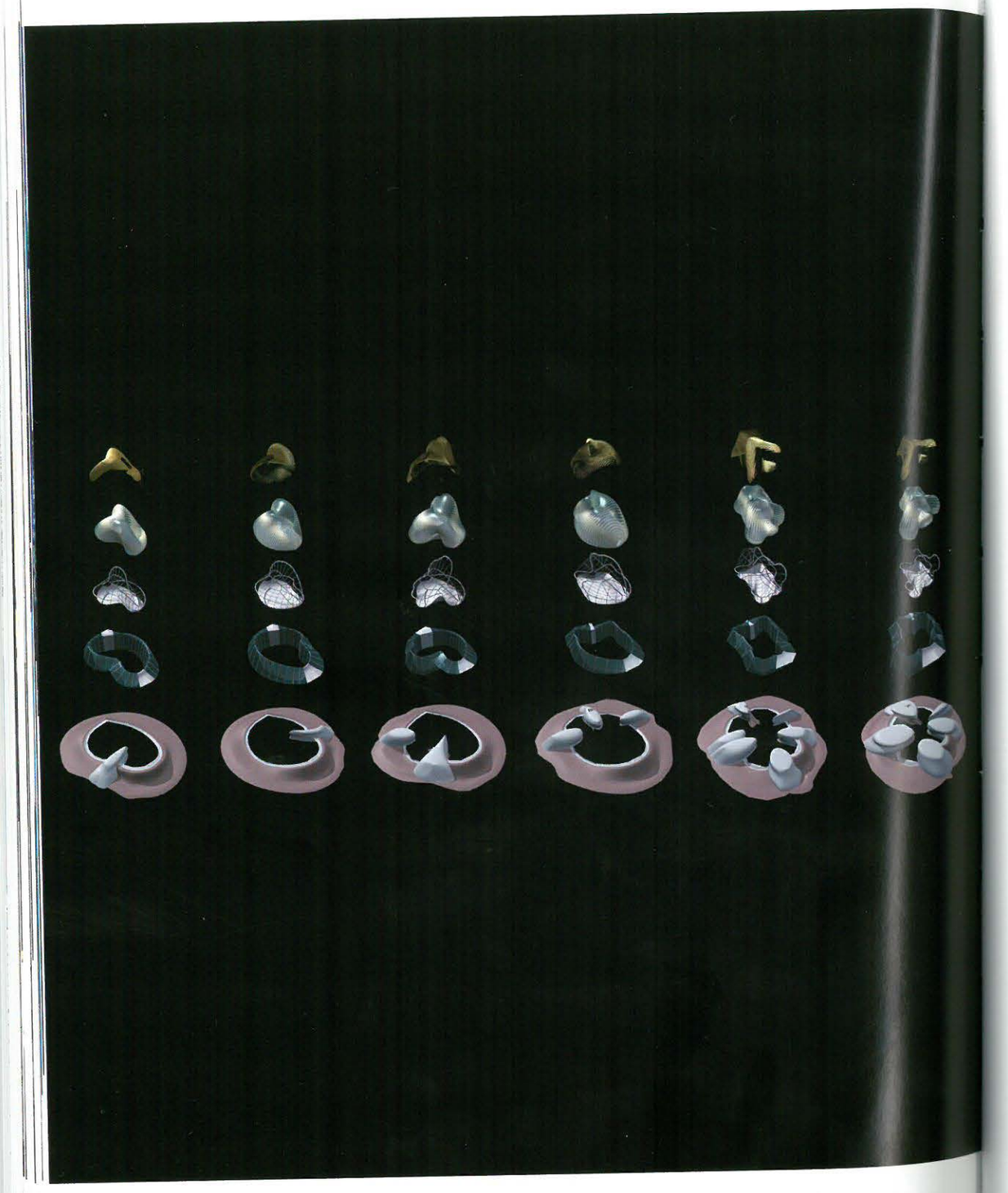

Greg Lynn FORM, Embryologic Houses©, 2000. Exploded axonometric view of six House system components.
© Greg Lynn FORM.

