

# ON PAPER // Reciprocity Between Architecture and Environment

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**This paper outlines and discusses a number of pedagogical strategies developed for a recent First Year Introductory Design Studio at Cornell University’s Department of Architecture. The global climate and resource crises are calling for paradigm shifts in the way we design, build, and manage our physical environment. Importantly, those paradigm shifts also fundamentally challenge the way we teach architecture. The studio aimed to introduce students to the issues, elements, processes and interdependencies of both sustainability (environment, climate, politics) and architectural design (geometry, materiality, form, structure). A total of five assignments and their results are presented in this paper, historically contextualized, and pedagogically analyzed. Each of the exercises incrementally introduced new architectural concepts related to environment, body, material, culture, landscape, spatial tectonics, and representation. As the semester progressed, project narratives were layered, expanding a student’s understanding of architecture as a complex and playful set of abstracted, reciprocal – geometric, proportional, formal, performative, constructed and natural – relationships.**

## INTRODUCTION

The global climate and resource crises are calling for paradigm shifts in the way we design, build, and manage our physical environment [1, 2]. Importantly, those paradigm shifts also fundamentally challenge the way we teach architecture. This paper outlines and discusses a number of novel pedagogical strategies developed for the Fall 2020 First Year Design Studio at the Department of Architecture at Cornell University, aiming to introduce students to the fundamental issues, elements, processes and interdependencies of both sustainability (environment, climate, politics) and architectural design (geometry, materiality, form, structure).

The studio *ON PAPER // On the Reciprocity of Bodies and Spaces, the Intangible and the In-Between* [3] aimed to challenge our understanding of paper, engaging it both in theory and practice, as medium and material, as mediator and actor. Throughout the semester, paper created the foundation and constituted the common thread which we used to dissect

architecture, pedagogy, and spatial exploration while training the skills, methods and tools of the discipline. In this context, paper can be understood as a practical and widely available resource that is easy to manipulate with basic tools, either at home or at school, which constituted an essential logistical requirement in Fall 2020 during the global COVID-19 pandemic [4].

## ON PAPER

Paper is both representational and representation, something it has in common with architecture. On the one hand, paper can be understood as a blank medium and neutral receptacle for ideas. On the other hand, however, paper itself is indubitably also a material with unique properties and not nearly as neutral or characterless as one might assume at first glance. In addition, paper has the ability to capture and develop an idea, as well as visualize it to a broader audience: in writing, in drawing, or in printing. While paper is often merely the tool or platform, it is yet never neutral. As such, paper is inherently programmable—both physically and theoretically—and can carry enormous spatial agency and cultural relevance.

Naturally, one may assume that architecture has a long history of engagement with paper as the material provides an ideal medium to draw or theorize upon [5]. However, what we still regard today as the natural occupation of an ‘architect’—the act of making drawings on paper—is in fact a fairly recent invention. Before the Renaissance, the architect was a master builder, a craftsman guiding the on-site construction of projects in collaboration with stone masons or carpenters. Since then—in theory, an architect is a person who creates drawings of projects on paper, which someone else would build. Today’s architect however is more than that: Through the emergence of new technologies and material explorations—far exceeding the shift from physical to digital paper—as well as a growing social and environmental awareness, our understanding and the role of an architect is beginning to shift yet again [6, 7].

Paper as a medium and vessel for abstract architectural exploration plays a historically significant role in modernist architectural pedagogy and the beginning of this studio followed its modernist predecessors. The first series of exercises loosely borrowed and appropriated pedagogical strategies developed by Josef Albers in his *Vorkurs* at the Bauhaus [8],

which themselves are based on the work of Friedrich Fröbel [9] and Japanese Origami traditions [10]. However, the exercises aimed to drastically augment abstract-geometric and analytical “Bauhausian” investigations and digital paper-folding explorations [11] by imbuing assignments with new critical narratives about the environment and its phenomena for creative exploration and analytical reflection. Later exercises dramatically challenged paper as a physical building material, asking students to reinvent paper and its material characteristics from the ground up. The final exercises of the studio focused on paper as a medium for abstracted architectural representation and translation of design ideas. Together, those three main paper methodologies formed a collective repertoire of critical tools and design strategies which offer students a wide range of conceptual approaches for future design exploration.

