SPECIFIC OBJECTS

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ABSTRACT

The research explores Donald Judd's concept of S*pecific Objects*, and how the notion of singular qualities, so essential to the concept, can be extended through the practice of sculpture. According to Judd, unity can only be achieved in sculpture when its form is specific and has only one quality. There must therefore be no apparent parts, no hierarchy and, therefore no relationships of parts. In addition, *Specific Objects* rejects illusion. The sculptor Robert Morris further defined singular qualities as those which predominantly distinguish 'good form', thereby positioning it within the syntax of Gestalt psychology. Significant though Judd's sculptures are, few seem to conform to his definition of S*pecific Objects* because through his use of orthogonal geometry and contrast of materials, many of his sculptures do indeed appear not only to be composed of parts, but actually rely on the relationships between the parts. In addition, the contrast of opaque and transparent surfaces, inevitably leads to illusion. Rather than follow Judd's use of orthogonal geometries from parts of differing materials and colours, this research has investigated the potential of circular geometry to create form of sculptural significance within Judd's strict definition of *Specific Objects*. Key to this research has been what Rosalind Krauss described as the *deflection of geometry*, of which there are two types: one is based on actual variations in physical geometry and the second results from the illusory qualities of materials and surface finishes.

The studio investigations sought to ascertain to what extent the 'deflection of geometry' can expand, but equally as importantly, maintain the viability of Judd's concept. In other words, the challenge was to extend the possible range of geometries that posses the singular qualities associated with *Specific Objects*; and in so doing provide an alternative response to the dilemma posed by the concept; how to make unified forms with variation and sculptural significance.

The studio investigations were project based. Each project was directed by its aims and the resulting studies evaluated through criteria in which unity and singular qualities were fundamental. A reductive approach to studio investigation led to two forms that conclude the research. The unified geometry of the first is elliptical, although visual tension derives from the rotation of the internal ellipse relative to its external counterpart, whereas the second form contains the implied division of an internal figure of eight derivative within an elliptical exterior. Both forms were cast in translucent resins to combine illusory and physical deflections of their geometry. By so doing, they expand Judd's concept, by demonstrating the potential for implied duality and perceived variance to exist within a singular, unified, and specific form.

AUTHOR'S DECLARATION

I declare that the work in this thesis carried out in accordance with the regulations of the University of Gloucestershire and is original except where indicated by specific reference in the text. No part of the thesis has been submitted as part of any other academic award. The thesis has not been presented to any other educational institution in the UK or overseas.

Michael Shaw

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CONTENTS

LIST OF ILLUSTRATIONS

HISTORICAL BACKGROUND

STUDIO INVESTIGATIONS

STAGE 1

PROJECT ONE

Fig. P1-0 5 'coiled' bronze sculptures.
Fig. P1-1 Plaster study with polystyrene core, burnt with soldering iron and two internal chambers.
Fig. P1-2 Plaster study with polystyrene core covered with masking tape.
Fig. P1-3 Plaster study with polystyrene core and three internal chambers.
Fig. P1-4 Conical plaster study with right angled edge of PVC visible.
Fig. P1-5 Elliptical plaster study with deflected geometry.
Fig. P1-6 Plaster study with balloon core with multiple internal chambers.
Fig. P1-7 Plaster study with balloon core with multiple internal chambers.
Fig. P1-8 Plaster study with balloon core and two internal chambers.
Fig. P1-9 Plaster study with balloon core, masking tape, and two internal chambers.

PROJECT TWO

Fig. P2-1 Plaster study with sequential deflections to the geometry of the interior.
Fig. P2-1b Detail of study P2-1.
Fig. P2-2a Plaster study with complementary internal and external geometries.
Fig. P2-2b Plaster study with contrasting internal and external geometries.
Fig. P2-2c Diagrammatic explanation of the geometry of study P2-2b.
Fig. P2-3a Plaster study using multiple horizontal contour lines to enhance rotational deflection of geometry.
Fig. P2-3b Plaster study using multiple vertical contour lines to enhance rotational deflection of geometry.
Fig. P2-3c Detail of study P2-3a.
Fig. P2-3d Detail of study P2-3b.
Fig. P2-4 Plaster study with a single contour line internally and externally.
Fig. P2-4b Detail of study P2-4.
Fig. P2-4c Diagrammatic explanation of the geometry of study P2-4.
Fig. P2-5 Plaster study with contrasting internal and external geometries with section cut-out.
Fig. P2-5a Detail of cut-out section from study P2-5.

PROJECT THREE

Fig. P3-1 5 cardboard studies with simulated contour lines.
Fig. P3-1a Detail of above.
Fig. P3-2 3 large cardboard studies with simulated contour lines.
Fig. P3-2a Detail of P3-2.
Fig. P3-2b Detail of P3-2.
Fig. 3-2c Diagrammatic explanation of the figure of eight.
Fig. P3-3 Diagrammatic explanation of the geometry of study P1-4.
Fig. P3-4a Plaster study with overlapped contour line.
Fig. P3-4b Plaster study with overlapped contour line.
Fig. P3-4c Plaster study with overlapped contour line.
Fig. P3-4d Plaster study with overlapped contour line.
Fig. P3-4 Table demonstrating 3 different edge geometries.

PROJECT FOUR

Fig. P4-1 Diagram demonstrating mould construction.
Fig. P4-2 Plaster study with a single contour line rotating around form and apex top edge.
Fig. P4-2a Alternative view of study P4-2.
Fig. P4-2b Alternative view of study P4-2.
Fig. P4-3 Plaster study with a single contour line rotating around form and sloping top edge, with a diagrammatic explanation of its geometry.
Fig. P4-3a Top view of study P4-3.
Fig. P4-3b Alternative view of study P4-3.
Fig. P4-4a Plaster study with convex base, with diagram of geometry.
Fig. P4-4b Plaster study with concave base, with diagram of geometry.

PROJECT FIVE

Fig. P5-1 Plaster study with 4mm overlapped contour line.
Fig. P5-2 Plaster study with 8mm overlapped contour line.
Fig. P5-3 Plaster study with 12mm overlapped contour line.
Fig. P5-4 Diagram demonstrating mould geometry.

PROJECT SIX

Fig. P6-1 Large scale elliptical plaster study.
Fig. P6-1a Alternative view of study P6-1.
Fig. P6-2 Mould for study P6-1.

STAGE 2

PROJECT SEVEN

Fig. P7-1 Two elliptical resin studies, one with embedded wire.
Fig. P7-2 Two elliptical resin studies, both with embedded plastic tubing.

PROJECT EIGHT

Fig. P8-0 Diagram demonstrating mould construction.
Fig. P8-1 Resin study testing rotational deflection of geometry on a conical cylinder
Fig. P8-1a Alternative view of study P8-1.
Fig. P8-1b Alternative view of study P8-1.
Fig. P8-1c Alternative view of study P8-1.
Fig. P8-2 Large elliptical resin cylinder with embedded plastic tubing, which evaluates the potential of horizontality to reduce spatial displacement.
Fig. P8-2a Alternative view of study P8-2.
Fig. P8-3 Large elliptical resin cylinder with augmented rotational deflection of geometry, achieved by manipulating the position of the formers during mould construction.
Fig. P8-3a Alternative view of study P8-3.
Fig. P8-4 Large resin cylinder exploring the potential for flexible geometry in the figure of eight.
Fig. P8-4a Alternative view of study P8-4.
Fig. P8-5 Jerwood bronze.

PROJECT NINE

Fig. P9-1 Figure of eight resin cylinder with amber pigment.
Fig. P9-1a Detail of study P9-1.
Fig. P9-2 Resin study exploring the implied duality found in the figure of eight, pigmented resin.
Fig. P9-2a Diagrammatic explanation of the geometry of study P9-2.
Fig. P9-2b Alternative view of study P9-2.
Fig. P9-2c Alternative photo of study P9-2 in natural light.
Fig. P9-2d Alternative view of study P9-2 in natural light.
Fig. P9-3 Resin study exploring the oscillation synonymous with the figure of eight
Fig. P9-4 Resin study exploring the potential of the ellipse to minimise the implied duality of the figure of eight.
Fig. P9-4a Alternative view of study P9-4.
Fig. P9-4b Diagrammatic explanation of geometry of study P9-4.

PROJECT TEN

Fig. P10-1 Resin study with the reversed geometry of study P9-4.
Fig. P10-1a Diagrammatic explanation of the geometry of study P10-1.
Fig. P10-2 Resin study exploring the potential of contrasting internal and external geometries, created through off-centred placement, to imply duality
Fig. P10-2a Diagrammatic explanation of the geometry of the formers for study P10-2.
Fig. P10-2b Diagrammatic explanation of the geometry of the cylinders walls of study P10-2.
Fig. P10-3 Resin study exploring the potential of contrasting internal and external geometries, created through rotation and reversal, to imply duality.
Fig. P10-3a Diagrammatic explanation of the geometry of the formers for study P10-3.
Fig. P10-3b Diagrammatic explanation of the geometry of the cylinders walls in study P10-3.
Fig. P10-4 Resin study exploring extreme contrasts between internal and external geometries.
Fig. P10-4a Diagrammatic explanation of the geometry of the formers for study P10-4.

STAGE 3

PROJECT ELEVEN

Fig. P11-1 Penultimate sculpture, resin.
Fig. P11-1b Diagrammatic explanation of the geometry of the formers for the penultimate sculpture.
Fig. P11-1c Diagrammatic explanation of the geometry of the walls of the penultimate sculpture.
Fig. P11-2 Final sculpture, resin.
Fig. P11-2a Diagrammatic explanation of the geometry of the formers for the final sculpture.

CONCLUSION

Fig. C1 First plaster study that was subject to the deflection of geometry; repeated from Fig. P1-5.
Fig. C2 Repeated from Fig. P9-3.
Fig. C3 Penultimate sculpture, resin, repeated from Fig. P11-1.
Fig. C4 Final sculpture, resin, repeated from Fig. P11-2.

APPENDICES

APPENDIX 1A-D Drawings investigating degree of rotation in deflected geometries.

APPENDIX 2A-B Prints created through rotation.

APPENDIX 3 X-Rays of plaster sculptures with wire armatures.

APPENDIX 4A-B Forms created by moving light, and recorded photographically.

APPENDIX 5 Blind emboss prints.

ENDNOTES

Fig. E1 Lipchitz, *Arlequin*, 1919, bonze. Source, Livio (2002:170)
Fig. E2 Lipchitz, *Sculpture*, 1916, painted bronze. Source, Lipchitz (1978:30)
Fig. E3 Rodchenko, *Hanging Construction*, 1920, wood. Source, Lodder (1983:26)
Fig. E4 Gabo, *Cube I and II*, 1930, drawing. Source, Nash (1995:14)
Fig. E5 Kobro, *Spatial Composition No.6*, 1931, painted metal. Source, Kobro (1999:105)
Fig. E6 Gygi, *Second Generation Airbag*, 1998, rubber. Source, Topham (2002:110)
Fig. E7 Reinoso, *La Parole*, 1998, canvas, fans. Source, Topham (2002:113)
Fig. E8 Hall, *Like Thunder*, 2004, wood. Source, Bickel (2004:43)
Fig. E9 Trial polystyrene cores.
Fig. E10 Trial polystyrene cores constructed from planar discs.
Fig. E11 Trial polystyrene cores, contour lines burnt in with soldering iron.
Fig. E12 Trial plaster form with polystyrene core burnt out.
Fig. E13 Trial plaster form with polystyrene core wrapped in masking tape and then removed.

INTRODUCTION

In 1965, the minimalist sculptor Donald Judd defined the concept behind what he called, S*pecific Objects*. Specific Objects belonged to a new kind of art based upon unity that required the eradication of illusion[1] and relational composition; the relationships between parts in sculpture. This unity, so essential to *Specific Objects*, was to have an overriding singular quality; Judd asserted that, "the thing as a whole, its quality as a whole, is what is interesting".[2] The sculptor Robert Morris further defined singular qualities as those which predominantly distinguish 'good form'; thereby positioning them within the syntax of Gestalt psychology. This research is therefore principally concerned with an exploration of some of the singular qualities that are essential to the creation of *Specific Objects* and indeed to investigate just how singular, the form of a sculpture might be whilst remaining of sculptural significance. It is an approach that appears to be supported by theoretician and critic Michael Fried when summarising Judd and Morris's concern for, "the values of wholeness, singleness and indivisibility of a work's being, as nearly as possible, 'one thing' a single, 'specific object'."[3] Fried believes that in minimalism, "The shape is the object: at any rate, what secures the wholeness of the object is the singleness of the shape."[4]

The term 44minimalism was described in 1965 by Richard Wollheim, as being the result of 'minimal means' and, "to an extreme degree undifferentiated in themselves".[5] Yet, as David Hopkins noted "its connotations of reductive 'paring down', however, were rejected by all of the key figures who came to be identified with it... Donald Judd, Robert Morris, Carl Andre, and Dan Flavin."[6] Nonetheless, the description of minimalist continues to be applied to a broad range of artists, and though all were concerned with values of wholeness, singleness, and indivisibility, few except Judd subscribed to a rigid orthodoxy. In fact, even Judd did not propose that other minimalists should adhere strictly to *Specific Objects*. He did however, continue to subscribe through his sculpture to what he regarded as 'singular qualities', whilst remaining opposed to illusion and relational composition. Minimalism therefore encompasses contrary, as well as, common methods of practice. For example, Morris not only used what might be termed 'relational composition' in his cut felt sculptures, but also noted that minimalist sculptures can generate relationships through the interplay of solid and void, as well as through contrasting material and surface qualities. Consequently, Morris contended that relational composition is implicit, if not openly acknowledged. His criticisms also extended to the use of cubic forms and simple polyhedra with regular geometries because he felt it required a preconception of the outcome prior to its making. Yet, despite Morris's concerns, Judd continually focused on the

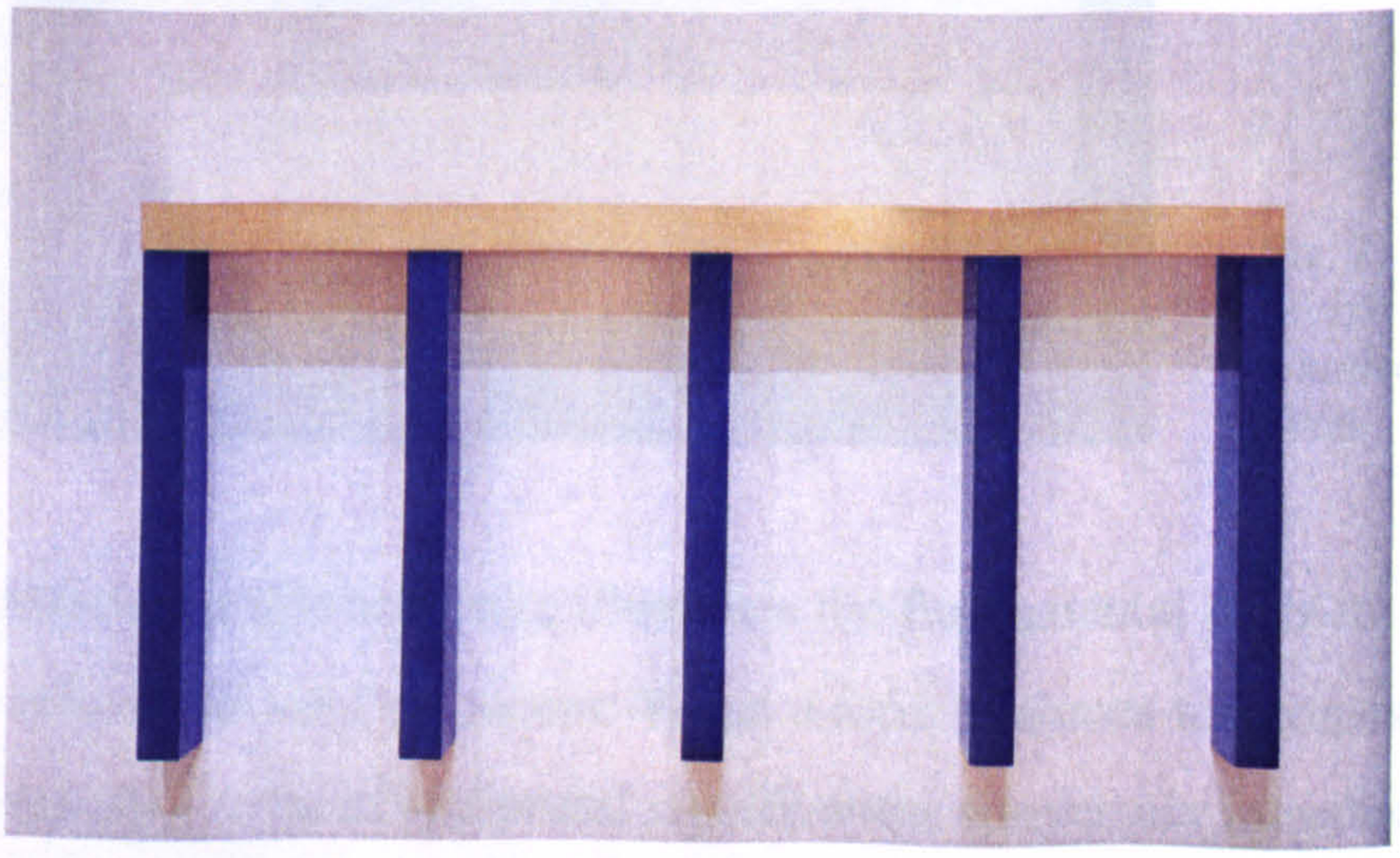
symmetrical and regular geometries of cubes and boxes, which he sought to purge of relational composition through mathematical progressions; as opposed to judgements of the eye.

Even though Judd insisted that the absence of relational composition and illusion are the two preconditions to 'singularity of form', there are, as mentioned earlier, disparities between his theories and practice. For example, the presence of illusion, part-to-part relationships, and the relationship of his sculpture to the surrounding architecture, as in sculptures such as *Untitled* 1985, (Fig. 19) and *Untitled* 1969, (Fig. 20), which do indeed suggest that illusion and relational composition are, as Morris had said, 'implicit'.

Whilst Judd was promoting the idea of *Specific Objects* with an overriding singular quality, Robert Morris provocatively asked whether a work could actually exist, "with one property". He considered that this would be a form with no parts or internal relationships.[7] Whilst there is no doubt that a simple geometric form, such as a sphere is singular in its form and its geometry is extremely consistent, relationships inevitably exist between length, height, and depth. Morris acknowledged this, but went on to propose an alternative solution. He was interested in applying Gestalt theory to sculpture,[8] which actually explains visual phenomena in terms of their constituent parts. Gestalt psychology maintains that the human eye tends to perceive one, specific and optimal, form: a *good form*.[9] The human tendency to seek a Gestalt is ordered by the six *laws of Pragnanz* (or good form) from Gestalt psychology, which includes symmetry, closure, continuity, proximity, and common fate.[10] Morris suggested that relationships between sensations could be minimised and ordered through simple geometric solids that establish a Gestalt. He stated that simpler forms "create strong Gestalt sensations. Their parts are usually bound together in such a way that they offer a maximum resistance to perceptual separation."[11] Therefore, according to Morris the minimalists exploited the regular geometries, symmetry, and innate unity of "cubes and pyramids" because of their relative resistance to perceptual separation and also because "one need not move around the object for the sense of the whole, the Gestalt to occur. One sees and immediately 'believes' that the pattern within one's mind corresponds to the existential fact of the object."[12] For Morris this resulted in "constant and indivisible" forms.[13] It is noteworthy that Morris eventually rejected the regular symmetries of simple polyhedra because we can easily visualise and therefore preconceive their form. Nevertheless, the preconceived design was symptomatic of Judd's sculptural practice, which evolved through two-dimensional drawings that were handed to craftsmen to make into three-dimensional objects.

As Morris observed, sculpture that has one quality as well as being devoid of relational composition, presents genuine challenges for the sculptor as well as the observer, and it might even be questionable if such a sculpture ever existed within the minimalist canon. Clearly Judd thought he had achieved it through the use of mathematical sequences and the geometrical division of the square or cube into halves and quarters etc. However, the ordering of sculptural form through such means, may only serve to make so called 'relational composition' all the more evident. Indeed, Judd's actions were not always quite so logical, and he exposes an apparent contradiction when stating how he spent a lot of time juggling (i.e. composing) to make certain sculptures look un-composed; notwithstanding his strenuous rejections of judgements of the eye.[14]

Other factors that seem at odds with his theories include; formal complexity, illusion, and the meeting of two planes resulting in the confluence of two parts. Consider for example, *Untitled*, 1965, illustrated in Fig.1, which consists of a horizontal brass bar with five pieces of iron, lacquered blue and joined perpendicularly at intervals along its length. Here, the change of direction and contrast of materials surely highlights the notion of relational composition, even though the verticals are spaced equidistantly. Neither is it without significance that the orthogonal geometry connects with the surrounding architecture because the linear elements all project outwards into the surrounding space. The strict horizontal and vertical orientation of the parts directly aligns with the floor, ceiling and walls, thereby establishing additional relationships with the surrounding architecture. Nonetheless, Judd still maintained it is unified because it has become a hybrid form, "To me the piece (*Untitled*, 1965) with the brass and five verticals is above all that shape."[15]



Judd
Untitled
1965
Fig. 1

Despite the diversity of approaches encompassed by minimalism there are nonetheless, concerns common to most of the artists involved in the movement, not the least of which initially placed great emphasis on orthogonal geometry. Others include: denial of illusory qualities; anonymous fabrication by craftsmen; symmetrical and regular geometry; repetition of standardised units ordered by elementary mathematical proportions; integral colour. To this glossary, one might provocatively add: additive construction from parts; non-uniform materials and surface finishes; applied colour; relationship to architectural context. Perhaps two noteworthy exceptions to this list are the sculptures of Anne Truitt and the felt sculpture of Morris. The former place particular emphasis on the asymmetry that results from the subtle deviation away from the vertical; which deflects the geometry and vertical axis of her sculpture. In the latter emphasis is on randomness, and the way in which the strips of felt hang.

If Morris's felt sculptures do not readily conform to the unified and singular characteristics of most minimalist production, then his *Untitled*, 1966, (Fig. 2) could be considered a paradigmatic example of a *Specific Object*. This sculpture conforms to Judd's concept: which deems the elimination or reduction of relational composition and illusion as preconditions. This sculpture has symmetrical and regular geometries so that an observer can easily comprehend it from any viewpoint, which generates an orthogonal Gestalt. Additionally, any illusory qualities are reduced by its exterior surface, which is visually consistent and lacking any sign of the artist's hand.

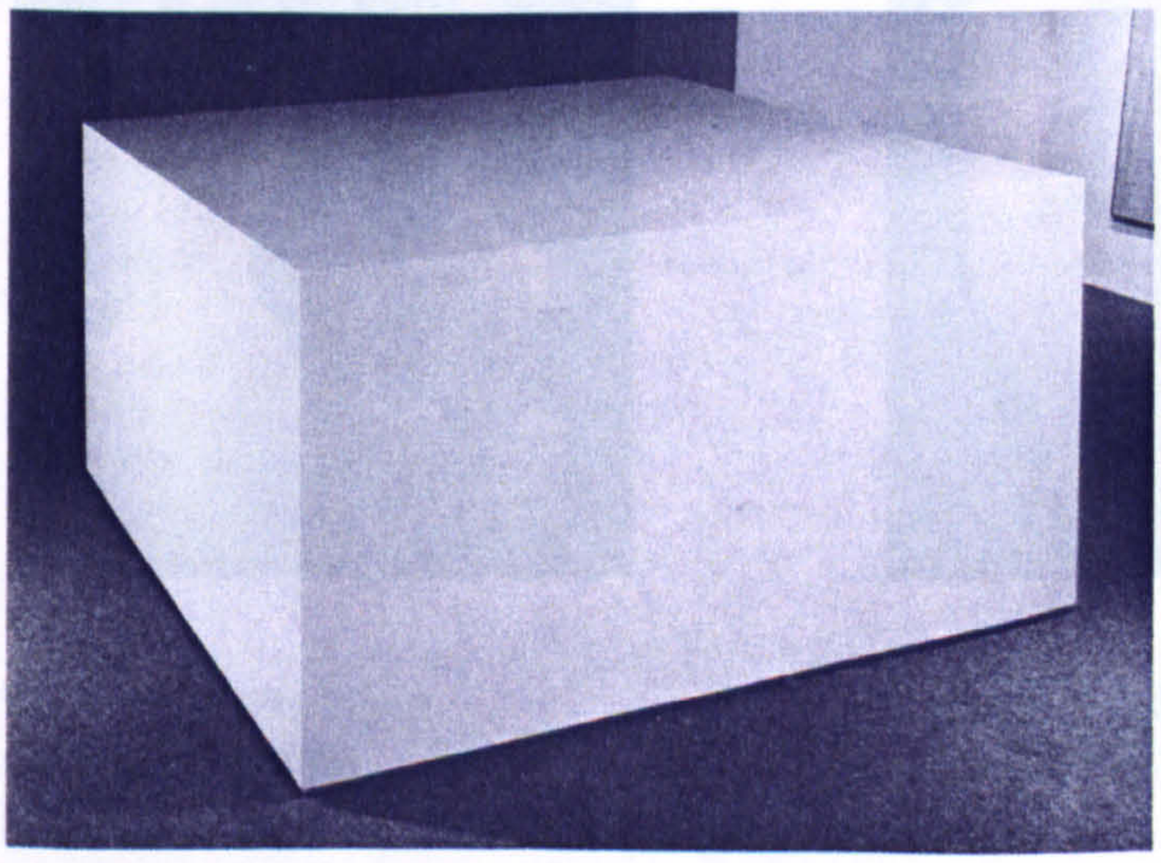


Fig. 2
Morris
Untitled
1966

However, this sculpture illustrates the fundamental problem facing any sculpture that strictly adheres to Judd's concept: When a form becomes too consistent and lacking in variation, it is unlikely to be of sculptural significance; conversely introduce too much variation and run the risk of relational composition undermining singularity and unity. Obviously, these two issues are central to this research.

HISTORICAL BACKGROUND

The historical background will explore the sculptural precedents for the qualities of singular form that Judd was so keen to achieve. It will begin with early examples such as Cylcadic Art and trace a path through to Judd's development of *Specific Objects*. Attempts will follow to show the discrepancies between Judd's practice and theory with particular emphasis on the frequent and contradictory presence of relational composition and illusion in his sculpture. Thereafter, it will describe how the theories of Judd and Morris have influenced contemporary sculptural practice. The findings will then be summarised to present the context within which the Studio Investigations occurred.

Although Judd published his *Specific Objects* in 1965, there are many previous examples of sculptures dating back thousands of years that have a high degree of internal integrity, synonymous with what he describes in this article. Therefore, the singular qualities associated with his concept are by no means a new concern to the language of sculpture. Early examples include: the Venus of Willendorf, Mycenaean female figurines, Boetian Plank figures, Fig. 5, and of particular relevance, Cycladic sculpture, Fig. 3 & 4.

Cycladic *Violin Types*
Ca 3200-2800BC
Fig. 3

Cycladic Head
2800-2300BC
Fig. 4

Boetian 'plank *figurine'*
Ca. 550 BC
Fig. 5

In the figure based examples of Cycladic sculpture, the body's extremities are often defined through inscribed lines that rarely break up the overall mass into a series of appendages. Details are subtle and the overall focus is on the external contours of the body as a single entity. Consequently, at least in the unpainted form in which we now see them; there is little evidence

of illusion. The paring down of the human figure may represent the development of a refined symbol of cultural significance, even if we remain unsure as to its exact purpose. Nonetheless, the simplicity and purity of the rendering of the body cannot be doubted, as in the sinuously subtle contours of the detached head, Fig. 4.[16] Yet, despite Cycladic sculptures being amongst the most reduced sculptural representations of the body, as in *violin types*, Fig. 3, the absence of the limbs does in fact heighten our perception of something is missing.[17]

Compacting the pose of a figure is another device that can be used to make the human body appear more elemental, as in Egyptian funerary sculptures. For example, in the *Statue of Haroua*, Fig. 6 & 7, the figure is depicted sitting with the limbs drawn into the body, under a shroud. The compactness of the figure reduces the human body to an approximation of a cube, with only the head protruding. A similar compression of the figure can also be seen in many Buddha sculptures such as the one illustrated from Japan.

Statue of Haroua, (front)
Egyptian
700BC
Fig. 6

Statue of Haroua, (rear)
Egyptian
700BC
Fig. 7

Statue of Buddha
Japanese
9-12th C
Fig. 8

Perhaps some of the earliest three dimensional forms to have a strong singular quality, and therefore a clear Gestalt, are the Platonic solids that were discovered by the ancient Greeks. The Platonic solids are unified because they "are the only existing solids in which all the faces (of a given solid) are identical and equilateral, and each of the solids can be circumscribed by a sphere."[18] For Plato these primary forms were "all beautiful because of the symmetries and equalities in their relations."[19]

The number Phi has a significant role in the proportions and symmetry properties of some Platonic solids[20] and Plato considered it the most binding of mathematical relations and therefore key to the physics of the cosmos. In nature, Phi is ever present from the micro through to the macro. Influences include the ergonomic spatial organisation of seeds in flower heads and optimisation of leaf exposure to sunlight through to the logarithmic spirals underpinning whirlpool, hurricane, and galaxy construction. Consequently, Phi is often referred to as the golden section or divine proportions. Its discovery as a quantifiable mathematical concept ensured its transformation into a tool for creating art and architecture. For example, it is accepted that the Egyptians were aware of its existence and may possibly have used it to assist the construction of the great pyramids, whereas in the Renaissance it sometimes ordered the composition of certain paintings, as well as architecture.[21]

Mario Livio, an astrophysicist at the Hubble Space Telescope Science Institute has written extensively on the extent to which Phi has been used in art[22]. He describes how proportional relationships in certain artefacts can be quite closely approximated to Phi. However, Livio notes that even in, what might be considered a paradigmatic example such as the *Parthenon* the deviation from Phi in its proportions can vary significantly according to which elements are selected for measurement and analysis (an inconsistency overlooked by golden section proponents). He contends that the ambiguity involved in the latter does not exactly suggest a decisive intent to use Phi as a guiding tenant[23]. Perhaps this particular area of conjecture is better suited to research other than the current; indeed a more pertinent issue centres on whether Phi can increase sculptural unity. It may not be without significance that Luca Pacioli describes in his 1509 treatise *De Divina Proportione* 13 effects of the divine proportion ascribing to each an adjective, including in one case 'singular' and 'unity and uniqueness' in another. So, to consider one particularly relevant sculpture that was deliberately fashioned according to Phi, *Arlequin, 1919,* created by Juan Gris in collaboration with Jaques Lipchitz[24]. The elements within the sculpture and their respective proportions are consistent with Kepler's triangle, which itself is based on the golden section. Visually, the sculpture is not especially singular in its geometry primarily due to its initial construction from blocks. A more convincing case for singular form is made by Lipchitz's 1916, *Sculpture*, which takes the elemental form of an obelisk.[25] It is noteworthy to consider Lipchitz's observation that, "at the time, I was very interested in theories of mathematical proportions... and I tried to apply them to my sculptures. We all had a great curiosity for that idea of a golden rule or golden section."[26] Lipchitz's second statement of 'applying Phi' is especially revealing because it alludes to the crux of Judd's objection to using Phi: namely a lack of artistic input, especially given that Phi derives from proportional

relationships, which he sought to eliminate. Yet, Judd did accord proportion considerable importance, explaining:

> "You can't exaggerate the importance of proportion. It could almost be the definition of art and architecture. Originally I ignored proportion as a subject, although I knew that good art was intuitively well-proportioned, because the subject was associated with the Renaissance and the idea that proportion is a quality of God and Nature, a reality to be deduced or intuited by Man. The Classical Golden Section was a fact of Nature just as the electron is now. This wasn't credible to me, since proportion is obviously a quality of ourselves. The Golden Section seems unnecessarily fancy, perhaps because of the perpetual academic desire for arithmetical justification, but the fact is that we can see the simplest proportions, 1 to 2, 2 to 3, 3 to 4, and guess at more."[27]

The use of Phi therefore appears to carry the inference of a kind of catch all formula for beauty and unity, and this concerned Judd. Likewise, it is also the reason why the studio practice did not order proportions in this way.

In fact, the research is somewhat more indebted to another irrational number that is the ratio of the circumference of a circle to its diameter: namely Pi. From the Gestalt perspective the circle is the most complete and perceptually resistant shape because it has no joins, and visually it has no apparent start or end points.[28] Consequently, from a visual perspective the circle can be considered infinite and its proportions entirely consistent due to the shape's underlying unity and symmetry. Interestingly, circles appear elliptical unless viewed from directly above, and as will be discussed later in the thesis, it is elliptical geometry that has been the focus of my studio investigations.[29]

The Renaissance artist Piero della Francsesca also studied the unity of the five 'divine' polyhedra in his *De Quinque Corporibus Regolaribus*, 1487-90.[30] Actually, the unity of much minimalist sculpture is derived from one of the Platonic solids, the cube. Yet, despite their singular qualities, the five Platonic solids are not particularly interesting from a sculptural point of view because their regular geometry lacks any significant variation. Therefore, I contend their very consistency may induce the perception of a sort of 'visual monotony'. Alternatively, they may become of greater sculptural significance when their symmetry is undermined in someway, a facet of their geometry altered, or when a part or parts are missing. This condition typifies the

dilemma posed by Judd's *Specific Objects*; how to create unified form that has qualities of sculptural significance.

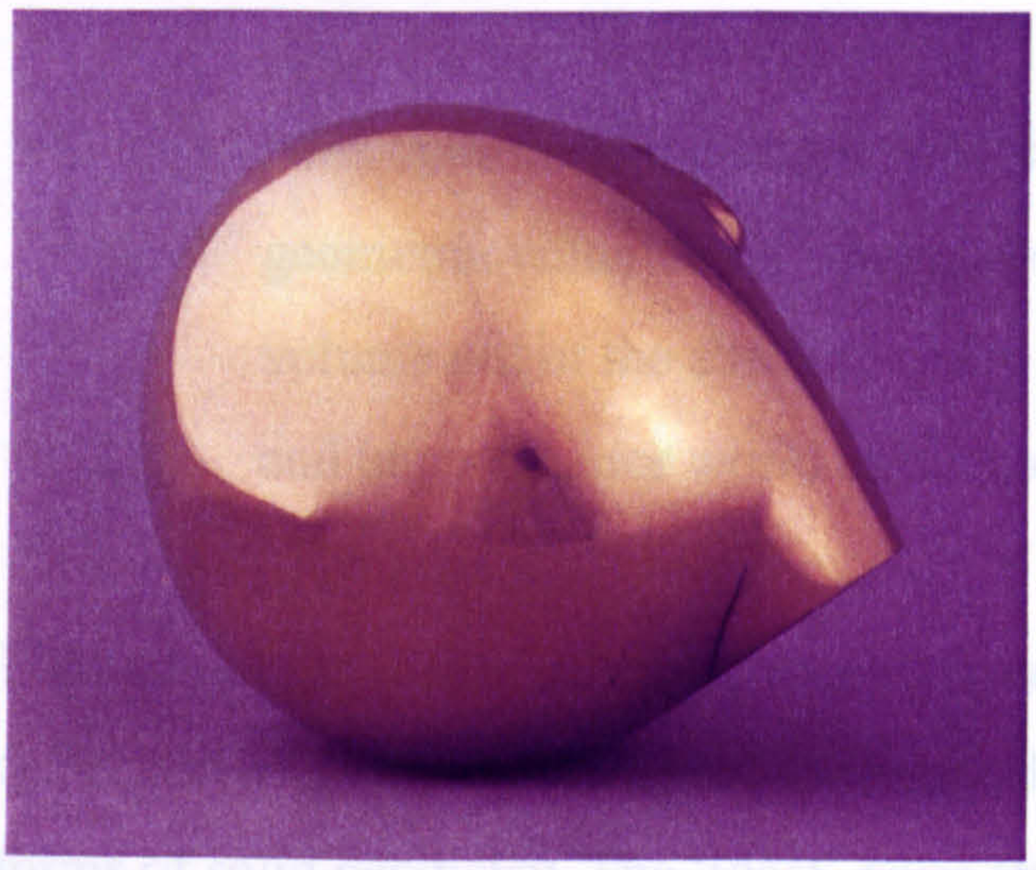
As far as the modern movement is concerned, Rodin was almost certainly the first sculptor to reduce sculptural form to what might be called, its 'essence'. He did this by condensing the human figure to a block with few protrusions, as in *Balzac*, 1897; in a manner that is similar to the compression and compactness of pose used in Egyptian funerary sculpture and sculptures of Buddha. Rodin spoke of his belief that, "the purest masterpieces are those in which one finds no inexpressive waste of forms, lines, and colours, but where all, absolutely all, expresses thought and soul."[31] His eradication of the 'unnecessary' evolved through *Walking Man*, 1895, and in 1905 he literally lopped off the extremities and decapitated the figure of *Monumental Torso of the Walking Man*.

Rodin
Monumental Torso of the Walking Man
1905
Fig.9

This revealed the figure's core: the torso. Nonetheless, as is the case with the violin type Cycladic sculptures, what remains testifies to the parts removed. Therefore, even Rodin's most reduced sculptures cannot be considered to have the singular qualities of *Specific Objects* because in Judd's terms they are incomplete and allude to parts that are missing.[32]

By refining the human figure to its essence, Rodin may have influenced the development of Brancusi's sculptures, whose defining formal characteristic might be described as singularity. Brancusi was one of the most significant forbearers for Judd's concept because his sculptures appear complete due to their smooth compact contours and seemingly regular geometries.[33] For example, *Prometheus*, 1911, (Fig. 10) exemplifies the unity Brancusi could achieve in one form, albeit displayed in relation to the other forms constituting the multi-part plinth. The 'head'

element has an intrinsic unity due to its proximity to a simple geometric form; it cannot be visually or physically subdivided into constituent parts; therefore, it is not subject to relational composition. Prominence is given to the unified geometry and smooth contours of the exterior form over the facial features. In fact, the mouth is absent and the eyes are only implied by a subtle raised line. This has similarities with Cycladic sculpture in which anatomical detail is almost reduced to the abstract. Yet, most of Brancusi's sculptures lack the inscribed lines and surface details that were carved into Cycladic sculptures. Henry Moore considered that, "since the Gothic, European sculpture had become overgrown with moss, weeds – all sorts of surface excrescences which completely concealed shape. It has been Brancusi's special mission to make us more shape-conscious. To do this he had to concentrate on very simple direct shapes." This refinement of a sculptural form to a point where it can be described as 'singular' is epitomised by *Prometheus*; a sculpture that is consistent with the Gestalt concept of completeness, and could easily be described as *good* form.[34]



Brancusi
Prometheus
1911
Fig. 10

Brancusi's concern for singular qualities prompted Rosalind Krauss to write, "Given the unified quality of the single shapes, whether ovoid or finlike or voluted, there is no way to read them formally, no way to decode the set of internal relationships, for to put it simply no relationships exist."[35] Yet, Krauss overlooks the existence of relationships between length, width, and height even in the simplest form. Nonetheless, Brancusi minimised these relationships, intentionally or otherwise, through forms whose compelling completeness is a consequence of its singular qualities.[36] It is apparent that the compactness of the external contours of both Brancusi's and Rodin's sculpture displace space, and the surrounding lines all appear to converge on them. This is not the case in Judd's orthogonal sculptures because the lines of the edges project outwards and establish relationships with architecture. However, the most fundamental difference between

Judd and Brancusi relates to the underlying Gestalt in their sculpture. Judd's Gestalt results from the square or rectangle, whereas Brancusi's is primarily elliptical and on a few isolated occasions circular; it is therefore indebted to the ellipse.

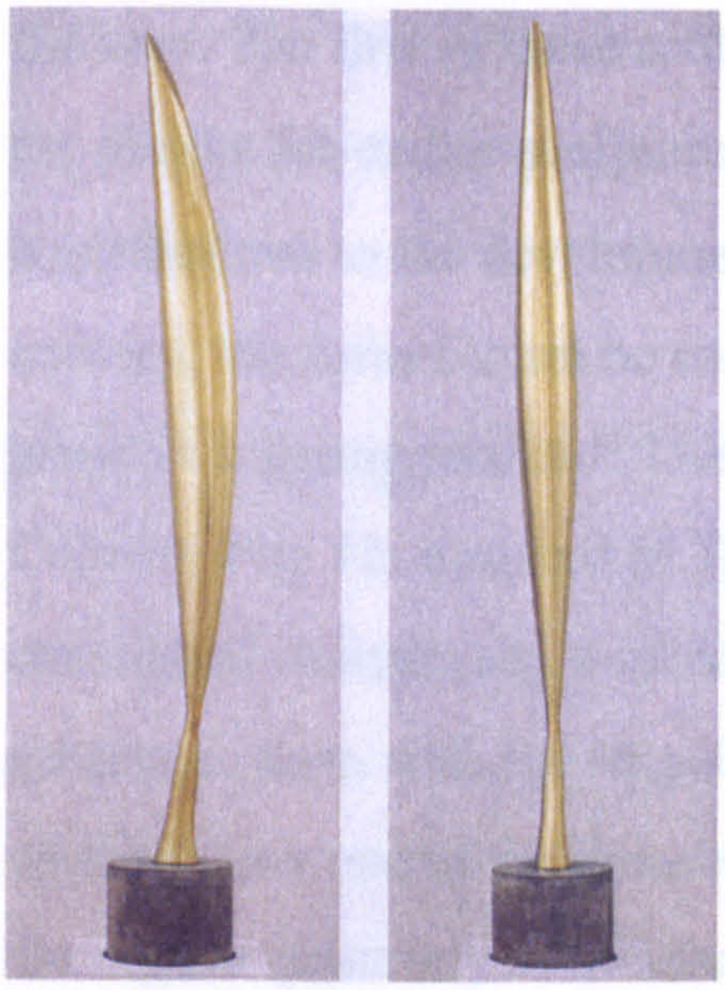
Brancusi's sculptures have a high degree of internal integrity; perhaps even more so than Cycladic sculptures, and the individual units or moreover the primary element of each sculpture has no separate parts. Because they are based on, what might be described as elliptical geometry and not on orthogonal geometry, they therefore seem to flow endlessly. On first sight his sculptures appear to be extremely simple, yet more detailed examination reveals geometries of extreme complexity and subtle variation. Krauss also identified this tendency, which might appear contrary to unified form, noting that it were as though Brancusi had aimed for and achieved 'perfect' form in the geometrical sense, only to then take a step backwards. She describes this condition of undermining regular geometry as the, 'deflection of an ideal geometry'.[37] She observes how the geometries of his sculptures appear to have been somewhat deformed and that,

> "this deformation is slight enough so that it does not disturb the quality of the geometric volume as a whole...yet the deformation is great enough to wrench the volume out of the absolute realm of pure geometry and install it within the variable and happenstance world of the contingent."[38]

Throughout the course of this research I have appropriated Krauss's term by referring to the 'the deflection of geometry' as a means of describing how sculptors have manipulated 'absolute' forms of solid geometry. The 'ideal' geometry that Krauss refers to is less relevant to this research because of its connotations with harmonious and divine proportions; and therefore relational composition. I therefore refer to, *the deflection of geometry*, as a means of describing my own attempts to introduce variance to the geometry of unified forms.

Within this notion of deflected geometries, there appear to be two basic types: one based on actual variations in physical geometry and the second resulting from the illusory qualities of materials and surface finishes. Both physical and illusory deflections of geometry are present in Brancusi's sculpture. The former is achieved through a variety of techniques including shearing off slices of mass as in *Seal*, 1937; effectively squeezing forms as for example in the extended ovoid of *The Beginning of the World*, 1924; and the seeming stretching and elongation of the

Bird in Space sculptures.[39] These two kinds of deflected geometries can also be observed in the work of contemporary sculptors such as Anish Kapoor and Richard Serra.



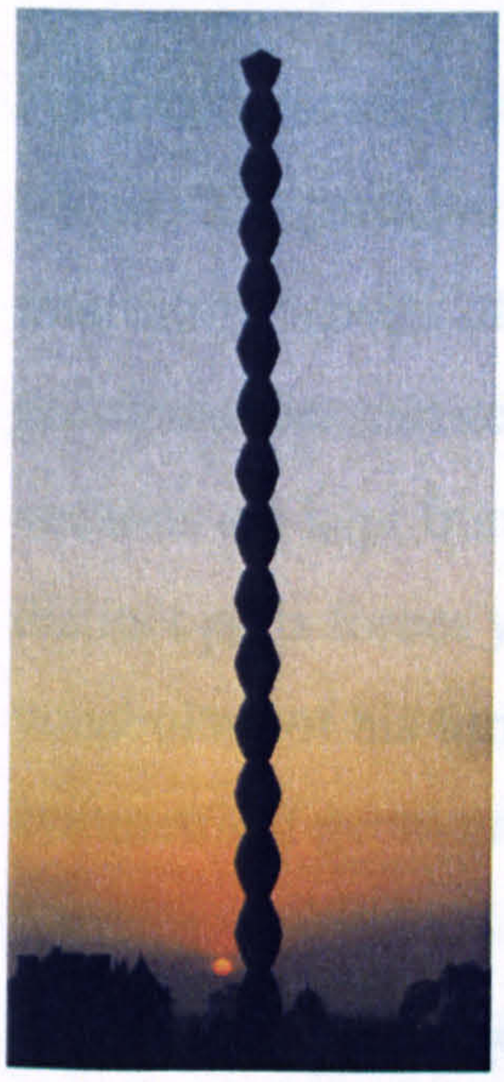
Brancusi
Bird in Space
1930s
Fig. 11

Brancusi also exploited the surface qualities of highly polished metals to transcend physical geometry, in what might be described as *illusory* deflection of geometry. A good example are the *Bird in Space* series of sculptures from the 1930s, where their curved surfaces reflect the surrounding room, which in turn becomes a series of curved horizontal lines that perceptually deflect the vertical contours of the sculpture. This effect frequently causes them to become unstable and difficult to define.[40] This illusory quality and seemingly transient geometry is similar to that which is apparently present in Judd's Plexiglass lined boxes such as *Untitled*, 1969, Fig. 20.

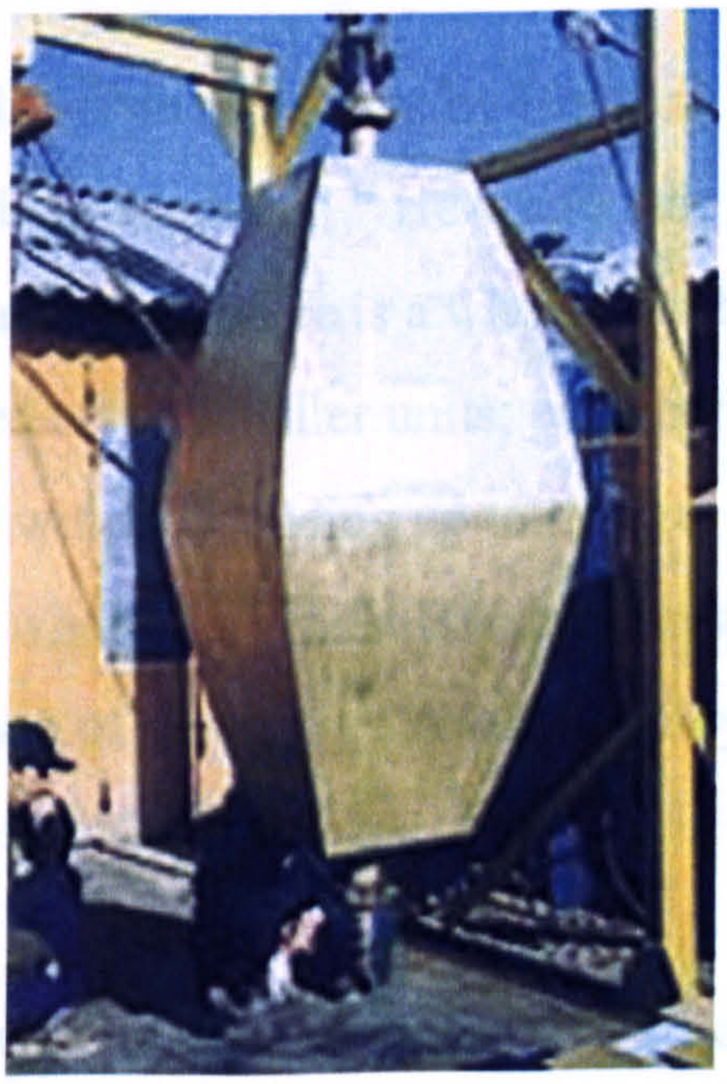
It may well be that the deflection of geometry is counterproductive to the realisation of *Specific Objects* because it seeks to introduce perceptual variance, and even illusion. Such may be the case with the reflections on Brancusi's polished bronzes, which can challenge the homogenous consistency of their surfaces. Additionally, those of his sculptures in which appendages appear to have been sheared off, allude to a missing part or parts and therefore may imply relational composition through actual material absence.[41] Part to part relationships are even more prevalent when the main element of the sculpture is considered in relation to its 'plinth'. In this sense, the sculpture then distinctly follows the very European traditions of art to which Judd so strongly objected.

Brancusi's treatment of the plinth as an integral, and equally important, part of a sculpture meant that his sculptures began to share the same space as the observer. This contrasted the spatial

isolation of recent nineteenth century 'salon sculpture', which was invariably set apart on a deliberately autonomous plinth. In fact, Brancusi's exploration of the plinth as sculptural form may have led to the development of another archetype within his vocabulary: *The Endless Column*. The first of these sculptures was carved in 1918, yet its form is intimated by several of the plinths for earlier sculptures. It was in many ways, one of Brancusi's outstanding contributions to the development of the language of sculpture in the twentieth century. In its entirety, the form cannot be considered singular because it is constituted by modular units, which result in a zigzag profile.[42] This serrated geometry is clearly visible in the largest *Endless Column*, Fig. 12, installed in Târgu Jiu, Romania in 1935. However, if each constituent unit is considered individually a somewhat different impression emerges; one that involves a simple geometric form with the singular qualities of a *Specific Object*. This can be seen in Fig. 13, which shows one of the rhomboid sections during the sculpture's restoration in 2000. As such, the regular geometry of this innovative sculpture may be considered a precursor to *Specific Objects* and was an acknowledged influence on those minimalist sculptors such as Judd and Carl Andre, who created sculpture through the repetition of modular units.



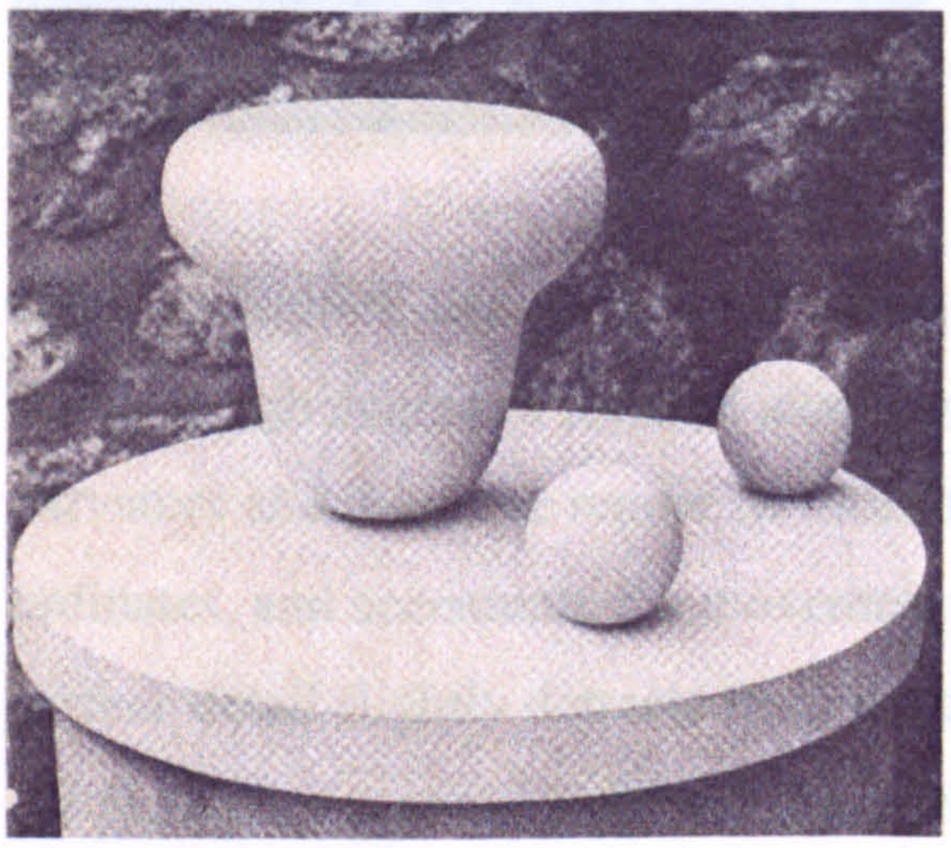
Brancusi
Endless Column
1935
Fig. 12



Brancusi
Endless Column (detail)
1935
Fig. 13

/ho was contemporary w a concern for representing ng them to some kind of ans Arp. For instance, the forms in *Bell and Navels*, 1931, Fig. 14, have a prevailing singular quality, due to their circular Gestalt. They are therefore typical of the high level of internal integrity Arp could achieve. Judd praised Arp's work and in so doing implicitly acknowledged the unitary characteristics of the circle, as demonstrated by the symmetry and consistency of curvature in the 'bell' and 'spheres'.

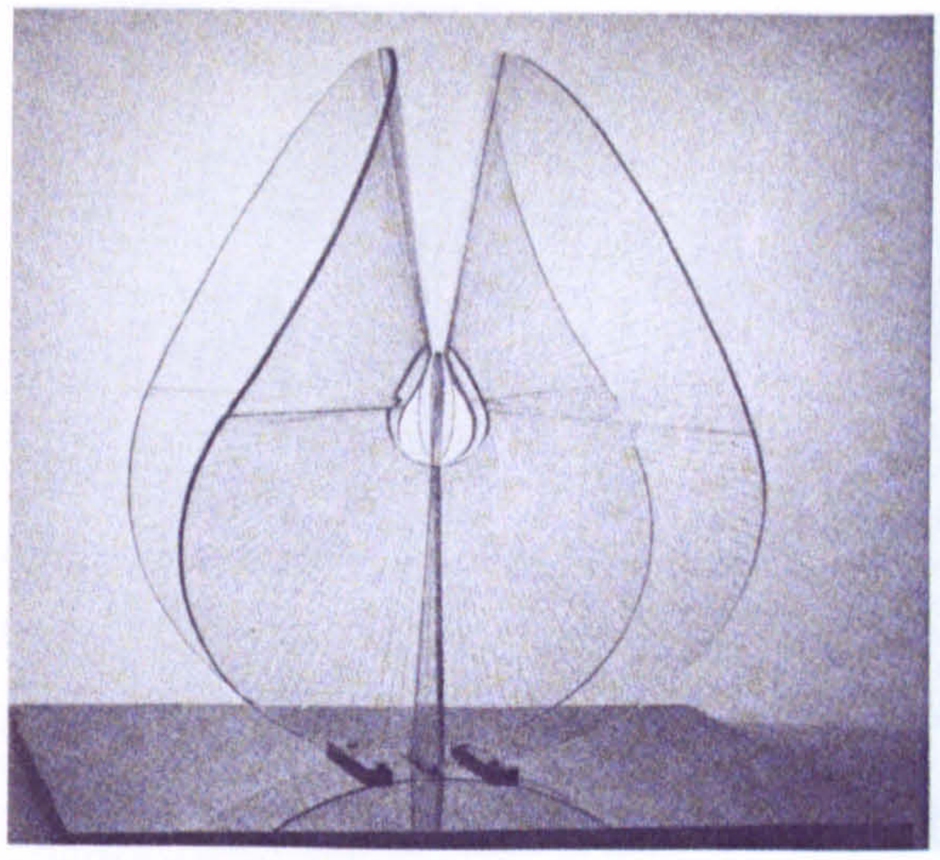
Furthermore, these opaque wooden forms do not exhibit any of the illusory qualities of materials that Judd rejected. However, whilst the constituent parts appear consistent with *Specific Objects*, their very existence and the relationships between them means the sculpture cannot conform to the concept.[43] Even then, each of the unified parts may actually be too regular and consistent to be described as sculpturally significant, which again underlines the dilemma posed by Judd's concept.



Arp
Bells and Navels
1931
Fig. 14

Judd recognised, even admired, the more indivisible sculptures by Brancusi and those by Arp in which, "the parts are usually subordinate and not separate."[44] He wrote that, "One of the interesting aspects of Arp's sculpture... is that a good piece is a whole which has no parts. The protuberances can never clearly be considered other, smaller units; even partially disengaged sections are kept from being secondary units within or adding up to a larger one. The lack of distinct parts forces you to see the piece as a whole."[45] Whilst Brancusi broadened the vocabulary of his forms through the 'deflection of geometry', Arp invariably maintained symmetrical geometries in his singular and unified forms.[46]

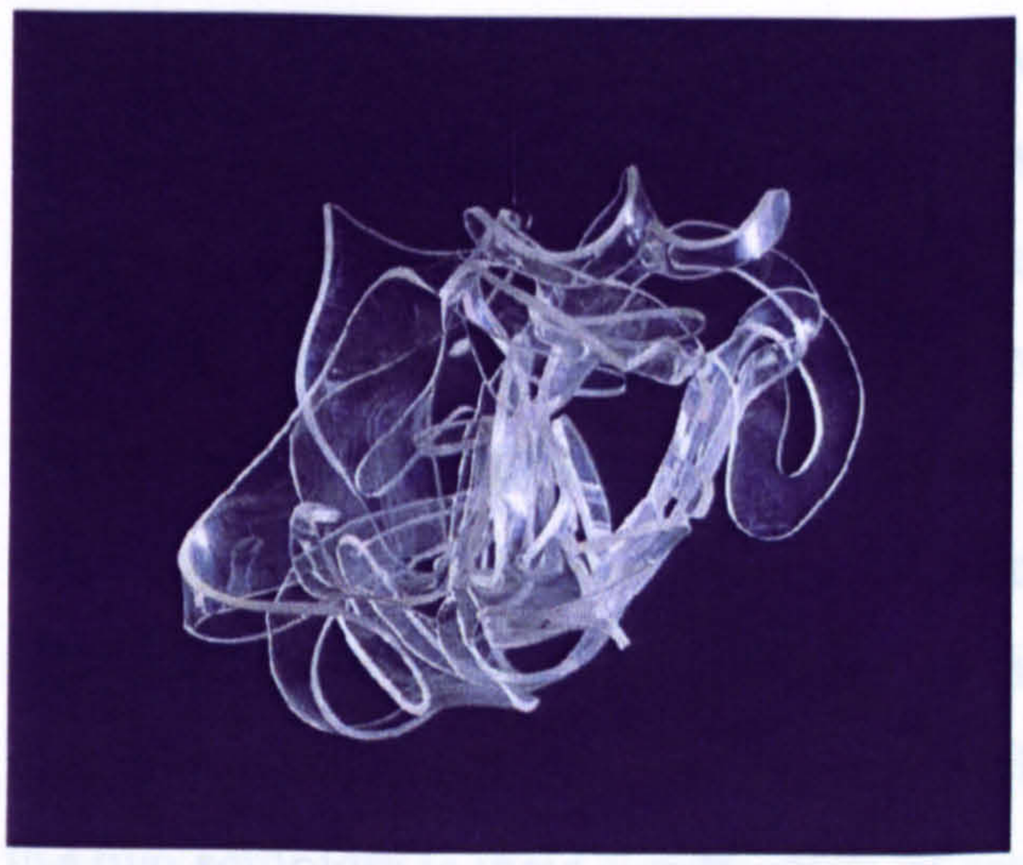
Naum Gabo is another sculptor who is of interest to this research because he made sculptures that may be described as 'singular'. His investigation of transparent materials is of particular significance to the research because of its potential to be *specific*; that is to say, nothing is hidden.[47] Gabo's *Translucent Variation on a Plastic Theme*, 1937, Fig. 15, might be described as a single form because of its curved geometry, which reduces the duality or the relationships between form and space so that the latter becomes unified.



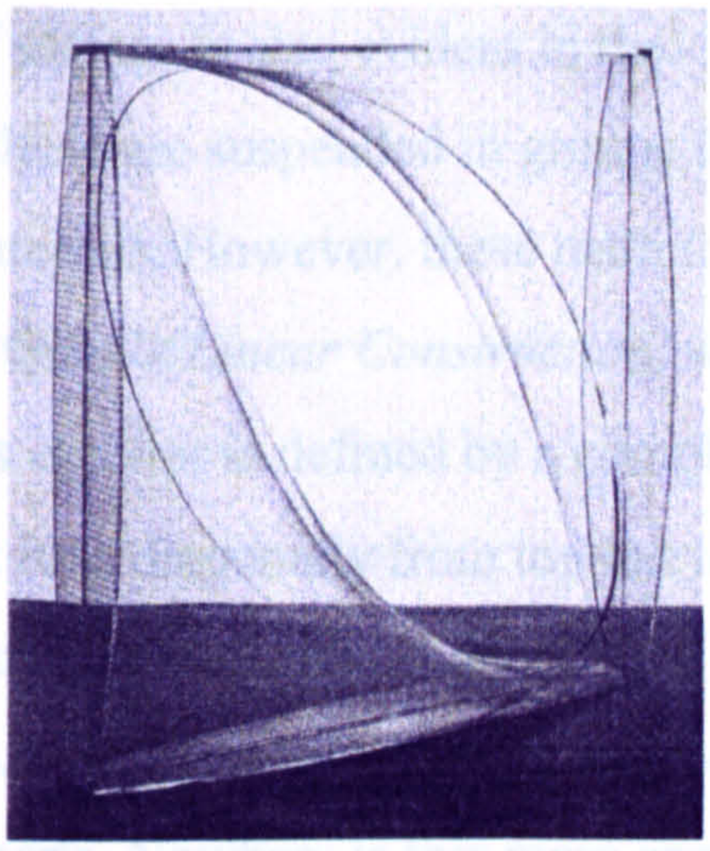
Gabo
Translucent Variation on a Plastic Theme
1937
Fig. 15

Gabo's sculpture stands out for the sinuous continuity of its planar surfaces, where the geometry shows a high degree of internal integrity. The lines inscribed into its surface are radii of curvature and therefore render its location in space slightly less ambiguous by defining its co-ordinates, and accentuate the movement of the curving plane. As in Cycladic sculpture, this surface detail slightly detracts from the consistency of the form's external contours. The edge of the plexiglass captures light and makes the geometry of the form seem quite specific, whilst at the same time introducing an illusory quality whereby the edge appears to shimmer; creating sculptural interest. The latter is naturally inconsistent with the strict terms required by *Specific Objects* because of the prominence of the illusion, but is not dissimilar to the highly reflective surfaces of Brancusi's polished metal sculptures. In fact, Judd later explored highly reflective surfaces, not through metal but instead using plexiglass, whilst denying their self evident illusory qualities.

Other sculptures by Gabo, Vantongerloo, and Moholy-Nagy exploit transparent material and structure; examples include Moholy-Nagy's *Ribbon Sculpture*, 1943, Fig. 16, which is significant for its simultaneous combination of transparent structure and materials, and *Linear Construction*, 1942 by Gabo, Fig. 17.[48]



Moholy-Nagy
Ribbon Sculpture
1943
Fig. 16



Gabo
Linear Construction
1942
Fig. 17

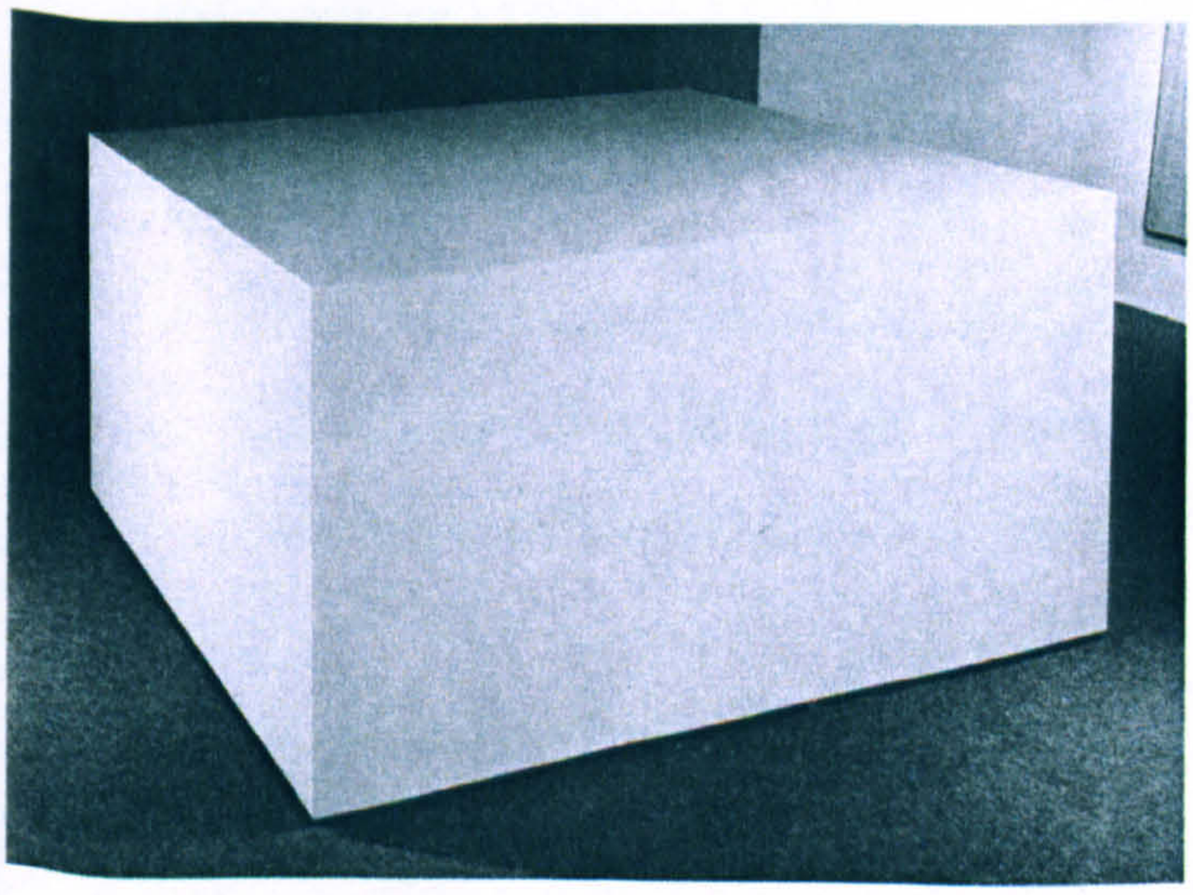
Both of the above sculptures define a specific interior without ever fully enclosing it. They define form with the minimum of interference to the flow of surrounding space. However, neither are coherent with Judd's concept, and this is particularly the case with *Ribbon Sculpture*, 1943, because of the plethora of relationships that exist within its swirling linear geometry, which has the qualities of a scribble. Despite this sculpture being cut from one sheet, the complexity of the relationships that develop through its subsequent manipulation demonstrate that the perception of singularity is not the same thing as physical singularity i.e. something actually being one piece, as a casting is for example. This in turn implies that a form with singular geometry is likely to be perceived as 'singular' even if it is constructed from parts because the Gestalt of its geometry will dominate the viewer's perception of it. Sculptures by Martin Puryear and Richard Deacon, such as those illustrated in Fig. 28 & 29 appear to confirm this notion.

Despite being constructed from parts Gabo's *Linear Construction,* still has a greater sense of internal integrity than *Ribbon Sculpture* for instance. Its singular quality is transparency and how a form can be defined through the illusions of lines in space.[49] The density of the internal nylon threads creates the illusion of opaque mass, which continually shifts according to the observer's position, resulting in instability that causes perceptual ambiguities in the definition of the sculpture's geometry. However, the presence of illusion and the compound relationships, or relational composition, between the edges and contour lines means the sculpture somewhat lacks the prerequisites required by *Specific Objects*. Similar structural variation can be observed in Morris's wire mesh *Untitled*, 1969, Fig. 26, which can appear more or less dense according to

the position of the viewer. This apparent inconsistency of surface is also evident in the translucent fibreglass sculptures that Morris made; often these are suspended in groups thereby creating the perception of different optical densities of materials. However, these resin forms are invariably have regular geometries and therefore contrast Gabo's *Linear Construction*, which has extremely contrasting internal and external geometries. Its exterior is defined by a complete square, whereas the interior is defined by an ellipsoid that runs diagonally from top left to bottom right within the interior. Nonetheless, the internal partitioning is similar to Judd's use of diagonal planes to subdivide the interior of his open box sculptures. Yet, the most pertinent link between the two sculptors is their construction of sculptures from parts. Nowhere is this more apparent than in Gabo's invention of *Stereometric Construction*,[50] which reveals the volume within mass by articulating it through the organisation of planes. Possibly this, more than any other sculpture, creates a precedent as well as highlighting a dilemma. The former is because Judd's sculptures rely on the organisation of square planes within the geometry of the cube; the latter is because the planes can be perceived as parts that relate to one another.

SPECIFIC OBJECTS AND SINGULAR QUALITIES

This section of the Historical Background will present the fundamental attributes required by Judd's concept and discuss the dilemma that *Specific Objects* incites. As previously discussed, *Specific Objects* requires forms with an overriding singular quality, in which any relationships between parts and illusion have been eradicated, or at the very least minimised. However, by defining sculpture through singularity, *Specific Objects* poses a somewhat contradictory problem: In reality, it is questionable if an object with just one characteristic can have sculptural significance, especially when the latter depends on changes in geometry and/or material qualities. Consider for example, Morris's *Untitled*, 1966, Fig. 18. This sculpture conforms to Judd's concept because it is entirely symmetrical and without variation, yet this actually reduces its impact. In very simplistic terms, it is just a plain white box! Judd himself acknowledged the conflict between the unified geometry that *Specific Objects* requires and the creation of sculpturally significant form, stating; "The big problem is that anything that is not absolutely plain begins to have parts in some way. The thing is to be able to work and do different things and yet not break up the wholeness that a piece has."[51] Judd additionally noted the pitfalls of regular geometries, "When the exclusive use of symmetry became probable, I worried that it would be very restrictive and also that the unity I considered necessary in a work would become a trap allowing little variation."[52] Considered from Judd's point of view the concept may indeed seem incompatible with the dynamics of sculptural form.



Morris
Untitled
1966
Fig. 18

This inevitably provokes the question; to what extent did Judd's sculptures substantiate his concept of *Specific Objects*; and is it possible to create sculptures of significance without resorting to relational composition and illusion? Highly significant though Judd's sculptures are,

a comparison between them and his concept reveals crucial disparities, foremost amongst these are the presence of illusion and relational composition. Yet, some of the inconsistencies are mitigated by Morris's coherent and logical assertion that a form with strictly one single quality is impossible because relationships will inevitably exist between height, depth, and length.[53] Nonetheless, it does seem that within the minimalist movement all of the artists, including Judd, either consciously or unconsciously, used illusion and relational composition. The following two sections of the thesis will highlight examples, and present possible explanations for their occurrence.

RELATIONAL COMPOSITION

This section of the Historical Background will focus on relational composition and draw attention to the presence of relationships between parts in Judd's sculpture and describe how this undermined his attempts to fulfil his concept. It will also attempt to assess whether Judd's use of proportional systems and predilection for orthogonal geometry was actually compatible with his intentions.

Specific Objects directly opposes a set of canonical laws that had frequently governed Western art for at least the preceding 3000 years. The adoption of such a confrontational stance may therefore be perceived as Judd 'staking his claim' for a piece of art history. This contention is sustained by the fact that he was operating immediately after the period when, for the first time, American artists were at the vanguard of new developments in art through the activities of the abstract expressionist painters. What more controversial, individualistic, and trailblazing approach could an artist adopt than rallying against the ideals that had informed the practice of art for many periods over the last two millennia? Classical theories of harmonious proportional systems had frequently been used to formulate the relationships between parts in architecture and sculpture, and are exemplified by such devices as the golden section or divine proportions.[54] Judd described this method of arranging, balancing and counterbalancing disparate pictorial elements within a painting or sculpture as 'relational composition', or in other words the relationships between parts. Judd perceived relational composition to have blighted the entire history of European painting and therefore rejected it.[55] He was especially dismissive of the arrangement of pictorial elements by judgements of the eye, what he described as:

> "Typical part-by-part play, as in David Smith, or in all earlier painting and art, or European art.... Mondrian is typical. The idea of taking some little part down here to adjust it to balance some big part up there."[56]

Nonetheless, it may well have been that the presence of relational composition in Judd's sculpture was the direct consequence of two contributory factors. Firstly, his combination of non-uniform materials including opaque, transparent, and translucent materials, in addition to a wide range of surface finishes. Secondly, his unrelenting preference for orthogonal geometry. It is surely entirely logical to assume that should one wish to eliminate any relationships between parts in a sculpture the first step would be to reduce the number of constituent parts by using only one material. Yet, Judd chose to do the exact opposite, and with rich results. For example,

one might consider *Untitled*, 1969, Fig. 20; which was constructed from aluminium panels and lined with Plexiglass. Described this way it gives the impression of a visually subdued, and geometrically consistent, sculpture. But imagine now: the brushed opaque silver coloured aluminium exterior surrounding a highly reflective deep purple Plexiglass interior. This demonstrates how Judd could establish complex visual effects and distinctly contrasting relationships by simply combining two materials or colours. Yet, the latter inevitably required him to take compositional decisions. Referring to an early sculpture, "Untitled", 1963, and without a trace of irony, Judd admits that he "did a great deal of juggling to make it un-composed."[57] Interviewer John Coplans then bravely pointed out his tendency to compose to which he responded, "Yes, but I wouldn't want to call it that. I mean I'm working with the form. I know I'm doing something with the form, but I wouldn't call it composition because I hate the term."[58]

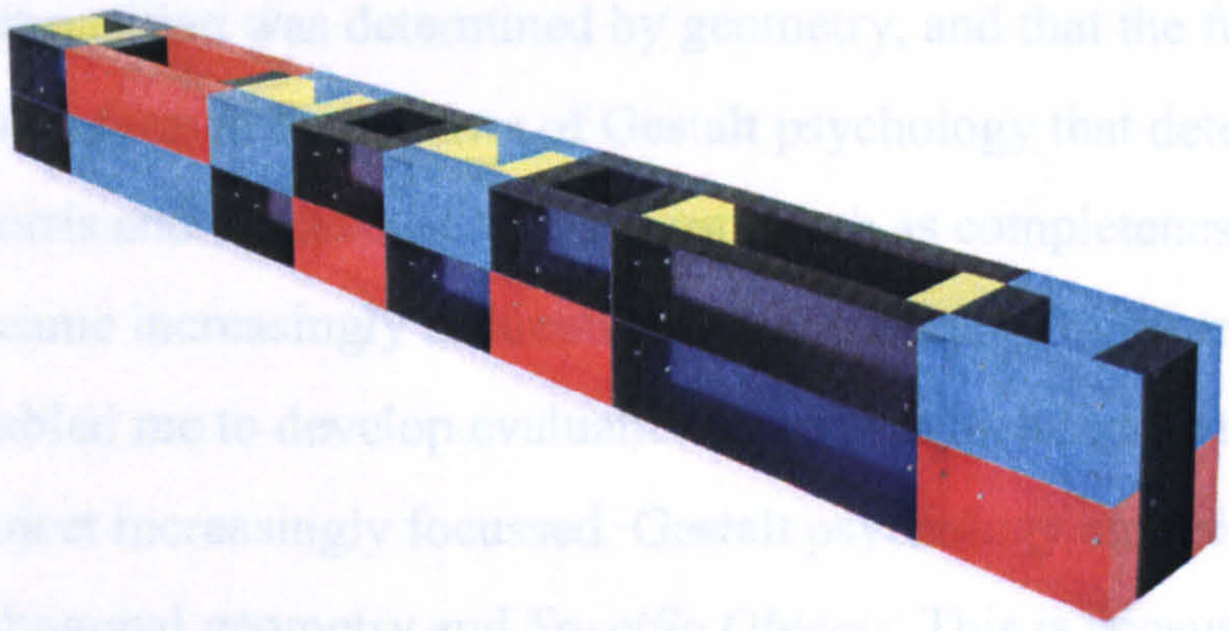
Judd's attempts to order relationships without judgements of the eye were achieved through mathematical proportions. This effectively involved two approaches that on first inspection seem visually consistent, but are actually underpinned by diverse numerical systems. Perhaps what might be considered the more consistent with his desire to purge relational composition was the use of whole number fractions including the simplest ratio of 1:1. The latter is clearly demonstrated by his stacks; sculptures consisting of box units cantilevering away from the wall where the interval between one box and another is identical to the box's height, (which therefore emphasises neither form nor space). These proportions are the embodiment of what Judd considered to be 'just one thing after another'.

