



Delft University of Technology

Document Version

Final published version

Licence

CC BY-NC

Citation (APA)

Rout, A., Tjia, M., & Mateljan, M. (2026). The future of architectural design research: An emerging niche in digital transition. In L. Simeone, C. M. Gray, A. Verhoeven, A. de Götzen, Y. Bakırlioğlu, H. Zohar, M. Stead, & P. Buwert (Eds.), *DRS2026: Research Papers* (Proceedings of DRS; Vol. 2026). Design Research Society.
<https://doi.org/10.21606/drs.2026.598>

Important note

To cite this publication, please use the final published version (if applicable).
Please check the document version above.

Copyright

In case the licence states "Dutch Copyright Act (Article 25fa)", this publication was made available Green Open Access via the TU Delft Institutional Repository pursuant to Dutch Copyright Act (Article 25fa, the Taverne amendment). This provision does not affect copyright ownership.
Unless copyright is transferred by contract or statute, it remains with the copyright holder.

Sharing and reuse

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

Takedown policy

Please contact us and provide details if you believe this document breaches copyrights.
We will remove access to the work immediately and investigate your claim.

This work is downloaded from Delft University of Technology.

Jun 8th, 9:00 AM - Jun 12th, 5:00 PM

The future of architectural design research: An emerging niche in digital transition

Angela Rout
Delft University of Technology, Netherlands, The

Michael Tjia
Delft University of Technology, Netherlands, The

Marija Mateljan
Delft University of Technology, Netherlands, The

Follow this and additional works at: <https://dl.designresearchsociety.org/drs-conference-papers>



Part of the [Art and Design Commons](#)

Citation

Rout, A., Tjia, M., and Mateljan, M. (2026) The future of architectural design research: An emerging niche in digital transition, in Simeone, L., Gray, C. M., Verhoeven, A., de Götzen, A., Bakırloğlu, Y., Zohar, H., Stead, M., and Buwert, P. (eds.), *DRS2026: Edinburgh*, 8–12 June, Edinburgh, United Kingdom. <https://doi.org/10.21606/drs.2026.598>

This Research Paper is brought to you for free and open access by the DRS Conference Proceedings at DRS Digital Library. It has been accepted for inclusion in DRS Biennial Conference Series by an authorized administrator of DRS Digital Library. For more information, please contact library@thedrs.org.

The future of architectural design research: An emerging niche in digital transition

Angela Rout*, Michael Tjia, Marija Mateljan

Delft University of Technology, Netherlands.

*Corresponding author e-mail: a.e.rout@tudelft.nl

doi.org/10.21606/drs.2026.598

Abstract: To remain effective in an era of technological flux and AI-driven tools, architects must continuously expand their knowledge base. Architectural research and education must evolve alongside these digital transitions to secure legitimacy and funding within academic institutions. This paper asks how the architectural design research community can self-manage in response to these changes. Using the lens of Strategic Niche Management (SNM), we examine how design research behaves as an emerging niche seeking to participate in broader academic regimes. We conducted a multi-stage review of the Design Research Society (DRS) Conference Biennale Series (2002–2024), involving a quantitative analysis of over 2,000 papers and a systematic deductive qualitative review of 71 selected contributions. Our findings: 1) visualize longitudinal design research trends; 2) identify eight key approaches categorized into the SNM pillars of expectations, social networking, and learning; and 3) discuss strategic directions for architectural design researchers to manage digital transitions.

Keywords: Architectural design research; design research; digital transition; architecture research culture

1. Introduction

In the next 25 years, the global building stock is expected to double (Green Building Council, 2017). As people spend most of their time inside buildings (Klepeis et al., 2001; Morris et al., 2025), the design of this massive new building stock will have deep and lasting implications for human and non-human life. The discipline of architecture, thus, has a profound responsibility for shaping the environments and spaces where most social, political and economic processes take place. A significant part of this responsibility entails sustained research and innovation in architecture. While professional practice focuses on the immediate demands of design and construction, academic inquiry examines the spatial, social, environmental and technical factors that reconcile scientific and non-scientific objectives. Yet, architectural design research remains a relatively small domain in academia, often receiving less funding than related fields such as engineering, science, or management (AIA Architectural Research Agenda, 2019). The relative scarcity of resources reflects a



This work is licensed under a [Creative Commons Attribution-NonCommercial 4.0 International Licence](https://creativecommons.org/licenses/by-nc/4.0/).

broader underestimation of the field's potential contributions to both design practice and academic inquiry.

Architecture is not alone in this struggle for legitimacy; however, its path to innovation is often complicated by its unique standing among the design arts. Architectural design practice differs from other design disciplines (like industrial, graphic or interaction design) in its scale, social entanglement, temporality and modes of knowledge production (Foqué, 2010). Similarly, architectural design *research* is distinct from other design research disciplines, requiring architecture-specific design research cultures. While application distinctions can complicate the translation and adoption of research methods from other fields, they simultaneously signify a potent source of intellectual innovation that can benefit the wider landscape of design research, bolster funding sustainability, and improve the design and production of buildings inhabited by the global population.

1.1 Architecture design research within the academic research context

Architectural design research occupies a fragmented position at the intersection of the arts, humanities, and applied sciences. It simultaneously operates within an arts-based research cultures (Maciver et al., 2016), with roots in the Beaux-Arts tradition (Leopold et al., 2020). Yet it also can also be housed within technology universities (Jukić & Kostesić, 2024), or occasionally categorized as a vocational trade (Ruamsanitwong & Campbell, 2021). This multi-faceted identity creates a legitimacy paradox: while some argue architecture should be treated as a science (Illies & Ray, 2009), or have compared it to fields such as Law and Medicine (Foqué, 2010; Tzonis & White, 1994), its publication impact metrics lag significantly behind fields like engineering (Asfour & Al-Qawasmi, 2024). This reliance on external, often ill-fitting metrics makes it difficult for researchers to demonstrate credibility to interdisciplinary boards.

