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### The design and development of a community based multisensory room

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## The design and development of a community based multisensory room

### Abstract

This case study describes the design and development of a multisensory environment for use by a local community, in response to local needs. Multisensory environments allow users to control the sensory inputs they experience from the environment. This autonomy may be especially impactful for those living with autism or dementia. The evidence base supporting the design, development and implementation of multisensory environments has been limited to date. This case study explores the evolution of the interdisciplinary team from a request for collaboration to the creation of a functioning multisensory room. It describes the experiences of the group of researchers finding shared understandings and evolving to a transdisciplinary approach.

### Keywords

multisensory, room, community, design, development

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## **The design and development of a community based multisensory room**

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### ***Biographical notes on contributors***

***Pippa Burns*** has a background in public health, with extensive experience in the planning and management of research projects. This includes experience evaluating programs conducted in real-world settings, such as schools, hospitals, aged-care facilities and the community.

***Grant Ellmers*** research interests include knowledge transfer through the creative process, design expertise, reflective practice, co-design, and design education including studio and project-based learning. Grant teaches design thinking, design process, user interface design, research methodology, and photography.

**Holly Tootell** has a background information technology. By examining technology-based solutions from the perspective of social impact she has built a strong background in multidisciplinary enquiry. Holly is currently leading three multidisciplinary research projects that bring together teams across engineering, design, business, health and education.

**Sue Slowikowski** is a lecturer in Public Relations where many of her courses embed work-integrated learning providing students with practical opportunities to immerse themselves and develop relevant skills sought after by industry. Most of the clients Sue works with are not-for-profit organisations.

**Carly Pascoe** was the West Dapto Community Development Officer for CareWays Community, based in the Illawarra region. Carly holds a Masters in Regional and Community Development and is passionate about making a positive and lasting contribution to the local community.

**Andrea Garner** is a practitioner and researcher specializing in the education of people on the autism spectrum and disadvantaged youth. Andrea currently works directly with children, their families, and with teachers developing programs and strategies to improve long-term outcomes for young people.

**Sim Lau** has a background in information technology. Her research in recent years has focused on applying information technology and knowledge management on supporting the disability sector, in areas including cerebral palsy research, developing the multisensory room and creating an autism-friendly community.

**Rose Dixon** focuses on the social and emotional health of students with extra support needs in inclusive and special settings. She is committed to the participation of individuals with Autism Spectrum disorders through inclusive school settings and has been involved in research evaluating an innovative Transition model for High School.

**Michael Szafraniec** is the Manager Operations – CareWays Community. Michael is an international expert in citizen engagement working with public administration

authorities around the world through the United Nations Department of Economic and Social Affairs. Michael has a formal background in Population Health.

## **The design and development of a community based multisensory room**

This case study describes the design and development of a multisensory environment for use by a local community, in response to local needs. Multisensory environments allow users to control the sensory inputs they experience from the environment. This autonomy may be especially impactful for those living with autism or dementia. The evidence base supporting the design, development and implementation of multisensory environments has been limited to date. This case study explores the evolution of the interdisciplinary team from a request for collaboration, to the creation of a functioning multisensory room. The case describes the experiences of the group of researchers finding shared understandings and evolving to a transdisciplinary approach.

Keywords: design, multisensory environment (MSE), multisensory experience, user-centred, interdisciplinary

## ***Introduction***

Multisensory environments (MSEs) are spaces created to allow users to control their sensory experiences. Users interact with equipment specifically designed to support sensory interactions (Cameron et al. 2019). The equipment found in such a room may include bubble tubes, essential oils and projectors with changing light patterns. These provide visual, auditory, tactile, olfactory, and proprioceptive stimulation (the sense of self-movement and body position). Importantly, users can control their sensory input, creating an environment that may stimulate or calm their senses, according to their preference (Scanlan & Novak 2015). Typically, such spaces have been established in institutions e.g. schools, nursing homes and hospitals, and have only been accessible to people who are part of those institutions. Research has shown that MSEs can improve quality of life and provide safe and enjoyable leisure experiences for people living with autism or dementia (Cameron et al. 2019). Other terms commonly used to refer to MSEs, include “comfort rooms,” “sensory rooms” and “Snoezelen rooms” (Hulsegge & Verheul 1987).

