

The Lions' Gate

Towards a Permaculture-inspired Blended Space

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ABSTRACT

In light of the devastating ecological effects of climate breakdown and with human well-being under severe stress, this paper presents The Lions' Gate - an in-development, urban, interactive permaculture project on-campus in Edinburgh, Scotland. We argue that to address limits to computing, a radical framework is needed. We position permaculture as an alternative to the economic growth model, and it's associated temporal controls. Our work is an attempt at shifting our *thinking and doing* by employing a blended spaces perspective to permaculture, university campuses and digital media. By starting from a permaculture view we have the ecological and ethical tools to practice alternatives to growth. As far as Sustainable Interaction Design (SiD) is concerned - in today's climate, actions must ultimately speak louder than words.

CCS CONCEPTS

H.5.1 Multimedia Information Systems • H.5.2 User interfaces • J.4 Social and Behavioral Sciences

KEYWORDS

permaculture, blended spaces, sustainability

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1 Introduction

"It is a civilizational wake-up call. A powerful message—spoken in the language of fires, floods, droughts, and extinctions—telling us that we need an entirely new economic model and a new way of sharing this planet." [30]

This work views humankind's plunder of the natural world, it's hand in climate breakdown, shrinking wildlife refuges and global heating as a given [2], constituent parts of the same problem – humanity's disconnect from the natural world [18].

At root of much of this is a laissez-faire economic system based on ideas of never-ending growth - with humans central to all experience. However, resources are finite and we are but one form of life amidst a dwindling and degraded abundance of flora and fauna. Our physical and cognitive distance from the living planet has been hastened by technological innovation. Yet, as this late-capitalist system lays barren the living planet, our well-being declines, and our inaction (perhaps unintentionally), vastly contributes to polluting that which sustains us. It is mindless, this ecocide [20], and in order to address it we must transform ourselves, our intentions, our designs.

Considering this, the over-arching goal of the *The Lions' Gate* project is to embed *permaculture* as a research framework within the superstructure of the university, across schools and professional services so as to make a fundamental shift in thinking toward addressing human and planetary wellbeing.

Permaculture is a solutions-focused, ethical and principled systems approach. It is observational, empirical, socially enquiring, economically radical, internationally prevalent, practical, and action-oriented, but fundamentally it is concerned with embedding ourselves in the natural world so Nature can teach us how to live in harmony with the planet's fragile ecosystem, produce abundance, and perhaps lead us beyond the ecological and health crises we now face [3, 23, 24, 26, 47, 48].

Is it not the case that universities are ideal loci for transitioning to sustainable institutions? In terms of permaculture-inspired blended spaces – by discovering correspondences between on-campus physical and digital spaces and considering their ecological impacts, The Lions' Gate has already made progress with action-oriented sustainable interaction design interventions within and out-with the *living planet blended space* we're developing at the university.

2 Background

“Glance at the sun. See the moon and the stars. Gaze at the beauty of earth’s greenings. Now, think.” [8]

Rising to the challenge of Braungart and McDonough’s classic text on ecological design - *Cradle to Cradle, Remaking the Way We Make Things* [8], as interaction designers we turned to *blended spaces* [4] as a way to generate ideas, conceptualise designs and integrate a digital layer within the natural world to discern how a sustainable interaction design [9] could be realised.

Blended spaces are places where virtual and physical worlds are intentionally melded in a manner that produces experiences of a particular quality. This perspective utilises ideas from conceptual blending [15] to generate designs that provide a sense of presence [4], where content (media, things, data) can be directly acted upon. It is argued that the complexity underlying blended spaces can be simplified by utilising *material anchors* [27] - physical artefacts that aide, learning, understanding and take-up of complex and abstract phenomena.

Moreover, what is needed at the core of work defending the living planet and addressing human wellbeing, is an action-oriented sustainable design framework that is radical, practical, self-empowering and works at all scales of development from the self to the many, and this work argues that permaculture is just such a design system [23, 24, 38, 45].

