

DESIGNS FOR EXPERIMENTATION AND INQUIRY

Approaching Learning and Knowing in
Digital Transformation

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and Mark Elam*

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Chapter 5

Imagining, designing and exhibiting architecture in the digital landscape

Palmyre Pierroux, Rolf Steier and Birgitte Sauge

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IMAGINING, DESIGNING AND EXHIBITING ARCHITECTURE IN THE DIGITAL LANDSCAPE

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Foregrounding

Curators in museums have art historical expertise that provides insight into artists' creative processes, forms of expression, and means of production. In architecture museums, this expertise includes knowledge of conventions in models and drawings that were created by architects to convey a concept or design. Historically, architects' design materials have been viewed both as works with inherent aesthetic value and as documentation of architects' ideas and processes (Sauge, 2003); produced by tools and technologies that have developed historically, representations used in architectural practice comprise the core of works that museum curators acquire to collections, display in exhibitions, and make available in study rooms to mediate architects' ideas and designs to the public and to researchers. In keeping with historical developments, then, curatorial expertise in architecture museums also includes specialized knowledge of the digital tools used in architectural design processes today. However, architect and professor Greg Lynn contends that curators' selections of models, mock-ups, drawings, renderings, photographs, and texts discerned as 'pivotal to a designer's creative process' (Lynn, 2013, p. 13) are more likely to be based on expertise in traditional media than digital media. In other words, as digital media have become more embedded in all aspects of architects' design processes, a gap has emerged between architectural practices and architecture collection and exhibition practices in museums. The inclusion of 'born digital' materials in architecture exhibitions (e.g., 2D or 3D data files and models) has only recently begun to be explored as a topic, despite the impact that digital tools and processes have had on architectural design and records since early CAD (computer-aided design) in the 1970s (Picon, 2010; Carpo, 2013).

In this chapter, we study the role of digital tools and representations in the creative design work in an architect firm, and we follow how ideas were developed for and ultimately presented in three different temporary exhibitions: *Transcribed*

Nature, an installation (physical model and film) made for the exhibition ‘Light Houses: On the Nordic Common Ground’ in the Nordic Pavilion in the Venice Biennale in 2012; *Corporeal Space (Kroppssrom)*, a full-scale work in ‘Under 40. Young Norwegian Architecture’ at a national architecture museum in 2013; and a 1:50 physical model of *Corporeal Space* made for the museum’s touring version of ‘Under 40’ in 2015. The following research questions are posed in a study designed to gain insight into how new types of digital tools and representations are remaking practices – in architecture, in museums, and ultimately in the museum visitor experience. In which ways does the context ‘architecture exhibition’ frame the architects’ imagining and designing activities? What is the role of digital representations and tools in the architects’ imagining and designing work for the different exhibition contexts? In which ways are digital aspects of architects’ creative work relevant to and made apparent in architecture exhibitions?

The interdisciplinary study presented in this chapter is part of ongoing research that is based on a research–practice partnership model. The participants include learning science researchers at a university, an art history scholar and senior curator at an architecture museum (authors), and an architect who is a founding partner at a young but prominent Norwegian architecture firm. The study provides a basis for ongoing design-based research (Barab & Squire, 2004) that examines how digital media are remaking epistemic practices in museums. The names of architect and firm are anonymized, referred to in this study as ‘Frank’ and ‘Frank Associates,’ respectively.

Studying experience-creating processes: an analytic framework

Digital methods and tools are integrated in all aspects of Frank Associates’ professional practices, including imagining, designing, and communicating architectural works for museum visitors to experience in an exhibition setting. The activities studied in this chapter are related to works and materials produced by the firm for three different architecture exhibition contexts over a four-year period. We define the object of activity for each exhibition as the ‘exhibition context,’ which is examined from both the architects’ and the curators’ perspectives. In their study of how new collaborative digital tools impact architectural practice, Miettinen and Paavola (2016) followed the object of activity using concepts from activity theory and the cultural-historical tradition (Engeström, 1990; Leontev, 1978). They note that in this tradition, the object of activity has had a dual meaning as an analytical concept:

On the one hand, it referred to the ‘purpose’ or aim, in other words the motivating background rationale of an activity (...). The second meaning of object of activity was a concrete object of activity, something that is designed and produced in the form of a product, a service or a commodity.

(p. 4)

This distinction also frames our analytical approach to the different exhibition contexts, which become the background rationale for the architects' object of activity, orienting their designing and imagining activities toward the production of concrete works using a hybrid of physical and digital representations. The exhibition contexts are thus both implicitly and explicitly relevant as analytical objects, with corresponding temporal dimensions.

As in any museum exhibition, the medium, techniques, concepts, and expressions of the works or collection on display have implications for the narrative approaches curators use to engage visitors in meaning making. Therefore, we examine narratives and rhetorical gestures (Bergdoll, 2015) in the architects' digital design work, but also how these are communicated in exhibitions through curatorial practices. Narrative discourse in architectural design often relies on future-oriented rhetoric, guided by imagination and the persuasive, 'experience-creating' use of verbal and visual languages (Murphy, 2011). Rhetorical devices are often used by architects to create a shared understanding of future, envisioned possible worlds (Pierroux & Skjulstad, 2011; Sauge, 2010). However, temporal orientations in *exhibition narratives* are one step removed from architectural design work, with curators instead re-telling the story of the work using a scholarly referential framework, for example, historical, societal, aesthetic perspectives. We thus explore the language of architecture for and in exhibitions, with a particular focus on temporal dimensions and the digital expressions, formulations, and means. Although our perspective on museum narratives and meaning making is dialogical (Wertsch, 2002), we focus in this study on the narratives of architect and curator, as they mediate – and become embodied in – work with the exhibitions.