The evolution of the CareWays Community multisensory room has occurred over several years (Figure 1). CareWays Community is a not-for-profit community organisation that operates a number of neighbourhood centres and community-based services in New South Wales, Australia (*Careways Community* n.d.). CareWays Community offers a range of services to assist the aging, youth at risk of disengagement, young people with a disability, those who are socially isolated, and carers of children and adults living with disability in the community (*Careways Community* n.d.).

In 2012, CareWays Community undertook a needs assessment, which identified the desire for a multisensory room by the community of Horsley. Horsley is a suburb of Wollongong, primarily composed of young families (47.7%) (.id 2016). As at June 2018 the population of Wollongong was 302,739, making it the third-largest city in NSW. The MSE is located in the Horsley Community Centre and owned by Wollongong City Council, with CareWays managing the centre as the licensee and coordinating the centre on a day-to-day basis.

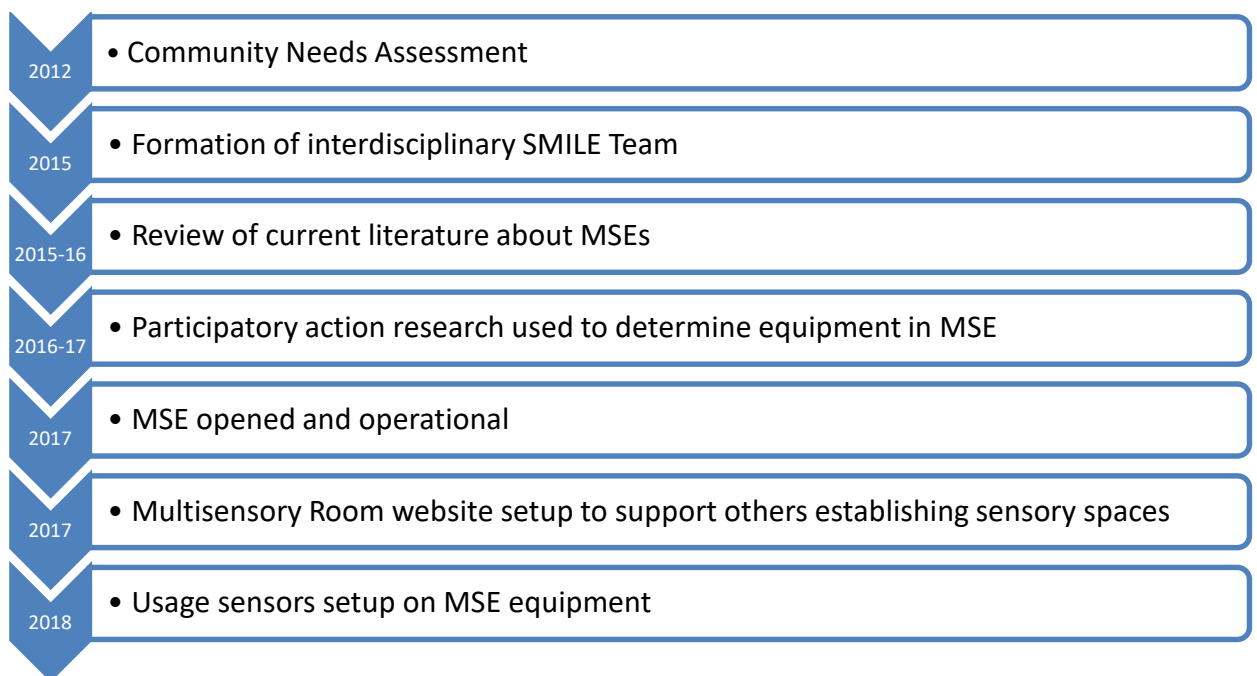


Figure 1: Timeline of the design and evolution of the CareWays Community multisensory room

***Our story: How the MSE was created***

In 2015, CareWays Community approached the University of Wollongong (UOW) for support in creating an MSE. A multidisciplinary team of researchers were asked to join the working group, which was established with two main aims:



- to develop a community-based MSE for the Horsley community
- to identify evidence-based research to support the development of MSEs and contribute research findings to the limited international research on community-based MSEs

