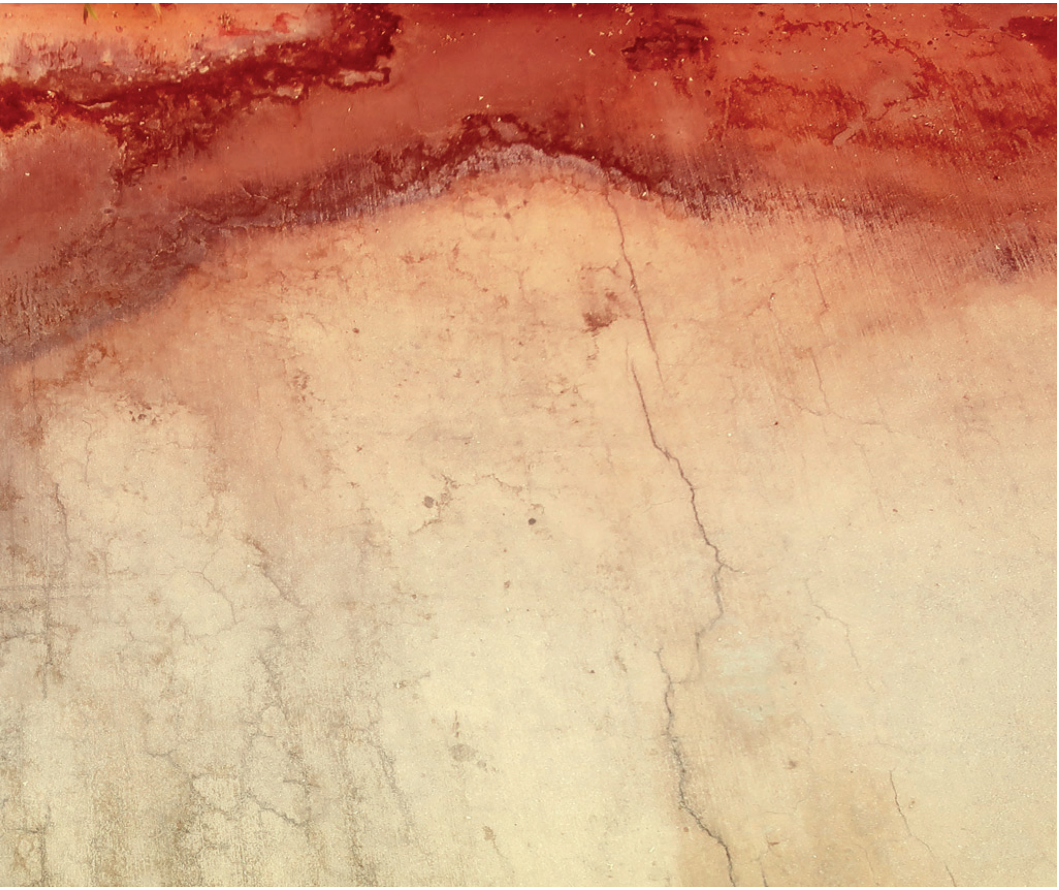
Climate Pathways



Projects from the Imaginaries Lab

A view of personal pasts and futures coming together, from a group exercise in the class using the Mental Landscapes toolkit developed by Delanie Ricketts and Dan Lockton

Introduction

Dan Lockton, Assistant Professor, School of Design

How do we imagine the climate crisis? In an era of urgency for some and apathy for others, where Greta Thunberg and Donald Trump are 'thought leaders' in very different ways, what futures do we understand, or can we envision, for our own communities or others? It's easy to be completely overwhelmed with powerlessness, and the complexities and uncertainties of the situations we might have ahead of us.

International bodies such as the IPCC, and climate science researchers, have the idea of plural 'pathways' (see page 28) which give insights into possible futures for humanity, but what could they look like in everyday life? How might we actually experience these pathways?

The five projects in this book, produced by interdisciplinary student teams in Pittsburgh in fall 2019, tackle these questions from a variety of directions. As part of the Imaginaries Lab's *Research Through Design* studio class—an experimental format running over three weekends, a month apart—we took inspiration from the notion of climate pathways and explored the issues through team projects which each came to focus on specific facets of everyday life:

Scentrees: How can we train our senses to detect changes in air quality? (page 4)

Collaging Shared Worlds: How can people have improved conversations with loved ones about the climate crisis? (page 8)

#closedloopcloset: What would be our relationship with our clothes once we opt out of fast fashion? (page 12)

CarbonCash: Can we close the intention-action gap through financial incentives or environmental impact information? (page 16)

A Quest for The Good Meal: What we learned by designing an experiential quest that exposed the disengaged (yet environmentally interested) to a stewardship worldview (page 22)

This book also includes essays by Megan Urban and Matt Geiger, exploring the background to the 'shared socioeconomic pathways' model (page 28) and a personal perspective on reframing climate action (page 32).

Over the three weekends and in between, we are lucky to have had guest speakers and visiting critics, in person and remotely, including Katja Budinger (Fjord), Charlotte Kessler (Queensland University of Technology), Stuart Candy (CMU), Györgyi Gálik (Design Council and Royal College of Art), and Muireann McMahon and Niall Deloughry (University of Limerick), and, as part of the Plurality University Network's **Many Tomorrows Festival** (see page 37), we had a collaborative creative *charrette* with Elliott Montgomery's students at Parsons School of Design in New York, 'Rebuilding the ship as we fly it'.

We would like to offer our thanks to all our guests and visitors, and also to Chloé Luchs-Tassé and Lara Emond from the Plurality University Network, Meg Richards and David Gerritsen from Carnegie Mellon's Eberly Center, and to Stef LaVattiata and Michelle Chou from the Imaginaries Lab for their help.

This book has been produced initially as an exhibition catalog to accompany the projects being shown for the first time, in November 2019, but will be revised and updated in due course.

Scentrees

Rachel Kim, Shawn Koid, David Lin, Matt Prindible

How can we train our senses to detect changes in air quality?

AQI, a quantitative measure of air quality, is yet another data point to add to the heap of climate data we're meant to track in our minds. In this project, we explore ways to engage the human sense of smell in the process of better understanding AQI and changes in the environment.

Color-coded scent cards allow visitors to experience what different air quality ranges smell like.

52, 51, 39, 42, 41, 58, 61.

These are a small sample of the Air Quality Indices that one might experience over the course of an autumn week in Pittsburgh, Pennsylvania. According to AirNow.gov, AQI "tells you how clean or polluted your air is, and what associated health effects might be a concern for you." While mostly background data rounding out a table of current conditions in a weather app, the consequences of shifting AQI become apparent when "sensitive groups" are politely encouraged to "limit prolonged exposure" or when the stench of rotten eggs creeps through the city.

The AQI's ability to impart any practical knowledge of how and why these changes occur is as fleeting as the indicator itself. Indeed, we're not quite sure what AQI 61 is, but sometimes it smells like eggs. Here begins our inquiry: Is it possible to tune our sense of smell to practice a sensuous way of knowing—creating an embodied

and intuitive way of accessing data about the quality of the air we breathe?

The human nose becomes numb to scent in as little as two breaths. This phenomenon, *nose blindness*, is helpful in identifying sharp changes in smell that might signify environmental danger, but helpless in our recruitment of the nose as a persistent environmental sensor. Borrowing from the practices of sommeliers and perfumers, we recreated the scents associated with the five major air pollutants for which AQI accounts: ground-level ozone, particle pollution (PM10 and PM2.5), carbon monoxide, sulfur dioxide, and nitrogen dioxide.