To delve further into the role of digital materials and modeling technologies in the architects' creative processes, we also draw on the concept of *design constituents* (Binder et al., 2011). Representations, in the form of physical and digital models, sketches, drawings, and prototypes become design constituents in the sense that they signify the materially present form of an object of design that does not yet exist (Binder et al., 2011). They also serve to orient bodily aspects of shared design work (e.g., gesturing, performing) that become ongoing depictions of ideas and understandings (Jornet & Steier, 2015). At the microlevel of human interaction, then, design constituents are future-oriented, in that they help coordinate a team of architects when the object of the activity is to collectively imagine in their design work. Below, we investigate the architects' work for the different exhibition contexts by applying these concepts as analytic framework: object of activity, narrative, and design constituents.

Methodological approach

The data corpus includes documentation of the curators' and architects' aims, processes, and products: 1) interviews with the curators and architect; 2) a video recording (60 minutes) of the architects' presentation at a workshop with the research partners; 3) museum publications and other archival documents from the

exhibitions and exhibition design processes (i.e. photos, texts, drawings), including educational materials; and 4) architectural materials from the firm's archive that were made in different media for different purposes at various stages of the design process (3D animations and films, physical models, sketches and drawings). We use the data to first provide a rich description of the architects' and curators' work with each exhibition 'case' (Yin, 2006). We then summarize each case in an integrative analysis, and we conclude with a discussion of findings across the three cases that models the relationships between exhibition context, digital materials and processes, and temporal orientation.

Exhibition work: *Transcribed Nature*

Juulia Kauste and Peter MacKeith at the Finnish Museum of Architecture curated the exhibition 'Light Houses in the Nordic Pavilion' at the Venice Biennale in 2012. The exhibition echoed the overall theme of this particular Venice Biennale, which aimed to highlight social and environmental themes and the serious economic constraints and diminishing environmental resources that challenge architects today. The rationale for this particular exhibition is explained from the curatorial perspective in a press release from the Museum of Finnish Architecture (2012):

Contemporary Nordic architectural culture offers both exemplary approaches and significant constructions addressing these most challenging circumstances of our time. The classical hallmarks of Nordic architecture – simplified form, frugal use of materials and sensitive treatment of daylight and the natural setting – embody the basic principles of responsible, sustainable architecture.

In celebration of the Nordic Pavilion's fiftieth anniversary, the curators invited thirty-two architects born after 1962 to present a model of a conceptual 'house' that reflected their personal philosophy of architecture. Eleven Swedish and Finnish architect firms and ten Norwegian architect firms responded to the competition call, and Frank Associates was one of the firms invited to present its work in the show.

During a workshop with the museum and university researchers in 2016, Frank illustrated how 'the digital' is inextricably intertwined with his firm's design thinking more broadly by showing a film that had been produced as a work for the Biennale exhibition. The making of animations for the film, which was titled *Transcribed Nature* (2012), involved architectural research that was motivated by the curator's call for works; namely, to convey the firm's philosophy of architecture. Frank explained that the firm's response to the call was in the form of an exploration of the question 'what are we, i.e. the human body, *made* to do?' The exploration entailed 'an investigation into the spatial conditions of nature, its relations and dimensions.' Frank further elaborated on how nature allows distinctions to be made between complex and complicated experiences of space:

Nature is not a mess; it is a hierarchy. The tree is a hierarchy, a cluster of different branches. Same with a terrain. Everything in nature is super complicated in terms of forms. But one experiences nature as complex and not as complicated. For me, this is the ideal.

The aim of the project is similarly described on the firm's website:

Nature offers a perspective that is in continuous development. Each individual point of view gives a unique reference. This project is an attempt to search for an architecture where the human being feels at rest. A search that is driven by an unconsciousness longing for a more natural architectural space. Within the reconstructed Nordic light of the Venice Pavilion our space comes to life.

To present this architectural ideal or philosophy as a 'work' in an exhibition context, the process of translating nature into a constructed environment involved digital mediation from the very beginning. The architects hired a land surveying company to produce a 3D laser scan survey of a forest alongside a meandering river, converting three-dimensional surfaces and objects in the terrain into highly accurate mathematical representations using the laser scanners. The architects treated the scans to reduce pixels and visual information (Figure 5.1), using different angles to identify architectural characteristics in landscape forms that could 'say something about us' and how we are 'made to move' in different types of spaces, for example, under light penetrating tree canopies, around rock outcroppings, between tree columns meeting the ground at different levels. The 'fly through' animation and abstraction of the scanned images allowed viewers to perceive and imagine movement through both conceptual and physical space. Through this investigative approach, the architects selected and sculpted into architectural shapes



FIGURE 5.1 Still image from animation showing abstraction from nature scan.

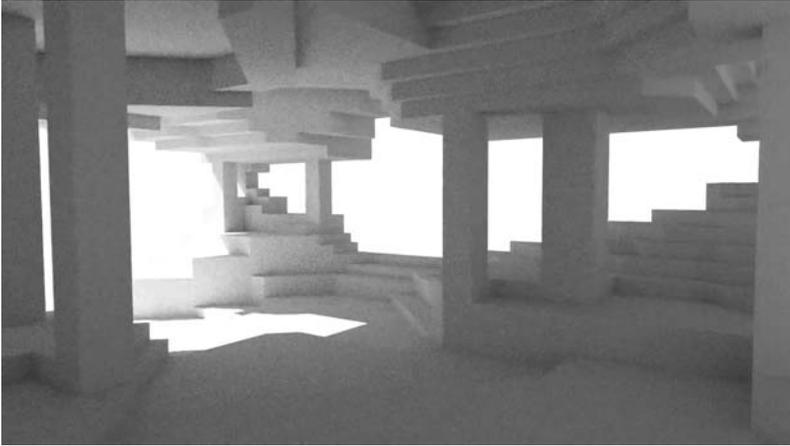


FIGURE 5.2 3D model of architectural shape based on nature scan.

phenomena recognized in nature, and a 3D printed model (Figure 5.2) was subsequently produced. Both the animation and model are titled *Transcribed Nature* and were displayed in the Biennale exhibition to convey the architects' ideals and conceptualization process, and to illustrate how these could be applied in a model of a 'conceptual house.'