On the other hand, Judd also ordered elements within certain sculptures by means of the Fibonacci sequence, which concerns an altogether more complex set of proportions. Interestingly, the ratio of any two successive numbers from the sequence closes in on the golden section, getting progressively closer the further along the sequence one advances. The golden section has long been considered a manifestation of harmonious and perfect beauty. Yet, if absolute beauty can be quantified through numeric definition, then to a certain extent the imagination, intuition, decisions, and whims of the artist are rendered of lesser importance, if not obsolete.

In fact, Judd acknowledged the restrictions involved with using such systems and this may account for his less controlled, and even exuberant, decision making when selecting materials. Consider *Untitled*, 1972, Fig. 21, which has extensive interplay between its copper walls and

cadmium red floor. The latter suggests quite deliberate and elaborate relationships, a quality often absent in Morris's sculptures, which are invariably made from just one material, as in *Untitled*, 1966, Fig. 18. Indeed, it appears as though Judd actually revelled in amalgamating different materials, colours and surface finishes; and he did so with increasing sophistication in later works such as *Untitled*, 1985, Fig. 19. This sculpture is a conglomeration of multi-coloured boxes arranged to encapsulate several internal spaces. Admittedly, many of the constituent parts are symmetrical, as is the geometry of their combined form along the longitudinal axis. Nonetheless, it is an extremely visually and geometrically complex sculpture in which many compound relationships clearly exist between parts. This is almost certainly what Morris was referring to in the following uncompromising statement:

> "Minimal Art, with two or three substances, gets caught in plays of relationships between transparencies and solids, voids and shadows and the parts separate and the work ends in a kind of demure and unadmitted composition."[59]



Judd
Untitled
1985
Fig. 19

Judd may have argued that by incorporating more materials into his sculptures he was introducing the variation that he simply could not achieve through orthogonal and symmetrical geometries. In this way, visual interest could be added through the perception of variance, albeit at the surface. Judd may also have suggested that his 'progressions' generated considerable variation in geometry, despite them inevitably involving part-to-part relationships: "The progressions made it possible to use an asymmetrical arrangement, yet to have some sort of order not involved in composition." Judd believed this order would enable observers to "understand there is a there, and that it doesn't look as if it is just done part by part visually. So it's not conceived part by part it's done in one shot."[60]

Whilst one cause of relational composition undeniably was Judd's combining of different materials, colours and surface finishes, the second, and probably more important, reason was the orthogonal geometry that defines his sculptures. This contention was increasingly informed by Robert Morris's theories about Gestalt psychology and its consequences for attempts to create sculptures with the singular qualities embodied by Judd's concept. According to Morris it was quite logical that Judd might seek to make objects that exploit the geometry of regular polyhedra, such as the cube, because:

> "Objects were an obvious first step away from illusionism, allusion, and metaphor. They are the clearest type of artificial independent entity, obviously removed and separate from the anthropomorphic...Of all the conceivable or experienceable things, the symmetrical and geometrical are most easily held in the mind as forms."[61]

However, an analysis of Morris's, Notes *on Sculpture I-IV* reveals how unity was not entirely undermined by part-to-part construction. Instead, it suggested that the extent of relational composition was determined by geometry, and that the fundamental cohesiveness of the latter was informed by the laws of Gestalt psychology that determine 'good form'. Consequently, Morris and the laws of 'good' form, such as completeness, continuity, similarity, and closure became increasingly influential as the research progressed. So much so, that their application enabled me to develop evaluation criteria, which in turn made the aims for each subsequent project increasingly focussed. Gestalt psychology also revealed the apparent incompatibility of orthogonal geometry and *Specific Objects*. This is because despite the square having a strong Gestalt, or overriding singular quality, it can still be broken down perceptually due to its union of four lines. Obviously, this has consequences for Judd's sculptures because most are ultimately based on the square or rectangle and all therefore inherently relational. The convergence of lines, edges and planes at right angles interrupts the perceived continuity or flow of a form. Orthogonal geometries also create additional complementary relationships with the surrounding architecture because the lines, planes, and edges of the sculptures imply projection into space, in direct alignment with the floor, ceiling, and walls. The result of this is that the sculpture becomes more a 'relational' object, than a 'specific' object.

One might therefore ask, why did Judd persist with orthogonal geometry throughout his career, given that it seems to be in opposition to his values? Possibly, there are two reasons. The first is Judd's apparent disinclination to critique his sculpture within the context of Gestalt theory,

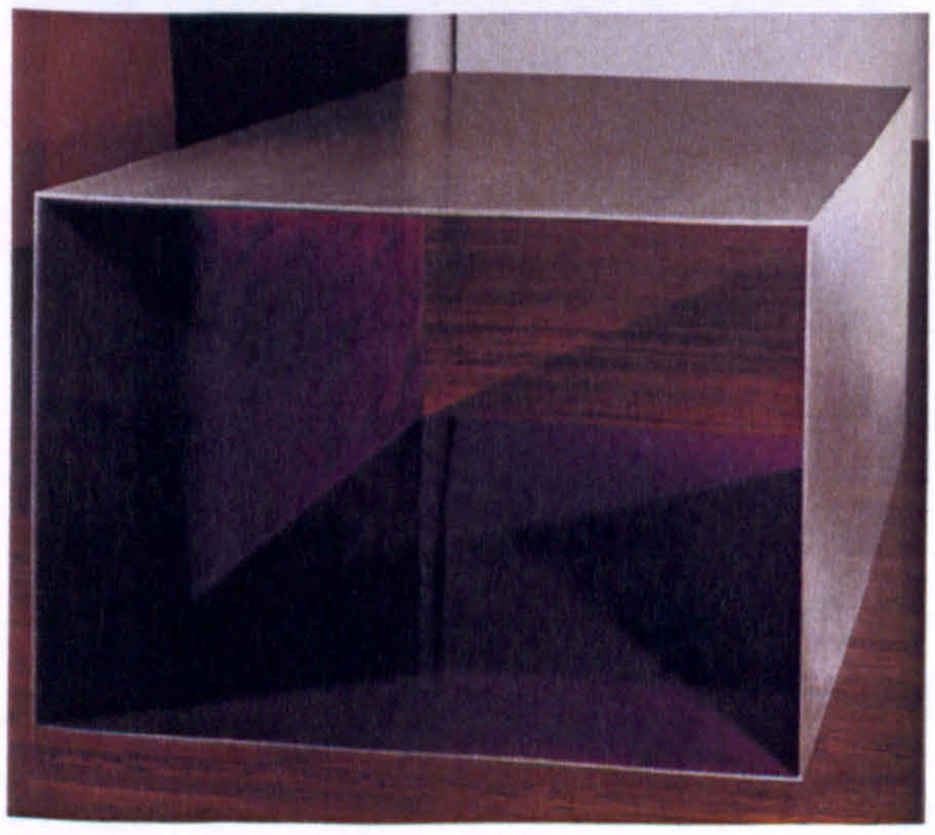
which effectively encouraged, or at least allowed, him to continue using orthogonal geometries. This contention is supported by the increasing complexity of his later work such as the multi-coloured multi-chambered *Untitled*, 1985, Fig 19. The second, and perhaps more important reason, is because he did not make his own sculptures. Instead, they emerged through drawing, within an undoubtedly rectangular surface, only to be made according to Judd's designs by craftsmen. Consequently, there was never any room for deviation, change, or accident because the making process was more akin to preordained industrial fabrication. Judd could not respond to materials first hand through exploration, and this contrasts Morris's working method, which frequently involved him making his own sculptures. The latter resulted in a broader exploration of geometry, as demonstrated by Morris's felt sculptures, which actually seem to rely on relational composition for their form and are worlds apart from his early orthogonal sculptures that strictly adhere to *Specific Objects*.[62]

Additionally, there is a strong relationship between the cutting out and construction of forms from planar shapes and Judd's method of designing sculptures two dimensionally. Naturally, orthogonal geometries lend themselves to the constructive techniques that were best suited to Judd's 'hands-off' working method. Besides, it is generally much more complicated to create elliptical geometries that simultaneously curve in more than one direction, using constructive techniques. On the other hand, casting is generally better suited to non-orthogonal 'organic' forms; and it is of no small consequence that the latter are less easy to accurately define on paper, and more difficult to interpret when translating from a 2D design into three dimensions. This may well go a long way to explaining why Judd did not investigate elliptical geometries despite openly admiring the sculpture of Arp and Brancusi, whose overriding singular qualities are surely derived from curvature. Nonetheless, given that the square can be broken down perceptually into the union of four perpendicularly joined lines, whereas the circle is continuous and therefore more perceptually resistant to division, it is certainly perplexing as to why Judd never investigated curvature or elliptical geometry. The latter may have permitted him to integrate geometrically diverse forms into his concept, without resorting to relational composition.

ILLUSION

The primary focus of this part of the Historical Background is the role of illusion in Judd's work. It will commence by considering the influence of painting on the development of Judd's ideas, and suggest that it may even have been the presence of illusion that gave much of Judd's work its sculptural significance; notwithstanding that *Specific Objects* required its elimination. It will also consider if and how Judd used the deflection of geometry. Thereafter it will describe the work of two sculptors, close to the fringes of minimalism, who subtly distorted the geometry of regular forms: Namely Anne Truitt and Ellsworth Kelly.

According to Judd, the singular quality of unity that is central to *Specific Objects* also relied on the elimination of illusion. This must surely have been influenced by Judd's formative training as a painter and the theories of Clement Greenberg, who noted that Modernist painters had increasingly referred to the specifics of their medium; including Manet who openly acknowledged, "the limitation that constitutes the medium of painting – the flat surface, the shape of the support, the properties of pigment"[63]. In his essay *Modernist Painting* he observes that, "by the middle of nineteenth century all ambitious tendencies in painting were converging in an anti-sculptural direction."[64] By this, Greenberg meant that there was a reaction against previous attempts, informed by sculpture, to create the illusion of deep space beyond the painting surface. Therefore, painting now placed great emphasis on flatness, the elimination of spatial illusion, and the absence of direct figure ground relationships. Judd appears to have translated, what might be described as a 'truth to surface' philosophy into three-dimensions. Consequently, it might be that Judd's sculptures, not unlike Ellsworth Kelly's sculptures, were the result of an artist making three-dimensional objects whilst thinking as a painter.

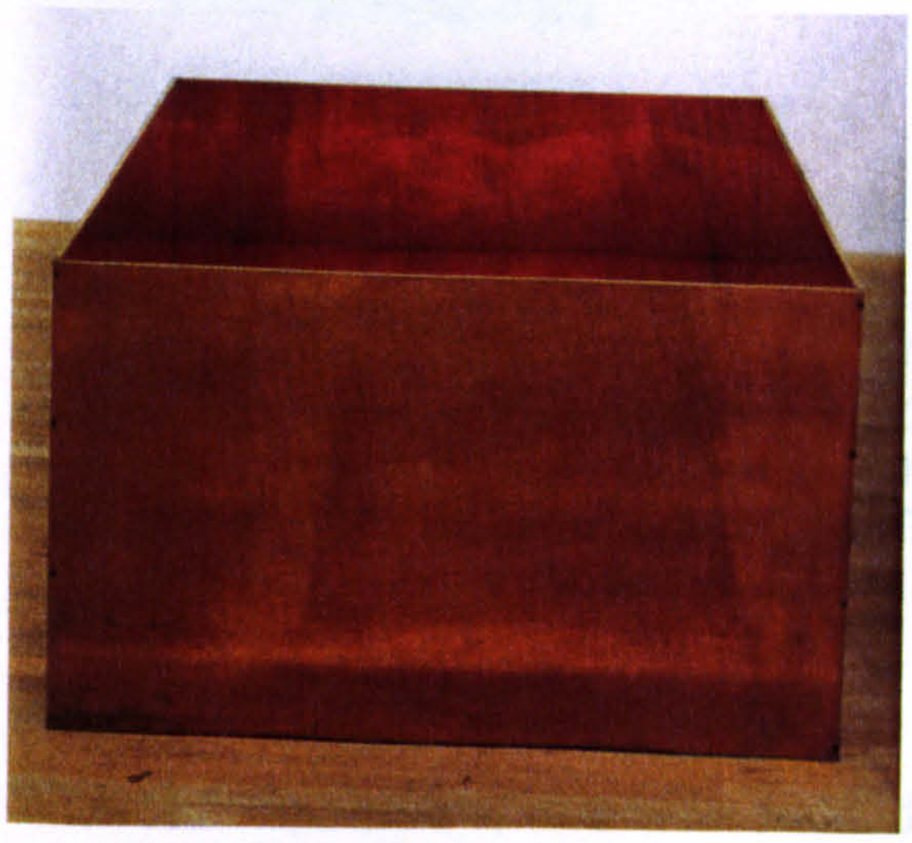


Judd
Untitled
1969
Fig. 20

Despite rejecting illusion, certain of the reflective surfaces he used, including Plexiglass, were inevitably illusory. By lining the interior of his metal box sculptures such as *Untitled*, 1969, Fig. 20, with reflective Plexiglass, Judd created the illusion that its interior actually exceeds its exterior. Perhaps surprisingly, Judd implicitly acknowledged the role of illusion, though he deliberately avoiding using the word, when discussing a box sculpture with plexiglass inside:

> "The box with the plexiglass inside is an attempt to make a second surface. The inside is radically different from the outside. While the outside is definite and rigorous, the inside is indefinite. The interior appears to be larger than the exterior."[65]

Another example where the presence of illusion and relational composition is particularly pronounced is Judd's *Untitled*, 1972, Fig. 21; an open box with four upright copper sides and an aluminium floor that has been enamelled cadmium red. Shapes and shadows bounce around its reflective interior again creating the illusion that the interior exceeds the confines of its external boundaries; an effect that is obviously contrary to the strict requirements of *Specific Objects*. Intense relationships occur between the copper walls and the reflected glow of its red floor. When compared to the homogeneity of a Brancusi sculpture such as *Prometheus*, 1911, Fig. 11, the juxtaposition of parts in *Untitled*, 1972, is undeniable.

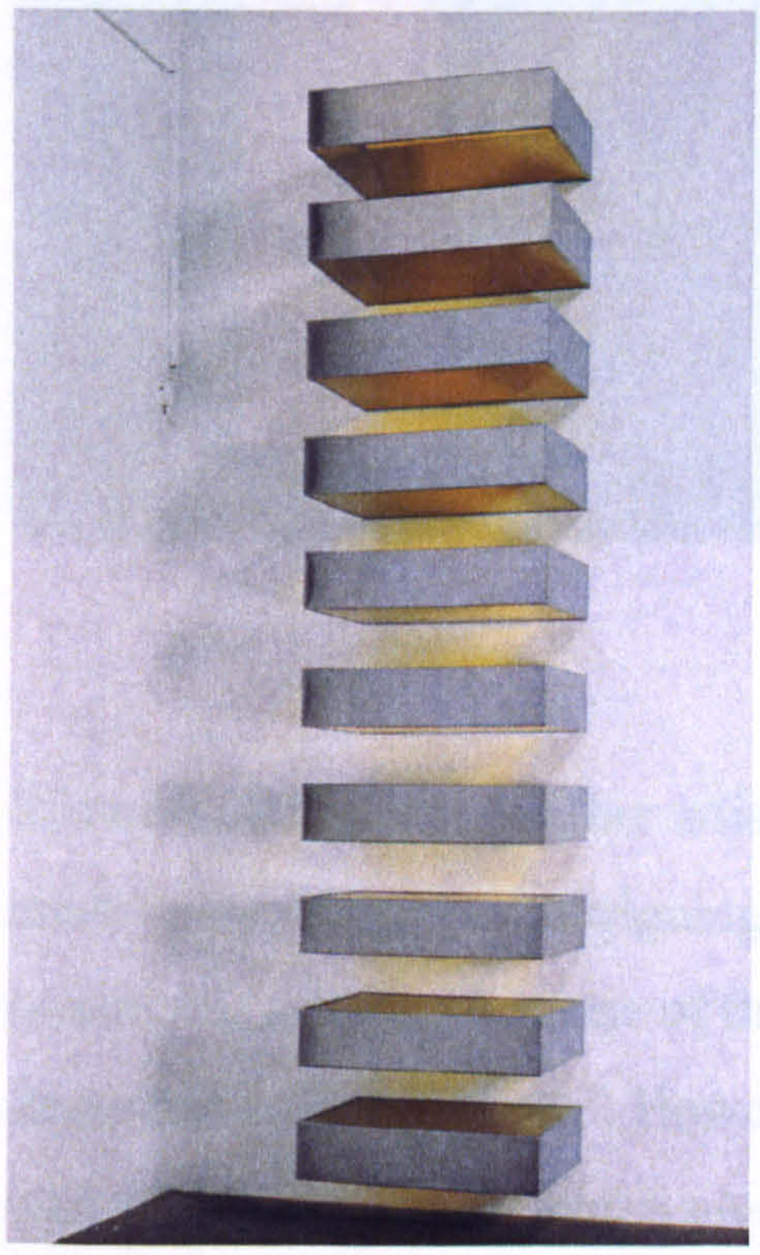


Judd
Untitled
1972
Fig. 21

Art critics of the time, including Krauss, frequently noted the presence of illusion in Judd's work. The artist Robert Smithson said of one of Judd's 1965 sculptures, constructed from plexiglass and stainless steel, and strung together internally with wire:

> "It is impossible to tell what is hanging from what or supporting what. Ups are downs and downs are ups. An uncanny materiality inherent in surface engulfs the basic structure.... The concept of 'anti matter' overruns, and fills everything, making these very definite works verge on the notion of disappearance."[66]

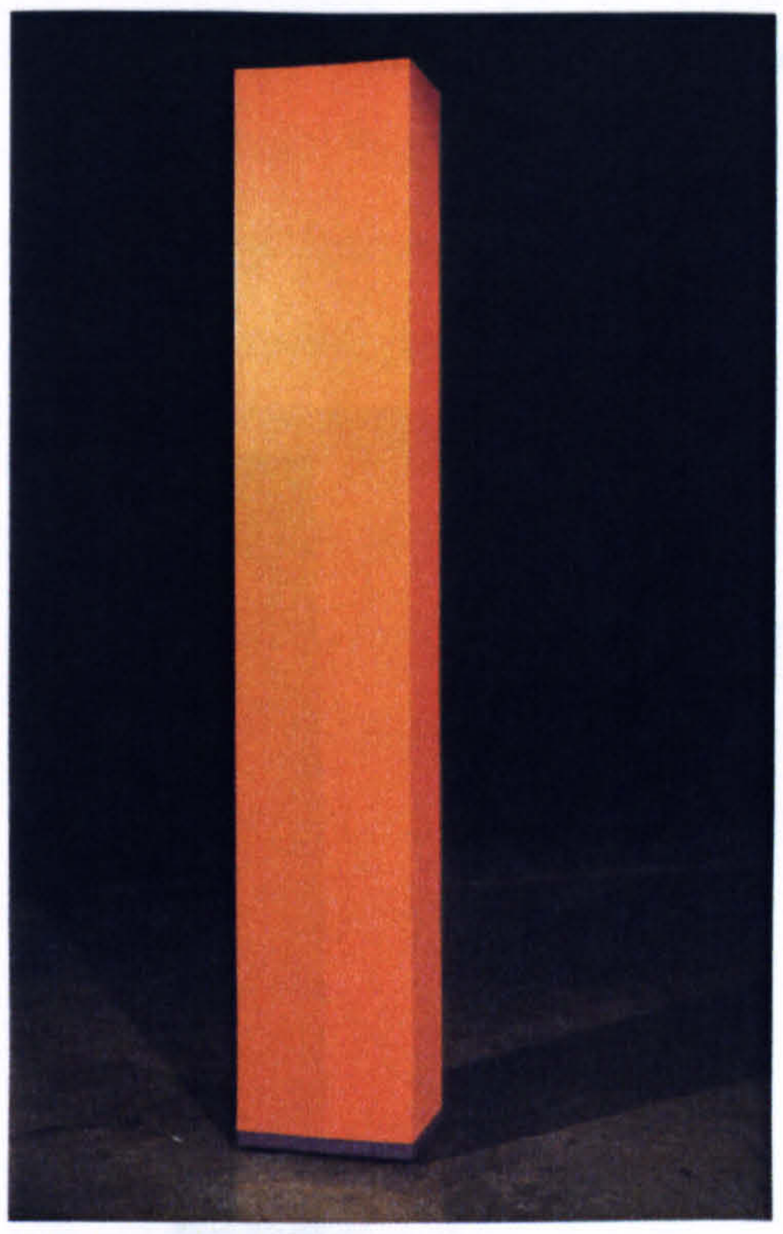
Many years later the art critic James Meyer went even further, and suggested that Judd's work might have indeed been "visually arresting because it incorporated illusion."[67] Illusion is also a fundamental quality evident in Judd's 'stacks', which invisibly cantilever away from the wall thereby appearing to defy gravity. This can be witnessed in the visually dynamic sculpture *Untitled*, 1968, Fig. 22. Interestingly, its Plexiglass is also illusory, from one viewpoint appearing transparent, and from another opaque.



Judd
Untitled
1968
Fig. 22

What the minimalists, or at least Judd, did not explore was the 'deflection of geometry', as exemplified by Brancusi's sculpture.[68] Perhaps this was because his forms rely on symmetry for their singularity, meaning that anything undermining geometry's ability to induce a Gestalt could not be contemplated.[69] The predominance of the horizontal, vertical, and 45° diagonal is a common theme in minimalist sculpture, with one significant exception. This exception can be seen in the sculpture of Anne Truitt, whose work has rarely been exhibited in this country. Truitt

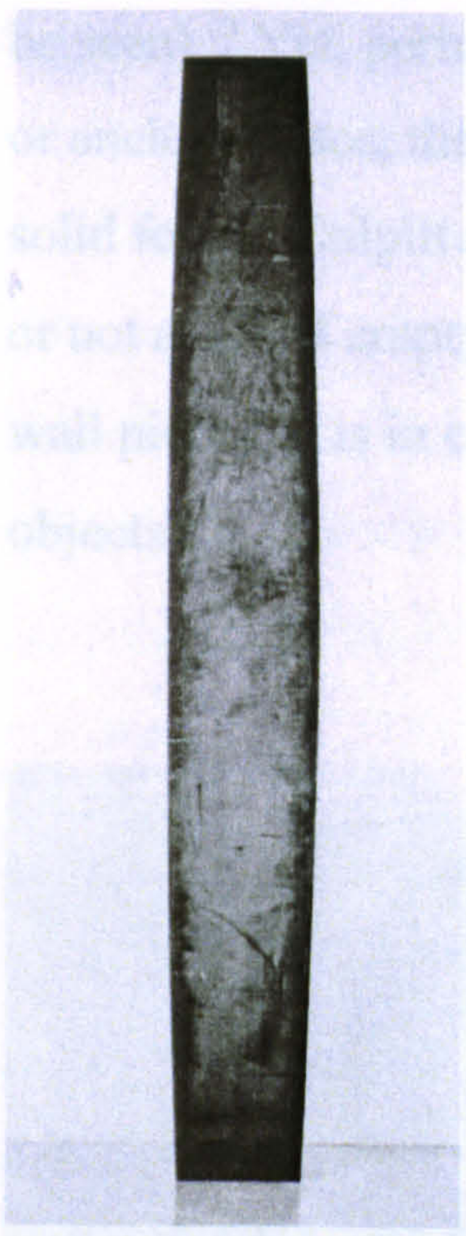
brings illusion to her sculpture through a very subtle deflection of the vertical. This results in a perceptual ambiguity in which uprights appear to move about the true vertical. Observe for example, her sculpture *Autumn Dryad*, 1975, Fig. 23; it relies on oblique relationships, just set off the vertical as if deflected from it. This slight deviation is similar to the extremely subtle curves evident in Ellsworth Kelly's sculpture.[70]



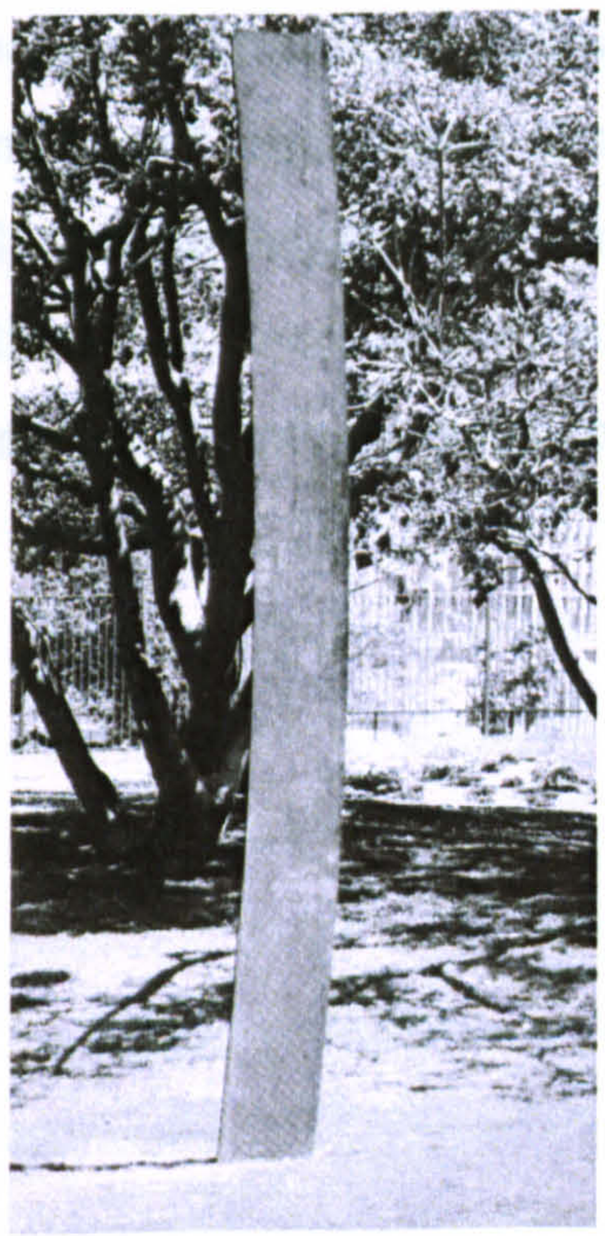
Truitt
Autumn Dryad
1975
Fig. 23

Ellsworth Kelly was another artist who trained and predominantly practiced as a painter, but also made some sculptures. Intriguingly for this research, he has often been associated with minimalist thinking because of the purity and simplicity of his sculpture, which could be described as 'pared down'. However, the artist always refuted this. Kelly's sculptures are often wall-based and planar, which gives them predominantly two-dimensional characteristics. The latter, as in Judd's sculpture, demonstrates the effect of an artist effectively making sculpture whilst thinking as a painter. Nonetheless, Kelly's sculptures appear to embody the principles of S*pecific Objects* and, in contrast to Brancusi's sculptures; each consists of one single form. The geometries of his sculptures appear to have been deflected through entasis, a slight convexity or swelling; and therefore create the illusion that the vertical and horizontal are offset.[71] In some of Kelly's sculptures, the curvature of a line can be so subtle that its true geometry is difficult to fix. Notwithstanding the presence of symmetry about one axis in many forms, the remaining geometry somehow manages to exacerbate the illusion of instability. The slight misalignment or

deviation away from the horizontal or vertical is similar to that which can be observed in Anne Truitt's sculpture. In front of Kelly's sculptures *Curve XI*, and *Curve XV*, 1974, Fig. 24 & 25, one cannot be sure of the precise location of its geometry in space because it constantly appears to oscillate. These sculptures perceptually refuse to stay still, despite the symmetry about the vertical axis of *Curve XI* and the horizontal axis of *Curve XV*.[72] However, it is extremely difficult to convey through language the subtlety of the formal relationships present in his sculptures. I have faced similar challenges in describing some of the refined geometries and formal relationships within my own studies for the research.



Kelly
Curve XI
1974
Fig. 24

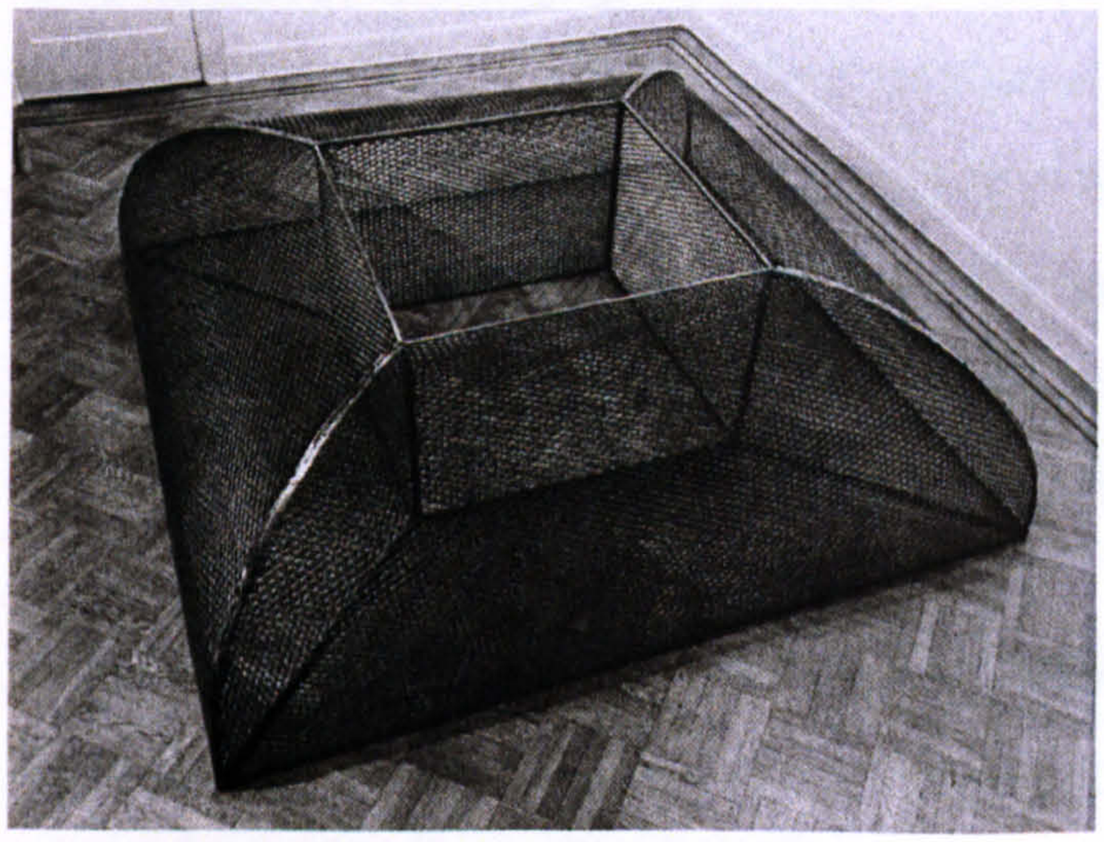


Kelly
Curve XV
1974
Fig. 25

FORM AND SPACE IN JUDD'S SCULPTURE

This section of the thesis will consider the relationship between form and space in minimalist sculptures. It will focus on how the use of closed symmetrical forms, the perceived lack of content in their work, the establishment of meaning through experience, and their abandonment of the pedestal all contributed to a somewhat disparate relationship between form and space.

The surface opacity of much minimalist sculpture gives the appearance of solidity, which was invariably not the case, prompting Michael Fried to criticise their sculptures as 'hollow'. Conversely, Francis Colpitt argues that the hollow forms by Morris do not produce the illusion of displacement because there is obviously space inside them (notwithstanding the fact it cannot be seen).[73] Yet, perhaps her argument is untenable because whilst closed hollow forms may trap or enclose space, the encapsulation results in the same visual displacement of space created by solid forms. Colpitt also believes that "minimal sculptors used negative space non-relationally, or not at all. If empty areas do enter into the perception of an object, such as in Judd's vertical wall pieces, it is in external, rather than internal, terms. The empty spaces are not part of the objects".[74]



Morris
Untitled
1967
Fig. 26

Many minimalist sculptures appear solid, though exceptions include, LeWitt's grid structures and Morris's caged sculptures, such as *Untitled*, 1967, Fig. 26, above. In the latter, the way the edge captures light and articulates geometry is similar to Gabo's curved planar plexiglass sculptures.[75] Yet, from certain viewpoints there is the illusion that it is perhaps opaque. Within Judd's oeuvre, it is obvious that many of his sculptures are indeed open structures. *Untitled*, 1969, Fig. 17, is an example of a singular form that does not impede the flow of space and

displaces relatively little space because it consists of a skin,[76] much like the open structure of Gabo's transparent sculptures. The relationships between form and space are self-evident in *Untitled*, 1969; it therefore creates no illusions in terms of its spatial displacement.

The idea of sculpture existing in the same space as the observer was a fundamental characteristic of minimalism. It was indebted to Brancusi's incorporation of the plinth as an integral part of the sculpture, and the relationship to architectural context that he developed in sculptures such as *The Table of Silence,* 1937, and *The Gate of the Kiss*, 1937-1938. However, in minimalism, space appears to be host to the sculpture that displaces it; that is to say, sculpture is *in* space and not just *surrounded* by it. This is a kind of space that Herbert Read associated with Greek sculpture: the concept of space as place.[77] In minimalism, this place is effectively a stage for an experience of the object, and the basis of Michael Fried's critique. In his essay, *Art and Objecthood*, he maintains that minimalism was innately theatrical, because the very lack of content became content in itself, as meaning was established through experience. The observer becomes conscious of themselves in relation to the object through their search for meaning. Rosalind Krauss concurs and suggests that "the ambition of minimalism was, then, to relocate the origins of a sculpture's meaning to the outside, no longer modelling its structure on the privacy of psychological space but on the public, conventional nature of what might be called cultural space".[78] Therefore the location of meaning in experience emphasises space as a site, the stage for interaction and this isolates a sculpture from the space it displaces. This segregation was further augmented by the abandonment of the pedestal in favour of placing sculpture directly on the floor. This eradicated any ambiguity in sculpture's relationship with its support prompting Jack Burnham to describe it as "floor bound sculpture".[79] The solidity of the planar bases that grounded the sculptures underlines the presence of a form displacing space.[80]

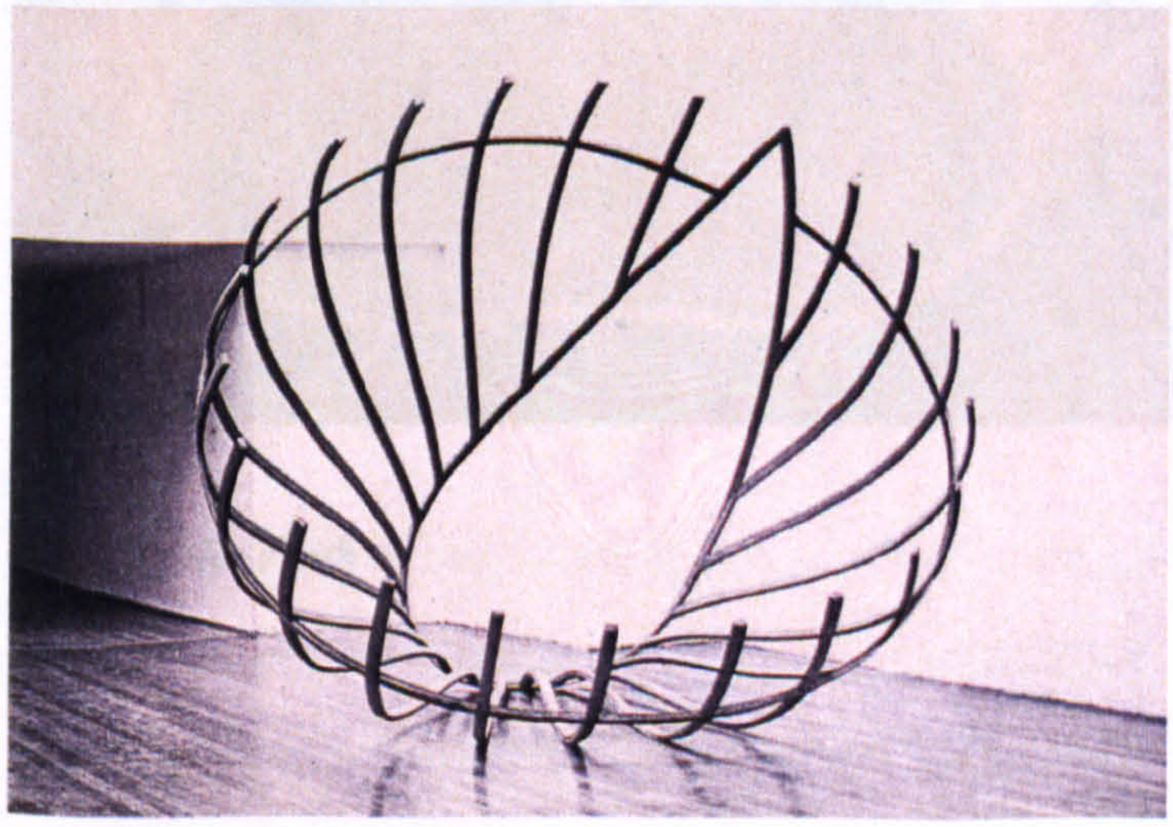
Judd argued that he was one of few artists to have dealt seriously with space, notwithstanding that many of his sculptures do indeed displace it.[81] Consider for example those sculptures, which consist of progressions of identical units or asymmetrical forms such as the 'stack' *Untitled*, 1968, Fig. 22. Each unit is closed and displaces space. Judd orders space by displacing it or by charging/activating the space between multiple forms. However, in each single form the articulation of space is passive. Often, space is compartmentalised, encapsulated, or trapped; rarely can it be seen to flow through work in a dynamic manner. Richard Serra acutely describes one progression sculpture as "hot-dipped galvanised-iron boxes cantilevered off the wall that pushed the space and displaced the room".[82] Overall the effect of much of Judd's sculpture on the surrounding space is passive, in the sense that it is neither visually compressed nor stretched, it is

simply displaced. There is no change in rhythm and no acceleration or deceleration in the momentum of the surrounding space. I contend that this is due to the orthogonal geometry, which means that the way any given plane meets the floor or walls is always perpendicular and therefore abrupt. In contrast, one might consider Brancusi's sculpture *Prometheus,* 1911, Fig. 10, which contacts the ground in an altogether different manner. Its form means that a much lesser proportion of its surface area is in direct contact with the ground and that it curves away from this contact point. The combination of these two characteristics creates the impression that the space surrounding the sculpture is being compacted and expanded. This creates a much more dynamic relationship between form and space than is present in Judd's work and one whose rhythm and momentum change dynamically.

POST-MINIMALIST DEVELOPMENTS

This section will focus on the influence of Judd and Morris's theories and sculpture on contemporary sculptors. It will present the work of several sculptors who have adopted the minimalists 'pared down' approach to the development of a formal language and attempt to show how they have developed some of Judd's ideas through non-orthogonal geometries.

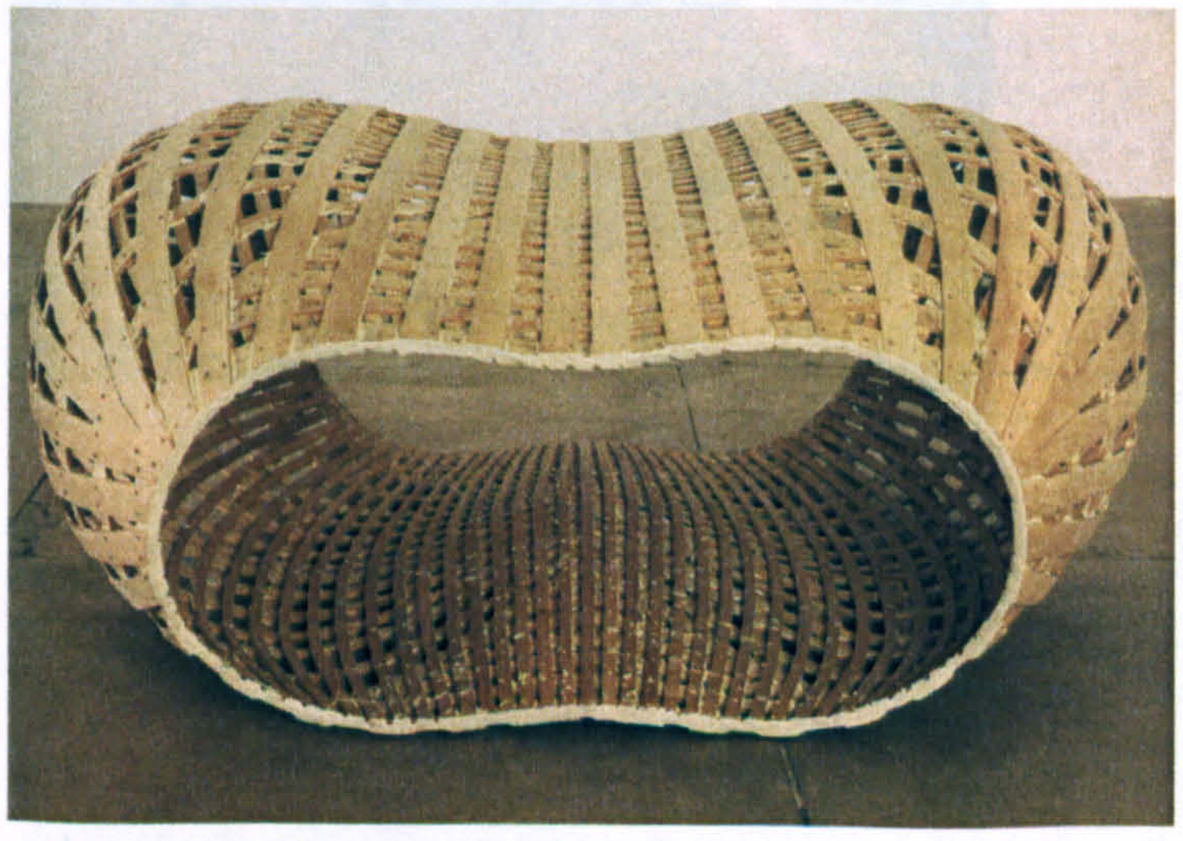
Significantly for this research, some of the sculptors who were influenced by Judd explored the deflection of geometry in relation to forms that might be said to have singular qualities: they include, Anish Kapoor, Martin Puryear, and Richard Serra. What is especially relevant about their sculptures is that they do not rely on Cartesian geometries, with the exception of Serra's early work. Instead, their use of mostly elliptical and occasionally circular geometry suggests a way forward distinct from the rectilinear language of minimalism; as indeed does Brancusi's sculpture. All three have acknowledged the impact of the minimalists, and especially that of Judd, a legacy articulated by Puryear, who after having seen Judd's sculptures at the 1968 Venice Biennale, remarked "at that point minimalism became a stronger clue for me about how powerful primary forms could be."[83] The sculpture of Puryear shares many formal qualities with those by Richard Deacon, both of whom have explored the potential of transparent structures to encapsulate rather than confine space in singular sculptural forms. The extent to which the interior space remains visible has been controlled through an extensive exploration of structural possibilities. In Deacon's, *Untitled*, 1980, Fig. 27, skeletal lines in space define form whereas Puryear has pushed caged structures towards the limits of opacity in *Sanctum*, 1985, and *Maroon*, 1987-88, sculptures made from tar covered wire mesh, supported by a structural framework.[84] Puryear exploits structural transparency to establish a connection between the interior and exterior, which allows the observer to see both simultaneously.



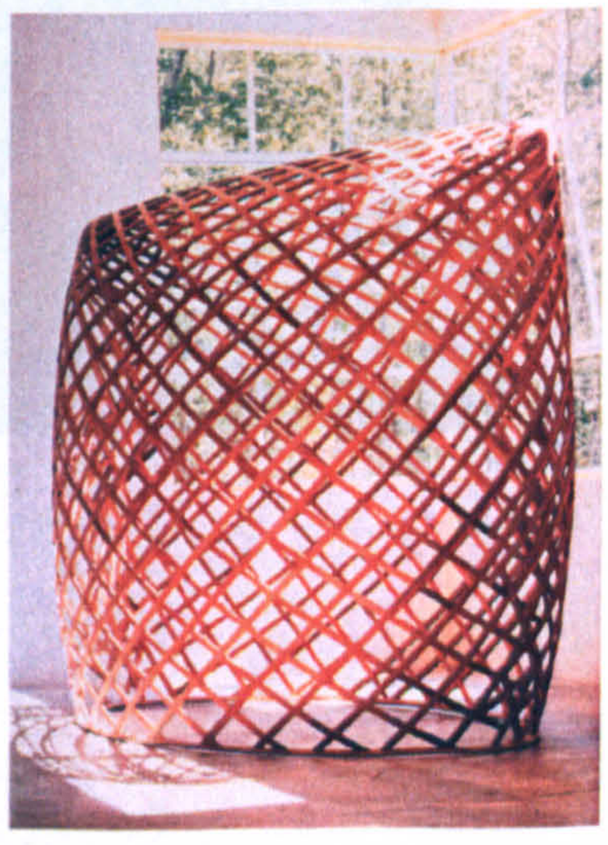
Deacon
Untitled
1992
Fig. 27

Yet, what is noteworthy about these sculptors is their ability to combine many parts into one unified and singular form, a quality aided by their elliptical and organic geometry. There are no orthogonal corners or edges to underline the confluence of parts;[85] they are therefore more resistant to being broken down perceptually. In contrast, anything blocking the flow of energy around a form may become the focus of the observer's attention. In the case of a typical minimalist box sculpture, a source of stasis would be the corners, and/or its edges, which highlight its multiple facades. An observation elaborated by Deacon who stated; "I found that where one part meets another part in a rectilinear structure becomes a focus of attention. Whereas in a curvilinear structure the curve as it were rides over these points."[86] The singular quality of their sculptures is enhanced by the similarity of the constituent materials and elements that make them up, which helps create a Gestalt.

Both sculptors have frequently chosen to create singular forms with regular geometries. Deacon's geometry is invariably uniform as in *Keeping the Faith*, 1992, Fig. 28. The symmetry of his sculptures with singular forms is rarely challenged. In contrast, Puryear appears to have extensively explored the deflection of geometry by accelerating and decelerating the momentum of forms to abrupt pinched points or bulging curves. *Brunhilde*, 1998-2000, Fig. 29, impetuously expands as if billowing out from within, an effect intensified by the curves of its linear structure; yet its geometry is in fact symmetrical across one axis.[87] Neither sculptor has investigated illusory deflections to geometry that depend on the qualities of materials and their surface finish.



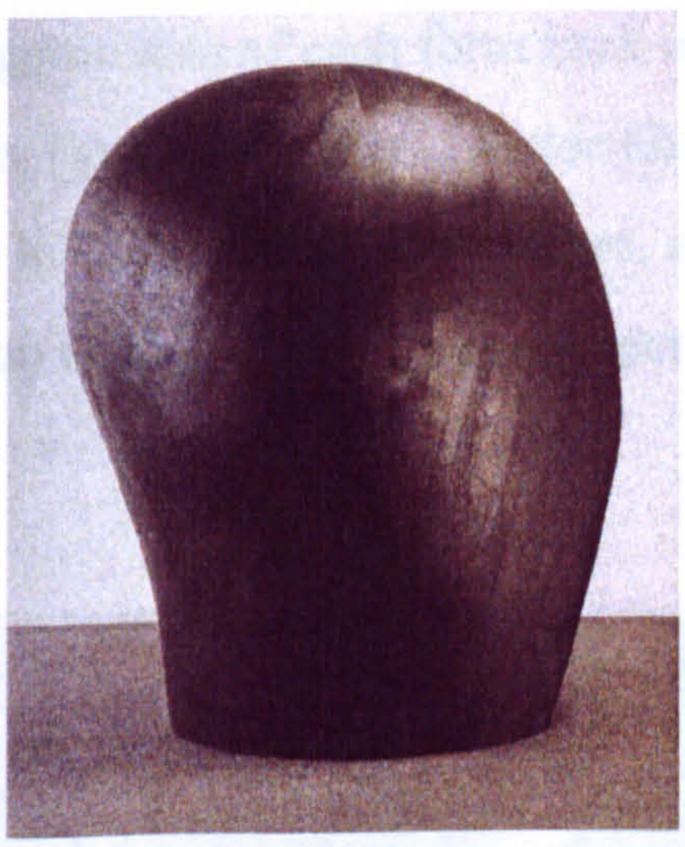
Deacon
Keeping the Faith
1992
Fig. 28



Puryear
Brunhilde
1998-2000
Fig. 29

Interestingly, Deacon's *Keeping the Faith*, 1992, bears more than a passing resemblance to the sculpture of Max Bill, which is primarily concerned with replication and infinite continuity. His *Endless Ribbon* sculptures are based on the Möbius strip[88], and therefore imply questions about interior and exterior. More importantly, it implies a duality that results from the union of not two parts, but one; a length of material is twisted and joined end to end to give only one 'side'. This action might be described as a transformation of geometry, which creates the simultaneous perception of implied variance and unity. However, this unity seems more 'conceptual' than physical because visually the form produces quite complex relationships. Although carved in one piece, *Endless Ribbon Version V*, 1935-95, Fig. 30, seems to be composed of three curving parts that are inclined at different angles. It is essentially Baroque in conception and therefore at odds with the pared down minimalist aesthetic described by Richard Wollheim.[89] Its form actually appears multifaceted, notwithstanding one's 'knowledge' of its singular surface, because of the transformation of geometry it has undergone. The strength of the latter is in contrast with the subtler deflected geometries evident in Puryear's asymmetrical forms. These sculptures tend to be closed and monolithic, and the deflection manifests itself as a kind of bulging or swelling. An example of this is, *Untitled*, 1997, Fig. 31, which resembles a bloated simple geometric form.

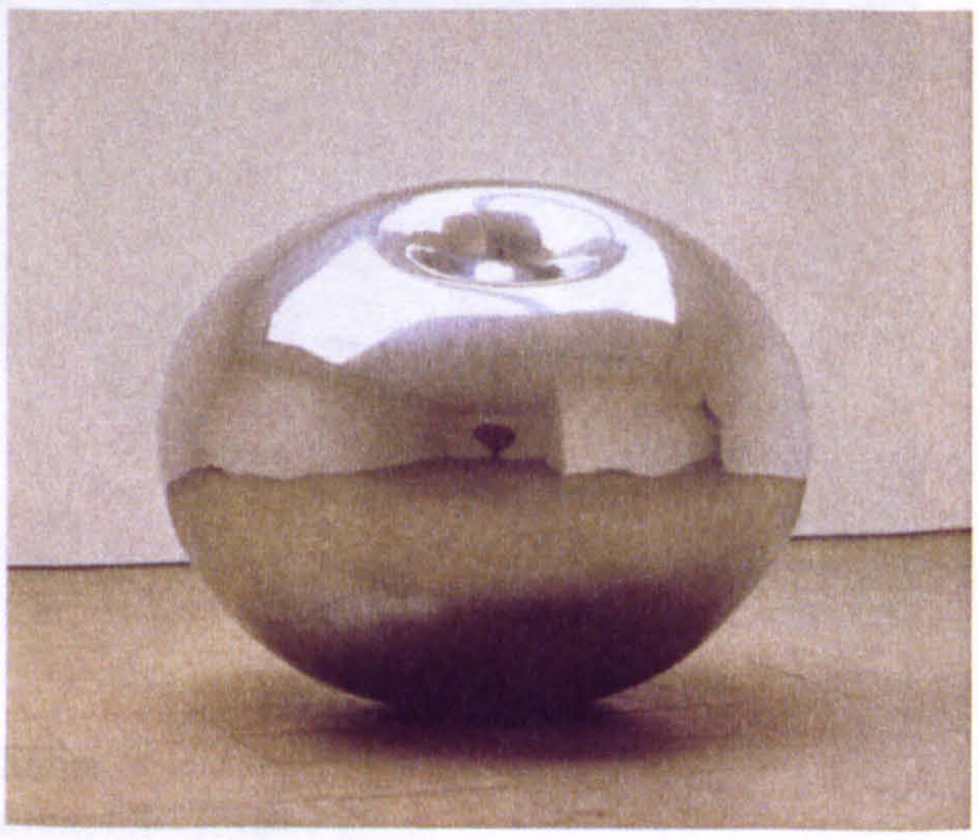
Bill
Endless Ribbon
1935-95
Fig. 30



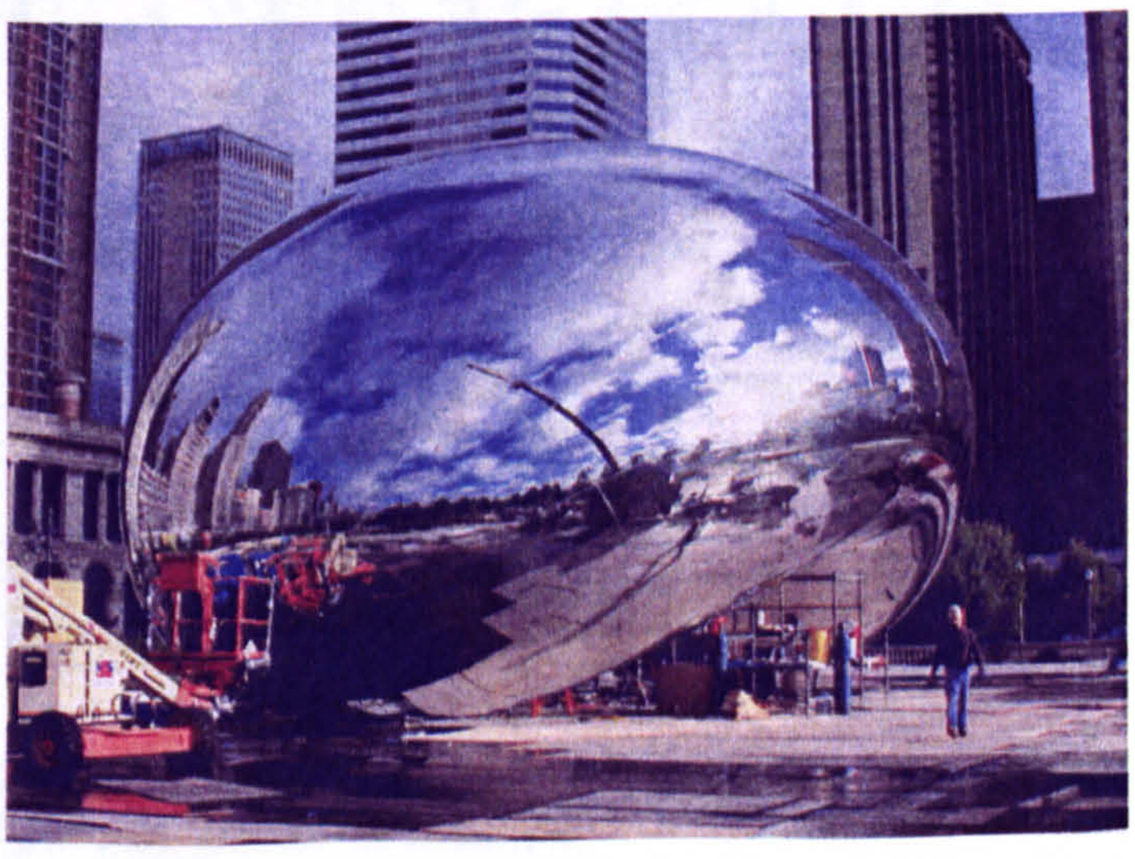
Puryear
Untitled
1997
Fig. 31

Another contemporary example of deflected geometry in sculpture is Anish Kapoor's use of 'shine' and somewhat more innovatively, the application of dark pigments to render the interiors of sculptures indefinable. *Void Field*, 1989, consists of several stone cubes, each of which has a black dot on top that on closer inspection reveals itself as the aperture of a hole. The cavity

appears to extend indefinitely, due to the application of dark blue pigment to the hollowed out interior surface. In this state, the illusion becomes so powerful that two contrary phenomena appear to occur in one form. This quality of perceptually 'non-specific' geometry is similar to that induced by the plexiglass lining within Judd's sculptures such as *Untitled*, 1969, Fig. 20 etc. Later works by Kapoor have wider openings, as in *Adam*, 1988-89, and *Untitled*, 1990, whose internal surfaces have been rendered non-specific and formless through dark pigment. In this condition, the interior has a sense of weightless, of otherworldliness in which its inherent darkness defies a clear reading of the form. Correspondingly, this is also true of his sculptures with highly reflective exteriors. Kapoor has drawn parallels between the two; "the polished surface is in fact not different from the pigment",[90] explaining that "mirrors and colour work in a very similar way. The gaze returned and the gaze absorbed"[91]. The exteriors of *Turning the World Inside Out,* 1995, Fig. 32, and *Cloud Gate*, 2004, Fig. 33, were polished to a highly reflective sheen, which reflects and actively rebuffs the observer's attempts to establish the forms' geometries. Their surroundings are drawn onto their exterior surfaces. Kapoor notes that "the exterior of my piece is about the recall of the sky... in this sense it's very Baroque, an endless series of decorated and geometrically conceived moments."[92] These sculptures underline the relevance of Kapoor to this research because they have entirely consistent contours yet manage to combine illusory and physical deflections of geometry. The latter is manifested through what appears to be the after effects of pushing one area of each form back in on itself. This concave impression or 'dent' is slightly subtler in *Turning the World Inside Out,* whereas it happens underneath and on a more monumental scale in *Cloud Gate*. Nonetheless, each sculpture has an entirely coherent form that distorts the reflection of the surrounding architecture.



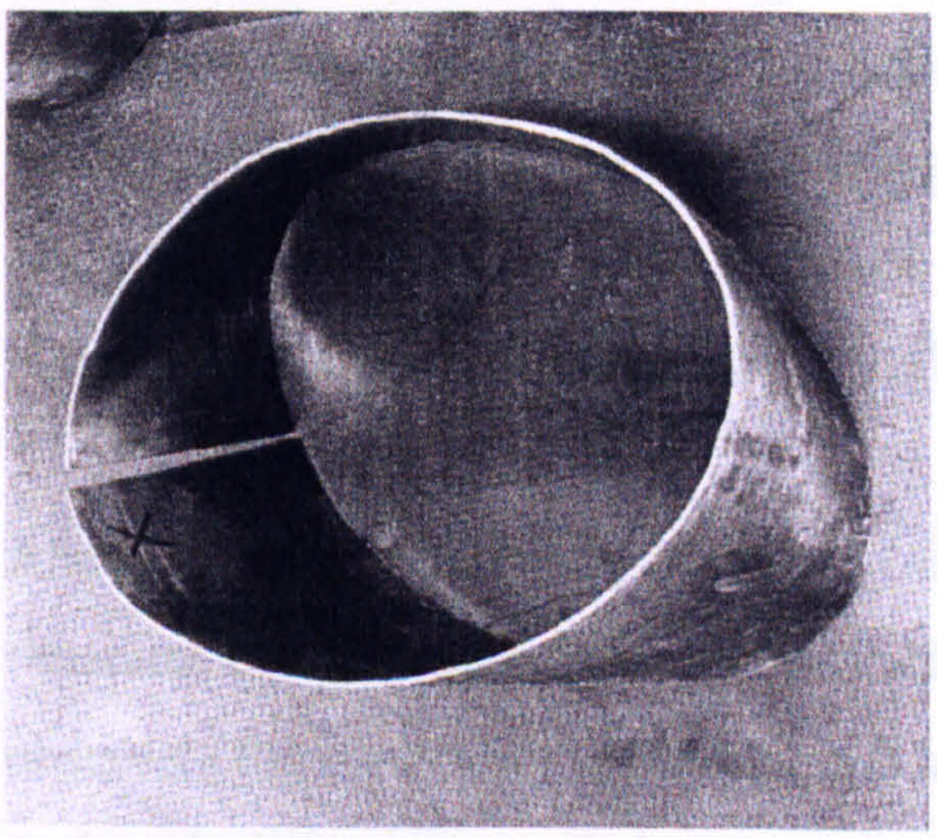
Kapoor
Turning the World Inside Out
1995
Fig. 32



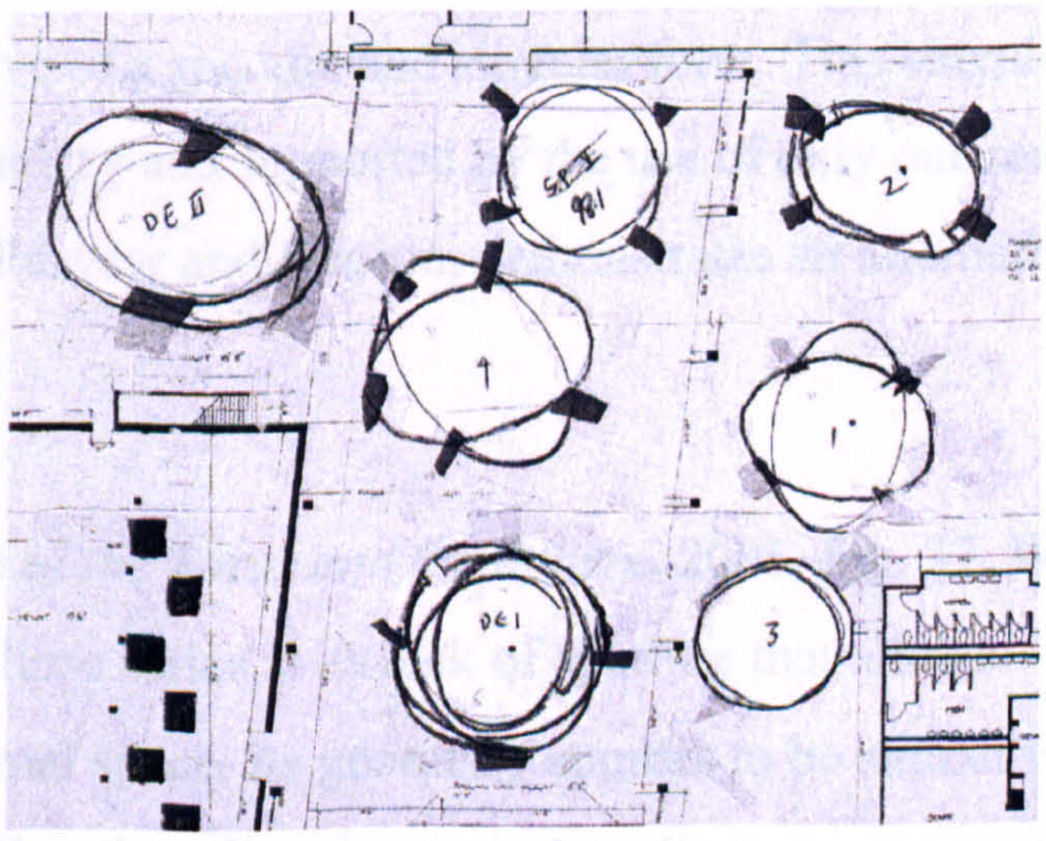
Kapoor
Cloud Gate
2004
Fig. 33

Naturally, the geometry of each of Kapoor's sculptures seems consistent with *Specific Objects*, and the aforementioned deflections to their geometry suggest how it is possible to create unified and singular forms that have sculptural significance. However, the dominance of their illusory surface qualities renders the sculptures at odds with Judd's concept.

A sculptor who is sometimes associated with the minimalist movement and more frequently to subsequent post-minimalist developments is Richard Serra. Around 1996 he became preoccupied with the effects of twisting and torque on solid geometry. In the series of planar steel sculptures *Torqued Ellipses*, 1997-8, the predominant Gestalt is elliptical; yet it is challenged by Serra's rotation of the top and bottom edges of elliptical cylinders in relation to one another. This makes the geometries of seemingly singular forms difficult to grasp, as Serra notes that "one of the key features of these sculptures is that their outside is totally different from their inside. From the outside, you have no sense of what the form is on the inside: and when you're in the inside, it is very difficult to understand how the form leans on the outside. They challenge your memory."[93] This effect exists despite the volume of the interior having the same dimensions throughout its height during rotation, only its polar co-ordinates change. The continually curving walls defy a reading, much like Kapoor's non-specific surfaces, it is for this reason Serra considers that they "break with the tradition of autonomous sculpture in that there's no Gestalt reading. You don't know if you walk around it several times. When you walk inside the piece, you become caught up in the movement of the surface and your movement in relation to its movement."[94]

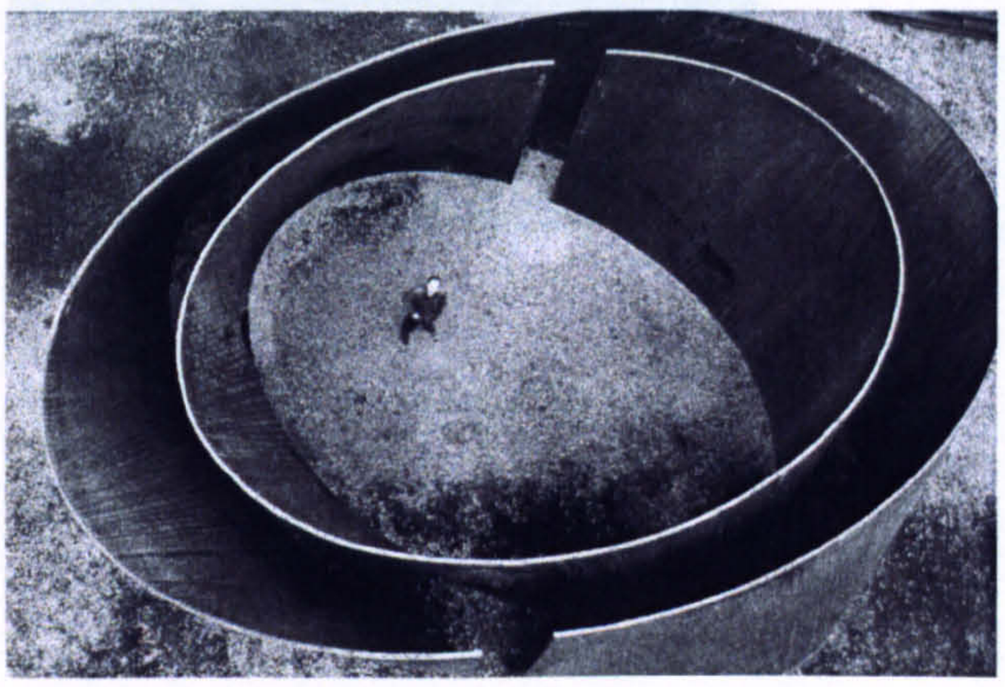


Serra
Model for Ellipse II
1996
Fig. 34



Serra
Floor plan for MOCA show, LA
1998
Fig. 35

In the series the degree of torque was altered in each sculpture, the most extreme being the ninety degrees of rotation in *Torqued Ellipse I*, 1997, a sculpture that Serra considers the most disorientating of the series. In fact, plan views of the sculpture, Fig. 34 & 35, reveal how significant a deflection of geometry has occurred. The latter means that the base is different from the top, so much so that the top and bottom ellipses have become perpendicular to one another. This is particularly well demonstrated by the schematic drawing of the central sculpture in the exhibition floor plan, Fig. 35.



Serra
Double Ellipse
1998
Fig. 36

Overall, what is interesting about Serra's elliptical geometries and especially the elliptical cylinders is the deflection of geometry achieved by manipulating its major and minor axis; a possibility that is much reduced when using simple geometric forms based around the square, rectangle or circle because they have fixed internal angles of 90° or 360°.[95] Nonetheless, each sculpture has a strong Gestalt that is indicative of a specific and singular form. This singular quality is primarily defined by elliptical geometry and supported by the use of only one material at a time. The former, as in the sculpture of Puryear and Deacon, demonstrates an alternative to the orthogonal geometry favoured by Judd.

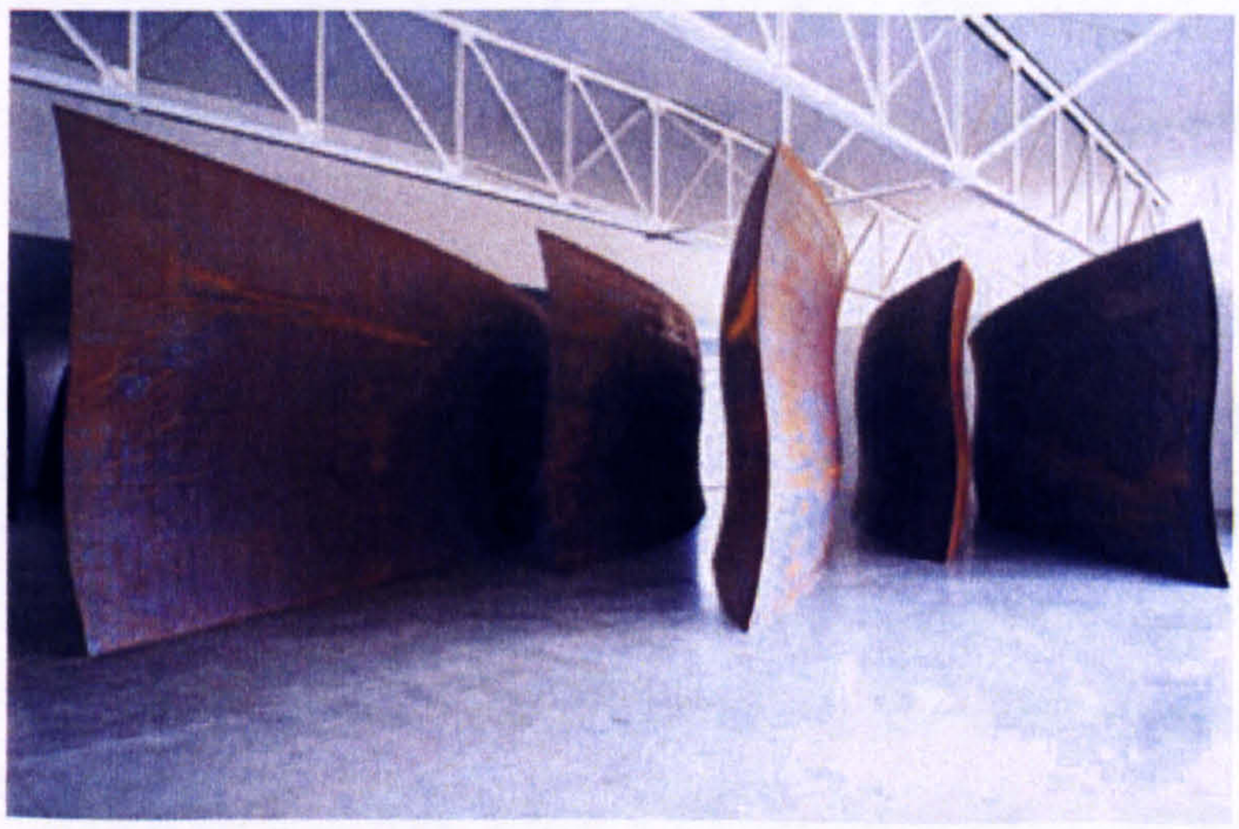
Another recent sculpture by Serra's is *Union of the Torus and the Sphere*, 2001, Fig. 37. What separates this sculpture from the Torqued Ellipse series is its lack of aperture that allows observers the possibility of entering the internal space. Its geometry appears to be similar to the vesica piscis[96], yet its angled and curving, rather than directly vertical, walls lean precariously. They therefore create the impression that the sculpture is falling over or on the verge of doing so. It appears to have extremely dynamic geometry and demonstrates the potential for the deflection of geometry to imply movement. The latter is synonymous with the slight deviation from the

vertical axis that challenges the viewers' sense of the upright, evident in a number of sculptures by Anne Truitt and Ellsworth Kelly.

