RENDERING REALITY REALITY RENDERING

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Summer 2019, the Cooper Union, Irwin S. Chanin School of Architecture

Rendering Reality / Reality Rendering
Haotian Zhang

Outsourced labor in rendering

There are two myths around rendering. First, rendering is considered the final step in practice that creates illusions, both a translation and beautification of the design, but its production is menial labor lacking intellect. The second myth, constructed by the Postdigital, positions rendering as a manifestation of banality in digital culture, no longer revolutionary but instead part of the new ordinary. In a playful tone, Postdigital artwork celebrates errors and default settings in rendering software and devalues the sophistication in rendering in order to critique the labor subordinate to the market, all the while perpetuating spectacular eye-candies.
Neither of the myths evidences the significant labor in rendering coded as automation and outsourced to computers. In pursuit of efficiency, software and hardware corporations have packaged rendering into an automated instrument that mimics reality, and have developed a specific machine, the graphic card, a suitable sweatshop for simple but repetitive calculations. Compared to the perspective machine depicted in Dürer's woodcuts, modern rendering instruments detach labor from our body, and seal the process of rendering in an impenetrable black-box. Although the user experience has been largely improved from manually drawing pixels, rendering software denies architects access to the rendering process and degrades their labor to applying material textures, adjusting lights and clicking "render", the unimportant final step of the design workflow to be denounced and abused.

The initial task of this thesis is to open the automated toolkit of rendering and regain architects' access. In order to expose the hidden process in rendering, I reconstructed the rendering mechanism through digital modeling and coding, peeling off the cultural connotations of rendering (a social practice or software) and reducing it to a process of measuring space, calculating shading and drawing pixels. To dispute the myths, I prolong rendering's instantaneous translation to re-establish architects' agency, via the architects' labor, over rendering's autonomy as a representation.

Beyond realistic: intellect in rendering

Being realistic, the espoused primary virtue of rendering, is also the inviolable principle coded in the algorithm that allows rendering to be an efficient automation. As a mimicry of the physical laws of light and sight, rendering can easily capture the finest

detail of realistic reflections and refractions, but may possibly fail in producing an image where light travels falsely. The inherent realistic quality in rendering establishes its credibility between software corporations and architects, architects and clients, which further entrusts rendering software as faithful automations.

By opening the toolkit, this thesis immediately challenges the faithfulness of rendering to the real and our faithfulness to rendering. By effectively dissecting the perspective machine, the searching rays from the vantage point can be interfered with before they arrive at the target,[1] as in refraction and reflection. As a result, rendering can escape the linear perspective and transcend the static 3D digital space. Through abstracting the spatial structure from the painting Las Meninas, I reconstructed the mutual gazes in a self-built rendering engine.[2] In the video, the view zooms through mirrors and screens, arriving at each other's reflections, during which the space is folded and reconnected back to itself, just as in the painting the painter sees himself again through the canvas in front of him. Rendering is thus transformed into a fabrication that contains architects' individual spatial narrative.

Traces of labor: materiality in rendering

Rendering pretends to be instantaneous, but it is actually suspended in time. It disguises itself to be operating in real time, updating frames at the same pace with reality. The frames, however, are discrete in time, and between two frames the fabrication process is obliterated. Rendering hides the data used in the digital calculations, whose physical registrations, traces in microchips, are too minute to be ever observed by the naked eye. Time in rendering remains suspended in a state never recorded until the next frame is rendered.

This thesis forces the hidden time and labor back into reality. Using an analogue tool that assists shading calculation just like in digital rendering, I distributed light proportionately to each spot in a real classroom and captured over two thousand instances with time-lapse photography. The rendering process concatenates parallel calculations of thousands of pixels into analogue calculations by one person across time, the traces of which are recorded in the final images. These traces (e.g. silhouettes of my hands and shoes) ultimately characterize the image's materiality. Rendering, conventionally a synchronic index of the digital scene, is now a diachronic fabrication of reality in reality, during which the traces inevitably lay on each other recording how reality evolves with the rendering. I

1 Rendering algorithm usually does not calculate the lighting condition of the whole scene and then project it to a plane. Instead it shoots searching "rays" from the vantage point to locate the necessary areas for calculation.
2 Cast: Princess - Camera; Velázquez - Cell phone; Canvas - Monitor; King - Lidar; Mirror - mirror.

also reconstructed rendering with a painting instrument and a lighting apparatus, either extending the process of rendering of compressing it to an instant, while in both cases materializing traces and manifesting labor.

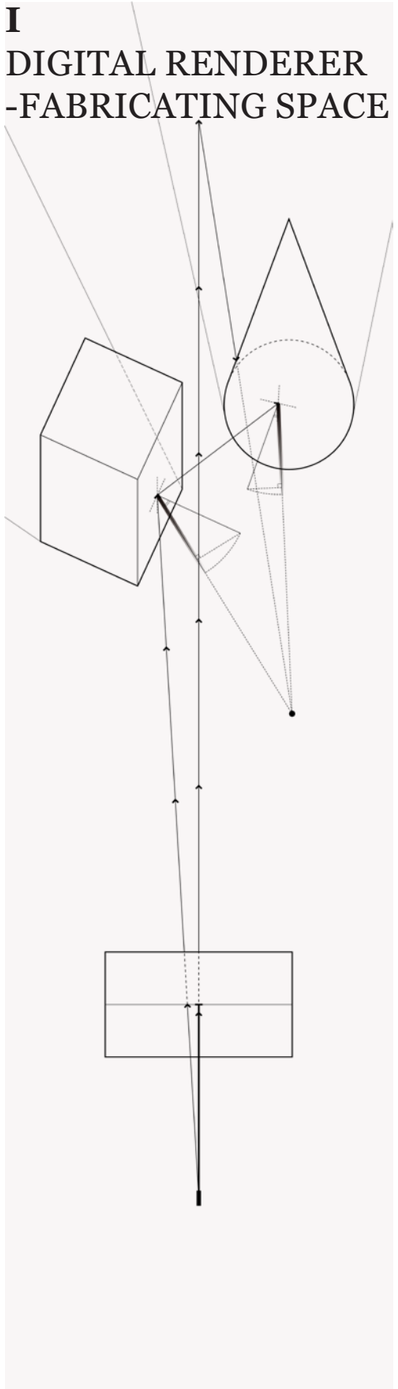
Reality rendering

This project seeks to expose the incompatibility between the analogue and the rendered, reality and its strenuous mimicry. Despite an advanced realistic machine, rendering fails to achieve the infinite complexity of reality. Time-lapse photography renders a high-resolution room illuminated with low-res lights,[3] therefore becoming an abstraction of reality, and intentional removal of information. It digitizes the analogue process of lighting, and retains the discrepancies between reality and its digitization. The discrepancies, the inevitable inaccuracies, constitutes the aesthetic qualities. To render in reality is to regard rendering not as a virtual simulation removed from reality, but a process entangled with reality, and discrepancies not as flaws but valuable traces of time and material.

