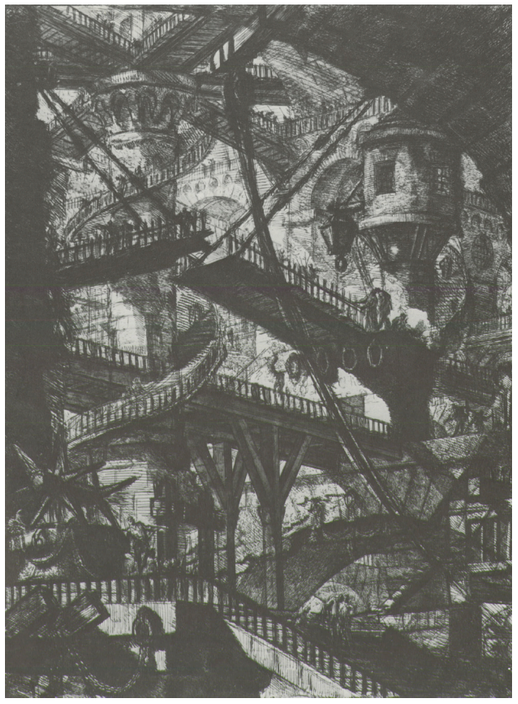
also fluent in perceiving and comprehending the delineated space. Professional vocational training in (structural) drafting in particular has dedicated itself to planimetric representation, and not to the concept of space. Even though contemporary CAAD drawing methods are increasingly capable of depicting the spatial fusion of planimetrically produced parts and their spatial effects, these hyper-professional computer programs can only support information management and the technical fusion of the parts—albeit in an impressive manner. Yet they cannot compensate for a lack of spatial imagination on the part of the designer or architect. In our opinion, this is an essential prerequisite for the conception of spatial forms and sequences, which are then captured in drawings, allowing their "buildability" to be verified, step-by-step, through plans. Creating a classic set of plans, which divides the design into a large number of individual parts that can be depicted in two dimensions, can only be linked to one another by well-developed spatial imagination, allowing them to be mentally assembled into a three-dimensional whole. The two-dimensional drawing follows the three-dimensional design, and is therefore an artifact of the design process rather than its originator. In drawings, a design idea or a spatial effect can be assessed, further developed, and refined—but it cannot improve an irreplaceable sense of spatial imagination.

My years spent training third-year architecture students at the ZHAW—of which eighty percent were drafting technicians and twenty percent high-school graduates or students from other construction-related professions—allow me to state, as previously explicated, that the ability to imagine a complex spatial condition "using the mind's eye" cannot, unfortunately, be assumed as a fundamental form of basic knowledge. Even if the utilized drawing technique itself seems convincing, at least at first glance, a closer look at the plans all too often reveals that spatial transitions are not under control, or are represented incorrectly. It is difficult to say whether this results from insufficient focus on developing an understanding of spatial issues in technical drafting studies, or if such issues perhaps may not be able to be transmitted or learned. Corresponding experiences in design theory lead to the conclusion that, above all, a basic knowledge of "spatial thinking" is not easy to convey didactically. One must assume that—similar to the question of musicality—predisposition is an essential, if not decisive component of success.

Even if relatively weak basic aptitude can be gradually improved through targeted exercises and/or professional routines, training alone, without such a corresponding predisposition, does not seem to lead to success. Nevertheless, the idea of training—as this book implies is possible in the sense of a playful deepening and improvement of one's own abilities—is certainly not without impact. It is even more effective if the exercises are completed at the beginning of students' course of studies, such that initial conclusions about their aptitude or deficits in spatial perception can be reflected upon. I assume that self-awareness and self-evaluation on this most essential aspect of the architectural profession—made possible by this book—will be of great benefit to students. Especially at the beginning of one's studies—or better yet, in advance thereof, such as part of a pre-study internship required for high school graduates or as part of a draftsman's apprenticeship—this book could be a great asset for this course of study, since highly developed spatial imagination is a prerequisite for maturing one's own representational techniques and styles. It seems the eternal question of the chicken and the egg has been clarified: The ability to imagine spatial complexities takes precedence significantly over the ability to depict it. No matter how successful a spatial representation may be, it cannot be perceived as such without a fundamentally spatial imagination. Since spatial imagination is such a basic prerequisite for professions related to architecture, it would be highly advantageous if students could acquire it when beginning their studies—or better yet, before pursuing them—as they would have enough time to reconsider this path before continuing it for several years in vain.



