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INSTRUCTIONS, SCORES, ALGORITHMS, PROCESSES, RECIPES, LAWS, OPERATIONS, TECHNIQUES, TITLES, TEACHINGS, PRESCRIPTIONS, MODUS OPERANDI, EQUATIONS, PROGRAMS, HAIKU, PHILOSOPHY, PARADOXES, REQUESTS, PUZZLES, PRINCIPLES, PROPOSALS FOR ACTIONS, METHODS, INVITATIONS TO PARTICIPATE, RESTRICTIONS, POETRY, PROVERBS, PURE CONCEPTS, TRAINING, COACHING, LESSONS, CONSTRAINTS, RESTRICTIONS, ABSTRACTIONS, RITUALS, MECHANISMS, CONDITIONS, PROTOCOLS...

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FOREWORD: PURPOSE OF THIS BOOK

This book should serve as an index of ideas related to and surrounding my own work at this point (April 2014). It should be a reflection on my own methodology and act as a reference for my work going forward. This book can be followed or reacted against, but for it to be successful, it must provoke a strong artistic or design response.

In this book, the index is primary. The selection of case studies in this book should serve as a reference to illuminate the ideas included in the index and vice versa, but neither should rely solely on the other. The index should be independent enough from the work which informed it that it function as a non-prescriptive guide for future projects, while also allowing for its ideas to be built upon and evolve naturally. Although the ideas in the index were crucial to the development of the presented projects, the projects should also stand alone without requiring the viewer to understand the theory behind them.

The purpose of this project is to use design as a tool for examining itself. By using an alternative design process for generating forms and relationships, I would like to heighten our awareness of, question, and spark discussion surrounding the commercial design process and the process of design in general.

This book is not the conclusion of this project. It is a snapshot of my current progress in developing this methodology. It is meant to be open-ended and explored in future work. This process should constantly be reevaluated, modified, and recontextualized to make it stronger and more applicable to many different media, ideas, and product categories.

ABSTRACT

The commercially-driven design process (research, ideation, prototyping, refinement) leads to familiar, non-discursive results and eliminates the opportunity for forms and ideas that are outside the realm of preconception. I am exploring how to use procedural systems and instructions to generate discursive images and forms, as an alternative to intuitive form making. My goal is for this methodology to yield surprising results that cannot be premeditated.

According to memetics, the design of ideas is the iterative evolution of the meme, a singular genetic unit of culture, processed by Darwin's evolutionary algorithm: variation, selection, imitation, repeat. In order to address human beings' severely limited capacity to imagine variation in form, caused by their inability to separate themselves from their prejudices and preconceptions, I am applying generative processes to the variation step of the memetic cycle with the goal of maximizing the breadth and volume of its products.

I will be developing a methodology for working with procedural systems and testing their effects on the production of images and objects through a series of case studies. A successful system should have the ability to produce objects, the meanings of which are in dialog with their perceived function and the system's input. After each case study, I will use the output of each experiment to reflect on and adjust the system.

The methodology I develop for working with procedural design should be a tool for my work, and ideally other designers' work, in the future. The outputs from these operations should act as non-prescriptive starting points for functional objects that can be interpreted, divided, and remixed into an infinite number of potential product types. Building this strategy for design is not an endpoint in itself, but an exploration into some of the potential avenues for working with procedural form generation.

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INDEX

Marcel Duchamp *Three Standard Stoppages*
1913-1914) The first example of chance-based
form-making in art.



3 STANDARD STOPPAGES

Marcel Duchamp's *3 Standard Stoppages* introduced the idea of chance operation in art. Duchamp wanted to define a new meter, a Duchampian meter, by dropping three, meter-long strings from one meter high, onto canvas to create lines which would then be cut into stencils and used in other works.¹

Duchamp used a process which he could not fully control to modify and redefine an existing concept. Nobody ever said a meter had to be straight.

See also: Chance Operations, *Sentences/Paragraphs on Conceptual Art*, Form Follows Concept, Inaccuracy, Indeterminacy, Instructions/Procedures

1. Temkin, Ann. "Marcel Duchamp. 3 Standard Stoppages (Paris 1913-14)." MoMA.org.

THE 4 FIELDS OF INDUSTRIAL DESIGN

Bruce and Stephanie Tharp of the design group Materious identified 4 fields of industrial design: Commercial, responsible, experimental, and discursive design (a.k.a. speculative or critical design).¹ Each of these categories is defined by a unique purpose. Commercial design is driven by profit, responsible design is meant to help people, experimental design is made to explore, and discursive design expresses ideas.²

Many design projects fall somewhere in between these four groups. My work tends to fall between experimental and discursive design. This project in particular uses instruction-based form-making to investigate and start discussion around the processes of design; it uses an experimental methodology for a discursive purpose.

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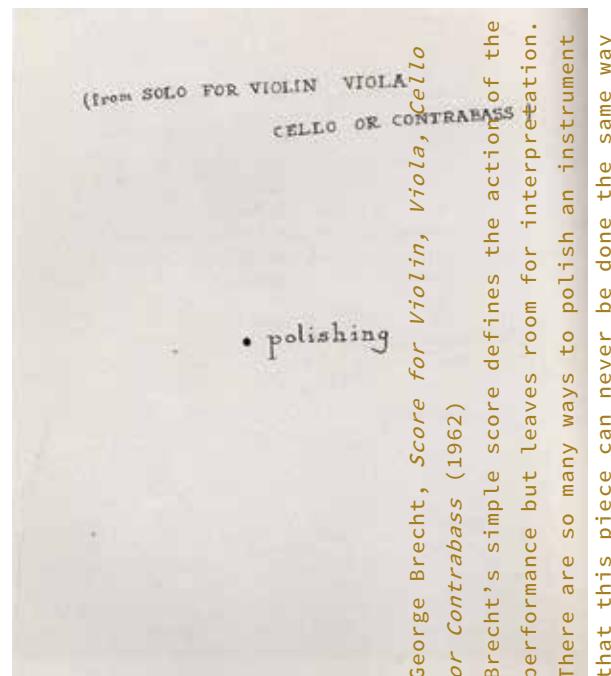
See also: Commercial Design, Experimental Design, Speculative/Discursive Design

1. Tharp, Bruce, and Stephanie Tharp. "The 4 Fields of Industrial Design: (No, not furniture, trans, consumer electronics, & toys), by Bruce M. Tharp and Stephanie M. Tharp." Core77.
2. Derringer, Jamie. "Friday Five with Materious - Design Milk." Design Milk.

A

AMBIGUITY/ INTERPRETATION

One of system-based or procedural design methods' advantages is its ability to maximize variation. Variation is caused by imitating something inaccurately, interpreting part of an instruction that is ambiguous, or by chance. Balancing prescription, simplicity, and ambiguity is always a challenge in both language-based and/or abstract sets of instructions. I have found that procedures that can produce different results each time they are executed, are powerful tools for creating variation in forms because of their room for interpretation.



My strategies for prescribing action while leaving room for interpretation have been writing instructions in plain language and generating abstract scores for creating work.¹

These programs and processes should:

1. Be as simple as possible
2. Be repeatable
3. Contain parts that interact in complex ways
4. Generate forms and structures that cannot be predicted by knowing the procedure ahead of time

See also: Inaccuracy, Infinity, Instructions/Procedures, Emergence

1. Reas, Casey, Chandler McWilliams, and Jeroen Barendse. *Form+Code in Design, Art, and Architecture*. New York: Princeton Architectural Press, 2010.

APPROPRIATION

Any system or set of instructions requires an input or starting point on which to perform its operation. This creates both a problem and opportunity for choosing the content of these raw materials. It is the job of the designer to choose what to manipulate, how the starting point and process relate to each other, and to the function of the resulting

artifact(s). Similar to Duchamp's definition of the readymade, procedural design is partially an act of appropriating.

According to Sol Lewitt's *Paragraphs on Conceptual Art* (1967),¹ in order to highlight the systems which produce form, one must pick a neutral subject on which to apply it or risk letting the complexity of the input cloud the meaning of the system. Although this approach makes sense in the context of conceptual art's value of its idea and process over its physical manifestation, starting with a neutral subject is only one of many opportunities for using procedures to manipulate form. In my work, I have found it useful to sample or appropriate a conceptually relevant subject as a starting point that then becomes the basis for meaning in the final work. Appropriating and then remixing these subjects creates an opportunity for artifacts that are in dialogue with their input.

See also: *Sentences/Paragraphs on Conceptual Art*, The Assisted Readymade, Remix,

1. LeWitt, Sol. "Paragraphs on Conceptual Art." *Artforum International*, June 1967.

THE ASSISTED READYMADe

Readymade: "An ordinary object elevated to the dignity of a work of art by the mere choice of an artist."¹

-Marcel Duchamp

The readymade is a source. It is any concept, or artifact, not made by the artist or designer, that is then appropriated to become an art or design object. Marcel Duchamp initiated the idea of the readymade when he set out to reevaluate the assumptions about the established definition of art. Duchamp proposed that art could be reduced to the act of choosing or declaring an object art, not necessarily linked to craft. He then built off of this idea to develop the "Assisted Readymade" which could be any found object, modified to become a work of art. In my procedural design process, remixing the readymade produces the Assisted Readymade.

See also: Appropriation, Emergence, Remix

1. Breton, André and Paul Eluard. *Abridged Dictionary of Surrealism*. José Corti Editions, 1938.



Marcel Duchamp, *Bicycle Wheel* (1913)
Duchamp's first "Assisted Readymade" sculpture.

C

B

John Cage, Series Score for Déreau (1982)
An example of I-Ching generated values used in
pocketing plates for Cage's Déreau prints.



CHANCE OPERATIONS

A chance operation is any action whose result can't be fully controlled. Including chance operations within an instruction set can be a useful technique for introducing variation by removing one's subjectivity and preconception when it comes to making aesthetic decisions.¹

Chance and unintentionality in art was first introduced by Marcel Duchamp in his *3 Standard Stoppages*² (and later explored more deeply by John Cage).

See Also: Emergence, Indeterminacy, Infinity, Instructions/Procedures, 3 Standard Stoppages

1. Brown, Kathan. *John Cage: Visual Art : To Sober and Quiet the Mind*. Crown Point Press, 2000.

2. Temkin, Ann. "Marcel Duchamp. 3 Standard Stoppages (Paris 1913-14)." MoMA.org.

COMMERCIAL DESIGN/ DESIGN THINKING

At the beginning of this project, I saw an opportunity for design techniques that operated outside the realm of the “commercial” design process, also or “design thinking.” I felt that the process of ethnographic research, sketching (ideation), prototyping, and refinement¹ was a disingenuous technique used to market a designer’s process to clients as a formula for innovation. Although this prescriptive set of steps may work for some, I felt that it only lead to a small, predictable subset of forms and images and an even smaller set of possible relationships that could be developed with those artifacts.² I was more interested in a process which constantly reevaluates itself.

Coming from a background in glass, with a strong interest in art history, I knew the breadth of valid creative processes within the fine arts and the infinite variation in form and meaning that these workflows could produce. Although the overwhelming drive to homogenize and market design process/thinking in recent years has expanded the reach and popular acceptance of the discipline, it has also limited the way we, as designers, think about the interactions between process, form, and content.³ I felt it was time to reevaluate and expand the relationship between these three

elements through the process of procedural design.

See Also: The 4 Fields of Industrial Design, Experimental design

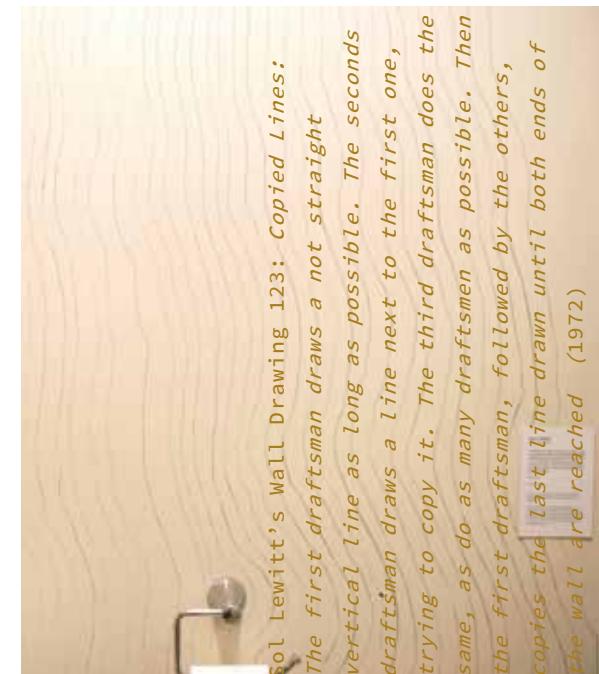
1. IDEO. *Human Centered Design Toolkit*. 2009
2. Antonelli, Paola. *Talk To Me: Design and the Communication Between People and Objects*. New York, N.Y.: Museum of Modern Art, 2011.
3. Stillman, Daniel. "Design Process Kills Creativity / Design Process Creates Creativity." Core77. 2012

D

DEMOCRATIC ART

Conceptual art was a movement which prioritized the development of ideas and systems over the physical manifestation of a work. It was developed as a more democratic means of production in reaction to the increasing commercialism of the art market. By identifying the idea which lead to a work’s execution as the work itself, a conceptual artwork could be transferred to, and therefore owned by anyone.¹

Similarly, the use of systems and scores as a design strategy is a reaction against the trend of prioritizing commercial viability of



Sol Lewitt's Wall Drawing 123: Copied Lines:
The first draftsman draws a not straight vertical line as long as possible. The second draftsman draws a line next to the first one, trying to copy it. The third draftsman does the same, as do as many draftsmen as possible. Then the first draftsman, followed by the others, copies the last line drawn until both ends of the wall are reached (1972)

Executed as part of John Gallery, an exhibition of conceptual art in my bathroom (2014)

identifying problems or financial opportunities. A conceptual process' value is not linked to a specific deliverable but instead to a method of structuring and exploring ideas that leads to infinite and surprising design results.

See also: Infinity, Instructions/Procedures, Sentences/Paragraphs on Conceptual Art

1. LeWitt, Sol. "Paragraphs on Conceptual Art." *Artforum International*, June 1967.

DESTRUCTION/CREATION

Destruction and creation are one in the same. When you destroy something, you also inevitably create something, even if that something is chaos. It is always a challenge to balance creation and destruction, especially in a procedural design process. Too much destruction leads to chaos and too much creation feels forced.

See also: *Erased de Kooning*, Emergence, Entropy

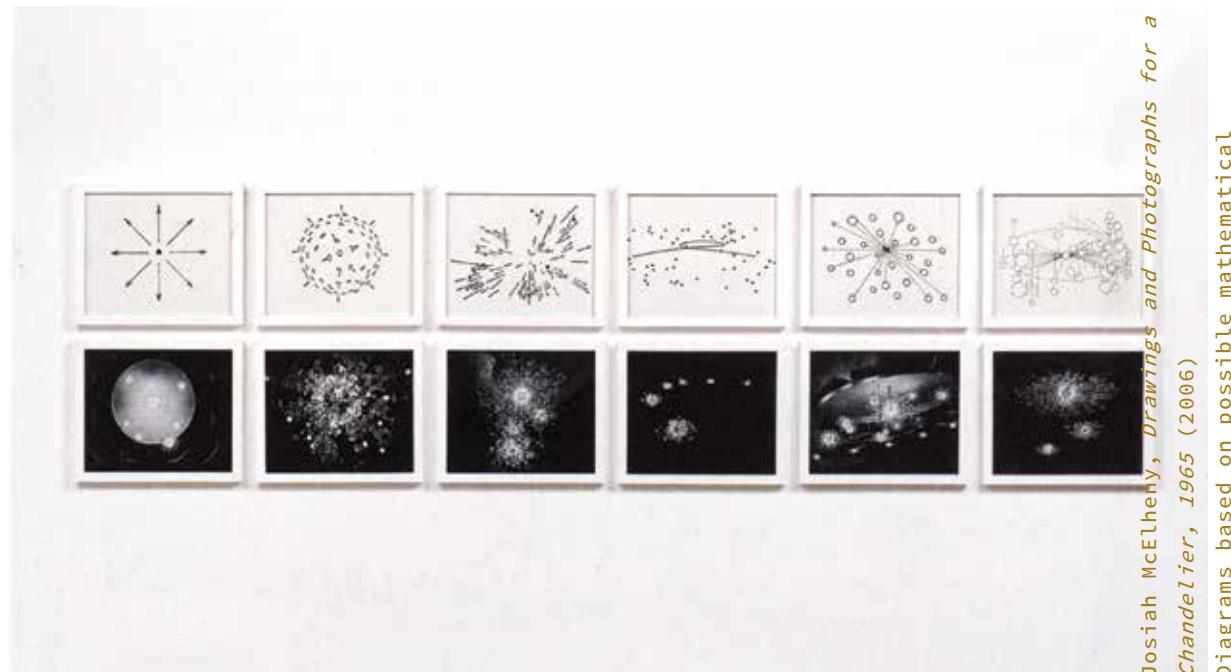
E

EMERGENCE

In science and art, emergence is usually known as the development of complex patterns and systems from

simple interactions. In my work, on the axis from order to disorder, I have found that there is a moment just before a system of simple operations upon a form breaks down into total chaos. This balancing point is where patterns and meanings seem to give way to new organizational structures and associations. Modifying or recombining preexisting forms can also reach a point where these forms completely lose recognizability and connection to their original context. Although I haven't found this point of total entropy to be particularly productive, at the point just before it, there are an infinite number of surprising possibilities for new meanings and formal languages to emerge; the area where Rauschenberg's *Erased de Kooning* lives.

These emerged forms and structures have some relationship to their original formal grammar and context, which opens an opportunity for dialogue between the two,¹ but they also stand on their own. The emerged object/structure's relationship to the source offers added meaning, but doesn't seem to be required for the viewer to find an entry point into the work. The knowledge of the emerged form's original context adds an extra layer to the aura surrounding the artifact for those who are curious enough to look for it.



See also: Entropy, *Erased de Kooning*, Indeterminacy, Infinity, Process Over Product, Myth

1. Taylor, Mark C., and Mark Tansey. *The Picture In Question Mark Tansey and the Ends of Representation*. Chicago: University of Chicago Press, 1999.

ENTROPY

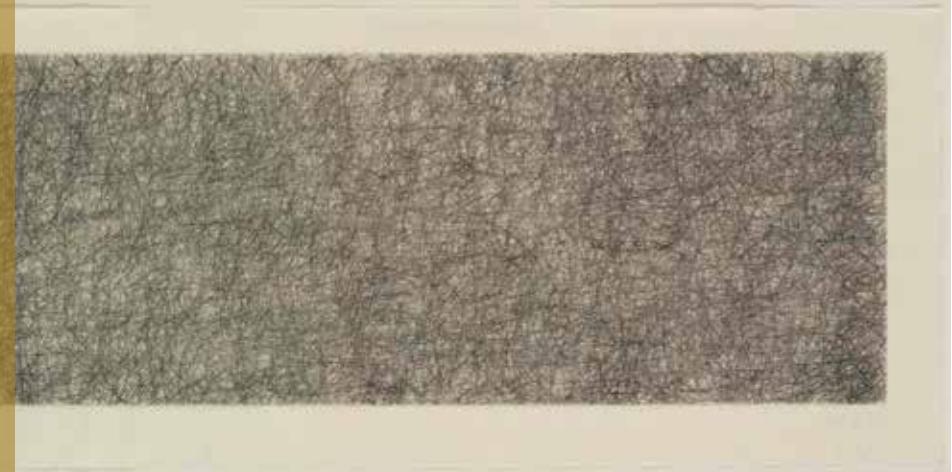
Entropy is the tendency toward disorder and randomness in a system; it is the force that opposes structure and organization. Design often opposes entropy above all else in order to create clarity and understandability in artifacts. From my experience in the world of design, design itself has become ordered, systematized, and homogenized into a process that is

not just consistently repeatable, but predictable. Using entropy as a tool can be a strategy for reintroducing unpredictability, delight and awkwardness back into the products of everyday life.

Entropy can be introduced through chance operations, inaccurate execution of a process, or interpretation. It can help us create forms that are meaningful but not contrived. It can also be applied in a controlled manner to intentionally chosen decision points within the form-making process: these are decisions like, position within a page, the size of an element, the number of elements, which elements to

Josiah McElheny, *Drawings and Photographs for a Chandelier*, 1965 (2006)
Diagrams based on possible mathematical structures for the universe after the big bang.

John Cage, *Where R=Ryoanji: R3* (1983)
 Print made by tracing stones onto a plate in chance determined locations 3375 times. After tracing enough times, the original shape of the stone disappears and new structures emerge.



use, or any other “creative” decision. On the other hand, there is also a danger for entropy to take over and lead to chaos. The ideal balance between entropy and order seems to be the point just before total chaos, where unpredictability is at its highest while still retaining some of the formal grammar, structure, and context of the original. This is the point of emergence, where new structures, patterns, and meanings begin to take shape.

See also: Chance Operations, Destructions/Creation, Formal Grammar, Emergence, Inaccuracy Indeterminacy, Instructions/Procedures

ERASED DE KOONING (1953)

Attempting to introduce drawing into his works with no image, Rauschenberg determined that the only way to use drawing as part of his all white painting was through the act of erasure. One day, he went to Willem de Kooning’s studio and told him about his idea. Although he didn’t like it, de Kooning understood the concept, and decided he needed to give Rauschenberg a drawing that he would really miss, one that would be extremely difficult to erase physically and emotionally.¹

Robert Rauschenberg’s *Erasèd de Kooning* is a perfect example of work

which, beginning as one form, is then altered to a point where its formal language is almost completely destroyed to create new meaning. Rauschenberg erasing de Kooning’s work is an act of destruction on the original, but it is the same operation which results in the creation of *Erasèd de Kooning*. Erasing de Kooning’s drawing into a few faint smudges brought that object to its point of maximum entropy before it lost its original context completely. Only the lore surrounding the object, the title, which is intentionally framed with the work, and the few, nearly imperceptible traces of the source, help the almost formless object to hold onto its original circumstances strongly enough to recontextualize it into its near mythic status. Nearly obliterating de Kooning’s work without reducing it to entropic static allowed Rauschenberg to imbue the object with the context of its creation (and grueling destruction) to build an aura for an object, with almost no perceptible formal qualities, that is deeper than the aura of the original.

See also: Appropriation, Entropy, Myth, Process Over Product

1. SFMOMA “Robert Rauschenberg’s Erased de Kooning Drawing.” San Francisco Museum of Modern Art. 1998



Robert Rauschenberg, *Erasèd de Kooning* (1953)
 The original drawing took one month to erase

THE EVOLUTIONARY ALGORITHM

The process by which organisms evolve was first described by Charles Darwin in his book *On The Origin of Species: by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life* (1859). Darwin proposed that groups of organisms evolve over many generations through natural selection. If organisms passed on some of their traits to their offspring (imitation), not all offspring were the same (variation), and only some of those children survive (selection), then the ones

Richard Serra casting lead into the corner of the Whitney Museum (*Cast Lead*, 1969) is an example of form driven completely by process.



that do will be better suited to their environment than their parents.¹

Although Darwin did not think of it this way, the process he described was essentially a procedure for designing organisms.² Darwin's evolutionary algorithm has since been applied to fields other than biology, the most relevant to my work being memetics and computer science.

See also: Memetics, Instructions/Procedures, The Unique Copy

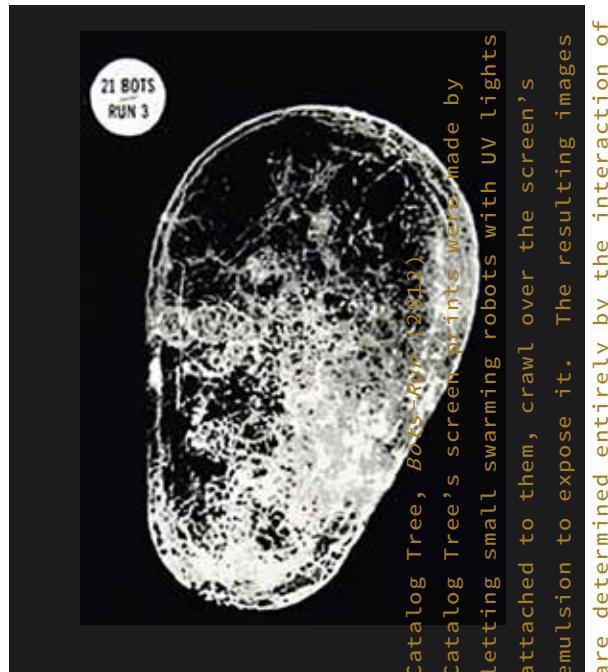
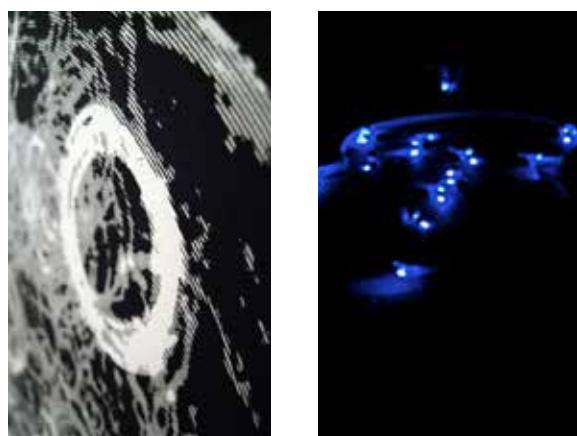
1. Darwin, Charles, and Gillian Beer. *The Origin of Species*. Oxford: Oxford University Press, 1859.

2. Blackmore, Susan. "Memes and Temes." Lecture, TED, February 1, 2008.

EXPERIMENTAL DESIGN

"Experimental Design represents a fairly narrow swath within the broad field of design, and its primary intention is exploration, experimentation, and discovery. Experimental Design is defined perhaps more by its process than its outcome. In its purest form it is not driven by an overly specific end-goal of application, but instead is motivated by a curiosity."

-Bruce and Stephanie Tharp, *The 4 Fields of Industrial Design* (2009)¹



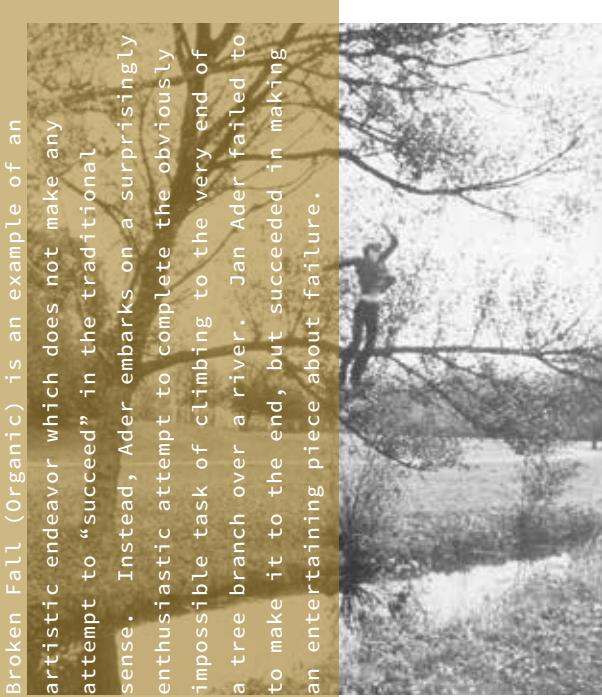
Catalog Tree, *Bots-RnR* (2012)
Catalog Tree's screen prints were made by letting small swarming robots with UV lights attached to them, crawl over the screen's emulsion to expose it. The resulting images are determined entirely by the interaction of the robots.

Experimental design, is related to Fluxus, process, and conceptual art beginning in the mid 1960s with artists such as Sol LeWitt, John Cage, Eva Hesse and Richard Serra (left). Artists who practiced process-based art usually created form via material or conceptual exploration as opposed to fulfilling a predetermined aesthetic. Only recently has this process-oriented workflow spilled over into the practice of design.