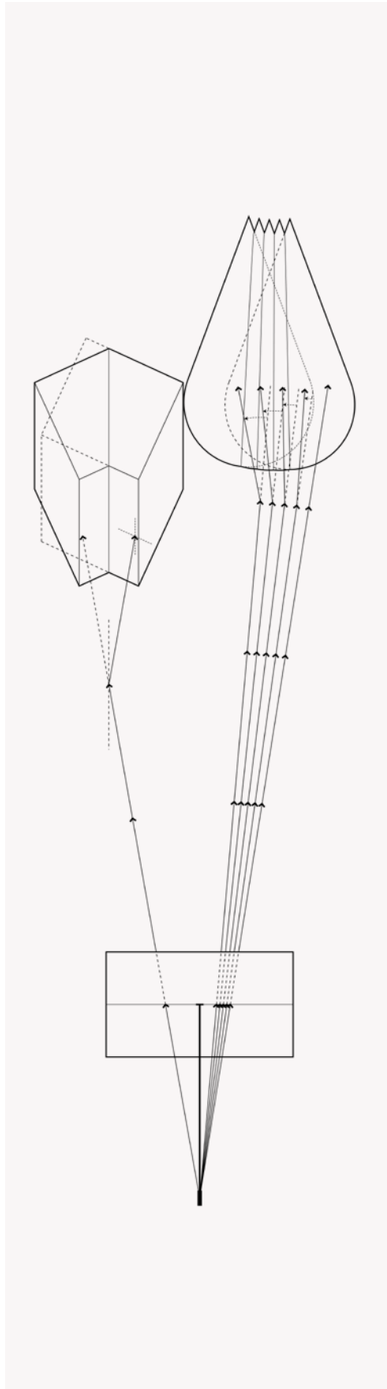
3 As opposed to an early digital rendering with exquisite lighting but crude textures.