The working group comprised of multidisciplinary researchers from UOW including the disciplines of Education, Medicine, and Computing and Information Technology (Figure 2). They named themselves the SMILE (Sensory Made Inclusive Leisure Environment) research team. In multidisciplinary teams, a richness of findings can emerge from the triangulation of known information from different research approaches. Multiple forms of data allow for triangulation (Yin 2003), which is important for qualitative research, as this approach enhances data dependability, credibility, and confirmability (Cresswell & Miler 2000). By bringing these different viewpoints in to the project, new ideas for future research were identified and validated as worthwhile pursuits. In the establishment of the research team, it was necessary to have a creative vision and question the benefits of an interdisciplinary approach over and above a single discipline approach (Austin, Park & Goble 2008; Fawcett 2013). The project team was formed with the intent of applying for funding from the UOW Global Challenges program. The Global Challenges program aims to foster “creative and community-engaged research” through interdisciplinary research.

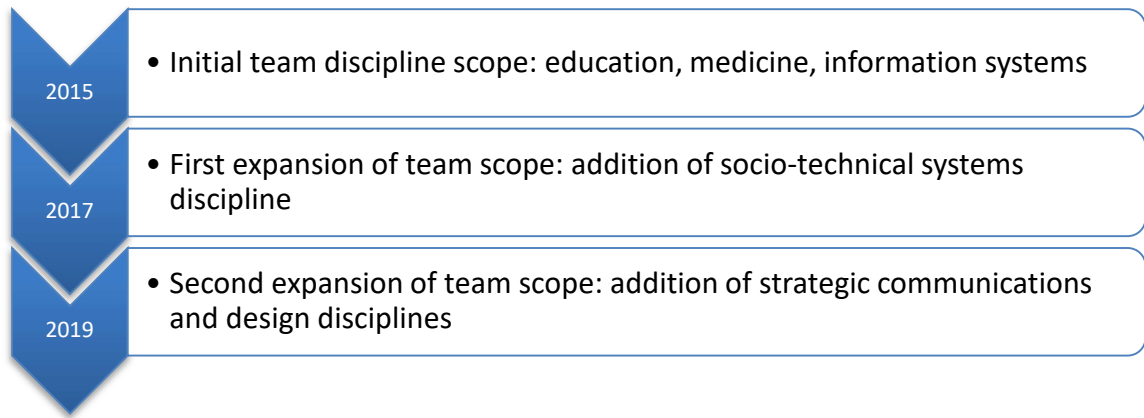


Figure 2: Changes in team composition and scope

Research involving multiple disciplines can be viewed on a continuum, starting with multidisciplinary moving through interdisciplinary to transdisciplinary (Fawcett 2013). Interdisciplinary research, which was the aim of the original team, involves researchers from various disciplines addressing a common goal (Zeiss & Steffen 1998). The research is undertaken interdependently in the same setting with the disciplines interacting both formally and informally (Zeiss & Steffen 1998). This sees an integration of knowledge (Choi & Pak 2006).

The project used the principles of community-based participatory research (CBPR), to gain an understanding of community requirements regarding the design and operation of the CareWays’ multisensory room. CBPR involves the establishment of research partnerships with stakeholders, to address a specific problem, such as the establishment of the MSE (Leavy 2017). CBPR sees the community as a unit of identity, which enabled the team to build on the strengths and resources of the Horsley community (Israel et al. 1998). The team recognised that many research participants would be socially and economically marginalised, especially through their role as caregivers for people with disabilities. Use of CBPR challenged these power dynamics promoting an

engagement process that addressed these social inequalities and furthered the partnership with the community.

Initial seed grant funding was obtained from UOW Global Challenges research program to explore the parameters of a community based multisensory room. The initial funding allowed a scoping review to be undertaken in order to identify the settings where MSEs are used, the reasons for their implementation, and the type of equipment installed and the reported impact of MSEs upon users (Cameron et al. 2019). MSEs were found to be used in mental health care, intellectual and developmental disabilities, dementia, traumatic brain injuries and maternity. Overall MSEs were found to offer benefits to users with a range of conditions. However, due to the wide range of research designs and methodologies employed, it was difficult to determine which equipment or sensory experiences were most effective (Cameron et al. 2019). In order to address these inconsistencies, the Multisensory Environment Research Reporting Framework (MERRF) was developed to provide a uniform approach in reporting the effectiveness of MSEs (Cameron et al. 2019). This was based on the Internet Self-Management Uniform Reporting Framework (iSMURF) (Burns et al. 2013). The MERRF framework supports researchers in identifying the active ingredients in MSE design (Cameron et al. 2019).