As the definition of *research* has expanded to include creative practices as forms of inquiry (Frayling, 1994; Kjörup, 2010), architecture has struggled to maintain ontological and methodological integrity. This reflects legacy of tensions between scientific, artistic, and design-based approaches (De Jong & Van Der Voordt, 2002; Foqué, 2010; Groat & Wang, 2013). This unstable ontological foundation can lead to methodological fragility, where procedures are borrowed from other fields without being properly reconciled. Without addressing this internal fragmentation, architectural design research remains unable to present a coherent, rigorous front to a science-oriented academic community, further compounding its challenges with funding and institutional recognition. This tension suggests that architectural design research is struggling to find alignment with the dominant academic regime, which prioritizes standardized metrics over the holistic, multimodal outputs typical of design inquiry.

1.2 Architecture design research production and dissemination

Outside of academic settings, architectural design research is also often conducted in architectural offices (Leopold et al., 2020). Design research conducted within private practice may be unwilling or unable to share proprietary knowledge openly. As a result, this research often remains embedded in architectural projects and works, encoded in forms of tacit knowledge of the architects involved. There is an obvious distinction between the expected outputs of academic research (research papers, academic books, volumes) and the typical

outputs of architecture practice research (books, magazines, exhibitions, catalogues or design projects focusing on specific agendas, approaches, urgencies, topics). A significant challenge for architectural design researchers lies in reconciling the inherently multimodal and holistic nature of their research questions with frameworks that are often structured around scientific research methods. That said, when attempting to legitimize architecture design research, scholars face the reality that books can be time consuming to produce, and difficult to access through digital searches. Early-career academics and PhD students have limited domain-specific publication venues to share their in-progress work or quickly disseminate study results. So, although the discipline of architecture offers a variety of valuable formats for sharing knowledge—including exhibitions, articles, public lectures, studio instruction, and professional associations—these outputs can be difficult to leverage in academic settings.

1.3 Digital transition in architectural design practice and research cultures

Architectural design and research cultures are facing digital transitions that unfold through many modalities and phases (Carpo, 2013; Picon, 2010). Across these phases, various tools and technologies play a critical role, including CAD software, fabrication tools, as well as emerging generative and machine learning algorithms. Because technology is evolving rapidly, architects must engage in additional research to critically understand its underlying principles and make the most effective use of it. Traditional architectural education alone is no longer sufficient as architects now need to integrate digital literacy and computational thinking into their practice. Universities must therefore foster stronger research cultures that emphasize the intersections of design and technology.

In architectural design, which is inherently concerned with functional use and human experience of space, the ethical integration of technology is essential, to safeguard social values and promote equitable outcomes. For instance, when working with large datasets and artificial intelligence (AI), architects must navigate privacy regulations and ethical considerations related to clients, users, and other individuals as human and legal entities. Additionally, they must manage proprietary knowledge produced within architectural firms, ensuring that sensitive design information is protected. Consequently, digitization and related challenges, hold particular relevance for the domain of architecture.

The digital transition thus, acts as a catalyst for niche-innovation, forcing architectural design research to negotiate new technical learning and processes (Schot & Geels, 2008).

Based on the discussion above, there is a clear need for structural approaches in architecture research that can help create cohesion for the community as they experience digital transition. Achieving this will require academic departments to reconsider and restructure budgets, hiring practices, and career development pathways. Specifically, research units will need to secure funding, expand staffing, provide targeted training, acquire technological resources, and cultivate robust interdisciplinary networks to support a more integrated and technologically informed design research culture. Legitimizing architectural design research methods is therefore not only essential for architecture to be recognized within broader scientific and academic contexts, but also holds substantial value at a societal level (Bernstein, 2018).

1.4 Problem Statement

Architectural design research remains an under-managed niche, rooted in the arts and humanities, which complicates its justification within broader scientific and academic regimes. The discipline suffers from fragmented dissemination and limited publication venues, hindering the development of robust intellectual networks. Consequently, the field lacks a coherent set of strategic approaches to manage the digital transition, leaving researchers with few resources to build upon rapidly evolving computational methods and data-driven practices.

1.5 What is DRS and why could it help?

The Design Research Society (DRS) is an international academic society focused on the promotion and dissemination of design research. The society has held biennial conferences since 2002 and published peer-reviewed proceedings for each. A key objective for DRS is to advance the theories, methods, and practices of design (Design Research Society, 2025). DRS conference proceedings have relevance to the establishment of interdisciplinary design research spanning multiple design disciplines, though product and software design have historically dominated the field. These areas engage in larger stakeholder communities and operate under different concepts of scale, iteration, and temporality than architecture. As a disciplinary field, design research also maintains ties with traditional academic venues and involves more researchers and participants than architecture design research. DRS serves as a valuable case study of a more established design research niche that has successfully navigated many of the legitimacy and methodological challenges now facing architecture. By analyzing approaches to research within the DRS community, specifically regarding expectations, social networking, and learning, this study seeks to identify transferable approaches for architectural design research. These characteristics make DRS a valuable case study, offering insights into framing design research culture, refining methodologies, and expanding collaborative networks. The objective of this study then, is to explore approaches and methods that could help architectural design researchers, by addressing the following questions:

1. What are trends in design research themes and approaches at DRS over time?
2. What contributions and methods have researchers who publish at DRS used, and what approaches respond to digital transitions?
3. Based on the DRS case study, what strategic moves (in expectations, networking, and learning) show potential for managing the digital transition within architectural design research cultures?

1.6 Theoretical Framework: Strategic Niche Management (SNM)

To analyze the digital transition within architectural design research, this study adopts the lens of Strategic Niche Management (SNM) (Schot & Geels, 2008). We leverage this framework because architectural design research functions as a radical novelty that faces a mismatch with existing infrastructure and user practices. SNM suggests that for a new niche to challenge an established regime, it must successfully navigate three internal processes: 1)

articulation of expectations: providing a clear vision to legitimate protection and nurturing, 2) building social networks: expanding the actor base to create a constituency behind the new developments, 3) learning and articulation: deepening technical, social, and infrastructural knowledge. We used these three pillars as the deductive basis for our primary coding categories. We hypothesized that DRS, as a larger and more established research community, already implicitly (or explicitly) manifests strategic approaches within these three SNM dimensions in contribution formats, research methods, or topical themes.

2. Methods

Our method included two quantitative analyses of the DRS corpus, and a qualitative analysis of 71 papers. The first quantitative analysis focused on keywords, the second focuses on the titles and abstracts of the entire corpus. The qualitative analysis involved an in-depth review of a literature sample, whereby we identified strategic approaches that respond to digital transition challenges.