> **“We recreated the scents associated with the five major air pollutants, to bring sensory awareness to people visiting the experience.”**

The experience of our research tool begins with the diffusion of these scents disguised amongst the leaves on the branch of a tree. Circulating air (or a fan) carries the noticeable scents toward idle noses. A closer inspection of the tree reveals their origin along with information about what kind of air is associated with this scent. Participants can take the perfume card with them for further inspection or as a sample "reference smell". After identifying the scent, participants can match it to a postcard which contains more information about the source of the smell.

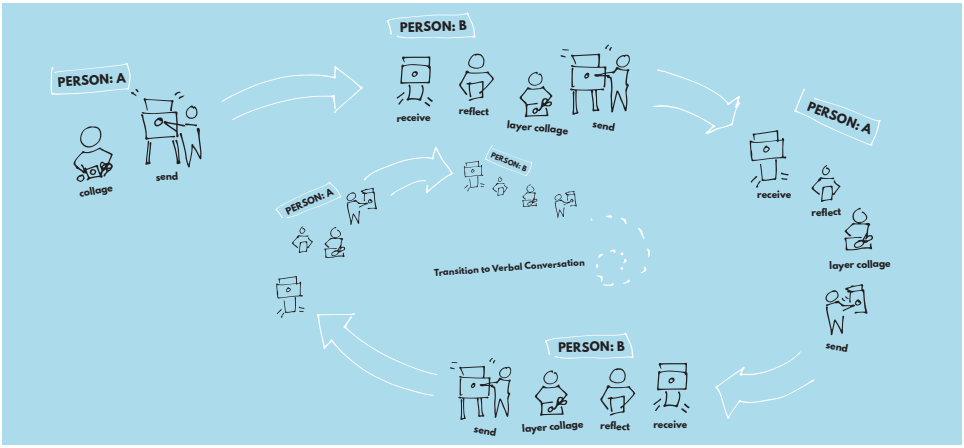
Unlike the quick whiff of some unidentifiable odor in everyday life, here the smell, its associated AQI, and its place or mechanism of origin persist. Nose blindness is no match for the high availability and portability of AQI's "reference smells." After engaging with the diffuser, participants are asked to reflect on their thoughts and feelings. All materials can also be collected and taken home by participants.

Collaging Shared Worlds

Lea Albaugh, Julia Petrich, Megan Urban, Tammar Zea-Wolfson

How can people have improved conversations with loved ones about the climate crisis?

Instead of getting heated or avoiding talking altogether, we need to find new ways to communicate with the people we love about the climate crisis. Our project is a set of two connected devices that allow loved ones to have a visual conversation that imagines a shared future.



Having conversations with loved ones who have vastly different stakes in issues like climate change (which in the US is both political and partisan) can be like walking in a minefield. A single word can set off either party, sparking a heated argument or shutting down discussion entirely.

Our design intervenes before a verbal discussion takes place, allowing loved ones to build a shared visual language and understanding through the act of collaging. Each of the two participants begins with a device which scans, sends, and receives collages. They are also given a starter kit with a guide and some materials to begin with.

As shown in the top diagram, one participant begins the conversation, the prompt being, “What do you imagine our world will be like in __ years?” The back-and-forth visual dialogue continues until the devices silently fail or somehow a verbal conversation begins. This is, of course, where communication begins in earnest.

So how did we get to connected devices for visual conversation between loved ones? Visiting the Climate Strike in Pittsburgh, those we spoke to felt a sense of urgency to have these conversations but had no idea where to begin.

When we started narrowing in on the topic of climate conversations with loved ones with different points of view, we began to look at some activism research. Conversion is most likely to occur in interactions that are repeated over time and where consent is obtained.

Visual conversations using imagery instead of language could bypass the "no-go" zones that are created through partisan divides, especially as they would allow for interpretation through an imagined pathway. As we sourced images for our starter kit, we attempted to imagine the potential lived realities of the SSPs and source imagery to represent the variety of outcomes within those pathways.

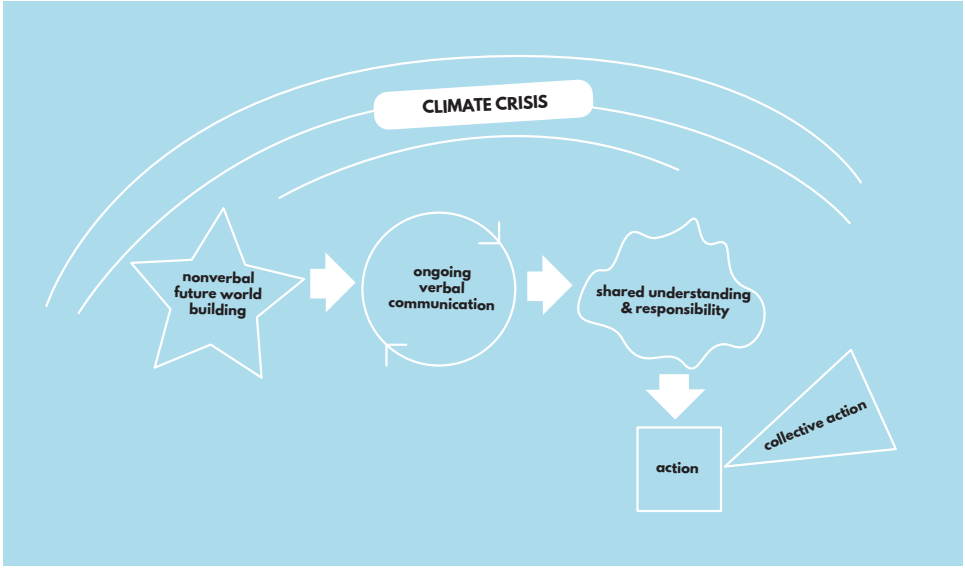
Visual conversation destabilizes regular communication dynamics.

As mentioned, this designed visual conversation is only the first step. A well-designed debrief of the nonverbal may lead to ongoing verbal communication, which ultimately could set pairs of loved ones on the course toward action.

Visual conversation destabilizes regular communication dynamics. Looking forward to future implications, our team imagines all sorts of potential applications that could prevent words from defining the rules of all communication. **For more information about this project, visit:**

imaginari.es/sharedworlds

Can you imagine a future in which policy makers widely use a visual language as a means of expression?

