

Here and There, Now and Then: Creativity, Design and Instruction for Hybrid Environments

Daragh Byrne
daragh@cmu.edu
School of Architecture, Carnegie
Mellon University
Pittsburgh, Pennsylvania, USA

Dina El-Zanfaly
delzanfa@andrew.cmu.edu
School of Design, Carnegie Mellon
University
Pittsburgh, Pennsylvania, USA

Daniel Rosenberg Munoz
drosenb2@andrew.cmu.edu
School of Design, Carnegie Mellon
University
Pittsburgh, Pennsylvania, USA

Daphne Peters
dfiros@andrew.cmu.edu
School of Design, Carnegie Mellon
University
Pittsburgh, Pennsylvania, USA

Peter Scupelli
pgs@andrew.cmu.edu
School of Design, Carnegie Mellon
University
Pittsburgh, Pennsylvania, USA

ABSTRACT

Hybrid Environments – spaces where physical and digital elements are blended in-situ – have been growing and expanding over the past few decades. As these technologies become woven into our everyday lives, new challenges and opportunities emerge as they transform our experiences in our homes, workplaces, museums, and cities. Designing Hybrid Environments requires training in both the design of physical environments and interactive technologies. Cross-trained students in higher education need to be able to creatively respond and adapt to these emerging landscapes. Students must bridge fundamental knowledge in design, architecture, art, interactivity, and computation. This is a complex pedagogical practice. How are educators meeting this emergent need? The workshop's primary goals are to (i) form a collective understanding of the current technological and pedagogical challenges to teaching the design and understanding of Hybrid Environments; (ii) bring together educators and practitioners interested in the future of Hybrid Environments, (iii) discuss creativity support tools as well as frameworks, methods, and approaches for teaching emerging technologies, (iv) form a multidisciplinary community to shape the future of pedagogical inquiry and implementation of Hybrid Environments.

CCS CONCEPTS

• **Human-centered computing** → **Interaction paradigms**; • **Applied computing** → **Interactive learning environments**.

KEYWORDS

mixed/augmented reality, hybrid environments, HCI pedagogy, embodied experience, multisensory interactions, creativity Support, cognition and instruction



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1 INTRODUCTION AND BACKGROUND

Hybrid Environments are spaces where physical and digital elements are blended in-situ. This encompasses a lineage of work in responsive spaces and architecture, kinetic installations, context-aware computing, adaptive buildings, sensor networks, urban gaming, as well as mixed-, augmented- and virtual- reality [3, 8, 13, 17, 21, 22, 29]. As these technologies become woven into our everyday lives, new challenges and opportunities emerge as they transform our daily experiences in our homes, workplaces, cities, etc. Over the past decade, with the increasing prevalence of consumer-ready extended reality (XR) headsets, and industry platforms for IoT systems, technology-mediated environments has transition from the lab to real-world, large-scale applications.

Within design, arts, architecture, and other creative domains, these new Hybrid Environments create new possibilities for design education: from designing new interactive tools and processes that support and enhance learning and creativity, to the development of novel and immersive educational experiences, as well as developing training and strategies to encourage students to imagine, craft, and consider these blended interactions. Within these endeavors, students in higher education must acquire new types of creative skills and face new cognitive challenges in bridging requisite multidisciplinary knowledge in design, architecture, interactivity, and computation. It is a complex and challenging pedagogical practice to teach students to craft blended experiences. How are educators and educationally focused researchers meeting this need? What creative approaches have emerged to building cross-trained interdisciplinary education in this space. With rapid shifts in enabling technologies, toolkits, and platforms, and adoption and application, how do we equip emerging interaction designers and researchers with resilient and creative skills to work on, (critically) respond to, and inquire upon these changing technology landscapes? How can we creatively support students to learn to perceive and think about

designing blended spaces? Instructors navigating these complex pedagogical challenges need new ways to interpret and evaluate the efficacy of their tools and methods. Educating for the design of next-generation Hybrid Environments will also require us to build understanding and assessments of instructional methods and how they enable the acquisition of new creative skills, support new kinds of creative work, and build new forms of simultaneously situated, embodied and virtualized knowledge¹.

