

DERVISH SOUND DRESS

– ODJEVNI PREDMET SA

SENZORIMA KOJI EMITIRAJU

ZVUK I HAPTIČKIM ODZIVOM

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Abstrakt: *Dervish Sound Dress* [Derviška zvučna odora] je tjelesni instrument – nosivi tehnološki uređaj; odjevni predmet inspirisan duhovnom praksom *vrtećih derviša* u Turskoj. Njeno muzičko zvučanje uzrokovano je aktiviranjem haptičkog vibracijskog odgovora i pokretima izvođača koji je nosi.

Ključne riječi: nosiva tehnologija; senzori; haptički odziv; kompjuterska muzika; derviš.

I. Uvod

Nosiva tehnologija može se definirati kao upotreba tehnoloških sučelja povezanih s tekstilom s ciljem postizanja modne ili praktične funkcionalnosti. Želja za razvijanjem tehnologije koja proširuje funkcionalnost ljudskog tijela odavno je prisutna (Olsson *et al*, 2008). Nosiva tehnologija također spada u okvire “pametnih” dodataka poput ručnih satova, pokrivala za glavu, naočala i obuće. U nosivu modnu tehnologiju spadaju “dizajnirani” odjevni predmeti ili nakit koji povezuju estetiku i stil s funkcionalnom tehnologijom. Dok se modna tehnologija izravnije bavi smislom za stil osobe koja nosi takve odjevne predmete dizajnirane s ciljem odražavanja pojačane imaginacije, nosiva tehnologija tiče se nosivih predmeta koji su elektronički dizajnirani ili programirani na takav način da osoba koja je nosi može s odjevnim predmetom biti u interakciji. Modnim dizajnerima koji koriste pametni tekstil ili na

neki način integriraju modu i tehnologiju, potrebna suradnja je suradnja s inženjerima elektrotehnike i profesionalnim programerima.

Kombinacija nosive i modne tehnologije sa haptičkim odzivom i muzičkim zvukom može imati transformativnu svrhu. Značenje se mijenja kad se zvuk koristi kao sredstvo u postizanju iskustva prosvjetljenja, postavljajući izazov pred konvencionalne norme o tome kako tehnologija može funkcionirati bez oslanjanja samo na uređaje i materijalne inovacije. Ove konvencije *Dervish Sound Dress* [Derviška zvučna odora] provocira kroz model sofisticiranijeg ideala korištenja tehnologije u prevazilaženju svijesti uzimajući duhovno iskustvo i stvarajući iz njega umjetnički izraz.

Razumijevanje dosega nosivih tehnologija u smislu koristi za krajnjeg korisnika smješteno je u okvirima funkcionalnosti i praktičnosti. Ako odjevni predmet sadrži nevidljivo sučelje za interakciju s osobom koja ga nosi, vjerojatnost komercijalnog uspjeha mnogo je veća. Ljudi postaju sve svjesniji mijenjanja pejzaža tehnoloških ostvarenja i činjenice da će društveni i ekonomski pritisci korištenja tehnologije na različite načine biti realan ishod u budućnosti. Stoga se komercijalni interes za modnu tehnologiju povećava, što se može vidjeti u sve prisutnijoj odjeći s ugrađenom tehnologijom na području sporta, zdravstvene zaštite, spasilačkih službi i sigurnosti (Seymour, 2008). Mogućnosti istraživanja emotivnog tekstila i odjevnih predmeta mogu promijeniti kapacitete učinka nosive tehnologije. Prostor za stvaranje tekstilnih sučelja koja uključuju globalnu publiku trebao bi biti intuitivan i kompatibilan s emocionalnim adapterima (Quinn, 2010).

Tamo gdje se modna tehnologija izravnije odnosi na smisao za stil koji osoba odražava dok nosi odjevni predmet, ona je dizajnirana s ciljem da iskaže pojačanu fantaziju. Nosiva tehnologija odnosi se na nošenje predmeta koji su elektronički projektirani ili programirani na takav način da osoba koja ih nosi može sa njima da ostvari interakciju. Berzowska (2005) napominje da “nosivi” odjevni predmet treba biti konstruiran na takav način da ima smisla za nositelja; da je praktičan za upotrebu na tijelu i da ne ometa njegovu funkcionalnost. Štaviše, trebao bi

podrazumijevati privlačnu i neprimjetnu integraciju na tkanini kako bi “nosivo računalo” bilo što manje krhko. Naše interakcije s nosivim tehnologijama se mijenjaju onoliko koliko i one nas mijenjaju (Cranny-Francis i Hawkins, 2008). Istraživanja raskrižja između nosive tehnologije i mode su neizbježna. Modni dizajneri koji koriste pametni tekstil ili integriraju modu s tehnologijom, na neki način zahtijevaju suradnju s inženjerima elektrotehnike i profesionalnim programerima.

Potražnja za nosivom tehnologijom se povećava. Tehnološke inovacije omogućile su da se procesorska snaga udvostruči, komponente fizički smanje, a alternativne energije postanu realne opcije (Seymour, 2008). Nosiva moda traži nova rješenja iz računalne tehnologije gdje je inovacija mnogo naprednija nego kod tehnologije dizajniranja odjeće (Zhang, 2016). Tehnološki napredak u korištenju pametnih ili provodljivih niti i tekstila, kao i biomimikrijskih, hemijskih, nano i bakterijskih tekstila pokazuju nove puteve u istraživanjima novih primjena nosive tehnologije.

Mnogi modni dizajneri surađuju s inženjerima elektronike i softvera kako bi razvili proizvode koji postaju sve dostupniji. *Moon Berlin* (2007) je dizajnerska tvrtka visoke mode koja u svojoj odjeći koristi jedinstvenu tehniku osvjetljenja stvarajući dinamiku između efekata svjetla i sjene (Berglin, 2013, 19). *Hövding* (Hövding Sverige AB, 2018) je švedska tvrtka koja je razvila kragu za bicikliste koja koristi akcelerometre i žiroskope koji se aktiviraju abnormalnim pokretima kod nosioca i koja se napuhuje u slučaju nesreće i time štiti glava (Berglin, 2013, 18). U posljednje tri decenije istaknuti modni dizajneri počeli su istraživati korištenje multidisciplinarnih pristupa u korištenju nosive tehnologije koja komentira šta ljudi nose na svojim tijelima i zašto. Modna dizajnerica Anouk Wipprecht (?) koristi modu kao sučelje u svojim dizajnima. Njena *Synapse Dress* [Sinapsna haljina] (Annouk Wipprecht Fashiontech, 2007) opremljena je sensorima koji reaguju na moždane talase osobe koja ju nosi.

