in wearable technology and a synopsis of the project *Dervish Sound Dress*).

Farion, C. (2022. *The Ultimate Guide to Informed Wearable Technology: A Hands-on Approach for Creating Wearables from Prototype to Purpose Using Arduino Systems.* (n.p.): Packt Publishing. (Contribution of my work in wearable technology and a brief description of the Soundrop).

Conferences

Hurban, H. (2022) *Augmenting traditional performance practices with wearable body instruments.* Musicology Symposium, Sarajevo, Bosnia Herzegovina, December 7-10, 2022.

Hurban, H. (2022) *A Sonic Exploration of Spanish Flamenco and the Whirling Dervishes of Turkey with Wearable Technology* ISEA Barcelona, June 10-16, 2022; International Symposium on Electronic Art, Paper presentation.

Hurban, H. (2022 Invited guest speaker: *Intersections of Cultural Performance Practices and Wearable Technology*) TECHNARTE Bilbao 2022; International Conference on Art and Technology, Spain, February 22-25.

Hurban, H. (2021) *An Exploration of Sound, Digital Art, Performance, and Wearable Technology Inspired by Traditional Whirling Dervish Movement and Flamenco Dance* Generative Art Conference, 24th Edition, Caligari, Italy, December 15-17, 2021.

Hurban, H. (2021) *Exploring the Intersections of Cultural Performance Practices and Wearable Technology* The International Academic Forum (IAFOR) Kyoto Conference on Arts, Media and Culture, November 9 -12, 2021.

Hurban, H. (2019) *Wearable Technology Garments for Use in New Musical Performance Practices.* Music and Sciences Symposium, ITU Technical University Istanbul, Turkey. April 17-19, 2019; Lecture Presentation.

Reviews on *Digital Dervish + Flamenco Sonic*

Review of Digital Dervish + Flamenco Sonic, May 7, 2022

By Arthur Endrich

A prolonged opening section with lovely warm sounds induces a meditative state, setting up an inner experience of the production that was profound and very real. The mirror visuals of street scenes during this opening seemed at times to create the illusion of water and reflections, images that are very much a part of Above-Below, Outer-Inner, Matter-Spirit references to an inner life and the world of Spirit, in which water is often a transition zone (cf. Escher, The BFG). I wasn't sure how the movement through urban streetscapes fit in with this and perhaps something might have been done to clarify its role but my experience throughout the production was of an inner quiet induced by the centering, balanced rotational movement expressed via the Dervish, the Flamenco dancer, the mirror visuals and Hedy's soundtrack with its repetitive motifs. This centering is a universal theme expressed in many other different ways as well, such as for example by movement around a pole in Spanish riding, or by balance and rotation in many circus acts. When Mayez Rahman as the Dervish began to spin, with ethnic music clips intensifying the experience, his responsive and expertly tailored garment filled out into an open wave shape that was a perfect embodiment of the centered rotational movement. With various gestures he triggered different parts of the soundtrack via his Sound Drop device. In this way he was able to adapt the performance of the music to his movements. No doubt a heap of technical expertise made this flexibility possible.

A program note spoke of the Dervish becoming "enveloped in a storm of chaos … collapse … eventually rising to embrace the mayhem." I did not perceive very much in the way of chaos or embracing of mayhem and wonder if this thinking may have led to a lessening of the primary imagery and intention of the production. If the central section of the production was meant to be chaotic, this didn't happen for me. For example, I found

the hand-drawn shapes still part of an inner quiet. Even though they moved rapidly, the colors were pleasant, the shapes had curved edges, and the movement often rotational. The beauty and appropriateness of Kaz Rahman's images, wonderfully projected onto the ceiling of the Dome included other 'darker' shapes which looked like underwater scenes with fish and plants (they may have been something else!) and evoked a sense of the inner world, rather than chaos — with the mirror imaging continuing.

The Flamenco dance, so expertly performed by Mercedes Romero, picks up the centered, balanced, rotational movement in its own way, and was very appropriate for the overall theme. There were castanets on the soundtrack (they sounded rather feeble — I would have preferred live castanets) and then perhaps an extension of this sound into more complex textures on the soundtrack. When the Flamenco dancer approached the Dervish, who had been 'collapsed' on the floor (half-sitting, not prone), he emerged from his dormancy.

These observations have focused on the centering aspect because that is what I experienced the most. The central section, I think, struck a note of profundity rather than chaos, and to bring this profundity out more may have enhanced the production. It would be quite reasonable to make the complexity of life and its chaotic elements a more prominent element of the storyline. If so, I think more would have to be done to make this perceptible (with convincing motivations) in a show that in many ways moved me very deeply: why the fast-moving urban images at the beginning- when the musical sounds were so measured and lovely (I did like them) and the Dervish was not yet active?

