Journal of Problem Based Learning in Higher Education

VOL 11, No. 2, 2023 – Page 100-125
10.54337/ojs.jpblhe.v11i2.7780

Interconnected Agencies for Sustainable Futures: A Discourse on the Notion of Adaptation and Space

*Pia Fricker, Friederike Landau-Donnelly, Constantinos Miltiadis, Shubhangi Singh **

ABSTRACT

This article presents a nuanced discussion of four episodes on the complexity of possible trajectories for sustainable futures through diverse but intersecting practices and discourses as heterogeneous but complementary articulations of 'adaptation and space.'

As design and creative processes evolve, new tools and methods, often adopted from science and technology, are integrated into art, design, and architecture. However, knowledge flow in these developments tends to be unidirectional, with science and technology influencing these fields more than vice versa. The diverse developments relating to the concept of 'space' have profound impacts on industries, urban habitats, design approaches, and the arts within the expanded field.

This article engages in a conversation from four different disciplinary perspectives, each articulating its own voice in relation to the broad notion of 'adaptation and space.' Through this multidisciplinary dialogue, presented in four episodes, it critically contributes to the ongoing discussion on sustainable futures, offering new trajectories for Problem-Based Learning (PBL) beyond disciplinary boundaries. In an era dominated by umbrella terminologies like sustainability, the field of higher education faces the challenge of integrating different expertise to foster new solutions for complex challenges. This article highlights the need for diverse fields such as architecture, art, and social science to engage in a dialogue about perception, interaction, and manipulation of space. Its purpose extends beyond the

---

* Pia Fricker, Department of Architecture, Aalto University, Finland
Email: pia.fricker@aalto.fi
Friederike Landau-Donnelly, Department of Geography, Planning and Environment, Radboud University, the Netherlands
Email: info@friederikelandau.com
Constantinos Miltiadis, Department of Design & Department of Architecture, Aalto University, Finland
Email: constantinos.miltiades@aalto.fi
Shubhangi Singh, Visual artist, Finland
Email: singh.shubhangisingh@gmail.com

exploration of novel solutions, instead inviting multifarious perspectives that shape interconnected agencies for sustainable futures and their impact on education.

Keywords: PBL for Transformative Learning, Interdisciplinary Perspectives, Complex Challenges, Adaptation, Space, Public Sphere

INTRODUCTION

By reviewing principles of co-living strategies with complex systems across scales in a dialogue format across disciplines and scales, we discuss concepts, definitions, and interpretations of space and of spatiality (Harvey, 1989). The article format shares traces of a larger discussion, focusing on different perspectives on how we construct the world, and by extent how we create means to intervene into that world, with our day-to-day practices (Latour, 2005; Law & Urry, 2004). The shared viewpoints in this article attempt to transcend technological solutionism, and instead invite the integration of new perspectives for addressing complex and dynamic challenges of today and the future. They invite for a new perspective to be integrated into defining solutions for complex and dynamic challenges of today and the future.

In this context, the concept of 'adaptation' can be a useful lens through which to view the design of Problem-based learning (PBL) activities, adding on the discussion by Fischer (2013, p.15) who states that "different kinds of problems require different kinds of learning approaches and different socio-technical environments to support them". Adaptation refers to the process by which systems or individuals adjust to changing circumstances in order to optimize their performance. In the context of PBL, adaptation offers the possibility to refer to the ability of individuals (human or non-human) to adjust their approach to problem-solving in response to the evolving nature of the problem (Illeris, 2003). The learning of concepts and principles, to support critical thinking and the creation of transferable skills, has proven to empower transdisciplinary collaborations beyond academic institutions.

The combination of the terms 'adaptation' and 'space' into a dynamic construct exemplifies critical pathways for negotiating the 'why?' rather than the 'how?' in support of a new way of thinking beyond established solution strategies (Cantrell and Mekies, 2018, p. 16). As Alpaydin (2016, p. 17) states, "a system that is changing its environment should have the ability to learn; otherwise, we would hardly call it intelligent. If the system can learn and adapt to such changes, the system designer need not foresee and provide solutions for all possible situations."

In the field of Artificial Intelligence (AI) enhanced design methods, Problem-Based Learning (PBL) offers the possibility of applying machine learning algorithms to develop predictive models for future scenarios dealing with the impact of complex sustainable challenges. This data-driven design methods use computational heuristics applied at various stages throughout the design processes, which offers new challenges for the field of education, as the creative part is extended towards the definitions of algorithms and relational models (Essary, 2021). While a comprehensive analysis of existing learning theories in the field of computational design is beyond the scope of this article, this digression in a multi-layered theme presents the current situation with respect to the increasing number of complex challenges imposed on the spaces we encounter and live in (Chen et al., 2020).

Thus, 'space' accumulates plural constructs, poetic artifices that we collectively produce and reproduce through time, within our cultures, sciences, and arts. Through the dimension of time, these spaces serve as vehicles for adaptation and transformation, from the individual to the collective societies and the environment at large (Fenton-Glynn, 2019).

METHODS

This contribution is structured over a multimethod approach and follows a format of four snapshots, called episodes, that intersect perspectives into 'space' from distinct and different disciplinary and methodological standpoints. The following four episodic snapshots originate in a collective discussion on 'adaptation and space' intended to communicate and demonstrate the nuances, sensibilities, and capacities of different epistemological frameworks to 'read,' investigate, tap into, and intervene into 'spatiality' in its manifold manifestations, scales, and materialities.

Through this approach, we aim to highlight the imperative of intersecting multidisciplinary perspectives for both identifying and for addressing the complex challenges of our times. Furthermore, against technological solutionism which all too often poses new inventions as panacea, we propose the notion of 'adaptation' in a twofold manner. On the one hand, adaptation entails a critical examination and cultivation of our epistemological frameworks and mental models pertaining to how we perceive and conceive the world, which follows how we also practically engage with the world (episodes 1 and 4). On the other hand, adaptation suggests a means for intervening to the world without negating its current state and complexity or necessitating its violent reconfiguration. Rather, the adaptation of our practices, structures, and infrastructures has a profound impact on how we produce and reproduce our lived environment, and how we participate in perpetuating or positively contributing to its current problems (episodes 2 and 3).

The rest of this section is devoted to a brief introduction of each contributor's background, and an outline of their contribution:

Constantinos Miltiadis is a transdisciplinary architect whose research concerns spatial constructs experienceable only through digital media such as virtual reality, through which we can explore the capacities of the human sensorium. In "The Complexity of Notions of Space" he unfolds an epistemological discussion of heterogeneous notions of space to set the ground for the subsequent episodes and the framing of this contribution. Through historical examples the episode shows that a shared agreed-upon concept of space is impossible. Rather, notions of space depend on discipline, context, and application, and follow different constructions of the world, different modes of engagement, and different repercussions. This complexity is by no means a nuisance or obstacle, but instead serves to highlight the multimodality required to account for the different aspects and modes of engagement with space.