2.2 Keyword Trend Analysis

We began the study by manually collecting keyword labels per year for all papers visible in the DRS Biennial Conference Series website. Due to a drastic divergence in the keyword tagging system introduced in 2024 compared to previous years, abstracts from 2024 were excluded. In addition, keywords were not available for publications in 2002. Therefore, our keyword analysis was conducted on data published from 2004 until 2022.

We analyzed Keyword frequency using an interactive visualization and linear regression to identify positive trending keywords over time. All quantitative analysis was conducted in RStudio Version 2025.09.1+401. Interactive plots were created using the plotly package and exported to HTML. Machine learning clustering was conducted using the cluster package version 2.1.8.1, and the factoextra package version 1.0.7 was used to visualize clustering results for the elbow method. All interactive visualisations, codes, and datasets will be made available through our GitHub page upon publication of this research.

2.3 Terms Clustering and Thematic Analysis

Since the keyword analysis could not include 2002 or 2024 data and because keyword designation may lack consistency over the full 23-year span of the DRS conference proceedings, we supplemented our keyword analysis with a machine learning k-means clustering of all paper abstracts. To gather the data, we scraped all titles, abstracts, publication years, and download counts from the open DRS website into a single database, resulting in a total corpus of n=2229 abstracts.

The abstract texts were cleaned by removing punctuation, numbers, common English stopwords, and whitespace. To determine the optimal number of clusters for the k-means algorithm, we used the elbow method and visually identified a distinguishable "elbow" in the plot at 9 clusters. After scaling the data, we ran the k-means clustering with a maximum of 100 iterations. The top five highest weighted key terms were generated for each cluster based on proximity to the cluster center. Finally, the top two terms were identified as the core theme label for each cluster. Clusters were plotted in an interactive visualization to

allow for visual exploration and comparison of location, density of points, and relative overlap between themes.

2.4 *Generating a Sample for Qualitative Research*

Through discussion among the team of researchers, we grouped emerging thematic trends identified from the k-means clustering and the keyword analysis into thematic categories. We then selected topics ("design/practice", "product/products", "visual/communication", "participatory/social", "user/users") to produce a sample for the second, qualitative part of our research. We reduced the sample to include a random selection of papers that maintained the yearly distribution of papers from the original corpus. We also excluded papers that had "architecture" in the title, maintaining a sample that had novelty for the architectural perspective. This exclusion was designed to avoid disciplinary insularity. Our intent was to identify legitimization strategies from the broader DRS community, fields that have often navigated digital transition and academic validation with different systemic pressures. This approach treats the general DRS corpus as a source of methodological innovation to be translated into the architectural context, rather than focusing on existing architectural precedents.

Finally, our sample prioritized papers with higher recorded downloads to incorporate papers that are more likely to have had a demonstrable impact in the DRS research community. Based on this filtering process, we identified a final sample of 71 papers.

The complete list of sampled papers is available here:

<https://github.com/livingdatadesign/ArchitectureDesignResearch>

2.5 *Qualitative Analysis on Paper Sample*

As outlined in the theoretical framework, we employed a deductive coding process based on the three pillars of Strategic Niche Management using ATLAS.ti. Our codebook was structured *a priori* to align with the three pillars of SNM: legitimizing design (Expectations), building community (Networking), and digital technology (Learning).

To ensure inter-coder reliability, the research team of three, conducted a primary review of a subset of papers, followed by a cross-review of each other's coding. Following the coding phase, we mapped patterns in methodologies and contribution types. We then identified eight key approaches that represent the specific ways SNM processes are currently being operationalized in the field. This allowed us to map the raw data of the papers back to the broader socio-technical transition occurring in architectural research.

Finally, the research team engaged in collaborative interpretation of the resulting thematic clusters to assess their applicability to future architectural design research cultures. Consequently, our discussion elaborates on each SNM dimension followed by an interpretive discussion of their implications for the architectural design research field, and related questions for architectural design researchers.

3. Results

In the following results sections, we describe our quantitative and qualitative analysis of the DRS sample. In the discussion section we elaborate on how these findings could relate to architecture design research cultures. The DRS corpus includes research papers every two years from conferences starting in 2002 and ending in 2024. The full corpus is publicly available at the DRS website with the number of papers from each conference increasing yearly (see Figure 1).

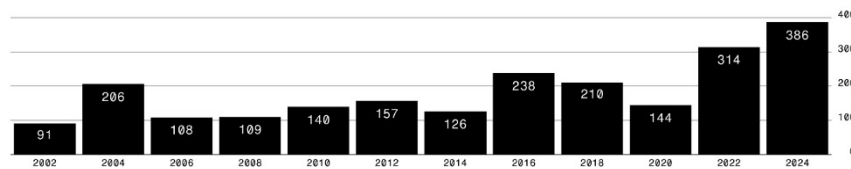


Figure 1 The DRS conference proceedings published papers have increased in number since 2002

3.1 Trends in Design Research themes at DRS

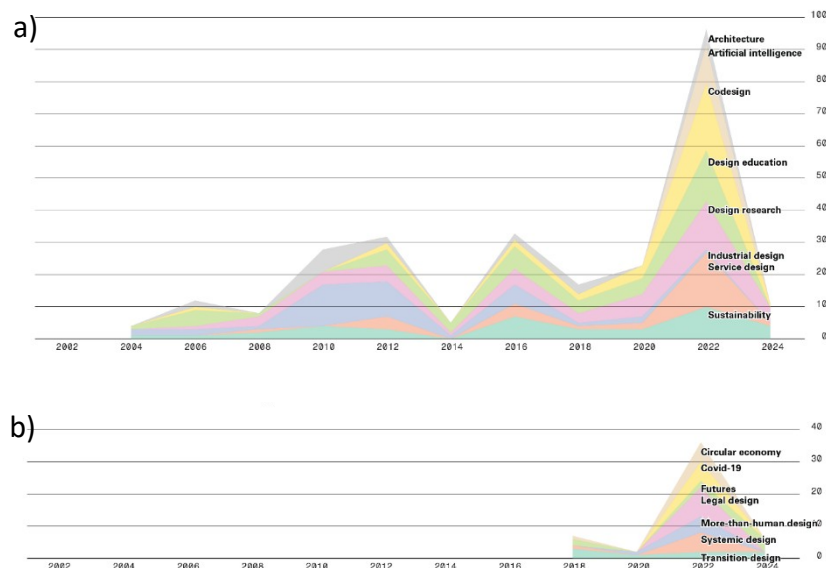


Figure 2 (a) Timeline visualization of associated keywords show a rise in the number of papers and keywords used in recent years. Peaks include “industrial design” in 2004, “Design” in 2016, and “codesign” in 2022. (b) Recent keyword introductions since 2018. * Note these visualizations do not cover all keywords due to retaining visual clarity. All keywords will be included in the interactive visualization:
<https://github.com/livingdatadesign/ArchitectureDesignResearch>