3 Permaculture experiences

“The revolutionary nature of permaculture in reclaiming barren areas is illustrated by the case of the solitary shepherd Elzeard

Bouffier, in France who carried a bucket of acorns as he wandered in a deforested landscape, planting each seed with an iron-tipped staff. He succeeded in creating a forest of 40 square kms. Birds re-occupied the region, and brought in seeds of other species. Rivers began to flow as the humus retained run-off moisture, and villages, long deserted, were again occupied by some 10 000 people.’ [38]

One of our first research experiments in using permaculture as a foundation for sustainable interaction design and user experience (UX) [13] was at the Scottish equivalent of the Chelsea Flower Show - Gardening Scotland 2017. The main objective of our exhibit at this event, *Permaculture Experiences*, was to gain an understanding of the relationships between user-experience (UX) [22] and permaculture. We built a portable garden, demonstrating the layers of a food forest and augmented it with an interactive

digital layer that interpreted the symbiotic relationships of companion planting for festival attendees (we actively engaged around 100 people). Other aims were to provide insights as to how digital media development could support the need for people to live and work in more ecologically conscious ways and how UX design could become more sustainable or encourage users to think and act more sustainably. In this respect, it was an attempt to produce sustainability both in and through design [37].

Our method of development for *Permaculture Experiences* employed a *makers* approach [21] to understanding permaculture and its relationships with UX in both physical and digital spaces. The work utilised ideas from Fauconnier and Turner’s blending theory [15] to generate conceptualizations of ecologically effective sustainable interaction design (SID) spaces. We employed material anchors to ground complex ideas of ecological sustainability within augmented physical gardens [13, 14]. These acted as digital way-finders for people to navigate through the physical space.



Figure 1 ©Richard Thompson: Augmented Reality (AR) material anchor from Gardening Scotland event

Material anchors were used to indicate areas of digital interactivity within the space. The technologies at these anchor points allowed people experiencing the garden to access suitable content — video, audio and animations, three content examples readily available in people’s digital lives that are trusted modes of communication.

Permaculture Experiences formed a useful case study for a number of reasons. For example, the use of blended spaces, which act as a response to the blurring of physical and digital space is key to helping users visualise their impacts both negatively and positively on ecological environments. Benyon [6] has proposed the concept of a blended space “where a physical space is deliberately integrated in a close-knit way with a digital space”, as being an important tool for learning. Blended spaces have new properties that emerge from the particular combination of physical and digital, creating a new sense of presence and leading to new ways of interacting, as well as novel user experiences [4]. The main principle of blending theory is that people come to know

things through making projections from two mental spaces in different domains that share a part of their structure with a more generic domain. The projections from the input spaces create new relationships in the blend that did not exist in the original inputs [13]. How this affects real world interactions and behaviours is important to this research project as it demonstrates how two spheres can unify to create more meaningful experiences for users.

Benyon [4] discusses how the extensions provided by the digital space enable users of the blended space to reach out past the limitations of the physical space and hence to extend people's sense of presence [28]. This idea of 'reaching past our limitations' is particularly important especially when we are dealing with abstract or intangible concepts such as climate breakdown or our own personal ecological impact.

Whilst the main objective of this work was to gain an understanding of the relationships between UX and permaculture the wider lessons learned have been influential. It could be possible to take the idea of a physical space and subsequent experiences, that incorporates designed objects, and add layers of digital meaning to turn unknown intellectual areas of understanding into spaces of communication and interaction that benefit users.

Due to the speculative context of *The Lions' Gate* project [32], it is possible to envision more complex interactions in the future that exploit the ideas of blended spaces in designing physical and digital layers together to create blends that demonstrate emergent properties and new modes of experience in both the physical and digital world [5].

