Hasten Slowly

Developing an interactive sustainability storytelling chair

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ABSTRACT

Responding to the climate crisis and a considerable downturn in planetary well-being due to human consumption patterns, The Lions' Gate, on-campus, urban, permaculture–inspired, interactive community gardens project aims to affect changes in attitude toward the natural world by leveraging potentials within the university set-up. Specifically, this work details the development of an interactive storytelling chair that will sit central to *goings-on* in the garden space as both a technological and social hub that propagates sustainability-based conversations.

We utilise a blended-spaces methodology to investigate the interplay of people, technology and environment, but further anchor our thinking in permaculture to understand the world in terms of planetary health and radical methods, that we posit are necessary in order to realise transition to a sustainable world. Rather than boycotting technology we seek to revise its use in a myriad of ways.

CCS CONCEPTS

• Applied computing • Interaction design • Information systems

KEYWORDS

Blended spaces, permaculture, internet of things

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1 INTRODUCTION

This work is the child of a parent project called The Lions' Gate - an interactive permaculture-inspired gardens habitat on-campus at Edinburgh Napier University, Scotland, where we undertake applied research into sustainability through the lens of interactive technologies.

The garden-situated interactive storytelling chair is inspired by the history of Plato's teachings in a garden outside Athens, connecting the whole idea of the academy with learning in garden settings. Our aim is to create a physical focal point for discussion of sustainability within a garden context, utilising appropriate technology to both support our aim and to provoke meaningful conversations about nature and technology.

Our designs are developed via two perspectives; *blended space*s - to understand how best to meld physical and virtual worlds [7, 8], and *permaculture* – to guide our minds and hands toward sustainable actions and connect us to a global movement of sustainability practitioners [23, 24].

We are also interested in how blended spaces and permaculture can together as a mixed-method produce what has been termed *sustainable interaction design* [9]. Both perspectives will be further unpacked as this paper proceeds.

2 BACKGROUND

Since late 2016 The Lions' Gate Garden Project [20] has been investigating ways in which digital technology and the sustainable design framework known as permaculture can be blended to produce actions that nourish human and planetary health.

Currently we are developing two spaces on an urban university campus, inspired by the ethics and design principles of permaculture – a rooftop allotment and a courtyard food forest.

Figure 1: The Lions' Gate rooftop allotment, ©Callum Egan

Figure 2: Staging area of The Lions' Gate courtyard food forest where the interactive storytelling chair will sit, ©Callum Egan

As interaction designers, we employ a blended spaces methodology [7] to understand how best to position technologies in the context of bio-diverse gardens.

One instantiation of this work is the development of an interactive storytelling chair that we hope will become a hub of activity both in the real and virtual worlds.

We posit that by bringing people into sustainable environments they are more likely to be inspired to take action in their lives to address the ecological ills of our times.

Our institution is fundamentally a supporter of applied research and our work reflects this hands-on approach to understanding the world.

In this paper, we will look first at permaculture [5, 6, 18, 23, 24] as the foundation of our thinking, then at the storytelling chair concept – the designed artefact, then at blended spaces [7, 8] to see how our design can be realised, and finally we provide a description of the technical sensor system, 'the machine' we employ and some results and outputs from it, suggesting future research directions.

3 PERMACULTURE

In order for our work to be ecological and radical we need a framework to guide our design decisions. Permaculture co-founder Bill Mollison [22] describes permaculture thus:

"Permaculture principles focus on thoughtful designs for small-scale intensive systems which are labour efficient and which use biological resources instead of fossil fuels. Designs stress ecological connections and closed energy and material loops. The core of permaculture is design and the working relationships and connections between all things."

Synthesised by permaculture co-founder David Holmgren, the following are broadly held to be the guiding ethics and principles of permaculture [18, 23]:

Ethics:

1. Earth care. The Earth is a living, breathing entity. Without ongoing care and nurturing there will be consequences too big to ignore.
2. People care. If people's needs are met in compassionate and simple ways, the environment surrounding them will prosper.