Neprimjetno integrisanje tehnologije na tijelu predstavlja brojne izazove, uključujući intuitivnu prirodu računanja. Za sada smo tek na početku proučavanja mogućnosti nosive tehnologije i njenog utjecaja na svakodnevni život ljudi.

Fokus ovog istraživanja je utvrditi zašto i dokle su ljudi spremni ići kako bi nadogradili svoju odjeću tehnologijom. Modni dizajneri koji u svom dizajnu koriste tehnologiju i nosive dodatke moraju se više baviti stvaranjem novih iskustava interakcije između čovjeka i računala s ciljem postizanja koristi koja nije samo površinska. Istraživanje tih odnosa sa utjelovljenjem kroz multisenzorno angažiranje može imati efikasnu privlačnost (Cranny-Francis i Hawkins, 2008).

II. Pozadinsko istraživanje

Dizajn odore inspiriran je obrednom praksom “okretanja” derviša mevlevijskog reda poznatom kao *sema*, a pod utjecajem sviranja instrumenata koji su postavljeni u blizini tijela, naprimjer žičanog instrumenta. Sufizam se može opisati kao mistično iskustvo, te ekstatično i emocionalno ostvarenje Božje prisutnosti i moći (Lifchez, 1992). Izvedba *vrtećeg derviša* je duhovni izraz ljubavi i predanosti Bogu. Muzika koja se koristi za vrijeme *seme* pojačava derviško iskustvo u nastojanju da dosegne viši nivo svijesti i povezanosti s vjerom. Iako odora nije nužno zamišljena kao “modni” odjevni predmet, korišteni tekstili su pod utjecajem osmanske odjeće koja je bogata vezom i raznobojnim tkaninama. Ovdje se ne radi o direktnom odrazu odore ili nošnje mevlevijskih derviša, međutim, ona jeste slična tradicionalnoj nošnji, budući da koristi naslojavanje boja koje su vidljive kada se odora tokom izvođenja “okrene” u potpunosti.

Sufizam ili misticizam na Zapadu su postali sinonim za ogranak “istočne” enigmatične religijske prakse. Pogrešno je smatrati da je sufizam neovisan od Islama (Lings, 1973, 16). *Dervish Sound Dress* temelji se na derviškom ritualu okretanja *sema*, što znači “čuti” ili “slušati” muziku. On podrazumijeva ekstazu koja je pokrenuta muzikom s ciljem pokretanja stanja ushićenja. Kühl (2008, 129) objašnjava da je osjećaj evociran slušanjem muzike i da ta muzika “rezonira u tijelu” i time vodi do dubljeg stanja svijesti. Ovo je premisa prema kojoj obučeni derviši slijede svoj put, kombinirajući elemente tjelesnog pokreta i muzike kako bi formirali ekspresivno muzičko iskustvo. Islamska dogma naglašava čistoću religijske prakse,

što je jedna od definicija sufizma (Rahman, 1966). Za vrijeme *seme*, mogućnost postizanja poboljšanog metafizičkog stanja ovisna je o samim dervišima i čistoći njihovog vjerovanja.

Derviši ili sufije su tako nazvani jer je njihova odjeća bila od jednostavne nerafinirane platnene vune (“suf”) u njenom sirovom obliku, neočišćene, bez boja i dodataka (Schimmel, 1975, 14). Estetika koja se prenosila kroz stoljeća, nastavila je da bude važan aspekt derviške odjeće, naročito tokom *seme*. *Dervish Sound Dress* kontrastna je strogom službenom odijelu tradicionalnog derviša; silueta odjeće je sličnog oblika, ali tekstil koji se koristi je smjelijih boja i tekstura.

Derviš ili sufija je neko ko se odrekao materijalnih posjeda, te posvetio i usredotočio svoju životnu i duhovnu čistoću Bogu. Perzijski učenjaci pozivaju se na “der” u značenju “vrata”, dok “viš” znači “moliti”; te je prihvaćeno značenje riječi kao siromaha koji ide od vrata do vrata tražeći pomoć. Ovo je također uobičajena riječ u Indiji, Turskoj, Egiptu, Siriji i drugim arapskim zemljama gdje se derviš naziva “fakir” ili “prosjak” (Brown, 1868). Značenje riječi “derviš” također se transformiralo u značenje “duhovni tragač” ili “posvećen Bogu”, ali u mnogim drugim krugovima je imalo značenje “siromašan čovjek”.

Cjelokupna izvedba *seme* od početka do kraja odnosi se na stvaranje uzoraka kroz oblik rotirajuće i rastuće odore ili *tenure* (Kılınc, 2011), kretanje tijela u kružnim rotacijama oko prostora za nastupe, pozicioniranje šaka, ruke i glave, kao i muzike koja inicira pokret u ponavljajućim formacijama.

Zvučni dizajn ovog odjevnog predmeta također je bitan za projekt. Senzori se programiraju sintetiziranim zvučnim uzorcima tradicionalnog turskog *tanbura* koji se ponekad koristi za vrijeme same *seme*. Održavanje integriteta instrumenta je osnovna komponenta dizajna i ukupnog proizvedenog zvuka. *Tanbur* je žičani instrument s visokom frekvencijom vibracija koje rezoniraju duže vrijeme, stvarajući atmosferu drona.

Motiv je oponašati vibracije koje se osjećaju dok muzičar svira instrument, te emocionalni odgovor koji muzičar i derviš osjećaju. Prema Eryamanu (2012), *sema* se sastoji od slušanja

muzike i sudjelovanja u plesnom okretanju, te pjevanju kako bi se uspostavila ekstaza i postiglo mistično stanje. Kako bismo dalje istražili ovu praksu, postavljat će se pitanje kako muzika i izvedba mogu utjecati na transcendentalno putovanje, što uključuje polaženje od svetog iskustva i njegovo prevođenje u umjetničko djelo. Iskustvo je izvedba koja je zabilježena od strane korisnika i reprodukovana kroz sustav zvučnika, pri čemu se posmatrači također mogu emocionalno uključiti. Suština odjevnih predmeta bit će u prizivanju empatije kroz komunikaciju osoba koje ih nose i muzike koju kontrolišu, a koja je izazvana odjevnim predmetom. Prema Thompsonu (2009), jedna od najvećih misterija muzike je njena snažna povezanost s emocijama. Korištenje ove tehnologije može rezultirati mnogo ekspresivnijim iskustvom za korisnika jer vibracije koje se osjećaju tijekom emitiranja zvukova pojačavaju napredak. Leman (2008) napominje da se istraživanje haptičkog odziva često povezuje s istraživanjima muzičke ekspresije i nijansama izvedbe. Ne samo da su vibracije važne zbog načina na koji objašnjavaju odjek instrumenta, već tokom izvođenja zvukovi mogu uzdići ovo iskustvo dok se izvođač kreće u odori.