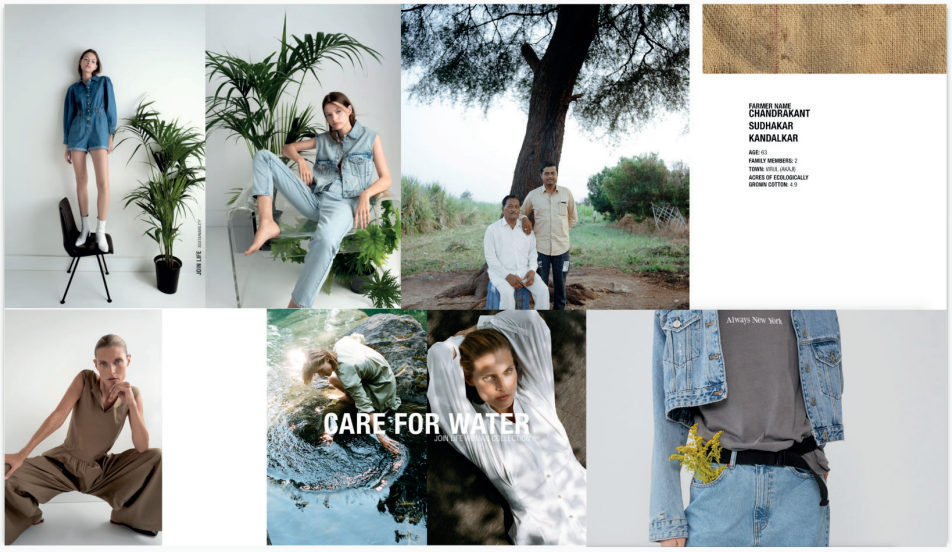


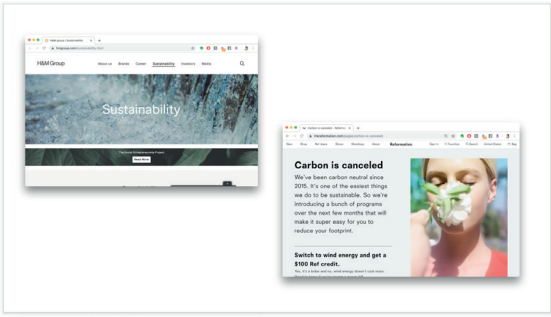
#closedloopcloset

Coco Allred, Joyce Wang, Yixiao Fu, Yingli Sieh

What would be our relationship with our clothes once we opt out of fast fashion?

We designed group activities for friends to envision a future together where we buy less. Together, we learn to become more attentive to the stories of our clothes, take better care of them, and share them with our friends.





The U.S. apparel industry in 2015 is a $12 billion business and the average American family spends $1,700 on clothes annually, according to the Bureau of Labor Statistics (https://www.forbes.com/sites/emmajohnson/2015/01/15/the-real-cost-of-your-shopping-habits/#4e7958551452). Enormous production and consumption are associated with enormous environmental and human cost. More and more businesses (e.g., H&M, Patagonia, and Gucci) are starting new initiatives to use recycled materials and enforce ethical labor practices. However, the messaging of sustainable fashion is still centered around "buying." In sustainability marketed by apparel companies, rarely are customers told to buy less. While material sourcing, packaging, and manufacturing processes have become more eco conscious, the scale at which these goods are produced is not.

In this project, we offer a few activities for friends to learn more about how to make the most and best use of your current wardrobe, and envision a future together where we can all buy less.

The first component of this project is a take-away zine. It provides guidelines for four group activities.


Take the pledge to
"shop" your closet!

I commit to build a lasting relationship with clothes I have.

I commit to purchase with internet.

I commit to take care of the things I own.

My goal is to only shop my closet for ___ weeks.

Signature:
Date:
Taking the challenge with me:

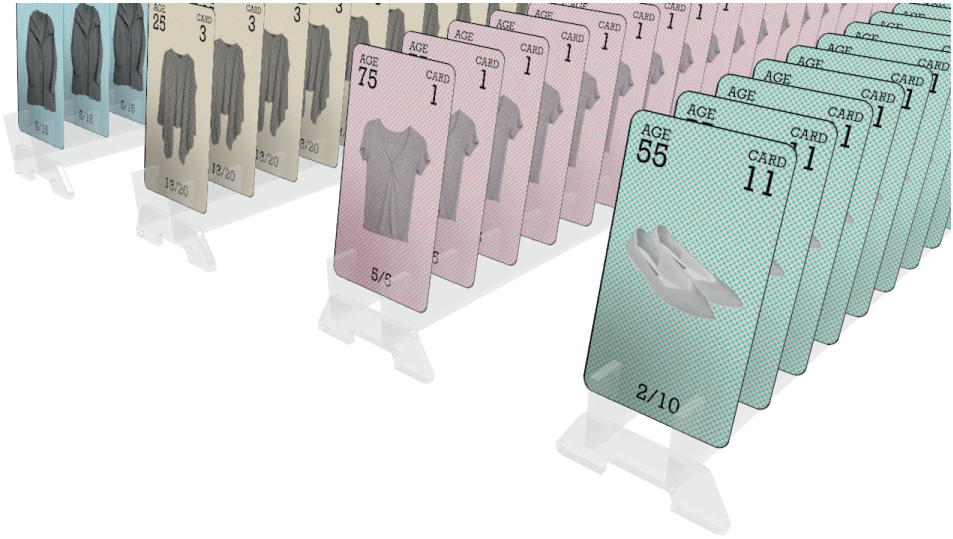
Looking and feeling great doesn't have to come at the cost of our environment !

- What are we wearing?: Look at each item you are wearing right now and talk about how they have changed and grown with you over time. We introduce the metrics of physical and emotional longevity to help consider their past, and how long they will last into the future.

- Skill sharing: Consolidate skills that the group has for hacking our wardrobes.

- Clothes swap: Learn how to organize a clothing swap event and think about who in our lives we are willing to share clothes with.

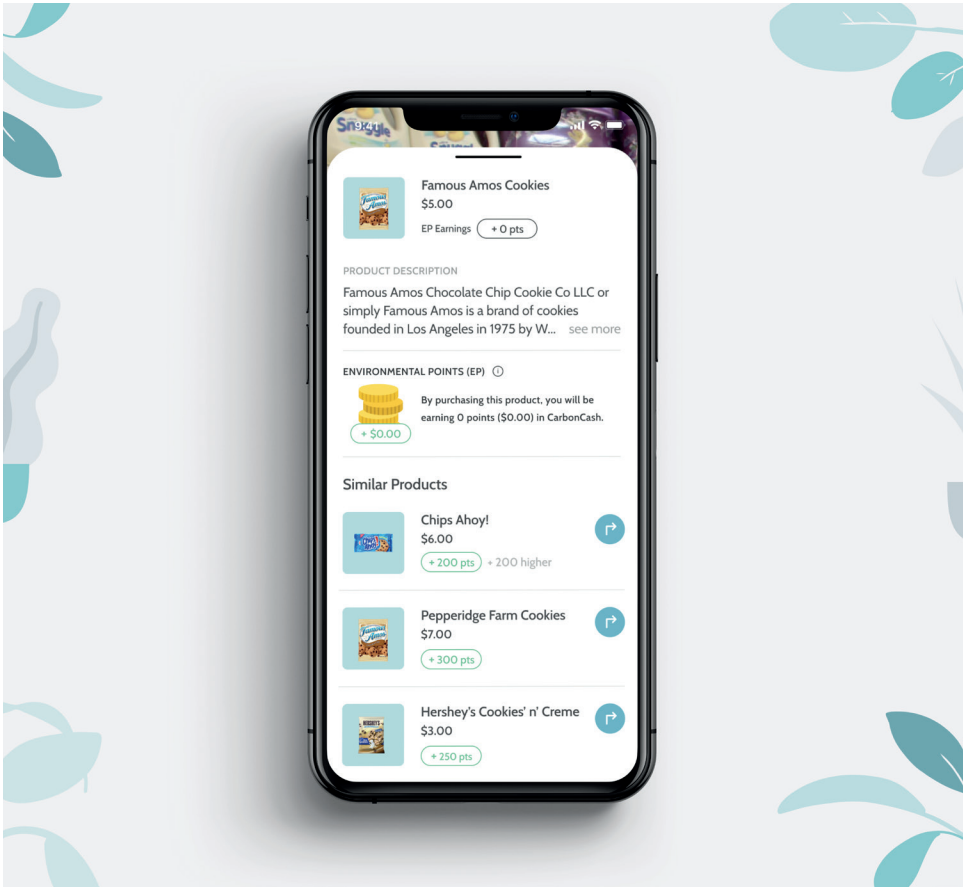
- Sign a pledge: Take the pledge to "shop" your closet. Looking and feeling great doesn't have to come at the cost of our environment!



