TRADITIONAL ARCHITECTURE GROUP

HOW ENERGY AVAILABILITY INFLUENCED BUILDING FORM

Historic England

DR ROBYN PENDER

BUILDING CONSERVATION + CLIMATE CHANGE ADAPTATION TEAM

Brussels' big building grab

The EU wants to mandate energy efficiency upgrades for millions of old buildings.

Buildings account for 36 percent of the EU's greenhouse gas emissions | David Ramos/AFP v a

TIMELINE: DYMCHURCH MARTELLO TOWER

DATE	OCCURRENCE	COMMENTS
1805–12	Tower constructed	Original render of lime-ash-tallow (permeable)
1870s	Military use ceases; Coastal Blockade and Coastguard take over	Was this when the original gun was removed?
Late 19th century	Brick exterior staircase installed	Was this coeval with the installation of hut on roof?
Before 1927	Timber hut installed on roof	What was hut for? How was it fixed in place?
Before 1940s	Roof covered in asphalt	Was this coeval with the installation of the hut?
1940s	Occupied by Royal Artillery	Did this result in any lasting alterations?
1951	Coastguard leaves	Maintenance issues as a result?
After 1955	Timber hut on roof removed	Was this part of the 1960s works programme?
After 1955	Exterior rendered in cement, tooled to resemble stone	Impermeable render will lead to moisture problems
1959	Transferred from War Office to Ministry of Works	Becomes historic monument
1960s	Major works programme	Was this when the render was applied and the hut removed?
Post 1960s	Total replacement of all wooden joinery in interior	When? Suggests severe moisture problems have begun
Date still unknown	Brick exterior staircase removed	Was this part of the 1960s works programme?


Practical Building Conservation
English Heritage Technical Handbook
Volume 4
John & Nicola Ashurst
Practical Building Conservation
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Volume 5
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Mortars, Plasters & Renders