See also: The 4 Fields of Industrial Design, Sentences/Paragraphs on Conceptual Art, Commercial Design/Design Thinking

1. Tharp, Bruce, and Stephanie Tharp. "The 4 Fields of Industrial Design." Core77. 2009

Bas Jan Ader, *Broken Fall (Organic)* (1971)



Broken Fall (Organic) is an example of an artistic endeavor which does not make any attempt to “succeed” in the traditional sense. Instead, Ader embarks on a surprisingly enthusiastic attempt to complete the obviously impossible task of climbing to the very end of a tree branch over a river. Jan Ader failed to make it to the end, but succeeded in making an entertaining piece about failure.

output, it is more important to critique the process itself. Success and failure is not measured by reaching a prescribed deliverable or target. Instead, a successful system should produce the unpredictable, slightly awkward, surprising forms that we, as designers, could never consciously think of.¹

See also: Indeterminacy, Instructions/Procedures

1. Maurer, Luna. “Luna Maurer.” Lecture, Seeing Orange: Dutch Design at CCA from CCA, San Francisco, April 9, 2014.

FAILURE/SUCCESS

Designing by procedure has forced me to reevaluate the meanings and connotations of failure and success. In procedural design, there are no mistakes or failures so long as you follow the rules of a given process. A successful output is only one that has not failed to meet the parameters of the instructions. Rather than evaluating the success of a process’s

F

FORM FOLLOWS CONCEPT

“Form follows concept” is based on the modernist ideal, “form follows function,” but expands the idea to say that forms should be based on the concepts which bring them into being. The dictionary definition of “function” does not specify utility. Limiting “function” to “utility” eventually caused “form follows function” to be updated to the Droog Design influenced ethos, “form follows concept.” In my interpretation, this departure from the modernist tradition means that products are no longer required to be primarily utilitarian, and can be designed to communicate ideas, or intentionally

to not function well in service of a deeper interaction or idea.¹ Designs which abide by form follows concept seem to imply that they prioritize concept over utility.

In my experience, form follows function and form follows concept separately are misleading. Both form and concept follow each other. One cannot exist without the second. Form communicates concept but concept simultaneously determines the best form to express itself.

See also: Myth, Process Over Product, Speculative/Critical/Discursive Design

1. Ramakers, Renny. *Less + More: Droog Design in Context*. Rotterdam: 010 Publishers, 2002.

Tobias Wong, *Aalto Doorstop* (2003)
A perfect example of form follows concept is Tobias Wong's piece based off Alvar Aalto's Savoy Vase. When Wong set out to design an object about deconstructing history and building off of it to evolve culture, rather than try to create a new form to convey that idea he chose to cast concrete into a Savoy Vase and shatter it to de-mold the concrete.



G

FORMAL GRAMMAR

Formal grammar is the structure of visual language used to communicate in forms and images. Like language, formal grammar is not tied to objective meaning. Formal grammar can be modified and remixed to create an infinite number of constantly developing systems of visual communication. In my procedural design experiments, I have been attempting to methodically deconstruct and reconstruct formal grammars to reach the point of emergence.

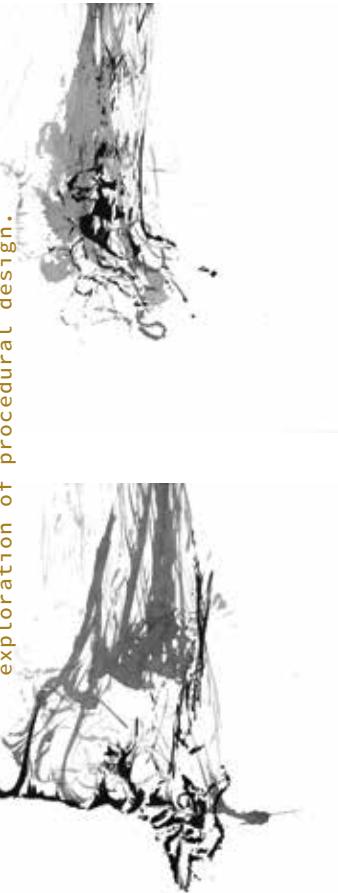
See also: Infinity, Instructions/Procedures, Emergence, Entropy

H

I

From left to right, top to bottom,
Christopher Yamane, *String Drops* #62, #10, &
#20 (2012)

These process prints are made by dipping string
into three ink densities, dropping them on
paper, and quickly pulling them off. These
drawings were a conceptual precursor to my



INACCURACY

Inaccuracy in design usually has a negative connotation, but I have found it to be an invaluable tool in the generation of forms and ideas. Having complete control over the outcome of a design can be helpful, but it can consequently limit the way we, as designers, think and the forms we produce.¹ Using inaccuracy intentionally can be a tool for

INDETERMINACY

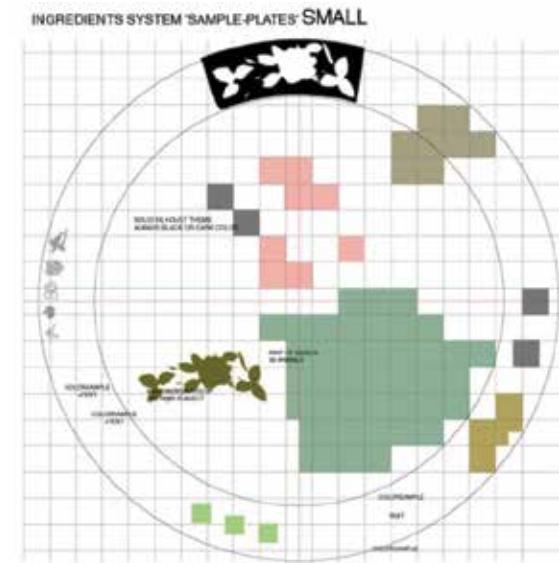
Indeterminacy is the ability for a procedure to be interpreted in many different ways.¹ In my work,

introducing unexpected variation to the design process that can increase the likelihood of what artists sometimes call the happy accident.

When writing procedures, ambiguous language, chance operations, and non-specific notation can be used strategically to produce intentional amounts of inaccuracy and, therefore, indeterminate, surprising results.

See also: Indeterminacy, Infinity, Process Over Product

1. Brown, Kathan. *John Cage: Visual Art : To Sober and Quiet the Mind*. San Francisco, CA: Crown Point Press, 2000.



Hella Jongerius, *Nymphenburg Sketches – Flowers and Game* (2004), Template and example outcome
Jongerius uses indeterminate templates to turn the craftsman into a collaborator.

purposely writing instructions that aren't precisely specified is a way of reaching indeterminacy and producing, many different, often surprising, results based on one process. A composition, its performance, or both can be indeterminate if chance operations or ambiguity are involved in their production.² I use indeterminacy to develop a wide variety of forms surrounding a concept rather than thinking of one "solution" to a specified problem.

Indeterminacy in a process can also make its performer a collaborator, and can be a strategy for the designer to use forces outside themselves to influence the work in ways they would

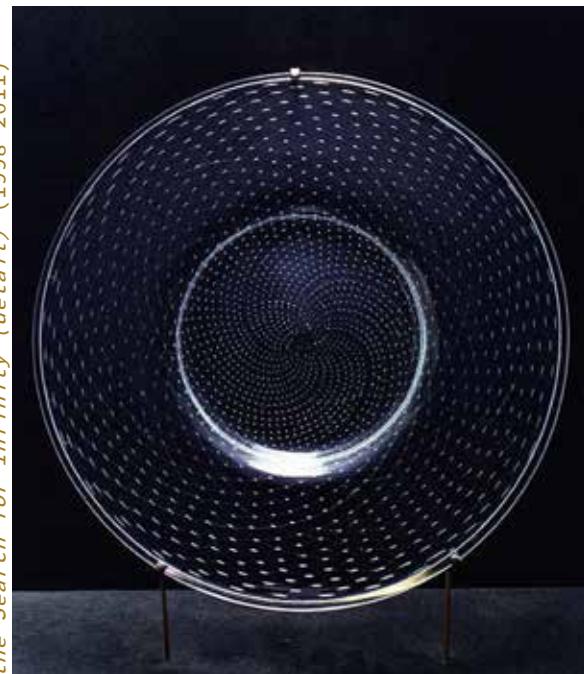
never think of on their own. Because I am not an intuitive designer, my own conscious influence on the formal qualities of a design can easily seem artificial. Giving up some control over compositional choices, in favor of chance, seems to reduce the tendency for my formal decisions to feel contrived.

See also: Ambiguity/Interpretation, Chance Operations, Emergence, Inaccuracy, Instructions/Procedures, Process Over Product

1. Pritchett, James. *The Music of John Cage*. Cambridge, England: Cambridge University Press, 1993.

2. Simms, Bryan R. *Music of the Twentieth Century: Style and Structure*. New York: Schirmer Books, 1986.

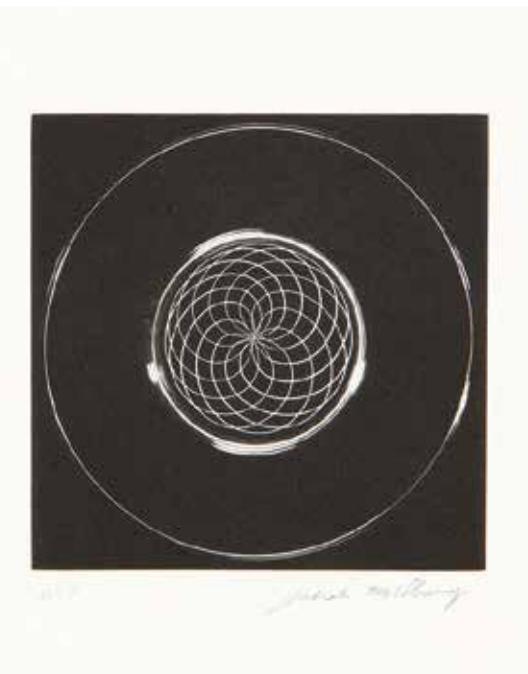
Josiah McElheny, *Collection of Glass Concerning the Search for Infinity (detail)* (1998-2011)



INFINITY

In part, the goal of using a procedural design method is to attempt to reach infinity in variation, interpretation, and volume. Even though physically reaching infinity, or even conceptually understanding its enormity, is impossible, the attempt is still a worthwhile endeavor. The genuine attempt to reach infinity produces such high variation in form in such volume, that the art and design applications for this methodology in my future work are endless in variety of scales, mediums, forms, functions, and ideas.

See also: Chance Operations, Indeterminacy, Inaccuracy, Instructions/Procedures, Process Over Product



INSTRUCTIONS / PROCEDURES

One way to circumvent the limits of the rational mind is to employ strategies similar to conceptual artists like Sol LeWitt or Fluxus artists like John Cage. The use of systems, instructions, or algorithms to generate the unexpected is one way to change the designer's role from directly producing form to parameterizing its structure instead. These procedures are meant to serve as compositional guidelines, just as a score provides the structure for a musical composition.



Instructions can range anywhere from language-based sets of actions such as a recipe in a cookbook, to a computer algorithm, to a musical score or abstract representation of another medium. Differences in outcomes are produced by inaccurate execution, interpretation, embedded chance operations, or all three.

A successful set of instructions balances specificity with ambiguity, guiding its performer while leaving room for interpretation. No cause of mutation is preferable to the other, but merely different strategies for producing variation. A successful system should be able to be applied in many instances, yielding unique

outcomes even if the processes which produce them are identical.

In part, developing a method of systems-based form generation for my design work is a way to address my own limitations, but hopefully it will provide insight for other designers who wish to develop alternatives to intuitive form making. The goal of using a procedural method to modify/remix existing content is to develop objects that create dialog between their perceived functions and its source. Both my procedural form-making method and its outputs are intended to be used as tools. The procedural design method is a tool for generating form, while the forms



Josiah McElheny, *Collection of Glass Concerning the Search for Infinity (1998-2011)*
McElheny explores the conceptual motivation for the traditional Italian glass technique, Reticello, and its relationship to his interest in the infinite.

Sol Lewitt, *Black Circles, Red Grid, Yellow Arcs from Four Corners* (1972)



are meant to act as starting points
for functional objects.

See also: 3 Standard Stoppages, The 4 Fields of Industrial Design, Ambiguity/Interpretation, Appropriation, Assisted Readymade, Chance Operations, Commercial Design/Design Thinking, Democratic Art, Destruction/Creations, Emergence, Entropy, *Erased de Kooning*, Evolutionary Algorithm, Experimental Design, Failure/Success, Form Follows Concept, Formal Grammar, Inaccuracy, Indeterminacy, Infinity, Instructions/Procedures, Memetics, Myth, Neutral, Process Over Product, Remix, *Sentences/Paragraphs on Conceptual Art*, Sherrie Levine, Statement (1982), Speculative/Critical/Discursive Design, The Unique Copy

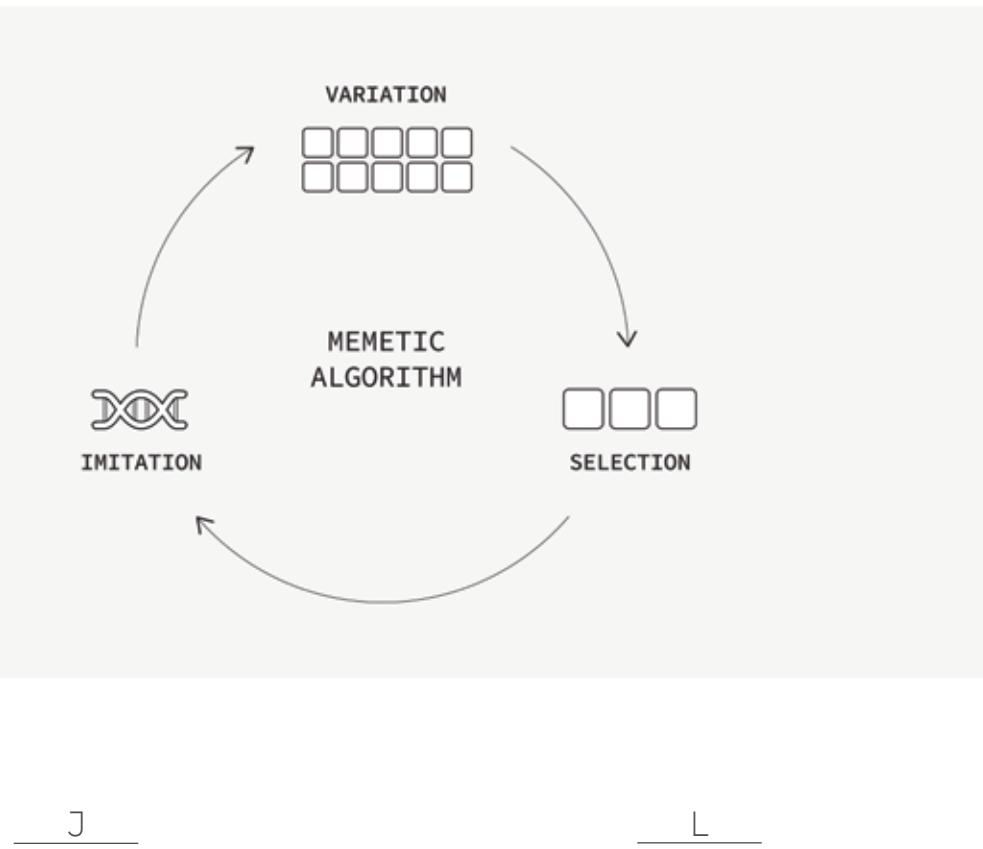
Instructions can be:

- Instructions
- Scores
- Algorithms
- Processes
- Recipes
- Laws
- Operations
- Techniques
- Titles
- Teachings
- Prescriptions
- Modus operandi
- Equations
- Programs
- Haiku
- Philosophy
- Paradoxes
- Requests
- Puzzles
- Principles
- Proposals for actions
- Methods
- Invitations to participate
- Restrictions
- Poetry
- Proverbs
- Pure concepts
- Training
- Coaching
- Lessons
- Constraints

Restrictions
Abstractions
Rituals
Mechanisms
Conditions
Protocols
...

-Modified from Hendricks, Fluxus Scores and Instructions

Diagram of the memetic process based on universal Darwinism. Procedural design focusses on variation by using instructions to generate breadth and volume of form.



MEMETICS

In the field of Memetics, ideas are not created, but merely processed and designed by Darwin's evolutionary algorithm.¹ Because humans are inevitably memetic creatures,² over time, we have unconsciously evolved a design process that is close to imitation, variation, and selection. The commercial design process of research, ideation, prototyping, and

refinement is essentially a memetic process even if it is not articulated that way. Designers are taught to perform ethnographic research to get ideas, sketch as many possible solutions as possible, select through them to find the most viable to prototype, and then pick the best of the prototypes to refine into the final product.

Of all three steps in the memetic process, the one we are by far the worst at is variation (or ideation). As humans, we imitate each other and the things around us so well that we often do it unconsciously. We all have a strong, but different, opinions on what is good and bad. The thing none of us can do is come up with forms that are uninfluenced by what we've seen before and by our prejudices of good versus bad.³ This limitation is the problem which procedural design attempts to address.

See also: Commercial Design/Design Thinking, Instructions/Procedures, Emergence, Entropy

1. Blackmore, Susan J. *The Meme Machine*. Oxford, England: Oxford University Press, 1999.

2. Dennett, Dan. "Dangerous Memes." Lecture, TED, February 1, 2002.

3. Blackmore, Susan. "Memes and Temes." Lecture, TED, February 1, 2008.

kris martin, 100 years (2004)
An extreme example, Kris Martin's 100 Years, is nearly 100% myth. Without knowing the object's story, it appears to be just a small golden ball. Supposedly, the gold sphere contains a bomb and a timer set to explode and destroy itself in 2104.



MYTH

All works of art and design have stories that surround them. Most of the time, these myths are external to the physical stuff that makes the work, but are inevitably part of the context which helps create the work's meaning. After learning the myth of an object, the artifact becomes totally inseparable from the narrative that defines its aura.

Myth, though not always physically part of a work of art or design, and not necessarily provable, can still be used to help build meaning.

See also: Appropriation, Erased De Kooning, Instructions/Procedures, Remix

N

NEUTRAL

Objects, forms, and images filled with cultural and historical context are abundant. In fact, locating objects that are not loaded with any cultural baggage or meaning is nearly impossible. The most “neutral” forms that I have identified so far (cube, line, and sphere) seem to work well for case studies that test or debug form generation systems because the objects do not distract from understanding the system’s procedures.¹

basic forms only disrupts the unity of the whole. Using a simple form repeatedly narrows the field of the work and concentrates the intensity to the arrangement of the form. This arrangement becomes the end while the form becomes the means.”

-Sol LeWitt, *Paragraphs on Conceptual Art* (1967)

I like to use neutral forms as tools for exploration, but ultimately, my goal is to move beyond them. To me, the most interesting potential of procedural design is in exploring the design-space where processes and their inputs, both chosen for their cultural context, can work together to create new discursive forms.

See also: Appropriation, Emergence, Paragraphs/Sentences on Conceptual Art

1. LeWitt, Sol. “Paragraphs on Conceptual Art.” *Artforum International*, June 1967.

“When an artist uses a multiple modular method he usually chooses a simple and readily available form. The form itself is of very limited importance; it becomes the grammar for the total work. In fact, it is best that the basic unit be deliberately uninteresting so that it may more easily become an intrinsic part of the entire work. Using complex

O

P

Q

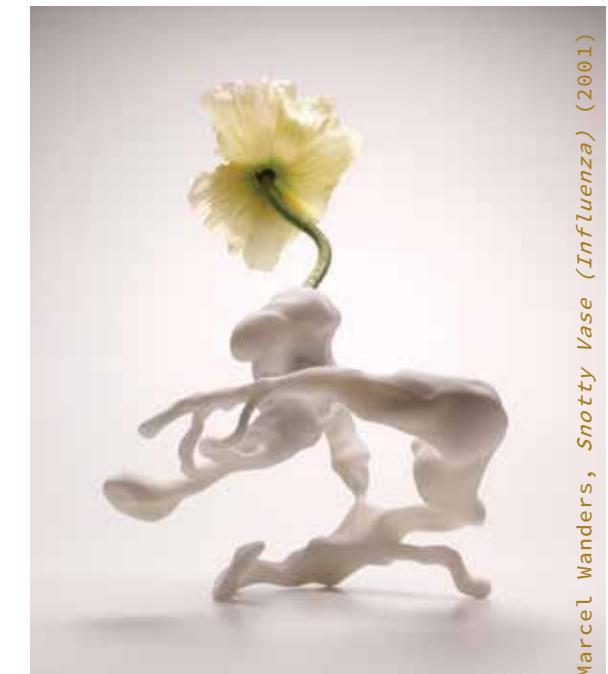
PROCESS OVER PRODUCT

In 1993, Dutch product designer Gijs Bakker and design historian Renny Ramakers founded Droog Design based on the premise of curating products made with minimal means and maximal concept.¹ The products curated, and later developed, by Droog taught me that the artifacts produced by industrial design techniques could be imbued with meaning through process and materials but, like sculpture, and did not have to limit themselves to pure functionality.²

See also: Destruction/Creation, Experimental Design, Inaccuracy, Indeterminacy, Infinity, Instructions/Procedures

1. Ramakers, Renny. *Less + More: Droog Design in Context*. Rotterdam: 010 Publishers, 2002.

2. Moors, Anneke, and Aaron Betsky. *Simply Droog: 10 + 3 Years of Creating Innovation and Discussion*. 2nd ed. Amsterdam: Droog, 2006.



Marcel Wanders, *Snotty Vase (Influenza)* (2001)
Droog member Marcel Wanders 3D scanned sneezes
and 3D printed the resulting forms.

R

REMIX

Remix is the act of appropriating, recombining, and manipulating past work to develop new work. Remix incorporates the original to create something that at once celebrates the original but also recontextualizes it to create new meaning.¹ Remix is usually associated with collage in music but can also apply to design and all artistic disciplines. For

designers, remix can be used to explore the relationship between the user's memories, cultural history, the remixed artifact, and it's input from a different perspective.² Remix requires the designer and the viewer to reexamine the input more deeply than if they were observationally studying the original.

See also: Appropriation, Assisted Readymade, Emergence, Entropy, Instructions/Procedures, Memetics

1. Foster, Hal, and Fredric Jameson. "Postmodernism and Consumer Society." in *The Anti-Aesthetic: Essays on Postmodern Culture*. Port Townsend, Wash: Bay Press, 1983. 127-144.

2. RiP: A Remix Manifesto. Film. Directed by Brett Gaylor. Montreal: National Film Board of Canada, 2008.

S

SENTENCES/PARAGRAPHS ON CONCEPTUAL ART

Sol LeWitt's *Paragraphs on Conceptual Art*, first published in Art Forum in June, 1967, describes his prioritization of the idea of a work over its physical manifestation.¹

"In conceptual art, the idea or concept is the most important aspect of the work...The idea becomes the machine that makes the art"

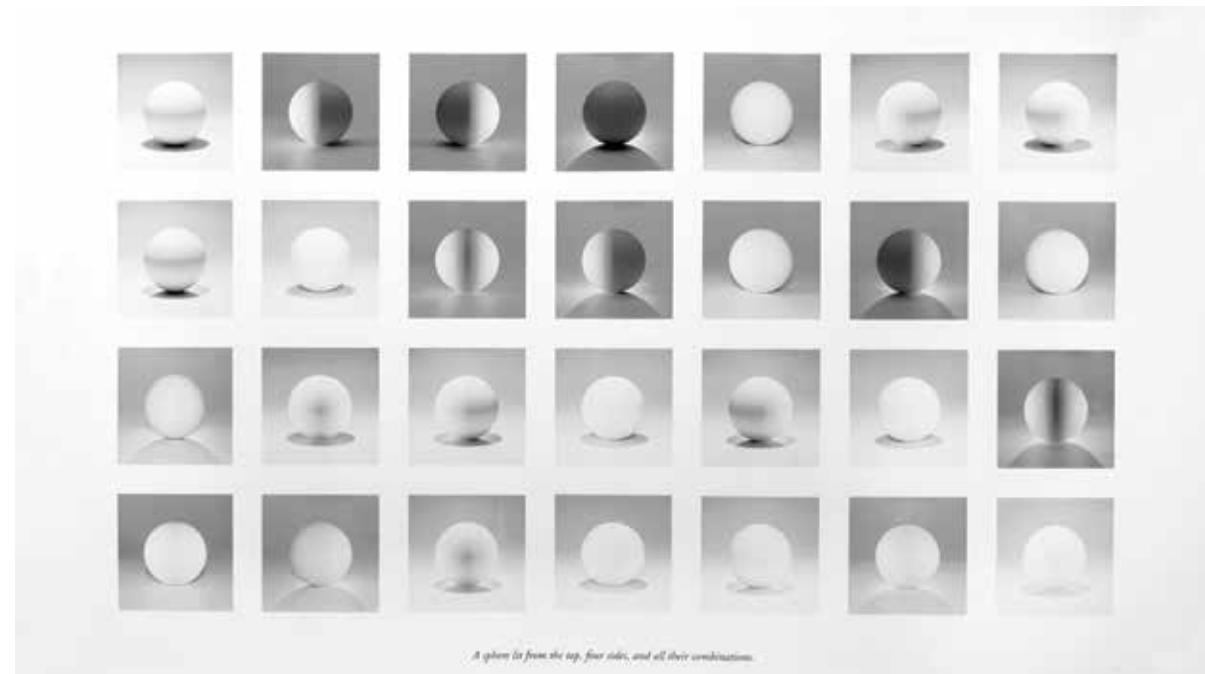
- Sol LeWitt

The process of designing forms and images via instructions or procedure is design's analog to conceptual art. Much like in LeWitt's practice, the execution of the work is reproducible and becomes secondary to the mechanism which produced it. LeWitt used his ideas (usually transferred as sets of instructions), to direct others to execute his work with the hope of eliminating the "arbitrary, the capricious, and the subjective as much as possible." In a conceptual design method, decisions should be made before execution and should run their course until the execution of the work is finished.² Allowing the procedure to complete itself with minimal interference can lead to surprising results that aren't mediated by the prejudice of the artist.

See also: Commercial Design, Democratic Art, Emergence, Indeterminacy, Infinite, Instructions/Procedures, Neutral, Process Over Product, Speculative/Critical/Discursive Design

1. LeWitt, Sol. "Paragraphs on Conceptual Art." Artforum International, June 1967.

2. LeWitt, Sol. "Sentences on Conceptual Art." Art-Language, 1969.



Sol LeWitt, *Sphere Lit From The Top, Four Sides, and All Their Combinations* (2004)

SHERRIE LEVINE, STATEMENT (1982)

After Roland Barthes's *The Death of the Author*.

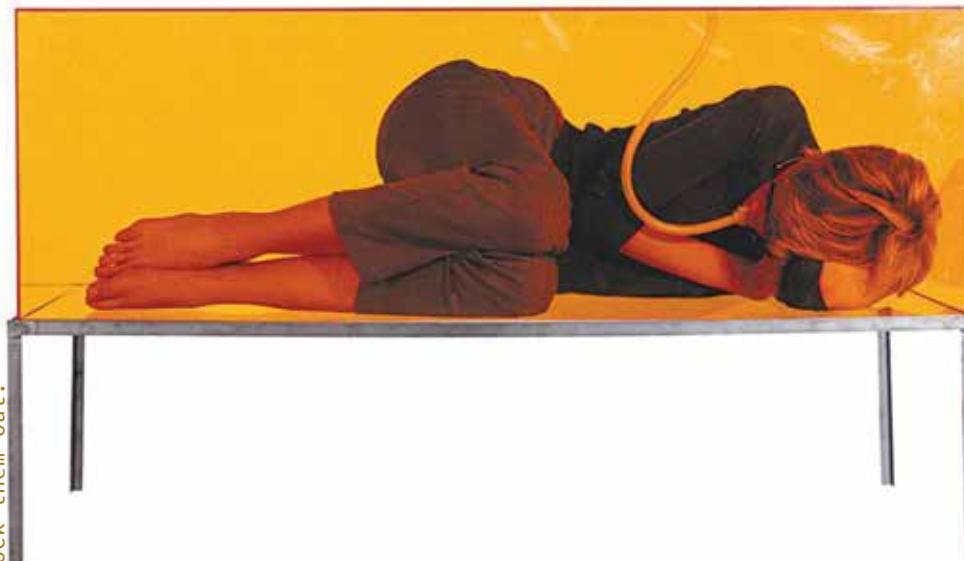
"The world is filled to suffocating. Man has placed his token on every stone. Every word, every image, is leased and mortgaged. And we note that the picture is but a space in which a variety of images, none of them original, blend and clash. A picture is a tissue of quotations drawn from the innumerable centers of culture. Similar to those eternal copyists Bouvard and Pechuchet, we indicate the profound ridiculousness that is precisely the truth of painting. We

can only imitate a gesture that is always anterior, never original. Succeeding the painter, plagiarist no longer bears within him passions, humors, feelings, impressions, but rather this immense encyclopedia from which he draws. The viewer is the tablet on which all quotations that make a painting are inscribed without any of them being lost. A painting's meaning lies not in its origin, but in its destination. The birth of the viewer must be at the cost of the painter."¹

See also: Appropriation, Assisted Readymade, Remix

1. Levine, Sherrie. "Statement." Style, March 1982.

Dunne and Raby, *Faraday Chair* (1994-1997)
 The *Faraday chair* imagines a future where
 electromagnetic waves fill our world so densely
 that we need to manufacture spaces specifically
 to block them out.