Serra
Union of the Torus and the Sphere
2001
Fig. 37

Serra
Union of the Torus and the Sphere
2001
Fig. 38

Perhaps, *Wake*, 2003, Fig. 39, is the most startling and adventurous expression of Serra's ability to manipulate sheets of steel. The sculpture appears to be bending in several directions at the same time due to the vertically flattened 'S' profile. It seems to be an example of deflected geometry so extreme that the linear has begun to oscillate.[97]



Serra
Wake
2003
Fig. 39

SUMMARY

It is possible that the objective of the research is an unobtainable paradigm, perhaps singular and specific form in its truest sense – completely devoid of relationships between parts can never exist. As discussed, Morris recognized that a sculpture with 'one quality' was an impossibility given the existence of relationships between length, width and height even in the simplest form. The contemporary sculptor Richard Deacon has spoken of a, "period when there was a considerable conflict between a desire to make a work which was 'whole' or 'equal' and the tendency to get taken up with part-to-part relationships."[98] It is then perhaps not so surprising that, despite the requirements of *Specific Objects*, relational composition is almost always present to some degree in minimalist sculpture, including Judd's.

It is noteworthy that in Brancusi's sculptures, and Serra's sculptures from 1996 onwards, there is an underlying Gestalt based on the circle, which helps create the perception of form with singular qualities. Circularity underpins the geometry of all these sculptures, thereby creating a continuous completeness of surface and strong contour. From the perspective of the laws of good form in Gestalt psychology, the circle is more resistant to being broken down perceptually because it has no apparent joins, whereas the square can be perceptually divided because it results from the union of four lines. Consequently, this latent potential to be perceptually broken down is present in those minimalist forms based on cubes because six planes are joined together in a 'specific' and perpendicular relationship. Therefore, orthogonal geometries do not appear best placed to substantiate Judd's concept. Additionally, because his forms are based on the square or rectangle their fixed internal right angles reduce the potential for sculptural significance through any variation in geometry; an outcome that Judd himself wanted.

Therefore, it is pertinent to ask why Judd did not explore elliptical geometry. Perhaps this anomaly occurred because Judd never personally made any of his truly minimalist sculptures. This meant that they did not emerge through hands-on interaction with materials, but instead evolved within the frame of Cartesian geometry. Judd's predilection for orthogonal geometry was also probably reinforced through his furniture design and printmaking. Nonetheless, it is still surprising that Judd never investigated elliptical geometry because, aside from its perceptual resistance and reduction of part-to-part relationships, it can be subjected to various 'deformations' without losing its integrity. Considering the ellipse in greater detail, it is predisposed to inconsistent or flexible geometry, because its radii, major and minor axis, and dimensions can be varied. Or perhaps even, what might be described as organic sculptural form,

based on convex and concave curves and planes. Conceivably, what we now recognise as, 'organic' form might have the potential to suggest variation, change or even imply metamorphosis.[99] Therefore, could elliptical geometry resolve the dilemma posed by *Specific Objects*; the necessity for unity and variation in one form?

As previously mentioned, Brancusi's sculpture relies on elliptical geometry, the consistency of which is sometimes challenged by a condition that Rosalind Krauss described as the 'deflection of an ideal geometry'. The historical background reveals the existence of two types of deflected geometries, the first is based on manipulating the physical geometry of a form and the second involves the more illusory qualities of surface finish. Contemporary examples of physical deflections to geometry include torqued forms by Serra, and bulging forms by Puryear, whereas illusory deflections of geometry are exemplified by Kapoor's exploitation of pigments to darken interior spaces and his use of highly reflective polished metal surfaces. However, some of the sculptures outlined in the historical background suggest that if the deflection of geometry is taken too far, a form's unity will be undermined to the extent that it is no longer coherent as a singular form. This occurs in Kapoor's sculpture, especially when the interiors have been covered with dark pigment, creating the impression of an infinite void whose boundaries far exceed its external confines. In this state, the illusion becomes so powerful that two contrary phenomena appear to occur in one form. Similarly, Brancusi's sheared forms imply missing parts and relational composition, and some of Serra's *Torqued Ellispes* stretch the geometry of one form so far that duality becomes paramount, and therefore singularity is challenged. This analysis is not meant to be intentionally critical for the sake of it; the extremity of deflected geometries in certain sculptures may simply be due to the fact that the artists' prime intention was not to retain unified and singular form. In fact, it is quite possible that they considered having two or more things appearing to occur in one form as an extremely positive quality. This approach is perfectly valid, but just one that does not fulfil Judd's concept. This literature review suggests that a more subtle examination of the deflection of geometry has not taken place so far, especially in relation to the unified and singular characteristics of *Specific Objects*.

Therefore, the forthcoming studio investigations sought to ascertain to what extent the 'deflection of geometry' can expand, but equally as importantly, maintain the viability of Judd's concept. In other words, the challenge was to extend the possible range of geometries that posses the singular qualities associated with *Specific Objects*; and in so doing provide an alternative response to the dilemma posed by the concept; how to make unified forms with variation and sculptural significance.

METHODOLOGY

The research began with a literature review and progressed through three stages of studio investigation, the latter being project based. The first stage explored physical variance in the geometry of specific and singular form and focused on opaque materials; the second stage explored implied and illusory variance in geometry by exploiting the transparent and translucent qualities of certain materials; and the final stage demonstrated the conclusions through two sculptures. The literature review entailed extensive reading of relevant sources, including texts by artists, critics, and theoreticians, in addition to exhibition reviews. Visits to museums, art galleries were vital, foremost amongst these being the Judd retrospective and Brancusi exhibitions at Tate Modern in 2004. Other noteworthy collections included the Nicholas Goulandris Museum of Cycladic Art, Athens and the modern and contemporary collections at the Pompidou Centre in Paris, Tate Modern, Tate St Ives and Yorkshire Sculpture Park.

Key artistic texts in the literature review were Donald Judd's essay, *Specific Objects*, Robert Morris's, *Notes on Sculpture parts I-IV*, and Michael Fried's critique of minimalism, *Art and Objecthood*. An analysis of these texts informed a sculptural vocabulary relating to aesthetics and techniques, which were considered within a minimalist paradigm. These included the predominance of anonymous fabrication by craftsmen, anti-illusionist, symmetrical and regular geometry, and orthogonal geometry, all of which can be observed to some extent in Morris's sculpture *Untitled*, 1966, (Fig. 1) a closed rectangular box with entirely consistent and even geometries. In addition to these texts, *Gestalt Psychology* by Alex Katz became increasingly useful in interpreting aspects of the perceptual framework of minimalist sculpture. The laws of Gestalt psychology contributed the qualities of closure, symmetry, completeness, and continuity as important in establishing a Gestalt, or *good form*. These informed the establishment of the geometry of each study and thereafter to assess its perceived unity.

The sculptural vocabulary established common characteristics of *Specific Objects* and its overriding singular qualities such as completeness, closure, and symmetry. The latter terms, derived from Gestalt psychology, were of particular importance to the formation of a set of criteria through which each study was evaluated to determine selections for further development. The criteria were used to decide whether a study could be perceived to have sufficiently singular qualities or if any variation in geometry had become too extreme, therefore rendering the study inconsistent with Judd's theory. The three stages of the studio projects were developed sequentially; therefore, the conclusions of the first project informed the aims of the second, and

so on. Initially some of the aims were ambiguous, but as the research progressed, they became more specific and focussed through the application of the following selection criteria:

- Had any variation, caused by the physical and illusory deflection of geometry, expanded the concept of specific and singular form in sculpture?
- Had any variation compromised the unity and completeness of the form?

The above selection criteria were put into practice and guided by the Gestalt qualities of completeness and closure, in addition to other sculptural qualities that could affect the cohesiveness of a form's geometry, which were revealed through an examination of minimalist and post-minimalist sculpture by artists such as Richard Serra, Ellsworth Kelly, Martin Puryear, Anish Kapoor, and Richard Deacon. The most pertinent of these qualities were:

- The duality of internal and external geometries.
- The geometry of the edge.
- The physical and illusory deflection of geometry.
- Asymmetry.
- Opacity, transparency and translucency.
- Contained and displaced space.
- Integral and applied contour line.
- Relationship to geometry of surrounding architecture.
- Actual and implied movement.

Some of these sculptural qualities had greater relevance to Judd's concept and this research than others. For example, 'integral and applied contour line' became less consequential as the research progressed, whereas 'the duality of internal and external geometries' was particularly significant to both my studies and to Judd's open sculptures where optical illusion seems prevalent such as *Untitled*, 1969, Fig. 20. This sculpture has translucent qualities due to its plexiglass interior, which also to some extent creates illusory deflections of geometry. It also displaces relatively little space, in contrast to another archetype of Judd's sculptural language; the stacked, *Untitled*, 1968, Fig. 22. The latter appears to displace space because of its opaque steel exterior, despite their being transparent panels set within.

Each stage of the studio investigations and its associated projects are subsequently documented through a description of the aims followed by text, photos, and diagrams that describe the

observations, results, and conclusions. 'Process' was essential to the studio investigations. My process required the setting up a structure or particular set of circumstances, which enabled an outcome where singularity of form was the sought after quality. It was achieved through the process of mould making and casting, to reveal new and original possibilities. Mould construction evolved throughout the research and finally consisted of PVC sheeting, sealed top and bottom around two wooden formers; the latter controlling physical deflections to geometry.[100] Illusory deflections to geometry were considered through the qualities of opaque, transparent, and translucent materials.

My working method can be considered specific because the definition of the mould's boundaries exclusively controlled the outcome, nothing was subsequently added to, and little removed from, the cast (any subtraction of mass only altered the geometry of the edge). Furthermore, the casting process has the potential to develop homogonous mass. Further significant differences between the methods used in this research and minimalist procedures included my exploration of open-ended cylindrical forms[101] to reduce the displacement of space; not one of Judd's prime concerns.[102] My sculptures are approximately of domestic scale and therefore somewhat smaller than the dimensions created by the minimalists. Judd's judgements about proportions were sometimes ordered by mathematical proportions such as the Fibonacci sequence, whereas my decisions have been somewhat more intuitive and guided by those qualities that define unity according to Gestalt Psychology (i.e. closure, and completeness etc.), primarily because I did not want to make aesthetic decisions according to preordained numerical formulae, (especially the connotations of natural growth patterns that the golden section and pi connote). The research eventually encouraged illusion, after initially seeking its rejection; as Judd's theory appears to require. Finally, they explored integral and applied colour whereas my method only incorporated integral colour.

In the subsequent paragraphs, I will discuss each stage of the research individually. The first stage investigated physical, rather than implied, variance in the geometry of forms cast in plaster. The sculptural taxonomy of singular form was used as a guide to broaden possible responses to Judd's theory. This initially focused on the identification and codification of contour line, such as integral or applied, and focussed on transparency, opacity, depth, direction, angularity, and rhythm. However, the focus of the investigation quickly shifted from line to variation in geometry that resulted from contrasting internal and external geometries, actual rotation and asymmetry, all of which were guided by the geometry of edge. The literature review had also included broader contextual investigations into geometry and Gestalt psychology. The former

was mainly, but not exclusively, informed by Robert Lawler's book, *Sacred Geometry* and *The Golden Ratio* by Mario Livio, whereas the latter was assisted by Boring's *Sensation and perception in the history of experimental psychology*. The concept of a Gestalt became increasingly important means of understanding the implications of the sculptural language I was developing, particularly as the first stage concluded.

The second stage examined physical and illusory deflections of geometry. It was precipitated by the realisation that the transparent PVC mould was, in many ways, more dynamic than its cast. Therefore, I began to explore how transparent and translucent materials could deflect the geometry of a form through illusion. Key to this was exploiting the sensitivity of materials to light, and how they could capture, diffuse, and reflect it. This was largely achieved through the moulds' formers to control the geometry of the edge and the thickness of the cylinder's walls. It also included augmenting the perceived internal light source of resin through the addition of various coloured and fluorescent pigments. Investigations into illusory deflections of geometry were combined with a refinement of the physical deflections discovered in stage one.

Part of my working method involved drawing to quickly generate forms susceptible to variance and to examine the taxonomy of singular form from an alternative viewpoint. In the second stage, diagrams and prints were used as a diagnostic tool to understand the underlying geometry of the studies (Appendices 1A-D & 2A&B). They were complemented by a series of photographic drawings whose main subject was moving light and X-rays, which were used as a method of internal examination (Appendices 3, 4A&B). Furthermore, the studies were informed by blind emboss prints (Appendix 5), whose value is demonstrated by their influence on mould construction. This was possible because the processes involved in both are similar: the embossed prints require a plate, (or what equates to, or could be used as, a former in one of my moulds), which directly defines the raised geometry of the paper through the application of pressure. Interestingly, the blind emboss prints articulate form through the light and shadow created by low relief, as opposed to ink or colour, and they therefore mimic the luminescent resin form's ability to capture and hold light at their edges. It is not without coincidence that the prints have successfully informed the development of the studies; this is because printmaking and casting sculpture both result from a specific process.

Developments sometimes occurred as a result of error and fault in the process of manufacture. On those occasions when the outcome was not that originally intended, the resulting studies were not instantly disregarded, but given due analysis for their potential to answer the research

questions. This approach enhanced my personal contribution to the progression of the research through what might be described as intuition, serendipity, or the X-factor. The latter was assisted by my decision not to order proportions through preordained numerical systems or ratios such as the golden section, which I contended might restrict the role of the aforementioned artist's intuitive decision-making process.

During the first two stages of the research, the studies were occasionally removed from the environment of the studio and placed on public display. This allowed the work to be seen in different contexts, with a range of ambient and natural lighting. The major benefit of doing this was that it allowed me to observe the work more candidly and without the attendant visual clutter of the studio. Venues included: RBS Gallery, London; Stamford Arts Centre; Babylon Gallery, Ely; 20/21 Visual Arts Centre, Scunthorpe; Thelma Hulbert Gallery, Honiton; Il Gianicolo, Centre for Contemporary Art, Perugia, Italy; MAC, Birmingham; and the Jerwood Space, London. The third and final stage of the research consisted of 2 full-scale 'finished' sculptures, which built on the research of the previous two stages, and explored the extent to which a duality can be implied, or perceived to exist, within a form with singular qualities.

STUDIO INVESTIGATIONS - STAGE 1

Prior to this research, my practice as a sculptor became increasingly concerned with the ramifications of singular form and how it could be defined as a sculptural concept. In my sculpture, these concerns were explored through simple hollow forms, in which line was either applied to the surface, or resulted from the process of its construction. The five cast bronzes shown below are from this period and they illustrate some of the issues that were arising in my work immediately prior to the commencement of this research. In these primarily circular sculptures, I was particularly concerned with how line could be used to give definition to a plane through being a consequence of the sculptures' construction, Fig. P1-0. In these sculptures, the latter was of course, 'coiling'. The unity of these forms was somewhat undermined because the interior surface did not consist of spirals directly resulting from the coiling process, but was instead modelled. However, this did permit a basic exploration of the effects that contrasting internal and external geometries had on the integrity of a singular form.

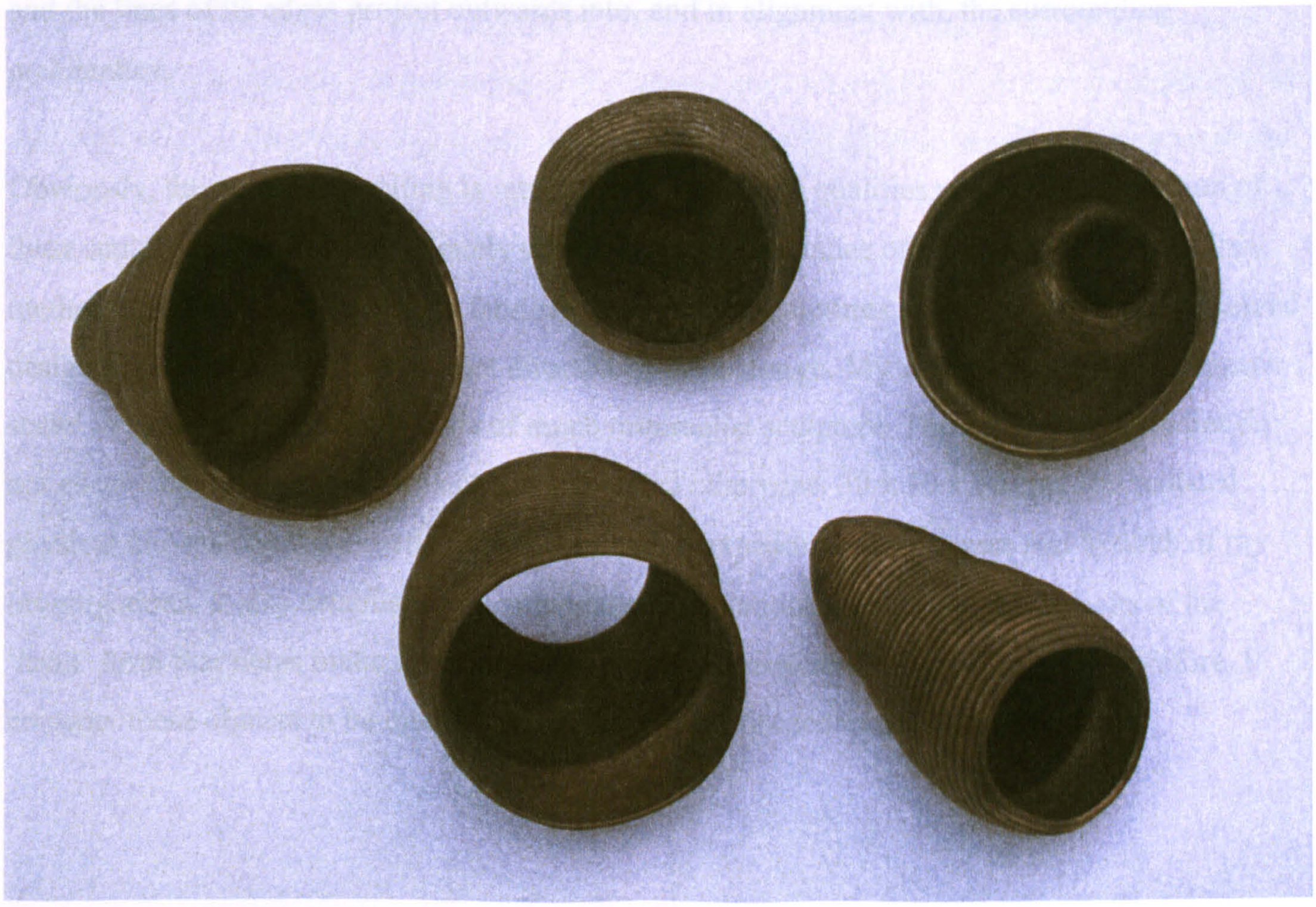


Fig. P1-0

However, the unpolished bronze did not reveal the surface detail of contour lines because the dark non-reflective surfaces reduced the effect of light as a descriptive element. Bronze was therefore replaced with plaster in the first project of the research so that the contour lines would be more visible. In addition, and more importantly, the time consuming nature of lost wax bronze casting committed me too early when I needed to work quickly and experimentally.[103]

The coiling effectively underlined the circularity of these sculptures' geometry, by repetitively drawing circles around their surfaces. The apparently continuous flow of the exterior plane combined with the lines, create a Gestalt based on the circle. It therefore appeared perfectly logical to use a circular cylinder as the basis for these PhD investigations. In this sense, the initial studies were informed by my recent work rather than any specific influence by other artists or as a considered reaction against the orthogonal geometry favoured by the minimalists. I did however choose to investigate open-ended hollow cylinders, in order to reduce the displacement of space that occurs in many minimalist sculptures. Overall, the intention was to minimise the establishment of any relationships between object and context through circular geometry and hollow form. Something which, for example, a solid cube cannot do because it displaces space and the lines of its edges project outwards into, and in alignment with, the surrounding architecture.

Obviously, the process of coiling is integral to the aesthetic qualities and surface definition of these sculptures and this immediately underlined the importance of process to my work. This method contrasts the autonomous fabrication of Judd's sculptures according to his preconceived designs, whereas my forms were not directed by prior design. My sculptures are of a 'domestic scale' in contrast to the larger scale of much minimalist sculpture. The forthcoming studies do not exceed the following dimensions unless stated otherwise: 30 x 30 x 30 cm. The reduced physical dimensions were particularly beneficial in expediting the progress and breadth of my investigations. It also established a complementary relationship with the dimensions of the 'head' form that helps make up Brancusi's sculpture *Prometheus*, 1911, Fig. 11. Therefore, I consider these objects to be maquettes, or studies, as opposed to finished sculptures.

PROJECT 1

In the introduction an examination of minimalist sculpture sought to identify those concepts that typified minimalist sculpture and theory, with particular reference to the work of Judd and Morris. These were singular and unified form and (in Judd's intentions) the denial of relational composition and illusion. Through an analysis of the sculpture, it was clear that the concepts were developed in part by the following characteristics:

- Duality of internal and external geometries
- Geometry of the edge
- Contour line
- Deflection of geometry
- Process driven

METHOD

Nine studies were cast in plaster around either roughly shaped polystyrene or balloon cores to exploit the light dark contrasts generated by plaster. Cores were used to control the definition of the interior geometry. The polystyrene cores were wrapped in masking tape to generate contour lines on the surface through casting, in order to continue exploring how line could give definition to a plane. The balloons were constricted with rubber bands to create contours. (Fig. P1-1 to P1-9)

RESULTS

Fig. P1-1

Fig. P1-2

Fig. P1-3

Fig. P1-4

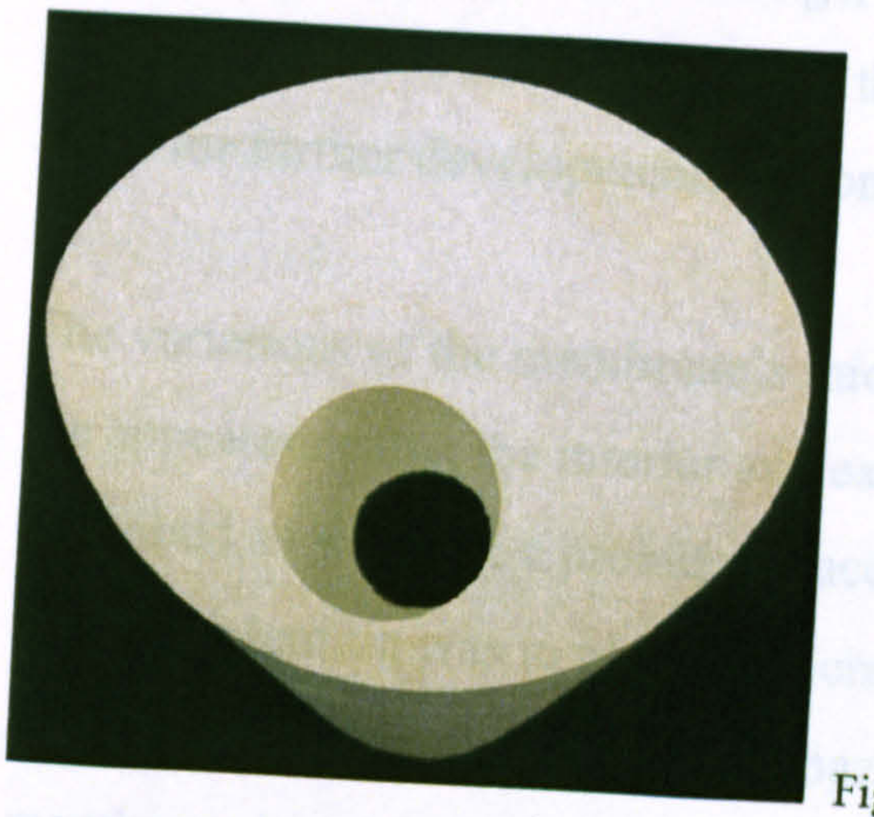


Fig. P1-5

Fig. P1-6

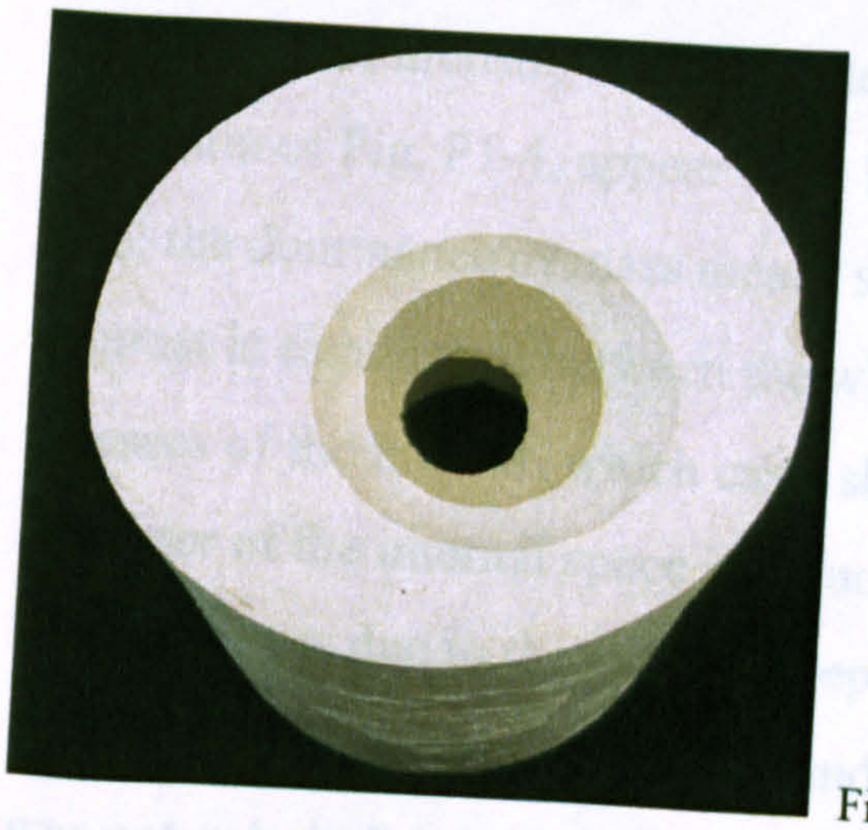


Fig. P1-7

Fig. P1-8

Fig, P1-9

The duality of internal and external geometries

In most of the studies from project 1, such as Fig. P1-6 & P1-8, the relationship between the internal and external geometry is somewhat arbitrary because no convincing contrast is established, one neither follows, nor significantly differs from, the other. They are neither complimentary nor contrasting. However there are two exceptions; Fig. P1-5 has a circular aperture located within an elliptical exterior boundary, which it contrasts with. Alternatively, the slightly conical study Fig. P1-4 has a circular interior that follows its exterior, reinforcing the geometry of the circle. At this stage, it seemed that complementary geometries were better placed to enhance unity. Therefore, the underlying geometry of Fig. P1-4 was selected as the basis for further development; by concentrating on similar interior and exterior geometries.

The variations of the membrane's thickness in all the studies, excluding only Fig. P1-4, creates the appearance that the interior and exterior are unrelated and therefore the studies cannot be described as singular; a problem exacerbated by the lack of symmetry in their geometries. My original intention was to place deliberately the aperture off centre to counteract any potential symmetry, but the results seem haphazard due to the relative thickness of the cylinders' membrane in relation to their interior spaces. This underlined the importance of establishing a meaningful relationship between interior and exterior. In fact, all of the studies with the exception of Fig. P1-4, appear to be large solid masses that have been punctured with a small hole; the dominance of mass means space is inevitably displaced. Consequently, a distinct contrast is established between the white exterior surface, which reflects light and the dark recesses of the interior, which casts shadows. This effect becomes more pronounced when the diameter of the internal space is reduced and additionally in those studies with balloon cores. The latter was due to the apparent depth of the internal chambers, as in Fig. P1-7, which gave the internal space increased definition and suggested it was composed by segments or parts. This was not only indicative of relational composition, but its connection with the exterior was unconvincing because the latter was plain and lacked any corresponding segmentation.

Geometry of the edge

In these sculptures, the 'geometry of the edge' is the meeting point of interior and exterior, what might be described as the interior/exterior edge in other words. In the studies from Project One, the differences between edge and plane were mostly revealed through the boundaries between shadow and reflected light; one plane adjoining the edge reflects light whilst the other remains in

dark shadow. For example, see study Fig. P1-7, in which the interior/exterior edge marks the boundary between these changes.

Integral and applied contour line

The contour lines on some of the studies, such as (Fig. P1-3), questioned whether the contour line from the masking tape was integral, structural or applied.[104] The answer was somewhat ambiguous, despite the contour lines resulting from the casting process; the overriding observation was applied (not integral) because the contour lines did not arise as a direct result of the casting process. The detail photo Fig. P1-3b demonstrates the clarity of the contour line that results from the mould construction and the less precise textured lines that are impressions of the masking tape.

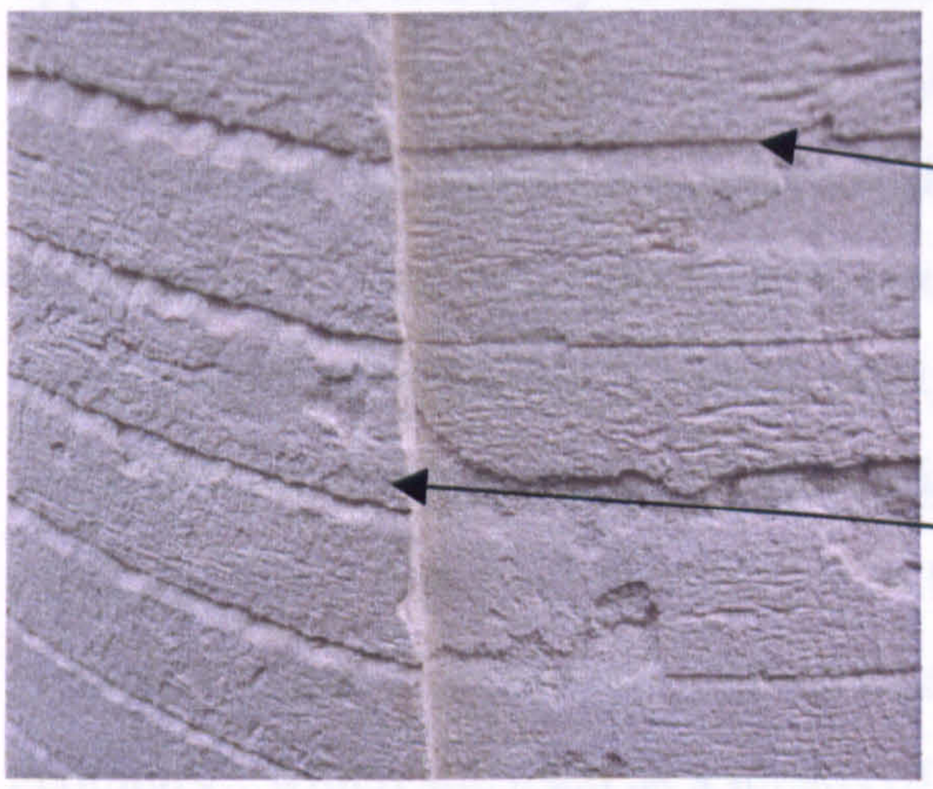


Fig. P1-3b

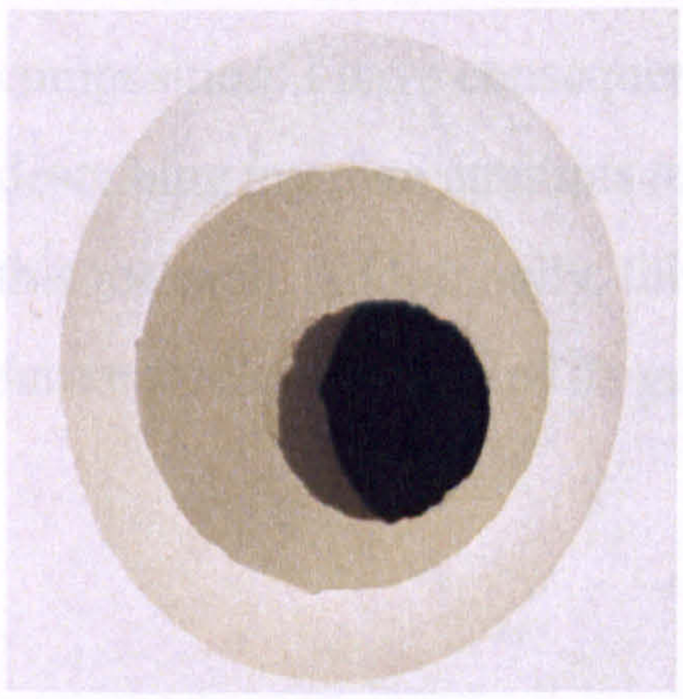


Fig. P1-7b

The balloon cores produced multiple internal spaces and not contour lines. Contours or distinct edges exist due to the changes in the movement of interior planes, as shown in Fig P1-7b detail of the study Fig. P1-7. The variation in geometry was too complex to allow a reading of

singularity because the contrast between light exterior and dark interior lacked coherence. This was particularly the case in the studies with the balloon cores. Therefore, what became increasingly apparent was the need for a coherent connection between interior and exterior.

The Gestalt law of continuity[105] suggests that the orientation of the contour line can affect the perception of the form's geometry. This may favour horizontality, verticality, or strike a balance between both axes. The studies of this sequence showed that when the contour lines follow the direction of the plane on which they are located, rather than running perpendicular to it, unity was enhanced; as can be observed in the study, Fig. P1-3b.

Deflection of Geometry

The study Fig. P1-5 is of particular significance because during casting the pressure of the wet plaster effectively twisted its circular mould through 90° and made its section elliptical at the upper non-fixed end (only the lower base of the cylinder mould was fixed into clay). This alerted me to the possibility that the moulds could be distorted and that the distortion could be controlled and amplified to allow a more subtle relationship between interior and exterior, especially if the dominance of mass was reduced to create a more shell-like cylinder as in, Fig. P1-4. The development of this study is a particularly good example of the unexpected benefits that defects in the manufacturing process, or what might be described as the X-factor, brought to the research. Study Fig. P1-5 therefore effectively marked the emergence of 'the deflection of geometry' a description appropriated from Rosalind Krauss's term 'the *ideal* deflection of geometry', which she used as a means of describing how Brancusi manipulated 'absolute' forms of solid geometry. The 'ideal' geometry that Krauss refers to is less relevant to this research because of its connotations with harmonious and divine proportions; and therefore relational composition. I have consequently referred to, *the deflection of geometry*, as a means of describing my own attempts to introduce variance to the geometry of regular forms throughout this research. Additionally, this study suggested the use of elliptical geometry as the basis for future studies because of its greater potential for variation than the circle.

CONCLUSIONS TO PROJECT 1

It was noted that the flexible exterior mould could create an extensive range of cylinders including round, elliptical, and conical, whereas the use of static cores limited the potential for variation in geometry. Of particular importance was study Fig. P1-5, and whilst its significance was not realised immediately, its relevance to the development of the research cannot be emphasised enough. This practice led development marked the physical emergence of both the *deflection of geometry* [106] and my concern for elliptical geometry. However, the actual terminology was subsequently revealed though a re-analysis of Brancusi's sculpture and Rosalind Kraus's description of them. I was unaware of this concept prior to commencing the research, but then went on to classify two types of deflected geometries; the first is based on manipulating the physical geometry of a form and the second involves the more illusory qualities of materials and surface finish.

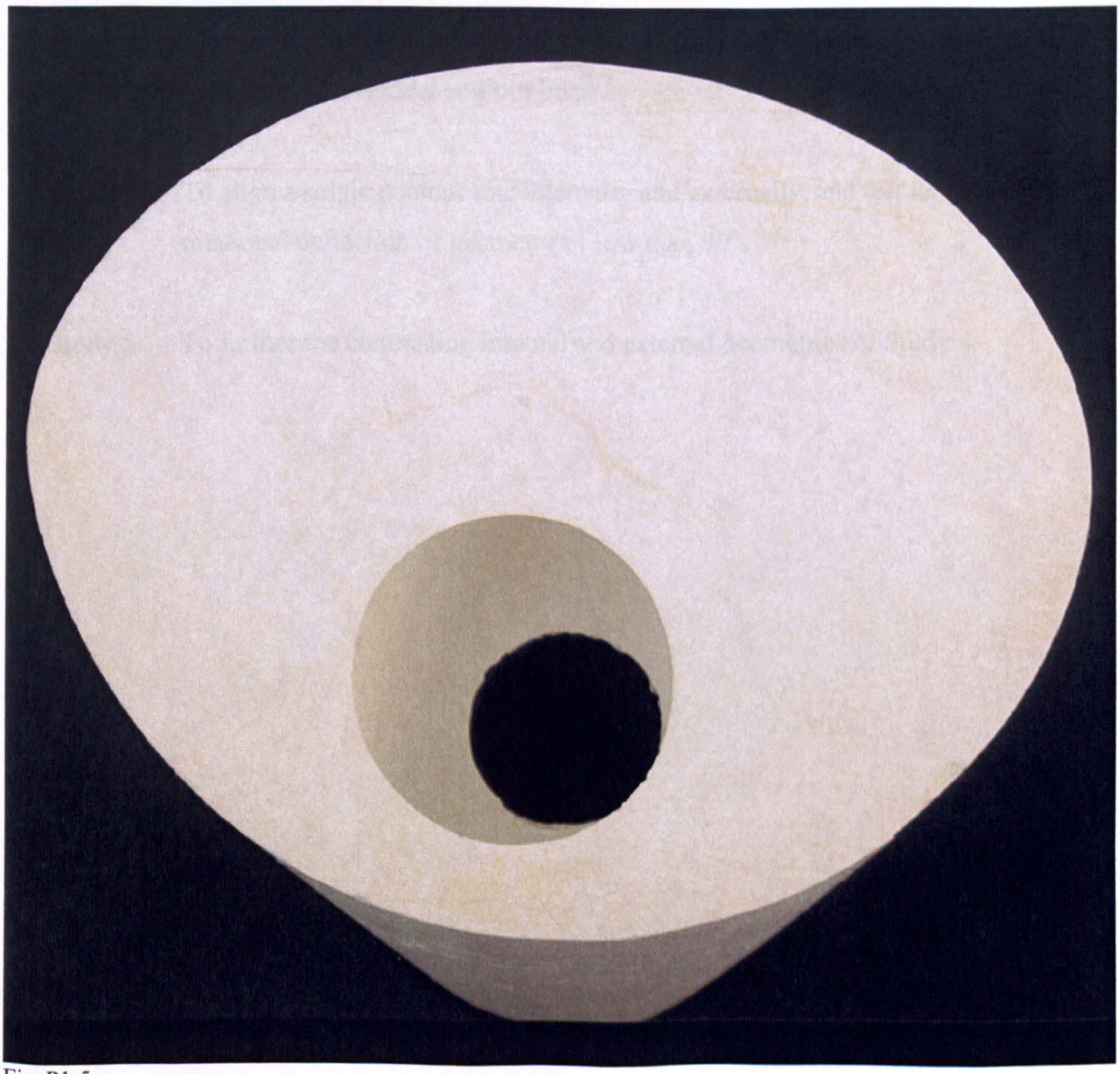


Fig. P1-5a

PROJECT 2

AIMS

The general aim was to develop the elliptical study Fig. P1-5 from Project 1, paying particular attention to the geometry of its edge and how the deflection of geometry might affect a singular form. It also sought to generate contour lines integral to form, rather than in addition to it. The project consisted of five studies, and the aim of each is as follows:

Study 1. To sequentially deflect the geometry of an interior.

Study 2. To examine the relative orientation between the internal and external ellipses through cylinders with thinner walls.

Study 3. To enhance the rotational deflection of geometry of Study 2 through multiple horizontal and vertical contour lines.

Study 4. To align a single contour line internally and externally, and test its effect on rotational deflection of geometry of less than 90°.

Study 5. To further the contrasting internal and external geometries of Study 4.

RESULTS

Study 1

The intention of the study Fig. P2-1 was to sequentially deflect the geometry of its interior in stages, so that the multiple chambers of Fig. P1-7 were replaced with an interior space that might be perceived as singular. The interior core of its mould was made from elliptical wax discs, stacked in diminishing sizes towards the centre from both ends, and incrementally twisted through 90°. This method of twisting the internal space failed to generate the anticipated coherence between interior and exterior form despite the similarity between the ellipses. The extent and shape of the torsion through the interior led to a constrained space into which restricted light enters. The contrast between the light reflecting off the white plaster and the shadows within the void-like interior establishes a duality, as seen in Fig. P2-1b. Therefore, the contrast between the internal and external geometries appears too extreme. Additionally, the repetition of the right-angled stepping establishes a relationship with the surrounding architecture that implies relational composition, a characteristic that is at odds with the overall aims of the research. Finally, the study was dominated by mass, which contrasted with the smaller void within. These contrasts set up a very specific relationship, but not one that was wanted. Nonetheless, one aspect of this study was of interest and was therefore developed further, namely the potential for rotation to imply movement and variation.

Fig. P2-1

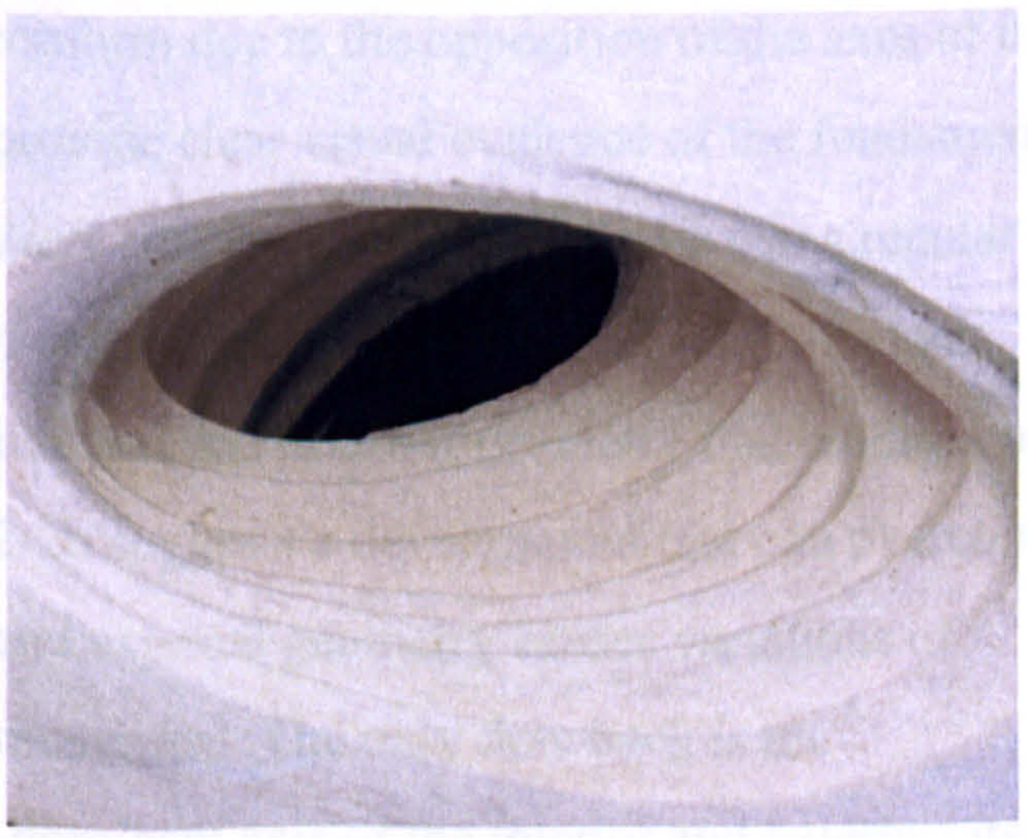


Fig. P2-1b

Study 2

As a consequence of the previous study, I was particularly keen to create cylinders with thinner walls and self evidently elliptical geometries; the latter differing only in scale and therefore consistent with the Gestalt law of similarity. Two studies were cast with proportionately larger interiors than in the previous study; these concentrated on the orientation between the internal and external ellipses. The studies demonstrate how complementary geometries can promote unity as in Fig. P2-2a, while the perpendicular orientation in Fig. P2-2b suggests duality.

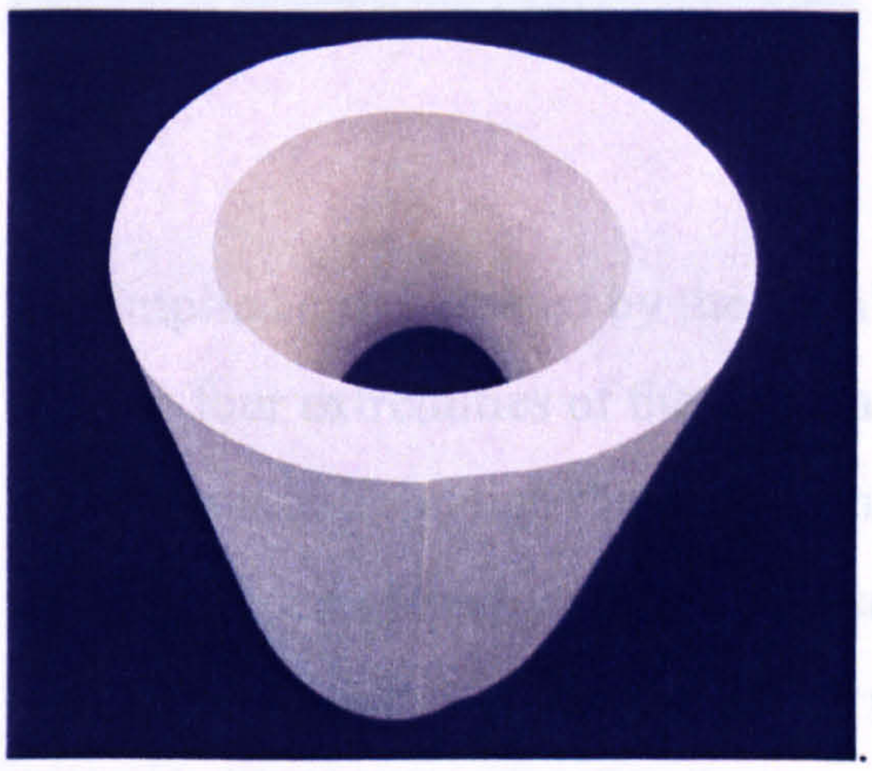


Fig. P2-2a

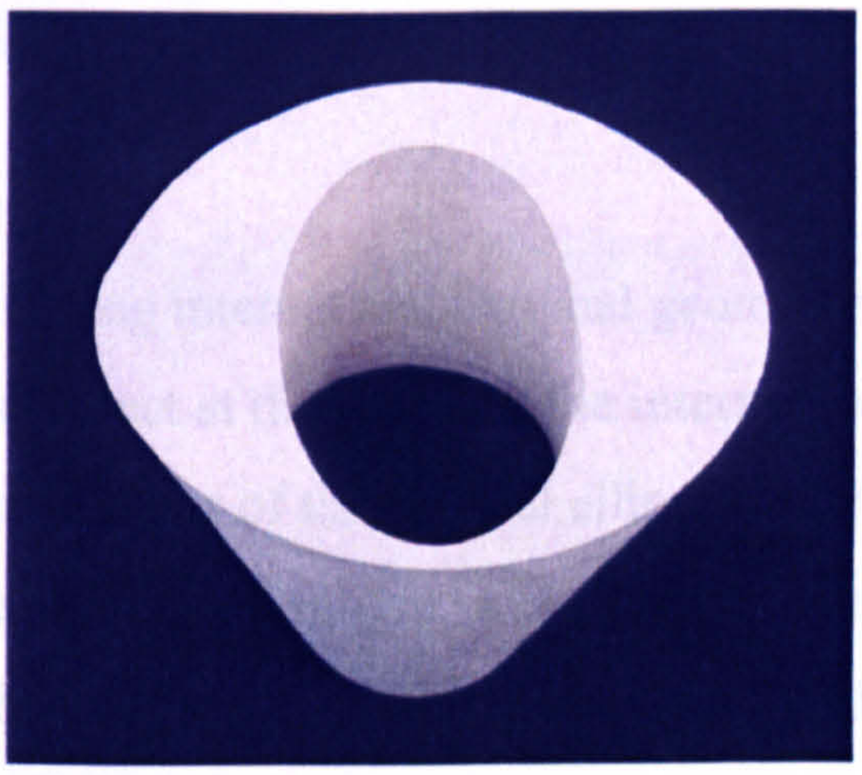


Fig. P2-2b

The geometry of the edge in the first study is entirely consistent with the Gestalt laws of similarity, symmetry, and completeness and overall it might be considered *good form,* whereas that of the second does not readily conform due to the opposition of the axes of its internal and external ellipses. These studies provide clear visual evidence of the fundamental problem that strictly adhering to *Specific Objects* creates; which is, just how can a regular geometric form be the basis for a sculpture of considerable significance. Fig. P2-2a has entirely consistent relationships between its internal and external geometry that render it not particularly interesting *per se*, whereas Fig. 2-2b suggests a development that can overcome the problem because its contrasting internal and external geometry causes variations of thickness, which suggest some potential for movement. The only drawback is the perpendicular (orthogonal) opposition of the dominant axis of the interior and exterior; its contrast is too strong and actually implies the division of the form into four parts, as

described diagrammatically in Fig. P2-2c. Nonetheless, the potential for variation is self-evident.

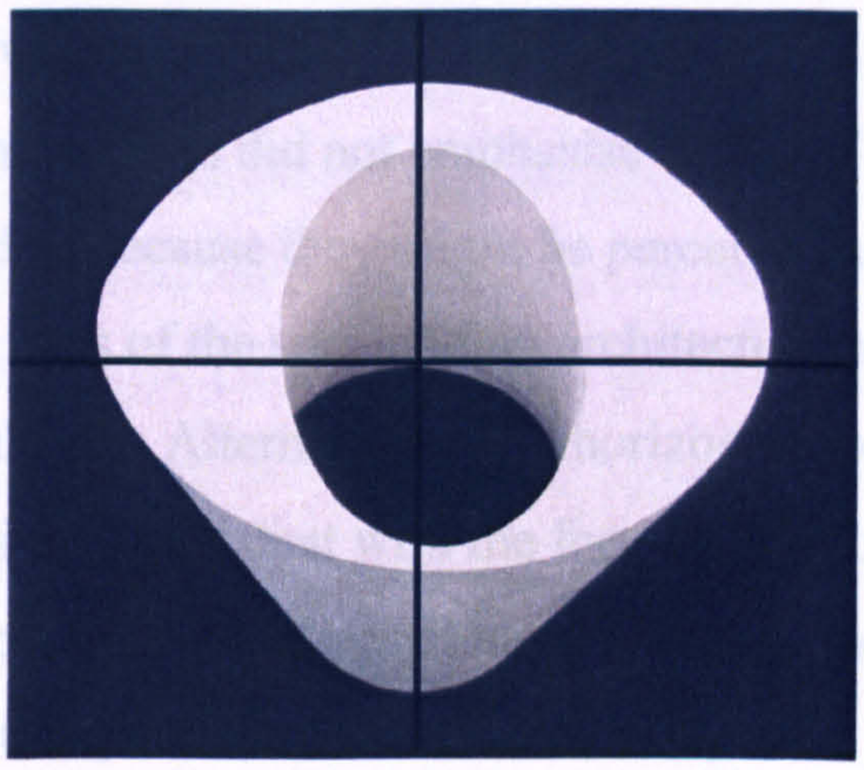


Fig. P2-2c

The implied cross created by the form's contrasting internal and external geometry means that the four extremities of the external ellipse bisect at the centre of the internal space, without passing through the corresponding extremities of the internal ellipse. They are still co-centred orthogonally aligned ellipses. The contrasting internal and external geometries result in variations in thickness in the wall of the cylinder,[107] which sets up a visual tension between the horizontal and vertical axes. Despite this tension however, the form seems more static than needs be because the axes bisect at 90° and therefore imply stasis, rather than movement. Consequently, it was realised that if the internal ellipse was rotated or 'deflected' through an angle other than 90°, then greater implied movement might exist and the resulting asymmetry might even lead to a greater unity between interior and exterior. At this point, what is referred to as 'deflected geometry' became of crucial importance to the research, and in particular the deflection of non-orthogonal geometry.

Study 3

The intention was to enhance, through contour line, the rotational deflection of geometry explored in the previous studies. Therefore, the first study had horizontal contour lines burnt into its wax cores Fig. P2-3a & c, and vertical lines in its counterpart, Fig. P2-3b & d. The vertical contour lines did not emphasise the form's underlying elliptical geometry, but actually contrasted with it because they might be perceived as incomplete sections; which project outwards towards the axes of the surrounding architecture; a phenomenon that frequently occurs in Judd's sculpture. Alternatively, the horizontal contour lines are elliptical, continuous, complete, and entirely consistent with the form's elliptical geometry: So much so that they also enhance the implication of elliptical torque through the form. Therefore, the horizontal lines suggested greater potential for further development.

Fig. P2-3a

Fig. P2-3b

Fig. P2-3c

Fig. P2-3d

The fundamental problem with these studies was caused by not transposing the internal contour lines to the exterior. This established a contrast between the smooth exterior and textured

interior. The latter gave particular emphasis to the interior, as opposed to allowing interior and exterior to have equal importance.

The most significant outcome of these studies was the development of study Fig. P2-2b. Fig. P2-3a demonstrates how rotating the inner ellipse by less than 90° can imply a transformation of the singular relationship between interior and exterior. This has created a more dynamic geometry than that of the perpendicular opposition in the earlier study. The combination of actual rotation and implied movement in the geometry of the edge creates visual tension, which is clearly absent when the internal and external geometries are entirely complementary. However, it was considered that the deflection from the perpendicular orientation between internal and external ellipse was too subtle. The following study therefore attempted to examine this further.

Study 4

This study aimed to align a single contour line internally and externally, and test its effect on rotational deflection of geometry of noticeably less than 90°. The mould for this study had a strip of thick tape stuck to its interior and exterior at identical heights, which, in retrospect, was actually additive rather than integral to the form, see Fig. P2-4. The resulting internal and external contour lines are closed and continuous. They did not align exactly and revealed how misalignment, a deflection of geometry, could affect a form's geometry. This misalignment is similar to the step back from 'perfect' form that Krauss described in relation to Brancusi's sculpture, and creates the illusion of vibration in the form. The curved elliptical lines and edges visually combine to augment the implied centrifugal force. The deflected geometry also implies movement, an effect amplified by the contour line almost dividing into three lines of highlight, mid-tone and shadow, as shown in detail in Fig. P2-4b overleaf. Therefore, the curving line, edge and plane all help the form to be specific, as well as dynamic.

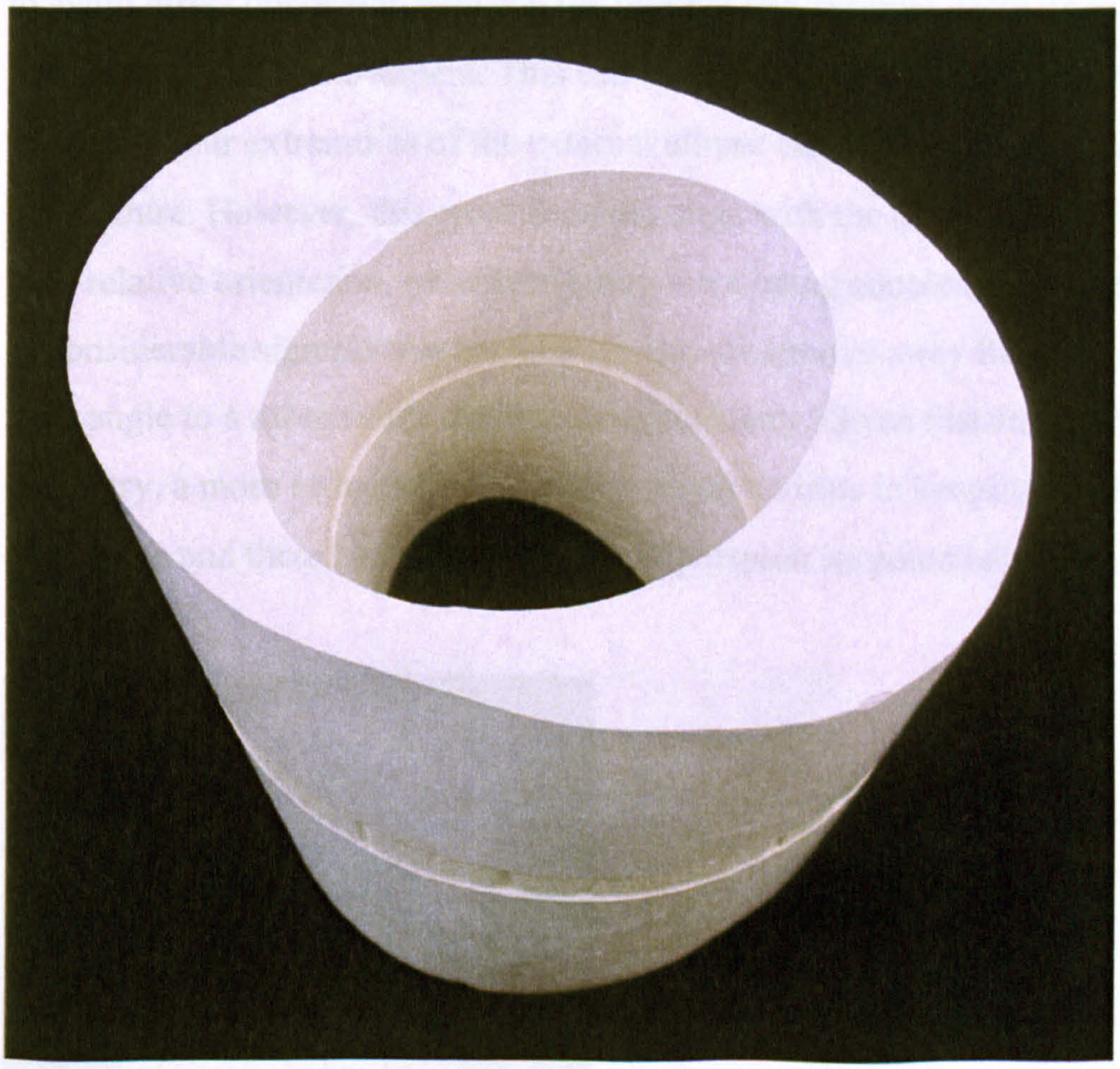


Fig. P2-4

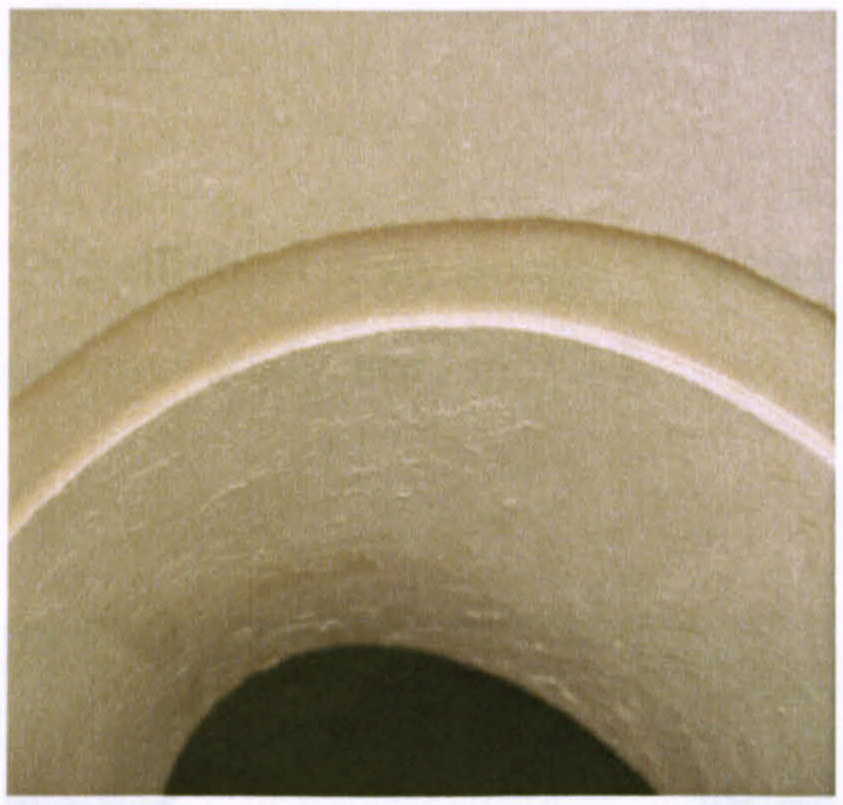


Fig. P2-4b

From a more detrimental point of view the contour line visually splits the form in two halves; thereby creating relationships. A second negative aspect was the imprecisely drawn geometry of the interior and exterior, which underlined the need for a precise and specific definition of volume, edge, and plane in terms of elliptical geometry. Nonetheless, Study Fig. P2-4 is important because it develops the underlying geometry of its predecessors; Fig. P2-2b, whose inner and outer ellipses were rotated perpendicularly, and Fig. P2-3a, which is just shy of perpendicular. Alternatively, in this study, the angle of rotation is sufficiently narrower than 90° to avoid direct opposition between the internal and external geometries, but also rotated enough to genuinely imply movement. This can be demonstrated diagrammatically as in Fig. P2-4c where the four extremities of the external ellipse can be joined to divide the internal space in four at its centre. However, this cross does not align with the outer edges of the internal ellipse due to their relative orientation, notwithstanding them being concentric ellipses. This study is therefore of considerable significance because it suggests a move away from the direct opposition of the right angle to a more subtle deflection of geometry. Given that Judd's concept requires unified geometry, a more refined approach now seems entirely in keeping; however I did not realise this at the time and therefore only began to fully exploit its potential during Projects 8 –10.

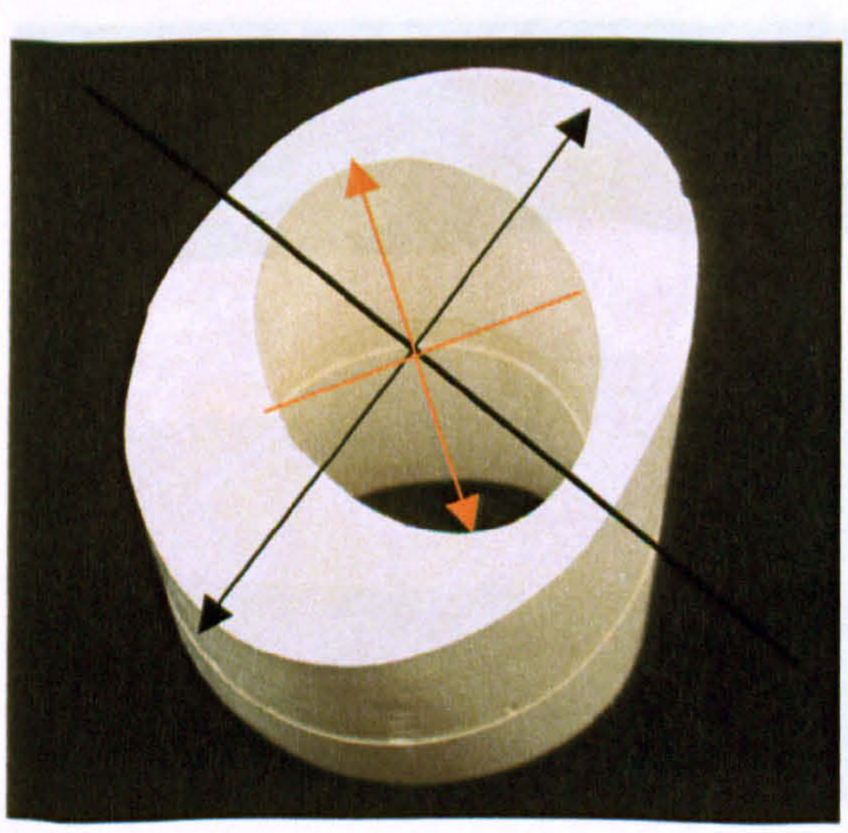


Fig. P2-4c

Study 5

This elliptical study, sought to further the contrasting internal and external geometries of the previous study, see Fig. P2-5.

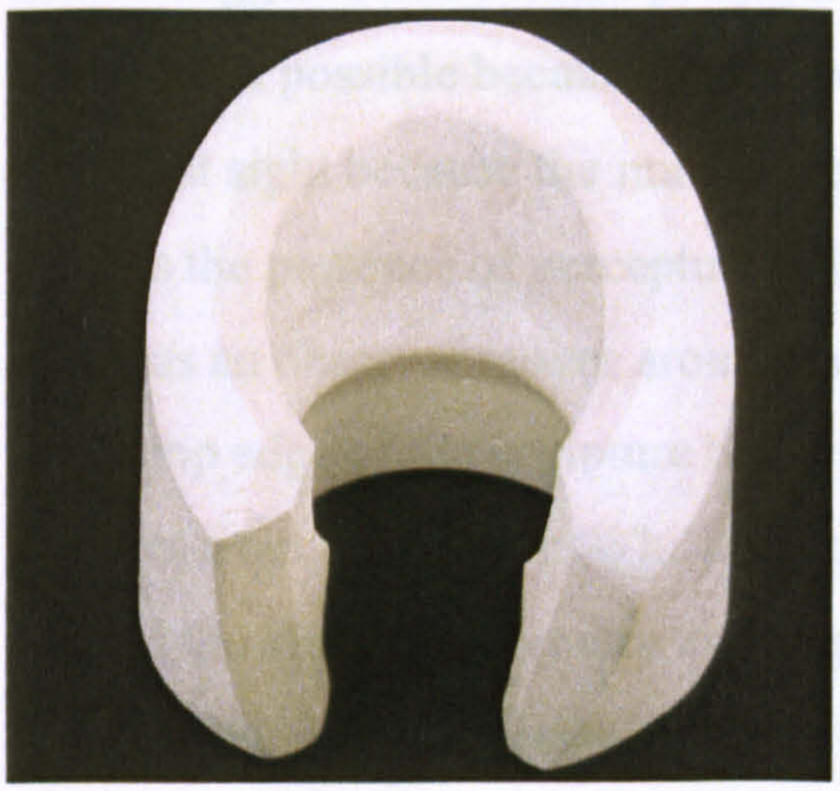


Fig. P2-5

The aim was achieved by carving an internal core with a horizontal curved groove; however this meant its geometry was independent of the ensuing rotation, which was realised by twisting the formers of the mould, and therefore not elliptical. This meant that the walls of the cylinder were consistently defined by an ellipse, with the exception of the 'bulge', which has irregular geometry.[108] A subsequent intervention removed a segment Fig. P2-5a. This broke the endless continuity of the elliptical geometry and the visual dominance of the gap undermined the form's unity. Therefore, this study suggests that when a single process exclusively determines form, and when no additional interventions to this process occur, there is a greater possibility of producing a form that is specific and singular.

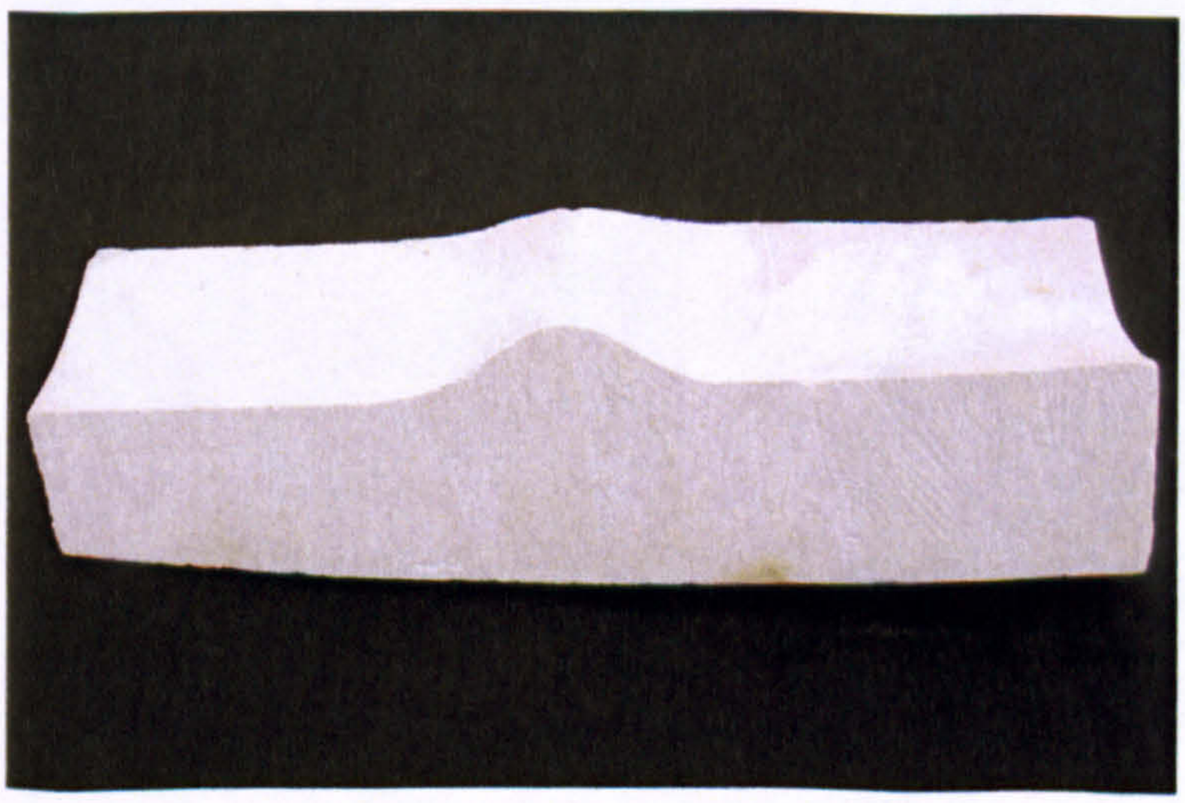


Fig. P2-5a

CONCLUSIONS TO PROJECT 2

This sequence of studies did not fulfil one of its original aims of creating contour lines integral to form. In fact, these ambitions were superseded by the investigation shifting towards variance in geometry. Most of the studies in this sequence had their geometries deflected by rotating the mould's top and bottom former in relation to one another. The deflection of geometry may indeed suggest some limited potential to mediate the dilemma posed by *Specific Objects*. This seems to be possible because it can create sculptural forms that retain the interest of the observer after first sight because the immediate establishment of a Gestalt is challenged. This condition implies the presence of perceptual ambiguities that would reveal a series of repeatedly changing views as an observer moves around the form. For example, this could involve the horizontal axis of the top edge of the sculpture being transposed to another angle at the base, or an interior that deviates from its exterior. Whilst the deflection of geometry clearly suggested some potential to expand the kinds of geometry that might be described as having singular qualities, the fundamental difficulty remained how to overcome the apparent contradiction of unity and variation existing within one form. Subsequent studies would consider to what extent geometry can be deflected before it introduces relational composition and renders the form incoherent as a singular entity.

It was also evident that the contour lines added by the impression of masking tape wrapped around the cores and exterior mould could not be described as integral because they did not directly relate to, or originate from, the shape of the plastic sheet used to make the mould. Alternatively, the contour lines generated by the overlap in the shuttering mould and its edges were integral.[109] Again, this was another observation that suggested process was better placed to produce singular and specific qualities. Previously, the qualities of the 'overlapped' contour lines, which could be ambiguous in terms of its relief, had been overlooked as in Study Fig. P1-6.

PROJECT 3

AIMS

In light of the previous conclusions, this project aimed to simulate the results of shaping the shuttering moulds to control 'overlapping' contour line, with particular emphasis placed on the continuity of line and its passage from interior to exterior.

RESULTS

Initially a series of cardboard studies examined the effects of lines that could be created by cutting the shuttering mould (Fig P3-1 & P3-2). Using thin card allowed the testing of other cylindrical shapes such as a figure of eight derivative. A black marker pen was used to simulate the 'overlap' contour lines, which included straight lines spiralling around from top to bottom; variations using the curves of ellipses; and larger ellipses running horizontally from top to bottom. The findings were then investigated in plaster studies, Fig. 30.

The ability of line to move from interior to exterior appeared to be a crucial element in maintaining the continuity of a *Specific Object*. The most favourable result was achieved when the internal and external line is effectively seen to rise and fall at similar points along the edges, as in the two studies of Fig. P3-1a. Although the line does not completely cover the entirety of the form's surface, its implied movement is sufficient to establish continuity. In the left hand study of Fig. P3-1a, the inner elliptical line enhances the rotational deflection of geometry because its relative orientation to the elliptical top edge induces visual tension.

Fig. P3-1

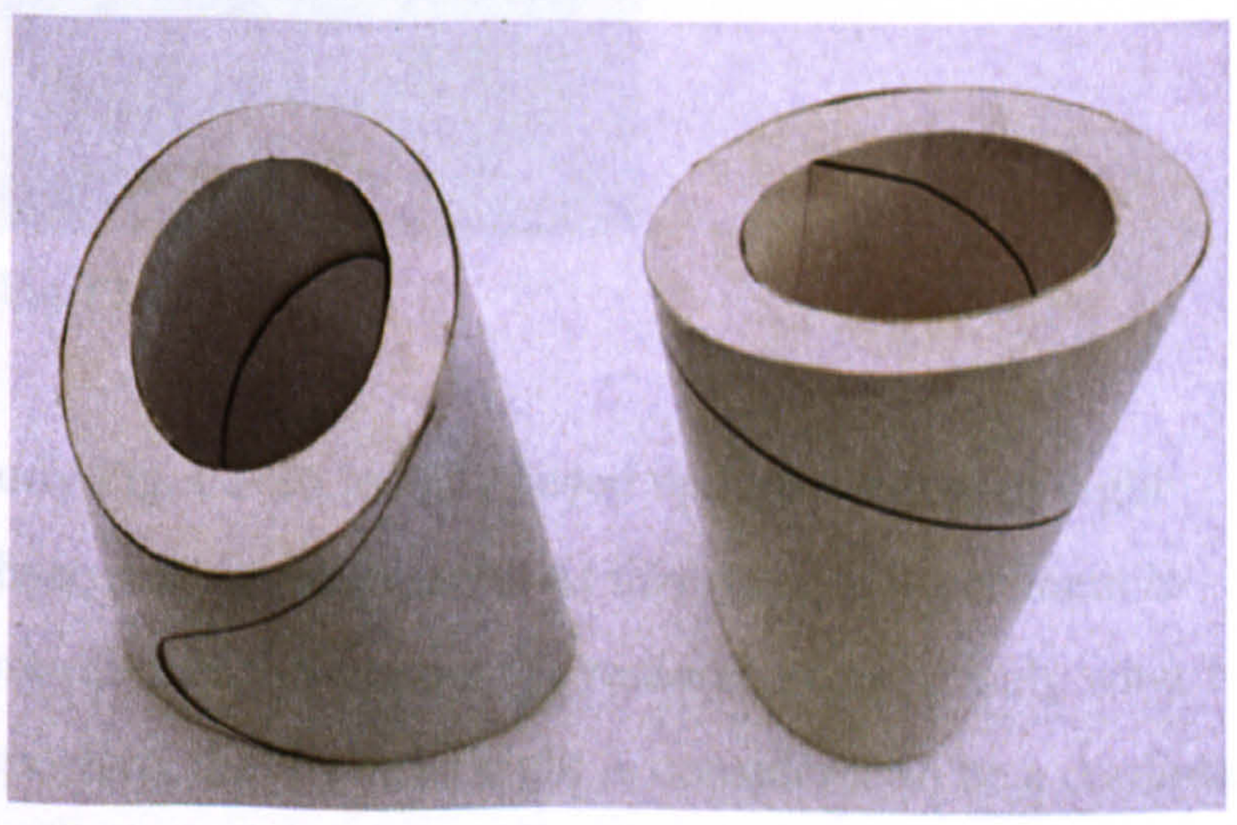


Fig. P3-1a

The least successful of the card studies, such as Fig. P3-2a, had multiple contour lines spiralling around them several times that suggested layering. In contrast, when the contour line circumnavigated the form once or less, as in P3-2b, the form's continuity was enhanced and therefore became specific. The multiple lines flowing around the study emphasised horizontality and drew attention to the elliptical continuity of its geometry, whereas the single lines struck more of a balance between the two axes, neither emphasising the horizontal nor the vertical axis.