Engaging students in higher education within Hybrid Environments is not limited to the craft and construction of blended technology-mediated spaces, but can additionally introduce and raise complex questions about our relationships to technology. Holan, Hutchins, and Kirsh highlight how environments and objects shape cognition and understanding [15]. This has many opportunities and implications for augmented, virtual and smart environments. For example, recent work by Verweij, Bakker, and Eggen [27] suggests how ambient objects and indoor localization can enhance awareness and coordination in instructional spaces. Equally, there is a need to cultivate critical sensibilities and reflective practices within emerging practitioners [1, 7]. This will enable them to inquire and speculate upon the increasingly entangled relationships we have with technology [4, 9], the continuing challenges of being social and embodied in Hybrid Environments [19], emerging questions of human agency and machine agency [5, 12], decentering the human in the design of systems [14, 17, 20, 26], and the sociopolitical aspects of networked technology [6, 16], and more besides.



Figure 1: Data Stamp, Image Credit: Se A Kim.

Within the context of a global pandemic, many in-situ approaches to teaching Hybrid Environments were unavailable and the practices for project-based learning, design education, and design research were dramatically altered [23]. As a result, instructors of smart, augmented, and intelligent spaces have experimented with new formats, creative interventions, and innovations big and small. They have leveraged a plethora of tools – from Gather.town, Slack,

¹ To showcase the wide range of approaches to hybrid spaces, and the implications for teaching, we offer examples in the figures. These come from our teaching and research focusing on Hybrid Environments in our studios, courses and labs at Carnegie Mellon University.



Figure 2: A participatory, immersive experience for the Carnegie Museum of Natural History that focuses on the impact of the anthropocene on natural systems.



Figure 3: Wanted Design: Fabric Partition with thermochromic pigment and conductive thread. Image Credit: Daniel Rosenberg

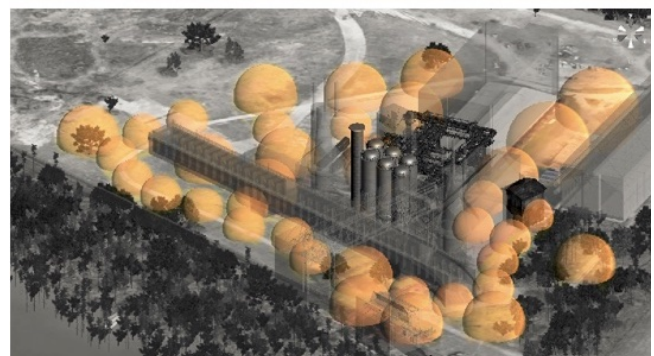


Figure 4: A mixed-reality spatial audio walk designed for the Carrie Furnace, a cultural heritage site in Pittsburgh [10]. Image Credit: Yixiao Fu.



Figure 5: A museum of failed products generated by students for immersive theatre production, *Project Amelia*. Speculative, interactive devices bring audiences into dialog with AI ethics [24]. Image Credit: Handerson Gomes.



Figure 6: Sand Playground: An physical interface for human-AI co-creation and collaboration. Image Credit: Yi-wei Huang.

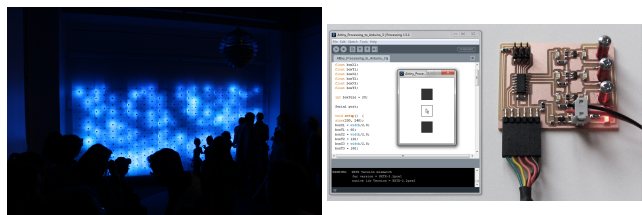


Figure 7: Maxwell's Dream: Interactive Wall with magnets, and LED controlled through analog sensing (OpAmps). Daniel Rosenberg and Kaustuv DeBiswas

and Zoom to experimental XR strategies – creative adaptations and rapid responses [2, 11, 18, 25, 28]. This workshop seeks to provide a timely forum to gather, reflect, and share on these experiences, to learn from one another, to distill valuable experiences and instructional practices, to critically examine how to teach students to design Hybrid Environments and to collectively craft research agendas for shared future inquiry.

2 WORKSHOP GOALS AND ORGANIZATION

The workshop's primary goals are to:

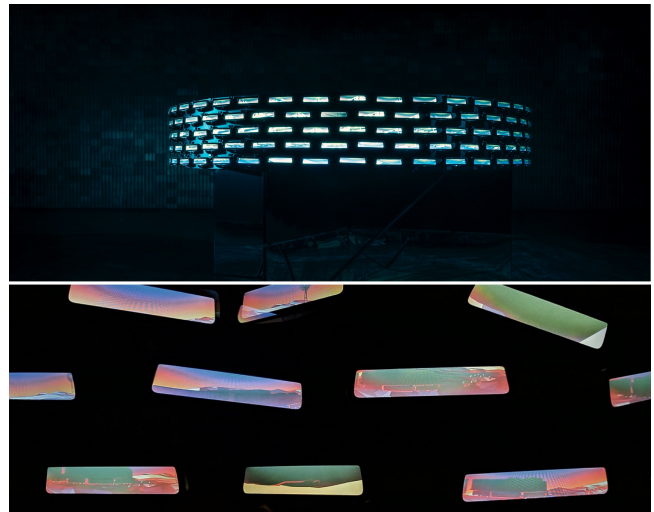


Figure 8: Horizon Interactive Sculpture with screen portals into a digital world. Shown at the Marfa Film Festival. Credits: Daniel Rosenberg, Midnight Commercial

