Universal Materiality

Wearable Interaction Design and Computer Aided Process for Accessible Wearable Solutions

Dr. Jeanne Tan
and
Grace Jun
We are living in an exciting time! People with disabilities seem to have more representation in the arts, in industry and in everyday life. Whether it is the focus on strength based performance and work by autistic people; or celebrities talking about their own experiences with mental health; all of us have more exposure to the wide variety of people with disabilities.

For so long, the needs of disabled people were addressed as afterthoughts, or worse, as something troublesome that needed to be removed. While physical and digital accessibility are still often an afterthought, many people, in many fields, are addressing disabled peoples’ needs as a matter of course. The time is ripe to plow forward. There has been more exposure in popular culture, from TV shows to blogs to podcasts—there’s something for everyone.

We’re also living “smart” lives. Everything is smart. Everything is connected. This connectivity is fun for many of us and interesting for others, but for many people, the connectivity makes a difference in a person’s ability to do what they want to do.

Such is the case with smart textiles and universally designed clothing. It’s thrilling for me to even write that sentence! Having worked as an occupational therapist for my adult life, I have certainly been involved in making clothing suggestions and even adapting clothing for my clients. Those clients certainly did not get ‘designer’ treatment. I didn’t know anything about smart technology or connective materials. I was happy to replace buttons with snaps for people with limited dexterity who were unable to fasten buttons.

In the creative spaces where Grace and Jeanne work, much more complicated problems are closely explored and peoples’ needs are addressed without having to compromise on design. With people like Grace Jun and Jeanne Tan, people with disabilities can wear clothing they like, not just what is easy to put on and take off. Amazing!

Many of us continue to work in universities where we can explore possibilities and link people together who should work together. Students with faculty and researchers; all of us with other resources and experts in the community. Grace and Jeanne have done just that with their own labs where they focus on different aspects of materials, clothing, and function. The Open Style lab partnership with Parsons allows designers to work with people with disabilities and with occupational therapists to explore use of clothing that fits bodies that do not match the typical mannequin. They learn from each other to solve important problems that impact peoples’ lives. Imagine having to always wear clothing that you don’t like, that doesn’t fit and that doesn’t do what you need it do it. Those are the problems they solve—beautifully.

Partnering with Jeanne Tan, this duo covers the bases. Jeanne’s work at the Institute of Textiles & Clothing demonstrates the beautiful use of photonics and smart materials meshes well
with Jun’s aesthetic perspective. Together they are able to integrate technology into the fabric and design of their clothing and to improve the usability by people who are not served by current manufacturing. Their shared interest in making clothing that works for the wearer is a match that will continue to move fashion for disabled people forward.

“All my best to both of you. I look forward to the day when all bodies are clothed and all needs are met by designers as a matter of course, rather than by only a specialized few. I hope that our work with students and your ability to share your experiences with large audiences pushes this movement forward, onto the runways and into stores everywhere.”

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Exhibition Review

The value of design is not only about economic benefits, but about improving “the lives of people towards a positive flourishing state”. This is especially true in the design philosophies of smart design, sustainable design and social innovation alike, which are becoming increasingly concerned by the design filed. While the focus and motivations of these types of design might be different, they share the common goal of building a good society and empowering people to live a better life.

Tan and Jun are undoubtedly part of this virtuous and exhilarating landscape. With their professional expertise, they turn their sights on the inevitable global issue of aging and disability. Given the important role clothing plays in people’s lives and the gaps in current research, Tan and Jun conducted a collaborative project by investigating interactive textiles and CAM processes for universal apparel design pertaining to aging and mobility with the aim to seek wearable solutions and improve their social participation and intangible well-being.

This transnational project was carried out in Hong Kong and New York, showing a highly interdisciplinary nature. Its team members include fashion designers, textiles designers, engineers and occupational therapists. With such diverse professional backgrounds, this team conducted a lot of experiments, covering material development, 3D printing, co-design process between researchers and user participants and therapy assessment. What is particularly worth mentioning is the co-design process. Users in the co-design sessions expressed their concern based on their real experience (concerning about independent dressing, re-learning dressing sequences and standards of presentability), which unwittingly enriches the research results and contributes to “universal clothing design” from a more humane perspective.