SPECULATIVE/CRITICAL/ DISCURSIVE DESIGN

"Discursive Design refers to the creation of utilitarian objects whose primary purpose is to communicate ideas—they encourage discourse. These are tools for thinking; they raise awareness and perhaps understanding of substantive and often debatable issues of psychological, sociological, and ideological consequence."¹

-Bruce and Stephanie Tharp, The 4 Fields of Industrial Design (2009)

According to Anthony Dunne and Fiona Raby, "when practicality and functionality can be taken for granted, the aesthetics of the 'post-optimal' object provide a much richer field of investigation."² Discursive Design, also known as Critical or \ Speculative Design, has its roots in the modernist ideal, "form follows function," but extends design's purpose to include emotional or critical utility.

In recent years, with the rising accessibility of rapid prototyping techniques, our manufacturing abilities have advanced so far so

quickly that our ideas about what design can and should be haven't been able to keep up.³ Fabricating objects has become so easy that a more appropriate question for contemporary design, rather than, "what can we make?", seems to be, "what *should* we make and how *should* we make it?" This discussion is where discursive design becomes relevant.⁴

See also: The 4 Fields of Industrial Design, Experimental Design, Commercial Design/Design Thinking Form Follows Concept, Process Over Product

1. 1. Tharp, Bruce, and Stephanie Tharp. "The 4 Fields of Industrial Design." Core77. 2009

2. Dunne, Anthony. *Hertzian Tales Electronic Products, Aesthetic Experience, and Critical Design*. Rev. ed. Cambridge, Mass: MIT Press, 2005.

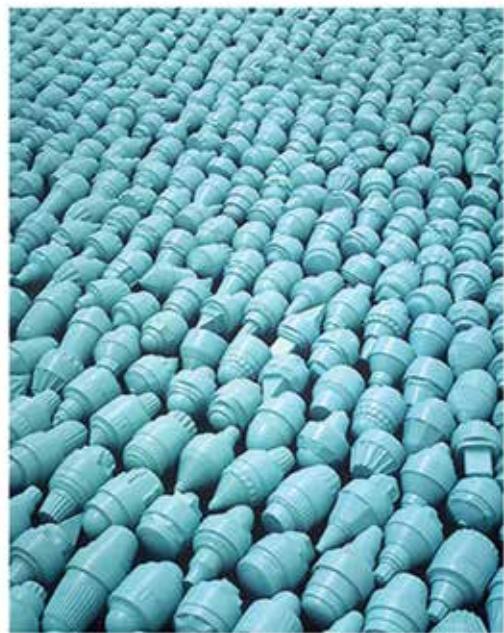
3. Dunne, Anthony, and Fiona Raby. *Speculative Everything: Design, Fiction, and Social Dreaming*. Cambridge, Mass: MIT Press, 2013.

3. Antonelli, Paola. "States of Design 04: Critical Design." Domus 949. 2011



Dunne and Raby, *Foragers* (2010)
 Foragers explores a world where synthetic
 microbial stomach bacteria and urban foraging
 develop in response to future food shortages.

Allan McCollum, *Over Ten Thousand Individual Works* (1987/88)



THE UNIQUE COPY

The act of copying is never perfect. If the differences created by imitating are consciously emphasized, copying can generate unique objects that are not necessarily duplicates.¹ For example, in his project, *Over Then Thousand Individual Works*, Allan McCollum makes molds of fragments of household objects and assembles them in different combinations to generate unique sculptures. Similar to the way children are grown from copies of their parents' DNA, objects and images can be copied, remixed, and recombined in infinite variations of themselves without ever having to "create" new forms. These unique

copies have can be individual while still retaining their connection with their parent.

See Also: Appropriation, The Assisted Readymade, Emergence, Entropy, Process Over Product, Remix

1. Benjamin, Walter. "The Work of Art in the Age of Mechanical Reproduction." *Zeitschrift für Sozialforschung*, 1963.

V



McCollum and his team make plaster molds of radially symmetric object fragments and systematically stack them back together in every structurally stable combination possible.

W

X

Y

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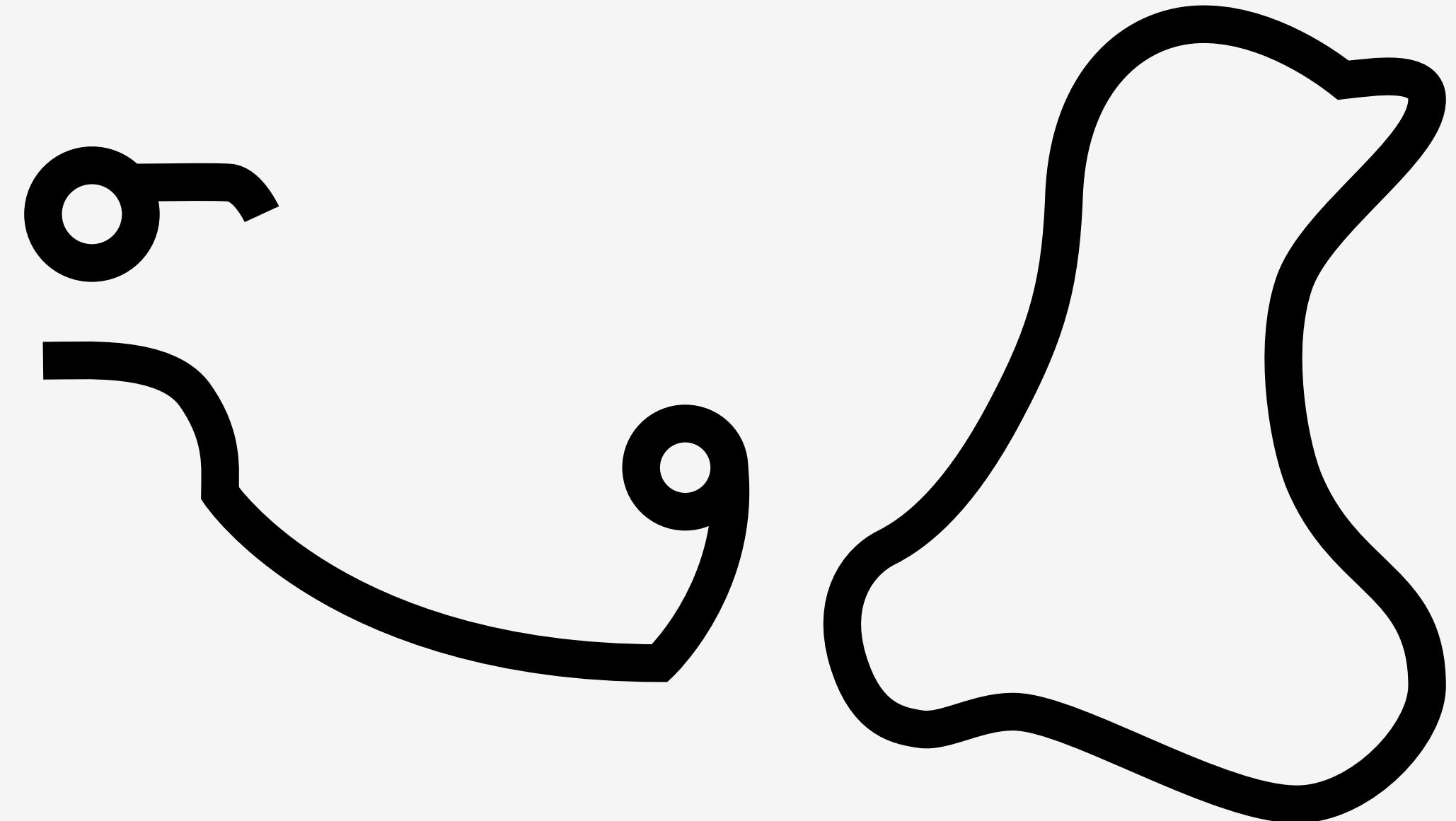
Z

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PLATES

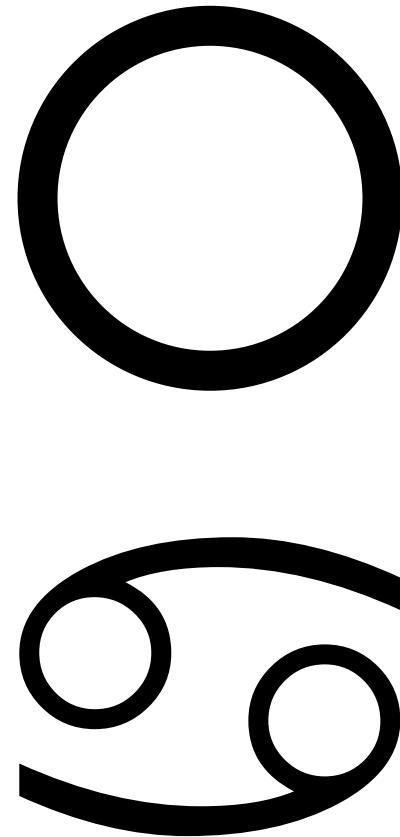
CASE STUDY #1&2

EVOLUTION
DRAWINGS



Case Studies #1 & #2

Circle and lower case “a” in the wingding typeface. Inputs for evolution drawing #1 and #2 respectively.

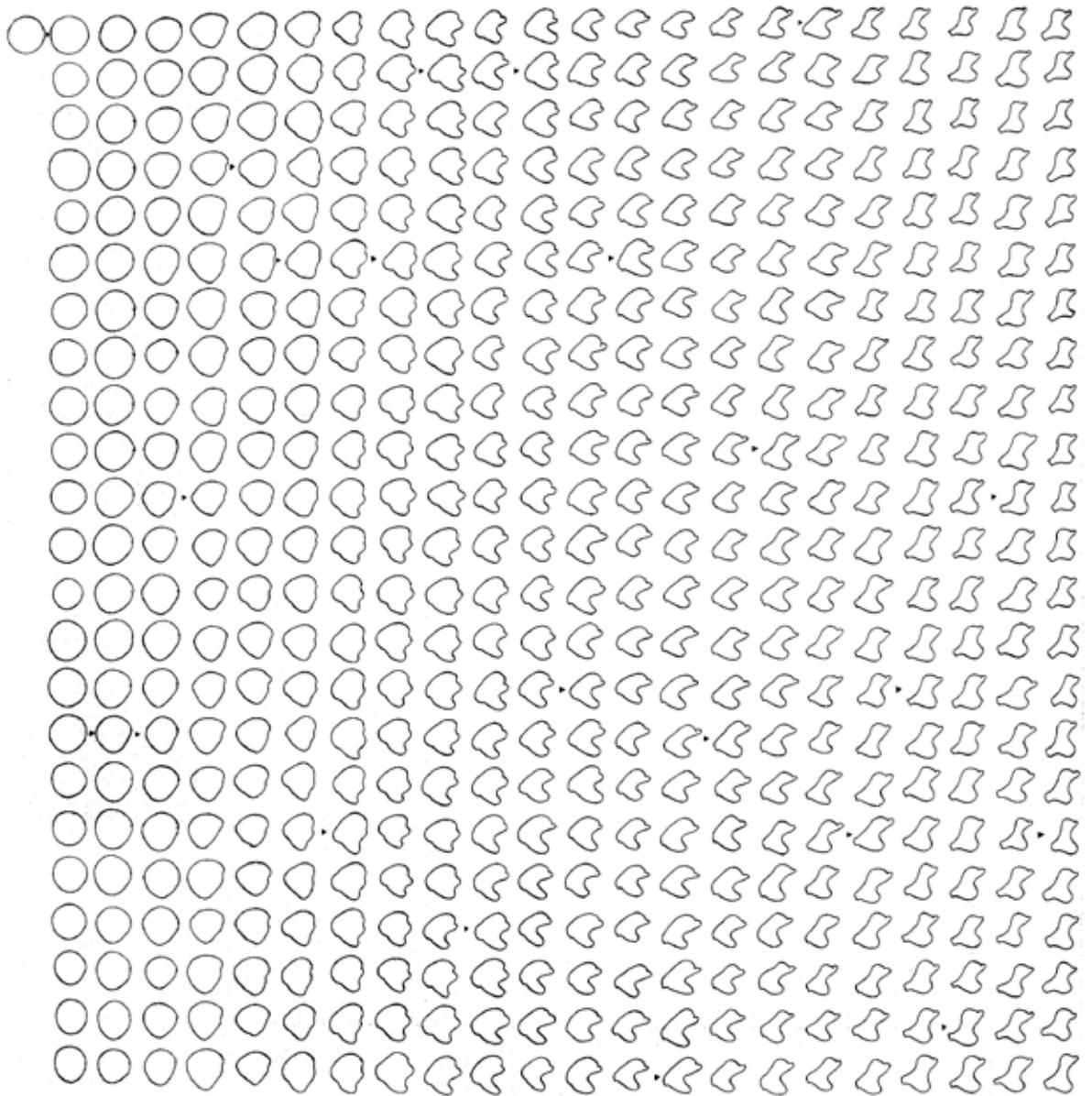


Evolution Drawings were my first experiments exploring the potential of an accelerated memetic process in 2D. The procedure used to generate these drawings was designed to demonstrate the effects of imitation, variation, and selections as quickly as possible, with the lowest stakes. Compounded human error and selection caused the inputs to quickly mutate into abstract symbols.

EVOLUTION DRAWING #1

INSTRUCTIONS

1. Trace a circle
2. Attempt to copy the circle by hand for one column
3. Attempt to copy the least symmetric shape from the previous step for 1 column
4. Repeat steps 3 & 4 until the end of the paper is reached

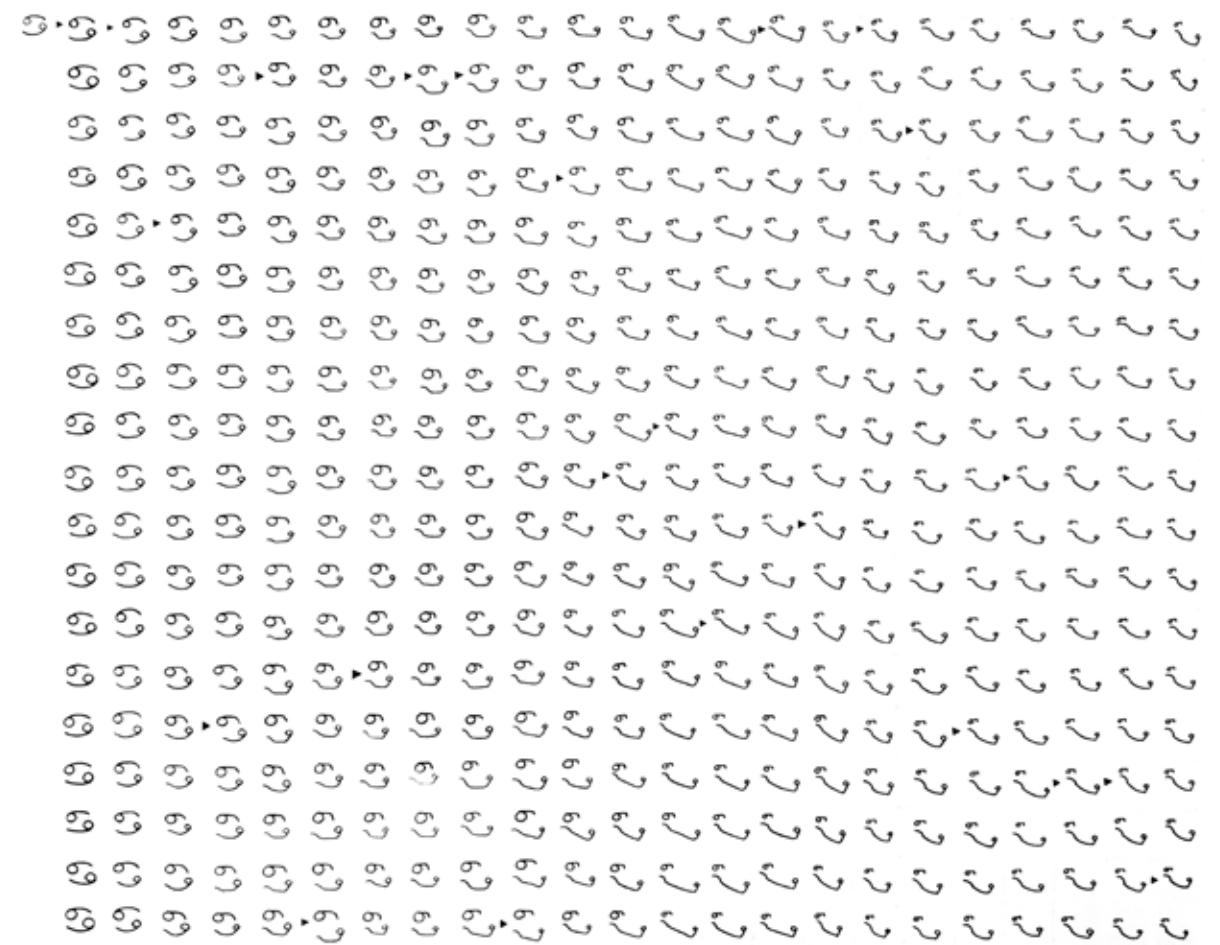


Output from executing *Evolution Drawing #1* for 22 generations of 23 shapes.

EVOLUTION DRAWING #2

INSTRUCTIONS

1. Trace wingding letter "a"
2. Attempt to copy the wingding by hand for one column
3. Attempt to copy the least symmetric shape from the previous step for 1 column
4. Repeat steps 3 & 4 until the end of the paper is reached

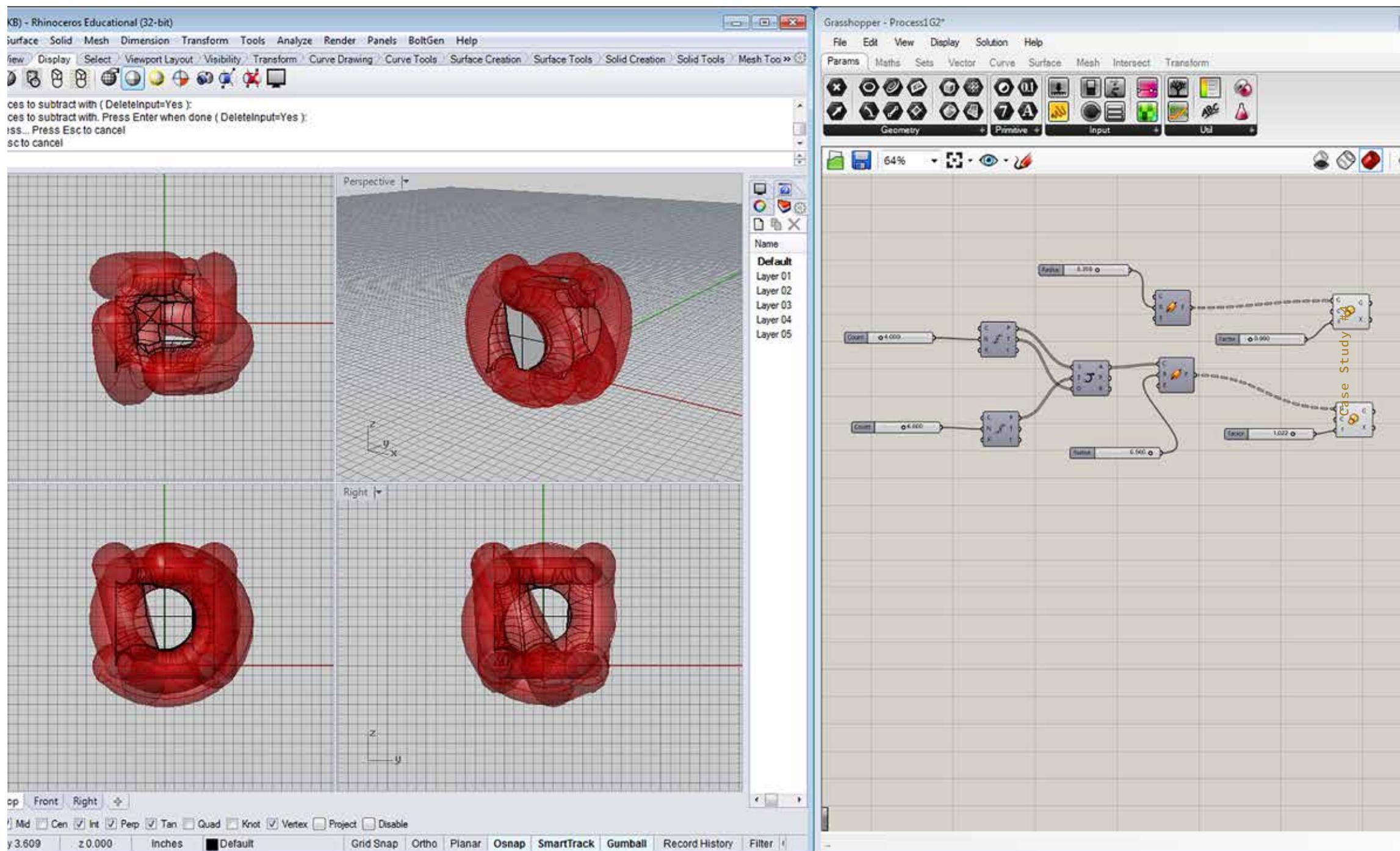


Output from executing *Evolution Drawing #2* for 23 generations of 20 shapes

Case Study #3 Omitted

Case Study #3 Omitted

CASE STUDY #4

CUBE
CHAIRS

Cube, torus, and piped arc;
Inputs for Case Study #4



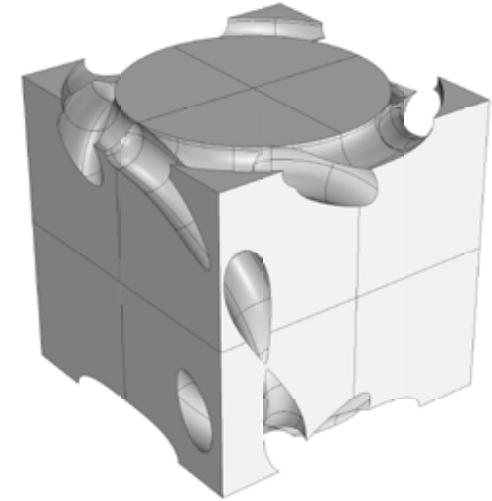
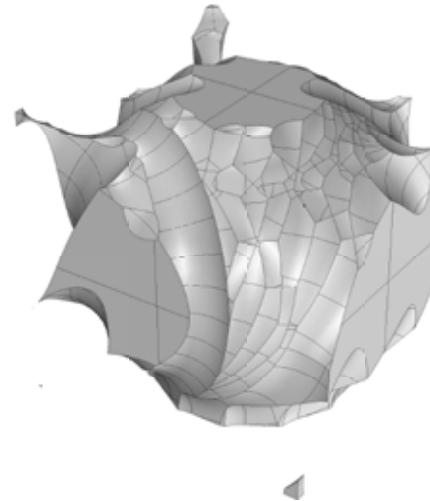
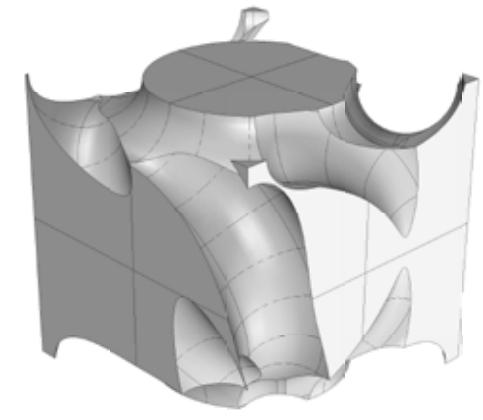
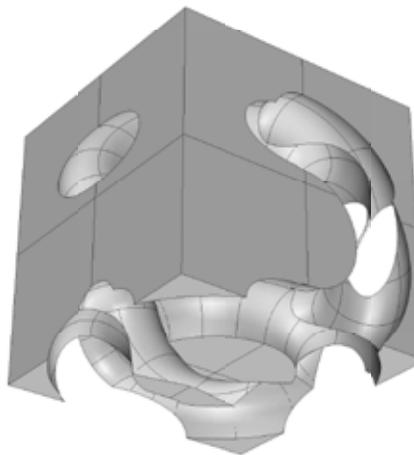
Cube Chairs was my first experiment into using computer algorithms in 3 dimensions. A written set of instructions was written for each generation of the process to imitate the selection from the generation before it. The instructions were implemented in Grasshopper, a procedural 3D modeling plugin for Rhinoceros. The abstract, modified cubes were intended to represent loosely functional chairs.

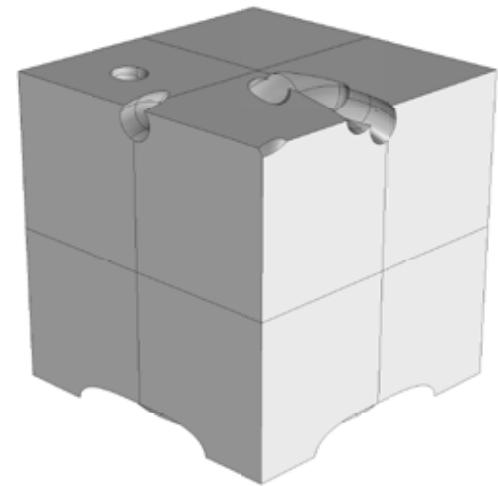
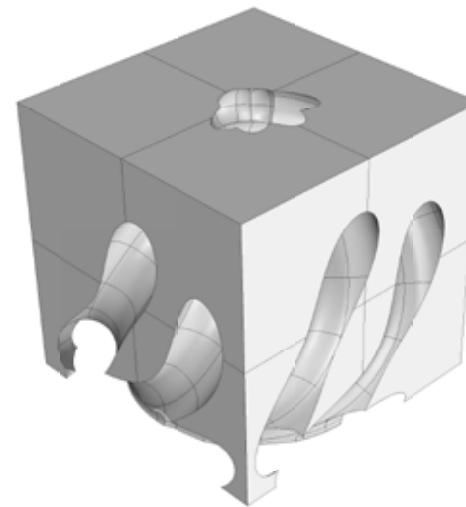
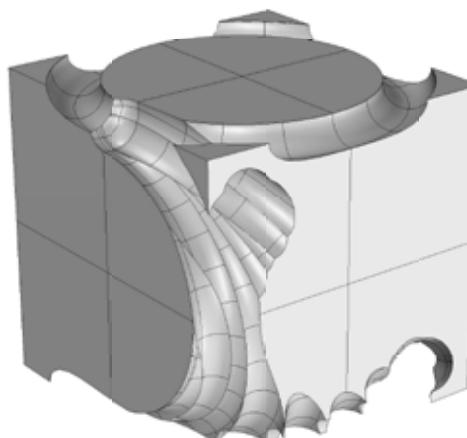
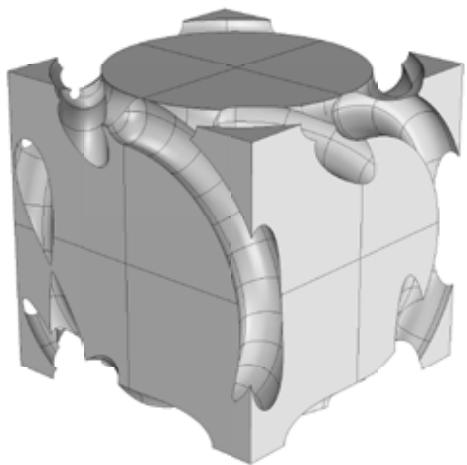
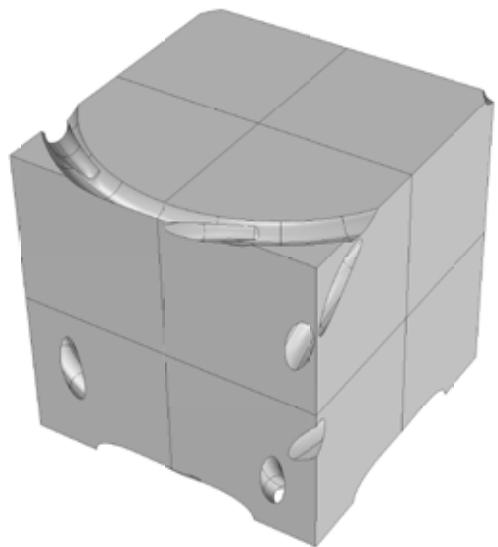
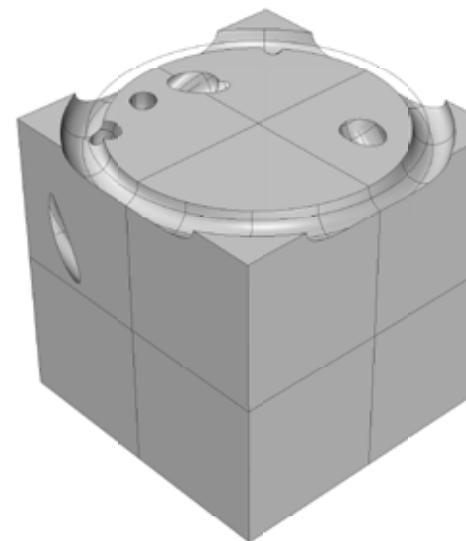
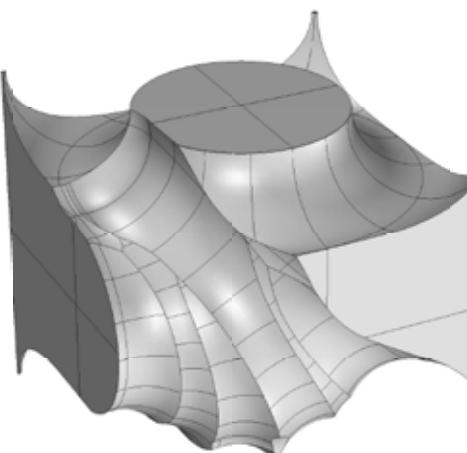
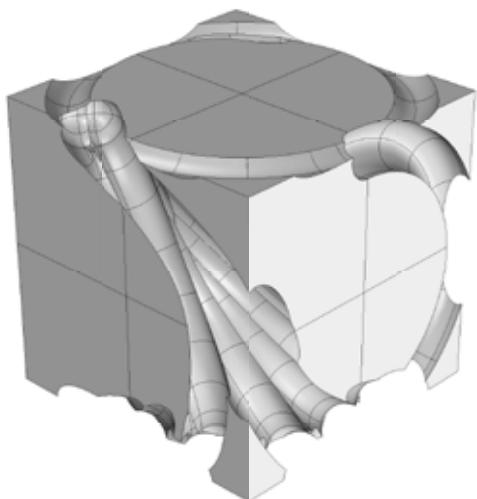
Although it lead to initially surprising results, purely digital, algorithmic 3D modeling was deemed a failure because it lacked a human layer of inaccuracy and interpretation causing its results to become predictable.

