



REFUGIUM WA

Crafting Connection Through Plant-Relating Arts-Science Experiences of Urban Ecology

by Dr. Tanja Beer & Cristina Hernandez-Santin

*Various platforms have demonstrated the value of hands-on activities – such as community gardening and crafting – in making meaningful connections and collective identities for a sustainable and resilient future. In his seminal book, *Flow: The Psychology of Optimal Experience* (1990), psychologist Mihaly Csikszentmihalyi describes how these activities can be an opportunity to engage with ‘flow’ – a highly focused mental state that increases awareness, connectivity and well-being. In *Through Vegetal Being* (2016), philosophers Luce Irigaray and Michael Marder also argue that it is through ‘vegetal’ (or plant relating) activities in particular (e.g. touching and smelling plants), that our relations with the more-than-human world can be reignited. Drawing upon these publications and others, this paper explores how combining these two modes of thought – to enable ‘flow’ through shared ‘vegetal’ or plant-based activities – may assist communities in gaining a greater awareness of and connection to sustainability. The potential of plant-based creative activities are examined through a recent, practice-led, arts-science research project (Refugium WA, Australia 2017), which used scientific knowledge and ‘vegetal’ or ‘botanical’ crafting as a way of engaging people in biodiversity issues. The project employed the community in creating mini native plant-sculptures which were temporally installed at the State Library of Western Australia. Indication of flow, increased nature-connection and biodiversity understanding were explored through gathering observations of the participants, pre- and post-activity surveys and discussions. The research sought to examine the capacity for vegetal-crafting activities to lead to new modes of arts-science communication that connect people to the importance of biodiversity in urban spaces.*

Keywords: *craft, sustainability, arts-science communication, flow, vegetal being.*

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Introduction

In a society where people are becoming increasingly urbanised, it is clear that we need new strategies that connect communities to their local ecologies and motivate them in the hands-on co-creation of a thriving future (Bennett and Beudel 2014^[1]). Disconnection from nature is a significant consequence of contemporary society. Since the rise of the industrial revolution, our rapidly changing urban environment and lifestyle has created an understanding of nature as 'out there' or as something separate from ourselves (Bateson 1972^[2]; Næss 1984^[3]). In recent decades, there has been a substantial decline in people engaged in nature-based recreation, due to the increasing value placed on passive screen-based entertainment (Pergams and Zaradic 2006^[4]; Kesebir and Kesebir 2017^[5]). Disconnection from nature has not only led to an array of physical and psychological issues, including obesity and attitude, cognitive and developmental problems (Mustapa et al. 2015^[6]), it has also been linked to a decrease in environmental awareness and a lack of concern for conservation issues (Wells and Lekies 2006^[7]; Kareiva 2008^[8]). This presents significant challenges for the future preservation of our natural environment.

Numerous commentators have argued for the value of the arts to inspire the public on environmental issues (Lesen et al. 2016^[9]; Heras & Tabara 2016^[10]; Thomsen 2015^[11]; Evans 2014^[12]). In particular, research suggests that collective learning through participatory arts (where audiences become collaborators or co-creators of the art) can produce meaningful change in pro-environmental behaviour (Curtis 2009^[13]). For example, various platforms have demonstrated the value of hands-on activities – such as community gardening and crafting – in making meaningful connections and collective identities. In his seminal book, *Flow: The Psychology of Optimal Experience* (2008^[14]), psychologist Mihaly Csikszentmihalyi describes how these activities can be an opportunity to engage with 'flow' – a highly focused mental state that increases awareness, connectivity, and well-being. In *Through Vegetal Being* (2016^[15]), philosophers Luce Irigaray and Michael Marder also argue that it is through 'vegetal' (or plant relating) activities (e.g. touching and smelling plants), that our relations with the more-than-human world can be reignited.

Drawing upon the above publications and others, this paper explores how combining these two modes of thought – to enable 'flow' through shared 'vegetal' or plant-based activities – can connect people to nature through hands-on creative experiences. Using a practice-led research project (Refugium WA, Australia 2017), the paper draws upon our observations of how vegetal crafting may become a conduit for linking people to the importance of biodiversity in urban spaces. The research was assessed using a pilot research design of pre- and post- activity surveys, including self-reported measures of flow, levels of nature connection and understanding of Perth's biodiversity. Qualitative and quantitative measures were also paired with the researcher's observations, reflections and participant discussions to help gain a holistic understanding of the study.

To help clarify our research, we consider four key concepts within the context of this paper: 'craft', 'nature', 'nature experience' and 'sustainability'. Firstly, we apply Sarah Kettley's (2016^[16]) contemporary understanding of 'craft' which is focused on collaborative creativity and potentiality, including the continuous capacity for authentic and rewarding personal and collective engagement. Secondly, we define 'nature' as a series of interconnected ecological relationships, of which humans are a part, rather than a separate entity that exists outside or separate to ourselves. Nevertheless, we also acknowledge that the concept of 'nature' can be ambiguous and can result in a variety of understandings for different people. Thirdly, we consider Freeman and Tranter's (2011^[17]) categories of 'nature experience' which recognises that encounters with nature can occur in three different ways: 'direct', 'indirect' and 'observation without contact'. According to the authors, 'direct experience' implies physical contact with nature through play or immersion within natural environments. Conversely, 'indirect' contact corresponds to understandings of nature obtained through various secondary mediums (e.g. scientific books, photography, nature documentaries). 'Observation without contact' corresponds to passive experience of nature (e.g. through a car or plane window). While each of these experiences are important modes for facilitating nature-connection, Freeman and Tranter suggest that 'direct' contact is the most effective for creating a strong and nurturing relationship with nature (Freeman and Tranter's 2011:162–163^[18]). Lastly, we adopt Chrisna du Plessis and Peter Brandon's (2015:56^[19]) definition of regenerative sustainability. As the authors explain:

Sustainability is based on a value system which holds that both people and nature should be treated with respect and in a spirit of fellowship and mutuality, and actions should focus not only on the wellbeing of humans, but on the wellbeing of the entire social-ecological system. This means that humans have a duty of care that requires them to support the wellbeing and evolution of the social-ecological systems of which they are part, and take responsibility for the consequences of their actions (du Plessis and Brandon 2015:56^[19]).