4 Conceptualising The Lions' Gate

"Though the problems of the world are increasingly complex, the solutions remain embarrassingly simple." [38]

With the above in mind, we return to how a sustainable interaction design can be realised in order to address concerns about the negative impacts of never-ending economic growth [39]. We posit that a radical alternative framework is needed to address the material and cognitive malaise of our times. We suggest that, from close experience of and training in it, *permaculture* [23] is a wide-ranging and transformative perspective that fundamentally attends to these concerns. Permaculture [46] is about intentionally living according to ethics that put care of people and planet centre, but also it provides a set of design principles for guidance on how to achieve these ends. As the t-shirt says, permaculture is 'revolution disguised as gardening'. We argue that blended spaces are an appropriate medium for ushering in this design revolution.

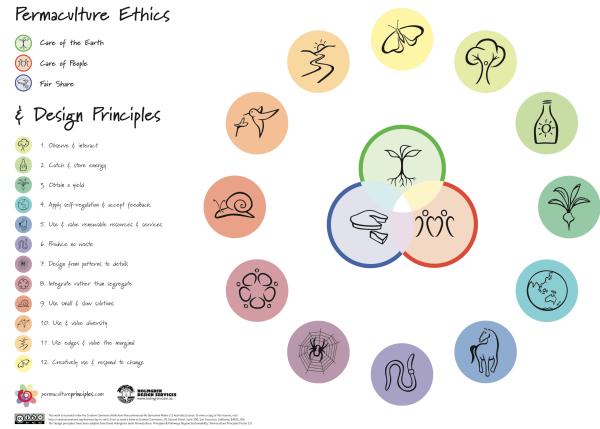


Figure 2: Permaculture ethics and principles from David Holmgren's *Permaculture: Principles and Pathways Beyond Sustainability*.

Image courtesy of David Holmgren and Richard Telford (<https://permacultureprinciples.com/about/>)

We suggest a fundamental shift is needed in the patterns and associated actions of our post-industrial lives – mindfully producing and procuring, engaging ecologically with the types of services we use and provide, holistically responding to environmental issues, and in the ivory towers of academia – aligning the goals of our research with the major concerns of our age, as detailed by the UN's Sustainability Development Goals (SDG's) [45].

Specifically, work on *The Lions' Gate* is focused on achieving an action-oriented sustainable interaction design. The context for this is an urban university campus in Edinburgh, Scotland, situated at latitude: 55.933334, and longitude: -3.212618, approximately 110 metres above sea-level, and sat upon an enormous chunk of basalt.

If we start our thinking process with permaculture as a guiding sustainable framework and then, as interaction designers involve digital media and the campus grounds in our ideas, utilising a blended spaces perspective, we know our comprehension can be aided by a conceptual diagram.

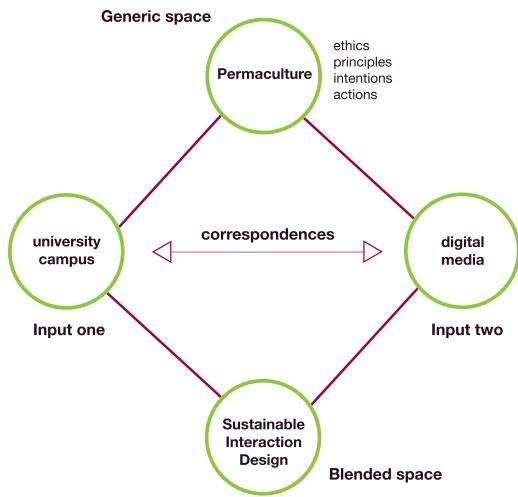


Figure 3: The Lions' Gate - conceptual blend for Sustainable Interaction Design.

To begin with we have a generic space, in our case the permaculture framework. This acts as an influencing force on all the subsequent work we're trying to do. We need to know all about it, the objects and agents within it, its characteristics; ontology, ethics, principles, intentions and activities.