In 2016, further funding was received from UOW Global Challenges to advance this research. This stage of the research was called: ‘Addressing Community Needs: Design, Delivery and Engagement of a Non-Categorical Environment’. This allowed the team to undertake formative research exploring what the community required from a MSE.

Focus groups and interviews were undertaken by a research assistant with community members identified by CareWays (n=24) in order to understand what they required from a MSE (Mayersen et al. 2019). The needs identified were categorised into three domains: 1. intrinsic features and functionality of the room; 2. accessibility and availability, and 3. specific equipment/sensory experiences desired. In summary, the community wanted a safe, non-categorical environment (one that is not themed) that could cater to a range of users and be available for use across a wide range of times.

This initial exercise was followed by use of a two-round Delphi to identify the specific equipment the community required in the MSE (n=87). The Delphi technique is a method used for gathering data from experts using surveys in the area of interest (Hsu & Sandford 2007). In this case the experts were members of the Horsley community.

Responses were sought from respondents on multiple occasions, creating a convergence of ideas amongst the expert stakeholders. Respondents to the Delphi prioritised the following equipment for inclusion in the MSE: aura light projector; bubble tube; fiber optic curtain; LED touch wall; vibro-acoustic chair; interactive keyboard; soft padded barrel; aroma panel; lycra cocoon; light sensor board and a soundboard. It was through this consultative process that an understanding of room function was established. This enabled the project to progress to implementation of the MSE room (Mayersen et al. 2019).

### ***Description of the multisensory room***

The room is 4m by 3m and contains nine sensory engagement items with soft padding on the floor (Figure 3). The sensory items include a:

- LED touch light sensor board (Light board)

- fibre optic light curtain
- bubble light tubes
- mirror ball with light projector
- tactile touch wall
- sound board and interaction keyboard
- aroma board
- soft padded barrel
- arm chair with vibroacoustic attachment
- foam wedge
- lycra cocoon

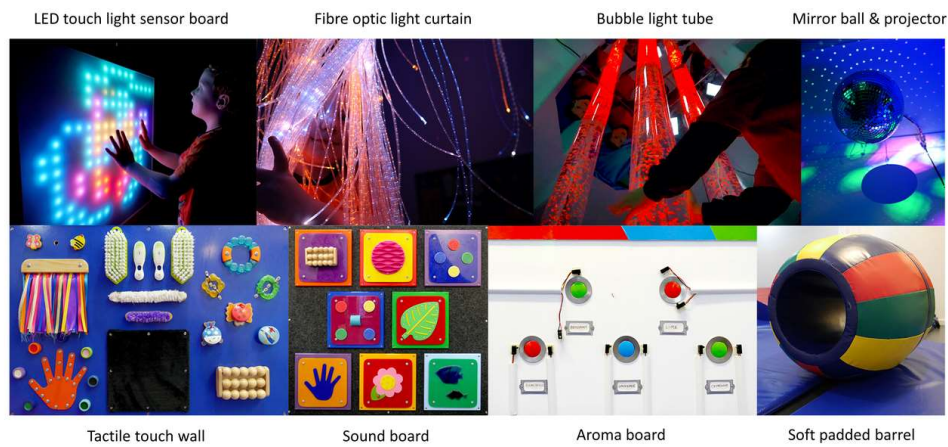


Figure 3: Room sensory items

CareWays SMILE Team members, sourced equipment for the MSE based on the results of the Delphi survey. Local people were employed to install the equipment. Two items from the Delphi survey were particularly difficult to source: an aroma board and a vibrating chair. The aroma board was subsequently designed and created by a local

artist. Due to difficulty sourcing an appropriate vibrating armchair CareWays Community devised a different solution that involved a large leather chair and a vibrating sound pad that simply sits on the chair behind the users back. The pad has a control panel where the user can control the intensity of vibration and volume of sounds. This approach has proved more accessible as it can be moved to the floor or onto a wheelchair.

The placement of each piece of equipment in the room was done by a CareWays Community staff member in consultation with the multisensory room expert on the team (Figure 4). The room was the only space available within the community centre. It was important to establish the best equipment layout before securing equipment to the walls, in order to maximise interaction opportunities. The team were conscious to not overcrowd the room with equipment and to ensure accessibility for those with mobility issues. In addition, all surfaces needed to be washable for health and safety purposes.