CUBE CHAIRS

GENERATION #1 INSTRUCTIONS

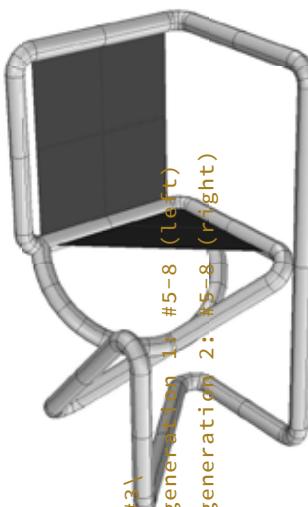
1. Inscribe a Torus of random thickness on the top and bottom of a cube
2. Divide each torus a random number of times
3. Draw piped arc of random diameter from each division point on the top to each division point on the bottom
4. Subtract the arc and torus from the cube



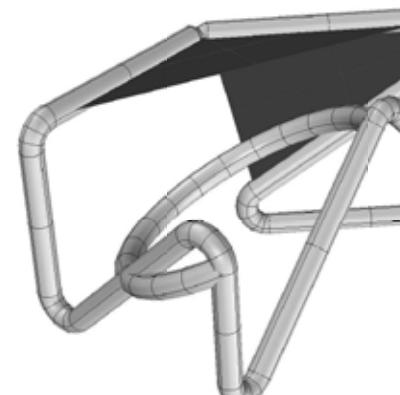
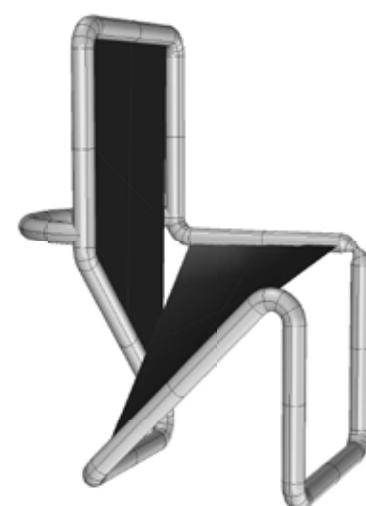
Cube Chairs generation 1: #5-8*Cube Chairs generation 2: #1-4*

CASE STUDY #5

C 3 3 CHAIRS



Case Study #3:
C33 Chairs generation 1: #5-8 (left)
C33 Chairs generation 2: #5-8 (right)



Marcel Breuer's Chair (B33)
Input for Case Study #5



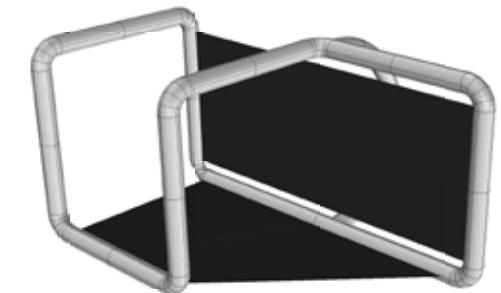
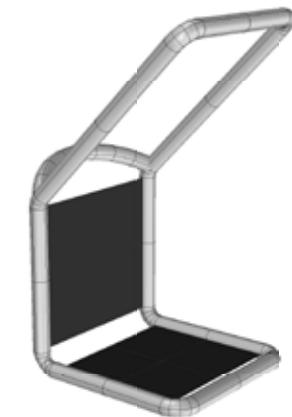
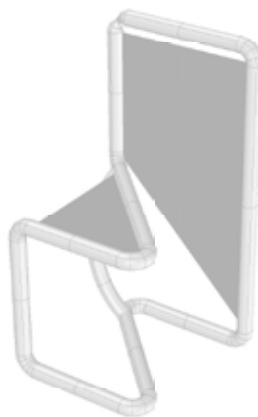
This case study was an experiment in using process to modify/mutate forms that reference cultural/historical context. I decided to use Marcel Breuer's *Chair (B33)* (a.k.a the Cantilever Chair) (1927-28) as the input because it's connection to pure modernism's philosophy, "form follows function," was in direct opposition to this project's discursive goals. In an instructions-based process, even the ugly and awkward results have to be embraced.

The models were made by evolving the set of instructions for each generation of object in parallel with the objects themselves. Each generation of chair was made by following a set of instructions written to describe the set of selected objects from the generation before. The initial instructions were written to abstractly describe *Chair (B33)*.

C33 CHAIRS

GENERATION #1 INSTRUCTIONS

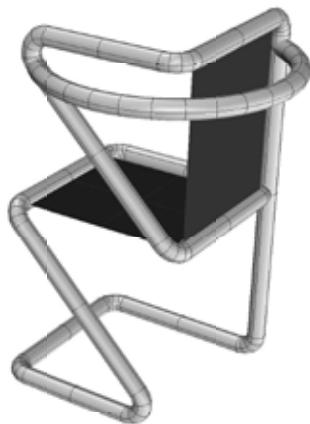
1. Draw a cube
2. Extend one face so it is 2 times as tall as it is wide
3. Connect all corners of the shapes with one pipe
4. Connect 2 sections of pipe with a plane two times
5. Connect 2 vertices with a pipe arc
6. Select next generation based on function and appeal



C33 CHAIRS

GENERATION #2 INSTRUCTIONS

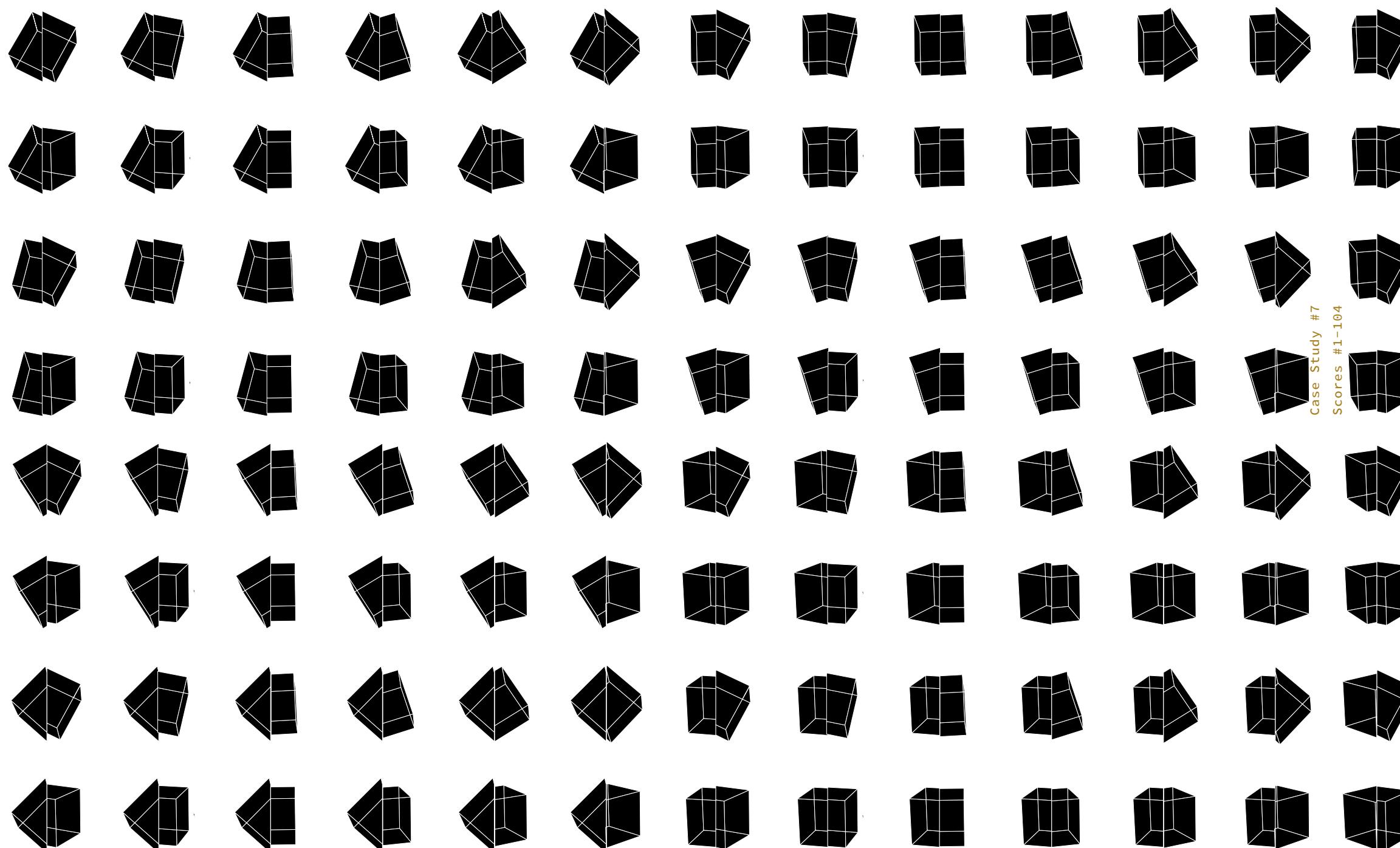
1. Draw 2 cubes that share 1 face
2. Connect at least 8 corners with straight pipes
3. Connect 2 pipe corners with 1 pipe arc
4. Connect 2 straight sections that share a side with planes
5. Select next generation based on function and appeal



Case Study #6 Omitted

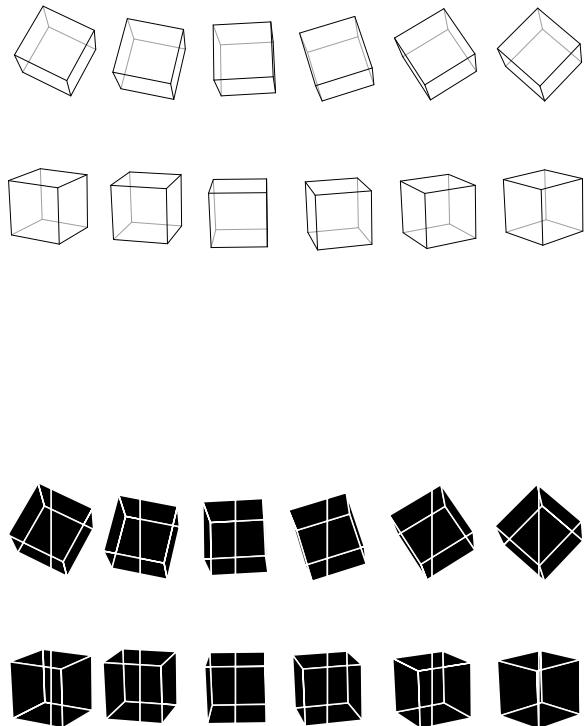
Case Study #6 Omitted

CASE STUDY #7
12²:
SCORES
FOR 144
OBJECTS



cube projections made using Rhino to rotate the cube at 15° increments at 2 different perspectives before dividing.

Input for Case Study #7



Scores for 144 objects was my first exploration into algorithmically generating a multiplicity of unique, indeterminate scores to define objects. These forms are starting points for objects similar to the way a musical score might provide guidelines for a performance. To isolate the effects of the process, I decided to use a neutral input.

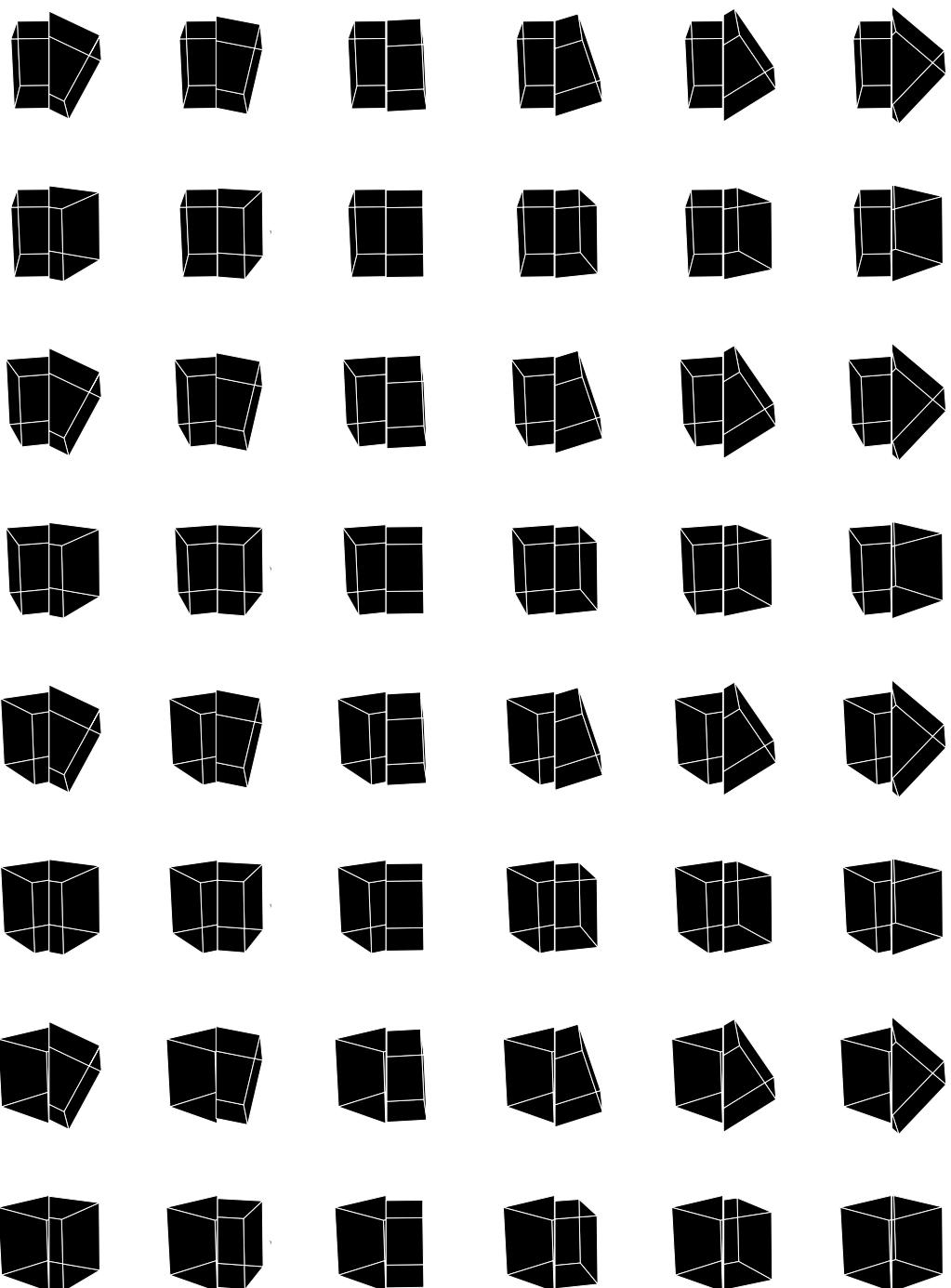
The written instructions were meant to be slightly ambiguous. If someone else were to execute the process, they would interpret the language differently and generate an entirely different set of outcomes.

12²

INSTRUCTIONS

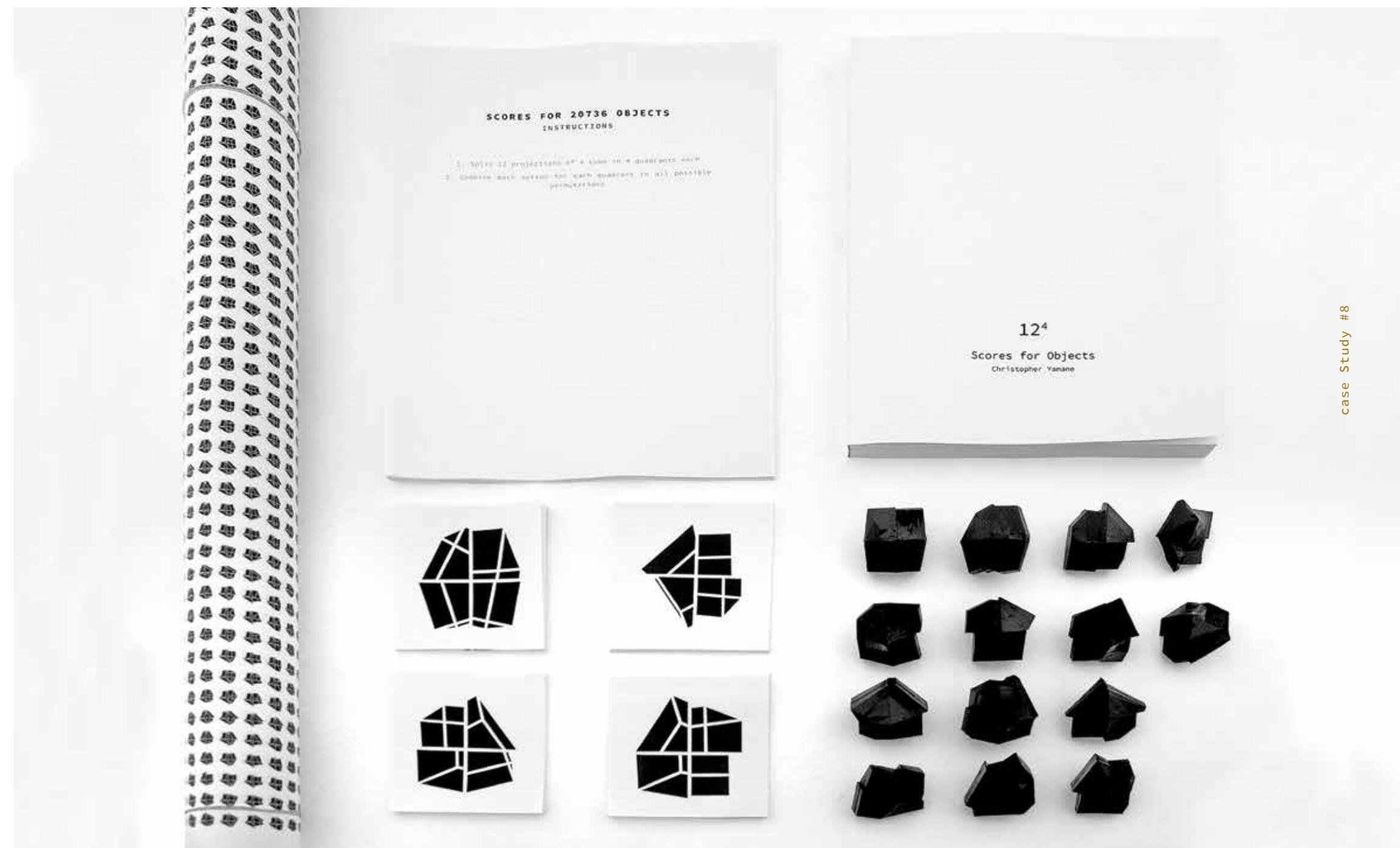
1. Split 12 projections of a cube in half

2. Combine each option for half in all possible permutations



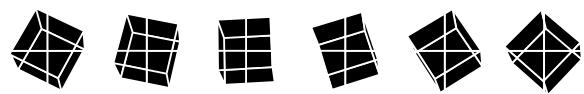
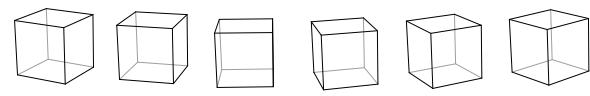
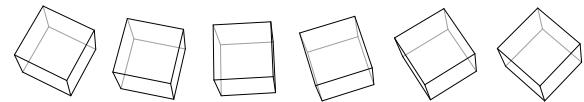
Scores #96-144

CASE STUDY #8

12⁴:
SCORES
FOR 20736
OBJECTS

cube projections made using Rhino to rotate the cube at 15° increments at 2 different perspectives before dividing.

Input for Case Study #8



¹²⁴ was a deeper exploration into algorithmically generating 2D scores for objects. Using 2D scores as an intermediate step before translating them back into 3D provides another layer of interpretation to create unexpected outcomes.

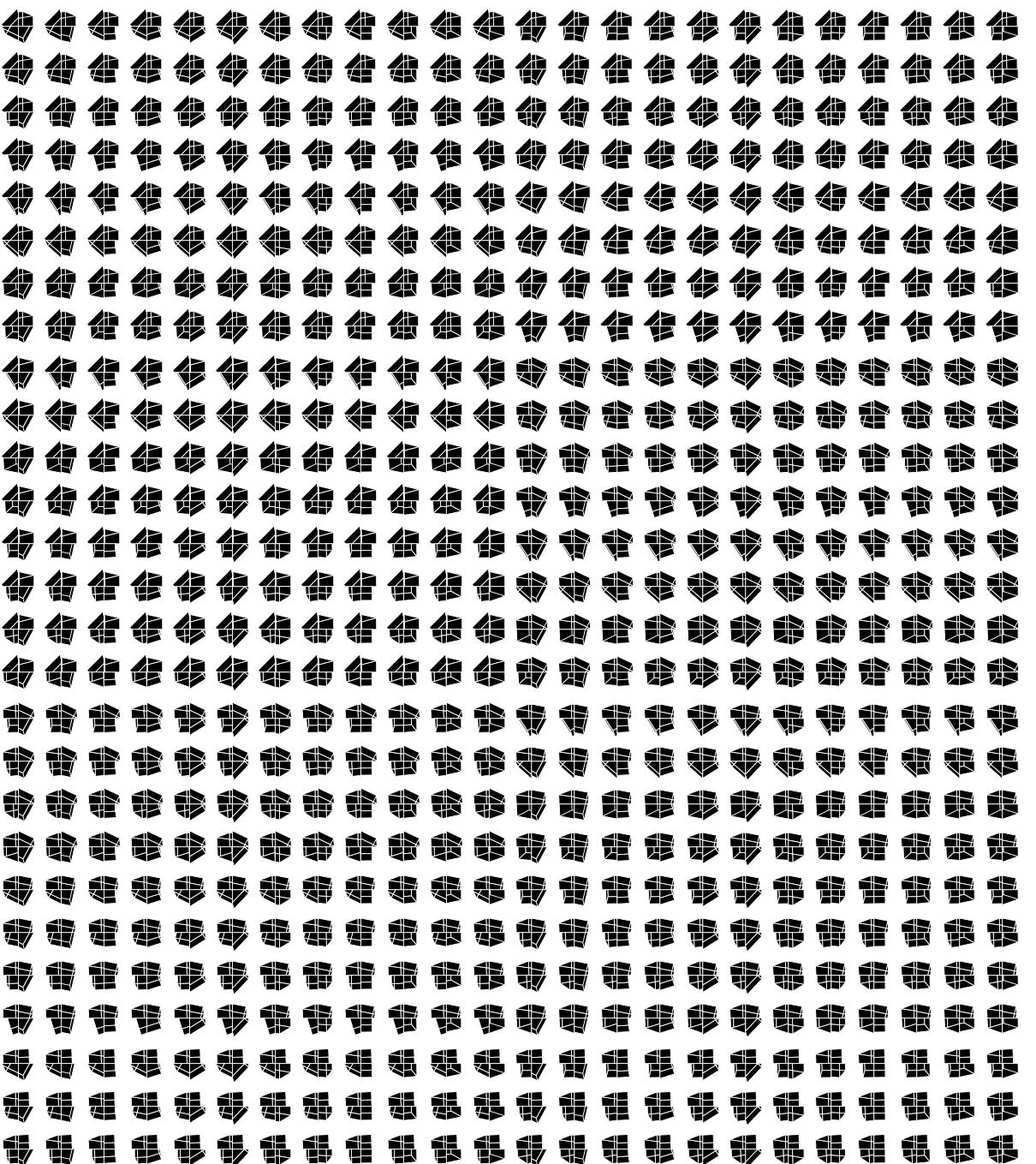
The following represents a selection of forms I translated into 3D prints myself in Rhino. Each translated shape was selected by chance operation.

The instructions were executed by a Processing script more quickly than I could do manually.

