ajar ARENA JOURNAL OF ARCHITECTURAL RESEARCH

Oliveira S et al. Reconceptualising sustainability practice research in architecture.
ARENA Journal of Architectural Research. 2023; 8(1): 2. DOI: https://doi.org/10.55588/ajar.390

HUMANITIES ESSAY

Reconceptualising sustainability practice research in architecture: Radical ways of seeing and ways of imagining

Sonja Oliveira,[1] **Ana Betancour,**[2] **Jonathan Mosley,**[3] **Torsten Schröder**[4]

1 University of Strathclyde, GB

2 Oslo School of Architecture and Design, NO

3 University of the West of England, GB

4 Eindhoven University of Technology, NL

Corresponding author: Sonja Oliveira (sonja.dragojlovic-oliveira@strath.ac.uk)

Abstract

In this introductory essay, which also frames the other contributions to this *AJAR* Special Collection that were selected from the papers given at the Radical Architecture Practice for Sustainability (RAPS) conference in 2021, we will – in our role as guest editors – explain our thinking behind that event.

What we suggest here are new conceptual approaches to expand the study of sustainability within the architectural domain. Research into transformational architectural practices suited to a climate-changed future has already accelerated rapidly in Britain and elsewhere, and yet the proliferation of new targets, frameworks and policies is typically dominated by an empirical focus rather than by theoretical advances. Therefore, this essay elaborates upon Assemblage Theory and scientific studies of human imagination in order to expand the modes of research into architectural sustainability. By doing so, we are bringing an expanded conceptual understanding to the topic of sustainability in calling for new 'ways of seeing' and for new 'ways of imagining' architecture.

Keywords:

architecture, sustainability, architectural practice, Assemblage Theory, entanglement, human imagination, ecology, climate change

A framework for this *AJAR* Special Collection

In the last decade, there has been a significant expansion of design guidance, assessment models, certification methods and policy strategies as well as research into ways of radically transforming architectural practice to make it more sustainable. Whilst significant advances have been made, most rely on what are one-dimensional instrumental frames which overlook the emergent, complex and entangled nature of architectural practice within a climate-changed future. There are also very few studies being carried out by the research community into the mechanisms, characterisations and conceptual dimensions that are entailed. There thus remains a paucity of representational, communicative and future-thinking visions that could enable a richer understanding of complex and entangled built environments across differing climatic, socio-spatial, economic and cultural contexts. How, then, do we mobilise radical interpretations of ways we can see and ways we can imagine these emergent complexities and relationships between architecture and society, whether physical or imaginary? What values underpin the entanglements of human and non-human encounters within architecture? How are these values shaped and negotiated in the ways that nature is imagined and constructed? How are the conceptualisations represented, communicated and enacted in education settings?

This *AJAR* Special Collection sets out to help answer these questions by showcasing new research on the topic. The collection has been edited by the founders of the Radical Architecture Practice for Sustainability (RAPS): namely, Sonja Oliveira,

Jonathan Mosley, Ana Betancour and Torsten Schröder. RAPS was founded in 2018 with the main purpose of developing a radical global research agenda to examine architectural practices through their entangled spatialities, and to study the values, meanings and relationships that they embody. Through this agenda, a reframed lens is to be provided for international policy-makers, practitioners and researchers to help sustain equitable lives for all species on the planet.

The first international RAPS conference, focussing on the theme of 'Radicality', took place online on 17th–18th September 2021. This conference aimed to explore, imagine and shift conceptualisations of architectural sustainability. The overarching theme of 'Radicality' was chosen to explore ways to view ecological problems as being rooted primarily in socio-political notions of nature, multispecies activity and needs, building and not building, activating and resisting. The RAPS Bristol 2021 Conference thus invited a range of submission formats which included papers, performances, exhibitions and films to encourage discussion and debate around the defined topics of 'Green Dreaming', 'Ecological Entanglements', 'Utopian Realism', 'Architects as Activists', and 'Not Building'.