While conventional approaches to sustainability generally focus on mitigation of impact, 'regenerative sustainability' aims to simultaneously improve environmental and human wellbeing and refers to the way in which 'sustainability' is nurtured through human-nature relationships. This concept of sustainability is one that is strongly associated with nature-connection. For example, from a regenerative perspective, an individual who already has a strong connection to nature, is not only likely to identify themselves as part of nature, but to also show value and care for their environment by supporting conservation efforts or taking action to enhance the capacity of the global and local social-ecological systems (Du Plessis and Brandon 2015^[19]).

We begin by discussing the key points of 'flow' and 'vegetable being', followed by a summary of the project, our research methods, outcomes, and analysis of the findings.



The concept of flow

Flow is a concept developed by psychologist Mihaly Csikszentmihalyi (1990^[1]) that describes an intrinsically motivated and highly enjoyable psychological state of engagement. It is “the state in which people are so involved in an activity that nothing else seems to matter” (Csikszentmihalyi 1990:4^[1]). Flow can be activated by a variety of activities that “involve patterns of action which maximize immediate, intrinsic rewards to the participant” (Csikszentmihalyi 1975:21^[1]). It is most often stimulated by engaging in an activity that is both inspiring and effortless, as well as challenging enough for one to maintain focus (Nakamura & Csikszentmihalyi 2002:89–90^[1]).

Flow activities lend themselves well to artistic practices that are focused on using creativity to increase intellectual and bodily cognition, focus and wellbeing. As psychologist Frances Kaplan (2000:76^[1]) explains, “when art making partakes of the characteristics of ‘flow,’ it provides the kind of optimal experience that produces feelings of psychological growth and makes life in general more worth living”. Striking the ‘right’ balance to activate flow, however, is crucial: the creative task needs to be stimulating enough to maintain interest

but not overwhelming as to cause anxiety to the participant. The “unfolding of flow experience is shaped by the person and environment” and often requires continuous goal and feedback loops (Nakamura & Csikszentmihalyi 2002:91^[1]).

Flow activities merge cognition, motivation and emotion – attributes that can lead to participants feeling greater self-worth and higher levels of concentration, opening up receptors for taking in new knowledge on a cognitive and visceral level (Csikszentmihalyi 1990^[1]). Key characteristics of flow include: increased concentration; a greater integration of action and awareness; loss of self-consciousness; improved sense of control; altered sense of time; and an appreciation for activities that are intrinsically rewarding (Nakamura & Csikszentmihalyi 2002:90^[1]). Over time, these attributes can be extended through regular flow-inducing activities to help increase concentration, creativity, and wellbeing – improving quality of life and building emotional capital for the future (Seligman 2002^[1]; Kaplan 2000^[1]). Thus, short term flow activities can also lead to more lasting effects.

Connection to nature through vegetal being

Humans have an innate affiliation with nature due to our long history of evolution within the natural environment (Wilson 1984^[1]). Connection to nature is defined as the degree to which an individual includes nature as part of their identity and is also an important predictor of well-being and ecological behaviour (Schultz 2002^[1]). It includes a deep sense of belonging to the natural world, feelings of peacefulness and harmony; a sense of timelessness; humility; respect and developing a sense of place (Bragg et al. 2013^[1]). One way in which humans can connect with nature is through ‘vegetal’ or ‘botanical’ crafting activities with living plants. Marder and Irigaray (2016^[1]) refer to these kinds of creative tasks as one that activates ‘vegetal being’, a mode of meaningful engagement with plants that reveres their presence as agentic beings. Essentially, ‘vegetal being’ involves an act of embracing “the constitutive vegetal otherness in ourselves” so that we can allow the functions and adaptability of plant life to resonate with our own human nature (Marder 2013:36^[1]).

Vegetal being “implies a heightened receptivity and openness to the endless variety of nonverbal languages that surround us” (Marder and Irigaray 2016:162^[1]). Vegetal relating activities “let our expressiveness resonate with that of the animals, plants, and even minerals or rock formations we encounter” – to “experience a similar bodily welcoming of existence, the same opening unto the world, as a plant” (Marder and Irigaray 2016:162, 163–4^[1]). Marder (2013^[1]) also refers to this way of being as ‘plant-thinking’ – one that is free from the classifications, measures, and structures imposed by current philosophies and ontologies of scientific study. Instead of seeing plants as separate and subordinate objects,

plant-thinking allows for a more “equalized register of being that affects our cognition and perception of plants that can inform the way we live in, and consciously perceive, the world around us” (Gibson 2015:1^[1]).

Ideas of ‘plant-thinking’ and ‘vegetal being’ extend culture, language, and social relations. Here, more-than-human encounters are considered as primal forces that exist within “state before ‘sense certainty,’” or “the indeterminacy of existence before it lends itself to self-assured judgment and interpretations” (Marder & Irigaray 2016:179^[1]). As Marder (2013:1^[1]) puts it, ‘plant thinking’ is “thinking without the head” in which the human is “de-humanized and rendered plant-like, altered by its encounter with the vegetal world”. Thus, engaging with vegetal life allows for humans to ‘think like a plant’ through the bodily and haptic. This allows for a co-creative engagement that disbands the anthropocentric divide between humans and plants, where activities with plants are given new insights that include a re-evaluation of their significance.