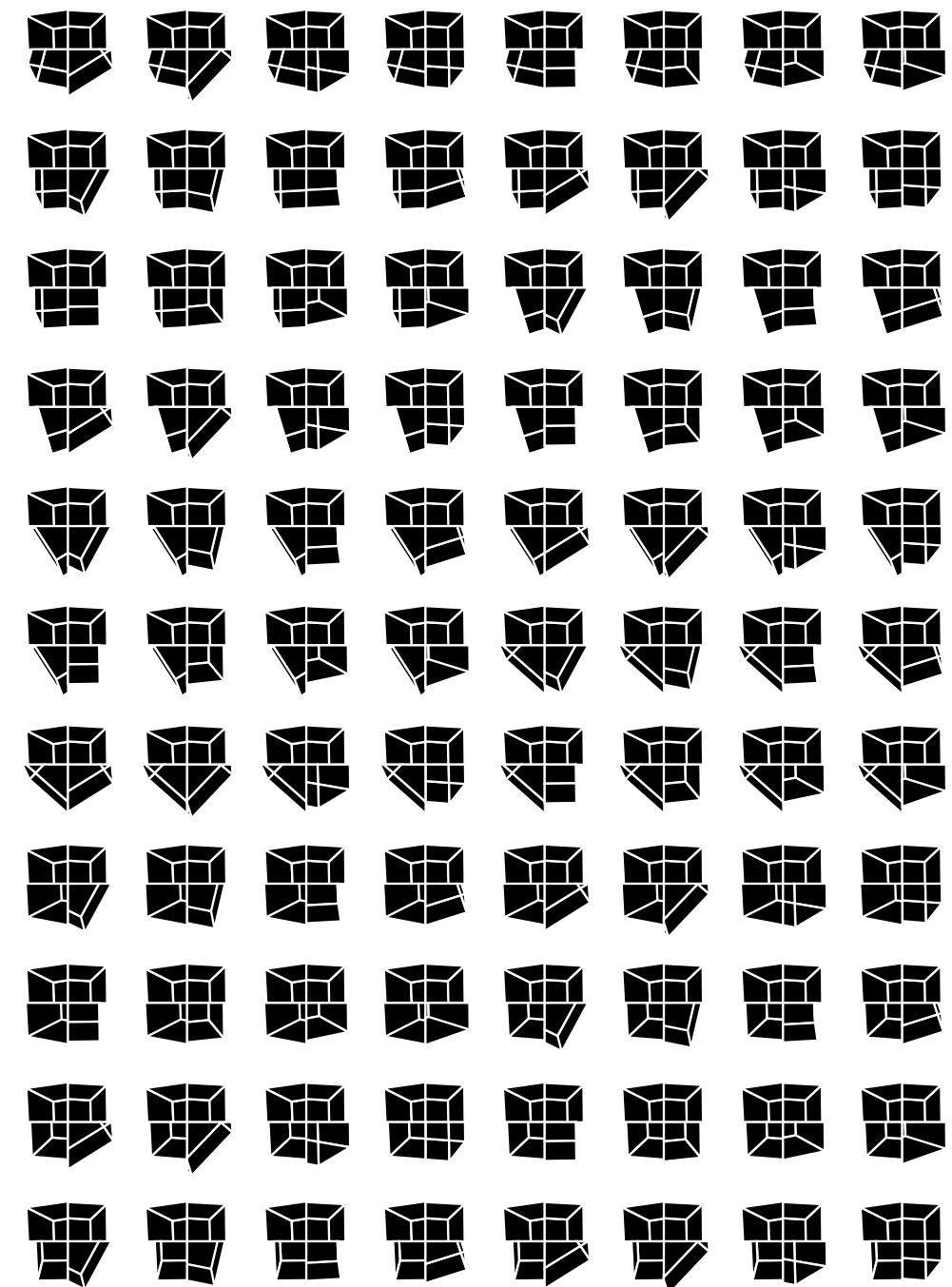
12⁴

INSTRUCTIONS

1. Split 12 projections of a cube into 4 quadrants each
2. Combine each option for each quadrant in all possible permutations

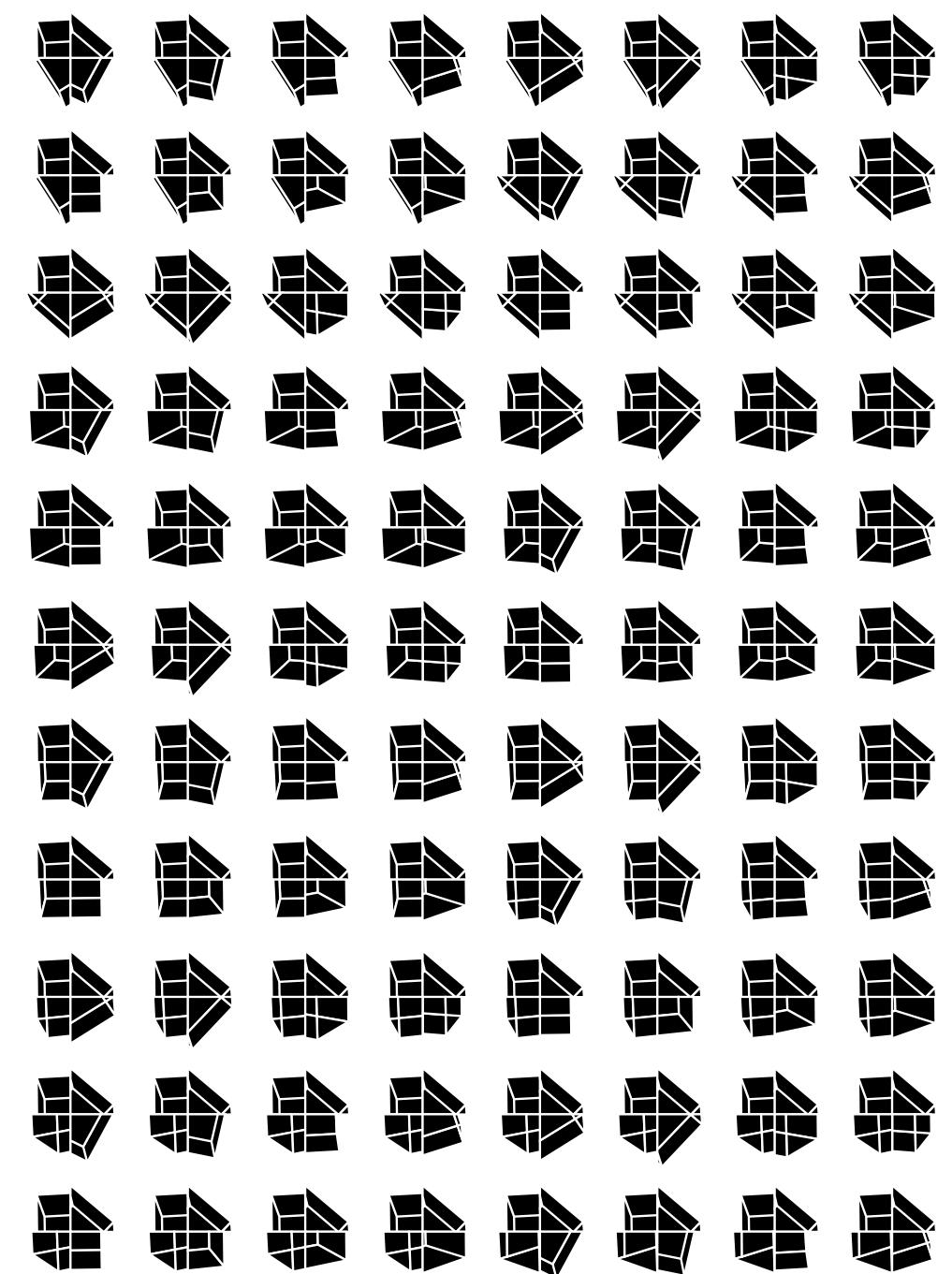


From left to right, top to bottom: translation
of shapes #18383, #8337, #14900, #12375



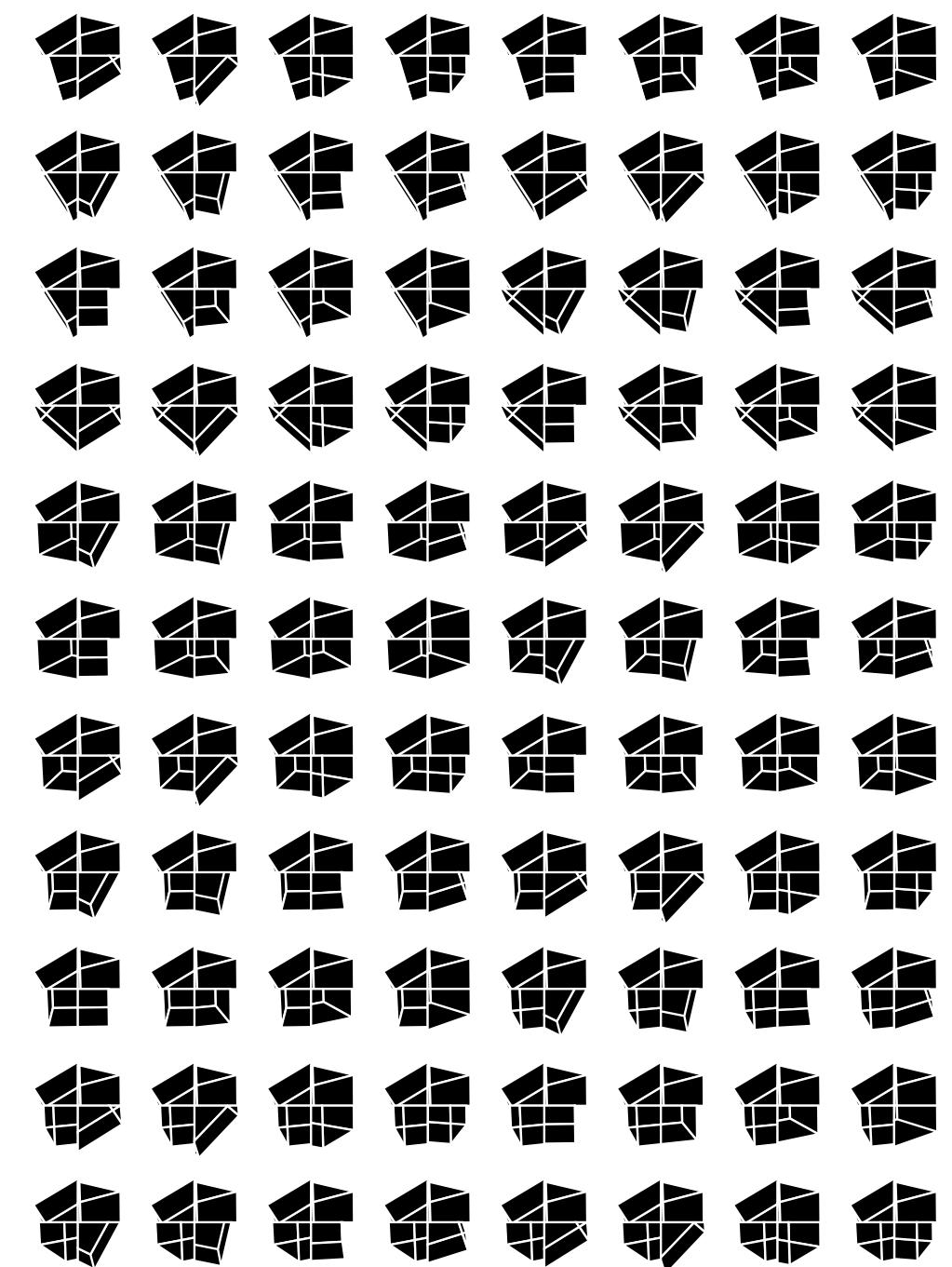
Scores #18305-18392

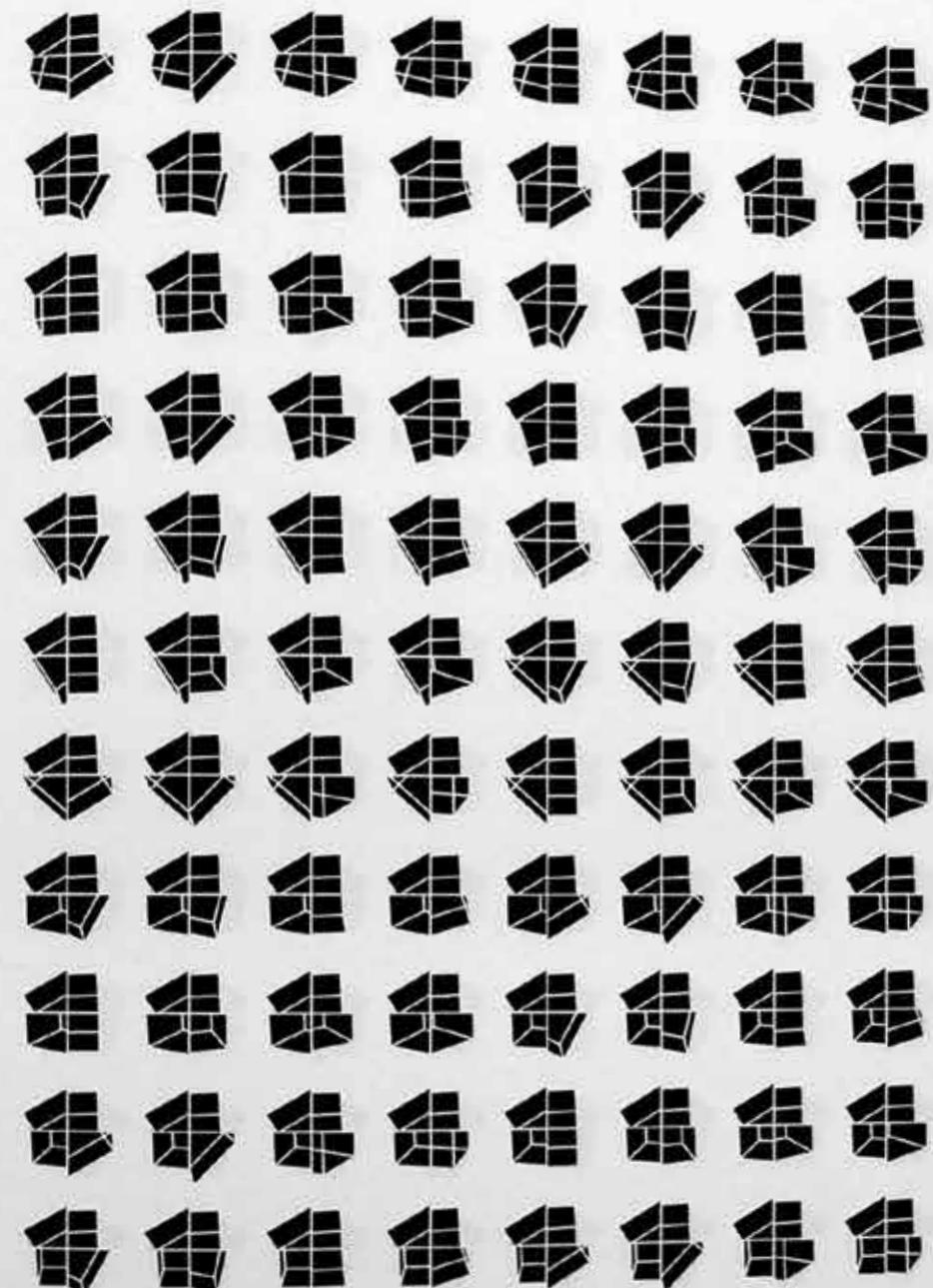
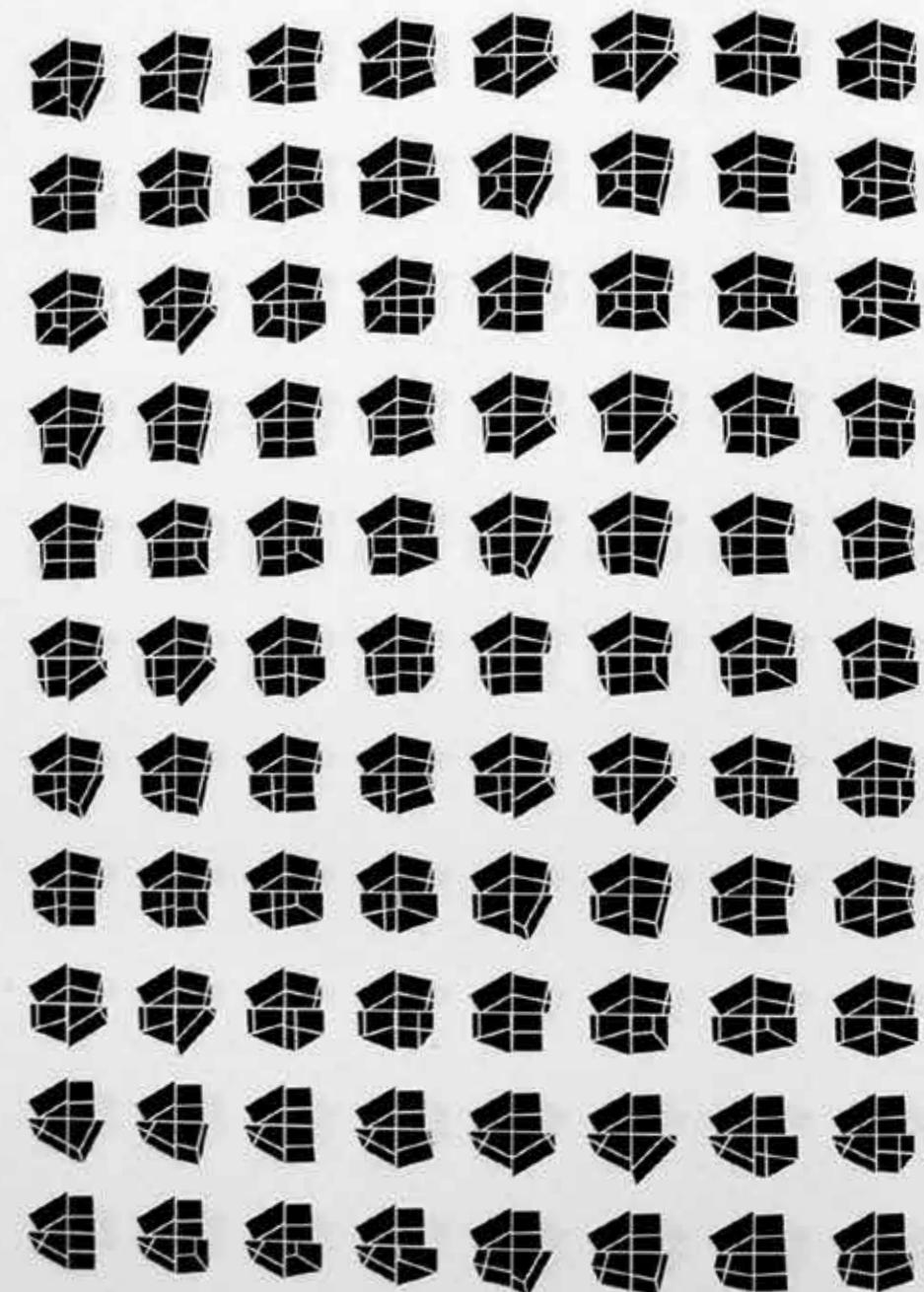
From left to right, top to bottom: translation
of shapes #4285, #15973, #8335, #8984



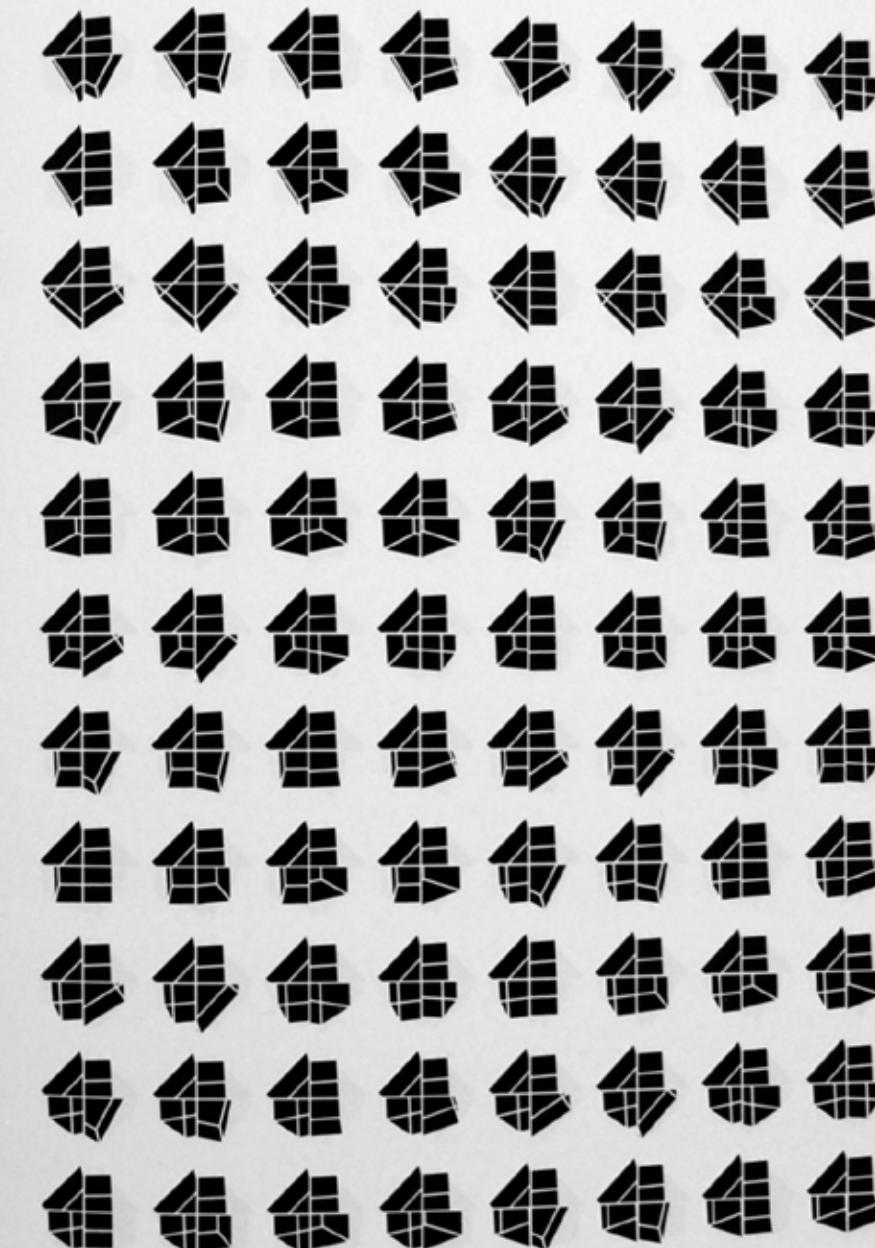
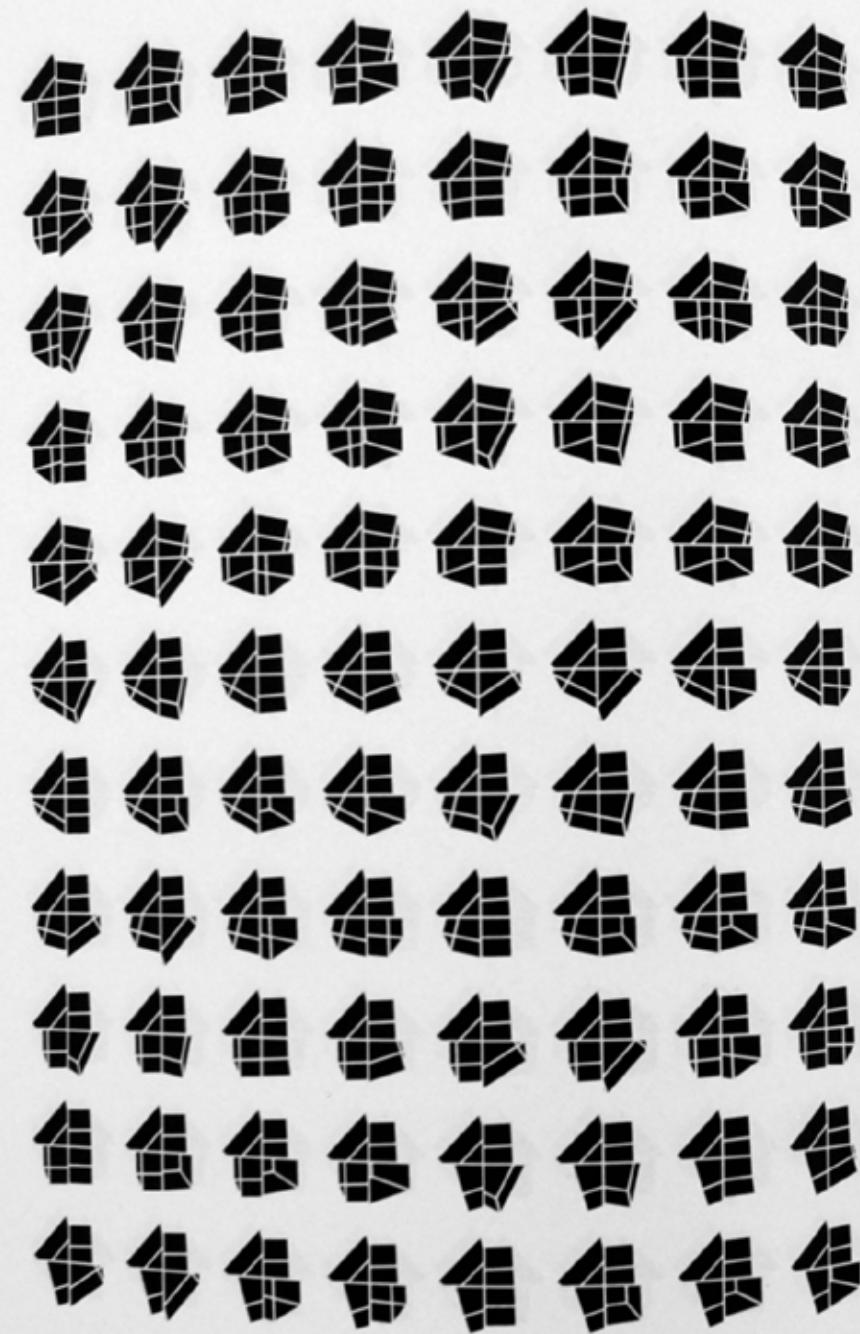
Scores #42225-4312

From left to right, top to bottom: translation
of shapes #8457, #12375, #579, #1509





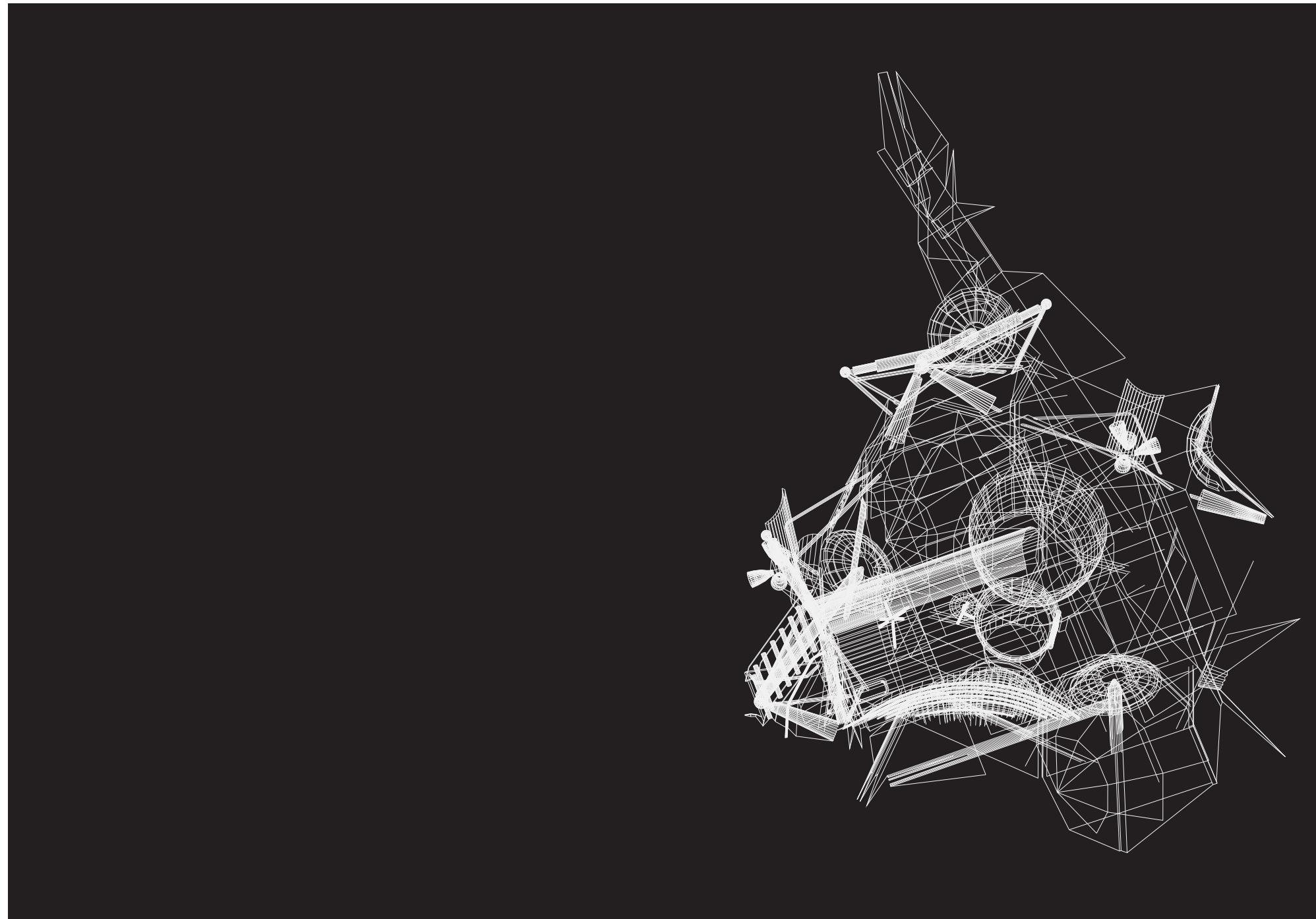
Spread from 12th book. The volume contains
all 20736 scores for reference.