The placement of the equipment was primarily to ensure that all users could access all of the equipment. Some equipment placement was driven by the space, for example, the position of power points in the room (e.g. the LED box) or the need for specific wall dimensions (the mirror backed bubble tube). Additionally, the lycra cocoon had to be in the middle of the room to ensure safety if someone was doing a full swing on it. All equipment was placed at a height that people in wheelchairs, using walkers, or young people could reach. Some equipment can be moved by room users, for example the vibrating chair pad, the rainbow tunnel, foam blocks and all mats. People with walkers, wheelchairs and children trial the space prior to the opening of the room to ensure they could move around the space and reach all of the equipment. The power switch to the

room was placed high on the wall to reduce the likelihood of children flicking it on and off but still within the reach of someone sitting in a wheelchair.

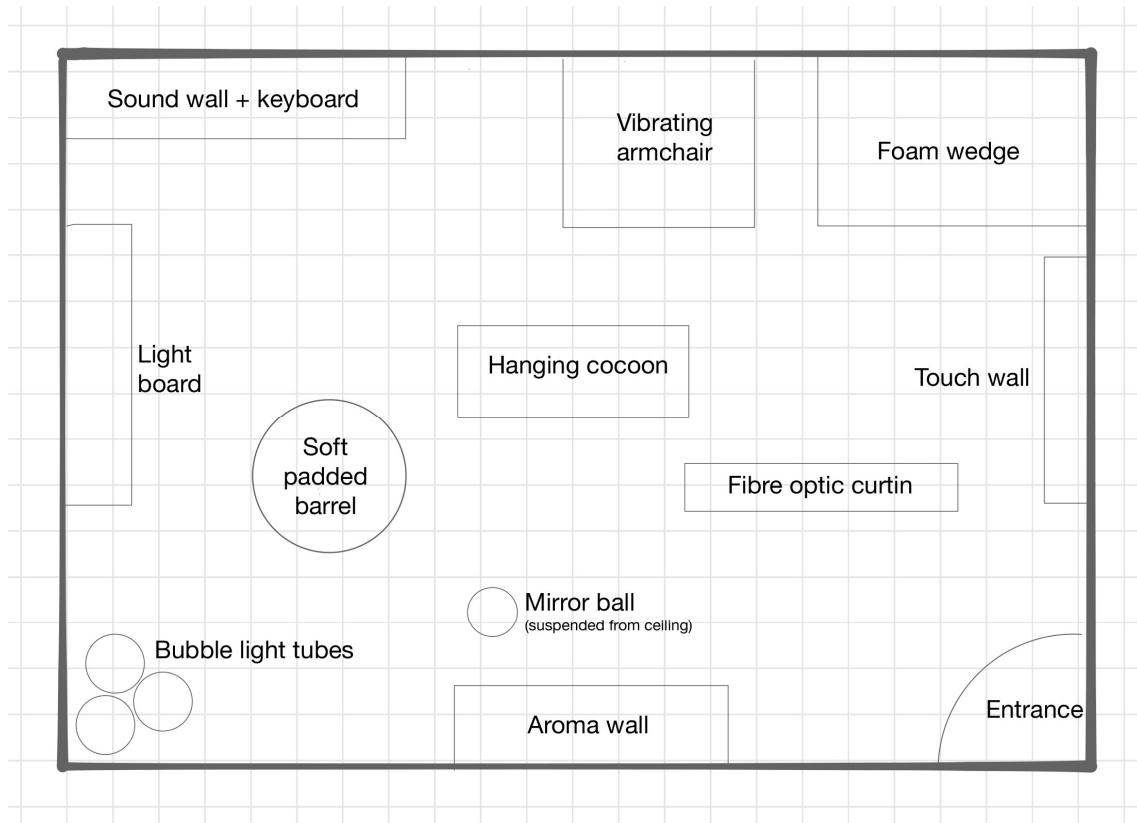


Figure 4: A sketch of the room layout (4m x 3m)

### ***Launch of the multisensory room***

The multisensory room was officially opened to the community on June 29, 2017 (University of Wollongong 2017). Unlike other multisensory rooms, the room is available from 7am – 11pm, seven days a week. It can be reserved through an online booking system, with the cost per session set at a minimal rate to cover running costs. Multiple people can use the room at once, providing a more cost effective option. The room is also registered with the Australian National Disability Insurance Scheme (NDIS), which can fund use of the MSE for people living with recognised disabilities.

