

04 february 2010
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Experimental structures

Towards a new materiality ... a necessity

Marine Bagnéris



Outline

1 Introduction

2 Shape classification

3 Apparent immateriality

4 Conclusion

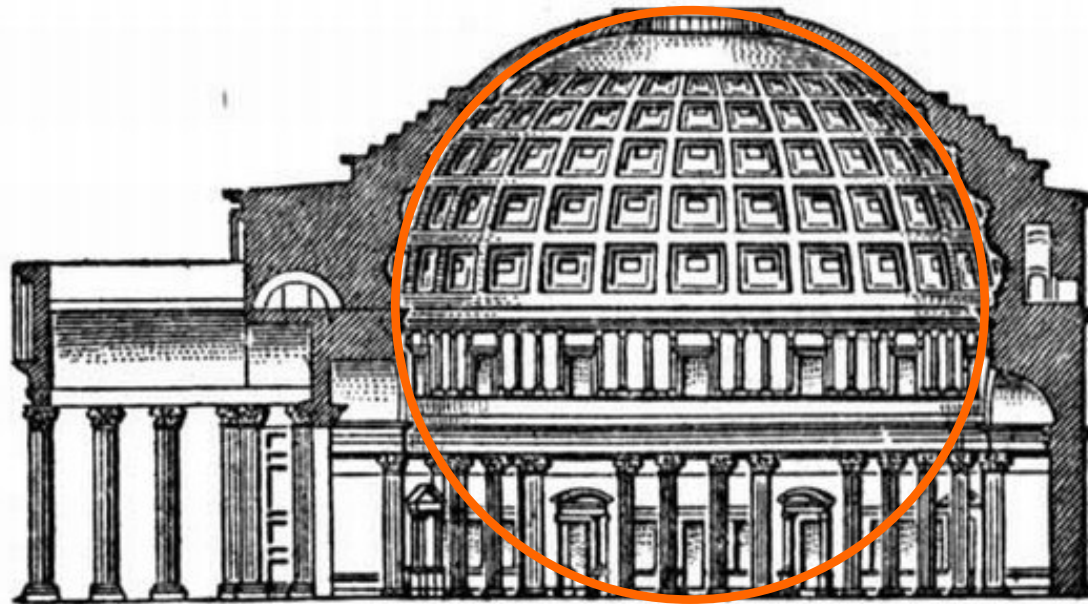
Shape classification

► Analytical shapes

—● Geometrically constrained

—● Derived from the circle

Cylinder, sphere, torus, cone, ellipsoid etc



Pantheon – Roma –Italy – 2nd century

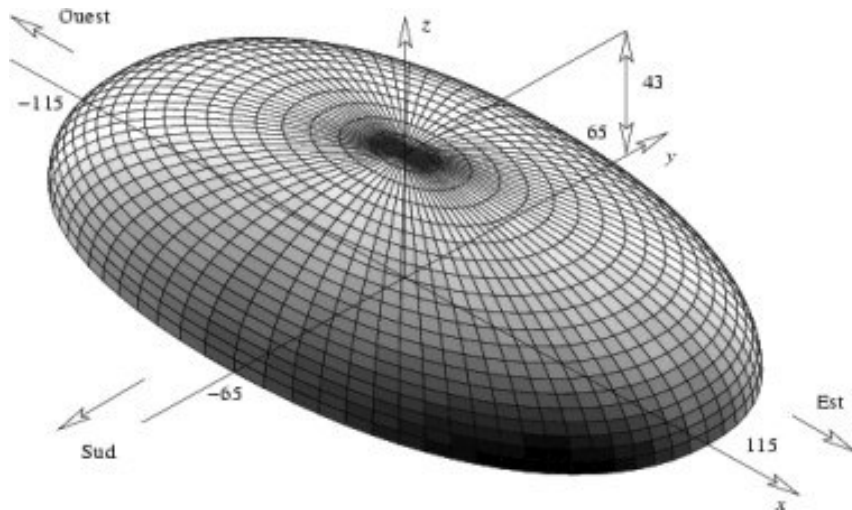
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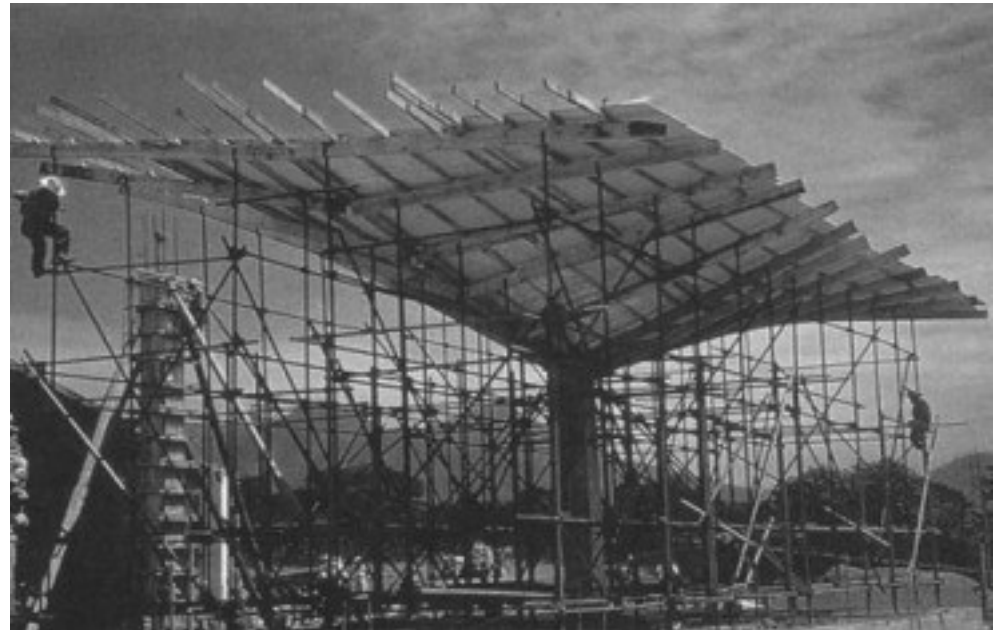
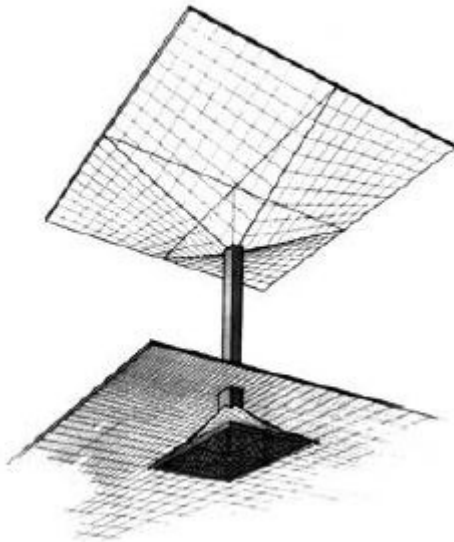
Beijing Opera – China – P.Andreu – 1999-2007

Shape classification

► Analytical shapes

- Geometrically constrained
- Derived from the circle
- Ruled surfaces

Paraguas de una columna (dibujo Prueba de resistencia, 1953, Vallejo)



Hyperbolic paraboloid Shell – F. Candela - 1953

Shape classification

► Analytical shapes

- Geometrically constrained
- Derived from the circle
- Ruled surfaces



One-sheet hyperboloid – Freiburg - 2008

Shape classification

► Analytical shapes

- Geometrically constrained
- Derived from the circle
- Ruled surfaces



Cooling tower – Schlaich Bergermann und partners - Germany - 1974

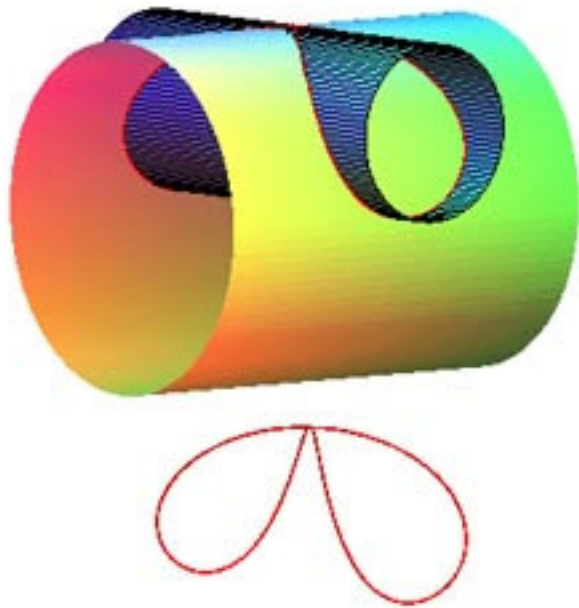


Kobe Port Tower – 1963

Shape classification

► Analytical shapes

——● More complex shapes born from their combination



Shape classification

► Analytical shapes

- More complex shapes born from their combination

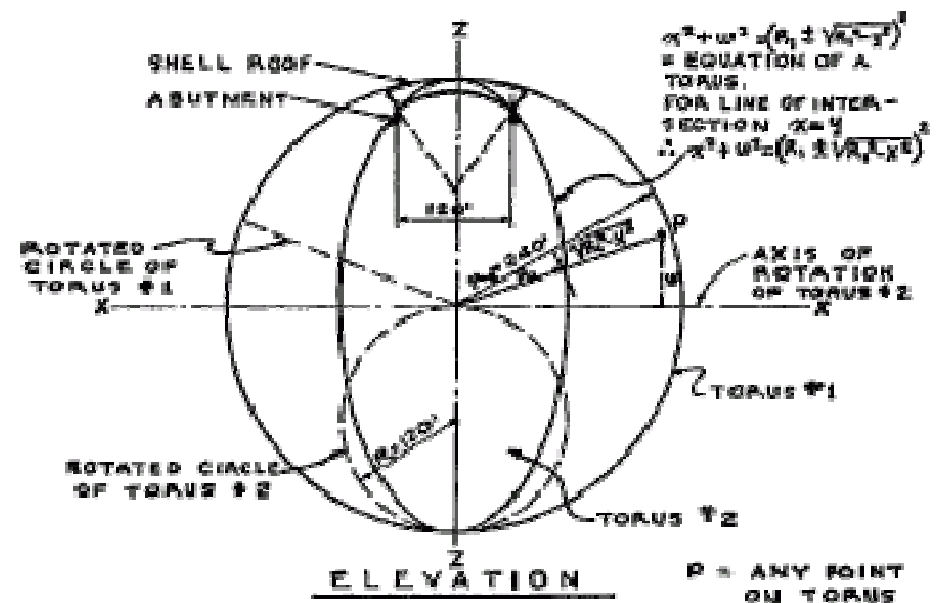
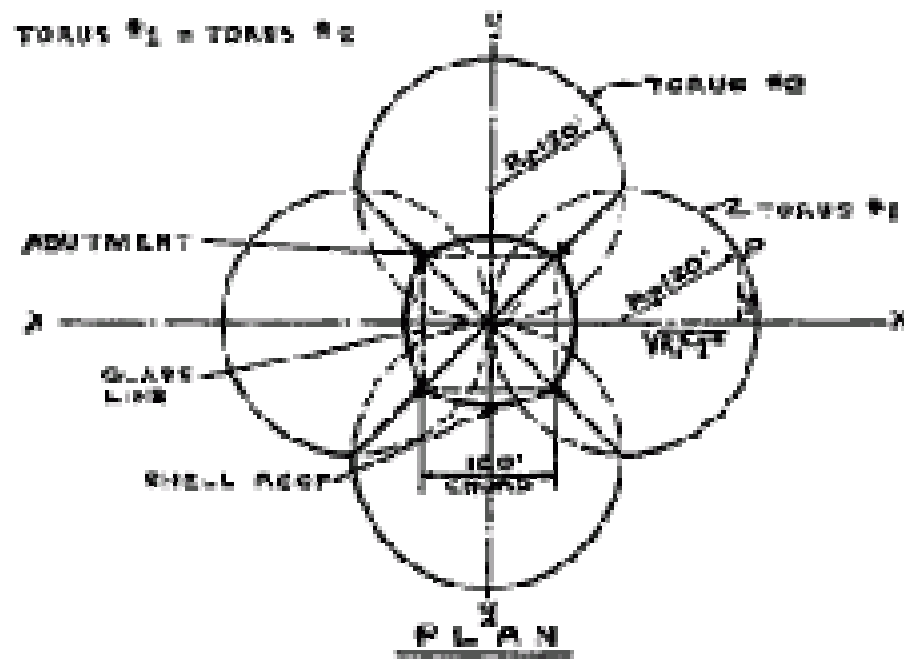