4 Giovanni Battista Piranesi, *Carceri VII*, 1760

URGENCY

Dieter Dietz, Lucía Jalón Oyarzun, Julien Lafontaine Carboni, and Teresa Cheung

In a time when the depletion of reason seems to have become a normality—and a fundamental disruption of the ecosystem forecasts its imminence through abnormal climate events—the question that comes to mind, first and foremost, is about the foundations of society and life as a whole. By extension, this question is one of architecture—a foundational kind of knowledge if there ever was such a thing. Under these circumstances, we can't help but wonder if the "fundamentals" that we have been taught by our teachers, by history, and by our own experience conducting our profession are adequate for the present moment. How should we learn from the incredibly rich and abundant substance amassed by the many cultures of this planet? Which values will have to be abandoned or entirely replaced, if we want to recognize this wealth and reclaim agency?

Emergence/Plurality

In our teaching and research activities, we emphasize two aspects that we deem fundamental to rethinking architecture's agency. The first is to reclaim and sustain architecture's emergent nature. We understand this notion in a deeply political way, by accepting that the outcomes of our actions as architects cannot be controlled. Architecture is a practice in motion; it does not belong to a mechanically conceived world that can be divided into a series of well-defined problems and solved by shaping objects and forms. Rather, architecture is always entangled in existence: the expression of an immanent and endless movement. Being alive—us, the environment, and our society—we all are in a perpetual state of becoming. Therein, every architectural act is the expression of a complex cultural and technical assemblage, from which the formal devices that we invent to trigger their unfolding and diversification emerge as gestures and extensions of our bodies.[1] As such, they are in a constant state of transformation. Architecture is therefore both an expression and concretization[2] of this "becoming" condition, and how we act on space must encompass this motion, learn from it, and articulate from and with it.

The second aspect we consider essential is considering architecture's collective and plural nature. Architecture is never made alone—its practice always implies a collective endeavor—but it is also the assemblage of complex multiplicities, from the smallest of houses to the largest of cities. The Roman poet Lucretius wrote how *in uno tempore, tempora multa latent*: under one single moment, there are several temporalities beating together.[3] Could we speak here of something akin to a "plural spatiality," implying that, under one singular space, endless spatialities beat, ceaselessly becoming and interacting with one another? Confronted with this plural spatiality, could we consider architecture as a means of communicating, of composing a common ground interweaving the multitude of spaces—a common ground understood as medium that densifies and reorients the relational quality of the real?[4] The way architectural languages, tools, and practices manage to grasp and operate within this collective and multiple nature, but also how they are simultaneously defined and shaped by it, plays a fundamental role in how we conceive the education of an architect. Our practice exteriorizes this entanglement of dimensions,[5] while gestures—and the spatial dispositions, makings, and significations that emerge through them—form a dynamic cultural and technical fabric of matter, languages, repertoires, and strategies. This we make *together*, and making is as intrinsically linked to thinking, as is the will of the soul that allows a gesture to take place.[6]

Scaffolding/Protostructure

What kind of spatial abilities can we develop to sustain and enhance these emergent and collective dimensions? To us, the pedagogical framework is a field of experimentation, wherein fundamental research, design research, and education meet on a horizontal common ground. Theoretical concepts filter into the studio, and studio practices open up questions and problems grasped through fundamental research activities, or are further developed by design research. Such interferences between research and teaching are seen in mutual interplay in the conceptual and structural model supports and "protostructures"—as defined and

1 See Stiegler, Bernard. *La technique et le temps*, *La Philosophie en effet.* Paris: Galilée/Cité des sciences et de l'industrie, 1994.
2 Simondon, Gilbert. *L'individuation à la lumière des notions de forme et d'information.* Grenoble: Millon, 2005.
3 See verses 794–796, book IV of Lucretius's *On the nature of the universe.* Oxford: Clarendon Press, 1997.
4 Easterling, Keller. *Medium Design.* Moscow: Strelka Press, 2018.
5 See Stiegler, Bernard. *La technique et le temps*, *La Philosophie en effet.* Paris: Galilée/Cité des sciences et de l'industrie, 1994.
6 We refer here to Tim Ingold's critique of hylomorphism in *Making: anthropology, archaeology, art and architecture.* London/New York: Routledge, 2013.