This AJAR Special Collection collates some key contributions from that conference, expanding our conceptual and theoretical positioning through ideas for new 'ways of seeing' and 'ways of imagining', as will be discussed later in this essay. Another alternative conceptual pathway that draws upon the work of Ken Wilber and Hans Ulrich Gumbrecht is outlined in another essay within this Special Collection, written by Yahya Lavaf-Pour and Fidel Meraz, which critically examines the effects brought about by the current dominant conventions and understandings of sustainability practice which prevail in architectural research [1]. Ana Betancour and Carl-Johan Vesterlund in their essay focus on imaginaries for radical socio-ecological change by tracing alternative views about the notion of nature in order reconfigure and transform practice of sustainable urban planning and design [2]. Meanwhile, Jonathan Mosley and his co-authors in their essay take ideas about entanglement even further by considering architecture as a psycho-social subject which is entwined with the psychology of its creators and its inhabitants – the awareness and management of these entwinements potentially impacting upon the liveability and lifespan of buildings themselves [3].

Next, the essay by Matthew Jones and his colleagues looks at the mechanisms that might help to nurture conditions for radicality in architecture education through an analysis of the experiences of students, educators and wider stakeholders in a 'live' project that was aimed at social innovation, as run in collaboration between the Birmingham School of Architecture and Design and Co-Lab Dudley [4]. In their text, they emphasise the pressing need to go beyond 'technological solutions to suggest deep cultural changes' whenever one is engaging students with actual urban communities. The final essay taken from the conference, written by Ellen Grimes, traces the gridded map of Chicago to discuss how a Chicago community organization, Blacks in Green, was able to advance a form of radical sustainability which requires us to learn how to think and be 'otherwise' [5]. What this means is that the challenges set out by this *AJAR* Special Collection are both methodological and theoretical – helping us to reimagine our current entanglements and how they might reconceptualise globally responsive architectural visions, interventions and modes of governance. Having introduced these other essays, this one here will now explore the aims of RAPS in more detail.

Finding other ways forward

The last decade has seen an expansion of ideas about architecture practice, including policy discourses about the need to retrain and upskill architects [6; 7; 8; 9], and to better prepare for and respond to growing decarbonisation agendas [10; 11; 12], and to mitigate the effects of the climate crisis [13]. In parallel there has been a growth internationally in climate action groups and think-tanks urging the need for transformative change to tackle interconnected challenges arising from climate change, widespread poverty and social degradation [14]. Research into how to improve sustainable practices in architecture has also gained traction, albeit dominated by an emphasis on empirical investigations rather than theoretical advances. The diverse implications of not addressing the assumptions and conventions embodied within these policy and research developments have been discussed in recent work by Kim Förster et al [15] and by Kiel Moe and Daniel Friedman [16], who each call for a reconsideration of the political, economic and cultural relationships between architecture and society.

All this means that calls for theoretical frameworks 'in pursuit of more critical, even operative, engagement with environmental relations beyond the themes of energy and climate change' now abound across many disciplines, and indeed have never been more significant [15]. The potential ignorance that resulted in the unquestioning acceptance by architects of the conventions and assumptions of modernisation – and which has helped to lead to the current climate crisis – is argued by Kiel Moe to have taken us away from architectural thinking and actions that could overcome the dominant narratives of 'inevitability and apocalypse'. Moe seeks to reconsider conceptualisations of energy use in order to argue that the prevailing energetic concerns with passive controls, fuel efficiency and optimisation, whilst obviously important, are however making us 'miss the big picture' [17]. Leblanc and Catros reflect upon how the construction industry persists in striving for certification standards and 'green' awards even though those are largely proven to have very little positive environmental benefit: instead, the authors call for 'evolved thinking about sustainability in architecture in order to prepare for practice in the post-2°C era' [18].

Fewer ideas have been put forward for methodological proposals that can help us to arrive at this higher ethos of sustainable architecture. Exceptions include the work of Terri Peters and Stephen Verderber, who offer 'ten territories for engagement' in the design of eco-humanist healthcare environments as the framework for understanding the complex entanglements of a patient, the patient's significant others, and caregiver between the built environment and occupant wellbeing [19]. However, whilst of clear value to studies about sustainable practice in architecture, their model is primarily applicable to healthcare buildings. There is also some emerging research on novel conceptions of architecture as experimental, living or bio-informed, even if this literature is not yet fully engaged with mainstream built environment policy and practice [20].

