Customization of e-textile sensory tools for people with dementia

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Abstract

Sensory activities are used to increase social engagement for people with dementia, who may struggle to participate in activities due to deteriorating cognitive functions. Sensory tools are used but these can be inappropriate since they are not designed for people with dementia. This paper details the design of an e-textile sensory tool for people with dementia, with stakeholders in Mainland China. The concept, a sensory wall, was derived from a previous co-design project in Hong Kong. However, the design context differs, and this work highlights barriers to implementing co-design in sensory tool design. Instead, this project took a collaborative customization approach. This paper describes the design processes and evaluations for the first and second sensory wall, with context on dementia care in Mainland China. This paper highlights considerations in the design of a sensory tool for people with dementia, and the benefits of stakeholder engagement in sensory tool design.

Introduction

Dementia affects a large population. In 2010, approximately 36 million people worldwide were living with dementia, and this figure is expected to double every 20 years (Prince et al. Citation2015). The gradual deterioration of cognitive functions in people with dementia means that as the condition progresses, it can become more difficult for them to engage in activities. Sensory activities that use props to stimulate the senses can be used to increase the social engagement of people with dementia and promote enjoyable interactions with their carers (Chang and Johnson Citation2013). The design of sensory tools for people with dementia frequently uses participatory design to take user needs into account. In participatory design, stakeholders, i.e. end-users and care staff, cooperate with the designer during the design process, ensuring that the design takes into account their specific processes and current practices (Simonsen and Robertson Citation2013). However, whilst participatory design is effective in producing outcomes that meet user needs, it has its disadvantages. It is resource-intensive in terms of time investment and requires stakeholders willing to collaborate. There are also hurdles associated with collaboration, like power sharing and decision making (Björgvinsson, Ehn, and Hillgren Citation2010; Spinuzzi Citation2005). In addition to these issues, the situation may not be able to leverage the benefits from a participatory design approach, situations in which certain stakeholders may not have the necessary expertise.

This paper details the process of designing a sensory wall named ‘Joyous Ocean’, an e-textile sensory tool for the multi-sensory stimulation of people with dementia. This

was a collaborative project, designed to introduce expertise in dementia care from the collaborating organization's Hong Kong care centres to its Zhuhai (Mainland China) care centre. While participatory design has been used frequently in the design of sensory tools for people with dementia, including in previous work by the authors, using a participatory design process within this project was seen as inappropriate and impractical since it was a newly established care centre. To overcome this issue, while still taking a human centred approach, a customization style design process was used. This approach adapted the design of a sensory tool created using a co-design process. This paper firstly presents the design development of the first sensory wall 'Joy, Peace, Grace and Life', its evaluation and the findings. The context of dementia care in Mainland China is given to provide a broader context for the 'Joyous Ocean' project. The paper compares the design process of the two projects. To determine if the 'Joyous Ocean' sensory wall satisfies the needs of the users, the authors interviewed the project collaborators to gather their feedback on the design of the sensory wall.

Literature review

Multi-sensory environments

Multi-sensory environment (MSE) equipment is commercially available from companies such as Snoezelen (Ball and Haight Citation2005), Rompa (Citation2019) and SpaceKraft (Citation2019). All such products stimulate the sense of touch, and more complex interactive equipment also provides visual and auditory stimulation. The sensory tools range from textile soft toys to colourful, malleable plastic props. For larger immovable MSE equipment, illumination and colour changes are common features, enabled by illuminating bubble tubes and optical fibres (Figure 1). Interactive equipment includes buttons and switches to allow users to change the illumination pattern and activate sound responses.

Figure 1. Bubble tube and optical fibres in a sensory room in a Hong Kong elderly home.

Whilst existing commercial props satisfy the basic requirement of sensory stimulation, they may be inappropriate for people with dementia. Hedman (Citation2008) states that many MSE tools are similar to children's toys, making them inappropriate for older adults. This is part of a wider issue of insufficient consideration of the design and use of MSEs for people with dementia, causing MSEs to be underutilized. Jakob and Collier (Citation2014) emphasise the importance of appropriate design choices for MSEs to facilitate interaction for people with dementia. For example, props should always be presented with context, to ensure that the user understands and can engage with the sensory tools.

Sensory tools using participatory design

Participatory design is an effective approach for designing sensory tools, as it acknowledges the importance of stakeholders' tacit knowledge, which the designer uses to inform the design process and create the most appropriate end product (Spinuzzi Citation2005). Within the concept of participatory design, there is co-creation and co-design, distinguished by subtle differences between their definitions (Sanders and Stappers Citation2008). Building upon the principles of latent and collaborative creativity of the stakeholders, Van Mechelen et al. (Citation2019, 181) describe co-design as 'a set of constructivist techniques and tools to enable people to participate in the design process by the act of making and giving meaning to things'.