**ON RECIPROCITY**

We prefer to think of architecture as a reciprocal system of ANDs .... and of layered narratives. Reciprocity is “*the quality or state of being reciprocal*”, in other words being of “*mutual dependence, action, or influence*” [12]. As a concept, reciprocity is of great importance to the studio, architecture in general, and the way we act and interact with society and our environment. One interesting aspect about reciprocity is its constantly implied *simultaneity*. Mutual dependence is defined not by linear relationships (first this, then that) but by simultaneous relationships (this/that and – at the same time: that/this). The

title of the studio speaks about the reciprocity of Bodies and Spaces, the Intangible and the In-Between. Architecture lives through its reciprocity with intangibles and the in-between. A material comes to life through light and shade. Its interaction with energies and the forces of nature creates patina, gradients and readability. Built thresholds such as walls, windows, doors, screens or building skins comprise a zone where different spatial, environmental, thermal, or political systems collide and interact. These in-betweens often exhibit specific spatial qualities and properties – they can be thick or thin, massive or light, porous or closed, transparent or opaque.

During the semester, each student chose two postcards randomly: the first, an Intangible (Wind, Scent, Cold, Heat, Sound, Shade, Light or Vapor), the second a Tangible (Smooth, Viscous, Spongy, Fluffy, Granular, Thorny, Cracked or Rough). The students were encouraged to use these terms as both inspiration and client, while working towards positive and beneficial architectural solutions of filtration, mediation and reciprocity.

**STUDIO STRUCTURE**

The structure of the semester addressed bodies, spaces, intangibles and the in-between through 5 assignments in changing combinations and on various scales. As the semester progressed, project narratives were layered, expanding a student’s understanding of architecture as a complex set of abstracted, reciprocal relationships. Incrementally, each

**ON PAPER //  
CORNELL  
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Cornell University Architecture  
Design Studio I - Fall 2020