Similar to accessing flow-states, immersing oneself in ‘vegetal being’ includes engaging with plants in a way that is intrinsically motivated and receptive to sensory information with and about the natural world, without judgement. It offers a counter viewpoint to a more learned, scientific and cognitive understanding of plants which can be useful in engaging people of all ages and walks of life. We are interested in how these ‘vegetal’ (sensory) and ‘scientific’ (cognitive) ways of knowing can be linked together to help facilitate a connection with, and an understanding for nature.

Introduction to Refugium



Figure 1: Refugium, Federation Square, Melbourne, 2016. Photo by Nick Roux.

Using vegetal-relating activities to facilitate nature connection was the impetus behind the first Refugium¹ arts-science project, created by Beer at Federation Square in Melbourne in 2016. Responding to the City of Melbourne's Draft Urban Ecology and Biodiversity Strategy, the project explored biodiversity in the city through participatory art-making with native plants. The work employed the community in creating kokedamas² (a Japanese art-form using moss and string to create a living sculptural piece) that were temporally installed in the centre of Federation Square for The Light in Winter Festival (June 2016) – creating a 'bush refuge'

in the heart of the city (Figure 1). The aim of the project was to use vegetal-crafting to foster a collective re-imagination of Melbourne as an interconnected, regenerative, and resilient system³.

It was during Melbourne's Refugium that Beer first noticed how flow was activated through the kokedama making vegetal-crafting activity – one that required increased focus but was not overwhelming, and provided immediate positive feedback through the emergence of a beautiful artefact. This observation was reinforced by responses from the participants who emphasised the 'relaxing', 'peaceful', 'meditative'

¹ A 'refugium' is a scientific term that describes an area where environmental conditions (abundance of resources and suitable micro-climates) have enabled a species or a community of species to take refuge during unfavourable circumstances (such as adverse climates, fire or disease). This area, acting as a 'refuge' allows the species to recover, thus making the ecosystem more resilient to environmental changes. As an artist, Beer was motivated by the idea of creating a 'bush refuge' that celebrated ecological diversity and resilience as well as providing a sanctuary from inner city life.

² Beer chose a simplified version of the Japanese technique, which was inspired by her personal and professional connections with Japan and Japanese culture. Kokedama is a unique waste-free art-form which uses moss (or coconut husks) and bio-degradable string to substitute the need for a pot. The merging of Japanese culture and native plants also plays homage to Australia's layered history of Indigenous culture and multiculturalism – a focus of The Light in Winter festivities

³ A short 3 minute film of the project is available via <https://www.youtube.com/watch?v=QyDY4kKRX5U>

and 'grounding' qualities of the workshop⁴. Another feature that Beer noted was the eagerness of the participants to learn more about the scientific qualities of the native plants. These observations prompted Beer to seek out further possibilities to test the work, including examining how cognitive and sensory knowledge could be brought together to precipitate biodiversity understanding through flow-activities.

Less than a year later, an opportunity arose to take the Refugium concept to Perth (Western Australia/WA) as part of 2017 Propel Youth

Arts KickstART Festival. As a result, Refugium WA was designed specifically for Perth with a focus on celebrating its heritage as a biodiverse wetland. Hernandez was invited to co-lead the public workshops and impart valuable ecological knowledge to the participants during the plant-crafting activity. Together, our goal was to use the second iteration of Refugium to explore how Perth's unique climate could be communicated to the public through vegetal flow activities, thereby enhancing people's understanding of socio-ecological systems.

Perth as a biodiverse wetland system

The aim of Refugium WA was to draw attention to the importance of Perth's unique biodiversity history, including its wide variety of plants and animals. Biodiversity is intrinsic to the sustainability, health and wellbeing of our planet but also to our survival as humans (Babu et al. 2005^[9]; Sandifer et al. 2015^[10]). Perth is the capital of Western Australia and the fourth most populated city of Australia. The city was founded in 1829 with settlement initially limited by temporal wetlands to the north east of the area. However, by 1838, Perth had grown across five wetlands, a trend which has continued to expand the city over more than 6,000 km (Figure 2). It is estimated that Perth's urban expansion has resulted in 72% of the wetlands of the area being lost or in extreme degradation since settlement (Parks & Wildlife 2014^[11]). One of the factors driving the continued decimation of wetlands may be the historic lack of appreciation for them. The conviction that these 'unsanitary' and 'miasmatic' wetlands should be converted to more useful purposes is one that has largely prevailed Perth's trajectory since settlement (Black in Ryan et al. 2015^[12]). As the region experiences seasonal inundation, many areas still suffer from re-emergence of water, often in areas where it acts as a hindrance for local businesses.

Nonetheless, Perth is recognised as one of the 15 biodiversity hotspots of Australia (Department of Environment and Energy) and is also one of the 25 global biodiversity hotspots (Myers 2002^[13]). Perth's wetlands support a large diversity of aquatic flora and fauna, housing frogs, migratory birds and providing reliable sources of water for the wildlife, making it a priority area for conservation. According to Stenhouse (2004), in 1995, Dixon et al. estimated that there are 3,780 reserves scattered within Perth's metropolitan area and yet, because these reserves are generally small in size (~5oha) and highly fragmented (Stenhouse 2004^[14]), their presence can easily go unnoticed within the city. Thus, our impetus for Refugium WA was to use arts-science knowledge to bring attention to Perth's wetland systems as unique and beautiful biodiversity hotspots within the urban landscape.