The term sensory tool will also be used to describe several research outcomes designed to engage the senses, whether for multi-sensory stimulation, reminiscence therapy for people with dementia, or parent/child bonding for children with visual and intellectual disabilities. Sensory tools created through participatory design projects vary greatly in their use of materials, technology and physical form, primarily because the users and activities they are designed for differ. However, all sensory tools leverage the benefits of tactile interaction. Sensory tools for people with dementia can be designed either for general sensory stimulation and social interaction or specifically for reminiscence therapy, where the goal is to trigger memories through pictures and/or music.

A common feature of sensory tools for people with dementia is that their overall form resembles conventional household objects. The sensory tools of Huber et al. (Citation2019), the Drawers and Jukebox, resemble their namesakes, as do the Telephone and Steering Wheel by Treadaway et al. (Citation2019), with the addition of display screens, and lighting and/or speakers. The technology allows the simultaneous activation of multiple sensory triggers to facilitate reminiscence, making reminiscence activities easier to perform. Activities associated with household objects are often embedded as procedural memories that do not require conscious recollection (Treadaway et al. Citation2019; Huber et al. Citation2019). The use of technology in sensory tools allows greater personalization, and the sensory props of Huber et al. (Citation2019) and Huldtgren et al. (Citation2017) allow for the swapping of images and sounds. The interactive book features interchangeable page inlays, and the video content of Chrono TV can be changed to content from different decades (Huldtgren et al. Citation2017). The Telephone can be reprogrammed to suit the user, with the researchers exchanging Spanish songs for Welsh songs for a different individual. However, whilst the aforementioned sensory tools are interactive, they have limited

tactile variety. They are constructed from solid materials, primarily plastic, and most of the physical interactions they facilitate are button presses, with some twisting or turning of controls.

Researchers also use textiles in sensory tools, taking advantage of their familiarity, texture and affective qualities. Branco, Quental, and Ribeiro (Citation2016) illustrate how textiles with a range of textures can be used to create a sensory tool to stimulate the sense of touch, with their patchwork-style sensory blanket and a crocheted ring prop. HUG™ (Treadaway et al. Citation2019) (Figure 2) is a cushion-like sensory tool designed for a person with dementia. It resembles a child and is enhanced through electronics that can play a heartbeat sound.

Figure 2. HUG™ (Treadaway et al. Citation2019). Permission obtained.

Textiles can be further enhanced through the integration of technology. E-textile sensors can be used to create interactive sensory tools with the same physical qualities as conventional textiles. Tactile Dialogues (Bhömer, Tomico, and Wensveen Citation2016) is a cushion designed to facilitate communication between people with dementia and their caregivers, using textile-based sensors to elicit different patterns of vibrotactile feedback. Similarly, the interactive Playmat for children with visual and intellectual disabilities (Baars et al. Citation2019) uses textiles and pressure sensors in conjunction with fabric of contrasting colours and textures to control sound feedback. In both cases, the tactility and interactivity of the textiles are key elements of the sensory tool.

