Mind Over Matter: Generative Concepts In Three-Dimensional Sculpture

Marc Mancuso
Boston, Massachusetts
www.flickr.com/photos/marcmancuso
e-mail: marc_mancuso@hotmail.com

Abstract

This paper discusses the effect of generative concepts on the planning, execution, documentation, and interpretation of my recent series of three-dimensional sculptures. My intent was to build systems that had both cyclic and open-ended processes from which there is no combination of fundamental design or surface evidence that traditionally identifies an object as precursor or final product.

Metal, plaster, rubber, clay, and other commonplace sculptural materials are categorized as points on a set of continuums including rigid-flexible, absorbent-waterproof, opaque-transparent, buoyant-dense, and so on. Based on these intrinsic qualities, I build systems that manage constraints and define and implement rule-sets to regulate the order of interactions. Despite the limited use of virtual technologies, the results of these physical activities can be compared to computational and iterative processes including Boolean operations, graphical user interface tools such as *fill* and *skew*, programming structures such as loops, random number generators, and geometric identities.

Additionally, my intent was to allow any transformation to initiate or conclude another process. Observable “links” to preceding or successive iterations may be perceptible, but traditional notions of completeness or progress towards a particular state are discarded. The physical constraints in these systems inform a discussion of successes and failures encountered during the building of processes that respond to these requirements.

Of particular interest is the way in which plaster, metal, clay, and rubber are used over a series of transformations that demonstrate recursive structures, variations in high- and low-fidelity data compression, and distortion.

Documenting ongoing systems that have one or more real-time unfolding aspects and one or more physically durable artifacts raises philosophical issues as well as practical ones. The paper examines the implications of documentation through still images and time-dependent mediums.

The paper concludes with a brief discussion of how the classification systems and transformational rules could inform future work.

Overall Objective

This paper describes sculptures and imagery that emerged from generative fabrication processes developed between January and November 2014. The overall objective of this work has been to achieve diversity over the course of iterations by adding or removing subdivisions. Having learned traditional mold-making techniques in which containment fields are blocked off one section at a time in a worthy but time-consuming process, a faster means was sought to make plaster objects fit closely together without cutting. The traditional means of using metal shims to divide a soft clay original into a short wall for plaster to rest against led to the insight that perhaps the role could go entirely to the metal shims or to thin partitions in general. The response was devise ways to assemble a certain set of rigid objects to contain and/or subdivide a material in its fluid phase, then disassemble that set of objects from the system after the liquid reaches its solid phase.

An additional objective was that the parts be modular and repositionable among themselves. With a small number of materials and completely quantifiable parameters, they define a great variety of spaces, allocate material to those spaces, group or subdivide that material, and create objects which are completely repeatable or widely variable. In so doing, the physical materials manipulated here mimic or embody aspects of Boolean logical operators and familiar aspects of digital interface tools. The generative aspect of the processes refer to what aspects of the system can be quantified and varied, and the degree to which that potential is expressed, if at all.

Result: Partition Cycle--Styles One through Six
The generative fabrication processes are identified by six styles, presented in an order that demonstrates progressively complex changes in construction rules. It will be seen that each material may take on the role of form-giver or thing formed, often displaying distinctly different qualities across the sculptures and photographs that emerge during the many constructing, assembling, and disassembling processes. The set of objects or materials that creates subdivisions is called a *mesh*, regardless of the differences of material.

Means
The straightforward choice was to use plaster and liquid clay slurry, both of which have fluid and rigid modes and which release from each other easily. This releasing quality has been used for centuries all over the world, but adding the thin partition concept, embodied here by thin metal sheet, rubber latex sheet, and brushed clay slurry, allows the creation of an unprecedented diversity of objects. The thin partition arrangement allows many close-fitting parts to be made *in situ* from one or perhaps several batches of liquid material. The resulting separated shapes can then be reused as containments for further processes in many combinations.

Notably, these processes can both increase or reduce complexity with equal ease, by installing a greater or lesser number of partitions into a containment space. The six styles differ in part because, with the appropriate separator, each material explored here can function either as "tool" (thing-former) or "content" (thing formed). Moreover, since the waterproof separators are all reversible, it enables an absorbent material to be waterproof for a certain period of time in order to form new materials.

The separation apparatuses involved often take on qualities of generative art as much as the filling materials do.

Introduction to materials

The materials used in this series are commonly available, simple to use and modify, and combine easily with each other. Basic information on materials and processes that are not germane to the manipulations in this series can be found in the voluminous literature available elsewhere. Notably, plaster use for statuary and mold-making, and clay use for absorption casting represent a vastly interesting and complicated subject. But since only one type each of plaster and clay slip is completely sufficient for these systems, I only describe the quantifiable aspects that are allowed to vary that have direct "generative" bearing on the results.

Plaster
This series involves plaster as material that is at first a liquid that flows, then gradually gels, and finally hardens. When it first hardens, plaster is completely saturated with the water used in mixing, and over approximately 2-3 days, the water completely evaporates, leaving a rocklike absorbent material. These systems exploit the fact that a plaster object is absorbent, is rigid, is not too brittle (but can be made to fracture), and allows for easy subtraction of material by standard means. Moreover, its unsurpassed ability to capture and retain detail is exploited by leaving many of the marks it takes on during casting.

The current procedural constraints do not allow sawing of plaster objects into pieces; however, breaking a single plaster object into more than one piece is allowed because the fracture plane is an attractive separation surface that otherwise can't be sculpted. Since plaster's ability to capture detail is so complete, nearly all process marks are left alone, but constraints do allow for the shaving down of slightly rough surfaces that were intended to be flat.