To facilitate the plant-crafting activities, we chose five wetland plants (sedges) that were native to Perth. These included: *Carex fascicularis* (Tassel sedge), *Isolepis cernua* (Salt Marsh Bulrush),

Jun-cuskraussii (Sea Rush), *Meeboldina scariosa* and *Lepidosperma squamatum*. Our intention was to draw attention to the resilience of these wet-land species, including their ability to thrive in full sun exposure, tolerate high levels of salt, and withstand conditions of abundant rain-fall and drought as well as provide vital habitats for native fauna. These plant characteristics and others became the details for the scientific knowledge which was imparted to the participants throughout the 1.5 hour time-frame of the kokedama-making activities.



Figure 2: Perth's Wetlands: A) Australia's biodiversity hotspots. Blue areas represent the different hotspots with the red dot indicating Perth. Source Modified from Department of Environment, and Energy; B) Reconstruction of Perth's Wetlands by Ryan et al. 2015. The red line indicates explorer Fanny Balbuk's journey to the area; C) Pre-settlement wetlands are superimposed to show that they are now completely urbanised. Google Earth image of Perth in 2017.

⁴ A paper on the original Refugium project, "Refugium at Federation Square: the politics of participatory ecological artwork in public-private space" (Condliffe, Beer and Badham) is available in the forthcoming GPS journal.



Refugium WA research design



Figure 3: Participants completing the pre- and post-activity survey. Photo by Paul Sutherland.

The research design for Refugium WA was conducted as a pilot for testing ways in which nature-connection could be examined in participants using a mixed-methods approach. We were interested in how the act of vegetal-crafting could facilitate a hands-on connection with the more-than-human world. Referring to Freeman and Tranter's (2011^[5]) categories of 'nature experience', our study involved engaging participants in both 'direct' (through the vegetal-crafting exercise itself) and 'indirect' encounters with nature (via the scientific information conveyed by the kokedama teachers) during the workshops.

The workshops were conducted at a fully enclosed lab setting at Scitech – a science education facility devoid of outdoor views; thus, providing a stable environment where any change in the participants' experiences could be attributed to the botanical crafting exercise. A total of three 1.5-hour workshops were conducted with 53 out of 58 participants agreeing to partake in the research⁵. Five kokedama teachers were trained in both creative and scientific aspects of botanical crafting, facilitating the experience for smaller groups of 4-6 people and thus, enabling a more personalised activity to occur.

Indication of flow, biodiversity understanding, and increased nature-connection were measured by gathering observations of the participants, including collecting results from the pre- and post-activity surveys (Figure 3) to assess any changes in attitudes as observed by the participant. Questions were extracted from a series of index surveys, including the Nature Connection Index (Cheng and Monroe 2010^[6]), Nature Relatedness Scale (Nisbet 2009^[7]), EPOCH Measure of Adolescent Well-being (Kern et al. 2016^[8]), PERMA Profiler Measure for Wellbeing for Adults (Butler and Kern 2016^[9]) and Inclusion of Nature in Self Scale (Schultz 2002^[10]). The pre-survey of ~50 questions combined a five-point Likert scale (1= strongly disagree; 5= strongly

agree), a sliding scale (1-10), a mood spot-check ('how are you feeling right now?') and demographic information. The same post-activity survey also included open-ended questions to allow the participants to expand on their experiences and perception of native plants, as well as express future aspirations for engaging with nature. Table 1 summarises the measures applied for each variable.

Data Analysis

Once all the data was collected, we used the index surveys to calculate scores for wellbeing (as evidence of flow) and nature connection before and after the crafting activity. We then used the qualitative data to categorise nature connection into one of four stages: 1) increased awareness of nature, 2) desire of increased nature in the city, 3) ability to visualise or contextualise opportunities to increase nature in the city, and 4) the expression of action statements. Lastly, we applied a narrative analysis to reflect, interpret, understand and make connections between participants' responses in pre- and post-surveys, the conversations experienced by the kokedama teacher's and the researcher's observations (Clandinin 2007^[11]). The multi-level analysis allowed us to record key moments across the workshops whilst identifying re-occurring themes before and after the activities. Together with the surveys, our observations and conversations with the participants became the main vehicle for gathering data on the project experience. The scores were not analysed for their statistical significance, but rather, used as evidence to build the narrative discourse analysis.

Based on Beer's observations of the original Refugium project in Melbourne, we hypothesised that the plant crafting activity would trigger a flow state in the participants, as well as increased capacity for nature connection through enhanced vegetal experience ('direct' engagement with nature) and cognitive understanding

⁵ The research included a standard ethics process, whereby adult participants (or parents of child participants) signed consent forms which included permission to be photographed and filmed. To protect the participants' anonymity, survey responses were de-identified and thus, the photos in this paper have also been randomly selected and do not represent specific people discussed in the data or case study.