As Sociologist and world-renowned “happiness” expert Ruut Veenhoven showed, happiness can be used as a reliable metric to measure progress in societies. In this sense, virtuous design surely helps to promote our society head toward a more harmonious orientation. It is believed that apart from demonstrating wearable solutions, this coruscating exhibition will drive more viewers to focus their attention on the needs of older people who are currently under-represented in society.

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Studies by the United Nations (2015) indicate that more than 46% of the world’s population of older people, aged 60 and above, have disabilities with more than 250 million experiencing moderate to severe disability. The projected growth of older people with disabilities is expected to surge from 901 million in 2015 to 1.4 billion in 2030. It is evident from the data presented that aging and disability is a pressing global issue.

Clothing plays an important role in promoting and protecting the rights of older people with disabilities and facilitating their full participation in society. The current availability of clothing meeting their needs is not reflective of the growing demand. Although subjective, Gwodz, Nielsen, Gupta & Gentry’s (2017) study indicates that there is a positive relationship between style orientation and personal wellbeing. Unmet clothing needs prevent people with disabilities from actively participating in important life experiences and have a negative impact on overall well-being (Kabel, Dimka and McBee-Black, 2017). There is also a tendency to only focus on practical functionality, often neglecting the relationship between the style that is reflective of the wearer’s identity and their well-being. The primary challenges in clothing development and production firstly, lies in the disconnected relationship between the design process and the end users, based on perceived needs. Secondly, how the integration of materials and production processes can contribute to the user’s physical and functional requirements. These challenges reveal a need to seek solutions to strengthen the relationship between designers and users.

The advancement of technology in both interactive textiles and CAM processes offer customizable functions with the tactile familiarity of everyday textiles. The interactive characteristics of such materials offer design opportunities to adapt to the evolving needs of older people with disabilities. Current universal clothing options are often limited to conventional materials and processes that are passive and confined to traditional production methods.
This body of work is based on the research collaboration between the Institute of Textiles & Clothing (ITC), The Hong Kong Polytechnic University, HKSAR (HKPolyU) Open Style Lab (OSL), and Parsons School of Design, New York, USA. The study involves interdisciplinary smart material explorations at HKPolyU during March-June 2018 and Open Style Lab’s 10 week clothing design and development summer program at The New School, Parsons School of Design, involving multidisciplinary practitioners (inclusive of fashion designers, textiles designers, engineers and occupational therapists) with participants from The Riverside Premier Rehabilitation and Healing Centre, New York, USA in June-August 2018.

The collaborative study addresses gaps in current wearable design and assistive technology research by investigating an interdisciplinary co-design process for universal apparel design. It studies how smart textiles and digital processes can address the specific needs of the users, in particular people with disabilities and older people. Without the use of technology designed to help older adults and people with disabilities, this population may choose to employ a personal care giver or move to an assisted living facility, for constant access to care on a designated premise to accomplish ADLs (Jun & Liao, 2018). The study examined considerate uses of technology and design applications or practices in clothing with long-term residents at Riverside Rehab.
Material and Computer Aided Manufacturing (CAM) Investigations

Material development was conducted from March to June 2018 at ITC, HKPolyU. Initial experiments were conducted with polymeric optical fibre (POF), conductive yarns, the CAM process and 3D printing. The team selected the materials and processes for design investigations based on their ability to be applied to textiles without compromising on tactility.

Polymeric Optical Fibre (POF)
The material exploration was conducted using 0.25-mm POFs made from poly(methyl methacrylate), a strong and transparent thermoplastic. Previous research by Tan’s group has shown that such POFs yield positive flexibility and tactility (Tan, 2015). Conventionally, POFs transmit light from one end to the other via a fibre core. Surface damage to the fibre allows light to be emitted from the lateral side. The fibre cladding can be damaged by thermal, physical and chemical means. For this study, the POFs were woven with conventional polyester yarns into textiles. The POF textiles were connected with light and power sources to enable illumination. Based on the design requirements, the sensors and components were integrated to enable interactivity.
**Conductive Yarns**

Conductive yarns are resilient and highly flexible. Silver coated and stainless steel coated yarns were used to create fabrics on the single bed knitting machine. The conductive yarns were knitted with wool yarn of different gauges to develop fabrics of different weights and tactility. Conductive yarns offer a non-obtrusive integration of technology by excluding cumbersome wires.