09/10/2019-09/27/2019, Arthur A. Houghton Jr. Gallery, The Cooper Union

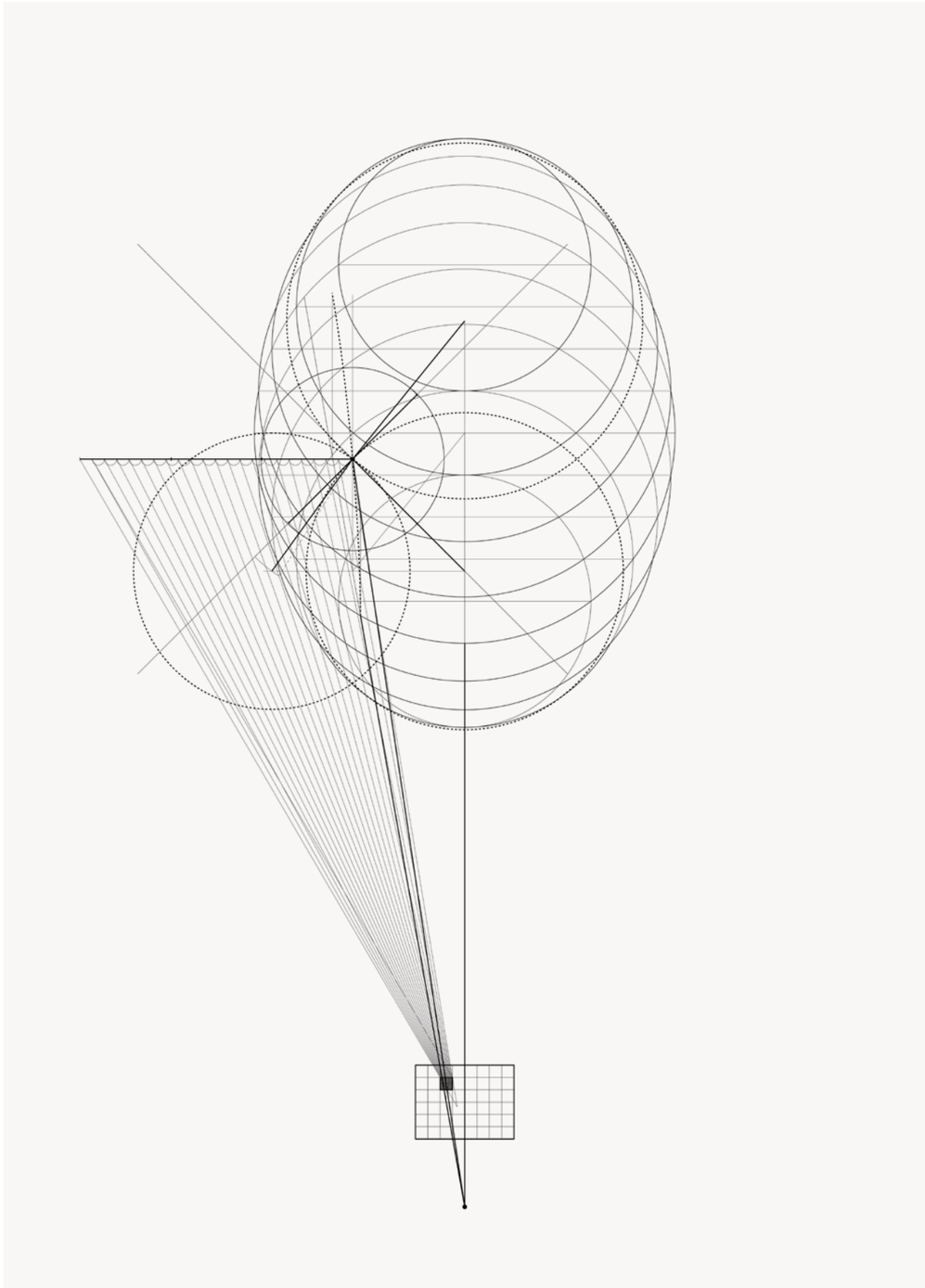
I
DIGITAL RENDERER -FABRICATING SPACE



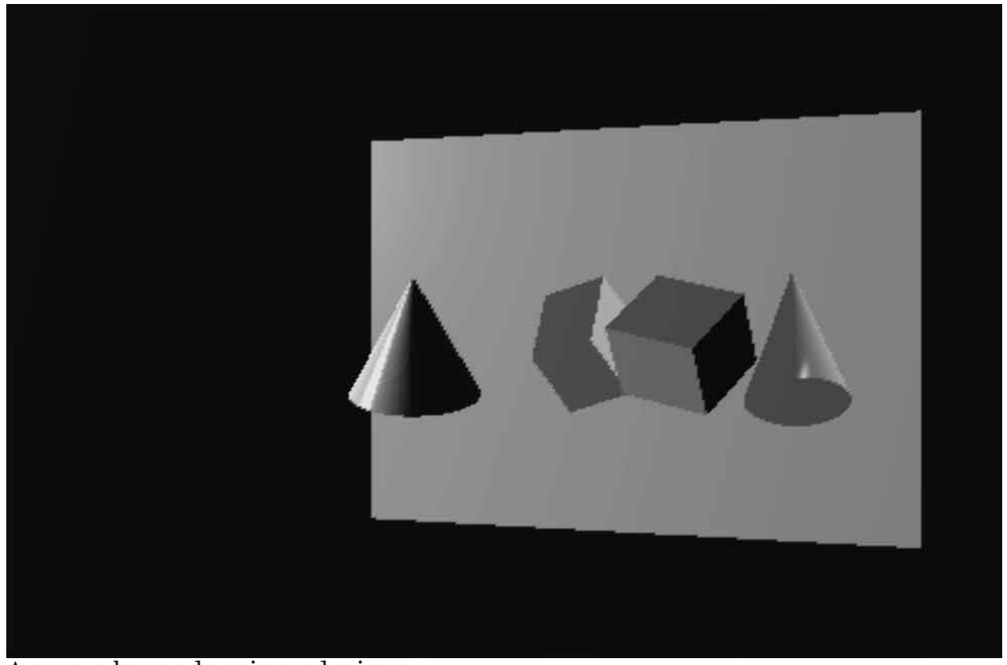
Diffuse shading and reflection