Exhibition context: conceptual

Summing up the design activity in this exhibition context, the architects' inquiry into 'what the human body is *made* to do' was made possible through the born digital articulation of their theoretical perspectives and research interests, that is, digital photography (2D), scanning (3D), and 3D printing. Such investigative approaches are increasingly common according to Ivarsson & Nicewonger (2016), who use the phrases *making as research* and *research through design* 'to describe the aesthetic, material, and immaterial exploration of theoretical problems through architectural processes' (italics in original, p. 5). Moreover, as presented in the cases below, the research and works produced for the Venice Biennale become a shared reference that informs future orientations in the architects' design work. In this trajectory, the object character of the *Transcribed Nature* animation and model thus shift from 'object of activity' to 'design constituent' underpinning subsequent projects. As mentioned above, design constituents give presence to the imagined, and mediate architectural collaboration through shared references and orientations.

The curators' approach to the Nordic exhibition aligned with the international theme of the Biennale; a narrative of how young Nordic architects today embody a philosophy of architecture that addresses in an exemplary manner pressing environmental and sustainability issues in architecture. Frank Associates drew on this narrative in their approach to the works in *Transcribed Nature*, which Frank

described as an investigative and explorative process of developing architectural concepts. As background rationale for the object of activity, then, the prestigious international exhibition context became an opportunity to present the firm's design philosophy – ideals and concepts about relationships between body, nature, and space. Accordingly, we characterize this particular exhibition context as primarily *conceptual*.

Frank highlighted the central role of digital tools and representations in the creative process through which the *Transcribed Nature* works were realized and visualized, for example, the 3D laser scanning methods involved in translating a natural landscape into architectural form. This digital translation was key to the architects' conceptual work. The animated film and printed 3D model presented at the exhibition evidence a view shared by curator and architect alike: digital images or presentations may be displayed as – and have the status of – conceptual and physical *works*. The physical model is both a digitally produced result of a digital exploration of spatial qualities in nature, and an imagining of these spatial experiences in architectural form.

Exhibition work: *Corporeal Space*

The context for the work *Corporeal Space* was the temporary exhibition 'Under 40. Young Norwegian Architecture 2013' produced by the Architecture Department at the National Museum of Art, Architecture and Design (NM). The aim of the exhibition, according to the curator, Anne Marit Lunde, was to present the 'fields of interest, methods and creations' of eleven young Norwegian architectural firms (Lunde, 2013). The larger rhetorical and narrative structure of the exhibition was thus a curated presentation of eleven younger architect firms in Norway, providing insight into what characterizes their work, their interests and concerns, how they conceive and realize new ideas, and how they are positioning themselves at home and abroad (Lunde, 2013). A competition call invited the firms to submit proposals for works that addressed societal challenges (locally or internationally) likely to impact architectural practice in the future. Further, the winning work should be a distinct and innovative installation that captured public interest and provided knowledge about the philosophy of their firm, preferably through an experimental approach that moved between art and architecture. In other words, the competition challenge was not formulated as a specific task, but rather encouraged architectural firms to explore and experiment with the concept and very essence of architecture.

The selected works were to be installed in the Ulltveit-Moe Pavilion, designed by Sverre Fehn, at the architecture museum (Lunde, 2013). The pavilion is a distinctive and light cubical space surrounded by large glass walls, with concrete slabs and ceiling carried by four freestanding columns. *Corporeal Space* (Figure 5.3) was one of the two winning entries, the other work was titled *House for a Medley of Norwegian Birds* by Huus og Heim Architecture. In addition to the pavilion, the adjacent *Bucher* gallery presented more or less traditional displays including models, images, films, renderings, and texts by each of the eleven architects.

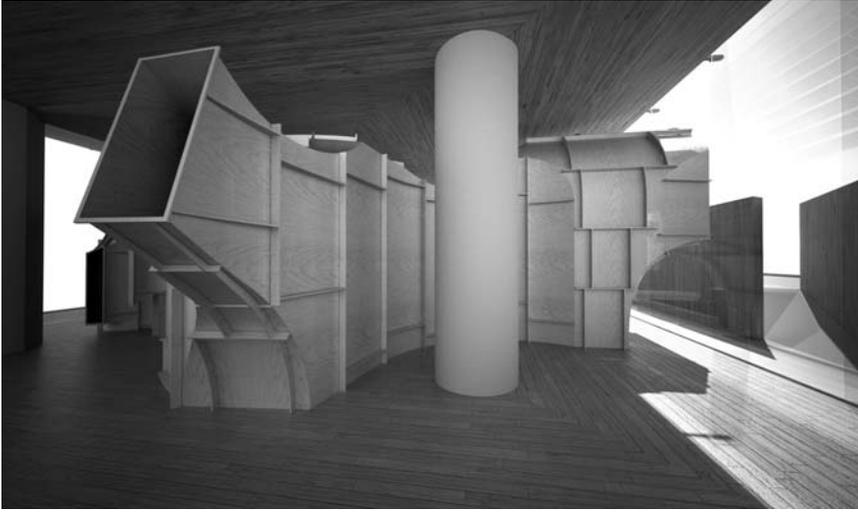


FIGURE 5.3 3D rendering of *Corporeal Space* in the Ulltveit-Moe Pavilion, visualizing the architects' final design.

Corporeal Space was a highly complex spatial experiment and the architect viewed it as an extension of the design ideal expressed in *Transcribed Nature*. The aim of the work, as explained by Frank, was to inspire visitors to think about how spaces formed in nature are similarly experienced in architecture. Moreover, *Corporeal Space* was designed to heighten visitors' awareness of the body's dimensions and functions as one moved through the interior, to become conscious of how tall one is, how one moves and situates oneself in space to sit, read, or talk with others, and to challenge the body to be aware of what it is made to do. A description of the visitor experience appears on the firm's website: 'inspired by nature, the visitors could use the space as they please, in the same way stone in the woods would become a chair, a table, a bed or a step when confronted with our intention and imagination.' The work was also tailored for the pavilion, to enhance visitors' awareness and sensual experience of the space.