U posljednje dvije decenije, evidentan je porast zanimanja za kombiniranje mode i tehnologije. Ljudi sve više zahtijevaju da njihova tijela budu opremljena najnovijim tehnologijama. U ovom istraživanju ključno je prepoznavanje dizajnera u sferi mode koji rade s nosivim modnim tehnologijama, te koliko su njihove kreacije korisne za inspirisanje budućih razvoja u ovoj oblasti. Nosive i modne tehnologije spajaju se u jedinstvenu oblast. Rad dizajnera kao što je Hussein Chalayan (Hüseyin Çaçlayan, 1970) koji u svojoj kolekciji proljeće/ljeto 2000 spaja modu i tehnologiju, poput njegove *Remote Control Dress* [Haljina na daljinsko upravljanje], koja se ponekad naziva i *Airplane Dress* [Zrakoplovna haljina], istražuje mogućnosti korištenja motorizirane mehanike za otvaranje haljine, kreirajući novi oblik (Chin, 2006). Ying Gao (1973) koristi interaktivne odjevne predmete poput haljina (*No*)*Where* (*Now*)*Where* [(Ne)Gdje (Sada)Ovdje] koje koriste fotoluminiscentnu nit i ugrađenu tehnologiju praćenja pokreta očiju tako da pogled gledatelja mijenja oblik odjevnog predmeta (Ying Gao, 2017). Iris van Herpen (1984) za svoje kolekcije koristi digitalnu tehnologiju

štampanja, što rezultira inovativnim tekstilnim ishodima u kombinaciji s tehnologijom (Iris van Herpen, 2020). *Philips Design* surađivao je s mnogim izvođačima i umjetnicima, te je razvio haljinu *Bubelle* koja mijenja oblik i boju na temelju emocionalnog stanja osobe koja ju nosi (Koninklijke Philips N.V., 2004–2020). Mnogi od ovih dizajnera koriste tehnologiju u kombinaciji s modnim dizajnom koji uključuje značajnu upotrebu zvuka kao alata za stvaranje emocionalnog i interaktivnog odnosa s odjećom. Ziya Azazi (?) je turski umjetnik čiji je performans *Dervish in Progress* (2016) istraživanje plesa i performansa bez korištenja tehnologije, a ipak njegova izvedba okretanja i dizajniranja odjeće koja podsjeća na dervišku odoru otkriva jedinstvene mogućnosti za preplitanje disciplina. Seymour (2008) govori o važnosti suradnje dizajnera i inženjera kao ključnoj za razvoj tehnologije i nosivih odjevnih predmeta.

Imogen Heap (1977) je muzičar/izvođač čiji rad s *Mi.Mu* rukavicama mijenja način izvođenja elektronske muzike uživo (*Mi.Mu*, 2016). Rukavice su dizajnirane tako da mogu upravljati gestualnim pokretima pomoću senzora i provodljivog tekstila povezanih s računarom pomoću bežičnog sučelja. Rukavice imaju mogućnost proizvodnje različitih zvukova mijenjanjem pokreta prstiju opremljenih fleksibilnim sensorima.

Još jedna kompanija i tim dizajnera zainteresiranih za haptički odziv putem nosive tehnologije je *Cute Circuit* čija je *Sound Shirt* [Zvučna košulja] (*CuteCircuit*, 2017) napravila napredak u razvoju korištenja vibracija u odjeći za oponašanje živih orkestralnih izvedbi koje se “osjete”, a da ih ne čuje osoba koja košulju nosi. Važnost načina na koje se muzika može osjetiti kao osjetilno iskustvo vidljiva je u njihovom radu (Kempe, 2016).

Modni dizajneri prihvaćaju potražnju za komercijaliziranjem svojih proizvoda, čineći ih dostupnim za masovno tržište. Integriranje softverskih sučelja s odjećom postaje sve više zastupljeno i sve manje manje liči na eksperimentalne naprave.

III. *Dervish Sound Dress*

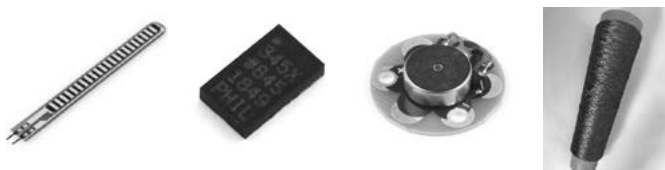
Na *Dervish Sound Dress* utiče duhovna praksa “okretanja” vrtećih derviša. Izraz vrteći derviši je zapadnjački opis mevlevijskih sufija u Turskoj. Iako je srž sufizma suštinski dio načela ponašanja derviša, povezivanje sufizma i savremene prakse plesa derviša u Turskoj nisu široko izučena tema. Odjevni predmet nastoji istražiti mogućnosti angažiranja nositelja s interaktivnim iskustvom koristeći muzičke zvučne kompozicije, haptički odziv i izvedbu. Odora nastupa kao instrument koji je produžetak tijela i reflektuje informacije koje proizvodi osoba koja ju nosi.

Sadržaj je zasnovan na asocijacijama koje derviši kreiraju prilikom izvođenja *seme*, koja je ritualna izvedba ili ples. U idealnom slučaju sema uključuje upotrebu poezije i muzike kako bi se slušateljeva koncentracija usmjerila na Boga i možda izazvala stanje nalik transu kontemplativne ekstaze (Lewis, 2000). U osnovi, ova praksa je način usmjeravanja ljudi ka pojačanom obliku prosvjetljenja i povezanosti s božanskim kroz muziku i kretanje tijela. Srce *seme* je muzika sama po sebi, koja se pokreće vrtložnim pokretom *semazena* ili derviša, te ponavljanjem svetog teksta kao i Mevlanine poezije. Tokom izvođenja *seme*, derviši počinju svoje “okretanje” veoma sporo; kao da su neprijetni. Ruke se počinju širiti van, tako da se jedna okrene prema nebu, a druga usmjeri prema zemlji, a “okretanje” počinje kao da njihove suknje odražavaju orbitalne obrasce planeta.