Assistant Professor Dr. Friederike Landau-Donnelly is a political theorist, urban sociologist and cultural geographer. In "Infrastructuring Vulnerability" Landau-Donnelly discusses practices of infrastructuring as political practices to enact adaptation within ongoing systemic (and pandemically reinforced) crises. After introducing 'infrastructuring' as a political verb, rather than infrastructure as a noun, she proposes an analytic of vulnerability as the much-needed political trajectory to be considered in future-oriented discussions about societies, spaces and politics in multiple processes of adaptation.

Shubhangi Singh is a visual artist who works with moving images and text. Her work considers ideas of absence and absenting as a way of reflecting upon what is visible, particularly in relation to the shared spaces, history and memory. In "A Space of Micropolitics" Singh observes public spaces as sites of hegemony, power and nuanced interactions, a view that provides valuable data correlating to the larger social settings that surround the space. It adopts spatial strategies such as loitering that has been employed by groups of women in India and Pakistan in Finland as a tool to not only be present and claim 'space', but to further make embodied observations and collect notes about experiences that traverse class, race and gender in the mixed use and shared public domains. The title of the episode is a reference to Deleuze and Guttari's term 'micropolitics' (2013, pp. 208-231), who claim that "life is spatially and socially segmented" (2013, p. 208). They point to our participation in the order of the social structures that have been laid before us (through caste, class, generational and familial networks), which by extension, also influences our participation in the segmentation that these existing structures hold us to. Deleuze and Guttari are driven by their purpose to classify this unwritten, often unspoken lines of subjectivity by further characterizing the lines that constitute our ability to become subjects as well

as actants that uphold or control the segmentation beyond the (more visible) macropolitics.

Dr. Pia Fricker is professor of Computational Methodologies in Landscape Architecture and Urbanism at Aalto University. “Mind meets Machine” draws from research and teaching within the area of computational design thinking., to discuss pedagogical strategies directed toward skill development for the purpose of addressing current and future challenges. It proposes a shift towards systems thinking, and the abstraction from specific operational skills and mental models, as a means to better reason with the complexity of the challenges of our times.

EPISODES

Episode 1: The Complexity of Notions of Space

Whichever the context or discipline, notions of space are inevitable constructs for reasoning with where we are, who we are, and what we could do. Constantinos Miltiadis explores the term space, and the impossibility of a shared and agreed-upon definition. Space therefore emerges as a species of variations, that we occupy in time through the different realms: the physical, the conceptual, the sensory, the social, the emotional, and so on. Borrowing examples from the sciences and the arts, the following unfolds space as a qualitative substance, one that we can think through, examine, compare, but also play with, construct, learn, unlearn, and get a feeling for.

***

Space matters. Space is the place; space is where things happen; space is what we can inhabit; space is what we can fathom. But if space is the answer, what do we actually mean when we talk of space? This brief passage will discuss the variability of notions of space that follow different ways of engaging with space. This, also to suggest and highlight the richness of our different views through which we come to understand space, also as a discursive topic, and mode of engagement.

The inherent complexity of the very notion of space, according to David Harvey, comes not from the keyword itself, but from the contingency of its meaning which is dependent upon the context and application:

> Space, is, of course, one of those words that frequently elicits modification. The complications perhaps arise more out of the modifications (which also frequently get omitted in the telling of the writing), rather than out of any inherent complexity of the notion of space itself. [These] seem to render the meaning of space itself entirely contingent upon the context. [We] seem to be saying that the arena of

applications defines something so special about the meaning of space as to render any general consideration of its properties a hopeless task (Harvey 2006).

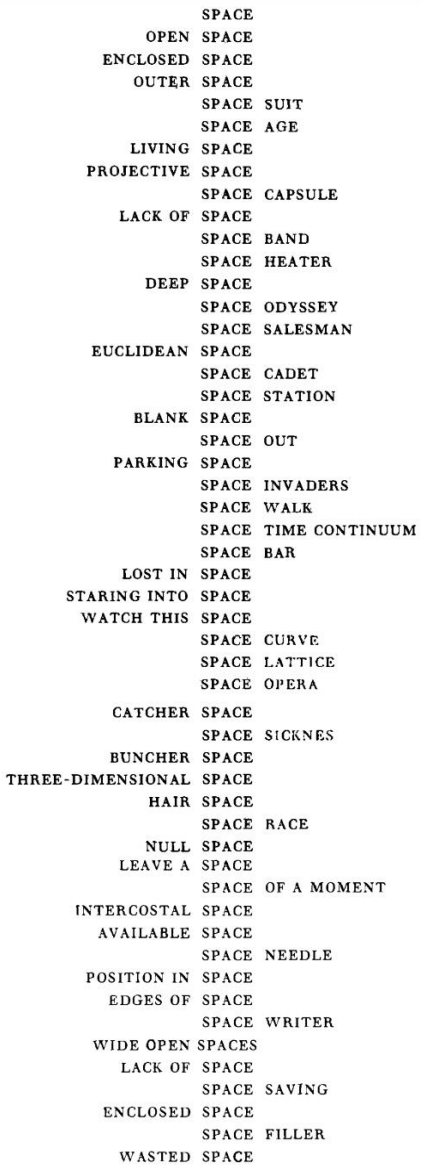

Figure 1. Collage from Species of Spaces and Other Pieces (Perec 2008, ii-iii).

In the first pages of his book Species of Spaces, Perec ([1959] 2008, ii–iii; Figure 1), provides a demonstration of exactly the same problem discussed by Harvey. That permutations of the word space are inherently ways to frame things, to provide a container as context, which render space itself a rather elusive keyword. With this complication established, let us briefly look into formal categories, or paradigms of space through history and epistemology.

First is Euclidean space, the space that most of us know and love, taught continuously in schools for millennia. As geometry, this mode of space served as the first form of mathematics, the first scientific method, and a form of philosophical meditation (Miltiadis 2019). Euclidean geometry was also the basis of Renaissance perspective, and the modern scientific revolution (Edgerton 1985; Longo 2019), and as such is ingrained in Western culture. We can observe its predicates in Isaac Newton's (1642-1726) universal laws of motion, which suggest the idea of universality: of a space that is absolute, uniform, with all positions equal, dictated by the same rules, and organised around a centre, the Cartesian origin point that distributes difference and meaning (Wertheim 2010).

Another flavour of space is relational space that we got from Gottfried Leibniz (1646-1717). Space here is composed of relations between objects, with the implication that it cannot exist in the absence of matter. This space only exists when we have two or more things, so that we can articulate relationships between them. It is a space of flows, of social networks, and of interconnected global economies and events (Castells 1997).

Then we come to relativistic space from non-Euclidean geometry, which came to us from the 19th century to overcome the 'parallel postulate' of Euclidean geometry (Riemann 1854; Keyser 1906). Relativistic space is an altogether different beast, as we can see in its application in relativity theory (1905; 1915), which we try to understand from its paradoxes. Perhaps the most counterintuitive of all, it does away with space and time, and introduces their interweaving in spacetime. Relativistic space has no outside, no objective vantage point or origin as with Euclidean-Cartesian space. Each position resides on its own reference frame, all differences are local, relative, and equally subjective.