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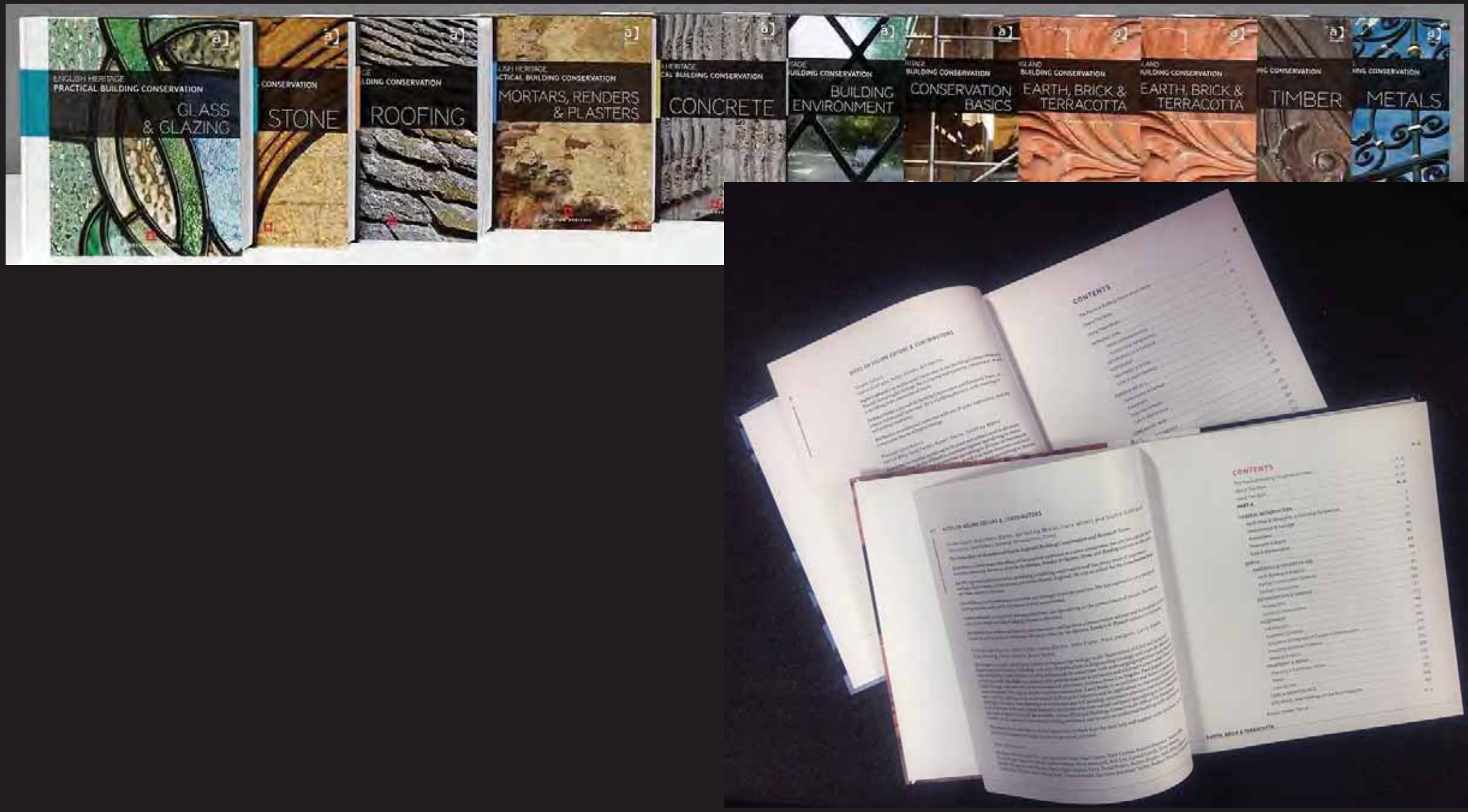
ENGLISH HERITAGE
PRACTICAL BUILDING CONSERVATION
MORTARS, RENDERS & PLASTERS
EARTH, BRICK & TERRACOTTA PART A
EARTH, BRICK & TERRACOTTA PART B
ROOFING
STONE
TIMBER
BUILDING ENVIRONMENT
PRACTICAL BUILDING CONSERVATION
CONCRETE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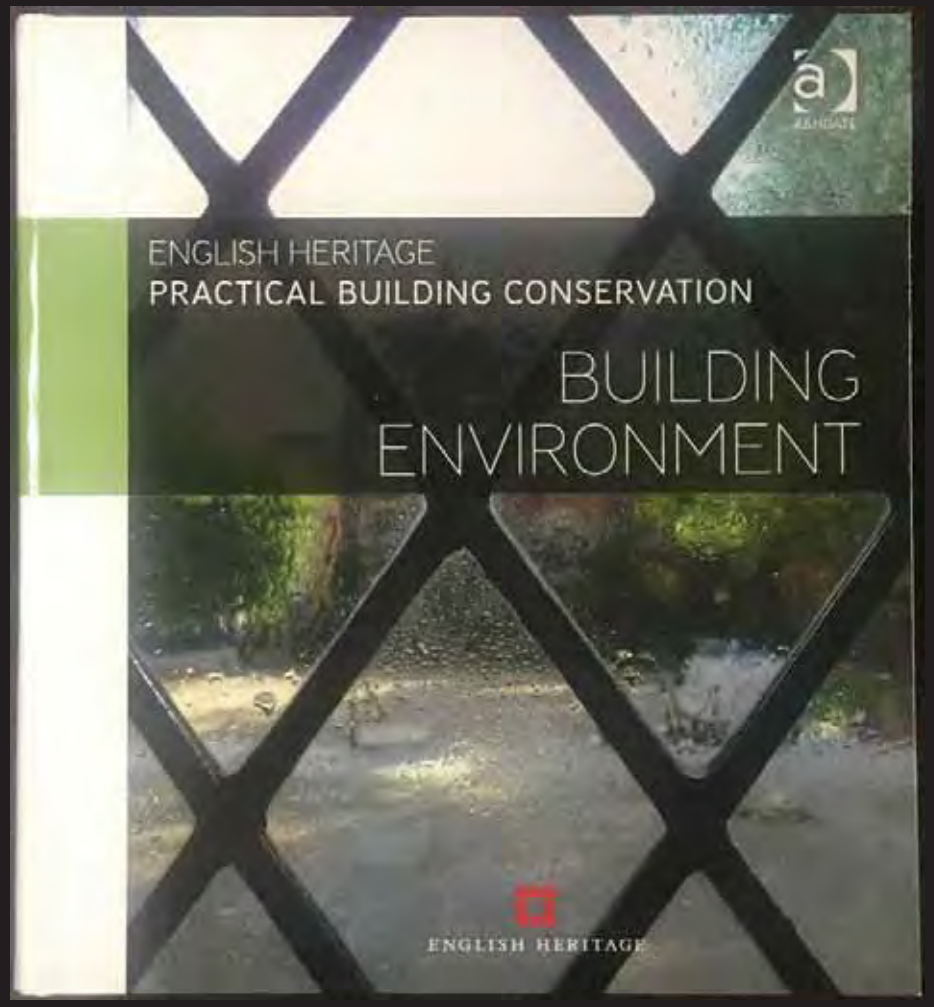
GLASS & GLAZING
STONE
ROOFING
MORTARS, RENDERS & PLASTERS
CONCRETE
BUILDING ENVIRONMENT
CONSERVATION BASICS
EARTH, BRICK & TERRACOTTA
EARTH, BRICK & TERRACOTTA
TIMBER
METALS
CONTENTS
CONTENTS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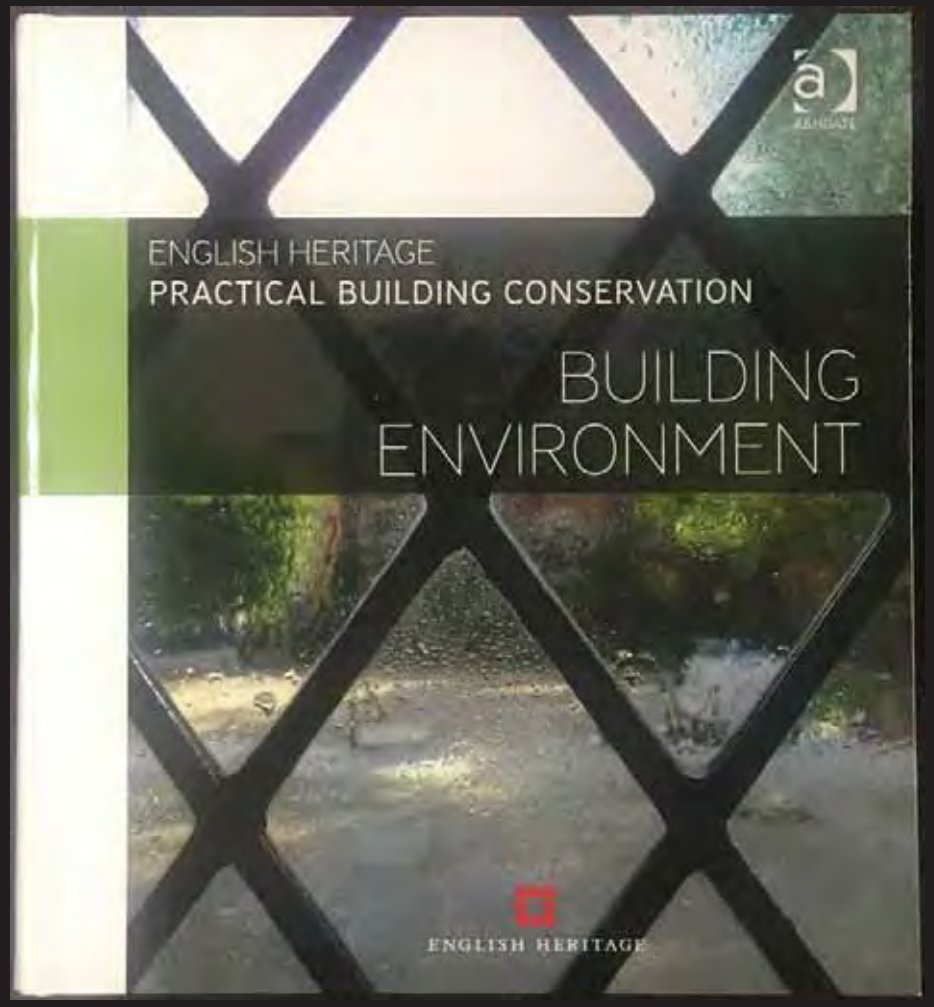
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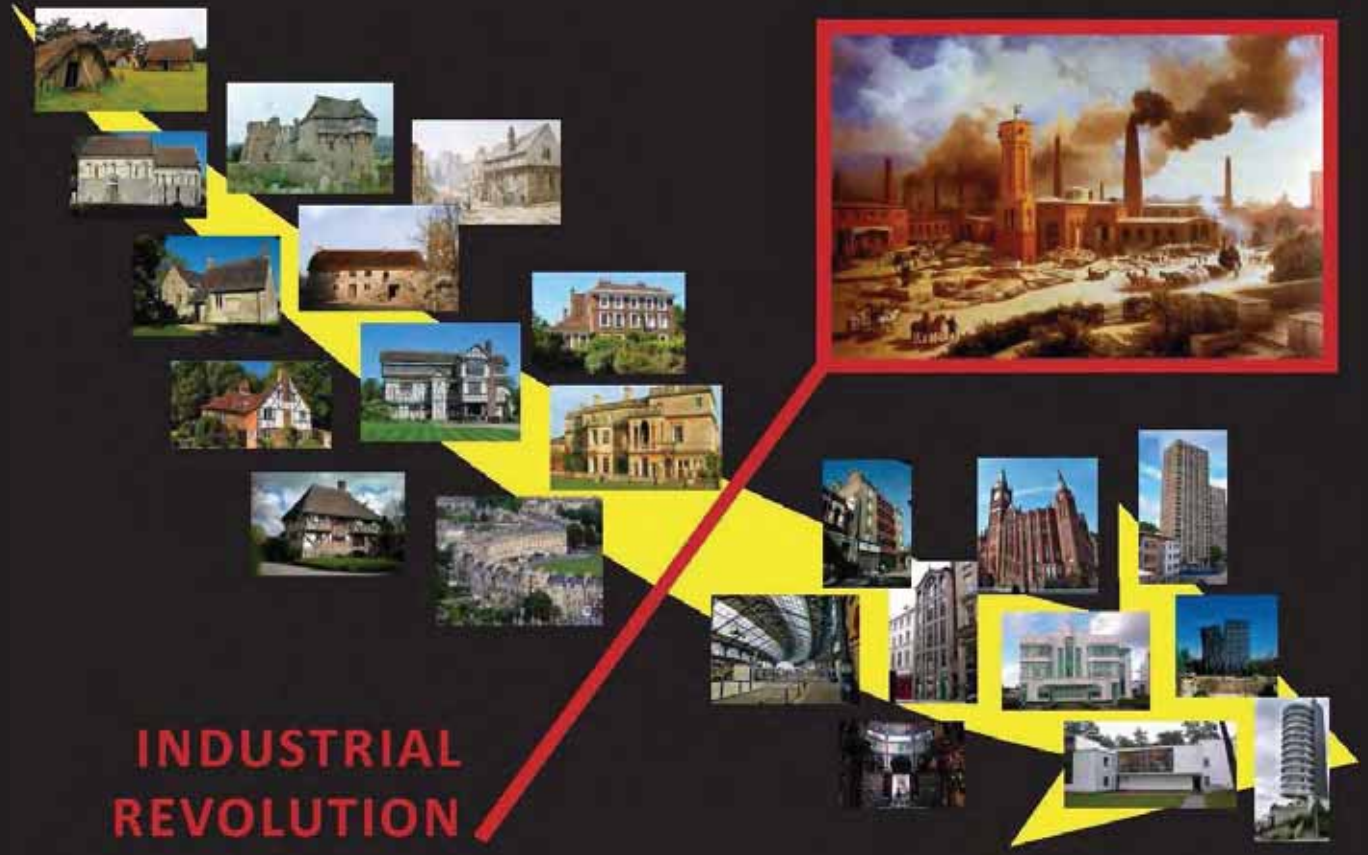
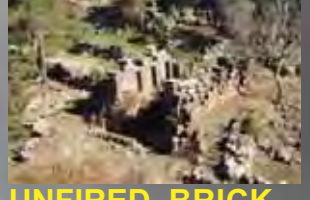