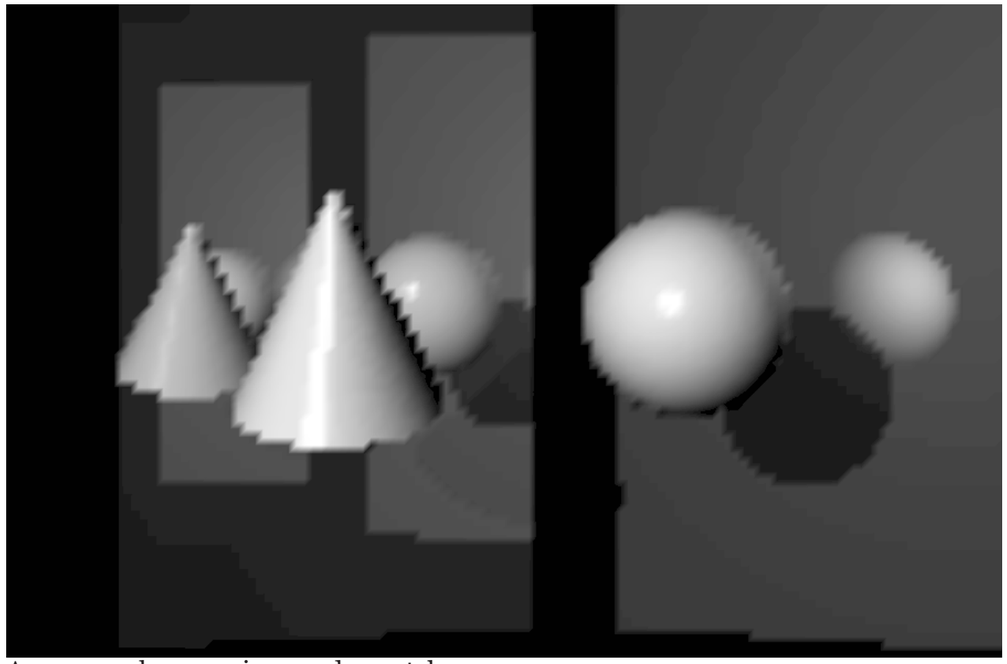
Reflection and refraction, through interfering with the searching rays



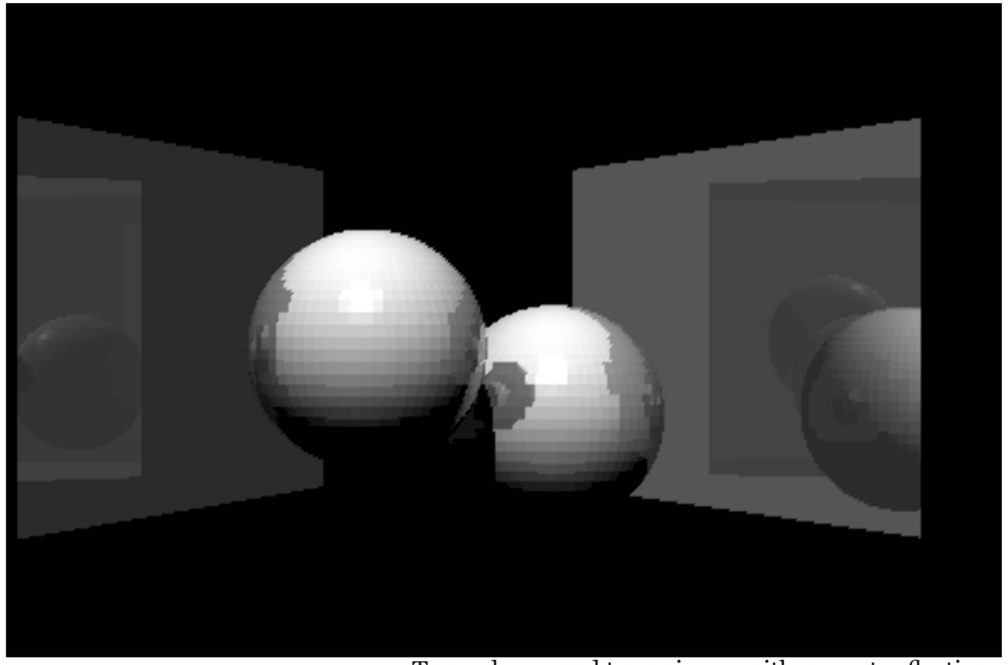
Calculating the shading value of a point on a sphere