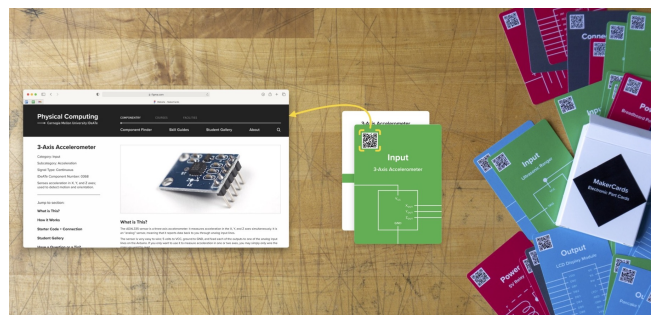


Figure 9: MakerCards: a creativity support tool to help novices learn physical computing [18]. Credit: Miranda Luong, Robert Zacharias, Daragh Byrne and Marti Louw.

- (1) form a collective understanding of the current technology and pedagogical challenges to teaching Hybrid Environments in higher education contexts;
- (2) bring together educators and practitioners that are interested in design, learning and craft for the future of Hybrid Environments,
- (3) discuss tools, frameworks, and methods for teaching emerging technologies and fostering creative outcomes,
- (4) form a multidisciplinary community to shape the future of the pedagogical inquiry, implementation, and approaches to Hybrid Environments.

The workshop seeks to address the future of Hybrid Environments by sharing emerging instructional approaches and research agendas that are helping to educate emerging designers today. Specifically, we will:

- Identify problems of practice facing educationally-focused researchers across design, learning sciences, HCI.

- Share pedagogical responses, creativity supports, visions, and perspectives.
- Develop and coordinate shared research agendas and pedagogical inquiry for future

Audience: We invite researchers, educators, and practitioners with interests in design education and hybrid spaces from across domains including but not limited to design, art, architecture, the learning sciences, and computing to join the workshop.

The workshop will be a full-day event. This will be supplemented with hybrid activities two weeks before the workshop at Creativity and Cognition 2022 to enable the broadest audience to participate in the discussion.

We anticipate hosting 12-15 participants in person, along with the five workshop organizers.

3 WORKSHOP THEMES

Theme 1: Creative Approaches to Teaching Emerging Technologies for Hybrid Environments

- *Emerging Technologies* (e.g. Tracking Technologies, Internet of Things, XR, AR, VR) and how they shape creative pedagogies
- *Crafting Learning Environments* for Hybrid Environments
- *Post-Pandemic Hybrid Environments*: Telepresence, Distributed Spaces and the temporality of experience
- *Creativity Support Tools*: Technologies and other supports for accelerating learning and exploration.

Theme 2: Current Challenges to Teaching Hybrid Environments

- *Cognition and Instruction in Blended Spaces*: Learning objectives and cognitive challenges in reasoning, conceiving, and building Hybrid Environments.
- *Experiences from the pandemic*: What have we learned about teaching augmented, hybrid and embodied experiences?
- *Teaching adaptations for new technologies*: From exploratory and speculative approaches to practical skill-building and tool-learning.
- *Learning assessment and performance methods*: Pilot studies, curricula, or cases of evaluating Hybrid Environments design and instruction.
- Best practices and cases for the integration of teaching and research

Theme 3: Speculative Futures and Opportunities

- *Training for Adaptation*: Training students to respond to ‘always emerging’ adaptive technology landscapes and teaching today’s designers what they might need to know in the future
- *Training for Resiliency*: Designing instructional experiences resilient to rapid change of technology infrastructures.
- *Training for Innovation*: Classroom innovations for new technologies and enabling students to imagine technology in new ways.

4 CALL FOR PARTICIPATION

The workshop will bring educators, researchers, and practitioners working with students in higher education contexts on the design

of Hybrid Environments together to share their experiences, tools, frameworks, methods for teaching and discuss how to prepare future designers to shape the hybrid spatial experiences of the future.