After cleaning the data we found 64 keywords were used from 2004 until 2022. We visualised the count of keywords over time to understand thematic trends in the DRS proceedings (Figure 2a). Visually, some topics have more dominance in later years with the highest count being in 2022 for “Codesign”, the second for “service design” and the third for “design education”. The term “Industrial design” was dominant in 2004, and second moment in 2016 but is nearly unused in 2022. The keyword “architecture” was most common in 2010, and rarely applied again until 2022. The keyword “Artificial Intelligence” was first used in

2022 and applied to 12 papers. We also visualize terms introduced since 2018 (Figure 2b). Significant positive trends ($p < 0.05$) were found with the terms “design education”, “design research”, and “sustainability”.

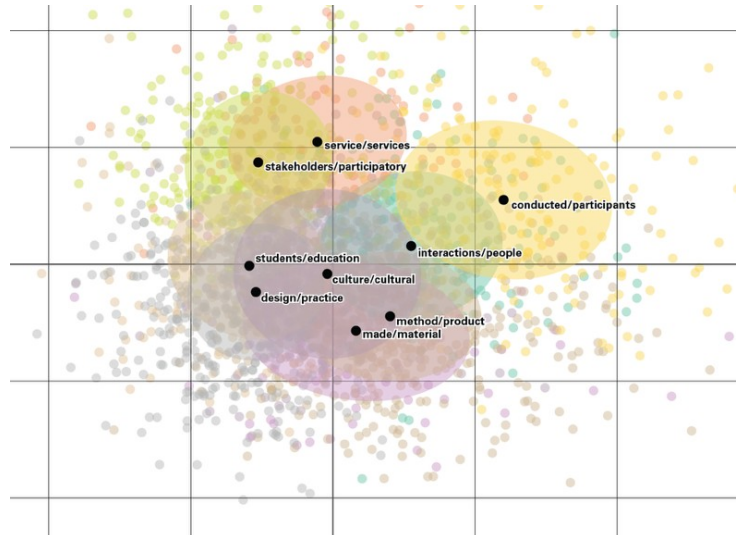


Figure 3 Clustering visualization shows that most clusters have a high amount of overlap. Cluster centers are also near each other meaning that the identified groups are highly related.

We also conducted a text-based clustering analysis to identify themes in the corpus titles and abstracts. From a visual elbow analysis, we determined that the number of emerging themes from 2330 abstracts was 9. The clustering algorithm prioritizes two theme labels based on their proximity to the center of the cluster (figure 2). The most common three themes for the DRS corpus were “design/practice”, “method/product”, and “stakeholders/participatory”. Interactive visualizations are available here: <https://github.com/livingdatadesign/ArchitectureDesignResearch>

Table 1 Papers identified for each cluster theme

Cluster Labels	Count of papers in each cluster
culture/cultural	79
made/material	81
service/services	82
interactions/people	187
students/education	196
conducted/participants	206
stakeholders/participatory	246
method/product	549
design/practice	604

3.2 Framing design research for transition

After coding 71 papers we found that the sample represented a wide range of methods and contribution domains. Most papers in our sample primarily aimed to make a theoretical contribution (n=40), or a methodological contribution (n=31). A smaller number made summative or integrative contributions such as literature reviews (n=15). Only nine papers presented empirical contributions, and 6 primarily contributed practical or applied tool or designed object. Most papers used qualitative research methods (n=52) although many leveraged mixed qualitative and quantitative approaches (n=17). We use a Sankey visualization (fig. 3) to link contribution types with methodologies. Here we see that the most common contribution-method combination is a conceptual framework contribution with content analysis methods (n=17). Conceptual frameworks contributions also often leveraged case studies (n=12). Opinion pieces also often used case studies (n=11). Design methodology contributions primarily used interviews (n=9), focus groups or workshops (n=9).

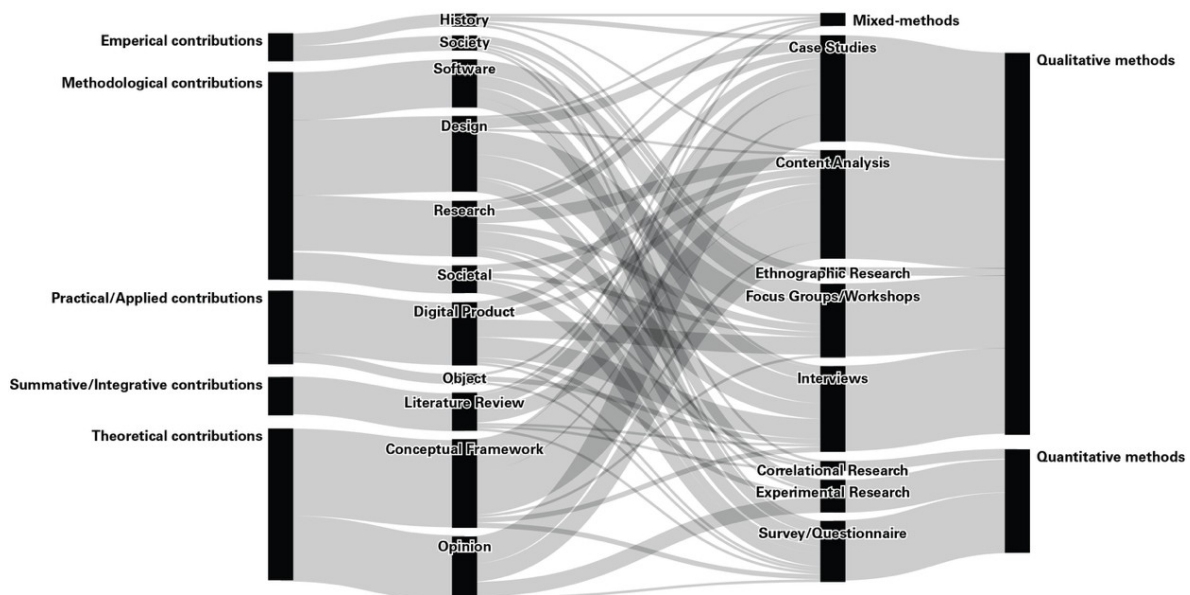


Figure 3 Sankey visualization showing coded contributions and their associated research methods. Each discrete code per paper is counted for every research method mentioned in the paper. We see that the largest contribution-method relationship is between conceptual frameworks and content analysis. The second is between conceptual frameworks and case studies. Interactive visualization here: <https://github.com/livingdatadesign/ArchitectureDesignResearch>