The second component is an interactive game that allows players to explore a hypothetical future where the contents of one's closet are closed—for good. No new tops, bottoms, accessories, or outerwear items can be added, with the existing contents being that of a 22-year-old woman looking to maintain her existing closet for the next 50 years.

In this game, the player outlines a single outfit in each year of the character's life, from age 25 to 75. Certain elements along the character's lifecycle also affect the longevity of their closet items: this can be anything from getting pregnant and stretching out one's clothes to learning how to sew patches to repair a favorite shirt.

This game purposely challenges the existing system of 'buying green'. The current system of 'green' retail shopping revolves around choosing brands that are low in water and chemical waste—however, these brands are ultimately producing more waste by making new clothing than one would consume by simply extending the life of what they already have.

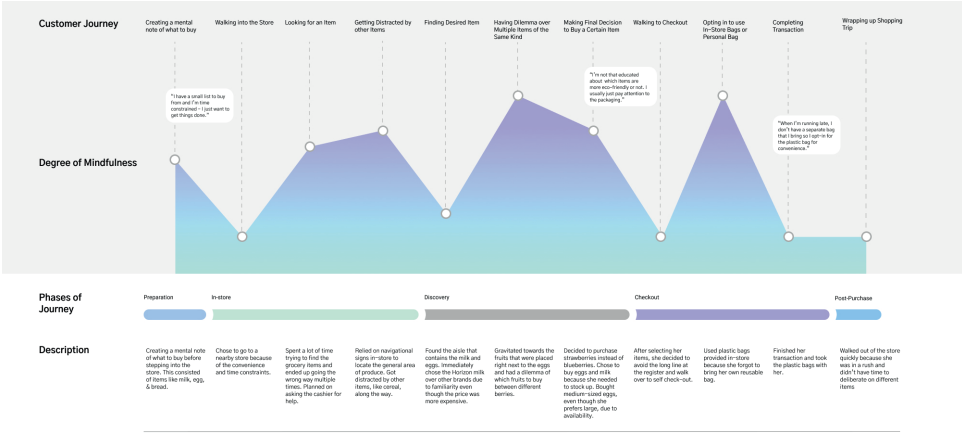


CarbonCash

Antonio Song, Elena Deng, Judy Chun, Sharon Lee

Can we close the intention-action gap through financial incentives or environmental impact information?

Despite the fact that many people want to live more environmentally consciously, only 26% actually put it to action.



In trying to move our society into a more environmentally-friendly direction, individual participation is essential. One of the biggest hurdles in this transition is the "intention-action gap", where while many people have the intention to go green, the actual action rate is significantly lower. CarbonCash is a mobile application that helps in making environmentally friendly purchase decisions easier than ever.

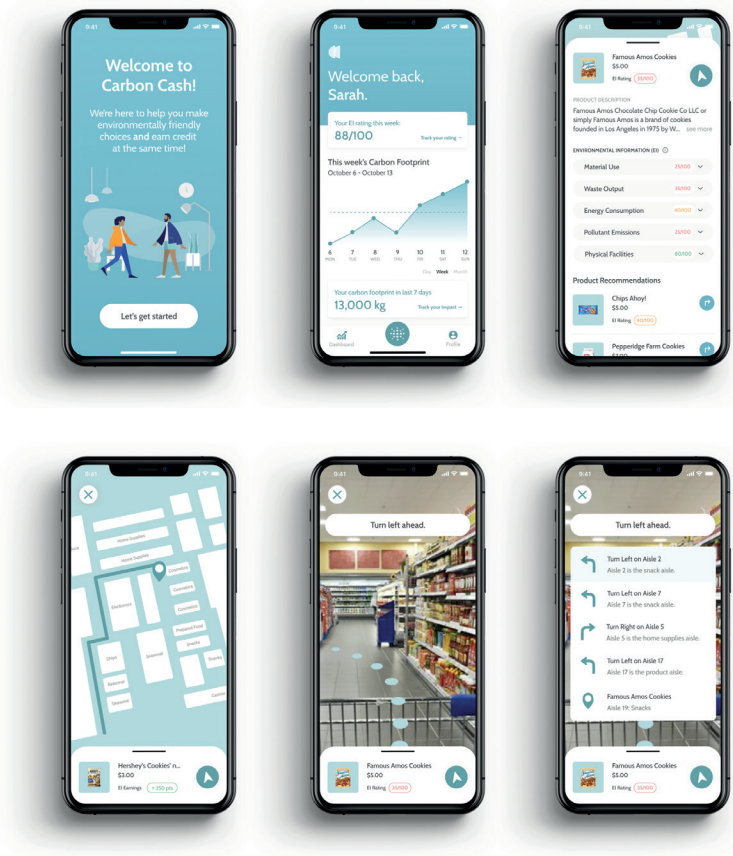
As the initial step towards delivering the app, we posed a hypothesis that consumers will be able to gear towards a more environmentally-friendly purchase habit if they were provided with the right information to nudge them. Here, we posed another question: "Do consumers who are buying appliances or electronics typically don't think about energy efficiency because the information hasn't been delivered in a consumable way or because they

AR Prototyping with Vuforia + Unity

react better when financial gains are involved?" In other words, are consumers more responsive to environmental information, such as the carbon footprint of the product, or financial incentives in the form of points or reward systems?

In order to answer these questions, we set out to define specific environmental metrics that could define the impact of our everyday food & products. We conducted preliminary interviews with focus groups consisted of environmentally-aware and less environmentally-aware cohorts in their 20s to better inform us of their current purchase patterns and the pain points during that process.

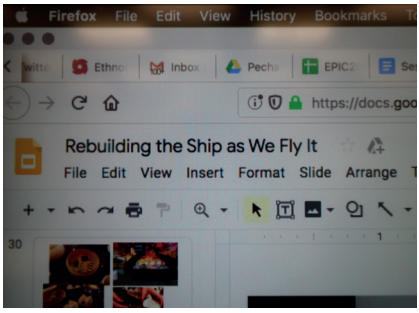
"Helping consumers find their inner green."

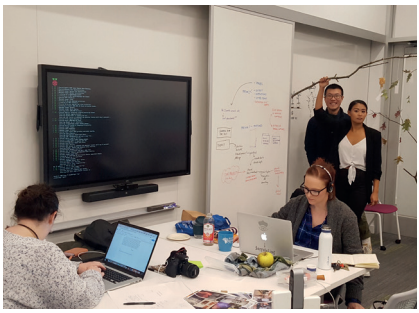


As a result, we came up with a CarbonCash app with two variants. The first version of the app offers consumers with environmental information, which informs users of their eco-friendly performance based on their purchases made using CarbonCash. The second version informs the user of their environmental points (EP) earnings, which they can use as a store credit in participating stores.

The two versions of the app both feature an in-store AR navigation feature, where the real-time AR scan reveals either EI or FI to the user, informing consumers about the environmentally friendlier alternatives. Furthermore, in-store AR navigation makes the switch to a more environmentally- friendly product as effortless as possible.

