Beginning with simple pop-up book techniques, we ran through innumerable material and form tests. On paper, we tested folding designs for structure, intricacy, and ease of assembly. Adding thickness with chipboard and plastics, we began to address the problems associated with folding materials thicker than paper. As complexity increased, we took our designs to the laser cutter to begin testing mass fabrication strategies. All of these explorations combined helped us to better understand our aims and influenced the direction our project would take.
1. TRANSFORMING CUBE

BASS WOOD CONSTRUCTION

This evolution of a closed, wooden block to an exploded figure was an exploration of body movement, specifically the action of working on a computer. The block is constrained to movement along two faces of the cube, which challenges the abstraction of the movement. The block becomes dynamic as it unfolds, mimicking the action of a daily routine.
2. THE LIVING FLOOR

CONCEPT & DRAWINGS

The inspiration behind “The Living Floor” was to create an innovative indoor farming system that is integrated into the unused space beneath raised floors. Many large buildings have raised floors, including the MIT Stata Center. This space can be used for bringing in greenery and new technologies in indoor farming to enhance the already existing space without intruding on potentially needed area in the building.

3D printed model of the first full prototype.

SECTION

PLAN

CONCEPT IMAGE
2. THE LIVING FLOOR

RENDERINGS

Rendering explorations of the exploded and connected versions of the initial full size prototype.

Visualization of the modules in the Stata Center floor.

The initial design is based around a frame that is the size of a floor tile. The plants are held in pipes where water and nutrients flow, utilizing the Nutrient Film Technique (N.F.T.) hydroponic system. The plants would be lit by LEDs from above, and the surrounding area beneath the floor houses the electronic components, the water tank, and pumping system. This system would grow leafy greens due to the limited root space.
2. THE LIVING FLOOR

3D PRINTS

3D printed prototypes of a corner of the full module.
3. LONG-SPAN ROOF DESIGN

PARTNER: Johanna Greenspan-Johnston

This long span roof design was a structural project exploring arch shapes and tension cables. The shape was inspired by a canopy of trees. The design consists of seven arches arranged around a central point, with supporting arches spanning between them. A steel cable network forms the secondary structure to hold up the membrane of the roof and the arches. Using graphic statics, my partner and I developed the shape of the arches in order to create a protected exterior space for community use.
4. RIVERSIDE SHELTER DESIGN

3D PRINTS & RENDERINGS

This shelter design was inspired by a wave-like curve. The shelter provides people with a place to view sporting events on the river or sit peacefully along the water’s edge. This design exploration was realized through renderings and 3D printing.

A visualization of the shelter by the Charles River in Boston.
5. NEPAL SCHOOL DESIGN

GROUP PROJECT: Justin Carrus & Madison Noteware

The design of this school was inspired by the need for education facilities in Nepal due to the recent earthquakes. Many of the nation's schools were damaged or destroyed. In order to conceptualize an earthquake resistant structure, our team created and analyzed several designs throughout the semester while also conducting research about materials, the education system in Nepal, and the climate. The final design consists of a main soil-cement brick structure reinforced with concrete. The roof is metal and is held up by a system of trusses. There is a series of clerestory windows along the top of the walls for natural daylighting purposes, and shuttered windows in the walls for natural ventilation. To the right is an axonometric diagram of the conceptualized two classroom building.

South elevation showing the "band of compression" during earthquake loading.

A diagram of the wall construction.
5. NEPAL SCHOOL DESIGN

DIAGRAMS & RENDERING

Above is a rendered image in a Nepalese setting emphasizing the materiality of the structure (Background image courtesy of Dirk Kloss).

Seen above is a structural detail illustrating a U-bolt connection of the bottom chord of the truss to the concrete frame. To the right is an exploded diagram illustrating the different materials and elements of the design.
5. NEPAL SCHOOL DESIGN: DAYLIGHTING ANALYSIS

This project involved daylighting analysis. An important element of the design is a different window configuration for winter and summer months, as illustrated in the diagram on the left. The reason our design includes this is because it gets quite cold during the winter months in Nepal, and so insulation is high on our priority list. Because of this, the clerestory windows along the top are significant for daylighting during the winter. Below is a visualization of electric lights that provide the required amount of lux when daylighting is not enough, or for night time use.