**3D Printing**

3D printing is an additive manufacturing process that can print layers of material to either create a solid object or a layer on a surface from a digital file. The process is quick and efficient, thus enabling customised designs in a short time. 3D printing experiments with thermoplastic polyurethane (TPU) and polyactide (PLA) were conducted at the HK Poly U U3DP lab and the 3D Print Lab at Parsons. The experiments were conducted to develop raised flexible structures on existing textiles to create collapsible structures, surface embellishments and closures. The coated textiles were printed with layers of TPU.
‘Co-design’ refers to collaborative creativity, which involves designers and people not trained in design working together in the design process (Sanders and Stappers, 2008). This approach enables diverse multi-disciplinary groups to work closely with stakeholders to develop hybrid designs to meet the specific needs of users. For this practice-based research, the design process involved two main phases, as follows.

**Phase 1**
Material-led design and development practice between Tan’s research group and Jun’s group at ITC, HKPolyU. Students created swatch explorations to imagine the potential applications of electronic materials on the body in forms, such as, jackets, knee braces, and jean pockets.

**Phase 2**
Co-design process between Tan’s research group, OSL’s fellows and participants from The Riverside Premier Rehabilitation and Healing Centre. The 10-week co-design process involved Tan and Jun working alongside 6 material design researchers, 20 fellows (with backgrounds in occupational therapy, design and engineering) and 7 participants. Prior to the project, each participant signed a consent form.
in line with human subject ethics. The designers investigated dressing challenges relating to the participants through practices and protocols used in occupational therapy practice. Design inspirations were derived from the collective discussions and observations about user’s preferred creative expressions, aesthetic preferences and functional requirements, while also considering current fashion trends. The designs were further refined using sketches, toiles and samples throughout the 10-week session via discussions, observations with users, and mentorship from people with disabilities.
Occupational Therapy Assessments

In addition to techniques used in fashion design and wearable technology, the co-design teams drew on a range of test methods used in occupational therapy practice to assess the users’ physical capacities. Such methods ensured that the design considerations were balanced without being confined to a single discipline. Relevant assessment methods were conducted according to the user’s diagnosis. The Moberg Pick-Up Test involved picking up, holding and manipulating everyday objects to test dexterity. Tremors were tracked via a mobile phone application and assessed at rest, in action and with extended arms using the Webster Rating Scale for Parkinson’s disease. Frequent direct questions over the course of the visits also revealed insights into the users’ moods, levels of fatigue and pain. The participants were also encouraged to help designers locate the areas where they experienced pain using a drawing of the body. This allowed the team to design garments that specifically addressed the users’ physical needs.
Clothing Issues Concerning Aging and Mobility

The co-design sessions yielded rich insights into the needs of the participants and posed new questions about universal clothing design. Teams used video and voice recordings to qualitatively document the participants’ responses and a survey asking residents questions regarding their dress. The study showed that the participants were concerned with independent dressing, re-learning dressing sequences and standards of presentability.

Independent Dressing
Due to hindered mobility and the onset of delayed cognitive abilities, the participants often required assistance to dress and select clothing. The teams made considerate choices regarding technology and design to enhance access to the dressing experience. However, the body extends into the environment of the rehab space and activities outdoors. The summer program participants explored different silhouette designs to find a balance between client style preferences and functional solutions. Self-expression through clothing and the act of dressing were design problems shared not only by the participants, but also by the caregivers who worked at Riverside Rehab. A survey distributed to 50 residents at Riverside Rehab showed that their clothing needs depended on the assistance needed in their given environment. For the majority of participants in the survey, the bedroom was the main area where dressing occurred. They identified that assistive devices, such as the wheelchair or grippers, were not the only co-dressing factors; other objects, such as side tables, bars and other furniture, were part of the experience.
In the survey with Riverside Rehab, more than 70% of the long term patients were unable to fully answer the survey due to cognitive difficulties. Products do not function in isolation, even clothing. The survey results depicted the bed, wheelchair, and bathroom was the top products residents identified contacting or using frequently as part of his or her dressing process. A majority of the residents and survey participants were also women, further supporting the consequence of women’s greater longevity is an older population that is predominately female” (United Nations, 2017). Finally, 87-100 year old residents used multiple assistive devices, where many of them used walkers or wheelchairs.
Re-Learning Dressing

