A third phase of architectural design research, moving from disrupting traditional knowledge production to expanded possibilities that embrace further disruptions to architectural knowledge.

Disrupting design research in architecture: Speculating on a third phase of architectural design research

George Themistokleous and Yasser Megahed

Design research in architecture has evolved significantly in the last three decades. The term architectural design research refers to systematic investigation in which architectural design is a central component of the research method and/or its outcomes.[1] As Murray Fraser suggested in 2021, this type of research foregrounds possibilities for media, tools, and techniques in designing and making, such as drawing, modelling, and writing – tools that are used in both the educational studio and in architectural practice – to inform the research itself.[2] This article traces a historical lineage of architectural design research to speculate on its contemporary trajectories. Building on the evolution of architectural design research as a discourse,[3] this article investigates two interrelated threads. The first provides an overview of significant moments in the history of academic architectural design research in the UK and Western Europe, drawing from relevant literature. The second thread focuses on the 1995 book *S,M,L,XL* by OMA (Office for Metropolitan Architecture), Rem Koolhaas, and Bruce Mau, which coincided with the emergence of architectural design research discourse in academia. We demonstrate how the medium of this book marked an important moment for design research, offering a precedent that contributed to a reorganisation of architectural design knowledge, coinciding with what was later defined as the early phase of systemised design research in architecture.

To explore these ideas, the notion of hypermediation developed by media theorists Richard Grusin and Jay David Bolter, as well as Michel Serres's reading of signal and noise in *The Parasite*, will be used to reconsider how *S,M,L,XL* systematically reorganised the three fields in which architectural knowledge is conventionally generated: practice, research, and pedagogy. Our paper concludes by speculating on a similar paradigmatic turning point for design research that we are facing today. With the emergence of AI image generators and their expanding impact on architectural design, including examples such as Midjourney and DALL-E, the field is confronted with a new horizon. If the birth of architectural design research was ushered in by hypermediated formats whose multiple narratives were co-constructed by the reader/viewer, then AI

technologies signal a phase of post-mediation that challenges the authorship of the architect. The article ends by speculating on the role of architectural design research at a time when the very agency of the architect is challenged by such external forces.

Design research: A very short history
Architectural design research refers to the process of making original investigations – through generative and propositional modes of producing work in which researchers interactively use and reflect upon methods associated with design and practice – for critical inquiry. This mode of research employs multiple media such as drawing, modelling, and other creative tools familiar from architectural design studio and practice.[4] The use of multiple media has expanded research methodologies, offering more dynamic interpretations of ideas from Donald Schön's famous book *The Reflective Practitioner*.[5] Design research has changed the landscape of architectural knowledge by bringing 'academic' architectural research closer to design practices, while considering the irreducible complexity of what constitutes architectural knowledge.[6] This shift has transformed how architectural knowledge is produced, disrupting the established systematisation of academic architectural research. Through architectural design research, relations between research, practice, and pedagogy continue to be redefined.[7] To understand these intertwined relations, it is useful to outline a brief history of architectural design research.

Architecture and early formations of design as a research discipline
The origins of architectural design research are contested. While the term 'design research' was first mentioned in Eliel Saarinen's 1943 book *The City*,[8] it wasn't until the 1990s that its application in architecture began to be formalised in academia.[9] The pursuit of design as a scientific field and methodology for research gained significant momentum in the second half of the twentieth century. Such aspirations were reflected in the Design Methods movement of the 1960s, as advocated by Geoffrey Broadbent, John Christopher Jones, and Christopher Alexander, for

example, under the framework of 'design as science.' This movement led efforts to externalise the design process to make it appear controllable, systematic, and rational. [10] These initiatives expanded the debate on establishing design as a distinct discipline, and were accompanied, for example, by the founding of the Design Research Society (DRS) in the 1970s. [11]

Although architectural design was just one area of study under the bigger umbrella of design methods, there was a general push during this period to make architecture more objective and scientific. Following the RIBA's influential 1958 Oxford Conference on architectural education, masterminded by Leslie Martin, architectural education became integrated into universities, establishing its legitimacy by adopting the traits of an academic discipline and developing a coherent body of architectural research rooted in the scientific tradition. [12]

The Design Methods movement was relatively short-lived, facing a backlash against its underlying values in the 1970s. Architects, notably including some previous pioneers of the movement like Christopher Alexander, criticised Design Methods for being overly reductive and incapable of addressing the complexity of real-world issues. [13] They argued that design science and organisations like the Design Research Society were too narrowly focused to be of much relevance to architectural design. [14] Meanwhile, in practice, the seeds of architectural design research began to germinate in the work of radical architect Cedric Price, for example, who ran his office more like a research laboratory than a conventional architectural practice. Around the same time, other early examples of architectural design research gained more widespread prominence, including speculative experimental practices of Archigram, Superstudio, and others.