TABLE 1

Variables	Flow	Nature Connection
Indexes (quantitative data)	<p>A total of ten Linkert-scale statements were borrowed from the EPOCH Measure of Adolescent Well-being (Kern et al. 2016). Wellbeing was measured through five dimensions, including:</p> <ol style="list-style-type: none"> (1) optimism (“I believe things will work out”) (2) happiness (“I love life”; “I am cheerful”), (3) social connection (“When I have a problem, I have someone who will be there for me”) (4) engagement (“when I do an activity, I enjoy it so much that I lose track of time”) (5) perseverance, (“when I make a plan I stick to it”) <p>Questions inspired by the PERMA Profiler Measure (Butler and Kern 2016) included three questions focused on strategies to deal with stress (“I seek out creative activities when I want to relax”).</p>	<p>A total of 20 Linkert-scale statements were borrowed from the Nature Connection Index (Cheng and Monroe 2010) and the Nature relatedness scale (Nisbet 2009). The statements measured four dimensions of connection to nature:</p> <ol style="list-style-type: none"> (1) experience of nature (“When I feel sad, I like to go outside”) (2) empathy for creatures (“Taking care of animals is important to me”) (3) sense of responsibility (“People do not have the right to change the natural environment”; “My actions will make the natural world different”) (4) sense of oneness or relatedness (“Humans are part of the natural world”) <p>Additionally, the participants’ sense of ‘oneness with nature’ was measured using the Inclusion of Nature in Self Scale (Schultz 2002), a diagram presenting five levels of increasing identification with nature (See Figure.7)</p>
Open-ended questions (qualitative data)	<p>Mood spot-check: asking the participants to reflect on their current feelings. 15 words were provided, ranging from ‘stressed’ and ‘sceptical’ to ‘happy’, ‘peaceful’, and ‘exited’.</p> <p>Open-ended questions include: “What are you thinking about?”, “Describe how you felt making the kokedama”</p>	<p>Connection to nature was assessed across 3 different categories:</p> <ol style="list-style-type: none"> (1) Kokedama-nature perception (“How do you feel about your kokedama?”) (2) Understanding urban nature (“How has this activity made you think differently about nature in the city?”; “Has the activity encouraged you to seek out more opportunities to engage with nature?”) (3) Understanding native biodiversity (“What are your impressions of native plants?”)
Research observations	<p>Observations and conversations with the participants were collected via debrief sessions with the kokedama teachers via audio and video recordings, journal notation and photographs. These observations became the main vehicle for analysing enhanced social connection and immersion in the crafting activity, as well as evidence of flow and biodiversity understandings through conversations with the participants about Perth’s wetlands.</p>	

Table 1. Summary of variable measures

(‘indirect’ encounters with nature) as proposed by Freeman and Tranter (2011⁶). Professional limitations restricted us from following up with participants after the activity and thus, we were unable to determine how a short-term project could have an impact over time, particularly in regards to a person’s environmental actions. Therefore, the focus of our research design was to simply assess if the vegetal crafting activity could lead to increased nature-connection and biodiversity understanding within the 1.5-hour timeframe, including if it triggered any future aspirations for the participants⁶.

While our study aimed to adopt a holistic approach to data collection and analysis, our research design was largely used as a pilot for testing new approaches across arts-science methods. Thus, it was subject to limitations and bias which may have impacted the outcomes of the study, particularly in regards to our recruitment strategy, data

treatment and resource limitations. For example, the self-selected participant recruitment strategy (conducted via youth festival promotion) attracted participants who already had a keen interest in botanical crafting, and thus, tended to have higher levels of nature connection than the general population. Another limitation was the lack of a ‘control group’ to rigorously assess the potential of arts-science plant-crafting activities in facilitating nature-connection and understanding of biodiversity. A study containing a comparison between our integrated arts-science activity and ‘scientific only’ presentations of Perth’s biodiversity or kokedama-making without scientific input would have provided a stronger indication of the relationship between the sensory experience of botanical crafting and the cognitive knowledge transfer. However, due to the pilot study nature of the project, only limited resources were allocated to the research which did not allow for a control group to occur at the time.

6 For example, we considered any ‘action statements’ as the ‘intention to take action’ and viewed this as a positive result.



The vegetal-crafting activity



Figure 4: Participants immersing themselves in the vegetal crafting activity. Photos by Paul Sutherland.

The vegetal crafting activity began with the participants engaging in 'plant thinking' as sensory exploration. Closing their eyes, the kokedamas teachers took the group through a meditative process of 'vegetal exploration', "of immersing oneself in the experience of (and with) plants" (Marder and Irigaray 2016:164⁶¹) by touching and smelling the sedges provided (Figure 4). The workshop then continued with an intellectual discussion of Perth's ecological con-

text as the participants crafted a nest of moss and/or coconut husks around their plant. As the participants gently wrapped the string around their plant spheres, the kokedama teachers spoke of the importance of biodiversity in facilitating resilience in a crisis (e.g. a disease, a flood or drought) and the importance of forging a notion of sustainability built upon the reciprocity of more-than human relationships.



Figure 5. Final installation of Refugium WA. Photo by Paul Sutherland.

Our intention was to draw the participant's attention to the sedges they were holding, as living objects of great value that can offer a safety net in times of uncertainty. We also invited people to think about how they could take part in regenerative sustainability by increasing the urban ecology of their own gardens. In summary, there were three key messages that we hoped to convey to the participants through the process of 'crafting sustainability': 1) an increased appreciation for vegetal matter; 2) a greater awareness of the importance of native plants for Perth's resilience, including their aesthetic value; and 3) an improved understanding of the need to encourage the propagation of native plants for a resilient future.

By incorporating both cognitive and sensory knowledge into the botanical crafting activity, we sought to create an opportunity for participants to forge a hands-on 'direct' connection with their plant-sculptures while also learning about the scientific concepts that related to its importance. As the groups became absorbed in the activity, we observed how their postures became more relaxed and a sense of ease and satisfaction washed over people's faces – there was a general sense of the participants becoming more focused and engaged. In handing over their plant-sculptures for the exhibition, participants expressed an enormous sense of pride and achievement in their work. What was created out of the workshops was a diverse assortment of kokedamas in all sizes, shapes and wrapping techniques – a wonderful depiction of 'the many hands' that shape a community. A few days later, the kokedamas were installed at the First Edition Café at the State Library of Western Australia with an invitation for participants to collect their plant-sculptures at the end of the week (Figure 5).