Beyond the realm of architectural debate, there is increasing recognition in climate change and decarbonisation agendas of the need to address complexity and interdependence through diverse kinds of evidence and knowledge [21]. The challenge of understanding spatial, social and technical entanglements across all architectural scales from individual buildings to cities, from one set of infrastructures to the fringes of others, from individuals to mass populations, is presenting scholars in engineering, computation, social sciences, and the arts and humanities with demanding new problems that require interdisciplinary approaches. This suggests a shift away from focusing on architecture as buildings, or architecture as a professional service, or architecture as a unit of financial investment, towards a view of architecture as involving the design, realisation and operation of equitable and multi-sensory environments [22; 23].

Recent work across disciplinary domains has hence begun to expand upon conceptions of architecture practice by calling instead for participatory design and anthropogenic transitions [24; 25], for an increase in handicrafts and the rights of nature [26; 27], or for the creation of bio-inspired and living matter [28], or such like. However, whilst valuable, these views are nevertheless still tightly coupled with seeing and imagining architecture in terms of measurable 'buildings' that are then experienced and inhabited by human 'users'. Studies of the human user and of the measurable building have been omnipresent in sustainable design thus far. Libby Schweber and Roine Leiringer argue however that this is limiting research into the 'non-technical dimensions' of architectural sustainability [29: p. 482]. Schweber and Leiringer are therefore criticising the prevailing research emphasis on specific aspects such as occupant behaviour and user perceptions and energy usage, echoing the views of other writers who call for investigations into crucial matters such as water supply and biodiversity [30]. What this means is a need both to find better ways to simulate user behaviour through metrics and analytics, and to broaden our understanding of how human and non-human users relate to and experience buildings [31; 32].

'Ways of seeing': Shifting the focus

Whilst there are a growing number of studies into socio-technical aspects, and increased recognition of the need for experimental and innovative design approaches, there has been little done within architecture research to investigate 'ways of seeing' the interrelationships between buildings, people, other species, and technology. Multi-scalar and more interdisciplinary approaches are largely missing, and there has been little to offer novel methodological and theoretical insights, except in some writings such as those by Albena Yaneva and Torsten Schröder [33; 34]. The fundamental problem is that current modes of thinking about sustainability within architecture are unable

to engage with the breadth and complexity of interconnected factors that are affective in contemporary situations. A shift in the conceptual underpinning of architectural sustainability is essential in order to 'see' these entanglements, best achieved by focusing not on any single entity as sovereign but instead by looking at the web of relations between entities. This conceptual approach is underpinned by relational philosophers from Alfred Whitehead to Gilles Deleuze and Felix Guattari, and including Michel Callon, John Law and Bruno Latour, as well as recent developments in Entanglement, New Materialist, and Assemblage Theory as put forward by Karen Barad, Jane Bennett and Manuel DeLanda [35; 36; 37].

There scholars offer diverse inspirational sources for us to re-conceptualise the relationships between practices, society, materiality and agency in sustainable architectural practice. There are also a broad new range of approaches drawing on Science and Technology Studies (STS, sometimes also called Science, Technology and Society). Typically, STS-inspired approaches aim to abandon thinking in layered realities – such as the technical, the material, the social – and to instead welcome and encompasses hybrid characteristics. These are specifically suited to exploring how design issues are constructed, how design knowledge is produced, and how design strategies are assembled [38; 39]. The limitation so far is that few offer an analytical capacity to 'see' multiple dimensions and entities of entanglement across different scales of activity or inactivity.

With this problem in mind, the notion of entanglement – a term derived from quantum physics – has been applied to numerous aspects of our contemporary condition, with scholars arguing that to be 'entangled' does not simply mean the state of being intertwined with other separate entities, but of lacking an independent and self-contained existence altogether [35]. The multifaceted dimension to this relational way of thinking immediately necessitates an appreciation of the mutual impacts and affects which are essential to sustain any relationship with an environment. Jane Bennett, who is concerned with 'thing-ness' and non-human perspectives, argues that by 'experiencing the relationship between persons and other materialities more horizontally' we can thus develop a greater 'ecological sensibility' [36: p. 10]. Timothy Morton uses the concept of a 'mesh' to refer to the interdependence and interconnectedness of all living and non-living things. He contends that ecological thought explores this mesh and is itself 'the thinking of interconnectedness' [40]. In light of these contemporary notions there is a critical analytical need to reconsider architecture practice beyond the independent built object, reconceptualising its assessment and performance as a sovereign environment within any particular scale of activity, as though it were excluded from other dimensions of being. By applying these approaches to architecture, any building or urban space can be considered as a complex amalgamation of human and non-human occupants, systems, objects, built elements, materialities, and immaterialities – each with their own entangled relations with other entities. Architecture is hence part of the 'mesh' and it is only through recognising its connective existence with many diverse ecologies and seeking to understanding its relations, that improved measures to practice sustainability may be imagined.