INDUSTRIAL REVOLUTION

PREHISTORY

FIRED BRICK
4400BC

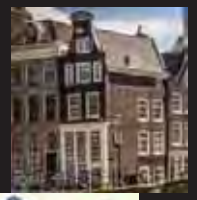
LIME MORTAR
c.6500BC

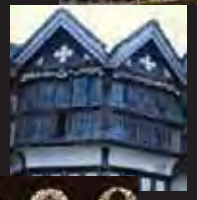


UNFIRED BRICK
before 7500BC

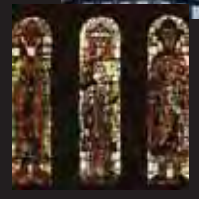
WINDOW GLASS

1670s



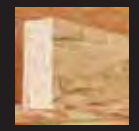


1550s



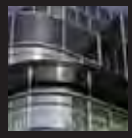
800AD

ENGINEERED WOOD



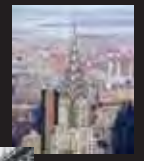
1960s

SS



1930s

AI



1900

IRON

1790

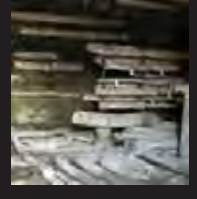
INDUSTRIAL
FOSSIL FUEL USE
BEGINS

PORTLAND CEMENT

1870s

SILICONE

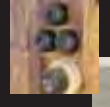
1940s



LEAD
200BC

PLASTICS

1907



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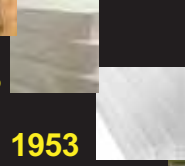
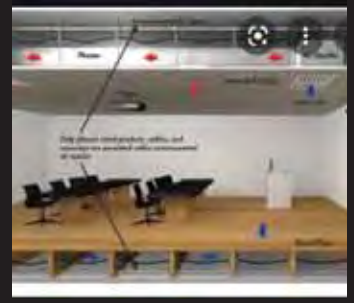
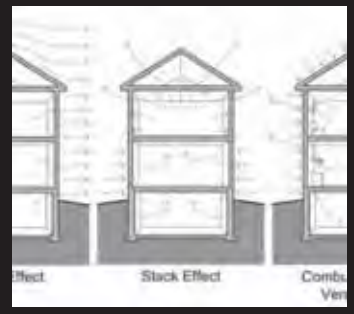


1953

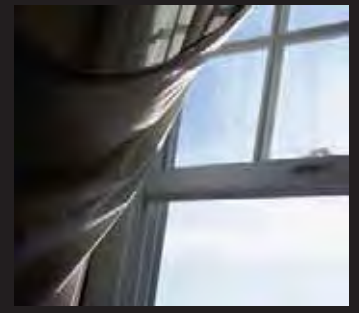
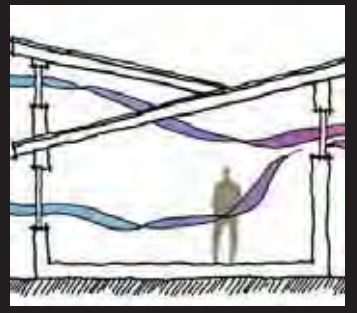
1965






TOUS GENRES


MAÎTRE JACQUES

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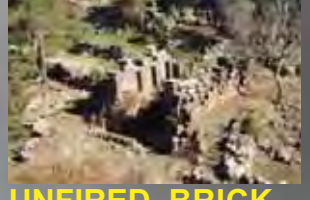
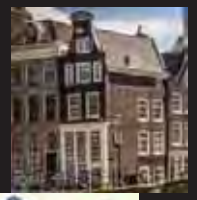
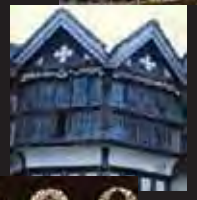


UNFIRED BRICK
before 7500BC

WINDOW GLASS

1670s





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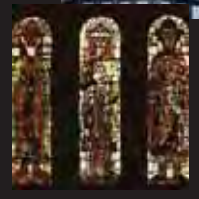

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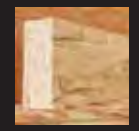
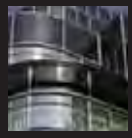


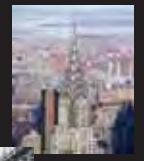
1960s

SS



1930s

AI



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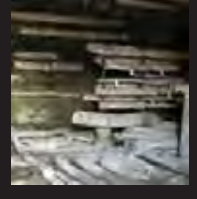

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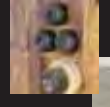

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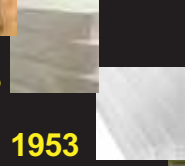
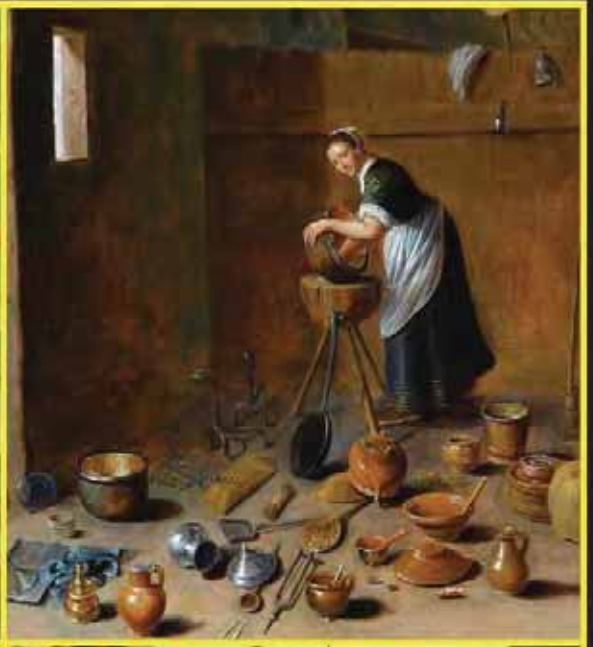


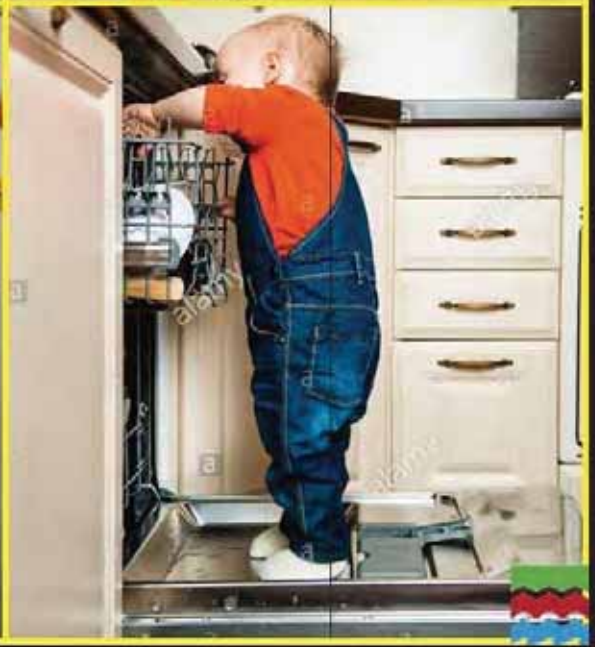
1953

1965







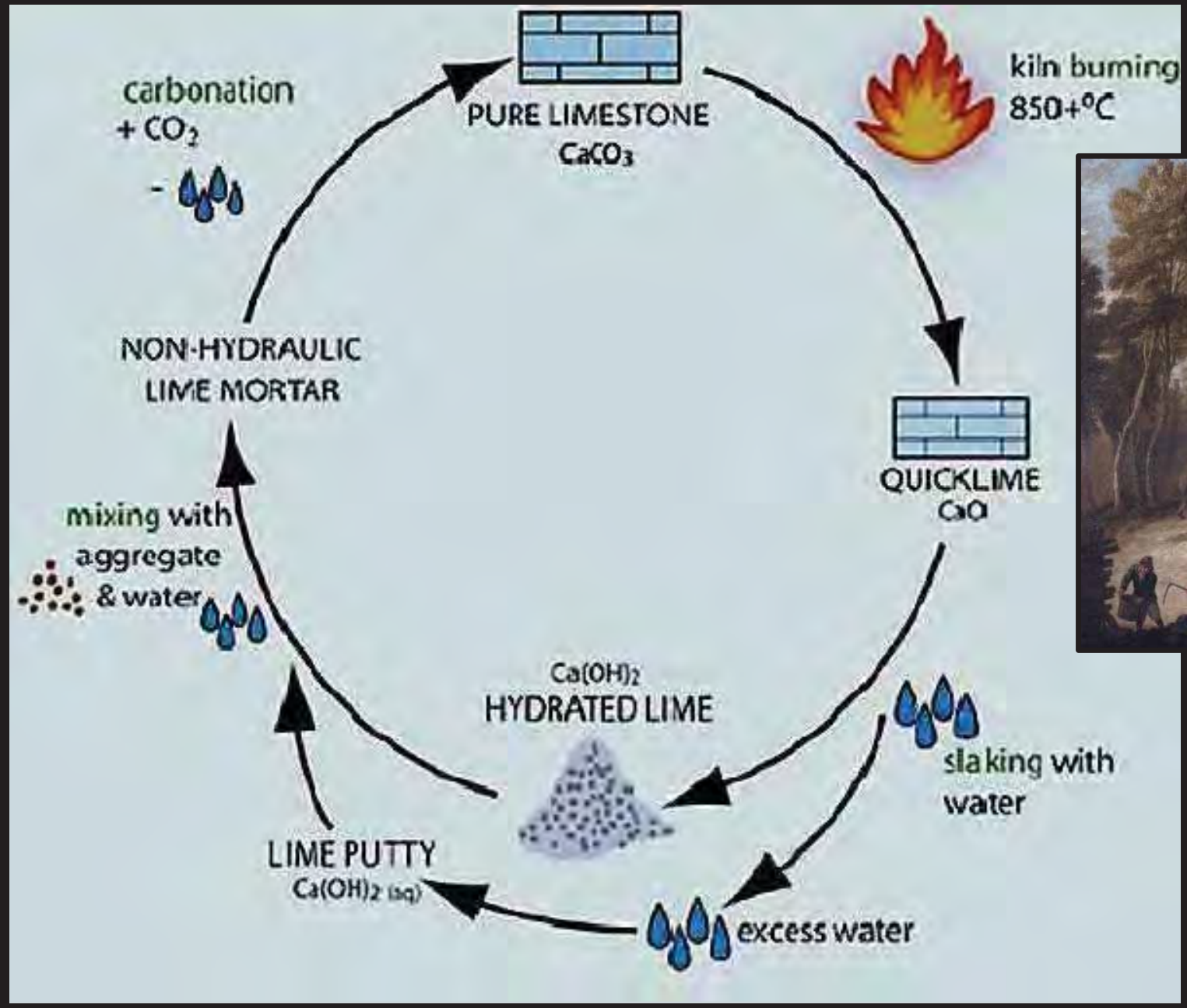
anaſti in terra ſanctuarium eius.
eſtruxiſti omnes ſepes eius: poſu