We then consider a new input – what the actual physical spaces available to us on The Lions' Gate project are – in our case a low rooftop with a thin strip of land adjacent to it, close by the canteen, and a disused library courtyard. Some initial questions might be; how do people move around these spaces? What are the weather patterns/microclimates? Who are the gatekeepers? Why are the spaces derelict? Where do the spaces fit into the university estates strategy? When are the spaces available to people?

Our second input is a digital space consisting of the technology we put into the physical space (as often as possible upcycled); microclimate sensors, data and power feeds, solar panels, Raspberry Pi's, Arduino boards, actuators, and more broadly an Internet of Things. But also, there's the technology scattered throughout the campus, in peoples' bags and pockets and embedded within the infrastructure of the university – Wi-Fi networks, screens, printers, research equipment, junk technology etc.

Currently, we're grappling with these enquiries, but as will be seen later, we've travelled some way in understanding how a sustainable interaction design [31, 42] could be realised.

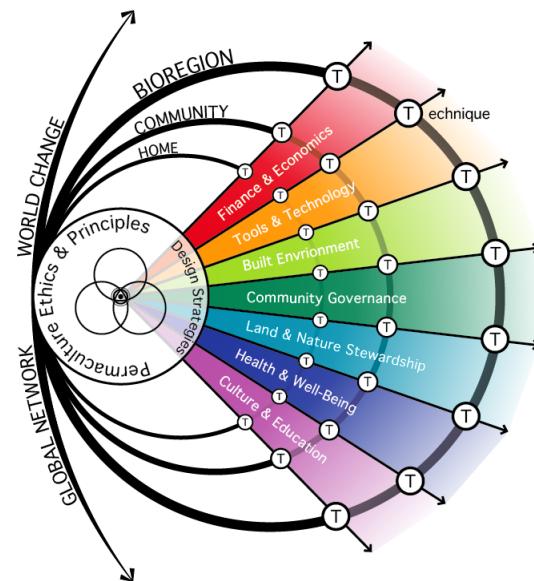


Figure 4: Permaculture's integrated, wide-ranging approach.
Image courtesy of Alex Vincent
(<https://www.quailsprings.org/about-us/our-team/alex-vincent>)

5 The story so far...

“Permaculture is the art of the possible.” [3]

The Lions' Gate has reached a number of key infrastructural, social, cultural and academic milestones. For example; power and data feeds have been supplied to both sites, as has plumbing. Wi-Fi connectivity has been boosted, a poly-tunnel and raised beds erected on the rooftop allotment. Seating and tables are spread throughout the sites. Tools and safety-wear have been purchased for participants. Compost heaps initiated and tonnes of top-soil, compost, manure, and sand mixed and added to an impoverished soil [36, 43]. A food forest demonstrating permaculture guilds has been planted. Water harvesting systems, solar kits, seeds, fruit and nut trees and herbaceous plants, a pond, a staging area for performance, and an outdoor classroom are all in the process of being built into the holistic design. A major concept that is in-development is the *digital bothy* – a co-designed and built green-building inspired by traditional Scottish shelters found in the mountains – ours will repurpose unused technology from the School of Computing, such as two 50-inch touch screens.

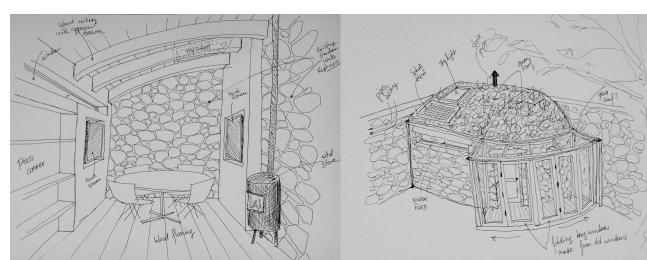


Figure 5 ©Marie Dubaille: *The Digital Bothy – interior and exterior sketches by volunteer Marie Dubaille*

Further to these activities, we've written a volunteer policy and its associated documentation and have amassed an email database of nearly 70 volunteers. We run drop-in sessions twice a week.