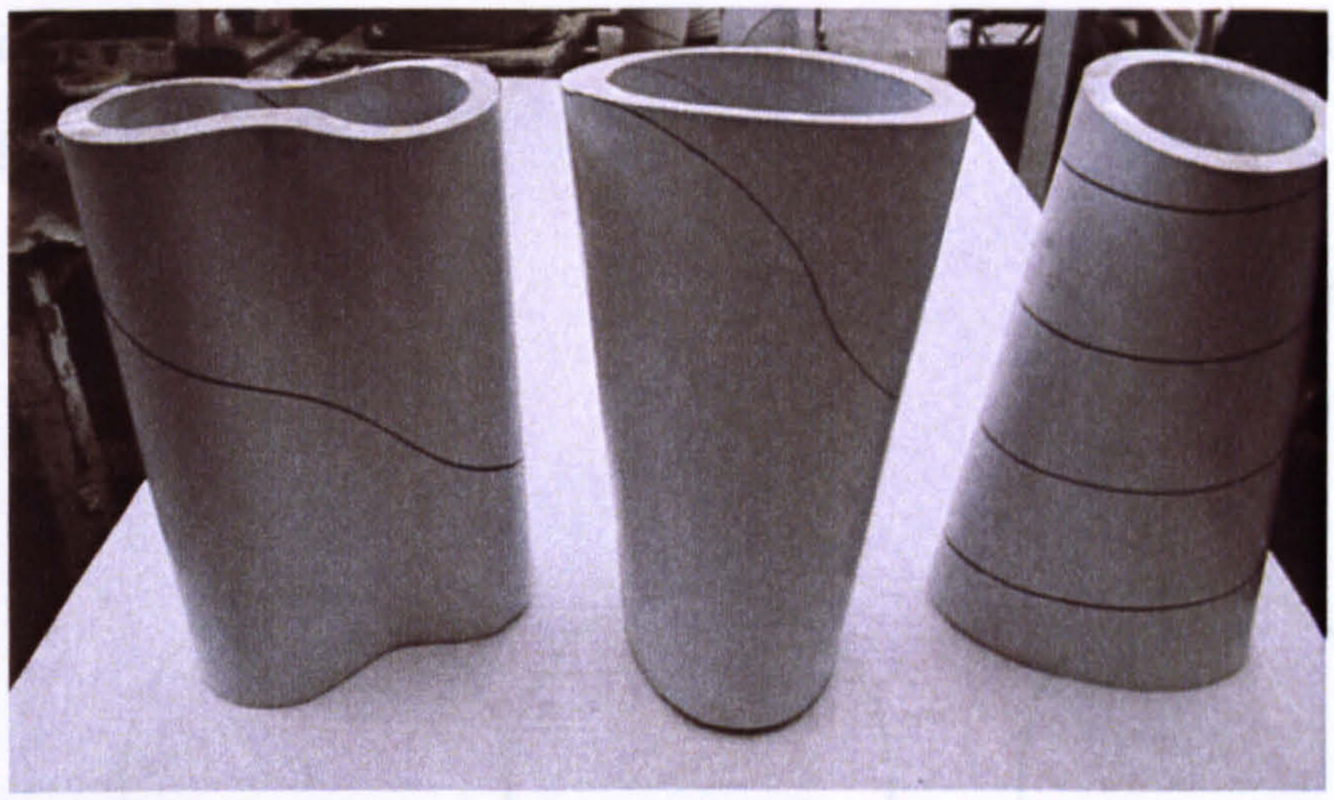


Fig. P3-2

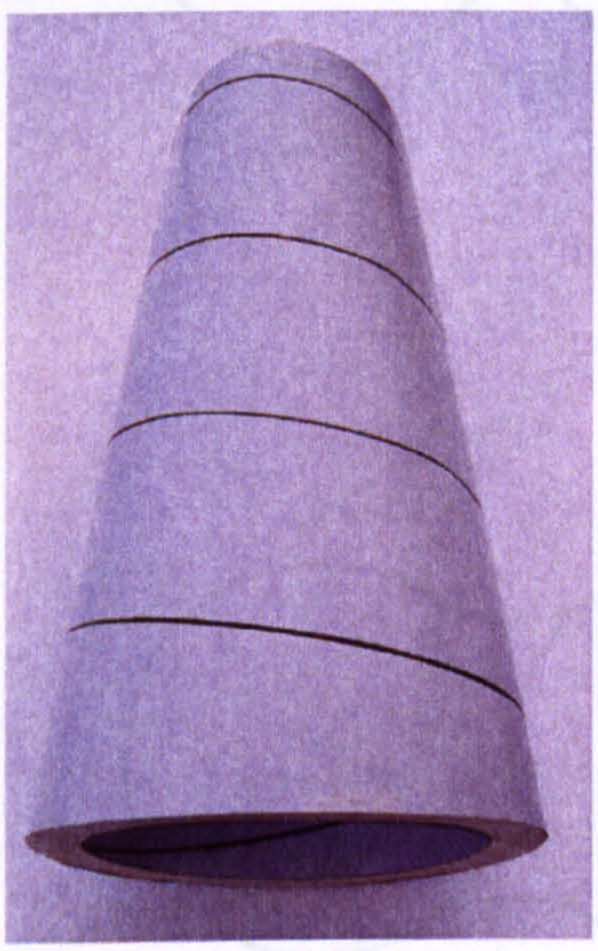


Fig. P3-2a

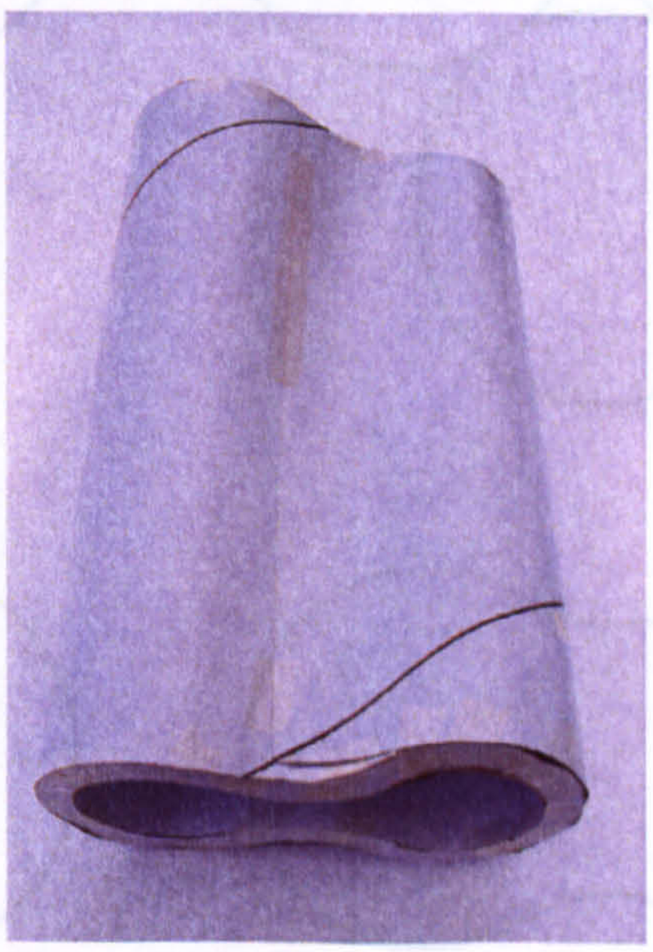


Fig. P3-2b

The decision to create a cylindrical study Fig. P3-2b loosely based upon the figure of eight would be especially significant for subsequent developments. At this stage, it is pertinent to explain how I have used the term figure of eight throughout the research and precisely what I mean by it. From a mathematical perspective, the figure of eight is considered to be a continuous line that crosses itself, literally like the number 8 or the Egyptian symbol for infinity. It is therefore constituted by two tangential circles, as shown diagrammatically below in Fig.3-2c. For

the purposes of this research I was particularly concerned with cylindrical forms that have a distinct and singular interior space. I therefore created a shape that is similar to the figure of eight with the exception that its perimeter line does not crossover itself. This was achieved by joining two tangential circles with arced sections of two further identical and perpendicularly placed circles. Thereafter, the interior sections of the original circles were removed, all of which is demonstrated by Fig. 3-2c. My shape is therefore actually a derivative of the figure of eight, but for the purposes of expediency I continue to refer to it as a 'figure of eight' throughout the research. Interestingly, the figure of eight in my cylindrical version contains the visual implication of two circles, a duality, even if those tangential circles are not fully formed as they previously were.

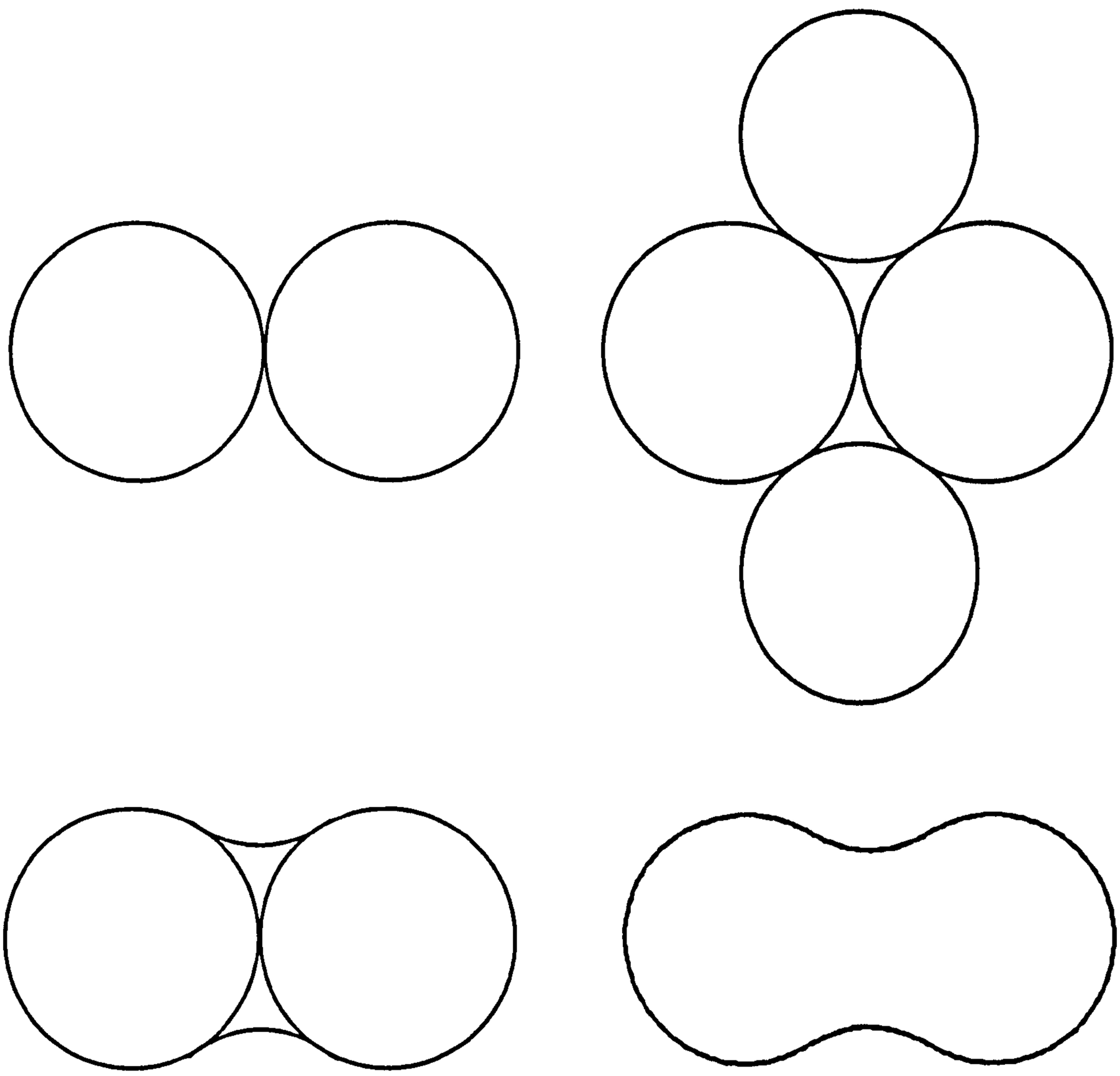
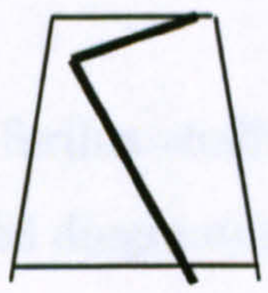


Fig. 3-2c

To test the orientation of contour lines from the cardboard studies, I created studies in plaster, based on the study Fig. P1-4, a conical cylinder where the impression of the top corner of the acetate remains clearly visible. The right angle line draws the eye up the form and then round

towards the top; however, its passage to the interior is blocked by the planar cut of the top edge, shown below in Fig. P3-3. The new studies Fig. 30 a-d investigate elliptical lines within the complementary context of an elliptical cylinder.

Fig. P3-3



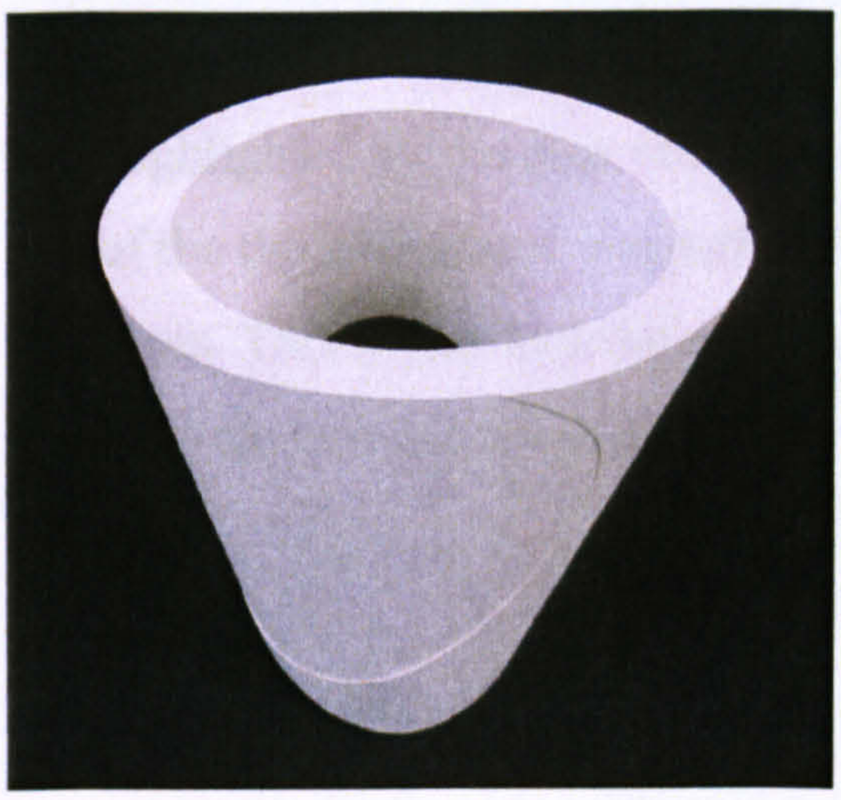


Fig. P3-4a

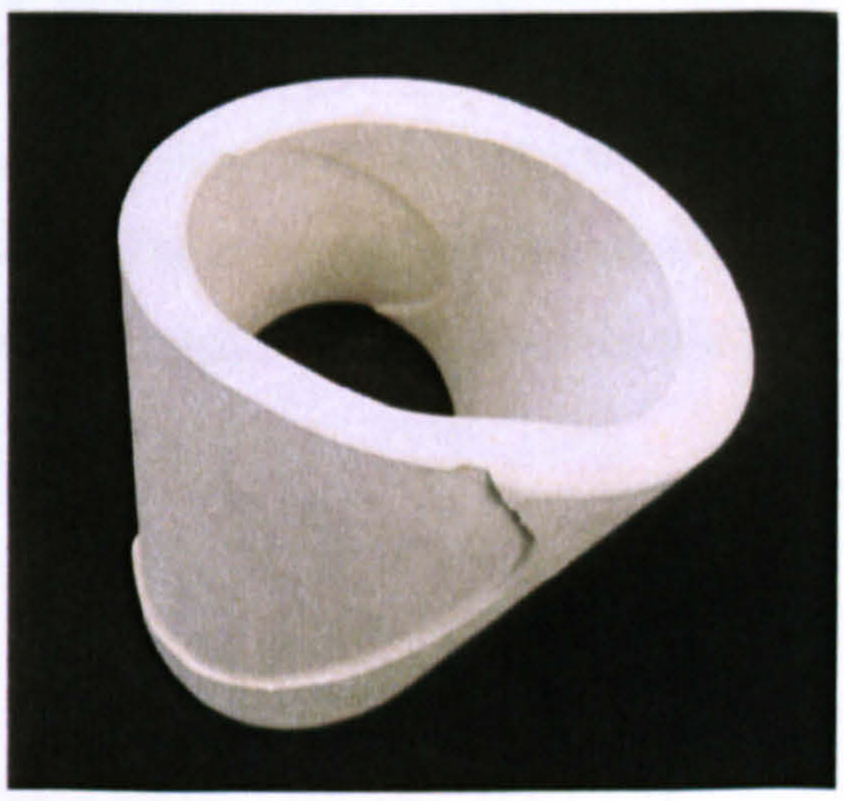


Fig. P3-4b

Fig. P3-4c

Fig. P3-4d

Fig. P3-4a-d built on studies Fig. P3-1a. They showed how cutting the acetate strip's edge around a 2D ellipse before constructing the mould allowed a sinuous elliptical line to guide the eye around the resulting form's geometry. A visual sense of endless flow can be observed, which is similar to the perceived visual continuity in Max Bill's *Endless Ribbon* sculptures and the Möbius strip. (It should however be noted that the latter is geometrically distinct from an ellipse because by its nature amongst other characteristics it has no edges or boundaries). The use of

formers in the mould meant the line was not cast on the top and bottom of the form. Therefore, the studies rely on an implied transition from the interior to exterior. This underlines the significance of the geometry of the edge, whereby the transition between interior and exterior is crucial.

Consequently, several further studies were cast and their edges carved using three approaches, each profile is explained diagrammatically in Fig. P3-5. The first brought the edge to a point in an inverted V form, drawing a line at its pinnacle. The second was intended to be a perfectly semi-circular edge. However my attempts produced a far from accurate semi-circular profile, which undermined the precision of the cylinder's elliptical form. The vague drawing I achieved was highlighted by the play of light where the surface plane passed from interior to exterior. The last of the three solutions was technically more forgiving and involved chamfering the corners of the edges. This meant that the exterior surface gently curved round to become the interior with no easily discernable transition.

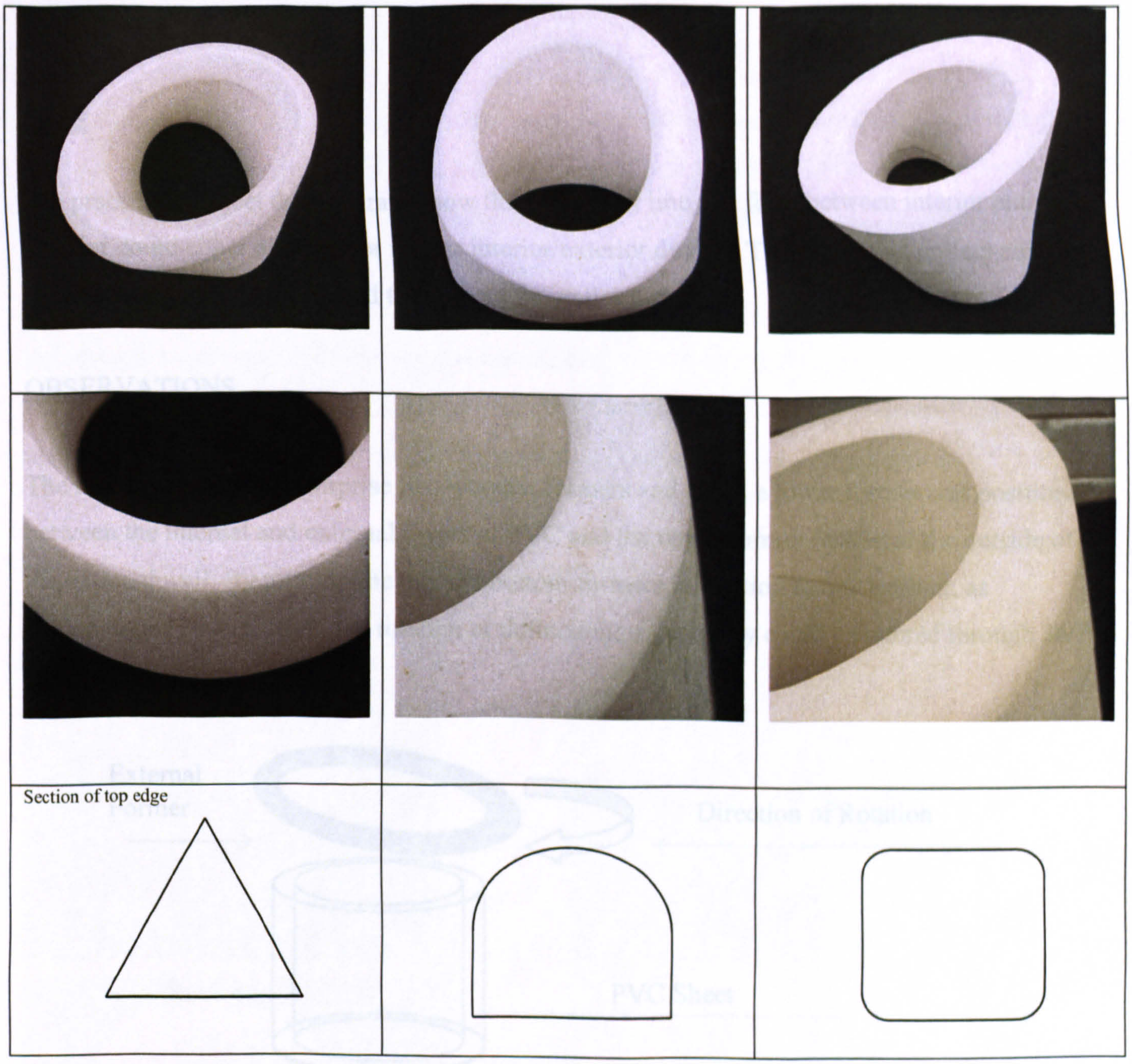


Fig. P3-4

CONCLUSIONS TO PROJECT 3

This project demonstrated how the PVC sheeting in the mould could be shaped in order to control the line its edge cast onto the surface of the studies. The most successful approach involved using a curving elliptical line that appears to flow continuously around the form; however, because it was an incomplete loop it required perceptual closure by the observer. It also showed how the geometry of the edge can create continuity between interior and exterior, or at least a sense of ambiguity between the two states.

PROJECT 4

AIMS

The preceding project demonstrated how the passage of line and form between interior and exterior could either augment or reduce interior/exterior duality. Therefore, this project aimed to unite line and plane as it moved throughout the entire form.

OBSERVATIONS

The moulds evolved to comprise two wooden formers and PVC; a lower former was positioned between the internal and external layers of PVC and the upper former restricted the outside of the external wall. By rotating the top and bottom formers in relation to one another, as demonstrated by Fig. P4-1, the rotation or deflection of geometry could be altered through 360°.

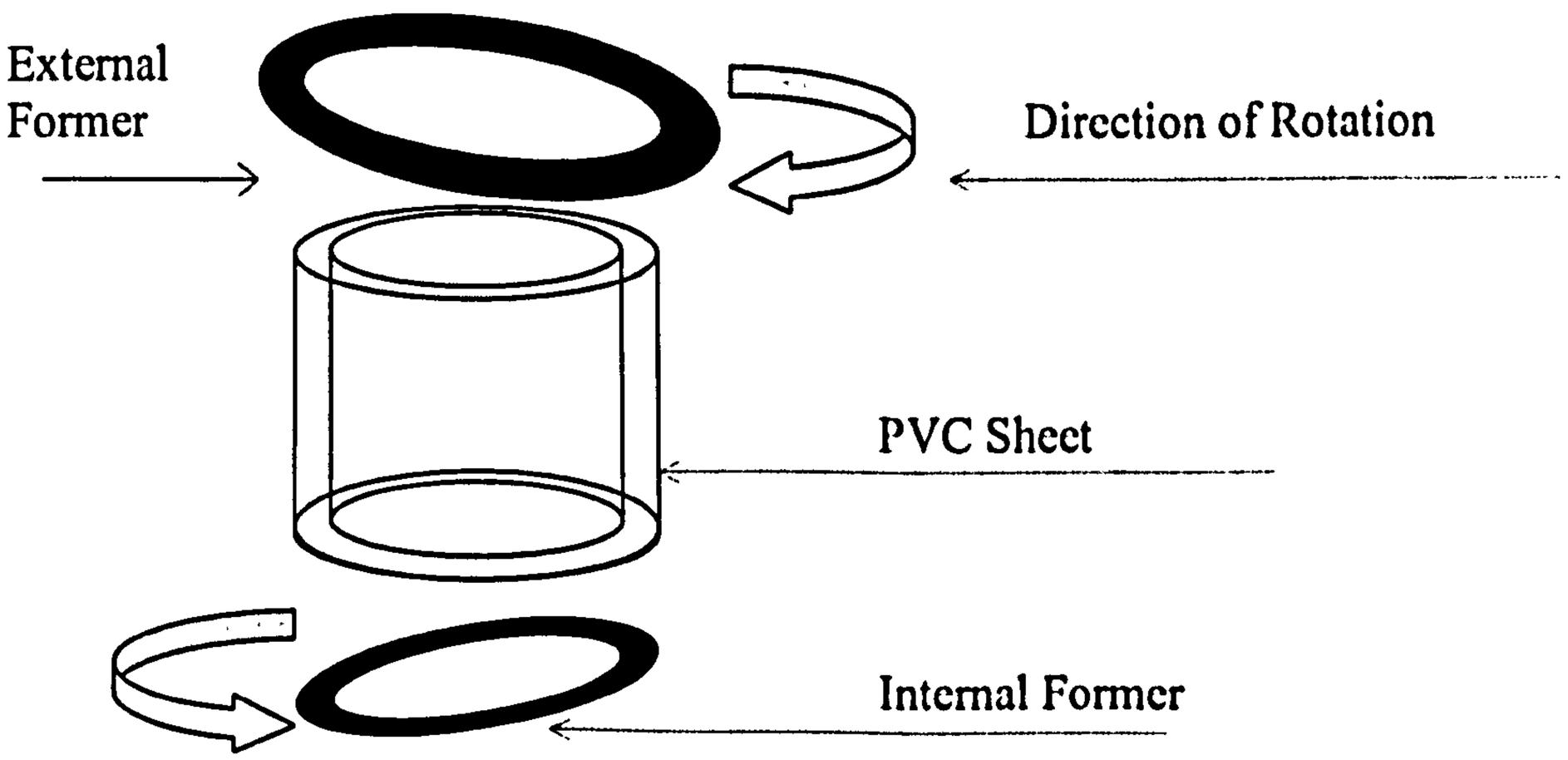


Fig. P4-1

I had also begun to use drawing to explore how much variation was possible before a form could no longer be described as having singular qualities. These drawings are illustrated in Appendices 1A-D. They include the rotation of two identical shapes, one fixed, the other rotated directly above, from a few degrees through to the perpendicular. This allowed me to investigate variations in the degree of torque as though I were manipulating the formers of the mould. I also produced prints by rotating a board pierced with nails over the printing plate; the repetitive process coiled lines into shapes whose precise geometry is somewhat ambiguous because their external contours are off centre, which also involves a deflection of geometry (Appendices 2a-b).

RESULTS

As previously mentioned, moving the passage of the contour line between interior and exterior had become of increasing importance. Initially a spiralling contour line was cast onto the interior and exterior of a study, and then experiments followed to join them into one continuous line. The first involved incising the top and bottom edge with a line that replicates the cast line; any judgement about this technique was compromised by technical difficulties, so it was therefore abandoned. I consequently followed a more subtle approach in Fig. P4-2, by carving an apex in the top and bottom edge where the two lines would cross if they were continuous. It showed some potential in creating a transition form interior to exterior through implication.

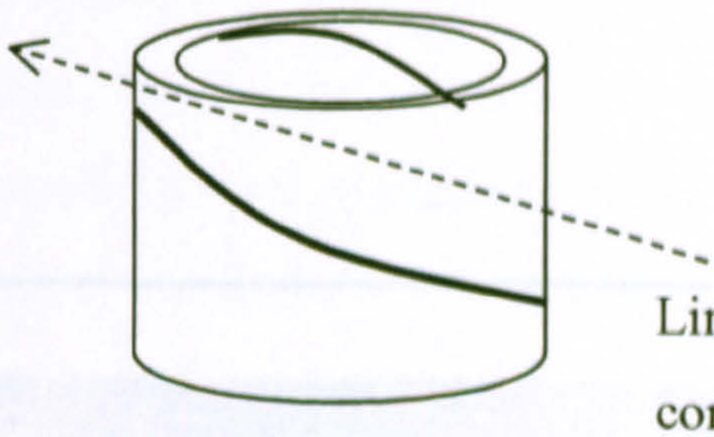
Fig. P4-2

Fig. P4-2a

Fig. P4-2 b

Implied continuity between interior and exterior was a particularly successful method when the top edge was slightly inclined to the horizontal; the latter drew the eye up from the lower top edge to the top and then into the interior. See Fig. P4-3.

Fig. P4-3



An interesting development arose during the mould construction for study Fig. P4-3; by twisting and pushing down the external upper former, any rotation in the form would occur over a half of the cylinder's height, above the upper former the mould began to narrow and close, stretching to produce elongated ellipses. This was another example of deflection of geometry, as shown in the views from above, photos Fig. P4-3a/b.

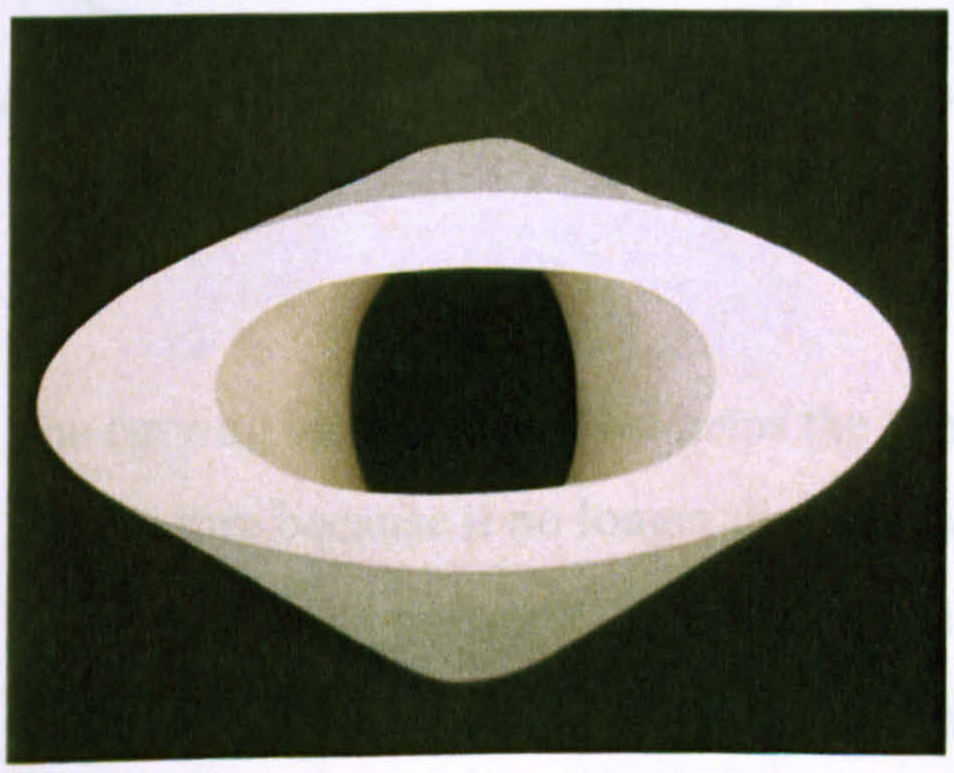


Fig. P4-3a

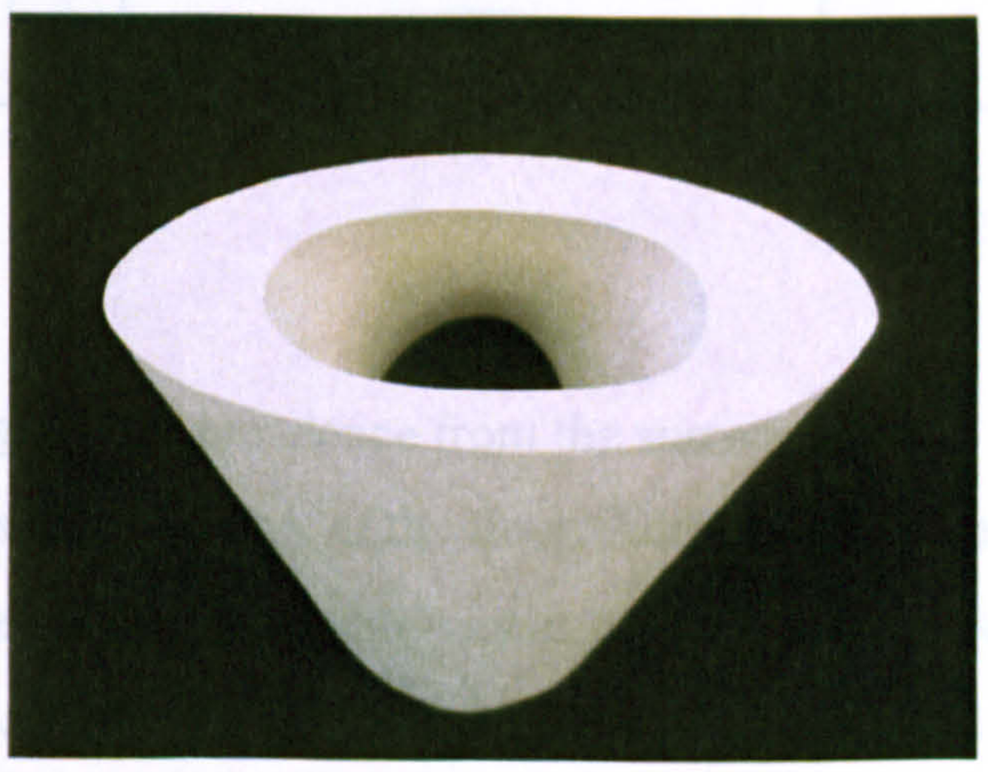


Fig. P4-3b

Shaping the top edge after casting prompted an analysis of the relationship between each form and the ground. Any form sitting flush with the floor obviously has a flat planar base and therefore a 'cut', albeit a hidden one, much like the sheared forms present in some of Brancusi's sculptures, alludes to construction from parts and therefore relational composition. The bases of two further studies (Fig. P4-4a/b) were carved with two opposite approaches. One concave, meaning it would rest on its apex, visibly curving away from the ground at both ends, and able to

rock. The second involved a convex curve so that it was more stable at its ends. While both had two contact points with the ground, the first method appeared to minimise the effects of gravity, and give it autonomy and weightlessness.

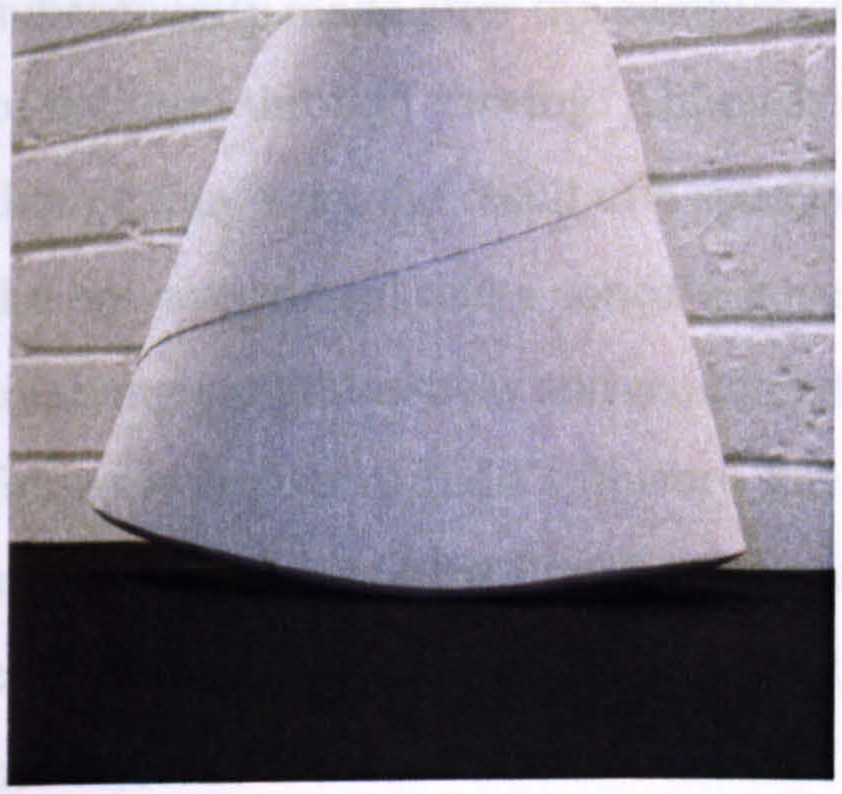


Fig. P4-4a

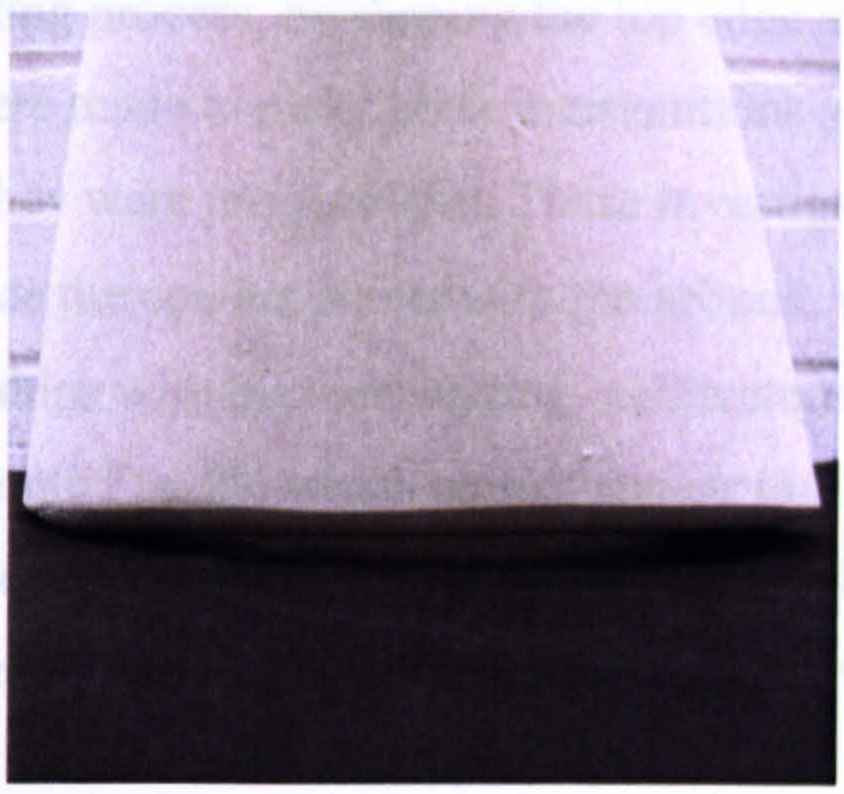
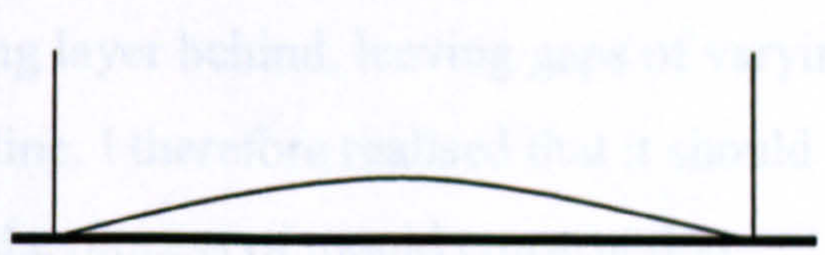


Fig. P4-4b



The curving base of Fig. P4-4 helps the form suggest independence from the surrounding architecture because it no longer directly follows the geometry of the floor. Additionally, lines no longer project outwards from the form's lower edge in direct alignment with the ceiling etc. This makes the form more 'specific' and less relational. Clearly, this autonomy is not evident in the orthogonal geometries favoured by Judd because lines visually extend from them, thereby establishing complementary relationships with the floor, walls, and ceiling.

CONCLUSIONS TO PROJECT 4

This project aimed to unite line and plane as it moved throughout the entire form and revealed that aligning an 'overlapped' contour line with a top edge that is subtly deflected from the horizontal is a strong unitary option. It gives the impression of a single line that continually circumnavigates the form, as in Fig. P4-3. The shortfall of this project was the interventions subsequently made after the completion of the casting process, by shaping the top edge and base of the form through carving. Although attempts were made to make these interventions seem as though they were the result of a specific process, they were unsuccessful. These investigations did however reveal that a concave base could reduce the contact points with the ground, thereby implying weightlessness and reducing the relationships with the surrounding architecture. The former is similar to Judd's illusory stacks, for example Fig. 22, which almost appear to float in space, in contrast to his floor bound sculptures. The potential advantages of minimising the complementary relationships between the base of each study and the floor were further explored in Project 6.

Whilst constructing the mould for study Fig. P4-3, I observed that where its curvature was acute, one layer of acetate peeled away from the supporting layer behind, leaving gaps of varying thickness that were reproduced in the cast contour line. I therefore realised that it should be possible to control the thickness of the line during the process of mould construction.

PROJECT 5

AIMS

The previous project suggested that the dimensions of the cast line could be varied to create a unity between interior and exterior. The aim here is to explore this in more detail.

METHOD

Using three studies with a similar form, the contour line was amplified beyond the material thickness of the PVC, using draught excluder. 4mm, 8mm, 12mm deep lines were cast, see Fig. P5-1a-c.

RESULTS

Fig. P5-1

Fig. P5-2

Fig. P5-3

These studies were somewhat problematic within the context of Judd's concept; this is because what was intended to be line relief had become much more pronounced. Rather than functioning as surface detail the thickening of the overlapped line created distinct layers of form between which relationships were evident. Therefore, future investigations were to ensure the line did not project significantly beyond the external surface. Nonetheless, it was interesting that because the line had become an edge more light and shadow was cast onto it, which accentuated planar movement and the effects of deflected geometry.[110] The consequences of this effect on the geometry of the edge would come to the fore in later projects.

The studies Fig. P5-1, P5-2, & P5-3 had 4, 8, and 12mm deep contour lines respectively. They revealed surface qualities resulting from the direction in which the shuttering mould had been wrapped. They confirmed that not only can the direction of the spiralling contour line be altered between interior and exterior surfaces, but also that wrapping the acetate mould clockwise or anticlockwise can transform the line from overhang to shelf (as illustrated below, in section - Fig. P5-4). Varying these qualities in the internal and external sections of the moulds could create complementary or contrasting internal and external geometries. These thick lines did amplify the effects of rotational deflection of geometry.

Fig. P5-4

Complementary geometries

Overhang x2 Shelf x2

Contrasting geometries

Shelf Overhang Overhang Shelf

CONCLUSIONS TO PROJECT 5

Although increasing the thickness of the contour line accentuated implied movement by reflecting more light, it was not successful in terms of the unity of singular form. This was because the thick contour lines created the impression of a form that had been wrapped, or was made up of layers, and therefore constructed from parts. At this stage of the research, the work and ideas of the minimalist Robert Morris became increasingly informative, and particularly those relating to Gestalt psychology. An analysis of the latter and the laws of 'good' form prompted the realisation that geometry, in particular, could help moderate the dilemma posed by Judd's concept; undoubtedly more so than contour line. This enabled me to understand that line needed to be a surface detail, and that the precise geometry and external contours of each study required more in-depth exploration. This realisation gathered pace from Project 8 onwards.

PROJECT 6

AIMS

The previous conclusions suggested a shift away from contour line in favour of changes in geometry. Therefore, this project aimed to investigate the consequences of horizontally orientating cylinders.

RESULTS

One study was cast, Fig. P6-1 with dimensions of 60 x 38 x 38 cm. It was then positioned horizontally so an observer could look directly through it (Fig. P6-1a). This caused a stronger, and, one might say 'specific', relationship between the interior and exterior space, because the connection between the two appears unbroken. Enlarging the dimensions of the mould increased the ratio of interior space relative to the thickness of the cylinder's membrane, reducing the apparent displacement of space by each form.

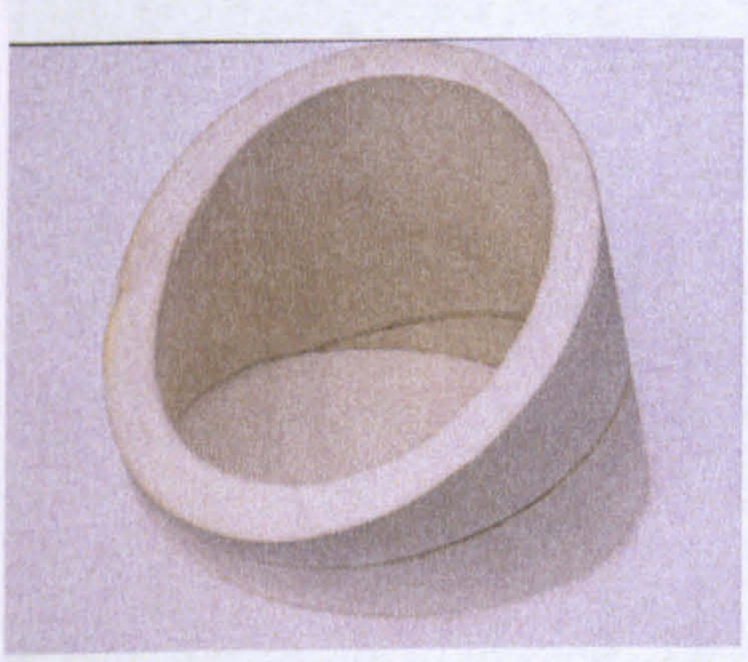


Fig. P6-1

Fig. P6-1a

It was also significant that this study no longer had such a direct relationship with the floor because a lesser proportion of its surface area was in direct contact than had previously occurred. This rendered it somewhat more independent of its context and therefore more specific. Interestingly, this study's altered relationship with the floor also induced a much more dynamic relationship between its form and the surrounding space. No longer did it appear to displace space because of a perpendicular union between form and the ground, instead the manner in which its exterior surface curves away from the ground appears to compress and accelerate the momentum of the surrounding space. This perception of dynamism seemed to introduce an

element of variation that in retrospect had been missing from earlier studies. It was therefore an approach that was fully adopted from Project 8 onwards.

Overall, the process of casting this study was far more rewarding than the intended result. The mould was left empty for a day before being filled, giving me time to observe that the interior space remained visible through the transparent PVC mould Fig. P6-2, as seen overleaf. This was to be a pivotal point in the development of the research.

Fig. P6-2

After casting, the opacity of the plaster removed the possibility of looking through the mass of the form. The transparent mould suggested considerable potential, its cast far less so; therefore, an investigation of transparency and transparent material seemed appropriate. (This development is another pertinent example of the unexpected X-factor contributing to the course of the research). Immediately prior to this period of the research, I had begun to explore ways of coiling continuous lines into singular forms using light.[111] This involved light boxes illuminating

x-rays taken of plaster sculptures that were cast around coiled metal armatures (detailed in Appendix 3). My specific intention was to use x-rays to '*look through*' the plaster form and expose its internal linear structure. I also made drawings by taking long exposure photographs in the dark of myself swinging/lassoing a light bulb on a long flex. The resulting light drawings had structural transparency and the lines diffused into translucency, see appendix 4a-b. Both methods of drawing anticipated the need to investigate transparency and translucency.

CONCLUSIONS TO PROJECT 6

Though significant, the conclusions of this project were not those that were anticipated. All the previous studies had been based on opaque materials, yet the unexpected and highly significant outcome suggested that transparency and translucency could provide an alternative approach to the dilemma posed by Judd's concept.

Therefore, this project marked the end of stage one of the studio investigations and introduced stage two, in which the potential of translucent materials to affect illusory deflections of geometry was investigated.

STUDIO INVESTIGATIONS - STAGE 2

Stage two of the Studio Investigations marked a transition from the exploration of opaque to translucent materials. With this change came the intention to explore the illusory qualities of these materials and how they could be accentuated through the geometry of a form.

PROJECT 7

AIMS

This study began to investigate the consequences of transparency and translucency and how it could be used to create greater unity between interior and exterior.

RESULTS

The first two studies were cast in clear resin, Fig. P7-1 after their removal from the mould the potential of transparency to reduce the duality of form and space was confirmed because the mass of the form took on spatial qualities. The latter were enhanced by the perception of light being held within the form, and the way in which light is transposed from interior to exterior.

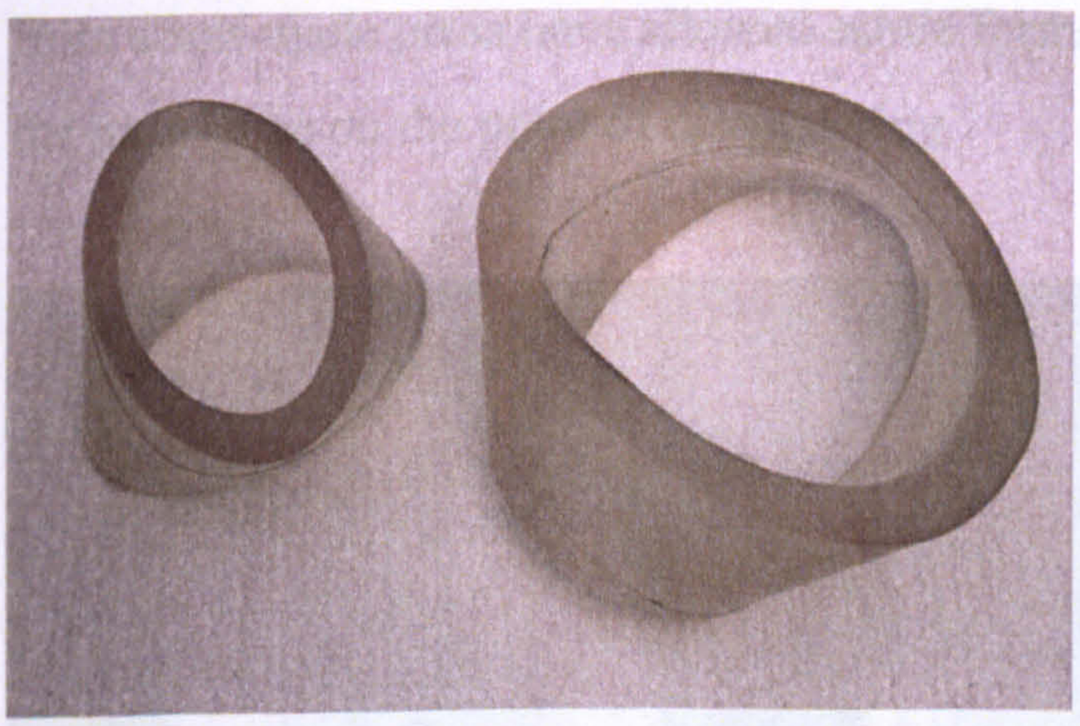


Fig. P7-1

It appeared as though a significant breakthrough had been made. Not only could the overlapped contour line be followed from interior to exterior with the eye focussed on the surface, one could actually look through the form to unite the passage of the contour line internally and externally. Interior space could also be observed, or at least sensed more acutely, directly through the entire

thickness of the cylinder's membrane. The clear resin studies obviously responded to light in a different way to plaster and any subtle variations in the thickness of the membrane were revealed through varying tones and saturations of light, an event that simply could not occur in a plaster form. Transparency also affected the appearance of edges and planes. The cross section of the plane now appeared to have a very different appearance to the actual plane: At the extremities of the edge, the mass is almost transparent due to its relative thinness, and then moving inwards it becomes denser and almost opaque. The possibility that the unity of singular sculptural form might be enhanced through materials with similar physical properties as space was particularly exciting.[112] Overall, this new material suggested further possibilities such as:

- Embedding line into form.
- Simultaneously drawing in space and within form.
- Using transparency and translucency to create the illusion of deflected geometry.

In order to expand the notion of the ephemeral and de-materialised object I began to use blind emboss prints, which are displayed in Appendix 5. This involved exploring variations of the figure of eight derivative shape through subtle deflections to its geometry. Creating blind emboss prints is similar to the casting process because a former or plate, (this might be considered the mould) is used repetitively to stamp a 'cast'. It articulates form through the light and shadow created by low relief rather than ink, and is therefore closer to sculpture. Embossed prints mimic the resin forms' ability to capture and hold light, particularly at the edges. Variations in pressure from a self-made press have allowed subtle forms to be embossed, which appear to emerge from the page or be on the point of disappearing.

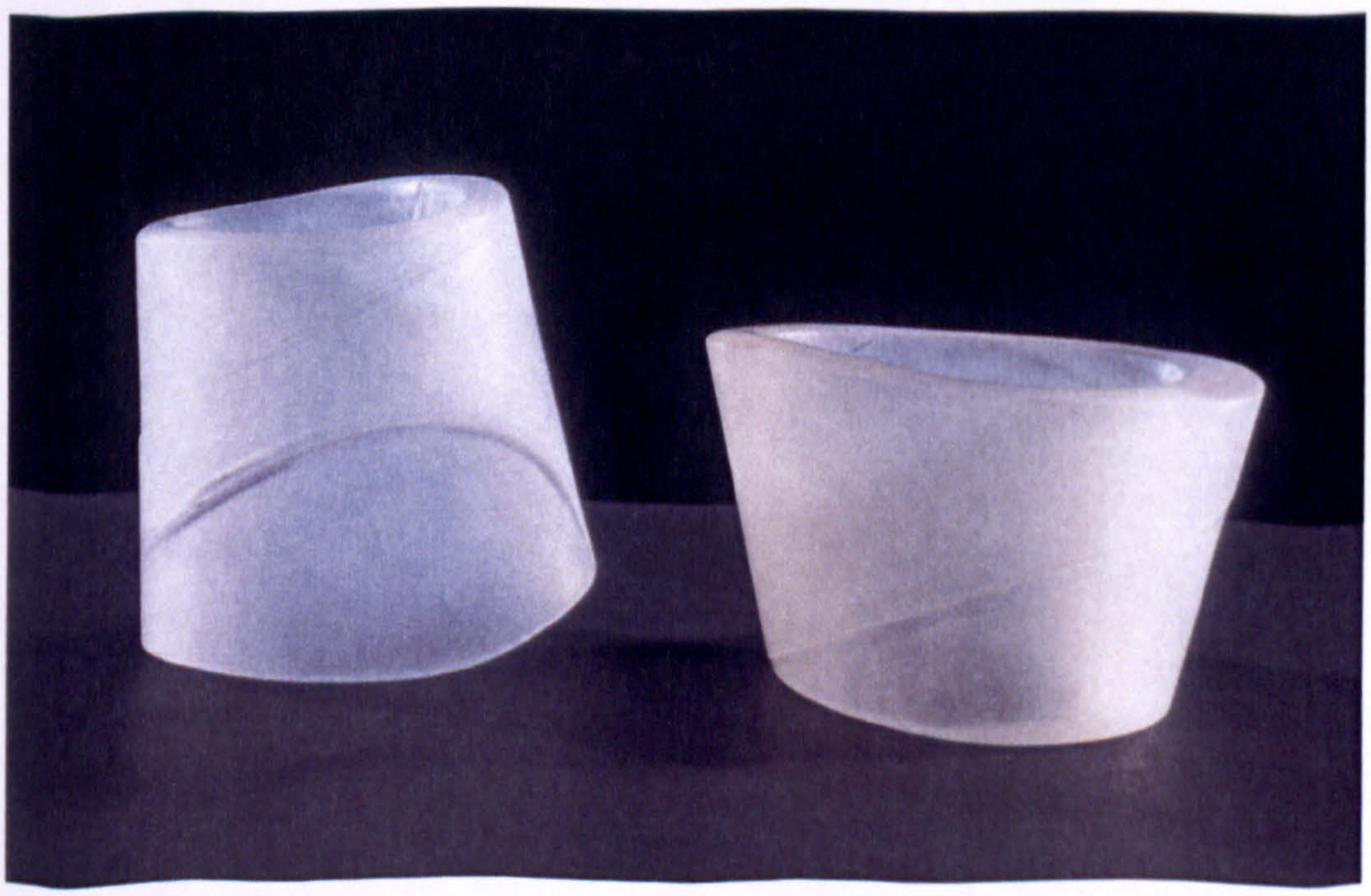


Fig. P7-2

Each of the two resin studies, Fig P7-2, had translucent tubing embedded into them during the casting process. However, the geometry of the line is somewhat arbitrary and not integral to the casting process. In addition to generating relationships, the embedding of the line made the study less 'specific'.

CONCLUSIONS TO PROJECT SEVEN

These small-scale studies showed translucency had some potential to unify form and space by reducing their duality. In addition, the material responded to light in a completely different way to plaster and demonstrated a potential to imply variance in singular forms through illusion. It dramatically changed the way the geometry of the edge was perceived, to the extent that the cross section of the plane had a very different appearance to the actual plane. As the thickness of the material diminishes towards the edge the density of light captured and diffusing changes accordingly. In some ways translucency appeared to make the forms more specific because nothing is hidden within mass and changes in geometry are literally highlighted by the perception of an internal light source. The latter suggests the potential to develop illusory deflections to geometry and that it was therefore essential to pursue these investigations.

PROJECT 8

AIMS

This aim of this project was to demonstrate the effects of illusory deflections on a broader range of elliptical and circular geometries. It also considered to what extent geometry can be deflected before a form loses its singularity. The project consisted of the following four studies:

Study 1. Test rotational deflection of geometry on a conical cylinder.

Study 2. Evaluate the potential of horizontal orientation to reduce spatial displacement.

Study 3. Increase rotational variance by manipulating the position of the formers during mould construction.

Study 4. Examine the potential for implied variance in a 'figure of eight' derivative.

METHOD

The four studies were cast into moulds constructed with two internal formers between the walls. This meant that any arbitrary variations in the geometry of the cylinder's wall were eliminated, Fig. P8-0. Conversely, it provided an opportunity to accurately define and vary the thickness of the membrane as required. The closure of the new moulds with tape also served to seal the clear resin from any contamination.

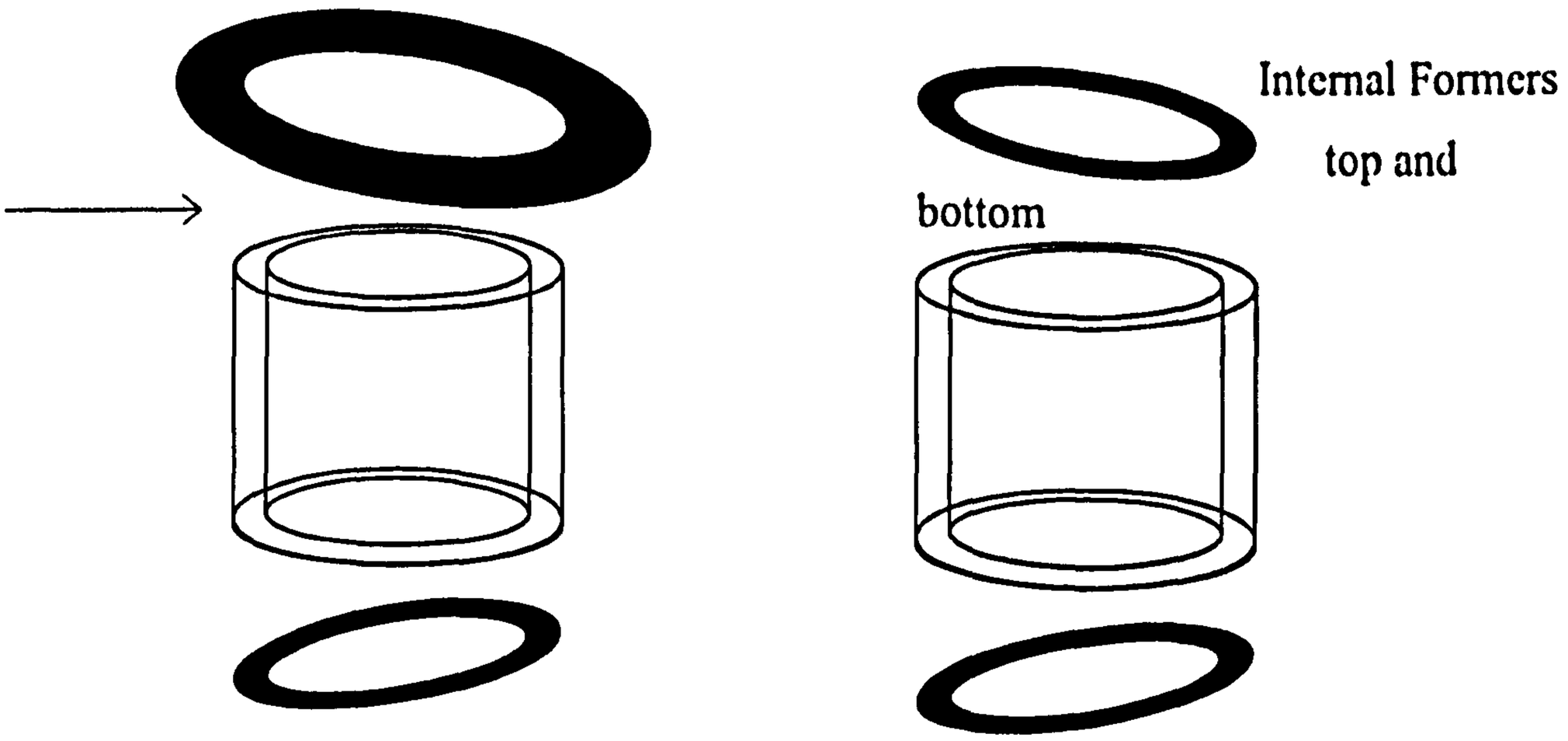


Fig. P8-0

RESULTS

Study 1

The first study to be cast was an elliptical cylindrical cone sized 58 x 32 x 82 cm; its geometry was selected because it terminates at a point, and might therefore be considered 'specific'. The sides converge towards an apex or point; therefore, the apparent removal of the apex in this study suggests a missing part. Yet, opening the form was beneficial because it made it possible to look into the interior and see the quality of light inside and the 'glowing' within the resin. The form is materially consistent, but nonetheless demonstrates a rich variety of visual qualities according to the light falling on it. Its response to light makes it simultaneously explicit and ambiguous, marking this as the first study where two seemingly contradictory qualities occur in a single form. It is therefore the first example of what I describe as the accommodation of 'perceived paradox'. This study also suggests that the variations in visual qualities could be exploited through the thickness of the sculpture's mass. Its downfall, if it has one, is the extremity of the deflected geometry, caused by the perpendicular opposition of its openings, and the non-parallel relationship between them.

Fig. P8-1

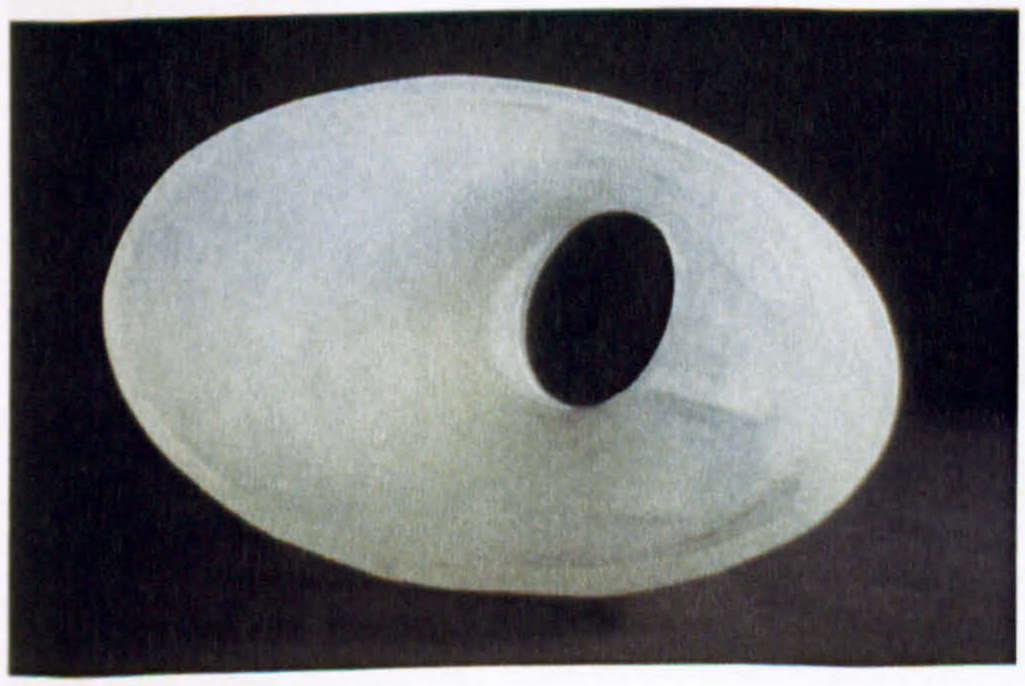


Fig. P8-1a

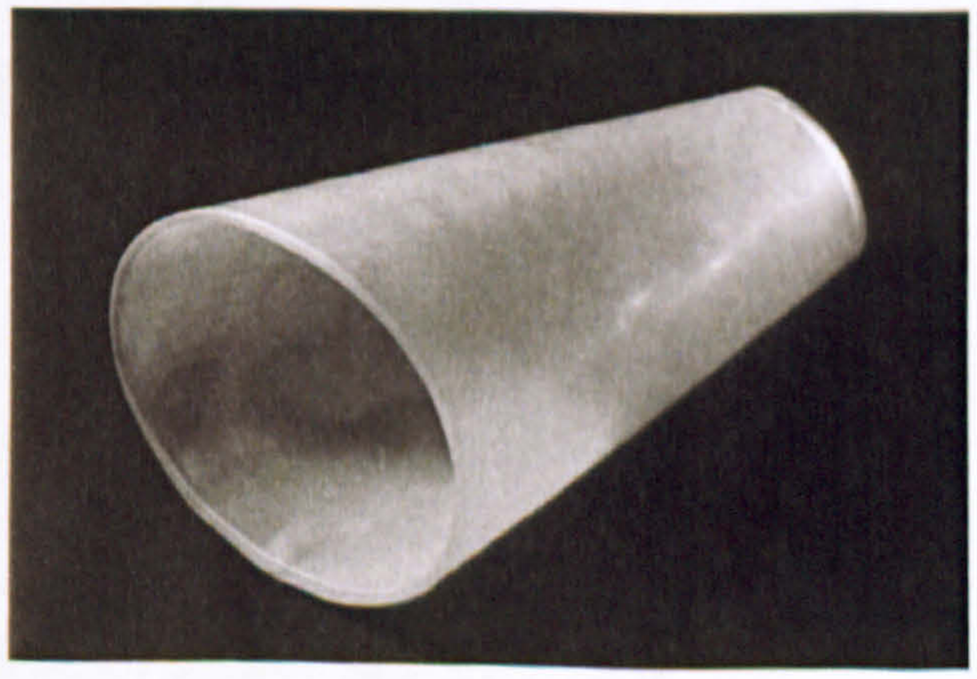


Fig. P8-1b

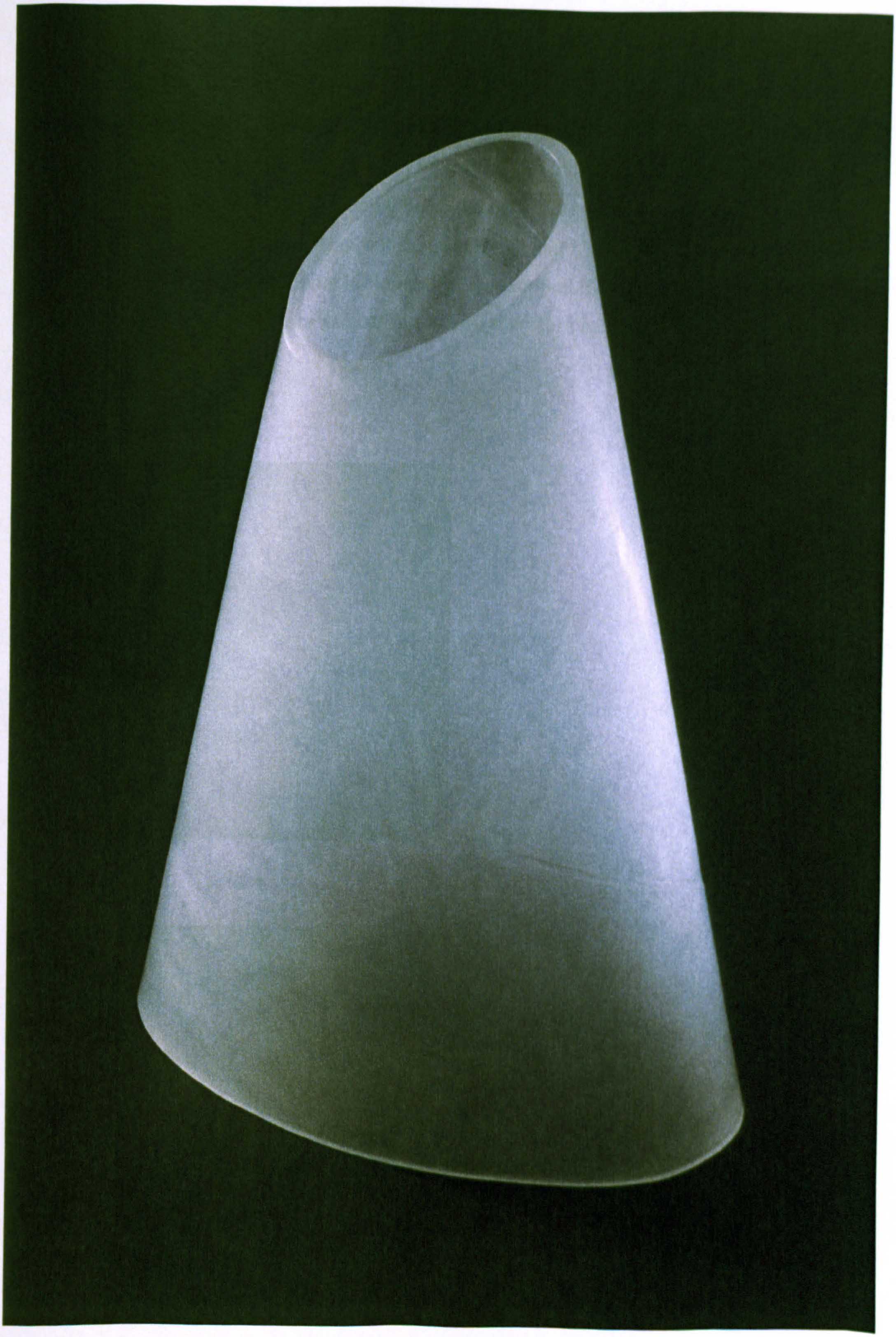


Fig. P8-1c

Study 2

The intention of this study was to assess horizontal orientation in a translucent form, and it therefore marks an important and final shift away from the domination of the vertical axis towards the horizontal; as first suggested in Project 6. The latter enables space to flow through the form, whereas previously one opening had been on a flat surface, which effectively created the impression of a closed form. This was assisted by its slightly larger dimensions of 52 x 34 x 44 cm. Placing the curving cylinder horizontally also stopped the form having a direct and consistent relationship with floor and ceiling, which therefore made the study less relational and more specific.