The multisensory room users are required to undertake an induction, which ensures they know how to access the community centre outside normal business hours. The induction also includes information on the community centre e.g. emergency procedures and location of toilet facilities. A social story has been made available on the website to assist users that struggle with transitioning to new settings (CareWays Community n.d.).

### ***Widening the scope of the project***

After the room opening, the team was able to look at ways in which the impact of the room could be shared with a wider community. The development of online resources and videos to support individual and small community groups wanting to develop their own multisensory spaces was one method identified. These resources were created using funds from UOW's Community Engagement Scheme (The SMILE Team 2017) and have supported the research team and CareWays in providing advice on setting up MSEs in other organisations.

The introduction of a socio-technical perspective through the involvement of an information systems researcher in 2017, allowed for purposeful integration of technology within the room. Socio-technical approaches are not always explicitly identified (Avgerou, Ciborra & Land 2004) but often take the form of participatory methods that seek to understand the links between human, social and organisational factors (Baxter & Sommerville 2011). This approach was a good fit with the CBPR work that had already been completed, and in that context was a natural extension of the work.



In 2018, the information systems researcher was able to facilitate three new student research projects related to the MSE. The first, a final year Computer Science project built a sensor network to monitor use of each piece of equipment in the room. The network delivers detailed reporting on usage of each piece of equipment in the room. This data has the potential to inform management of the MSE and guide subsequent design refinement. It also provides an opportunity to understand equipment use patterns by different user groups and provide data for personalisation for individuals and/or groups of users in the future.

The other two student studies were undertaken to complement the design and management of the MSE. One project looked at the wider issue of technology integration within the multisensory environments to improve engagement and to better understand client needs. The other student project (a Masters project) examined the role of social media in promoting the space to a broader audience and developed a social media strategy for CareWays based on effective evidence-based research.

### ***Next Stage of the Project***

As the existing funding ended, a review of the MSE team process and outcomes was undertaken. In order to evolve the interdisciplinary outcomes that were emerging through the project, it was necessary to extend the research team (Figure 5). Two areas of additional need were identified: design expertise and strategic communications. It was also identified that the working of the team needed to move from interdisciplinary to transdisciplinary.