What we want to highlight with the previous is that whichever notion of space we ascribe to, serves different applications and purposes, and, inevitably, follows completely different repercussions. Since we are spacetime natives, notions of space are models, at least as much as they are philosophies; philosophies of being. Moreover, whether conceptually or practically, space is essential. We cannot do without space:

> The very sense of self depends on its sensory relationship to the external world. Everyone exists someplace, conversely, sensory deprivation disconnects our internal reference frame from the physical and social environment, and rapidly produces hallucinations. The experience of spacelessness does not exist as a normal state; it produces disorientation (Blesser and Salter 2009).

Notions of lived spatiality is an intriguing topic that can be explored empirically. An experiment staged in an architectural workshop, attempted to question the primacy of the visual, by focusing instead on the contribution of aural faculties in the perception of space (Miltiadis and Sharma 2021). In that, we handed architecture students blindfolds as instruments for investigating spatiality through hearing (Figure 2). We came to study a binaural spatial audio piece blindfolded and explore what we can 'see' through our ears. Surprisingly, the experiment yielded vivid hallucinations of space, which were transcribed from mental images to sketches and then into spatial-temporal scenes of a virtual reality (VR) experience (Figure 3).

Figure 2. Blindfolded listening sessions of a spatial audio music piece. OSSA Architectural Festival, Łodz, 2018.

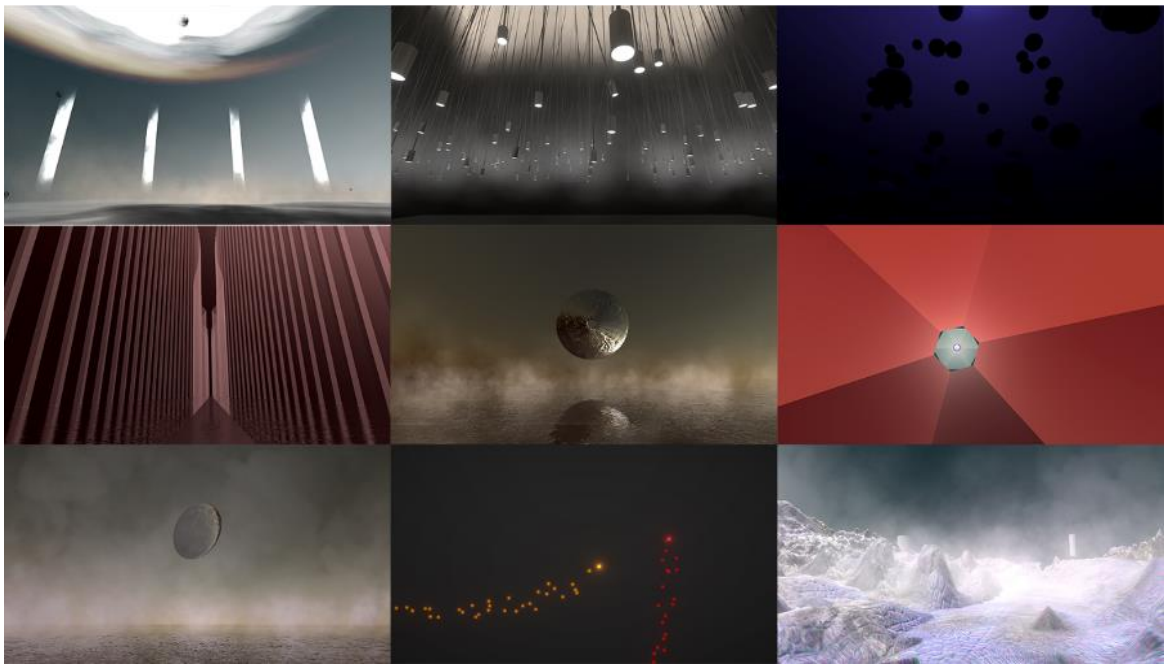

Figure 3. Screenshots of VR scenes conceived through blindfolded listening. OSSA Architectural Festival, Łodz, 2018.

Eventually, spatiality is inescapable — ever-present in everyday life, deeply ingrained in our culture, professional practices, arts, and sciences. It is also multiple — dependent on discipline, application, and worldview. Moreover, spatiality is an intersubjective

sensibility and a skill that can be learned, unlearned, trained, and cultivated to tap into further, unexplored potentials:

> It is necessary to unlearn space in order to embody space. It is necessary to unlearn how we see in order to see with our bodies. It is necessary to unlearn knowledge of our body in three dimensions in order to recover the real dimensionality of our body. Let's dance space. Let's re-space our bodies. Let's celebrate the felt feeling of presence (Eliasson 2014).

If we may add to that, this we need to do collectively, together.

Episode 2: Infrastructuring Vulnerability: Politics of Adaptation beyond Pandemic Times

This episode by Friederike Landau-Donnelly reflects on the impact of the COVID-19 pandemic and its constraints for limited but also growing possibilities of the adaptation of spaces. It suggests shifting gears from the concept of "adaptation" to the lens of "infrastructuring". More specifically, it proposes to move from the terminology of "infrastructure" as a noun to "infrastructuring" as a verb to better grasp the complex and politically charged transformations of public spaces in times of multiple crises. By examining the concrete socio-spatial example of pandemic experiences in urban public spaces in Vancouver, Canada, which have revealed significant disparities between bodies situated in uneven conditions of vulnerability, mobility, and creative expression, this episode seeks to explore the politics of infrastructuring.

***

The pandemic has exposed the vulnerability of many social institutions, which are often viewed as rigid and solidified entities. This crisis of institutions has opened a possibility to think of institutions rather as infrastructures, which are eager to respond and adapt to socio-spatial crises. The closure of museums, for example, has confronted us with limited accessibility to art collections. The shutdown of theaters has also contributed to accelerate transitions in thinking culture not through the lens of institutions, but rather malleable infrastructures. Notably, this attunement to adaptation, change or transformation has certainly preceded the COVID-19 pandemic, but has certainly been fast-tracked by it.

Zooming in on the shift from viewing infrastructure as a noun to the concept of "infrastructuring" as a verb, Matthias Korn and his colleagues (2019) propose the notion of "infrastructuring publics", which emphasizes the relationality of infrastructuring. For Korn et al. (2019, pp. 1-2):

> infrastructuring publics as a new research perspective that (1) is practice-oriented (instead of starting with strong assumptions on the shape of things); (2) is aware of the common scaling of infrastructures and publics as a media-his-toric constant (instead of beginning and stopping at digitisation); (3) acknowledges the inevitable interrelation of social and material agencies (instead of a technosceptic "people only/people first ontology"); (4) addresses the shape and practical usage of infrastructural media and the omnipresent, but often hidden and invisible infrastructural and bureaucratic work (instead of primarily focusing on the contents and the aesthetics of public media); (5) highlights testing, experimenting and projecting publics as important modes of infra-structuring publics (instead of following a teleological approach); and (6) takes a cautious approach to placing normative demands, but has its own normative bias in the efforts of making infrastructures and practices of infrastructuring public (instead of leaving the black box unopened).

So, how are we connected through practices of infrastructuring? How are human agents infrastructurally entangled with non- or more-than-human actors, places, things? How are we implicated in different materialities? What kind of poetics of relation, or poetics of infrastructuring, emerge through infrastructuring?