Torus Shell – R. Bradshaw – 37m span – 64 to 127mm thickness without ribs

Shape classification

► Analytical shapes

- More complex shapes born from their combination



Shape classification

► Analytical shapes

- More complex shapes born from their combination

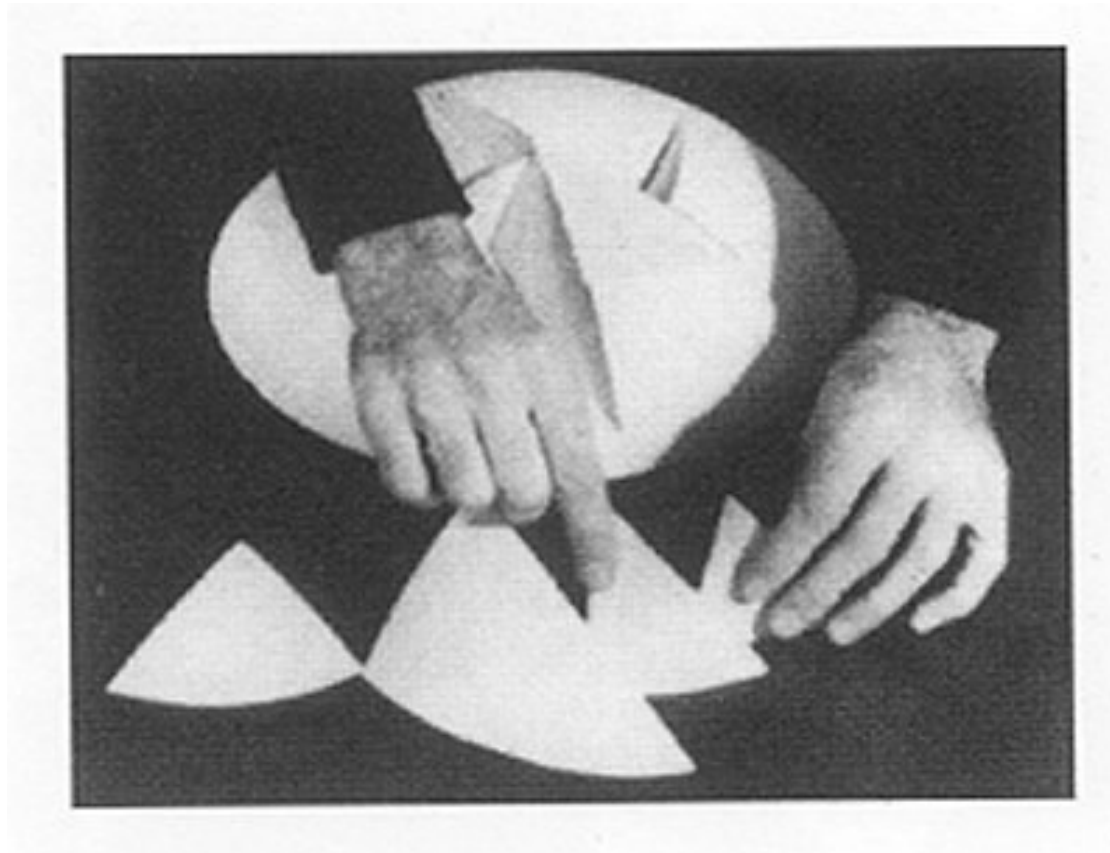


Sydney Opera House – J.Utzon – 1959-1973 – precast concrete elements

Shape classification

► Analytical shapes

- More complex shapes born from their combination

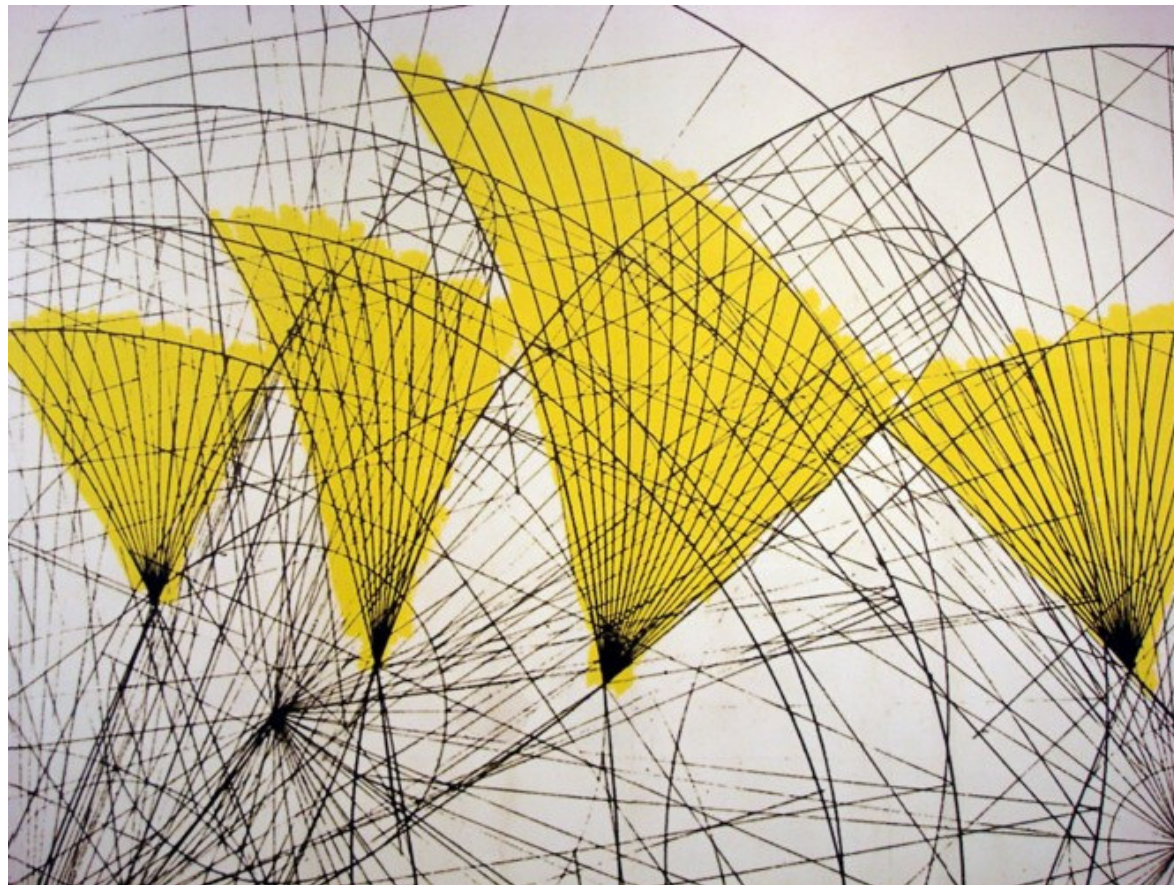


Sydney Opera House – J.Utzon – 1959-1973 – precast concrete elements

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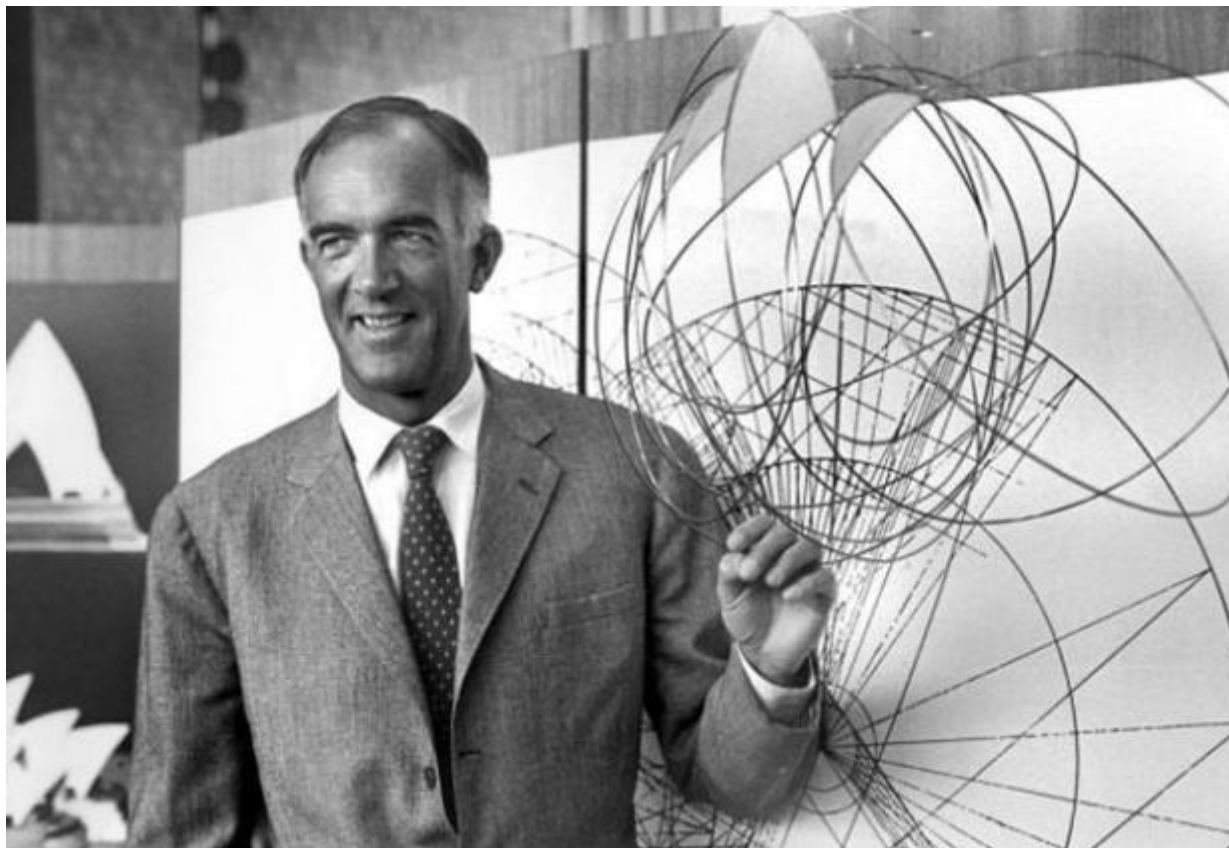