Many of the participants experienced chronic pain and a limited range of motion brought about by age-related illnesses. The participants often had to relearn and adapt dressing sequences to conventional clothing. Clothing choices were made based on ease of dressing and comfort rather than personal choice. Fashion trends and the sequence of dressing was a process that participants observed had innovative potential. Teams looked at client behaviour to identify ways that they could change the way people dress. Each team aimed to design universal clothing that was adapted to wearers or clients, instead of wearers adapting to the clothing. The teams used different methods, including video documentation, observation and identifying the clients’ sequence of dressing. Traditional design elements, such as coloured lining, were used to help clients navigate dressing. Digital tools such as CLO3D were used to simulate difficult dressing behaviours, such as clients who had survived stroke and had paralysis on one side of their body.

Presentation Standards

The participants wanted to look presentable and clean. Many enjoyed fashion and engaged in social activities. Clothing was not only functional, but also regarded as a medium for creativity and self-expression. The ability to gain ownership of the way that they presented themselves contributed to their overall sense of well-being. Social barriers for people with disabilities are often based on appearances, and context or current environment. Style is an extension of the bodily self, in which both personality and social constructs converge to a visible form of self-expression. The perceived value of things that are beautiful or aesthetically well designed motivates purchases. Good design or style increases the likelihood that people will adapt their clothing, instead of throwing items away that don’t look good or may resemble medical accessories. The functional elements of clothing, such as a fit and materials, also directly affects quality of life. Clothing that is comfortable, convenient and considers well-being provides a habitat for the body just like a second skin. Style not only increases visibility for people with disabilities, but is related to the act of dressing itself. ‘Dress is, in the fullest sense a “social model”, a more or less standardised picture of expected collective behaviour, and it is essentially at this level that it has meaning’ (Barthes, 2006). From athleisure wear to referencing a 1980s Coco Chanel tweed jacket, the following three case studies demonstrate the power of dress and style.
Design Case Study I
Ada Stewart

Ada Stewart is 78 years old. A wheelchair user, her mobility was hindered by rheumatoid arthritis, oedema of the legs, venous stasis ulcers (non-healing) and bilateral deep vein thrombosis. Due to arthritis and ulcers, Ada experienced chronic pain that affected her fine motor skills and limited her range of motion for dressing.

Ada’s team comprised Julie Osipow (physical therapist), Heeyoung Kim (material designer) and Grace Wu (fiberscience engineer), and was supported by Dr Jeanne Tan and her interactive material design team from ITC, HKPolyU.

Ada enjoyed crocheting and often forgot to move her legs when indulging in her hobby, resulting in poor circulation that may lead to further deterioration of her deep vein thrombosis and ability to maintain her body temperature. Ada expressed a preference for trousers as they kept her warm, but she found it challenging to get her legs into each trouser leg. She had to fold the trouser leg to ensure that each foot went through before mustering the strength to pull up the trousers.

The team developed a pair of trousers with collapsible leg panels and an interactive function to facilitate dressing and exercise. The structure was inspired by complex Japanese origami. The fold lines enabled the structure to retract without deliberate folding. The team experimented with 3D printing grid surfaces on textiles to mimic the origami folds. TPU was selected over PLA materials due to its flexibility. The 3D printed grid structure was placed specifically at the lower front and back panels of the trousers to enable easy folding without the need for detailed dexterity of the hands.