audiunt et letata eſt ſyon
t exultauerunt filie iu
iudicia tua domine
Quoniam tu dominus
ſuper omnem terram:
tus es ſuper omnes deos


LINCOLN
CATHEDRAL

Cennino Cennini *Il Libro dell'Arte*

"When you want to work on a wall... first of all get some lime and some sand, each of them well sifted. And if the lime is very fat and fresh it calls for two parts sand, the third part lime. And wet them up well with water... And let it stand for a day or so, until the heat goes out of it."


carbonation
+ CO_2
-
PURE LIMESTONE
$CaCO_3$
kiln burning
850+°C
QUICKLIME
CaO
sla king with
water
excess water
LIME PUTTY
$Ca(OH)_2$ (sq)
$Ca(OH)_2$
HYDRATED LIME
mixing with
aggregate
& water
NON-HYDRAULIC
LIME MORTAR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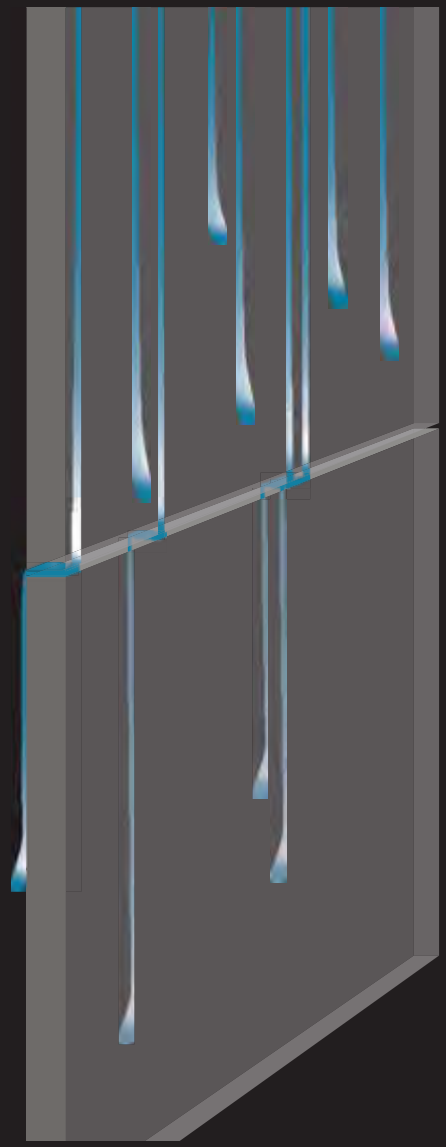