Deploying this form of Assemblage Theory as a research approach, and extending it through a visual-spatial account, enables a deliberately open positioning towards the types of relations and the human and non-human elements involved in environmental, social and spatial effects of cities, buildings and spaces. Recent debates in environmental and sustainability science are thus increasingly relying on relational thinking and this openness as key to researching the challenges of the climate emergency [41]. The goal is not to arrive at a single 'best' perspective, but to contribute to ongoing learning. Relational thinking hence provides resources to re-work and re-think conventional research practices and the residual, often difficult-to-detect, assumptions of architectural modernism [41].

Research into architecture, as well as the practice of architecture, both require a shift in conceptual underpinning to engage with the challenges being posed by the climate emergency – a shift that has to be relational in considering new 'ways of seeing' multiple dimensions and entities of being. This need to shift thinking is particularly critical within those contexts where the inhabited environment is mostly already built, as is the case in most European countries. Efforts need to be placed on how we can manage an interconnected and entangled built environment and how we can better 'see' how to coexist within it visually, socially and spatially in a way that sustains life for all. This imperative to tackle these interconnected entangled issues is recognised widely, yet despite this we continue to rely on visual language and props that are ill-prepared in being too simplistic and overly targeted at individuals. These limitations in our current ways of seeing also affect our studies to inform/feedback/change human behaviour, offering little to us as a

species and certainly not recognising the relevance of other species. Assemblage Theory and other relational approaches have the capacity to open up new modes of seeing entities and entanglements as they unfold across empirical settings and scales of being, yet a further consideration for expanding our methodological capabilities is in imagining new realms of possibility and systems of being which draw upon concepts from the analysis of imagination and dreams.

'Ways of imagining': Dreaming realms of possibility

As a way to move away from instrumentally driven approaches, bounded as they are by the empirical, sensorial and terrestrial world, a more meaningful analysis of transformative and future thinking dimensions of sustainability practice needs to consider the role and ontological status of human imagination. This methodological proposal may specifically open up new avenues for understanding human and non-human relations within and across spaces, opening up new representations, dynamics and discourses of coexistence. There remains as yet unknown potential in the study of designers' imagination. It is well established that, within any creative act, an 'image' is revealed that, in the words of Susana Alves, serves as the 'mediator between a sensible and a non-sensible world and has the function of bringing to light the most hidden modalities of being' [42: p. 209]. Images are thus seen as an expression of universal archetypes and the original mythological heritage of humankind [43].

Cornelius Castoriadis stresses that imagination helps produce systems of meanings and 'ways of imagining', which is an essential factor in our collective interpretations of social reality [44]. In addition, social imaginary significations are regarded as a central reference point to values, norms, and practices developed by society. The most practical utilisation of imagination is in the formulation of ambitions and ideals as exercised through visuo-spatial ability. Spatial intelligence, or visuo-spatial ability, is what enables us to create, recognise and use a sequence of visual images [45]. It is what human beings do whenever they visualise shapes in the 'mind's eye'. It is the mental feat that architects and engineers perform when they design, facilitate, and/or coexist within spaces, entanglements and assemblages of being. Visuo-spatial ability holds the capacity for scientists to analyse multiple dimensions of molecules, or healthcare professionals to navigate and treat the human body. According to David Lohman, visuo-spatial ability is necessary for the brain to develop a way to process all multi-sensory information [45]. Human beings use vision and the other senses to create a mental map of where objects are in relation to other objects and the environment. Sensory precepts and imaginaries are hence descriptions of visual scenes couched in the brain's inner 'language of thought' [46].