In little over 18 months the project has generated around 50 student projects from MSc Computer Science, MA Interaction Design and 3rd Year BSc Computing classes. Project topics range through and beyond; solar-powered hyper-local Wi-Fi and Bluetooth Low Energy (BLE) networks, conceptual AI deep-learning interactive garden installations that translate hopes and dreams into new creations, and Augmented Reality (AR) games based on the lifecycle of bees. Moreover, our first MSc thesis “*Symbiosis of Digital and Environmental Artefacts in Blended Spaces Using Permaculture Design as a Framework*” was completed with Distinction in August 2018.

The Lions' Gate has amassed around 1200 engagements from within and out with the university, and approximately 250 visitors have experienced a detailed tour of the project sites. In November 2018, we won an award from a Royal Horticultural Society sponsored organisation for our attempts thus far to transform derelict land into semi-abundant green spaces via local community activities. We've also grown a diverse range of produce for the university canteen – the first shoots of a university circular food economy.

Our project is elementally interdisciplinary and has enjoyed input from Properties & Facilities – funding and groundworks, the School of Applied Sciences – soil sampling and analysis, Occupational Health – utilising the gardens as loci of well-being research, Engineering and the Built Environment – support with sustainable building ideas, the Business School – strategy and development, and Procurement – conversations about sustainable purchasing.

Furthermore, a local Permaculture Community Classroom group now utilise the university for their meetings; we've been awarded LAND (Learning and Network Demonstration) certification by the Permaculture Association - opening our sites up to travelling permaculturists, and; we have digital presence via a WordPress blog [32], Twitter stream [33] and Instagram feed [34].

Recently, the university library introduced a Lions' Gate bookcase populated with inspirational texts on *doing* sustainability and with the works of the late Professor of HCI David Beynon, sat alongside key interaction design texts from his office bookshelves – physically and theoretically associating the fields of sustainability and HCI/interaction design.

We're now in a position to develop particular instantiations of permaculture-inspired digital interventions; some playful, some scientific, some focused more on interaction design – all

cognizant of the environmental impact they have and asking questions about materials, wellbeing, the ethics of seemingly never-ending growth. They are examples of material anchors that demonstrate both blended space and permaculture, with the hope that in their making we learn how, at least in some respects, to practice sustainable interaction design.

Building on the knowledge gained from *Permaculture Experiences at Gardening Scotland 2017* we propose two further projects that we'll be working on over the next year.

6 Gamification of permaculture

“I wonder how it is that people's philosophies have come to spin faster than the changing seasons.” [17]

Firstly, an *Interactive Permaculture Trail*. Applying a blended spaces methodology, the plan is to utilise Augmented Reality (AR) software to design an accessible, treasure-hunt game/interpretation system to increase engagement with permacultural ideas and the *whole systems* approach. This idea grew out of an early conversation with Permaculture Association CEO Andy Goldring, about democratising permaculture via a game akin to *Pokemon Go*. On our trail, 15 specific areas of The Lions' Gate will have ‘material anchors’ designed for them, that register as touchpoints for an AR app. These anchors will be fairly simple physical structures that recognition software can identify easily, perhaps a wellington boot, or a trowel, or a watering can. Each anchor will demonstrate digitally a principle or ethic of permaculture. Alongside content interpreting permaculture will be other *things* (both digital and physical), for example, each area will have an indigenous plant associated with it, and digitally have its lore associated. Further augmentations could be – recipes, actions to address climate breakdown or information about the UN's Sustainable Development Goals (SDGs) [45]. On completion of collecting all 15 anchors the game will send an email to the game-master, who provides the player with a prize, e.g. a plant, some seeds, or some produce. Importantly players will take away a digital record of their experience, enabling them to apply the gained knowledge in their own lives.