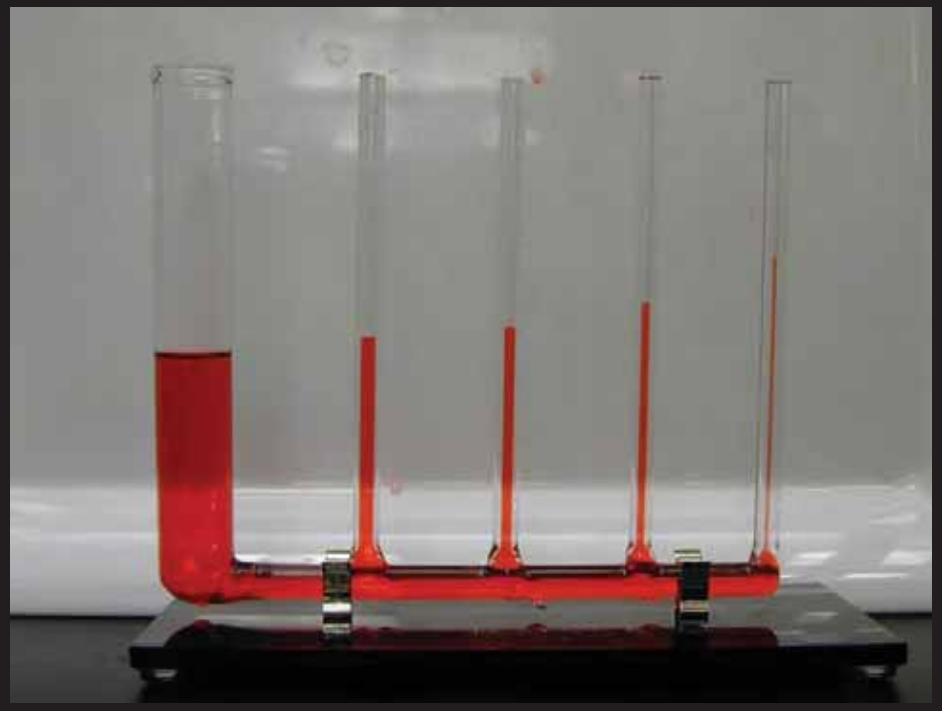

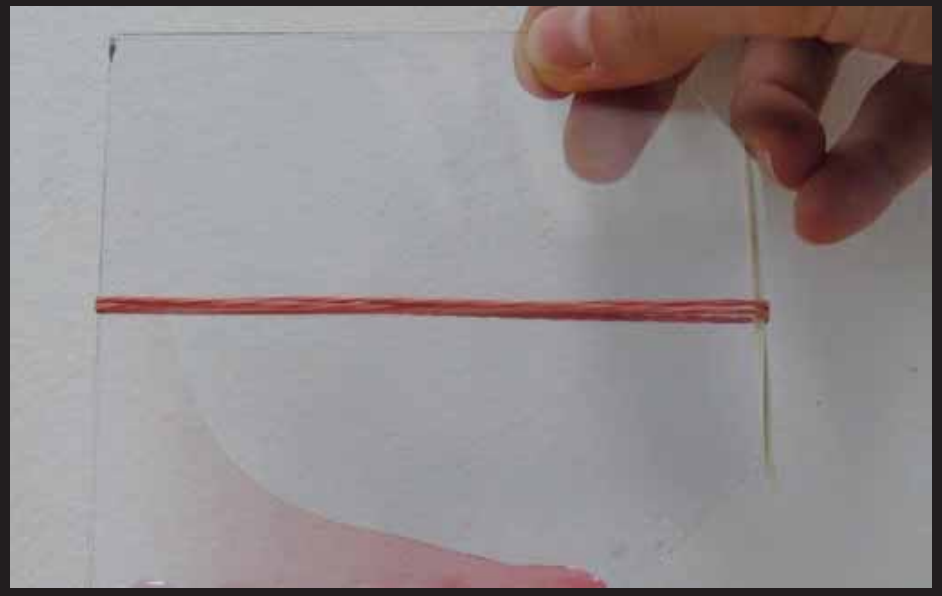


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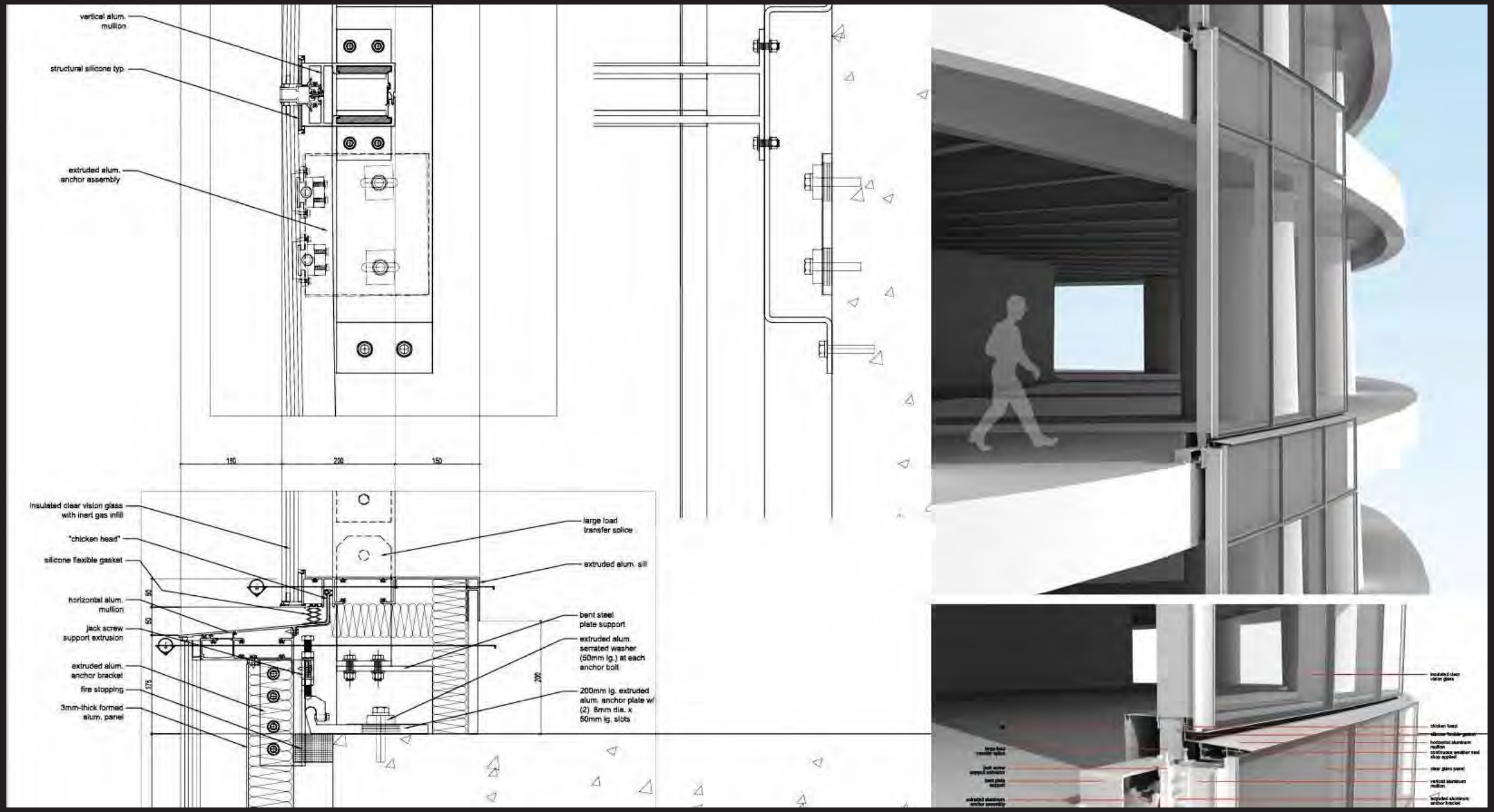
vertical alum. mullion
structural silicone typ.
extruded alum. anchor assembly
150
200
150
insulated clear vision glass with inert gas infill
"chicken head"
silicone flexible gasket
horizontal alum. mullion
jack screw support extrusion
extruded alum. anchor bracket
fire stopping
3mm-thick formed alum. panel
large load transfer splice
extruded alum. sill
bent steel plate support
extruded alum. serrated washer (50mm lg.) at each anchor bolt
200mm lg. extruded alum. anchor plate w/ (2) 8mm dia. x 50mm lg. slots
50
50
175
200


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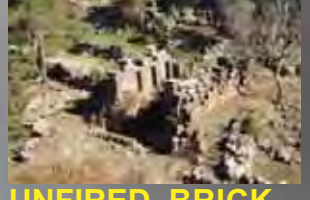
AMPUS

PREHISTORY

FIRED BRICK
4400BC

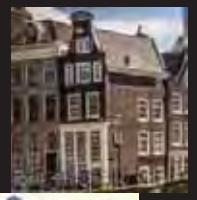
LIME MORTAR
c.6500BC

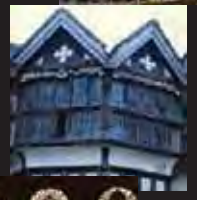


UNFIRED BRICK
before 7500BC

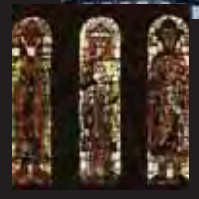
WINDOW GLASS

1670s



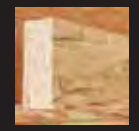


1550s



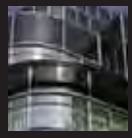
800AD

ENGINEERED WOOD



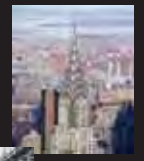
1960s

SS



1930s

AI



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PORTLAND CEMENT

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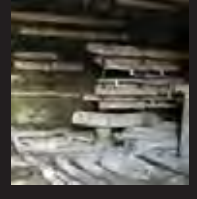
SILICONE