Results

Overall, 53 participants agreed to participate in the research project. This included: young adults between 18-25 years old (49.06%); participants aged 12-14 (13.21%); participants under 12 (9.43%); 15-17 years (9.43%); 26-35 years (7.55%); 36-45 years (5.66%); and 46-55 years (3.77%). Other demographic data highlighted that participants were mostly from English speaking backgrounds (84.91%), lived in metropolitan Perth (75.45%), and were female (66%).

Based on self-reported feelings (mood spot-check), it could be proposed that 96.5% of the participants engaged in flow. Many noted how the activity allowed them to be interiorly focused on the task at hand, while others found that the activity opened them up to conversations with the other participants around them, many of whom were strangers (Figure 6 a-b). Our data revealed that the wellbeing score was very high both before and after the activity (44 and 45 out of 55 points respectively). This shift was equivalent to 1.65 higher after the botanical crafting activity, and further evidencing the potential for crafting activities to improve wellbeing (Table 2). However, it is important to highlight that we did not assess the statistical significance of this shift as the results are only relevant to

the participants of this study, and therefore, cannot necessarily be extrapolated to other groups.

Similar results were found when calculating the nature connection score. Table 2 shows an increase in nature connection equivalent to 1.03 points based on the Nature Connection Index and 0.3 based on the Inclusion of Nature in Self Scale. Upon further comparison of before and after responses to the Inclusion of Nature in Self Scale it was revealed that a total of 30% of the participants experienced an increased connection to nature. The shift occurred mostly through participants experiencing 'one-degree' increase (i.e. shifting from C to D) with 4% showing a two-degree increase in their connection to nature (i.e. shifting from C to E). These shifts towards a higher sensation of oneness between the participant and nature resulted 30% of the participants identifying themselves as part of nature compared to 20% of the participants at the beginning of the activity (Figure 7). However, not everyone experienced an increased connection with nature. In fact, 66% showed no change at all, while 4% had a negative shift of one degree (i.e. from C to B). For some, we identified that this was because they already felt connected to nature.



Figure 6: Indication of Flow during the vegetal crafting activity: a) participant engaging in an introspective flow; b) Participants actively chatting and becoming more socially active.

TABLE 2

	Max Score	Baseline	After the activity	Shift
Wellbeing Score	55	44.11	45.76	+ 1.65
Nature Connection Score	105	85.65	86.69	+ 1.03
Inclusion of Nature in Self Scale	5	3.56	3.86	+ 0.3

Table 2: Shifts in wellbeing and nature connection pre-and post- the botanical crafting activity.

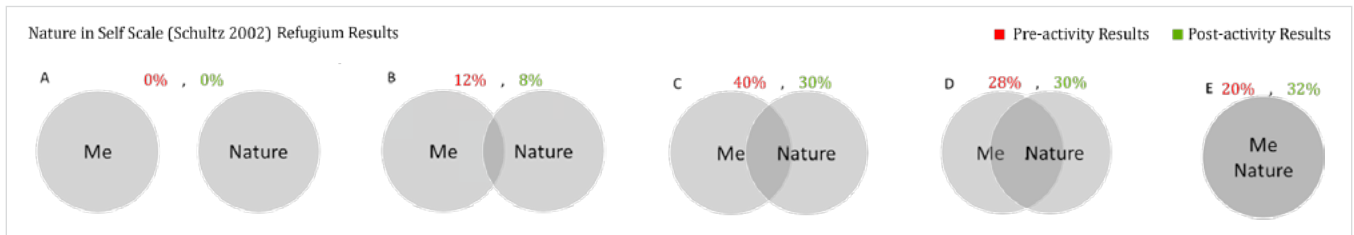


Figure 7. Nature in Self Scale (Schultz 2002)

Nevertheless, the short-time frame of the activity and restrictions in data collection made it difficult to assess the authenticity and depth of the 'nature-connection' experienced in the participants.

As highlighted above, the enclosed room of SciTech, allowed us to observe how the plants could serve as a medium for connection to ecology or 'nature' without the presence of the outside world. This meant that the value of 'spending time with nature' was reduced to the experience of the participants' engagement with the native plants. However, as the kokedama teachers were associating the

plant-crafting activity with broader ideas of ecology, it was hoped that the participants would connect their experiences with the wider world. While the concept of 'nature' was discussed as one that was about crafting ecological connection in the workshops, we acknowledge that the term 'nature' has many meanings and interpretations and thus, the participants' own understanding of nature cannot be differentiated as part of the analysis. This discovery was also observed through two case studies that we use below to illustrate how nature-connection was experienced subjectively amongst participants.