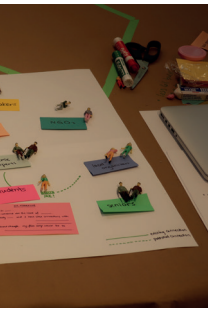
We intend to test out CarbonCash app during the class exhibition and synthesize findings to make improvements to the app.


Firefox File Edit View History Bookmarks
Rebuilding the Ship as We Fly It
File Edit View Insert Format Slide Arrange




WHAT ARE YA WILLING TO GIVE UP?




Some scenes from the class







the good meal

A Quest for The Good Meal

Cathryn Ploehn, Chris Costes, Ema Karavdic

What we learned by designing an experiential quest that exposed the disengaged (yet environmentally interested) to a stewardship worldview.

Problem space: The importance of resilience

The climate crisis is a large and complex issue driven by an individualistic mindset that places humans above all rather than acknowledging the interconnected web in which we exist.

To overcome the issues of the climate crisis, we must begin by reinforcing the resilient systems that are already in place. By building out these systems, we can strengthen the ability for ecosystems to balance and successfully deal with change. This requires a shift in mindset from "me" to "we" as well as a redefinition of our sense of place to include our bioregion, and more broadly, our biosphere. We defined resilience systems as having the following characteristics:

- Distributed
- Diverse
- Symbiotic

Why a quest?

Framing the conversation around a quest, afforded us the versatility to engage with resilience on multiple levels.

Engaging and experiential. By guiding participants through new experiences in a structured quest, we hoped to reveal how easy it is to engage in the ecosystems that are already in place. This, in turn, would help overcome the nervousness and anxiety associated with Farmer's markets, community farms, and other sites of local resilience.

Pleasure, not shame. A quest is a fun way to bring people together to learn. As a team,

we observed that how much communication about the climate crisis was centered around negative messaging. In contrast to this we wanted to show participants positive experiences and local opportunities.

Building a shared project. Our quest asks participants to collaborate both with their team and the systems around them. This allows the participants to see the connections and roles both people and environments play in resilience and feel as though their contributions had tangible meaning this project.

Repeatability. Finally, a quest can be replicated for other cities, creating what Ezio Manzini calls "community-oriented toolkits". These toolkits are adaptable and scalable, spreading the ability for people to become more engaged in place and their local systems.

Audience. We decided to focus on activating people who care about the environment and the climate crisis but are currently disengaged. This audience already has latent pro-social and pro-environmental attitudes but often doesn't know how to activate them or believe activating them would be to difficult, which is where the quest can play a meaningful role.

Goals

Through the conversations created by the quest, we wanted to expose the local ecosystem that already exists in Pittsburgh in a fun and memorable way. Specifically highlighting the different levels of engagement and roles that people can play to contribute to resilience.

In addition, we wanted to learn whether this type of experience could shift people's

worldview towards stewardship and change how they talked and felt about the environment around them. Through learning the answer to these questions, how would that change the way in which we engage the public in conversations and actions around the climate crisis?

Framed by a quest, the larger project carried out by the participants would be to create The Good Meal.

The Good Meal

Changing a paradigm with one quest would be a near-impossible shift. Instead, we hoped to plant a seed. With this goal in mind, The Good Meal was a way to focus the attention of the participants on something that was attainable and familiar. At first exposure, this meal was framed purely by taste. However, by the end of the quest, "good" was revealed to echo the characteristics of a resilient system. Each of these features was highlighted by a different location within the larger system of Pittsburgh.

"we wanted to learn whether this type of experience could shift people's worldview towards stewardship"

The Farmers' Market

At the farmers' market, our first location, the quest established a goal for the participants as both information and ingredient gathering. To varying levels, the members had to converse with growers, consider the vegetables thoroughly, and navigate a new space. This not only contributed to the physical requirements of The Good Meal but also put encouraged the group to interact directly with their food and those who grew it. While navigating this section of the quest, our goal was to provide an awareness of their own ability to contribute to this feature of resilience.

The Community Farm

Following the farmers' market, the quest brought the participants to a community farm. After receiving a brief intro to what the farm does and being guided around the grounds, they began to tend the farm's plants. Specifically, they performed tasks that promoted or strengthened a large variety of native plants, contributing to the farm's diversity. While learning how to care for each of the unique plants, each member had the opportunity to see their contribution to the diversity, and thus the resilient system of Pittsburgh. To show a direct benefit from this diversity, we collected a healthy variety of herbs for seasoning on The Good Meal. Having an understanding of the importance of diversity and how to enact it in practice, our hope was to give questers the tools and confidence they needed to contribute to the diversity of their ecosystem in the future.

The Kitchen

After visiting two locations to gather ingredients for The Good Meal, the participants were brought to a kitchen to make it. It was our hope that by creating the space of a shared meal, all aspects of which were collected as a team, would create vibrant discussion and shared understanding. The participants would see the culmination of their hard work, shared memories, and vegetables, giving them a very real example of the value brought by symbiosis to an environment. Unlike the previous two examples of resilient systems, we were explicit about the meaning of the final act in the kitchen. By being direct, we planned to reinforce the meaning of resilience and how members could contribute. Along with this revelation came a facilitated reflection, which made symbiosis something that everyone felt they understood and valued.

Planting a Seed

Beyond taste and moral obligations, by the end of the meal, participants had an understanding of the community, ecology, and actions that contribute to making The Good Meal. Through this, our goal was to

share an awareness of diversity, distribution, and symbiosis as important parts of a resilient system. Perhaps most importantly, we also worked to give an understanding of how they might contribute to this resilience.

Learnings

The following takeaways highlight aspects of our intervention that may be key in designing experiences that shift worldviews.

Reweaving social fabric of local communities

We learned that the quest afforded several ways to reweave the social fabric of a community connecting people and place.

Connecting people with key community stewards. First, through engagement with farmers, participants connected with knowledgeable people as guides and gatekeepers already building sustainable futures.

Connecting community stewards through organizing the quest. Through the organization and build-out of the quest itself, a possibility for connecting existing communities (that aren't necessarily collaborating) emerged. Through the creation of a quest, we reached out to several different kinds of organizations (student groups, grassroots urban farming efforts, etc.), and could imagine further quests affording coordination between these groups.

Having fun experiencing new social scripts. We found that a light-hearted, food oriented quest format provided a way to frame a celebration or pleasurable exposure to new social scripts. Further, the structured and guided introduction to these sites of resilience made these new social scripts less intimidating, and more accessible.

"We learned that the quest afforded several ways to reweave the social fabric of a community connecting people and place."

Conversations centered around a shared project as critical design context

At the core of the quest were the conversations people had. We found that conversations were a critical context to design for the transition towards new ways of understanding the world, particularly what makes resilience systems. Key to this was considering how participants talk about the farmers market, particularly as an act of stewardship.

Providing explicit framing of activities through the lens of stewardship. Significantly, the way in which participants spoke about what they were doing at the market and on the farm differed greatly from the consumptive, individualistic mode of interacting. By providing a script of questions, we allowed participants to enact a new way of situating themselves with regard to these establishments. This indicates our experience could be a good first step in transforming how people view resilience and their part in maintaining it, how they develop a "care" relationship at the farm and the market.

Building a project (the meal) together. Specifically, conversations succeeded in the context of building things together. Using a cooking a meal as a small shared project, served as a tangible symbol of the larger project of caring for local resilience that participants could talk through.