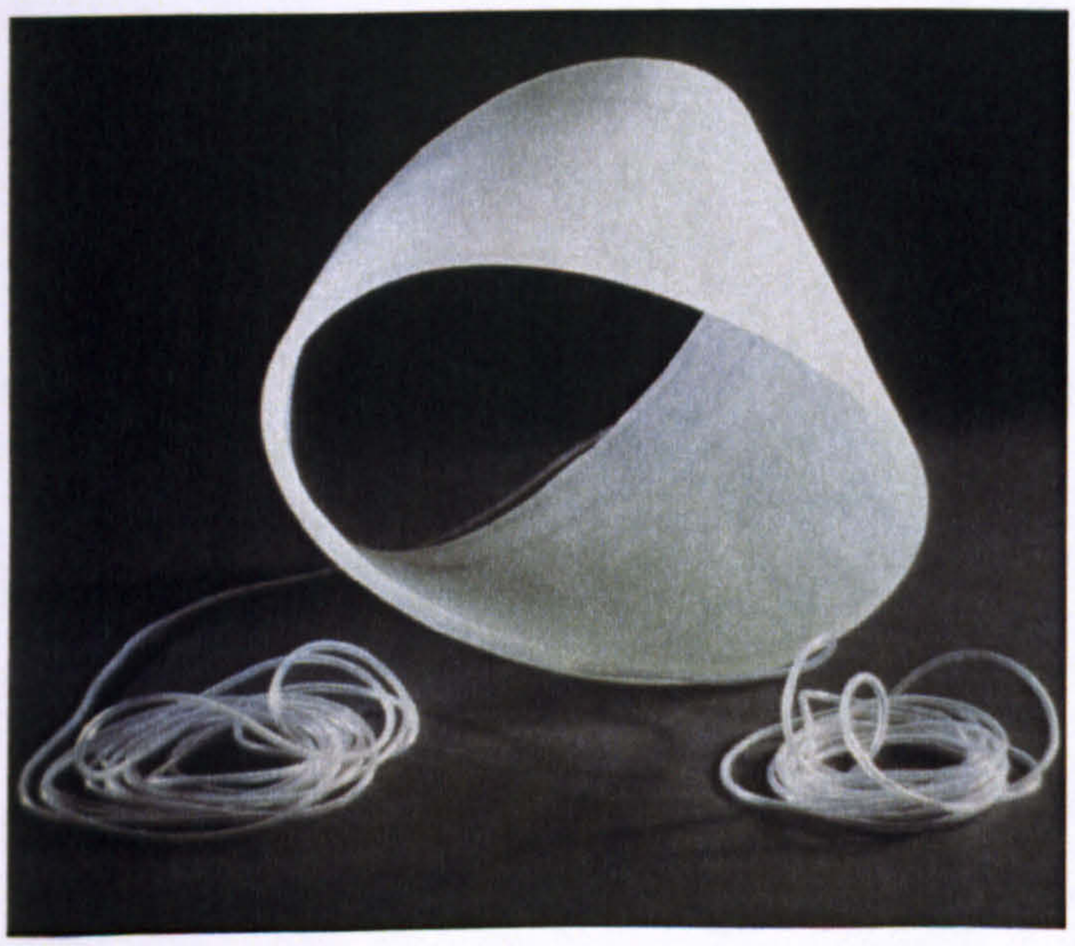


Fig. P8-2

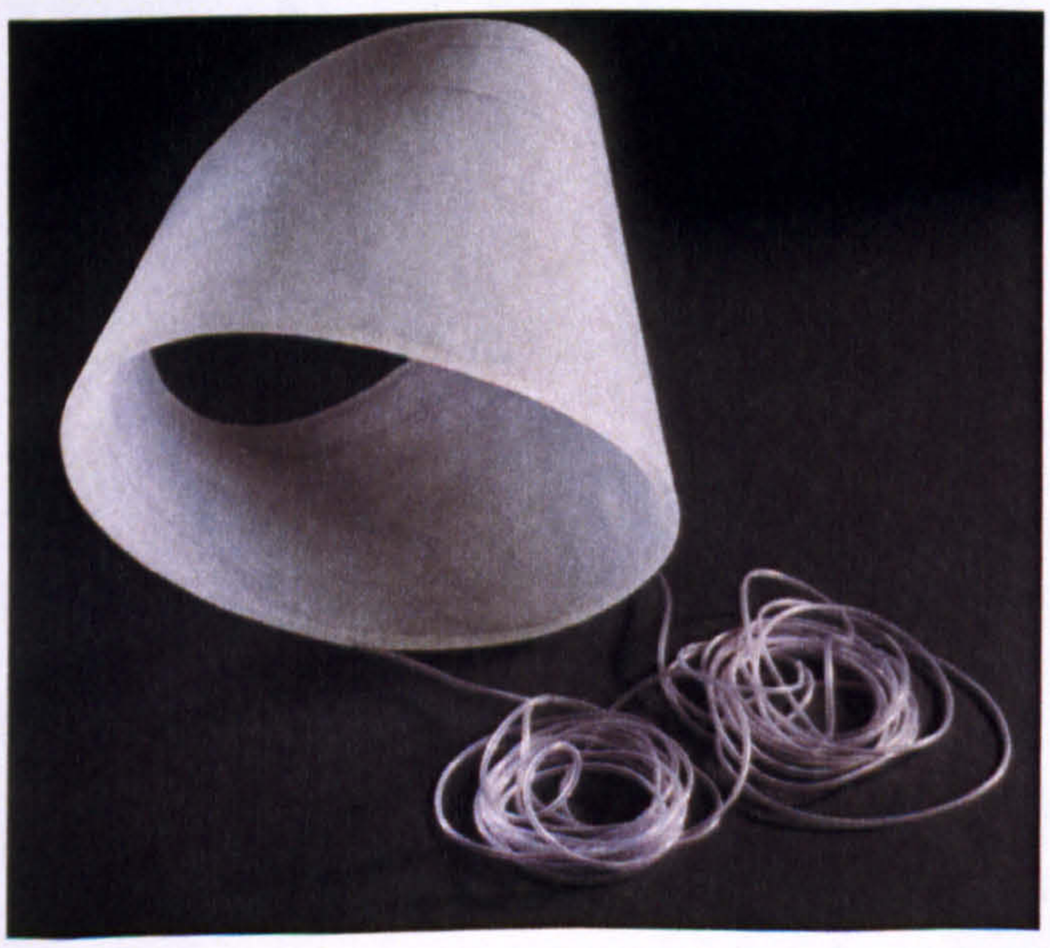


Fig. P8-2a

The second study involved a cylindrical ellipse with contour line that is embedded clear plastic tubing. During casting the layers of coiled tubing floated in the liquid resin, therefore the relationship between line and form became somewhat arbitrary. Moreover, the act of embedding introduced an additional element into the resin that was not integral. It was an unnecessary addition and not part of the simple mould making and casting process. Therefore, it was eliminated from the research; an outcome that underlines how important process had become, and the connection between process, specificity and the precise definition of form.

Study 3

The intention of the third study was to increase the effect of rotational geometry in an elliptical cylinder by manipulating the height of the formers during mould construction. The resulting study Fig. P8-3a, 44 x 38 x 48cm, was more geometrically complex than its predecessors. The orientation of the top and bottom ellipses causes a strong contrast, which explores whether the form is coherent as a singular entity. This is exacerbated by the distortion to the lower ellipse that was caused by twisting and pushing down an external former during mould construction, a technique discovered in making study Fig. P4-3. This had the effect of narrowing the mould and stretching its base to produce an elongated rather than elliptical shape. The elongated shape, in contrast to the ellipse was perceptually and structurally weak because it was no longer recognisable as a geometrical shape. This underlined the necessity of precisely articulating elliptical geometry and the need to deflect it in such a way that the resulting shape or form remains visibly derived from the ellipse.

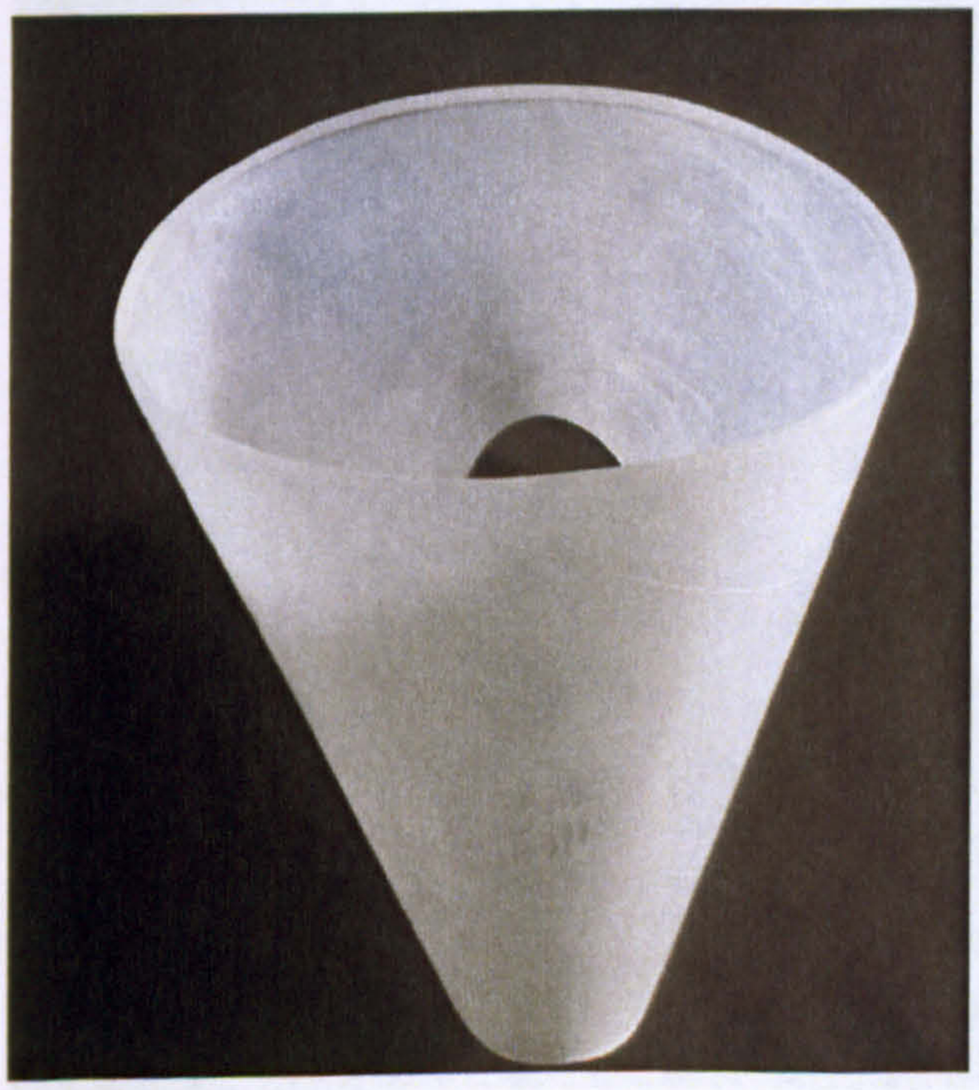


Fig. P8-3

Fig. P8-3a

It is noteworthy that because the exterior surface did not cure properly, the remaining sticky residue had to be scraped away, which at the same time removed much of the overlapped contour line. This enabled me to understand that the line was perhaps an unnecessary and relational surface detail, if not one that was distinctly at odds with Judd's concept. Consequently, I decided to eliminate contour line from the research.

Study 4

Study Fig. P8-4, deliberately explored geometry similar to that of the *figure of eight*[113], a shape suggested by the distorted 'pinched' lower aperture of the previous form. This form has a strong unified contour that appears to result from the union of two circular cylinders. Consequently, it suggests the completeness associated with a Gestalt good form, yet, at the same time appears somewhat ambiguous by implying division.

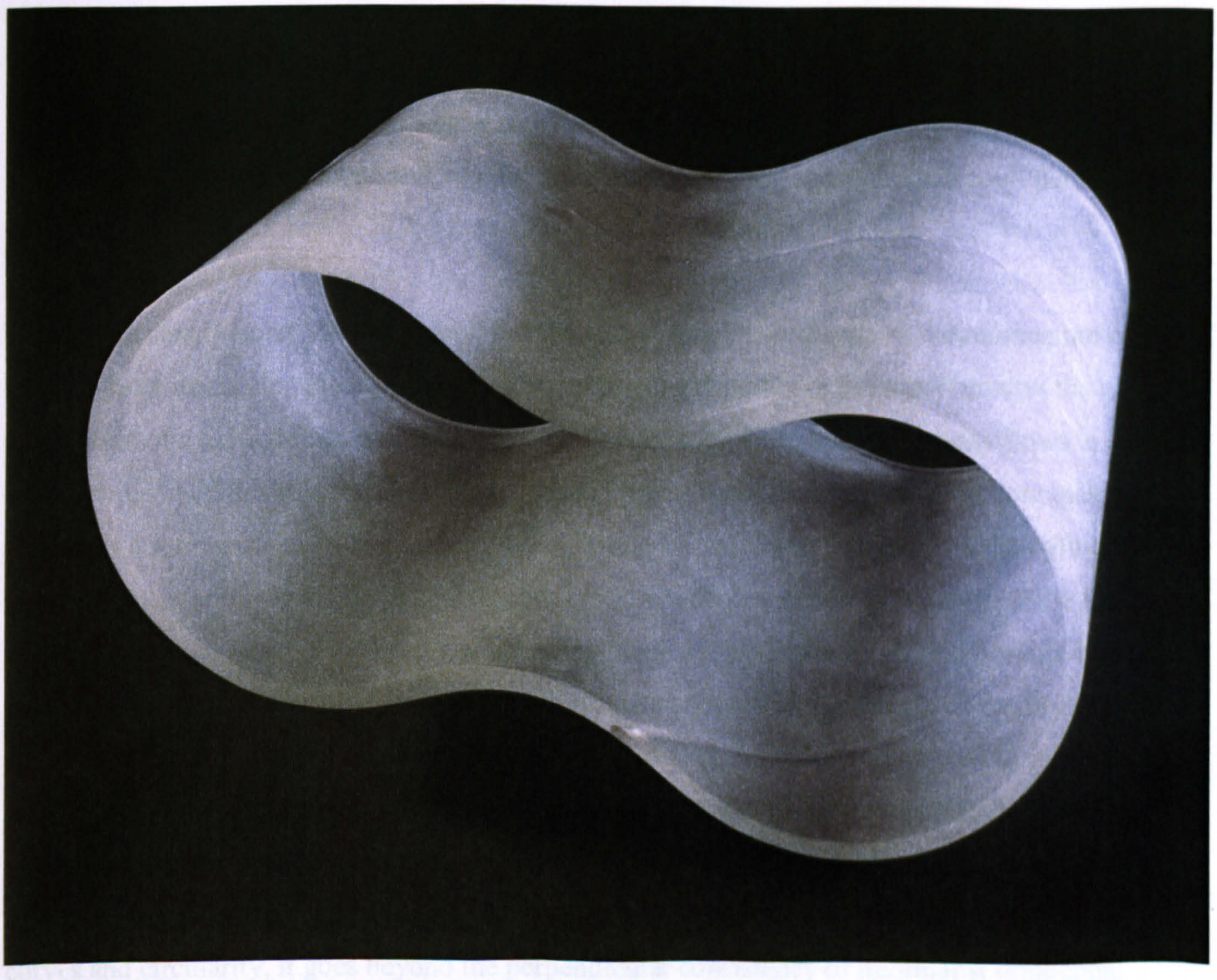


Fig. P8-4

This study is sized 44 x 34 x 24 cm. Its form is particularly susceptible to the deflection of geometry because it can be derived from two circles, (which can be considered topologically equivalent to a double torus) two ellipses, or a circle and ellipse, each of which can have different dimensions. The final combination of a circle and ellipse would result in an irregular figure of eight. As previously described, the ellipse is predisposed to transformation in its

geometry because for example its height and length can be altered, as can the position of the intersection of its axes. Therefore, it does not have the same prescriptive geometry as a square.

This 'figure of eight' derivative has 'good' form because the geometry of the two circular sections is symmetrical and of consistent curvature, and this consistency is further enhanced by the circular section, which is then transcribed back onto itself to complete the perimeter of the shape and the concave central channel in a cylindrical format. This combination of concave and convex has particularly encouraging consequences; this is because it creates a contrast between open and closed, or expansion and contraction. The form can be both open and closed from the same viewpoint. This means that one can see through and out of it when looking down the two outside cylinders, whilst at the same time the interior remains opaque and almost closed. Therefore, the figure of eight has a geometry that allows two opposite characteristics to exist within the same form; a second and equally good example of the accommodation of 'perceived paradox'.

Whilst it is clearly not a Möbius strip, it has the same sense of continuity in the momentum of either side of its curving planes. This quality is particularly pertinent because it creates the impression of a unified form without beginning or end; something that continually flows in visual terms. Additionally, the endless roundness implies replication and rejuvenation, making this study a form with singular qualities in the process of evolution. The two circular cylinders within its interior imply the latter, and this suggestion of duality positions the form at the limits of Judd's concept. The only caveat is whether the sense of splitting is too strong because it is not being contained by the external contour, yet this tension between singularity and duality does create significant visual tension. It is the most successful of the studies completed so far because it suggests a way of countering the dilemma posed by *Specific Object*. It seems well placed to establish unity through the circle and replication, yet simultaneously has variation due to its deflected geometry and the implication of duality. By placing greater emphasis on continuous curves and circularity, it goes beyond the perpendicular consistency of minimalist orthogonal geometries.

Another factor that distinguishes this study is the more subtle deflection of geometry it has undergone; the formers of its moulds were rotated approximately fifteen degrees in relation to one another, which produced a slight torque along its length. Interestingly, this made it impossible for the form to rest on all four corners when laid flat, meaning that at either end one side of the form is raised off the ground and appears to float. This deflection of geometry gives

the form a sense of weightlessness. Henceforth, I abandoned extreme physical deflections of geometry, such as those in study Fig. P8-2, which resulted in a strongly contrasting perpendicular relationship between top and bottom.

Whilst creating study Fig. P8-4 I cast a similar version in bronze, as a maquette for the Jerwood Sculpture prize 2003, Fig. P8-5. The two sculptures enabled a direct comparison between the effects of translucency and opacity on two near identical editions of the same form. By comparing photos of each side-by-side, it is possible to observe how the translucent study appears to capture light internally and glow, while the patinated bronze study absorbs light. These differences are accentuated at the edges of the form; the translucent form's edges are luminous and emphasise the form's geometry, whereas the bronze's surface remain more visually consistent throughout. Although both forms are visibly clear of the ground on two corners, which accentuates the changes in the momentum of the surrounding space, the translucent form appears slightly less prone to the effects of gravity; I believe this is due to its response to light, through which it becomes transient and ethereal, whereas the bronze does not. These effects are naturally accentuated by the colour of the base on which the sculpture rests; were the base of similar tone to the sculptures the illusion of weightlessness might be reduced.

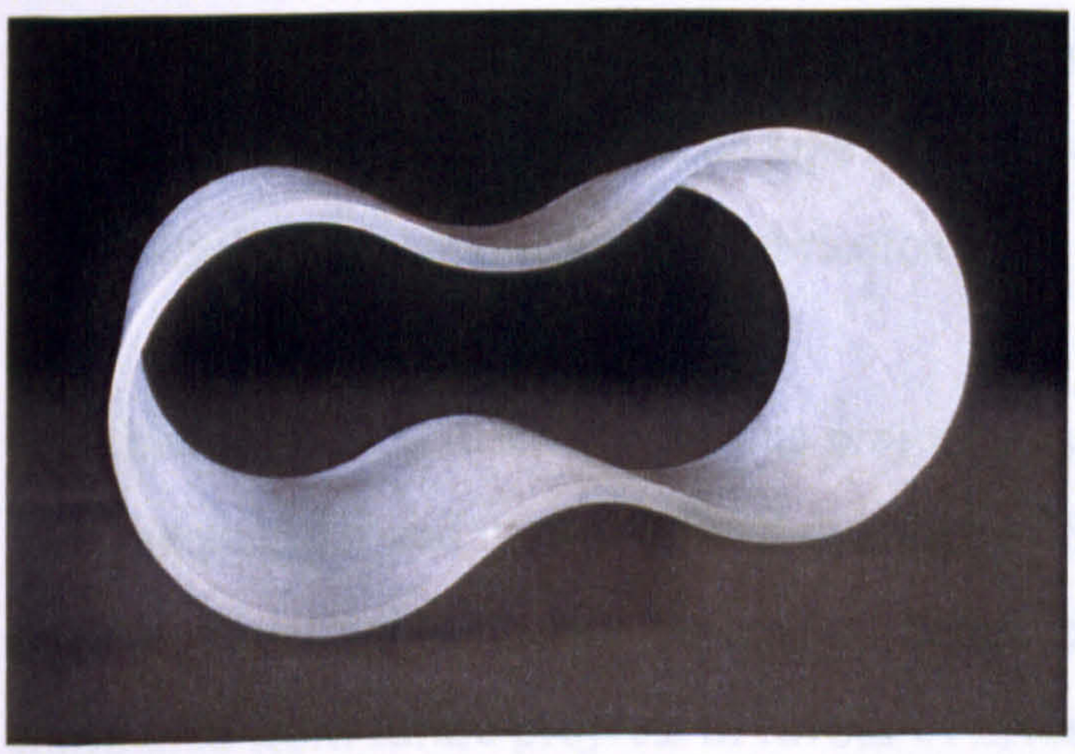


Fig. P8-4a

Fig. P8-5

CONCLUSIONS TO PROJECT 8

These four studies demonstrated that the more geometry is deflected, the greater the likelihood that two forces or divergent qualities appear to simultaneously occur in one form. Perhaps the most successful deflection of geometry is found in study Fig. P8-4, where the degree of rotation is restricted to 10-15 degrees, as opposed to the near perpendicular rotation in the other studies such as Fig. P8-3. This slight deflection is enough to prevent it from resting on all four corners and this, alongside its seeming material weightlessness and the way it captures light, releases it from the effects of gravity. It therefore appears that a subtle deflection of geometry, or what might even be described as a misalignment, is better placed to establish variation and unity in a sculpture that could still be considered a *Specific Object*. This project demonstrated that the geometry of the figure of eight derivative was most definitely worthy of further investigation because of its potential to imply duality.

The slightly increased physical dimensions of these studies, which exceeds the previous maximum of 30cm^3, perhaps locates them at the limits of the scale at which they will specifically function as maquettes, perhaps with the exception of the first conical piece, which is the largest and appears to be neither a coherently scaled study nor full-size sculpture. An example of a successful scale for a maquette is the Jerwood study, Fig. P8-5, which seems sculpturally significant at its currently reduced size of 44 x 34 x 24 cm: A quality that would hopefully be successfully replicated if it were fabricated at its full-scale dimensions of 2.7 x 2.4 x 1.9m.

The final important discovery of this project was that contour line appeared to be inconsistent with the singular and non-relational qualities of *Specific Objects*. The contour lines were merely extraneous parts that establish relational composition. Consequently, line as a surface detail was eliminated from future projects in favour of investigating the potential of edge to indicate contour.

PROJECT 9

AIMS

The general aim of this project was to examine the potential of the figure of eight to imply variance in physical geometry, and particularly that of a duality. It also intended to investigate how the illusory qualities of materials and surface finish can affect physical deflections of geometry involving both complementary and contrasting internal and external geometries. This project consisted of four studies whose individual aims were to:

Study 1. Combine a figure of eight with pigmented resin.

Study 2. Extend the implied duality found in the figure of eight.

Study 3. Build on the oscillation synonymous with the figure of eight within a singular shape.

Study 4. Refine study 3 by reducing actual oscillations to two.

RESULTS

Study 1

The first study is based on the figure of eight, its width being equivalent to the diameter of the implied inner circle. This made it appear too shallow and incomplete. The rotational deflection of geometry was slight, but enough to subtly undermine and destabilise symmetry. The aim was achieved by adding coloured pigments to the resin prior to pouring into the mould, therefore it can be considered integral colour because the eventual study becomes inherently *of* that colour. The introduction of an amber pigment to the resin had a significant and unexpected effect, as can be seen below in Study Fig. P9-1.

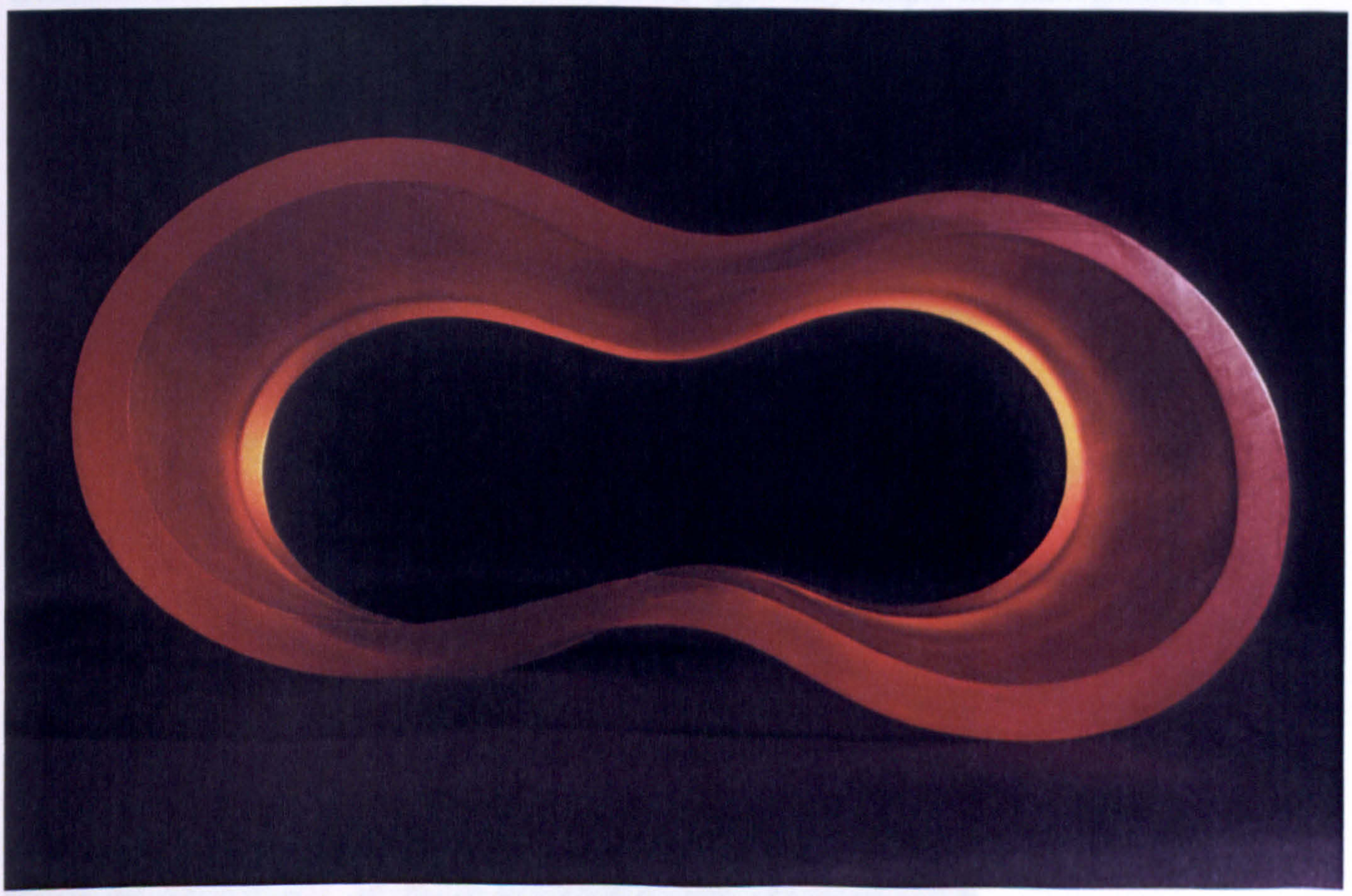


Fig. P9-1

The edge of the form, whether subject to natural or artificial light, becomes pronounced and more effectively describes the circular contour of the study. Now, the edge accurately describes the contour, in what might be described as, a very 'specific' manner; (this effect was also present in the clear translucent studies, but much less pronounced). The addition of a colour has increased the luminescence of the form as the light disperses through its edges; so much so that

the study actually appears to have its own internal light source, a quality that relates to the X-rays which were under lit by light boxes, (see Appendix 3). The quality of light retention and dispersion along the edge underlines the physical deflection of geometry though rotation. This happens because the relative orientation of the top and bottom edges becomes more evident; one appears muted, the other illuminated. Furthermore, the addition of colour appears to have made this study absorb and retain more light throughout its mass than previously observed.

The photograph Fig. P9-1a demonstrates just how visually significant the geometry of the edge has become; one is a luminescent yellowy orange as opposed to the slightly duller and dark orangey red of the actual plane. It reveals how variations in the thickness of the material, both actual and those perceived by the viewer depending on their position, alters the saturation of colour and intensity of light. It is another example of a 'perceived paradox' existing in a singular form. Richness and complexity evolves out of the apparently simple and homogonous, a seemingly contradictory outcome, but evidently a real possibility.

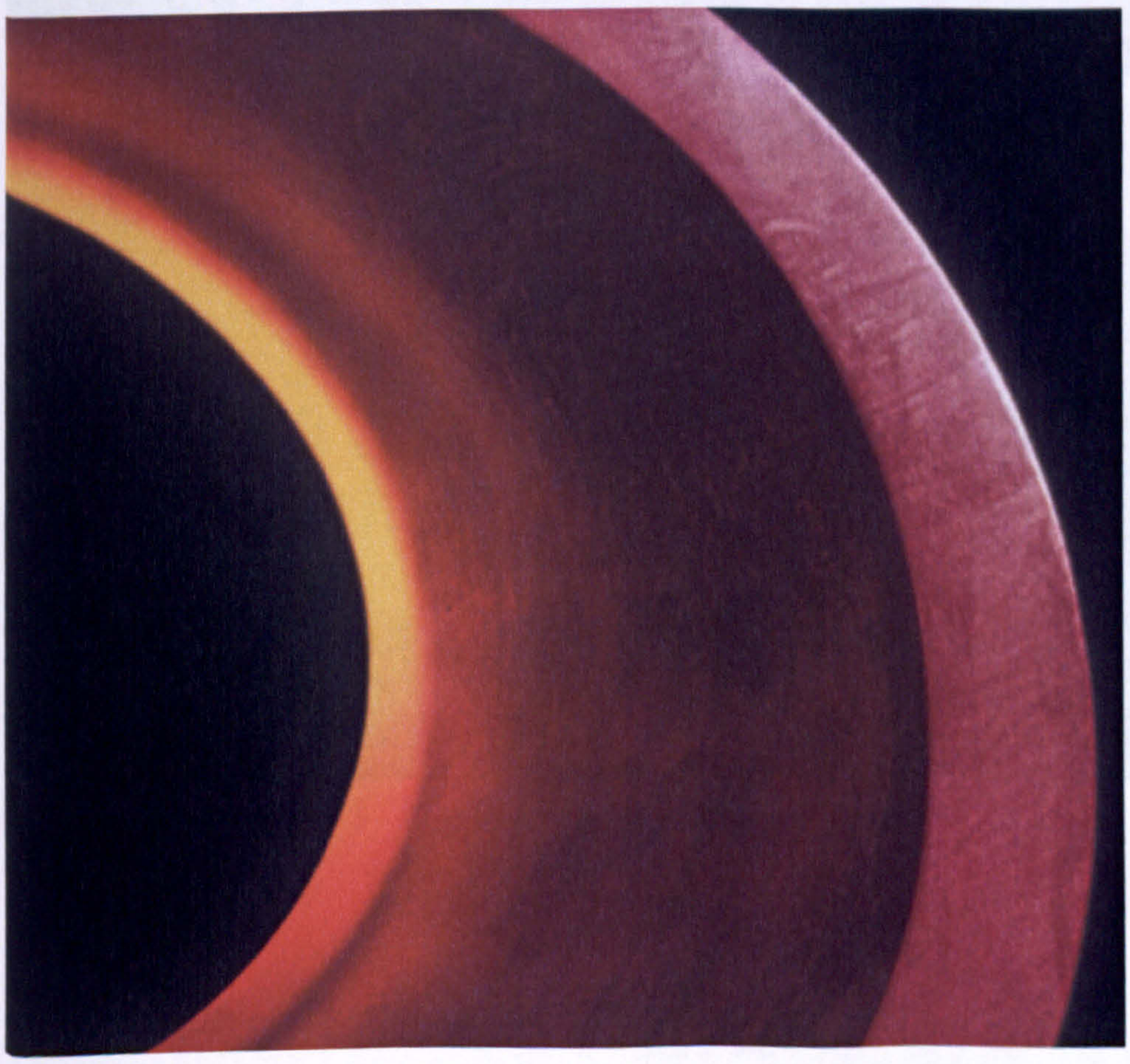


Fig. P9-1a

Study 2

The intention of the second study Fig. P9-2, 44 x 26 x 24cm, was to combine amber pigment with an extension of the figure of eight. The geometry of the form is based on a continuous line oscillating around an ellipse, as shown diagrammatically overleaf in Fig. P9-2b. The underlying visual quality in this study is one of roundness and oscillation because the semi-circle has been used consistently and specifically in the individual elements and the ellipse as an overriding compositional device. However, although the edge rotates around a central ellipse, this is not apparent unless the observer has a simultaneous view of the end and the length.

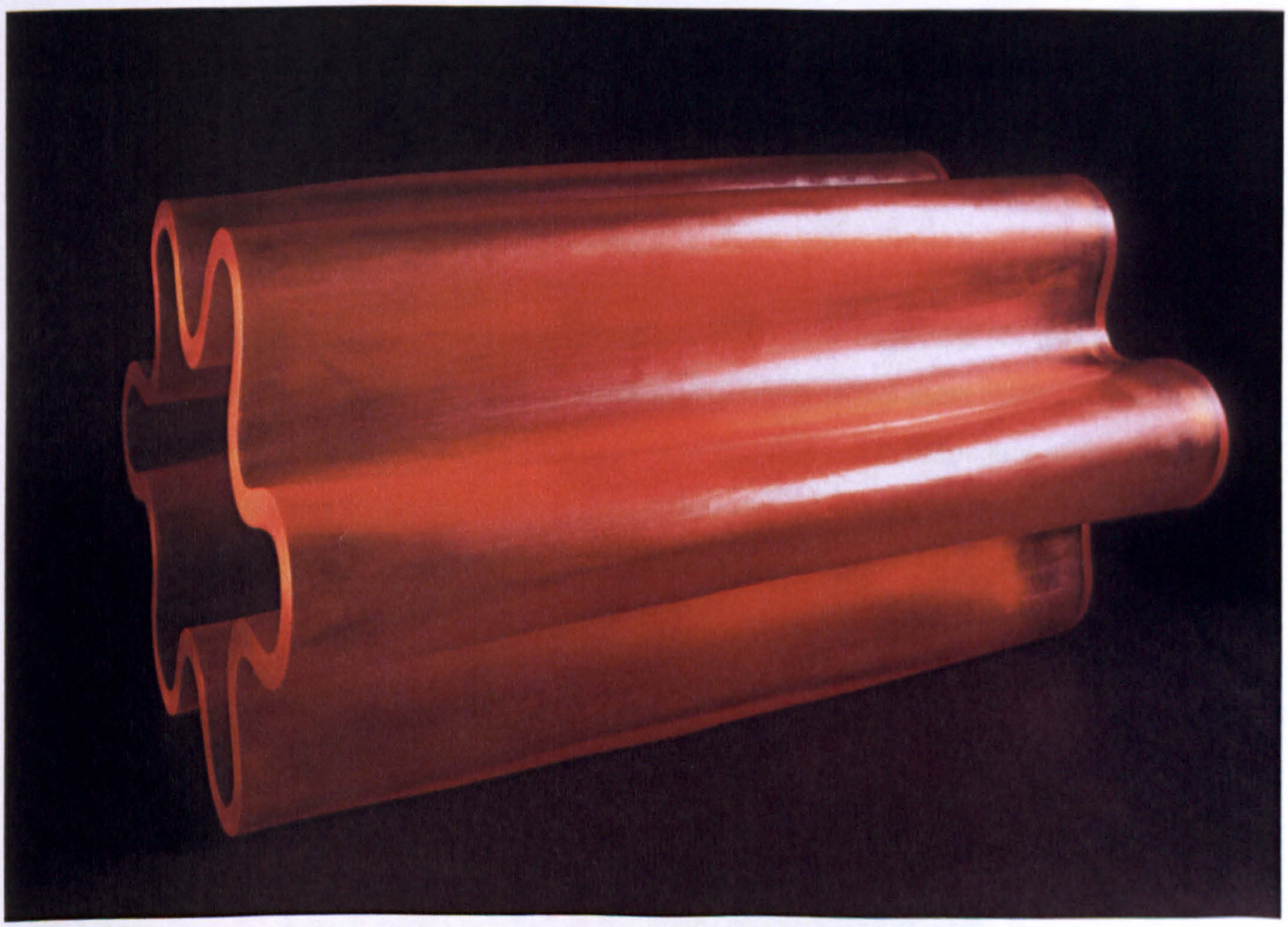


Fig. P9-2

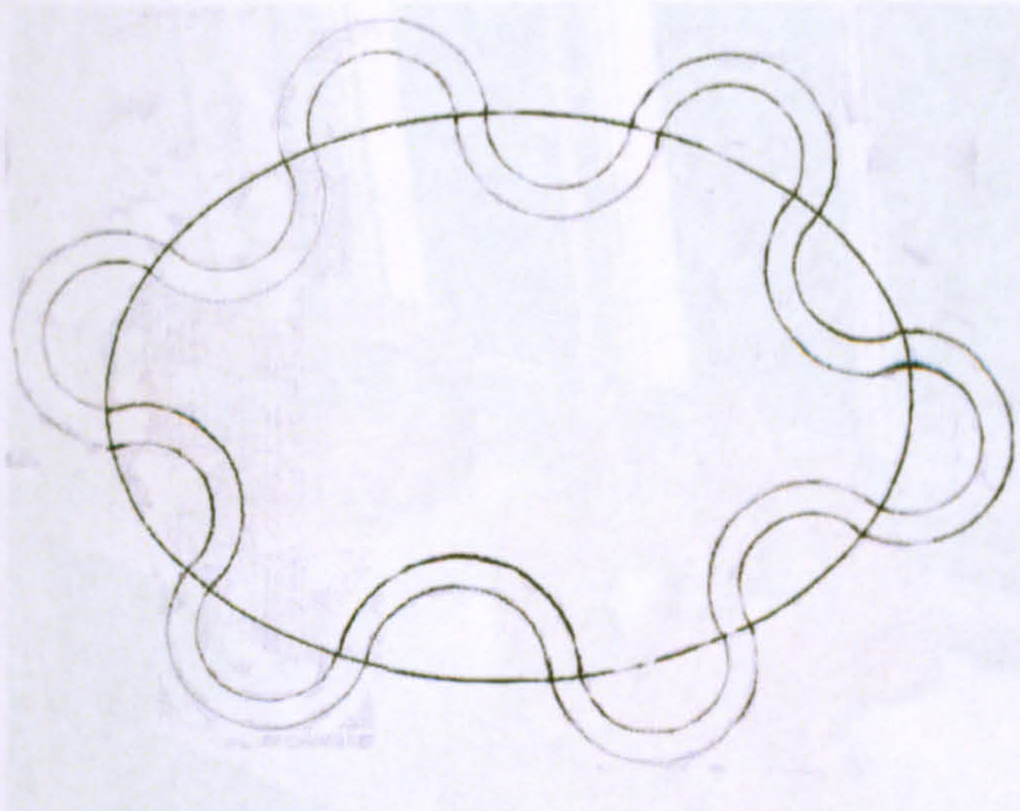


Fig. P9-2a

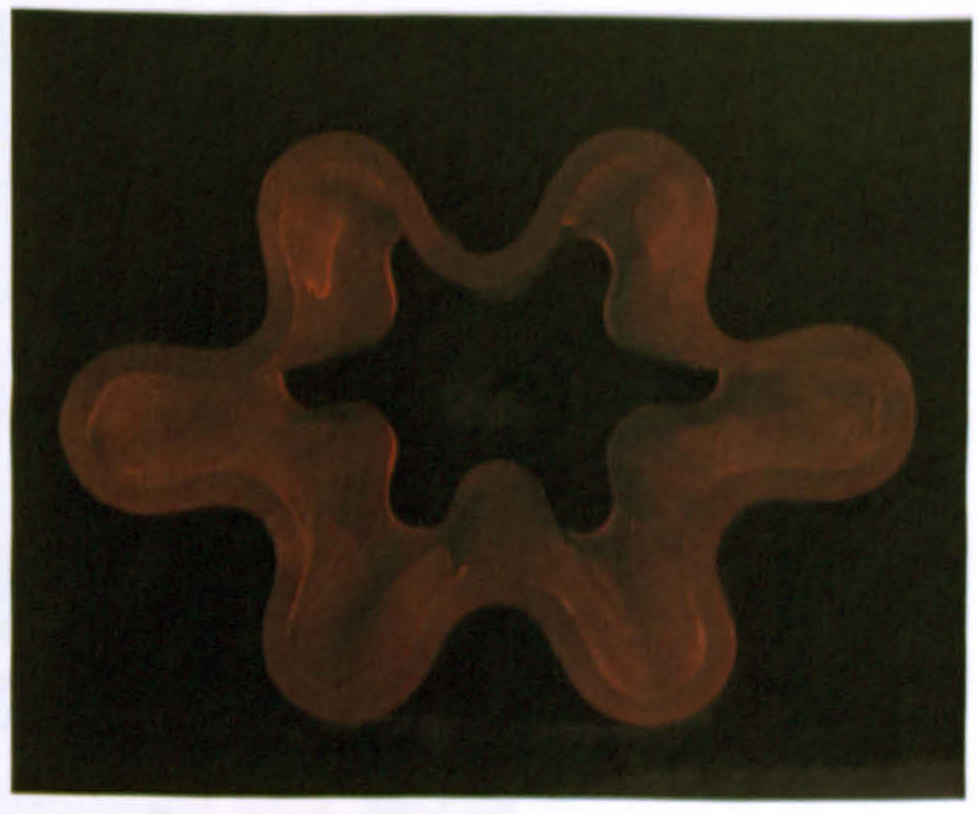


Fig. P9-2b

In this study, the contrast between edge and plane has been enhanced because the visual qualities and colour density of the edge are so different to the plane, which is not the case in the early bronzes Fig. P1-0. The contour has emerged in a very different way to that which was originally anticipated. It has become the specific form.

Interestingly, various images of this study demonstrate just how important the quality of the light source radiating upon the work is and how it can dramatically affect these resin studies. The initial images above were taken in artificial light, and the slight underexposure of the photograph looking through the form shows how these resin forms require strong lighting for the edges and contours to be visually prominent. Images Fig. P9-2c & d pictures the studies in close proximity to an abundant supply of natural light that fully illuminates their gleaming surfaces.

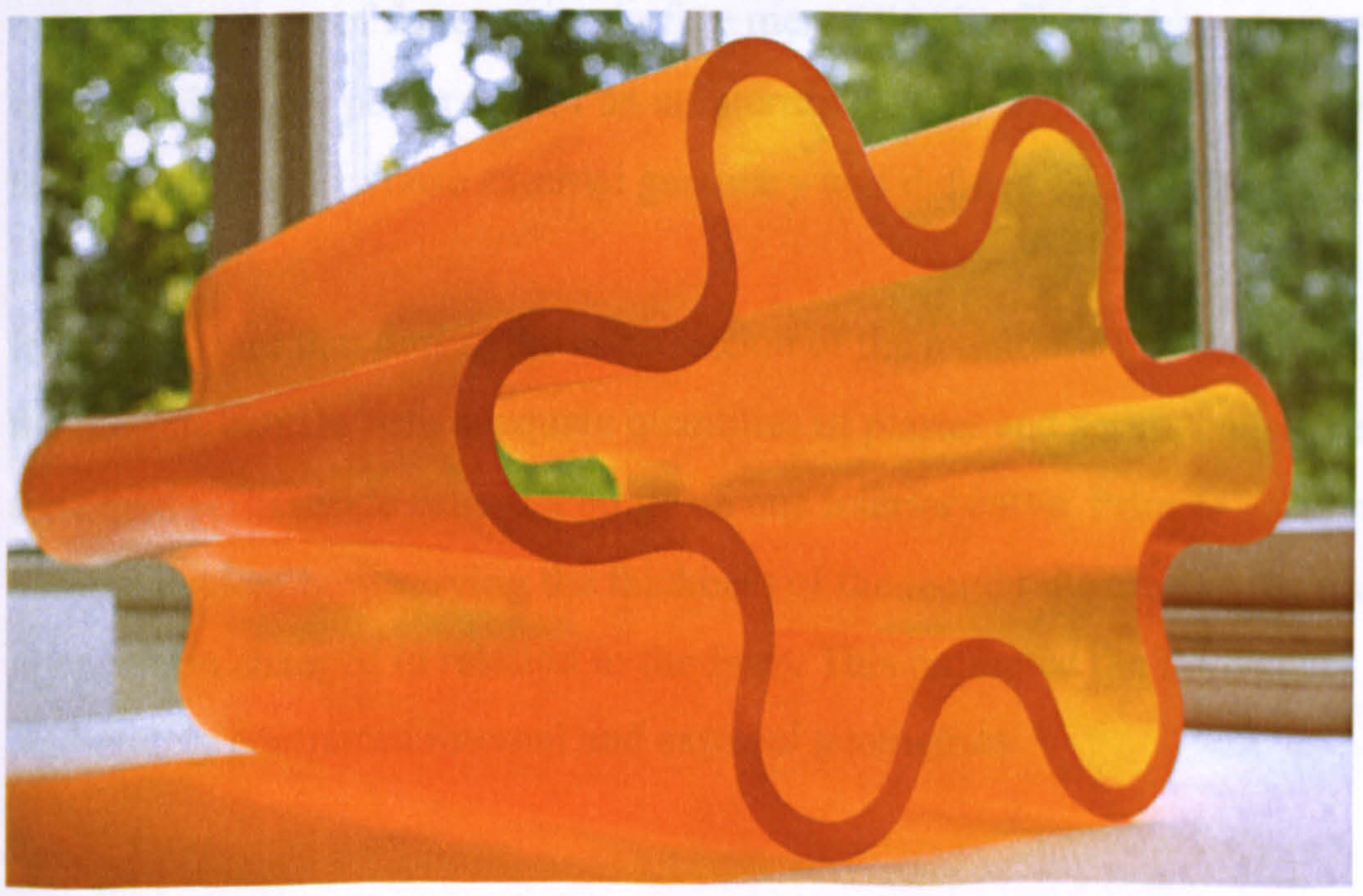


Fig. P9-2c

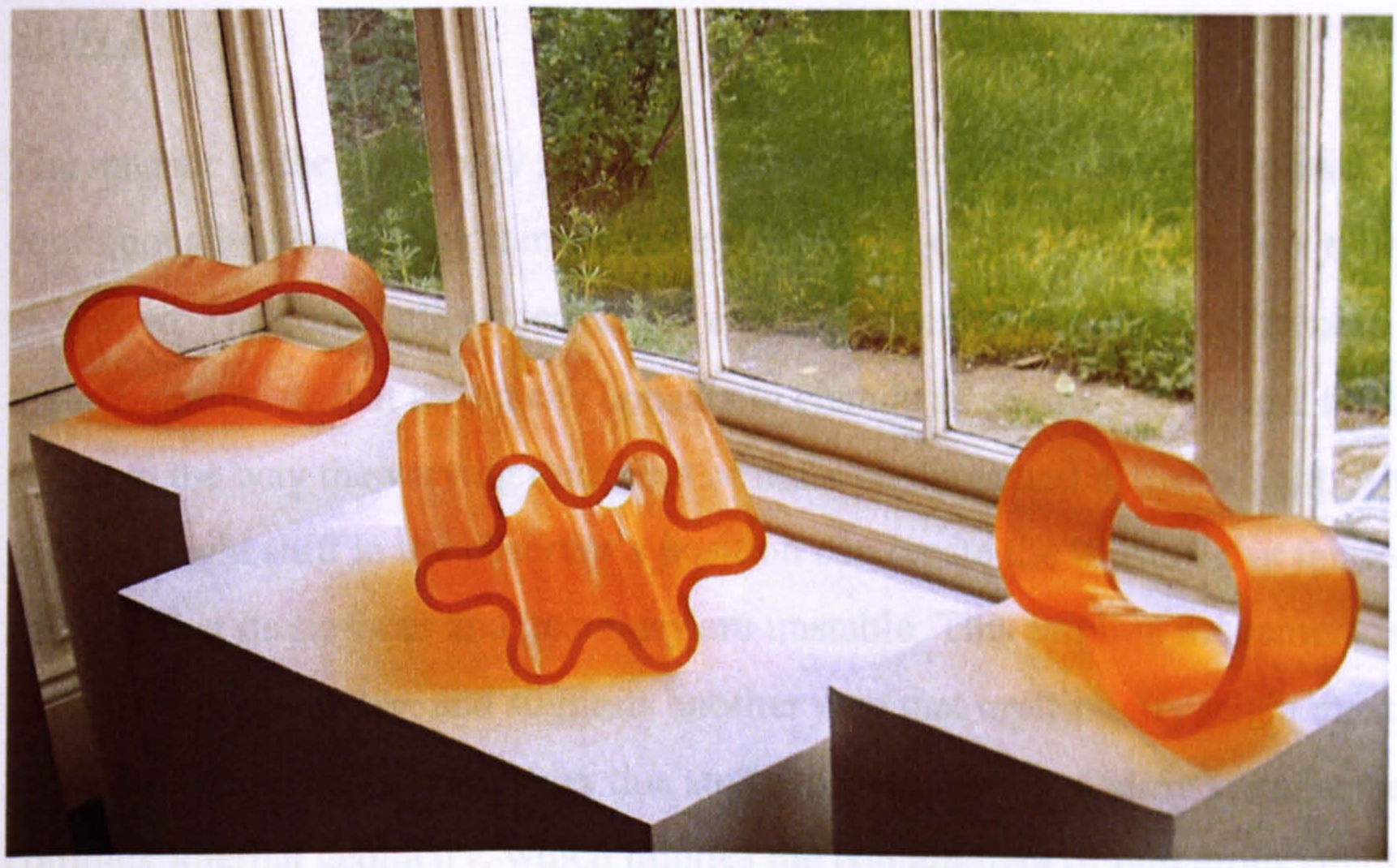


Fig. P9-2d

The study has complementary internal and external geometries, resulting in a membrane that has an even thickness. The problem with this study was that, notwithstanding the subtle entasis along its length, its geometry was complex in terms of the confines of this research. Whilst the material consistency, continuous momentum of its curving planes and the repetition of elliptical geometry contribute to its inherent completeness, I subsequently felt uncertain as to whether the six implied half-cylinders perhaps created too much variation. This notion was strengthened by the visually complex relationship that the sculpture created with the space surrounding it. The latter was not as coherent as when an ellipse defined the external geometry. Consider for example, Fig. P8-2, which allows space to visually flow around the sculpture. The fact that this particular study rests on two lines of the exterior surface means that it effectively traps a corridor of space within, which inhibits the perception of an uninterrupted flow occurring. Therefore, I subsequently focussed on forms whose external geometry was defined by an ellipse.

It was apparent that during the construction of the mould for this study, I had failed to back up the flexible acetate with adequate quantities of plaster and scrim; consequently, the pressure of the liquid resin inside caused a bulge on one interior curve. Prior to grinding the bulge away, it became evident how varying the thickness of the membrane created the illusion of movement as my position changed in relation to the form. This prompted the third study in which I deliberately contrasted internal and external geometries.

Study 3

The interior of the next study Fig. P9-3 has similar internal geometry to its predecessor, having a continuous line oscillating thirteen times around an ellipse; however, it is now contained within an ellipse. The contrasting internal and external geometries create differences in the thickness of the membrane, so that its density appears to change as one moves around the form. This illusion is due to the way the varying thickness of mass captures and diffuses light. Although the form is static, a slight shift in the observer's position can create the illusion that the form is no longer still and that its surfaces and geometry are unstable. This implied movement is an illusory deflection of geometry, and suggests another way that multiplicity might exist within a single form. However, I do not consider this study to have one overriding singular quality because of its complex internal geometry, which implies the containment of numerous small cylinders. For that reason, I then decided that the next appropriate step was to simplify the internal geometry without completely removing the inference of multiplicity that results from the implied cylinders. This meant not creating geometries that imply more cylinders than could result from the simplest division of one, i.e. two. This naturally suggested the geometry of the figure of eight derivative.

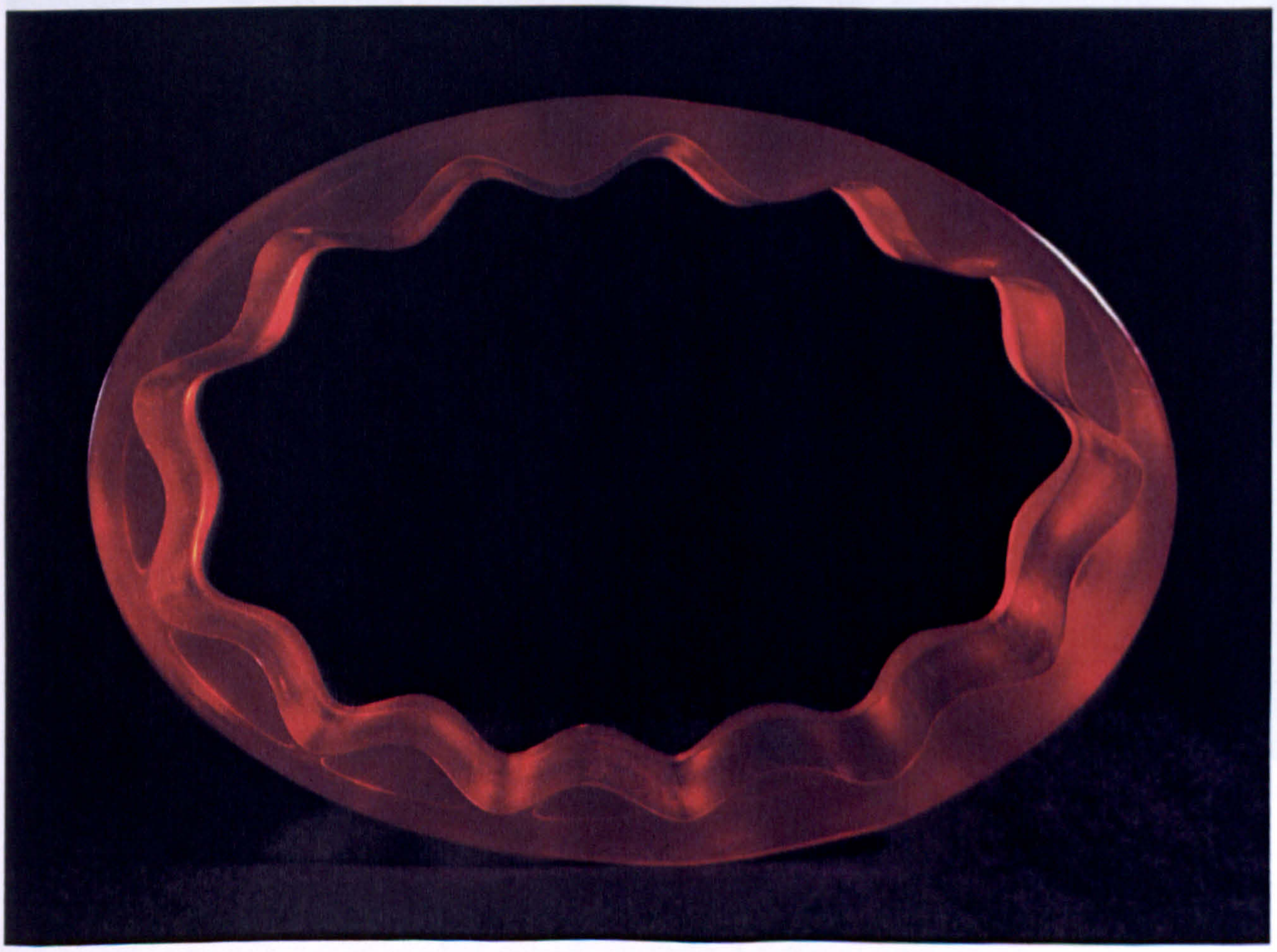


Fig. P9-3

Study 4

In the final study of this project, Fig. P9-4, the internal geometry does not always follow the external geometry, sometimes it is complementary and on others occasions contrasting. It is particularly significant that because the sections of contrasting internal and external geometries directly result from the mould making process, (due to the formers having inconsistent depths), the consequent variation in the form's thickness occurs throughout the entire height of the cylinder. This means that the rotation, achieved by twisting the mould's formers occurs, throughout the form even where there is variation in membrane thickness. Therefore, a consistency in geometry has been achieved notwithstanding the exploration of wall thickness.

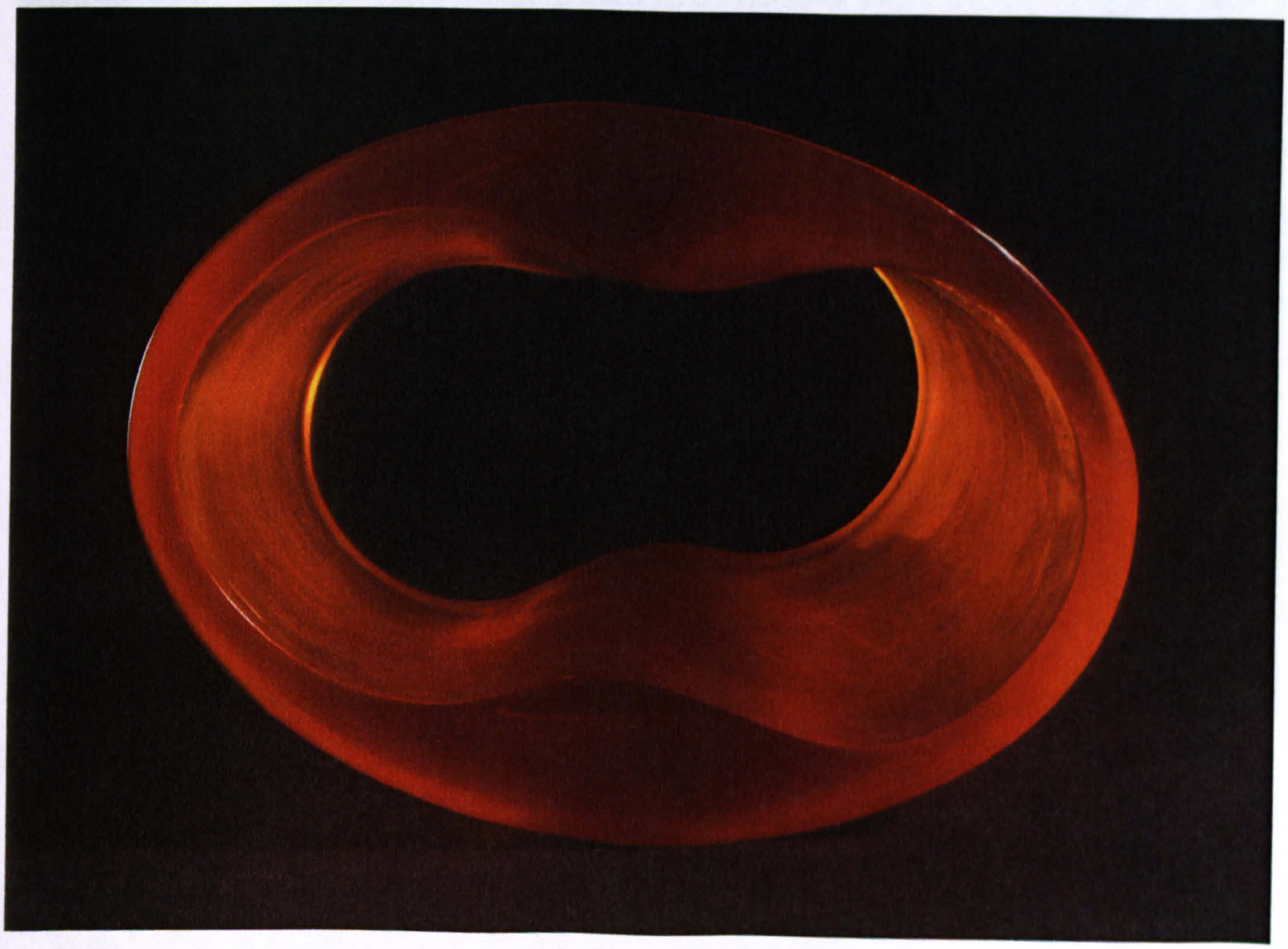


Fig. P9-4

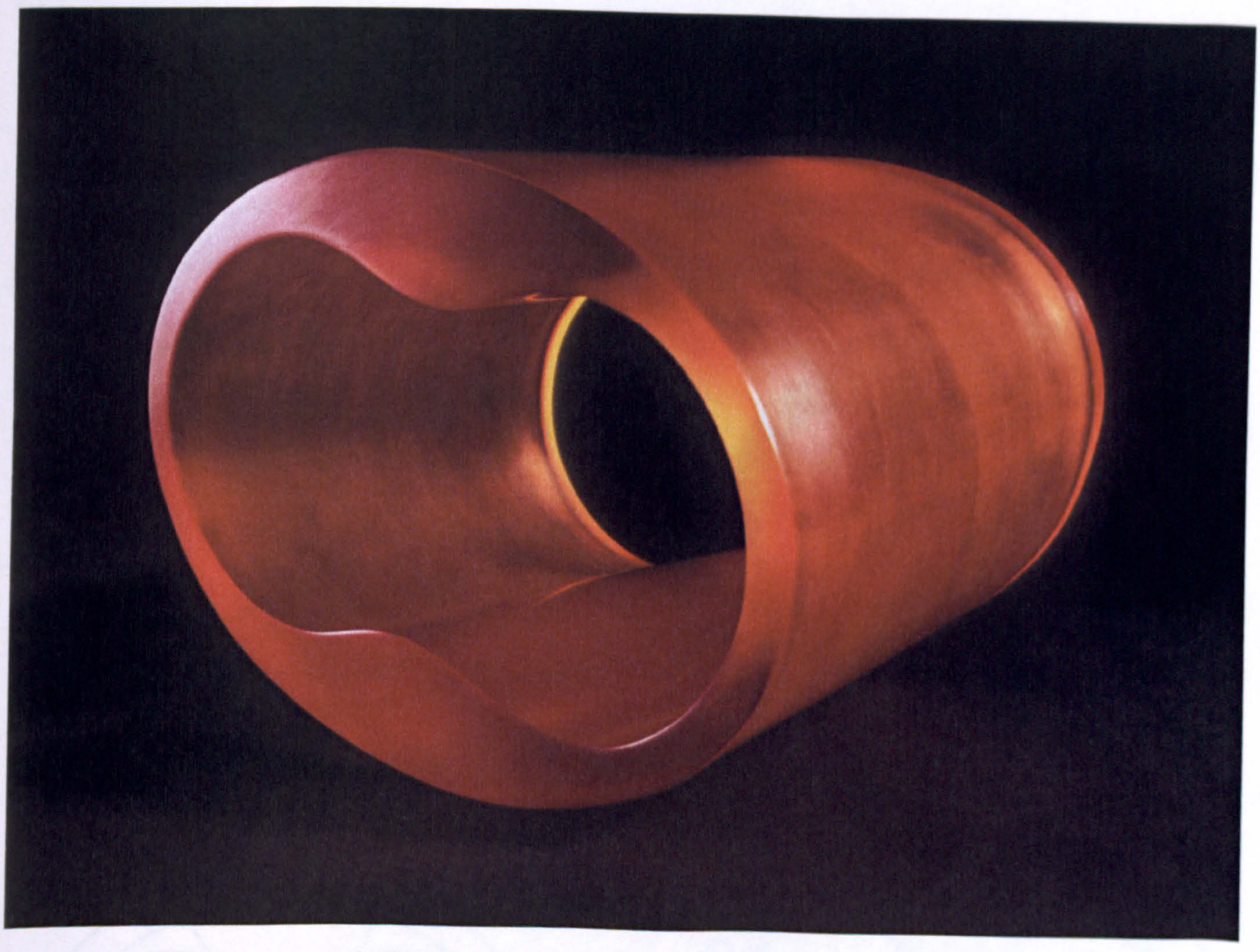


Fig. P9-4a

Reducing the complexity of the previous study's geometry has resulted in a form that can be perceived as singular. This sculpture consists of a cylinder that is elliptical externally and has the geometry of a figure of eight internally. This figure of eight derivative results from the union of several identical shapes; sections of circles arranged to create one sinuous shape. This study balances the singularity of the exterior and the implication of division within; the implied duality of the figure of eight bound within the continuity of the elliptical exterior. Pronounced visual tension exists between the completeness of the ellipse and the potential for change, evolution and splitting suggested by the interior. This form might be metamorphosing. Nonetheless, it remains as one because the underlying Gestalt is curvature based on the ellipse.

Fig. P9-4b below, demonstrates the underlying geometry of the form and how the interior of the figure of eight-like shape is derived from two identical tangential circles exactly adjoining one another, subsequently intersected by arcing sections of a further two identical circles.

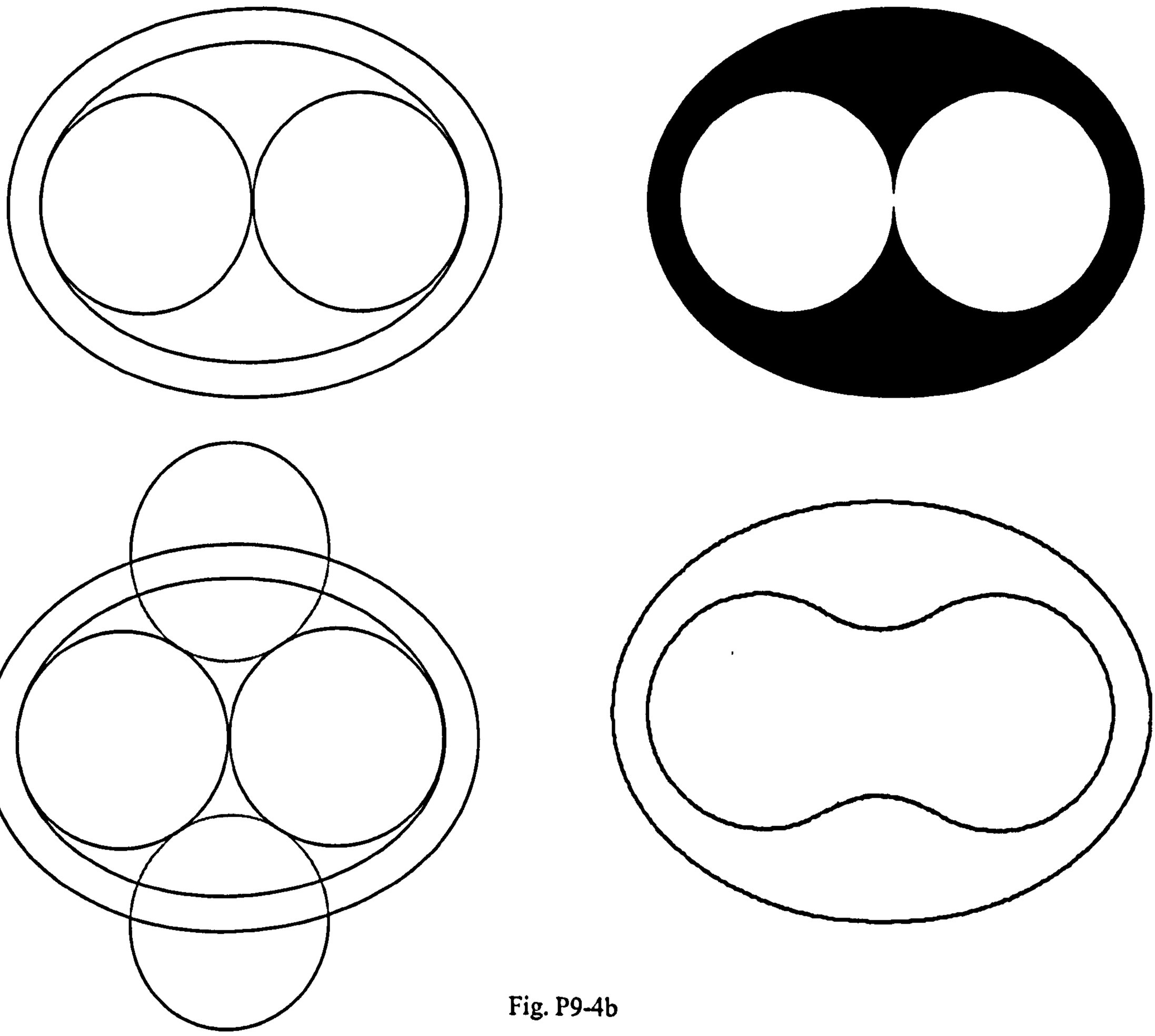


Fig. P9-4b

It is the use and position of two primary circles that allows the inference of division and duality to be established. Yet, it is important that the figure of eight is contained within an ellipse that is of similar proportions to its external counterpart, and that at the extremities of the figure of eight, where the circle is most evident, it actually follows the geometry of the internal ellipse. This confers a sense of unity on the dimensions of the cylinder wall, because at its thinnest the internal and external geometry is almost identical. Consequently, the proportions have a sense of completeness and continuity associated with Gestalt 'good form'. However, the overall consistency of the form's geometry is questioned by the slight rotational deflection of geometry. This is demonstrated in Fig. P9-4b below, which shows the subtle misalignment between the cylinder's top and bottom edges.

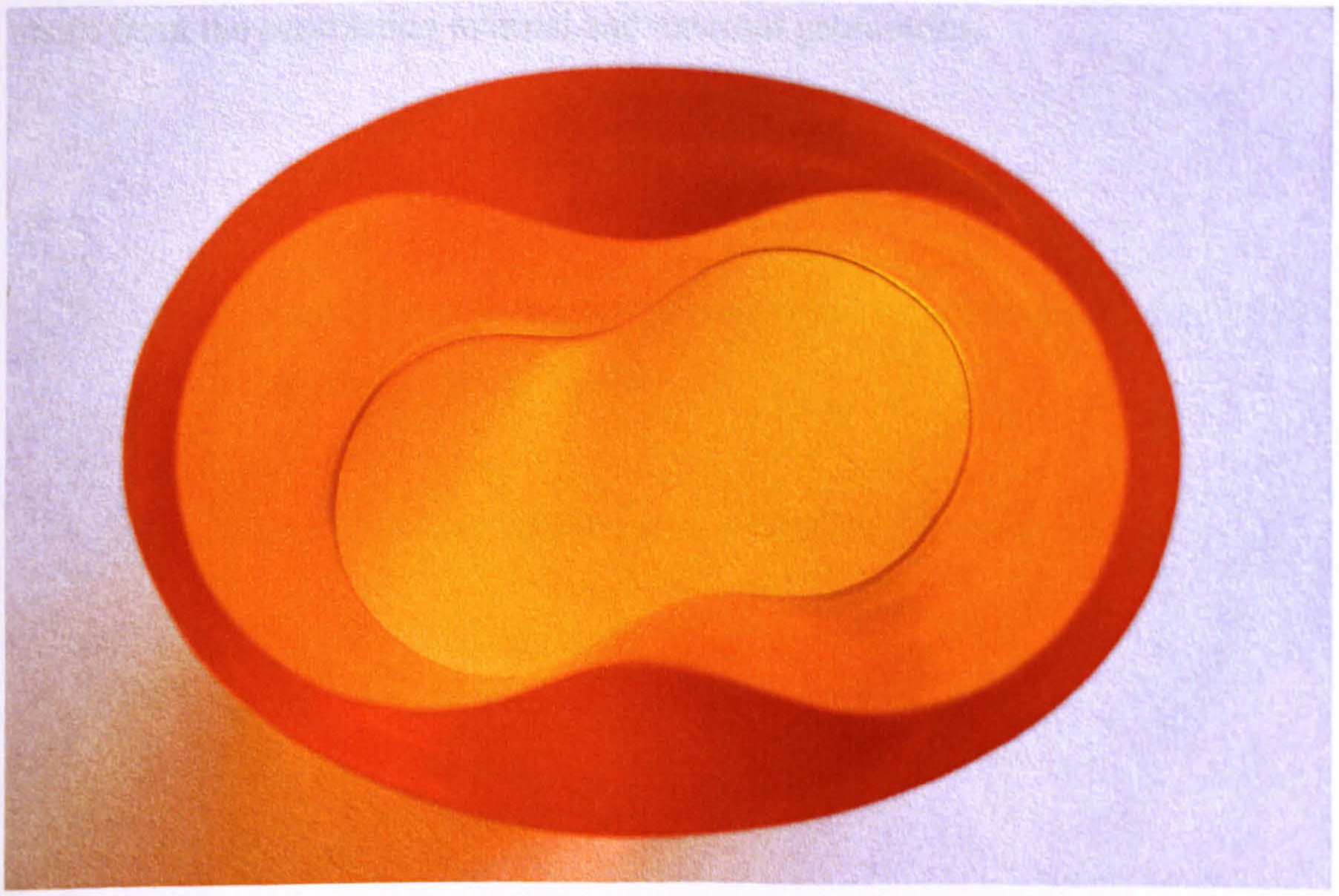


Fig. P9-4b

CONCLUSIONS TO PROJECT 9

Fig. P9-4 is the most successful of the studies completed so far; its geometry is based on a combination of the ellipse and figure of eight derivative, which originate from sections of four identical circles. Therefore, its underlying perceptual qualities are roundness, and continuity. It contrasts Judd's orthogonal sculpture and most importantly, its inherent sense of completeness establishes 'good form'. The latter is underpinned by the specificity of the circle and ellipse, which constitute its geometry. However, it still manages to accommodate perceived paradox though the amalgamation of rotational deflection of geometry, implication of duality, and illusory deflection of geometry within a unified and singular form. Put more simply, the study has unity and variation, and therefore mitigates the dilemma posed by Judd's concept. Whilst variation originates from physical changes in geometry, it is significant that additional sculptural significance is derived from changes in the diffusion of light and saturation of colour, which result from the contrasting internal and external geometries.

PROJECT 10

AIMS

The previous project, and particularly its final study, demonstrated the potential for the dual to exist, or at least to be perceived, within the singular. Therefore, the broader aims of this project were to examine other contrasting internal and external geometries that could imply a duality in a single form. It also sought to test the effects of fluorescent pigments on the diffusion of light through the edge of the form. This project therefore consisted of four studies, whose dimensions do not exceed 24cm³, and are as follows:

Study 1. Explore reversing the geometry of study P9-4 to imply duality in a single form.

Study 2. Explore contrasting internal and external geometries, created through off-centred placement, to imply duality.

Study 3. Explore contrasting internal and external geometries, created through rotation and reversal, to imply duality.

Study 4. Examine contrasts between internal and external geometries.