3.3 Key approaches for design research cultures

Through our coding analysis we identified key approaches in DRS research that align with SNM categories

Table 2.

Strategic Niche Management (SNM) Pillar	Function in Digital Transition	Associated Key Approaches
Expectations & Visions	Signaling Rigor and Establishing Creative Authority	Co-opting the mechanisms of academia Establishing what design can do without overpromising Claiming a seat at the table for big-picture societal challenges
Social Networking	Enrolling Actors and Positioning the Artifact	Building interdisciplinary and multi-media networks Positioning the designed artifact as a shared research culture
Learning & Articulation	Refining Methods & Critical Reflection	Learning how technology functions within social systems Bridging current to new conditions by mapping analogue-to-digital translations Engaging in critical and self-reflective scholarship

4. Discussion

Our findings indicate that design researchers at DRS have often applied strategies found in the model of strategic niche management (SNM), although we found no evidence that the DRS community self-identifies as a technological niche. Despite this, we conclude that DRS is an evolving socio-technical research culture already engaging with niche strategies, and we posit that DRS can be a productive frame of reference for architecture researchers managing internal processes of evolutionary digital transition. We observed that SNM at DRS often occurs simply as a result of participation within the overall DRS publication and dissemination structures. These mechanisms are helpful to researchers because they provide protected research spaces that allow for experimentation alongside the co-evolution of technology, user practices, and regulatory structures (Schot & Geels, 2008). We postulate that by developing their own strategic niche dimensions, architecture design researchers could also better manage their own digital transition. We observed a rich diversity among the papers at DRS that made our work of sampling and categorizing it, challenging. Yet, it is precisely because of this heterogeneity that we believe DRS to be fertile ground for resilient niches to emerge in the socio-technological landscape. As stated by Ye and Zhang (2024):

“the future is not a single vision defined by scientists or designers; rather, it is a collective exploration of various forms and actions at the intersection of design and everyday life, across different possible scenarios.” (Ye & Zhang, 2024)

4.1 Expectations & Visions:

Signalling Rigor to Academic Regimes and Defining Disciplinary Value

1. **Co-opting the mechanisms of academia:** Architecture design research can benefit from the ways DRS conference proceedings frame and share design research, offering useful models for communicating and leveraging design knowledge in academia. DRS research occupies a middle ground between academic journals and the diverse media and outputs used across design domains. The standard peer-review infrastructure serves as a strategic articulation of expectations. DRS provides a protected space (Schot & Geels, 2008) where design-related content is translated into a format recognized by

the academic regime without sacrificing the discipline-specific nuances of the design artifact. For example, researchers shared the first iteration of a font (Seward et al., 2024), autoethnographic research (Salaric et al., 2024; Turtle, 2022), reflective practices (Christiansen & Gudiksen, 2022; Gribbin et al., 2016), action-research (van der Bijl-Brouwer et al., 2024), or critical analysis (Ciliotta Chehade et al., 2024; Wen & Ng, 2020).

2. **Establishing design as a creative authority:** Our analysis found that design research strives to establish creative authority by making advanced technologies understandable and usable for a broad, interdisciplinary audience. This vision-building process, explaining large language models (Chen et al., 2024; Li et al., 2024), explicitly advocating for technologies to address design challenges (Li et al., 2024), or improving production workflows (Maciver et al., 2016) is essential for design researchers to maintain creative authority. This reflects a focus on accessibility, practical application, and the creative affordances of technology in design.
3. **Claiming a seat through societal relevance:** In our study, we found design research often legitimizes its contributions by linking them to pressing societal issues, such as physical disability (Borzenkova et al., 2018), climate change (Slingerland & Wang, 2024), social justice (Costanza-Chock, 2018), waste reduction (McLaren et al., 2016), globalization (Loza, 2018), and workspace wellbeing (Fayyad et al., 2024). Researchers also focus on outline the problems that designers face (Slingerland & Wang, 2024), or articulate theoretically-grounded methods (Michel Auernhammer, 2024).

4.1.1 Implications for architectural design research:

Logistically, the lower cost and faster publication of conference proceedings could benefit architectural designers who work in a competitive domain. We expect that many architectural design researchers will publish at DRS to engage with the larger design research community, yet this should not undermine the emergence of discipline-specific conferences. Architectural design research could translate complex technologies into design-relevant concepts, helping architects maintain creative authority and justify decisions. By clarifying realistic possibilities, design research could support communication and preserve professional integrity in a digital landscape. Finally, architecture inherently engages social, environmental, and technological dimensions, positioning it to address complex societal challenges. Future architectural design research could clarify this role by showing how architecture operates as an integrative form of knowledge production.

Architectural design researchers seeking to signal rigor and authority to established regimes should ask:

- In what ways can computational tools expand creativity?

- How might more accessible technology influence interdisciplinary collaboration and design education in architecture?
- How can architectural design research more strategically address urgent societal issues to enhance public relevance and impact?
- How might architects reclaim conceptual space in interdisciplinary domains by framing systemic, theoretical, or speculative challenges as design problems?