3. Fair share. We are provided with times of abundance which enables us to share with others.

Principles:

1. Observe and Interact – "Beauty is in the mind of the beholder". By taking the time to engage with nature we can design solutions that suit our particular situation.
2. Catch and Store Energy – "Make hay while the sun shines". By developing systems that collect resources when they are abundant, we can use them in times of need.
3. Obtain a yield – "You can't work on an empty stomach". Ensure that you are getting truly useful rewards as part of the working you are doing.
4. Apply Self-Regulation and Accept Feedback – "The sins of the fathers are visited on the children of the seventh generation". We need to discourage inappropriate activity to ensure that systems can continue to function well. Negative feedback is often slow to emerge.
5. Use and Value Renewable Resources and Services – "Let nature take its course". Make the best use of nature's abundance to reduce our consumptive behavior and dependence on non-renewable resources.
6. Produce No Waste – "Waste not, want not" or "A stitch in time saves nine". By valuing and making use of all the resources that are available to us, nothing goes to waste.
7. Design from Patterns to Details – "Can't see the forest for the trees". By stepping back, we can observe patterns in nature and society. These can form the backbone of our designs, with the details filled in as we go.
8. Integrate Rather Than Segregate – "Many hands make light work". By putting the right things in the right place, relationships develop between those things and they work together to support each other.
9. Use Small and Slow Solutions – "Slow and steady wins the race" or "The bigger they are, the harder they fall". Small and slow systems are easier to maintain than big ones, making better use of local resources and produce more sustainable outcomes.
10. Use and Value Diversity – "Don't put all your eggs in one basket". Diversity reduces vulnerability to a variety of threats and takes advantage of the unique nature of the environment in which it resides.
11. Use Edges and Value the Marginal – "Don't think you are on the right track just because it's a well-beaten path". The interface between things is where the most interesting events take place. These are often the most valuable, diverse and productive elements in the system.
12. Creatively Use and Respond to Change – "Vision is not seeing things as they are but as they will be". We can have a positive impact on inevitable change by carefully observing and then intervening at the right time.

Permaculture is also an international network of thousands of practitioners working to live sustainably and share resources so as to create nature-inspired abundant eco-systems that support people and the planet [24].

We posit that permaculture is a rich foundation upon which to realise a sustainable future. It's ethical core and solutions-focused principles ensure that we are placing planetary, and by holistic association, human health and well-being central. For more detailed explanations of our use of permaculture in the context of our interactive gardens project The Lions' Gate please consult our previous publications in this area [13, 14, 15].

Permaculture too, is concerned with making connections. Author and teacher Graham Bell [5], calls it the 'worknet', a bringing together of people's skills to achieve sustainable outcomes. The collective intelligence of a group greatly outstrips that of the individual. Understanding that Euclidian space can be further abstracted in terms of the relationships between things is key.

For the purposes of this work we will highlight a number of permaculture design principles that may lend themselves to the development of an interactive storytelling chair, that functions as a gathering place for collaboration on how to live symbiotically with nature. The chair sits in the context of an urban university food forest.

As the storytelling chair is developed, other permaculture principles will aid in its development, but as of the writing of this paper, the following principles are utilised as a lens:

1. Design from patterns to details
2. Integrate rather than segregate

3. Use edges and value the marginal
4. Creatively use and respond to change

3.1 Design from patterns to details

Both permaculture and the design of interactive systems make frequent use of Christopher Alexander's [2] writings on design patterns as a way of understanding the holistic components of a rich experience.

Gardens are social spaces. Seating is often an integral part of the garden experience. It makes sense that The Lions' Gate garden as a space on a *new* university campus, be a place of applied academic learning. These abstract general patterns connect to questions about details - who uses the garden, what is the purpose of the seating, how do we place education in nature? These are the root questions that as interaction designers we must investigate to inform the function and form of our design.

However, our intention for this work, as interactive designers in semi-wild, bio-diverse landscapes, is to use patterns found in data collected from environmental sensors, as design artefacts for use in the blended space of our interactive storytelling chair. For example, we may consider trees to be data visualisations. By observing the properties of a healthy tree, we can posit the health and habitability of the space the chair occupies and trigger novel interactions based on this data.

3.2 Integrate rather than segregate

The storytelling chair project is a collaboration between the School of Computing and the School of Arts and Creative Industries. Another intention of our design is to bring people from different disciples and walks of life together in an inspirational learning space to work out how to *do* sustainability. Every walk of human life has to consider its environmental impact and adapt its actions to nourish the planet. We suggest that the yield in action/knowledge-gain from these gatherings will have a measurable influential effect on those taking part and by association their networks.