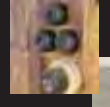
1940s



LEAD
200BC

PLASTICS

1907



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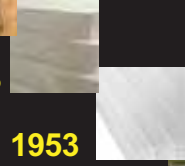
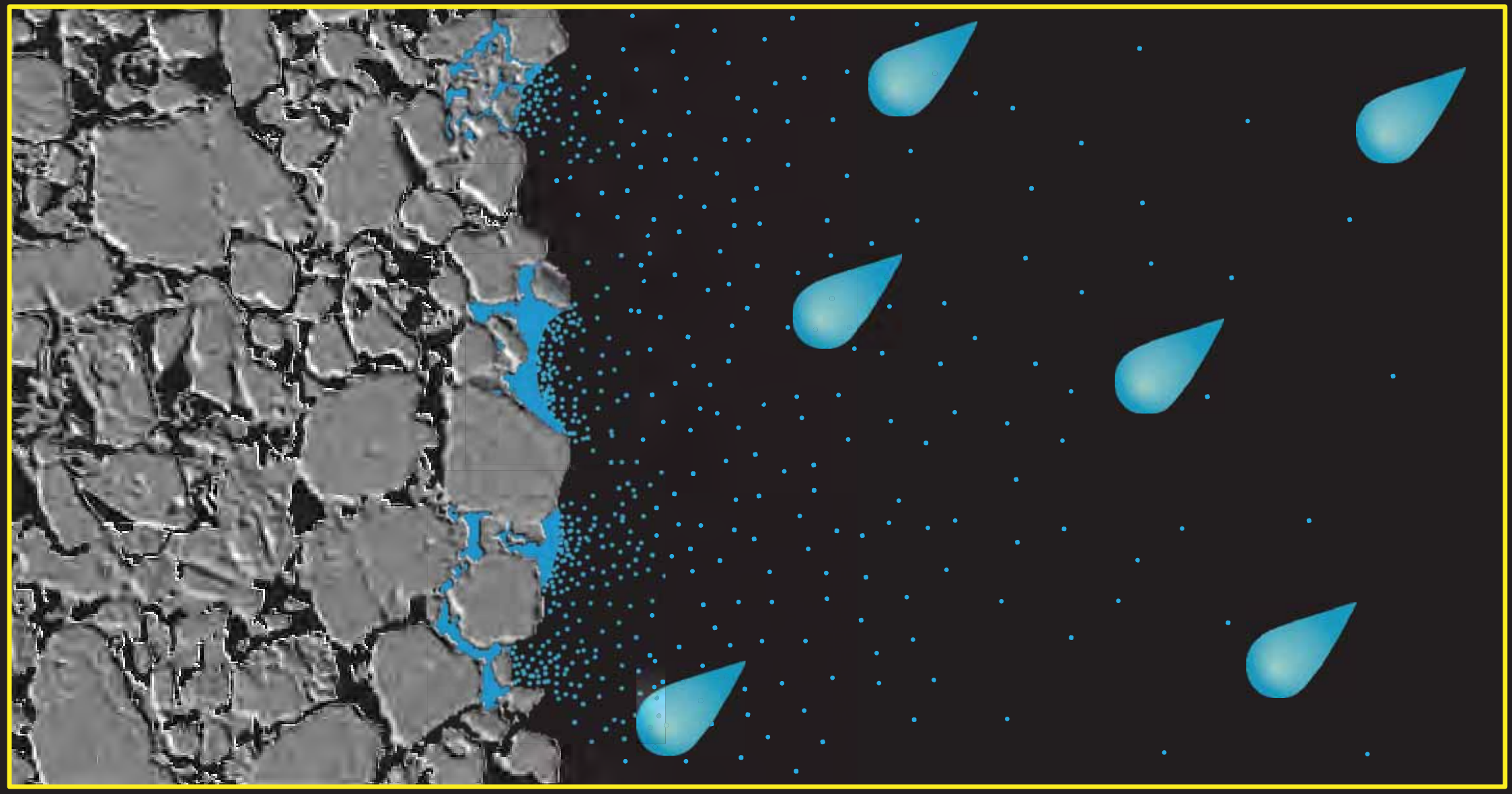
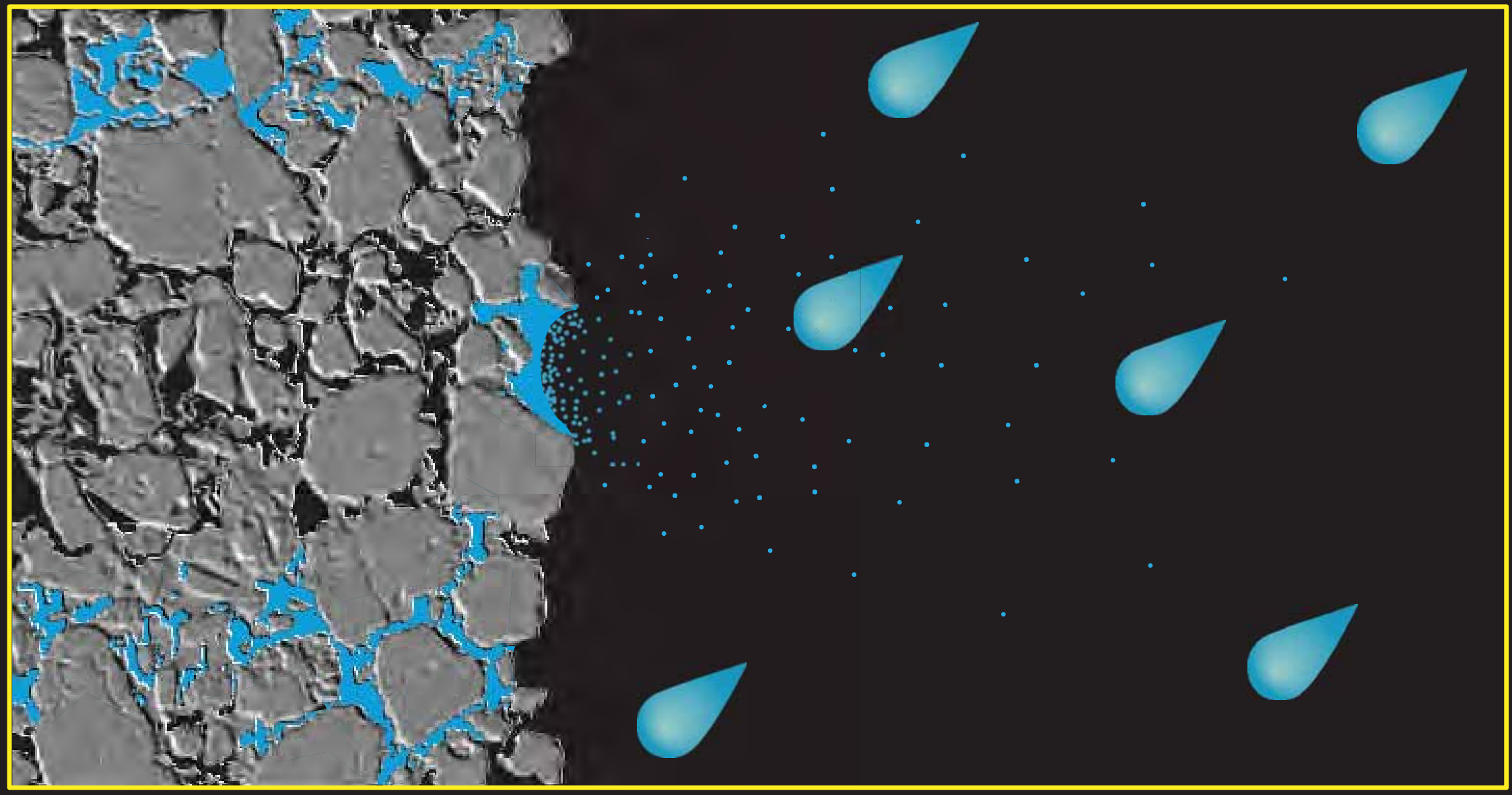