4.2 *Social Networking: Enrolling Actors and Positioning the Artifact*

1. **Building interdisciplinary networks:** We found that DRS researchers utilize a strategic enrollment process to expand the niche's resource base (Schot & Geels, 2008). By presenting positions on the current topics in their field (Hepburn et al., 2024), by sharing events, or community-based organizations (Costanza-Chock, 2018), or exploring how new media can connect technical and tech-averse audiences (Sturdee et al., 2022), the community fosters a highly interdisciplinary environment. We also observed the DRS community experts from scientific domains (Elizarova & Kahn, 2018; Garde & Voort, 2016), connecting education with design professionals (Giri & Stolterman, 2022), and collaborating with graphic designers, computer scientists, and practitioners (Meron, 2022). This networking is often supported by translation tools, visual summaries, tables (Fayyad et al., 2024), diagrams (Tarcan et al., 2022) and photographs (Tarcan et al., 2022), toolkits (Fassi et al., 2016; Seward et al., 2024) or materials like cards (Mazzarotto & Serpa, 2022). These materials or visuals function as boundary objects, allowing designers to engage experts from scientific domains, computer science, and professional practice (Meron, 2022) without requiring those actors to share the same tacit background.

"...artistic methods in combination with design research methods may allow the visualisation of complex data in more evocative ways. Consequently, our goal is to contribute to greater accessibility to the field for design and art researchers..." (Dumičić et al., 2022)

2. **Positioning the design artifact:** A central strategic approach in design research is to treat designed artifacts as primary research contributions, often accompanied by formal evaluation. In the DRS sample, these artifacts include cards (Roy & Warren, 2019), political campaign media (Suhendra et al., 2020b), or LLM applications (Chen et al., 2024), each revealing different dimensions of design, from tacit knowledge and communication practices to societal implications and data-driven decision making. Researchers also introduced new evaluation methods for playful or speculative propositions (Kinch et al., 2024), such as play equipment, (Borzenkova et al., 2018) playful research tools (Christiansen & Gudiksen, 2022; Garde & Voort, 2016), and

temporality in design (Wegener & Cash, 2020). This allows the niche to maintain its core values while building a systematic culture. By introducing formal evaluation methods for these artifacts the community bridges the gap between creativity and academic evidence, creating a shared repertoire that others can cite and build upon.

4.2.1 Implications for architecture design research:

Architectural practitioners already use various visuals to communicate design processes however these are often treated as proprietary or project specific. To foster a robust research niche architectural visuals should be adapted to also serve as effective academic outputs that bridge practice and scholarship. This aligns with the architect's role as a "generalist" who navigates complexity. By developing systematic reviews and integrative overviews architectural research can play a crucial role in synthesizing knowledge into a coherent, interdisciplinary niche.

Architecture design researchers seeking to build social networks should ask:

- How can collaboration with other domains (behavioral science, computing, graphic design) strengthen research and creative practice?
- How can the impact, quality, or validity of a design artifact be assessed systematically, to account for tacit knowledge and context-specific reasoning that resists quantification?
- How can such assessment account for tacit knowledge, creativity, and context-specific reasoning embedded in design work that resists quantification?

4.3 Learning and articulation: Refining methods & critical reflection

1. **Learning how technology functions within social systems:** The analyzed DRS papers demonstrate that recent design research is expanding into technologically mediated and socially complex contexts. Rather than treating technology as a neutral tool, researchers are utilizing media such as prompts (Jin et al., 2024), social media visuals (Suhendra et al., 2020), and human behavior simulations to negotiate policy processes (Reshef Kera et al., 2024). This reflects a deep articulation of technical requirements within the niche, moving toward a sociotechnical understanding of digital systems and their implications in design fields.

“By conducting pilot studies of AI agent simulations of stakeholder participation and representation based on engagement, we demonstrated the importance of human values such as agency, autonomy, and dignity alongside the technological pursuit of predictability and automation...” (Reshef Kera et al., 2024)
2. **Bridging current to new conditions by mapping analogue-to-digital translations:** A key learning process that we identified is the use of established design practices as a lens to understand technological innovation. We found

that design research is exploring connections between traditional analogue methods and new technologies, using established design practices to anchor new technologies in known design ontologies. Examples include describing traditional design processes to integrate technologies (Chen et al., 2024), reframing AI in relation to human-centered design (Auernhammer, 2020), replicating painting through computation (Sturdee et al., 2022), and physicalizing data (Dumičić et al., 2022).

3. **Engaging in critical and self-reflective scholarship:** The design research we examined provides theoretical and critical reflections on technology, examining its social, cultural, and ethical implications. This includes theorizing more-than human perspectives (Nicenboim et al., 2024), and examining the ethical assumptions embedded in emerging technologies (Allen & Queen, 2018; Figoli et al., 2022; Turtle, 2022). Overall, DRS research emphasizes reflective scholarship that situates technological innovation within broader societal and ethical contexts.

4.3.1 Implications for architecture design research:

Architecture design researchers should explore how textual or visual prompts and generative AI shape design thinking, creativity, and collaboration. They might study public perceptions of architectural forms through social media analysis or develop AI simulations modeling stakeholder dialogues in planning. Such studies could show how technology can enhance creative and social dimensions of architectural design research and practice. Architectural design research could integrate traditional techniques, such as sketching, model-making with computation, grounding technologies like AI in human-centered values. By transforming data into tangible forms, architects could better bridge digital abstraction and material reality. Publishing critical work on technology helps architectural design research to move beyond technical applications toward cultural, ethical, and philosophical understanding, enabling students and practitioners to question assumptions in digital tools and advocate for more responsible, ecological design.

Architecture design researchers seeking to learn and articulate design in digital transition should ask:

- What happens when architectural design methods, traditionally rooted in spatial and social contexts, begin to rely on data-driven systems?
- How should architects leverage analogue workflows to make technologies more accessible and meaningful in practice?
- How can analogue design methods inform the ethical and creative integration of technology in architecture?
- How might critical design research inform architectural approaches that consider non-human actors, or ecologies?

- How can architects engage with the cultural assumptions embedded in digital tools to ensure responsible design?

4.4 Final comments and limitations

In our paper we brought together our knowledge, experience and literature on architectural design research with an analysis of a sample of papers from the DRS conference proceedings. Our findings are limited to the sampled DRS papers and therefore our results should not be generalized across all design research outputs. We also highlight that this research is not intended to show causation between SNM dimensions in DRS and successful niche management in architecture research. Instead, the findings are meant to provide a structured lens for architecture researchers seeking inspiration from other design fields. Aggregating contributions and methods in coding led to some loss of variation across approaches. Our review of architectural applications draws primarily from our research team's experience and engagement with the literature. Further validation or refinement could be achieved through interviews or focus groups with a broader community of architectural design researchers.