3.3 Use edges and value the marginal

At the edges beyond our ordinary perception often lies inspiration - the new, frontier spaces. Clearly, in terms of symbiosis, there is something fundamentally flawed in the way humans produce and consume. Carrying on the same old way in light of contrary evidence is the definition of stupidity. We need to look beyond the strictures of 'legacy' organisations as they are often a part of the problem. We need to engage with diverse publics, and be prepared to find challenging new questions at the margins of society and thinking. Our hope is that the storytelling chair will bring radical ideas into an inspirational space in order to regularly challenge the status quo.

3.4 Creatively use and respond to change

Creativity is embodied, it has no fear of change. Transition is what we need. Our goal is fixed – to realise a sustainable future, but our methods are open and considered. The chair is in a constant, if slow sometimes, state of decay. The technological parts of the chair will deteriorate. The ideas for the blended space will fade and change. Changes which humans can comprehend are often defined as ones which are predictable resultant outcomes of emerging events. As Ananthaswamy [3] says, the brain is a prediction machine. It is continually being assaulted by signals from the body and its environment and must predict what's causing them. When we observe the natural environment, we have a rich array of definitions to use in order to explain changes i.e. seasonal change. Technology on the other hand is a mysterious entity that humans often look upon with fear and distrust. The predictability of changes in a technological entity are far more alien to us. In our attempts to rationalise changes in these entities we often recount words like error or glitch.

In order to bridge this void where distrust accumulates we must redesign the expectations that humans have of electronic technologies. Just as when a tree or a bird acts in a way that we would consider irrational, we can design technology to be perceived with the same distinction from the human. Therefore, with the integration of non-human-centric sensory triggers and responses we can begin to design the line between what humans expect a technological machine should do, and how we feel when it chooses to do something else.

With this in mind, what follows is a description of the form of our focal interactive artefact, the storytelling chair.

4 HASTEN SLOWLY: DESIGNING AN INTERACTIVE STORYTELLING CHAIR

The catalyst for this work was reading a passage about Plato's philosophical teachings in an olive grove outside Athens. The word academy comes from these garden-located dialogues. Thus, early on we knew we wanted to use the garden as educational and social space for discussion and performance of ideas. We had already been donated a memorial bench dedicated to a long-serving academic. When, our mentor and champion Professor David Benyon passed away in Autumn 2018 we hit upon the idea of designing a memorial bench in dedication to him, but also a bench that demonstrated Blended Space [7, 8] – the interactive design method he developed along with other colleagues in interaction design. The storytelling chair is to be engraved with one of Professor Beynon's favourite oxymoron's – festina lente 'hasten slowly' – an adage that resonates strongly with the paradox of our times – the need for humans to slow down and become more thoughtful, yet the call to action demanded by increasing planetary degradation, ecocide, pandemic et cetera.

We've employed the services of a designer in wood to craft the structure of the chair. He has provided us with the following description:

"The chair is made from oak. The tree was near the River Ettrick, near Selkirk and was windblown or lightning struck. I was able to get sections big enough to take to the sawmill once I had bought it from the local estate. The back is a slab sawn at that stage. The legs were from pieces with natural splits and shakes. I had the wood for years before the chair, and the wood was almost waiting for the job.

The brief was for a storytelling chair that looked old. The framework below the seat was reclaimed from a door to a Victorian walled garden and was already beautifully weathered and grey.

The design really came from the materials at hand, but is also loosely based on country furniture from County Sligo, Eire, which had the back and back legs as one section. Supposedly, this chair design originated in Scotland prior to its marketing as an Irish concept. I have made chairs in this style before, it is a good sculptural form and I have exhibited a few of them. This also provided space for the decoration which is still to be done."

Our task as sustainable interaction designers has been to work out the appropriate technology [16] to embed within the environment of the chair. Our intention is to make the chair a social and technological hub. A place of congress. A glocal space – fundamentally local and global in essence. But we're also investigating ideas around the chair being a representative of the garden with a kind of autonomy outside of human meddling – a sense of wildness inherent to it.

Figure 3: Reclaimed oak form of the storytelling chair, ©Neil Fyffe

5 BLENDING AND INTEGRATING

A blended space is a designed environment where physical and virtual worlds meet in a kind of symbiosis, where a sense of presence is achieved; where actions are performed directly on the content of the blended space [7].