Embryologic Houses© (2000)

Greg Lynn

Greg Lynn's Embryologic Houses© epitomise the spirit and achievements of digital mass-customisation and computational morphogenetics at the turn of the millennium, on the eve of the dotcom crash which would dampen the technological optimism of the 1990s. Almost coeval to the author's celebrated Coffee and Tea Piazza, a non-standard series of 99 teapots for the Italian silverware manufacturer Alessi, the Embryologic Houses© project explores the logic of digitally designed and produced variations at the scale of building, as each of the Embryologic Houses© is a two-floor residential unit set in a landscaped environment, with a floor space ranging between 167 and 300 square metres (1,800 and 3,200 square feet); the series itself is parametrically determined and open-ended.

Given the size limits of digital production, which are set by the dimensions of what can be fabricated in a single piece, larger objects, such as houses, must be built by the assembly of smaller pieces, individually fabricated using non-standard technologies (CNC milling, stereolithography, etc) then assembled on site. To this end, the project envisages a system of nine steel frames and 72 aluminium struts, meant to support up to 2,048 digitally fabricated panels, each endlessly variable within parametric limits; using technologies borrowed from the automobile, naval and aeronautic industries, a change in every individual component can be 'transmitted throughout every other element in the system'. But the implementation of this apparently banal technical requirement would soon appear as a major impediment to digitally based construction: the 'scalability' of the blob, ie, the transfer of non-standard technologies from the small scale of fabrication (a teapot) to the large scale of construction (a building) became a major design issue early in the 21st century.

Embryologic Houses© *AD* May–June 2000

The Embryologic Houses© can be described as a strategy for the invention of domestic space that engages contemporary issues of brand identity and variation, customisation and continuity, flexible manufacturing and assembly and, most importantly, an unapologetic investment in the contemporary beauty and voluptuous aesthetics of undulating surfaces rendered vividly in iridescent and opalescent colours. The Embryologic Houses© employ a rigorous system of geometrical limits that liberate models of endless variations. This provides a generic sensibility common to all Embryologic Houses©, but no two buildings are ever identical. The technique engages the need for any globally marketed product to have brand identity and variation within the same graphic and spatial system, allowing both the possibility for recognition and novelty. In addition to design innovation and experimentation, many of the variations in the Embryologic Houses© come from an adaptation to contingencies of lifestyle, site, climate, construction methods, materials, spatial effects, functional needs and special aesthetic effects. For the prototyping stage, six houses were developed, exhibiting a unique range of domestic, spatial, functional, aesthetic and lifestyle constraints.

There are no ideal or original Embryologic Houses©: every one is perfect in its mutations. The formal perfection does not lie in the unspecified, banal and generic primitive but in a combination of the unique, intricate variations of each instance and the continuous similarity of its relatives. The variations in specific house designs are sponsored by the subsistence of a generic envelope of potential shape, alignment, adjacency and size between a fixed collection of elements. This marks a shift from a modernist, mechanical technique to a more vital, evolving, biological model of embryological design and construction.

Traditionally, modern architecture, and especially domestic space, has been conceived as an assembly of independent parts, or a kit. The advent of industrialised factory-line fabrication and the marketing, distribution and assembly of these components conspired to support the generic kit-of-parts house. Likewise, the atmosphere of a limited advertising and media culture engendered a broad interest in simple generic structures of identity. The banal modernist notion of generic housing involved the invention of a mass-produced minimum structure to which customisations, additions, modifications and alterations could be performed by the addition of components. This kit-of-parts identity was an appropriate technique for this cultural and industrial moment. With the progressive saturation of our imaginations by an advanced advertising media culture – which becomes more and more creative, artistic and cunning in its techniques of creating desire for formal variation and uniqueness while maintaining brand identification – a more advanced generic identity is not only possible, but necessary for contemporary domestic space.