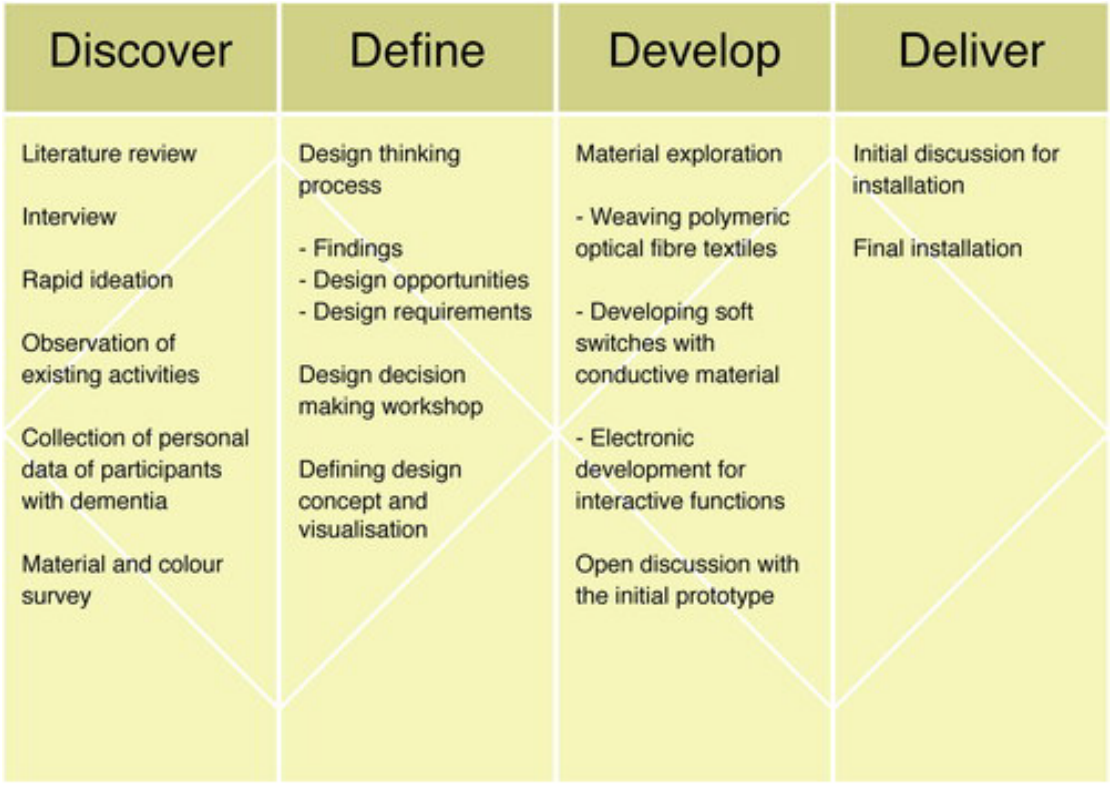
The participatory design approach leads to sensory tools tailored to the user, often by factoring in their personal histories and tastes. The ultra-personalization approach (Bhömer, Tomico, and Wensveen Citation2016) is advantageous, especially in the case of reminiscence therapy, as this helps to create a personal connection between the user and the sensory tool. Treadaway et al. (Citation2019) use a similar approach in their work. However, in addition to the problem of resource-intensiveness associated with participatory design, highly personalized sensory tools may be less beneficial for other users. For instance, the Steering Wheel was specifically developed for an individual who had worked as a mechanic, raising the question of whether another individual without this experience would connect with it. This problem can be mitigated by designing around a less user-specific theme. For example, the Giggle Balls developed by Treadaway et al. (Citation2019), which produce the sounds of laughter when tilted, were originally designed for an individual who passed away. However, they could still be used by others, likely because laughter sounds are universally relatable.

‘Joy, Peace, Grace and Life’ project

The sensory wall concept was the outcome of a co-design project, the ‘Joy, Peace, Grace and Life’ (JPGL) sensory wall. JPGL is a sensory tool designed collaboratively with an elderly community care service in Hong Kong. The stakeholders in this project included 13 people with early-stage dementia, 9 caregivers, 4 family members, 6 social workers, 1 occupational therapist and the care centre director. The aim was to create a sensory tool for people with dementia that would meet the needs of the stakeholders. This project was an opportunity to further explore the use of e-textiles in sensory tools design, as existing work on sensory tool design had demonstrated its potential benefits (Jakob and Collier Citation2017; Branco, Quental, and Ribeiro Citation2016; Ball and Haight Citation2005). The textile element provides interesting tactile properties, and

the inclusion of electronics produces multi-sensory stimulation through sound and light responses. The co-design process followed the double diamond design process (UK Design Council Citation2015), and within each stage, there were multiple research and design activities (Figure 3).

Figure 3. Double diamond co-design process for the JPGL sensory wall.



Discover stage

The Discover stage was used to gather insights before the Define stage, in which the project's key design challenges are identified. Group interviews with social workers, an occupational therapist and the care director were used to learn about the existing practices of the care staff, the wider dementia care context and the care staffs' needs. To involve the different stakeholders in the design process, several design activities were designed to suit the capabilities of the stakeholders. A rapid ideation workshop, which introduced illuminating polymeric optical fibre (POF) fabric and e-textiles to the care staff, was used to allow the care staff to contribute ideas for its use within the sensory tool. The workshop allows the researchers to understand the care staff's expectations of the materials.

Involving people with dementia in research and design activities is more difficult due to communication difficulties, either as a symptom of dementia or due to hearing

impairment. As such, in addition to relying on direct observation of their behaviour during dementia activity sessions and an observation session with the POF fabric, the researchers designed a colour and material survey activity that would allow the people with dementia to contribute directly in the design development. The activity aimed to identify the colour and material preferences of the people with dementia. This activity was conducted with 13 people with dementia, as well as 3 caregivers, 2 family members and 2 social workers. Communication aids were made. The colour survey used cards with a happy or unhappy face to indicate colours the participants liked or disliked. For the material preference survey, a range of material samples were presented mounted onto a card. People with dementia were asked to interact with the samples and asked to place a sticker on the back of the sample they preferred. In both activities, care staff, caregivers and family members were asked to engage with the people with dementia to encourage them to take part in the activity.