While these multiple interrelations are poetic, affective, multi-species, they are political, too. Hence, the question this episode addresses so how the trope of infrastructuring, as opposed to infrastructure, can help to advance understanding of new practices to adapt, or to infrastructure politics and space. In this context, Korn et al.'s (2019) notion of infrastructuring is not least informative because it emphasizes the practice-orientated dimension of infrastructuring. Furthermore, the authors argue that infrastructuring, as opposed to infrastructure, allows us to acknowledge the inevitable interrelation of social and material agencies.

Instead of being techno- skeptical, however, this episode proposes that we might find new ways of understanding how we influence technology, and technology influences us, via the lens of infrastructuring. It allows to broaden the scope of where to look for beginnings, reasons and pathways for adaptation or change. More specifically, Korn et al. (2019, p. 2) argue that infrastructuring pushes us to think about testing, experimenting, and projecting publics, broadly defined, as important modes and moments of infrastructuring.

These introductory thoughts on the *political* underpinnings of infrastructuring cautiously lead to approaching practices of infrastructuring as a political activity , broadly defined as negotiation between realms of 'politics' and 'the political' (Marchart 2012). As manifestation of the political, the notion of infrastructuring points to collective acts of constructing, but also deconstructing, or dismantling, institutions or systems that build

and sustain but also limit and oppress human, and more-than-human life. In the field of socio-spatial adaptation and change, we need to consider both the built and materially lasting, tangible aspects of infrastructuring, but also its immaterial, or more-than-material, intangible, ephemeral and affective aspects. In sum, infrastructuring might heighten sensitivity about who and what matters in designing socio-spatial realities, which are always undergirded by political negotiations for meaning, space and belonging.

Besides an increased focus on infrastructures and infrastructuring as porous practices of institutional response to multiple crises, the pandemic has also brought about a (renewed) engagement with the trope of vulnerability, which certainly has existed and been inscribed into our different bodies prior to the pandemic (Butler, Gambetti and Sabsay 2016). But it is interesting to see that a lot of cultural institutions and discursive reflections of pandemic time have taken up on the notion of vulnerability or uncertainty, "Verletzlichkeit" and care in research, political claims-making, strikes, descriptions of the crisis etc. There seems to be a political and emotional momentum now to respond to vulnerability as something that affects us all. In short, the pandemic has jumpstarted a more or less collective awareness and acknowledgement of vulnerability as a constitutive dimension of human, or more-than-human, life.

After briefly unpacking thinking of infrastructuring as a political verb and vulnerability as shared yet hugely different condition, let's push these terms into the conversation about space, adaptation, or the spatial politics of adaptation. How, who, why, and where do we adapt space? What is the purpose and teleology of adaptation? Are we stuck in a short-sighted trajectory of transformation if we speak of adaptation? Is the rhetoric of adaptation falling prey to wanting to fix something that cannot be fixed?

These questions led to question the term "adaptation" as it felt limited to maintaining the status quo, or nail down a singular goal or way of being. The term seemed teleologically constricted and does not seem to embrace the radically open-ended nature of spatial dynamics, or processes of transformation (see Landau et al. 2021). The search for alternatives led me back to the term infrastructuring. Through this concept, transformative potentials for more fluid, contingent and in that sense, more adaptable socio-spatial or socio-technological arrangements, spaces, places, as well as built environments, can emerge.

Tracing the above-mentioned politics of vulnerability, Landau-Donnelly refers to her empirical field work conducted during a postdoc in Vancouver, Canada, on the unceded territories of the Musqueam, Squamish, or Tsleil-Waututh peoples, where commissioned murals in the downtown Chinatown neighborhood were examined (see Landau-Donnelly 2021).

Figure 3. Eight Immortals Crossing the Sea by Bagua Artist Collective 2019, photo: courtesy of Bagua Artist Collective.

Zooming into the *Eight Immortals Crossing the Sea* mural, commissioned by the City of Vancouver in the first-ever Chinatown Artist Call (2019), painted by the local Bagua Artist Collective, which consists of the artists Sean Cao, Xingyue Feng, Yuan Liu and Katharine Meng-Yuan Yi, one gains insights into the politics of spatial adaptation and contestation (Landau-Donnelly 2021), or in the context of this episode, the politics of infrastructuring. Part of the mural construction process can be seen in Fig. 3, whereas the final result appears in Fig. 4. The motive, *Eight Immortals Crossing the Sea* references an antique Chinese myth of eight different types of immortals or saints, crossing the sea, each equipped with special powers to survive the strenuous journey. The myth tells stories of very different capacities, motivations, dreams and experiences of trans-local migration and movement. In Vancouver's contemporary Chinatown, which is arguably also a site of arrival of Chinese Canadian travel, migration, struggle, and survival, it was interesting that the emerging artist collective chose this motif.

Figure 4. Eight Immortals Crossing the Sea (2019) by Bagua Artist Collective. photo: Friederike Landau-Donnelly.

It relates poignantly with contemporary anti-Asian discrimination as well as spatial crises such as gentrification, displacement, and upscaling. Examining the above image more closely (Fig. 3), which occurred during the construction of the mural in the summer of 2019, the graffiti tag stating *Refugees Welcome* almost uncannily interconnects the final motif of the mural – advocating for intergenerational intersectional bonds of solidarity – with the contemporary plea for embracing trans-local migrations.

This enmeshing of motifs and messages can be viewed as an encounter of different vulnerabilities, being inscribed into an artistic work-in-progress. Instead of a narrowly defined goal of spatial adaptation, the mural unravels the open-ended, multiple logic of infrastructuring. More precisely, the infrastructural dimension of the mural, or its multiple practices of infrastructuring, become visible in the various claims for visibility and requests to make voices heard and seen in and on the very same wall. While the official commission was maybe instructed with a straight-forward mindset of spatial adaptation (e.g., to brighten up an alleyway, to institute a happy motif, to celebrate Chinese Canadian culture), the logic of infrastructuring exceeds this rationale and writes the walls differently. While it remains unclear whether the graffiti writers knew that the final mural would be embracing migration and, in a sense, conjure a century-old iteration of Refugees Welcome, the incident shows how socio-spatial, contemporary, and historical vulnerabilities can collide in public space.

In sum, this episode suggested to think about the adaptation in and of space in terms of infrastructuring. Infrastructuring, in my view, allows us to systematically and systemically embrace vulnerability, rather than suppressing it. In doing so, we can approach space and spatial transformation in a non-teleological manner. This intertwines

with a notion of 'politics' in the sense of 'the political', which is broader, more unruly, radically open-ended and exceeding the ready-made institutions and apparatuses of politics, power and space (see Landau et al. 2021). From the cursory discussion of the Chinatown mural images above, we have seen different layers of meaning, power, historical hardship, discrimination arising from this palimpsest of public art in Vancouver. The logic of infrastructuring might also bring to forth other memories, voices, positionalities into public space – those which might have been forgotten, neglected, but maybe also those that continue to fight for trans-local solidarity and diversity. At last, an infrastructural approach to both spatial and political adaptation might forge for problem-based learning, broadly (re)defined.