Original Utzon's sketch from the design stages of the opera house

Shape classification

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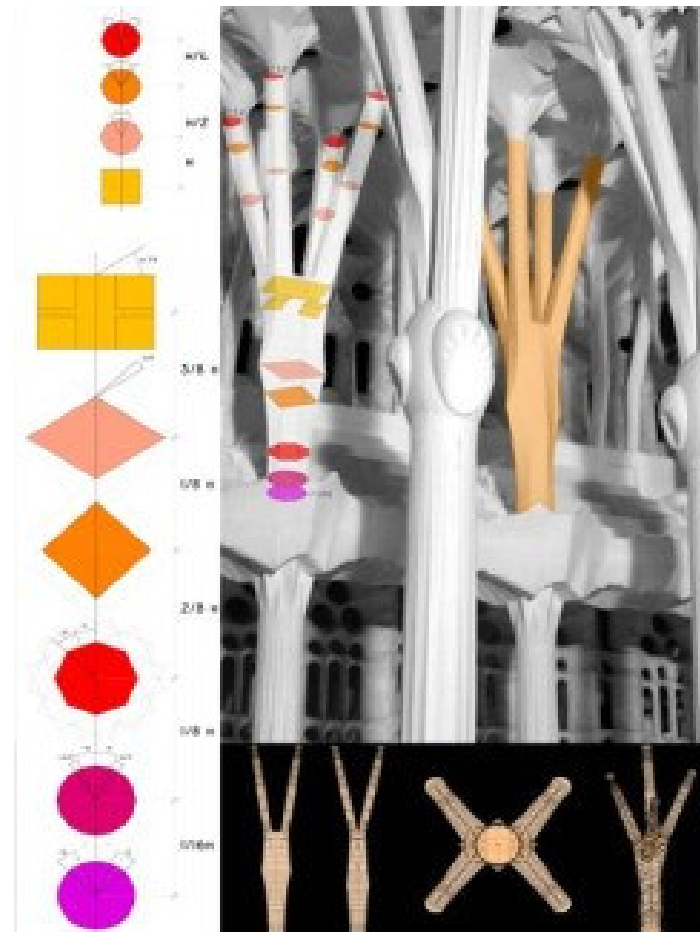
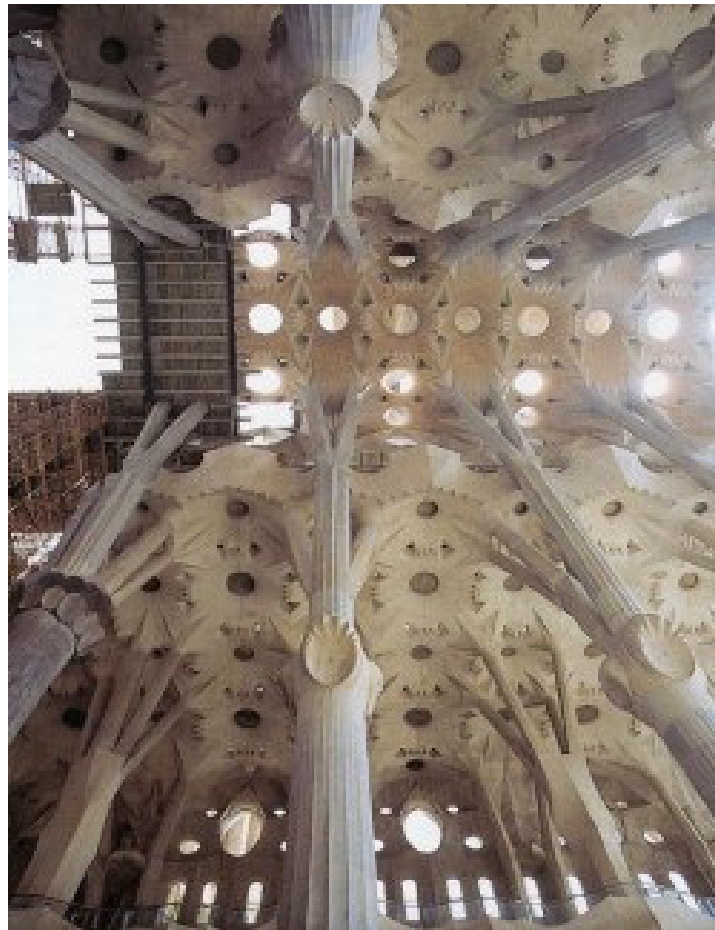


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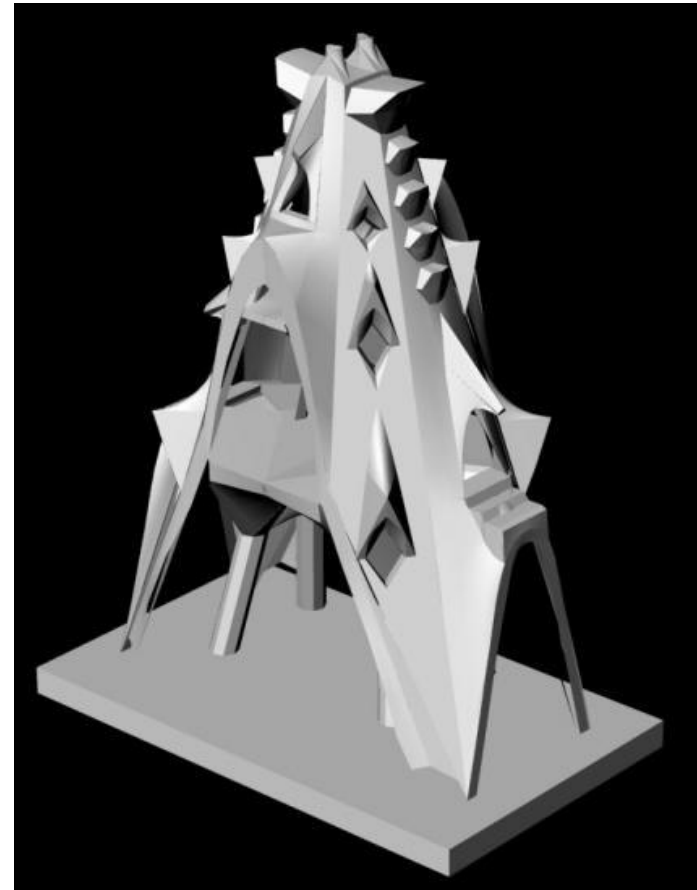
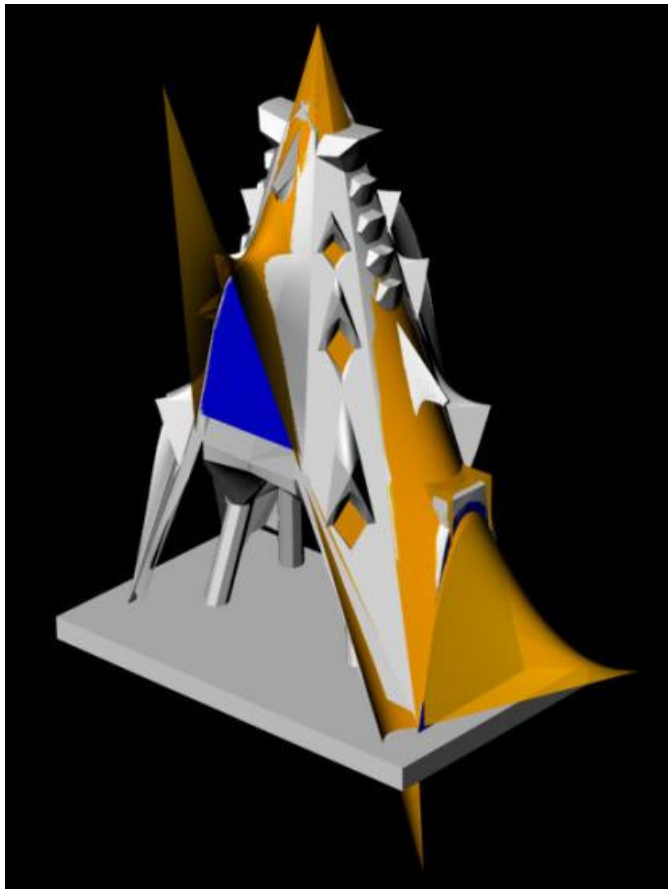


Sagrada Familia – A. Gaudi- 1882 -...