Define phase

During the Define phase, the researchers identified challenges faced by some of the stakeholders. For the care centre, the key challenge was the limited resources available to the care staff for sensory activities. Social workers were tasked with planning new activities to prevent the people with dementia from getting bored. However, they were limited by the materials and equipment available to them, restricting the diversity of the sensory stimulation they could provide. There was also a lack of manpower available, and the task of creating the activities adds to the social worker's workload. Space was a limited resource, as new activity tools require space to store them. There were several design criteria identified for the sensory tools. In addition to providing multisensory stimulation, the sensory tool needed to promote positive feelings amongst people with dementia and should use motifs with relevant associations to the participants with dementia.

The researchers engaged in a design decision-making workshop with four social workers and the care director, taking into account the findings from the Discover stages. Through this activity, the concept of a sensory wall was established, and the design of the motifs and interactions were decided. The sensory wall used a variety of textile textures to stimulates the sense of touch. Physical interaction with the wall panel produces both light and sound responses linked to the theme of the wall panel. To decide the themes, the participants linked the textures and colours favoured by the participants with dementia in the material survey to relevant associations. As the sensory wall was designed to be used by a group of people, the motif designs were drawn from associations with Hong Kong, which the users were likely to relate to: a

Chinese dance lion, the sea, wind chimes and singing birds. The participants decided on the most appropriate lighting and sound responses. The wall-mounted form and placement in the corridor of the care centre took into account the space limitation, although this also resonates with Jakob and Collier (Citation2014) observation that multi-sensory stimulation can be incorporated into the design of both public and private areas of a care home.

Develop and deliver phase

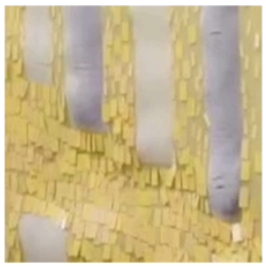
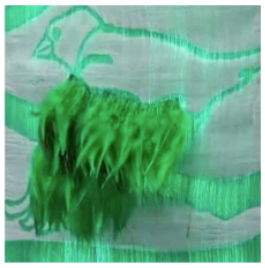
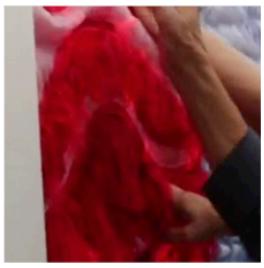
During the Develop phase, the researchers designed and prototyped the JPGL sensory wall. The motifs were woven into the POF fabric, with a double cloth structure to add surface texture. Touch-sensitive e-textiles embellishments were created using conductive yarn through knitting, embroidery and other textiles constructions. The conductive yarn was combined with a variety of materials, such as textural yarns, feathers and sequins to provide different tactility. The stakeholders were involved in the refinement of the design, as prototypes were presented to them and they provided feedback with regards to sensory experience from the perspective of the people with dementia and safety considerations. Once the design was finalised, the sensory wall was installed in the care centre (Figure 4).

Figure 4. JPGL sensory wall.

The sensory wall interaction consists of two stages. Without interaction, the sensory wall is unilluminated with no sound. When the sensory wall detects someone in front of the wall panel, the wall panel illuminates to prompt touch interaction. When the user touches the touch-sensitive embellishments, the wall panel illuminates in a specific pattern and plays the sound for that panel (Table 1).

Table 1 of 2

Table 1. The JPGL wall panel production techniques and interactions.

			
• Woven optical fibre fabric • Hand-stitched knitted conductive tassels	• Woven optical fibre fabric • Embedded conductive cushion	• Woven optical fibre fabric • Hand-stitched sequins • Embedded conductive cushion	• Woven optical fibre fabric • Hand-stitched conductive feathers
			
Touching the conductive tassel results in flashing illumination and cymbal sounds	Touching the conductive cushion results in flashing illumination and sea sounds	Touching the conductive cushion results in flashing illumination and windchime sounds	Touching the conductive feather results in flashing illumination and bird call sounds

Evaluation procedure

Following installation, the sensory wall was evaluated through a field trial, using the sensory wall in activities with participants with dementia. The evaluation consisted of three-steps: pre-interview, task performance and post-interview. The pre-interview was conducted before the task performance to gather their initial impressions of the wall, to establish the care staffs' expectations of using the sensory wall and to determine ways to measure its impact on the people with dementia. The occupational therapist stated that it is difficult to measure improvements in cognitive function and visuospatial perception but some changes in behaviour can be observed and evaluated, such as their level of attention and aggressive behaviour. It is also possible to observe positive emotional responses by observing their facial expressions. With these considerations in mind, interviews and observations were used to collect data for later analysis.