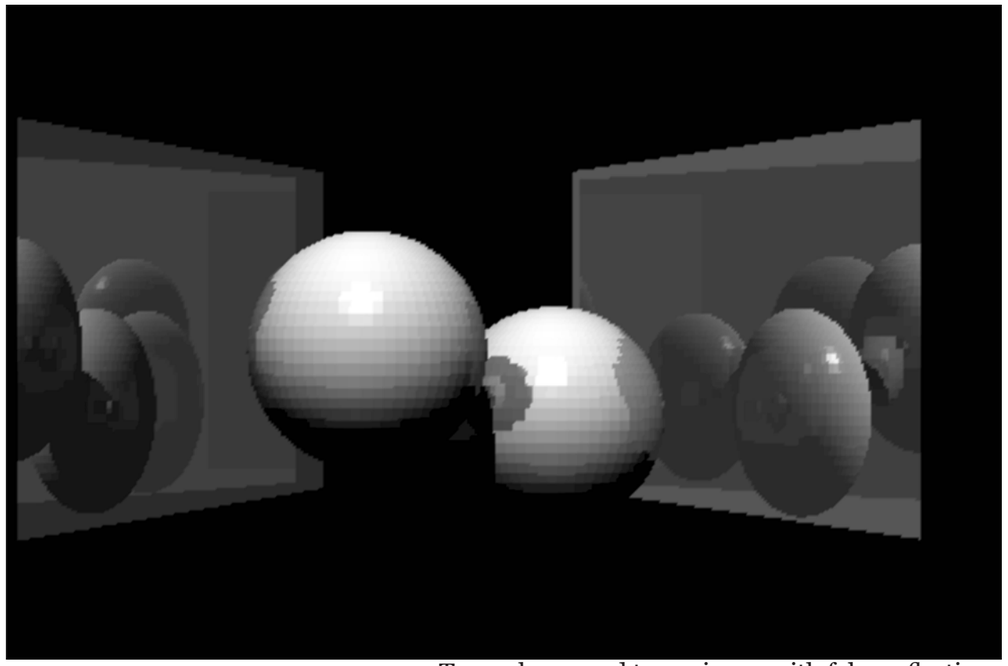
A cone, a box and a mirrored mirror



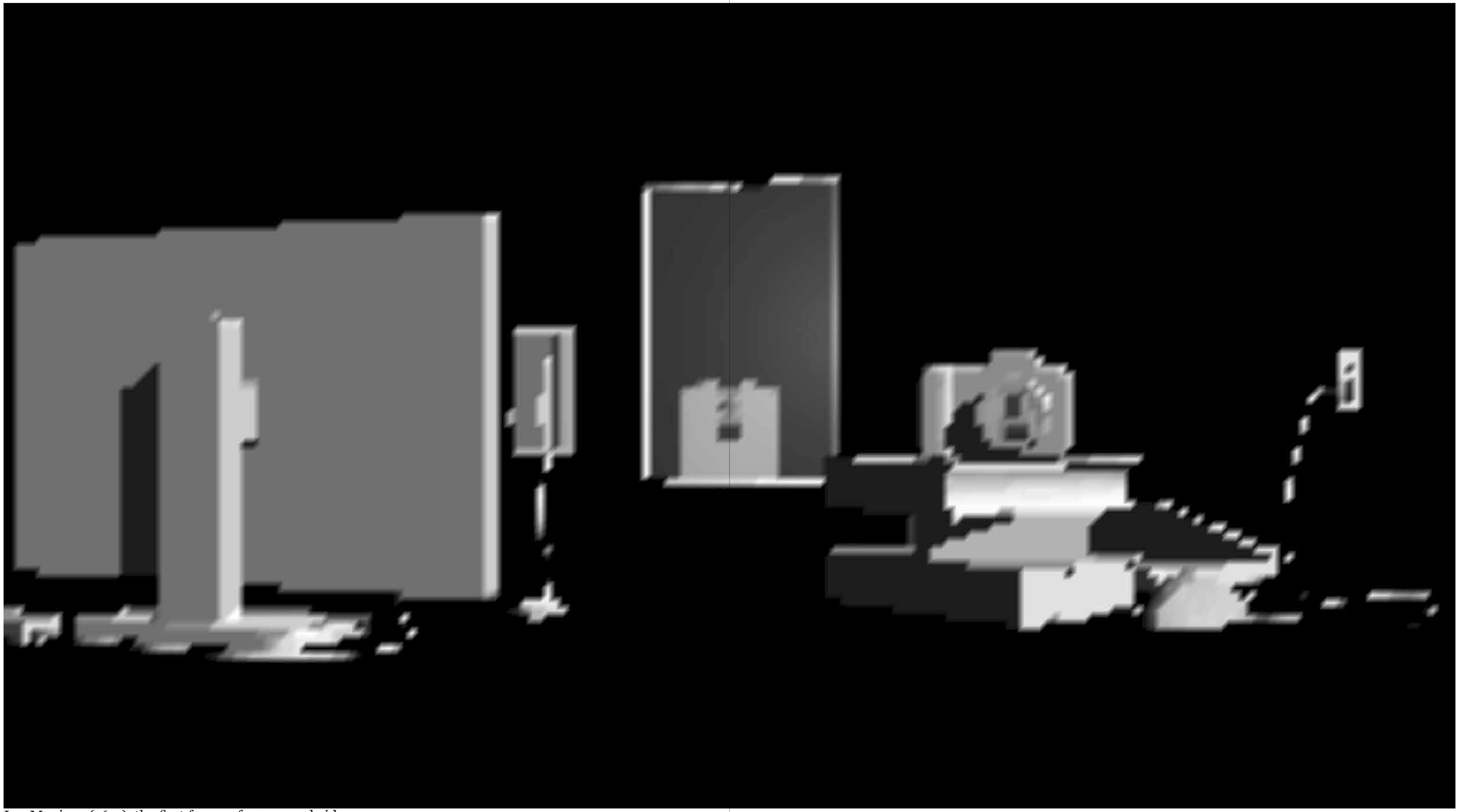
A cone, a sphere, a mirror and a portal



Two spheres and two mirrors with correct reflections



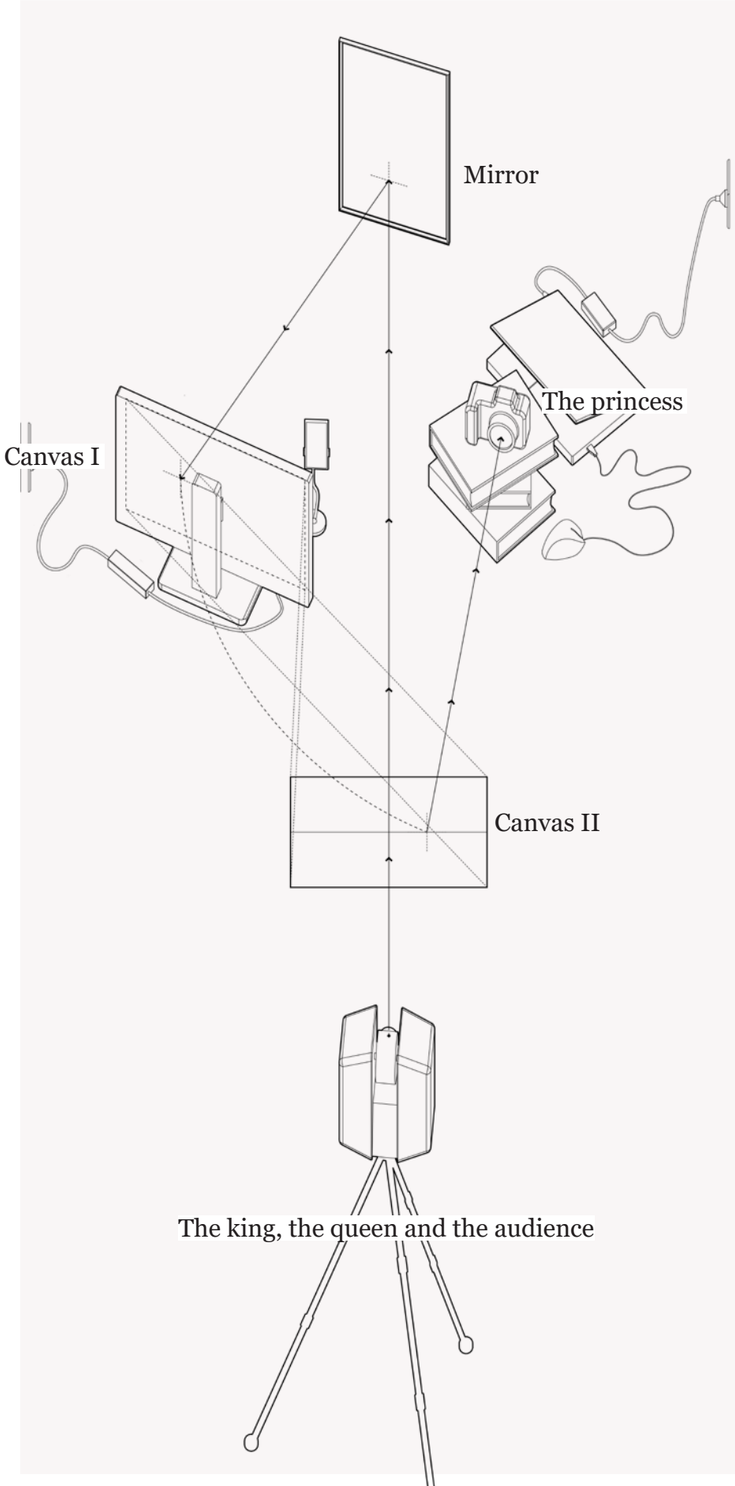
Two spheres and two mirrors with false reflections