Shape classification

► Analytical shapes

—• More complex shapes born from their combination

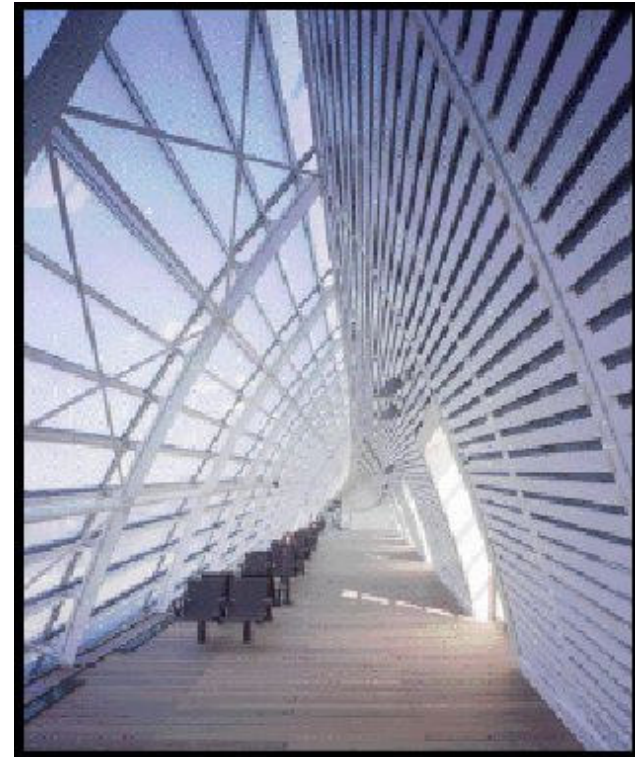


Sagrada Familia – A. Gaudi- 1882 -... and M.Burry's work

Shape classification

► Analytical shapes

- More complex shapes born from their combination



TGV station – Avignon – France

► Analytical shapes

——● More complex shapes born from their combination



TGV station – Avignon – France

Shape classification

► Analytical shapes

- More complex shapes born from their combination



Saint Lazare Lens – Paris – France – 1997-2003

Shape classification

► Analytical shapes

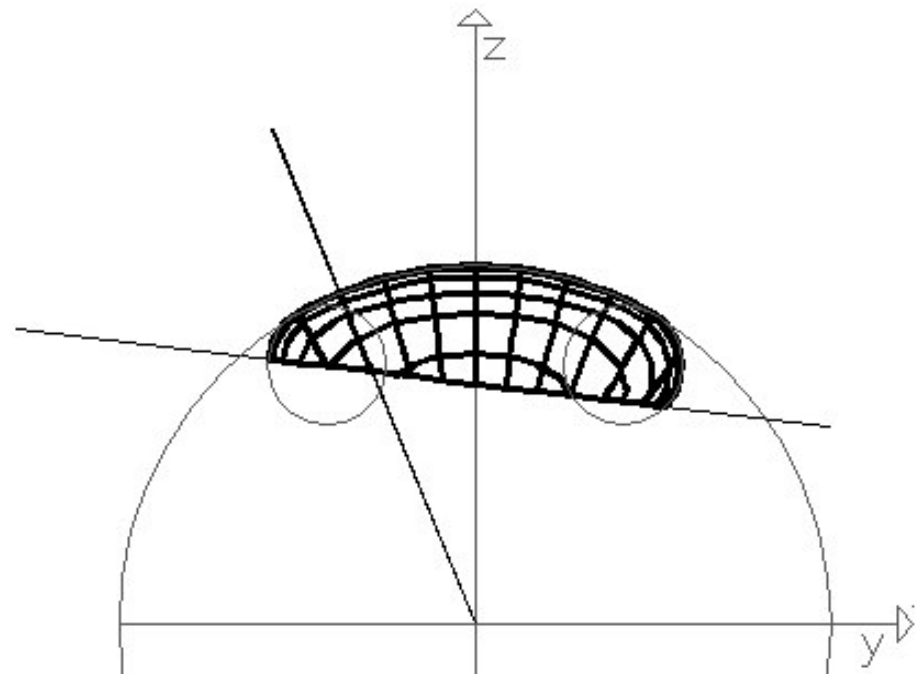
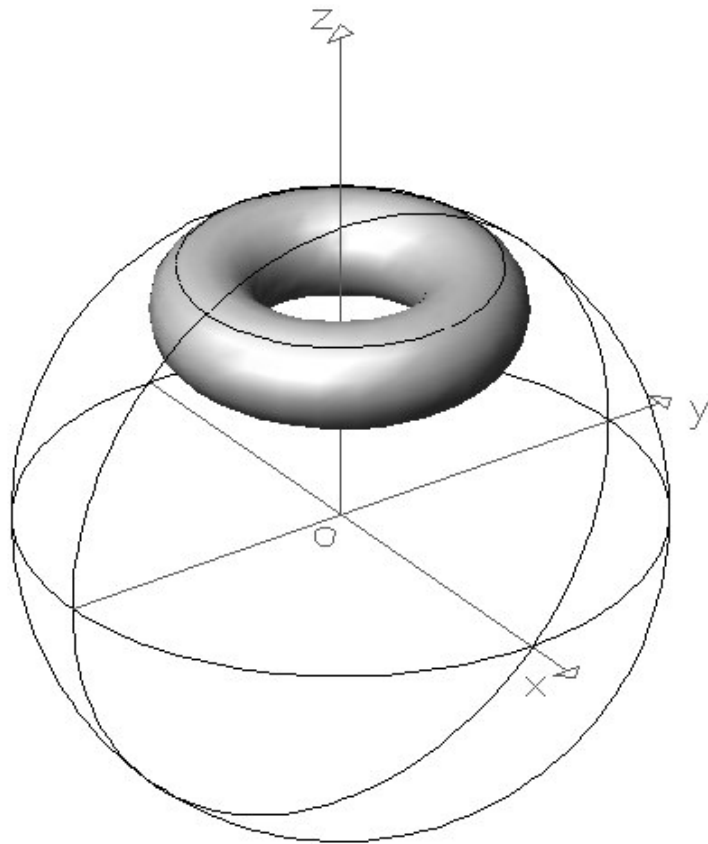
- More complex shapes born from their combination