Why does this matter to practice and research in architectural sustainability? It is because human imagination, and ways this may be tangibly or intangibly communicated, has ramifications for how life in all its forms is sustained. How do we sense and see, both collectively and individually, what kinds of spaces, entanglements, systems we need, and how we can manage and/or coexist through and beyond them? Though there is a growing understanding that people's mental models – their internal representations – about the use of buildings, or the inhabitation of cities, or the co-design of environments, are not largely based around consumption, but rather on the visual categorising of external phenomena, and therefore there is currently a lack of knowledge or understanding of what such a visual categorising entails or how it may be characterised [47]. Indeed, there is a paucity of methodological innovation in the use of imagination-driven visual and representational techniques by architectural designers [48]. Although there have been limited studies which explore visuo-spatial responses towards sustainability through instrumental analysis of energy usage as a design tool [49; 50], or the creation of images to express what architectural sustainability might be [51], there are few empirical or theoretical accounts of design imagination. One exception is work carried out in the 1990s by The New London Group that offers a possible approach to analysing imagination within the architectural realm [52]. They defined the modes of visuo-spatial communication as 'resources that permit the design of meanings', although they did not explicitly refer to any specific studies about human imagination. Rather, they categorised the terms for 'meaning/making' communication systems: linguistic, audio, spatial, gestural, and visual. Here we would also suggest the addition of a further concept that is drawn from the multimodal, relational entities and entanglements that were discussed in the previous section, that of 'ways of imagining' which use these modes of communication to add up together about the general meaning of an image.

Thus, there is a critical need for architects to study, document and invent new modes of communicating 'what is imagined' in relationship to space, social relationships, environmental cues and collective needs. Imagination has not yet been sufficiently examined as a way of creating a new 'language', spatially and socially, that might develop more resilient understandings of the resources that we depend on, such as energy, water, land and air. Being able to conceive and express these imaginative visualisations of essential resources could help to develop new infrastructural properties within our cities and towns. Such an approach would enable initial mappings of propositions and viabilities that could suggest new realms and dreamscapes – thereby opening up entirely new conventions and propositions – as indeed was the call for provocations by RAPS which have culminated in this *AJAR* Special Collection [22]. Given that architects and designers at a fundamental level operate as orientators and communicators between individuals and collectives, their imagination carries the potential of indicating new directions for sustaining life [53].

Methodological approach

Our fundamental argument having been made in the preceding text, it is here worth stressing that the methodological approach of rethinking the 'ways of seeing' and 'ways of imagining' is rooted in the tradition of Deleuze and Guattari, whereby they hold that 'every concept has components and is defined by theme … [and that] these components, or what defines the consistency of the concept; its endo-consistency; are distinct, heterogeneous and, yet, not separable' [54: pp. 15, 19]. In this paper, our suggested concepts act as analytical positions, being interlinked in that together they provide a comprehensive understanding of the relational characterisation of entanglements and complex entities. Yet, to arrive at the concepts, we have relied on grounded theory tactics that aim to generate, identify, and trace this conceptual basis. Our tactics involved multiple dialogues that involved 40 hours of discussion between the authors that were carried out between 2020–22, alongside four research events involving up to 120 participants [22]. These dialogues explored alternative ways of knowing and representing sustainability practice in architecture, and they also helped to articulate some of the most important theoretical and empirical obstacles and constraints. Supported by semi-structured literature reviews, our dialogues were seen as an effective and rigorous research technique which, alongside with other methods, helped to develop our argument [55].

Crucial insights developed through these dialogues and literature reviews were then explored in multi-stakeholder events with larger groups to expand thinking, ensure credibility and provide peer-evaluation. Records were also kept of key insights during the research process, helping to focus the analysis for designing further events and writing up the findings [56]. The propositions and concepts were also tested out with invited participants via debate panels from those of academic and non-academic backgrounds, to help ensure the reliability of the approach that we were taking. The resulting methodology we have adopted is one that is often used whenever the aim is to develop new conceptual insights within complex, multi-dimensional fields of study [57].

Concluding comments

In Europe, it is now widely acknowledged by academic communities as well policy-makers that we need to imagine alternative societal futures. Our essay builds upon that call to suggest new experimental ways of seeing and imagining the entangled phenomenological processes involved in the three-dimensional contexts of houses, buildings, cities and infrastructures, each of them inhabited by diverse ecologies, technologies, humans and non-human species. Whereas the imagination of architects and designers has been invoked to explore alternative future scenarios that better suit a sustainable planetary system, or 'new nature', this has not yet been promoted as a new socio-spatial method to use our collective resources more wisely.