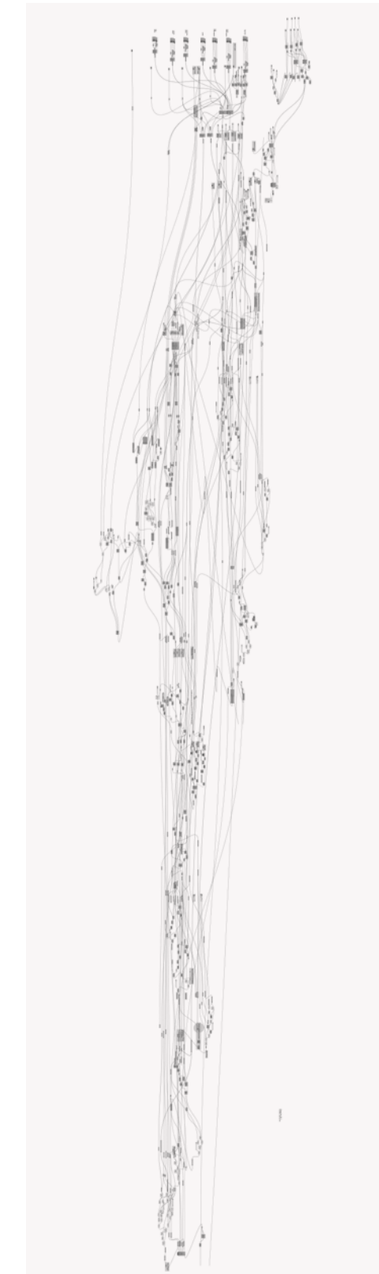


Las Meninas (16:9), the first frame of a 7-second video

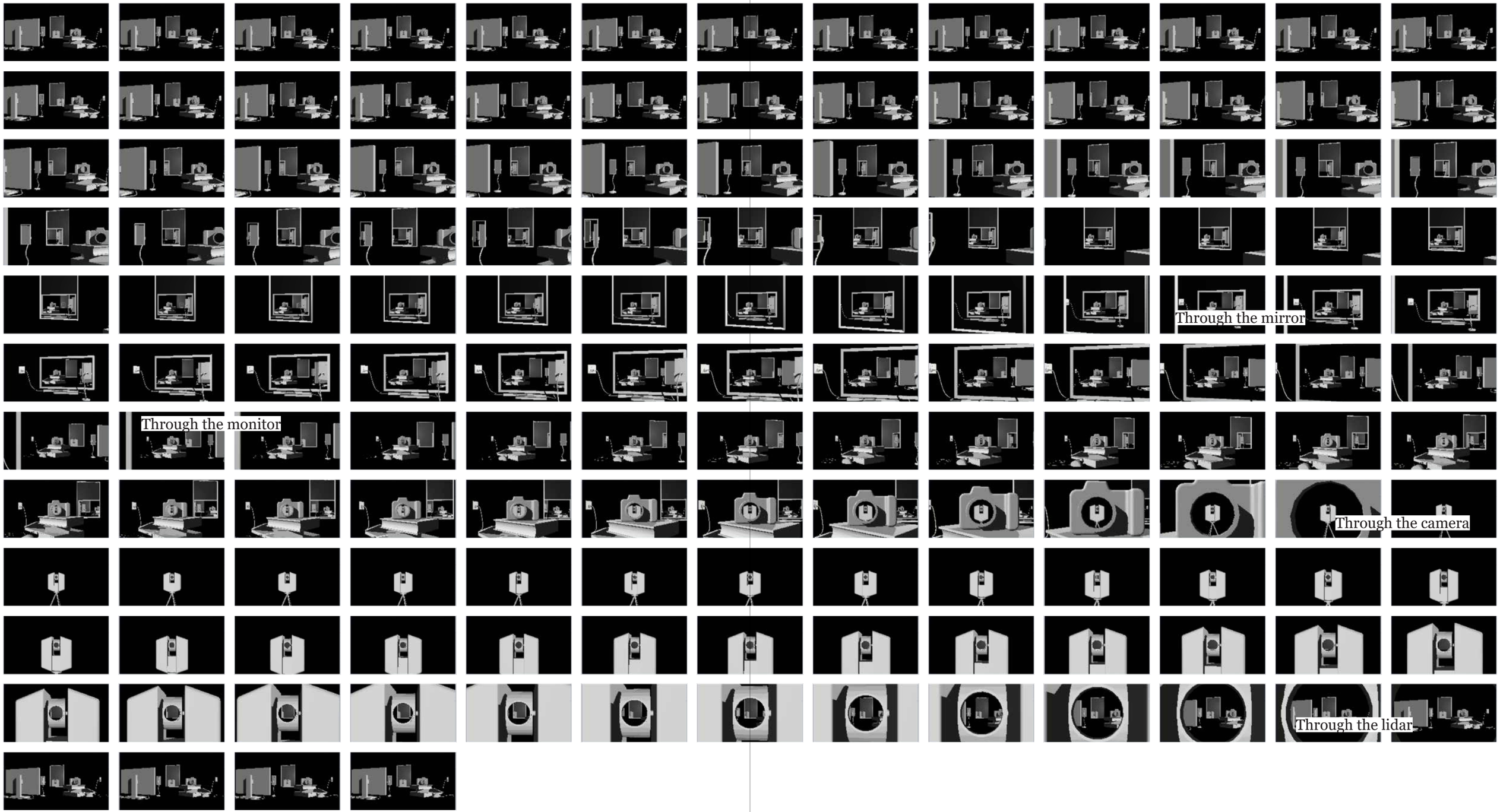
Diego Velázquez, *Las Meninas*

To further escape from the linear perspective that rendering is coded to perform, I reconstruct the spatial structure of Las Meninas, a construction of mutual gazes that transcends three-dimensionality, using a self-built render engine.
Referring directly to the characters in the painting, the monitor stands for the canvas, lidar the king, camera the princess.
In the video, the view zooms through mirrors and screens, arriving at each other's reflections. It moves across the scene, to the mirror, through the monitor, to the camera, and to the lidar, and in the lidar's reflection it returns to the start. Light rays that travel through the monitor are teleported to the front of the scene. The space is folded and reconnected back to itself.
The model rendered, however, is a static 3d model. In this way I embed information that is contained only in rendering, which challenges rendering's faithfulness to the 3d model.





Grasshopper code for the self-built render engine


Through the mirror
Through the monitor
Through the camera
Through the lidar

A reflective room

II
REALITY RENDERER -FABRICATING LIGHT AND REFLECTION

This is a collage of over 1000 photos. The reflection in this image is carefully constructed: except for the large mirror on the upper half of the image, all the other mirrors are manually added to the existing environment. Using a flashlight to each time illuminate a spot, while attaching a small piece of mirror onto it, I alter surfaces' reflectivity and control their depth of reflection.
The final image is an impossible collage of multiple realities. Reflection becomes a fabrication.

The original room

The existing mirror
(reflection depth: 1)