In the text accompanying hand drawn sketches and digital renderings in the competition entry (Figures 5.4, 5.5, and 5.6), the architects described the design intention. *Corporeal Space* consisted of a series of rooms that merged into a single, cohesive space. The proportions of these rooms varied according to the human body, with narrow openings and vertical movements forcing the visitors to use their bodies in a creative manner. Since it required a deliberate effort to move from one room to the next, the visitors would become more aware of the physical structure that surrounded them. The installation related not only to the pavilion's interior architecture, but also to the natural environment through a window opening onto a large tree outside the pavilion, the sky, and the surroundings.

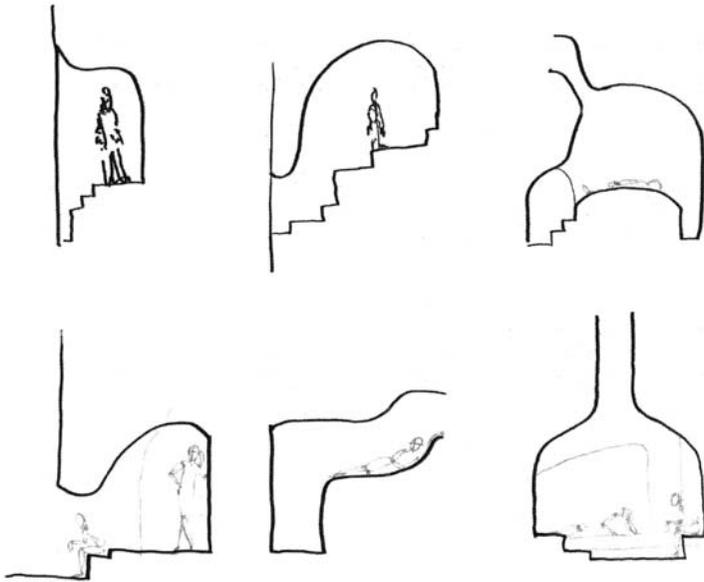


FIGURE 5.4 Hand-drawn sketch of different sections through *Corporeal Space*, from competition entry.

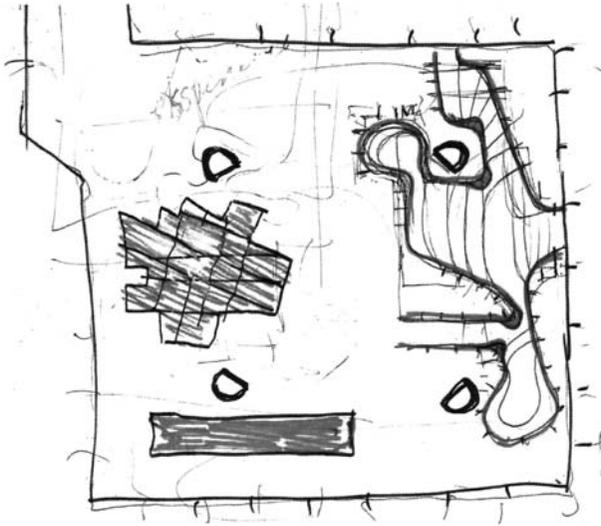


FIGURE 5.5 Hand-drawn sketch of *Corporeal Space* plan, from competition entry.

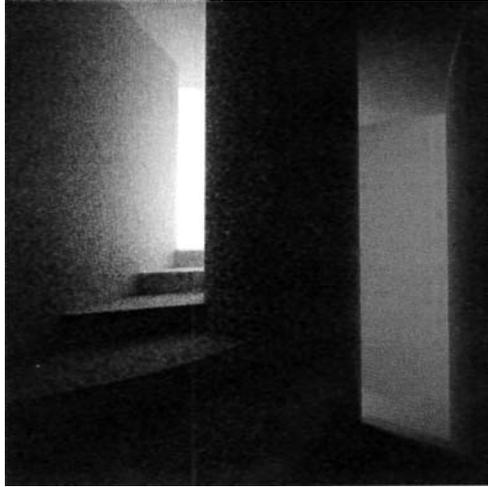


FIGURE 5.6 Digital visualization of light and space in *Corporeal Space*, from competition entry.

Based on the architects' winning idea for the competition, the design process for *Corporeal Space* started with conceptual sketches of the plan and with models in plasteline modeling clay in 1:100 scale (Figures 7a, b, c). According to the architect, the initial design approach using double curved shapes was so complicated that it could not be tested using hand drawn sketches of the volume, making plasteline modeling in three dimensions essential in this phase. This

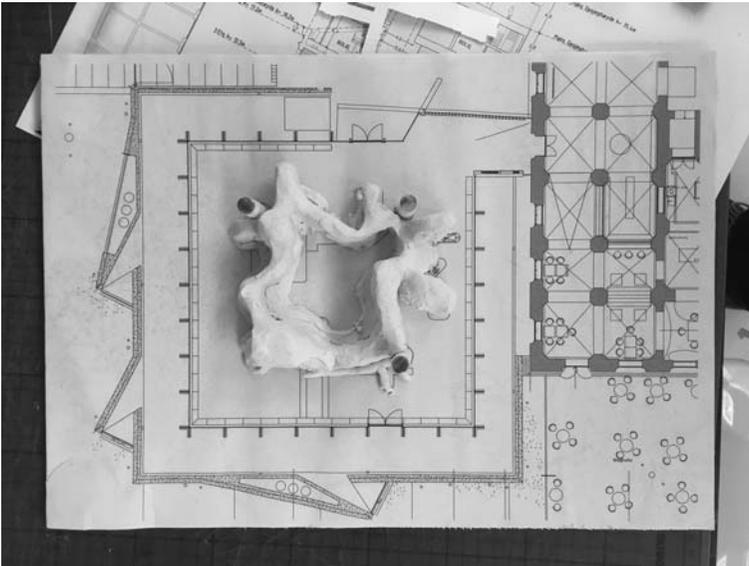


FIGURE 5.7 *a, b, c* Three different sketch models in plasteline exploring the overall shape and volume of *Corporeal Space* and its position in the Ulltveit-Moe Pavilion.