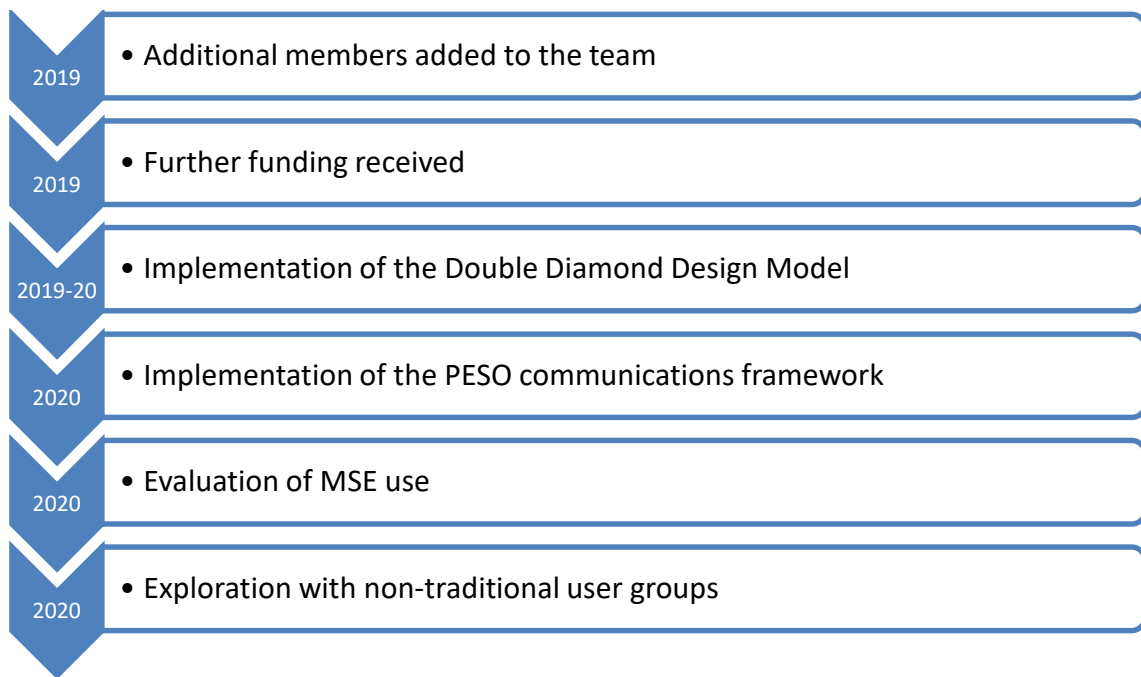


Figure 5: Timeline of the second stage of research

Transdisciplinary research sees the integration of knowledge and skills from different disciplines, merging the traditional boundaries (Fawcett 2013). Team members share their discipline specific knowledge and skills, allowing for effective collaboration and decision-making and the emergence of new knowledge (Choi & Pak 2006). Austin, Park, and Goble (2008) indicate a transdisciplinary way of working supports the development of a common language that blurs existing discipline boundaries, supports establishment of defined roles and responsibilities, and requires the development of trust and mutual confidence between team members. Such collaborative research allows the research team to explore the problem from various disciplines or lenses allowing for richer research outcomes (Austin, Park & Goble 2008). This approach allows the researchers to make connections between different concepts and ideas across disciplinary boundaries (Appleby 2019). Transdisciplinarity forms a natural fit with participatory methods in providing researchers with a strong basis for progressing understanding of real-world problems (Lam et al. 2019).

The design researcher is contributing a user experience design context and a design process framework (double diamond process model). User experience and co-design employs a process that supports the creation of meaningful and relevant experiences for end users (Abbas et al. 2018). This is particularly important in the creation and refinement of the MSE where user experience is paramount to the success of the MSE.

The design researcher identified the potential for differences in the concerns and focus between the industry partners and academic researchers. Typically, researchers are more interested in collecting data and documenting the questions surrounding the development and use of the artefact, in this case the MSE. Whereas, the industry partners are typically focused on the development and use of the artefact, the MSE. If these different interests are not managed effectively, tensions can develop within the team, hindering project outcomes.

In diverse transdisciplinary teams, differences of focus are often magnified. It can be problematic bringing together the varied interests of a diverse range of project members, in a way that supports the development of the project. One solution is to employ a framework that provides a common language for the team to communicate. Moving forward, the design researcher will introduce the Double Diamond Design Process model (Design Council 2005), to aid communication and documentation of the MSE project. This model describes a four-stage process identified as: Discover; Define; Develop; and Deliver (see Figure 6). These stages are summarised as:

- **Discover:** where the design problem is identified through the exploration of a broad range of ideas, with key activities that include identifying user needs, analysing market research, trends and other information sources;
- **Define:** where a combination of the ideas or directions identified during the Discover stage are analysed and synthesised into a design brief, with key activities including project development, project management, and project sign-off;
- **Develop:** where design-led solutions are created, iterated and tested, with key activities including multi-disciplinary working, visual management, development methods, and prototype testing;
- **Deliver:** where the final design concept is taken through final testing, signed-off, produced and launched, followed by product evaluation and feedback loops.

While it is possible to identify and describe the characteristics of the design process, it is important to note this process seldom follows a linear path. The process of design generally involves an iterative activity of recycling and repetition, and it is important to ensure flexibility in approach is maintained to allow responses to creative change (Ellmers 2014).