Ada and the co-design team based their design objectives on the following criteria.
• Easy to dress with limited independent standing.
• Integrate technology that will remind Ada to move during prolonged periods of inactivity.
Physical activity is beneficial to maintain muscle tone, decrease pain and increase endurance. Exercise was important to Ada. Any exercise performed by the elderly increases their ability to regulate body temperature, circulation and positively affects their metabolism. This led the team to include wearable technology, in the form of interactive strips programmed with two modes. An alarm mode alerted the user that their current activity level was below the threshold – based on movement during a set period – and that the user would benefit from movement. The exercise mode offered positive feedback to the user through the accelerometer sensors, which detected the movements from the joint and lit up to ‘congratulate’ the user on a successful workout. The exercise mode could be customised to the user’s preferred colour and light sequence to offer a personalised response. The team ensured that the strips could be easily attached to and detached from the garment for use when exercise was beneficial for Ada, or if exercise was deferred due to her diagnosis of chronic obstructive pulmonary disease and deep vein thrombosis. The removable strips also allowed for the proper laundering of the garment, without compromising the integrity of the POF technology. The electronic system of the interactive strips was small and lightweight to ensure ease of application. It consisted of a 32-bit Flash microcontroller, six-axis (gyro + accelerometer) motion tracking sensor, power supply and light-emitting diode light source.
Wanda Rosario is 74 years old and used a wheelchair as her primary mode of locomotion. Wanda was diagnosed with Parkinson’s disease with tremors and weakness. Due to her Parkinson’s disease, she needed assistance with her daily activities, such as dressing. Wanda needed clothing that was easy for her to put on and take off, with consideration for her tremors and limited range of motion.

Wanda’s team members were Nicholas Paganelli (fashion design), Mikael Kalin (engineer) and Amélie Lavoie (occupational therapist). Using Wanda’s love of rock and roll music as key inspiration, the team wanted to develop a stylish leather jacket that allowed pain free movement. In addition to making critical design choices in terms of fit and material to ensure the functionality of the garment, the team recognised the importance of Wanda’s story and her desire to express herself. It was vital to balance the practicalities and aesthetics of the design to achieve an overall sense of well-being. To address Wanda’s taste, personality and history, the team looked at a biker jacket as inspiration. With that came the idea to develop a jacket that Wanda could perform in.

3D printing offered the possibility to embellish the material with lightweight studs without the use of heavier conventional metal studs. The team developed 3D printed studs that were applied to the epaulets of the jacket. These sat on the surface of the fabric and did not need a backing stabiliser, thus providing a smoother surface that would not scratch the wearer.

The 3D stud patterns were designed and printed on neoprene, wool and leather samples to test adhesion to unadulterated fabrics. To increase the adhesion of the studs, the holes were cut where the 3D print studs would be, then the material was sandwiched into the 3D printer. To do this the team started a 3D printer, then paused it to lay the fabric on top, securing it to the printing bed, and continued the print with the fabric swatch sitting between the two layers of the print. While the 3D printer printed the remaining layers, bits of plastic could melt through the holes and join to the layers beneath the fabric to fasten the stud to the fabric. The studs were added to epaulets on the shoulder due to their common association with leather jackets. The additional structure and detailing complemented Wanda’s sloped posture.
The final jacket was made of leather and a wool/synthetic blend from Woolmark. Functionally, what worked best for the user was a closed back in a stretch material. The structure was designed to be simple, without back bodice panels and armholes, to facilitate easy dressing in a wheelchair. Fringes, 3D printing studs on the epaulettes and embroidery on the chest helped to create a rock and roll look that represented the user. The design intention was to have a garment that enabled pain free independent dressing and that accommodated the user on her best and worst days.
Valda Alleyne, an 81-year-old wheelchair user, was born in Barbados. She enjoyed talking and wearing clothing from her native culture. Velda’s major diagnoses included hyperthyroidism, diabetes, hypertension and cerebrovascular accident, with residual weakness on her left side. Due to her stroke, Velda had difficulty using the left side of her body and her left hand. She had an extra arm rest on her wheelchair to accommodate for this, but could not perform daily activities on her own.