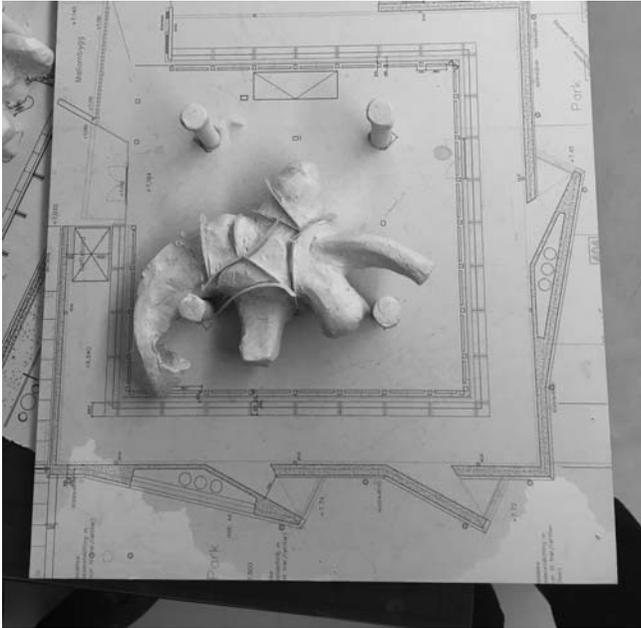
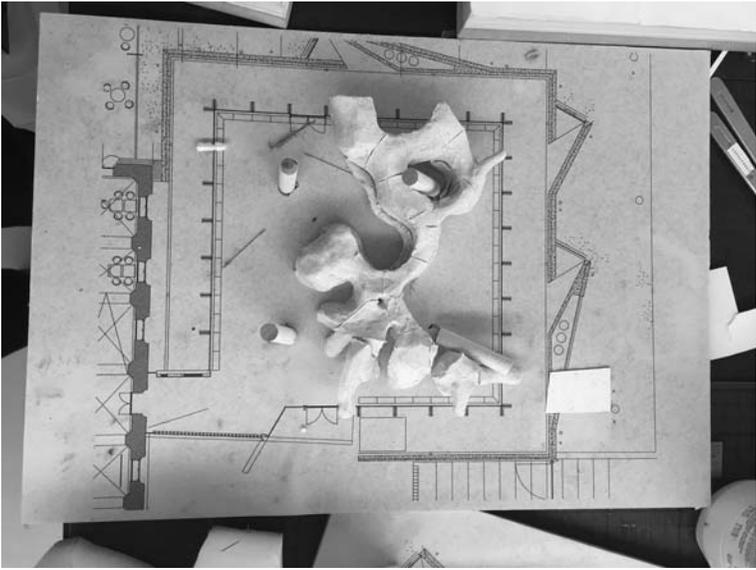


FIGURE 5.7 (Continued)

material is easy and fast to shape, using the hands to explore different solutions for the building volumes. The rough plasteline models allowed the architects to begin 3D modeling in *Rhino* software to understand the geometry of the shapes and how they might be constructed. The architect explained: ‘This is when 3D modeling came in. We began to test to see what the different solutions looked like. So it is useful to have a 3D model that can also be used for illustrations.’ Moreover, the architects used illustrations as a design tool in all stages of the process:

But we illustrate the project or render it the whole way to test – Let’s see what effect it has on people, what effect does it have on the architecture, on the light? One of the most important things 3D renderings allow is to see it underway. We see *how it will actually be*.

(italics added)

Accordingly, 3D renderings played a key role as design constituents, mediating the object of activity.

A technical architectural challenge lay in constructing a complex whole by combining buildable ‘shaped’ forms and spaces for the intended corporeal experiences. To accomplish this, the architects iteratively refined drawings based on the initial sketches to simplify the structure into geometric shapes modeled from birch plywood (Figure 5.8), the material used in the final work. Styrofoam components were used to model how to cut and then assemble straight parts and planes in construction (Figure 5.9).

These shapes became design constituents, facilitating the iterative investigation of spatial experiences and buildable components. The design constituents also mediated imagining together with curator and the museum’s technical staff assisting with the installation in the pavilion. The analogue materials became the basis for modeling and refining the space in digital drawings (Figure 5.10) and 3D models. According to the architect, *Corporeal Space* was impossible to realize using only 2D representations because that would imply folding out very complicated shapes (such as two single curved shapes intertwined). Moreover, information about the shapes needed to be transferred to a robot (CNC) that cut the actual pieces out of plywood. This would not work with drawings in 2D, according to the architect, who expanded on how digital tools were used:

Corporeal Space is a good example of using all the tools. To me this represents a complete project regarding the tools. We could not be without the sketches made by hand or the models in plasteline or the simply made models in Styrofoam. And we could not work without 3D modeling and renderings to understand what it would look like. And don’t forget the actual production. Because the drawings (design) became so complicated.



FIGURE 5.8 A veneer model used to explore a double curvature construction. The architect noted: 'It shows how unsuccessful this idea was.'