Cjelokupni dizajn odore *Dervish Sound Dress* proizlazi iz bogatih boja i tekstila osmanskog perioda koje potiču iz sredine 16. stoljeća. U tom periodu obično su se nosile bujne, žive i kontrastne boje tekstila. Mnoge *entare* koji su nosili osmanski sultani također su prisvajali derviški redovi u Turskoj, iako su njihovi odjevni predmeti bili daleko manje ukrašeni i detaljni. Različiti slojevi tkanine važna su karakteristika raznolikosti tradicionalne odjeće iz Turske (Koç i Koca, 2011, 10-29). Tradicionalna odjeća koju nose mevlevije sastoji se od bijelog prsluka vezanog oko struka, pojasa i velike bijele kružne suknje ispod koje su duge hlače. Kako se suknja otvara tokom izvedbe “okretanja”, silueta postaje veličanstvenija. *Dervish Sound Dress* dizajnirana je koristeći blijedoplavi žakard i crveni donji sloj

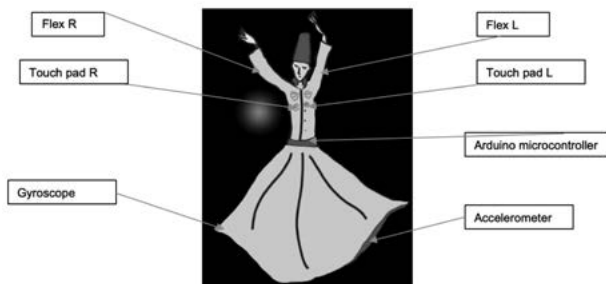
koji se otkriva tokom nastupa osobe koja ju nosi, a otvoren je u svojoj najvišoj poziciji.

Izgradnja odore uključuje upotrebu različitih senzora koji funkcioniraju ovisno o načinu pokretanja zvuka u odnosu na pokret osobe koja je nosi. Oni određuju učinak na temelju rotacije odore pomoću žiroskopa i akcelerometra, koji će mjeriti brzinu odore dok se okreće, i fleksibilnih senzora koji će pokrenuti zvuk kad su ruke u određenim položajima (Primjer 1 i 2). Progresija odore odgovara načinu na koji se razvijaju zvučni elementi. Komponenta dizajna zvuka temelji se na korištenju organskih uzoraka zvuka klasičnog turskog *tanbura*. Uzorci su snimljeni od strane izvođača *tanbura* i manipulirani su računalnim softverom za dizajn muzike stvarajući ambijentalne tonove koji nalikuju ovom instrumentu. To daje odjeći jedinstven karakter funkcionisanja i kao računalno digitaliziranog prikaza klasičnog žičanog instrumenta koji se aktivira pokretima tijela. Zvukovi se aktiviraju pomoću algoritama stvorenih u softveru *Max Cycling '74*. Ovi “patchovi” će otkriti prag kretanja osobe koja nosi odoru prije nego što se pokrene zvuk.



Primjer 1.

Izbor senzora koji se koriste u odori *Dervish Sound Dress* (s lijeva na desno: flex senzor, akcelerometar, motor haptičke vibracije i provodni navoj)



Primjer 2.

Koncept dizajna za *Dervish Sound Dress*

Bilježenje pokreta derviša je inspiracija za način na koji odora inicira zvuk u zavisnosti od položaja odore (Tabela 1). U izvedbenoj postavci početni položaj odore je dok su izvođačeve ruke prekržižene na grudima. Kako se jedna ruka otvara, a zatim i druga, zvukovi se aktiviraju početnim okretajima izvođača. Kako se brzina okretanja povećava, pokreće se više zvukova sve dok odora nije u potpunosti otvorena omogućavajući emitovanje kakofonije zvukova. Druga bitna odlika dizajna odore jeste korištenje haptičkih vibracija kao senzorne reverberacije, tako da je iskustvo nošenja i izvođenja u odori umerzljivije i interaktivnije. Ovo će se sprovesti pomoću haptičkih vibrirajućih motora pokrenutih nakon što se zvuk aktivira pokretima osobe koja nosi odoru. Ostale komponente i senzori uključuju jastučice za pritisak na gornjem dijelu odore; kada se dodirnu, aktiviraju se ambijentalni zvukovi koji prate melodične zvukove koje inicira okretanje odore i pokreti ruku. Odora je u potpunosti bežična, omogućavajući izvođaču slobodno, neograničeno kretanje. Zvuk se emituje putem sistema zvučnika, ali se razvijaju integracije upotrebe mehanizama za izlaz zvuka na samoj haljini. Daljnja istraživanja u integrisanju pametnih tekstila i provodnih navoja dovest će do konceptualizacije mogućnosti pojednostavljenja dizajna za neprimjetno integriranje hardverskih i softverskih komponenti za intuitivno razvijanje sučelja za nošenja tokom izvođenja.

SENZOR/HARDVERSKA KOMPONENTA	OPIS FUNKCIJE
Flex Sensor Right(R) and Left(L)	Fleksibilni senzori u rukavima otkrivaju kretanje i proizvode zvuk kada vrijednost senzora dosegne određeni prag.
Touch Pad Right(R) and Left(L)	Senzori unaprijed programirani ambijentalnim zvukovima; kada se dodirnu, proizvode zvukove.
<i>Arduino</i> mikrokontroler	Mikrokontroler se smješta u pojas odore i programira se bežično.
Akcelerometar	Otkriva brzinu kojom odora inicira pokrenuti zvuk.
Žiroskop	Otkriva položaj odjavnog predmeta. Na osnovu definisanog praga kretanja, pokreće se zvuk.

Tabela 1.

Opis funkcija senzora i mikrokontrolera i pozicija na odori

Odora je programirana pomoću sustava mikrokontrolera *Arduino* koji je pričvršćen na pojas odore. Sve zvučne kompozicije programiraju se pomoću *Max by Cycling '74*.

IV. Završne napomene

Bitne karakteristike koje omogućuju odori *Dervish Sound Dress* da koristi haptički odziv, dizajn zvuka kompjuterske muzike i religiozne ili metafizičke uticaje za transcendentalno iskustvo putem izvedbe su kombinacija elemenata koji još nisu temeljito istraženi u oblasti nosivih i modnih tehnologija ili u performansu. Na odoru utječu klasični osmanski tekstil i slojevi tkanine, te duhovno iskustvo mevlevijskih derviša i sama izvedbe *seme*. Stoga je ona i komentar na načine na koji se nosiva tehnologija može neprimjetno integrisati za smisleno interaktivno iskustvo za osobu koja ju nosi i koja kroz pokret i performativni čin izražava zvuk.

Mogućnosti za daljnji razvoj na ovom polju koristeći računalnu muziku, tehnologiju i modni dizajn mogu pružiti platformu za razvoj odjevnih predmeta koji prenose zvučne vibracije koji pobuđuju ili pojačavaju emocionalne reakcije.