The evaluation tasks were designed in conjunction with the care staff and allowed the care staff and the researchers to observe the impact of the sensory wall. The first task was undertaken over the courses of 8 weeks and consisted of a short navigation task. The person with dementia was asked to navigate to the activity room from the reception, with minimal engagement from the social worker, their family member or caregiver. This task was used to see if the presence of the sensory wall can help them remember the location of the activity room and navigate there more independently. 13 participants

took part in this exercise, although individual attendance was inconsistent over the 8 weeks. Once the participant navigated to the room, they were asked by the social worker how they were able to find the room, and these answers were recorded. The second task consisted of a comparison between two similar activities, one designed around using paper, audio and visual content displayed on a projector, and another activity designed around using the sensory wall. These activities were centred around colour identification and association. The paper-based activity was conducted in the first week and the sensory wall activity in the following week. 13 people with dementia took part in the activities, split into two groups, 6 and 7 in each group respectively. The activities were led by the social workers, with some family members and carers taking part. Following the task performance stage, the three social workers and the occupational therapist were interviewed to gather their observations on the impact of the sensory wall on the people with dementia's behaviour, based on the verbal and non-verbal reactions they observed. The care staff also discussed the advantages, disadvantages and areas for improvement for the sensory wall.

Evaluation results

Navigation task

The social workers noted that over the course of the navigation task, there was some improvement in a few of the participant's ability to navigate independently. In the first and second week of the navigation tasks, 9 participants were able to identify the room primarily because they recognised the other participants when they entered the activity room. In week 4, 7 participants indicated that seeing the sensory wall led them to the activity room. There was one participant who started attending the care centre more recently, compared to the others who had been attending for over a year. After being introduced to the sensory wall in week 1, they used it as a landmark for finding the activity room. However, two participants struggled with completing the task throughout the 8 weeks.

Activity comparison

The sensory wall had some practical benefits in comparison to the tools typically used in activities. The social workers found that the sensory wall reduced the burden of creating the materials for activity 2. The sensory wall didn't face the issues of storage and setup and it facilitated activity planning as it was already designed with various associations and interactive functions.

The social workers remarked that the textiles materials were able to better stimulate the people with dementia's sense of touch compared to the paper tools used in activity 1. The multisensory stimulation provided by the sensory wall promoted positive responses from the people with dementia. The social workers noticed that the participants frequently responded to the illumination and would imitate the sounds from the sensory wall. The tactile material prompted a conversation about other association linked to colour and texture. While the sensory wall is not designed specifically for reminiscence therapy, it was found that the tactile material prompted some recollection. One participant remarked that the feathers of the green wall panel reminded them of a broom they used at home. The participants would also interact with one another, encouraging or helping others in the group interacting with the sensory wall.

Disadvantages and areas for improvement

The design of some of the wall panels proved to be too abstract for the people with dementia to recognize, particularly the blue sea panel and the yellow wind chime panel. The occupational therapist found that the touch-sensitive areas for these panels were also not distinctive enough when compared to the tassels and the feather textures used for the other two panels. This was found to confuse the participants. The placement of the sensory wall occasionally proved problematic, since the public area could be noisy, and the presence of other care centre users in the corridor could distract the people with dementia.

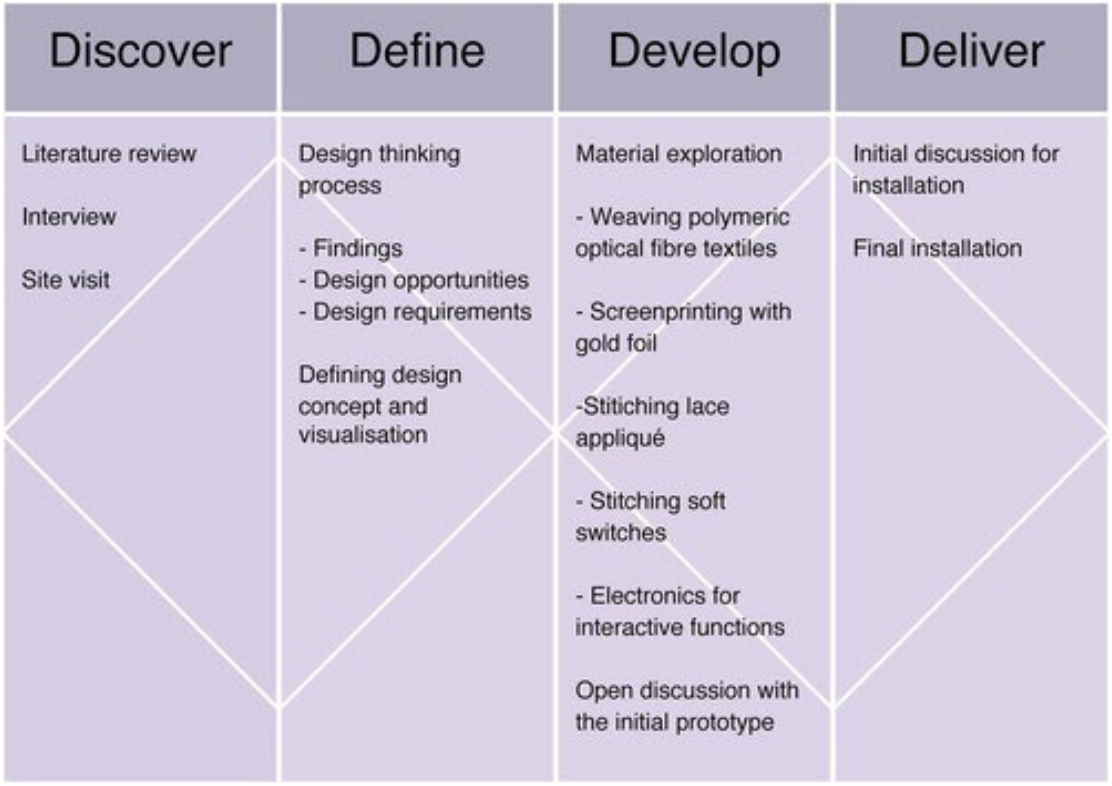
The participants with dementia were not all engaged in the wall panel, and some only interacted with it for a short time. This may be in part due to the way the sensory wall activity was conducted. Unlike the first activity, the activity was adjusted from being a group activity to being more one-on-one. The design of the user interaction limited interaction with the sensory wall to one person at a time. If two or more people interact with the wall, there is no response. This was designed as there were concerns about multiple audio and visual responses confusing the people with dementia.