By encouraging ways to imagine and visualise the resources that our human lives depend on – water, energy, land, air – new paradigms for these infrastructures, spaces and entities could be made possible. More theoretically informed and empirically insightful 'ways of seeing' and 'ways of imagining' could open new methods of socio-spatial communication that also consider our involvement with resources that we and other species depend upon. Whilst opening up methodological and theoretical opportunities, the propositional nature of these new 'ways of seeing' and 'ways of imagining' offers undoubted challenges. Imagination has typically

been under-examined, yet it is also seen as the most powerful cognitive resource in envisaging new paradigms of communication across many disciplines [42]. The need to rethink how we use shared entangled resources, entities and spaces is a global challenge that requires experimentation and creativity. This essay, whilst speculative, aspires towards a new field of research into sustainable architectural practice through a merging of perception, imagination, visualisation and design.

Acknowledgements

The authors wish to extend their gratitude and thanks to the *AJAR* editorial team of Murray Fraser and Stephen Parnell for the opportunity to put together this Special Collection as well as all the work that has gone into the editing process. We also acknowledge the participation and enthusiasm of many people who have engaged in discussions around ideas of 'ways of seeing' and 'ways of imagining', particularly in the sessions held at the 2021 Venice Biennale's Korean Pavilion and the 2022 New European Bauhaus Festival.

We would like to thank the organising committee for the RAPS 2021 Conference as well as ARENA for its continued support for the RAPS project. Special thanks also need to be given to all the reviewers of the papers from and to Anosh Butt at the University of Strathclyde for their support with copy-editing and proof-reading of the selected essays.

Competing interests

The authors have no competing interests to declare.

References

1. Lavaf-Pour Y, Meraz F. MetaPhysics of architecture: An integral theory-framework for sustainability. ARENA Journal of Architectural Research. 2023; 8(1): 5.
2. Betancour A, Vesterlund C-J. Green imaginaries. *ARENA Journal of Architectural Research*. 2023; 8(1): 4.
3. Mosley J, Crociani-Windland L, Warren S, Williams N. Architecture on the couch: A transdisciplinary exploration of buildings as psychological subjects. *ARENA Journal of Architectural Research*. 2023; 8(1): 3.
4. Jones M, Vowles H, Prescott L, Orchard-Webb J, Doron H. Educating radical practitioners: A case study of regenerative design on a UK high street. *ARENA Journal of Architectural Research*. 2023; 8(1): 7.
5. Grimes E. Thinking and being otherwise: Liberatory environmental justice and the 'Black Metropolis'. *ARENA Journal of Architectural Research*. 2023; 8(1): 6.
6. Guerra-Santin O, Tweed AC, Zapata-Lancaster MG. Learning from design reviews in low energy buildings. *Structural Survey*. 2014; 32(3): 246–264. DOI: https://doi.org/10.1108/SS-08-2013-0030
7. Royal Institute of British Architects. *Sustainable Outcomes Guide*. RIBA; 2019.
8. Architects Registration Board. *ARB Competence Guidelines: Sustainability*. ARB; 2021.
9. Bouw en Techniek Innovatiecentrum. *Kennis-en Innovatieprogramma: Circulair Ontwerpen voor Gebouwen en Infrastructuur*. Building and Technology Innovation Centre, BTIC Delft, 2021. Available at: https://tki-bouwentechniek.nl/wp-content/uploads/Kenns-en-Innovatieprogramma_BTIC_CirculairOntwerpen_02022021.pdf
10. World Green Building Council. *Advancing Net Zero Status Report*. WGBC; 2022.

11. United Kingdom Green Building Council. *Impact Report 2021-22*. UKGBC; 2022.

12. London Energy Transformation Initiative. *Climate Emergency Design Guide*. LETI; 2020.

13. Climate Change Committee. *2022 Progress Report to Parliament*. CCC; 2022.

14. United Nations. *The Closing Window: Climate Crisis Calls for Rapid Transformation of Societies*. UN Environment Programme; 2022.