Nakon savjetovanja s različitim grupama iz Londona (Velika Britanija) i Istanbula (Turska), koji prakticiraju tradicionalni oblik *seme*, ustanovljeno je da zanimanje za upotrebu tehnologije u kombinaciji s tradicionalnom uporabom živih instrumenata i recitovanjem iz Kur'ana nije poželjno. Štaviše, iako su razgovori s tim grupama pobudili izvjesnu znatiželju, većina nije bila sklona odvajanju od ustanovljene prakse koja se stoljećima smatra istinitim načinom izvođenja *seme*. Međutim, došlo je do novog porasta ove prakse među suvremenim izvođačima i izvedbenim grupama u kojima su mnogi preuzeli vještinu "okretanja" uključivanjem u fiktivske predstave koristeći elektroničku muziku i teatarske postavke. Postoje odabrane grupe na mjestima poput Istanbula, u Turskoj, gdje su suvremeni izvođači koristili elemente *seme* i novim idejama nadograđivali stoljetnu praksu.

Jedan takav izvođač, turski *semazen* (derviš) Sercan Çelik, 20. oktobra 2018. godine testirao je *Dervish Sound Dress* u Istanbulu, Turska (Primjer 3). Çelik je umjetnik performansa i aktivan derviš koji je zainteresiran za savremene interpretacije *seme* i vještinu okretanja. Budući da je on profesionalni plesač i aktivan derviš od 12. godine, Çelikovi pokreti u testiranju *Dervish Sound Dress* bili su direktni odraz derviških pokreta. Çelik je dobio smjernice o tome kako upravljati odorom, te je bio ohrabren da odoru koristi slobodno, te razvije vlastitu interpretaciju kako bi odora mogla raditi za njega i s njim. Kompozicija koju je stvorio dok je koristio odoru bila je dinamična s kontinuiranom fluidnošću. Beskonačno se kretao kružnom preciznošću koristeći različite tipke i fleksibilne senzore u rukavima izmjenjujući zvukove. Çelik je prokomentisao kako osjeća da zvukovi koje je mogao stvarati na temelju njegovih gesti pojačavaju njegove pokrete i omogućavaju proširivanje vlastite prakse kao savremenog derviša. Çelik je odoru koristio intuitivno i rotirao se dok je koristio ruke kako bi promijenio svoje položaje i geste. Komentarisao je i da mu je zanimljiv čin dodirivanja tijela dok se okreće, te da osjeća vibracije dok emitira zvuk. Ovo je pomoglo da se razvije odnos između njegovih gesti, pokreta i njegovog tijela zbog doživljaja vibracija. Na kraju, Çelikova reakcija dok je koristio odoru bila je vrlo uspješna napomenuvši da ga odora može potencijalno dovesti u stanje transa na jedinstven način koji je važan dio njegove prakse. Mogućnost kontrole muzike pomoću njegovih gesti i pokreta tijela može biti imerzivnije iskustvo kako za njega, tako i za publiku.

Značaj ovog istraživanja mogao bi utjecati na buduće razvoje u oblasti nosive tehnologije u području novih praksi umjetničkog performansa. Razumijevanje onoga što nosiva tehnologija može pružiti u modnom dizajnu pomoću zvuka još se razvija. Daljnjim istraživanjem mogle bi se ispitati mogućnosti upotrebe ovog odjevnog predmeta za blagotvorne učinke na osobe koje pate od anksioznosti ili za bilo koju drugu grupu. Dokazano je da zvuk i muzika imaju blagotvoran učinak na moždanu aktivnost, pa bi se takav odjevni predmet mogao i dalje razvijati kao intimniji i emotivniji dio tehnologije koju svako može da nosi.

Daljnja istraživanja ispitat će kako razvoj odjevnih predmeta korištenjem inteligentnog tekstila može poslužiti svrsi izvan konteksta izvedbe i umjetničkog izraza. Polazna pozicija u duhovnoj praksi poput mevlevijske *seme*, podrazumijeva fokus na aspekt izvedbene tradicije. Međutim, razvoj i inovacije modnih nosivih tehnologija mogu istražiti upotrebu takvog odjevnog predmeta za osobnije i interaktivnije iskustvo nošenja. Budući modni odjevni predmeti koji koriste nosivu tehnologiju poput *Dervish Sound Dress* mogu se konstruisati na mnogo naprednijim tehnološkim mogućnostima. Ove inovacije mogle bi dodatno obogatiti mogućnosti kako bi odjevni predmeti funkcionirali kao produžetak tijela, kao instrument, sposoban za autonomno stvaranje muzičkih kompozicija upotrebom gesti. Ovakav odjevni predmet bio bi primjer neprijetne integracije tehnologije i modnog dizajna.



Primjer 3.

Dervish Sound Dress, izvedba Sercana Çelika (Hurban, 2018)

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THE DERVISH SOUND DRESS

– A GARMENT USING SENSORS

THAT EMIT SOUND AND HAPTIC

FEEDBACK

Hedy Hurban

Abstract: *The Dervish Sound Dress* is a wearable piece of technology, and a garment inspired by the sacred experience of the *Whirling Dervishes* of Turkey. The dress is a body instrument that emits musical sounds when the wearer moves in it, as well as triggering a haptic vibration response.

Keywords: wearable technology; sensors; haptic feedback; computer music; dervish.

I. Introduction

Wearable technology can be defined as the use of technological interfaces that are interlinked with textiles for fashion or practical functionality. Humans have had a desire to develop technology that extends the functionality of the human body (Olsson *et al*, 2008). Wearable tech also falls under the umbrella of “smart” accessories such as wristwatches, headgear, eyewear and footwear. Wearable fashion technologies are, in fact, “designed” garments, accessories, or jewelry that bring together aesthetics and style with functional technology. Where fashionable technology refers more directly to the sense of style that a person reflects whilst wearing a garment that is designed with a mode of conveying an amplified fantasy, wearable technology deals with wearing objects that have been electrically engineered or programmed in such a way that the wearer can interact with the garment. Fashion designers who

are using smart textiles or integrating fashion and technology in some way require collaboration with electrical engineers and programming professionals.

Combining wearable and fashionable technology with haptic feedback and musical sound can result in a transformative purpose. The significance changes when using sound as a means of attaining an enlightened experience, thus challenging conventional norms of how technology can function without relying solely on gadgetry and material innovations. *The Dervish Sound Dress* challenges these conventions by drawing upon a more sophisticated ideal of using technology to transcend consciousness by taking a sacred experience and creating artistic expression from it.

Understanding the scope of where wearable technologies will lead to in terms of beneficial use for the end-user lies in the framework of functionality and practicality. If a garment can perform seamlessly with an interface that can be used to interact with the wearer, the likelihood of commercial success is more conceivable. Humans are becoming more aware of the changing landscape of technology and how societal and economic pressures of using technology in different ways is what the future beholds. Thus, commercial interest in fashionable wearables is increasing as seen in clothing using embedded technologies that are becoming more evident in the areas of sport, healthcare, rescue services and security (Seymour, 2008). The possibilities of exploring emotive textiles and garments can change the shape of the capabilities that wearable technology can provide. The scope for creating textile interfaces that engage a global audience should be intuitive and compatible with emotional adapters (Quinn, 2010).