**ARCHIVE**

**STUDENTS**

ASSIGNMENT 01 //  
INTANGIBLE\_SURFACE

ASSIGNMENT 02 //  
DISTANCE\_INBETWEEN

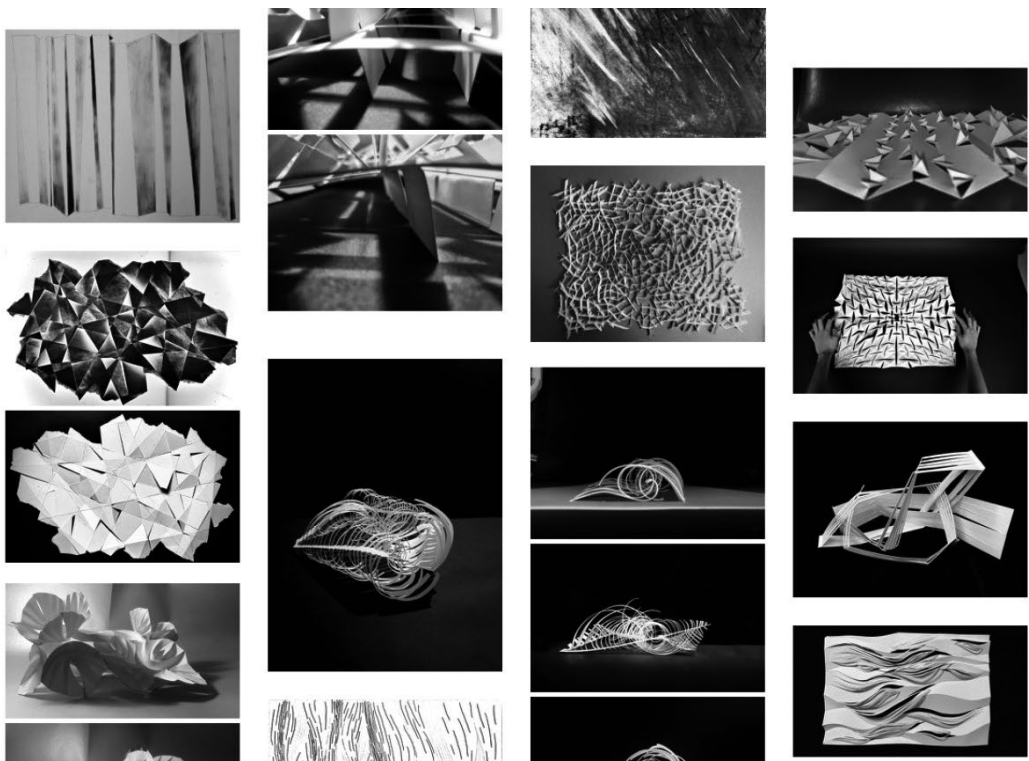
ASSIGNMENT 03 //  
MATERIAL\_BODY

ASSIGNMENT 04 //  
BODY\_APPLICATION

ASSIGNMENT 05 //  
TOPOGRAPHY\_SPACE

ASSIGNMENT 06 //  
SPACE\_INBETWEEN

ASSIGNMENT 07 //  
INTANGIBLE\_SPACE



PAPER

Figure 1. Screenshot of the studio tumblr page displaying the assignment structure and student work of Assignment 1

exercise introduced new architectural concepts related to environment, body, material, culture, landscape, spatial tectonics, and representation – developing from a cut and folded piece of paper that engages an environmental condition to an architectural-scale spatial intervention in the final exercise. In addition, the exercises are designed to incrementally develop skills in model building and drawing representation.

### INTANGIBLE\_SURFACE

Assignment 1 playfully introduced the notion of environment and performance: utilizing origami and kirigami techniques, students manipulated a planar sheet of paper into a complex and performative surface. *Kirigami* constitutes a variation of the more well-known Japanese *Origami* (from *ori* “folding”, and *kami* “paper”) which was first documented in the Edo Period (1603–1867) [10]. In contrast to origami, kirigami allows the cutting and folding of a single piece of paper to create spatial objects. The addition of environmental forces in the form of the intangibles introduced new design objectives that address environmental performance. The goal was to manipulate the surface of a piece of paper in order to react, enforce, block, shield, direct, control, augment, enhance, or confuse the intangible. Restricted by the size and properties of the sheet of paper, the final projects resulted in “thick” 2-dimensional surfaces with distinct patterns and geometries. The surfaces generated unique spatial qualities and were abstractly linked to environmental parameters as predetermined by the intangibles. Pedagogically, this assignment also served as a general introduction to drawing and model making. Students were encouraged to draw on their paper before folding it, creating hybrid representations between model and drawing, while continuously improving skills and craft through a series of iterative studies. *Figure 1* shows exemplary student work produced during Assignment 1.

### DISTANCE\_IN-BETWEEN

Assignment 2 asked students to analyze, draw and construct the negative spaces in between human bodies, and to study the influence of intangibles on these bodies and spaces. Students from the Cornell Department of Performing and Media Arts presented a socially distanced dance performance – specifically rehearsed for the design brief of this exercise (see *Figure 2*). Admittedly, dancing with a partner, while 6ft apart, is somewhat new and possibly awkward. However, seen from an architectural viewpoint, it allowed for a new perspective – not of the dancers, but of the space in-between.

During the performance, the students were asked to carefully study the space that is created between the bodies of the dancers. Based on their analysis, students abstracted two-dimensional studies into a three-dimensional form, aiming to characterize the constantly moving space through specific or characteristic instances, and merging these characteristic elements into a new representative spatial form.