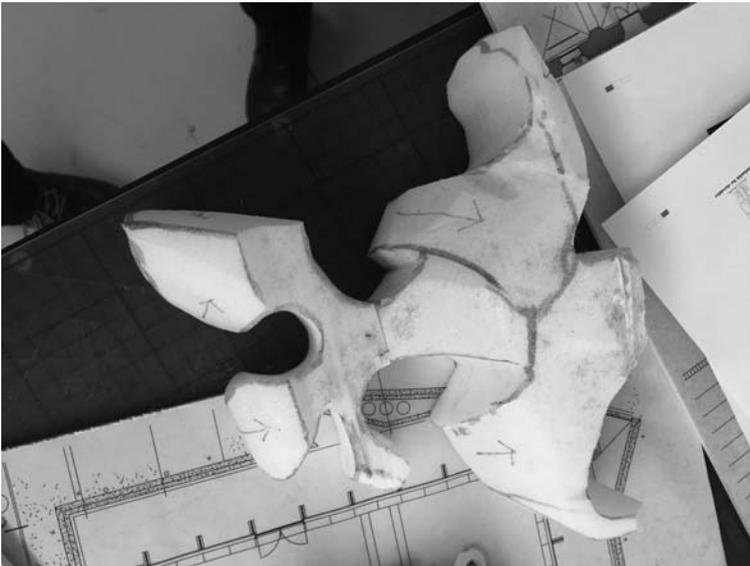


FIGURE 5.9 Styrofoam shape used to explore construction approaches.

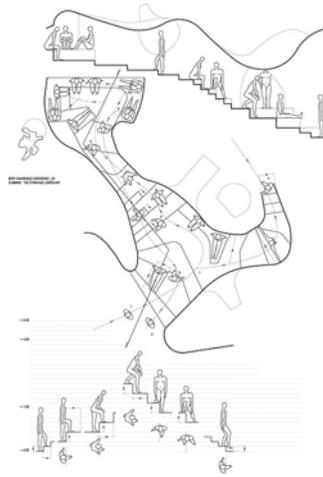


FIGURE 5.10 Digital drawing of bodily movements in *Corporeal Space*.

The trajectory of design activity for this exhibition context thus illustrates how the premise of ‘born digital’ is tenuous in architectural practice, particularly in the work of realizing complex architectural concepts.

Exhibition context: experiential

Similar to the *Transcribed Nature* case, the background rationale for the object of activity in *Corporeal Space* was a commissioned work for an exhibition that invited experimentation, conceptual development, and themes with societal relevance. The architects’ philosophy of architecture was similarly on display in the two exhibitions, but with the significant difference of experiencing an actual building instead of a more intellectual experience through video and model. However, to illustrate philosophical and conceptual connections to *Corporeal Space*, the film *Transcribed Nature* was shown in the gallery adjacent to the pavilion (Lunde, 2013).

While the overall aim for the ‘Under 40’ exhibition was to feature eleven Norwegian architect firms, the narrative for *Corporeal Space* was established by the curator in the competition call for ‘spatial installations’ specifically designed for the pavilion. Architects were invited to explore problems already identified in their philosophy and practice by developing a concept linked to the exhibition context. Moreover, the call wanted experimentation: ‘We are quite open to experimental approaches to selected themes and expressions that lie in the borderland between art and architecture.’ The curator’s invitation to experimental approaches is not without historical precedent: movements in the late 1960s and early 70s explored social, political, economic, and cultural manifestations of architecture in experimental exhibition designs. As in the call for works for the Nordic

Pavilion in Venice, architecture exhibitions are often used to explore theoretical and technological shifts that call into question architecture's role and status in society (Buckley, 2015). The call further specified that the successful work would 'capture the public's interest and provide them with new knowledge about the subject.'

The architects' response in *Corporeal Space* provided the public with new experiential knowledge – moving through the work and creating awareness of the body's relations to and movements in both nature and architecture. Yet the architects also hoped that the corporeal experiences would enable visitors to explore the formats of their body on an abstract level to enhance their understanding of the relationship between the human body and its surroundings. Thus, the choice of building material and assembly method was connected to the abstracted and imagined experiences of both architect and visitor. The design to achieve this effect was framed by an understanding of the visitors' embodied and present experience of motion, sight, and touch, and we thus characterize the exhibition context as *experiential*.

In *Corporeal Space*, the mediational role of digital tools and representations was clearly related to different phases of work, such as the competition phase, the design phase, and the construction phase. Spaces were initially hand sketched and visualized digitally, forms were explored through physical models that were translated in modeling software to produce buildable components, and 3D renderings were used to imagine movement and the experience of what the work would 'actually feel like.' Looking across the diverse collection of models, sketches, and renderings, both analogue and digital, this case demonstrates the multitude of affordances of different kinds of representations. A key role of these representations was to serve as design constituents in the imagining and design process, future-oriented in that they mediated architectural processes geared toward the production of the work for the exhibition.

Intentionally, the curator included neither digital nor analogue representations from the design process in the exhibition context for *Corporeal Space*. Rather, the exhibition narrative was very much oriented toward the final work and visitors' 'lived' experience of the constructed physical space, where the digital played no role. The exhibition narrative evoked a temporal orientation towards the present, as reflected in the catalogue text:

The works in this category question, reflect on, and examine various aspects of the spaces surrounding us (...). The two spatial installations (...) challenge the viewer's perception of the nature of architecture. Both play on our senses through sound and the body's encounter with architecture, while also touching on issues and challenges related to sustainability, climate change and our relationship to nature and space.

(Lunde, 2013)

As such, the curator explicitly bridged museum and architect narratives in the exhibition by linking an experiential focus on body in space to larger topics in architecture.

Exhibition work: Corporeal Space model

The final case is the model of *Corporeal Space* made for a touring version of the exhibition 'Under 40.' The National Museum produces shows that travel to galleries and schools located throughout Norway, and former architecture exhibitions had been very successful in terms of visitor attendance and engagement. An external design firm was responsible for the exhibition design. A touring version of *Corporeal Space* posed practical challenges, however, in that its scale would limit the number of gallery spaces able to display the work. Therefore, curators from the museum and the architect mutually decided to make a representation of *Corporeal Space* as a model in 1:50 scale. The use of models and representations in architecture exhibitions is a familiar topic of reflection and debate in architectural theory, which often frames this tradition in terms of a paradox: 'how to exhibit something so large and complex as a building or a city or how to represent something as elusive as an architectural experience that unfolds in space and time?' (Pelkonen, 2015, pp. 9–10). The architect firm was in charge of the design and production of the model and used the same 3D program as the full-scale *Corporeal Space*, with only minor adaptations to accommodate, for example, the difference in thickness of the material.