The period from the 1980s to the 1990s saw significant developments in design research marked by the growth of research-based journals in the design world. Notable examples include *Design Studies*, launched in 1979; *Design Issues* first published in 1984; *The Journal of Design History*, established in 1988; *Research in Engineering Design* in 1989; and *Languages of Design* in 1992. [15] During this time, Bruce Archer and Nigel Cross were pivotal figures, advocating design as a 'third culture' of knowledge distinct from the two established cultural fields: science and the arts. Cross argued in various publications, including a seminal 1982 paper, for 'designerly ways of knowing' as unique methods and epistemologies distinct from those of other disciplines. [16] With a stronger architectural focus, architect, academic, and psychologist Bryan Lawson conducted observational studies on how architects think, the decision-making processes in design, and the interplay between human behaviour and architectural environments. [17] Despite these contributions, such efforts did not gain significant traction within conventional architectural academia. Instead, attempts were made to 'academicise' the architectural discipline by adopting methods from established models in other fields to legitimise itself as a latecomer to academia. During this time, established architectural knowledge depended on external validation from other disciplines to secure its place within academia. Research in architecture often relied on

models of knowledge from fields such as the humanities, sciences, and social sciences. Among these established academic disciplines, design practice was often regarded as a form of applied science. Consequently, architectural researchers felt it necessary to distance themselves from their professional backgrounds as designers to be accepted into the academic research community. [18]

Against this backdrop, multiple voices in the UK and Western Europe emerged in the 1990s, criticising academic architectural research for its reliance on disciplines beyond architecture. Such critiques rekindled interest in design practices as the core of the architectural discipline and its research, leading to efforts to establish a clearer definition of design-based research. This moment marked the initial formalisation of design research in architecture, signalling the beginning of its quest for legitimacy within academia.

Seeking legitimacy: the first phase of design research in architecture

The 1990s saw a series of research initiatives and events in the UK and Western Europe that documented a growing awareness among practitioners, educators, and researchers of the need for a mode of inquiry specifically tailored to architecture's modus operandi. [19] In the UK, Christopher Frayling's essay 'Research in Art and Design' (1993) marked a significant moment in the history of design research. Frayling's definition of research *through* design was foundational in shaping a new approach for the design fields in general and architecture, in particular. [20]

In parallel, a series of conferences held at TU Delft and Sint-Lucas School of Architecture in the late 1990s highlighted a growing recognition of the disparity between design and architectural research. Events such as the European Association for Architectural Education (EAAE) conference on 'Doctorates in Design + Architecture' (1996), questioned the scientific status and autonomy of design research. [21] While these conferences sparked renewed interest in design-based research in architecture beyond conventional academic frameworks, they also ignited debates about the validity of this supposedly new research method. These discussions revealed the challenges of establishing clear boundaries and values specific to the discipline of architecture. Other events explored the potential for developing doctoral scholarship in architectural design and the criteria for evaluating such work. While acknowledging obstacles facing architectural design research, this period fostered a positive outlook, focusing on creating opportunities and finding pathways for architectural design research to thrive within academia.

In the UK, the first issues of newly established refereed architecture journals – **arq** (established in 1995) and *Journal of Architecture* (launched by the RIBA in 1996) – were preoccupied with the status of design as research in architecture. Under the banner 'can architectural design be considered research?' these journals prompted debates about how the architectural design process and its outcomes might be classified as research. The discussions also explored the pedagogical, bureaucratic, and practical challenges of integrating architectural design as a form of research within the academic research framework. [22]

A key catalyst for debates around design research in architecture during this period was the establishment of the Research Assessment Exercise (RAE) in the UK (later renamed the Research Excellence Framework, or REF). This funding mechanism for British universities relied on evaluating research productivity, significantly impacting how design research was perceived and assessed.[23] With this new mechanism, schools of architecture faced a predicament: design studios and their modes of practice, central to knowledge production in architectural schools, might not be considered valid forms of research for this assessment. Such research was deemed 'research with a lowercase r' due to its association with more informal and personal processes of inquiry that lacked accessibility and transferability of knowledge.[24] This kind of 'research' rarely held much currency or authority in the context of formal academic inquiry and was therefore not considered legitimate for the purposes of the RAE.[25] With this challenge to the architectural discipline, and particularly its research and teaching, design research became crucial in mediating relations between practice, research, and pedagogy. This changed how the architectural discipline would consider design. As a mode of producing architectural knowledge stemming from practice and education, design research would gain legitimacy within academia, carving out more space as an accepted form of research.

Events and initiatives of the 1990s provided platforms for architectural researchers and educators to explore opportunities for knowledge production. This period marked the beginning of a 'formalised' disruption to traditional modes of systematic knowledge production in architectural academia, signalling the first phase of design research in the field.

Forms of proto-architectural design research

Before the formalisation of design research in architecture, the production of architectural knowledge relied on rigid distinctions between practice and research. In contrast, the architecture book served as a common platform connecting practice, research, and pedagogy. As Jonathan Hale states, '[architectural design research] is within a tradition that has been intrinsic to what architects have done for five hundred years [...] through the architectural book.'[26] Retrospectively, various forms of early 'architectural design research' can be recognised in the work of renowned figures from architectural history, whose knowledge creation was deeply rooted in their architectural projects and design practices, often manifested through the particular medium of the architecture book – as seen, for example, in the work of Jean-Nicolas-Louis Durand, Eugène Viollet-le-Duc, Le Corbusier, or Zaha Hadid.[27] While the architecture book did not directly inform the systematisation of architectural design research discourse, certain moments, such as the paradigmatic shift in the architecture book by Rem Koolhaas and collaborators in *Delirious New York* (1978) and *S,M,L,XL* (1995) helped to consolidate architectural design research.[28] The latter specifically coincided with the formation of the first phase of systematised design research in architecture.