A meaningful variable that affects plaster's shape is the short window of time after it is a completely mixed liquid, but before it completely hardens. Quantifying and allowing this time variable to change affects future processes dramatically. The most common use for this frosting-like, gelling state is that it allows for partitions to be pushed into plaster and immediately held there by the plaster with an absolute minimum of disturbance to the surrounding surface.

The implications for generative processes is that as mixing time changes from standard duration of about 5 minutes to longer than that, the gel window starts sooner and sets up faster, leaving less time for liquid- or gel-specific events. For example, larger or more convoluted areas that need to be filled with freely flowing liquid plaster might be completely covered or might not be covered, which we see in Style No. 6. A great number of partitions that need to be positioned might not all drive in easily or only do so with evidence of disturbance, as we see in Style No. 4, in which a certain number of metal parts that must be arranged--often improvisationally--within the 2 minutes the single plaster layer is still gelling. If that gel should set up sooner than all partitions are in place, will the fewer number of partitions affect the layer favorably?

The standard recipe of plaster is completely sufficient as absorptive material for clay slurry. Additionally, there are instances in the Partition Cycle in which new plaster is cast against old plaster. In traditional processes, a waterproofing agent is applied between old and new plaster to prevent chemical bonding. This sealant is generally considered irreversible, meaning that clay slip will no longer cling to and build up against the waterproofed surface.

Since the goal of these systems is to be more open-ended than that, a different method was needed. After the thin layers of spilled slip that often happen when emptying the mold were seen to peel off cleanly, it was an indication that the same thin release could be used deliberately. Applying a very thin coat of clay slip to old plaster proved the best choice for enabling new plaster to release cleanly. Afterwards, the thin, detail-preserving clay slip film used as separator can be cleaned off completely. Establishing plaster's binary and reversible role either as a surface to be sealed to itself or absorbent to clay slip is a key element of these discoveries.

Clay Slip (Slurry)

The standard usage of specially prepared liquid clay is that it builds up a structurally sound 2-5mm shell when it fills a containment area made of absorbent surfaces like plaster or other clay. The greater the length of time the liquid dwells in the containment area, the thicker the coating on all surfaces becomes. Draining the excess material stops the thickening process, and starts the drying and shrinking process until the casting is stable enough to release itself from the mold. The outside surface of the clay casting takes an exact impression (negative) of the mold surface, while the inside of the clay casting exhibits a somewhat rounded surface where the clay built up in the narrow spaces that inhibited complete draining. When both surfaces are visible as in several of the Styles, the comparison between the two is appealing.

It is worth clarifying here that these systems are designed to have clay slip function at a very wide range of thicknesses. In separator mode, clay slip is applied as thinly as possible, approximately 0.2mm-0.5mm thick, used between old and new plaster. Conveniently brushable, the separator coat can be applied by hand. But perhaps more useful is the fact that clay slip can be poured into very complex inaccessible surfaces and drained immediately. In structural mode, clay slip is built up to a standard thickness of approximately 2-3mm, appropriate for ceramic objects intended to hold their own shape. In "erosion filter" mode, clay slip is left to dwell for up to 30 minutes to really obscure its own interior details with a wall as much as 4mm thick. Thickness growth slows down as the wall gets thicker, even when excess liquid clay still dwells in the mold. Programming that specifies times greater than approximately 20 minutes does not appreciably affect thickness. (The effects of leaving all the liquid clay in the mold without draining are not discussed in this paper.)

Generally the only thickness of clay slip wall that is intended to survive as a baked object is the structural coat. Timing of the dwell can run short or long, which might or might not build a shell at an appropriate thickness for its intended function. In this way, like plaster, which has more than one role depending on manipulation of the materials around it, clay slip can function as a separator, a structure, or a filter.

Another quantifiable and potentially meaningful aspect of using clay slip is fact that it can be colored beforehand. In some cases, as in the combination casting from Styles Nos. 2 and 3, different colors act as visual cues that separate events have taken place in time, using color to identify an event that might otherwise have gone unnoticed because no textual or structural evidence can be seen.

Future developments regarding clay slip usage

An obvious but unexplored generative aspect of using clay slip for baked objects is the fact that its approximately 20% shrinkage after baking is a form of "data filter" that can be used without computation for feedback loops. A baked clay structure can be brought back into the mesh creation stage and its shrinkage accommodated. In addition to shrinkage, baked clay objects may exhibit some shape distortion from unavoidable or deliberately induced warping. If the object is used in further processes, this distortion is analogous to a shape filter in digital systems.

Aluminum sheet

Commercially available aluminum metal flashing is thin, waterproof, easily cut, and bendable. It is reusable depending on what was used to connect pieces together and whether dismantling it after use went smoothly. Conveniently, it can be scored and snapped into pieces with minimum of effort and maximum accuracy. Because cutting with scissors or guillotine invariably bent the metal, cutting curves from flat metal was not explored in this series. (Bending curves was explored, however, in Style No. 4.) In this generative aspect, it provides very close tolerance between plaster objects when plaster is on both sides of the metal. Extending the traditional use of metal sheet to separate mold sections when plaster is used, metal thinness created an equally thin gap between flows of liquid plaster that was leakless when properly reassembled before use with plaster or slip.

A quantifiable and meaningful generative aspect to using metal shims is that connectives vary and each contributes to information captured by the plaster flowed into it: tape and magnets used to join pieces leave surface/process information. If care is taken not to distort the metal, another generative aspect is that a set of metal pieces can be reused in different arrangements, leading to an underlying consistency of form. In Style No. 4, the same set of a dozen or so separator glyphs were sunk into gelling plaster and rearranged every time a new layer had to be cast. Though the patterns were different, there was an unmistakable design resemblance among overall patterns.