In a second step, students were asked to involve their intangibles into the study of the in-between space. While it might have seemed hard to actually ‘see’ the Intangible, it yet existed and had an impact on the performance. Questions asked included: How do you represent and imagine the intangible in a series of quick drawings? Can you draw the in-between space through observing the intangible only? How might the intangible and the in-between space engage in a dance of their own?

The assignment expanded the student’s skill set from creating a hybrid model-drawing representation to a fully 3-dimensional folded paper model that is informed by observational sketches. In this exercise, drawing and model operated side by side, informing each other reciprocally on a conceptual



Figure 2. Aerial shot and close up of the dance performance on the Cornell Arts Quad following social distancing regulations. Image Credit: Sasa Zivkovic, Felix Heisel



level and more directly on a practical level as the drawing also served as a fabrication template and diagram for the paper model that could be unrolled into a flat sheet.

### MATERIAL\_BODY

During the first four weeks of the semester we treated paper politely. Too politely! In the first two assignments, students designed with paper. Assignment 03 asked our students to design the paper itself. The goal of this exercise was to move material out of its “comfort zone” and, through rigorous experimentation, develop a material system in its own right. The assignment argued for material as an active participant in the design process: materials are perpetually invented, designed, re-designed, fabricated, or augmented, challenging the very nature of the material, its structural and chemical composition, economic business models and most often aesthetics. Pedagogically, the instructors aimed to stress that very few things are ever a given or unchangeable. Materials can be invented, re-invented, and fundamentally challenged in any architectural project.

Based on assigned haptic qualities (Tangibles: fluffy, spongy, rough, cracked, thorny, granular, smooth, viscous), students were asked to manipulate the materiality of paper and its composition of matter with the goal to investigate, react to, and enforce the many physical and aesthetic qualities paper might have. The resulting paper-based material systems created playful dialogues between performance, geometry, proportion, material, structure, and design concept. Students dissected paper from the ground up, studying fiber

composition, paper assembly, and various materially-informed joinery methods. *Figure 3* shows representative student work from Assignment 3.

### BODY\_APPLICATION

The material systems from Assignment 3 were then translated into applications that interact with the body and the Intangibles in Assignment 4. Students used their material system as a starting point to design a wearable device that mediates, filters, augments, controls, and/or protects from their intangible. While all previous explorations were devoid of context, this assignment introduced the human body as site and context, and as an important actor to the design process. The particular pairings of tangible and intangible naturally and conceptually affected this site selection process. The device had to be an object made from paper, and display performative and/or reactive qualities to the body’s movement.

Humans have been augmenting their bodies to mediate the effect of their environments since the very beginning of human development—from performative clothing to ceremonial wardrobes. Students were introduced to a range of precedents that illustrate the spatial and environmental relationship between clothing and bodies. For example, clothing might help to prevent the body from losing or gaining too much heat, to protect it from rain or wind, impact or view. A walking stick might help with balancing its weight, or extend its reach. Medical improvements in the past centuries have allowed humans to replace or augment elements of our bodies, react to and/or communicate with technological applications.