The goal was to create a stylish formal dress with integrated personalisation and independence opportunities. The multidisciplinary team collaborated to maximise the biomechanical fit of the dress. ‘Bio-mechanical fit’ refers to the level of effort required to dress, the ability to dress, how the individual dresses and productivity in dressing. The early prototype sought to maximise independence through a left side-seamed dress with magnetic buttons for Velda to close the dress independently. An adaptable sleeve with a pulley system was designed to enable Velda to choose the amount of closure that she preferred. Due to Velda’s deficit in sequencing dressing tasks, 3D printed tactile cues were printed along the pulley. This allowed her to gauge the distance and frequency of her pulls to close her sleeve. Garment construction and CAM solutions provide alternative strategies to overcome the challenges of dressing with partial paralysis.
Design Details: Magnetic Closures

- Magnetic snaps
- Magnet closure

+ Ease of use with one hand
+ Access points to participate in dressing
Leather flower
Push-buttons with red / black wires
Plastic Speaker
3D Printing Case with circuits inside
Magnetic buckle

Leather
Conductive Fabric Red Electronic Wire
New Print Foam
Conductive Fabric Black Electronic Wire
Cotton
The design objective to implement wearable technology sought to improve Velda’s emotional quality of life through her love of reggae music. A textile-based brooch with an integrated touch sensor was developed. Reflecting her heritage, the brooch was designed in the form of a Pride of Barbados flower. It consisted of a flora board trigger, a sound-board, amplifier, speaker and battery. The flora board trigger was implemented to trigger the capacitive touch sensor. The flora board trigger connected to the soundboard, which stored the music. The soundboard was connected to an amplifier for volume control.

Finally, the style of Velda’s garment was inspired by a 1980s archived image of a Coco Chanel tweed jacket with ribbed shoulder edges. The result was a stylish formal dress with integrated personalization, which offered independence opportunities for individuals with limited mobility. The pleated material and the pulley system in the sleeve design enabled a range of motion. The garment had a detachable wearable that played music of the user’s choice. The pleated wrap sleeves facilitated a range of motion in an elegant way. The design was developed based on balanced considerations for design, functionality and well-being.
Conclusion

The results of this practice-based research showed that the observations, interviews and experimental design processes involved all stakeholders and yielded rich qualitative data that contributed to the design of universal clothing. The co-design approach was vital to gain first-hand data specific to the physical and emotional needs of the users. Furthermore, the exchange of information between participants and disable people ensure that segregation is no longer the common experience in the creative process. Listening and working with disabled people may lead to a re-evaluation of how all people can accomplish daily activities. This contributed to designing for holistic well-being instead of simply satisfying functional practicalities. The research identified a range of strengths and weaknesses related to the co-design approach, and the integration of interactive materials and CAM processes for universal clothing design.

Strengths of co-design approach

• Improved clothing design ideation specific to the needs of the users.

• Specific problem solving through in-depth observations and interdisciplinary practice involving the therapist, engineer and designer.

• The design process was beneficial for all stakeholders with specific design solutions and users gaining a sense of ownership in contributing to their own designs.

• The process was reflective and flexible, enabling all stakeholders to continuously refine and customise the design.

Strengths of integrating interactive materials and CAM processes

• Transforming conventionally passive clothing into interactive platforms to engage the user in beneficial exercise and enjoyable activities.

• 3D printing offered an effective and efficient solution to help the mechanical function of the clothing for innovative structure, tactile cues and embellishments.
The results highlighted how a range of stakeholders from different disciplines contributed to detailed solutions for real situations, which may not have arisen if the research had been limited to a laboratory or studio environment. It also showed how technology can advance both functionality and ease of use. The elderly users were receptive to integrated technology, suggesting that there are further potential applications in the context of clothing design for people of all abilities. In terms of design, a pedagogy that encouraged community and collaboration changed the making, teaching and learning of design.

Weaknesses of the co-design approach

- Resource intensive process in terms of time, expertise and effort.
- Customised designs need to be further tested to understand its viability for the mass market.

Weaknesses of integrating interactive materials and CAM processes

- The involvement of electronic components that require separate laundry options.