Rubber latex

Commercially available rubber latex sheeting at a thickness of .03mm serves perfectly well as a thin separator for plaster that is flexible, waterproof, reusable, and easily measured and cut. Since it is never absorbent, it has no use in these systems as a separator for clay slip. Making connections among separate pieces of latex is easily accomplished with double-stick tape if tensions are not too great and the width of the tape can be exploited or ignored, and with rubber cement when the connections need to withstand greater tensions. Double-stick tape was sufficient to hold up under the tensions involved in Style No. 5. The generative aspect of using latex as a mesh is that while the mesh components might be very accurately measured and assembled, during use the resulting mesh varies considerably based on what forces act upon it before and during use. Moreover, because the rubber mesh can move during the flow of plaster, varying the starting location and number of pours has great impact on the resulting objects.

Foam core
At a thickness of 3-5mm, commercially available foam core is lightweight, easily cut, somewhat rigid even when thin, and somewhat reusable depending on whether it gets bent or wet and whether its deterioration can be exploited. While foam core can be sealed with brushable coatings like shellac or paint, it is slower to execute, and, other options are preferable.

Various plastic packaging tapes and water-resistant edging tapes were used to waterproof the foam core partitions because of two additional attributes those materials contribute. The waterproofed panels became miniature abstract paintings in themselves from the color, translucency, and direction of the tape application. Moreover, the thickness and surface qualities changed subtly, definitively captured by the plaster that was poured against it. A great many distinctive patterns can be executed by means of the tapes, which in turn would have graphic validity in themselves, or transfer their textures to plaster objects. Moreover, since the panels themselves can be joined at any point, the tape/noise patterns are interrupted and collaged anytime two panels are combined in a different way.

Several other generative aspects emerge from tape-waterproofed foam core. From a graphic standpoint, the texture imparted to the plaster surfaces can be a target site for other events, such surface decoration. The tapes may not release plaster in the same way, causing bits of plaster to adhere to the panels on disassembly, leaving physical chunks that can be resealed and incorporated as "noisy" data in the next iteration.

Structurally, foam core as a mesh element is by far thicker than the other materials in use, providing a 3-6 millimeter gap between plaster pieces. This is more than enough room for liquid clay slip to flow and be structurally sound enough to survive unmolding, which, incidentally, is the only way in these systems a clay wall could be created from plaster mold pieces in their original positions. Alternately, the narrow gap within the plaster mass provides easy access for leverage to pry open the mass and crack it somewhere, using that violent act as a secondary form of separation.

Regrettably, though the tape-waterproofed foam core is in theory reusable, the complications of building Style No. 6 were of great value to improvisational nature of casting plaster, but bad news for recovering and saving the mesh. Fortunately, many interesting pictures were taken of that mesh, and it provided generative material all by itself. Future attempts at making such labor-intensive, information-rich meshes reusable are likely to be more successful.

Operational concepts

Throughout the entire Partition Cycle, various operational concepts governed choices of shapes and guided priorities of timing. Several major topics, discussed below, define the narrower set of options these systems operate in than those of more generalized sculptural processes involving these materials.

Draft angle
As will be familiar to those exposed to a wide range of manufacturing and molding practices, for two rigid objects that meet exactly that are required to move apart without breakage, all shared surfaces must be visible along the direction of movement. Much literature exists explaining the pragmatic and ingenious solutions this requirement has inspired. All the separators and rigid objects in this Cycle satisfy the requirement of positive (releasable) draft angle. For example, in Style No. 4, all the "puzzle" pieces slide sideways away from each other because when the missing ones are cast in clay or plaster, it is likely that there is only one direction of unmolding. Systems that allow locked-in pieces, while fascinating, are not addressed in this cycle.

Computational analogs
Many aspects of the systems described in this Cycle rely on materials that can be quantified by shape or volume, and processes that can be quantified by time, location, or rate. The variety of objects created and used throughout the Styles have computational analogs in virtual processes common to 3D modeling and mathematical logic. The following list of concepts will be familiar to anyone comfortable with digital design environments and programming languages: FLIP, SKIP, SLIDE, CONCATENATE, STRING, ROTATE, GROUP/UNGROUP, UNION, SUBDIVIDE, FILL, SKEW, BLUR, SHRINK, INTERSECT, ADD/REDUCE NOISE, SELECT.

Some of these concepts are mentioned in the description of the styles where noteworthy. Conceptualizing these early demonstrations in this way, future work in these Styles can easily progress not simply from an intuitive ordering of events, but also from a kind of pseudo-code or program that drives events, limits options, and results in a "render" or some manifestation of the command-implementation cycle.

Intuitive input
The Styles vary considerably in appearance, but the level of choice involved in changing features of mesh creation was based more on intuition than on rigorous method. As each style is described, it is often noted what future recommendations could be made to the generative aspect of the existing Style. The next Style is described in terms of what it addresses from the previous one.

Conservation
In some styles, an aspect of the partition is conserved, or in other words, limited in how much it varies. Most meshes made of metal sheet that are used in the Styles have some basic dimension equal to the size of the original sheet. The height of the mesh in Style No. 2 is conserved so that other variables can be made important. In Style No. 4, the same metal "glyphs" are repeatedly used in different combinations. Obviously, no such restrictions need occur. Think on how different the configurations of metal mesh would be in Style No. 3 would be if the number of prefabricated triangles could be chosen from 5 to 100.