Participants will be asked to write position papers on the future of teaching Hybrid Environments or share case studies focusing on their own work, instructional approaches, and teaching methods. As part of the workshop, participants will also show their teaching spaces remotely, directly from their labs, office spaces, and classrooms, so that we can learn from one another.

As physical-digital technologies keep evolving and disrupting the industry with new products and experiences, there will be a need for a skillful and thoughtful workforce of designers, creative technologies, scholars, and thought-leaders ready to participate in shaping this future. This workshop invites participants interested in discussing the pedagogies of emerging hybrid technologies and ultimately join us in building an area of exploration in the years to come.

5 IMPORTANT DATES

Below is a list of proposed key dates for the workshop:

- *Submission Deadline*: May 6th, 2022 (see below for details)
- *Final Decision Notification*: May 13th, 2022
- *Remote Gathering (3 hours)*: June 5th or 6th
- *1-Day Workshop*: June 20th, 2022

6 PRE-WORKSHOP PLANS

6.1 Attracting participants

We will develop a website for the ACM C&C workshop to publicize the upcoming event. This initial platform will later develop into the website where the outcome of the workshop will be posted, along with a Booklet including position papers, course syllabi, and relevant ongoing developments in the field. The workshop will be publicized to ACM C&C researchers through a website, known networks of educators and researchers at other international institutions, SIGCHI email distribution lists, and social media. We will also communicate the workshop structure and aims, a call for participation, and a schedule on the Workshop’s website.

6.2 Documentation of University Settings

Participants will produce and present video walkthroughs (3-minute maximum) of the learning spaces where they teach hybrid experiences and/or smart environments, and to highlight current technology available for student learning. The objective of these videos will be to introduce the participants’ work and workspaces and spark the discussion of the current state of hybrid environment pedagogy. These will be curated on the workshop website and made accessible as a resource for discussion before and after the Workshop.

6.3 Online Workplace

Several asynchronous methods of communication will be provided to remote and in-person participants. We will prepare a Slack channel for participants to share and discuss topics before, during, and

after workshop events. We will also create a Miro board to allow participants to share artifacts, as well as annotate and discuss examples of Hybrid Environments.

6.4 Remote Gathering - 2 weeks before C&C 2022

To kick off the discussion prior to the workshop, we will stage a remote gathering two weeks before ACM C&C's workshop day. This will consist of a short keynote presentation, presenting position papers from attendees who cannot attend in person, and identifying challenges to and opportunities for future research and practice that can be discussed further in the actual in-person workshop.

This pre-workshop will take place in a video conferencing application and parts of it will be recorded. The recording will be made available to all participants. The total duration of the workshop will be 3 hours, including a short break of 5 min.

6.5 Remote workshop schedule

3 hours total. Required for remote attendees, optional for in-person.

10 min - Welcome and Introductions

45 min - Keynote Speaker - TBC

30 min - Papers from remote attendees (5 mins per person)

30 min - Screenings of Educational Cases (3-min video tours).

45 min - Worksession and Discussion of challenges and needs.

30 min - *Close*: Online Workplace Setting, Next Steps, and Logistics for in person.

7 IN-PERSON WORKSHOP SCHEDULE

Morning- Current state: where are we?

30 mins - *Breakfast Conversation*:

- Meet and greet over coffee and tea.
- Screenings of educational cases (3-minute video tours) played in the background.

10 min - Welcome and Introductions

50 min - *Lightning talks*: 5 minute for each paper

10 min - Short break

90 min - *Breakout groups work session*:

- How do you incorporate this technology into your courses? (projects/prompts/hands-on workshops)
- What are the creative and cognitive skills required to design Hybrid Environments?
- Current challenges to teaching Hybrid Environments

15 min - Small group share out

30 min - *Morning Wrap-up*: Collective mind map of current situation and challenges

Lunch - 30 mins

Afternoon - Future state: where should we be going? 10 min

- Introduction to afternoon's discussion

60 min - *Breakout groups work session*:

- What do we want the future of Hybrid Environments to look like?
- How can we innovate in the classroom as new technologies change?

- How might we assess Hybrid Environments instructional methods?

20 min - Small group share out

15 min - Short break

30 min - *Work session and Discussion*: How to teach designers today what they need to know to develop this future?