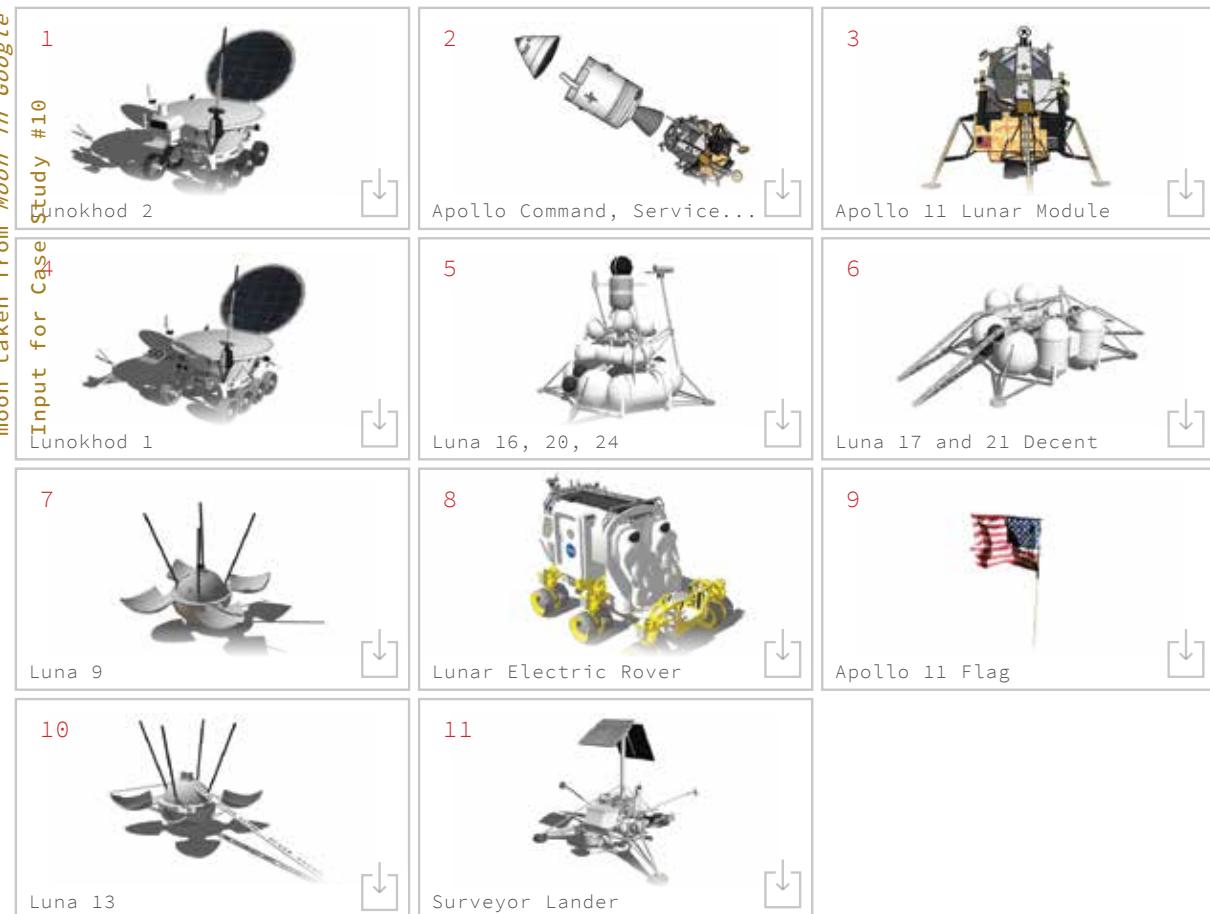
Spread from 12th book. The volume contains
all 20736 scores for reference.

CASE STUDY #9

ORBIT CONDI- TIONS



3D models of spacecraft that have landed on the moon taken from *Moon in Google Earth*.



Orbit Conditions is an experiment in procedurally generating form using an intentionally content-driven input rather than a neutral one. Aiming the instructions at a predetermined subject seemed like the logical next step in the development of a procedural design process. Similar to Case Study #9 these forms are meant to serve as guidelines for 3D objects.

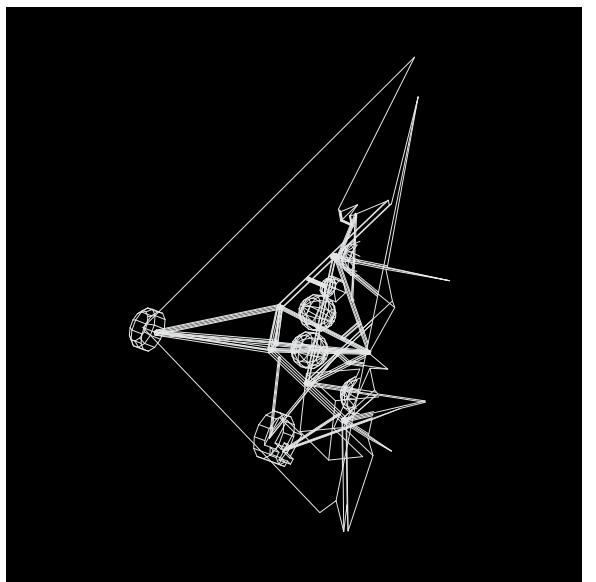
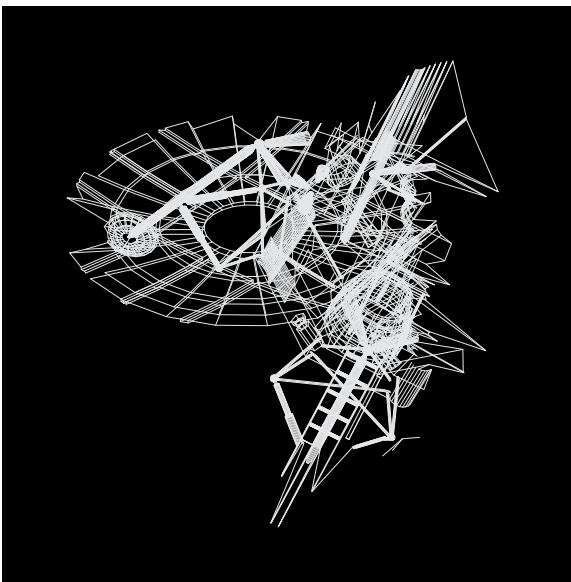
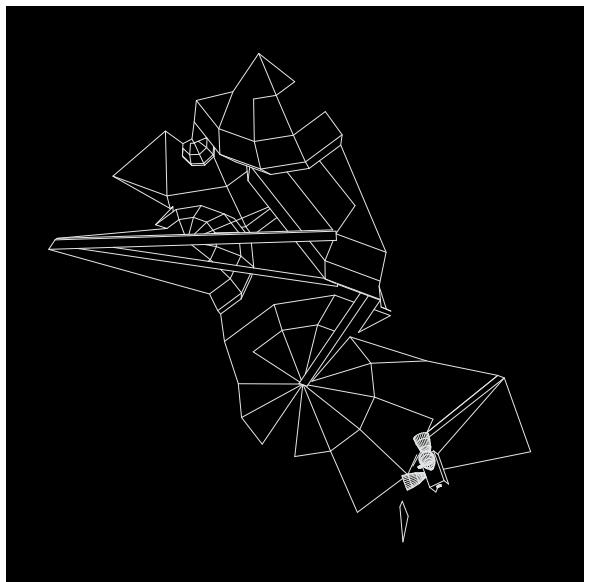
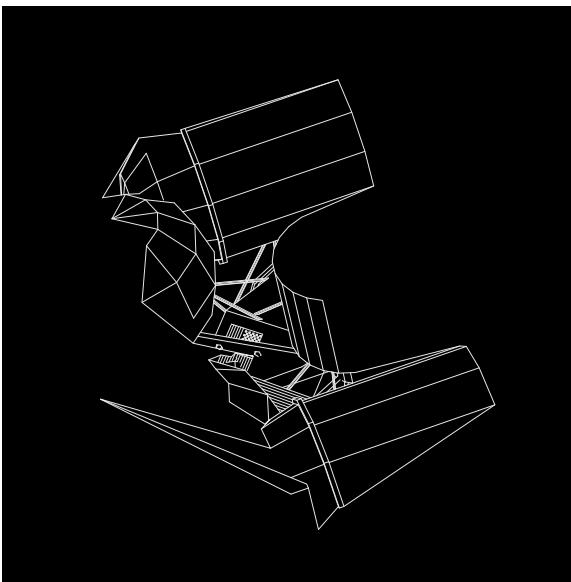
The drawings that resulted are not specific to any product category or material and can be imagined as lighting, jewelry, satellites, or any number of other objects. Because of the chance operations involved, and the ability to choose any 3D model, following these instructions should provide an infinite number of potential outputs.

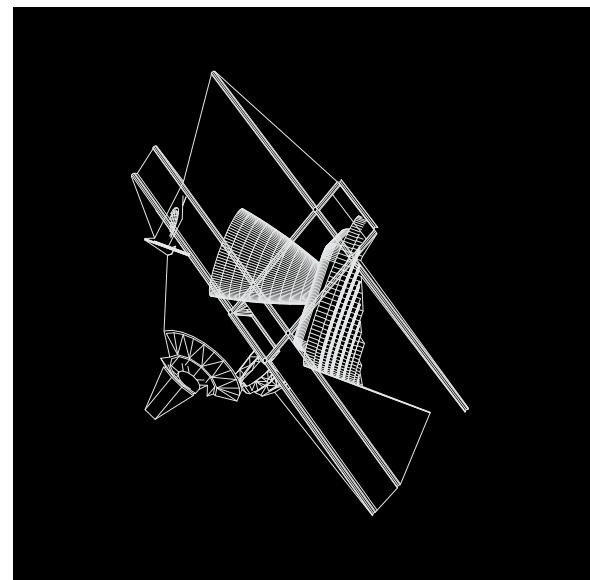
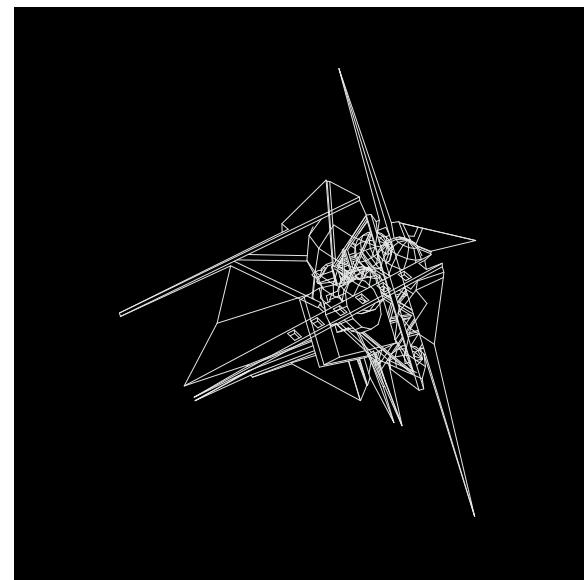
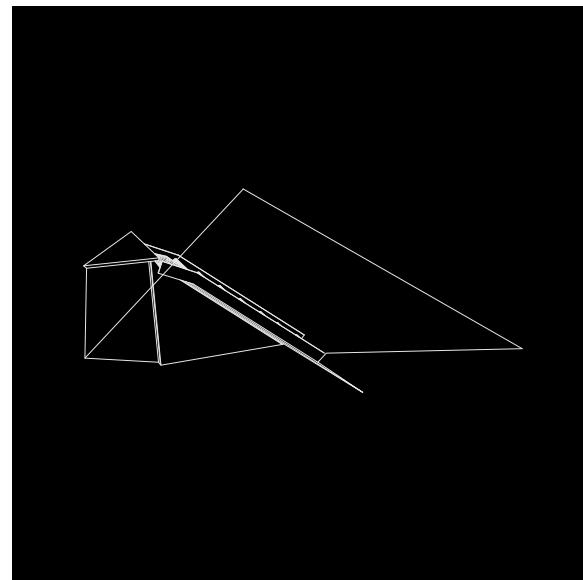
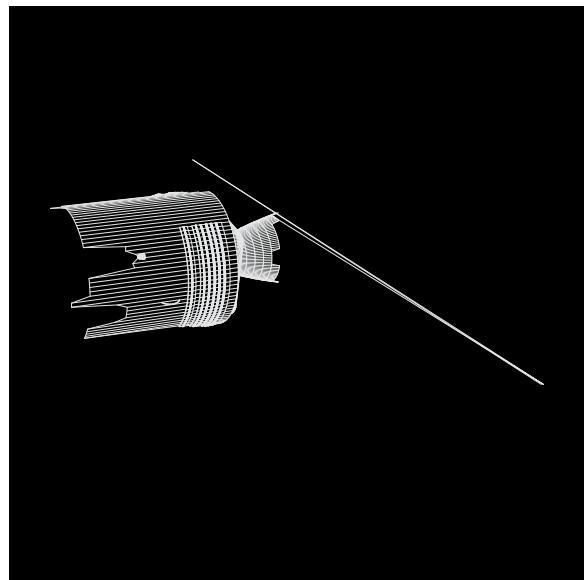
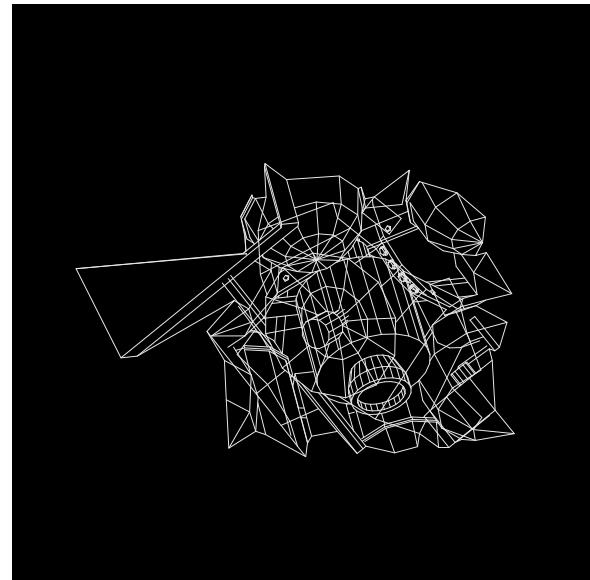
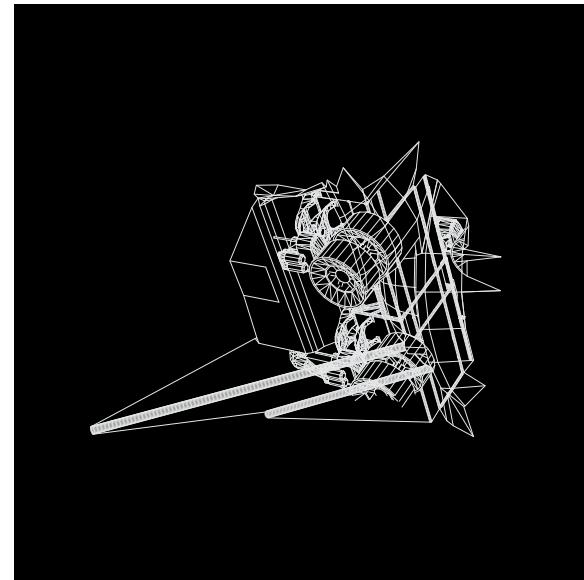
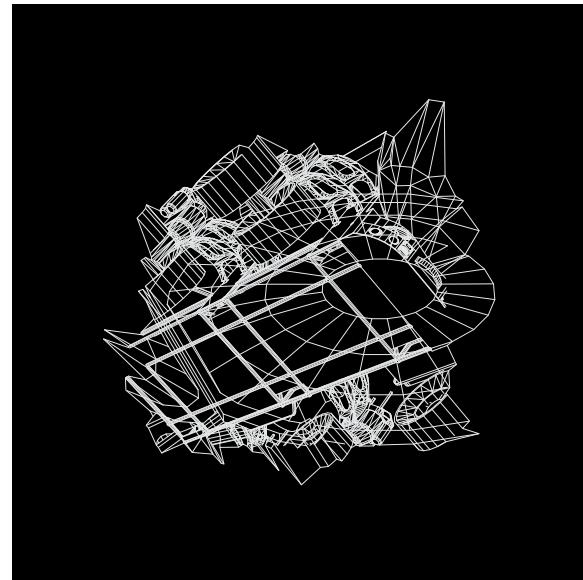
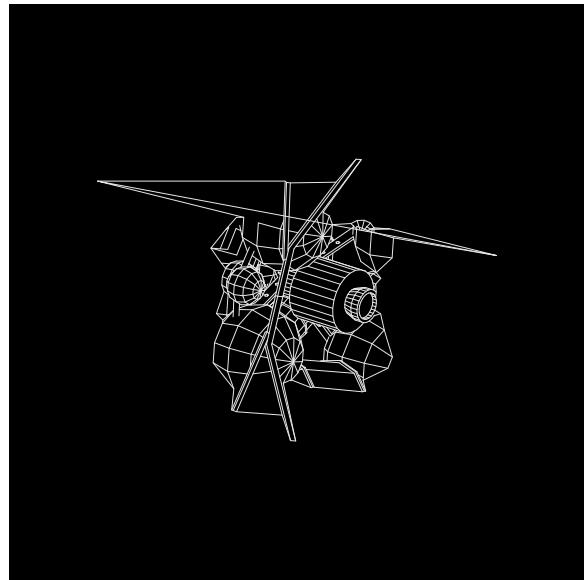
I imported the models into rhino and wrote a Rhinoscript to pick objects, generate the required chance values, spin, project, and edit the resulting vectors quickly.

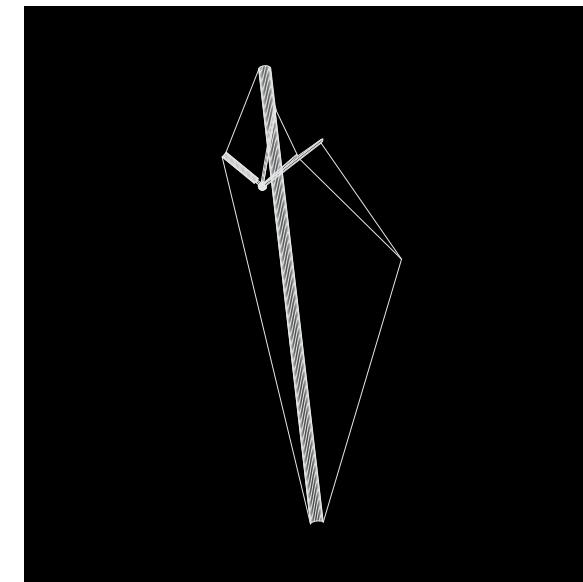
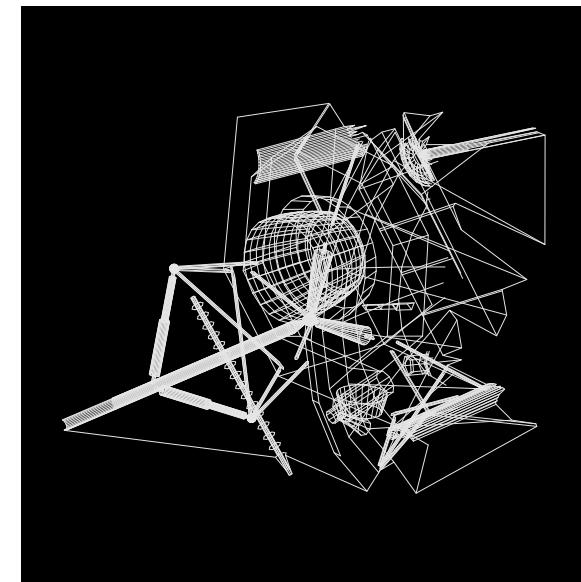
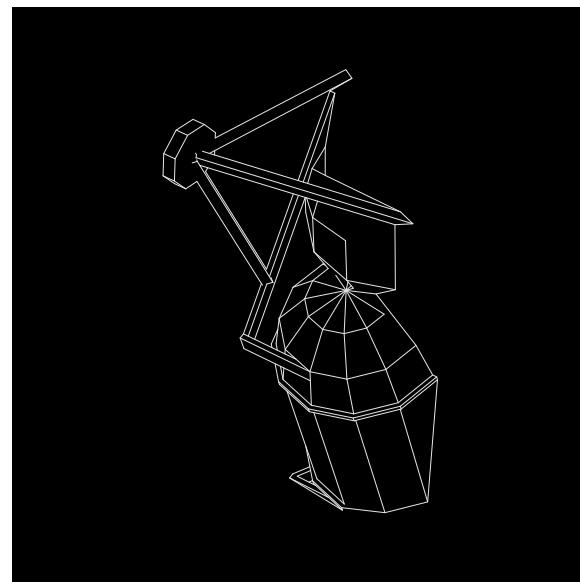
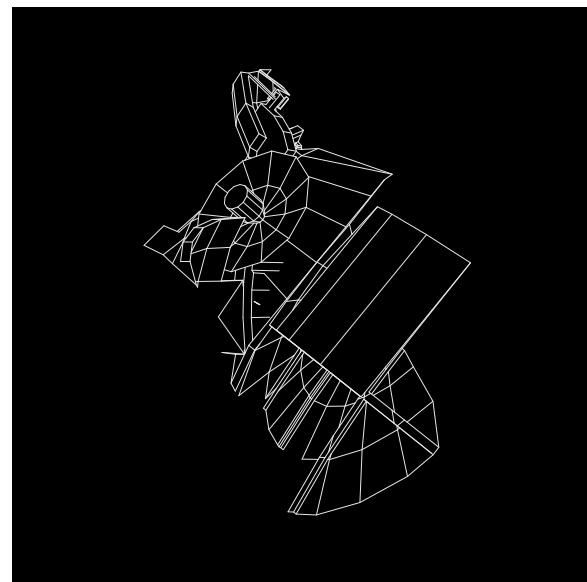
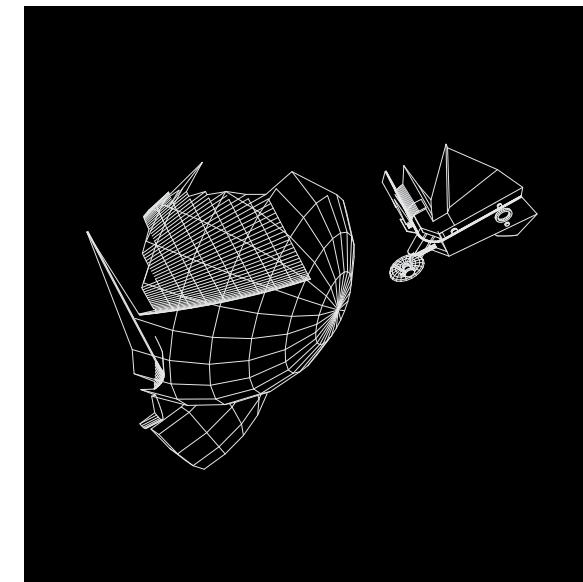
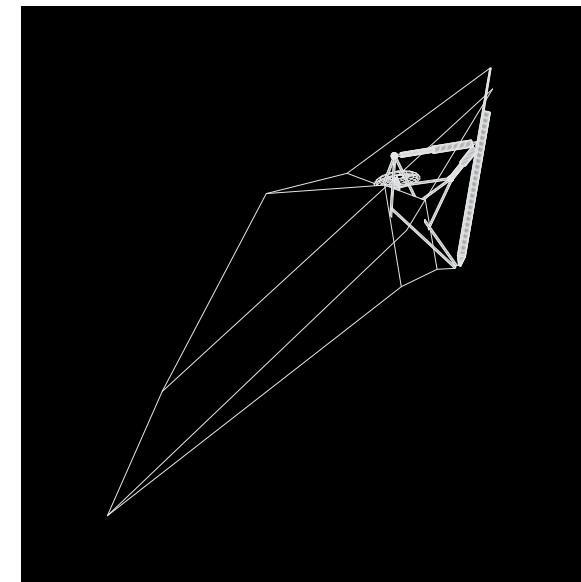
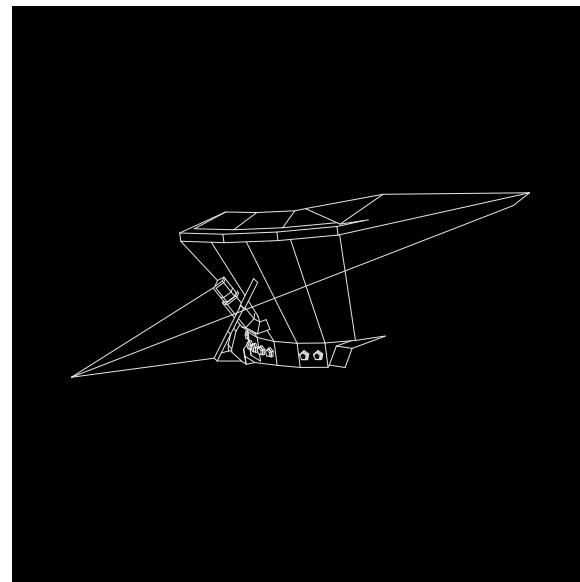
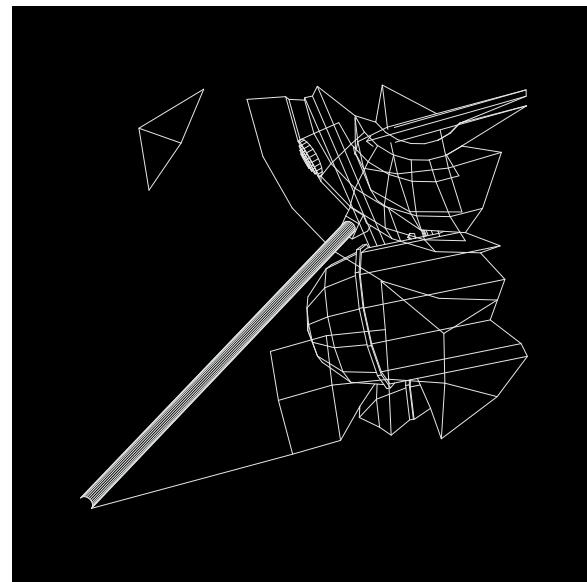
ORBIT CONDITIONS