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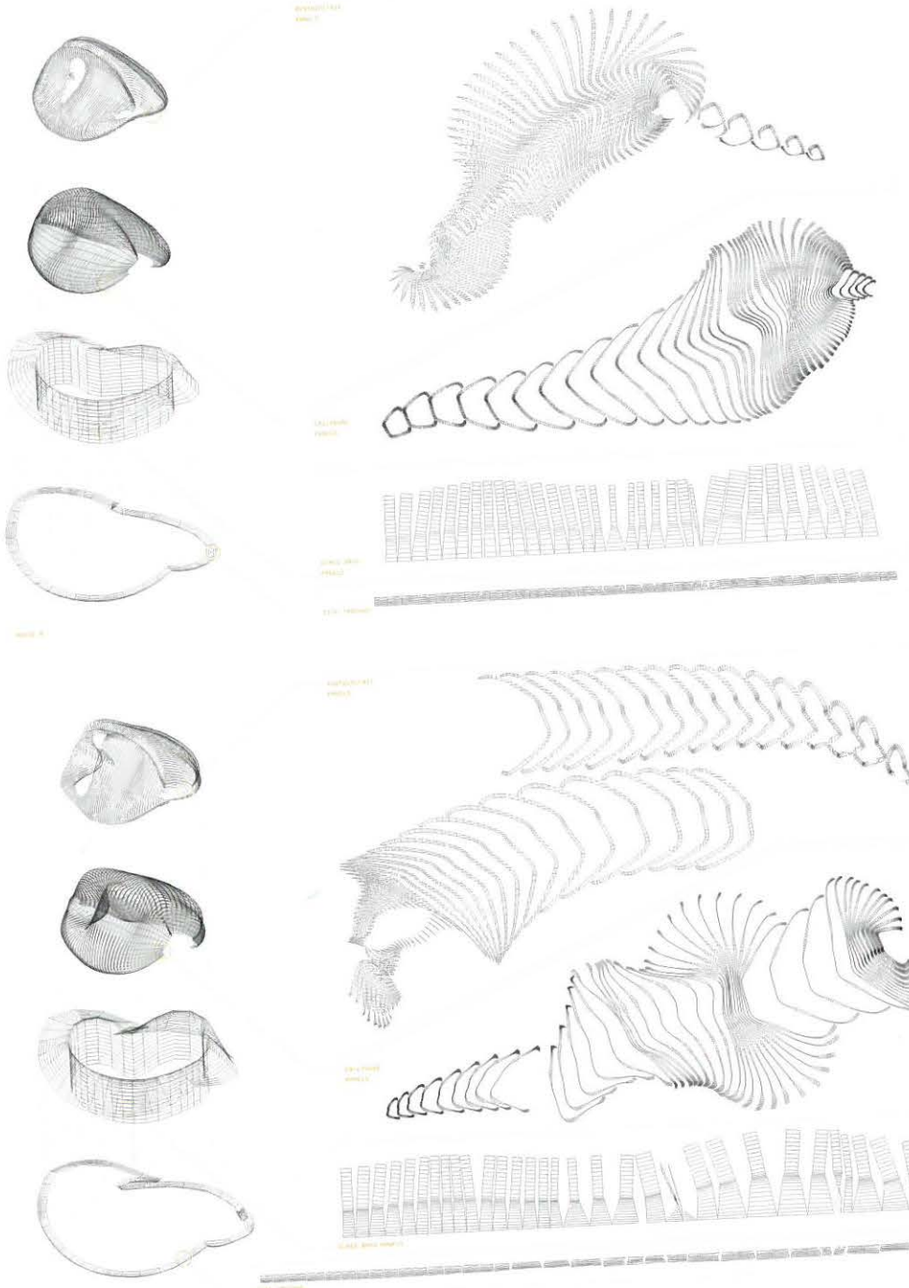
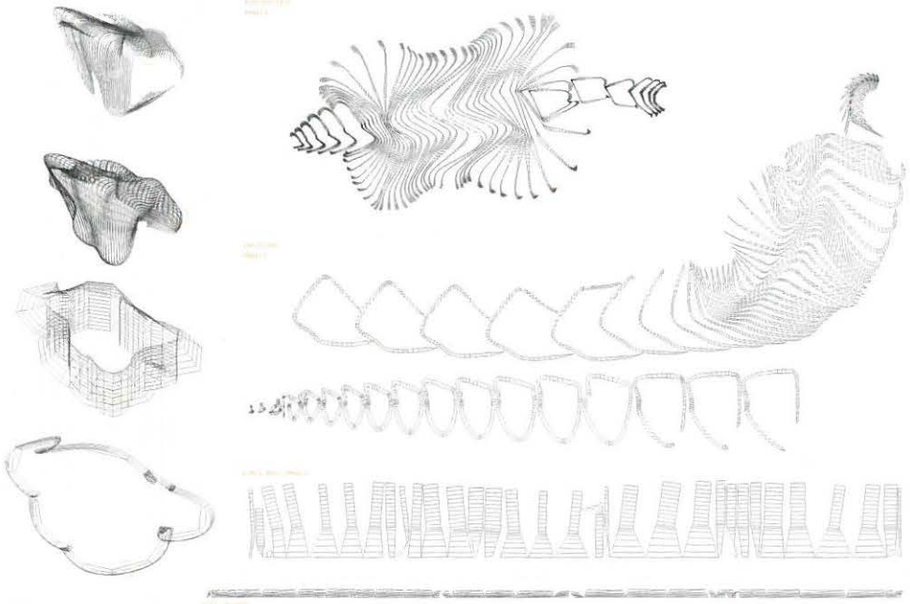
top: Greg Lynn FORM, Embryologic Houses©. Matrix of structural frames.