Similarly, the quantity of material for filling might be conserved. Style No. 4, for example, features plaster layers of consistent thickness because the containment does not change shape, the same amount of plaster is mixed (conserved), and the metal pieces that sink are of negligible volume. But what if the metal shims were replaced with the thicker foam core partitions? The displacement could become quite noticeable from one layer to the next. Similarly, what might have happened in the case of Style No. 1 if the plaster poured for the layers had been conserved. (It wasn't.) As the same amount of plaster is poured between the consistent containment field around a form that becomes smaller, the resulting plaster layer becomes thinner and thinner. In this way, the thickness of that layer is not arbitrary, but conceptually and physically directly indicative of the form it buried. Many aspects of future Cycles will exploit such events that arise from conserved materials.

By recognizing the implications of conserving materials or operations, these physical systems acquire more attributes that define recognizable styles of object. Further variation will emerge from similar systems not just from my intuitive approach, but also when combined with further refinements to how conserved resources are used.

Style Descriptions and Documentary Photographs

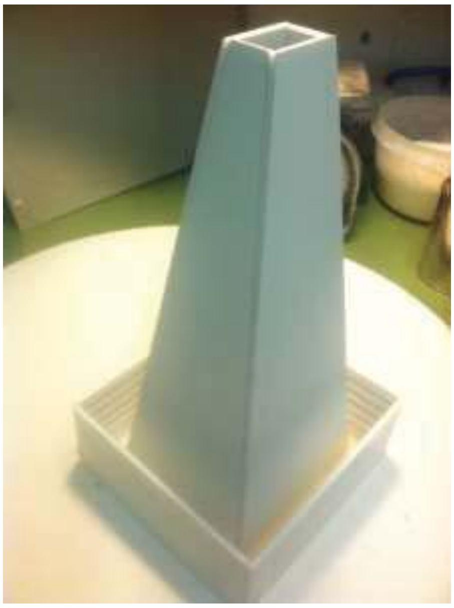
The following sections present an analysis of the Styles in terms of what was accomplished and how its generative aspects were changed to continue this exploratory Partition Cycle. The images were all taken by the author and represent either the interesting graphic presentation of an apparatus, or documentation of some installation or "still life" aspect of the objects generated. Note that it is well within the intent of this Cycle that objects function both as "tools" and as "content," and so the photographs of the process are included as well.

Style No. 1

Foam core original, pyramid vase type.

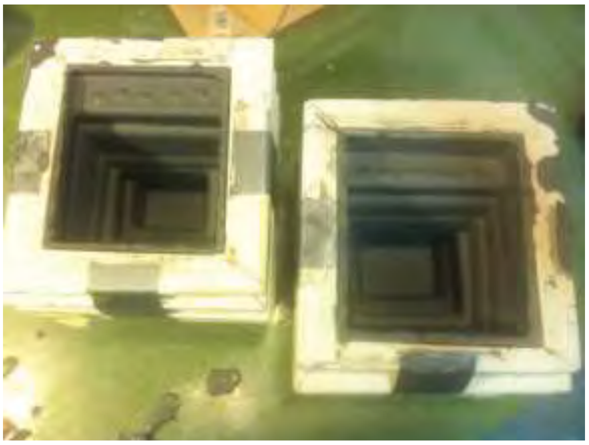
- Object design exists first.
- Plaster mold cast around it in standard box former not intended to be interesting.
- Generative qualities emerge from fact that form is buried in many thin layers that separate. The result is that layers can be used in many combinations for different profile, all but the most extreme "slide" variations are still leakless.
- Appealing concept is that if the twelve layers are divided up into more than one group, and all are used, family resemblance among objects cast is easy to see.
- Refinement needed: **Why build original in the first place?**
- Refinement needed: **Why have such bland exterior shape (mold only does one thing)?**
- Refinement needed: **Mold pieces cannot easily be used in rotation** or non-mesh defined spacings because outside is so bland.

Images for Style #1




(1.1) Foam core original form with repositionable containment box in lowest position, without plaster layers.
(1.2) Containment box moves upwards as plaster slices are poured until form is completely covered in plaster layers


(1.3) Separated layers after hardening.
(1.4) Labeling on plaster layers indicating reordering variations "skip" and "flip."

(1.5) Castings depicting (l-r) "flip," "skip," next to complete set in original order.
(1.6) Interior of castings still in mold with "slide" variation.

(1.7) Unmolding in progress for casting with "flip," "skip," and "slide" variations. Note split in each layer that solves draft angle problems.
(1.8) Unmolded castings when twelve layers of original mold are divided into two groups ("skip") and reoriented ("flip" and "slide").