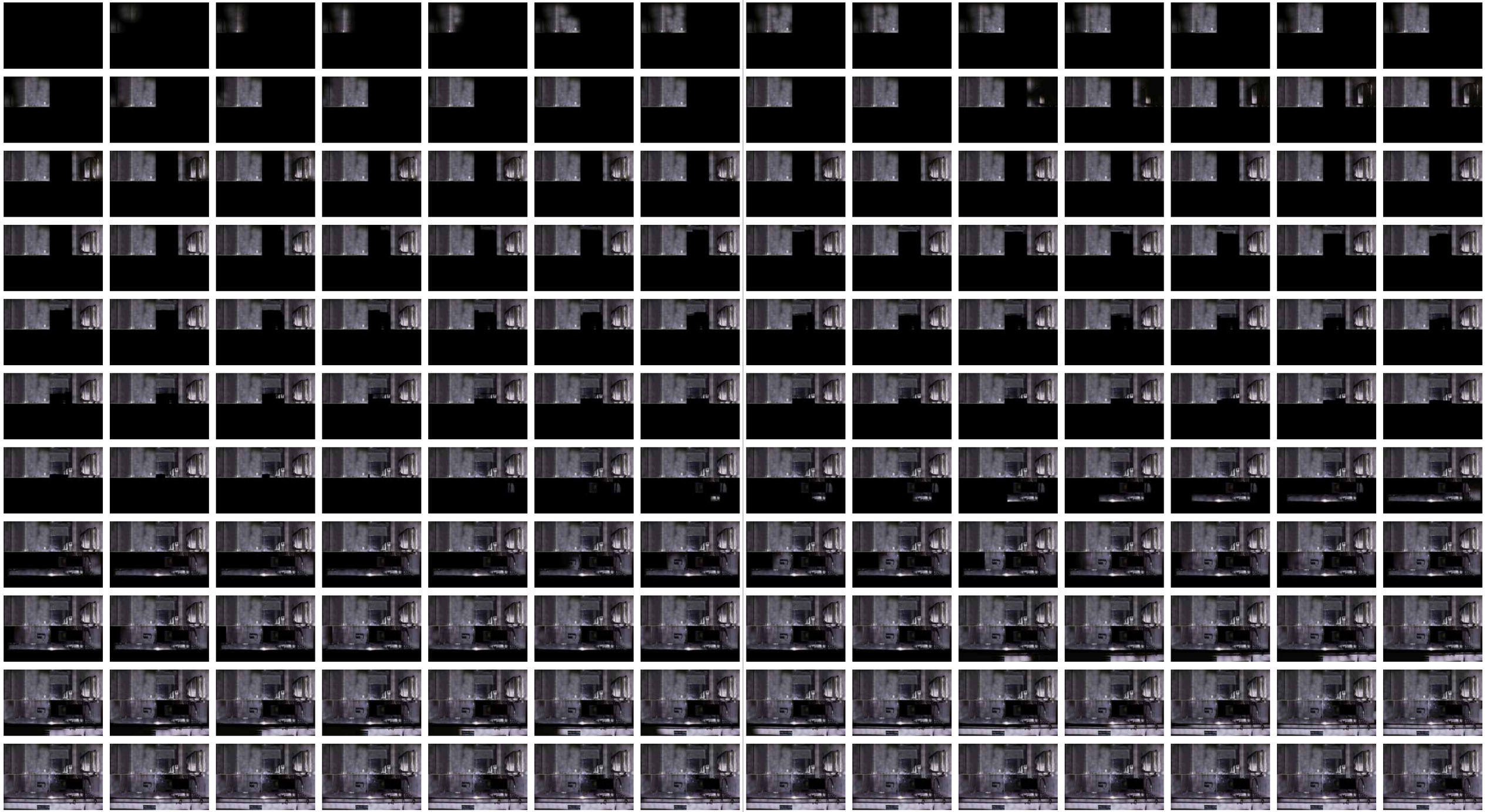
A reflective door in
the existing mirror
(reflection depth: 3)

The existing mirror
(reflection depth: 1)

A vertical mirror (reflection depth: 1)

The existing faucet and sink (reflection depth: 0)

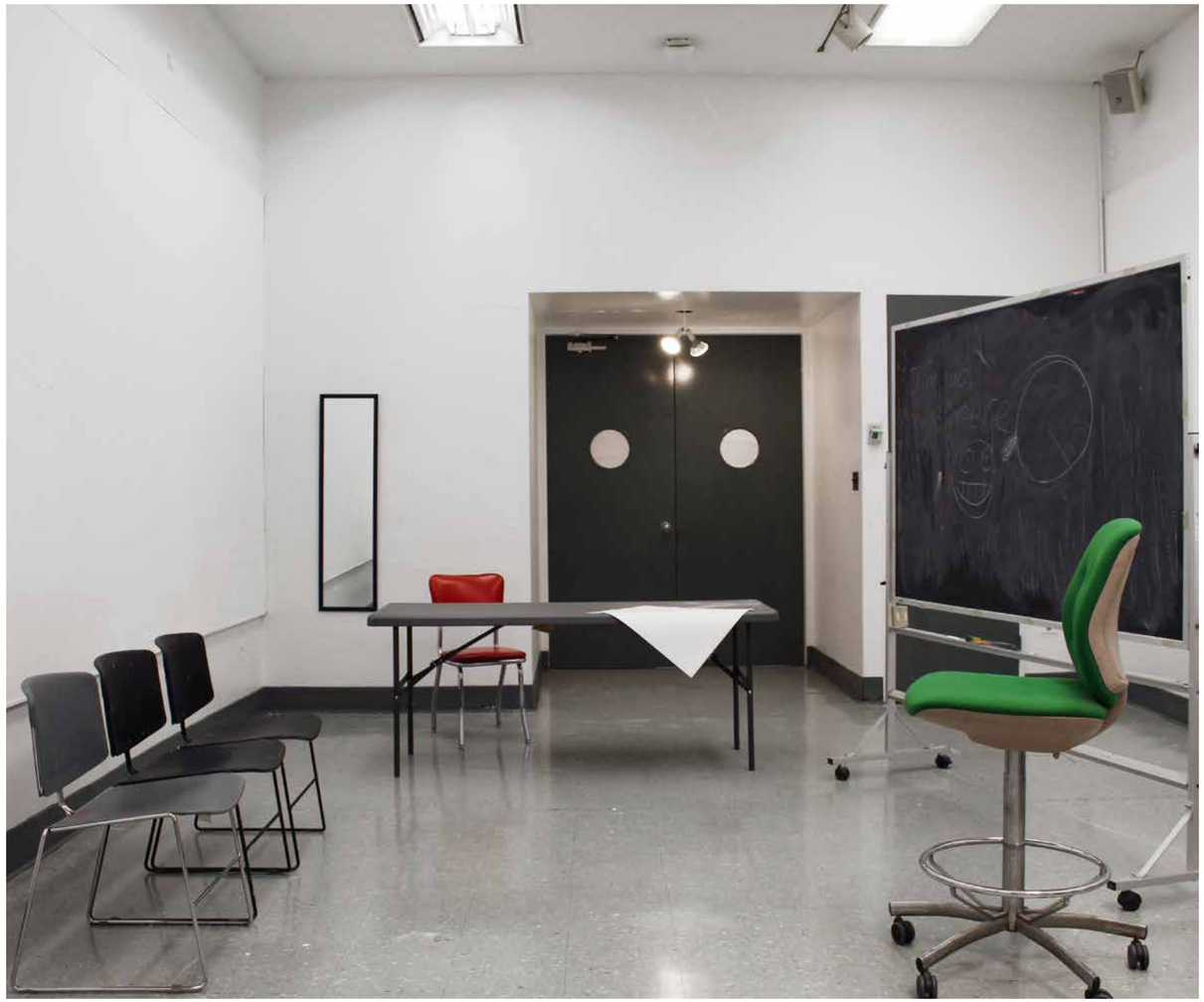
A horizontal mirror (reflection depth: 1)