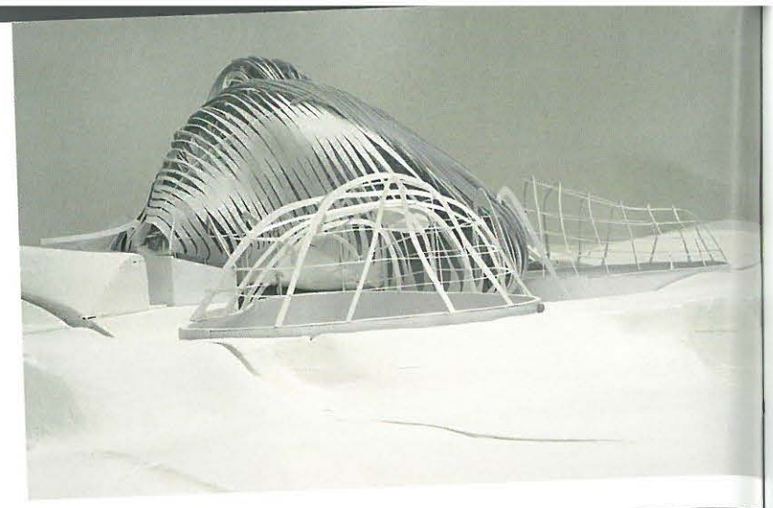
bottom: Greg Lynn FORM, Embryologic Houses©. Glass Base matrix plan and elevation.



The domestic envelope of every Embryologic Houses© [*sic*] is composed of 2,048 panels, nine steel frames and 72 aluminium struts, networked together to form a monocoque shell. Using design techniques of flexible manufacturing borrowed from the automotive, naval and aeronautical design industries, every house in the line is of a unique shape and size while conforming to a fixed number of components and fabrication operations. The form and space of the houses are modified within the predefined limits of the components. In addition, a change in any individual panel or strut is transmitted throughout every other element in the whole. A set of controlling points is organised across this surface so that groups of these generic panels can bud into more specific forms or 'nodules'. In every instance, there is always a constant number of panels with a consistent relationship to their neighbours. In this way, no element is ever added or subtracted. In addition, every element is inevitably mutated so that no two panels are ever the same in any single or multiple configuration and no area of the interior is ever identical to any area on the surface. Those panels, with their limits and tolerances of mutation, have been linked to fabrication techniques involving computer-controlled robotic processes. These include ball-hammered aluminium, high-pressure water-jet cutting, stereolithography resin prototyping through computer-controlled lasers, and three-axis CNC milling of wood-composite board.