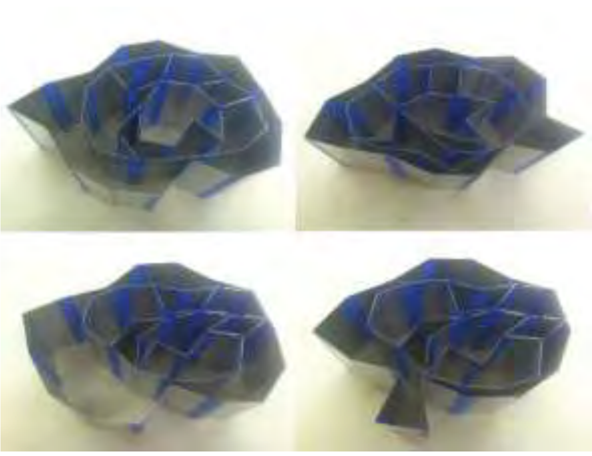
Style No. 2

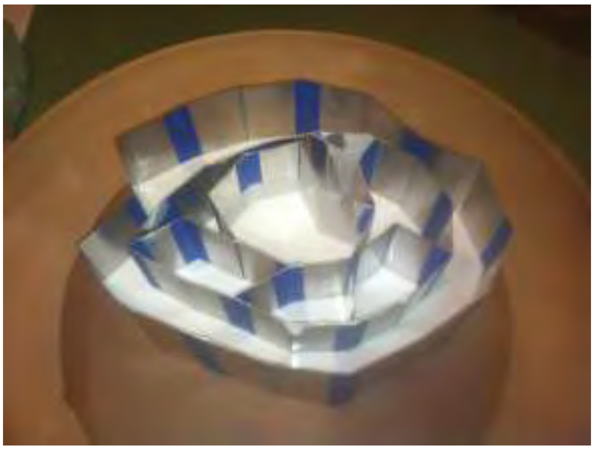
Prism mold set

- Addresses blandness of exterior shape by being irregular, directly expressing space-filling potential: perimeter has same character as contents.
- Very simple hinged metal strips as mesh; blue tape is compelling to me, also textural. Tape need not span entire height, and gaps in tape could be used in future for generative variation.
- Flat upper and lower surfaces invite combination with other sets. (See Style 2 atop Style 3 castings.)
- If flat panels of plaster are added to top and bottom, hollow castings can be filled from any direction: any combination of contiguous objects, with any being entry/drainage point for liquid clay.

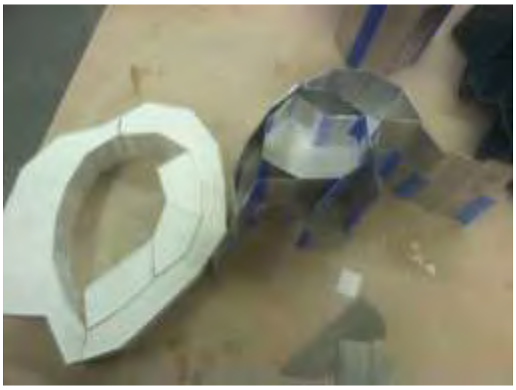
- Objects have non-mesh-defined arrangements as well, requiring minimum leak-management.
- Mesh arrangements used graphically in composited photographs.
- Refinement needed: **Need greater subdivision count, and outer surface of containment shapes themselves is not accessible at all.**
- Refinement needed: **What if mesh isn't flexible-strand type** and needs specific shapes?

Images for Style No. 2





(2.1) Various possible configurations of perimeter and subdivisions.
(2.2) Plaster poured into mesh.



(2.3) Partially disassembled plaster pieces from metal mesh, mold configuration (foreground) fits together perfectly.
(2.4) Completed mold with all pieces.

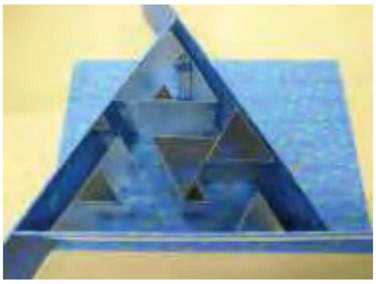
(2.5) Missing pieces (left) and liquid clay forming shell drying in their place.

Style No. 3

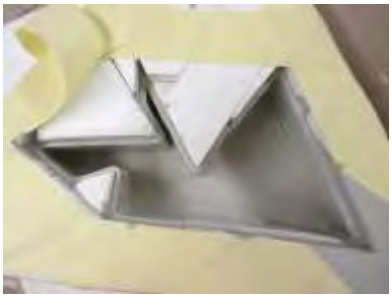
Triangle mold set

- Increases subdivision count, larger overall size, greater variety of convex surfaces.
- Faster installation times by virtue of tape coverage improvement (only top and bottom of metal partitions) with equally effective separation of plaster objects but easier disassembly.
- Perimeter shape identical to some of the interior division shapes; moreover, self-supporting units triangle "extrusions" are very strong.
- Mesh creation has prefabricated components like triangle prisms and flat panels.
- Generative variations emerge from liquid-gel progression and friction of smallest mesh shapes: dramatically lower fill-level surface inside smaller triangles demonstrates that time increased during mesh installation.
- Ceramic development **milestone**: within that same set, clay walls poured in two stages that fuse together (both same color, or different colors).
- Ceramic development **milestone**: used two different sets as stack to combine molds in two layers, with three pour-fusing stages as more mold parts are removed.
- Refinement needed: **Some curves would be nice.**
- Refinement needed: **Maybe tape isn't required at all.**
- Refinement needed: **Rebuilding mesh seems tedious** and metal panels are distorted (which could be a good thing elsewhere).

Images for Style No. 3


(3.1) Triangle prism shapes for predetermined aspect of subdivisions.
(3.2) Perimeter containment box also triangle prism shape with prefabricated triangle metal subdivisions arranged first.
(3.3) Disassembly of plaster pieces (side view) showing non-triangular straight pieces added to increase subdivision count.


(3.4) Disassembled plaster objects showing the downward-dragging effects of smaller-area partitions on what was originally level plaster.
(3.5) Example casting #1: Clay shell drying from example casting. Note thin section upper left.
(3.6) As clay wall hardens, this first casting supports its own weight as some plaster pieces are removed from containment area, creating new open spaces.



(3.7) Next set of open areas created for second casting filled to shorter level. Note thicker wall on newly exposed (most absorbent) plaster surfaces, and thinner wall fused to original wall (less absorbent).
(3.8) Fully unmolded casting showing higher wall of first pour and lower wall of second pour.
(3.9) Detail of casting. Note details on clay surface left from tape originally used to hold metal sheet together.

