

ALTERNATIVE FUTURES AS A METHOD FOR EQUIPPING THE NEXT GENERATION OF DESIGNERS AND ENGINEERS

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ABSTRACT

This paper discusses how futures methods could be used to help emerging generations of designers and engineers to be better prepared for the demands of a rapidly changing future.

Science and technology have a pivotal role in realising a better world; however, as the world changes increasingly rapidly, we are educating future engineers and designers for jobs and contexts that don't yet exist. They instead need to be equipped to identify and exploit new opportunities by working across disciplines and considering multiple intervention points - from hard systems transitions, such as mobility or energy, to soft systems transitions, such as culture, identity or narratives.

The fields of design pedagogy and futures studies bring significant insights to this challenge, including an array of methods, tools and frameworks for problem framing and problem solving through divergent and convergent thinking. This paper describes an intensive week-long workshop that used alternative futures as a prompt for teams of secondary school students (aged 16-17) with an interest in studying medicine, science and engineering. This week was part of Imperial College London's Global Summer School and was one in a series of workshops run by the authors to build and test these methodologies by employing alternative futures to develop products for, and eventually in, the future.

The results of this latest workshop suggest the potential for experiential learning to explore new ways of working and enable students to reflect and test their dominant assumptions about the future. Finally, the study highlighted the need for further research to better understand how students can embrace the dissonance between their stated preferred futures and the range of possible and probable futures.

Keywords: Futures Studies, Alternative Futures, Experiential Learning, Sustainability Pedagogy, Design Thinking

1 INTRODUCTION

Time is of the essence if we are to enable new generations of leaders, practitioners and academics to be equipped with the skills and capabilities needed to tackle sustainability challenges. Reaching the current sustainable development goals implies that the modern lifestyle will need to reduce consumption by ten times [1] and in response, a growing body of academics and practitioners are advocating for radical, transformative changes to achieve sustainability. Current approaches aim to address these through interventions across a wide array of levers of change [2] in multiple hard systems (such as energy, food, mobility, health, education, finance) and soft systems (such as fashion, culture, governance, religion and ritual). Tackling these challenges in a meaningful way therefore requires an ambitious re-imagining of almost every aspect of the modern lifestyle.

The shift in behaviour required to realise this transformation demands that we change the way we see the world, and our place within it. If we are to realise long term transition, this means creating interventions in the early years of worldview development to target a change in the mindsets of young people - through developing capabilities for critical thinking that strengthen resilience to the unknown unknowns of tomorrow, rather than focusing only on the current known and known unknowns.

Education and project-based learning in particular, are intended to prepare young people for the complexities facing them as citizens in a global community. However, the prevalent teacher-centred pedagogy is not conducive to the development of 'Earth-literate leaders' [3], who need a variety of skills that will be key in tackling the challenges outlined above, such as divergent thinking, creative problem solving, empathy, and self-reflection. This research explores how sustainability pedagogy can

be transformed to equip an emerging generation of engineers to meet these future challenges. It investigates the use of alternative futures and design-led approaches as a method for experiential learning, testing if the combination of these methods encourages self-reflective practices as a key first step towards becoming leaders of sustainable futures.

2 BACKGROUND

This research is rooted in the fields of design education, sustainability education and futures. Buchanan [4] defines design thinking as problem-solving that begins as universal in scope and can apply to any area of the human experience. Futures Studies encourage pushing even further and thinking beyond today's economic and social paradigms, and at every level of our society. Together, these approaches enable a systemic approach that is needed to tackle the wicked problems ahead.

2.1 Design Pedagogy

Since the 1980s, design education has evolved to be exemplary of thinking and learning processes which enable future practitioners to deal with complex problems and uncertainty [5]. This has led to the development of design thinking as a field in itself and the advent of 'designerly ways of knowing' [6]. Cognitive psychologists have argued that this represents the interplay between binary processes of convergent aspects (which asks 'what comes next in this logical sequence?') of rational, deductive thinking and divergent aspects (which asks 'what might this mean?') of intuitive, open-ended thinking [5]. Tools to develop these skills are few and far between outside design-led higher education and are typically less self-guided when offered at the secondary education levels. This is a clear area of opportunity for design pedagogy to build a more integrative capacity in all students, and especially to those from STEM backgrounds traditionally presented with linear and rational modes of study.