'Joyous Ocean' project

The 'Joyous Ocean' project follows on from the JPGL project. Figure 5 shows the design process for the Joyous Ocean Sensory wall. The researchers were approached by the partner organization to collaborate on the design of a sensory tool for a care centre that would open in Zhuhai, Mainland China. However, the context for the project differs from JPGL. The state of elderly care, specifically dementia care, is different between Mainland China and Hong Kong. The project was both the design of a sensory

tool for people with dementia and the transfer of dementia care knowledge from Hong Kong care staff to Mainland care staff. The stakeholders in this project were the organization's manager for ageing innovation, the Zhuhai care centre manager and 2 nursing staff.

Figure 5. The double diamond design process for the Joyous Ocean sensory wall.



Dementia care in mainland China

The partner organization, based in Hong Kong, wanted to develop a sensory tool for people with dementia, partly due to a recent government policy that encourages the development of enrichment equipment for elderly people and cooperation between service providers in Hong Kong, Macau and Guangdong province (People's Government of Guangdong Province Citation2019). The partner organization were opening a 'mini-nursing home' (Zhang Citation2020), which combines community-based elderly care with residential care. The mini-nursing home provides respite care and elderly care programs. This is preferred in Mainland China as elderly care is traditionally a family matter, with the children expected to take care of their parents in their old age. According to the stakeholders, the elderly person is less likely to feel like they have been neglected by their family when they use this service. The partner organization stated that compared to Hong Kong, there is an insufficient amount of elderly care services and a lack of knowledge of dementia care in Mainland China.

This is also stated by other researchers (Zhang Citation2020; Zhao et al. Citation2020). There is an assumption that dementia is a part of normal ageing, leading to people not seeking treatment, and a stigma around the diagnosis (Zhang Citation2020; Prince et al. Citation2016). Research in the Greater Bay Area, i.e. Hong Kong, Macau, Zhuhai and eight other cities in the Guangdong province (Leung et al. Citation2020) highlights inadequacies in dementia knowledge in community-dwelling adults, as with other areas in China. The World Alzheimer's Report 2016 (Prince et al. Citation2016) stated that there was no national dementia plan, although it was prioritized within the National Five-year plan for Mental Health (2015–2020).

As this was a new care centre with no users, and the frontline care staff did not have the same level of experience in dementia care as the stakeholders in the JPGL project, employing the same co-design process as JPGL was deemed inappropriate. However, the care staff in the Zhuhai care centre were still 'experts on their own experiences' (Visser et al. Citation2005, 129), as experienced care staff in Mainland China. This led to the adoption of a customization style design approach that would allow them to contribute their knowledge on the local elderly population while providing the sensory wall concept as a framework for the sensory tool design. The project built on the knowledge gained from the JPGL project and was used to determine whether the sensory wall concept could be applied to other dementia care communities.