Saint Lazare Lens – Paris – France – 1997-2003

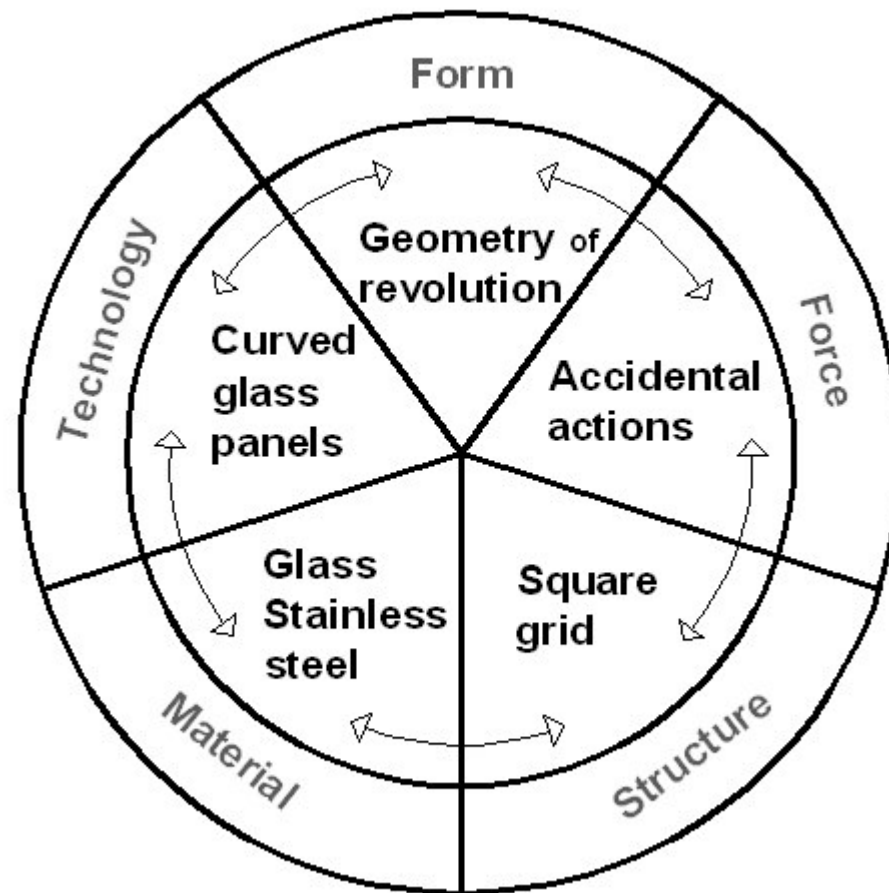
► Analytical shapes

—• More complex shapes born from their combination



► Analytical shapes

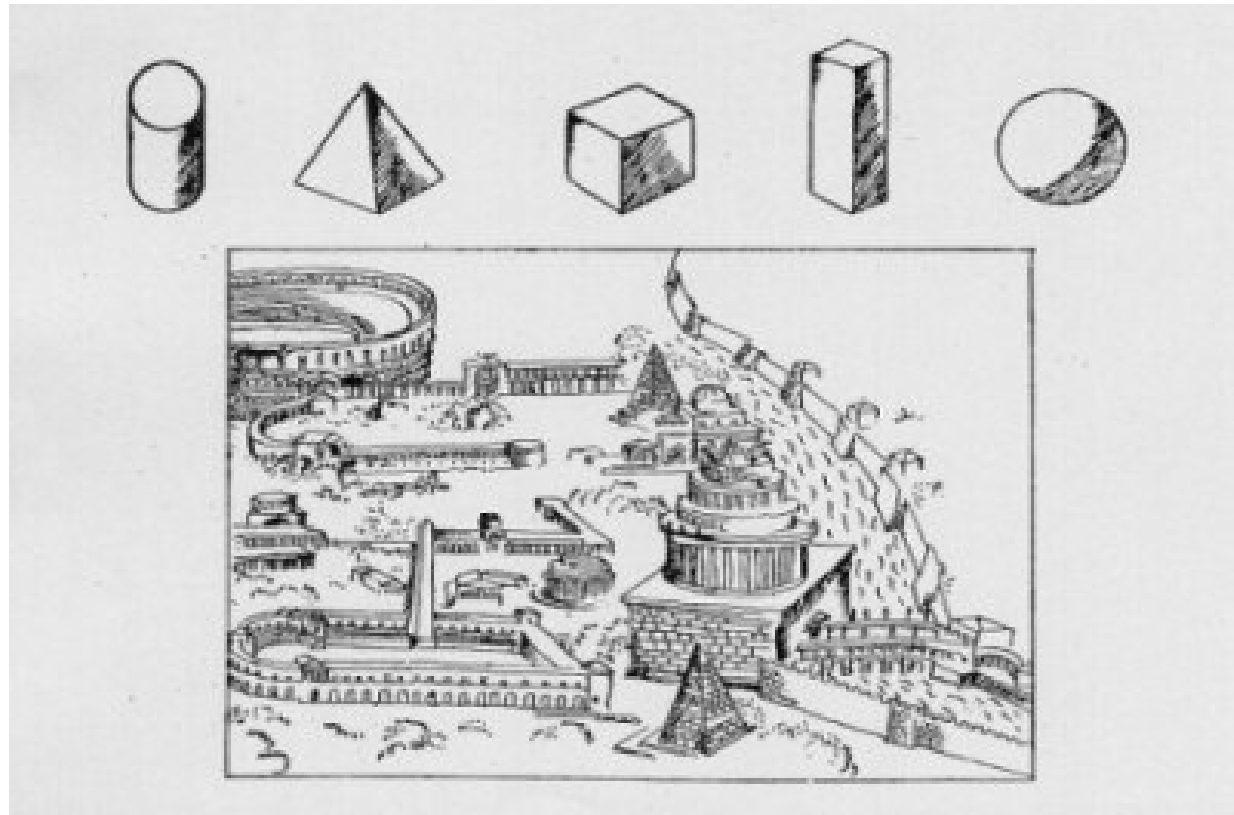
—● Design process is controlled



Shape classification

► Analytical shapes

- Design process is controlled
- Part of the architectural knowledge



Shapes of classical architecture – Le Corbusier – Vers une architecture – 1923

Shape classification

► Mechanical shapes

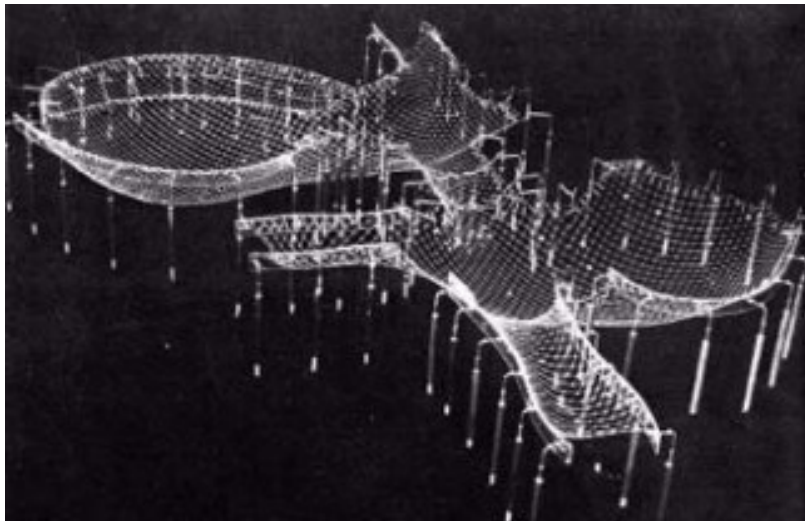
——● Funicular shapes



Shape classification

► Mechanical shapes

—● Funicular shapes

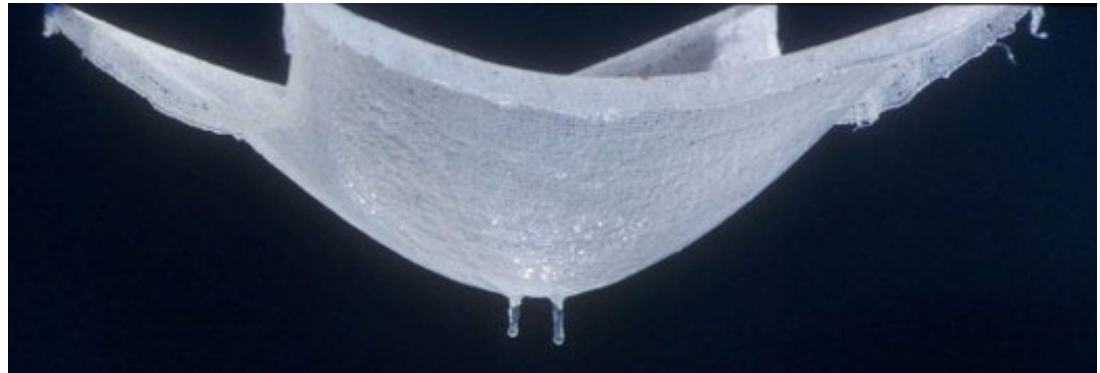


Mannheim – F.Otto - 1971

Shape classification

► Mechanical shapes

——● Funicular shapes



Tennis – H. Isler 1980-1985

Shape classification

► Mechanical shapes

—● Funicular shapes



Shape classification

► Mechanical shapes

—● Funicular shapes



Tennis – H. Isler 1980-1985

Shape classification

► Mechanical shapes

——● Funicular shapes



Tennis – H. Isler 1980-1985

Shape classification

► Mechanical shapes

——● Funicular shapes

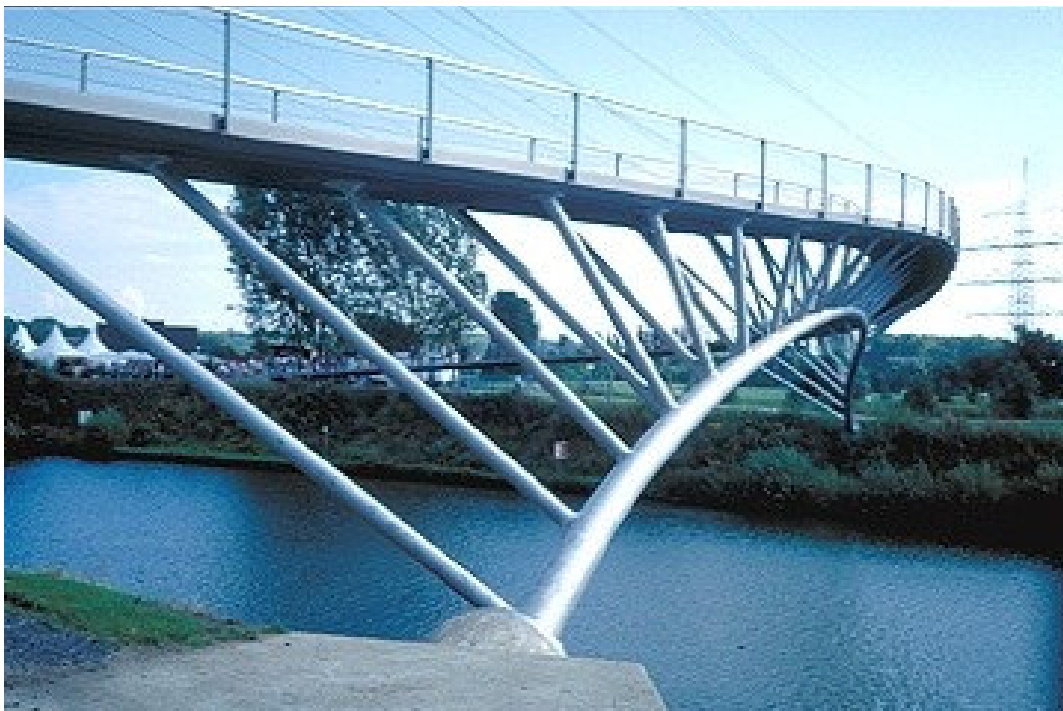


Gasoline Station— H.Isler - 1958

Shape classification

► Mechanical shapes

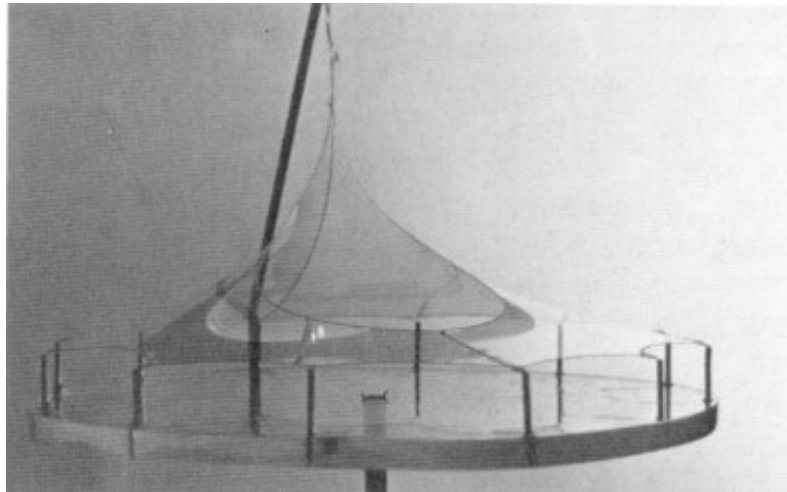
——● Funicular shapes



Shape classification

► Mechanical shapes

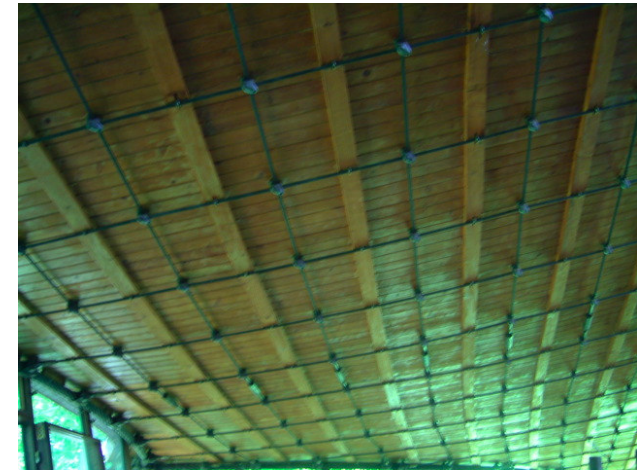
- Funicular shapes
- Prestressed and selfstressed shapes



Shape classification

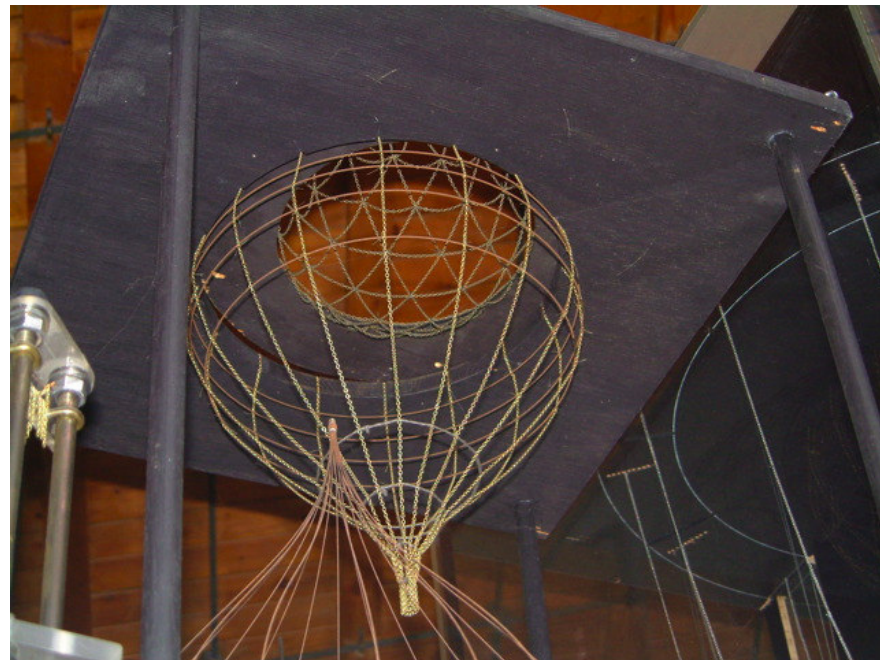
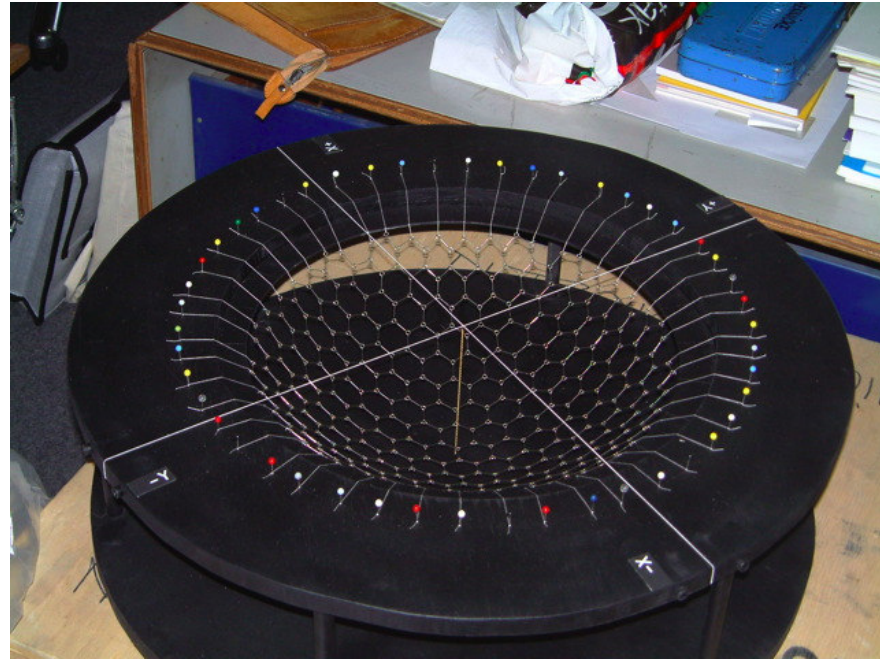
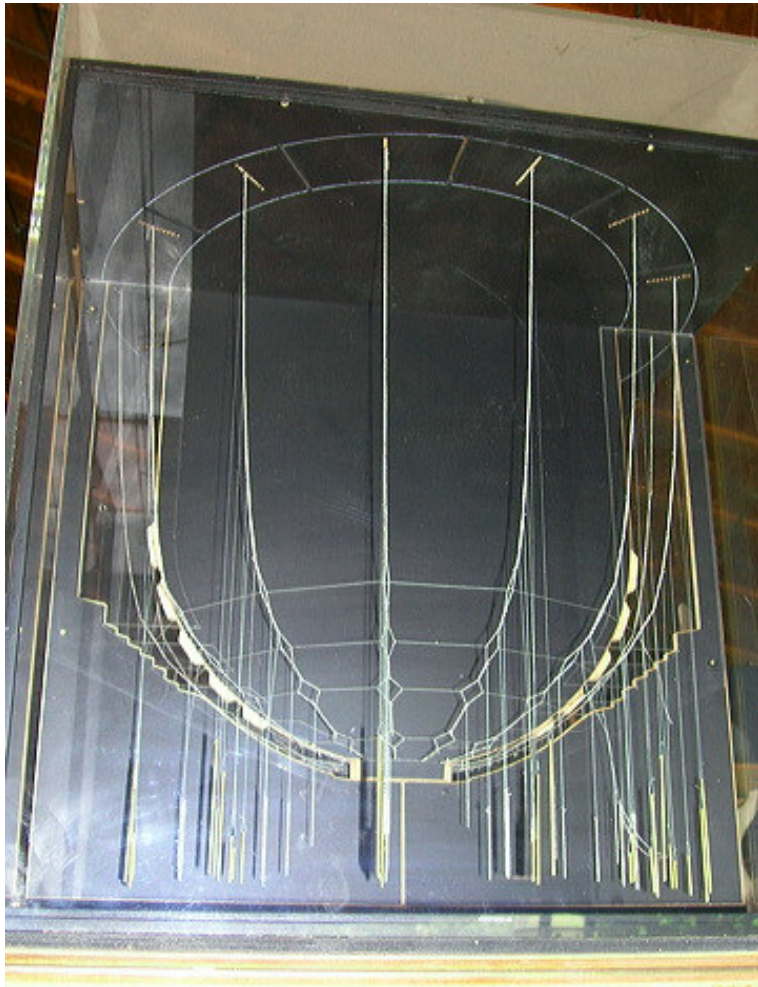
► Mechanical shapes