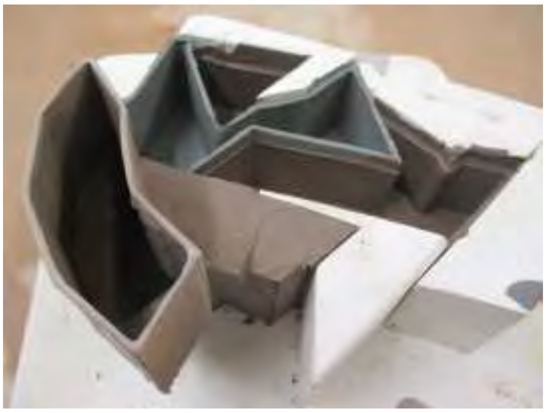
Images for Stacked Combination of Styles 2 and 3
A second casting event in Style 3 mold with Style 2 stacked on top.



(3.10) Missing pieces from Style 2 layered over missing pieces in Style 3.
(3.11) First pour of tan slip (seen as brown shiny liquid in photo).
(3.12) Drained and partially unmolded.



(3.13) Second pour of white slip (seen as grey shiny liquid in photo) in newly exposed containment.
(3.14) Drained and partially unmolded.
(3.15) Third pour of tan slip (seen as brown shiny liquid in photo).




(3.16) Entire casting shown partially unmolded.
(3.17) Completely unmolded object.

(3.18) Completely unmolded object in standing poses.

Style No. 4
Puzzle Étude

- Prefabricated strips of metal as a set of "glyphs" with curves and straights.
- Conserved amount of plaster in standardized overall containment, yielding regular layers/slices that can be stacked.
- Making use of 2-3 minute time constraint that liquid plaster becomes gel that accepts weight of metal strips, but must improvise quickly.
- Shaving meniscus unevenness is minor and brings leak-management to feasible minimum.
- Standardized surfaces on all six sides of plaster chunks allows leakless abutting in all directions.
- With additional flat panel containments above and below, many more open castings could result.
- Generative aspect: same "glyphs" are used as separators, the overall pattern relates well visually to others also made from them.
- Separation of parts is fastest yet and metal pieces almost completely unchanged.
- Ceramic development **milestone**: incredibly complex shapes still release from mold because all draft (withdrawal) angles are monitored and locked-in plaster chunks are rare.
- Graphic development **milestone**: while unmolding casting from plaster chunks, very interesting forms emerge, used as graphic content.
- Conceptual development **milestone**: casting and separable plaster parts thought of as abstract typography, resembling radical/stroke relationships of meaning with modifications.
- Refinements needed: **Reassembly of unmarked pieces very, very tedious.**

Images for Style No. 4

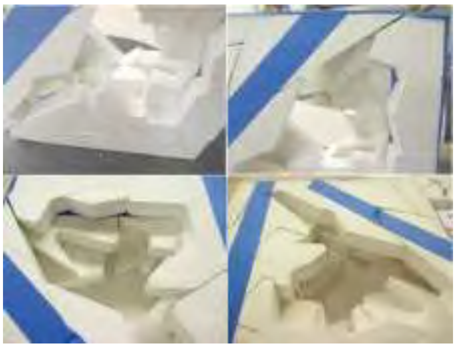


(4.1) Metal strips in straight and curved pieces for pushing into gelling plaster (not shown).
(4.2) Detail of metal subdivision being pushed downward into gelling plaster. Note close fitting strips against edge and against each other.
(4.3) Fully hardened plaster with metal subdivisions.



(4.4) Detail of disassembly. Note clean edges to complex shape.
(4.5) Minimal shaving on top surface of plaster layer ensures leakless stacking with future layers.
(4.6) Disassembly views.





(4.7) Comparison of four layers, each made with the same set of drop-in partitions.
(4.8) Four layers with various central pieces removed, edges bound together, and stacked into block. Reserved pieces shown at top.
(4.9) Comparison of viewing angles.

(4.10) Drained casting still wet



(4.11) Views of unmolding (raised stance).
(4.12) Views of unmolding (right side up stance).
(4.13) Views of unmolding (bottom side up stance).

(4.14) Completely unmolded object (baked color is white).


(4.15) Abstracted views, close detail.
(4.16) Abstracted views, close detail.

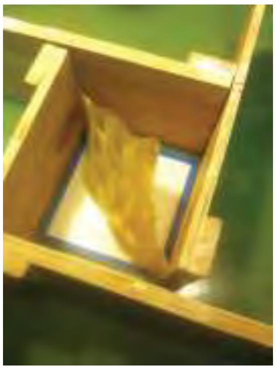
Style No. 5

Latex 9-cell

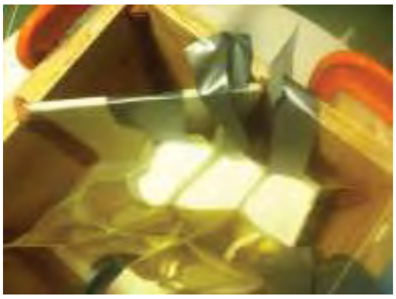
- Actually made before all the rigid systems, but conceptually distinct and evolved separately.
- Notion of partition grid starts with flat panels, but flexibility of mesh when unfilled is made dramatically distorted when filled.
- Procedural **milestone**: multiple-plaster pour enables early plaster layers to act as anchors to flexible material, which is distorted by creating more tension than was in original system.

- Containment is a bit less interesting than the latex mesh it contains but the technical means to make the outer containment out of latex under tension is still in development.
- Plaster shapes are the most variable, comparable to those from Style No. 6.
- Refinement needed: What about **horizontal subdivisions** within cells defined by meshes?
- Refinement needed: What if design of **mesh collapsed and deployed** over several uses?
- Refinement needed: What if partitions **contributed more to surface information**?