S,M,L,XL: hypermediation and noise

The architecture book is a loosely defined medium due to its diversity in historicity, content, and relations between image and text. Here, we would like to approach the architecture book as a mediator between design projects and writing. As Murray Fraser states, 'a particular concern is the implications for the potential methodology of design research in its task of interweaving projects (design) with texts or books (writing).'[29] So, what defined the architecture book during this early phase of design research in the early to mid-1990s? *S,M,L,XL* serves as the exemplary case study for addressing this question. It has been widely discussed because of its impact on architectural practice, pedagogy, and research. Upon publication, the graphic imagery of the book, co-designed by OMA and Bruce Mau, made a significant visual impact within the field. It has been argued that the medium of the architecture book – in this case, *S,M,L,XL* – systematically organises knowledge in an unprecedented way, revealing a change in how architectural design is produced and disseminated. Fraser is critical of *S,M,L,XL* because, for him, it lacks the critical import of Rem Koolhaas's *Delirious New York* (1978). According to Fraser, 'poststructuralism worked well as the basis of critical opposition in the 1970s, but it was inadequate for when an architect started to deal with the realities of architectural production within the capitalist system.'[30] He considered the book a disappointment because 'instead of offering a new model for design research, thereby updating and transcending *Delirious New York*, it came across as a practice brochure fattening up and hiding itself behind Bruce Mau's dazzling graphics.'[31] Reducing the design of the book to 'dazzling graphics' and a 'practice brochure', or considering it merely as a reflection of Koolhaas's ego, misses the point. The 'message' of the book must be closely examined through its medium. In other words, as Marshall McLuhan proclaimed, 'the medium is the message',[32] not the content. To 'dazzle' is more than a straightforward aesthetic choice.

Before going further, any architecture book needs to be considered in relation to its format, and the written word in general. As McLuhan wrote in 1964, 'Western values, built on the written word, have already been considerably affected by the electric media of telephone, radio, and TV.'[33] The first part of McLuhan's statement is instructive. If Western values inform the written word, to what extent does the format of the architecture book deviate from that of a non-architectural book? The architecture book – due to its reliance on images – disrupts the technology of the phonetic alphabet and its ensuing impact on culture. In this respect, architecture is similar to illustrated books or graphic novels. Through drawing, photography, and other visual media, the architectural book disrupts the linear format of the written word, creating new associations between text and image. For example, Le Corbusier's cataloguing of photographs of industrial products in *Towards a New Architecture* (1923) described the direction that architecture, according to him, should follow. As articulated by Beatriz Colomina in *Privacy and Publicity* (1994), the photographic cataloguing of *Towards a New Architecture*, as a medium, not only runs parallel to the

text but furthermore supplants the linearity of the written word.

With *S,M,L,XL*, the architecture book takes on a more radical scope. The book contains multiple media formats. It 'spills over with graphs, charts, poems, scripts, revisions, essays, metaphors, panic, chronologies, plans, cartoons, Beckett, events, big men, big type, models, diaries, competitions, notebooks, disasters, artworks, manifestos, drawings, rants, lectures, cities, speculation, invention and tragedies.'[34] The book thus makes no effort to provide a coherent, linear or overarching structure *[1]*. The bricolage-like structure of the book anticipates the media environments of the internet and websites, defined by Jay David Bolter and Richard Grusin as 'hypermediation.' For Bolter and Grusin, 'the logic of hypermediacy acknowledges multiple acts of representation and makes them visible.'[35] It is important to emphasise the shift that occurs in the medium of the architecture book. Hypermediation, according to Bolter and Grusin contrasts with immediacy, where the latter assumes that the medium itself becomes effaced. For example, the architecture book of modernism arguably sought immediacy, aiming to use the medium to communicate the message clearly without drawing attention to the medium itself. With hypermediation, the multiplicity and heterogeneity of multiple media call attention to their own fragmented nature. The viewer becomes an active contributor who must navigate the hypermediated formats. Thus, while *Towards a New Architecture* is a book of *immediacy*, *S,M,L,XL* comprises a hypermediated architectural book. The 'dazzling' array has had a profound impact on the discipline and cannot be reduced to a mere brochure. In contrast to Fraser's position, which argues that *S,M,L,XL* 'acted to sever the necessary continuities of design research between text and project',[36] we argue instead that the book contributed to a rethinking of these relations.