- Funicular shapes
- Prestressed and selfstressed shapes



Shape classification

- Just a look inside ILEK



ILEK – F. Otto

Shape classification

► Mechanical shapes

- Funicular shapes
- Prestressed and selfstressed shapes

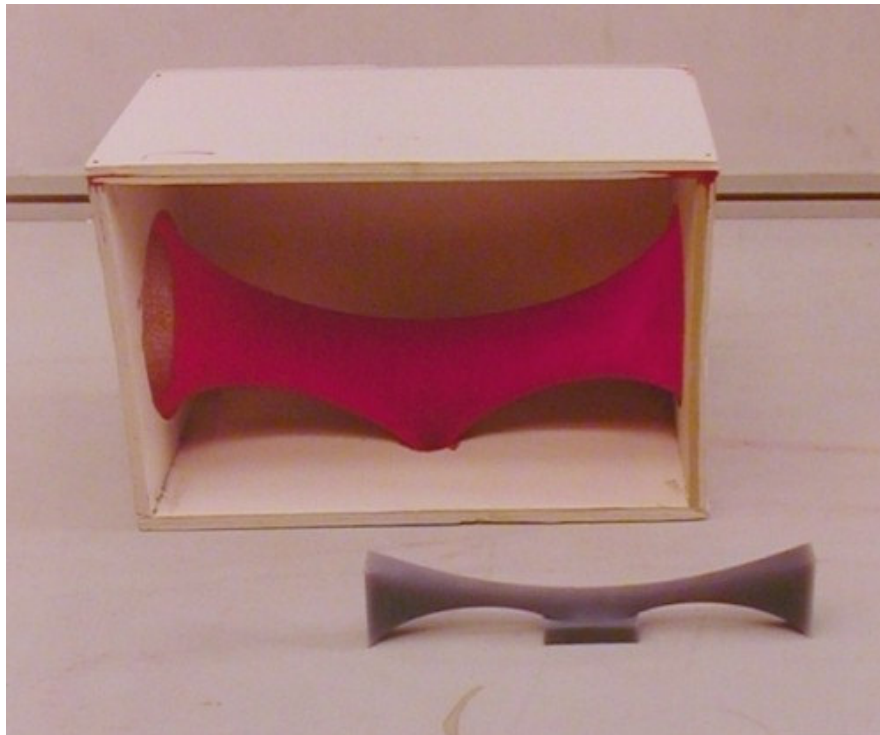
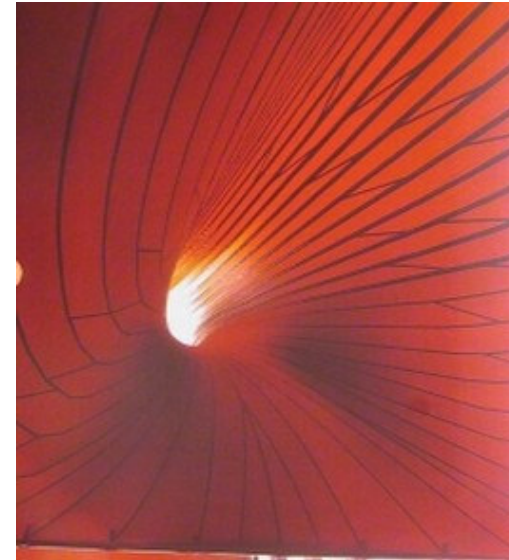


Sleeping dragon – K.Snelson – 2002-2003

Shape classification

► Mechanical shapes

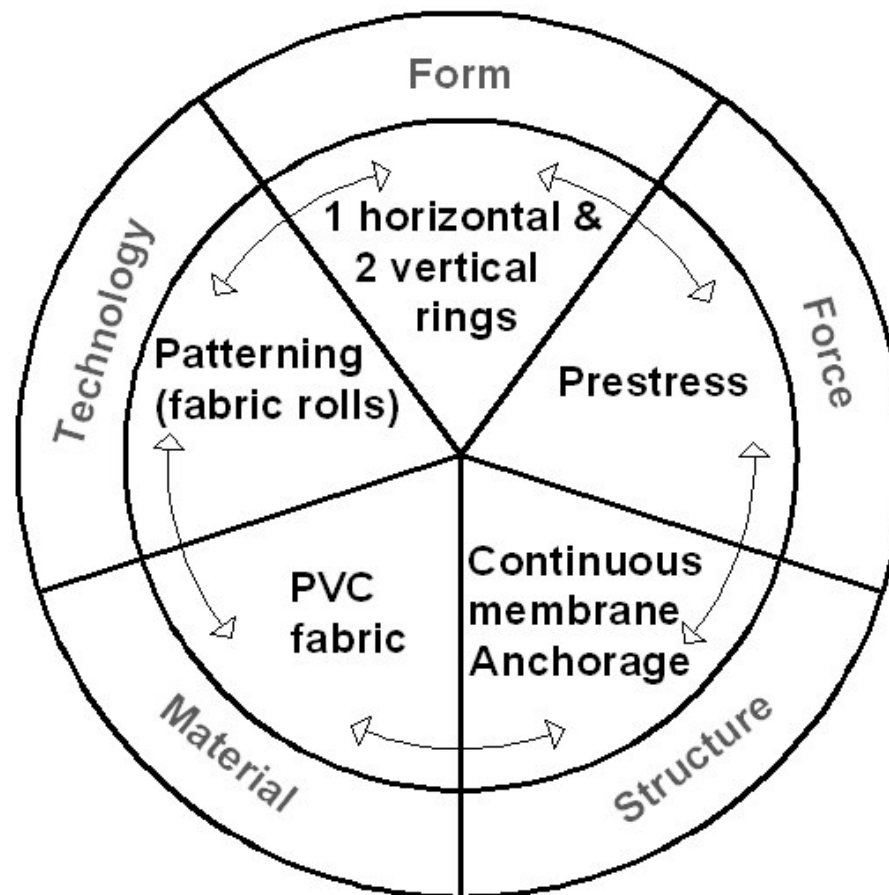
- Funicular shapes
- Prestressed and selfstressed shapes