Customization design approach

Customization is centred around product modification after a user has chosen from a limited selection of options, in contrast to personalization which involves more bespoke designs (Kuksa and Fisher Citation2017). Within customization, there are some nuances, particularly the point at which customization occurs and how it is presented. Gilmore and Pine (Citation2000) outline four types of customization, of which both adaptive and collaborative customization are relevant to sensory tool design research. Interactive books and Chrono TV (Huldtgren et al. Citation2017) demonstrate adaptive customization, in which customization is left to the user. Both feature user-changeable elements such as page inlays and audio-visual content. However, this approach may make the product more difficult to design and use, as it requires the designer to determine whether a feature is important enough to warrant the additional design complexity. Collaborative customization can be compared to participatory design, in that the end-user is involved before receiving the product. The key difference between the customization and co-design is that collaborative customization offers set options rather than being open-ended. In contrast with adaptive customization, collaborative

customization allows the designer to learn about the user, help them articulate their needs and make appropriate suggestions.

The customization approach suited the project as other practical considerations prevented a co-design approach from being used. The travel costs and transit time made frequent in-person interaction between the stakeholders and researchers unviable. Whilst the JPGL project involved twenty in-person meetings before final installation, the Joyous Ocean project involved two in-person meetings, a site visit at the beginning of the project, and a second site visit with the contractors before installation. It was possible to reduce the amount of contact because the Joyous Ocean customized an existing concept, rather than developing a new project from the ground up.

It was important to gather a well-rounded picture of the users and the context in which the sensory wall would be used. The care staff interviewed provided design ideas that they felt would be relevant to the users, including new forms of interaction, such as movement, and appropriate design themes associated with Zhuhai and Chinese culture. The kapok flower was suggested as a motif, as it is common in Zhuhai and watching it bloom is a popular activity. The sea was used as a design theme because fishing was once a major industry in Zhuhai; the users were likely to have some memories of this. A Chinese dragon and a design depicting square dancing, a public activity which many older people in China participate in, had strong cultural relevance.

The design of Joyous Ocean

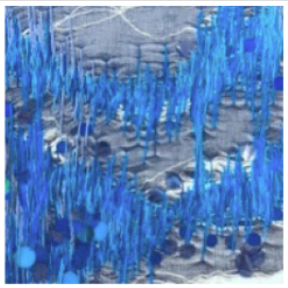
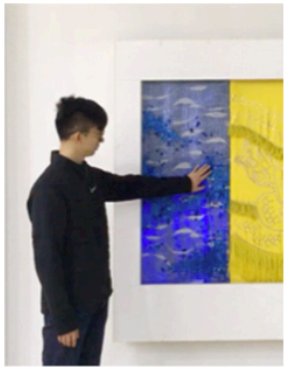
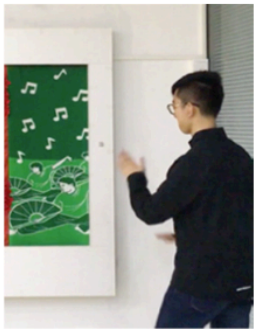
Improvements were made to the design of the Joyous Ocean wall to address the points raised in the evaluation of JPGL. The design of the interactions was changed to overcome the one-person limitation, by limiting sound output to the green dance panel to prevent confusion. The three remaining panels use illumination as the primary response, with the blue sea panel also using vibration.

Revisions were made to the design by the research group to ensure that the motifs were easy to recognize before seeking final approval from the stakeholders. The line thickness was adjusted, motifs simplified, and colour contrast increased. The design development of the surface embellishments focused on enhancing tactility and seamlessly integrating the conductive material (used for sensing) into the design. There were hygiene and safety concerns surrounding the sensory wall. The care staff were concerned about users picking off the sequins. This led to the choice of large round sequins from 12 to 15 mm in diameter, with two fixing holes. Extra care was taken in attaching the sequins to ensure that they could not be easily removed.

Joyous Ocean used jacquard weaving, machine knitting and screen and digital printing to produce the motifs on the wall panels (Table 2). In the Joyous Ocean project, only the sea panel used optical fibre, woven into the fabric using the industrial Jacquard weaving machine. The other illuminating wall panels used LEDs. This project adds to the repertoire of textile production techniques for the sensory wall design. Screen-printing allowed gold foil to be added to the wall panel design for added visual stimulation. The floral lace provided a level of three-dimensional texture that is difficult to achieve through hand embroidery alone. Knitted fringing was used in this wall panel, as with the JPGL sensory wall.

Table 2 of 2

Table 2. The Joyous Ocean sensory wall panel production techniques and interactions.