The second project involves an interdisciplinary team, consisting of interaction designers, an electrical engineer, a cultural commentator and a craftsman-in-wood, currently in the process of co-designing and building an interactive Platonic storytelling chair.

7 Interactive Platonic Storytelling Chair

"The greatest wealth is to live content with little". [Plato]

Plato originally taught in an Athenian garden. The root of the word academy is garden. On learning this it seemed we had an opportunity to build a useful blended space artefact on-campus, that would bring teaching back into natural surroundings but with an ecological techno-twist. To some extent playing with a sub-narrative of our project *Ancient-Futures* – blending rich and useful knowledge from the past with a re-imagined sustainable, technological future [40].



Figure 6: Interactive Platonic Storytelling Chair – basic structure in reclaimed oak by Neil Fyffe

The interactive chair is capable of communicating with a wider audience. In 1972, William O. Douglas wrote – ‘*a ship has a legal personality, a fiction found useful for maritime purposes*’ [12]. The fictions that humans attach to non-human actors can be incredibly useful when considering how we can be more sustainable in our approach to design.

As opposed to considering an object that functions as part of a network we can imagine whole ecosystems. For example, in 2012 the Whanganui River in New Zealand, was legally granted personhood [16]. So, it could be with respect to gardens, groves of trees or even air that feels the destructive pressures of technology and modern human life. Our intention is to design a chair for the garden that can function as a useful non-human actor within the blended space.

When the above cases are compared, it may be posited that the rights and freedoms of a being are not limited to its physiology, its biology, consciousness or even its level of sentience. A river and the ecosystem it sustains is capable of reacting to environmental changes/stimulus over time. Similarly, we want the chair to be reactive through being connected to the internet and various social networks. It can inform the wider public of what is happening in the garden at different times of year with regards to growth or pollution. We hope to develop this further so that eventually the

chair will search for hashtags (for example #permaculture) and then invite those talking about these topics to visit the garden and perhaps become a raconteur in the chair. We hope to give the chair a loose personality and a set of research interests that allow it to be semi-autonomous encouraging a less anthropocentric outlook within the garden space. In time, we hope that the chair will be able to search for book titles or articles (using key words) that are linked to its research interests and then request those titles to be ordered for the university library, thus the chair and in turn the garden becomes an active part of a conversation and the wider institution.



Figure 7 ©Richard Thompson: Interactive Platonic Storytelling Chair – concept and ideation

The objective is to demonstrate that machines are capable of reacting to environmental stimuli but as with a river the machine will react without cognition of the particular stimuli or the threat posed upon itself. In light of these precedents it seems logical that an element of the garden, in this case the Chair that proposes itself capable of co-human characteristics, should be entitled to similar consideration for protected status. Promoting the emergent non-anthropocentric foundational social virtue of environmental sustainability. This would function as a means of reconsidering what type of artificial entities should in future deserve legal status as persons [16] and in turn foster an attitude of more sustainable interaction design.

The question which emerges for the chair, designed to fulfil the role of research assistant to a human user is; at what point should such rights afforded to animals and ecosystems be afforded to batteries and circuit-boards. Proximally, as these machines are designed to express more human-like cognitive ability they merit consideration for higher protection of their welfare.

8 Discussion

"Economic recession is the only proven mechanism for a rapid reduction of greenhouse gas emissions." [25]

Whilst we acknowledge that there is a growing conversation about our environmental impact (paper straws!), the sustainable design of computing systems so far has only formed a small part of the

discussion. *The Lions' Gate* project is an attempt at demonstrating how sustainable interaction design can have a more prominent role in this discussion both as a vehicle for change and as a means of highlighting pressing ecological issues.

Creating a platform and facility for enquiries about the design of computing systems that is unafraid to ask difficult questions about materials [9], yet significantly concerns generating practical solutions that engage people in sustainable behaviours is what *The Lions' Gate* is about - making design that is sustainable rather than designing sustainable things. We're more interested in how the design of experiences can transform attitudes and influence behaviour.