Where fashionable technology refers more directly to the sense of style that a person reflects while wearing a garment that is designed with a mode of conveying an amplified fantasy. Wearable technology deals with wearing objects that have been electrically engineered or programmed in such a way that the wearer can interact with the garment. Berzowska (2005) remarks that a “wearable” garment should be constructed in a way that makes sense to the wearer; that it is practical

for use on the body and doesn't interfere with functionality. Moreover, it should be attractive with a seamless integration into the cloth so that the wearable computer is less fragile. Our interactions are changing with wearable technologies as we are changed by them (Cranny-Francis and Hawkins, 2008). The explorations of the intersections between wearable technology and fashion are inevitable. Fashion designers who are using smart textiles or integrating fashion and technology in some way require collaboration with electrical engineers and programming professionals.

The demand for wearable technologies is flourishing. Technological innovations have made it possible to allow for processing power to double, components to become miniaturized, and alternative energies to become viable options (Seymour, 2008). Fashionable wearables require new offerings from computational technology where innovation is much more advanced than in clothing design technology (Zhang, 2016). Technological advancements in using smart or conductive threads and textiles as well as biomimicry, chemical, Nano, and bacterial textiles are breaking ground in the research for new implementations of wearable tech.

Many fashion designers are collaborating with electrical and software engineers to develop products that are becoming more accessible to people. *Moon Berlin* (2017) is a design company that uses a unique light technique in its high fashion garments, creating a dynamic between light and shadows (Berglin, 2013, 19). *Hövding* (Hövding Sverige AB, 2018) is a Swedish company that developed a collar for cyclists that uses accelerometers and gyroscopes that are triggered by abnormal movements in the wearer and inflates in the case of an accident to protect the head (Berglin, 2013, 18). Prominent fashion designers in the last three decades have begun to explore using multidisciplinary approaches using wearable technology to make commentaries on what humans wear on their bodies and why. Fashion designer Anouk Wipprecht (?) uses fashion as an interface in her designs. Her *Synapse Dress* (Annouk Wipprecht Fashiontech, 2007) is outfitted with sensors that react to the wearer's brain waves.

Integrating technologies seamlessly with the body poses numerous challenges, including the intuitive nature of computing. So far, we are only just beginning to examine the possibilities of how wearable technologies will affect the everyday lives of humans.

The focus of this research is to determine why and to what lengths are humans willing to go to augment their clothing with technology. Fashion designers using technology and wearables in their designs need to be more concerned with creating new experiences of human to computer interactions for benefits other than for superficial uses. Exploring these relationships with embodiment through multi-sensory engagement can have an effective appeal (Cranny-Francis and Hawkins, 2008).

II. Background Research

The design of the dress is inspired by the ritual “turning” practice of the Mevlevi Sufi order known as the *sema* and is influenced by the playing of instruments that are situated close to the body, such as a stringed instrument. Sufism can be described as the mystical experience in, and the ecstatic and emotional realization of, the presence and power of God (Lifchez, 1992). The *Whirling Dervish* performance is a spiritual expression of love and devotion to God. The music that is used during the *sema* enhances the Dervish’s experience of striving to attain a higher level of consciousness and connection to his faith. Although the dress is not necessarily meant to be a “fashion” garment, the textiles to be used are influenced by Ottoman garments, which are rich in embroidery and colourful fabrics. However, it is not a direct reflection of the dress or costumes worn by the Mevlevi Dervishes; it is a resemblance of the traditional costume, layering colours that are exposed when the dress becomes fully “turned” during the performance.

Sufism, or mysticism, has become synonymous in the West as being a branch of an “Eastern” enigmatic religious practice. It is incorrect to imply that Sufism is independent of Islam (Lings, 1973, 16). *The Dervish Sound Dress* draws upon the

sacred turning ritual of the *sema*, which means “to hear” or “to listen” to music. It means moving with a frenzy, which is fueled by the music to enter into exhilaration. Köhl (2008, 129) explains that feeling is evoked by the listening of music and that music “resonates in the body”, effectively allowing one to delve into a deeper state of consciousness. This is the premise upon which a trained dervish follows their path; by combining the elements of body movement and music to form an expressive musical experience. Islamic dogma emphasizes the purity of the practice in religion, which is one of the definitions of Sufism (Rahman, 1966). During a *sema*, the possibility of achieving an enhanced metaphysical state is dependent upon the dervish themselves and the pureness of their belief.

Dervishes or Sufis were called such because their clothing was of simple unrefined cloth wool or “suf” in its raw form, unadorned without colours or accessories (Schimmel, 1975, 14). The aesthetic carried forward through the centuries and continued to be an important aspect of the garb donned by dervishes, especially during a *sema*. *The Dervish Sound Dress* is a contrast to the austere vestment of the traditional dervish; the silhouette of the garment is similar in shape, yet the textiles used are bolder in colour and texture.

A dervish or Sufi is someone who has renounced material possessions and devotes and focuses their life and spiritual purity to God. Persian scholars have taken the “der” to mean “door”, whereas “vish” means “to beg”; essentially, the accepted meaning is that of a poor man who goes from door to door requiring help. This is also a common word in India, Turkey, Egypt, Syria and other Arabian countries where the dervish is referred to as “fahkir” or “beggar” (Brown, 1868). The meaning behind the word “dervish” has also changed to mean “spiritual seeker” or “devotee of God”, but in many other circles has meant “poor man”.

The entire performance of the *sema* from beginning to end is about creating patterns through the shape of the rotating and expanding dress or *tennure* (Kılınc, 2011), the movement of the body in circular rotations around the performance space, the positioning of the hands, arms and head, as well as the music which propels the movement in repetitive formations.

The sound design of this garment is also essential to the project. Sensors are programmed with synthesized sound samples of the traditional Turkish *tanbur*, which is an instrument that is sometimes used during a *sema* performance. Keeping the integrity of the instrument is a fundamental component of the design and overall output of the sounds. The *tanbur* is a stringed instrument with a high frequency of vibrations that reverberate for a longer period, creating a droning ambience.