These ideas grew out of Fauconnier and Turner's work on conceptual blending – basically, how correspondences between two concepts can be integrated to produce a new idea? [17]

With reference to the conceptual blended space diagram illustrated in Figure 4, we can see that our starting space or idea is permaculture. More than anything our intention is for our work to be sustainable, so we put permaculture

central to our concepts. As discussed above we have chosen four permaculture principles to magnify our design in terms of sustainable space. We then have our intention of designing a storytelling chair that sits in a bio-diverse food forest (input/idea one) that is augmented with environmental sensors (input/idea two). We look for correspondences between the inputs. In this case, the sensors will monitor: temperature; humidity; lux light levels; barometric pressure; and air quality.

The resultant socio-technical blended space of an interactive chair as sustainability hub is an amalgam of inputs one and two, influenced strongly by our generic starting space of permaculture.

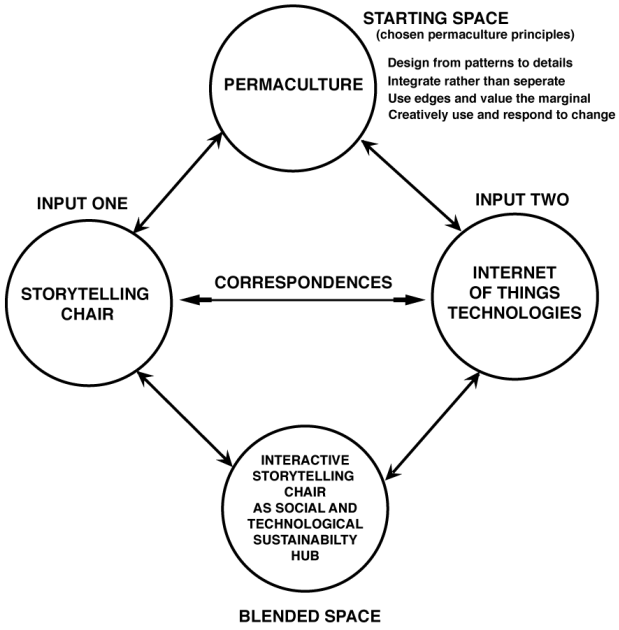

Figure 4: Interactive storytelling chair blended space diagram, ©Callum Egan

6 THE MACHINE

The key objective of the sensor system embedded around the storytelling chair is to observe the Lions' Gate Garden through the 'senses' of a plant based biology. In principle, a plant experiences the world around it through sensory receptors much in the same way a human does. Like a human, a plant demonstrates responsive action to air, temperature, and sunlight (direct and indirect). Their sense and communication are measurable in very much the ways as are humans [10].

The distinction between the human and plant sensory system lies primarily in the rapidness of their response to stimulus. While this may seem obvious to mention, it is a key principle in the intention of this project. Observing the livingness of the garden through the human's sensory system or through observation of changes in the garden will immediately lead to a human subjectivity in interpreting the data. In order to limit the human inference and maximise generative possibilities the sensory system acts as a simple environmental observer - finely tuned to observe the Lions' Gate Garden through the sensory lenses of a plant. The observations have been conducted using a low power electronic system which has produced numerical datasets that then act as triggers for creative engagements with humans. Once we 'datafy' things, we can transform their purpose and turn the information into new forms of value [11]. The design intention here is to reduce the human involvement in the system's function as much as possible, until it is at the point where the system itself acts with autonomy and chooses when and how to engage with the human world or when to simply experience the garden environment.

The system uses the Adafruit Feather M0 Huzzah micro-controller with on board Wi-Fi antenna. To this system are connected the Mikroe Electronics Ambient 2 and the Mikroe Electronics Environmental Sensors (see Figure 5). These sensors enable the machine to observe, record and store the data on the cloud via ThingSpeak. Connecting the sensor modules to the micro-controller via I2C protocol makes data transmission efficient and rapid. The system is powered via a 5 volt mains power with a Lithium Polymer backup battery to protect again mains power failure. In addition, data is stored locally to micro SD via the Adalogger module.