![Diagram showing different window configurations for summer and winter](image)

An annual spatial daylight autonomy simulation for the winter configuration of windows where 71% of the floor area has 300 lux over 50% of the time.

![Image of simulation result](image)

A useful daylight autonomy simulation run for the summer months where the blue areas right by the windows indicate that there could be glare issues.
6. FOLDING CONSTRUCTION

GROUP PROJECT: Anthony Kawecki, Johanna Greenspan-Johnston, & Marco Rosero.

Our group was inspired by paper folding techniques and the pop-up books we remember from our childhoods. We assembled a structure using simple folding as the main construction technique. Using sheets of 4 by 8 feet polypropylene, we constructed an intricate tower with a total height of fifteen feet. The individual elements follow a classic pop-up book folding technique, and are then stacked and intersected with one another to provide structural support. This folding and interlocking method allows for the construction of a tower of such height from sheets that are only ⅛” thick.
The First Full Scale Material Test

Cut Pattern and Execution of Folds

We decided on polypropylene as the final material for its appearance and folding ability. Experiments were run on the CNC router from this point on due to the scale and material. We tested everything from cut patterns to foldable lines along the way.

After all of this testing, we finally arrived at a design that combined an intricate appearance with structural stability. The simple folds in the tendrils would be achieved by CNC routing the plastic to get perforated lines. Assembly then consists only of folding and securing the angles of the folds before raising the tower.

6. FOLDING CONSTRUCTION

DIAGRAMS & PLAN

A diagram illustrating the CNC milled pattern on the plastic sheets, and the folding technique used to construct the tower.

A plan view of the finished tower assembly.
6. FOLDING CONSTRUCTION

FINAL STRUCTURE
This project was an exploration in subtraction from an assigned volume. My building “site” was one half of a Japanese joint, illustrated in Diagram 1 on the right. The goal of the project was to create 4 rooms with circulation between them. Each of the rooms had a certain constraint: ground view, sky view, horizon view, and natural light but no view. The joints came in pairs, so another limitation of this project was that the part covered by the matching joint could not be used to create views. Because of the vertical nature of my site, I created a tall atrium-like room as the diffuse room, shaped by the leftover space from the circulation. The rest of the rooms are distinctly round in order to create a contrast between the circulation that wraps around the diffuse room.
7. SUBTRACTION EXERCISE

PLANS & SECTIONS

A large part of this subtraction exercise was developed through plans and sections. This introduction to plan and section conventions clarified many aspects of the project through drawing. The base of the tall room is round in order to keep consistent with the round plan of all the rooms. The shape of the rooms themselves carve out the views to the outside. These selected sections and plans highlight significant aspects of the project, such as the rounded shape of the rooms and the tangential entry points to the rooms.
7. SUBTRACTION EXERCISE
PHYSICAL MODEL
8. HEIZER ON “A” STREET

SITE SHADING STUDY

The design of a multi-use space in Boston began as a site study exercise involving the creation of several types of maps. Each person in the class was assigned a piece of art to permanently display in the building as well. I was assigned Michael Heizer’s North, East, South, West piece which is currently on display in Dia Beacon. Other program requirements in the design of the building include office space, a rotating art gallery, a theatre/lecture hall, and a cafe space. The design of the building was highly influenced by the Heizer pieces due to their large size.

Michael Heizer’s North, East, South, West. Each depression sinks 20 feet below floor level and all four side by side span over 125 feet. (Image from The Journal News)
The vertical arrangement of the Heizer art provides the opportunity for new viewing experiences. The stairs circulating around the outside of the Heizer pieces become sculptural objects while viewing the art from more vantage points.
8. HEIZER ON “A” STREET

DIAGRAMS & SECTION

The diagram panel on the left illustrates the vertical placement and corner justification of the geometric Heizer pieces. It also shows the subtraction of the resulting shape from the building site volume to represent the remaining volume for program functions. The section to the right highlights the Heizer space as an exterior entity while the resulting space becomes the interior program.
8. HEIZER ON “A” STREET

PHYSICAL MODEL
8. HEIZER ON “A” STREET

RENDERING - “The Approach”
8. HEIZER ON “A” STREET

RENDERING - “Sunrise on Summer Street”