15. Förster K (ed.). *Environmental Histories of Architecture*. Canadian Centre for Architecture; 2022.

16. Moe K, Friedman DS. All is lost: Notes on broken world design. *Places Journal*. October 2020. DOI: https://doi.org/10.22269/201013

17. Moe K. Building agnotology. *Journal of Architectural Education*. 2021; 75(1): 10–12. DOI: https://doi.org/10.1080/10464883.2021.1859878

18. Leblanc M, Catros A. Path-dependency as a potential cause for the disjunction between theory and tools in the modelled reality of sustainable architecture. In: Walker T, Wendt S, Goubran S, Schwartz T (eds.). *Business and Policy Solutions to Climate Change*. Palgrave Macmillan, 2022: 291–310.

19. Peters T, Verderber S. Territories of engagement in the design of ecohumanist healthcare environments. *HERD: Health Environments Research and Design Journal*. 2017; 10(2): 104–123. DOI: https://doi.org/10.1177/193758671666

20. Armstrong R. *Soft Living Architecture: An Alternative View of Bio-Informed Practice*. Bloomsbury Publishing; 2020.

21. Leach M, Scoones I, Stirling A. *Dynamic Sustainabilities: Technology, Environment, Social Justice*. Earthscan; 2010.

22. Radical Architecture Practice for Sustainability (RAPS) agenda. Available at https://www.rapsresearch.com/

23. Spence, C. Senses of place: Architectural design for the multisensory mind. *Cognitive Research: Principles and Implications*. 2020; 5(1): 1–26. DOI: https://doi.org/10.1186/s41235-020-00243-4

24. McPhearson T, Raymond CM, Gulsrud N, Albert C, Coles N, Fagerholm N, et al. Radical changes are needed for transformations to a good anthropocene. *npj Urban Sustainability*. 2021; (1)5: 1–13. DOI: https://doi.org/10.1038/s42949-021-00017-x

25. Cielemęcka O, Daigle C. Posthuman Sustainability: An ethos for our anthropocenic future. *Theory, Culture and Society*. 2019; 36(7-8): 67–87. DOI: https://doi.org/10.1177/0263276419873

26. Apostolopoulou E, Cortes-Vazquez JA (eds.). *The Right to Nature: Social Movements, Environmental Justice and Neoliberal Natures*. Routledge; 2018.

27. Väänänen N, Pöllänen S. Conceptualizing sustainable craft: Concept analysis of literature. *The Design Journal*. 2020; 23(2): 263–285. DOI: https://doi.org/10.1080/14606925.2020.1718276

28. Camere S, Karana E. Fabricating materials from living organisms: An emerging design practice. *Journal of Cleaner Production*. 2018; 186: 570–584. DOI: https://doi.org/10.1016/j.jclepro.2018.03.081

29. Schweber L, Leiringer R. Beyond the technical: A snapshot of energy and buildings research. *Building Research and Information*. 2012; 40(4): 481–492. DOI: https://doi.org/10.1080/09613218.2012.675713

30. Hu S, Yan D, Azar E, Guo F. A systematic review of occupant behaviour in building energy policy. *Building and Environment*. 2020: 175. DOI: https://doi.org/10.1016/j.buildenv.2020.106807

31. Ardeshir M, Berger C, Amin H, Ampatzi E, Andersen RK, Azar E, et al. The role of occupants in buildings' energy performance gap: Myth or reality? *Sustainability*. 2021; 13(6). DOI: https://doi.org/10.3390/su13063146

32. Oliveira S, Badarnah L, Barakat M, Chatzimichali A, Atkins E. Beyond energy services: A multidimensional and cross-disciplinary agenda for home energy management research. *Energy Research and Social Science*. 2022; 85. DOI: https://doi.org/10.1016/j.erss.2021.102347

33. Yaneva A. Making the social hold: Towards an actor-network theory of design. *Design and Culture*. 2009; 1(3): 273–288. DOI: https://doi.org/10.1080/17547075.2009.11643291

34. Schroeder T. Giving meaning to the concept of sustainability in architectural design practices: Setting out the analytical framework of translation. *Sustainability*. 2018; 10(6). DOI: https://doi.org/10.3390/su10061710