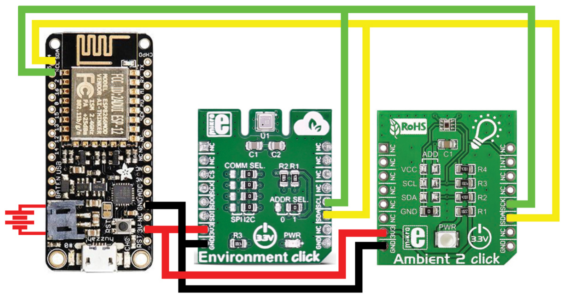

Figure 5: The sensor circuit, ©Andrew O'Dowd

The physical aesthetics of the machine itself were designed to look in keeping with the garden space. It was important that the look of the machine did not appear foreign to the

garden or attract the attention of visitors to the space. The first iteration of the machine utilised two planter grower pots (see Figure 6). These habitats were modified to insulate the electronic system from damaging weather as much as possible while maintaining the necessary environmental exposure for sensor readings.

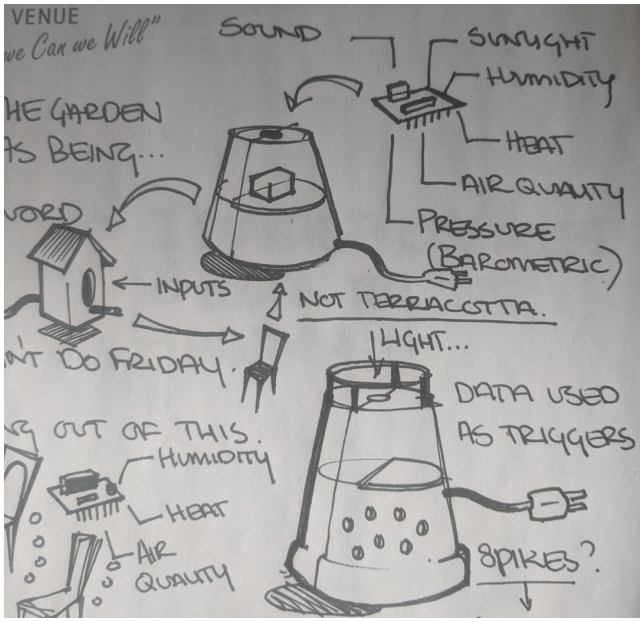

Figure 6: The sensor housing, ©Edinburgh Napier University

The first live incoming stream of data highlighted one simple fact, over the intended period of time the system is running it is going to capture a large volume of data. Much of this data will be predictable. For example, the transitions from night to day and the resultant readings of the sensor that monitors this phenomenon are obtainable through other third part data sources like BBC Weather.

However, the moments when clouds pass or the movements of various shadows and reflections are much more nuanced and provide the perfect opportunity for the machine to take bespoke action to a very unique event. It is only over time that these occurrences will become clear and the blended existence of the garden will emerge.

6.1 Environmental Data

The system has been designed to capture data every 15 seconds. An API access frequency restriction on the ThingSpeak platform. This frequency of data capture still produces 5760 recordings every 24-hour period. Over time a stabilisation of patterning is expected which will reveal the character of the Lions' Gate Garden. Initial representations of the incoming data were explored through the medium of visual arts.