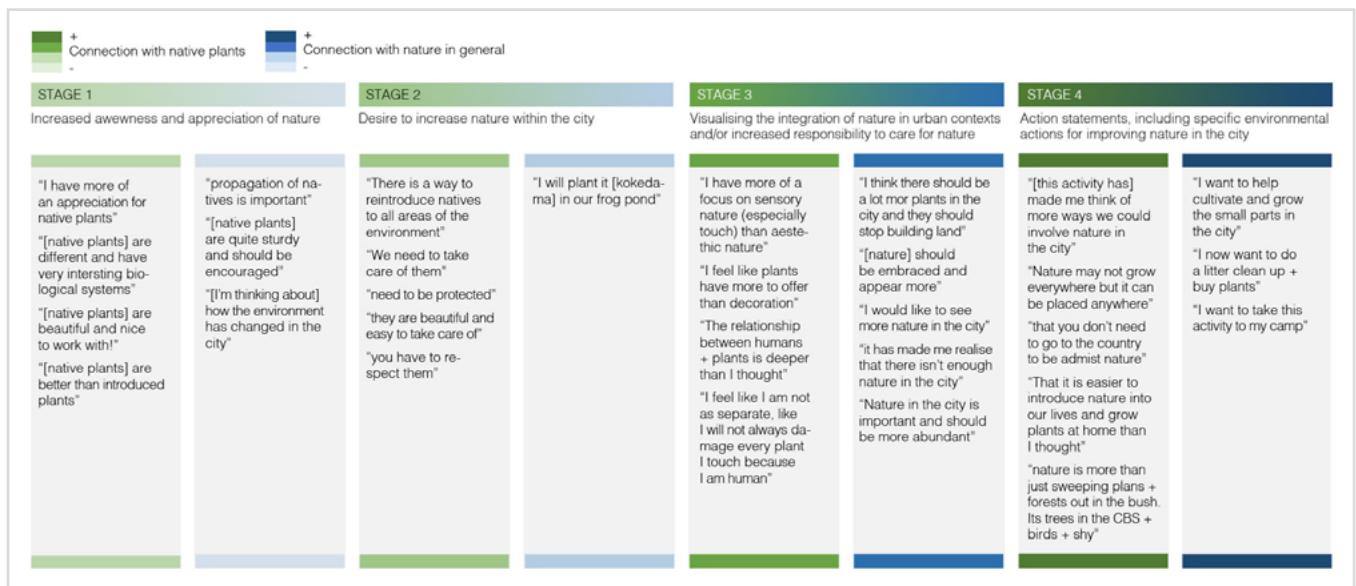


Figure 8. The trajectory of increased nature connection

Case study one: Andrew*

Andrew* reluctantly attended the crafting activity, claiming that he had only agreed to participate on his friend insistence. Despite his hesitant start, Andrew soon became immersed in kokedama-making process, describing his state as "fully absorbed" in the pre-activity survey. The kokedama teacher observed how through the group's collective engagement, Andrew increasingly opened up to the activity and the social interactions that occurred around it. Through their conversations and appreciation of each other's crea-

tivity, there was a definite sense of the group focusing in on the activity collectively and experiencing flow together. Conversations opened up as discussions occurred around the artistic choice of coloured string and integration of cocohusks and moss, as well as the attributes of the plants themselves (Figure 9).

In his pre-activity survey, Andrew expressed a strong disagreement to the statement "I enjoy digging in the dirt with my hands", which

* denotes name change to protect anonymity of participants. Andrew* and Kate* are not the participant's real names.



Figure 9. Community flow. Photo by Paul Sutherland. Disclaimer: photo chosen at random and does not necessarily portray the case study participant.

Case study two: Kate*

Similar to Andrew, Kate* was invited to attend the workshop through her friend. Coming from another event, Kate arrived 15 minutes after the workshop had already started and therefore, indicated in her survey that she was feeling 'stressed' and 'anxious' at the beginning of the activity. Her pre-activity survey results also revealed that she was also feeling 'sceptical' about the workshop and thus, may not have expected to experience any changes in her mood. However, soon after she began the botanical-crafting activity, the kokedama teacher noted shifts in her temperament, with each stage of the workshop experience leading to her appearing more relaxed. As indication of flow, Kate reported feeling 'optimistic', 'confident' and 'amazed', 'reflective' and 'empowered' in the after-activity survey. Describing nature as a 'healing therapy', Kate stated that her biggest learning experience from the project was the importance of remembering how nature can make you feel more connected, mindful and present in the moment.

According to the Inclusion of Nature in Self Scale (Schultz 2002^[9]), Kate's post-survey results demonstrated that she experienced one of the largest shifts in 'nature connection' in comparison to the other participants in the study. This scale demonstrated her moving from a close but separate identity between herself and nature to perceiving herself as part of nature (from C-E in the scale, see Figure 7). As one of only two people who included an action statement in their survey, Kate's transition was also revealed through her conversations with the kokedama teacher and her desire to replicate the plant-crafting activity at her upcoming youth camp as well as organise a litter clean up. Her keen interest to surround herself more with plants was also witnessed when Kate turned up at the State Library Café at the end of the week to pick up her kokedama (Figure 10). As she indicated in her survey, "I

he then shifted to 'strongly agree' at the end of the activity. While conversations with Andrew demonstrated that he already had a strong awareness of nature in the city, his post-survey revealed his increased appreciation for native plants, commenting that they are not only "beautiful and smell nice" but also that "nature can be very engaging and peaceful to work with". In one of his post-survey answers, Andrew wrote, "nature is more engaging and fun than I thought", potentially revealing how his initial reluctance to the plant-crafting workshop was overcome by the task at hand. At the end, Andrew circled the words 'empowered' and 'reflective' in the mood spot-check exercise of the survey. This reinforced our own observations of his transition through the workshop, as one of 'reluctance' or 'disengagement' to one of 'openness', 'enthusiasm' and 'commitment'. Overall, our results revealed that while Andrew already appeared to have a high level of connection to nature; there seemed to be a definite increase in his appreciation of native plants through the flow activity.

will pick it up because I would love to watch it grow and nurture it and look after it".

Overall, the case study may have revealed the clearest development in a participant within a short time-frame. For example, we could propose that from her initial state of disengagement, Kate engaged in flow which allowed her to experience mindfulness, this, in turn, enabled a stronger connection to nature – moving from stress, to flow, to the potential of eliciting ecological action and ripples beyond the project. Kate's action statements, supported by shifts in the survey, indicated that she was able to perceive her ability to positively impact the planet through the botanical crafting activity, which in turn, reignited her connection with nature.