35. Barad K. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Duke University Press; 2007.

36. Bennett J. *Vibrant Matter: A Political Ecology of Things*. Duke University Press; 2010.

37. DeLanda M. *A New Philosophy of Society: Assemblage Theory and Social Complexity*. Continuum; 2006.

38. Walker G, Karvonen A, Guy S. Zero carbon homes and zero carbon living: Sociomaterial interdependencies in carbon governance. *Transactions of the Institute of British Geographers*. 2015; 40(4): 494–506. DOI: https://doi.org/10.1111/tran.12090

39. Blok A. Urban green assemblages: An ANT view on sustainable city building projects. *Science and Technology Studies*. 2013; 26(1): 5–24.

40. Morton T. *The Ecological Thought*. Harvard University Press; 2012.

41. West S, Haider L, Stålhammar S, Woroniecki S. Putting relational thinking to work in sustainability science: Reply to Raymond et al. *Ecosystems and People*. 2021; 17(1): 108–113. DOI: https://doi.org/10.1080/26395916.2021.1898477

42. Alves S. Understanding intangible aspects of cultural heritage: The role of active imagination. *The Historic Environment: Policy and Practice*. 2018; 9(3-4): 207–228. DOI: https://doi.org/10.1080/17567505.2018.1517141

43. Corbin H. *Spiritual Body and Celestial Earth*. Princeton University Press; 1997.

44. Adams S (ed.) *Cornelius Castoriadis: Key Concepts*. Bloomsbury Academic; 2014.

45. Lohman DF. Spatial ability and g. In: Dennis I, Tapsfield P (eds.). *Human Abilities: Their Nature and Measurement*. Lawrence Erlbaum Associates; 1996: 97–116.

46. Thomas JA. *Meaning in Interaction: An Introduction to Pragmatics*. Routledge; 2014.

47. Gabe-Thomas E, Walker I, Verplanken B, Shaddick G. Householders' mental models of domestic energy consumption: Using a sort-and-cluster method to identify shared concepts of appliance similarity. *PloS one*. 2016; 11(7). DOI: https://doi.org/10.1371/journal.pone.0158949

48. Hajer M, Versteeg W. Imagining the post-fossil city: Why is it so difficult to think of new possible worlds? *Territory, Politics, Governance*. 2019; 7(2): 122–134. DOI: https://doi.org/10.1080/21622671.2018.1510339

49. Rahm P. Meteorological architecture. *Architectural Design*. 2009; 79(3): 30–41.

50. Moe K. *Convergence: An Architectural Agenda for Energy*. Routledge; 2013.

51. Guy S, Moore SA. Sustainable architecture and the pluralist imagination. *Journal of Architectural Education*. 2007; 60(4): 15–23. DOI: https://doi.org/10.1111/j.1531-314X.2007.00104.x

52. Cazden C, Cope B, Fairclough N, Gee J, Kalantzis M, Kress G et al. A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review*. 1996; 66(1): 60–92.

53. Schneider T, Till J. Beyond discourse: Notes on spatial agency. *Footprint*. 2009; 4: 97–112. DOI: https://doi.org/10.7480/footprint.3.1.702.

54. Deleuze G, Guattari F, Schwibs B, Vogl J. *Was ist philosophie?* Suhrkamp; 2000.

55. Delong J. Raising voice using dialogue as a research method for creating living-educational-theories in cultures of inquiry. *Educational Journal of Living Theories*. 2020; 13(2): 71–92.

56. Blaikie N. *Approaches to Social Enquiry: Advancing Knowledge*. Polity; 2007.

57. Jabareen Y. Building a conceptual framework: Philosophy, definitions, and procedure. *International Journal of Qualitative Methods*. 2009; 8(4): 49–62. DOI: https://doi.org/10.1177/160940690900800406.

How to cite this article: Oliveira S, Betancou A, Mosley J, Schröder, T. Reconceptualising sustainability practice research in architecture: Radical ways of seeing and ways of imagining. *ARENA Journal of Architectural Research*. 2023; 8(1): 2. DOI: https://doi.org/10.55588/ajar.390
Published: 12 April 2023

ARENA *ARENA Journal of Architectural Research* is a peer-reviewed open access journal published by the Architectural Research European Network Association (ARENA).

OPEN ACCESS