The motive is to emulate the vibrations that are felt while a musician plays an instrument, and the emotional response that the musician and a performer such as a Dervish feels. According to Eryaman (2012), the *sema* consists of listening to music and participating in whirling movements and chanting to reinforce ecstasy and attain a mystical state. To further explore this practice, the question will be addressed of how music and performance can inform a transcendental journey, which involves taking a sacred experience and translating it into a piece of artistic expression. The experience is a performance that is captured by the wearer and output to a speaker system, whereby spectators can also become involved emotionally. The essence of the garment will be to invoke empathy through the communication of the wearer and the music that they control, which is being generated by the garment. According to Thompson (2009), one of the greatest mysteries of music is its powerful association with emotion. Using this technology can result in a much more expressive experience for the wearer in that the vibrations felt while sounds are being emitted enhances the progression. Leman (2008) remarks that research on haptic feedback is often linked with research on musical expression and performer nuances. Not only are vibrations important because of how they explain the instrument's reverberation, but also during the performance because the sounds can heighten this experience as the performer moves in the dress.

In the last two decades, a rise in the rapidly growing interest in combining fashion and technology has become evident. Humans are increasingly demanding that their bodies become outfitted in the latest technologies. Identifying designers in fashion who are working with wearable fashion technologies and how their creations are valuable for inspiring future

developments in the field are key to this research. Wearable and Fashionable Technologies are merging to become a field. The work of designers such as Hussein Chalayan (Hüseyin Çağlayan, 1970) who fuses fashion and technology such as in his *Remote-Control Dress* for his Spring/Summer 2000 showcase (sometimes referred to as the *Airplane Dress*) explore the possibilities of using motorized mechanics to open a dress creating a new shape (Chin, 2006). Ying Gao (1973) uses interactive garments such as the *(No)Where (Now)Where* dresses, which use a photoluminescent thread and embedded eye-tracking technology so that the viewer's gaze changes the shape of the dressing (Ying Gao, 2017). Iris van Herpen (1984) uses digital printing technology for her collections, resulting in innovative textile developments combined with technology (Iris van Herpen, 2020). *Philips Design* has collaborated with many performers and artists and has developed *The Bubelle Dress*, which changes shape and colour based on the wearer's emotional state (Koninklijke Philips N.V., 2004–2020). Many of these designers are using technology combined with fashion design incorporating the significance of using sound as a tool for creating a more emotional and interactive experience within a garment. Ziya Azazi (?) is a Turkish performance artist whose *Dervish in Progress* (Dervish in Progress, 2016) is an exploration of dance and performance without the use of technology, yet his performance of turning and design of a garment which resembles a dervish dress reveals a unique possibility for interlacing the disciplines. Seymour (2008) discusses the importance of collaboration between designers and engineers as key to developing technology and wearable garments.

Imogen Heap (1977) is a musician/performer whose work with the *Mi.Mu gloves* is changing how electronic music is performed live (Mi.Mu, 2016). The gloves are designed with the ability to handle gestural movements through sensors and conductive textiles connected to a computer using a wireless interface. The gloves have the capability to perform a variety of sounds by changing the movement of the fingers, which are equipped with flex sensors.

Another company and team of designers interested in haptic feedback through wearable technology is *Cute Circuit*, whose

Sound Shirt (CuteCircuit, 2017) has made headway in the development of using vibrations in clothing to emulate a live orchestral performance that is “felt” rather than heard by the wearer. The importance of how music can be felt as a sensory experience is evident in their work (Kempe, 2016).

Fashion designers are embracing the demand for commercializing their products, making them accessible for the mass market. Integrating software interfaces into clothing is becoming more streamlined and less gadget-like.

III. *The Dervish Sound Dress*

The Dervish Sound Dress is influenced by a sacred experience: the “turning” practice of the *Whirling Dervishes*. The term *Whirling Dervishes* is a Westernized description of the Mevlevi Sufis in Turkey. Although the crux of Sufism is an essential part of the tenets of how a dervish performs and behaves, associations of Sufism and the modern-day whirling practice of dervishes in Turkey is not a widely studied subject. The garment seeks to explore the possibilities of engaging the wearer with an interactive experience using musical sound compositions, haptic feedback and performance. The dress performs as an instrument that is an extension of the body and releases information that the wearer provides.

The content is based upon the associations that the dervishes make when performing the *sema*, which is a ritual performance or dance. The *sema* ideally involves the use of poems and music to focus the listener’s concentration on God and perhaps even induce a trance-like state of contemplative ecstasy (Lewis, 2000). Essentially, the practice is a way to guide people to a heightened form of enlightenment and connection with the divine through music and body movement. The heart of the *sema* is the music itself, which is driven by the whirling motion of the *semazen* or dervish, and the repetition of the sacred text as well as Mevlana’s poetry. During a *sema* performance, the Dervish begin their “turning” very slowly, almost as though they are undetected. The hands start to spread out as one faces the heavens, the other points down to the earth, and

the “turning” begins as though their skirts reflect the orbital patterns of the planets.

The overall design of *The Dervish Sound Dress* draws from the rich colours and textiles of the Ottoman period dating from the mid-16th century. The lush, vibrant and contrasting colours of the textiles were commonly worn during this period. Many *entaris* that were worn by the Ottoman Sultans were also appropriated by the dervish orders in Turkey, although their garments were far less ornate and detailed. The different layers of cloth are an important characteristic of the diversity of traditional clothing from Turkey (Koç and Koca, 2011, 10-29). The traditional garments worn by the Mevlevi consisted of an ensemble of a white jacket tied around the waist, a belt or sash, and a large white circular skirt with long trousers underneath. As the skirt opens during a “turning” performance, the more magnificent the silhouette becomes. *The Dervish Sound Dress* is designed using a pale blue jacquard and red under-layer that is revealed when the wearer performs and it is opened to its highest position.

The construction of the dress involves using a variety of sensors that perform according to how the sound is triggered by the movement of the wearer. These determine the output based on the rotation of the dress using gyroscopes, accelerometers which will measure the speed of the dress as it is turning, and flex sensors that will trigger a sound when the arms are in certain positions (Figure 1 and 2). The progression of the dress corresponds to how the sound elements evolve. The sound design component relies on using organic sound samples of the classic Turkish *tanbur*. The samples have been recorded by a *tanbur* musician and manipulated in computer music design software, creating ambient tones that resemble the classic instrument. This gives the garment a unique edge by functioning as a computer digitized representation of a classic stringed instrument that is activated by motions of the body. The sounds are triggered using algorithms created in *Max Cycling '74* software. These patches will detect a threshold of movement by the wearer before a sound is triggered.

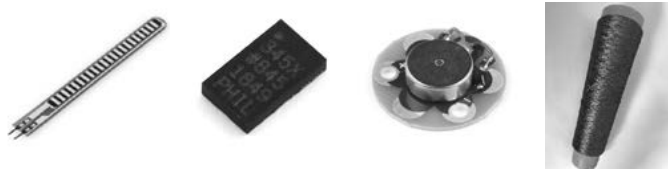


Figure 1.