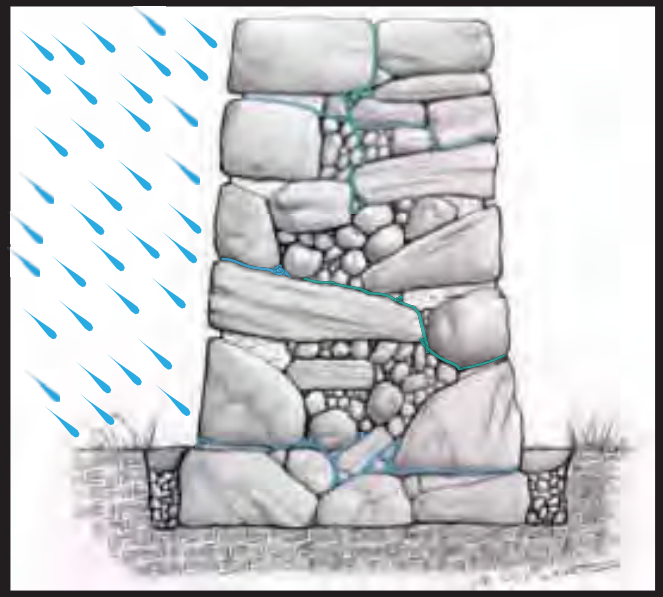
1953

1965

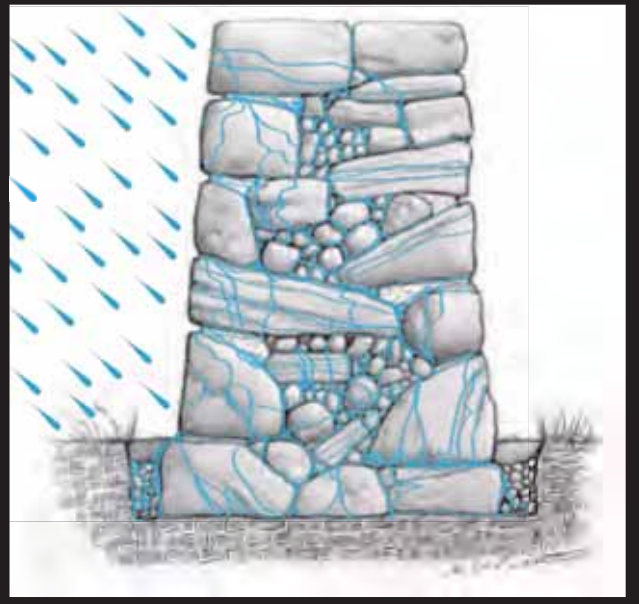


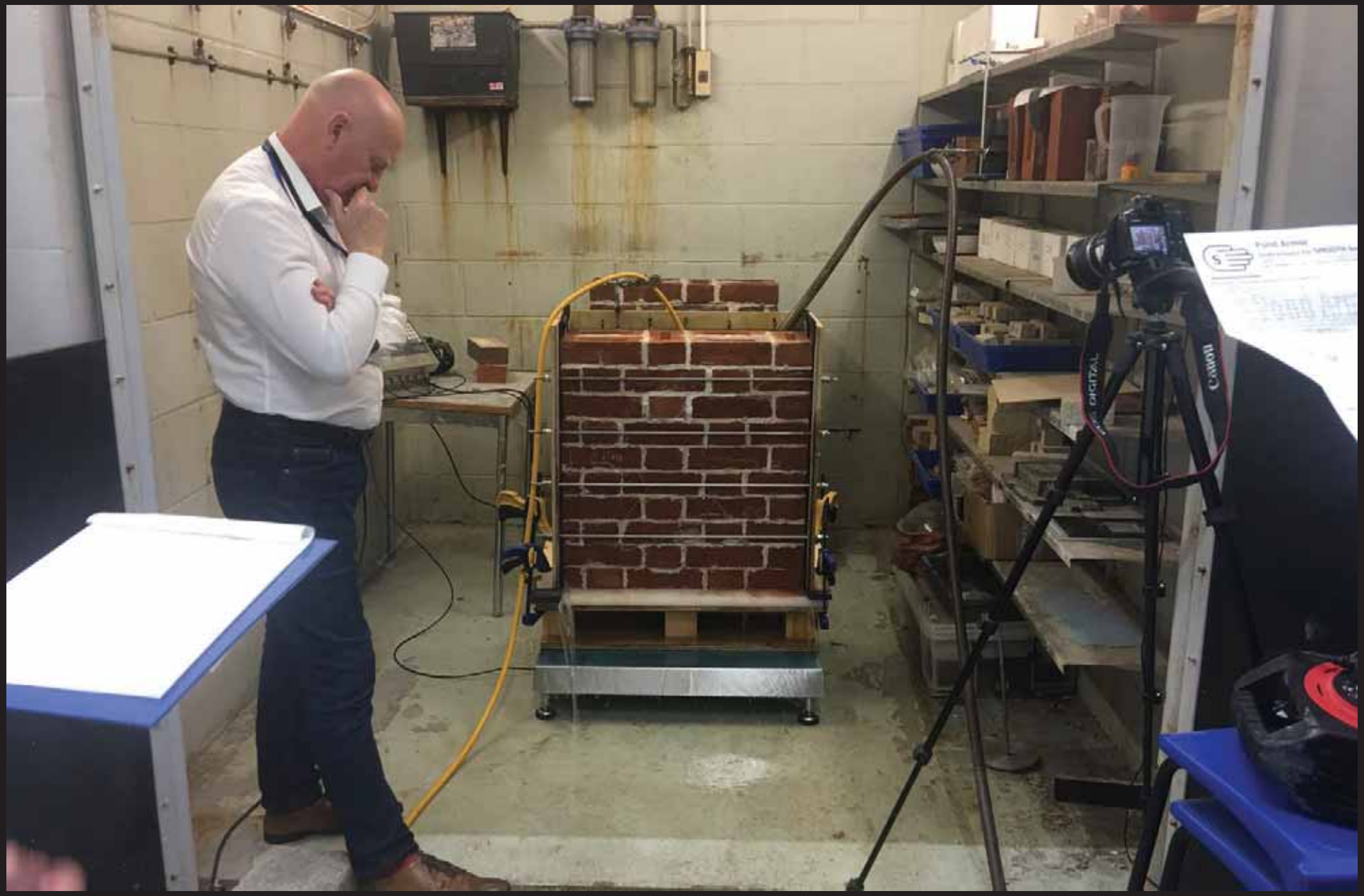


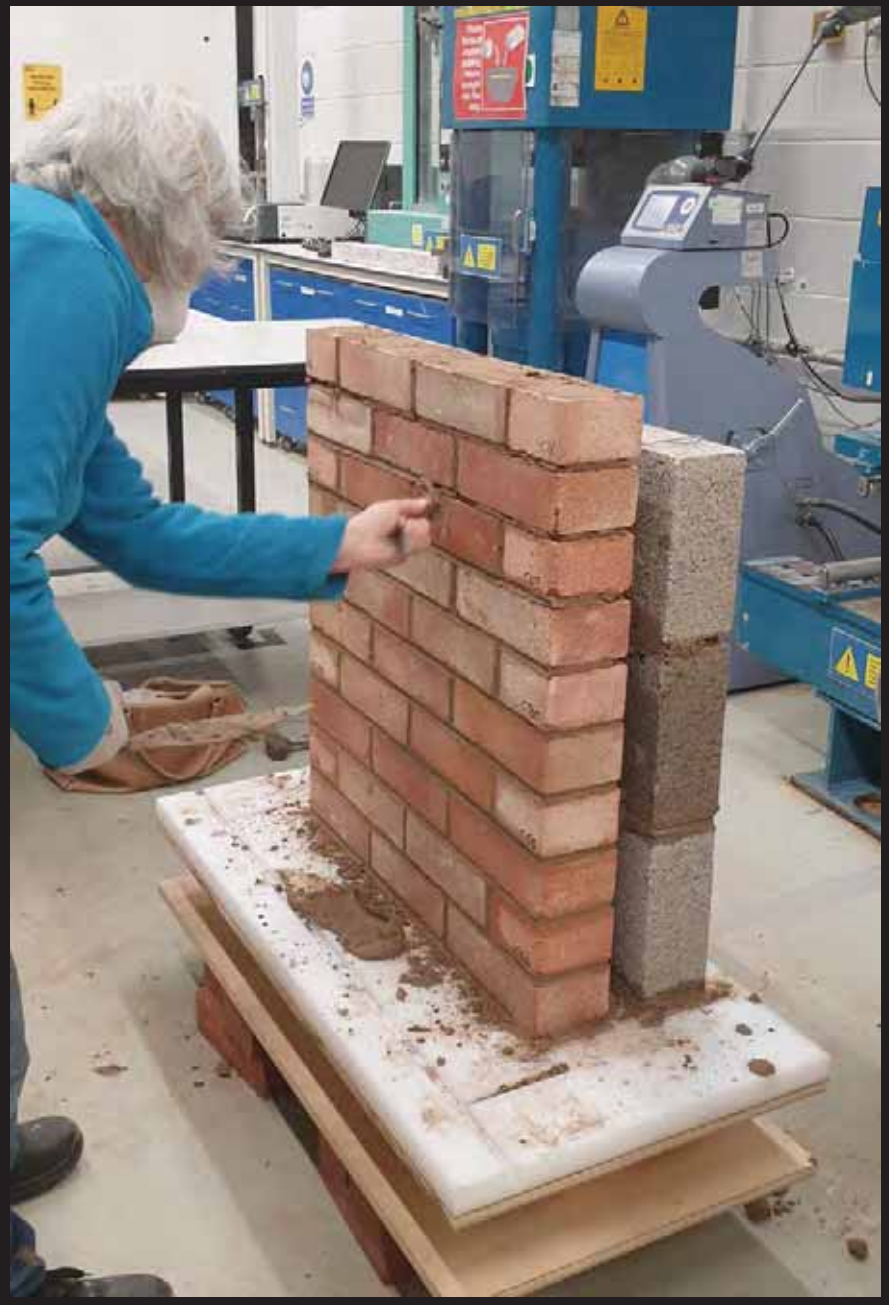
DRY WALL STAYS DRY



WET WALL GETS WETTER




CANON
DIGITAL

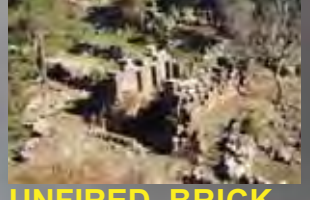



MER 2004
C30
C30 / C36

PREHISTORY

FIRED BRICK
4400BC

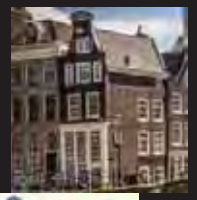
LIME MORTAR
c.6500BC

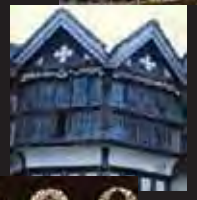


UNFIRED BRICK
before 7500BC

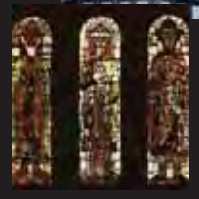
WINDOW GLASS

1670s



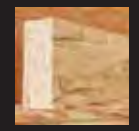


1550s



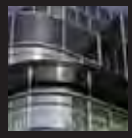
800AD

ENGINEERED WOOD



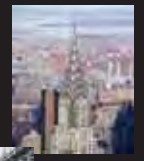
1960s

SS



1930s

AI



1900

IRON

1790

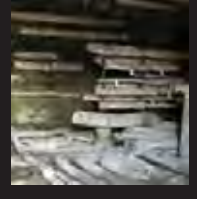
INDUSTRIAL
FOSSIL FUEL USE
BEGINS

PORTLAND CEMENT

1870s

SILICONE

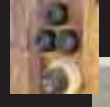
1940s



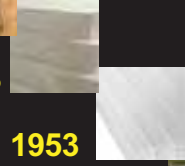
LEAD
200BC

PLASTICS

1907



1933



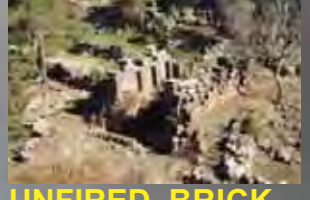
1953

1965

PREHISTORY

FIRED BRICK
4400BC

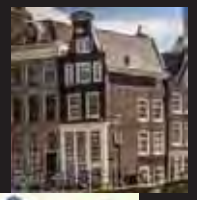
LIME MORTAR
c.6500BC

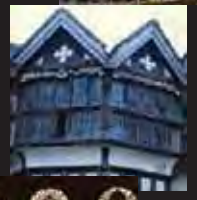


UNFIRED BRICK
before 7500BC

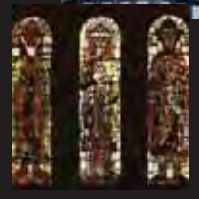
WINDOW GLASS

1670s



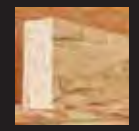


1550s



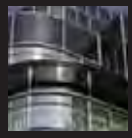
800AD

ENGINEERED WOOD



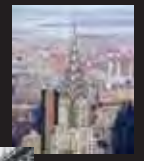
1960s

SS



1930s

AI



1900

IRON

1790

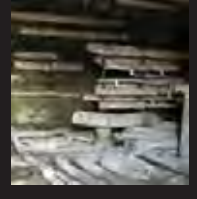
INDUSTRIAL
FOSSIL FUEL USE
BEGINS

PORTLAND CEMENT

1870s

SILICONE

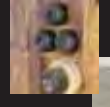
1940s



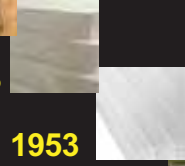