The hypermediated format of *S,M,L,XL* anticipated ways to consider what Ruth Blacksell and Stephen Walker term 'Spaces of Information.' In their 2016 article 'Architecture and the Spaces of Information', Blacksell and Walker introduce an issue of *Architecture and Culture* that explores architecture in relation to editorial design and art practice. They explore the changes that come with emergent, digitally mediated environments (such as online platforms) and how they formulate new relations between architecture and editorial design. They emphasise a 'different way of engaging the spectator as a participant who no longer has to be physically positioned in proximity to the work.'[37] Instead, the 'reader' or 'contributor', rather than the 'viewer' within 'this expanded conception of the exhibition space', provides another understanding of how the medium moves from 'the physical (and static) to the virtual (and dynamic).'[38] The authors note the importance of McLuhan's writing on media. They state that 'new forms of practice have required the understanding and appropriation of an entire mediating context and structure.'[39] Thus, it becomes possible to see how the hypermediated format of *S,M,L,XL* was a precursor to digital publishing platforms. However, the notion of hypermediated interactivity offered by contemporary emerging platforms is not the same as in the more innocent age of the early internet. Digital interactive

environments of today do not simply offer 'new opportunities for interactive manipulation',[40] they also 'position the user inside an imaginary universe whose structure is fixed by the author.'[41] Beyond the notion of control, it is important to posit here that, as McLuhan suggests, with electronic media there is a drastic change from the book that is based on the Gutenberg press. *S,M,L,XL* anticipated spatially the hypermediated multimodal temporality of the web, and the open temporality suggested by Blacksell and Walker in emerging information spaces, but it did so through the medium of the typographic book. Architectural historian Mario Carpo also explores how current technologies diverge from the Gutenberg model of print in terms of normative typographic processes.[42]

Within the hypermediated space of *S,M,L,XL*, there are threads of linear narratives such as project drawings, essays, a graphic novel strip, advertisements, film stills, a dictionary, etc. The various vectors in the book are organised in a way that disrupts any over-arching linear sequence, however. This is why it is argued that the book offers an unprecedented organisation of architectural knowledge: it was the first prominent architecture book to present information not just in a non-linear way, but in a hypermediated spatial format. This kind of textual space is not only meant to represent actual or speculative projects but becomes a space in and of itself. Coincidentally, *S,M,L,XL* was released at around the same time the World Wide Web began radically changing global communications. It reflected the emerging digital spaces of the early internet and their complex relations with actual spaces. Hypermediation thus opened up new ways to synthesise architecture's various visual and textual representational formats and connect different forms of realised practice with theoretical and practice-focused research. In this sense, the hypermediated format introduced an element of 'noise' into established ways of architectural knowledge production and communication at that time.

According to Serres, 'communication theory is in charge of the system; it can break it down or let it function, depending on the signal.'[43] In Serres's notion of a system, noise attains primary value. 'Noise, through its presence and absence, the intermittence of the signal, produces the new system.'[44] Cary Wolfe explains the importance of noise and its relation to the signal in Serres's theorisation, showing how noise is 'always already part of the signal', as 'blindness inescapably accompanies vision.'[45] Wolfe states that 'noise' (for the English reader) forms the third and unsuspected meaning of the French word *parasite*: '1. Biological parasite; 2. Social parasite; 3. Static or interference.'[46] Serres focuses on this third meaning. The idea of parasite as interference problematises the straightforward biological and social connotations of the term. We want to emphasise here that the disruption of the system and its emergent possibilities are not determined – at least initially – by human intentionality.[47] Similarly, *S,M,L,XL* and its hypermediated format acted as a parasite, as a 'noise' to the established modes of knowledge production and communication in the architectural field. While the book was not identified as design research *per se*, it nonetheless provided a reference for further developments in design research inquiry.

1 **The hypermediated space of the architecture book** *S,M,L,XL* **by OMA, Rem Koolhaas, and Bruce Mau.**

The second phase of design research: Systemised hypermediation

The first phase of design research in architecture 'disrupted' the systematic production of architectural academic knowledge, as it focused on legitimising itself within a broader academic context. With the advent of the new millennium, a new phase of design research in architecture began to emerge in British and Western European universities during the 2000s.

This second phase was defined by moving beyond the cautious question 'can architectural design be considered research?' to exploring the possibilities offered by design research, its medium, and message.[48] During the next two decades, design research gained more traction in the architectural academic field. This was evident in the increasing number of research events[49] and literature on architectural design research emerging during this time.[50] The period saw the publication of different volumes exploring the definitions and applications of design research in architecture. These included the volume *Mapping Design Research: Positions and Perspectives* (2012) edited by design theorists Simon Grand and Wolfgang Jonas.[51] This volume mapped out the territories of design research and its emerging vocabularies, spanning from speculative design studio projects to realised practice-based and practice-led research. Michael Hensel's *Design Innovation for the Built Environment: Research by Design and the Renovation of Practice* (2012) showcased design research approaches of many advanced architectural programmes from around the world.[52] *Design Research in Architecture: An Overview* (first published in 2013) by Murray Fraser aimed to bring together different understandings of design research in architecture.[53] A similar interest in design research was also evident in publications such as *Perspectives on*