A common view of architectural models is that they are easier for laypersons to comprehend than orthogonal drawings, and that they are more 'true' than perspective drawings. However, models are also abstractions. The curators of the exhibition were well aware of the loss of the physical experience of space and time, as well as sensations of motion, sight, odor, and touch when translating the work into a model. The aim of representations in this touring exhibition context was thus to provide insight into the complex spaces that comprise *Corporeal Space*. The model was divided into two parts, hinged together to open and allow visitors to more clearly grasp the differentiated interior spaces. Together with the model (Figure 5.11), a filmed interview with the architect while sitting inside the full-scale *Corporeal Space* was shown on small screen nearby.

Re-contextualized in a new 'Under 40' exhibition design, the model of *Corporeal Space* became part of one of the eleven architect presentations for visitors to experience in displays that were allocated a similar amount of space for models, texts, images, films, and other sources of information. All of the presentations had originally been made for display in the Bucher gallery in the architecture museum as part of the 'Under 40' exhibition. There were minimal changes to written material to accommodate the shift from the national museum setting to various touring exhibition settings, with many of the original curator texts repurposed in the form of brochures and information that would be easily accessible to the museums and galleries on the tour. The



FIGURE 5.11 *Corporeal Space* model on display in touring exhibition.

architectural projects in the exhibition were organized in the five original themes from the 'Under 40' exhibition, for example, to highlight the different firms' approaches to specific concepts and architecture in general: Spatial Experiments, Intermediate Spaces, Places and Urban Rooms, Spaces That Bring About Change, and Spaces for Reuse (Lunde, 2013). *Corporeal Space* was presented under the theme Spatial Experiments. The exhibition toured from the south of Norway to the north during a three-year period, making ten stops. Each host museum provided an educational program for schools in the area, based on the material developed by the National Museum's educational curators.

Exhibition context: educational

The curator emphasized an educational design for the touring exhibition and made effective and aesthetic use of both existing and new models, texts, images, and films to convey important concepts and information about the works of the eleven architecture firms. An external design firm was responsible for the touring exhibition design, which had the explicit aim of creating a context for the public and especially school children to learn about the architects and their work. While the first two cases emphasized architectural research and embodied experience, this touring exhibition involved contextualizing experiences and explorations in past architectural projects, *Corporeal Space* among them. Similar to the full-scale work in the national museum exhibition, the touring exhibition conveyed the architects' concept and materiality of the *Corporeal Space* built environment; however, the design intent and communicative potential of the model – as a representation – afforded a different temporal and bodily experience. In contrast to the future-oriented and present-oriented narratives of the cases described above, then, the narrative of *Corporeal Space* in the touring exhibition context was past-oriented. As in many exhibitions with this orientation, models and texts are conventional means of representation. The screen displaying a film of the architect speaking from inside the actual installation might thus be considered a first person historical account of the experience, highlighting the scale of body in space. Similarly, the decision to open up the model with a split design invited visitors to project themselves into the space to imagine what it may have been like to be inside. This choice is significant because it changes the model from a primarily scaled replication to signaling a communicative and abstracted relationship to the original. Similar to the 'experiential' context, the digital was present only implicitly, in the sense of tools that had been used to translate the full-scale work to a scaled model.

Discussion

In this section we return to the topic of how digital practices in architectural design, increasingly pervasive and intertwined with the materiality of traditional practices, may be relevant to architecture exhibition practices in museums. As mentioned, this is a topic that has only recently begun to be explored in research and in practice, as a challenge not least to the disciplinary expertise of architectural historians and curators. The following research questions were posed: In which ways does the context 'architecture exhibition' frame the architects' imagining and designing activities? What is the role of digital representations and tools in the architects' imagining and designing work for the different exhibition contexts? In which ways are digital aspects of architects' creative work relevant to and made apparent in architecture exhibitions? Based on case studies of architectural and curatorial practices involved in three different exhibitions, we orient our discussion to the model below, which organizes findings in terms of relationships between *exhibition context*, *digital materials and processes*, and *temporal orientation* (Figure 5.12).

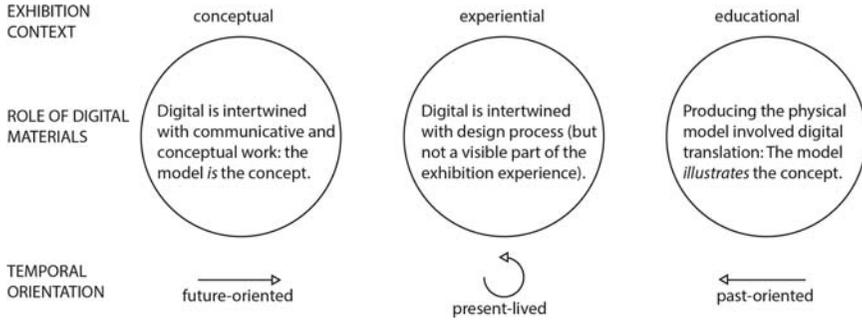


FIGURE 5.12 Model of the role of digital materials in architectural works in three exhibition contexts.

Exhibition context

Regarding the question of how the context ‘architecture exhibition’ framed the architects’ imagining and designing activities, we found that not unlike designing for ‘real’ projects, the architects responded to both the commissioning client (i.e. the museum and curator), the program needs (i.e. competition call), and the site (i.e. the museum gallery). Across the three cases, we noted how the different exhibition contexts served as motivating background rationale for the object of activity (Miettinen & Paavola, 2016), and we identified these contexts as *conceptual*, *experiential*, and *educational*. The first case presented a context for the architects to communicate their conceptual work. The second case, in contrast, involved a context for a fully realized installation that focused on the embodied experience of the visitors moving through the space. In the third case, the exhibition created more of an educational than conceptual or experiential context for visitors to explore, and the use of a model and supplementary information were intended to support visitors in making sense of the presented work.