used in our studio—which led to the development and integration of the concept of scaffolding, which in turn feeds back to the studio practice.[7]

In his article "Minds: Extended or Scaffolded," Kim Sterelny states that "human cognitive capacities both depend on and have been transformed by environmental resources. Often these resources have been preserved, built, or modified precisely because they enhance cognitive capacities. The extended mind hypothesis proposes that human cognitive systems include external components." Accordingly, the "scaffolding" theory proposes that cognitive processes are supported—scaffolded—by environmental resources. Following this logic, spatial thinking and abilities, if not supported by tools and instruments and the environment, would comprise an unbearable cognitive load. Furthermore, these external resources are considered possible driving forces to processes such as imagination, which emphasize a more active, agential, and inventive role of environment and nature than the term "resources" allows us to conceive. This input from cognitive sciences therefore encourages us to envision the studio, the program, and the human organization of our teaching activities as resources—or as a field of cognitive supports.[8]

The *protostructure*, in turn, designates the set of living and nonliving agents that allows for the extension or support of one's cognitive capacities, through the solicitation of additional and emergent resources. The value of care in this frame is emphasized: the more reliable and trustworthy a resource, the more it enhances material continuities, processes' resilience, and the potential of things to extend cognitive processes. Accordingly, the *protostructure* aims to foster the trust[9] of each individual regarding his or her own and/or their shared resources, but also encourages evolution toward individualization. The environment of the studio—its temporalities, and more broadly, space itself—are considered enablers, possessing an "agency" as actors of the process; both are then transformed into a field of emergence, in which each cognitive process can be supported in a myriad of ways. *Protostructures*, for instance, articulated as a light timber framework, can then act as catalysts between individuals for collective decision-making and design processes. As such, when becoming a physical cognitive support for collective conception, *protostructures* are structures in a *proto-state*, ready to receive any manner of alteration in themselves.[10]

Discussing spatial abilities through the realm of *protostructure* engages our focus on spatial knowledge as a capacity to understand, follow, and act with matter in a constant flux of motion. Spatial ability is then agency; and making architecture becomes a way to relate to the world, a way in which the world will support our actions and cognitive processes—a process of imagination with and of the world.

Space/Imagination

Every action has a spatial effect, from the minor gesture to the largest interventions—they all put a new relational fabric of the real into motion. All these spatial modes, disturbances, and reorganizations challenge our imagination. But imagination, even if sustained by the outside world, remains deeply embodied. The images *(Vorstellungen)* it stages are always anchored in the materiality of our body, and cannot be paralleled, delegated, or substituted by any foreign artifact. Accordingly, concern for both matter and its link to our imagination must be at the heart of our investigations. One of the main strategies to nurture this concern is to foster drawing, its gestures and traces, as both trigger and medium of imagination. Drawing articulates endlessly rich and plural ways of thinking. In the design studio we foster drawing as a way to empower imagination towards action and critical conception—in embodied immersion as opposed to passive consumption.[11] First-year students experience this catalyzing role of drawings firsthand. The links between imagination and materiality are then expanded, spatialized, and turned into built elements, crafted by the same hands that drew them and assembled into a collective artifact. This plural and emergent dimension of the final artifact is essential. We want to encourage the contributive disposition of the architect to real situations: creating places and social situations based on a new social contract and an idea of architectures of contribution.[12] We believe that engaging with one place that concerns and matters to us makes a real difference, and that teaching and research is not only about taking critical positions; it is about enabling architectural gestures, practices, and actions that can start to parallel and interfere in the margins of the macro-scale that binds us so much today. We believe immersed, bottom-up,

7 See Clark, Andy, and David Chalmers. "The Extended Mind." In *Analysis* 58, No. 1, 7–19, January 1998. Clark, Andy. *Supersizing the Mind: Embodiment, Action, and Cognitive Extension.* Oxford: Oxford University Press USA, 2008. Most significantly, for a theoretical exploration of this notion's architectural consequences in the contemporary city, see Negueruela del Castillo, Darío. "The City of Extended Emotions." unpublished PhD dissertation, EPFL, 2017.