Figure 10. Collecting kokedamas at the end of the exhibition. Photo Paul Sutherland. Disclaimer: photo chosen at random and does not necessarily portray the case study participant.

* denotes name change to protect anonymity of participants. Andrew* and Kate* are not the participant's real names.



Discussion

While the pilot research design presented limitations in our capacity to accurately generalise the outcomes of the project and its effects on the participants, there were some notable observations that are worth considering. Firstly, the biggest shifts were examined in participants who had attended our workshop unexpectedly or with little prior knowledge of what would be involved. This may suggest that flow activities may have the largest impact on those that do not anticipate its effects. Alternatively, creative tasks precipitating flow may also have the capacity to open up attitudes to subjects that are outside of one's current interests. As Kaplan posits, participating in creative activities "satisfies something deep within us" (1999:76^[9]), opening up new receptors and experiences that can take us by surprise. For example, both Kate and Andrew indicated an initial reluctance to the plant-crafting activity which was overcome by becoming immersed in the task at hand. For Kate, experiencing flow through vegetal crafting may have been a way of letting go of personal stress and rekindling her connection with nature. For Andrew, experiencing the group's collective sense of flow could have allowed him to be more open and receptive to receiving scientific information.

According to their survey responses, Kate and Andrew appeared to reach different stages along the nature connection trajectory, particularly in regards to their perspectives of native plants. For example, while Andrew's survey results depicted that he had only progressed to stage one along the trajectory ('increased awareness and appreciation of nature'), his comments included an appreciation for native plants and their importance for biodiversity

Conclusion

This paper has examined how activating flow through vegetal crafting can offer new strategies for arts-science communication that can connect people to the importance of biodiversity in urban spaces. As explored in Refugium WA, art-making with plants can provide an opportunity to engage in flow, opening up optimal experiences for taking in new knowledges that include the intellectual, kinaesthetic, olfactory and somatosensory. This can provide potential for positive social interactions, increased perceptions of human-nature relationships, better awareness of the value of plants, as well as a greater confidence in the ability to positively contribute to the life-enhancing capacities of local communities and environments for a regenerative future.

Nevertheless, we acknowledge that there are limitations to determining the effectiveness of short-term research projects of this kind and the transferability of the study, particularly in regards

– thereby fulfilling both categories. As stated above, the group's lively conversations during the flow activity may have made Andrew more open to taking in the scientific knowledge that was imparted during the activity. In Andrew's case, the act of 'making together' appeared to be integral to his experience of flow and perceived nature connection. This may also suggest that activating flow in one person can help precipitate flow in another.

By contrast, Kate was one of a handful of participants who reached all four stages of our proposed trajectory – including indication of her 'intention to take action' (stage 4). Csikszentmihalyi (1990:3^[10]) explains how flow enables one to feel "in control of our actions, masters of our own fate". As flow merges cognition, motivation and emotion, we suggest that these experiences may lead to participants feeling greater self-worth and higher levels of concentration. For example, based on Kate's survey results, we could assume that her journey was more inwardly focused than Andrew's – one that was more engaged with 'vegetal being', which emphasised her own relationship with nature rather than scientific understanding⁷.

While both case studies demonstrated some evidence of how flow inducing vegetal activities can provide an opportunity to connect with nature, we also acknowledge that this experience can differ greatly amongst participants. The degree of nature-connection facilitated through the vegetal-crafting activity itself is also difficult to assess as it cannot easily be extrapolated from an individual's pre-existing understanding and experience of nature. This presents an important consideration for future research.

to how vegetal crafting can propagate long term impact. While this consideration is likely to influence the research design of the next iteration of Refugium, indication from the literature suggests that flow's positive and pleasurable characteristics may influence participants to engage in vegetal activities in the future (Chilton 2013:64^[11]). As Nakamura & Csikszentmihalyi (2002:95–96^[12]) contend, "experiencing flow encourages a person to persist at and return to an activity because of the experiential rewards it promises, and thereby fosters the growth of skills over time". This implies that there is potential for plant-relating activities (such as kokedama-making) to play a role in assisting communities to engage more with scientific concepts on a more personal level. For example, the inclusion of sensory knowledge through vegetal crafting could be a useful strategy for engaging children and people of mixed intellectual abilities in sustainability education.

⁷ This is not to say that Kate did not register the scientific information. She may simply have chosen not to include it in her survey. However, this omission can also be interpreted as one that which is less important to her.



At the heart of Refugium WA was the investigation of alternative narratives for (re)connecting urban communities to ecological themes and practices. Sustainability issues are intrinsically social and any hope of changing people's hearts and minds requires breaking down cultural and social boundaries that reinforce nature-human dichotomies. Crafting together can allow groups to make meaningful and connections, form collective identities, which in turn may assist communities in tackling ecological and social issues more collaboratively (Beer 2017^[1]). As writer Hannah Van Den Bergh contends, creativity's value is in its ability "to tap into a different instinct, rationale and emotion than political rhetoric, corporate sales-patter or even scientific data (2015:3^[1]). We propose that vegetal crafting has the capacity to engage people of all walks of life in environmental projects – people who might not immediately

identify themselves as being devoted to sustainability, but through the act of being creative and engaging with flow may find themselves suddenly entwined in the process. Here, the notion of 'crafting sustainability' through kokedama-making is seen as one that actively fosters reciprocal connection of more-than-human relationships through the hands-on co-creation of a thriving future.

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