Architectural Design Research: What Matters – Who Cares – How (2015), edited by Jules Moloney, Jan Smitheram, and Simon Twose. This book featured a collection of short essays and projects demonstrating how design research can catalyse architectural knowledge production in academia and practice.[54] Meanwhile, the Bartlett Design Research Folios, produced by UCL scholars for REF and collected online, served as an important platform for presenting educational and experimental works informing both education and broader research in architecture.[55] *Demystifying Architectural Research* (2015) by Anne Dye and Flora Samuel linked design research in both academia and practice.[56] Similarly, Michael Hensel and Fredrick Nelson's *The Changing Shape of Practice* (2016) and *The Changing Shape of Architecture* (2019) explored evolving relationships between research and design within architectural practice. These books reflected on how practice increasingly incorporates research methodologies, leading to a more informed and reflective design process. They emphasised the dual role of the architect as both designer and researcher – concerned not only with the creation of buildings but also with the generation of knowledge through design contributing to both academic and professional fields.[57]

During this period, multiple conferences and symposia showcasing architectural design research projects were held in the UK and Europe. These included the 'PhD by Design' conference series at Goldsmiths University, showcased in *Instant* Journal (2014–17), and the AHRA (Architectural Humanities Research Association) PhD student symposia, which provided

platforms to disseminate design research alongside more conventional academic formats. Not coincidentally, the AHRA journal *Architecture and Culture* (Routledge), launched in 2013, became a key journal supporting the publication of design research. In Europe, there was a similar appetite for design research, made evident by events such as TU Delft's ARENA Architectural Research Network Meeting in 2013 and the Lisbon Conference on Architectural Research by Design (ARbD'14). Design research events in this period expanded modes of architectural knowledge production and led to an increase in design research doctoral programmes in architectural schools, whereby doctoral students integrated their own creative practices into their research projects.[58] Still, during this period, although PhD by-design programmes became more common, architectural design research – at least within UK schools of architecture – remained relatively niche and insular.[59] It was still under pressure to prove itself as an equivalent to longer-established modes of research in architectural academe – a status that generally mirrored the atmosphere of the second phase of the development of architectural design research.

As in *S,M,L,XL*, hypermediation defined the second phase of design research in architecture. During this period, a new generation of researchers used an expanding array of media – including drawing, model-making, photography, film, digital media, installations, material explorations, prototyping, and construction methods – familiar from design studios in architectural schools. This use of multiple media opened up new relations with written textual formats. Yielding an expanded toolkit, this enabled a broad spectrum of spatial research investigations. Design research became recognised at this time as a methodology capable of reframing and reorienting other fields in the humanities and sciences. While the first phase of architectural design research focused on establishing credibility, the second phase was characterised by experimentation with the possibilities that this mode of research could uncover.

Our current moment: the third phase of design research in architecture

The traditional methods of producing architectural knowledge through academic research are increasingly being eclipsed by architectural design research. Relations between research, practice, and pedagogy are also shifting due to the expanded role of architectural design research. With its inherent agility, design research mediates these relations effectively. Recent volumes on design research illustrate the broad range and potential of creative practice inquiry in architecture that emerged in this second phase. These include volumes like *Visual Research Methods in Architecture* (2021), edited by Igea Troiani and Suzanne Ewing, and *Creative Practice Inquiry in Architecture* (2022), edited by Ashley Mason and Adam Sharr.[60] These volumes consolidate a broad interpretation of architectural practice, including practice-led design, material and place-based practices, multidisciplinary studios, and educational studio practices. They emphasise the importance of creative practice and emerging critical visual methodologies to chart connections between different processes and outcomes, paving the way for narrative, temporal, and affective

design-based research to be foregrounded. They thus contextualise the setting for a new phase of design research in architecture.

What determines this new phase of design research? Architectural knowledge will continue to be restructured according to the expanded possibilities offered by design research. In the 1990s, the embryonic phase disrupted the systematic knowledge production of academic research, coinciding with the experimental format of *S,M,L,XL* and the explosion of the internet, as noted above, and an unprecedented change in global communication systems and knowledge production in general. The hypermediated spatial organisation of knowledge disrupted established modes of architecture communication, introducing an element of noise into the established 'system.' Hypermediation echoed the digital space of the web, with non-human noise playing a crucial role in shaping urban and architectural imaginaries.[61]

Today, we find ourselves on the precipice of further disruption to the system. With the recent emergence of AI image generation software such as Midjourney, architecture faces an unforeseen challenge. In a February 2023 article in *The Guardian* newspaper – 'A.I. is Putting our Jobs as Architects Unquestionably at Risk' – Neil Leach addresses how AI could pose an existential threat to the practice of architecture.[62] The period defined as hypermediation is now arguably being eclipsed by 'postmediation.' Postmediation assumes that the human agency of architectural knowledge production is becoming disrupted by the non-human agency of AI. With the emergence of this further *noise*, architectural knowledge production is once again being challenged.

In *Architecture in the Age of Artificial Intelligence* (2022), Leach draws from posthuman thinkers such as N. Katherine Hayles to show how we can consider AI in its relation to architecture. As Leach states, 'we can explore the full potential of AI as being not an end in itself, but a prosthetic device that can enhance the natural intelligence of the human being.'[63] In this reading, Leach wants to emphasise the 'potential synergy' between AI and human intelligence. However, in the conclusion of the book, Leach poses an important question for architectural design research. He asks: what if we 'start to design using voice commands and hand gestures, instead of drawing?'[64] Will AI be able to generate customised designs completely autonomously? According to Leach, this is expected to happen by the end of the decade.