5. Conclusion

By reviewing the DRS conference proceedings through the lens of Strategic Niche Management (SNM), this study provides a frame of reference for architectural design research cultures navigating digital transitions. Our analysis highlights that the digital transition is not merely a technical challenge but a socio-technical shift requiring a systematic management of expectations, social networks, and learning processes. Through the coding of 71 contributions, we articulated eight approaches that function as strategic moves in the DRS community. These findings suggest that there are multiple processes by which architecture can strategically manage digital transition in the socio-technical landscape. In summary these approaches include: 1) signaling rigor: use established academic formats to communicate design value to external regimes. 2) enrolling actors: utilize the design artifact as a boundary object to build interdisciplinary networks. 3) refining methods: ground new digital technologies in the deep, reflective traditions of analogue design. These findings offer a foundation for framing critical questions and guiding future research strategies, thereby helping architectural design research evolve in ways that respond to the changing technological landscape.

Use of AI: Generative AI (Google Gemini) tools were used in the development of this paper for spelling and grammar.

Acknowledgements: The authors would like to acknowledge the support of the Faculty of Architecture and the Built Environment, and the Department of Architecture at TU Delft for the academic environment that has facilitated this work. We would also like to acknowledge the other members of the Design Data and Society group who have engaged with us in many discussions on the topics of this paper.

6. References

- AIA *Architectural Research Agenda*. (2019). The Americal Institute of Architects.
<https://www.aia.org/advocacy/research/architectural-research>
- Allen, T., & Queen, S. G. (2018). Critical Placemaking: Towards a more critical engagement for participatory design in the urban environment. *DRS Biennial Conference Series*.
- Asfour, O. S., & Al-Qawasmi, J. (2024). Research Metrics in Architecture: An Analysis of the Current Challenges Compared to Engineering Disciplines. *Publications*, 12(4), 1–17.
- Auernhammer, J. (2020). Human-centered AI: The role of Human-centered Design Research in the development of AI. *DRS Biennial Conference Series*.
- Bernstein, P. G. (2018). *Architecture Design Data: Practice Competency in the Era of Computation*. Birkhäuser.
- Borzenkova, G., Niedderer, K., & Rozsahegyi, T. (2018). Designing Play Equipment for Children with Cerebral Palsy: The context and design guidelines. *DRS Biennial Conference Series*.
- Carmo, M. (2013). *The Digital Turn in Architecture 1992-2010—ADReader*. Wiley.
- Chen, L., Tsang, Y., Jing, Q., & Sun, L. (2024). A LLM-augmented Morphological Analysis Approach for Conceptual Design. *DRS Biennial Conference Series*.
- Christiansen, L., & Gudiksen, S. (2022). Play probe: An approach that reveals emergent identity building in youth. *DRS Biennial Conference Series*.
- Ciliotta Chehade, E., Mages, M. A., Bhungalia, H. G., Haley, S., Seitz, U., Kim, M., Ciuccarelli, P., Maffei, S., Villari, B., & Bianchini, M. (2024). Mapping patient-centered design practices and actors within stakeholder networks to reimagine healthcare. *DRS Biennial Conference Series*.
- Costanza-Chock, S. (2018). Design Justice: Towards an intersectional feminist framework for design theory and practice. *DRS Biennial Conference Series*.
- De Jong, T., & Van Der Voordt, D. (Eds.). (2002). *Ways to study and research urban, architectural and technical design*. Delft University Press.
- Design Research Society. (2025). *About the DRS*. About Design Research Society.
<https://www.designresearchsociety.org:443/cpages/about>
- Dumičić, Ž., Thoring, K., Klöckner, H., & Joost, G. (2022). Design elements in data physicalization: A systematic literature review. *DRS Biennial Conference Series*.
- Elizarova, O., & Kahn, P. (2018). Align and Combine, Customer Journey Mapping and COM-B Analysis to Aid Decision-Making During the Design Process. *DRS Biennial Conference Series*.
- Fassi, D., Galluzzo, L., & Rogel, L. (2016). Hidden public spaces: When a university campus becomes a place for communities. *DRS Biennial Conference Series*.
- Fayyad, N., Lam, B., Evans, R., & Choi, Y. (2024). Workplace wellbeing and interior design: A systematic literature review. *DRS Biennial Conference Series*.
- Figoli, F., Rampino, L., & Mattioli, F. (2022). AI in design idea development: A workshop on creativity and human-AI collaboration. *DRS Biennial Conference Series*.
- Foqué, R. (2010). *Building knowledge in architecture* (J. M. Dixon, Ed.). Academic & Scientific publishers.
- Garde, J. A., & Voort, M. C. van der. (2016). Could LEGO® Serious Play® be a useful technique for product co—Design? *DRS Biennial Conference Series*.