A selection of sensors used in *The Dervish Sound Dress* (from left to right: flex sensor, accelerometer, haptic vibration motor and conductive thread)

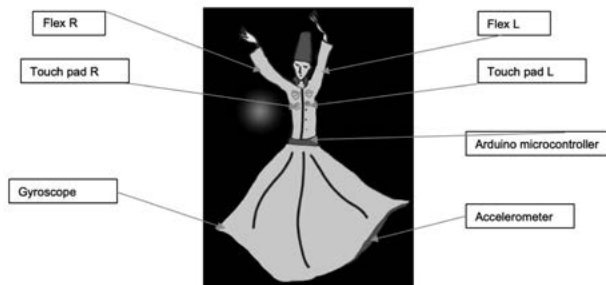


Figure 2.

Design concept for *The Dervish Sound Dress*

Capturing the movement of the Dervish is the inspiration for how the dress initiates sound depending on the position of the dress (Table 1). In a performance setting, the starting position of the dress is while the performer's arms are crossed at the chest. As one arm unfolds and then the other, sounds are triggered until the performer begins to turn. As the speed of the turning increases, more sounds are triggered until the dress is fully opened, allowing for a cacophony of sounds to be emitted. The other essential design feature of the dress is using haptic vibration as a sensory reverberation so that the experience of wearing and performing in the dress is more immersive and interactive. This will be employed using haptic vibrating motors that will be triggered when sound is activated by the wearer's movement. Other components and sensors will include pressure pads on the bodice of the dress; when touched, these will also activate ambient sounds to accompany the melodic sounds output from the turning of the dress and the arm movements. The dress is completely wireless, giving the performer free, unrestricted movement. The sound is output

through a loudspeaker system, but developments are being made to integrate the use of sound output mechanisms on the dress itself. Further research on integrating smart textiles and conductive threads will lead to conceptualizing possibilities of streamlining the design for a seamless integration of hardware and software components for the intuitive interface development of wearables in performances.

SENSOR/HARDWARE COMPONENT	FUNCTION DESCRIPTION
Flex Sensor Right(R) and Left(L)	Flexible sensors in the sleeves detect movement and produce sound when the sensor value reaches a certain threshold.
Touch Pad Right(R) and Left(L)	Sensors pre-programmed with ambient sounds; when touched, they produce sounds.
<i>Arduino</i> mikrokontroler	The microcontroller is placed in the uniform belt and programmed wirelessly.
Accelerometer	It detects the speed at which the uniform initiates the sound.
Gyroscope	It detects the position of the garment. Based on the defined movement threshold, the sound is triggered.

Table 1.

Description of sensor and microcontroller functions and placement in the dress

The dress is programmed using the *Arduino* microcontroller system which is attached to the belt section of the dress. All the sound compositions are programmed using *Max by Cycling '74*.

IV. Final Remarks

The essential features that enable *The Dervish Sound Dress* to perform use haptic feedback, computer music sound design, and religious or metaphysical influences to create a transcendental experience through performance. They are a combination of elements that have not yet been thoroughly explored in the realm of wearable and fashionable technologies or in performance. The dress is influenced by the classic Ottoman textiles and layers of fabric and appropriates the sacred experience of the Mevlevi

dervishes and the *sema* performance. It is a commentary on how wearable technology can be seamlessly integrated for a meaningful interactive experience for the wearer that expresses sound through gestural movement and performance.

The possibilities for further development in this field using computer music, technology, and fashion design can provide a platform for developing garments that induce or enhance emotional responses while wearing a garment that transmits sound vibrations.

After consulting with various groups in both London, UK and Istanbul, Turkey, who are members of a more traditional form of practicing *sema*, it was found that interest in using technology combined with the traditional use of live instruments and Quranic recitation was not favourable. Moreover, although conversations with these groups piqued some curiosity, most were not inclined to separate from the regimented practice that has held true to the way the *sema* has been performed for centuries. However, there has been a new resurgence in this practice amongst contemporary performers and performance groups in which many have taken the practice of “turning” to include fantastical shows using electronic music and theatrical displays. There are select groups in places such as Istanbul, Turkey, where contemporary performers have used elements of the *sema* and interlaced new ideas building upon centuries-old practices.

One such performer, Turkish *semazen* (dervish) Sercan Çelik test performed *The Dervish Sound Dress* in Istanbul, Turkey, on October 20, 2018 (Figure 3). Çelik is a performance artist and practicing dervish who is interested in contemporary interpretations of the *sema* and the practice of turning. A professional dancer and practicing dervish since the age of 12, Çelik’s movements while testing *The Dervish Sound Dress* were direct reflections of dervish movements. Çelik was given a guideline as to how to operate the dress and was encouraged to use the dress freely to develop his own interpretation of how the dress can work for and with him. The composition that he created while using the dress was dynamic and had continuous fluidity. He moved with circular precision infinitely whilst

using the various buttons and flex sensors in the sleeve's interchanging sounds. Çelik commented that he felt that the sounds he was able to make based on his gestures amplified his movements and made it possible to augment his own practice as a contemporary dervish. Çelik used the dress intuitively and rotated while using his arms to change his positions and gestures. He commented that the act of touching the body while turning and feeling vibrations while outputting sound was interesting for him. This helped to develop a relationship between his gestures, movements and his body due to feeling vibrations. Ultimately, Çelik's reaction whilst using the dress was very successful in that he remarked that the dress could potentially drive him into a trance-like state in a unique way, which is an important part of his practice. Being able to have control over the music by using his gestures and body movements can be an immersive experience for him as well as audience members.

The significance of this research could have an impact on future developments of wearable technology in the realm of new performance art practices. The realization of what wearable technology can provide in fashion design using sound is still developing. Further research could examine the possibilities of using this garment for beneficial effects for persons suffering from emotional or mental anxieties, or for others in general. The way in which sound and music benefit brain activity has been proven, and a garment such as this could be further developed for a more intimate and emotional piece of technology that can be worn by anyone.

Further research will explore how the development of a garment using intelligent textiles can serve a purpose outside the context of performance and artistic expression. Appropriating a sacred tradition such as the Mevlevi practice of the *sema*, bases its focus on the performance aspect of the tradition. However, the development and innovations in fashionable wearable technologies can investigate the use of such a garment for a more personal and interactive wearable experience. The future of fashionable garments using wearable technology such as *The Dervish Sound Dress* can be built with much more enhanced technological capabilities.

These innovations could further explore how the garment would function as an extension of the body; as an instrument capable of autonomously making musical compositions by using gestures. The garment would be a seamless integration of technology and fashion design.



Figure 3.
The Dervish Sound Dress performed by Sercan Çelik (Hurban, 2018)

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