AI is clearly here to stay and looks set to be a paradigm-changing technology for the architecture discipline. This will elevate the importance of design research. Knowledge that consolidates multiple media, including AI, and addresses how architectural design relates to other disciplines, will likely make design research even more invaluable in the coming decades. Architectural design research is best placed to confront the ways in which AI could impact how architecture will be produced. Architectural design research allows us to explore how AI can be integrated into research. In other words, AI will need to be used in design as an extension of human intelligence. The role of design research will be critical in allowing architecture to address this emerging challenge to its modes of production.

Notes

1. *Design Research in Architecture: An Overview*, ed. by Murray Fraser (2013; repr. Abdington: Routledge, 2021), p. 2.
2. Murray Fraser, 'Design Research in Architecture, Revisited', in *Artistic Research: Charting a Field in Expansion*, ed. by Paulo de Assis and Lucia D'Errico (Lanham, MD: Rowman & Littlefield Publishers, 2019), pp. 128–45 (p. 129).
3. The term discourse here is taken from Michel Foucault in *The Archaeology of Knowledge* (1969). Foucault writes: 'the term discourse can be defined as the group of statements that belong to a single system of formation; thus I shall be able to speak of clinical discourse, economic discourse, the discourse of natural history, psychiatric discourse.' It is argued here that architectural design research is evolving into its own discourse, due to its engagement with facets of architectural knowledge: practice, research, and pedagogy. Whilst these formations have their own histories and dynamics that intersect and change with time, the essay focuses on how they coalesce to form the discourse of architectural design research. See *The Archaeology of Knowledge*, trans. by A. M. Sheridan Smith (New York, NY: Vintage Books, 2012), p. 121.
4. Yasser Megahed, 'On Research by Design', **arq:** *Architectural Research Quarterly*, 21:4 (2017), 338–43 (p. 339).
5. Ashley Mason and Adam Sharr, 'Introduction: Creative Practice Inquiry in Architecture', in *Creative Practice Inquiry in Architecture*, ed. by Ashley Mason and Adam Sharr (London: Routledge, 2022), p. 4; Donald Schön, *The Reflective Practitioner: How Professionals Think in Action* (1983; repr. London: Routledge, 2017).
6. Christopher Frayling, 'Research in Art and Design', *Royal College of Art Research Papers*, 1:1 (London: Royal College of Art, 1993), p. 4.
7. *Visual Research Methods in Architecture*, ed. by Igea Troiani and Suzanne Ewing (Bristol: Intellect Books, 2021), p. 28.
8. Eliel Saarinen, *The City: Its Growth, Its Decay, Its Future* (New York, NY: Reinhold Publishing, 1943) as cited in Fraser, *Design Research in Architecture*, p. 240.
9. Fraser, *Design Research in Architecture*, pp. 4–5.
10. *Design Methods in Architecture*, ed. by Geoffrey Broadbent and Anthony Ward (Wittenborn: Lund Humphries Publishers Ltd, 1969).
11. Paul Rodgers, Francesco Mazzarella and Loura Conerney, 'The Evolving Landscape of Design Research in the UK', in *International Association of Societies of Design Research Conference IASDR* (Manchester: Manchester Metropolitan University, 2019).
12. Dean Hawkes, 'The Architect and the Academy', **arq:** *Architectural Research Quarterly*, 4:1 (2000), 35–9. Before the Oxford Conference, British architecture students took various paths into the profession, each with its own standards and definitions of education and training. To elevate these standards and unify qualification criteria, the conference decisively separated architectural education from its vocational roots, redefining it as an academic pursuit. This led to the establishment of frameworks for professionalisation, pedagogical methods, and research that influenced the field for decades. For more details, see: Raymond Verrall, 'Situational Perhapsing', in *Creative Practice Inquiry in Architecture*, ed. by Mason and Sharr, pp. 28–39 (p. 29).