Tangible artifacts from the experience

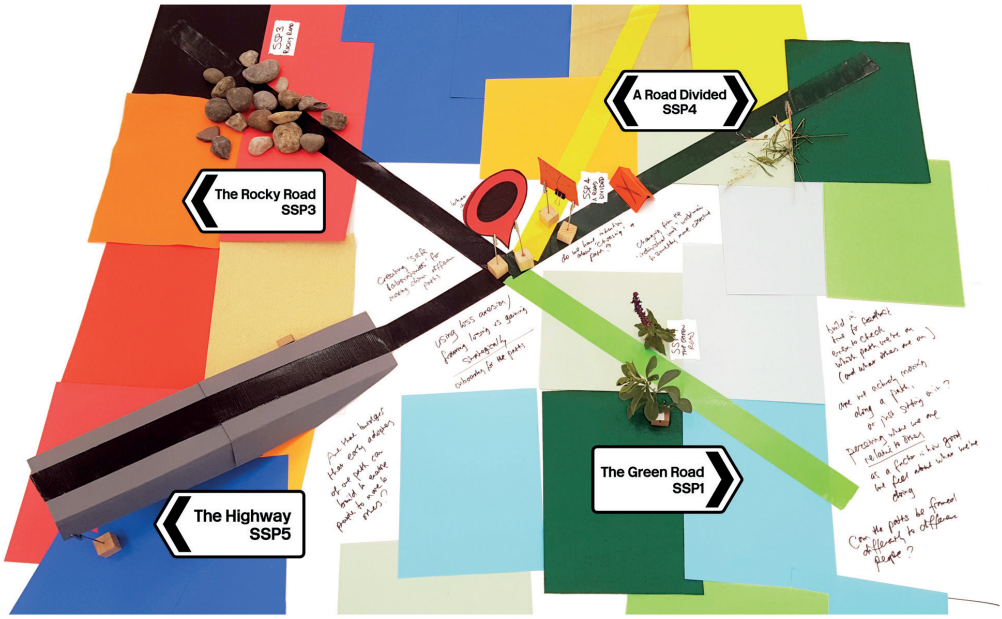
Our quest book seemed to be an artifact the participants enjoyed. After the quest ended, they wanted to hold onto it, both for their notes and for the information it provided. Giving it the potential to serve as an everyday reminder of the experience and the values within.

Iterating the design of the quest

What should be updated in future iterations of the quest? We found that increased facilitation, balancing the quest framing with consumptive and moral aspects, situating the quest as a social bonding experience, and adding practical next steps at the end of the quest were some key areas of improvement in future quests.

Conclusion

The Quest for a Good Meal proved a successful apparatus for the disengaged (yet environmentally interested) to interact with. This success was primarily the result of its accessibility and a focus on exposing already existing communities of stewardship. While there are many areas to iterate on (as mentioned above), our findings led us to believe that this type of experience could begin a shift towards a stewardship world view.



What are the SSPs?

Megan Urban, PhD candidate in Transition Design

The Shared Socioeconomic Pathways, or SSPs, are a tool developed to facilitate research into the impact of the climate crisis and model possible directions of global development. They are not predictive themselves but are a set of scenarios that provide researchers with data that may be used to evaluate how different policies, levels of climate change, and other factors may potentially affect world regions. The SSPs also define the degree of challenge for the **mitigation of**, and **adaptation to**, climate change.

Initially, they were proposed in the paper, 'A new scenario framework for climate change research: the concept of shared socioeconomic pathways' by Brian C. O'Neill and colleagues, published in 2014. Building on existing research, the SSPs combine radiative

"The SSPs describe plausible alternative trends in the evolution of society and natural systems over the 21st century at the level of the world and large world regions. They consist of two elements: ***a narrative storyline*** *and* ***a set of quantified measures of development****."*

(O'Neill et al 2014, p.389)

forcing—the amount of energy the atmosphere retains—and potential directions of socioeconomic development.

The initial descriptions of the five SSPs were minimal in detail, yet their titles evocative of the general state of global society, demographics, economics, and technology:

- **SSP1 Sustainability: Taking the Green Road**
- **SSP2 Middle of the Road**
- **SSP3 Regional Rivalry: A Rocky Road**
- **SSP4 Inequality: A Road Divided**
- **SSP5 Fossil-fueled Development: Taking the Highway**

(summaries overleaf)

As intended, additional studies expanded the elements considered—population, education, urbanization, GDP, per capita GDP, energy use, and land use, Greenhouse gas emissions, aerosol and air pollution, radiative forcing, etc—to create more detailed models of the pathways and allow for more comprehensive evaluation of the possible qualitative and quantitative impact of proposed actions on the global climate. These updated pathways are currently in use to generate the 2020 sixth assessment report of the Intergovernmental Panel on Climate Change (IPCC).

By their very nature, SSPs are not descriptive of the lived experience. However, they also express five possible shapes of our future in the face of the climate crisis and can be used to extrapolate the experience of living in a world affected by global heating. They proffer a view of the potential physical reality thus far described by percentages, parts per million, degrees, and inches, and centimeters. Such numbers are abstract. Yet addressing the climate crisis requires changes in behavior on the part of individuals, corporations, and governments, often requiring time, resources, and inconvenience. When asked to evaluate an abstract concept against a lived reality, most people will choose what they know and understand—the status quo of a resource-intensive lifestyle, which is unraveling ecosystem and disrupting climatic cycles. The SSPs allow the expression of that abstract concept of how human lives may be affected. They allow us to envision the consequences of our actions, or inactions, on our futures.

The image facing is part of our attempt, as a class, to build a quick physical model of the pathways (SSP1 & 3–5) to understand the dimensions better. The horizontal dimension represents the challenges to climate change mitigation, with high challenge to the left and low challenge to the right, while the vertical dimension represents challenges to adaptation.

Abridged SSP narratives from Riahi et al (2017, p.157)

SSP1 Sustainability: Taking the Green Road
Low challenges to mitigation and adaptation

The world shifts gradually, but pervasively, toward a more sustainable path, emphasizing more inclusive development that respects perceived environmental boundaries… Consumption is oriented toward low material growth and lower resource and energy intensity.

SSP2 Middle of the Road
Medium challenges to mitigation and adaptation

The world follows a path in which social, economic, and technological trends do not shift markedly from historical patterns. Development and income growth proceeds unevenly, with some countries making relatively good progress while others fall short of expectations.

SSP3 Regional Rivalry: A Rocky Road
High challenges to mitigation and adaptation

A resurgent nationalism, concerns about competitiveness and security, and regional conflicts push countries to increasingly focus on domestic or, at most, regional issues. Policies shift over time to become increasingly oriented toward national and regional security issues… A low international priority for addressing environmental concerns leads to strong environmental degradation in some regions.

SSP4 Inequality: A Road Divided
Low challenges to mitigation, high challenges to adaptation

Highly unequal investments in human capital, combined with increasing disparities in economic opportunity and political power, lead to increasing inequalities and stratification both across and within countries… Social cohesion degrades and conflict and unrest become increasingly common.

SSP5 Fossil-fueled Development: Taking the Highway
High challenges to mitigation, low challenges to adaptation

This world places increasing faith in competitive markets, innovation and participatory societies to produce rapid technological progress and development of human capital as the path to sustainable development… Local environmental problems like air pollution are successfully managed. There is faith in the ability to effectively manage social and ecological systems, including by geo-engineering if necessary.

Useful references on the SSPs

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Reframing Climate Action

A perspective by Matt Geiger

Climate change represents an existential threat to all human and non-human life on our planet. This is a global crisis. It is a complex, compounded problem, representing a multitude of technological, political, and economic challenges; as big and complex as they are, we should welcome these challenges. We can start by reframing the debate.