Over 1000 photos overlayed on each other

A matte room

This is a collage of over 2600 photos. I used an analogue tool to manually calculate the shading value of a classroom in darkness, and then illuminated each spot accordingly, applying the mechanism of rendering back to reality. The rooms appears to be illuminated by a light on the ceiling, but actually by over 2600 independent light spots.
Light and shadow become fabrications.



The original room

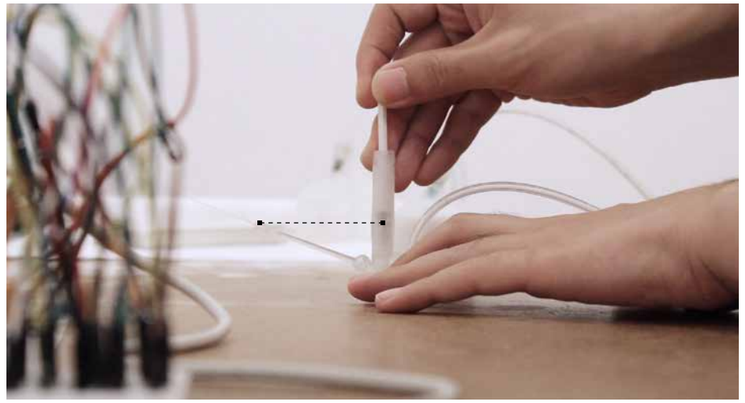
Illumination process

Over 2600 photos overlayed on each other

A slow renderer and an instant renderer

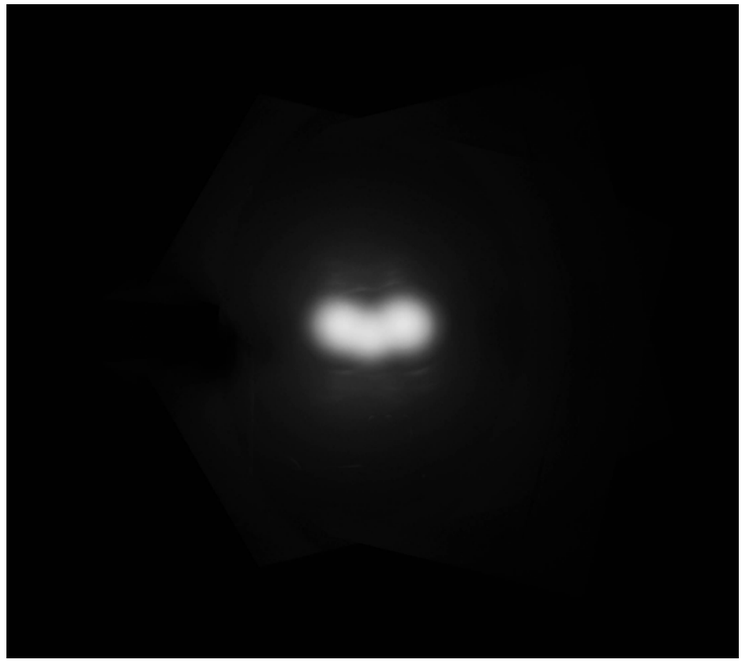
The slow renderer paints the physical environment the same as a digital model illuminated by a point light in a rendering. The analogue instrument embodies the Lambertian diffuse shading algorithm: in an extremely strenuous way, it illuminates a particular spot in space through measuring its shading value and putting on it proportionate white ink. In around 30 seconds, it illuminates a round area of a coin's size.

Absorb ink: level the piston with the tip of the probe

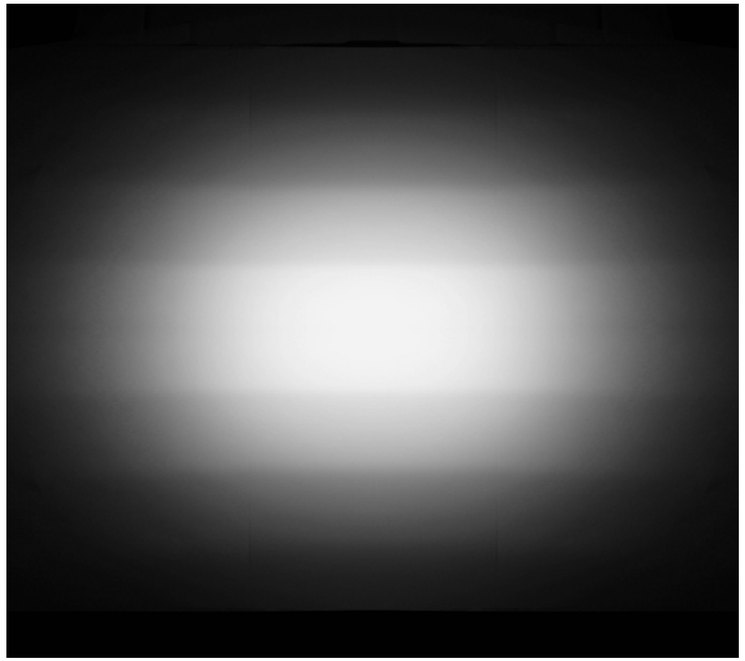


Eject ink

The instant renderer holds diodes and a lamp in specific spatial locations, so that the sewing machine would receive the same illumination as from a virtual point light in a rendering. The rendering process takes only an instant, the minute time delay between switching on the circuit and having the scene lit, while most labor is concealed in the measurement of light distributions and the luminosity simulation, only manifesting itself physically as wires and scafoldings that support the lighting.



Light distribution of three diodes



Light distribution of the lamp