13. Nigan Bayazit, 'Investigating Design: A Review of Forty Years of Design Research', *Design Issues*, 20:1 (2004), 16–29 (p. 20); Nigel Cross, 'From a Design Science to a Design Discipline: Understanding Designerly Ways of Knowing and Thinking', in *Design Research Now*, ed. by Ralf Michel (Birkhäuser: Basel, 2007), pp. 41–54 (p. 42). Alexander was one of the founders of the Design Methods approach and promoted it in the 1960s. Later, in the 1970s, Alexander revised and later criticised the concept of controllable design processes.
14. Fraser, *Design Research in Architecture*, pp. 4–5.
15. Nigel Cross, 'Design Research: A Disciplined Conversation', *Design Issues*, 15:2 (1999), 5–10 (p. 5).
16. Nigel Cross, 'Designerly Ways of Knowing', *Design Studies*, 3:4 (1982), pp. 221–7.
17. Bryan Lawson, *How Designers Think* (London: Routledge, 2006).
18. Halina Dunin-Woyseth and Fredrik Nilsson, 'Design Education, Practice, and Research: On Building a Field of Inquiry', *Studies in Material Thinking*, 11 (2014), 1–17 (p. 7).
19. David Yeomans, 'Can Design be Called Research?', **arq:** *Architectural Research Quarterly*, 1:1 (1995); Winyu Ardrugsa and Vimolsiddhi Horayangkura, 'Design Research as an Intermediator', *The International Journal of Design Education*, 17:1 (2022), 183–97 (p. 183); Dunin-Woyseth and Nilsson, 'Design Education, Practice, and Research', p. 10.
20. Frayling, 'Research in Art and Design'; Megahed, 'On Research by Design', (p. 341).
21. Seppo Aura, Juhani Katainen, Juha Suoranta, 'Theory, Research and Practice: Towards Reflective Relationship between Theory and Practice in Architectural Thinking', *Nordic Journal of Architectural Research*, 15:1 (2002; repr. 2015), 73–81 (p. 73); Halina Dunin-Woyseth and Fredrik Nilsson, 'Developing Making Scholarship: From Making Disciplines to Field-specific Research in Creative Practices', in *Knowing (by) Designing: Proceedings of the Conference Knowing (by) Designing at LUCA, Sint-Lucas School of Architecture*, ed. by Burak Pak and Johan Verbeke (Brussels: 2013), 40–9 (pp. 40, 41). Meanwhile, the journal series *Reflections+*, published at the Sint-Lucas School of Architecture (Ghent), was an important arena for communicating the debate on research by arts and research by design.
22. Examples of those debates can be seen in: arq Editors, 'Emerging Practices in Design Research', **arq:** *Architectural Research Quarterly*, 19:3 (2015), 195; Colin Davies, 'Letters: Remember the Readers', **arq:** *Architectural Research Quarterly*, 1:1 (1995); Dean Hawkes, 'The Centre and the Periphery: Some Reflections on the Nature and Conduct of Architectural Research', **arq:** *Architectural Research Quarterly*, 1:1 (1995), 8–11; Eric Parry, 'Design thinking: The Studio as a Laboratory of Architectural Design Research', **arq:** *Architectural Research Quarterly*, 1:3 (1995); Francis Duffy, 'Letters: Architecture is Different', **arq:** *Architectural Research Quarterly*, 1:1 (1995), 6; Michael Brawne, 'Research, Design and Popper', **arq:** *Architectural Research Quarterly*, 1:4 (1995); Patricia Tindale, 'Letters: An Assessor's View', **arq:** *Architectural Research Quarterly*, 1:1 (1995), 6–7; Simon Pepper, 'Further Thoughts on Design Research', **arq:** *Architectural Research Quarterly*, 2:2 (1997); Yeomans, 'Can Design be Called Research?'.
23. Philip Steadman and Bill Hillier, 'The 2001 RAE Dissected: Some Facts and Figures', **arq:** *Architectural Research Quarterly*, 6:3 (2002), 203–7; Yeomans, 'Can Design be Called Research?', p. 12.
24. David Durling and Kristina Niedderer, 'The Benefits and Limits of Investigative Designing', in *IASDR International Conference* (Hong Kong: Hong Kong Polytechnic University, 2007), p. 8.
25. Simon Pepper, 'Further Thoughts on Design Research', **arq:** *Architectural Research Quarterly*, 2:2 (1997), p. 7; Yeomans, 'Can Design be Called Research?'.
26. Jonathan Hill, 'Design Research: An Eye on the Past and the Future', in *InterVIEWS: Insights and Introspection on Doctoral Research in Architecture*, ed. by Federica Goffi (London: Routledge, 2020), pp. 102–14 (p. 104).
27. Jørgen Hauberg, 'Research by Design: A Research Strategy', *AE Architecture & Education Journal*, 5 (2011), 46–56 (p. 53); Jørgen Hauberg, 'Research by *Design*: Situating Practice-based Research as Part of a Tradition of Knowledge Production, Exemplified through the Works of Le Corbusier', *AE Architecture & Education Journal*, 11 (2014), 57–75 (p. 58); *Creative Practice Inquiry in Architecture*, ed. by Mason and Sharr, p. 5.