Episode 3: A Space of Micropolitics

The places that we live in do not only influence us but are, in turn, equally affected by our contact with them. Far from being static, these shared landscapes are in fact, in a state of constant flux caused by the agents responsible for building, reframing, and breaking existing structures. Shubhangi Singh observes and reiterates through examples how public spaces are far from being a neutral site that is co-inhabited by a host of individuals or groups but instead, they are charged contact zones that have the everyday ability to challenge, subvert or reproduce the existing social hegemony.

***

While the streets are sites where social hegemony is exerted, expressed, reinforced, or challenged, they are also a fertile ground of study – a space of micropolitics (Deleuze and Guattari 2013, pp. 208-231). Being locations of where existing social hierarchies can be viewed as well as experienced, one's body and its mobility in cities are matters of urgent inquiry within the larger context of how public spaces can be developed or reviewed for gendered and racial inclusivity.

Within the discourse of one's right to the city, how can we address the historic exclusionary patterns that continue to exist in our everyday life? Moreover, how can we remedy this imbalance in public spaces that are normalized and reinforced through the policies we make or plan for our public spaces, which may further affect these shared interactions?

It does not take long for certain minorities in cities, say, gender and caste in India, and racial and class in Finland, to realize how coded public spaces really are. The position which these individuals then hold in these spaces may as well be one of being mere travelers, where we are always transiting, and never staying. But this does not mean that it has to stay that way. Spaces can be influenced through sustained engagement. They can

be trained to include paths retreaded. For instance, by loitering to reclaim and recalibrate the established order within public spaces.

The term 'loitering', brought to India through its colonial legacy, has since expanded in definition within social, as well as domestic spaces. The irony of this invisibility in public spaces is brought to attention by some existing feminist actions that call for assertion and visibility of marginalized bodies in public spaces, in order to resist existing social and gender hegemony. By the act of women occupying these spaces and visibly *doing nothing*, they are asserting their right to safety, to leisure, and to visibility in these shared public domains. In their seminal work, 'Why Loiter?' (2011), activists, academics, and feminist writers, Shilpa Phadke, Sameera Khan, and Shilpa Ranade write about the importance of loitering as a tool for women to reclaim public spaces. '*Meet to Sleep*', a feminist action initiated by Blank Noise (Banglore, India) take their cue from the provocation offered by the authors of Why Loiter?' as they invite women to bring themselves – individually or collectively – to parks, or any other open spaces that they may find, in order to sleep, to nap, to rest, and to visibly 'do nothing'. By undertaking the gesture of rest and leisure, the actants thus shift the responsibility of personal safety from themselves on to the public, as a collective. On the other side of the border, in Pakistan, *Girls at Dhabas* (loosely: Girls at the tea stalls) expand upon this strategy, by spending leisure time at tea stalls — either alone or with groups of friends. These forms of loiterings transform otherwise sequestered spaces into subversive, salon-like spaces.

Though it may appear counterintuitive, by lowering their guards and exhibiting a sense of trust in the other, the actants are denouncing their fear and exercising their right to safety. By occupying these spaces, the women hence, are becoming a regular and new visual in the parks. The politics of pleasure defy social order that quantifies individuals solely as contributing members of society. The acceptance of women in public spaces (or the lack thereof) has historical distortions encased in the language of patriarchy. That is, the reiteration of power through social order subjugation. Thus, as much as loitering is a tool to claim leisure, it is just as equally an act of resistance. A Hannah Arendt way of looking at publics, social, and commons would mean that the publics are often formed in the presence of others making the public sphere a necessary condition for the practice of politics (Arendt, 2019). This would also mean that one's understanding of self too, does not occur in a vacuum but is largely formed in relation, in realization, and in retaliation to others. Interactions could be shaped such that the publics are training together, collectively, and constantly, in learning how to negotiate and interact with the shared spaces. Here, we are learning and unlearning together as a (dys)functional collective, updating and renewing our social contracts, in perpetuity. In an (imperfect) call-and-response, we are affecting while simultaneously being affected. It is a constant feedback loop.

Not surprisingly, several areas in a city seem to have certain coded ways of enquiring whether one may belong there. This though can be adjusted through affecting, sustained engagements and appropriating spaces that could diversify the spaces. This way, also keeping the spaces dynamic, activated, and always a little unpredictable. A wide range of engagement, however minor, affect how spaces then get planned, occupied or mobilized thus enabling multi-use of these shared spaces, ground up. The responsibility of this however does not lie with an individual or a community alone but rather, with a larger society that must demand, and the structural powers and authorities that must provide.

The Puotinharjun Ostoskeskus "Puhos", a shopping centre located in Helsinki's Itäkeskus district, opened in 1965, designed by architect Erkki Karvinen (Fig. 5). It was the first, and for a very long time after, the only shopping mall that had escalators incorporated within the building's design that fall outside of the building in the open air.

Figure 5. Puhos Shopping Center: Original escalator and glass roof from the late 1960s. Image Credits: Helsinki City Museum, photographer unknown.

After 1984, when a newer shopping mall opened across the street, Puhos slowly began to lose its customers to this new indoor shopping space. Around the 2000s however, Puhos started to gather some interest again when immigrants began to open multicultural stores at Puhos. To this day, there are several stores, bazaars, and halal butchers, specialized sweet shops and restaurants in Puhos which, at this point in time, makes it the biggest multicultural food and grocery market center in Helsinki. This also means that many people of immigrant background (still just mostly men, however), hang around the mall

visibly and are seen simply spending time with their friends and companions. It is one of the few places in the city to casually congregate and not necessarily spend much money while doing so.

In an urgent need of renovation, the future of Puhos remains uncertain. The city plans to renovate one part of the Puhos in line with its original design and will go ahead with demolishing the other part (the newer part added in the 1980s) that will be converted into residential buildings.

Though the development plan (proposed by Puotinharjun Puhos Oy) intends to retain the shops that are currently in the premises, what this would mean in terms of the shops rents as well as free open spaces remains to be seen.

The original outdoor escalators at Puhos have been in a state of disrepair for close to ten years now (maybe even more). If this tells us anything it is that if the same escalator were to be in a predominately 'white' neighbourhood of the city as opposed to the demographic that frequent it, then perhaps it would have been repaired and cared for until the very end of its lease. The building's steadily declining condition is a testament to how public spaces, when occupied by immigrants or minorities, fall out of grace and funding for upkeep from the planning authorities. The ignored state of the site makes the occupants themselves seem responsible for its condition, putting the blame squarely on the people who occupy the space. The state of overall dilapidation only further legitimizes easy evictions and a higher rate of policing, surveillance and force. Not too different then, from the women and their challenges in (re)claiming safety in public spaces mentioned earlier– – a responsibility of which should not have to lay entirely with the users of the space. This case study of Puhos highlights the complexities in generative coexistence – an argument for co-adaptability of common spaces, and the range of potentiality (and challenges) that a single space could offer.

A broken escalator can never completely be out of use. It simply becomes a stairway.