Later this month, families in the United States will gather to celebrate Thanksgiving. You may find yourself sitting at a table with someone who opposes the radical transformations necessary to address the climate emergency—someone who refuses to acknowledge the dire warnings from climate scientists, and who sees no real need to change our economy, food production or modes of transportation. Instead of browbeating them for their lack of concern or sense of ecological stewardship, consider this alternative: talk about how *exciting* this transformation could be.

Sustainability cannot be achieved if the only source of inspiration is our fear of a climate catastrophe. We need enthusiasm and a sense of adventure; we need to dream of big, radical shifts from the brightest corners of science fiction. We need to inspire people's imagination, and show them a future that is possible: with proper planning and investment into new technologies, we can build something better. Recycling our plastic bottles, taking public transportation or riding a bicycle to work might make us feel good about our carbon footprint (and if you do these things, thank you), but these kinds of actions do little to inspire. We need a moonshot of new technologies that make fossil fuels obsolete. This cannot be a lateral transition.

One of the most common objections to adopting the necessary changes and policies to address climate change (e.g. generating 100% of our electricity from solar, wind, and other renewables, massive expansion of public transportation infrastructure, abandoning fossil fuels in virtually every area of the global economy, sweeping reforms to agricultural practices and global trade, etc) is the notion that these changes are both radical and sudden. In fact, these changes are. It is radical to reshape how

people power their homes, what they eat, or how they commute to and from work. The IPCC says that "unprecedented and urgent changes"[1] are needed to keep warming below 1.5℃, and that failing to meet that goal will have catastrophic impact. In fact, even with the target of 1.5℃ we are likely to see significant ecological impact beyond what has already taken place.

What these objections fail to account for is that radical change is happening, and it will continue so long as new technologies are being developed. At the beginning of the twentieth century, most people traveled long distances by rail, ships, or even by riding on the backs of domesticated animals. The Wright brothers sparked a radical change in 1903, when they successfully completed the first heavier-than-air powered flight in Kitty Hawk, North Carolina. Less than thirty years later in 1927, Charles Lindbergh became the first aviator to successfully complete a non-stop trans-Atlantic flight. A little more than a decade later in 1941, the Japanese Imperial

forces launched a massive naval air strike against the United States Pacific Fleet at Pearl Harbor. That same decade, in 1947, Chuck Yeager became the first pilot to break the sound barrier. Roughly twenty years after that, in 1969, Neil Armstrong walked on the moon. By the end of the twentieth century, massive fiberoptic networks and satellites connected people from around the world and enabled communication at the speed of light.

It is an undeniable fact that some of the most transformative technologies of the twentieth century were not planned by governments or voted on by the consent of the public, but instead began with hobbyists. From powered flight to the home computer, radical change can come from the most humble beginnings. With proper funding, institutional support, public and private investments, and an insatiable drive for continual improvements, these new technologies have reshaped every aspect of our daily lives.

Even though it is commonplace today, flying on a commercial jet is still an adventure. One century ago, the wealthiest and most powerful people in the world could not enjoy the convenience or speed we now take for granted. It is an optimistic act to step inside of an aluminum tube and to trust total strangers to safely accelerate to over five-hundred miles per hour, thirty-thousand feet above the ground.

Unfortunately, this miraculous convenience comes at a heavy price: air travel is also a major source of greenhouse gas emissions. According to one study from 2016 [2], air travel alone could account for a quarter of our carbon budget by the year 2050. This is alarming but not hopeless. We do not need to abandon air travel and or return to riding on the backs of horses. The fundamental physics of aviation do not even require burning fossil fuels. In fact, there are already a number of prototype hydrogen-fueled aircraft that fly without producing any carbon emissions [3]. Research indicates that hydrogen is the most suitable alternative fuel; hydrogen is abundant (it is the most common element in the known universe) and because it burns clean, it could extend the life of jet engines by 25% [4].

Why stop there? Jet A-1 (one of the most common jet fuels in use today) was developed in the 1950s. Considering the rapid progress of modern aviation, why should we continue to use a seventy-year-old fuel? Jet A-1 has a maximum burn temperature of roughly 4,000°F;

that is impressive, but hydrogen can burn over a thousand degrees hotter at 5,100°F. The byproduct of burning this fuel is water vapor. What can we do with that extra thermal energy? SABRE hypersonic Reaction Engines are currently in development, and could potentially lead to commercial aircraft with a speed of over 4,000 mph. That's three times faster than the (now defunct) supersonic Concorde airliners.

Imagine flying from New York to London in one hour [5].

That's exciting, but I forgot to mention something: that speed only accounts for altitudes of 30,000 feet. Hydrogen-oxygen engines, unlike their antiquated kerosene-burning counterparts, are not dependent on atmosphere for their combustion. At higher altitudes, where there is no atmosphere or wind resistance, these hypersonic jets could reach speeds of up to 19,000 mph.

Imagine flying from London to Sydney in less than four hours. This is radical change; it is faster, higher, hotter, and cleaner than anything we have ever built before, but it is not unprecedented. This is what we have always done: better, and more exciting.

Matt Geiger is a US Navy veteran and recipient of the 2005 Vice Admiral William P. Lawrence Award, (Naval Air Force, U.S. Pacific Fleet) Air Traffic Control Technician of the Year. He is currently a candidate for Master of Arts in Design at Carnegie Mellon University and a research assistant for the Imaginaries Lab.

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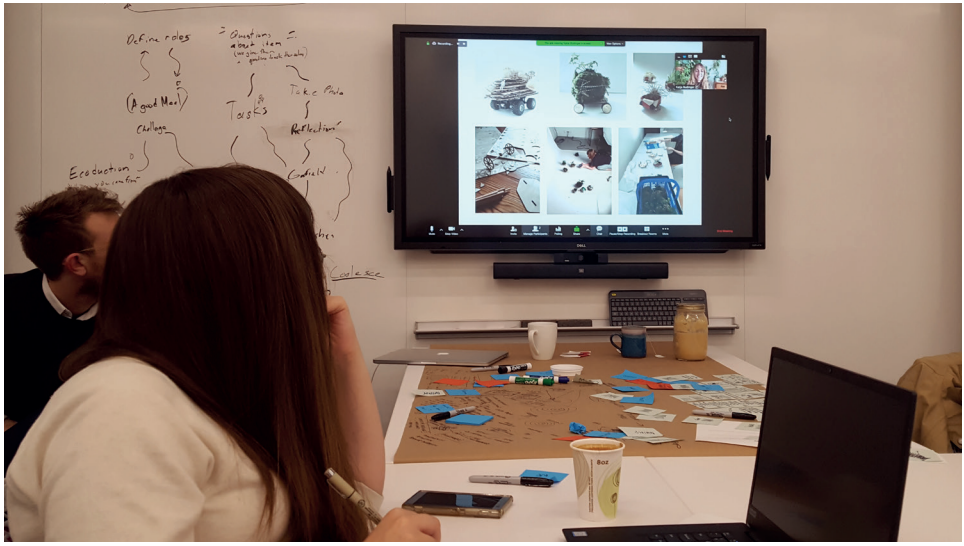
Inspiration

Over the course of our work, we've come across many other projects, initiatives, and inspiring writing which tackles the climate crisis and creative responses to it in different ways, from speculative design to climate fiction. We'll be updating a list at **imaginari.es/climate** so please do have a look, and if you have suggestions, please let us know.