28. Fraser, *Design Research in Architecture*, p. 7; Peter Lunenfeld, 'The Design Cluster', in *Design Research: Methods and Perspectives*, ed. by Brenda Laurel (Cambridge, MA: MIT Press, 2003), pp. 10–15 (p. 13).

29. Fraser, *Design Research in Architecture*, p. 217.

30. Ibid., p. 237.

31. Ibid., p. 238.

32. Marshall McLuhan, *Understanding Media: The Extensions of Man* (1964; repr. Cambridge, MA: MIT Press, 1994), p. 7.

33. Ibid., p. 94.

34. OMA, Rem Koolhaas, and Bruce Mau, *S,M,L,XL: Small, Medium, Large, Extra-Large* (New York, NY: Monacelli Press, 1995).

35. Jay David Bolter and Richard Grusin, *Remediation: Understanding New Media* (Cambridge, MA: MIT Press, 2000), p. 328.

36. Fraser, *Design Research in Architecture*, p. 217.

37. Ruth Blacksell and Stephen Walker, 'Architecture and the Spaces of Information', *Architecture and Culture*, 4:1 (2016), pp. 1–8 (p.2).

38. Ibid.

39. Ibid.

40. David N. Rodowick, *The Virtual Life of Film* (Cambridge, MA: Harvard University Press, 2007), p. 138.

41. Lev Manovich, *The Language of New Media* (Cambridge, MA: MIT Press, 2001), p. 90.

42. Mario Carpo, *The Alphabet and the Algorithm* (Cambridge, MA: MIT Press, 2011).

43. Michel Serres, *The Parasite*, trans. by Lawrence R. Schehr (1980; repr. Minneapolis, MN: University of Minnesota Press, 2007), p. 6.

44. Ibid., p. 52.

45. Cary Wolfe, 'Bring the Noise: *The Parasite* and the Multiple Genealogies of Posthumanism', *Media Theory*, 1:5 (2021), pp. 273–94 (p. 275).

46. Ibid., p. 276.

47. George Themistokleous, 'The Parasitic Speedrun: Super Mario 64, Noise and the Cosmic Glitch', *Journal of Posthuman Studies*, 6:2 (2022), pp 186–98.

48. *Creative Practice Inquiry in Architecture*, ed. by Mason and Sharr, p. 3.

49. These include 'The Unthinkable Doctorate' in Brussels, Belgium (2005); 'Design Enquiries' in Stockholm, Sweden (2007); 'Research into Practice Conference' in London, UK (2008); 'Changes of Paradigms in the Basic Understanding of Architectural Research' in Copenhagen, Denmark (2008); 'Communicating (by) Design' in Brussels (2009); 'The Place of Research/The Research of Place' in Washington, US (2010); 'Knowing by Designing' in Brussels (2013); and the 'Fourth International Conference on Architectural Research by Design' in Lisbon (2014), among many others.

50. Important figures from this period include the late Jonathan Hill and Jane Rendell from UCL's Bartlett School of Architecture, and Teddy Cruz from the University of California at San Diego. Other important figures of this phase include Halina Dunin-Woyseth, Fredrik Nilsson, Flora Samuel (then at the School of Architecture, University of Sheffield), and Johan Verbeke – Aarhus School of Architecture and Faculty of Architecture Sint-Lucas.

51. *Mapping Design Research: Positions and Perspectives*, ed. by Simon Grand and Wolfgang Jonas (Basel: Birkhäuser, 2012).

52. *Design Innovation for the Built Environment: Research by Design and the Renovation of Practice*, ed. by Michael Hensel (London: Routledge, 2012).

53. Fraser, *Design Research in Architecture*.

54. *Perspectives on Architectural Design Research: What Matters-Who Cares-How*, ed. by Jules Moloney, Jan Smitheram, and Simon Twose (Stockholm: AADR – Art, Architecture and Design Research, 2015).

55. Hill, 'Design Research: An Eye on the Past and the Future.'

56. Flora Samuel and Anne Dye, *Demystifying Architectural Research: Adding Value to Your Practice* (2015; repr. London: Routledge, 2019).

57. *The Changing Shape of Practice: Integrating Research and Design in Architecture*, ed. by Fredrik Nilsson and Michael Hensel (London: Routledge, 2016); *The Changing Shape of Architecture: Further Cases of Integrating Research and Design in Practice*, ed. by Fredrik Nilsson and Michael Hensel (London: Routledge, 2019).

58. *Creative Practice Inquiry in Architecture*, ed. by Mason and Sharr, pp. 7, 8.

59. Graham Farmer, 'Building Practices', in *Creative Practice Inquiry in Architecture,* ed. by Mason and Sharr, pp. 124–135 (p. 125).

60. Ibid.; *Visual Research Methods in Architecture*, ed. by Suzanne Ewing and Igea Troiani (Bristol: Intellect Books, 2021).

61. George Themistokleous, 'Digitally Stitching Stereoscopic Vision', in *Visual Research Methods in Architecture*, ed. by Ewing and Troiani; George Themistokleous, 'Bursting into the Image: Towards De-automatization in VR', *Cinema & Cie. Film and Media Studies Journal*, 23:40 (2023), pp. 105-18.

62. Neil Leach, *Architecture in the Age of Artificial Intelligence* (London: Bloomsbury, 2022), p. 9.

63. Ibid.

64. Ibid., p. 163.

Illustration credits

Competing interests

Authors' biographies

George Themistokleous' critical spatial research investigates the role of the body within media assemblages in contested territories, particularly borderland spaces. Using custom-made interactive installations, he explores blurred hybrids of electronic and actual selves to challenge identity constructs. George's installations and writings have been presented and exhibited internationally. He currently teaches design studio and architectural theory at Norwich University of the Arts. He is founder of *Para-sight* (www.para-sight.net).

Yasser Megahed is Senior Lecturer at the Welsh School of Architecture, Cardiff University, and Associate Architect at Design Office, Newcastle (selected for the *AJ* 40 under 40 awards, 2021). Megahed's research bridges design research and professional practice, using design fiction, storytelling, and cartoons as research and communication tools. His research culminated in the architectural graphic novel *Practiceopolis: Stories from the Architectural Profession*, published by Routledge in 2020.

Authors' addresses

George Themistokleous
g.themistokleous@norwichuni.ac.uk

Yasser Megahed
Megahedy@cardiff.ac.uk