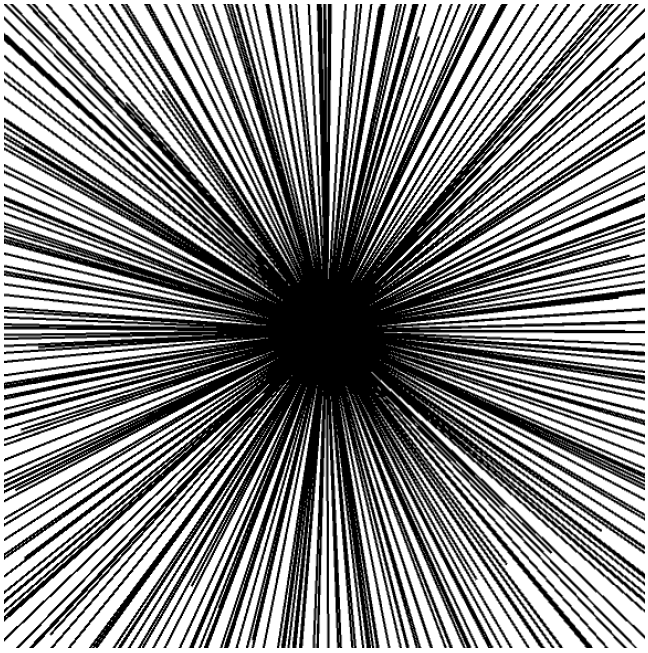

Figure 7: Abstracted visualisation of the data, ©Andrew O'Dowd

This representation of a 24-hour period shows the changing stimulus the garden experiences. It does not attempt to present this data in a humanly recognisable way. It does not attempt to tell the human what it would be like to experience this data. Instead, the artwork presents an alternative way to experience changing environmental conditions. A way which has been abstracted almost entirely from human narrative making. The purpose of this representation of the data is not to reduce its meaning but to highlight the disinterest the system has beyond human acknowledgement.

Over time the machine will monitor incoming data and anomalies will inevitably occur. It is these moments when the machine will manifest itself to the human community. It is the fidelity of the environment, a permaculture environment, that stimulates working relationships and connections between things.

As the data accumulates the system will be encouraged to express its existence in other ways. Currently, the system is primed to generate its first call for direct human interaction. This activity has been designed to enable the storytelling chair to present itself as a pseudo-human entity. This event

will also catalyse the emergence of the chair as a co-human entity.

7 DISCUSSION

During the development of this work, permaculture has helped to remind us what we are doing. Constantly bringing our thinking back to how this project addresses sustainability. It has shaped the narrative toward integration of people and ideas, focused our thoughts on the need to consider renewable materials and power sources, more generally provided guidance when faced with difficult design decisions and given us confidence in exploring marginal ideas from an ethical standpoint.

In terms of blended spaces, the correspondences between the garden-situated chair and the sensors we use, are in the reaction each has to the environment. The sensors in the garden react to light, pressure, temperature, humidity and air quality and so do the plants. So, we can begin to build up a data set that reflects the experience of a micro-climate within the garden. Our artificial model can then be made to react in surprising, novel and particular ways with as little human direction as possible, but with actions that can be made to benefit humanity, for example, the machine can invite a raconteur to deliver a story in the chair based on some environmental happening it has sensed. The extent to which this is successful in terms of yield of sustainable conversations that produce climate change actions is what future work will explore.

Our garden machine is an attempt to understand the garden from the garden's point of view. Our system is reliable and offers us a sandpit to play with environmental data in both scientific and creative work. Ideally, we are looking for a balance between the two. Our project is fundamentally empirical and artistic.

Due to the onset of Covid19 much of what we wished to achieve with this paper has not been possible. For example, we have not been able to put the technology and the chair materially together, though we have developed conceptual work in this area and view the chair as a catalyst for knowledge exchange that over time contributes strongly to the university placing sustainability central to its strategy.

We are acutely aware of the unsustainability of many computing materials and processes. Our intention is to move all technological components of The Lions' Gate off-grid and work from a 12-volt power system. We're also interested in modular design, inspired by products such as Fairphone [16], that utilise repair, learning and ethics in their development method.

As permaculture teacher and author Graham Bell explains 'pollution is assets that are in the wrong place' [6]. Further, as McDonough and Braungart [21] posit - if polluting technology is kept apart from biological systems in a techno-loop, then its toxic potential is reduced until a solution can be found. These perspectives guide the design decisions we make.

Our hope is that the storytelling chair will provide a forum for exploration of these ongoing issues.

More than anything we are keen for this paper to kick-start discussion of, and contribution to, our ideas.

8 FUTURE WORK

Going forward, a central aspect of the machine described above will be that it generates a database of contributor storytellers, triggered by environmental happenings in the garden.

We are also keen to modularise the design in terms of using found objects with appropriate technologies embedded within them. For example, utilising two tree burrs that will slot into the sides of the storytelling chair, hiding speakers and microphones that will enable users to have conversations with the chair.

We'd also like to develop the storytelling chair as a curator of an annual journal, where contributors are storytellers who have been invited by the chair to talk in the chair.

Another concept we're playing with is adding an interactive augmented reality layer to the existent concept of the layers of a food forest, opening up a digital permaculture interpretation system within a natural setting.

As a fundamentally participative and grassroots project we invite researchers and interested parties to engage with and contribute to our work.

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