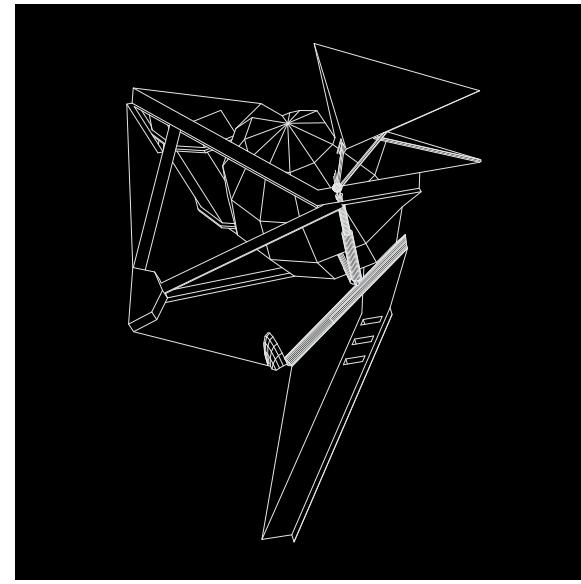
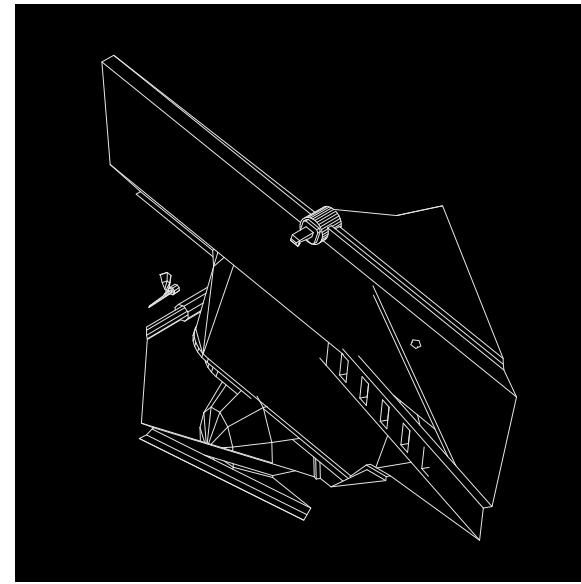
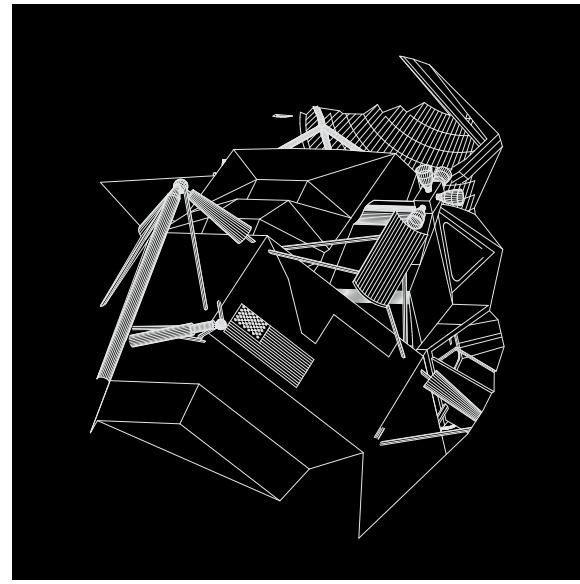
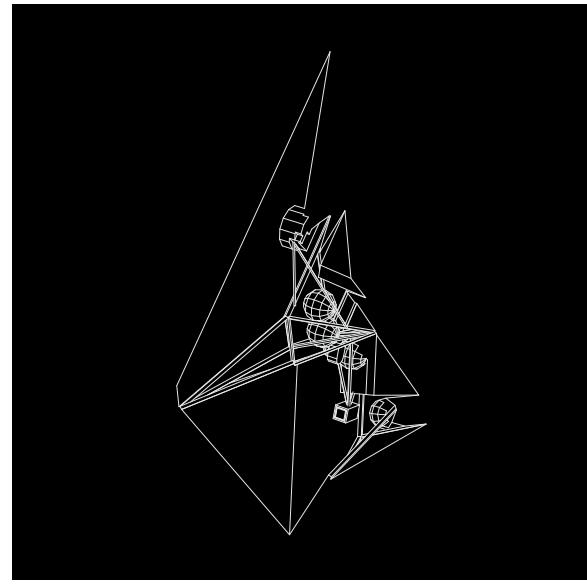
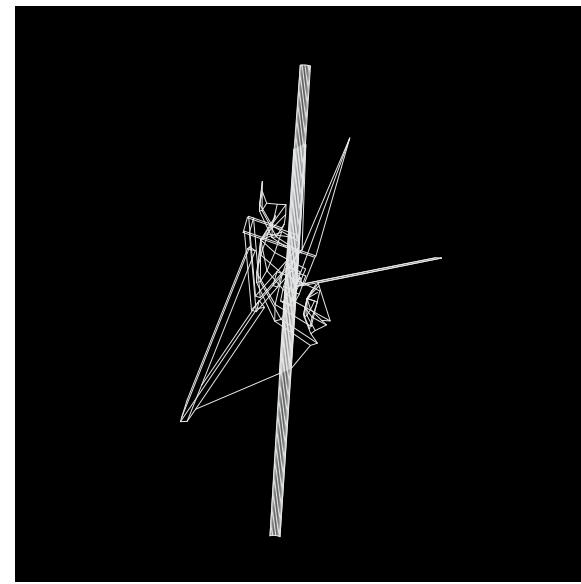
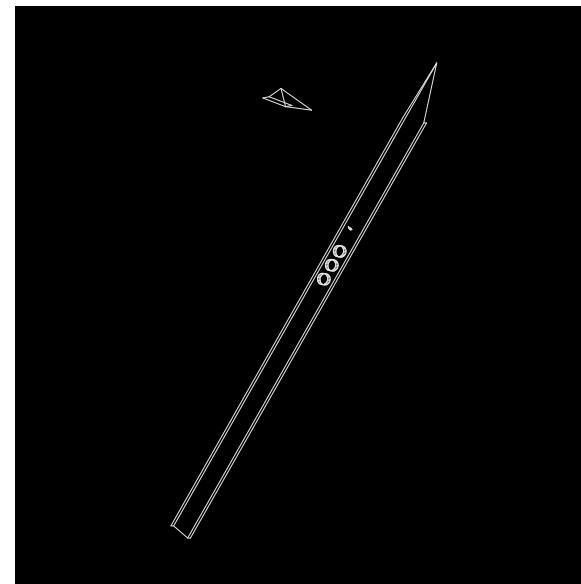
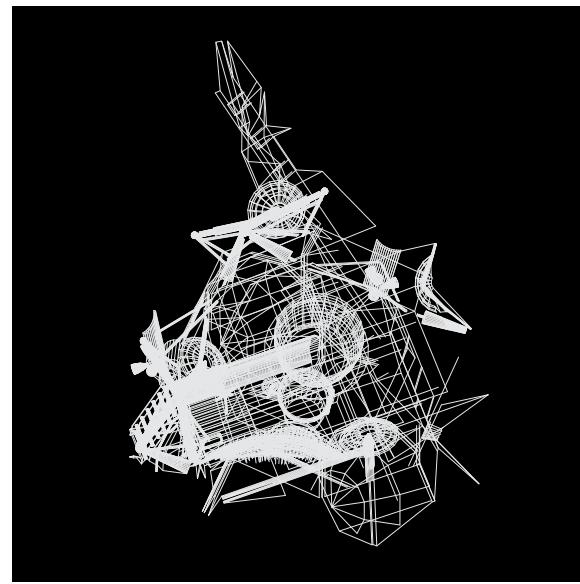
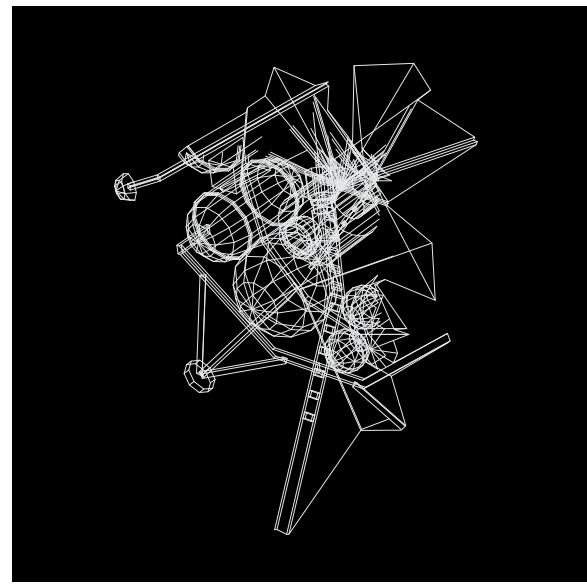
INSTRUCTIONS

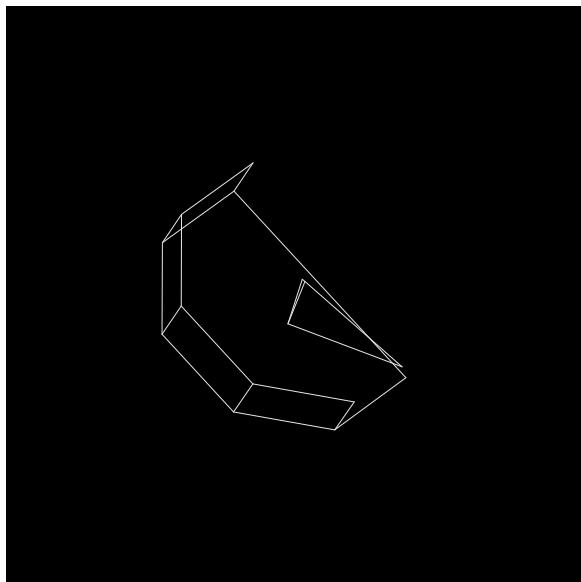
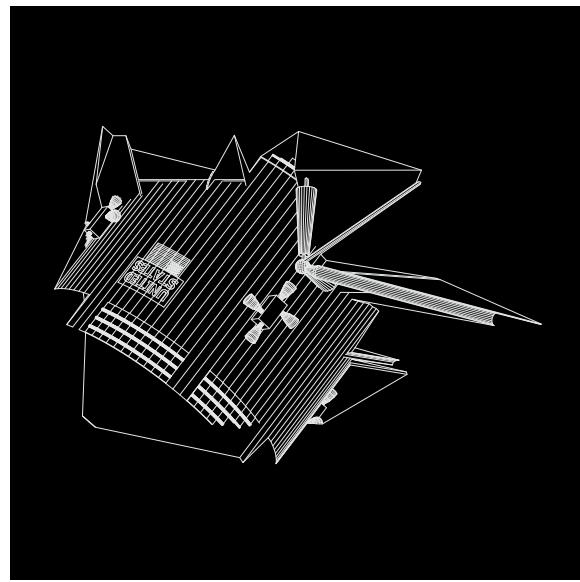
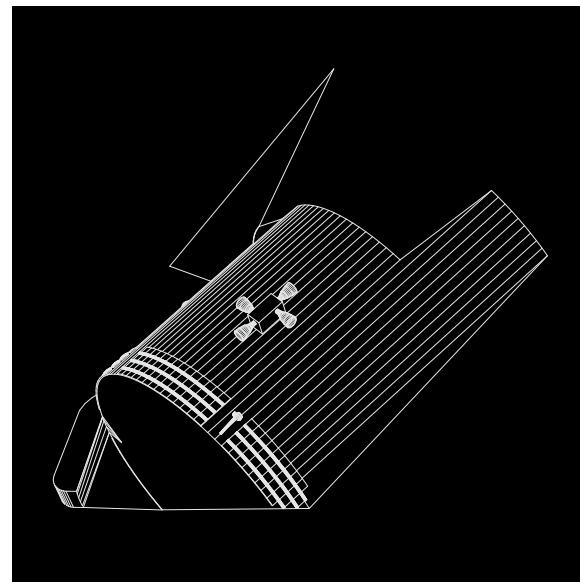
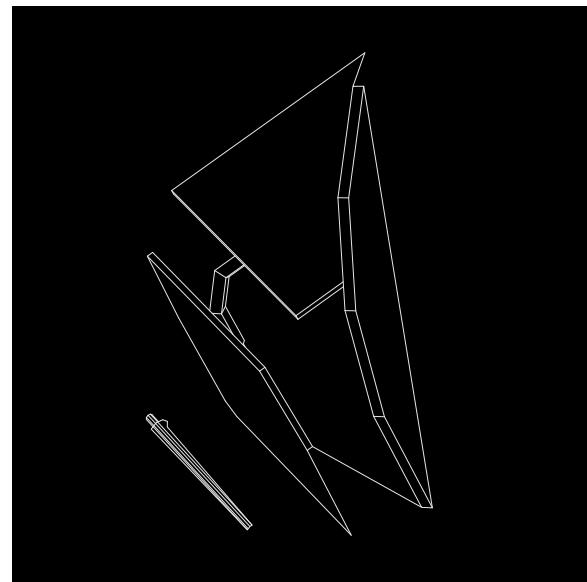
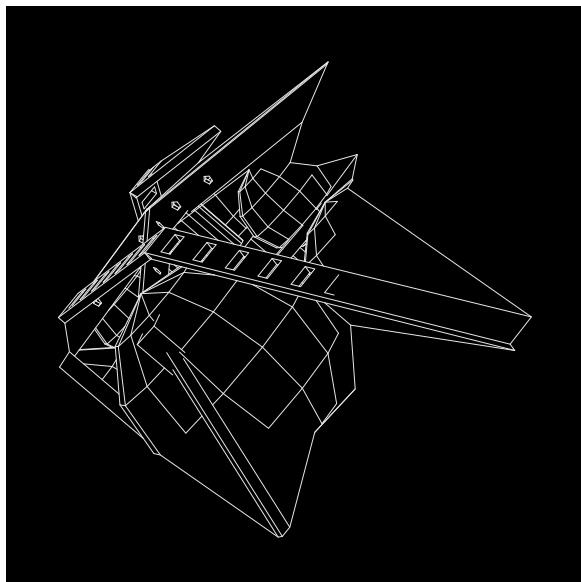
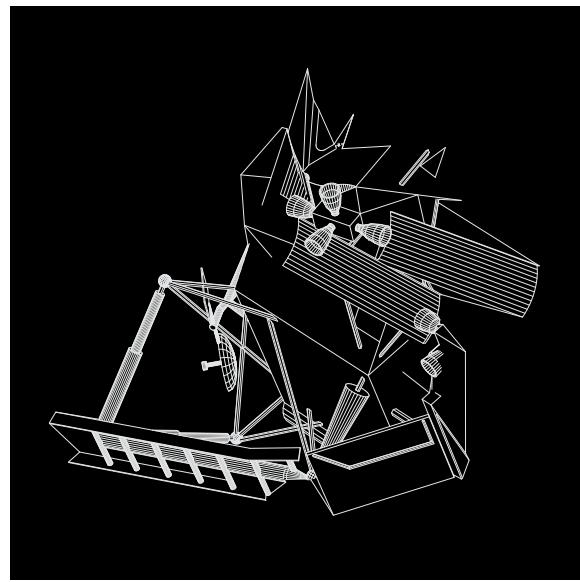
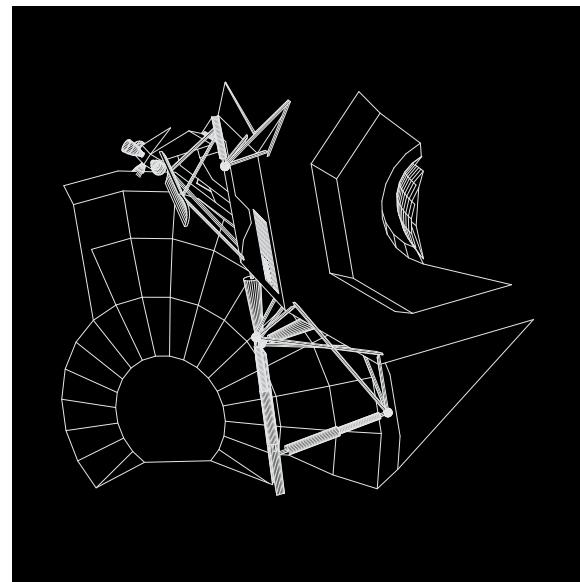
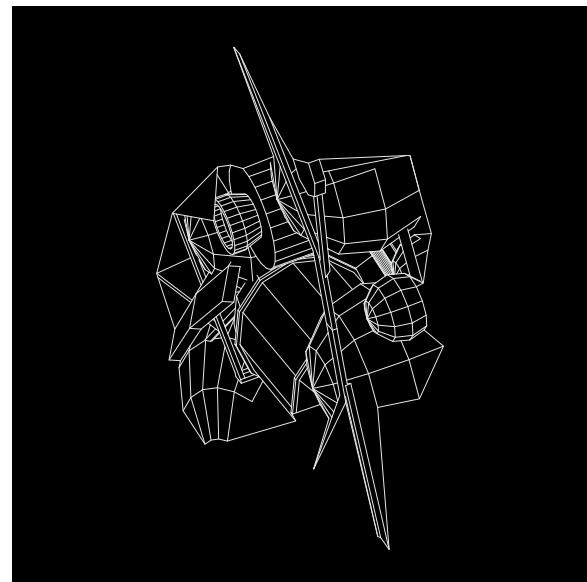
1. Select 2 random lunar objects from a set
2. Spin each of them randomly in space (x , y , z)
3. Project both results' edges onto a page
5. Enlarge the results by a random percentage
6. Move the results randomly (x , y) less than the size of the page
7. Select the lines touching the page and delete the inverse
8. Draw a line connecting the outside points



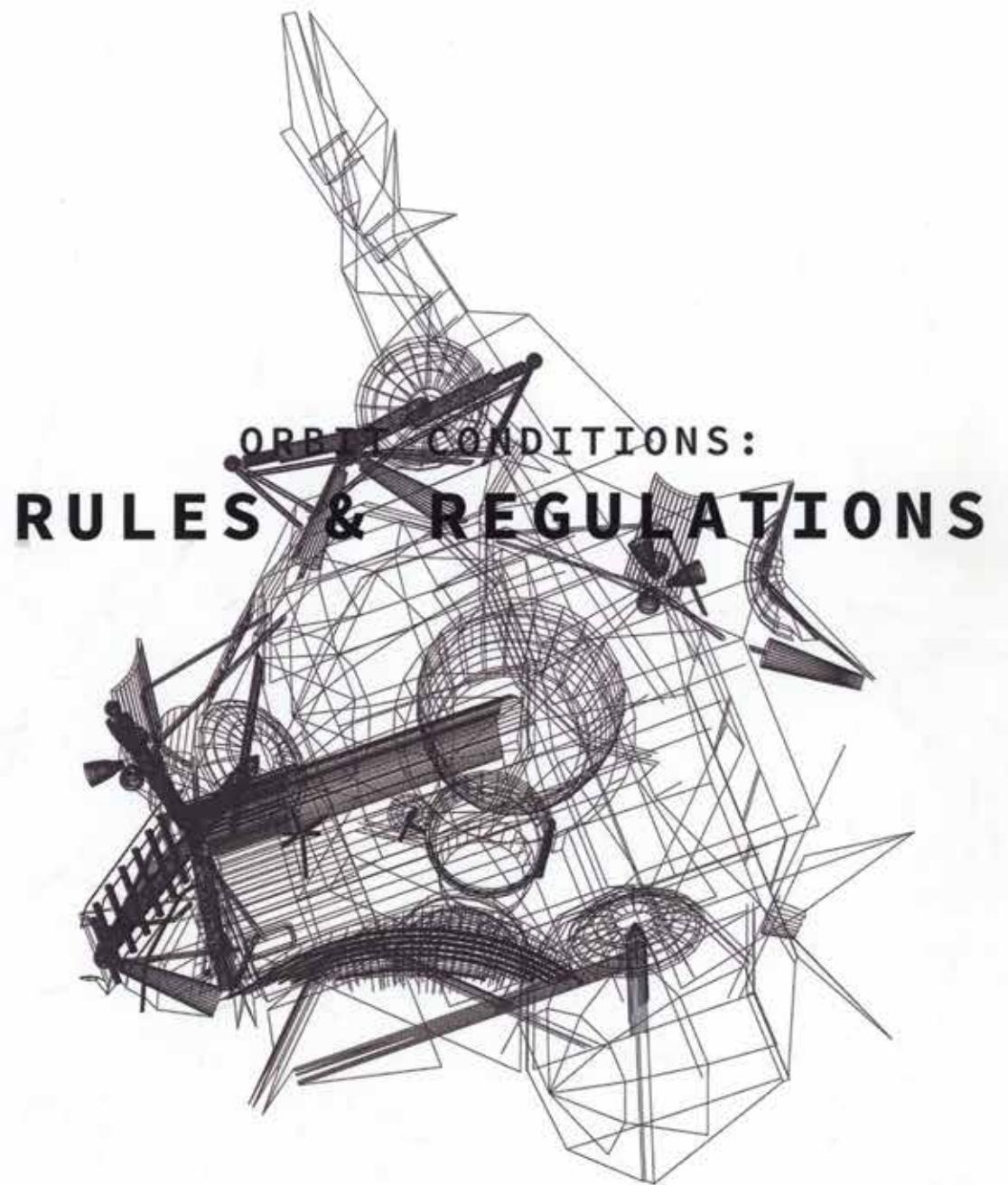








Orbit Conditions: Rules and Regulations book
containing instructions and data needed to
implement the process



ORBIT CONDITIONS

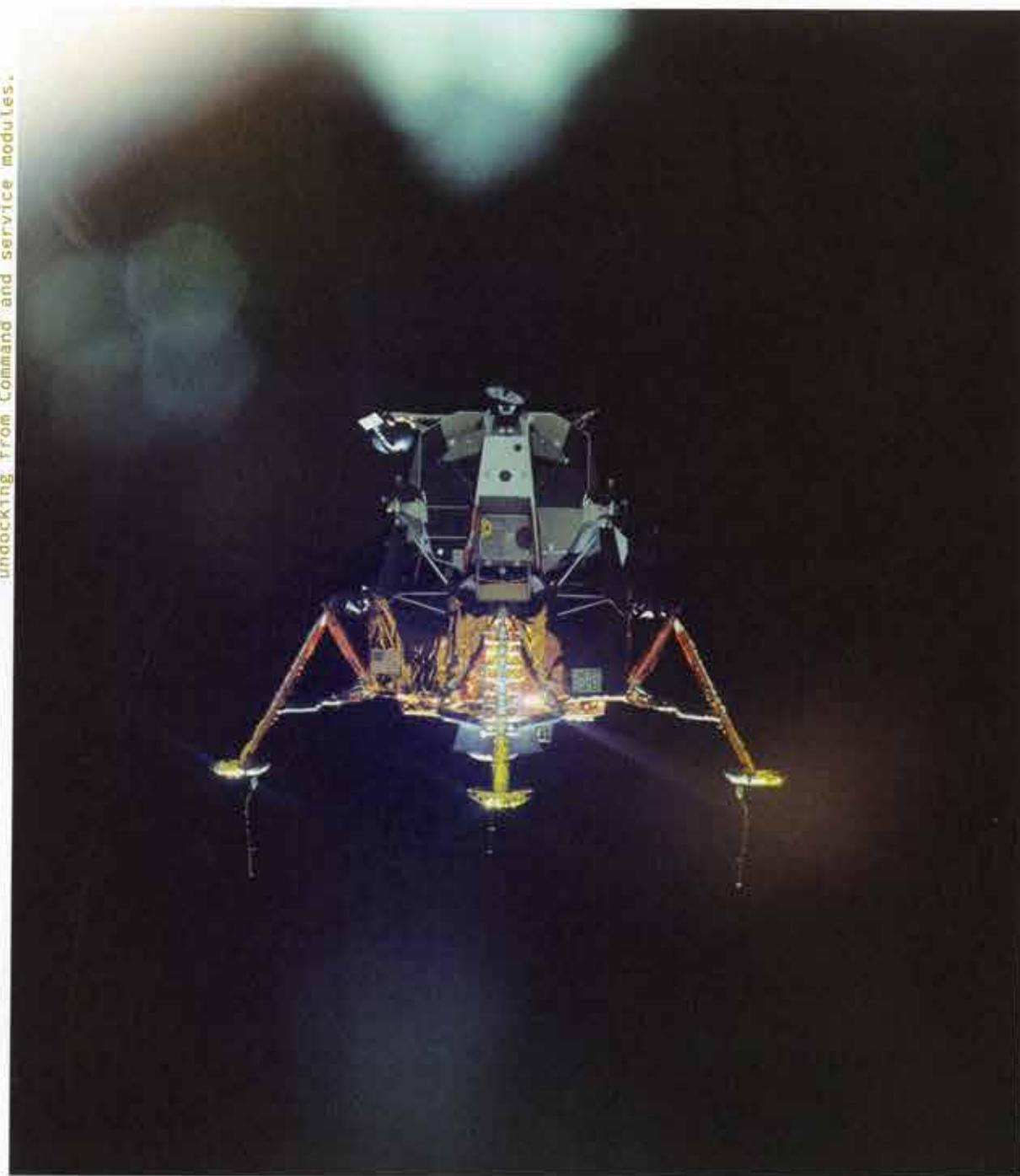
Orbit Conditions: Rules and Regulations
dedication page

CHRISTOPHER YAMANE

For Sol



Inspection of Apollo 11 lunar lander after undocking from Command and service modules.



"Through books you will meet poets and novelists whose creations will fire your imagination. You will meet the great thinkers who will share with you their philosophies, their concepts of the world, of humanity and of creation. You will learn about events that have shaped our history, of deeds both noble and ignoble. All of this knowledge is yours for the taking... Your library is a storehouse for mind and spirit. Use it well."

-Neil Armstrong

FOREWORD

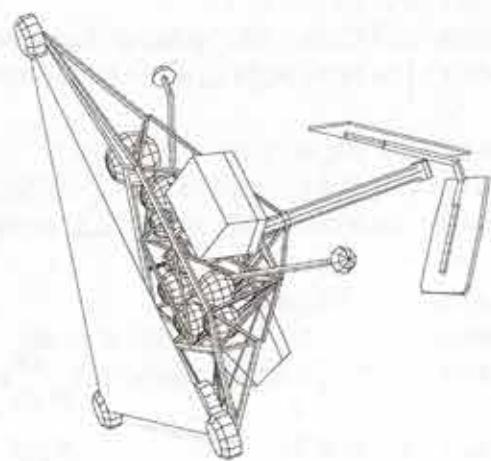
Orbit Conditions is an experiment in procedurally generated form using content-driven inputs. These forms are meant to serve as guidelines for 3D objects just like sheet music provides the structure for a song. The scores were generated by implementing the accompanying instructions (see p. 15)

Although the set of lunar object models I used were taken from *Moon in Google Earth*, this process can be applied to any number of other objects by many people in any number of object categories. Because of the chance operations involved, the ability to choose any 3D model, and the interpretation of the score, following these instructions should provide an infinite number of possible outcomes.

The sets of values in this book are meant to be used by others to develop new applications of these instructions.