Images for Style No. 5

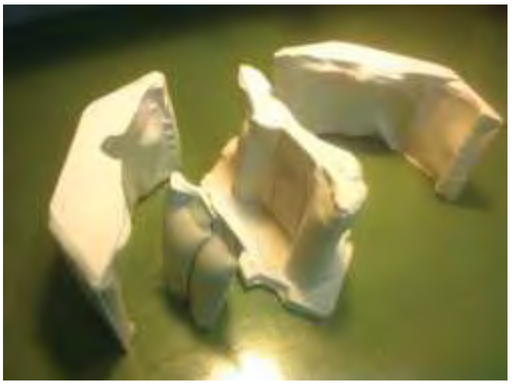
(5.1) Measured pieces of latex for flexible partitions.
(5.2) Mesh supported by containment box.



(5.3) Fill of first three minimally constrained cells, showing much distortion.
(5.4) Fill of middle row of cells, constrained by previous hardened plaster on one side, and round clay shapes in adjacent still-empty cells on other side, and tape (grey) pulling outward.
(5.5) Fill of last row of cells, similarly constrained as earlier row.

(5.6) Nine cells fully filled with plaster containment pieces around them, scraped

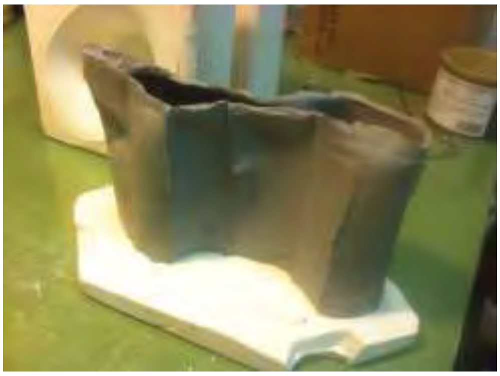
level (bottom view).

(5.7) Dismantling of mesh revealing organic plaster objects formed by latex distortions.
(5.8) 12-piece plaster mold from flexible latex mesh, partially disassembled.

(5.9) Largest possible form that results when all nine plaster pieces are removed (shown in background).


(5.10) Form that results when plaster pieces 1,8,9 remain in mold, creating union of pieces 2,3,4,5,6,7 (shown from bottom of mold)
(5.11) Form partially unmolded, side view. Plaster piece 1 (in hand), grey casting in middle (grey) union of pieces 2-7, plaster pieces 8,9 on other side.

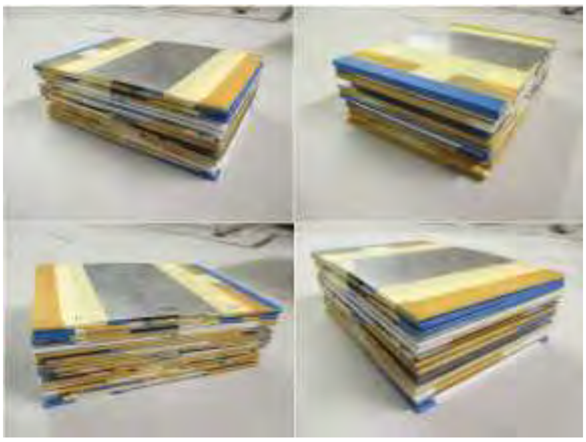
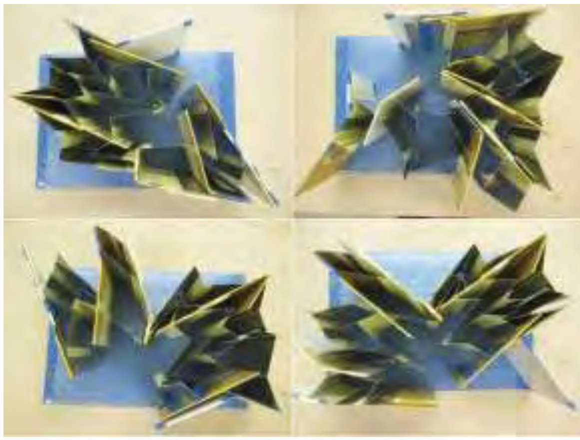
(5.12) Comparison of two castings created from same mold, full form (foreground) and partial form.
(5.13) Completely unmolded form created from "union" of pieces 2-7, showing wrinkle details from inside of original nine latex cells.

Style No. 6
Massive geologic mesh with complex mesh

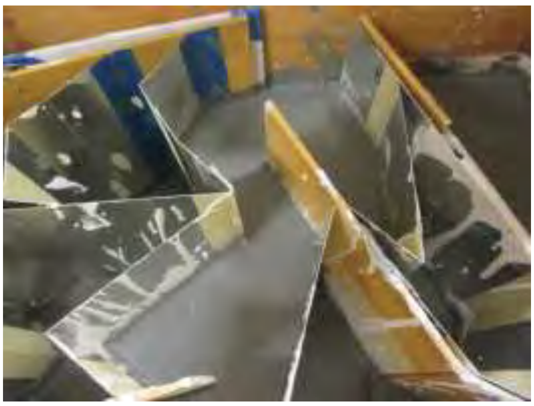
- Successful on several levels, but not pourable.
- Massive unliftable mold needs drainage platform (under development).
- Very noisy process with plaster amounts and gel times creating wandering surfaces at end of pour.
- Mesh built up from layers of foamcore, metal, and tape while completely flat; mesh cell shapes emerge only when parts are moved out of flat stowed position.
- Operational **milestone**: thin clay slip as separator between old and new plaster for subdivide again operation.
- Conceptual **milestone**: mesh parts not completely unfolded/deployed implies that information "within" mesh contains can be "expressed" or "suppressed"; stowed mesh elements create void in plaster object set that will be used by all neighboring arrangements. If identical mesh were constructed and deployed a little farther, "new" information/chunks become available, partition number increases.
- Clay slip used as separator among horizontal areas was completely successful, required no anticipation of shape, and interesting patterns emerged at disassembly when parts tore slip layer into abstract but complementary patterns.
- Generative aspect that shapes which emerged from noisy process have organic, almost geologic quality absent in all previous systems; pieces themselves can be rearranged as sculpture.
- Graphic potential of mesh by itself is greatest among others discussed so far.
- Technical challenge **not yet solved**: using mesh for plaster was far more destructive than anticipated, so mesh layers that used incrementally posed meshes will have to wait.
- Technical challenge **not yet solved**: leak-management for such noisy, broken-edged objects is beyond current ability to patch subtly.