References

Dr. Jeanne Tan

Jeanne Tan is Associate Professor of Design at the Institute of Textiles and Clothing, The Hong Kong Polytechnic University. Her work investigates the interface of design and technology. She is both a researcher and practitioner, and often uses textiles and fashion as a communicative platform, integrating traditional craft and engineering as the syntax of the creation’s narrative. Jeanne’s research interests include interactive textiles for communication and well-being, hybrid design processes and smart wearables. Her work on interactive textiles has been widely exhibited, including at the Victoria and Albert Museum, UK, Museum Fünf Kontinente, Germany, and Today Art Museum, China. She is a recipient of more than 10 international design and research awards. Jeanne is often asked to speak about practice-based research and interdisciplinary processes at institutions such as the Royal College of Art, Parsons School of Design and Hongik University. She actively engages with international creative communities and the general public via invited international designer residencies. Her design work has been featured in international and regional media such as Harper’s Bazaar, WGSN and Xinhua News. As a design consultant, Jeanne works with many companies and organisations to implement fashion, textile and creative education solutions. Some of her consultancies include Loewe, Alibaba, The Hong Kong SAR Government (Electrical and Mechanical Services Department) and The Hong Kong Red Cross.

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Grace Jun

Grace is a social design entrepreneur and thought leader working at the intersection of universal design and fashionable technology. She is Assistant Professor of Fashion at Parsons School of Design, and Executive Director at the OSL, a non-profit organisation dedicated to making style accessible to people of all abilities (elderly/people with disabilities, people facing injury). Grace’s research examines applied technologies and materials for the wearable user experience, as it pertains to ageing and disability. Her work at OSL and Parsons has received nationwide attention and has been featured at the White House Fashion Show Celebrating Inclusive Design, Assistive Technology, and Prosthetics, NBC News, Fast Company, Vogue, and most recently The New York Times. She has been asked to speak about disability and design in numerous settings, including Design Indaba 2017, Forum for the Future and SXSW 2018 Style.

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The Riverside Premier Rehabilitation and Healing Center

The Riverside Premier Rehabilitation and Healing Center is Manhattan’s premier location for short-term rehabilitation and long-term nursing. The Riverside has created an inimitable, revitalizing rehabilitation environment to provide the short-term patient with a luxurious, five-star experience that meets and exceeds all expectations. The Riverside offers an expansive program of therapies both standard and unique. Their programming is designed to help you regain mobility and independence, with a focus on helping you reintegrate into your familiar daily routine. Their highly skilled staff is renowned for their passion and love for helping their patients heal.

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Hong Kong Sheng Kung Hui Welfare Council Limited

Established in 1966, the Hong Kong Sheng Kung Hui Welfare Council (the Welfare Council) has been providing multifaceted services to individuals across all ages and socioeconomic backgrounds in line with its service philosophy, “Personalised Service, Holistic Care”, to “Transform Lives” so they may be “Lived in Abundance”. With over 200 service units and member agencies across the territory, in Macau and Guangzhou, the Welfare Council has established a comprehensive and close-knit service network.

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Universal Materiality Touring Exhibitions, Hong Kong and The U.S.

Hong Kong Museum of Medical Sciences
Madam Ku Kei Kwan Priscilla Gallery
2 Caine Lane, Mid-Levels, Sheung Wan, Hong Kong
18-27 December 2018

Sheila C. Johnson Design Center,
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Design Fellow
Therapy Fellow
Engineer Fellow
Design Fellow
Therapy Fellow
Engineer Fellow
Design Fellow
Therapy Fellow
Engineer Fellow

Team
Velda
Velda
Velda
Florence
Florence
Florence
Wanda
Wanda
Wanda
Ada
Ada
Ada
Robert
Robert
Roxy
Roxy
Michelle
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Michelle

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Research Repository
Universal Materiality Portfolio is accessible on the POLYU Institutional Archive.
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Create a stylish outfit that Wanda can wear for gymnastics or any activity without the need for support or assistance.

Make a skirt that is easy to put on and takes daily dressing easier
  - retractable
  - "wet" sensor
    - toilet
    - accident
  - height sensor
  - when gait is in correct place
  - locating magnets in hem