Marsyas – A. Kappor- London - 2002

► Mechanical shapes

——● Design process is controlled



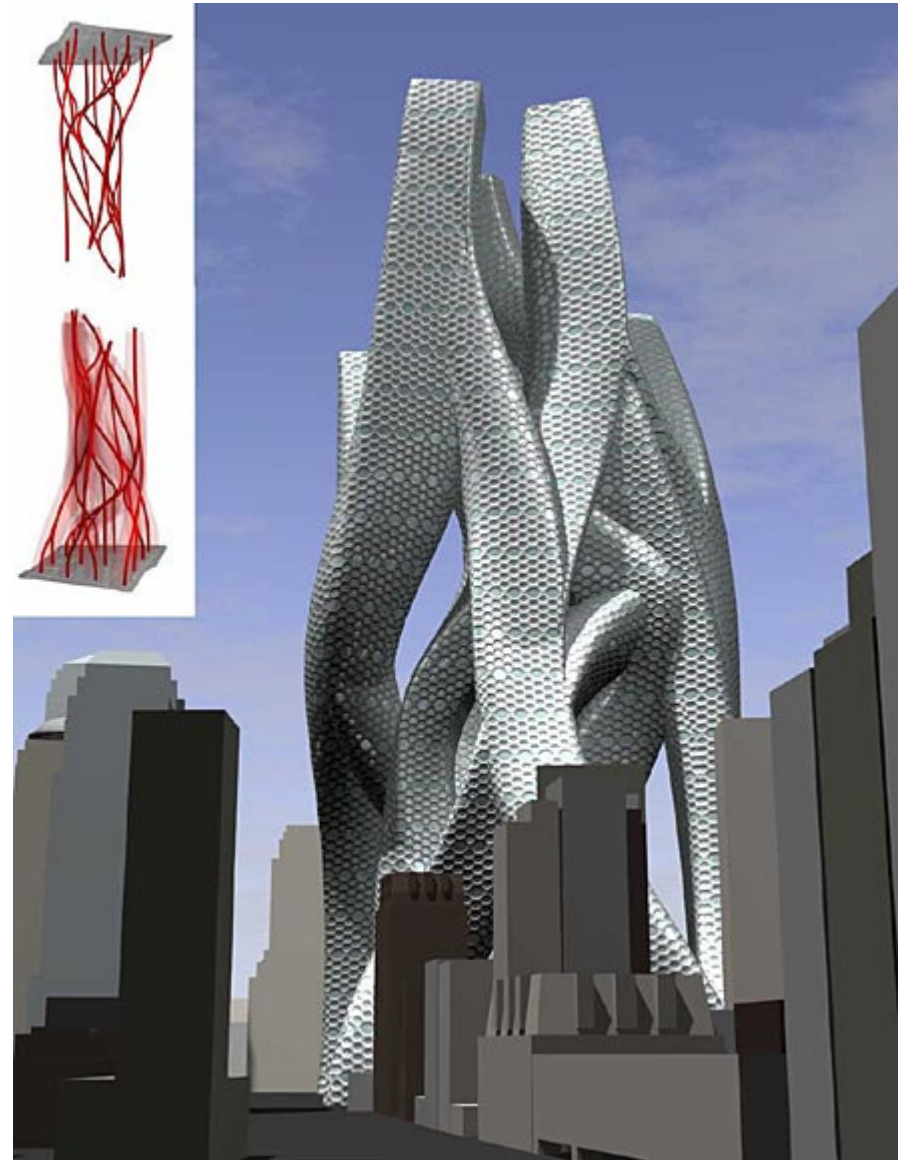
Shape classification

► Flexible shapes

—● No constrain



EMP – F.O Gehry – Seattle – 1997 - 2000



Oblique World Trade Center – Nox – NY - 2001

Shape classification

► Flexible shapes

—● No constrain

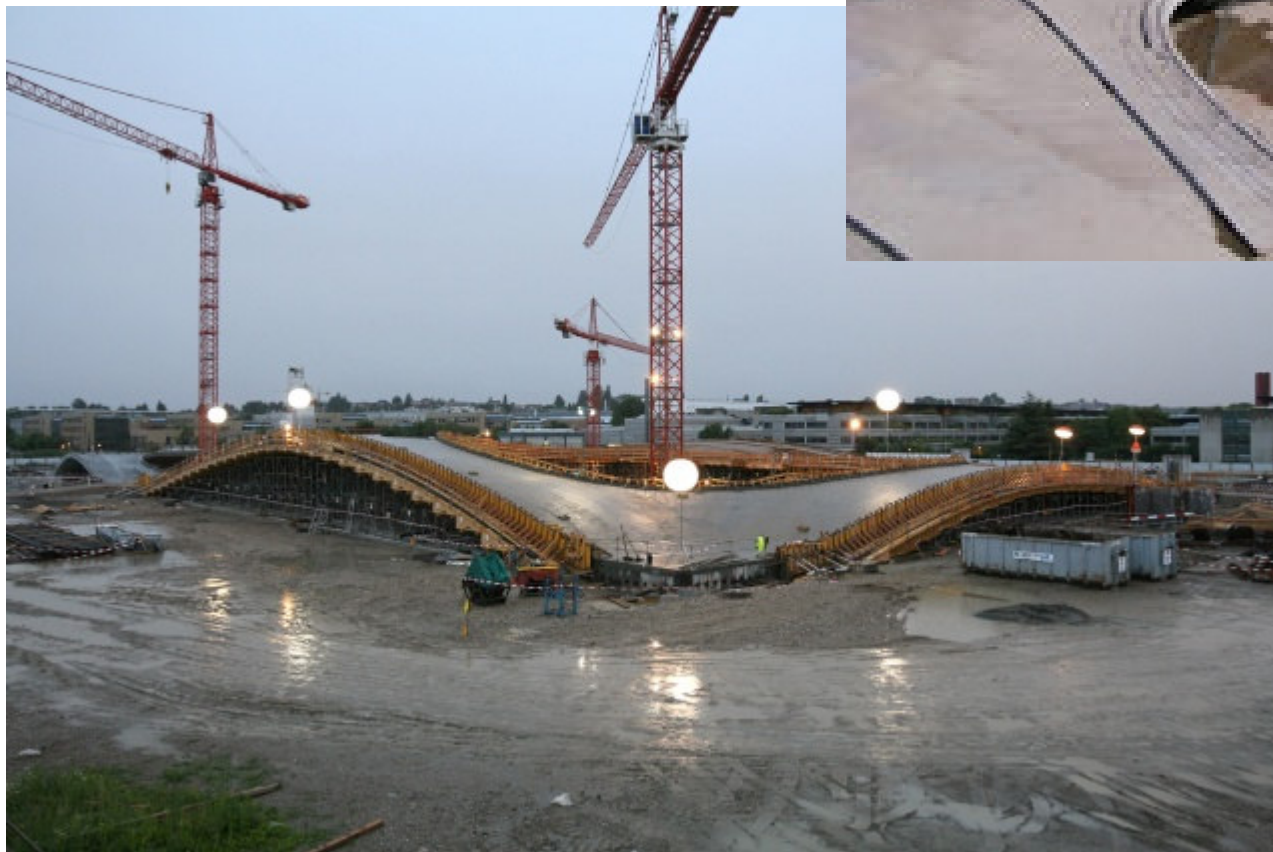


Rolex Learning Center – Sanaa – Lausanne 2010

Shape classification

► Flexible shapes

——● No constrain



Rolex Learning Center – Sanaa – Lausanne 2010

Shape classification

► Flexible shapes

—● No constrain



Rolex Learning Center – Sanaa – Lausanne 2010

Shape classification

► Flexible shapes

—● No constrain



Innsbruck stations – Zaha Hadid

Shape classification

► Flexible shapes

————● No constrain

Shape classification

► Flexible shapes

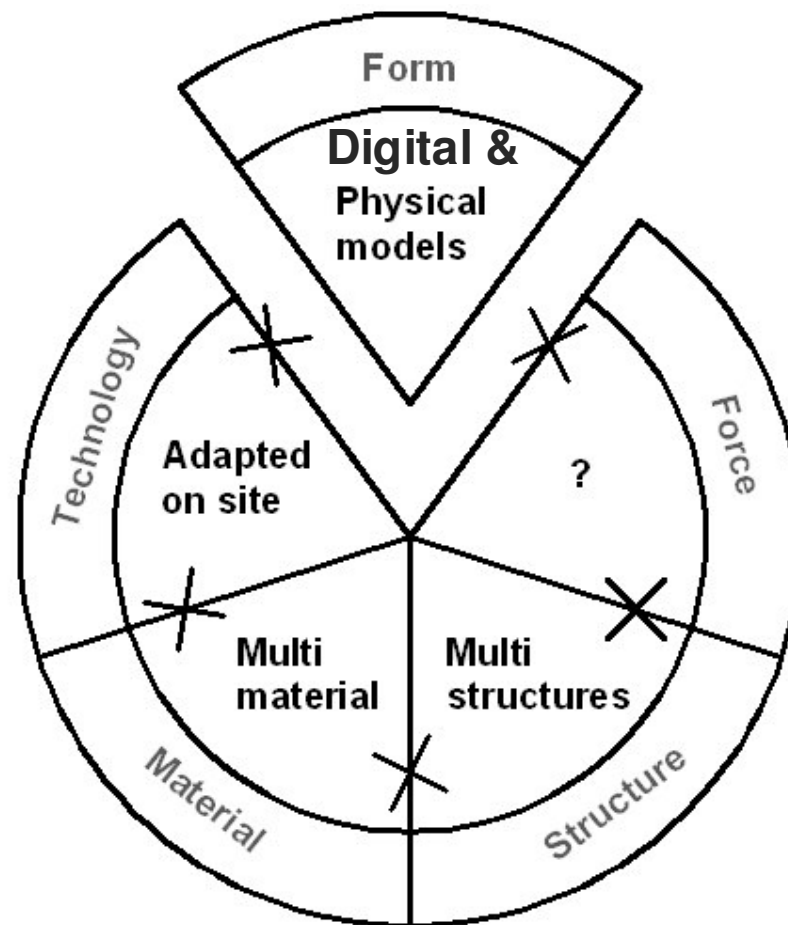
—● No constrain



Shape classification

► Flexible shapes

—● Design process issues



Apparent immateriality

► Flexible shapes

—● Material exploration



Astor Palace – F.O Gehry – NY - 1998

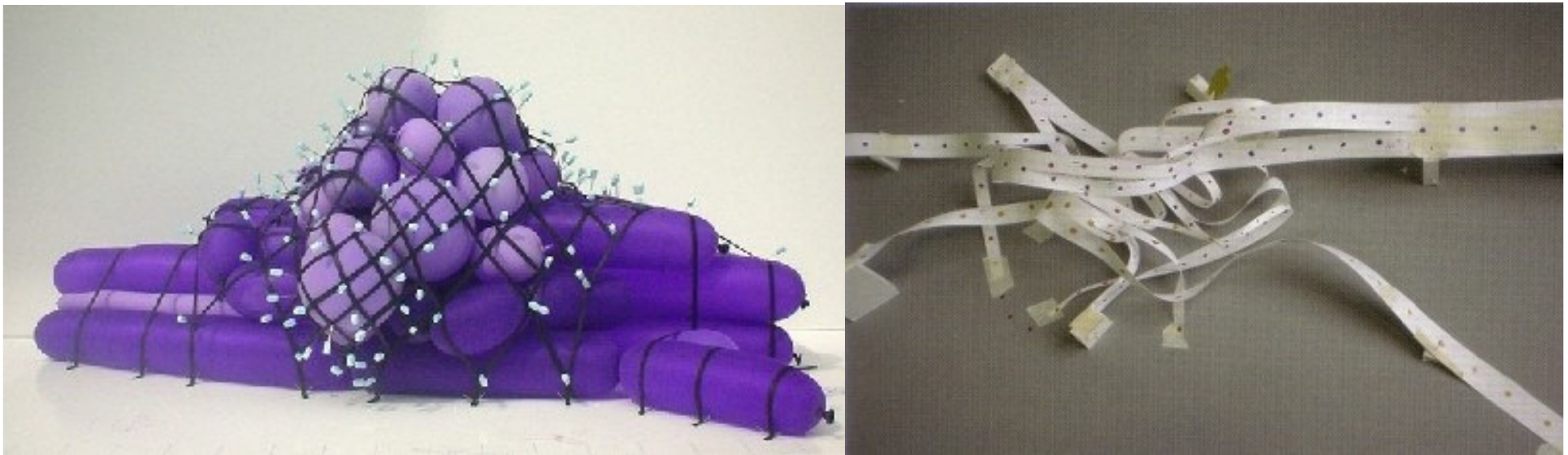


Blood Sense Tower – Royal College of Arts –
London – 2003-2004

Apparent immateriality

► Flexible shapes

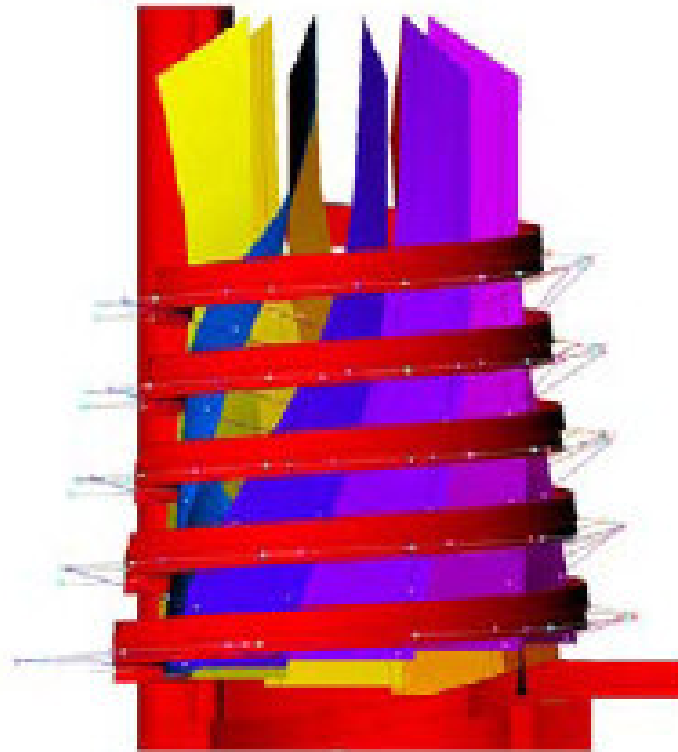
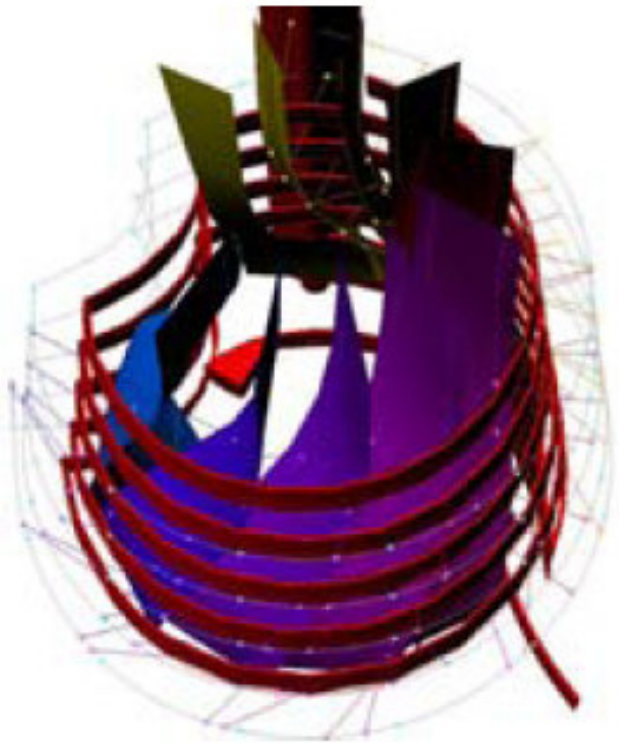
——● Material exploration