8 Vygotsky, Lev S. *Mind in Society: The Development of Higher Psychological Processes.* Cambridge, MA: Harvard University Press, 1980. Vygotsky, Lev S. *The Collected Works of L. S. Vygotsky: Problems of the Theory and History of Psychology.* Berlin: Springer Science & Business Media, 1997.

9 The notion of trust in relation to scaffolding is introduced into the work of Sterelny, Kim. "Minds: Extended or Scaffolded?" In *Phenomenology and the Cognitive Sciences* 9, No. 4, 465–481, December 2010. We also analyzed this aspect in relation to the HOUSE 1 protostructure in the forthcoming article by Negueruela Del Castillo, Dario et al. "Transformational Identities, Learning Scaffolding and Spatial Knowledge in Architectural Education. The Case of First Year Design Studio Teaching at EPFL." In *Charrette, Journal of Architectural Educators* 6, No. 1, 2019.

10 See Mignon, Agathe Claire Estelle. "Protostructure, Archéologie et Hypothèse d'une Architecture-Support." (unpublished PhD dissertation, EPFL, 2019).

11 See the chapter "Drawing for Real." In Dietz, Dieter, Matthias Michel, and Daniel Zamarbide (eds.), *All about Space (Vol. 3): Beyond the Object.* Zurich: Park Books, 2018.

12 See Industrialis, Ars. Économie de la contribution (n.d.) http://arsindustrialis.org/vocabulaire-economie-de-la-contribution (accessed 19 November 2019).

1 ALICE-EPFL, *House 1*, Lausanne, 2016

2 ALICE-EPFL, *House 2*, Zürich, 2017

grassroots movement must go hand in hand with rearticulating ontologies, situated both in local ecologies and in one planetary garden.[13]

We recently launched the *HOUSES* series[14] to emphasize the importance of the collective act. We hypothesized the possibility to think, design, and build one single project with 250 people, in which each participant is simultaneously author, co-author, builder, and maker. Underlining the emergent nature of architectural practice, our existential position is, by logic, one of immersion. This is articulated as a condition of "being-in": in making, and literally, in constructing the architecture that we have conceived and designed. We have pushed immersion as being-in space, as a phenomenological architecture. We have accentuated *inside-ness* as a collective phenomenon, by working in large groups and by leaving the sheltered academic environment, constructing full-scale projects in public places accessible to all. Each of the *HOUSES* that we have collectively built since 2016 is a forum; to mount these exchanges of ideas, gestures, and spaces built by many souls—to scaffold these communications—we used the aforementioned concept of *protostructure*.[15]

Landscape as Scaffolding

Yet the question of how we situate these architectures persists. The first iteration of our program *Becoming Léman* saw this very *protostructure* becoming fragmented and dissipated into multiple sites across a landscape. We need to fight against the reduction of architecture to building, and instead focus and help our students realize and be able to work with the architectural potential of materialities previously kept off grounds.[16] For this reason, we continue to explore how to relate architectures to the ground and beyond: how to situate ideas and spatial constructs—not only in society, but also in relation to our environment in its many different forms; not only as site or resource, but also as an agent deeply involved in our acting on space.

With our attention to landscape as scaffolding, we investigate these possibilities by sounding the waters and grounds of the relationship between architecture and our planetary garden.[17] To attain this common ground, as a respectful material involvement with our planet, we hope to develop architecture and its relationship to the ground simultaneously. In order to achieve that, we elaborate, test, and investigate the potential of *protofigure* and *protofiguration* as means, concepts, and tools to inscribe habitat and cultural imaginaries about our being in the world into the terrain.[18] We hope and believe that such an architectural approach can shift values—not only within our discipline, but also in broader social and cultural realms. We should never forget

13 Clément, Gilles. *Le jardin planétaire.* Paris: Parc de la Villette/Albin Michel, 1999.

14 See Dietz, Dieter, Matthias Michel, and Daniel Zamarbide (eds.). *All about Space (Vol. 2): House 1 Catalogue.* Zurich: Park Books, 2018.