The real potential of design thinking lies in its practical application as a project-based constructivist methodology. Design thinking becomes a tool for teachers and learners to develop the skills and competencies necessary for responding to the unknown challenges of the 21st century. Integrated into all stages, design thinking has the potential to affect a paradigm shift in education, and consequently our ability to improve our personal and societal conditions.

2.2 Futures Studies

In contrast to design thinking, futures and foresight methods have long been used in business and policy-making. However, the use of foresight methods in these regimes usually falls within two categories: as a prototyping method for product-service-experience innovation explorations, or as a strategy development method. The use of foresight methods in order to develop a prospective and systemic understanding of transitions for sustainability is a new area of exploration [7]. Much like the field of design, futurology is often portrayed as an expertise exclusive to experts, while in fact the participatory approach is a core value for both professions. Challenging the misconception that 'professional experts' are the only ones who can tackle long-term and large-scale problems, new tools are emerging to popularise and lower the barrier to entry to both design [8] and futures methods [9]. Scenarios are one tool commonly used to help expand our 'possibility space' by encouraging speculation of multiple and widely varied alternative futures [10] and can offer new potential for education.

2.3 The Global Summer School

The research has been conducted as part of teaching in the Global Summer School (GSS) at Imperial College London conducted in August 2017. Two hundred secondary school students from all over the globe attended four different academic tracks, out of which forty-three students joined the 'Future Envisioning' track described here. The GSS attracts highly competent and confident STEM oriented students, where most are aspiring engineers and medics from affluent, globally mobile backgrounds. The brief for 'Future Envisioning' was to develop a glimpse into life in 2050 and visualise this through designing a set of future interactions and touch points with a particular product, service, experience or system. The learning outcome of the sprint was to engage students in the application of interdisciplinary and systemic thinking about uncertain futures through experiential learning, thus giving them a taste of the various decisions and implications they'll encounter during their future careers. In this way, this project was also designed to help the authors explore new modes of sustainability education to equip the designers and engineers of the future, by bringing together design

methods such as speculative design and foresight methods such as scenario explorations in order to cultivate prospective thinking.

3 DESIGN AND DISCUSSION OF THE STUDY

The Future Envisioning track of GSS built on a series of preliminary workshops designed and facilitated by the authors [11] that explore the role of alternative futures as a design method in enabling systemic sustainability transitions, and suggest an opportunity for extended research in the role of these methods in for creating future imaginaries and back casting present actions.

3.1 Research Design

An overview of the structure for the project is shown in Figure 1, where the week long design sprint was divided into two halves to encourage divergent thinking using futures methods and convergent thinking using design. The first half began with a narrative exercise, creating prose in order to imagine a positive future in 2050 and describe the path there. Following this, the participants were guided through the co-creation of several futures methods designed to encourage divergent thinking, followed by a discussion and development of signals of change and trends. Finally, the participants were divided into teams exploring one of four scenarios, which were used as lenses to explore possible future worlds through role play and improvisation. In the second half of the sprint, participant groups were assigned a single scenario to aid their design development. This phase included ideation, concept development, rapid prototyping; design through making, and culminated in a series of presentations to a panel formed of academics and industry experts.