- Giri, N., & Stolterman, E. (2022). An analysis of design maturity models used in design organizations. *DRS Biennial Conference Series*.
- Green Building Council. (2017). Global Status Report. *World Green Building Council*.
<https://worldgbc.org/article/global-status-report-2017/>
- Gribbin, J., Aftab, M., Young, R., & Park, S. (2016). Double-loop reflective practice as an approach to understanding knowledge and experience. *DRS Biennial Conference Series*.
- Groat, L., & Wang, D. (2013). *Architectural Research Methods: Groat, Linda N., Wang, David: Amazon.nl: Books* (2nd ed.). Wiley.
- Hepburn, L.-A., Ulas, E. B., Cabrera, D., Cooper, C., Gough, P., Grace, K., Hespanhol, L., Hoggemuehler, M., Hu, W., Ijaz, K., Meron, Y., Pinilla, A., Parker, C., Sosa, R., Araci, Y. T., Watts, J., Wu, B., Zafeirakopoulos, M., & Lulham, R. (2024). Speculative design positions on future liveable cities. *DRS Biennial Conference Series*.
- Illies, C., & Ray, N. (2009). Philosophy of Architecture. In *Philosophy of Technology and Engineering Sciences* (pp. 1199–1256). North-Holland. <https://doi.org/10.1016/B978-0-444-51667-1.50047-1>
- Jin, Y., Yoon, J., Self, J. A., & Lee, K. (2024). AI as a Catalyst for Creativity: Exploring the Use of Generative Approach in Fashion Design for Improving Their Inspiration. *DRS Biennial Conference Series*.
- Jukić, T., & Kostešić, I. (2024). Institutionalized Interdisciplinary Approaches in Architectural and Design Education. *Prostor*, 32(1(67)), 74–83. [https://doi.org/10.31522/p.32.1\(67\).7](https://doi.org/10.31522/p.32.1(67).7)
- Klepeis, N. E., Nelson, W. C., Ott, W. R., Robinson, J. P., Tsang, A. M., Switzer, P., Behar, J. V., Hern, S. C., & Engelmann, W. H. (2001). The National Human Activity Pattern Survey (NHAPS): A resource for assessing exposure to environmental pollutants. *Journal of Exposure Analysis and Environmental Epidemiology*, 11(3), Article LBNL--47713. <https://doi.org/10.1038/sj.jea.7500165>
- Leopold, C., Robeller, C., & Weber, U. (Eds.). (2020). *Research Culture in Architecture: Cross-Disciplinary Collaboration*. Birkhauser. <https://birkhauser.com/en/book/9783035620238>
- Li, Y., Li, Y., Yan, W., Yang, F., & Ding, X. (2024). Advancing Design With Generative AI: A Case of Automotive Design Process Transformation. *DRS Biennial Conference Series*.
- Loza, I. (2018). The Ethics and Values of Visual Communication Strategies in European Advertisements in 21st Century Western and Islamic Culture. *DRS Biennial Conference Series*.
- Maciver, F., Malins, J., Kantorovich, J., & Liapis, A. (2016). United We Stand: A Critique of the Design Thinking Approach in Interdisciplinary Innovation. *DRS Biennial Conference Series*.
- Mazzarotto, M., & Serpa, B. (2022). (anti)dialogical reflection cards: Politicizing design education through Paulo Freire's critical pedagogy. *DRS Biennial Conference Series*.
- McLaren, A., Goworek, H., Cooper, T., Oxborrow, L., & Hill, H. (2016). The effect of consumer attitudes on design for product longevity: The case of the fashion industry. *DRS Biennial Conference Series*.
- Meron, Y. (2022). Graphic design and artificial intelligence: Interdisciplinary challenges for designers in the search for research collaboration. *DRS Biennial Conference Series*.
- Michel Auernhammer, J. (2024). Strategic Design: The integration of the two fields of Strategy and Design. *DRS Biennial Conference Series*.
- Morris, E. A., Speroni, S., & Taylor, B. D. (2025). Going Nowhere Faster: Did the Covid-19 Pandemic Accelerate the Trend Toward Staying Home? *Journal of the American Planning Association*, 91(3), 361–379.

- Nicenboim, I., Lindley, J., & Redström, J. (2024). More-than-human Design and AI: Exploring the Space between Theory and Practice. *DRS Biennial Conference Series*.
- Picon, A. (2010). *Digital culture in architecture: An introduction for the design professions*. Birkhäuser : [Springer Verlag].
- Reshef Kera, D., Navon, E., Wellner, G., & Kalvas, F. (2024). Governance in Silico: Experimental Sandbox for Policymaking over AI Agents. *DRS Biennial Conference Series*.
- Ruamsanitwong, N., & Campbell, J. W. P. (2021). Architectural research in university schools of architecture: Cambridge and the Bartlett, 1960–9. *Arq: Architectural Research Quarterly*, 25(3), 278–287. <https://doi.org/10.1017/S1359135521000312>
- Salaric, P., Cain, R., Zitkus, E., & Visch, V. (2024). Tinder, I Don't Like This: Identifying Desired User Interaction Qualities to Support Intimacy Building in the Online Environment. *DRS Biennial Conference Series*.
- Schot, J., & Geels, F. W. (2008). Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda, and policy. *Technology Analysis & Strategic Management*, 20(5), 537–554.
- Seward, R., Breit, A., Keelor, J., Halovick, J., Creaghead, N., Fernández, O., Srivastava, A., Medrano, F., Roberts, S., Healey, S., Plattner, J., & Stojanovic, L. J. (2024). Impacting literacy through the power of a font: Design research for inclusive reading experiences. *DRS Biennial Conference Series*.
- Slingerland, G., & Wang, G. (2024). Co-design for change: Propositions and dilemmas. *DRS Biennial Conference Series*.
- Sturdee, M., Knudsen, S., & Carpendale, S. (2022). Data-painting: Expressive free-form visualisation. *DRS Biennial Conference Series*.
- Suhendra, F. M., Wragg, N., & Barnes, C. (2020). Social Media Research and the Impact of Graphic Design: A case study examining an Indonesian political campaign. *DRS Biennial Conference Series*.
- Tarcan, B., Pettersen, I., & Edwards, F. (2022). Making-with the environment through more-than-human design. *DRS Biennial Conference Series*.
- Turtle, G. (2022). Mutant in the mirror: Queer becomings with AI. *DRS Biennial Conference Series*.
- Tzonis, A., & White, I. (Eds.). (1994). *Automation Based Creative Design—Research and Perspectives*. Elsevier Science.
- van der Bijl-Brouwer, M., Celik, S., Koning, J. de, Nieuwborg, A., & Tromp, N. (2024). Systemic Design Reasoning for Societal Transitions. *DRS Biennial Conference Series*.
- Wen, Q., & Ng, S. (2020). Inclusive Design Museums and Social Design. *DRS Biennial Conference Series*.
- Ye, Y., & Zhang, D. (2024). Co-creating pluralistic futures: A systematic literature review on participatory speculative design. *DRS Biennial Conference Series*.

About the Authors:

Angela Rout is an Assistant Professor at the Faculty of Architecture and the Built Environment at TU Delft, and a Member of the Design, Data and Society Group. Her research integrates data visualisation in and for architectural design processes.

Michael Tjia is a PhD candidate at the Faculty of Architecture and the Built Environment at TU Delft, and a member of the Design, Data and Society Group. His research investigates data visualisation to bridge architectural design and post-occupancy data.

Marija Mateljan is a PhD candidate at the Faculty of Architecture and the Built Environment at TU Delft, and a member of the Design, Data and Society Group. Her research explores perception, representation and reasoning at the intersection of architecture and artificial intelligence.