15 We developed this notion of space and protostructures as catalysts of imagination in Dietz, Dieter et al. "HOUSE 1 Protostructure: Enhancement of Spatial Imagination and Craftsmanship Between the Digital and the Analogical." In *Digital Wood Design (Vol 24)*, edited by Fabio Bianconi and Marco Filippucci, 1229–1252. Cham: Springer International Publishing, 2019.

16 Several authors have advanced this necessity for a long time; recently it has been Keller Easterling who developed the most lucid and coherent approach to this problem with her notion of active form in *The Action Is the Form: Victor Hugo's TED Talk* (Moscow: Strelka Press, 2012): "The designer of active forms is designing not the field in its entirety but rather the delta or the means by which the field changes—not only the shape or contour of the game piece but also a repertoire for how it plays."

17 Clément, Gilles. *Le jardin planétaire.* Paris: Parc de la Villette/Albin Michel, 1999.

18 *Protofigurations* are both an instrument of analysis and a potential tool of design. They designate two series of operations: one that is performed during a settlement or a foundation, outlining psychosocially and/or materially new geographies, and one which consists in the re-inscription of a spatial order into psychosocial bodies through embodied practices. See Lafontaine, Julien. "*Protofiguration*, opérations d'installation." In *L'archaïque et ses possibles aujourd'hui* (Paris: GERPHAU/Metis Presse 2020).

3 ALICE, *House 3*, Kanal - Centre Pompidou, Brussels, 2018

4 ALICE, *Houses*, Evian, 2019

architecture's extraordinary potential to shape our environment, transform our imaginaries, and thus to radically relocate values—from profit in a capital-based economy to an ecological, contributive economy, in which space is not only a channel for the expected, but for new openings and opportunities.

It is in the spirit of *urgency* that we propose to engage with values other than efficiency, profitability, or the long-standing knowledge of architectural types and languages. Grounds, plants, structures, rhythms, details, materials may all evolve by themselves into new forms through the interplay with many and in continual, ongoing deliberation. To find a new spatial commons, resisting reduction to property, to demarcation lines, and to both political and architectural representation, because they are the expression of the immanent self-production of the real. What would happen if we started thinking about these commons as parallel structures that we can traverse, cut, or navigate; as fields of potentials that draw out new collective ideas, to be brought into material life through open operations, intrinsically coordinated?[19] We must think of new canvases and new tools, in order to unlearn and relearn architecture. Values will shift and form and may be very different: projects and resulting spaces will be material articulations of liminalities, and potentials articulated by material and temporal processes. And so, we go back to the beginning, back to the sense of urgency that pushes us to address these potentialities—fully aware of our incapacity to control them, and comprehend that in order for our world (and our knowledge) to survive, it must be embodied, and thus political, ethical, ecological, and economical beyond mere capitalism.

Architecture is inherently political, not because it applies a particular ideological program, but because these two fields share a common ontological ground. The same potential of bodies establishing our being together in a political community allows us to situate ourselves and compose complex forms of spatiality.[20] Consequently, the way we operate in space reconfigures matter, places or uses, as well as communities, cultures, ecologies, imaginaries, and values: in summary, life in all its forms.[21] Thus, our intent to act upon space must be ascertained as a collective responsibility, in which we must, first and foremost, call the values that demand full control over these actions into question. Instead, we must reclaim their embodied nature and their link to these emergent phenomena. Because who or what governs life and us? What are the values that truly matter?

19 See Bühlmann, Vera. "Architectonic disposition: ichnography, scaenography, orthography." In *Posthuman Glossary*, edited by Rosi Braidotti and Maria Hlavajova. London: Bloomsbury, 2018.; and the idea of "parallelism of structure," in which a new potential appears between things, rather than within themselves only.

20 See Jalón Oyarzun, Lucía. Excepción y cuerpo rebelde: lo político como generador de una arquitectónica menor / "Exception and the rebel body: the political as generator of a minor architecture." unpublished PhD dissertation, Higher Technical School of Architecture of Madrid (UPM), 2017.

21 See Bennett, Jane. *Vibrant matter: a political ecology of things.* Durham: Duke University Press, 2010.

MEASURING SPATIAL ABILITIES