opposite and above: Greg Lynn FORM, Embryologic Houses©. The form and space of the houses is modified within the predefined limits of the components. In addition, a change in any individual panel or strut is transmitted throughout every other element in the whole. Here the structural elements are shown flattened. All images © Greg Lynn FORM.



Greg Lynn FORM, Embryologic Houses©. Prototype model view. © Greg Lynn FORM.

Embryologic Houses© are designed as a flexible, curvilinear surface rather than as a fixed set at rigid points. Each encloses two floors. The upper floor of 55 to 110 square metres (600 to 1,200 square feet) is a gently sloped dish with custom-designed furniture, appliances and entertainment equipment. The lower floor is a single level of 110 to 185 square metres (1,200 to 2,000 square feet). The voluptuous fenestration, apertures, openings and orientation to light, air, human and mechanical penetration occur through a technique of curvilinear shreds, louvres and pores that derives from the topology of the surfaces. Rather than being cut into the surface, these apertures are achieved via an alternative strategy of tears, shreds and offsets in their soft geometry. Any dent or concavity of surface provides an opportunity for domestic occupation and the integration of apertures.

The surface envelopes are connected to the ground so that any alteration in the object is transmitted outward into the landscape. For instance, a dent or concavity in the envelope generates a lift or plateau in the ground. In this way, a deformation in the object has a corresponding effect on the field around it, facilitating openings, views and circulation on a potential site.

The landscape is pulled upwards at the two poles of the house, generating a mound garden that rings the house. The houses are adaptable to a full range of sites and climates. The minimum requirement for any site is a 30 metre (100 foot) diameter clear area with less than a 30 degree slope. A sea of mounds planted with alternating strips of decorative grasses surrounds each house. Nestled within these wave mounds, an undulating berm of earth receives the house. The berm slopes from the lower level to the upper level of the house in order to meet the front and back entries. The house appears to be buried in the ground from some orientations, while appearing to float above it from others. Wherever the exterior form of the house is indented, a corresponding garden pod is formed, off which a formal garden flows. These microclimate pods with their corresponding gardens are ringed by a perimeter of drift gardens that feather into the wave landscape of grasses.

Greg Lynn, 'Embryologic Houses', Ali Rahim (guest-editor), *Contemporary Processes in Architecture*, *AD* Profile 145, *AD* 70, May–June 2000, pp 26–35.

Versioning (2002)

SHoP/Sharples Holden Pasquarelli

Taking a stand against the 'stylistically driven' excesses of digital design in the years leading up to the 'dotcom crash', in September 2002 the New York office SHoP, guest-editing *AD* Profile 159, *Versioning*, argued for a renewed interest in the actual practices of building, advocating a more hands-on approach to the production process. While a rejection of the formal exuberance of the 1990s was widespread in the new, post-2001 socio-cultural environment, the shift from form to process in design was also due to technical issues: free-form objects were proving difficult and expensive to construct at full scale, warranting SHoP's call for a new 'intelligence of fabrication', based on the search for a 'common language between design and execution'.

The contributing authors, reviewed in the introduction, interpreted 'versioning' in somewhat diverse ways (the architectural definition of the term is to this day unclear), but the editors' essay, illustrating works of their own practice, pertinently illustrates various attempts to 'erode the barriers' between design and construction. The featured buildings often look angular, not curvilinear, and follow simplified geometries; the final recommendation to use digital tools to facilitate the early involvement of and collaboration between participants in the design and construction process anticipates the agenda of Building Information Modelling software, which was in development at the time.