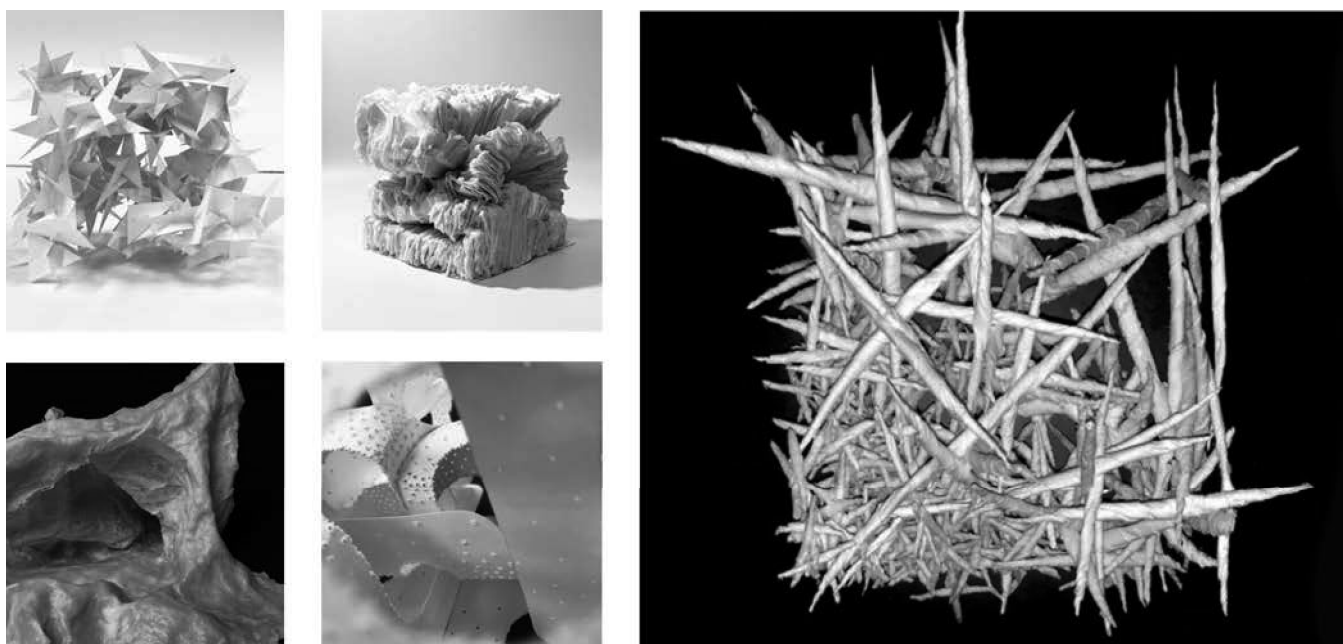


Figure 3. Representative student work from Assignment 3. Image Credit: Ann Ren, Ziyang Jiang, Landon Hale, Omar Leon-Mora, Jonah Ginsburg.

Some of these augmentations are purely practical while others constitute a form of cultural expression. Ceremonial masks and ceremonial clothing, for example, are used in a variety of contexts to convey ritual narratives and define cultural identity. The assignment however specifically asked for a device or a performative application based on a reciprocal relationship between body and Intangible. Students first analyzed their paper system and intangible/ tangible in order to help determine its best placement in the context of a body.

Through a series of iterative studies, students developed a wide range of conceptual approaches towards interactions between material system, "site", and spatial expression of environmental performance. *Figure 4* displays representative student work from Assignment 4.

### INTANGIBLE\_SPACE\_IN-BETWEEN

In the final assignment, students were asked to design a small shelter, providing protection from – or augmenting – their intangible for a maximum of three people. It was not a home or house, nor did it not provide amenities or supplies. The small shelter was to be a direct derivative of earlier explorations and design research. Assignment 5 aimed to combine the lessons from the semester spatially, structurally, and systematically. The resulting shelter designs create abstracted connections to the environment, expressed through geometry, material articulation, and spatial configuration. The architecture aims to communicate its conceptual intent formally and spatially, articulating connections to the intangible forces that shape our environment as well as our human interventions. The

projects explored spatial ordering systems based on emergent behaviors and often chose to amplify environmental conditions such as wind, light, or sound. Through abstraction, the projects aimed to develop a critical attitude or argument towards reciprocal relationships between architecture and the environment. *Figure 5* shows representative student work from Assignment 5.

### ON DESIGN EDUCATION

The global climate and resource crises are calling for paradigm shifts in the way we design, build, and manage our physical environment. These shifts require us to develop a new understanding of the issues, elements and processes of both intangibles (environment, climate, politics) and in-betweens (materiality, connections) in connections to body, space and architecture. They require a beneficial reciprocity of all these aspects, today and over time - and the first year curriculum is, in our opinion, just the right moment to begin the conversation about these complexities of the discipline.