Apparent immateriality

► Flexible shapes

—● Digital exploration

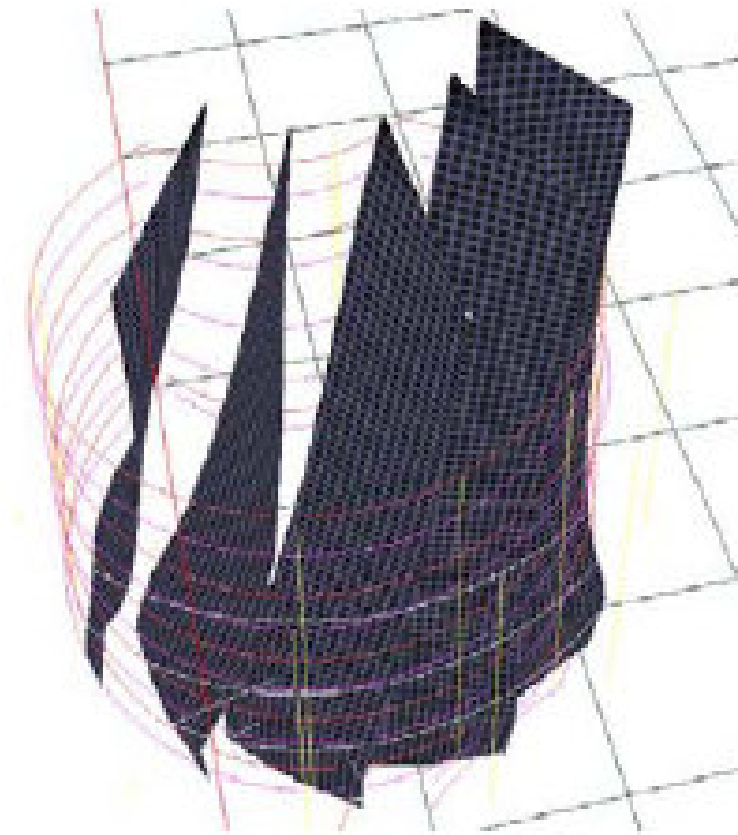


Guggenheim installation - 2001

Apparent immateriality

► Flexible shapes

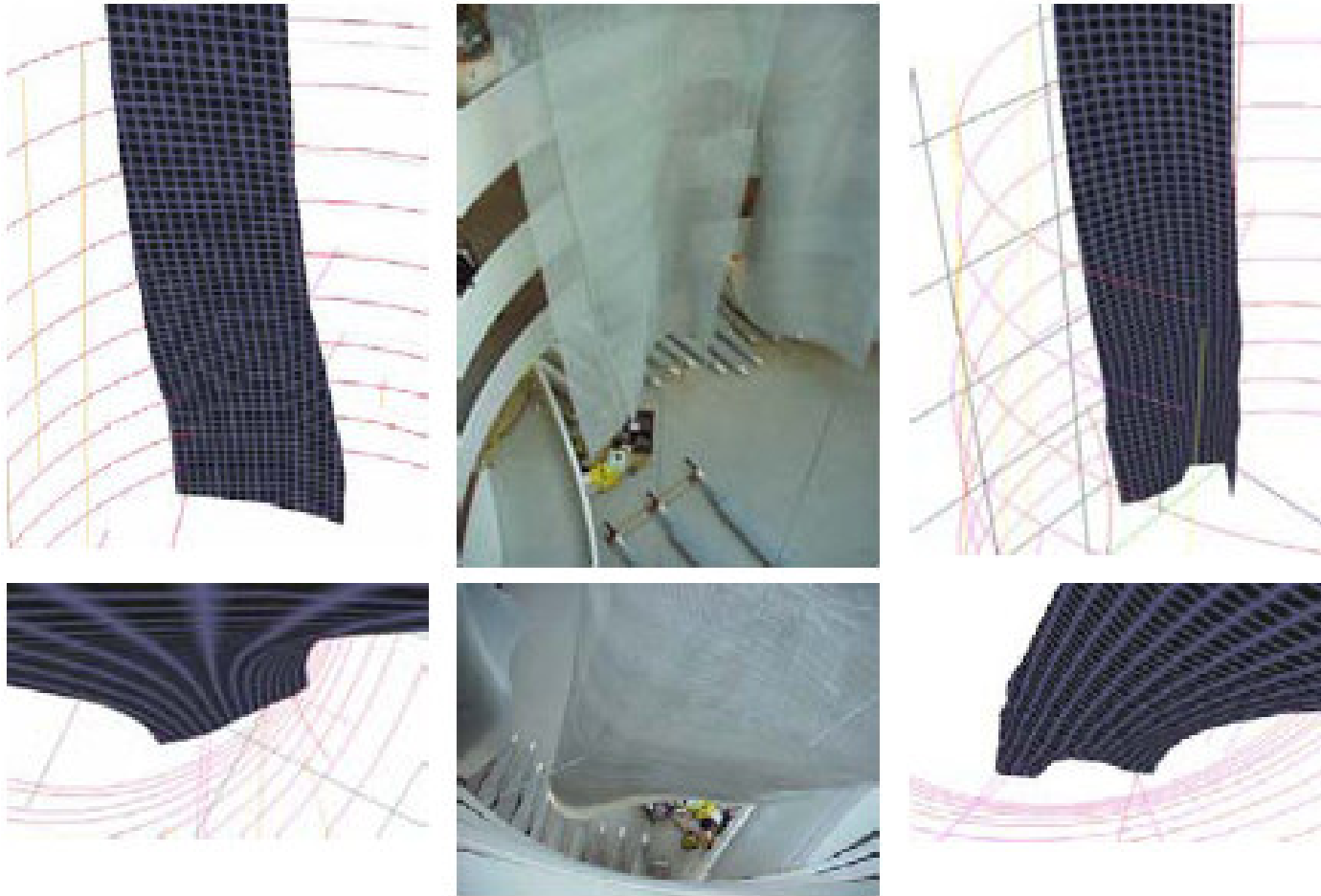
—● Digital exploration



Guggenheim installation - 2001

Apparent immateriality

► Flexible shapes



Original prediction

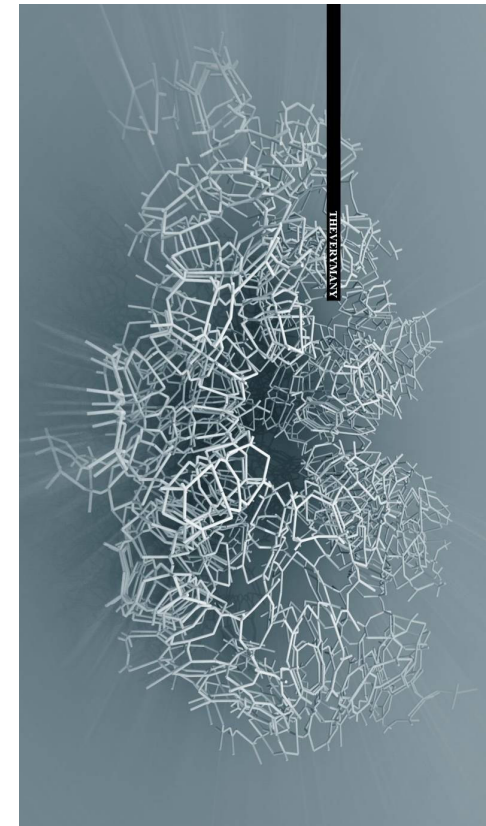
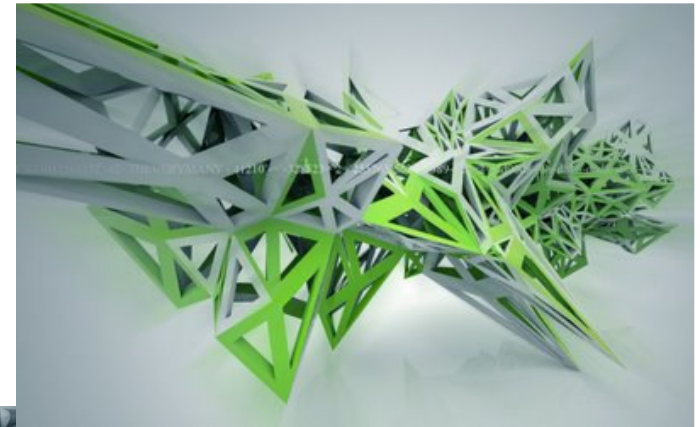
Results in field

Recalibration results

Figure VII-25: Recalibration of material properties based on initial installation results

Apparent immateriality

► Flexible shapes



Theverymany – Marc Fornes

Apparent immateriality

► Flexible shapes



Theverymany – Marc Fornes

Conclusion

- ▶ New design tools
- ▶ Necessity of hybrid approaches
 - Flexible / analytical
 - Flexible / mechanical



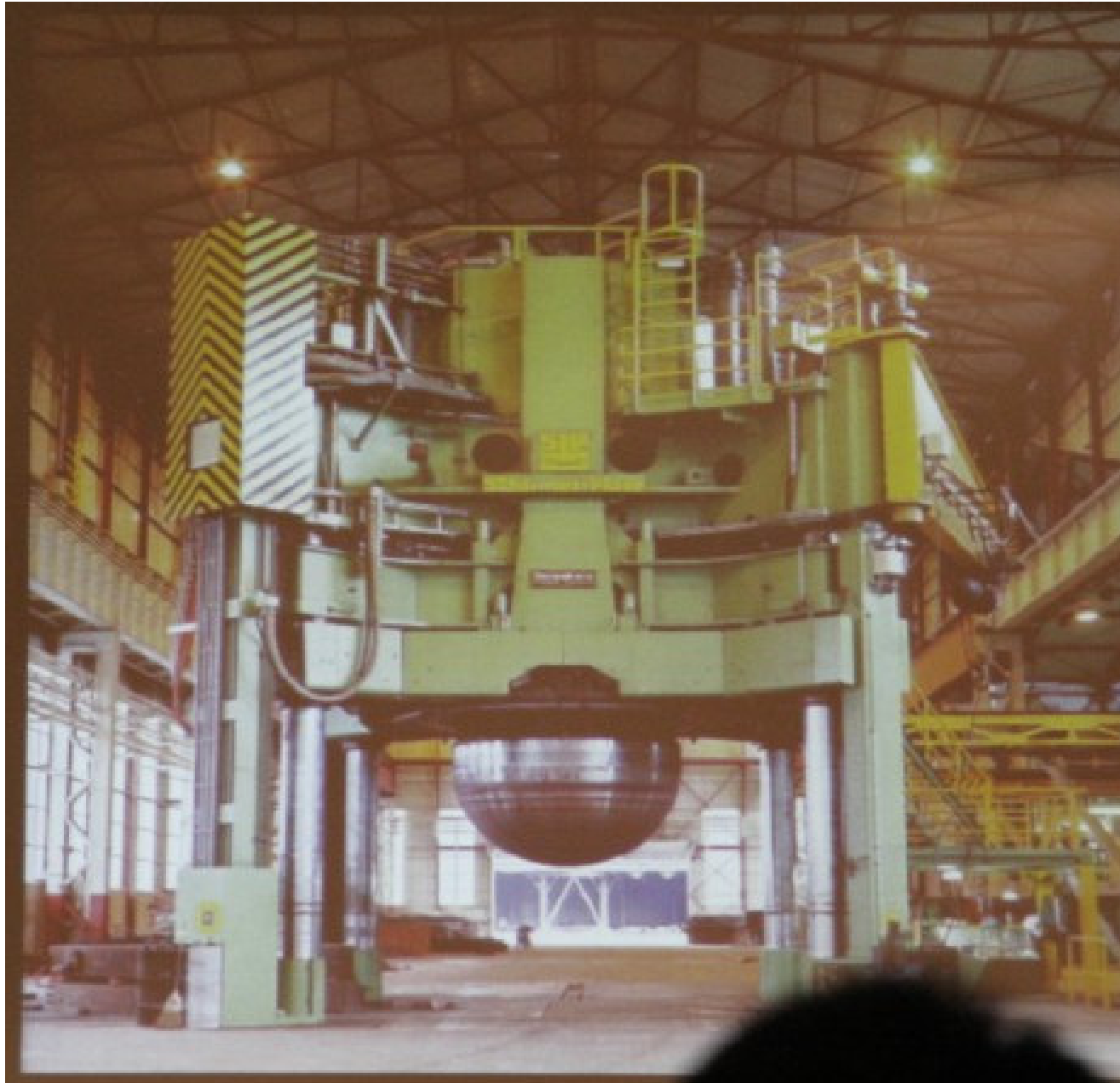
Belts – R.Serra – NY – 1966-1967

Conclusion

- ▶ New design tools
- ▶ Necessity of hybrid approach
 - Flexible / mechanical
 - Flexible / analytical



Conclusion



Conclusion