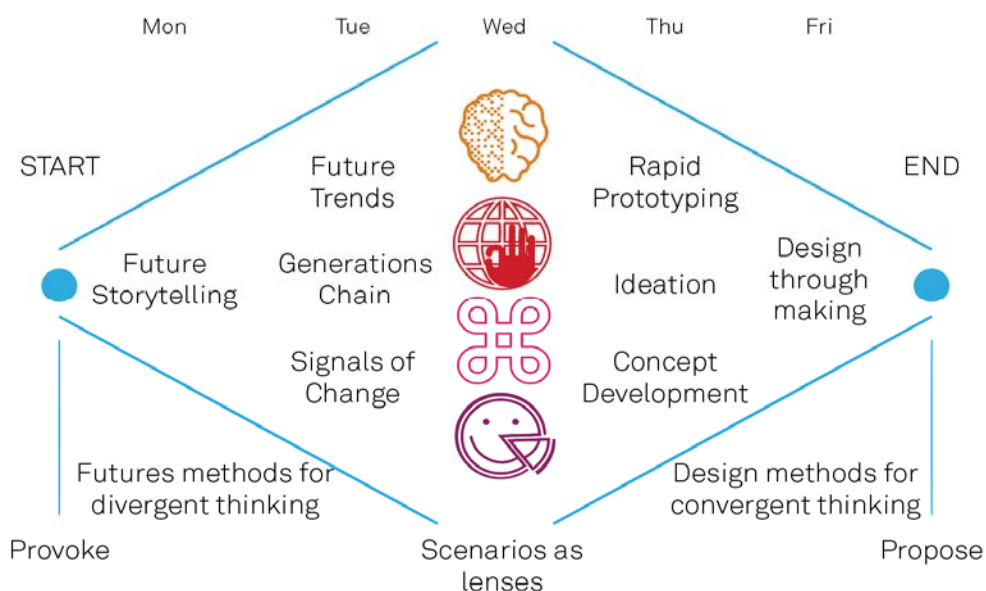


Figure 1. Journey through GSS: A method for divergent and convergent future thinking

3.2 Future Visions and Storytelling

The following subsections describe chronologically the design of the workshop and the key methods employed in more detail. Discussion of the results is included inline to unpack the findings.

3.2.1 Generations Chain

The Generations Chain is a futures method which argues that *'in order to obtain a grasp of our own context in time, we require a notion of the present which recognises that we are: 1. rooted in the past, 2. responsible for creating our near-term futures, and 3. also responsible for protecting future generations'* [12]. The exercise invited participants to depict the hopes, fears, and major events experienced by five generations, including their own. The historical lens provided a rich source of inspiration while, perhaps unsurprisingly, future generations proved more difficult to speculate. The grandparents' generation is marked by experiences around the aftermath of WW2 or the Cold War. Their hopes were as a result more foundational, including basic needs, peace, and building a family. Meanwhile, the parents' generation has been marked by the formation of the EU, globalisation, wars

in the Arab world and the internet. The participants' reflections on their parents were considerably more specific, personal, and nuanced. For many of the participants, who are first generation or second generation immigrants, their parents' lives were defined by aspirations of studying abroad, going to university, and supporting their children's education. With regards to the participants' own generation, unsurprisingly, this exercise came most naturally and responses had the most depth and personal meaning. Their hopes reflected recent political debates including the editing of human genomes, thermonuclear energy, and decriminalising cannabis. Key themes were climate change, social media and rapid technological change. Fears touched on pollution, overpopulation, and deforestation as well as the lack of jobs, rising inequality, and later retirement age. Projected into the future, the acceleration of technological change is seen as key, with related hopes and fears. Participants strongly envision collapse-related markers for their children's generation ('WWIII, nuclear holocaust, machines taking over'), many of which share similarities to the fears experienced by their parents and grandparents generations. In terms of hopes, there was a unifying trend towards universalism for their grandchildren's generation ('world language, world currency, people on Mars'). The use of the Generations Chain as an opening exercise to the week enabled participants to reflect on the scale and time required for societal change to happen and created the space for an upfront conversation about preferred, possible and probable futures. The Generations Chain was followed by a reflective session which was underpinned by a discussion on values [13] and the role they play in shaping our imaginaries of the future. This process enabled the participants to reflect on aspects concerning path-dependency and the events and innovations as pre-conditions that would need to be true in order for their vision for future generations to be possible.