The described 5 assignments incrementally introduced new architectural concepts related to environment, body, material, culture, landscape, spatial tectonics, and representation. As the semester progressed, the project narratives were layered and expanded our students' understanding of architecture as a complex and playful set of abstracted, reciprocal – geometric, proportional, formal, performative, constructed and natural – relationships.



Figure 4. Representative student work from Assignment 4. Image credit: Idil Derman, Jack Mieszkalski, Isabella Bettencourt, Dana Zou , Ella Brindle, Susan Cook, Jessica Kim

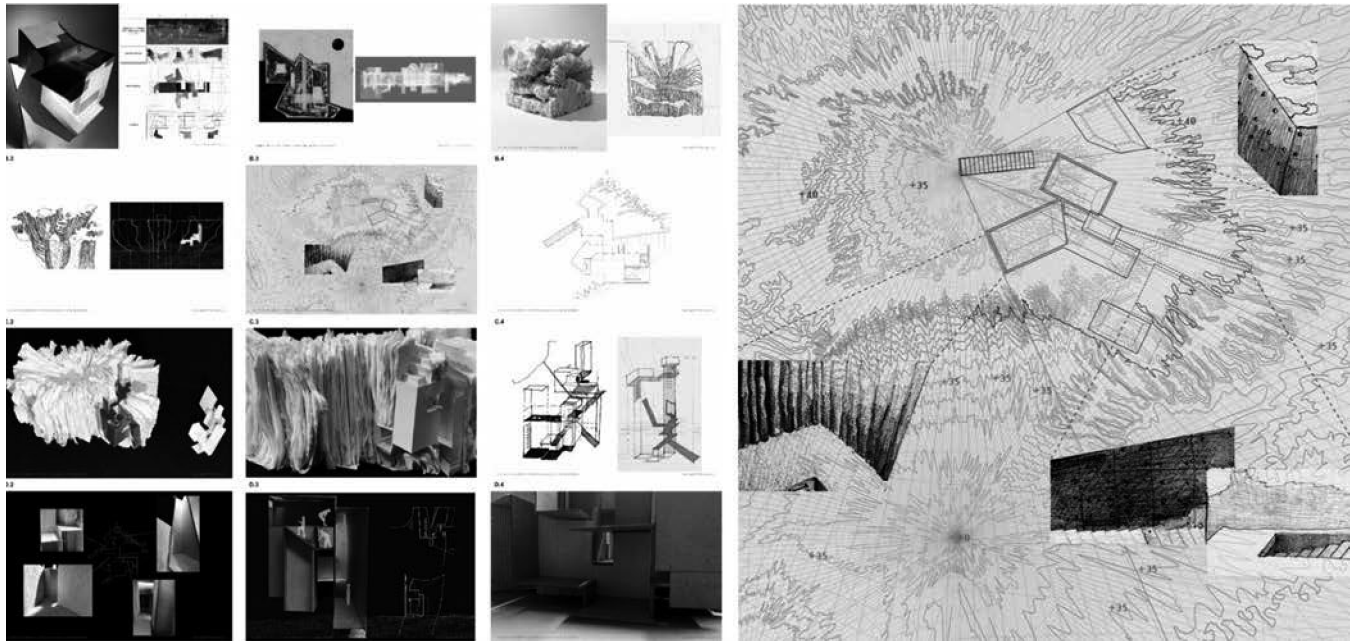


Figure 5. Representative student work of Assignment 5. Image Credit: Ziyang Jiang.

For our students, this first semester represented the beginning of a 5-year Bachelor of Architecture curriculum at Cornell University that will gradually broaden opportunities to explore architecture's myriad bodies, spaces, intangibles and in-betweens. We hope that the described approach establishes the necessary conceptual tools and foundations for our students to engage deep-rooted and holistic questions of architectural sustainability through the lens of design, by encouraging curiosity, observation, criticism and the formulation of questions through architectural design methodologies. And we hope that the studio laid the technical and conceptual foundation to act upon architecture as a complex and expressive interplay of broad mechanisms and environmental forces.

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#### ENDNOTES

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