Study 1

RESULTS

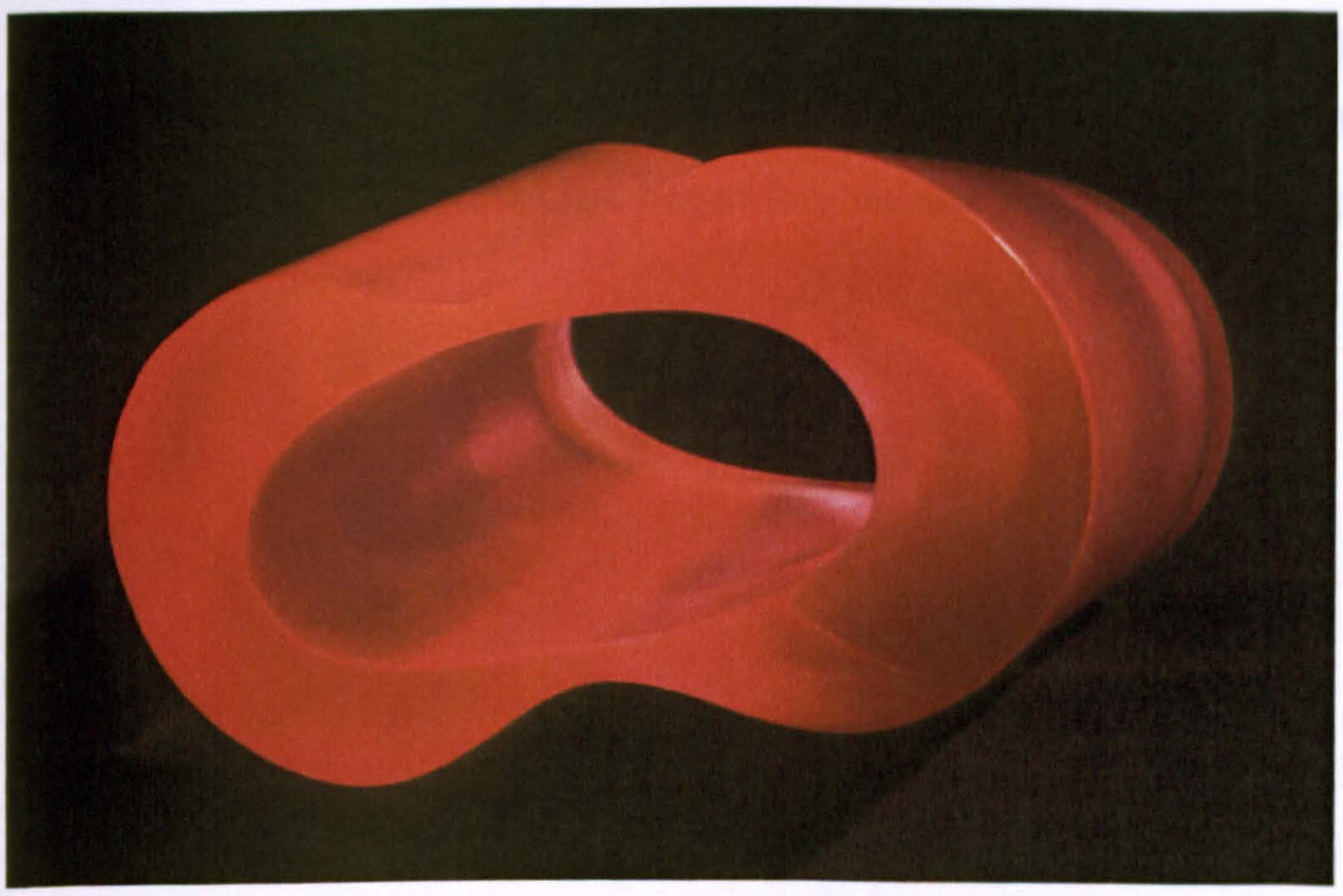


Fig. P10-1

At this stage of the research, and inspired by the implication of duality in the figure of eight, I examined sacred geometry through the writings of Robert Lawler. In his book, *Sacred Geometry*, he outlines unity in terms of a philosophical concept and explains how one and oneness has often symbolised God, whereas two represents duality and multiplicity. Most interesting is his observation that from a philosophical viewpoint, "Unity creates by dividing itself."[114] Therefore, in this the first study of project ten, Fig. P10-1, the internal and external geometry of Fig. P9-4, which demonstrated the potential for implied duality to exist within one form, was reversed. Thus, an elliptical interior is encapsulated by an external figure of eight; the geometry is shown diagrammatically in Fig. P10-1a.

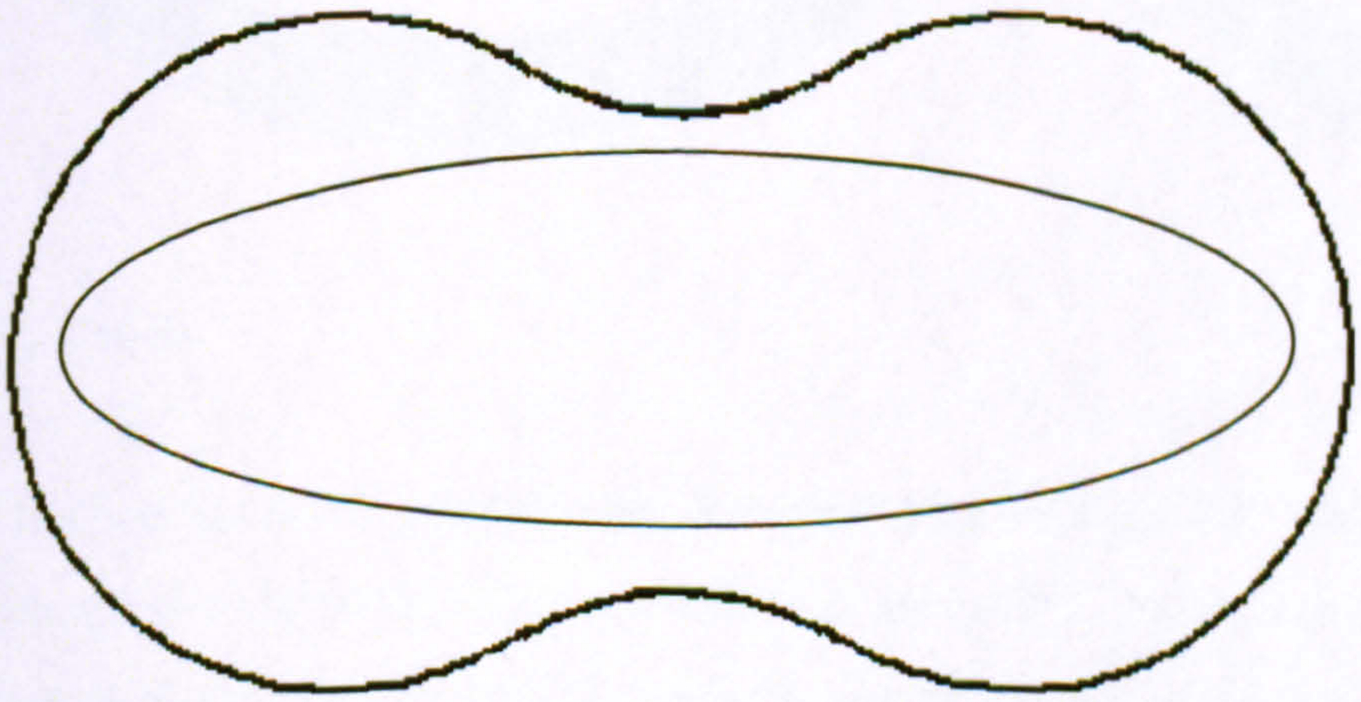


Fig. P10-1a

One of the problems with this study is that because the implied duality occurs externally, the sense of constriction and containment previously established by the external ellipse of study Fig. P9-4 is now absent. Therefore, it is less likely that the form is perceived to be singular, as the emphasis is on the continued expansion and completion of the duality rather than its restriction. Consequently, I did not proceed with the geometry of this study. The introduction of fluorescent pigments to the resin enhanced the effect of the light diffusing through the form's geometry. This was precisely the effect that I had hoped for, because it would augment the illusory deflection to the form's geometry.

Study 2

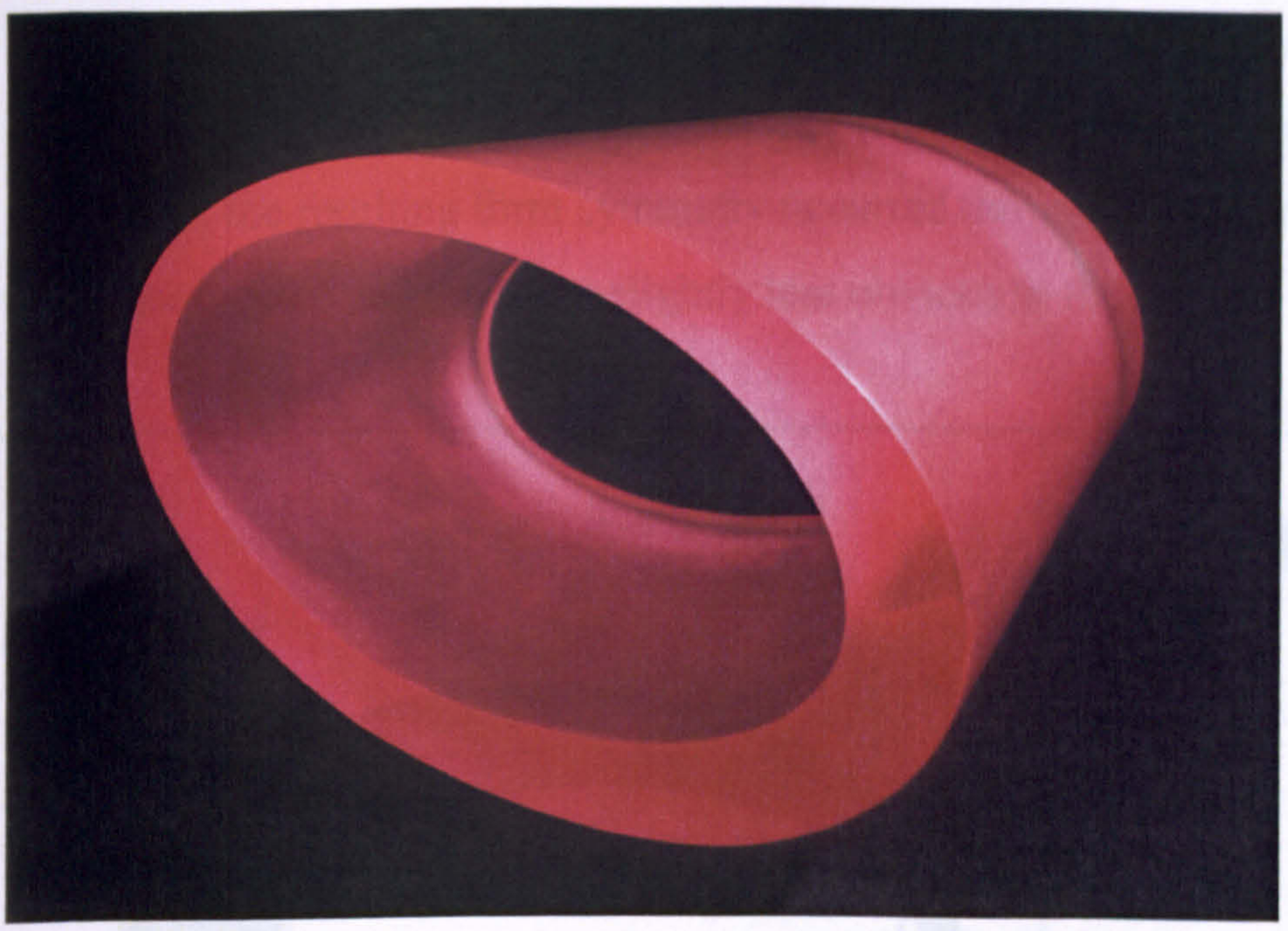


Fig. P10-2

The intention of this study was to test the potential of contrasting, but similar, internal and external geometries created through off-centred placement to imply duality. It was effectively a slightly more subtle approach to contrasting internal and external geometries. Rather than giving the interior and exterior different shape, the contrast was achieved with an elliptical interior and exterior. In study Fig. P10-2, the inner ellipse was moved off-centre to the left, explained graphically in Fig. P10-2a.

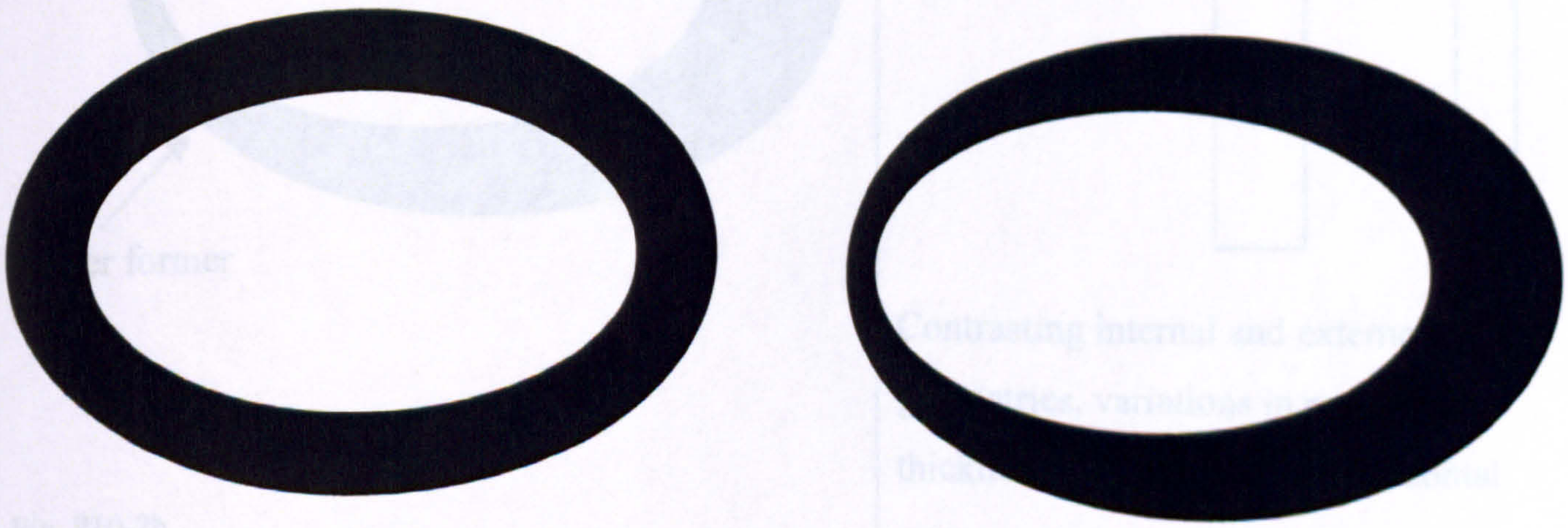


Fig. P10-2a.

This had the result of removing the symmetry through the vertical axis that had previously existed in most of the previous formers' geometry. In this case, the former only has symmetry though the horizontal axis. In order to enhance the perception of variation I reversed one former

in relation to the other with the result that the changes in the thickness and consistency of the cylinder's membrane would occur in the x and y axes simultaneously, as explained diagrammatically below in Fig. P10-2c. This was only possible due to the contrasting internal and external geometries of the formers. The latter had symmetry through the horizontal axis, whereas in the resulting form symmetry occurred through the diagonal axis, making it somewhat more unexpected and therefore slightly less obvious to the viewer.

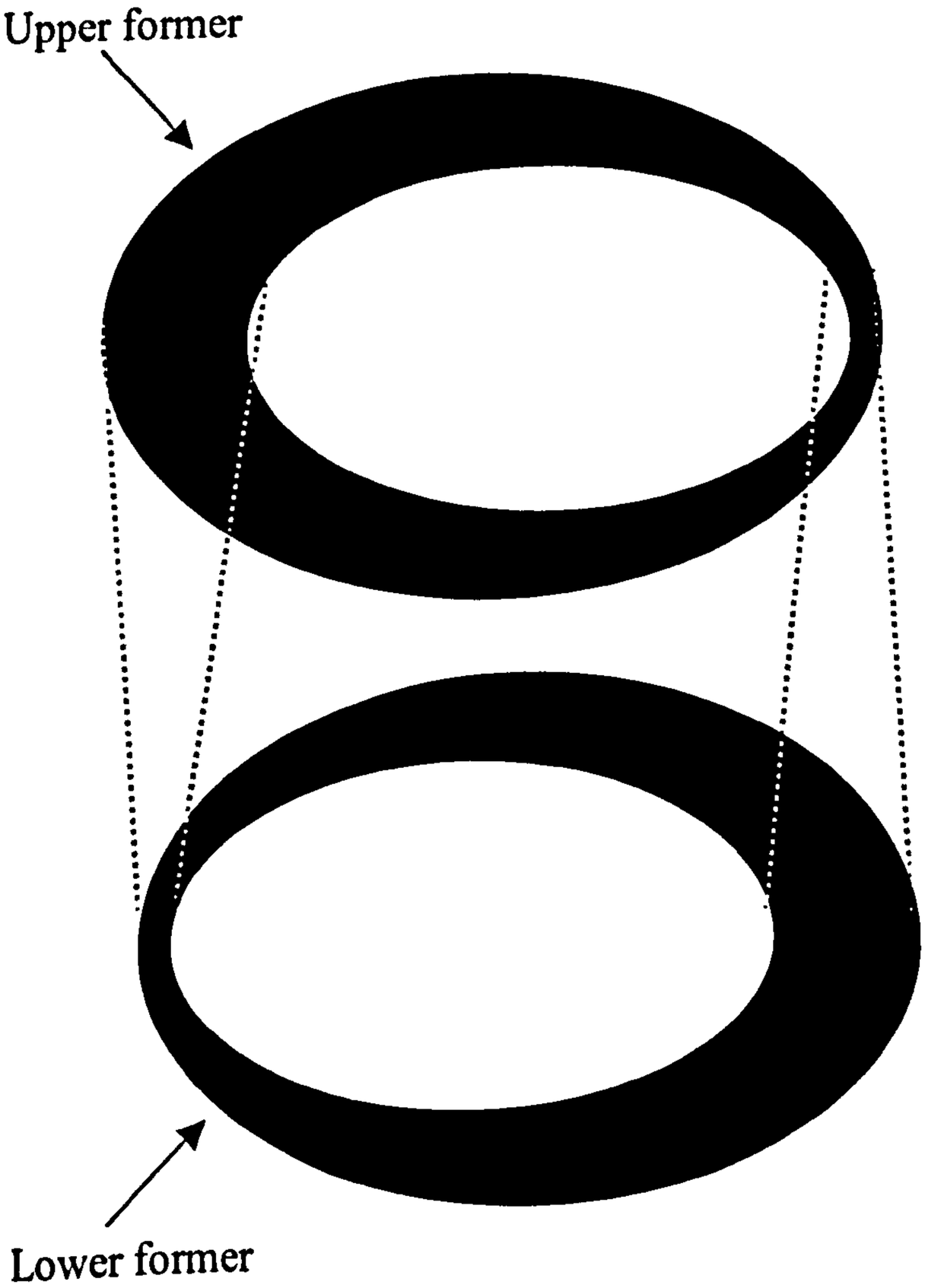
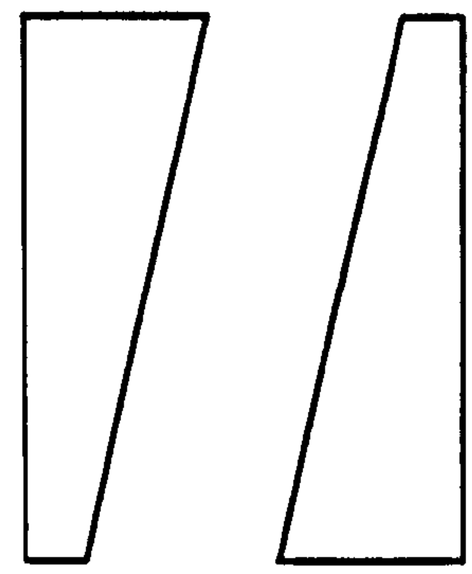
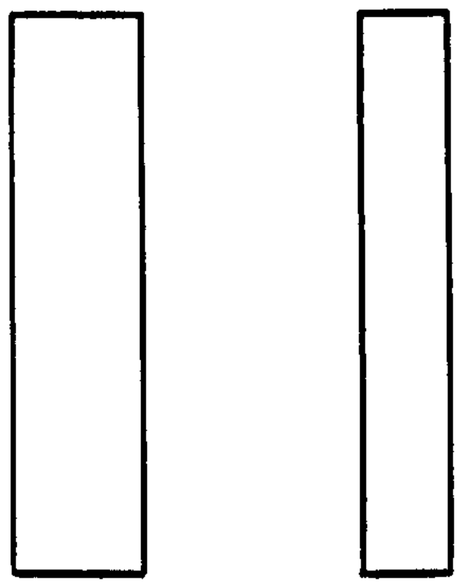


Fig. P10-2b

CYLINDER WALL GEOMETRY



Contrasting internal and external geometries, varying thickness through both horizontal and vertical axis.



Contrasting internal and external geometries, variations in membrane thickness only occur in the horizontal axis

The repetition of the ellipse grounds the study's geometry in one shape; therefore, according to the Gestalt law of similarity, which states that similar items tend to be grouped together, a Gestalt should be established and the form is likely to be perceived as singular. The fact that a duality is not implied in the form may at first seem advantageous, yet it may actually be

problematic to my expansion of Judd's concept due to the geometry being perceived as regular. Nonetheless, the variations in the thickness of the walls result in varying intensities of colour to height and width. This helps to create a significant degree of variation in the study, both physical and illusory.

Study 3

Fig. P10-3

The study Fig. P10-3 examined the potential of contrasting, but similar, internal and external geometries created through rotation and reversal to imply duality. The inner ellipse was moved off centre through a slight rotation, explained diagrammatically in Fig. P10-3a. The study appears at first to be symmetrical, but as in the yin/yang symbol, the geometry is actually unsymmetrical, and therefore a deflection of geometry has occurred. This is a slightly subtler version of study Fig. P2-2b from Project 2, in which the inner ellipse is perpendicular to the outer one.

Fig. P10-3a

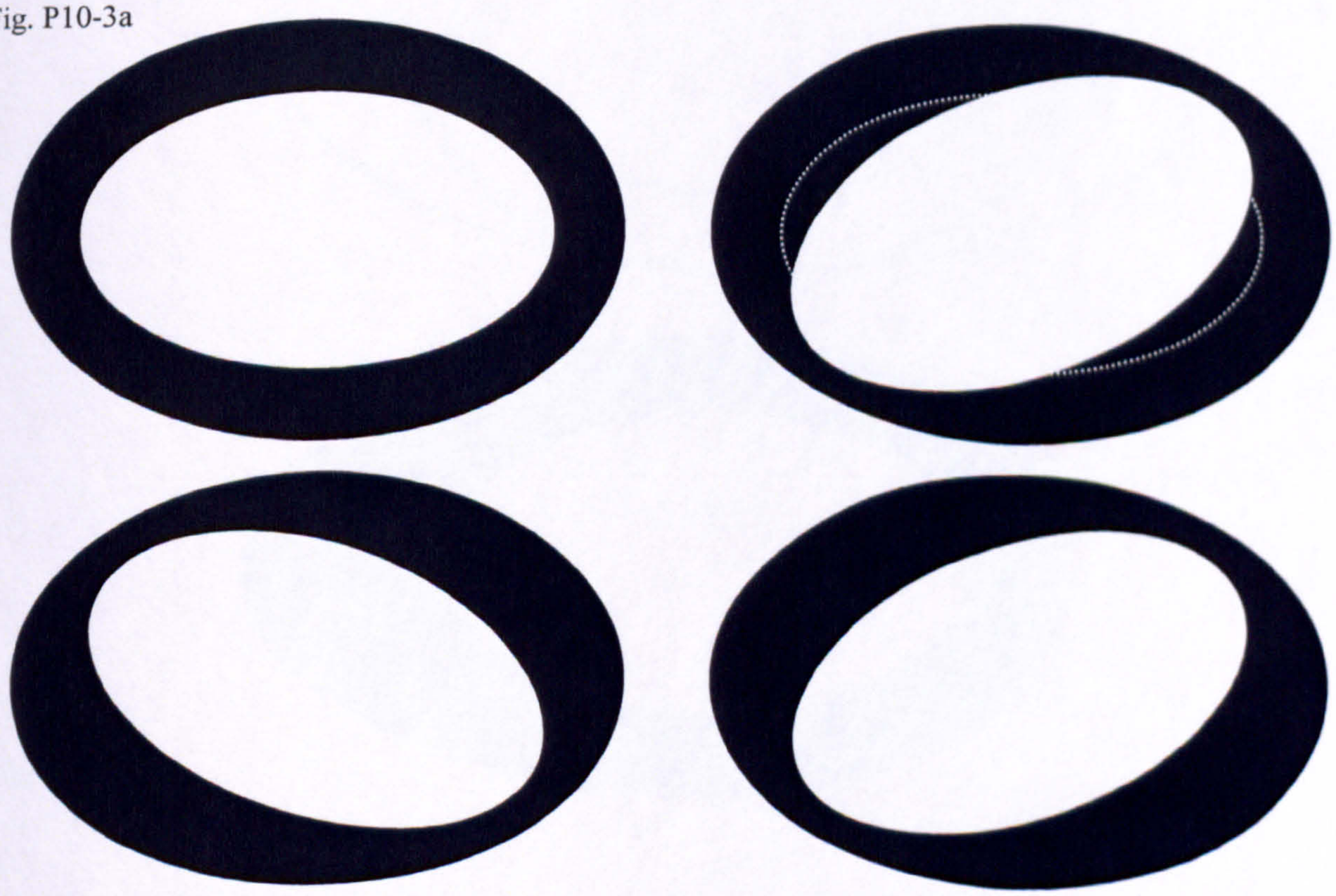


Fig. P10-3b demonstrates how the visible differences in the thickness of the study's membrane change through both axes as in the previous study; meaning different saturations of the fluorescent pigment become visible. The deflection transforms what might otherwise be a simple geometry into a sculpture that is unlikely to be criticised for being monotonous, despite not implying a duality. The orientation of the internal and external ellipses is aesthetically satisfactory, whilst subtle and yet distinct enough to imply continued vibration and oscillation.

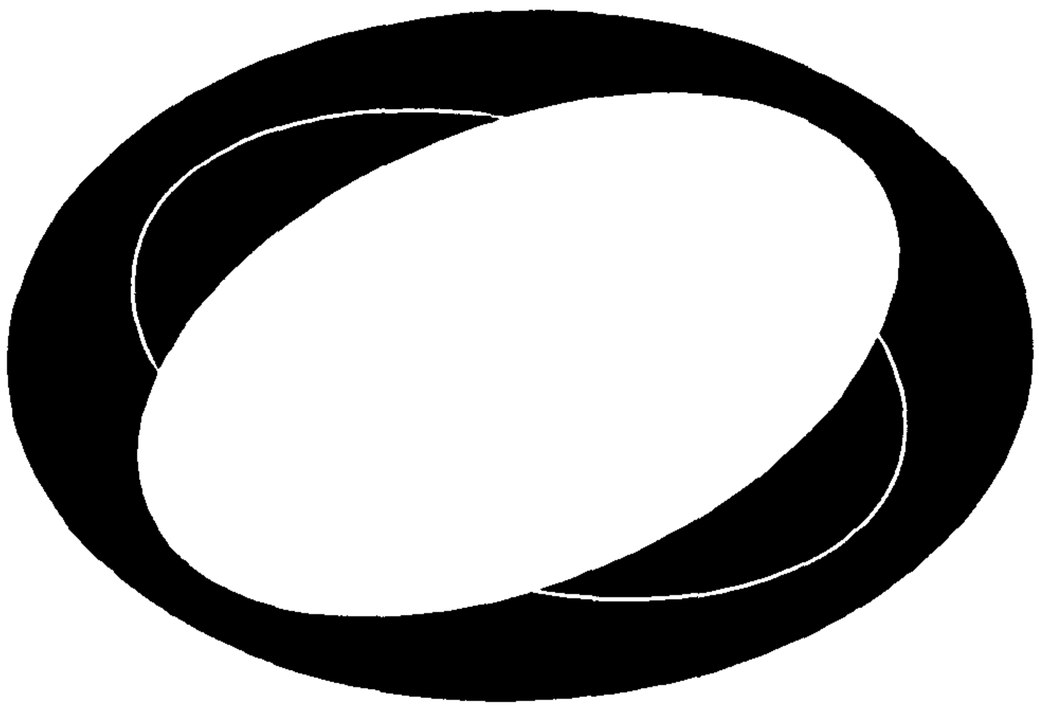


Fig. P10-3b

This study also shows a slight degree of rotational deflection of geometry through its length. The form's unity is grounded in the repetition of the ellipse but, as in the previous study, lacks the implication of duality found in the fourth study from Project 9, Fig. P9-4.

Study 4

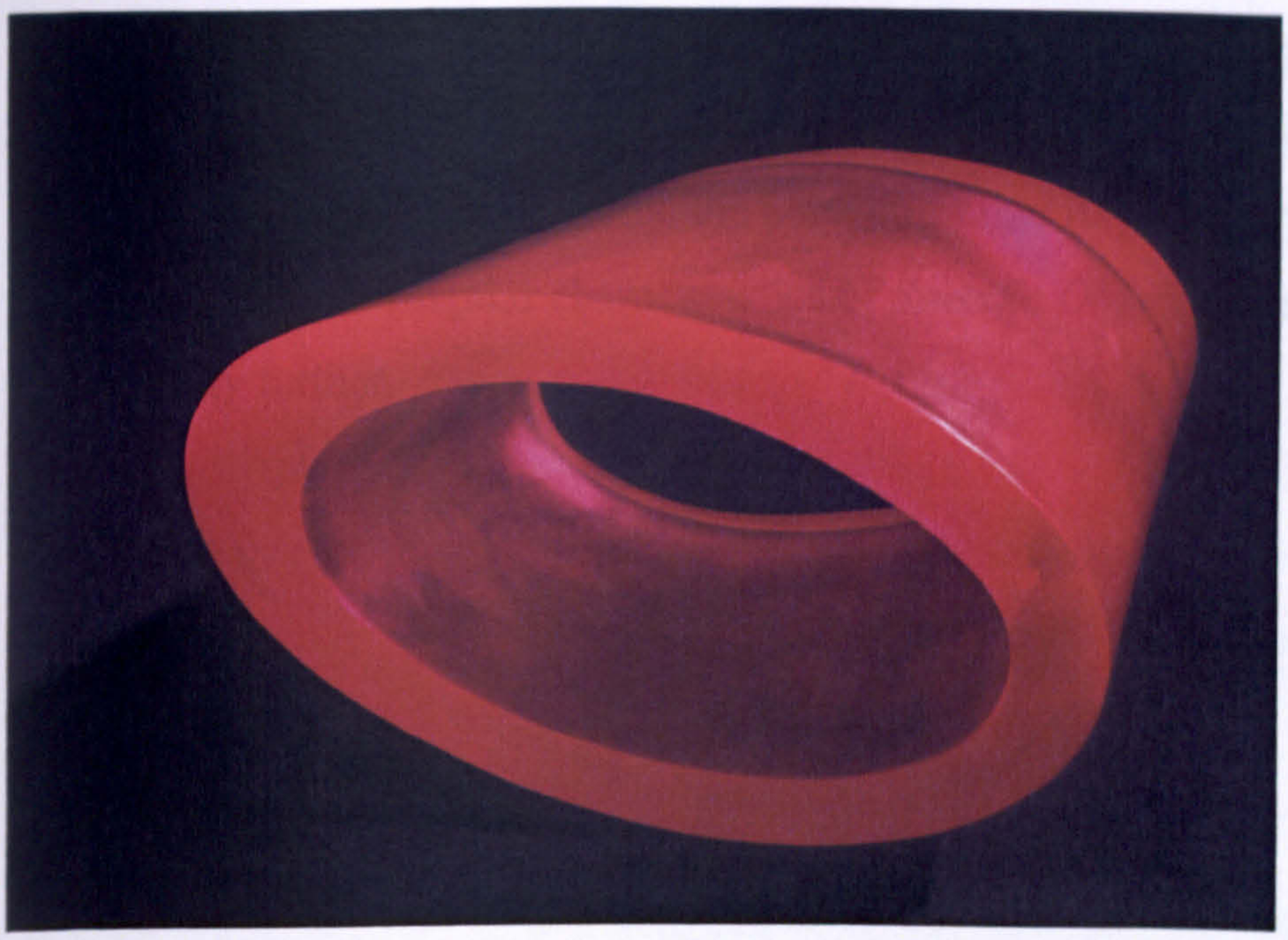
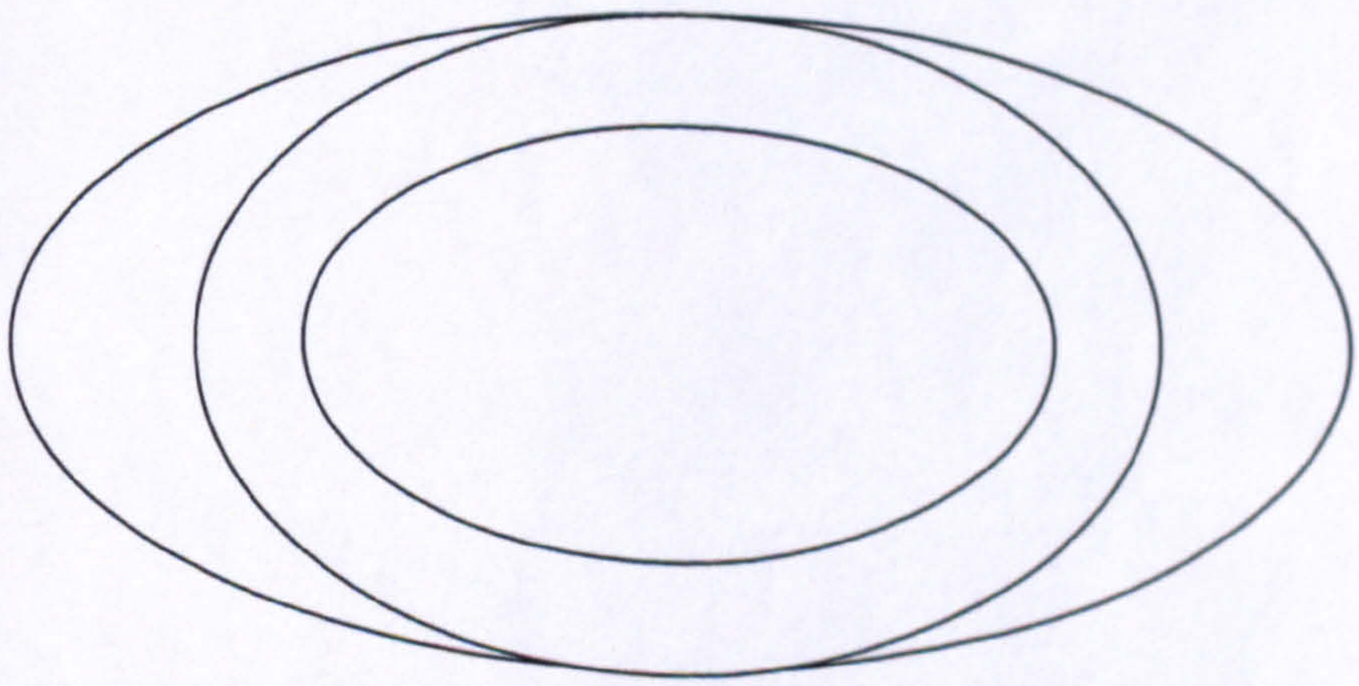


Fig. P10-4

The fourth and final study of the project sought to set up internal and external geometries of significant contrast. The formers of Study P10-4 resemble the shape of an aerofoil. The interior is defined by a single ellipse and the exterior is composed of the union of two concentric ellipses with the right outer half removed and the left half filled in, as shown diagrammatically below in Fig. P10-4a.



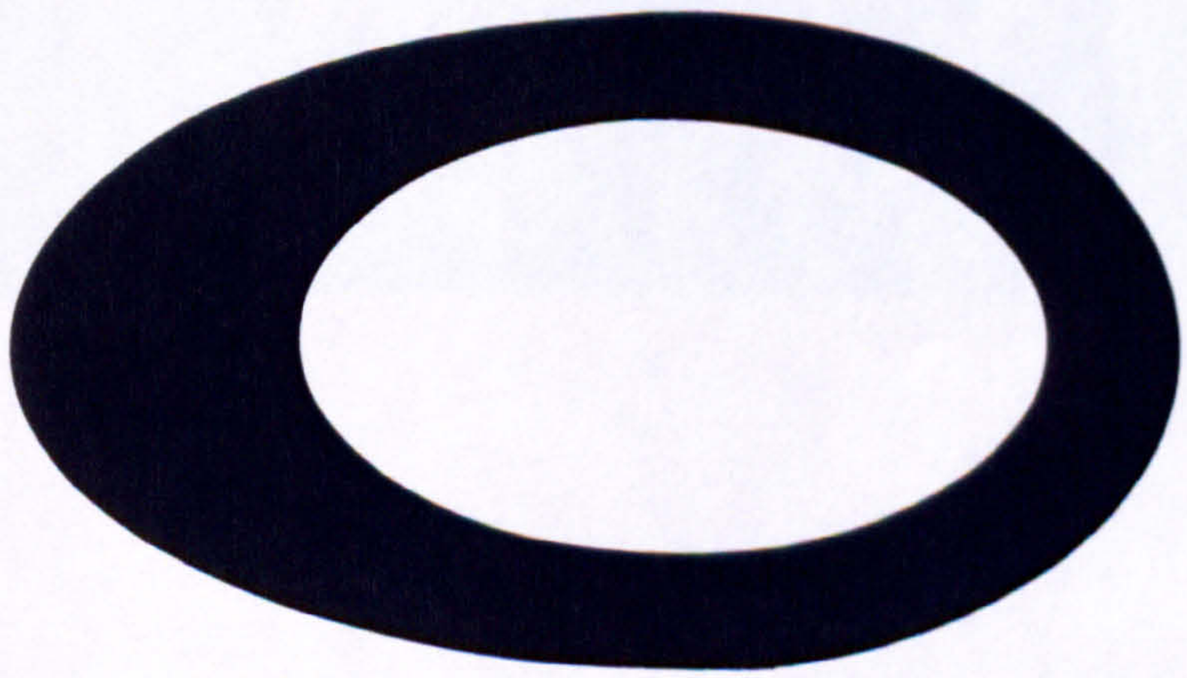


Fig. P10-4a

The geometry of this study does not infer duality; it is more akin to a form being stretched (as in Brancusi's *Bird in Space*) and not divided. The geometry of its formers appears more visually consistent than in the previous two studies; each former is actually symmetrical through one axis; hence, the variations in the membrane's thickness occur only through one axis. Overall, the more negative aspect of this study, the perception that its geometry has too much variation to be consistent with the singular characteristics of *Specific Objects*, meant that this geometry was not pursued any further.

CONCLUSIONS TO PROJECT 10

The third study of the project, Fig. P10-3 was the most successful because it balanced the requirements for variation in geometry whilst maintaining the perception of a unified and singular form. This delicate balance was tested to the extreme in a previous study, Fig. P9-4, which despite its contrasting internal and external geometries, which are based on two different shapes, still manages to demonstrate the characteristics of a *Specific Object*. These two studies would therefore appear to answer the original research question of how to expand Donald Judd's concept of *Specific Objects* by creating forms with unity and variation. Consequently, they were used as the basis for the third and final stage of the research.

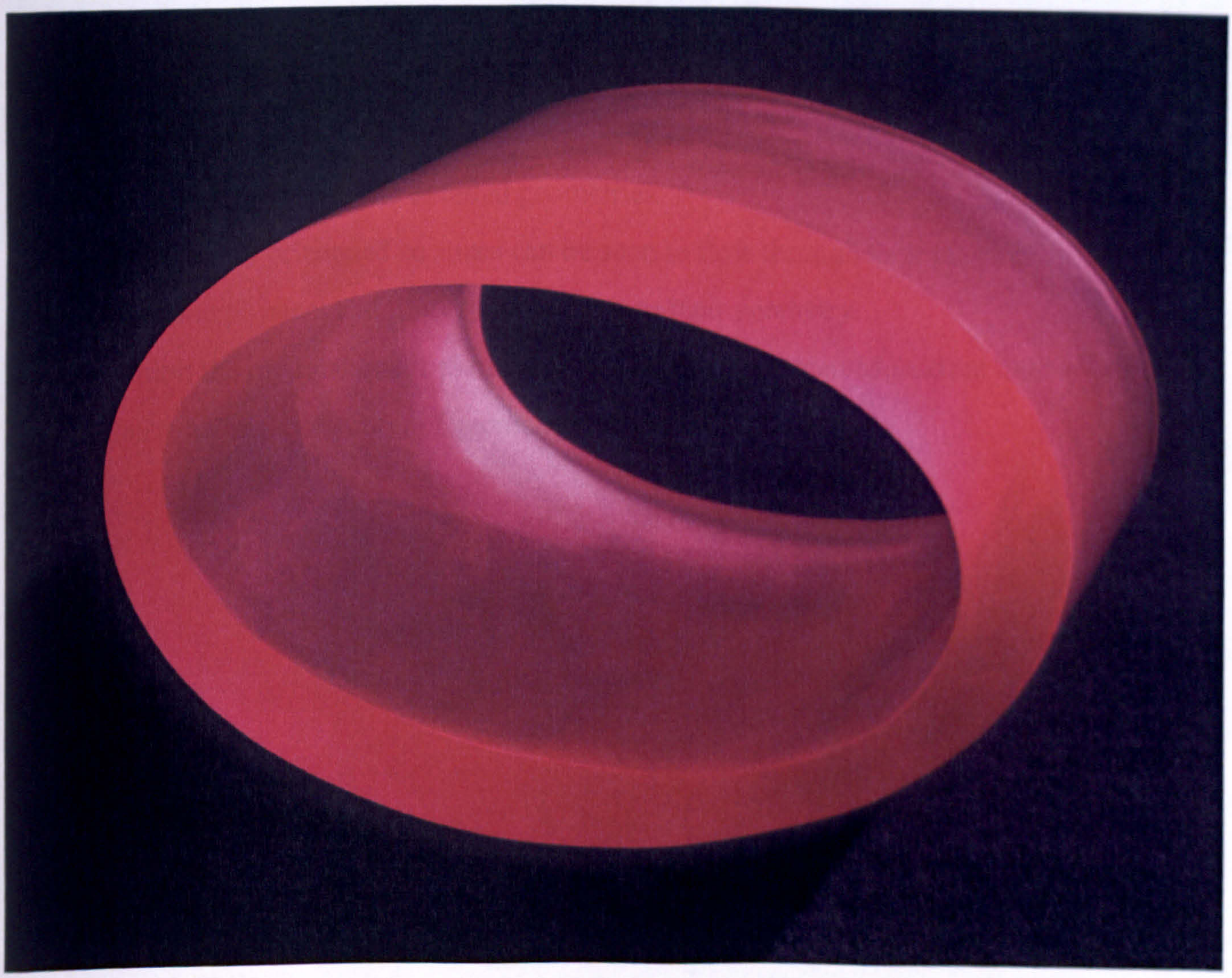


Fig. P10-3

STUDIO INVESTIGATIONS - STAGE 3

PROJECT 11

AIMS

The aim of this, the final project, was to focus the results of the research into two studies that expand Judd's concept; *Specific Objects*.

RESULTS

Both sculptures share the following characteristics:

- Elliptical external geometries, which underpin their unity.
- Circular internal geometries.
- Contrasting internal and external geometries.
- Horizontally orientated so space can be seen to flow through their interiors.
- Combine physical and illusory deflections to their geometry.
- Exploit the material qualities of resin and generate a perceived internal light source.
- Use rotational deflection of geometry to undermine symmetry.

Sculpture One – Penultimate Study

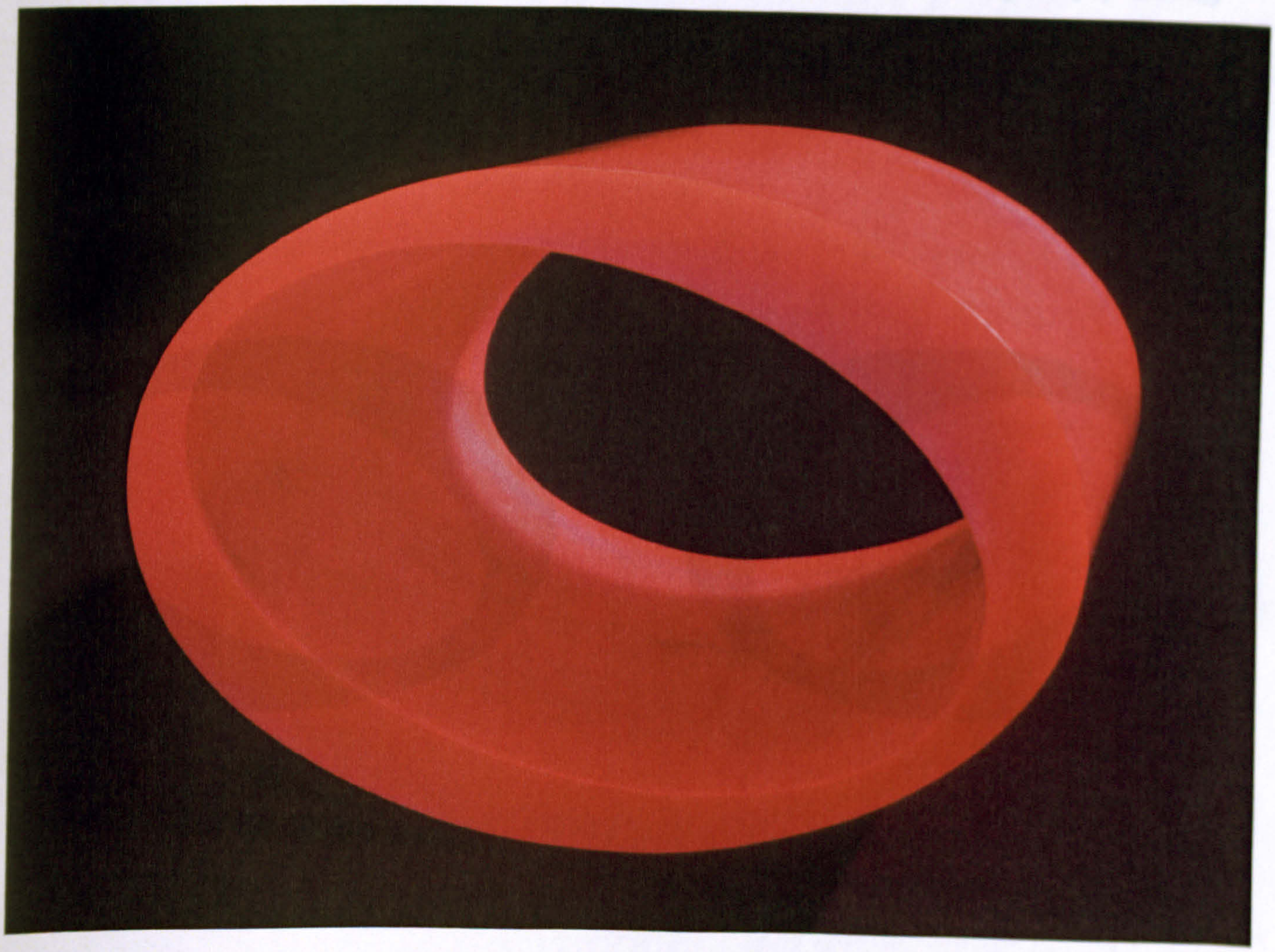


Fig. P11-1

The first study, Fig. P11-1, is a cylinder based on the ellipse, it conforms to the Gestalt law of similarity because the elliptical motif is repeated internally, externally and throughout the form. An ellipse of similar proportions to its larger external counterpart defines the sculpture's interior. The potential consistency of this relationship has been destabilised by rotating the internal ellipse of each former about its centre. The real and implied torque in the form's geometry is further intensified by the rotational deflection of geometry achieved by twisting the upper and lower formers in relation to one another. Most importantly, what really distinguishes this sculpture from its predecessors is that the rotation in each former's geometry means that they are no longer symmetrical through the major axes of the external ellipse. This meant that by simply turning over one of the formers it reversed the direction of the internal ellipse, as clearly shown through the diagrams in Fig. P11-1a.

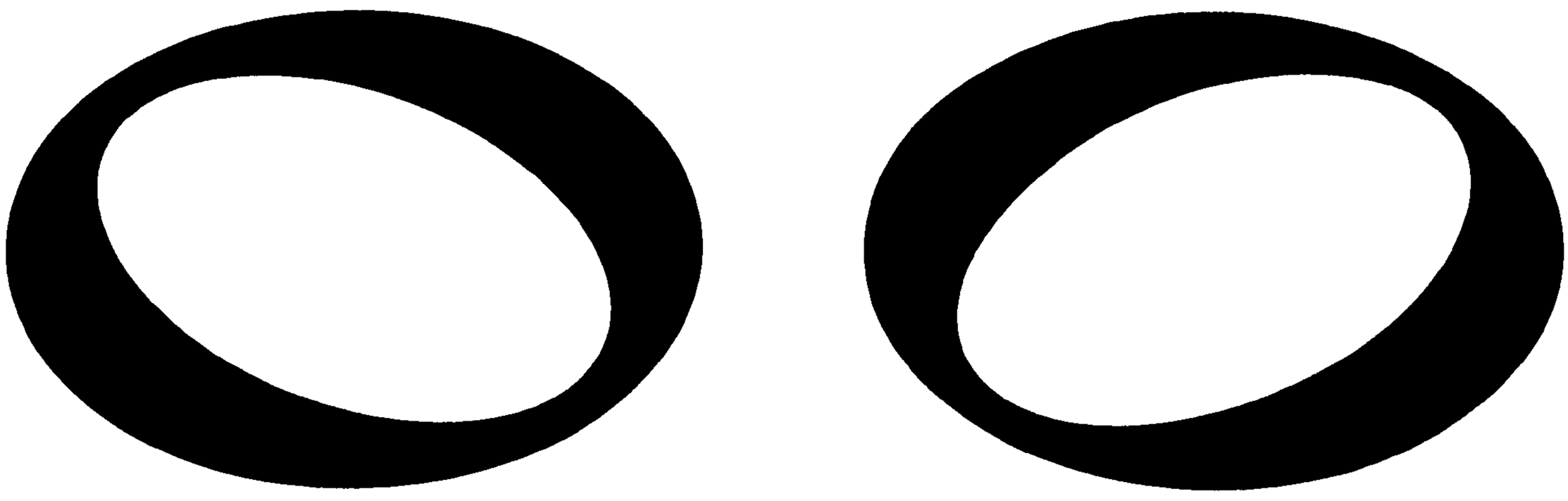


Fig. P11-1a

Therefore, the contrast between the internal and external geometries is not just consistent through one axis, but variations in thickness in the cylinder's wall simultaneously occur through the horizontal and vertical axes of the form. This geometrical variance is shown below in the drawing Fig. P11-1b.

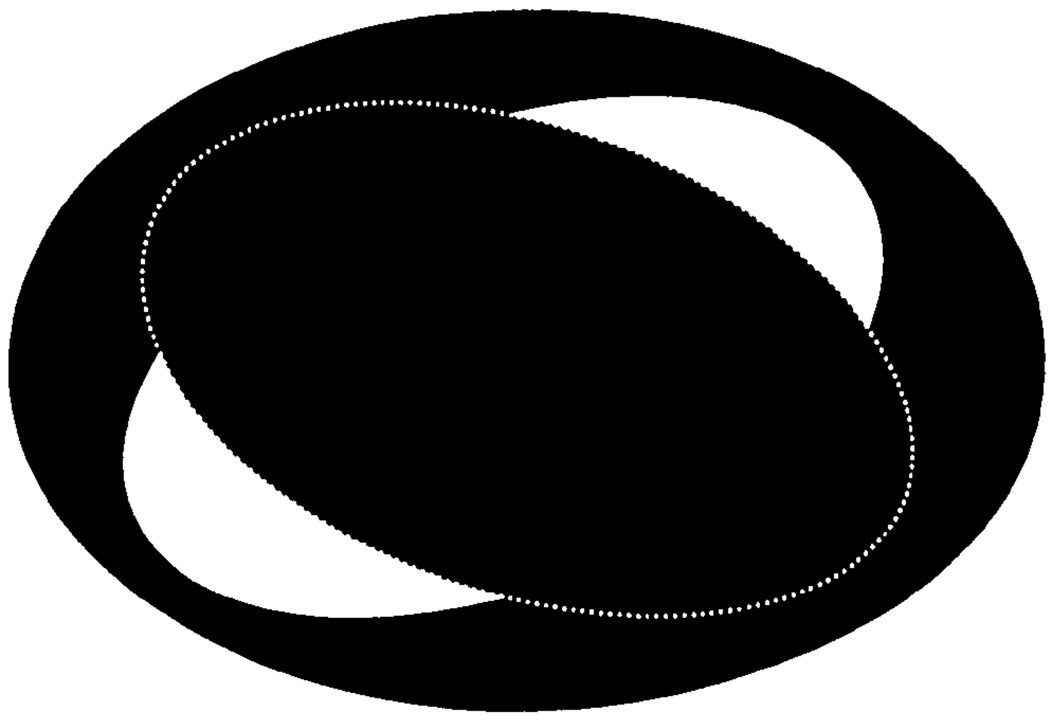
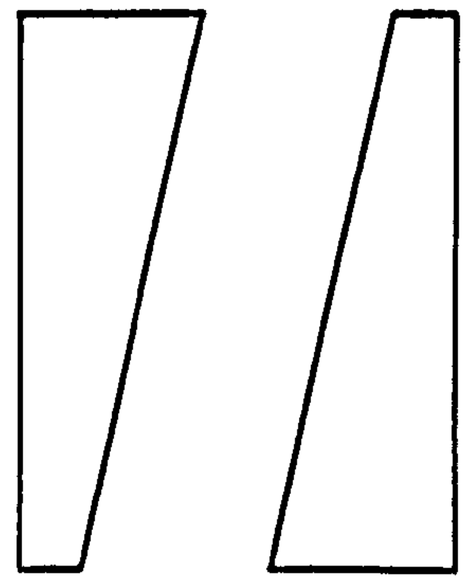


Fig. P11-1b

CYLINDER WALL GEOMTERY



Asymmetrical contrasting internal and external geometries, varying thickness through both horizontal and vertical axes.

In summary, whilst this sculpture offers one possible solution to the dilemma posed by Judd's concept, perhaps the repetition of one shape, the ellipse, does not create or imply sufficient variation to prevent the sculpture from being perceived as unambiguously singular. This is a concern that is not apparent in the second and final study that concludes the research.

Sculpture Two - Final Study

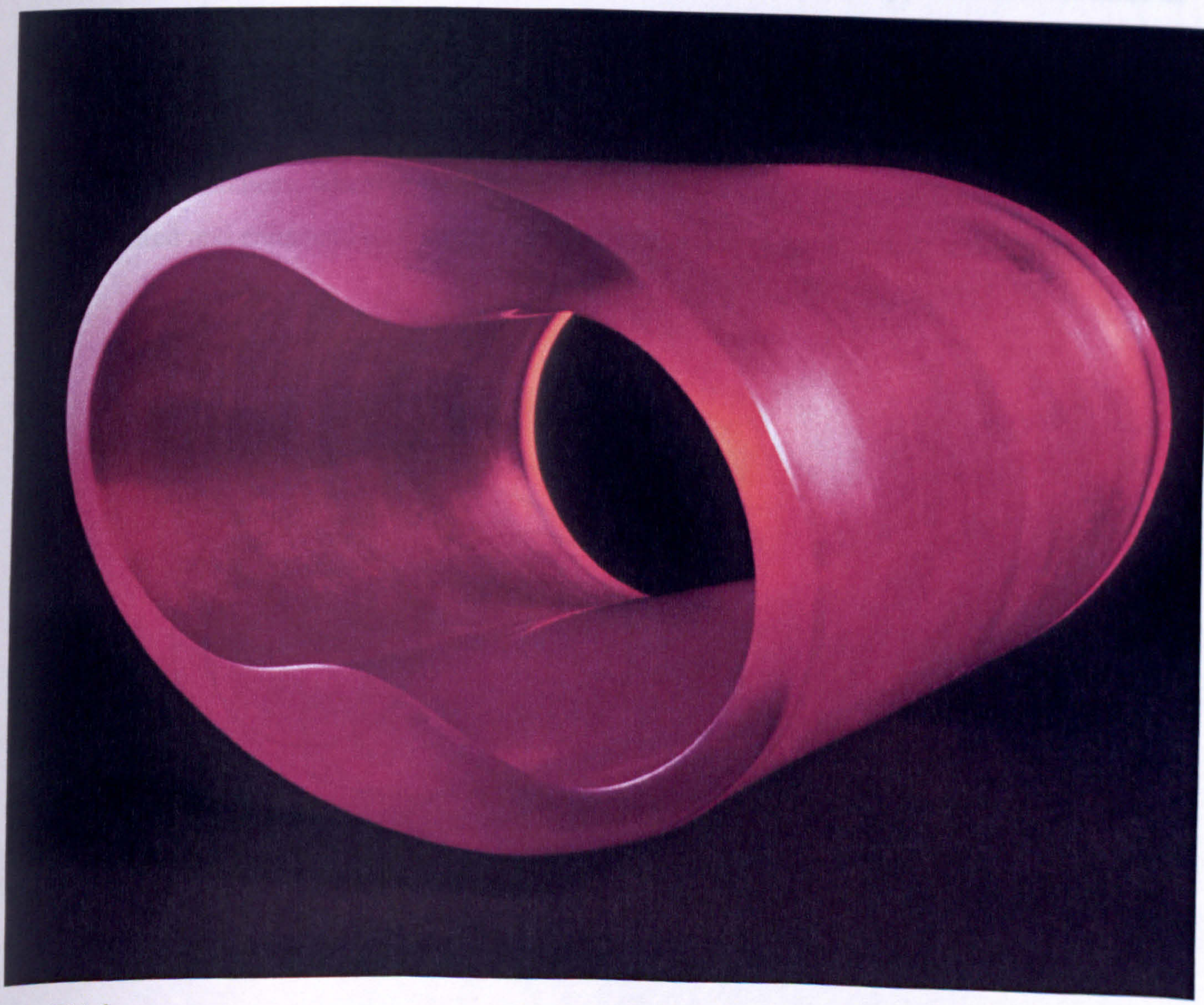


Fig. P11-2

The geometry of the second and final study exploits more than one shape; namely a circle, ellipse and the figure of eight. The interior is prescribed by a figure of eight, a sinuous shape resulting from the union of sections of four identical circular sections, two ¾ sections and two ¼ sections. Consequently, two primary circles are implied internally. This establishes a sense of division, if not a duality. Yet, this is counterbalanced by the singular consistency of the external ellipse within which it is constrained. A dynamic visual tension exists between the interior, which appears to be straining to divide, and the consistency of the external ellipse. The duality contained within the single form follows Robert Lawler's affirmation that, "unity creates by dividing itself"[115] or in other words that one becomes two and not the opposite. The variance in this sculpture's geometry is more refined and subtle than in the previous example because the shapes of the top and bottom edges are symmetrical and identical. Therefore, the contrast between the internal and external geometries is consistent through one axis, that is to say the variations in thickness, where present; happen through the entire length of the form. This is accompanied and enhanced by a slight rotational deflection of geometry of less than ten degrees.

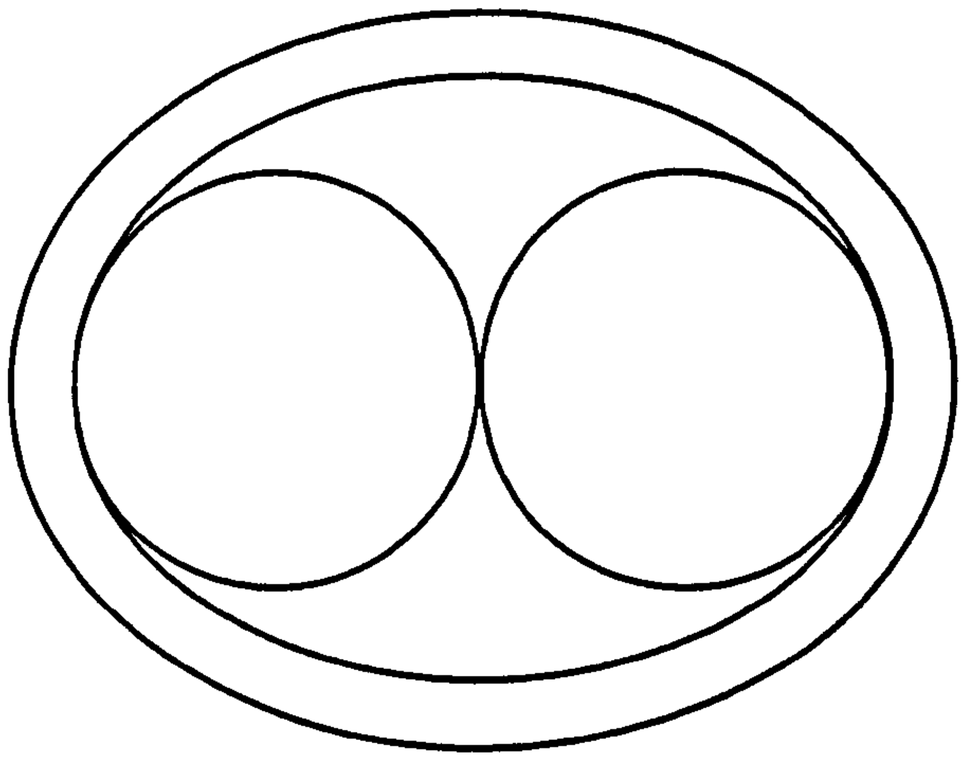


Fig. P11-2a

The difficulty of establishing a Gestalt of this form results from a combination of the rotational deflection of geometry and the illusory qualities of the translucent resin. As an observer moves around the sculpture a series of changing views are revealed in which the density of fluorescent pink varies in intensity, saturation, and tone. The illusory deflection of geometry is heightened by the appearance of an apparent internal light source within the form and the extreme diffusion of light along the sculpture's edges, which explicitly defines the edges' geometry.

This study has dynamic geometry. It might be transforming, yet remains singular because the division is incomplete. There is vibrant tension between union and division as the variance in the singular geometry nears duality. Nonetheless, the internal geometry of the sculpture is constrained by the exterior shape, which are almost proportionally identical at the evidently circular ends of the figure of eight because the latter follows the geometry of a smaller internal concentric ellipse. The study finely balances the desire for variation and consistency in a single form; it borders on not being *good form* but still offers the tentative promise of a Gestalt. The implied and actual rotation combined with the containment of an inferred duality suggests an answer to the dilemma posed by Judd's concept of *Specific Objects*, i.e. a sculptural form with both variation and unity. This sculpture demonstrates that *Specific Objects* is not too restrictive and shows how the physical and illusory *deflection of geometry* can expand the concept without compromising its unity.

CONCLUSION

The review at the beginning of the research established a visual vocabulary that was essential to understanding what was meant by *Specific Objects*. Significant terms were the geometry of the edge and the deflection of geometry. The former denotes changes, terminations, and apertures in plane – therefore revealing specific geometry, whereas the latter emerged through an early and key study, Fig. C1. This twisted through 90° in the mould resulting in an unexpected geometry that has similarities with Richard Serra's *Torqued Ellipse* sculptures. My categorisation of Rosalind Krauss's term, the *deflection of geometry* into physical and illusory can be a considered an original refinement. The former is based on variations in the physical geometry of form and the latter results from the illusory qualities of materials and surface finish.

Fig. C1

This unforeseen development derived from what was initially considered to be an error in the process of manufacture, which therefore enhanced my appreciation of how significant a contribution the intuitive X-factor could make to the research. Additionally, this particular occurrence led me to understand the potential of rotating a form's geometry and that any rotation could be carefully controlled through mould construction. Therefore, it underlined the importance of process to the research, especially when the process of creation defined everything that is subsequently visible. My process was distinct from Judd's because I undertook each stage of manufacture, so that practice became an investigative tool. This resulted in an extensive exploration of circular and elliptical geometries. A combination of physical deflections to geometry and elliptical geometries suggested one possible method of introducing variance into specific form. This desire for sculpturally significant, yet unified, form was important to Judd, and in fact is what prompted the original question as to whether his concept is too restrictive.

Perhaps this may have led him to combine materials of differing surface finishes and colours in one sculpture. However, I pursued an alternative strategy that involved casting sculptures in one piece of the same material and with a consistent surface finish.

The study, Fig. C1, marked the emergence of the deflection of geometry; however, the variance achieved through rotation and contrasting internal and external geometries seemed insufficient. Somewhat later, I realised that the transparency of the mould Fig. P6-2, page 80, had the potential to expose interior space, and that it could affect the perception of a form's geometry. Again, this is another example of progress in the research resulting from an intuitive realisation, or what can be considered as the X-factor. Casting clear resins, instead of opaque plaster, meant physical and illusory deflections to geometry could exist in one form. It also meant that light was transmitted from exterior to interior, giving the form greater perceptual cohesion; light and the luminescence of the material gave a unity through the interrelationship of interior and exterior. This articulation of light was particularly effective in minimising the duality of internal and external geometries. Antecedents for this are Gabo's planar Perspex sculptures such as *Linear Construction*, 1942. Brancusi's *Bird in Space* is also relevant to a historical placement because it combines subtly expanding and contracting contours with highly polished reflective surfaces i.e. physical and illusory deflections to geometry. Inevitably, my sculptures do share certain geometrical relationships with Richard Serra's recent work including the series, *Torqued Ellipses*, (Fig. 34-36); however, my exploitation of contrasting internal and external geometries and transparent materials differs from his use of opaque planar materials of constant thickness. The role of torque and rotation is vital to Serra, yet it does not reach the extremes of that demonstrated by Max Bill's *Endless Ribbon* sculptures. However, my approach to deflected geometry has been more refined in its deviation from expected trajectories. It therefore appears closer in intent to the sculpture of Anne Truitt and Ellsworth Kelly. The geometry of the final sculpture I have produced demonstrates a subtlety of geometry that allows for the simultaneous perception of unity and variance. This difference is particularly acute in comparison to Judd's orthogonal geometries, which appear rooted in the classical values of symmetry and perfection and contrast my slightly irregular asymmetrical geometries.

As the research progressed, illusion played an increasingly important role in expanding Judd's concept. At first, this may seem somewhat contrary to Judd's overtly anti-illusionist stance and the strict requirements of *Specific Objects*. However, observers and critics of his work noted the presence of illusion in his most successful sculptures; and, as already mentioned on page 27, Robert Smithson even suggested illusion actually gave his work its sculptural significance. Judd,

himself, implicitly acknowledged it when interviewed by Coplans in 1971.[116] Interestingly in this research, the role of illusion, derived from translucency, appears to some extent to be paradoxical because it simultaneously makes the forms' geometry specific, yet also mysterious. (I consider this condition to be the accommodation of perceived paradox, a condition that permits unity and variation to exist in one form). Casting in translucent resins emphasised the geometry of the edge because increased light collects, diffracts, and diffuses through it; so much so that the cross section of the plane has a very different appearance to the actual plane. The geometry of the edge thereby almost becomes linear, despite its depth, and effectively describes the geometry of the form's Gestalt as through it were a flat shape.

The effect is intensified in the third study from Project 9, Fig. C2. This sculpture is almost thin enough to be relief, and it therefore correlates to the emboss prints (Appendix 5), which define form through the shadows and light that are reflected from the raised edges. This sculpture demonstrates dynamic changes in scale internally and externally that both conform to the same elliptical Gestalt.

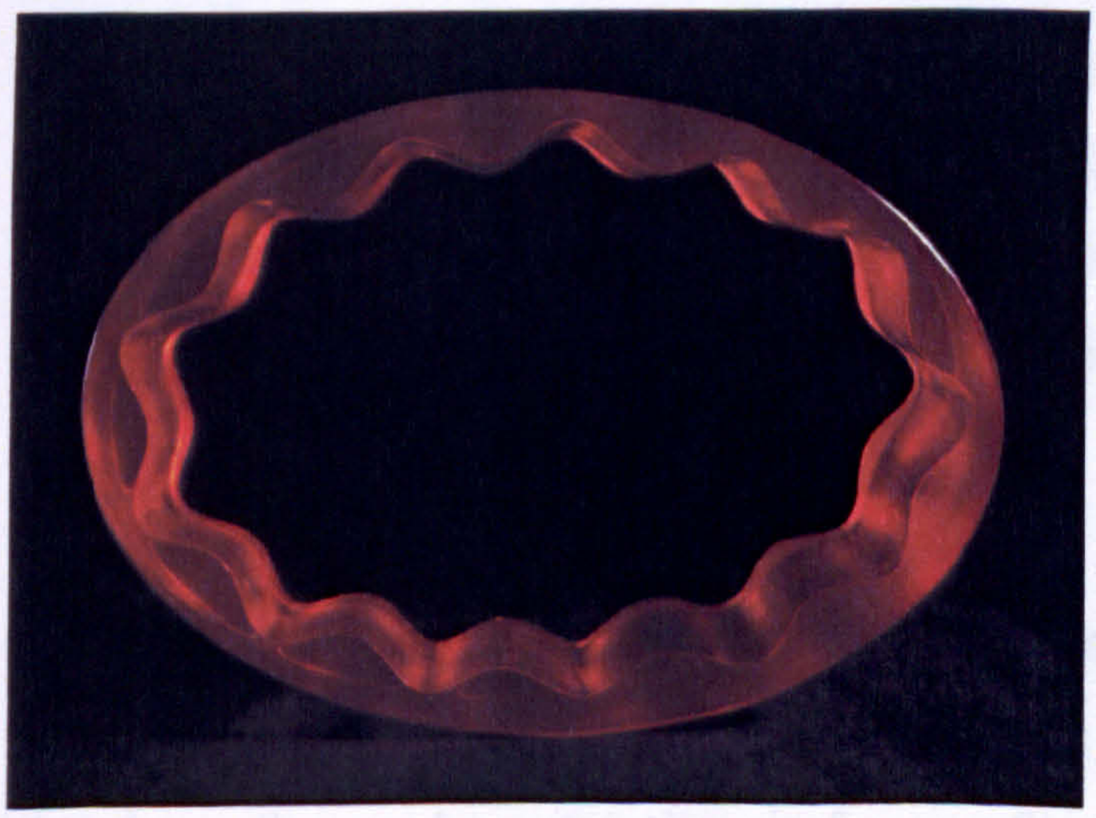


Fig. C2

The study above demonstrates how the greater perceptual cohesion caused by light passing through the resin caused the sculptures to have an almost iridescent glow where light became an important element in creating unity. The translucency of the resin appears to make the forms more specific because nothing is hidden within the internal mass and variations in the geometry of the edge and the planes are self evident, if not literally highlighted by a perceived internal light source. Yet, at the same time, the differing thickness of mass, defined by the contrasting internal and external geometries, creates the illusion of movement and changes in optical characteristics according to the position of the viewer. Therefore, it is inevitable that the use of

illusion, as opposed to its rejection, has underpinned the success of my sculptures. My exploitation of illusion to create perceptual ambiguities and mysteries, contrasts Judd's stated intent when using transparent Plexiglass to open out the interior of his boxes and make them less mysterious.[117]

A reductive approach to studio investigation gradually decreased the dominance of physical deflections to geometry. I reduced the deflections of geometry by lessening any rotation through each form from the direct opposition of perpendicular orientation to a subtler torque of approximately fifteen degrees. This refinement of geometry was assisted by the drawings and prints, which are detailed in the appendices. Of particular significance were the blind emboss prints because of their influence on mould construction and the geometry of the formers (Appendix 5). They were especially useful in encouraging me to experiment with overtly contrasting internal and external geometries, without too much concern for the eventual consequences for sculptural form. Counterbalancing the fine-tuning of physical geometry was an increased role for illusory deflections to geometry; which eventually resulted in two sculptures that conclude the research. Both of these sculptures embody Judd's concept of *Specific Objects* because relational composition has been minimised, thereby resulting in the perception of one overriding quality of singular geometry. They also have the Gestalt of a 'good' form, a concept that was of interest to Morris. However, these sculptures have more subtly complex geometries than Judd's regular and symmetrical orthogonal boxes. They therefore extend and open out his concept by showing that forms with singular geometries can embody variation, illusion, perceived movement and implied duality.

As previously discussed, Morris acknowledged the difficulty of a form existing with one overriding singular quality, as required by Judd's concept. In fact, Morris's own response was to abandon orthogonal constructions in favour of investigating materials such as steam or felt etc. Morris's approach appears closer to the Japanese concept of *Wabi-Sabi*, which favours asymmetry and imperfection over symmetry and order.[118] This is in keeping with my somewhat more intuitive approach to the ordering of proportions, geometry and scale, which did not follow Judd's use of simple mathematical proportions, such as halves, thirds, and so on, but were informed by the Gestalt laws of good form, such as closure and completeness. My decision-making was process driven, much in the same way that process dictates the appearance of Morris's and Serra's sculptures.

Instead of adopting Morris's approach of using materials that produce seemingly random but singular geometry, the research has exploited the unity of elliptical geometry. The ellipse underpins the geometry of the penultimate study, Fig. C3. Both its interior and exterior is elliptical. However, the consistency of this relationship is challenged by the rotation of the internal ellipse relative to its external counterpart. This rotation transcends the symmetry of what would otherwise have been a simple geometry, creating a dynamic visual tension. However, I felt that whilst this sculpture was of significance and had one overriding characteristic of singularity, it did not have sufficient variation to expand Judd's concept convincingly. Although rotating the internal ellipse created asymmetry throughout the form, which made it difficult for the viewer to comprehend the geometry of the entire form from a single viewpoint, the repetition of the ellipse perhaps created too much consistency.