Episode 4: 'Mind meets Machine': From Formalized Learning towards Systems Oriented Learning for Adaptive Spaces

This episode presents research and teaching findings conducted by Prof. Dr. Pia Fricker in the field of Computational Design at the Department of Architecture at Aalto University, Finland. The discussion expands on the topic of adaptation and space towards a discourse on the topic of future-oriented computational design thinking for education, which requires a combination of practical and theoretical discourse, enhanced by problem-based learning (Fricker & Kotnik, 2023a, De Graaf et al., 2003). Specifically, this discussion explores the relationship between architecture, landscape architecture, and information technology, in an era characterized by an overwhelming influx of data

(Fricker, 2022, Nunez et al., 2016). As these fields have an integrative character, the exploration lies in the integration of computational thinking to develop new hybrid forms and solutions that are as sustainable as they are versatile (Figure 6). "Computation is not introduced as technological topic but primarily as a way of thinking and cross-disciplinary link, as unifying common denominator of discourse, as locus of production and systematization of knowledge within the discipline of architecture across various scales of application" (Fricker, 2020, p. 686).

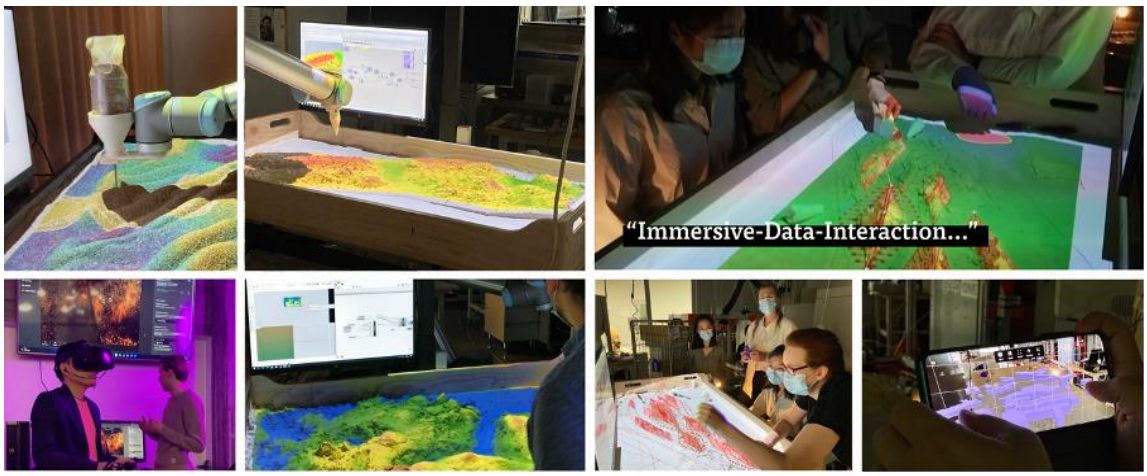

Figure 6. The developed teaching pedagogy is rooted in a comprehensive understanding of the theories that underlie algorithmic definitions. This approach integrates elements of systems thinking with classical theories from the field of computer science (Fricker, 2018). The accompanying series of images depicts an interactive data-informed design method, which utilizes a sandbox as the co-design platform with a robotic arm (Hermansdorfer et al., 2020). The system is complemented by real-time feedback projected on top of the sand and displayed in the 3D modeling software. Image Credits: Pia Fricker.

For the field of Architecture, thinking in systems offers a bridge to incorporate AI-informed methods, like Machine Learning from the perspective of a creative curator (Yang et al., 2022). As the challenges are getting more global and dynamic, the process to create possible sustainable solutions for the future needs to build upon the classical understanding of PBL, in particular focusing on the creation of immersive methodologies that facilitate the development of competences essential for effective collaboration and problem-solving on virtual communication platforms, achieved through dialogue and interaction (Jensen, 2017). The findings by Forrester employ didactic principles from the area of "System Dynamics" in order to simulate the relationships and interaction of diverse objects in a dynamic system (Forrester, 1969). As outlined by Fisher (Fisher & Margolis, 2002), the three main objectives of system dynamics education are defined as:

- Development of personal skills in relation to the challenges of a complex world by understanding the interrelationships and active search for the interconnectedness that gives meaning to the parts of systems.
- Understanding the benefits and limitations of mental models and the potential to combine the mental model with a computational model.

- General understanding of complex systems and their existence in nature, which enables them to make better-informed decisions for problem solving.

The system dynamics approach allows for a shift in thinking towards system thinking. The next level of learning takes place in observing and understanding patterns, described by Forrester as 'generic or transferable structures' (Forrester, 1992). This skill allows for quickly de-coding a certain structure and its underlying set of rules and to apply this knowledge to another field, which might have totally different variables, but nevertheless operates according to the same rules (Figure 7). Currently we are faced with questions like: “How to develop better and ecologically more relevant forms of engineered nature that could enhance social cohesion while establishing a stronger bond between society and nature, encouraging good governance, environmental stewardship and respect” (Girot, 2016, p. 314).

*Figure 7. The image series describes the newly developed co-design methodology, driven by a creative interaction with elements of Machine Learning and robotic interaction. By incorporating computational thinking into design education, students are empowered to think more systematically and holistically about design problems across scales and temporal dimensions (*Fricker*, 2016). This systems-oriented approach to learning emphasizes the importance of understanding the interdependencies between different elements of a system, as well as the dynamic relationships between those elements over time. This approach enables*

students to design solutions that are not only innovative but also sustainable and adaptable to changing conditions. Student project by: Antti Rantamäki, Kaisa Koskinen, Laura Tuorila, Teo Rinne.

De-coding spatial patterns provides a platform for discussing the development of systems that can withstand the test of time. This phenomenon of "generic structures" is widely used in biology and has become a common practice in computational landscape architecture (M'Closkey & VanDerSys, 2017).

As introduced by Sarah Williams, data can be regarded as the new infrastructure, and it is vital for our profession to explore new ways of creatively engaging with the fields of artificial intelligence, robotics, and mixed reality to create adaptive solutions for the challenges we face today (Williams, 2020). As stated by Picon, "the entire city could be considered intelligent in a new way, founded on the interaction and composition of the perceptions and deliberations of multiple entities, human, non-human, and often a mix of the two" (Picon, 2015, p. 12). To make the most of the wealth of data available, it is essential to focus on the "why" of the design process. This requires a critical discussion of the choice of method, to ensure that the design process is data-informed rather than data-overloaded (Fricker & Kotnik, 2023b).

The symbiotic integration of computational thinking and problem-based learning (PBL) stands as an imperative stride in preparing students for the multifaceted challenges of the future, where artificial intelligence (AI) and advanced technologies play pivotal roles. Embracing a systems-oriented approach to education empowers students to cultivate the essential skills and knowledge required for designing sustainable and adaptive solutions. As AI continues to shape our world, students adept in computational design through PBL will be at the forefront of crafting a built environment that not only withstands but thrives amid the intricate and ever-evolving complexities of the 21st century. This transformative pedagogical approach resonates with the emerging educational paradigms, laying the foundation for a generation of adaptive, forward-thinking designers and problem solvers.