One set of projects which inspired us, and whose creator Katja Budinger joined us for a talk during the class, is *Our Symbiotic Life*. In these projects, Katja uses four of the SSPs as a base for exploring new forms of relationships between humans, plants, and technology.

Katja Budinger and Frank Heidmann (2019). Our Symbiotic Life: An Exploration of Interspecies Relations. In Proceedings of the 2019 on Designing Interactive Systems Conference (DIS '19). ACM, New York, NY, USA, 1349-1362. DOI: https://doi.org/10.1145/3322276.3323698



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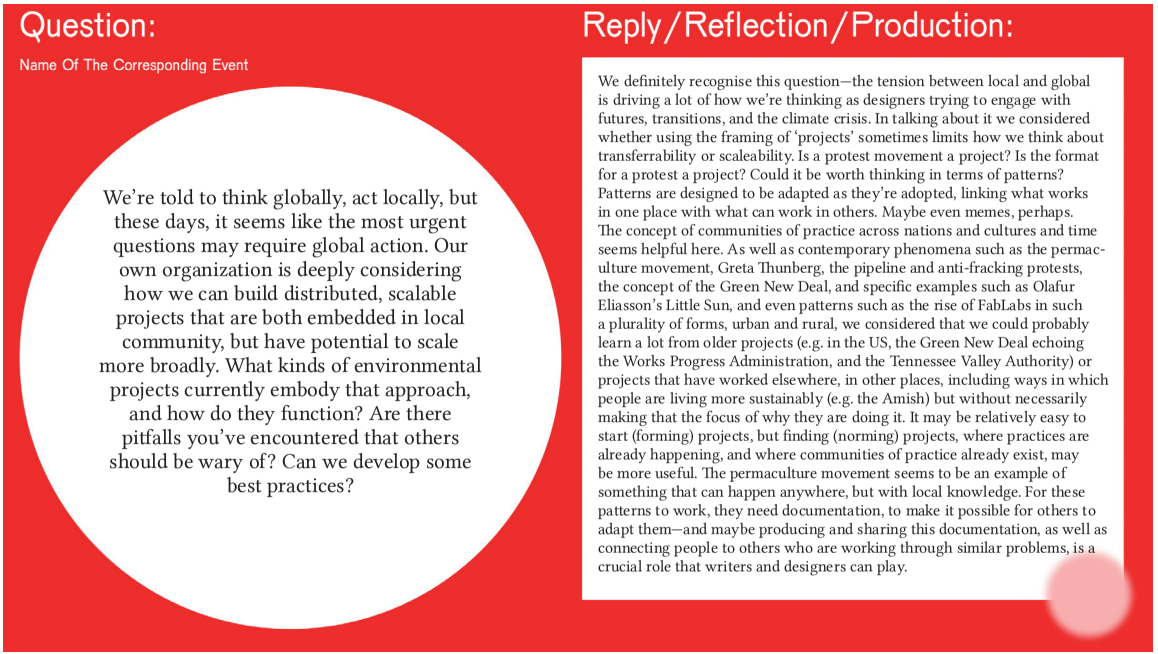


The Plurality University Network is a Paris-based international collective of designers, futurists, and science-fiction writers, founded in 2018 and in 2019 intiating the first Many Tomorrows Festival, an international, distributed sequence of events dedicated to alternative futures, and the role of arts in figuring them out and making them happen. We took part in the Festival, including a 'passing of the torch' where we received a question (above left) from the previous event in the program, run by the Speculative Literature Foundation, and offered our answer (above right). Many thanks to the Plurality University Network for their support for the class.

About the Imaginaries Lab

At the Imaginaries Lab, a new (2017–) research studio at Carnegie Mellon, based in the School of Design, we believe that humanity needs tools to enable new ways of understanding and imagining, and new ways to live, that provide more equitable socially and environmentally sustainable futures. We create those tools through developing creative research methods, adapted from those used in design practice, and explore their use in a variety of cross-disciplinary contexts.

A team of Master's, PhD and undergraduate student researchers are working with Assistant Professor Dan Lockton to build on an international research track record around interaction design for behavior change, to take this work into new directions. We are using creative approaches to envision alternative ways of thinking and living, now and in the future, to inform interdisciplinary academic research and practical applications for social and environmental benefit. The group's goal is to become a world-leading center for this kind of research, collaborating internationally and across disciplines to support transformative innovation. We carry out research projects, teach studio classes, publish, and run workshops internationally, including at interaction design industry conferences.

We're actively looking for collaborators inside and outside of academia, and would welcome a discussion if you're interested—please get in touch: **danlockton@cmu.edu**

imaginari.es

Above: Tangible Thinking workshop at RSD 8, IIT Institute of Design, Chicago; Right: Electric Acoustic project, New Metaphors cards, and Empathy Rock Garden project

Our three main research areas are:

Understanding ourselves better through design: wellbeing and mental health

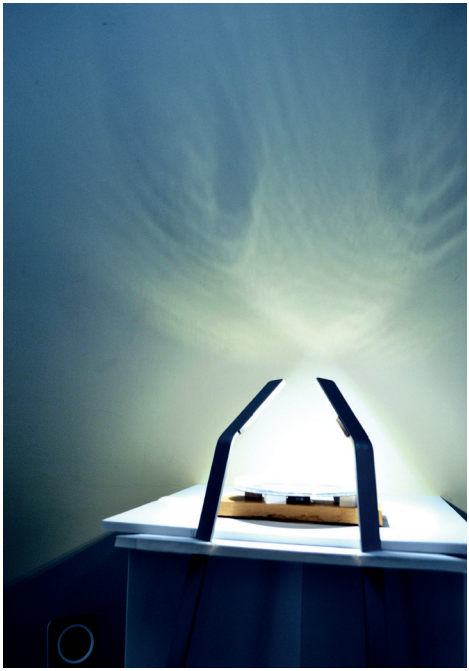
Design methods have the potential to allow people to explore, express, track, and understand aspects of everyday life, emotions, wellbeing, and health in new ways. We're working on a range of Research through Design projects investigating the possibilities of these 'innovative social research' methods for addressing challenges including mental health, sleep habits (in collaboration with Philips), and personal career and life planning. We recently ran a workshop at the Mozilla Festival using creative physical modeling methods to address neurodiversity issues.

Understanding the systems we're part of: climate change, artificial intelligence, energy, and government

The technological and societal systems and infrastructures around us are often invisible, even though their effects are felt every day. The Imaginaries Lab is using studio projects, prototypes, workshops, and speculative design to explore ways of making these systems engageable-with in new ways, from climate futures to energy use.

Tools for re-imagining the world creatively: new metaphors and new kinds of interface

A major part of our work is about developing tools for thinking differently—tools to re-imagine and understand the world in new ways, now and in the future. This includes both creative ideation methods and new kinds of interaction design and interface. We have a successful track record with the Design with Intent toolkit which has been widely adopted by educators, researchers, designers and businesses worldwide, and are currently launching New Metaphors, a new toolkit for creativity.



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Carnegie Mellon

PLURALITY
UNIVERSITY
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Megan Urban
Lea Albaugh
Julia Petrich
Tammar Zea-Wolfson

Elena Deng
Judy Chun
Antonio Song
Sharon Lee

Coco Allred
Joyce Wang
Yixiao Fu
Yingli Sieh

Chris Costes
Ema Karavdic
Cathryn Ploehn

Shawn Koid
David Lin
Rachel Kim
Matt Prindible

Matt Geiger

Dan Lockton

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