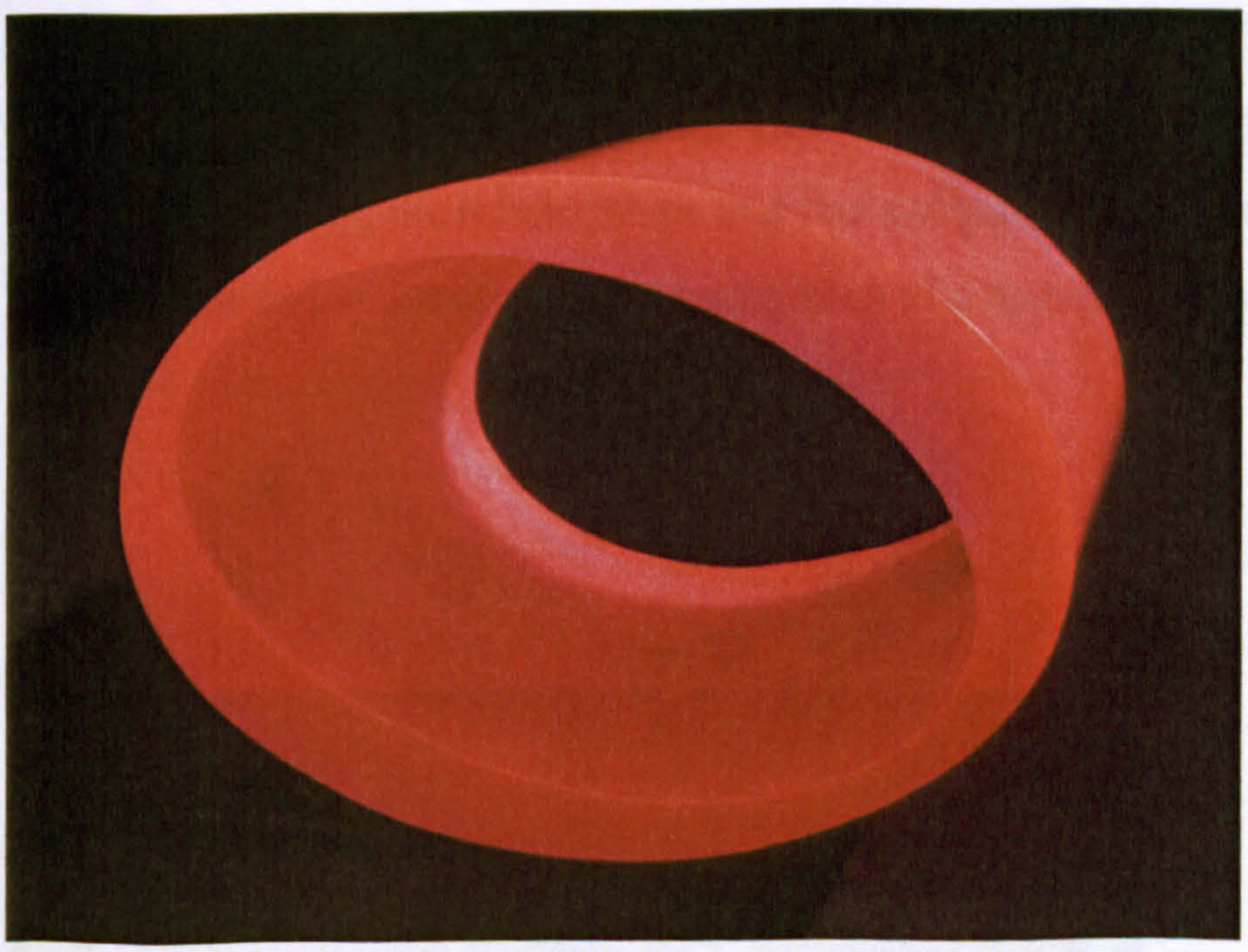


Fig. C3

The final sculptural study, Fig. C4, attempts to expand the boundaries of what geometries can be consistent with Judd's *Specific Objects*. It challenges how much variance a unified form can have, and yet still retain an overriding singular quality. This is because its interior and exterior are not of the same shape; it has distinctly contrasting internal and external geometries. This sculpture contains the implied division of an internal figure of eight derivative within an elliptical exterior. This geometry creates the impression of a duality beginning to emerge, whilst restricting its completion: the dual interior is projecting outwards yet remains bound within the

singular exterior. As mentioned previously in Project 10 of the Studio Investigations, this geometry is synonymous with Robert Lawler's assertion that unity is singular and becomes multiple through division rather than addition. The underlying elliptical geometry of the form means it curves away from its base and this helps strengthen its claim for independence from the surrounding architecture. Only its edges are planar, whereas its external contours continuously curve and therefore do not project outwards into space in direct alignment with the floor, ceiling, and walls. In this way, one could argue that it establishes fewer relationships than Judd's orthogonal geometries and is therefore more consistent with his *Specific Objects*. Although the sculpture is not pictured below in relation to architecture, its contrast from the rectangular borders of the image effectively demonstrates its claim for independence from the orthogonal frame of Western architecture. Additionally, the curving geometry of the sculpture's exterior affects a much more dynamic relationship with the surrounding space than occurs in a typical minimalist orthogonal sculpture. Rather than simply displacing space because of a perpendicular union between the form and the ground, this sculpture actually appears to compact and expand the surrounding space. The changes in the rhythm of this visual momentum accelerate and decelerate according to how close the viewer looks towards the line of direct contact with the ground. Therefore, the relationships that this sculpture establishes with the surrounding architecture and space assist the development of a *Specific Object* with dynamic variation.

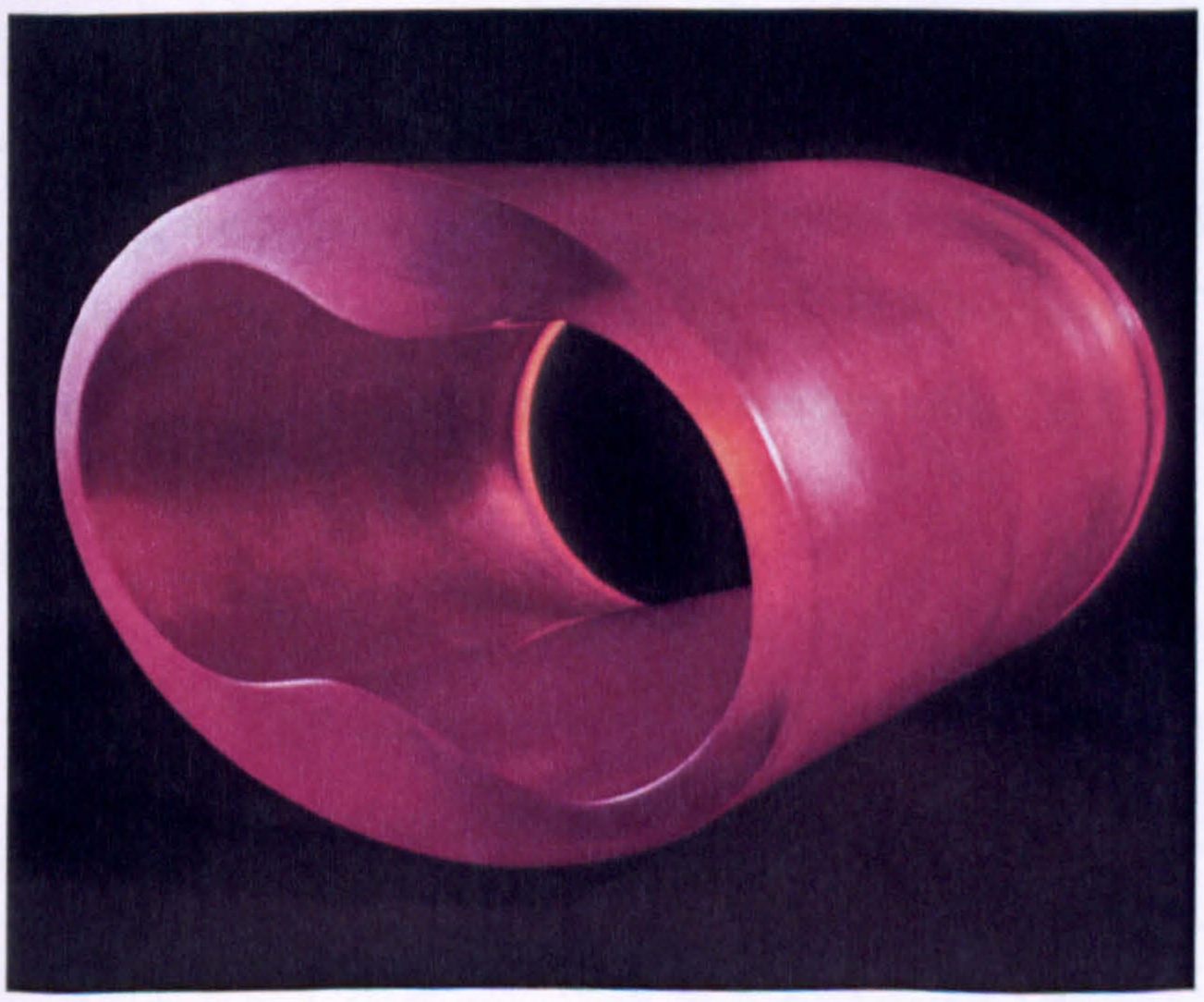


Fig. C4

As in the penultimate study, the rotation through the form augments the physical deflection of geometry and implies a sense of spiralling motion, whereas the material qualities of the resin and its response to light creates illusory deflections of geometry. As the thickness of the material diminishes towards the edge, or according to variations in the cylinder's thickness, the density of light captured and diffusing changes. This effect is augmented by the position of the viewer as they move around the sculpture. This induces ever-changing tones and saturations of colour that increase the illusion of movement. The capacity of the resin to capture and to diffuse light along its edges, also contributes to an illusion of weightlessness and the perceived existence of an internal light source within the sculpture. Illumination of the edge through captured light makes the form specific, it is a technique that is synonymous with Judd's use of the colour red[119], which he believed was, alongside grey, "the only colour that really makes an object sharp and defines its contours and angles."[120] The transparent fluorescent pigment further heightens the responsiveness of the sculpture's mass to light: its colour is vivid, luminous, and unusual in sculpture. Therefore, the sculpture establishes a new precedent for the articulation of illusion through light in translucent mass.

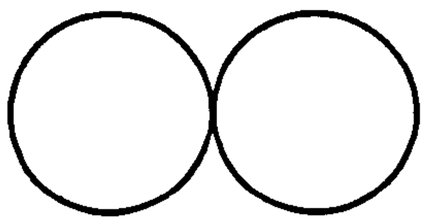
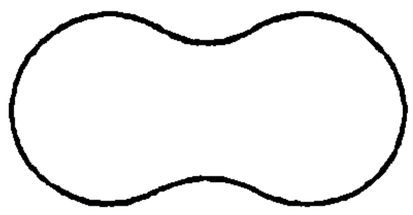
The intention of this final study was to strike a balance between the perceived potential for a Gestalt and the undermining of its establishment. This may appear contradictory, yet this sculpture attempts to demonstrate how it is possible to create a form that may initially be perceived as a simple entity from one viewpoint, but reveals its complexities on lengthier examination in the round. I am excited by the apparent incongruity between the fact that nothing is hidden in this sculpture, yet the physical and illusory deflections of geometry make its precise polar coordinates difficult to fix. The subtle undermining of symmetry and material consistency through the physical and illusory deflection of geometry has resulted in a sculpture of both unity and variation. This sculpture proves that Judd's concept of *Specific Objects* is not too restrictive. Furthermore, it establishes how the concept can be broadened without loosing its validity.

EPILOGUE

The conclusions were drawn to a close by stating that the final study "proves that Judd's concept of *Specific Objects* is not too restrictive. Furthermore, it establishes how the concept can be broadened without losing its validity."[121] Whilst the aforementioned contention is undoubtedly justifiable, it is not however to state that the final doctoral study signifies the end of the journey. It is just but one example of a singular form that extends Judd's *Specific Objects* through a combination of unity and variation. Naturally, others are likely to exist and their development will be the subject of my post-doctoral research. This will probably involve computer aided design and manufacture (CAD/CAM). For example, by exploiting the potential of 3D computer software to create subtle variations on a given virtual form through Boolean operations and manipulation tools such as shear, twist, rotate, shell, and skew etc. Thereafter, the extreme precision of rapid prototyping systems will be taken advantage of to make the subtly deflected virtual geometries manifest. These attempts to develop additional sculptures with variation and unity are likely to focus on geometries with contrasting internal and external geometries in which the interior suggests the variation of multiplicity contained within an entirely singular exterior. The eventual development of these sculptures will continue the extension of Judd's concept *Specific Objects* that has been initiated with this research.

GLOSSARY

Asymmetry	A lack of symmetry or equality between parts or aspects of a given geometry.
Circle	A round plane figure whose boundary consists of points equidistant from its centre.
Cast	To create a form by pouring a liquid material into a mould and allowing it to set prior to its eventual removal.
Concave	Having an outline or surface that curves inwards like the interior of a circle or sphere.
Contour line	A line that joins points of similar value on an object or plane.
Convex	Having an outline or surface that curves outwards like the exterior of a circle or sphere.
Deflection of Geometry	The undermining of the geometry of a regular form to the extent that it can no longer be considered absolutely uniform. I have identified two types of deflected geometry: one is based on actual variations in physical geometry and the second is the perception of variation that results from the illusory qualities of materials and surface finishes. I refer to these as the physical and illusory deflection of geometry. The term was first used by Rosalind Krauss in relations to describe the geometry of Brancusi sculpture; Krauss (1977:86). However, Krauss actually referred to 'the *ideal* deflection of geometry'. Krauss's notion of 'ideal' geometry is less relevant to this research because of its connotations with harmonious and divine proportions; and therefore relational composition. I consequently refer to, *the deflection of geometry*, as a means of describing my attempts and that of other sculptors to introduce variance to the geometry of unified forms.
Duality	The quality or condition of consisting, or appearing to consist, of two parts.
Ellipse	A regular oval shape, traced by a point moving in a plane so that the sum of its distances from two other points is constant, or resulting when a cone is cut by an oblique plane, which does not intersect the base.

Figure of Eight	Mathematically defined as a shape similar to that of the number eight. Therefore, its perimeter is defined by a continuous line that crosses itself whilst following the paths of two tangential circles. Alternatively, I have used the term to refer to a shape that is similar except that its perimeter does not cross itself. Instead, the shape is achieved by joining the two tangential circles with arced sections of two additional identical and perpendicular circles. Thereafter, the interior sections of the original circles were removed, as shown diagrammatically below.   Mathematical figure of eight My derivative 'figure of eight' For the duration of the research I have used the term figure of eight to refer to what is actually a derivative, for reasons of convenience and because my use of the term has invariably been in connection with my own 3D studies.
Form	The geometry of a three-dimensional entity. (Judd occasionally referred to a 3D object as a shape, when in fact the correct terminology would have been: form. This occurs in several quotations of his words)
Former	A tool, mould, template, or similar device used to shape materials or form objects. In this research, this term was used to describe the wooden ends around which the plastic shuttering was wrapped to create the moulds for the studies.
Geometry of the Edge	I have used this to describe the edge between the interior and exterior of a hollow cylinder.
Gestalt	An entity with one overriding singular quality that is perceived as in its entirety, and an organized whole that exceeds the sum of its parts.
Illusion	A deceptive appearance or impression.
Minimalism	The term for the 1960s artistic movement, coined by Richard Wollheim, to describe the 'pared' down and 'of minimal means' work

	of artists such as Donald Judd, Roberta Morris, Carl Andre, Dan Flavin *et al.*
Opaque	Something that cannot be seen through.
Open Ended Hollow Cylinder	A geometrical figure with; straight sides, circular or oval section, empty interior and not closed at its top and bottom.
Optical Illusion	Something that deceives the eye by appearing to be other than it is.
Relational Composition	The relationships between any parts in a painting, sculpture or artefact.
Shape	Geometry of two-dimensional entity. (Judd occasionally incorrectly referred to a 3D object as a shape, when in fact the correct terminology would have been, form)
Singular Form	A three dimensional entity that has one singular and overriding quality.
Specific Objects	A concept articulated by Donald Judd in 1965; based on the elimination of relational composition and illusion from 3D objects that were to have singularity of form and unity as their fundamental characteristics.
Symmetry	The quality of being made up of equal parts along an axis or facing one another.
Translucent	Material or article that allows light to pass through it, but does not allow objects behind it to be seen in detail.
Transparent	Material or article that allows light to pass through it so that objects behind it can be distinctly seen.

END NOTES

HISTORICAL BACKGROUND

[1] Judd's attitudes to illusion almost certainly have their origins in his initial training as a painter, when at that particular time, illusion was viewed as something negative, since it was the task of painters to deal with surface and non-illusory space.

[2] Harrison &Wood (1992:813)

[3] Fried (1998:150)

[4] Fried (1998:151)

[5] Wollheim, R. (1965:26)

[6] Hopkins (2000:138)

[7] Morris (1993:6)

[8] Gestalt psychology is particularly germane to the singular characteristics of Judd's concept. Developed by German psychologists, Max Wertheimer, Kurt Koffka and Wolfgang Köhler in 1912, it suggests that spatial concepts are inherent in the brain and not objects.

[9] A good form or Gestalt is a whole that is different from the sum of its parts and is defined by the dictionary as "a perceptual pattern or structure possessing qualities as an entity that cannot be described merely as a sum of its parts" (OED definition). According to the psychologist Edwin Boring, a good form is "well articulated and as such tends to impress itself upon the observer, to persist and recur" Boring (1942:253).

[10] Psychologist Edwin Boring subsequently identified a total of 14 laws, among which the most pertinent to the research include: Constancy of Form; Symmetry of Form; Fusion of Forms; Strong and Weak Forms; Open and Closed Forms. Boring (1942:253-54)

1. **Constancy of Form**: A form tends to preserve its proper shape, size, and colour. This is the well known constancy phenomenon.
2. **Symmetry of Form**: A form tends toward symmetry, balance and proportion.
3. **Fusion of Forms**: Two forms can fuse; giving rise to a new form; or, in combination, the stronger one may actually persist, eliminating the weaker. Simple, poorly articulated forms fuse more easily than complex, good forms. A more meaningful form tends to predominate over a less meaningful one.
4. **Strong and Weak Forms**: A strong form coheres and resists disintegration by analysis into parts or by fusion with another form.
5. **Open and Closed Forms**: An open form tends to change toward a certain good form. When a form has assumed a stable equilibrium, it has achieved closure. Thus, a nearly circular series of dots may achieve closure by being perceived as a circle.

[11] Morris (1993:6)

[12] Morris (1993:6) Furthermore, Rosalind Krauss notes the fundamental importance of symmetry to the establishment of a Gestalt "when the psychologist goes on to speak of the Gestalt itself, the figure which is sensed as well built, as most securely hanging together, as guided by the rules of 'good form' to constitute a whole rather than a shapeless mass of inchoate fragments, it will be symmetry and particularly centre that will ballast these rules" Bois (1997:89).

[13] Minimalist sculpture with its universal viewpoint stands apart from the academic tradition of sculpture, as exemplified by Michelangelo's *David*, 1501-04, which has one idealistic viewpoint. This supreme viewpoint co-exists with a series of views of lesser importance from which the entire form cannot necessarily be defined. In contrast, Cellini believed sculpture must be viewed in the round, as would Rodin later, and he discarded the hierarchical idealised viewpoint for an infinite number of equally important views. This is clearly demonstrated by the orientation of the six figures in Rodin's *The Burghers of Calais*, 1895. By placing them facing in different directions Rodin made it necessary to walk around the entire sculpture to comprehend it. In successful minimalist sculpture the latter is neither wanted nor required because the entire form can be established from any viewpoint.

[14] Coplans (1971:43)

[15] Battcock (1995:151)

[16] Interestingly Henry Moore noted the vitality of Pre-historic sculpture, in which simplification led to a kind of direct raw energy. This is reflected by the utilitarian objects of many civilisations, including the beaker people, whose simple functional vessels have many of the characteristics of S*pecificObjects*.

[17] It is probably for this reason that there are few examples of forms with one predominant quality before the advent of formalist abstract sculpture in the 20th Century. Only by looking beyond sculpture can examples be found of a simplified language of forms. Good examples are to found in ceramics, where utilitarian pots take the form of simple vessels, largely due to the minimum requirements of function and available technical expertise.

[18] (With all its vertices lying on the sphere) Livio (2002:67)

The five Platonic solids are: tetrahedron, cube, octahedron, icosahedron, and dodecahedron. They are described as Platonic solids because Plato derived four of them from the equilateral triangle. In contrast, "the dodecahedron cannot be constructed out of basic triangles, and because it approaches the sphere most nearly in its volume is associated here with 'the whole (spherical) heaven' Plato (1974:76). Each of the remaining solids is allied with one of the four natural elements; so fire and the tetrahedron, earth and the cube, air and the octahedron, and finally water with the icosahedron. For a more in-depth description, see Livio (2002:67-72) and naturally Plato's *Timaues*. Interestingly in terms of Judd's frequent use of the cube, Plato considers this form to be "the most immobile of the four bodies and the most retentive of shape" Plato (1974:77).

[19] Livio (2002:71)

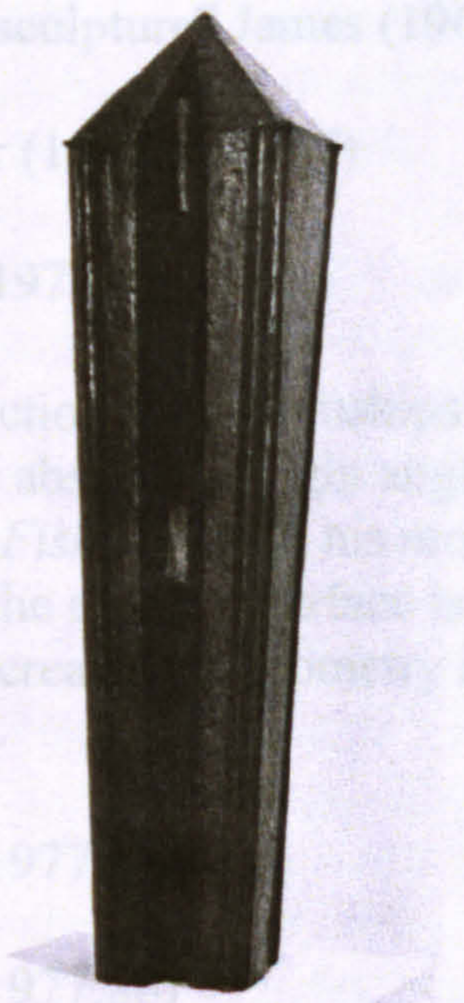
[20] Livio (2002:67-72)

[21] Rectangular canvases were particularly well suited to division according to Phi so for example, the ratio of width to height in the *Adoration of the Shepherds* by Giovanni Agostino da Lodi (about 1505) is 1:1.6. Furthermore, the internal proportions between elements including the sky and landscape also concord with the ratio. Additionally, the golden section can be established in various architectural works by Renaissance architects such as Brunelleschi and Bramante. The proportions of the latter's *Tempietto di San Pietro*, 1502, are clearly subordinated to Phi.

[22] Livio (2002:73/74 &160-183)

[23] Livio (2002:72-75)

[24] Lipchitz, *Arlequin*, 1919, Fig. E1



[25] Lipchitz, *Sculpture*, 1916, Fig. E2

[26] Livio (2002:170)

[27] Judd (1987:33)

[28] It is noteworthy to consider Sander's observation that "a circle is the most compact form. Integral form pressure is revealed with particular clarity when an irregular figure changes in the direction of circularity." Katz (1951:45).

[29] For examples of elliptical geometry in the studio investigations see study P9-4 and all the studies from projects 10 & 11.

[30] His drawings that illustrate the manuscript are the earliest depictions of the five Platonic solids and were made possible through the use of perspective, which he chronicled in *De Prospectiva Pingendi*, 1482-87. His knowledge of perspective was based on a scientific understanding of the way humans see and resulted in realistic portrayals of volumetric geometries in two dimensions.

[31] Rodin (1983:71)

[32] Rodin's integration of the complexities of the human form into a single but multifaceted entity might have been related to his use of the 'science of modelling'. Because of this technique, the surface reflects what is happening beneath, as the core radiates from the centre. The exterior is therefore born of the interior. The 'science of modelling' required him to "henceforth, when you carve, never see the form in length, but always in thickness. Never consider a surface except as the extremity of a volume". This resulted in form whose appearance resulted from what was happening beneath, revealing the subtle nuances of the volumetric figure at its surface. Rodin went on to explain how "instead of imagining the different parts of a body as surfaces more or less flat, I represented them as projectures of interior volumes" Rodin (1983:22).

[33] Brancusi was not especially concerned with representing visual appearances, but instead sought to reduce things to what might be described as an essence of their being. Nonetheless, he was preoccupied with a different kind of sculpture than that preceding him. The forms that Brancusi created could be extremely simple as Moore also noted: "Brancusi...simplified form...and made a martyr of himself really, for a single form, for the egg, or the egg form, as the basis for a sculpture" James (1966:98).

[34] Sylvester (1957:XXXIV)

[35] Krauss (1977:86)

[36] The reduction of relationships between parts *in Brancusi's* sculptures is primarily achieved through the absence of right angles or flat planes, even the most *seemingly flat planes gently* curve as in *Fish*, 1924. In his most unified forms, there are never any confluences of *planes; this* is because the external surface is a continuous and endlessly curving plane. This sense of singularity created by geometry is often enhanced though the consistency of material, surface and finish.

[37] Krauss (1977:86)

[38] Krauss (1977:86)

[39] The deflection of geometry in Brancusi's sculptures is restricted to the external contours because in his sculpture surface dominates the core. This creates the perception that they are so self-contained and compact they almost refute the presence of space and this isolation from

space underlines the duality of form and space. This is not a new condition. Form has traditionally dominated sculpture whereas, space, with which it shares a symbiotic relationship, has frequently remained concealed. Bronze, has for the last 3000 years been of central importance to the development of sculpture, it creates sculpture by casting in which the inside invariably remains hollow, its contours hidden within an external 'skin'. There seems to have been little interest in opening up and investigating the potential of this interior space prior to the twentieth century, and furthermore to articulating the space around sculpture, which had invariably been displaced preceding Modernism. Art Historian Stephen Kern has identified two changes that occurred in the late Nineteenth Century which prompted developments in spatial concepts, one proposed the existence of multiple spaces instead of the presupposed absoluteness of a singular space (extended artistically by Cubism) and the second considered space a positive material. Kern (1983:131-180). One of the ways space began to be articulated in sculpture was through the recognition of the context in which it is placed. Umberto Boccioni sought sculpture that would contain "within itself architectonic elements of the sculptural environment in which the subject has its existence" Coen (1989:241) and finally move into space as in *Development of a Bottle in Space*, 1912. At the same time Alexander Archipenko was investigating space as a positive sculptural material, he felt that "traditionally there was a belief that sculpture begins where material touches space. Thus space was understood as a kind of frame around the mass.... ignoring this tradition I experimented, using the reverse idea and concluded that sculpture may begin where space is encircled" Archipenko (1960:56). His ideas are demonstrated by the sculptures *Walking Woman*, 1912, and *Woman Combing Her Hair*, 1915, in which the mass of the figure's head has been replaced by space. Archipenko believed that space could be imbued with symbolic meaning. He sought to assert the equality of space with form; "a meaningless pierced hole can never become a proper symbol. In art the shape of the empty space should be no less significant than the meaning of the shape of the solid matter" Archipenko (1960:57).

The attempts of Archipenko and Boccioni to open the mass of sculpture were based upon figurative and therefore not consistent with the singular qualities of *Specific Objects*. Further developments were instigated by Vladimir Tatlin whose contextual development of form in space was led by *Corner Counter-Relief*, 1915. This constructed sculpture spans the space between the corner angle of a room, joining sculpture with site, allowing Tatlin to underline the existence of the space surrounding a sculpture by using architecture to support form. Also, see endnote 43, which describes the relationships between from and space in the sculpture of Henry Moore and Barbara Hepworth.

[40] This effect can make it difficult for an observer to understand the precise location of the form's external contours (which in itself may be considered of significance to the sculptural language and an extremely positive attribute). Consequently, a consistent perception of the entire form may be unlikely because differing geometries can appear to exist from the same viewpoint according to the light falling on the sculpture.

The ability of sculpture to respond to, and be modulated by, light was at the heart of Leonardo da Vinci's criticism of sculpture, which he considered inferior to painting because sculpture "is dependent on certain lights, namely those form above, while a picture carries its own light and shade with it everywhere. Light and shade are essential to sculpture. In this respect the sculptor is helped by the nature of relief, which produces them of its own accord; while the painter has to create them by his art in places where nature would normally do so" Richter (1966:207).

[41] Yet, the absolute unity derived from geometrical solids may not have been his intention: Brancusi sought to represent the 'essence' of things, and therefore wanted to reflect the flaws and abnormalities of nature; perhaps best expressed through irregular form as opposed to the

absolute mathematical perfection of regular geometries, such as the five regular polyhedra. Interestingly, this approach to geometry is encapsulated by the Japanese concept of *Wabi-Sabi*, which according to the author Andrew Juniper denotes:

> "Impermanence, humility, asymmetry, and imperfection. These underlying principles are diametrically opposed to those of their Western counterparts, whose values are rooted in a Hellenistic worldview that values permanence, grandeur, symmetry, and perfection." Juniper (2003:2)

This concept is present in the Japanese word *hacho* which literally means, 'to break harmony' and is used to describe the asymmetrical placement of rocks Zen dry stone gardens, *kara sensui*. It may be of no little importance that Brancusi was known to have been interested in Eastern philosophy and particularly the texts of Tibetan mystics.

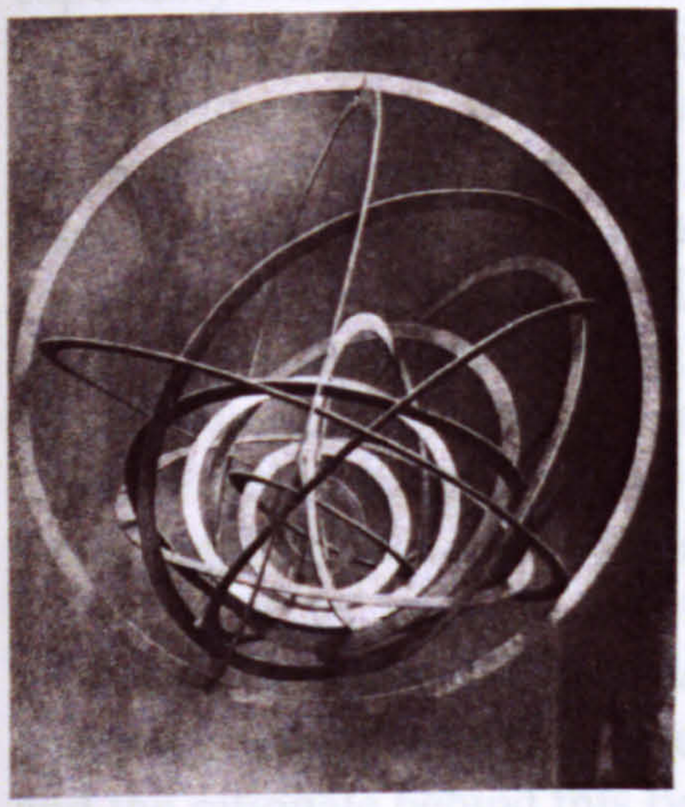
[42] According to Eric Shanes "the shape of the Endless Column derived partially if not wholly from his memory (Brancusi's) of the serrated forms of Oltenian folk architecture and artifacts" Shanes (1989:94).

[43] There are two sculptors whose sculpture can be perceived as similar to that of Hans Arp, in so much as it has singular qualities: they are Barbara Hepworth and Henry Moore. However, their sculpture is beyond the remits of this research because simple and unified geometrical forms rarely underpin their sculptures' geometry. Moreover, it is frequently anthropomorphic and somewhat lumpy, that is to say it is almost non-specific. Another reason for their exclusion from my detailed discussions is the dominance of opaque mass in their sculpture, unlike say for example Judd's thin walled sculptures and my own membranous cylinders. The latter is not negated by their attempts to introduce space to the interior of sculptural mass because one is always left with the overriding sensation of a large block having been penetrated rather than internal and external spaced being defined by a thin skin. Take for example Moore's *Internal External Forms*, 1951, about which critic Eduard Trier contends that "the piece is not transparent and only allows glimpses into the interior whose partial exposure does not break the overall cohesion of outline" Trier (1968:14). I concur with the author's reasoning and suggest Moore's puncturing of mass appears almost an afterthought, which results in a small volume of space surrounded by a bulky mass.

Hepworth's 1931 sculpture *Pierced Form*, is her earliest example, followed by Henry Moore's *Composition*, 1933. Yet, art critic, David Sylvester, observed that Moore was not alone in arbitrarily letting space into sculpture. Archipenko, Lipchitz, Gabo and Picasso had done so in modelled or constructed form and similarly Moore began by puncturing modelled form. Sylvester hints that Moore's original contribution to sculpture's development was confined to carved mass, noting that in piercing stone Moore probably sought to mimic the erosive effects of nature. Sylvester, D. (1968:71). It may also have been a reaction to the dominance of singularity of Brancusi's sculpture of which Sylvester noted "Brancusi's work, apart from its individual value, has been of historical importance in the development of contemporary sculpture. But it may no longer be necessary to close down and restrict sculpture to the single (static) form unit. We can now begin to open out" Sylvester (1957:XXXIV).

Other examples of sculptures in which there is an emerging unity between form and space include the work of sculptors Naum Gabo, Alexander Rodchenko, and Katarzyna Kobro. The latter especially, is beyond the parameters of this research because her linear transparent structures resulted from her theory Unism; which proposed the unification of form and space by creating a harmonious and complex rhythm between form and space. In other words, Unism

depended on relational composition and therefore directly contradicts *Specific Objects*. A similar, but not so extreme phenomenon can be observed in Alexander Rodchenko's sculptures, which are intrinsically relational. However, some of his later sculptures appear more likely to establish a Gestalt because their geometries are defined through the repetition of simple shapes, such as the circle. The best example of this is *Hanging Construction*, 1920, in which concentric circles were cut from a single plane of wood and the ribs rotated into hanging 3D kinetic form. Mass is implied by the kinetic rhythm of the moving circular ribs. In this sculpture, the repetitious use of the circle underpins its unity, albeit one not devoid of relational composition. Despite the existence of relationships between the parts, the transparency of its structure articulates space whilst allowing space to be seen to flow through it. This method of creating sculptural form suggests an alternative to the opaque singular forms of Arp, Hepworth and Moore.



Rodchenko, *Hanging Construction*, 1920, Fig. E3

[44] Judd (1975:184)

[45] Judd (1975:92)

[46] He also exploited the space created by cut outs and holes to diffuse mass. This can be seen in several later works such as *Heads or Tails*, 1959, where space is spliced and drawn into planar sections.

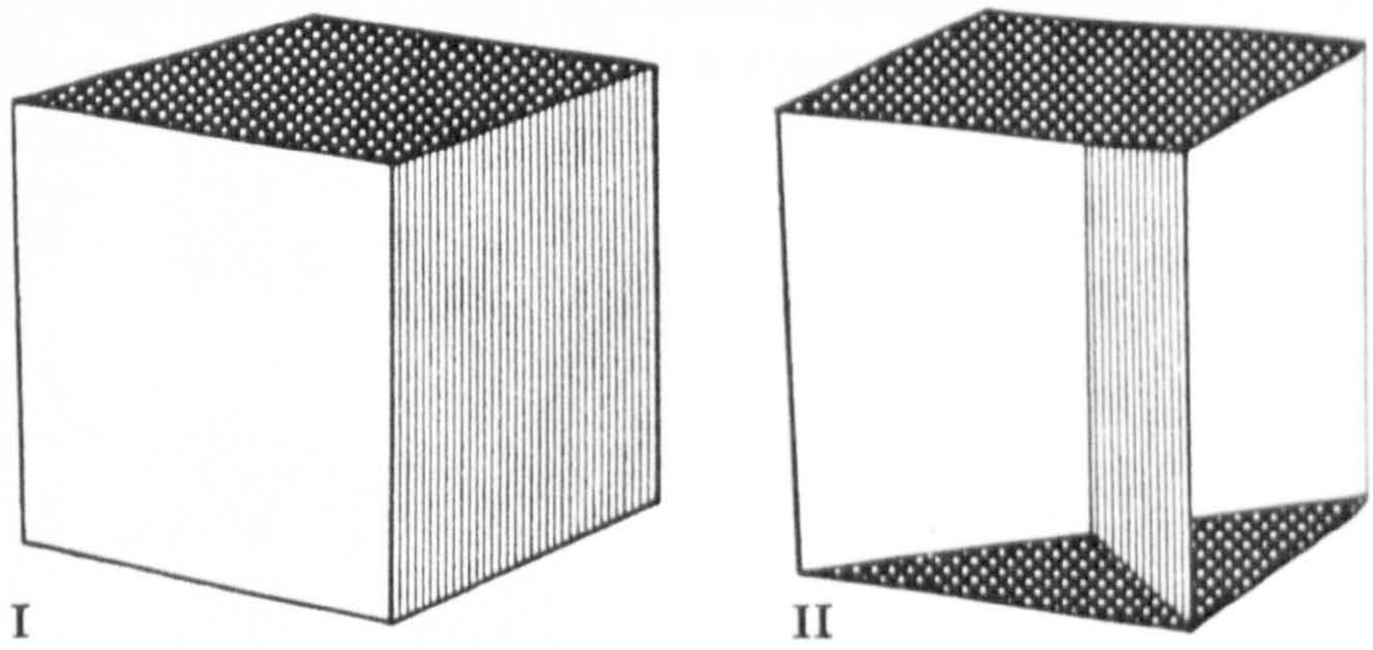
[47] The invention of new materials such as plastics allowed sculptors like Gabo greater freedom to make transparent sculptures through which light and vision could pass unimpeded. Prompting Trier to write of Gabo, "his compositions appear almost immaterial, surface and volumes carved out in space and consisting of it." He first explored these possibilities with celluloid in *Model for Column*, 1920-21; subsequently investigations were continued in plexiglass by Gabo, as well as Moholy-Nagy, and Vantongerloo. An additional quality of transparent and translucent materials is their capacity to create lines of light along their edges as light passes through the form. Trier describes these qualities in Gabo's *Column*, 1925, as "the spatial effect is obtained by the transparency of some of the materials which though they preserve some slight volume, all but abolish its function as a boundary by letting light through" Trier (1968:16).

[48] More recent developments in acrylic technologies have allowed sculptors like Alison Wilding and Rachel Whiteread to cast more complex and larger forms, complemented by large scale glass casting by Howard Ben Tre and the couple, Stanislav Libensky and Jaroslava Brychtova who explored the possibilities of 'light' spaces within hollow forms. In their sculptures, the interior space often has a different form to the exterior boundaries; this would appear to be deliberate,

but defining an additional form to that of the exterior through variations in the thickness of the membrane naturally challenges singular geometry.

[49] This approach was also explored by *Hepworth and Moore, who* both used string or thread to allude to mass through transparent structures. Threads were *invariably strung across part of a* large mass, in such a way as to create spectral net without defining or enclosing a space. *David* Sylvester considered that the string or wire in Moore's sculpture served "to create a transparent barrier between the space enclosed within the concaves of the sculpture and the space around the sculpture" in a sense trapping space; working as a "function of Moore's concern with making space within a sculpture a positive element. ('Sculpture in air is possible, where…the hole…is the intended and considered form')" Sylvester (1968:105). Sylvester also stated that "movement of the eyes along the length of the strings sharpens awareness of the space the sculpture encloses, especially when one set of strings can be seen through another, so that a counterpoint of movement is created which quickens the vibrations of space." Examples by Moore include *String Figure No1.*, 1937. Moore claimed authorship of the technique, but quickly disowned it, "when the war came I gave up this type of thing. Others, like Gabo and Barbara Hepworth have gone on doing it. It becomes a matter of ingenuity rather than a fundamental human experience" James & Moore (1966:209). Hepworth made similar sculptures to Moore, contrasting solid masses with stringed elements, for example, *Sculpture with Colour*, 1939. In contrast to Moore and Hepworth's somewhat clumsy combinations of strung and solid form is the sculpture of Gabo in which volume is subtly articulated by the interplay of delicate nylon wire and transparent Perspex frameworks.

[50] Naum Gabo invented *stereometric construction* to create volume without mass, to expose the space within a given mass. The technique was first demonstrated by *Constructed Head*, 1916, and the rationale behind this type of construction is explained by the diagram *Cube I and II*, 1930, which consists of two cubes, one solid that "represents a volume of mass" and the other an open 'stereometric' planar construction which defines the boundaries of the solid cube representing "the space in which the mass exists made visible" Gabo (1987:54). Gabo articulated space with specific relationships of planes that eliminate mass, which meant relationships exist between the parts, as seen even in the simple demonstration cube. This underlines the difficulty Judd would later face in unifying his cube and box forms by eliminating relational composition.



Gabo, *Cube I and II*, 1930, Fig. E4

[51] Battcock (1995:151)

During 'high' minimalism attempts to purge *relational* composition appeared to necessitate the unity and symmetry of solid geometrical forms, yet sculptures *based on these* forms were

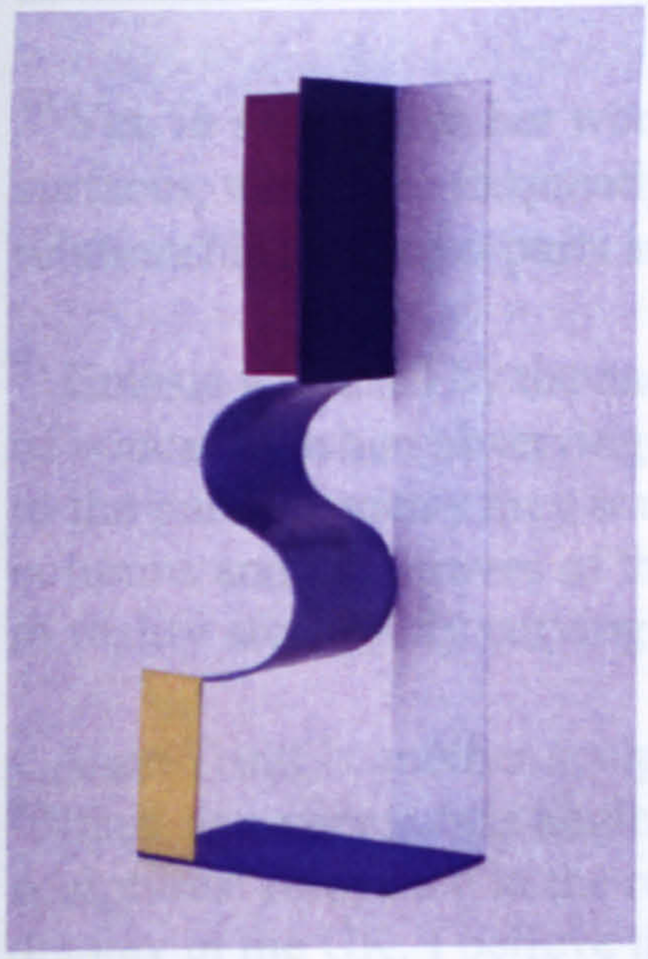
criticised for being boring by Barbara Rose amongst others. For a more detailed description on the various critical viewpoints on the relative 'boredom' induced by minimalist art see, Colpitt (1990:116-120).

[52] Judd, D. (1986:94)

Donald Judd was not the first artist concerned with the ramifications of order and perfection. In balance and symmetry, he was following in the footsteps of the Japanese Zen Gardeners. The Japanese word *hacho* literally means 'to break harmony' and is used to describe the asymmetrical placement of rocks Zen dry stone gardens, *kara senzui*. Within Zen art there is a strong element of reduction, which parallels minimalism. Tessen Soki, The possible architect of the famous gardens at Ryoanjii, Kyoto spoke of the art of "reducing thirty thousand miles to the distance of a single foot" in his garden book "*Ka Senzui No Fu*". – Ito, T. (1972) The Japanese Garden: An Approach to Nature. New Haven, London, Yale University Press. Similarly in *enso*, the ink circles drawn by Zen disciples, imperfections are perceived as the bridge between absolute geometry and man's humanity. In this context, there is also a link with the sculpture of Ellsworth Kelly and Anne Truitt.

[53] Morris also criticised the use of simple polyhedra because it requires a preconception of the entire object prior to making, so that the end defines the means. His eventual response to the dilemma posed by *Specific Objects*, (a form with unity and variation) was to achieve a homogeneity through materials such as, felt, steam, and slime which literally spread as one form, but did so without any tangible geometry. An example of this is *Untitled (Steam Work for Bellingham)*, 1971. However, this approach often resulted in seemingly random geometries where the external contour becomes perhaps complex, even haphazard.

[54] The ascendancy of the proportional concept of unity remain unchallenged until the Twentieth Century when in the 1920s, painter Walter Strzeminski, put forward an alternate theory called Unism, which postulated optical homogeneity in painting, and therefore the eradication of all part to part relationships. Conversely for his wife, the sculptor Kobro, Unism in sculpture meant treating space as an integral element of relational composition in order to unite form and space. In her sculptures surface homogeneity is intentionally destroyed by identifying parts with colour, as in *Spatial Composition No.6*, 1931 (Fig. E3). In fact her attempts to unify form and space depended on relational composition through the identification of all the parts constituting a sculpture; thereby directly contrasting *Specific Objects*. Interestingly, the curved blue element may well be a sine wave, which is symbolic of purity because a pure musical note is produced from it.



Kobro, *Spatial Composition No.6*, 1931, Fig. E5

[55] Judd started as a painter but abandoned it in favour of creating 'specific objects', because for Judd "actual space is intrinsically more powerful and specific than paint on a flat surface." Judd (1975:184)

[56] Coplans (1971:47)

[57] Coplans, J. (1971:43)

[58] Coplans (1971:47)

[59] Morris (1993:60-61)

[60] Coplans (1971:49)

[61] Morris (1993:64)

[62] As well as training as a sculptor, Morris performed dance, and was perhaps more familiar with the potential freedom for movement in space as a consequence. Interestingly, he wrote his MA dissertation on Brancusi, a sculptor that Judd greatly admired for the integral unity of his forms.

[63] Harrison, C. & Wood, P. Eds (1992:755)

[64] Harrison, C. & Wood, P. Eds (1992:757)

[65] Coplans (1971:50)

[66] Meyer (2001:138)

[67] Meyer (2001:138)

[68] This particularly surprising in the case of Morris who wrote his MA dissertation on Brancusi.

[69] This belief is supported by Judd's refusal to alter the symmetry of his sculptures' exteriors, which appears to be sacrosanct. Judd only ever intensified the basic geometry of his sculptures by introducing geometrical complexity internally through cuts, gaps, or the addition of slats and partitions.

[70] Yet, in some ways her work is beyond the current sphere of activity because of its painted surfaces, which are frequently split into two or three coloured sections. Consequently, relationships between parts are established despite the overall unity of her forms' geometry.

[71] Entasis was used by the ancient Greeks to compensate for eyesight, which creates the illusion of concavity when observing straight lines. They used it to circumvent any perceived distortion to the pure geometry they sought in their architecture. This can be seen in the floor, roof, columns and architraves of the Parthenon, all of which appear to be straight edges or planes, but in reality are slightly curving surfaces.

[72]Anne Truitt is another sculptor who exploits subtle variance in geometry; frequently it is 'offset' at a very subtle angle from the horizontal or the vertical. The difficulty of assessing her sculptures' relevance to the research was compounded by the lack of her sculptures on public display in the UK. I believe the potential negative impact of this is lessened by Truitt's concern that her painted surfaces should transcend form: in other words, singular geometry is not her overriding concern, whereas the primacy of colour is. In 1979 she stated "I find I have nearly abandoned form...what I want is colour in three dimensions, colour set free, to a point where, theoretically, the support should dissolve into pure colour." Truitt (1991: unpaginated see end notes of essay, which state quote is taken from; Munro, E. (1979) *Originals: American women artists*. NY, Simon and Schuster.) In fact, the use of several colours on the sculpture's surface is obviously not homogeneous and therefore inconsistent with Judd's concept. Those interested in combination of subtly offset geometries and painted surfaces in sculpture should also examine the work of the East Coast minimalists including Tony Delap and John McCracken.

[73] Colpitt quotes Michael Compton on the shell forms: "The sense one has of the sculpture being shells is also linked to the way they occupy space. That is, they fence it off rather than fill it absolutely" Colpitt (1990:57).

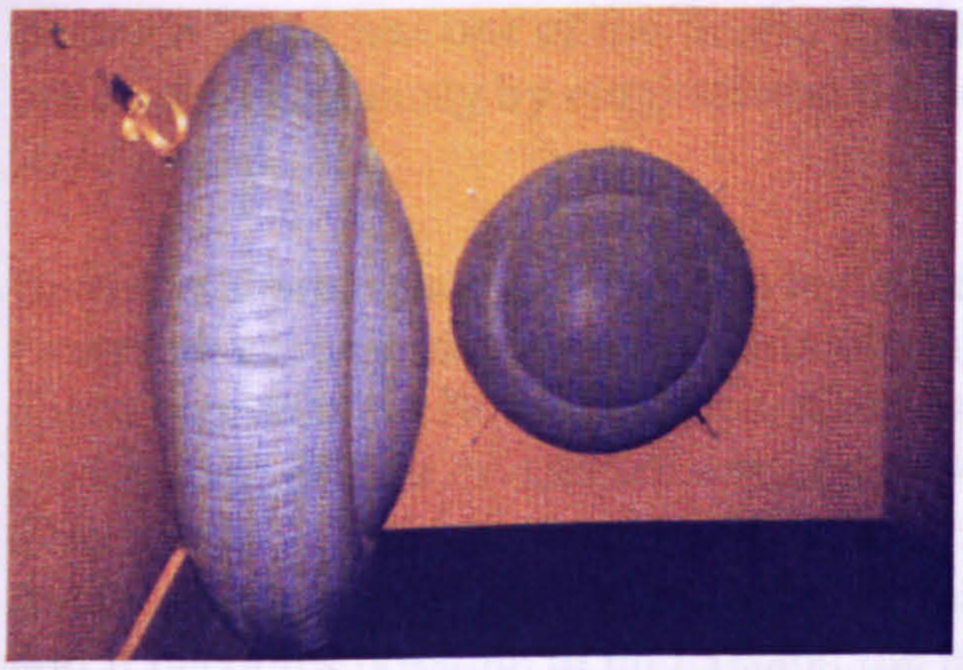
It is noteworthy that Judd's interest in the 'shell' form was not because it allows space to enter sculptures *per se*, but that it exposes the actual thickness of materials. Judd considered this trait important because it clarifies structure, exposes mass, and reduces any illusory characteristics. It was his desire to demystify art that led to a shift from wood to metal fabrication; "I wanted a thinner, more shell-like surface, so that the volume inside would be clear" Coplans (1971:44). Judd also exploited the qualities of transparent plexiglass to reveal structure and means of construction, and Judd exploited this in several stacks incorporating plexiglass, stating how "the use of plexiglass exposes the interior, so the volume is opened up. In the large piece owned by Passadena, the viewer has a clear idea of the volume because he knows how thick the walls are, even though it can't be seen into. It's fairly logical to open it up so the interior can be viewed. It makes it less mysterious, less ambiguous" Coplans (1971:45).

[74] Colpitt (1990:55)

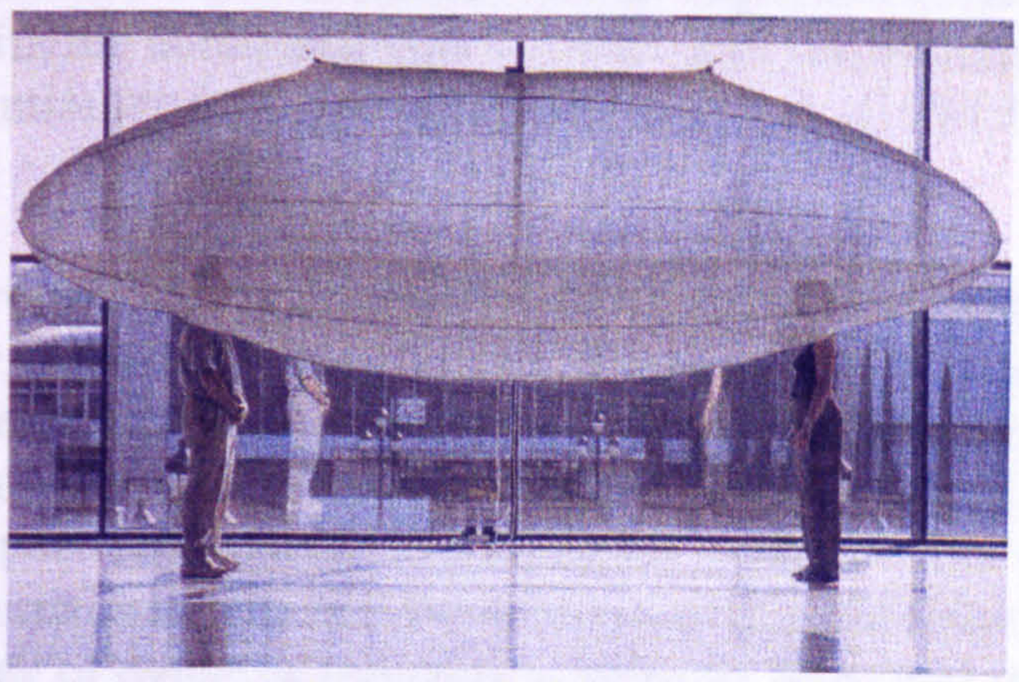
[75] Morris's sculpture is based on the hypercube, which is used extensively to generate a 4^{th} dimension variable in three dimensions. It can be topologically translated into a hyper-sphere by 'rounding' the orthogonal joins.

[76] I argue that Judd's overriding intention was not to explore the viability of singular form through transparent and open structures. Nor was it to reduce the duality of form and space; however, it is quite possible that the unification of form and space is an unobtainable paradigm, perhaps only the illusion is possible. Yves Klein searched for this illusive dream with the

photographic deception *Leap into the Void*, 1960 and also *The Void*, 1960, the empty gallery in Paris. These works have conceptual parallels with Manzoni's inflation of the balloons constituting *The Artist's Breath*, 1960. In fact a transparent inflatable might lend itself well to the illusion, however no artists have undertaken a sustained investigation of inflatable forms in relation to abstract forms with singular qualities, nor the deflection of geometry. Recent inflatable sculptures like those by Lang and Baumann tend to be figurative, though a few formalist examples include sculptures by Fabrice Gygi and Paolo Reinoso, Fig. E4 & 5. For more information on inflatable sculpture, see Topham (2002).



Gygi, *Second Generation Airbag*, 1998, Fig. E6



Reinoso, *La Parole*, 1998, Fig. E7

[77] Read (1955:57)

[78] Krauss (1977:270)

[79] Burnham (1968:40-44)

[80] Judd ardently claimed that he was responsible to extending the language of sculpture through the abandonment of the plinth. There are however many alternative claimants for this invention, including Rodin who wanted the heroic figures of the *Burghers of Calais*, 1885, to be on the same level as the observers; stating "I did not want a pedestal for these figures. I wanted them to be placed on, even fixed to, the paving stones of the of the square in front of the Hotel de Ville in Calais so that it looked as if they were leaving to go to the enemy camp…. But the commissioning body understood nothing of the desires I expressed. They thought I was mad…. Statues without a pedestal! Where had that ever been seen before? There must be a pedestal; there was no way of getting around it" Tancock (1976:385). Other precedents include Carpeaux, Tatlin, the Stenberg Brothers, to some extent Brancusi and more recently Caro with *Twenty Four Hours*, 1960. Generally, it does seem that there was a collective consciousness during minimalism through which it became widely accepted practice that sculpture no longer required a plinth.

[81] Judd professed a deep interest in spatial issues in his 1993 essay *Some aspects of colour in general and red and black in particular*, asserting how he had articulated space by charging the spaces between multiple forms, Judd (2000:81). In this essay, Judd contends that "the development of space is only 30 years old" and considers himself to be one of a minority of artists who have dealt seriously with it. Judd begins the essay by describing and asking questions about a rock:

> "How large is it? Is it on a level surface? Does it rest on the surface or does it perch? …Is the rock symmetrical? If not, does it face away or toward the tilted surface? Is

> the top of the rock pointed, rounded, flat but symmetrical with the sides, so that the rock is a thick plane parallel to the surface, level or tilted? That is, in general, in what way does the rock create space round itself?"

Yet, there is no mention of interior, no questions about the rock's interior and how it might affect space. Subsequently he evaluates the sculpture of Rodin, Brancusi and Arp as traditional, effectively 'one rock with complications'. Judd also describes how, having rejected the necessity of the pedestal, the way in which he placed sculpture directly on the floor, then in the corner of the room, and finally on the wall. Sculptor Richard Serra considers this an important contribution because "Judd was one of the first to deal with the contained interior space and surrounding space simultaneously by emphasising the continuity from the inside out" Serra, R. (1994:114 - *Art Forum*).

In minimalism, space just happens to be there, which does not follow the European traditional twentieth century mainstream of articulating space as positive matter. This may relate to how space is ordered in North America, space is neither tight nor defined. This may be because the grid system of land division discourages owners to relate their subdivision of a plot to any other. This results in the compartmentalisation of space and spatial independence. Combine this with the two dimensional painterly origins of minimalism, which is based on drawing and thinking, and it becomes possible to understand the lack of dynamic interaction between form and space that persists in Judd's sculpture.

[82] Serra (1994:114 – *Art Forum*)

[83] Puryear (1993:18)

[84] A visual tension he enjoys, stating that wire mesh creates "the appearance of heavy volume and solids, but once approached one sees that it is transparent at the same time" Puryear (2001:5).

[85] Deacon's sculpture *Untitled*, 1980, is admittedly not entirely based on curvature, and does have orthogonal edges throughout all of its constituent lathes, in addition to the corner at the point of its flame. However, the overall gestalt is one of curvature.

[86] Bickers (1985:17)

[87] Puryear stated he wanted to make a form with "an internal expansion, as though it were inflated, filled with something, like a filled bag, or a balloon, or an airship – like things that are inflated form within" Puryear (2001:9). Puryear also accedes that he works with intentional dualities, "The strongest work for me embodies contradiction, which allows for emotional tension and the ability to contain opposed ideas." He said the following of *Bask*, 1976, "its meant to float above the floor and to stretch taut along the floor....I wanted these differences to co-exist in a single work" Puryear (1984:23). This interest in the cohesion of duality without its destruction continues throughout his sculpture and is evident in *Box and Pole*, 1977, a 100 ft wood tapered pole with a square cube at its base, which he "determined to make a single concentrated element to pierce the space above landscape...the box was compact and drew your attention to the ground, while the pole was quite the opposite. The two elements were pressed into close proximity, and the two opposites surrounded by such a vast amount of space read as a single event" Puryear (1984:37).

[88] Discovered for the modern era by August Ferdinand Möbius, but already in existence for millennia as the Egyptian symbol for infinity. Bill (2000:14)

[89] For a more in depth discussion on Baroque geometry see, Deleuze (1992), who interestingly notes that the Baroque, "endlessly produces folds" Deleuze (1992:3). The latter appears to confirm the notion that Bill's *Endless Ribbon* is Baroque in both conception and appearance.

[90] Gaché (1996:22)

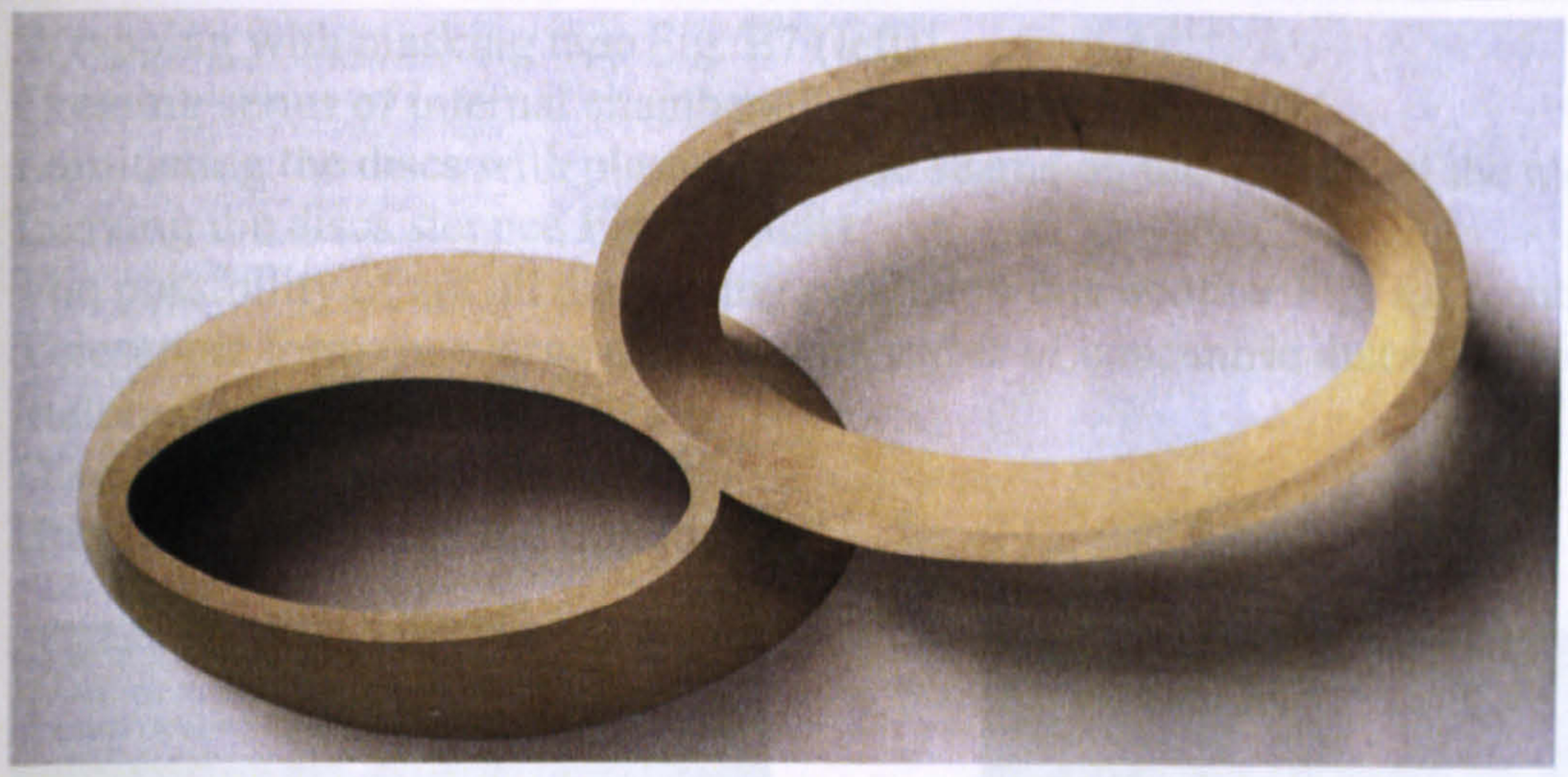
[91] Kapoor (1999:TV Documentary)

[92] Irving (2004:19)

[93] Serra (1997:18)

[94] Serra (1997:17). Despite the stability of *Torqued Ellipses'* 40 tonne mass, its geometries seem to shift fluidly like an imperceptible force field, resulting in internal and external geometries that are defined experientially and are thus unique for each and every observer. Art Critic David Sylvester, suggested that it involves "an Eastern aesthetic by which the organisation of forms is not evident from the outside. When you enter the work, and you become part of it, you move about in it, and the relationships constantly change according to your movement in it, and the thing is always changing, and you discover the organisation through your movement inside it, in time" Serra (1998:205). The inability to conceive the form in its entirety may relate to its monumental size, which means it simply can't be seen from one viewpoint. Anish Kapoor has recently extended monumental size beyond these boundaries in the sculpture *Marsyas*, 2002, which filled the turbine hall at Tate Modern. Its sheer dimensions means it obscures itself and can only be understood through a series of sequential experiences. It cannot be viewed in the round as an object in space because it is effectively jammed into an enormous gallery.

[95] Another contemporary sculptor who has explored the potential for variation to exist in the ellipse is Nigel Hall, demonstrated by the sculpture *Like Thunder*, 2004. Hall's recent sculptures explore the union of two elliptical conical sections, in which geometries are often irregular and offset. Describing these variations Stephanie Bickel noted that, "the offset individual elements repeatedly interrupt the perfect symmetry, present their surfaces to the viewers at different angles, and come to life with the play of light and shadow on their surfaces" Bickel (2004:43), and that "depending on the viewing angle and point of view, the work changes: the dimensions shift, deflect forward and back; a circle becomes an ellipse and back again" Bickel (2004:45). Whilst Hall introduces significant variation into regular geometries, the perceived relationships between multiple parts in his sculptures reduces their relevance to this research.



Hall, *Like Thunder*, 2004, Fig. E8

[96] The *Vesica Piscis* is the area within two equal circles positioned so that one's centre exists on the perimeter of the other, and vice versa.

[97] The curves in Sera's sculpture appear to be sine waves. Interestingly, this increases the paradigm of motion since the sine wave produces the pure musical note only obtainable from a tuning fork.

[98] Bickers (198:17)

[99] This notion is supported Robert Lawler in his book *Sacred Geometry* when he outlines the philosophical concept in which "unity creates by dividing itself" Lawler (1982:23).

[100] Flexible PVC has particular physical characteristics that were especially suited to exploring subtle variations in planar geometry. The formers were key to defining the mould's geometry. Varying the dimensions, thickness, proportions, geometry, and relative orientation of the formers facilitated a broad exploration of the vocabulary of singular form and physical deflections to geometry.

[101] A simple regular cylinder can be consistent with specific form. If it has circular geometry it can reduce relational composition through the elimination of right-angled edges where planar parts meet.

[102] Another difference concerns my focus on circular, as opposed to orthogonal geometries. Whilst dependant on the architectural context, Judd's sculptures frequently share geometry with their architectural surroundings, they are bound the right angle and also contained within them. Therefore, relationships are implied. By contrast, my circular geometries placed within similarly orthogonal rooms stake a claim for independence from architecture; although this might not be the case within other types of architecture, say for example, a circular building such as the Guggenheim, New York.

STUDIO INVESTIGATIONS

[103] Prior to the initial sequence, I began a largely unsuccessful investigation to find techniques for creating contour lines that were either integral to the form or applied to it. Approximately 10 polystyrene cores were carved (Fig. E7-9), onto which contour lines were created by:

Wrapping with masking tape Fig. E7 (left)
Creating series of internal chambers Fig. E7 (centre & right)
Laminating the discs with plaster to create seams on the interior of the model Fig. E7 (right)
Leaving the discs stepped Fig. E8 (left)
The possibility of not all discs being parallel to one another Fig. E8 (centre)
Telescopic form (one large disc cut with series of concentric discs that were pushed out, this included Fig. E8 (centre)
Discs misaligned Fig. E8 (right)
Burning with a soldering iron Fig. E9

Fig. E9

Fig. E10

Fig. E11

My original intention was then to build the cores with plaster prior to removing it. A test block of polystyrene was scored with grooves, built up with plaster, and finally burnt out with a blowtorch. This left a black residue that obscured the detail of the internal drawing (Fig. E10). Another sample was wrapped in masking tape, which enabled its subsequent clean removal from the plaster. The casting process transposed an impression of the masking tape surrounding the core's exterior onto the interior surface of the finished study (Fig. E11). The trial blocks exposed the inadequacy of hand laminating which, without extensive finishing, left indistinct geometries of inconsistent thickness and uneven planar surfaces. Consequently, I curtailed this approach in favour of a more process driven technique dependent on predefined moulds.

Fig. E12

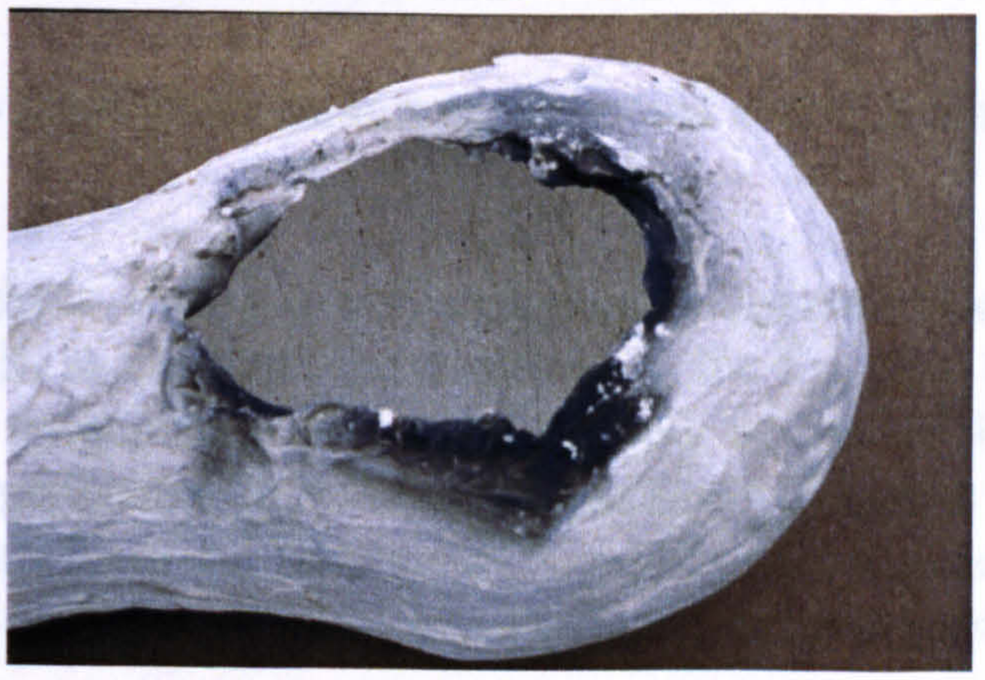


Fig. E13

[104] This research was originally titled: *The re-affirmation of singular and unified sculptural form through contour line*. Part of the earliest stages of the literature review identified two types of contour line: structural and applied. It showed that until the 20th century contour line frequently resulted from the application of drapery to the sculpted figure. Examples include; Classical *Korai* and *Kouroi* and Egyptian sculpture such as, *Rameses II*. In the twentieth century, contour line began to result from the structure of a sculpture. New technologies and materials allowed sculptors such as, Gabo to construct sculpture from parts, meaning that contour line resulted from the construction process. The use of line on form appears primarily to be a modernist concern that has not been explored in any depth. Therefore, the studio investigations set out to establish whether line can affect the geometry and planar momentum of singular form. As this thesis demonstrates, the lines at the surface were eventually recognised as details that contributed to relational composition and were therefore discarded.

[105] Boring (1942:253-54)

[106] Krauss (1977:86)

[107] The bronzes detailed in Fig. P1-0 first suggested the possibility of varying the thickness of a membrane to produce contrasting internal and external geometries. The risk of using this technique appeared to be that if the contrast is extreme then singularity of form might well be compromised.

[108] A more consistent approach, achieved much later in the research, involved manipulating the geometry of the formers to ensure any rotation also occurred through the deflected geometry of the membrane's thickness.

[109] These lines were caused by the mould construction, which involved wrapping a sheet of acetate around itself to create a cylinder that was sealed. Naturally, this created an abrupt step where the sheet began. At this stage of the research, in order to mask its presence after removing the study from the mould, I stopped using a vertical cut and begun to cut the acetate diagonally. This meant the line gradually travelled around the form, making it less noticeable once sanded *away.*

[110] These studies also suggested the line could be altered from relief *to incision* over its length.

[111] This was a direct consequence of the earliest direction of the research and my previous studio practice, which concerned the potential for contour line at the surface of form to affect the perception of a form's geometry.

[112] In addition, it might elaborate on Kobro's attempts to harmonise form and space, defined by her theory of Unism; see endnote no. 54.

[113] As previously mentioned the figure of eight is, from a purely mathematical perspective, often considered a continuous line that crosses itself, exactly like the number 8 or the Egyptian symbol for infinity. It is therefore constituted by two tangential circles. Alternatively, my use of the term refers to a shape that is similar except for its perimeter line does not cross itself. This was achieved by joining the two tangential circles with arced sections of two additional identical and perpendicular circles. Thereafter, the interior sections of the original circles were removed.

[114] A more complete quotation is:

> "Those who use geometric figures to describe the beginning of Creation must attempt to show how an absolute Unity can become multiplicity and diversity. Geometry attempts to recapture the orderly movement from an infinite formlessness to an endless interconnected array of forms, and in recreating this mysterious passage from One to Two, it renders it symbolically visible.... From both the metaphysical and natural point of view it is false to say that in order to arrive at two, you take two ones and put them together.... Unity creates by dividing itself" Lawler (1982:23).

Lawler also quotes R.A. Schwaller who stated, "the Number one is only definable through the number two: it is multiplicity which reveals unity" Lawler (1982:20).

The consequences for this research appear to be that in terms of unity, one becomes two as opposed to two becoming one, which equates to the morphing or sub-division necessary for evolution to occur in nature. This is quite significant for the research and appears to support the potential for duality to exist within, and emerge from, singularity (this suggests it is ever present but just hidden). It supports study Fig. P9-4 where the implication of a dual results from the division of a singular unity.

The Taoist symbol of *ying* and *yang* clearly expresses the aforementioned notion. It divides one circle with two semi-circles, resulting into two similar, but asymmetrical, halves. This shape demonstrates how a unity can be divided into an infinite multiplicity if the progression is continued, a succession Judd often explored when splitting the cube or square once and then in half again and so on. The symbol also represents the concept of alternation, an oscillation between two opposite states. The latter is evident in the second and third studies of Project 9, prior to reducing the alternation to two cycles in the more successful fourth study, Fig P9-4.

Another example is the *Vesica Piscis*, the area within two equal circles positioned so that one's centre exists on the perimeter of the other, and vice versa. Lawler notes that the overlapping circles are, "an excellent representation of a cell, or a unity in the midst of becoming a dual". Lawler (1982:33) However, its particular union of two circles results in two pointed ends that create an abrupt change in the direction for the two joining planes; therefore, the *vesica piscis* was not used in any studies.

[115] Lawler (1982:23)

[116] Coplans (1971:50)

[117] See Coplans (1971:45) and endnote no. 73.

[118] Juniper (2003:2) and also refer to endnote no. 41.