CONCLUSION

In this multidisciplinary exploration, we have delved into the intertwined concepts of adaptation and space in the context of sustainable futures and Problem-Based Learning (PBL). Our journey has revealed the intricacies and diverse interpretations of space, highlighting its crucial role in addressing the challenges of our contemporary environment and the spatial boundaries we inhabit.

Throughout our discussion, we have emphasized the importance of embracing diverse perspectives and approaches to problem-solving. By integrating the principles of adaptation into the design of PBL activities, we can create a dynamic learning

environment that enables individuals to adjust their problem-solving strategies in response to changing circumstances (Christiansen et al., 2013). This adaptive capacity not only enhances critical thinking, but also cultivates transferable skills necessary for collaboration across disciplinary boundaries.

We acknowledge the transformative changes that have occurred in fields such as art, design, architecture, science, and technology. While historically knowledge and innovation have predominantly flowed from science and technology to these realms, we recognize the growing reciprocal knowledge exchange and interdisciplinary collaborations that have emerged in recent years. Examples include the integration of artistic and design principles in scientific research and technological advancements, as well as the application of scientific methodologies in artistic and architectural practices. These collaborative endeavors demonstrate the potential for knowledge transfer and innovation across disciplines, open towards different viewpoints and interpretations (Savery, 2006).

As we have embarked on speculative explorations, we have observed the interconnectedness of various fields such as art, design, architecture, science, and technology. While these fields have undergone transformative changes, it is vital to acknowledge that knowledge and innovation have predominantly flowed from science and technology to the realms of art, design, and architecture.

Whether in public discourses, policymaking, or even through available research funding, today, fields of science and technology appear to be given significantly more gravitas, even monopolize the responsibility in the task of tackling the challenges of our times. This, often via captivating products of rapid technological advancement, which follow Promethean attitudes promising to address current problems by creating the world anew. In contrast, fields of design, architecture, and the arts, offer finer lenses for identifying and engaging with today's complex challenges, in their different scales and scopes, through sustainable operations of adaptation, that don't necessitate the negation of our current challenges. What we mean to suggest is not a binary dilemma between ‘the arts and the sciences,’ but instead that the complexity of our contemporary lived environment requires both. To fully harness the potential of adaptation and space, we must foster reciprocal knowledge exchange and interdisciplinary collaborations that enrich all involved fields.

In our quest for sustainable futures, Problem-Based Learning emerges as a catalyst for transformative learning experiences. By integrating the notions of adaptation and space into PBL frameworks, we empower individuals to tackle complex challenges and envision innovative solutions (Van den Akker, 2006). This expanded perspective beyond

disciplinary boundaries opens up new trajectories for PBL, enabling us to address the urgent and interconnected issues of our time.

In conclusion, this article has sought to contribute to the discourse on sustainable futures by emphasizing the significance of adaptation and space. By embracing interdisciplinary perspectives, engaging with the complexities of space, and fostering adaptive learning environments, we can navigate the challenges of our world and work towards a more sustainable and inclusive future.

Acknowledgments

This article emerged from a Laser Talk held at Aalto University during the pandemic. The limited freedom of spatial interaction beyond the virtual realm prompted a critical re-evaluation of current trends in higher education, shifting the focus from the production of tools and solutions to a critical discourse. The authors would like to express their gratitude to Dr. Ossi Naukkarinen, the Vice-President for Research, for his invaluable support in establishing Laser Talks at Aalto University. Special thanks are also extended to Prof. Dr. Laura Beloff for introducing the Laser Talks format at Aalto University and to the founding members of the Laser Talks format: Ksenia Kaverina, Kirsi Peltonen, Nitin Sawhney, and Koray Tahiroğlu.

References

Alpaydin, E. (2016). *Machine Learning: The New AI*. MIT Press.

Butler, J. Butler, Gambetti, Z. Sabsay, Z. (eds 2016). *Vulnerability in Resistance*. Duke University Press. https://doi.org/10.1515/9780822373490

Chen, Y., Lin, Y., & Yang, J. (2020). Learning to Adapt: A Meta-Learning Approach for Few-Shot Learning. In Proceedings of the 37th International Conference on Machine Learning (ICML), pp. 1746-1755.

Arendt, H. (2019). *The Human Condition*. University of Chicago Press.

Blesser, B., and Salter, L. (2009). The Other Half of the Soundscape: Aural Architecture. In *The Journal of the Acoustical Society of America*. Mexico City.

Cantrell, B., & Mekies, L. (2018). *Responsive Landscapes: Strategies for Responsive Technologies in Landscape Architecture*. Routledge.

Castells, M. (1997). An Introduction to the Information Age. *City.* 2(7): 6–16. https://doi.org/10.1080/13604819708900050.

Christiansen, E. T., Kuure, L., Mørch, A. & Lindström, B. (2013). Problem-based learning for the 21st century: new practices and learning environments. Aalborg: Aalborg Universitetsforlag.

Deleuze, Gilles, and Felix Guattari. *A Thousand Plateaus*. Translated by Brian Massumi. 1987. Reprint, London: Bloomsbury Academic, 2013.

Edgerton, S. (1985). The Renaissance Development of the Scientific Illustration. In *Science and the Arts in the Renaissance*, edited by John William Shirley and F. David Hoeniger, 168–97. Plainsboro, NJ: Associated University Presses.

De Graff, E., & Cowdroy, R. (1997). Theory and practice of educational innovation through introduction of problem based learning in architecture. *International Journal of engineering education*, 13, 166-174.

Eliasson, O. (2014). The Future Is Curved. *Architectural Design* 84(5): 86–93. https://doi.org/10.1002/ad.1813.

Fenton-Glynn, L. (2019). The Adaptation of Space: A Conceptual Framework for Understanding the Role of Space in Adaptation to Climate Change. *Journal of Environmental Psychology*, vol. 65, pp. 101325.

Fisher, A., & Margolis, J. (2002). Unlocking the clubhouse: The Carnegie Mellon experience. *ACM SIGCSE Bulletin*, 34(2), 79–83. https://doi.org/10.1145/543812.543836

Fischer, G., (2013). Supporting self-directed learning with cultures of participation in collaborative learning environments. In Christiansen, E. T., Kuure, L., Mørch, A., & Lindström, B. (Eds.). *PROBLEM-BASED LEARNING FOR THE 21st CENTURY: New Practices and Learning Environments*. (1 ed.) Aalborg Universitetsforlag.

Forrester, J. W. (1969). *Urban Dynamics*. MIT Press and Productivity Press.