3.2.2 *Storytelling 2050*

Following from the Generations Chain, we asked each participant to write a story about a positive view of the future in 2050 and describe how we got there, as well as how they would describe the story through emojis. The stories highlight different beliefs about how change can happen; who the stakeholders are who have agency and their ability to influence change. They also highlight the capacity to tell future stories and describe pathways to get there, as all participants submitted thoughtful and in depth passages. The stories can be mapped onto a model developed by Dator's Four Generic Futures [14], which observes that the narratives we develop about the future can be classified in four recurring archetypes: Grow (business as usual, continuation of status quo), Discipline (behaviours to adapt to internal or external limits); Collapse (system degradation or failure); and Transformation (game-changing new models or factors). Of the forty-three stories developed by the participants, ten map to 'discipline', twenty-two to 'transform', seven to 'grow' and four to 'collapse'. Out of these scenarios, six imagine a multi-planetary society by 2050. Given the science and engineering focus of the cohort, it's unsurprising to find recurring patterns depicting a techno-centric 'transform' pathway as key to solving climate change and evolving human cognitive capacity.

3.2.3 *Prototyping in the 2050 scenarios*

This project uses the 'SPREAD Sustainable Lifestyles 2050' [15], shown in Figure 2, as a foundation for the design sprint to tell a story about sustainability transitions and societal change, and act as a starting point for students by giving them visions of a set of preferable futures and an idea of the scale of transformation required to get there. These scenarios were developed by a consortium of experts led by the UNEP/Wuppertal Institute Coordinating Centre on Sustainable Consumption Production and describe four distinct sustainable future societies.