			
• Woven optical fibre fabric • Hand embroidery • Hand-stitched sequins	• Screen printing • Gold foil • Knitted fringing	• Digital printing • Hand-stitched beading • Stitched floral lace	• Jacquard knitted fabric
			
Touching the conductive embroidery results in illumination and vibrations felt through the fabric	Touching the conductive fringing results in illumination	Touching the conductive beading results in illumination	Motion in front of the wall panel results in music playing

Evaluation of the Joyous Ocean sensory wall

Following the completion of the project, the research group interviewed the stakeholders involved throughout the design process for feedback on the Joyous Ocean sensory wall and their experience of the design process. These were the organization manager, the care centre manager and two care centre staff. It was important to get their perspectives, as the organization manager had the experience

in dementia care, but the care centre manager and care staff were the individuals using the sensory wall with the people with dementia. The interviews were translated, transcribed and summarized.

The stakeholders wanted to create a sensory tool that satisfied not only functional demands but also expressive and aesthetic needs, and they felt that the final design did this. The interrelationship between functional, expressive and aesthetic considerations was highlighted by Lamb and Kallal (Citation1992) concerning apparel design, and it is interesting to see this reflected in the sensory wall. Aesthetics played a significant role in the function of the sensory wall. The care centre staff highlighted that it needed to be bright to provide effective visual stimulation, while also using motifs linked to long-term memories, such as local culture and childhood. The link between expressive qualities, i.e. that which the wall communicated, and its aesthetics was highlighted by the organization manager, who had initially felt that it should be part of the interior design of the care centre. The organization manager felt that a more medical appearance would stigmatize the users, as using it would then emphasize their cognitive impairment. The sensory wall also carried other expressive qualities, as it communicated information not only about the users but also about the care centre itself. The care staff expressed pride in the sensory wall and often introduced it as a highlight of the centre. The sensory wall helped to express the values and philosophy of the centre, as a place providing not only accommodation but also care for the mental health of its residents. This is an interesting point as families of the elderly tend to judge a centre's quality of care based on the facilities of the care centre (Zhang Citation2020).

The organization manager felt that the use of soft materials makes the sensory wall very interesting, as the textures created varied tactility and the wall provided sensory training in a playful and enjoyable way. The organization manager considered the sensory wall to be more interactive and provide more sensory stimulation than other tools they have seen. A Hong Kong care centre operated by the organization has a sensory corridor used for sensory and cognitive training, consisting of movable, wall-mounted wooden and plastic props focused on interacting through motion and creating patterns (Figure 6). The organization manager felt that the Joyous Ocean sensory wall provided better stimulation than the sensory corridor, particularly because it could play music.

Figure 6. Sensory corridor in another care centre in Hong Kong.

However, the administrator and care centre staff felt that improvements could be made. They stated that the music volume needed to be increased, as the ambient sound in the space was quite loud and the users were hard of hearing. The music associated with the green panel was occasionally triggered by interacting with another panel, causing confusion. The stakeholders suggested improving the design of the sensory wall by utilizing more space, either by making the sensory wall larger or by arranging it differently, e.g. in an L shape or double-sided. Compared with care centres in Hong Kong, the care facilities in China are often much larger, offering more opportunity to make full use of the space available (Figure 7).

Figure 7. Joyous Ocean sensory wall installed in the care centre.

Concerns

The design and installation process raised some concerns. It was necessary for the various parties involved in the project to learn from each other, as some aspects of this project were unfamiliar to different people. Some concerns related to the care centre's lack of familiarity with sensory training. The organization manager initially had concerns that the care centre staff in Zhuhai would not understand the rationale behind the sensory wall, as sensory training is a new concept. Amongst the care centre staff, there was apprehension, as they thought it would be too complicated for people with dementia to use. However, these concerns were eased as staff gained a better idea of the outcome following the initial meeting and after viewing the design visualizations.

Conclusion

The Joyous Ocean project took an approach closer to collaborative customization than the ultra-personalized approach used by other researchers to design sensory tools for people with dementia. However, the Joyous Ocean project does not fit the classic definition of customization by Gilmore and Pine (Citation2000). As the Joyous Ocean project lacks the standardized/modular approach to customization used in the commercial sector, it may be more appropriate to consider it as mass personalization

or bespoke customization, which shares the ethos of customization yet employs the techniques of bespoke design.

The Joyous Ocean project highlights a weakness of using co-design for sensory tools for people with dementia. The approach is typically reliant on the collaborators having the expertise in dementia care. However, this means that care communities with newly established dementia care facilities may not benefit from having a sensory tool specifically designed for their dementia care community since co-design would not be suited to their situation. The customization of an existing sensory tool helps bridge this gap, as the sensory wall serves as a physical manifestation of the transfer of dementia care knowledge from one party to another. The Joyous Ocean project demonstrates that the sensory wall concept has potential in other dementia care communities, despite originating from a co-design process with a specific group. This research illustrates a potential avenue for scaling up the production of tailored sensory tools to allow for wider dissemination. It is hoped that this work will encourage further consideration of e-textiles in dementia care, and the significance of design in health and well-being applications.

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