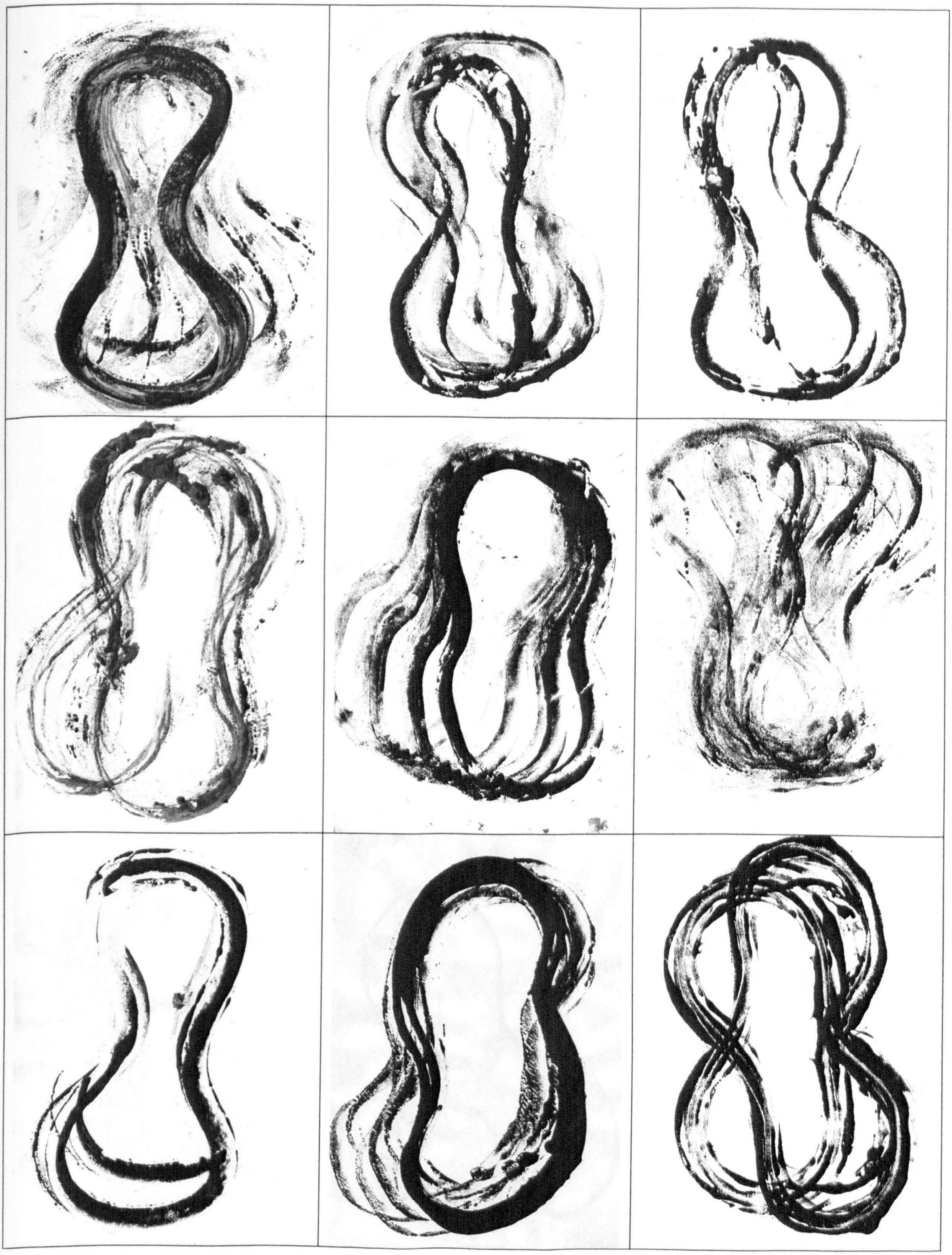
[119] Red stands out and appears to sharpen the geometry of form because it focuses beyond the retina.

[120] Coplans (1971:43)

[121] See p133.

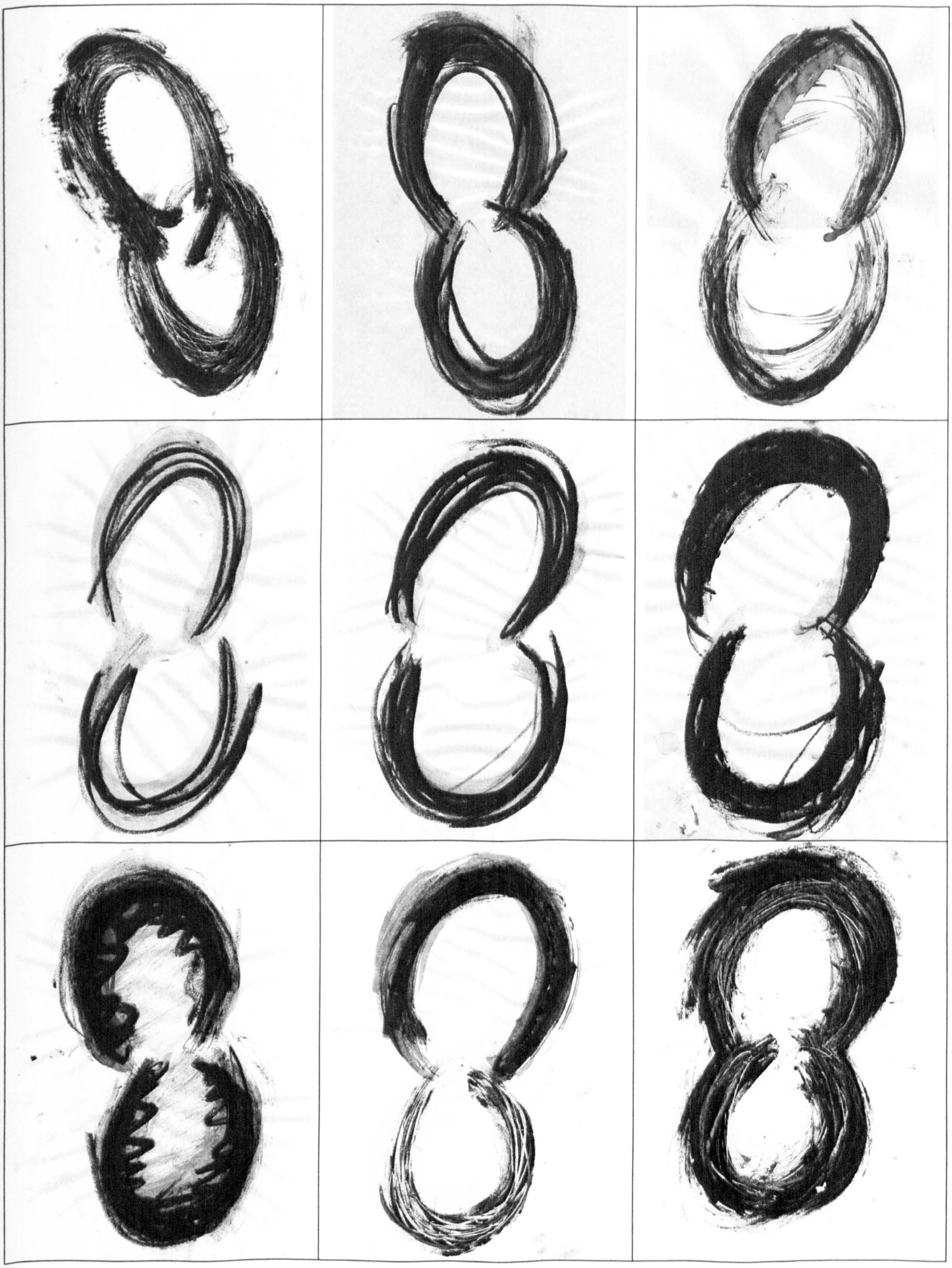
APPENDIX 1A

Drawings investigating degree of rotation of deflected geometries



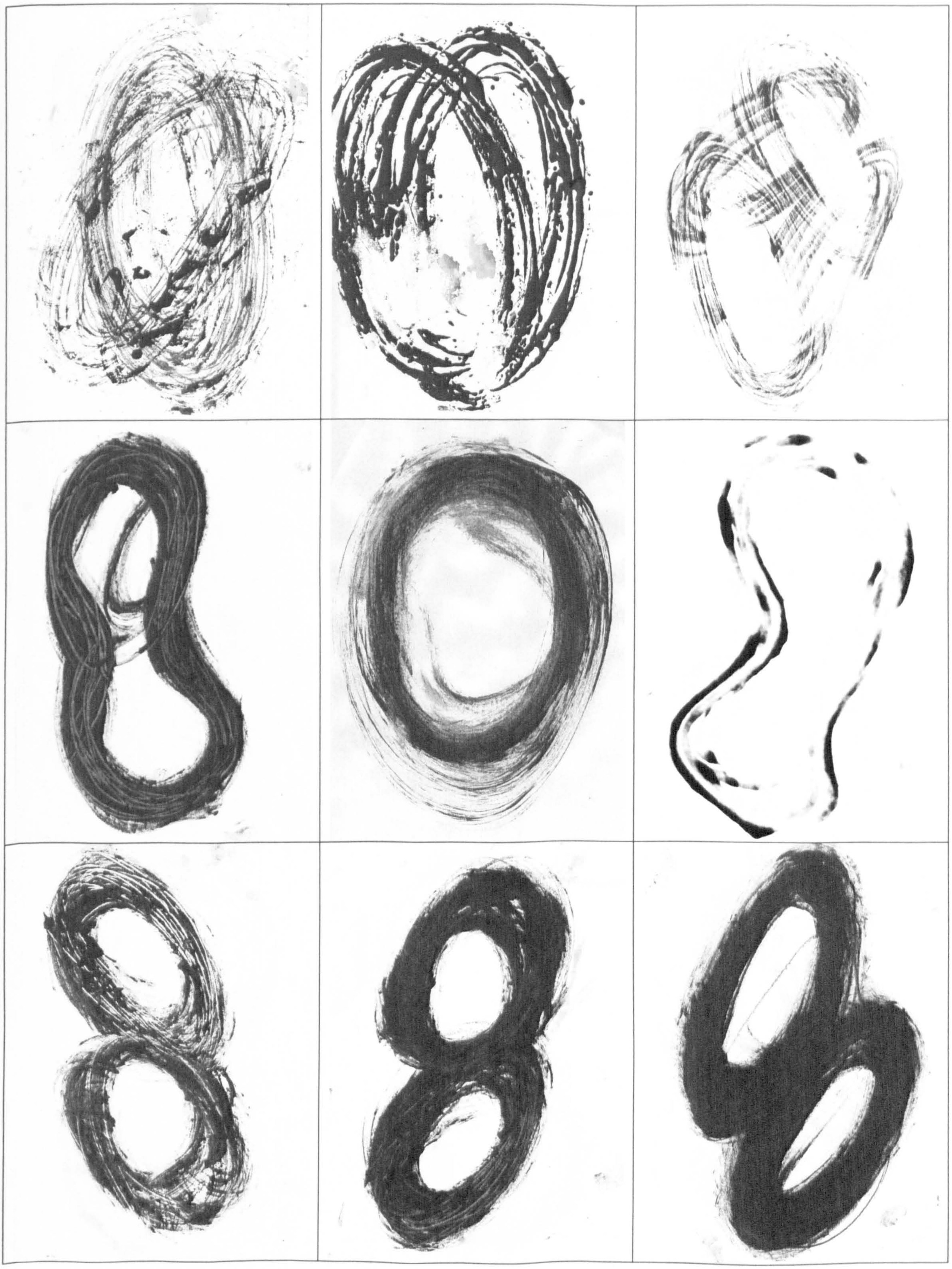
APPENDIX 1B

Drawings investigating degree of rotation of deflected geometries



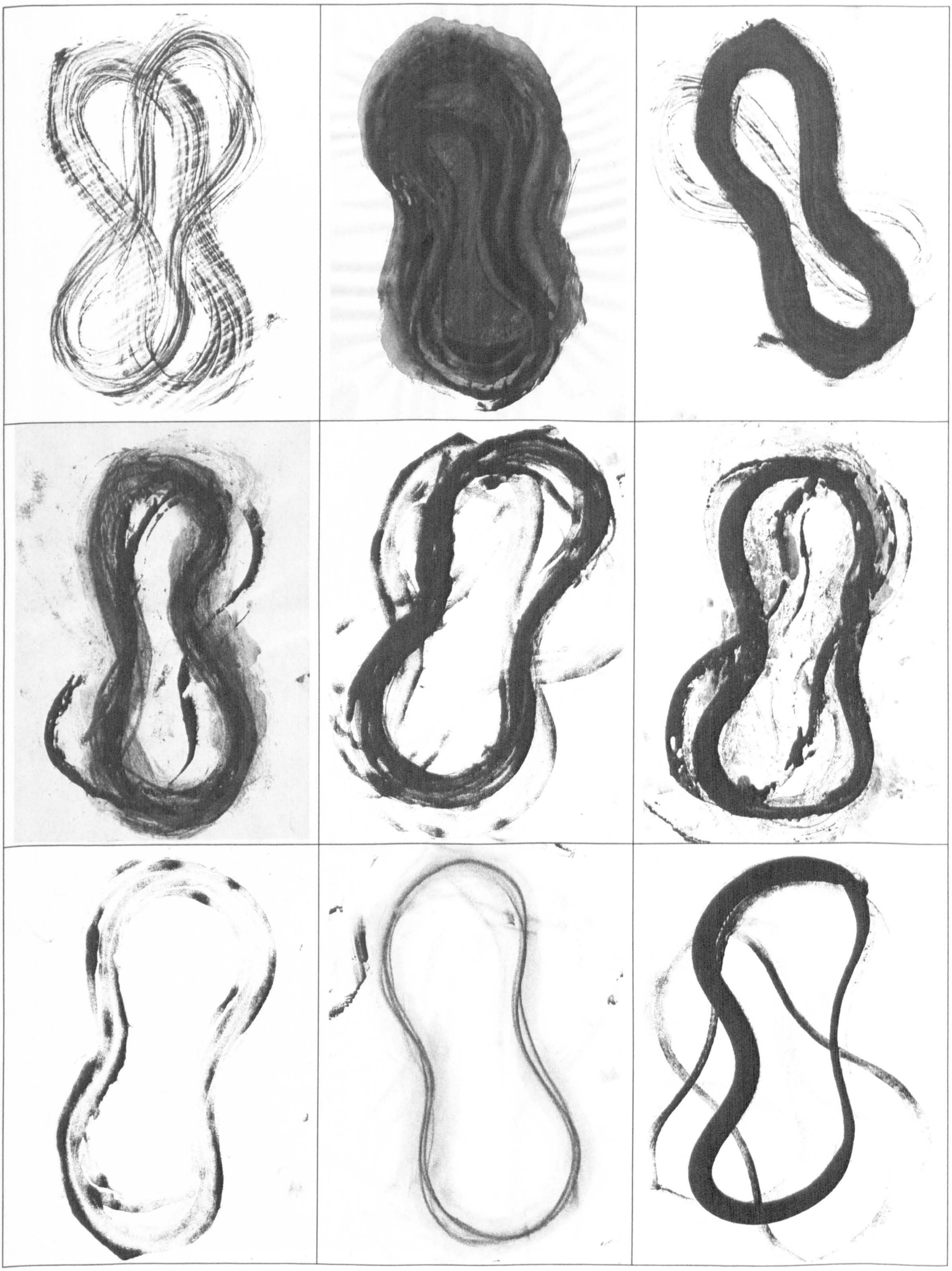
APPENDIX 1C

Drawings investigating degree of rotation of deflected geometries



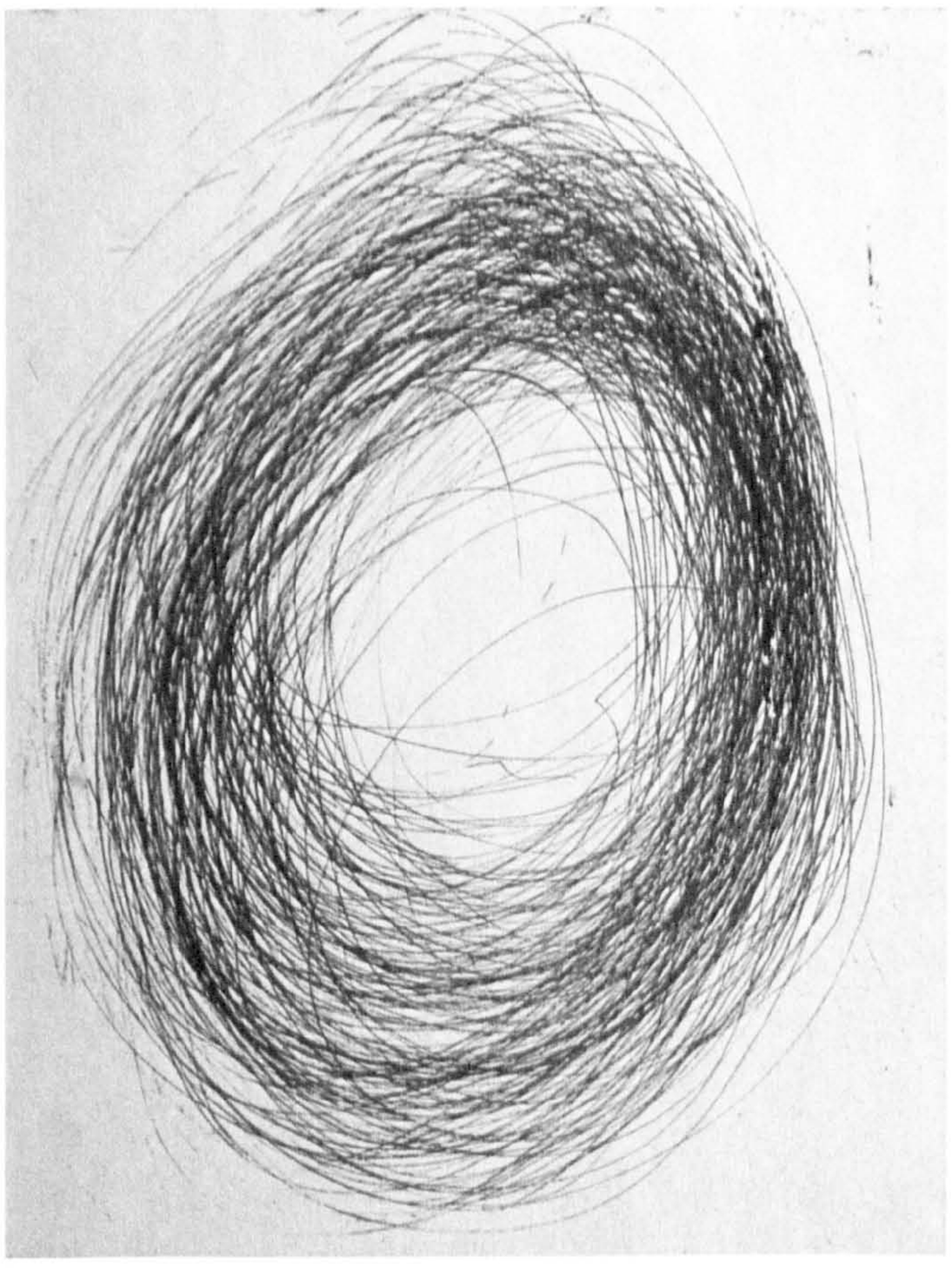
APPENDIX 1D

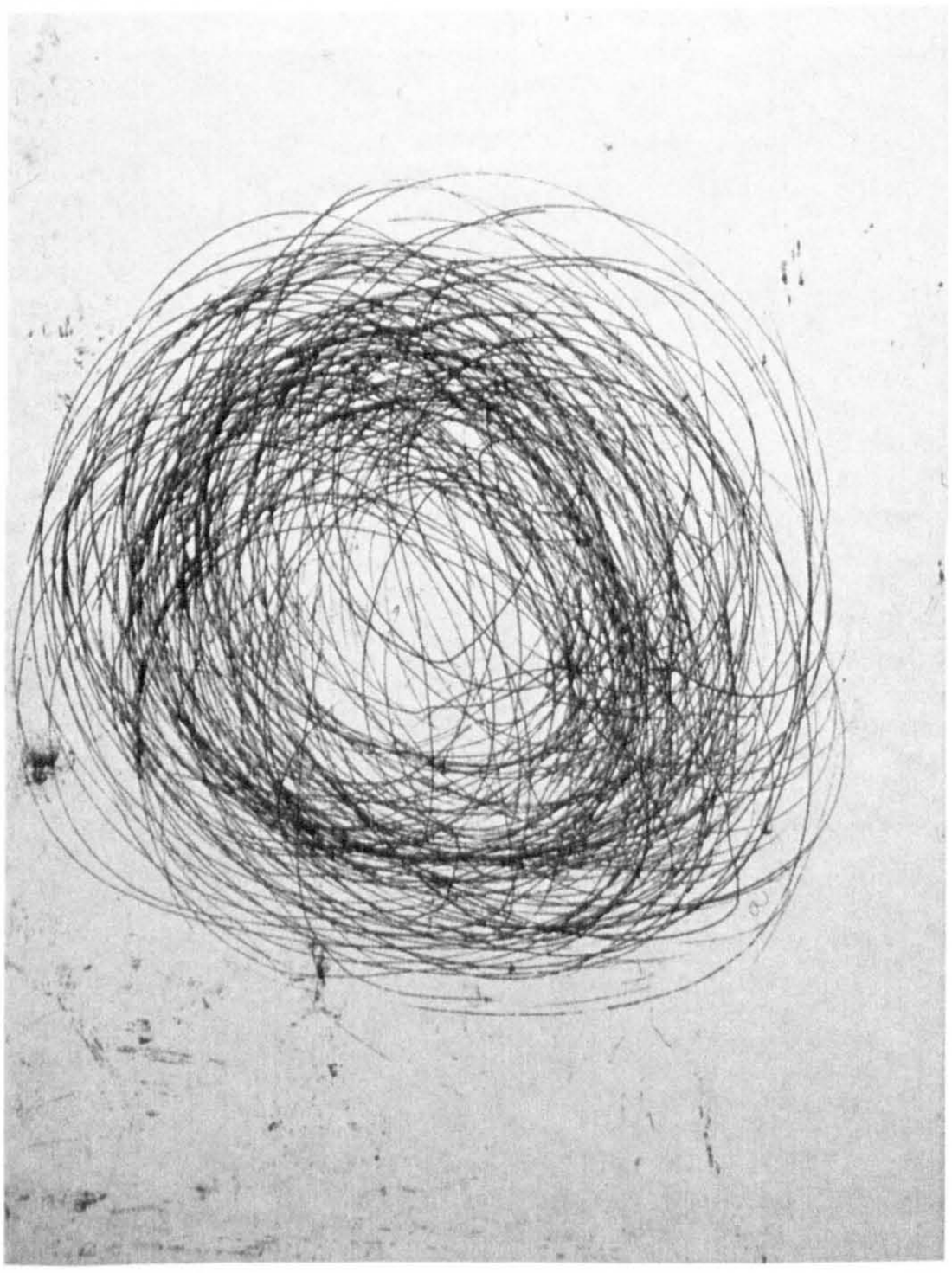
Drawings investigating degree of rotation of deflected geometries



APPENDIX 2A

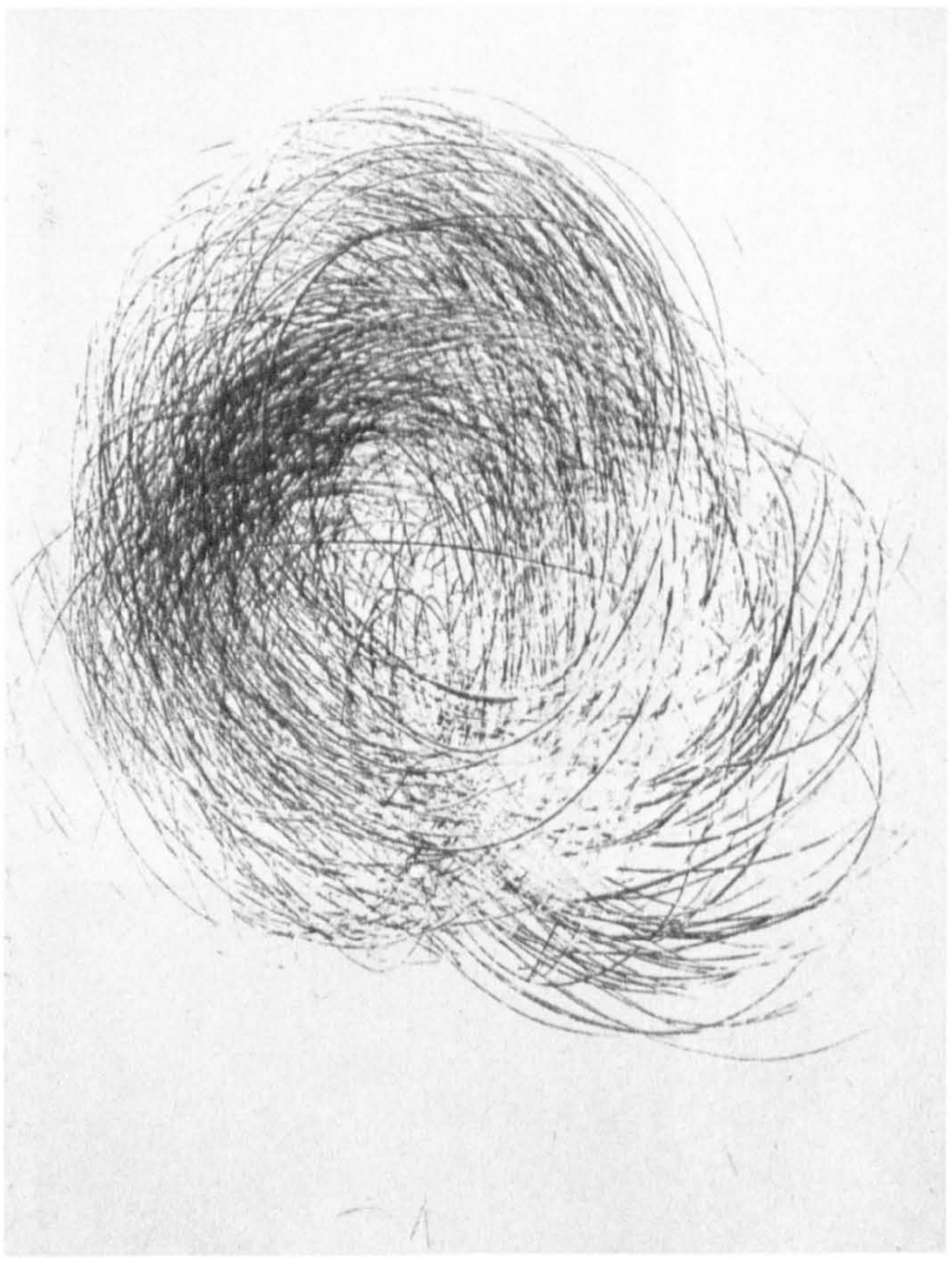
Prints created by rotating object pierced with nails onto printing plate without looking.





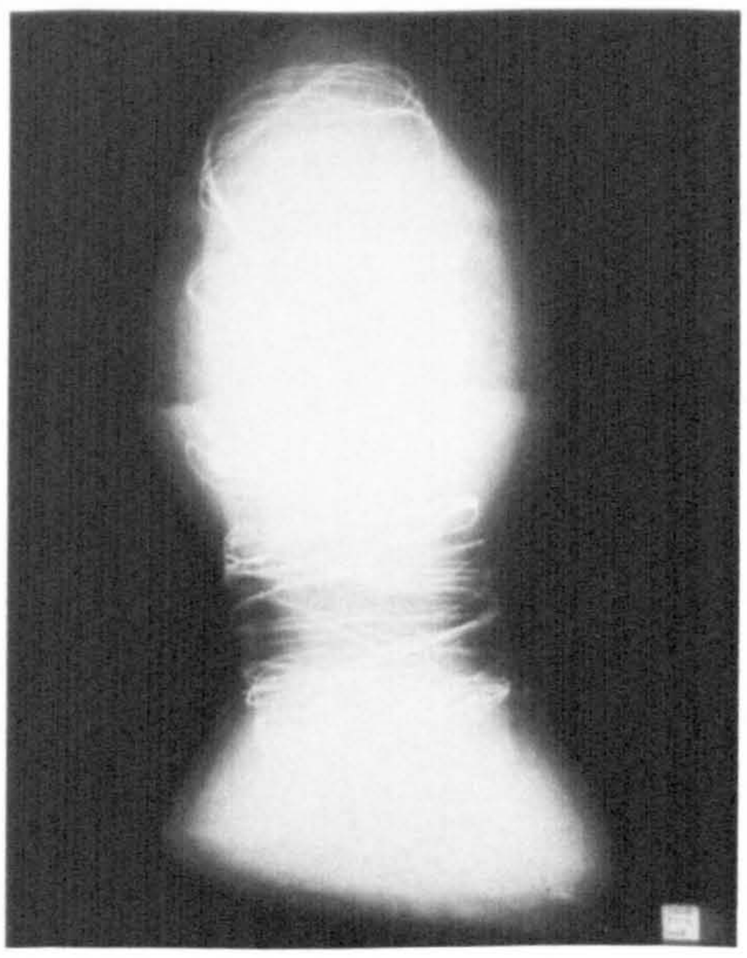
APPENDIX 2B

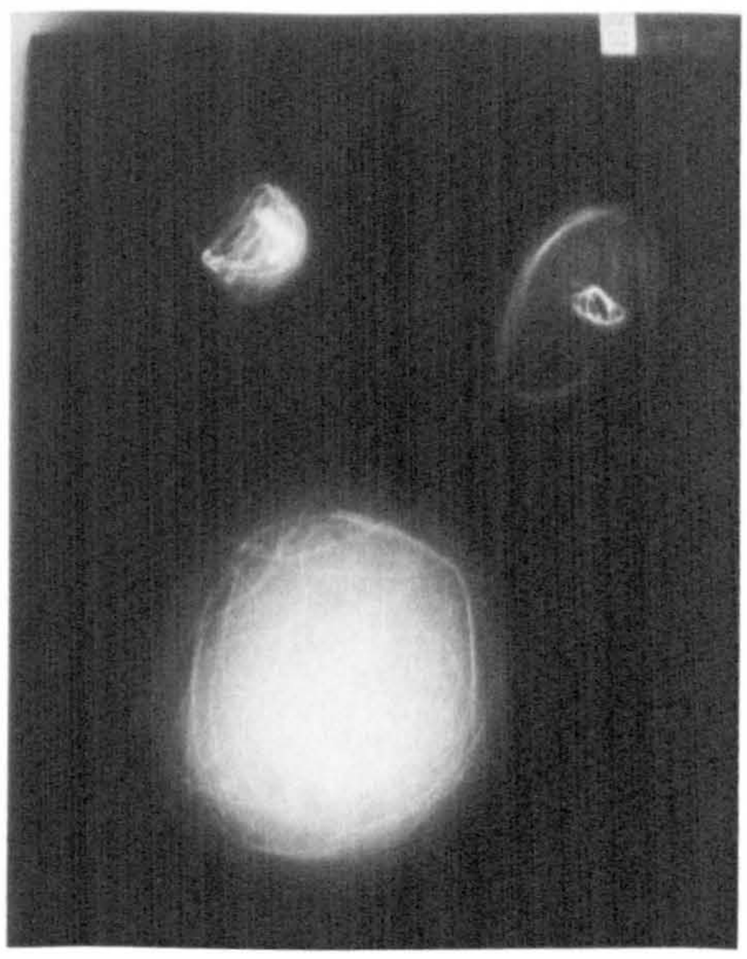
Prints created by rotating object pierced with nails onto printing plate without looking.

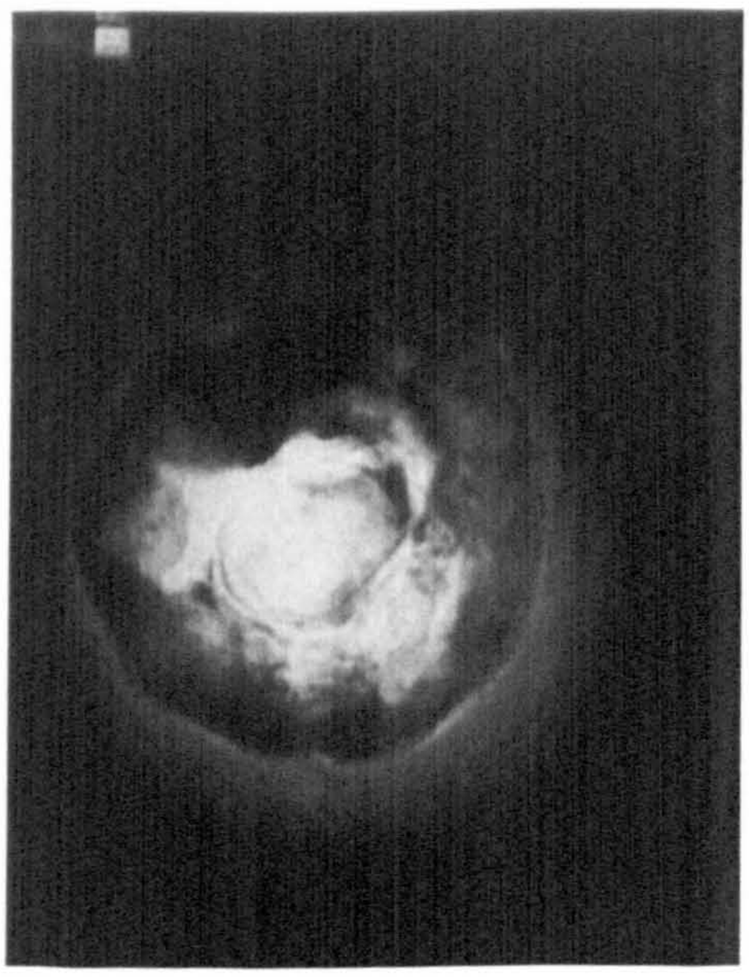


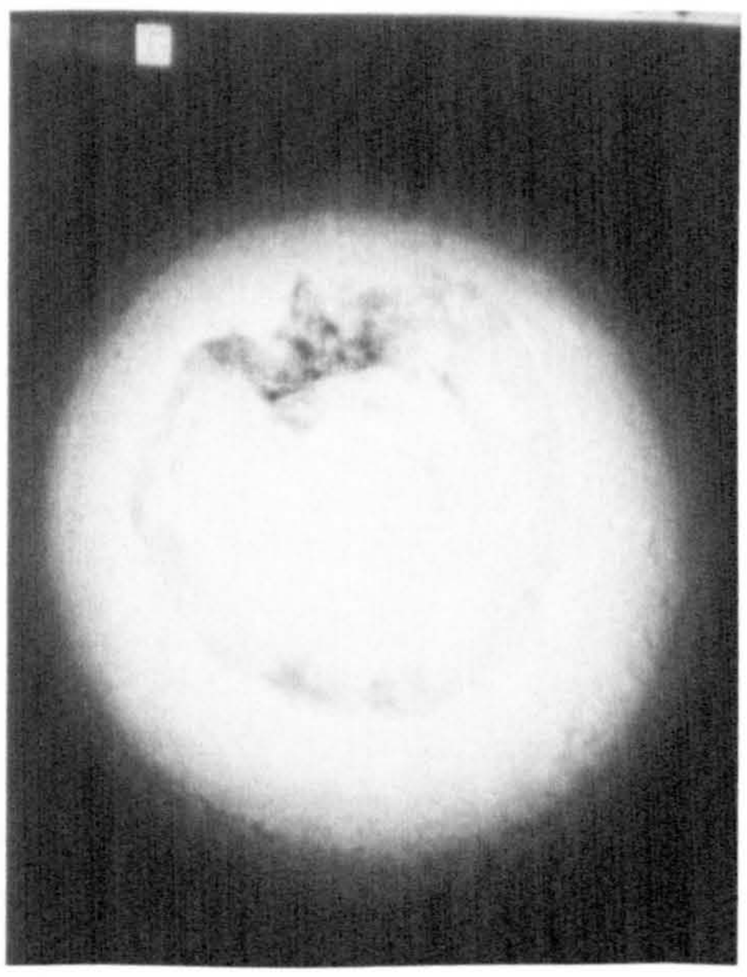
APPENDIX 3

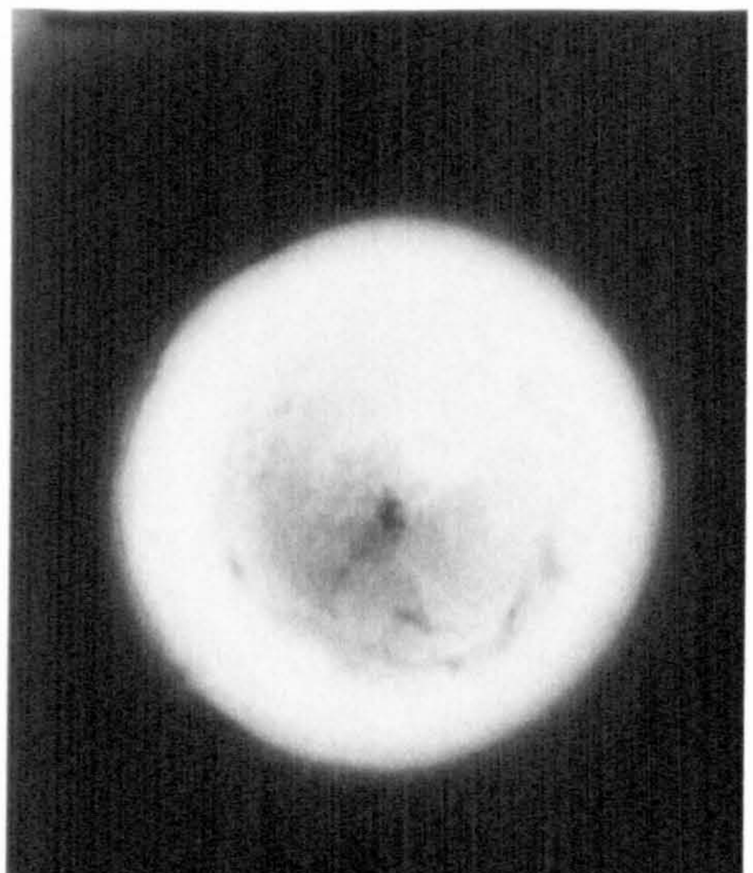
X-RAYS of plaster sculptures with wire armatures

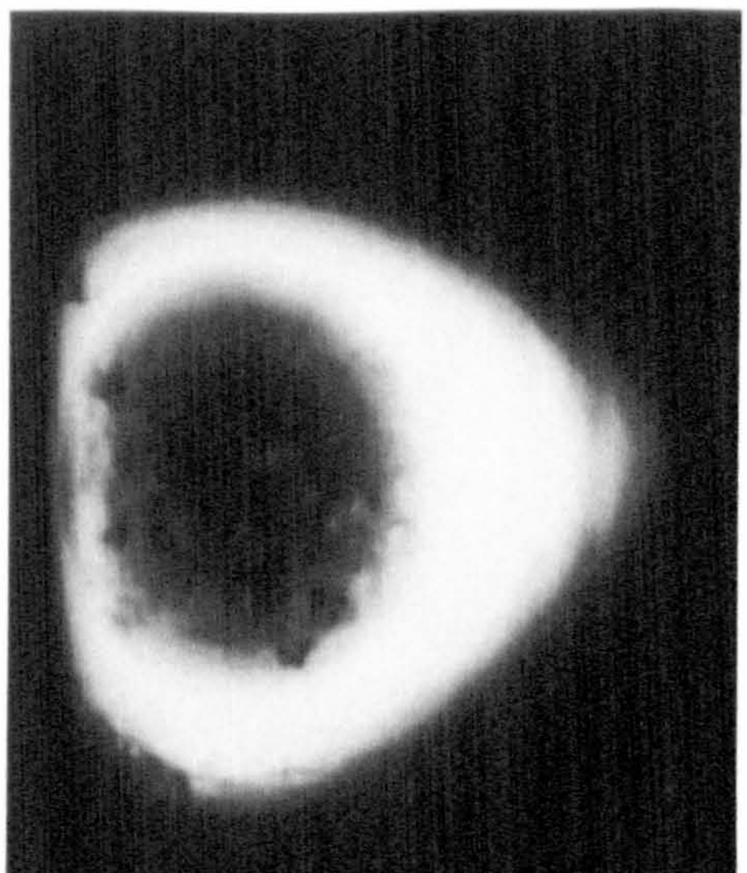






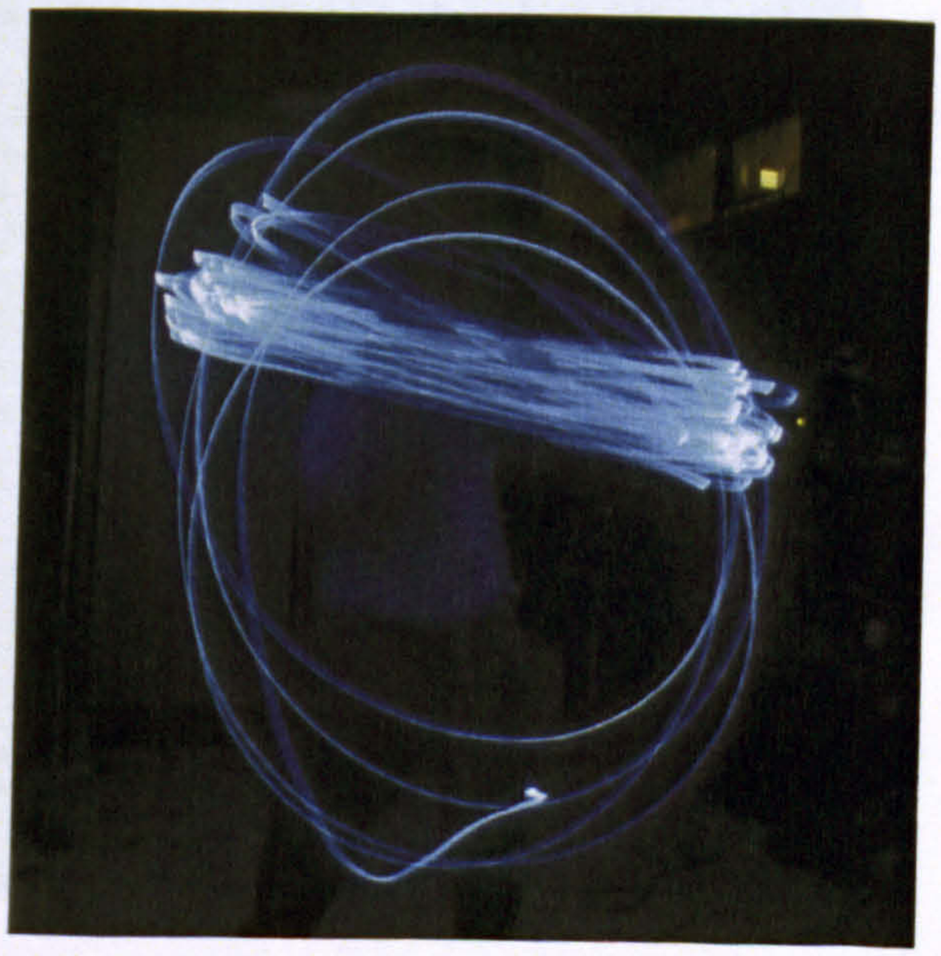


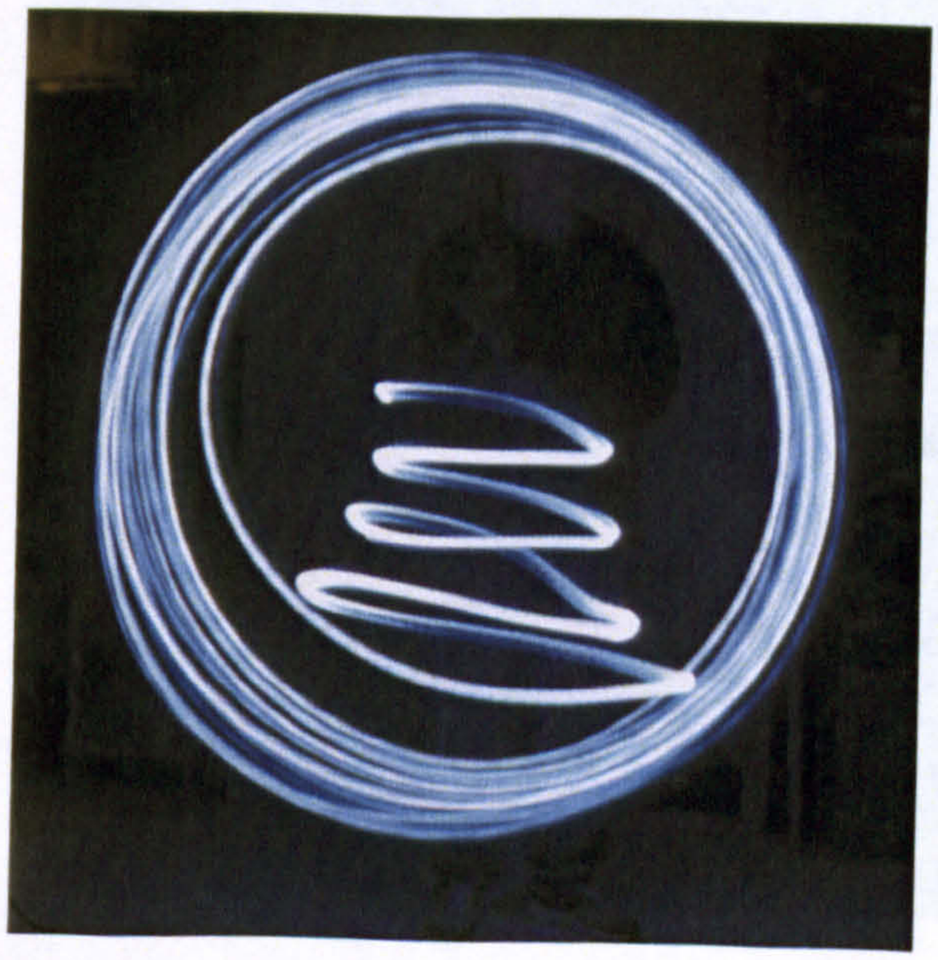


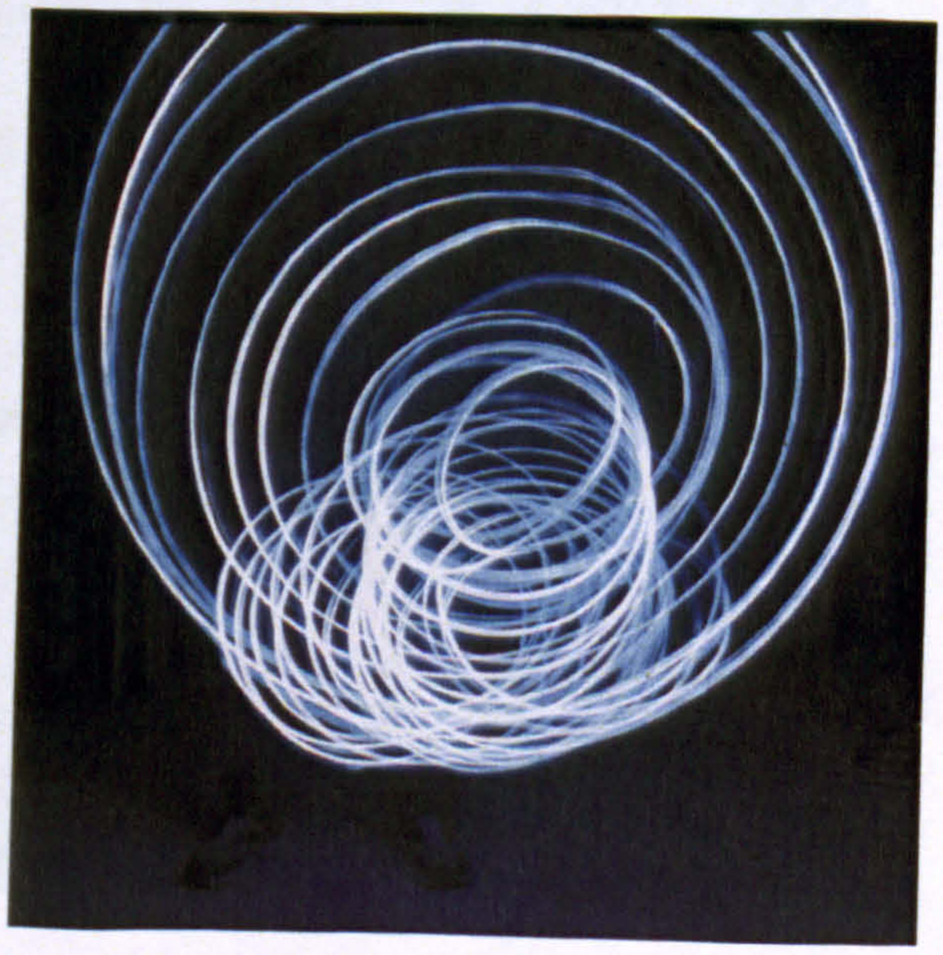


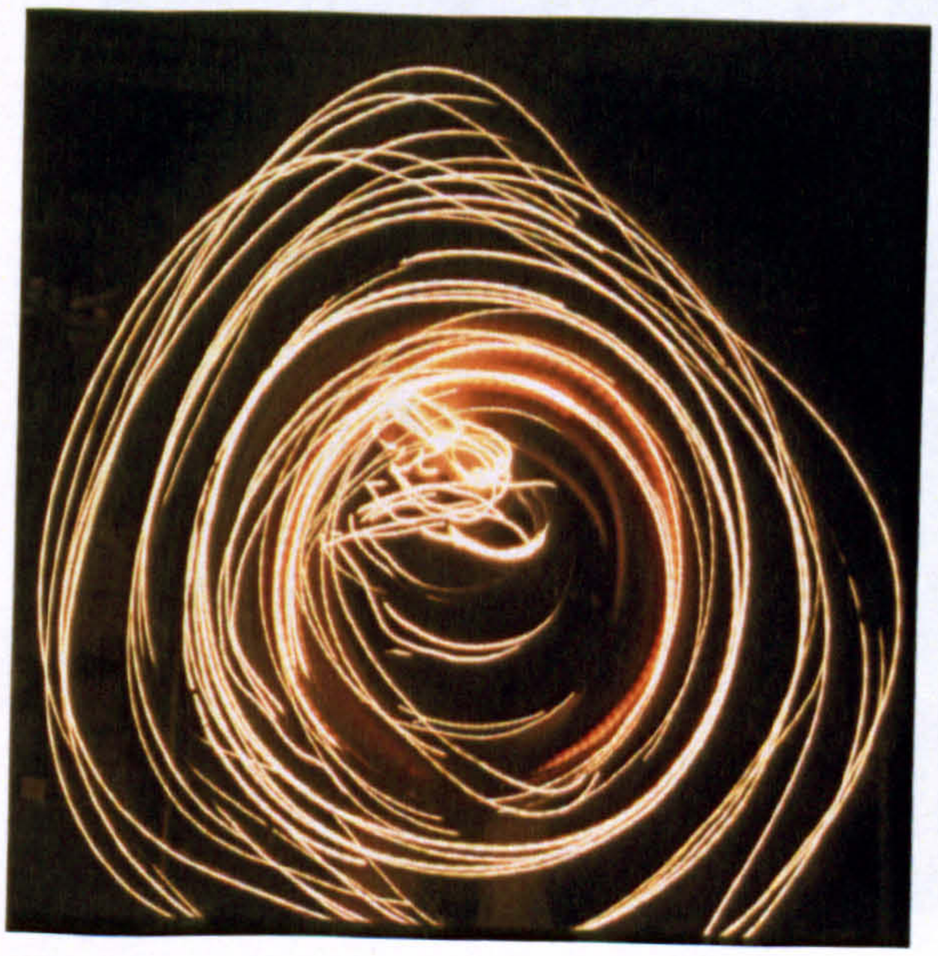
APPENDIX 4A

Forms created by moving light, and recorded photographically.



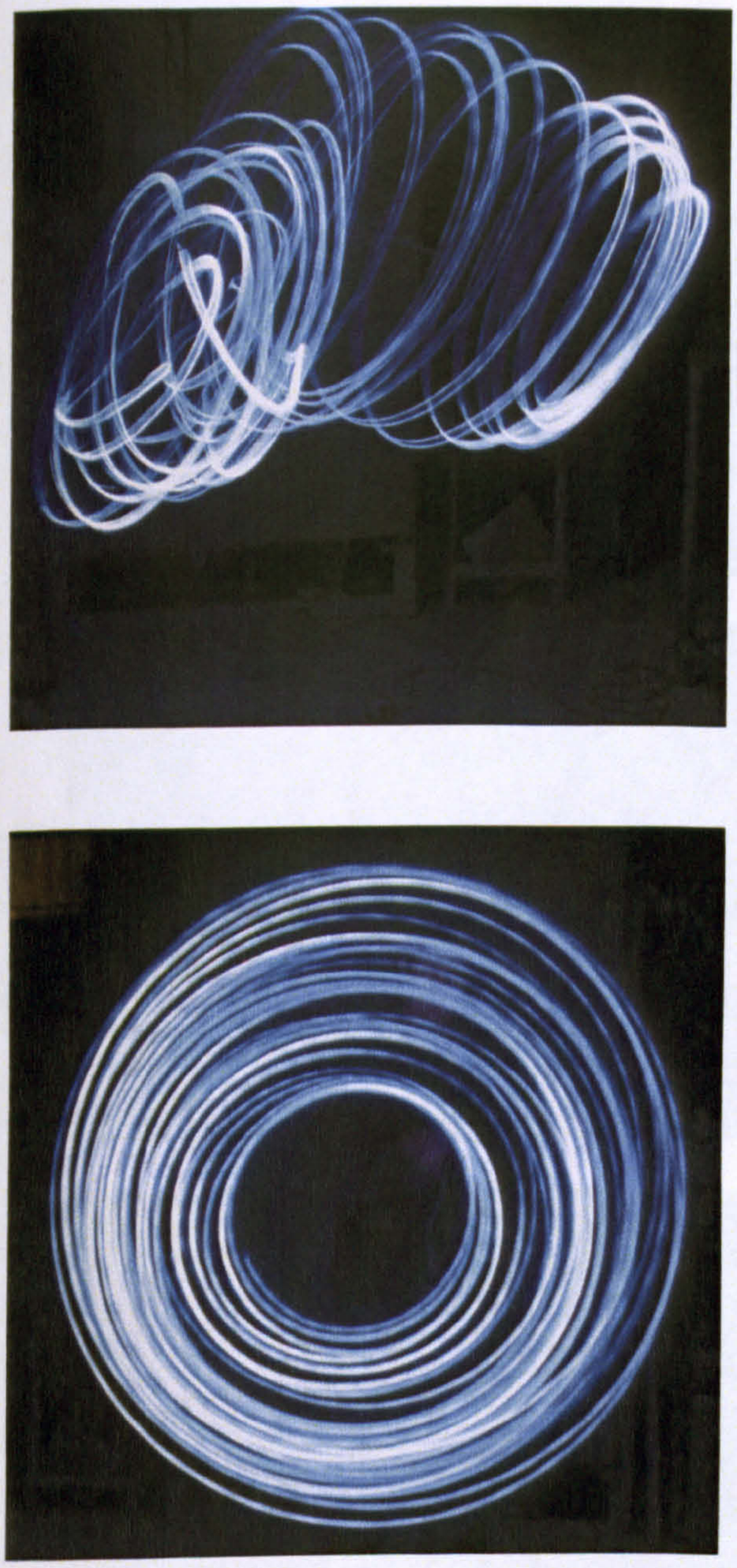


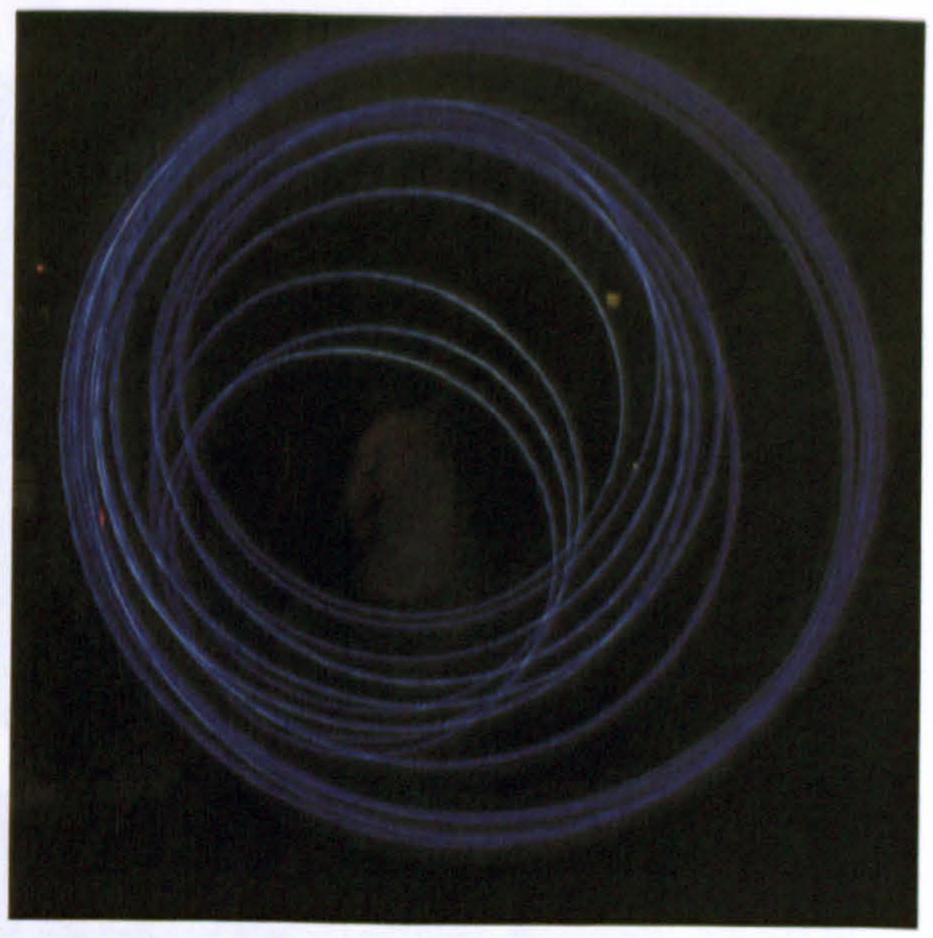


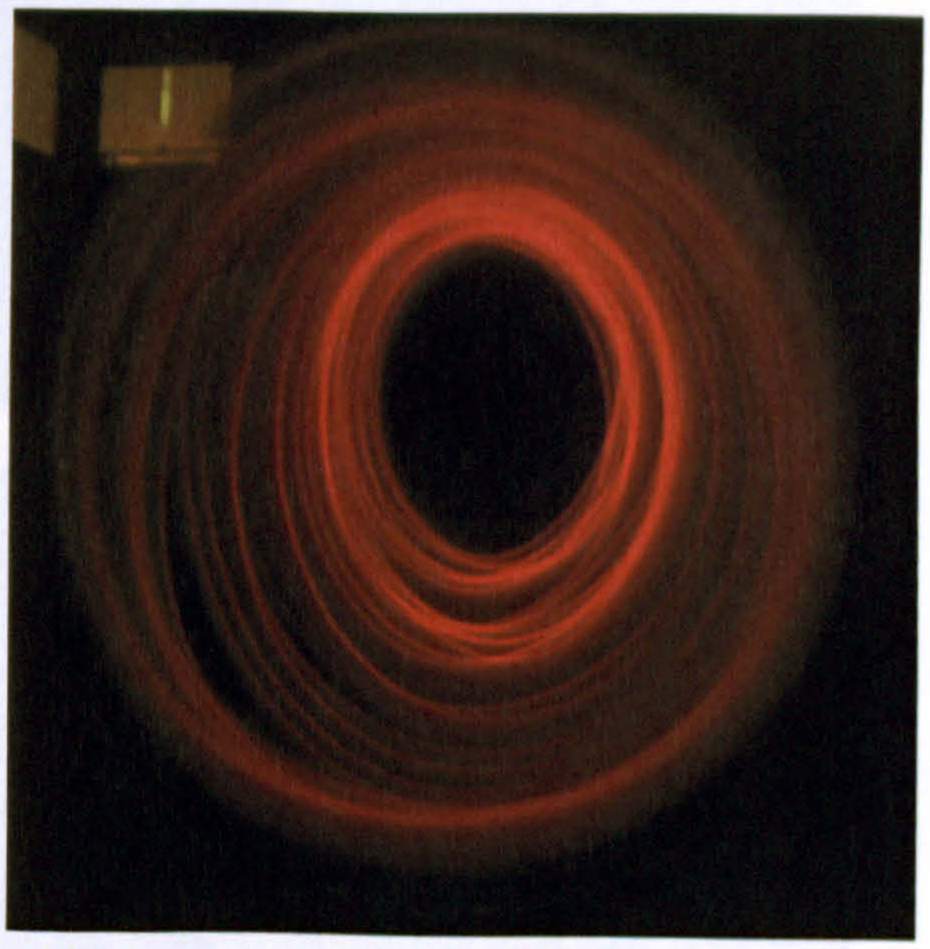


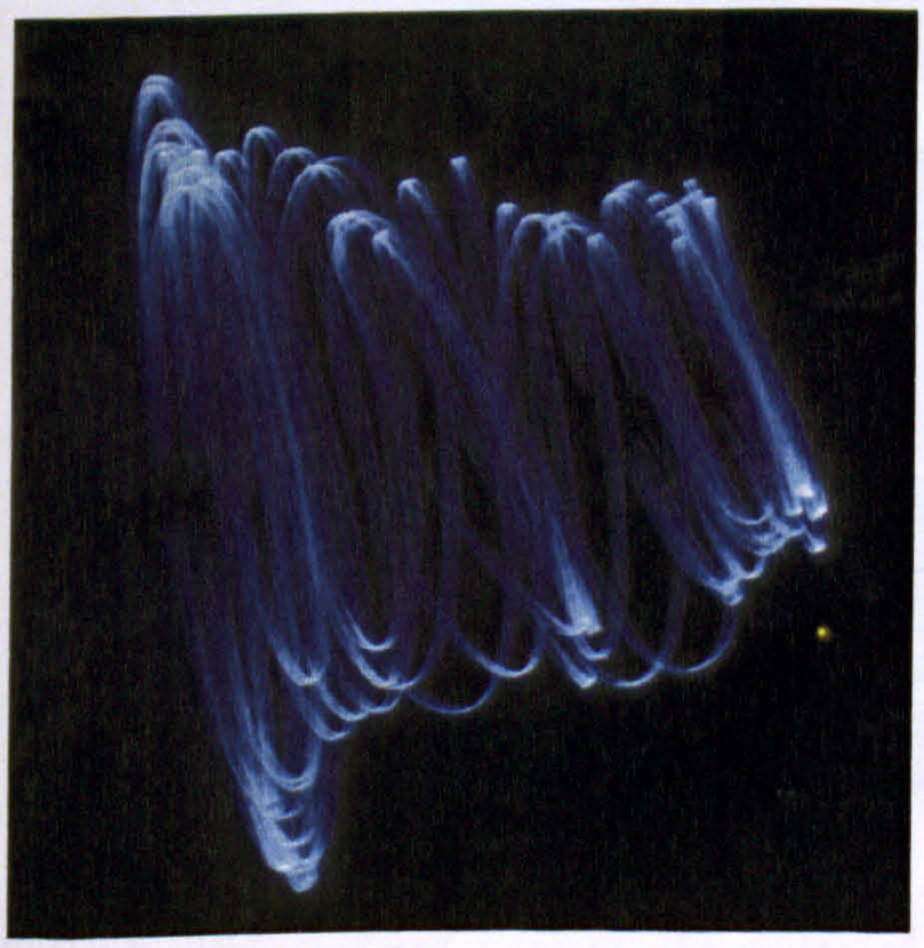
APPENDIX 4B

Forms created by moving light, and recorded photographically.



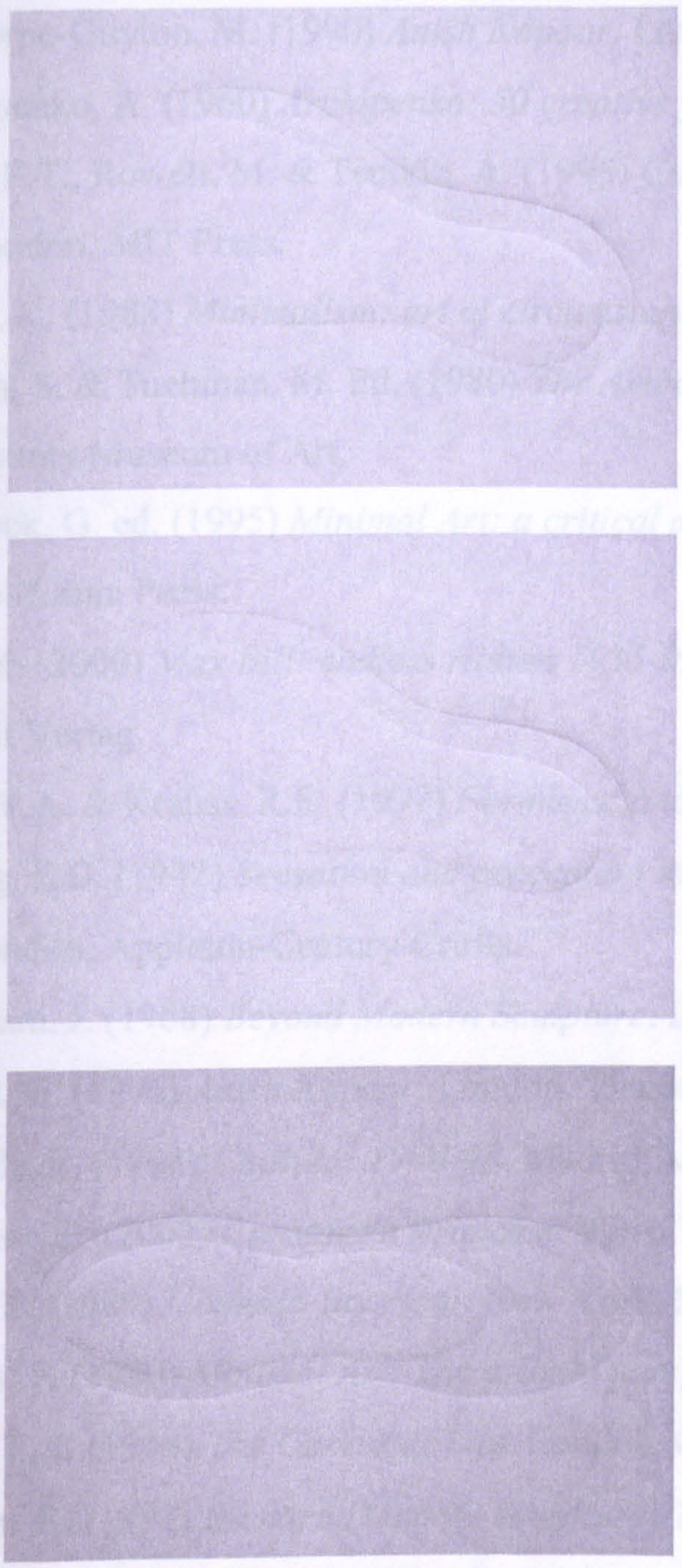


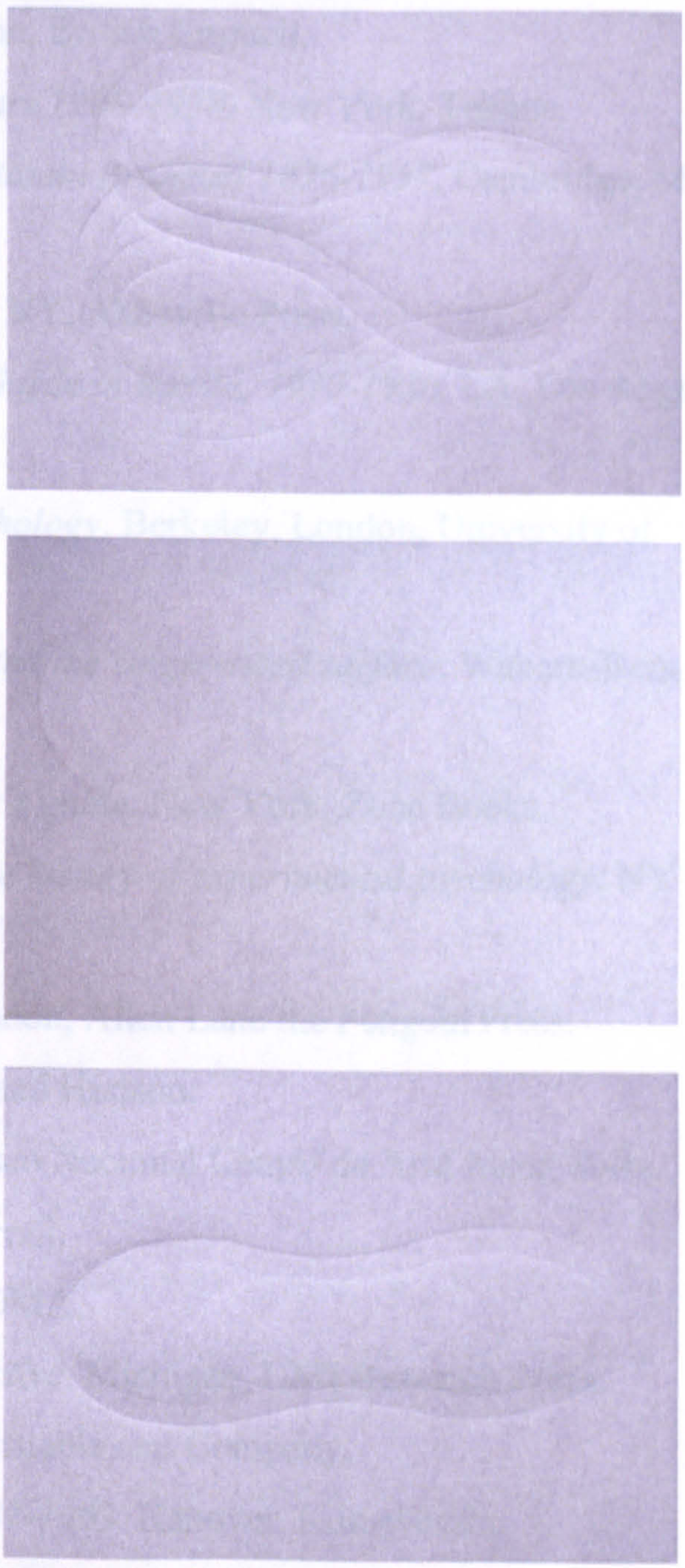


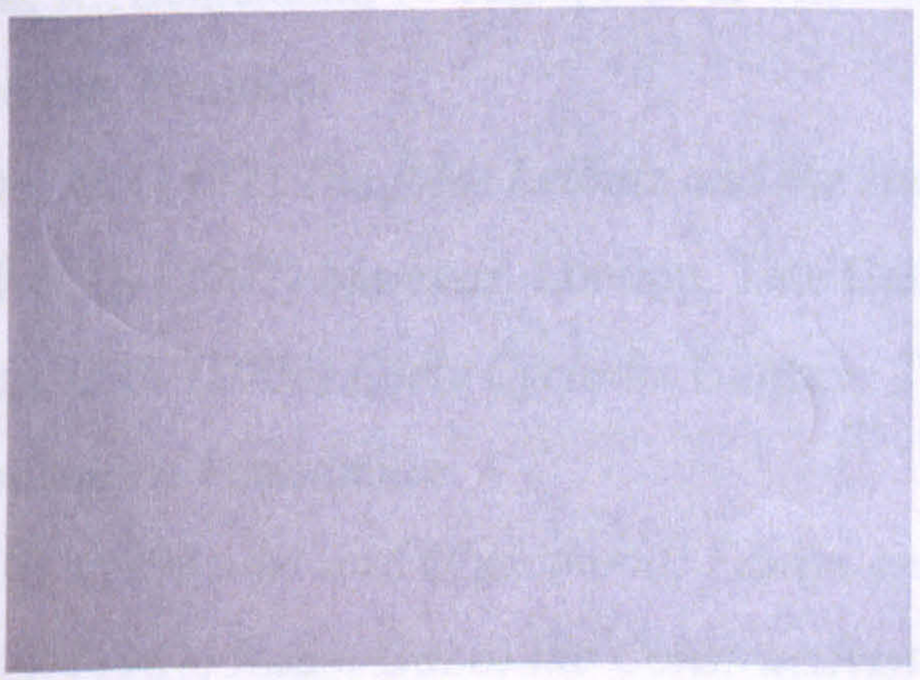


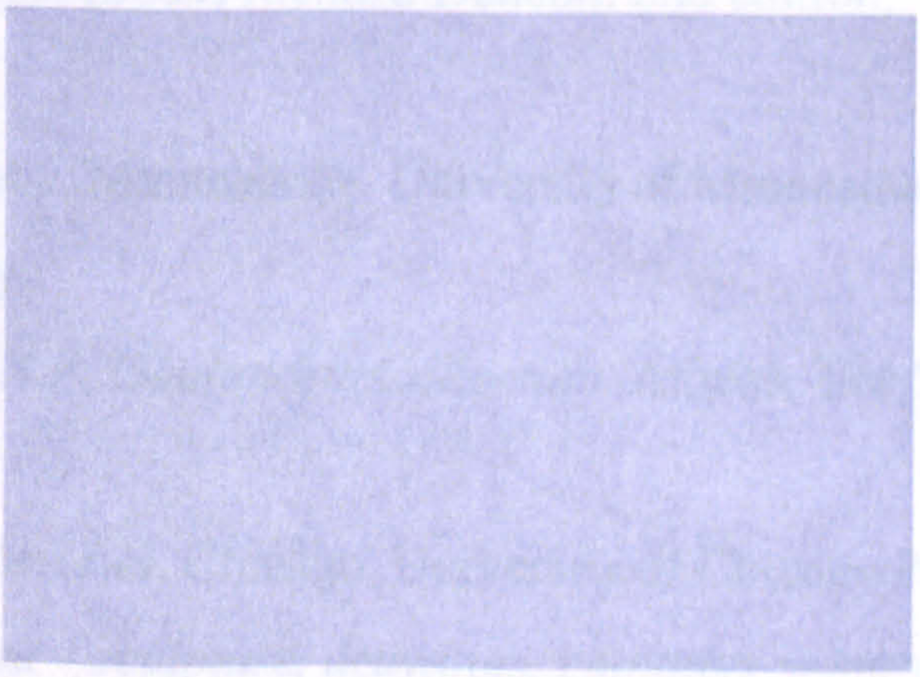
APPENDIX 5

Blind Emboss Prints









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