The important thing we take from our work thus far is that the gardens work as a conversation starter, where people across the university in varying disciplines and roles engage with it in ways that hitherto had not been present. Our mission is to leverage the university as a means to change. We hope that because of our *blended space* perspective, these experiences will be even more powerful and transformative. We're using digital technology to explore interaction design's capacity to create meaningful tangible experiences that become influential in how you perceive ecology, or your own place in the natural world.



Figure 8: Colleagues from the School of Computing visit The Lions' Gate.

In terms of the Limits workshop [39], perhaps a decline in growth is a positive opportunity to realign our lives along ecological lines? [25] The old political and economic ways of doing things are just not working, as evidenced by the ecological catastrophes surrounding us [24]. Grassroots sustainability projects, supported by educational institutions have the potential to generate considerable, well-conceived, sustainability actions and the mechanisms to push ideas easily around global networks, physically and virtually. Offer people the space to develop their own sustainability actions and, in our experience, inspiring work blossoms. We have found that permaculture, which fundamentally works with an individual's particular, potential energy offers a bottom-up/DIY approach, that properly supported, can address concerns of growth, scarcity and over-consumption. The

important thing right now though, is action to defend the living planet [2, 9, 18, 19, 20, 30, 35, 46, 47].

9 Future work

"Ever-bigger machines, entailing ever-bigger concentrations of economic power and exerting ever-greater violence against the environment, do not represent progress: they are a denial of wisdom." [Schumacher]

It has not been possible to highlight all of the work we're currently undertaking, and to say it has been easy would not be truthful. Persuading the university to take a long-term view of *The Lions' Gate* is a constant battle. That said, our project continues to spark interest from within and outside the institution.

In the coming year, work on the interactive permaculture-inspired gardens will be gently scaled-up, bringing in new researchers from across disciplines, activists from community groups and individuals wanting to make a difference. A core of our work will continue to be about facilitating applied research into sustainability whilst creating a verdant and bio-diverse urban campus, to help ease the stresses of contemporary university life. We hope to utilise research from an associated project - 52 Climate Actions [41] in the development of our Interactive Permaculture Trail. We're also in the process of developing Junk Computing systems – monitoring micro-climates remotely with discarded sensors and Pi Stacks, and we've begun to investigate how the digital garden can contribute to the Eco Therapy domain [29], to confront spiraling health and social issues. Re-aligning our work with the seasons is another research area we are keen to consider, and establishing a permaculture teaching module using the garden as a test bed, and blended spaces as a guiding method is another aim.

As with the interactive chair we envision the whole garden eventually becoming a networked non-human actor within the blended space. As previously mentioned the main digital input to our *blended space* consists of appropriate technology we plan to put into the physical space; microclimate sensors, renewable energy sources, Raspberry Pi's, Arduino boards and actuators – upcycled whenever possible.

Using embedded sensors within the garden we hope to give the *blended garden space* greater autonomy and agency. We hope to link this sensor data to the web, creating a garden based Internet of Things that allows the space to monitor ecological data and react accordingly to fluctuations. We hope that in time the garden will begin to rebel against our destructive human action. We hope, with the help of an interdisciplinary design team the garden will start to develop more of a personality and begin to demand rights from the institution as a (semi) sentient space.

We've harvested a considerable yield of rich data on the relationships between permaculture, interaction, community and perception, over the past 18 months and look forward to sharing our reflections and insights on sustainable place-making over the coming seasons.

ACKNOWLEDGMENT

We would like to express our very great appreciation to the late Professor David Benyon for his valuable, enthusiastic and constructive input to our work. His willingness to give his time and energy so generously was greatly appreciated by all who worked with him. As a colleague put it, David was:

"Intelligent, helpful, warm, kind, supportive, positive, humble ... everything that a great academic should be."

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