VARIABLES

The variables that follow
are computer-generated
for your convenience



Object 9, Object 11
 Rotate 1: (152, 275, 150), Rotate 2: (30, 164, 107)
 Move 1: (254,-120), Move 2: (17,308) Scale: (404)

Object 7, Object 4
 Rotate 1: (282, 260, 44), Rotate 2: (282, 311, 162)
 Move 1: (-141,251), Move 2: (241,187) Scale: (458)

Object 9, Object 8
 Rotate 1: (53, 173, 154), Rotate 2: (221, 189, 83)
 Move 1: (-111,-8), Move 2: (232,-95) Scale: (550)

Object 4, Object 7
 Rotate 1: (54, 90, 338), Rotate 2: (113, 140, 114)
 Move 1: (-107,186), Move 2: (259,-233) Scale: (533)

Object 3, Object 8
 Rotate 1: (146, 180, 166), Rotate 2: (327, 317, 126)
 Move 1: (-178,-1), Move 2: (211,289) Scale: (436)

Object 11, Object 9
 Rotate 1: (264, 1, 42), Rotate 2: (290, 113, 162)
 Move 1: (192,103), Move 2: (-9,-214) Scale: (597)

Object 4, Object 7
 Rotate 1: (11, 138, 360), Rotate 2: (66, 237, 49)
 Move 1: (254,34), Move 2: (77,279) Scale: (625)

Object 10, Object 8
 Rotate 1: (318, 274, 150), Rotate 2: (192, 151, 197)
 Move 1: (-83,108), Move 2: (42,-215) Scale: (640)

Object 7, Object 9
 Rotate 1: (123, 296, 43), Rotate 2: (341, 337, 165)
 Move 1: (-66,-48), Move 2: (-78,304) Scale: (606)

Object 3, Object 4
 Rotate 1: (185, 217, 281), Rotate 2: (295, 328, 49)
 Move 1: (125,253), Move 2: (-341,99) Scale: (628)

Object 10, Object 11
 Rotate 1: (127, 26, 65), Rotate 2: (6, 323, 332)
 Move 1: (94,255), Move 2: (-165,315) Scale: (608)

Object 5, Object 7
 Rotate 1: (85, 158, 294), Rotate 2: (4, 187, 218)
 Move 1: (41,246), Move 2: (-248,79) Scale: (665)

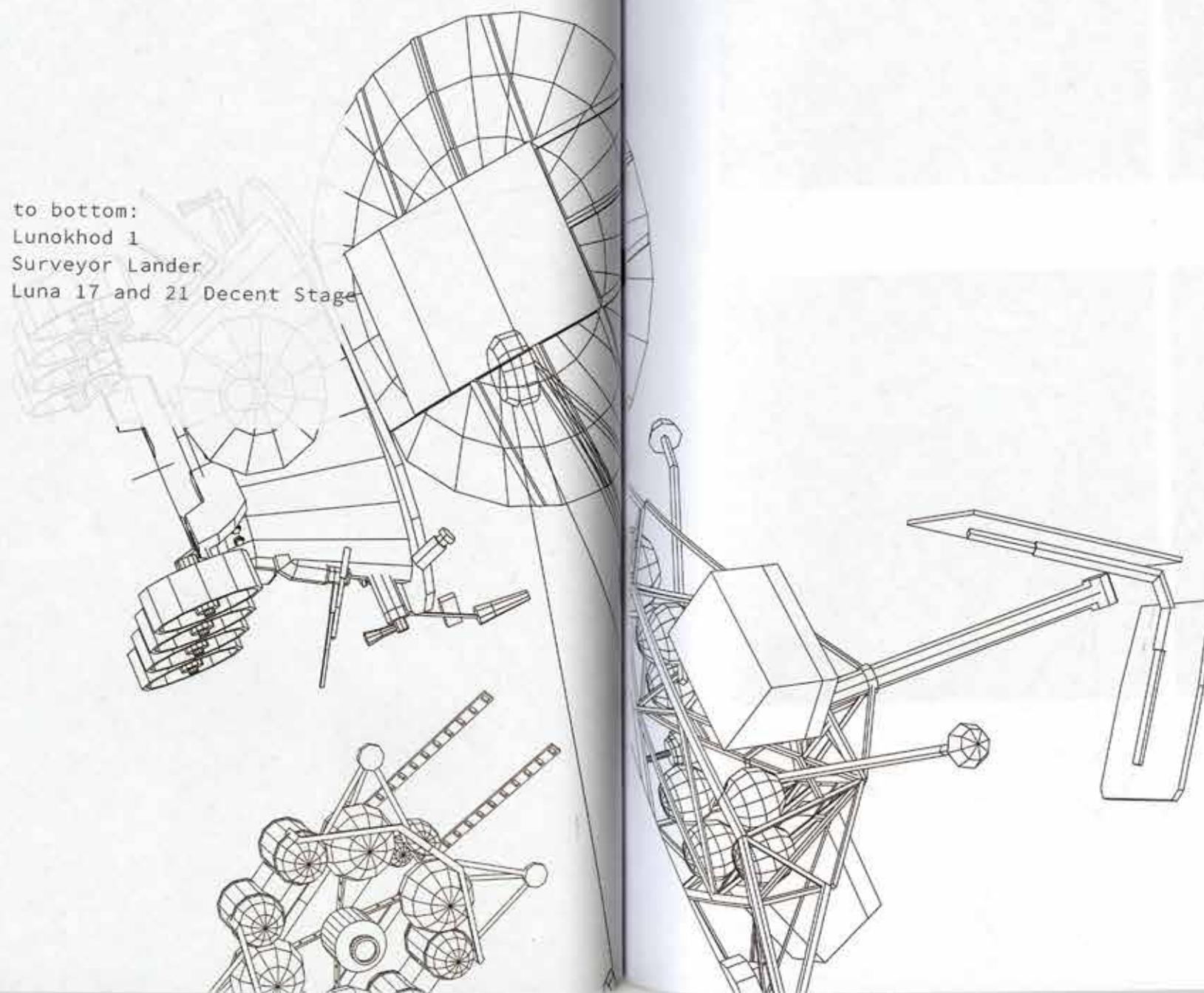
Object 9, Object 6
 Rotate 1: (197, 154, 253), Rotate 2: (172, 91, 230)
 Move 1: (266,309), Move 2: (350,-5) Scale: (665)

Object 5, Object 2
 Rotate 1: (103, 22, 141), Rotate 2: (103, 16, 78)
 Move 1: (-39,221), Move 2: (340,-31) Scale: (482)

Object 10, Object 3
 Rotate 1: (95, 306, 269), Rotate 2: (303, 133, 266)
 Move 1: (290,-247), Move 2: (93,-320) Scale: (552)

Object 6, Object 10
 Rotate 1: (21, 193, 44), Rotate 2: (176, 173, 272)
 Move 1: (-11,120), Move 2: (-156,317) Scale: (689)

From top to bottom:
Obj. 04: Lunokhod 1
Obj. 11: Surveyor Lander
Obj. 06: Luna 17 and 21 Descent Stage



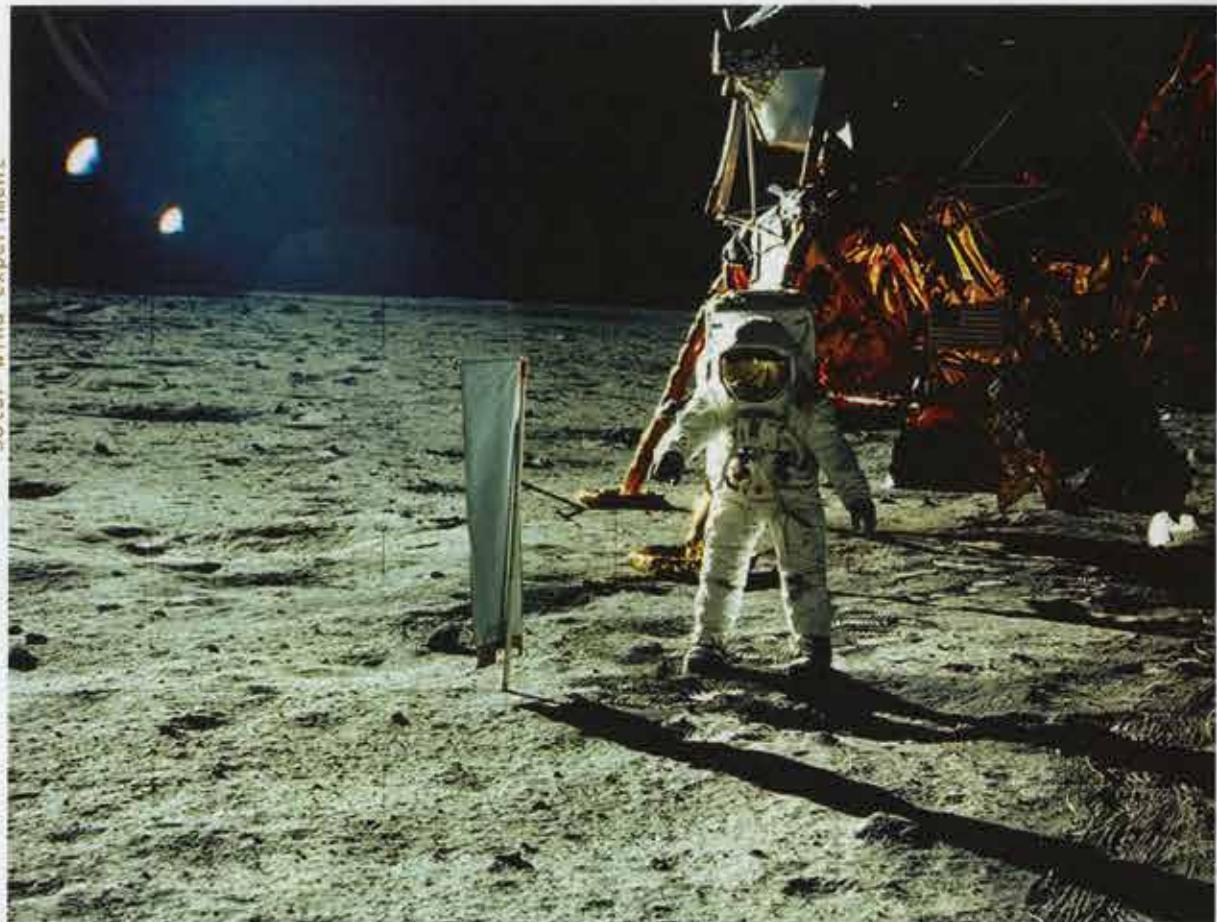
The objects on this page were chosen, placed,
and sized with chance operations similar to the
ones used in the lunar scores.

longer. Score: 45 (total)

WIND CONDITIONS

CLOUDS

Example spread #2 used to mark every 20th page
of random values



146



147

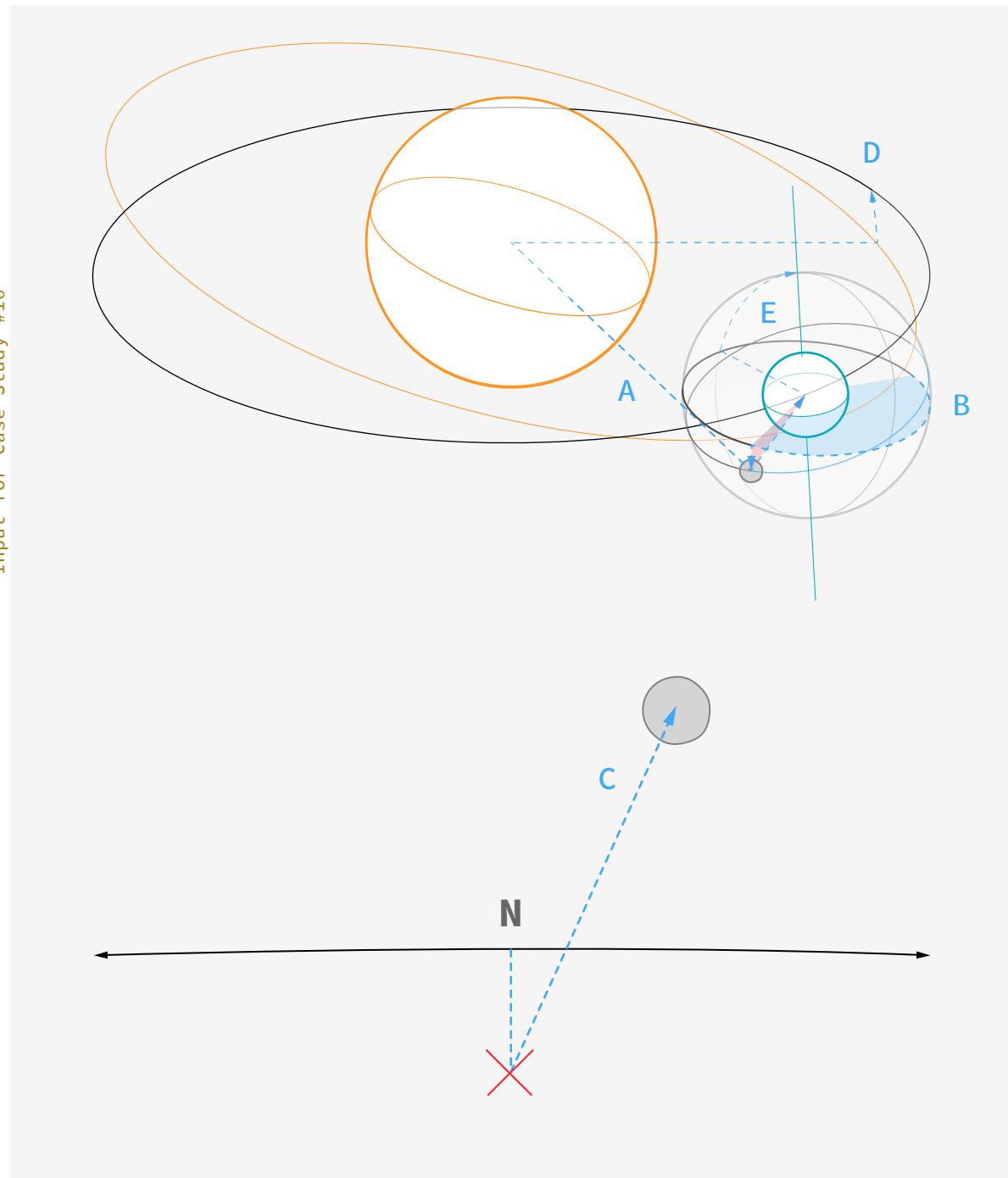
CASE STUDY #10

SATEL-
LITES



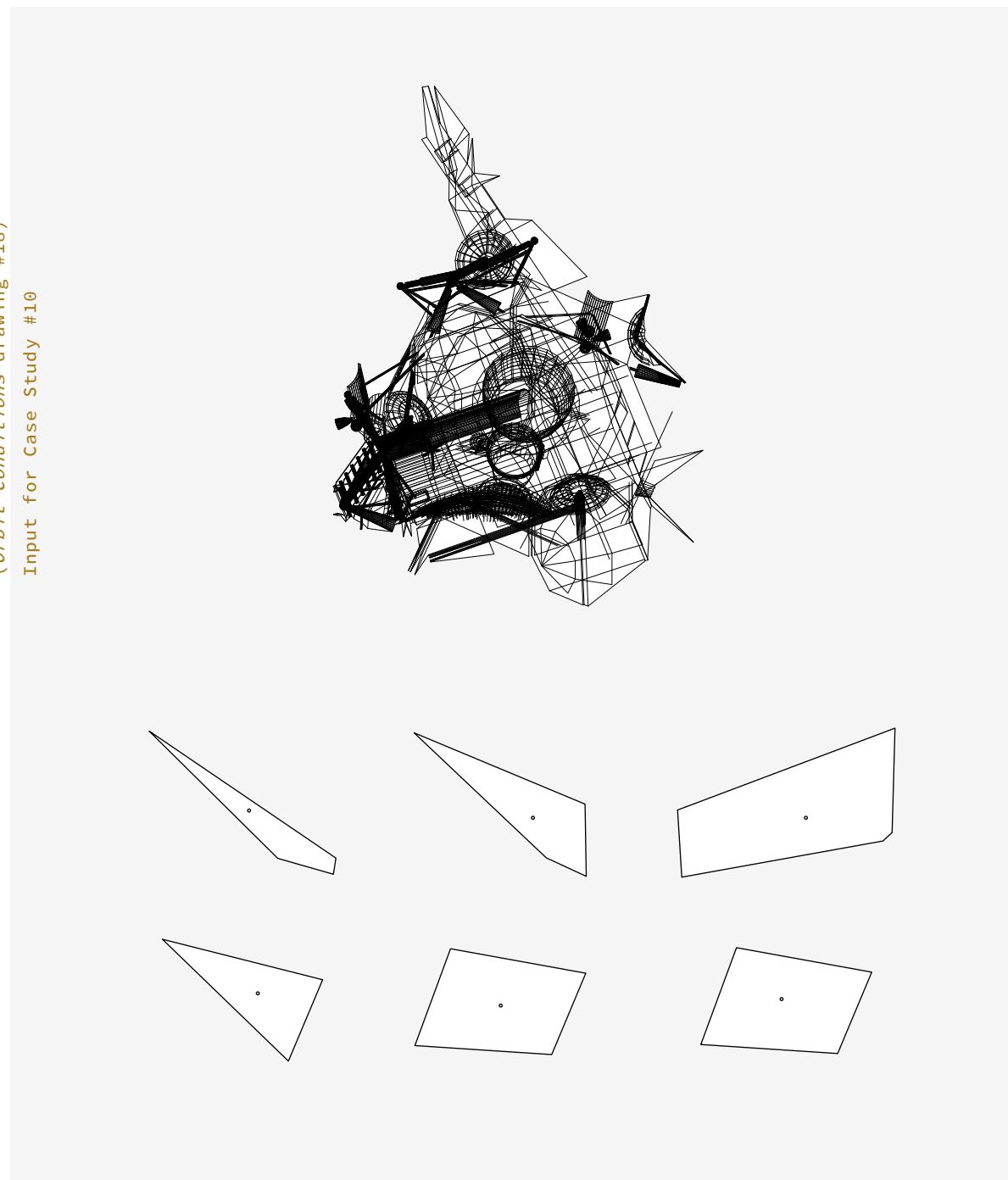
Case Study #10

Figure 1: Lunar positioning data
Input for Case Study #10



Satellites is an experiment in writing procedures for functional objects in 3 dimensions. Each mobile contains two different joints, each made by spinning hollow cylinders around a point. The first joint was spun according to lunar positioning data relative to my position on the earth at the time of 3D printing making each object time and site specific. The second “control” joint was spun according to the Earth’s tilt on its orbit. A similar Rhinoscript to *Orbit Conditions* was used to spin each connector on each joint.

Figure 2: Diffuser planes and their source
Orbit Conditions drawing #18)
 Input for Case Study #10



Chance operations determine the number of each joint and the selection of diffusion planes used to assemble each satellite. The diffusion planes were taken from *Orbit Conditions* drawing #18 but could be taken from any output from the case study. A fixed length of wooden dowel was prescribed to connect all elements to the light source. Because the arrangement of joints is extremely sensitive to orientation, and relies on/is constrained by the flexibility of the wood, it is almost impossible to assemble a combination of joints and diffusers the same way twice.

SATELLITES

INSTRUCTIONS

Joint 1 (J1): Spin the ends of 3 connectors according to the Moon's current location (figure 1).

Joint 2 (J2): Spin the ends of 2 connectors according to the current angle between the earth's equator and its plane of orbit and the angle between the earth's equator and the Sun's (see figure 1).

Diffusers: Cut 6 of the largest shapes from an *Orbit Conditions* drawing

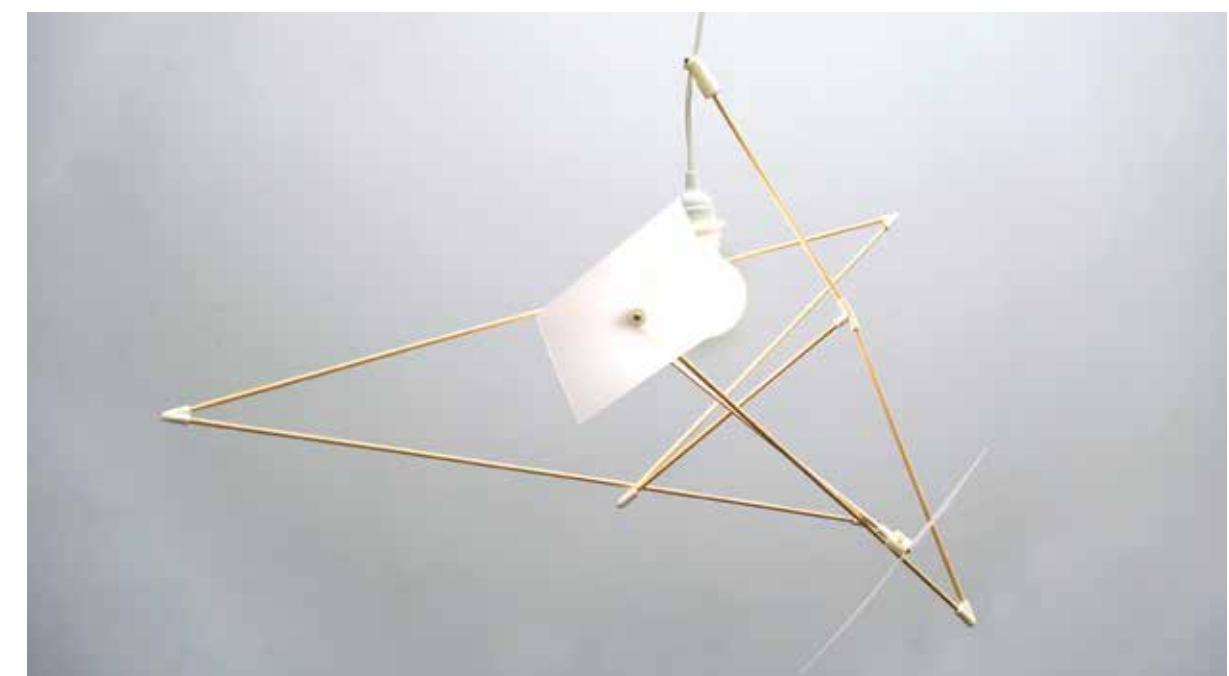
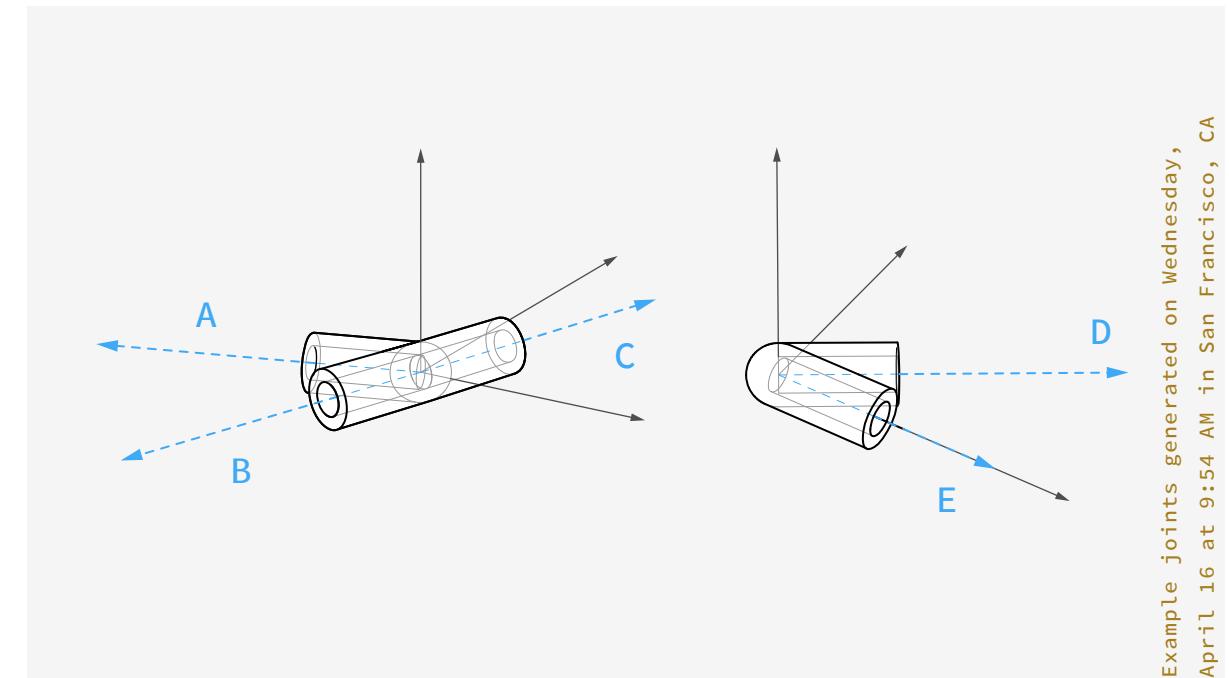
of J1: Die roll

of J2: Die Roll

of Diffusers: J1 + 1

Pick diffusers randomly from the set

Connect all joint holes, and diffusers to light source with 3, 48" wooden dowels.



Satellites generated on Wednesday, April 9 at
8:45 PM in San Francisco, CA



Satellites generated on Wednesday, April 16 at
9:54 AM in San Francisco, CA





Detail of binary satellites assembled with
joints generated on Wednesday, April 16 at 9:54
AM in San Francisco, CA

BIBLIOGRAPHY

- Antonelli, Paola. "States of Design 04: Critical Design." Domus 949. <https://www.domusweb.it/en/design/2011/08/31/states-of-design-04-critical-design.html> (2011).
- Antonelli, Paola. *Talk To Me: Design and the Communication Between People and Objects*. New York, N.Y.: Museum of Modern Art, 2011.
- Baas, Jacquelynn. *Fluxus and the Essential Questions of Life*. Hanover, N.H.: Hood Museum of Art, Dartmouth College, 2011.
- Benjamin, Walter. "The Work of Art in the Age of Mechanical Reproduction." *Zeitschrift für Sozialforschung*, 1963.
- Blackmore, Susan J. *The Meme Machine*. Oxford, England: Oxford University Press, 1999.
- Blackmore, Susan. "Memes and Temes." Lecture, TED, February 1, 2008.
- Blauvelt, Andrew, Ellen Lupton, and Rob Giampietro. *Graphic Design: Now in Production*. Minneapolis, MN: Walker Art Center, 2011.
- Bois, Yve Alain, and Rosalind E. Krauss. *Formless: A User's Guide*. New York: Zone Books, 1997.
- Breton, André and Paul Eluard. *Abridged Dictionary of Surrealism*. José Corti Editions, 1938.
- Brown, Kathan. *John Cage: Visual Art : To Sober and Quiet the Mind*. San Francisco, CA: Crown Point Press, 2000.
- Burton, Johanna, and Sherrie Levine. *Sherrie Levine: MAYHEM*. New York: Whitney Museum of American Art, 2012.
- Cage, John, and Jeremy Millar. *Every Day is a Good Day: the Visual Art of John Cage*. London: Hayward Publishing, 2010.
- Cage, John. *Interview with Laurie Anderson*. Tricycle, March, 1992.
- Cage, John. *Silence: Lectures and Writings*. 1st ed. Middletown, Conn.: Wesleyan University Press, 1961.
- Calvino, Italo. "Multiplicity." in *Six Memos for the Next Millennium*. Cambridge, Mass: Harvard University Press, 1988. 101-124.
- Darwin, Charles, and Gillian Beer. *The Origin of Species*. Oxford: Oxford University Press, 1859.
- Dennett, Dan. "Dangerous Memes." Lecture, TED, February 1, 2002.
- Dennett, Daniel Clement. *Freedom Evolves*. New York: Viking, 2003.
- Derringer, Jamie. "Friday Five with Materious - Design Milk." Design Milk. <http://design-milk.com/friday-five-with-materious/> (2010).
- Dunne, Anthony, and Fiona Raby. *Speculative Everything: Design, Fiction, and Social Dreaming*. Cambridge, Mass: MIT Press, 2013.
- Dunne, Anthony. *Hertzian Tales Electronic Products, Aesthetic Experience, and Critical Design*. Rev. ed. Cambridge, Mass: MIT Press, 2005.
- Foster, Hal, and Fredric Jameson. "Postmodernism and Consumer Society." in *The Anti-Aesthetic: Essays on Postmodern Culture*. Port Townsend, Wash: Bay Press, 1983. 127-144.
- Hendricks, Jon, Marianne Bech, Media Farzin, and Eric Andersen. *Fluxus Scores and Instructions: The Transformative Years : "Make A Salad" : Selections from the Gilbert and Lila Silverman Fluxus Collection*. Detroit. Detroit: Gilbert and Lila Silverman Fluxus Collection, 2008.
- Holt, Steven, and Mara Holt Skov. "Form Follows Provocation: Constantin and Laurene Leon Boym." in *Manufactured: the Conspicuous Transformation of Everyday Objects*. San Francisco: Chronicle Books, 2008. 87-95.
- Holt, Steven, and Mara Holt Skov. "Form Follows Variation: Livia Marin." in *Manufactured: the Conspicuous Transformation of Everyday Objects*. San Francisco: Chronicle Books, 2008. 117-125.

- IDEO. "Human Centered Design Toolkit." IDEO. <http://www.ideo.com/work/human-centered-design-toolkit/> (2009)
- Jongerius, Hella. *Misfit*. London: Phaidon Press, 2010.
- Levine, Sherrie. "Statement." *Style*, March 1982.
- LeWitt, Sol, Susan Cross, and Denise Markonish. *Sol LeWitt: 100 Views*. North Adams: MASS MoCA, 2009.
- LeWitt, Sol. "Paragraphs on Conceptual Art." *Artforum International*, June 1967.
- LeWitt, Sol. "Sentences on Conceptual Art." *Art-Language*, 1969.
- Maurer, Luna. "Luna Maurer." Lecture, Seeing Orange: Dutch Design at CCA from CCA, San Francisco, April 9, 2014.
- McElheny, Josiah, Helen Molesworth, and Mass Boston. *Josiah McElheny: Some Pictures of the Infinite*. Ostfildern: Hatje Cantz, 2012.
- Moors, Anneke, and Aaron Betsky. *Simply Droog: 10 + 3 Years of Creating Innovation and Discussion*. 2nd ed. Amsterdam: Droog, 2006.
- Pritchett, James. *The Music of John Cage*. Cambridge, England: Cambridge University Press, 1993.
- Ramakers, Renny. *Less + More: Droog Design in Context*. Rotterdam: 010 Publishers, 2002.
- Reas, Casey, Chandler McWilliams, and Jeroen Barendse. *Form+Code in Design, Art, and Architecture*. New York: Princeton Architectural Press, 2010.
- RiP: A Remix Manifesto*. Film. Directed by Brett Gaylor. Montreal: National Film Board of Canada, 2008.
- Sachs, Tom. *Tom Sachs: Space Program : Mission Guide and Experience Report*. Beverly Hills, Calif. Gagosian Gallery, 2008.
- SFMOMA "Robert Rauschenberg's Erased de Kooning Drawing." San Francisco Museum of Modern Art. <http://www.sfmoma.org/explore/multimedia/videos/24> (1998).
- Simms, Bryan R. *Music of the Twentieth Century: Style and Structure*. New York: Schirmer Books, 1986.
- Stillman, Daniel. "Design Process Kills Creativity / Design Process Creates Creativity." Core77. http://www.core77.com/blog/strategy_research/design_process_kills_creativity_design_processCreates_creativity_23480.asp#more (2012).
- Taylor, Mark C., and Mark Tansey. *The Picture In Question Mark Tansey and the Ends of Representation*. Chicago: University of Chicago Press, 1999.
- Temkin, Ann. "Marcel Duchamp. 3 Standard Stoppages (Paris 1913-14)." MoMA.org. http://www.moma.org/collection/object.php?object_id=78990 (accessed April 23, 2014).
- Tharp, Bruce, and Stephanie Tharp. "The 4 Fields of Industrial Design: (No, not furniture, trans, consumer electronics, & toys), by Bruce M. Tharp and Stephanie M. Tharp." Core77. http://www.core77.com/blog/featured_items/the_4_fields_of_industrial_design_no_not_furniture_trans_consumer_electronics_toys_by_bruce_m_tharp_and_stephanie_m_tharp_12232.asp (2009).

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