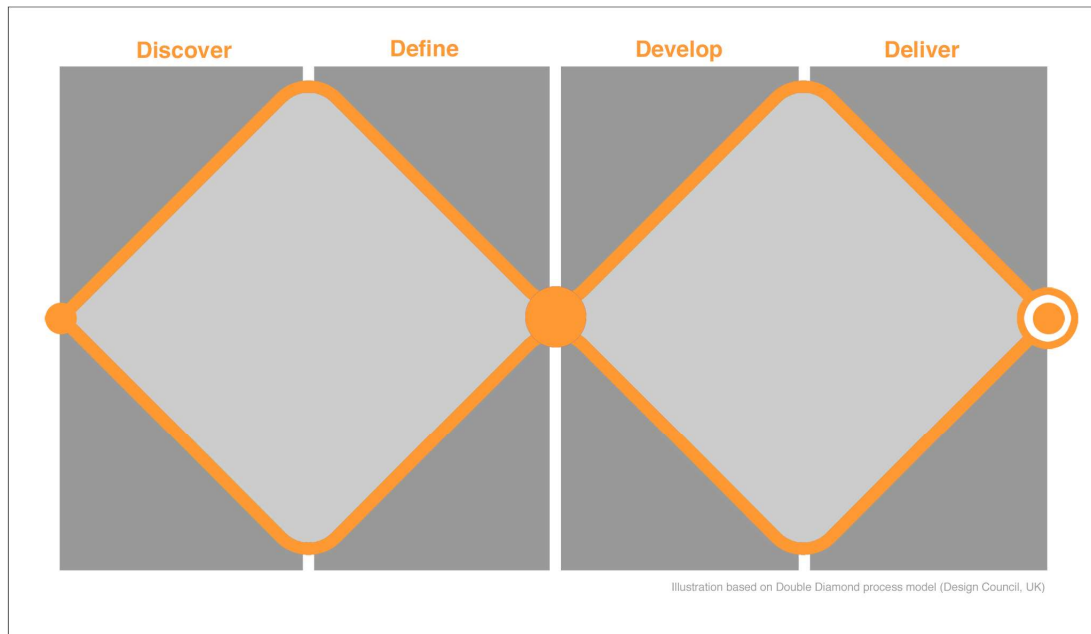


Figure 6: Double diamond process model (Design Council 2005)

The communications researcher is informing the development of a communication framework based on PESO (Paid, Earned, Shared and Owned channels), which explores the strategic use of multiple channels to effectively promote the MSE and communicate the value for the community. This framework integrates different forms of media when planning marketing and public relations campaigns. This development again highlights the transition of the team from a multidisciplinary way of working to an appreciation of the need for transdisciplinary integration.

The communications researcher will assist in the development of a strategic communications framework to increase usage rates and maximise value for the community of the existing multisensory space. A work-integrated learning opportunity for third year Public Relations students will result in a publicised activation to create wider community awareness and engagement from existing and potential stakeholders

who may be interested in designing a multisensory space in their own communities. The PESO framework (Dietrich 2014; Waddington 2018) will be adopted to guide and integrate communication tools across paid, earned, shared and owned channels, in order to ensure consistency of message and synergistic value of both digital and traditional options to better reach stakeholders.

With the addition of these team members, the group was successful in securing another round of funding. In recognition of the expanded scope, the research group was rebranded to “SENSE spaces” (where SENSE stands for Sensory Environments Supporting Experiences). In 2020, the SENSE Spaces team will be working towards gaining feedback about the MSE from visitors, families, carers and the wider community. This is important as the evidence base around MSEs is still evolving (Cameron et al. 2019).

### ***Conclusion***

This initiative provides a safe and secure environment for MSE users to explore sensory calming or stimulation, with an emphasis on those living with autism or dementia. By engaging the local community in shaping how this MSE was designed and used, the researchers gained insight into the importance of an accessible space. As far as the researchers are aware, this study is the first of its kind to design and develop a multisensory environment in collaboration with a local community. The bringing together of voices that are often marginalised in communities allowed for a meaningful community asset to be developed.

In parallel, a highlight of the research was the development of processes to enhance the synergy and collaboration amongst a team of diverse disciplinary backgrounds, and in response to local community needs. The introduction of two new team members extends the original team's expertise and marks a shift to a transdisciplinary approach.

The collegiality, passion, and commitment to this project at all levels, including engagement from the community, has resulted in an MSE that is contributing to best practice both in industry and research contexts. The applied nature of this research approach is a significant motivator for all stakeholders in the team. The vision that is being created through the sharing of knowledge, theory and practice of all stakeholders contributes to an expanded research agenda. Throughout the next stage of the project, the SENSE team is undertaking a wider exploration of MSE for a selection of non-traditional user groups.

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We acknowledge the Traditional Custodians of the lands on which we work. The University of Wollongong spreads across many interrelated Aboriginal Countries that are bound by this sacred landscape. We pay our respects to Aboriginal Elders past and present, who are the knowledge holders and teachers. We acknowledge their continued spiritual and cultural connection to Country.

As we share knowledge, teaching, learning and research we also pay respect to the knowledge embedded forever within the Aboriginal Custodianship of Country.

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## **Disclosure statement**

The authors have no conflicts of interest to report.

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