Forrester, J. W. (1992). *System dynamics and learner-centered-learning in kindergarten through 12th grade education*. Y_1993-01SD&LearnerCentered.pdf (clexchange.org)

Fricker, P. (2016). Towards a New Design and Teaching Methodology for Large-Scale Landscape Design in the Era of Digital Overload. In M. Boştenaru Dan & C. Crăciun (Eds.), *Space and Time Visualisation* (pp. 63–75). Springer International Publishing. https://doi.org/10.1007/978-3-319-24942-1_4

Fricker, P. (2018). The Real Virtual or the Real Real: Entering Mixed Reality. *Journal of Digital Landscape Architecture*, 3, 414-421.Wichmann Verlag. https://doi.org/10.14627/537642044

Fricker, P. (2020). Computational Design Pedagogy for the Cognitive Age. In Werner, L., and Koering, D. (Eds.), Anthropologic: Architecture and Fabrication in the Cognitive Age - Proceedings of the 38th ECAADe Conference - Volume 1, TU

Berlin, Berlin, Germany, 16-18 September 2020, Pp. 685-692. https://doi.org/10.52842/conf.ecaade.2020.1.685

Fricker, P. (2022). Computing with nature: Digital design methodologies across scales. In R. Monacella & B. Keane (Eds.), *Designing Landscape Architectural Education: Studio Ecologies for Unpredictable Futures* (1st. edition, p. 438). Routledge, Taylor & Francis Group. https://www.routledge.com/Designing-Landscape-Architectural-Education-Studio-Ecologies-for-Unpredictable/Monacella-Keane/p/book/9780367703653

Fricker, P., & Kotnik, T. (2023a). Computing Land-Scapes. In *Patterns of Interaction: Computational Design Across Scales* (pp. 49–67). Springer Nature Singapore. https://doi.org/10.1007/978-981-19-9083-0_4

Fricker, P., & Kotnik, T. (2023b). *Patterns of interaction: Computational design across scales*. Nature Singapore. https://doi.org/10.1007/978-981-19-9083-0

Girot, C. (2016). *The course of landscape architecture: A history of our designs on the natural world, from prehistory to the present*. Thames & Hudson.

Harvey, D. (1989). *The condition of postmodernity: An enquiry into the origins of cultural change*. Blackwell.

Harvey, D. (2006). Space as a Keyword. In David Harvey, *A Critical Reader*, edited by Noel Castree and Derek Gregory, 70–93. Oxford, UK: Blackwell Publishing Ltd. https://doi.org/10.1002/9780470773581.ch14.

Hermansdorfer, M., Borg, K., Fricker, P., & Skov-Petersen, H. (2020). Bridging Tangible and Virtual Realities: Computational Procedures for Data-Informed Participatory Processes. *Journal of Digital Architecture*, 5, 354-365. Wichmann Verlag. https://doi.org/10.14627/537690036

Illeris, K. (2003). Towards a contemporary and comprehensive theory of learning. *International Journal of Lifelong Education*, 22(4), 396-406. https://doi.org/10.1080/02601370304837

Jensen, C. G. (2017). Collaboration and Dialogue in Virtual Reality. *Journal of Problem Based Learning in Higher Education*, Vol 5 No 1 (2017): Special issue: Blended Learning in Architecture and Design Education. https://doi.org/10.5278/ojs.jpblhe.v0i0.1542

Keyser, C. J. (1906). Mathematical Emancipations. The Passing of the Point and the Number Three: Dimensionality and Hyperspace. *The Monist*, 65–83. https://doi.org/10.5840/monist190616134

Korn, M., & Reißmann, W., & Röhl, T., & Sittler, D. (2019). *Infrastructuring Publics*. Springer.

Landau-Donnelly, F. (2021). Contentious Walls. *CAP - Public Art Journal*, 3(2), Article 2. https://journals.ap2.pt/index.php/CAP/article/view/509

Landau, F., Pohl, L., & Roskamm (Eds.). (2021). [Un]Grounding. Retrieved April 10, 2023, from https://www.transcript-verlag.de/978-3-8376-5073-0/un-grounding/

Latour, B. (2005). *Reassembling the social: An introduction to Actor-Network-Theory*. Oxford University Press.

Law, J., & Urry, J. (2004). Enacting the social. *Economy and Society*, 33(3), 390-410. https://doi.org/10.1080/0308514042000225716

Longo, G. (2019). Mathematical Infinity "in Prospettiva" and Spaces of Possibilities. *Arts et Sciences*, 3 (1). https://doi.org/10.21494/ISTE.OP.2019.0415.

M'Closkey, K., & VanDerSys, K. (2017). *Dynamic Patterns: Visualizing Landscapes in a Digital Age* (1st ed.). Routledge. https://doi.org/10.4324/9781315681856

Marchart, O., (2012). *Die politische Differenz*. Suhrkamp

Meet to Sleep. (2016, April 5). Actipedia. https://actipedia.org/project/meet-sleep

Miltiadis, C. (2019). The Architectural Continuum: Choropoietic Media and Post-Physical-World Environments. In *Architectonics of Game Spaces. The Spatial Logic of the Virtual and Its Meaning for the Real*, edited by Andri Gerber and Ulrich Götz, 183–99. Bielefeld, Germany: Transcript. https://www.transcript-verlag.de/978-3-8376-4802-7/architectonics-of-game-spaces/.

Miltiadis, C., & Gerriet K. S. (2021). Beyond the Visual - A Research Curriculum for Explorations in Spatiotemporal Environments. *Journal for Artistic Research*, no. 24 (September). https://www.researchcatalogue.net/view/815001/815002.

Nakamura, T. (2018). Adaptive Design Strategies for Sustainable Architecture. In Proceedings of the 3rd International Conference on Sustainable Materials, Systems and Structures (SMSS), pp. 103-110.

Nunez, H. C., Jonasen, T. S.,Skov, M., & Ryberg, T. (2016). Deliverable 2.1: Data-driven PBL model. Retrieved from https://pdfs.semanticscholar.org/aa45/c5d1cd31453cf357c0a2aa56772edb3a314d.pdf

Phadke, S., Khan, S., & Ranade, S. (2011). *Why loiter? Women and risk on Mumbai streets.* Penguin Books.

Picon, A. (2015). *Smart Cities: A Spatialised Intelligence*. John Wiley & Sons. https://doi.org/10.1002/9781119075615

Perec, G. (1959) (2008). *Species of Spaces and Other Pieces*. Edited by John Sturrock. London: Penguin Classics.

Riemann, B. (1854). *On the Hypotheses Which Lie at the Bases of Geometry*. Habilitation, Göttingen: University of Göttingen.

Savery, J.R, (2006): Overview of problem-based learning: Definitions and distinctions. *Interdisciplinary Journal of Problem-Based Learning*, 1(1), 3. https://doi.org/10.7771/1541-5015.1002

Van den Akker, J., Gravemeijer, K., McKenney, S., & Nieveen, N. (Eds.).(2006). Introducing educational design research. In *Educational design research*, 1st edition, 3-7. Routledge. https://doi.org/10.4324/9780203088364

Wertheim, M. (2010). Lost in Space: The Spiritual Crisis of Newtonian Cosmology. In *Seeing Further: 350 Years of the Royal Society and Scientific Endeavour*, 42–59. Harper Collins Publ. UK.

Williams, S. (2020). *Data Action: Using Data for Public Good*. The MIT Press. https://doi.org/10.7551/mitpress/12261.001.0001

Yang, J., Fricker, P., & Jung, A. (2022). From Intuition to Reasoning: Analyzing Correlative Attributes of Walkability in Urban Environments with Machine Learning. *Journal of Digital Landscape Architecture*, 7, 71-81. Wichmann Verlag. https://doi.org/10.14627/537724008