Role of digital materials in architectural works and exhibitions

Regarding the second research question concerning the role of digital materials in the architects’ imagining and designing work, we found that digital media were relevant to all phases of the architects’ work across the three cases: the initial idea/creative phase, the modeling phase, the construction phase, and the realization phase. Moreover, the architects often used both analogue and digital media at the same time and in the same phases, with tools selected for the mediational features deemed most fruitful for the design task at hand; modalities shifted depending on the particularities of the creative work process. For example, plasteline models allowed the architects to quickly express volumes and shapes, while complex spatial relationships required 3D digital renderings to understand the architectural implications.

In *Transcribed Nature*, the concept of communicating a natural landscape as architecture was realized by means of a digital perceptual lens, eyeing and translating design opportunities. The context of presenting their philosophy of architecture led the architects to feature digital materials as inextricably linked to their conceptual work. The digital visualization *is* the concept communicated in the *Transcribed Nature* works, both animation and model. In *Corporeal Space*, the design process was also intrinsically intertwined with digital representations; the digital was essential to solving the problem of imagining and making complex forms into buildable components. In contrast to *Transcribed Nature*, however, the embodied experience of the visitors was essential to the realization of the work. The public took part in the exhibition by using their senses and bodies to experience the work, and as such, *Corporeal Space* was real architecture. The design of perceptual and sensory experiences that dynamically relate to architectural space necessitated the physical experience of visitors. At the same time, the aim of the physical experience was to foster abstraction and reflection on relations between nature and architecture; this conceptual aim connects all of the works and exhibition contexts. The role of the digital in the final case was tool-like, used to translate this physical experience into a model that illustrates and communicates the concept and design of the *Corporeal Space* work.

The third research question investigated how architects' creative processes were included in the different architecture exhibition contexts. We characterize all three works in this study as 'born digital,' in the sense that digital tools were essential to their making, yet the digital aspects of the design work were apparent only in the conceptual exhibition context and the *Transcribed Nature* works. From a curatorial perspective this is unsurprising, in that the focus of the competition call and the *Corporeal Space* work was an experience that bordered on art and architecture and thus differed from the call for conceptual works in the Venice Biennale exhibition. The role of digital tools in the architects' creative processes and methods to realize the work was thus not relevant to the experiential context. Similarly, the curator's choice of narrative and exhibition materials accompanying the model in the educational context was focused not on the architectural design process but on communicating the concept for the work.

Temporal orientation

The analysis further identified temporal orientation as a key characteristic of creative work in exhibition-making activity. Architectural design involves manipulating materials and representations in 'imagining work' in the present while orienting toward the future possibilities of the design product. The first case highlighted the future-oriented aspect of imagining a spatial experience in architectural form, and this temporal orientation of the architects' creative process was also already embedded in the exhibition narrative. In other words, the temporal orientations of architect and curator aligned in the object of activity – 'imagining' as exhibition making. Digital representations were essential to the

creative process *and* the presented work for this conceptual exhibition context. The second exhibition context, in emphasizing the lived experience of visitors making sense of body–space relationships, involved a temporal orientation toward present rather than future. Again, the temporal orientations of architect and curator aligned in exhibition making activity, this time as a full-scale installation experienced in a specific pavilion space. Finally, in the third case, the creative process was oriented toward engaging visitors in a work that no longer existed, temporally oriented toward the past, and the narrative also expressed this focus. In sum, the exhibition contexts created nuances in temporal orientations that entered into the architects’ creative process as well as the curators’ exhibition narratives.

Reflections

The role of digital representations and tools in architects’ imagining and designing work for different exhibition contexts is the research question framing our investigation. In the study we found that the exhibition contexts – conceptual, experiential, and educational – strongly framed the object of activity, as rationale for curatorial narratives and materials in the exhibitions but also in the architectural design work. Moreover, digital representations were part of the architects’ creative work in all cases: as *imagining* tools and means of expression, as *designing* tools for full-scale architectural works, and as *exhibiting* tools in constructing models of architectural works. We also note that the architects’ significant use of digital tools and media to produce *Corporeal Space* was not made apparent in either the experiential or educational exhibition contexts. This absence may be related to Lynn’s (2013) contention that curators’ selections of materials are often based on expertise in traditional media rather than digital media, but it is also linked to the aims of exhibition contexts that are not focused on the architects’ creative processes. However, this may change as the experiential and communicative potential of digital media, for example, virtual and augmented reality, continues to be explored and developed in architectural design practice, in architectural research, and in museum exhibition and education practices (Pierroux & Ludvigsen, 2013). The question ‘When Is the Digital in Architecture?’ was posed by the Canadian Centre for Architecture in Montreal in the research project *Archeology of the Digital*, which was also the title of the closing book (Goodhouse, 2017). This project put the Centre at the forefront of architecture museums exploring the display of digital architectural processes. In cooperation with Lynn, the Centre has collected outstanding examples of first generation digital projects from the 1980s and early 90s, and from contemporary architecture, many of which were presented in a series of three prominent exhibitions in 2013–2017. Our study aims to contribute to such explorations of the digital in architecture and in architecture museums.

In an interview, the architect Frank reflected on being in the last class of students at his college in Oslo taught to use analogue tools in all phases of a project, and he discussed implications of digital tools for his architectural practice. He explained

that key to his firm's practice is an understanding that digital tools mediate design thinking in ways that are fundamentally different from drawing with paper and pencil. In the early phases of CAD (Computer Aided Design), the purpose of digital tools was secondary, used to translate or communicate the design for clients or contractors after the concept was established. According to the architect, drawings made using paper and pencil were still considered the place in which the architectural concept resides: 'where architecture is.' Exhibiting architecture in museums thus entailed (and to a large extent still does entail) displaying these drawings as artifacts to convey the essence of the architectural concept. In the digital landscape, as we have shown in this study, exhibitions of 'where architecture is' must necessarily engage with far more complex representations and processes.

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