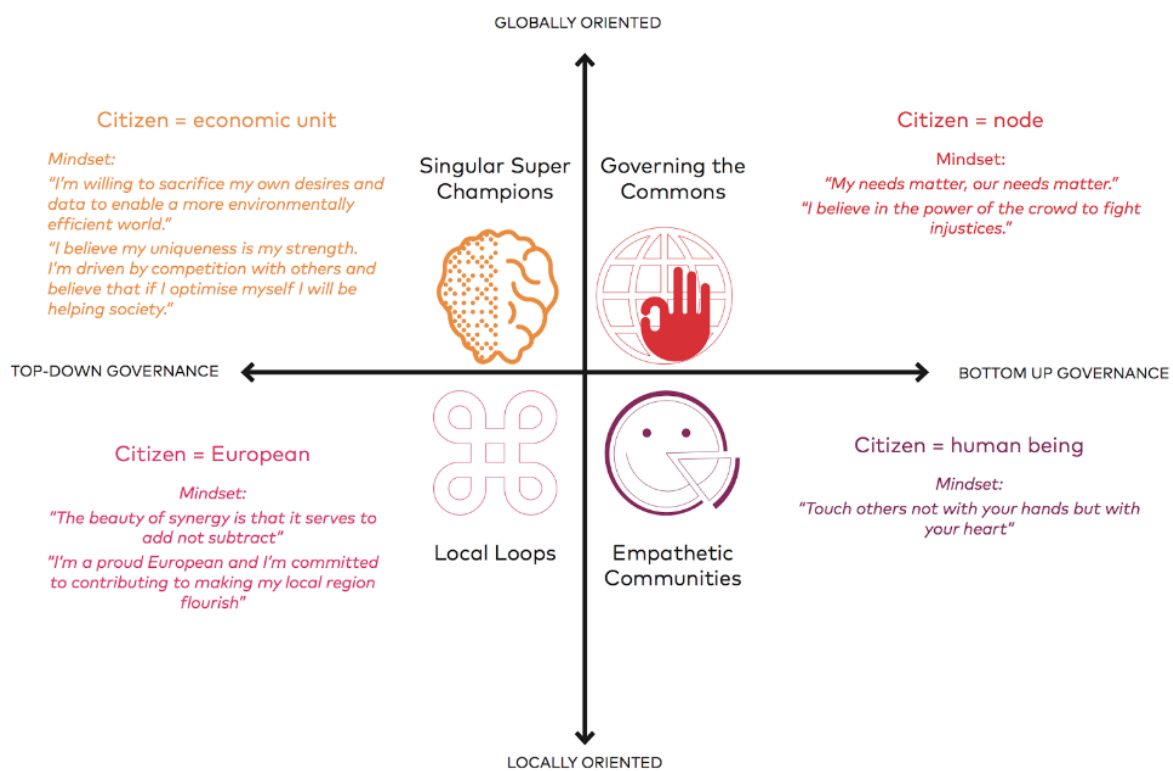


Figure 2. SPREAD 2050 sustainable lifestyles scenario axes and dominant mindset

The authors used deductive forecasting [16] to challenge the participants to develop the features of the scenarios. This was facilitated through an improvisation exercise, whereby small teams enacted a glimpse of what it would be like to be alive in the four different scenarios in 2050, based on a limited set of scenario information (the axes, mindset and headlines). They then received a set of visual cues describing the pathways to 2050, as well as the state of the world in each of the scenarios. This enabled them to explore the types of innovation needed to move towards a sustainable society by exploring the different pathways, and acted as a springboard for the design process which followed standard design thinking stages such as brainstorming, ideation, concept creation and prototyping.

The participants formed eight groups (two for each of the scenarios) and were asked to create an artefact/experience from the future and a video 'sketch'. Seven out of the eight concepts assumed a highly techno-centric future as given, which speaks to the dominant view that emerged from the storytelling exercise as the archetypal 'transform' future. In comparison, previous research conducted by the authors with postgraduate students using the same scenarios saw all groups speculating a 'collapse' event triggering societal change [11]. This highlights a potentially distinct generational difference in outlook and aspirations between 'millennials' and 'Gen Z'. Participants struggled most throughout the process with the bottom-up and local scenarios. Despite reflecting on the much more localised nature of their grandparents' and parents' lifestyles, participants found changes in the dominant globalised nature of our current world highly counterintuitive. This further reinforces the pervasiveness of 'transform' as a preferred pathway. Anecdotally, many participants struggled with a perception that the only viable paths suggested a departure from individualistic paradigms (linked to capitalism) towards communitarian pasts that their own forefathers had transitioned away from.

4 CONCLUSIONS

GSS was an exploration of a pivotal point in a young person's learning journey, a stage defined by university applications and corresponding career choices. The summer school format allowed for project-based learning atypical in the formal learning environment, as a first step towards cultivating 'Earth-literate leaders'. The process of design as an intervention, and not as content learning, enabled practically oriented students (future engineers) to consider the future glimpses they developed as touch points with potentially broader-reaching impact. As one student reflected, *"This is a science summer school, but the future visions topic got us to think more about the social impact of science"*. A shift in mindset such as this is key to unlocking behaviours and attitudes that can enable future practitioners to be geared towards enabling sustainable lifestyles. However, testing whether these insights and reflections have lasting effect is necessary to validate whether these methods create long-lasting change in mindsets.

Scenarios played two key functions: Firstly, they encouraged systemic speculation across a varied set of alternative futures. Secondly, they enabled reflection on the nature, pace and characteristics of radical long-term change. The assumption of a drastically changed future society enabled the students to think of change as a pathway, not unlike the lived histories of their own ancestors. Oftentimes future scenarios can seem intangible, especially when involving long timelines; the project based approach enabled students to develop propositional artefacts which facilitated a reflective conversation about what it might *feel* like to be alive in the respective scenarios. Design methods such as ideation, concept creation and prototyping enabled the students to move in a propositional space and sparked intense debate among students about what would and what would not be feasible in their respective scenarios, as well as what would be preferable and deemed to improve the quality of life in the future. The results suggest the potential for more experiential learning to explore possible futures and enable students to reflect and test their dominant assumptions around the role and applications of technology in achieving and maintaining sustainable societies over the next decades. The learning experience also illustrated the necessity of integrating politics, economics, and ethics into traditionally siloed STEM subjects and more generally into the conceptual stages of any design project.

Given that the sample of students represented a homogenous group from the point of view of the values they held as well as socio-economic backgrounds, further research is required with groups from different backgrounds and espousing different value sets. For example, the dominance of the ‘transform’ outlook as a preferred pathway to reaching a sustainable future would need further testing across different socio-economic and age groups, to establish whether it marks a generational shift between millennials and Gen Z, as well as across socio-economic backgrounds.

Finally, measuring success and monitoring the impact of this experience is a difficult process to construct given that the indicators required would need to address the ability to work with uncertainty, self-reflexivity, divergent and interdisciplinary thinking. Immediate feedback from participants however demonstrates the experience has had an impact on the ways they picture *the Future*.

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