Images for Style No. 6


(6.1) Separator plates of foam core with tape and metal waterproofing.
(6.2) Individual plates are grouped into a stack with more tape.

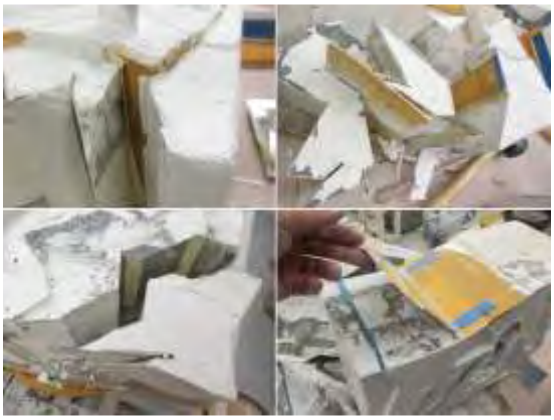
(6.3) Concept included a mesh that was originally flat and can expand into containment area.
(6.4) Exploring possible deployed arrangements.

(6.5) Pouring plaster into mesh in multiple batches.
(6.6) Detail of brushed clay slip separator for subdivisions not indicated by vertical mesh walls.


(6.7) Plaster pouring targets different areas of mesh, which fills them earlier. This means subdivisions will be at various levels.
(6.8) Example of plaster gelling state slowing down flow.


(6.9) Example of metal shim (not shown) pushed into gelling plaster and then pulling it back out when plaster has hardened enough not to close back up (seen here as the thin dark lines). These divisions will not be part of later layers.
(6.10) Plaster has filled the mesh and weighs over 30 pounds.

(6.11) The containment box is pulled apart and disassembly begins.
(6.12) Stages of disassembly.

(6.13) Complementary grey (clay slip) and white (plaster) designs from slip separator layer.

(6.14) Representative stacks of objects generated.
(6.15) Arrangement of objects reminiscent of geology and architecture.

Creative concepts, moving forward

The systems under discussion explore generative concepts in a very hands-on sculptural process. As these processes continue to unfold, a number of aspects should receive attention.

Style No. 4 is an extremely interesting set of objects that combine elements of abstract art and typography. Much thought will be given to the idea that the casting might represent a radical, as in Chinese writing systems, and that the mold parts all total represent the additional "strokes" that change the meaning. During the process of unmolding, as fewer and fewer mold pieces remain in their original locations, the object takes on more and more aspects of a changing set of graphics. The concept is compelling that the casting plus some of its mold might be as much the object of attention as is the casting by itself. Much effort will be put into having this concept affect choices as far back as the metal drop-in pieces, to see whether the resulting assemblages can be photographed and rendered as abstract typography.

Style No. 5 is perhaps the most distinct of the meshes because of its extreme fluidity. It will be difficult but interesting to bring some of the modularity of the other systems into those with latex meshes.

The tool-versus-content duality should be used to inform decoration on the surfaces of the plaster and ceramic objects, an application that has been conspicuously avoided in this Cycle. It would be relatively easy to generate 2D artwork from photographs of an arrangement, convert it to some imagery system like screen-printing, and decorate some surface with that imagery. Does the image represent some aspect of that object's past? Its future? Or depict some entirely different Style?

In all styles in which plaster is the former for clay slip, it is tempting to switch the roles. The thicker the casting, the more dramatically abstracted is the casting inner surface compared to the mold inner surface. Usually ignored as irrelevant, this interior form is actually very interesting because it represents a kind of "erosion filter" that in digital systems requires computations. In future Partition series, when liquid clay is left for long enough in the mold, the loss and distortion of information will likely be remarkable.

The flow of information toward or away from "surface noise" should be more pronounced in future systems. Iterations from one Style can magnify some minor detail until it is larger than the object that created it in its "formation history." By including a greater number of iterations into these Styles, these physical systems will even more take on aspects of digitally produced generative art than has been seen here.

Conclusion

These systems represent an achievement of planning over virtuosity of gesture. The generative nature of these processes should indicate to anyone with tenacity and a methodology that highly complex objects can be made. These objects can be interpreted as tools for what they do, and can be interpreted as photographic subject matter for what they look like. This open-ended, diversifying aspect aligns well with the basic intent of generative art in digital and physical form.

From a procedural standpoint, these systems exploit the often conflicting concepts of "flow" and "stasis." By combining these basic universal aspects in different proportions, the variety of objects in this Partition Cycle might develop into larger, meaningful, compelling collections of abstract objects. Perhaps, in so doing, these systems might remind viewers of how a constant dynamic that exists between "flow" and "stasis" can be beautiful while still being of uncertain outcome. These objects have no beginning and no end, but transform a little or a lot at a time. How much of this universe that inspires us is based on exactly those concepts?