To summarize, I enjoyed the performance of *Digital Dervish* + *Flamenco Sonic* (Plymouth Market Hall Dome, Friday 6 May 2022) and very much appreciated the smooth running of what must have been a very technically complex show to put together. It was a great achievement, and I've taken away some lasting memories that I shall cherish from a marvelous and moving show with many profound resonances.

by Archer Endrich

Born in the USA, Archer is a composer of both acoustic and electroacoustic music. He migrated to the UK in 1971 and completed a Doctorate in Music Composition at the University of York. He has been Coordinator and administrator of the Composers Desktop Project (CDP) since its inception in 1987. CDP is one of the most comprehensive software tools for sound transformations and composition ever developed. He has authored most of its Reference Documentation and Tutorials. Archer is a Visiting Research Fellow at ICCMR where he conducts research into electroacoustic music composition and sound design.

Dervish is Awakened…

***Digital Dervish + Flamenco Sonic* at Market Hall, Peterborough, Canada**

review by Sarazee Sept 12th, 2022

In our world of dying ecosystems and filter-less information, Firoza's production left me with a shot of **optimism** for humanity's ability to heal.

The dark stage was set with a young dervish resting in an illuminated circle on the ground plane. There was an identical projected circle off the back wall. The music, combined with the moving images of skies, trees and water on these circles soon made me forget about the physicality of the stage set.

Upon waking from a dream Dervish spins; the flowing images onto his immaculate skirt with his movement bring to mind both the fluidity of a stingray and a butterfly's celestial defiance of gravity. Both Dervish and audience are lulled into a meditative state, and we lose track of time. Some glowing devices on his wrist and ankle respond to the movements of Dervish with an instrumental strum. Dervish's reaction to these sounds resembles a baby discovering its own limbs for the first time. Dervish becomes self-aware. Audience and dervish emerge out of the calming realm. This self-awareness is reinforced by the music and imagery, beautifully synchronized with Dervish's movements. Images eventually morph to dehumanizing built environments and the destruction of the balance of nature. This spirals along with the collapse of Dervish. In the theatre the dizzying imagery was reinforced in the reflections of the surrounding glass guard rails of the balconies, conveying peripheral vertigo to the audience.

A split second (or an eternity) later, a flamenco dancer wanders in to discover the fallen motionless dervish. She has an earthy sensual air about her, reflected in her body hugging very human floral dress. She exudes confidence. She also dons a luminous shawl which feels more ephemeral. Her extremely controlled and yet fluid movements help us find ground. The music and now more abstract imagery feel like a dream in which human-made chaos is being beaten and sorted into a manageable order. The images are literally shaken into place with every tap of her shoe. Dancer uses her glowing sound sensors as instruments conveying the castanets and has as much control over them as each of her muscles. She is untangling the chaos.

Any unravelling that happened with Dervish feels like it is being stitched back together by Dancer. The use of the shawl in the dance echoes Dervish's conjuring of the motions of the stingray and the butterfly. Stingrays symbolize adaptability, balance, restraint among other things, and butterflies are associated with transformation and hope. Next the healing wings of an angel thrash out from the same shawl. They poke, prod, and embrace Dervish.

Dervish is awakened. Dancer and Dervish, for a lovely fleeting moment, share some common spins, bow with a gentle respect for each other and then part ways.

The production wove together four powerful elements. Each thread could have been a stand-alone performance but in this production added layers and complexity in meaning that will be left for the audience to unwrap over time. The stunning **musical score** was the narrative and backbone of the show. The lyrical animated film, colors and **moving imagery** drew the audience in and acted like a chorus, evoking emotional reactions in us. The highly skilled expressive seasoned **Dancer** and the brave beautiful **Dervish** who spun us into his world were perfect counterpoints to one another. The **sound-drop instruments** were an intriguing sonic layer to the performers' movements. I would love to see a show in which they are further explored- we merely got a taste of what they might be about. Perhaps a dedicated exchange would have been powerful, with no projections or music – just the performers and the sound-drop devices with more subtle light levels, as they emerge out of Dervish's darkness.

I left the performance with the feeling I had just experienced the Japanese concept of '**ma**'. It is the state of the pendulum neither coming nor going; or it could be described as

the space between musical notes – it is in this interval we are given a chance to **heal or grow** – **a fresh start**. This show gave us a glimpse into those elusive zones between audience and performer, young and old, natural and built, water and sky, mind and body, earthly and celestial, night and day, zeros and ones, and the dare I say **center of the circle**. Digital Dervish and Flamenco Sonic gave us the dream of a '**reset button**', which surely is something our world could use right now.

Sarazee is an Architect based in Vancouver, B.C.
Review of September 9th and 10th performances in Peterborough, Canada