15 min - Small group share out

30 min - Consolidate future plans and closing

7.1 Details

The one-day workshop outlined above consists of two main themes. In the morning, we will explore the current state of hybrid environment pedagogy, including what people are already doing and the challenges we face. We will start with a workshop introduction and then participants will share short presentation summaries of their position papers. These will be followed by two workshop sessions, where the larger group will be divided into four smaller groups, to allow for more intimate, involved discussions. At the end of each session, the groups will reconvene to share insights. We will wrap up the morning with a collective mind map of the current situation and challenges that practitioners and researchers face. In the afternoon, we will speculate on the future outlook for Hybrid Environments and their corresponding pedagogy. Through a series of sessions, participants will explore tools and methodologies that will give educators a framework for teaching Hybrid Environments in the coming years. The workshop will culminate with a consolidation of the insights developed in the workshop sessions and a discussion of post-workshop activities.

7.2 Venue Requirements

We are flexible in our requirements for the venue. We would ideally seek a design studio or space that can support design-led and creative activities including: whiteboards, pin-up space, and small breakout groups. If possible, having additional displays (portable monitors or TVs) would be useful to have rolling presentations, screen educational cases, and provide opportunities for virtual workspaces (Miro, etc) to be made visible across breakout groups.

8 POST WORKSHOP PLANS

The workshop organizers propose several post-workshop outputs that will serve as a resource for all educators and researchers. We will continue the dialog started with the attendees and broaden it to others who are interested in teaching students how to design hybrid experiences.

This will be accomplished by:

- (1) Preparing a short booklet based on the workshop's discussions that collates syllabi, instructional practices, challenges and agendas for future inquiry.
- (2) Updating and maintaining the workshop site to provide digital resources, educational case studies, and reference materials. The website will act as a platform for growing work and discussions on the main theme.
- (3) Aiming to coordinate an edited volume for attendees and other interested practitioners and researchers to share and publish scholarly articles.

9 ABOUT THE WORKSHOP ORGANIZERS

The organizers have multidisciplinary expertise across design, architecture, interaction design, and computation in research and education. They investigate human-centered and design-driven research and creative inquiry focusing on smart environments, multi-sensory interactions, and embodied experiences.

Daragh Byrne is an Associate Teaching Professor at the School of Architecture at Carnegie Mellon University. He is affiliated faculty with the IDEATe Network and holds courtesy appointments in the School of Design and the Human Computer Interaction Institute. As a computer scientist working closely with architects, designers and artists, he values multidisciplinary, human-centered, arts-integrative ways of working. His research and teaching bridges on experiential multimedia, the maker movement, with a recent focus on tangible interaction, IoT, and intelligent environments.

Dina El-Zanfaly is an Assistant Professor at the School of Design at Carnegie Mellon University. She directs the hyperSENSE: Embodied Computations Lab, where she examines the role of computational design and physicality in embodied sense-making that includes human perception, cognition, and everyday experience. She investigates designing interactions with intelligent systems from a critical human-centered lens. These interactions include Hybrid Environments, artifacts, computational methods, and co-creation and designing tools. She investigates the questions of: how can intelligent machines and systems learn from us and how can we learn from them? How can we work together to create and improvise?

Daphne Peters is an Assistant Teaching Professor and Chair of the Environments track in Carnegie Mellon University's School of Design. With a focus on Hybrid Environments, branded experiences, and service design, Daphne teaches students across all levels of the curriculum 3D form-building, how to design for experiences that take place over time, and interaction design in its many forms. Daphne's professional practice includes work that spans environmental graphics, print design, web design, and public art for clients that range from small businesses to institutions.

Daniel Rosenberg Munoz is an Assistant Professor in the School of Design at Carnegie Mellon University (CMU). Daniel investigates design methods and tools for mindful-experience design and has applied them by teaching and conducting over 20 design workshops in the US, Chile, Colombia, Ecuador, Mexico, Taiwan, and India. Professionally, Daniel develops large-scale immersive/interactive environments for the arts, entertainment, and brick-mortar businesses. His clients include Target, Cartier, Cadillac, Gentex, the New York Times, and TSG Entertainment.

Peter Scupelli is the Nierenberg Associate Professor of Design and Director of the Learning Environments Lab. Peter's training and career path link architecture, interaction design, and human-computer interaction research. Peter's current research focus is on learning environments. Peter teaches both undergraduate and graduate-level courses. He currently teaches required courses such as: Environments Studio I: Form and Context, Graduate Design Studio II, and Design Futures. Peter's teaching and research focus on two fundamental topics necessary to bring aspects of Transition Design to design practice: aligning short-term design action and long-term vision goals and embedding values into design processes.

10 WEBSITE

The workshop website is available at:
<http://workshop.embodiedcomputations.org>

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