LEAD
200BC

PLASTICS

1907



1933



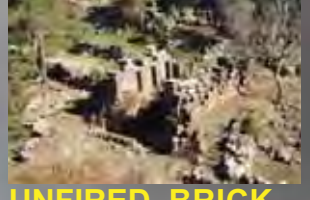
1953

1965

PREHISTORY

FIRED BRICK
4400BC

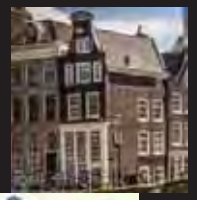
LIME MORTAR
c.6500BC

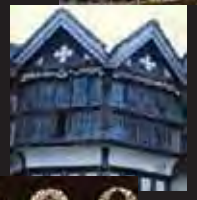


UNFIRED BRICK
before 7500BC

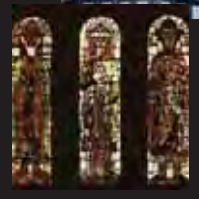
WINDOW GLASS

1670s



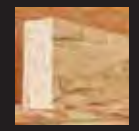


1550s



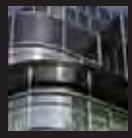
800AD

ENGINEERED WOOD



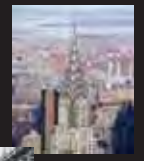
1960s

SS



1930s

AI



1900

IRON

1790

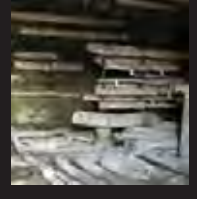
INDUSTRIAL
FOSSIL FUEL USE
BEGINS

PORTLAND CEMENT

1870s

SILICONE

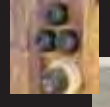
1940s



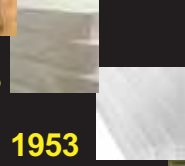
LEAD
200BC

PLASTICS

1907



1933



1953

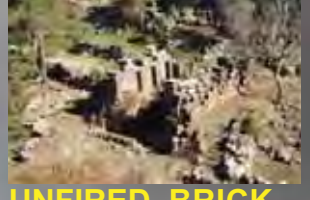
1965


les alut forger.

PREHISTORY

FIRED BRICK
4400BC

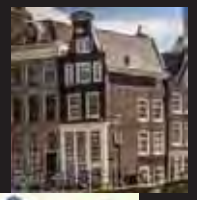
LIME MORTAR
c.6500BC

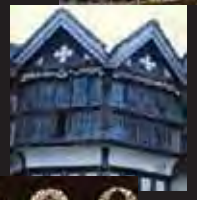


UNFIRED BRICK
before 7500BC

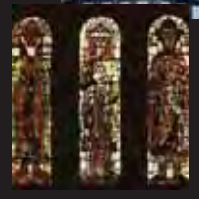
WINDOW GLASS

1670s



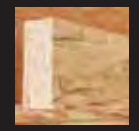


1550s



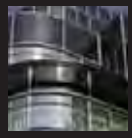
800AD

ENGINEERED WOOD



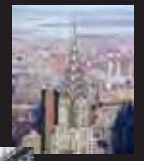
1960s

SS



1930s

AI



1900

IRON

1790

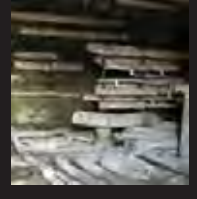
INDUSTRIAL
FOSSIL FUEL USE
BEGINS

PORTLAND CEMENT

1870s

SILICONE

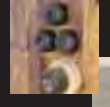
1940s



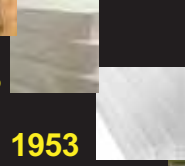
LEAD
200BC

PLASTICS

1907

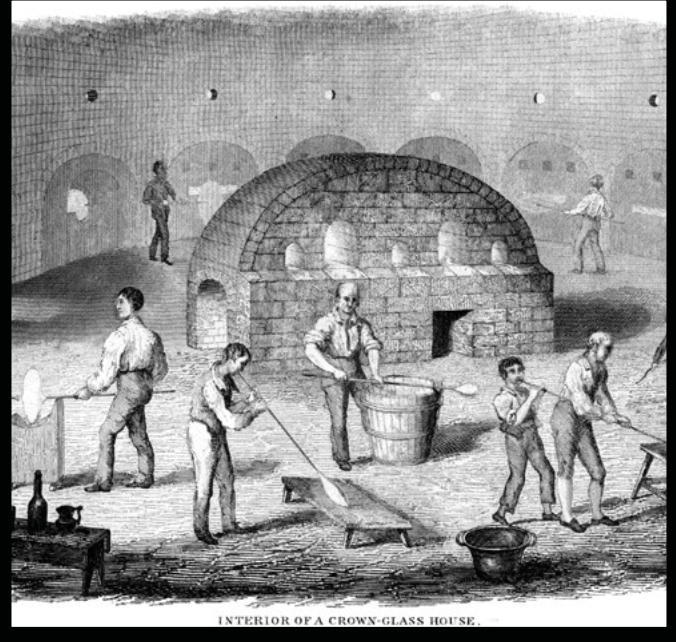


1933

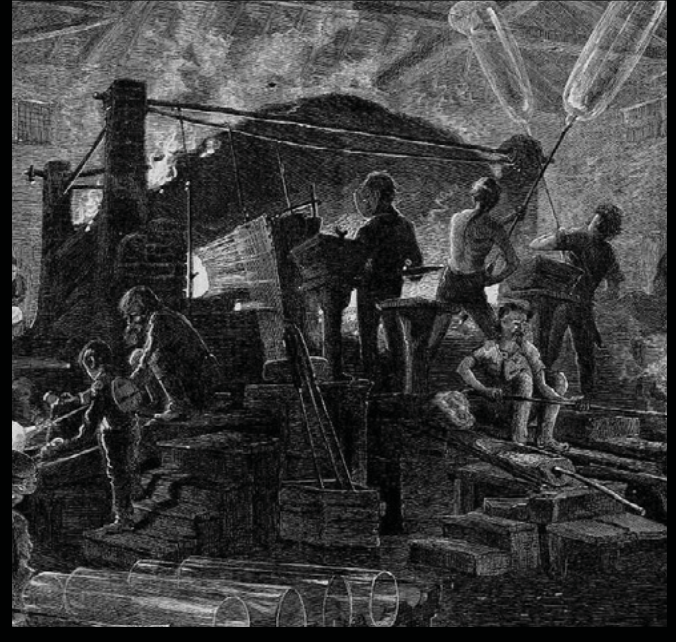


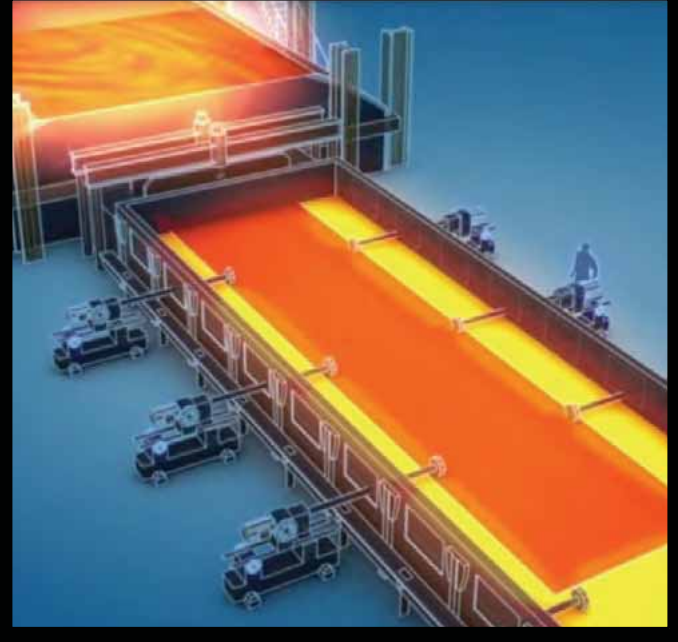
1953

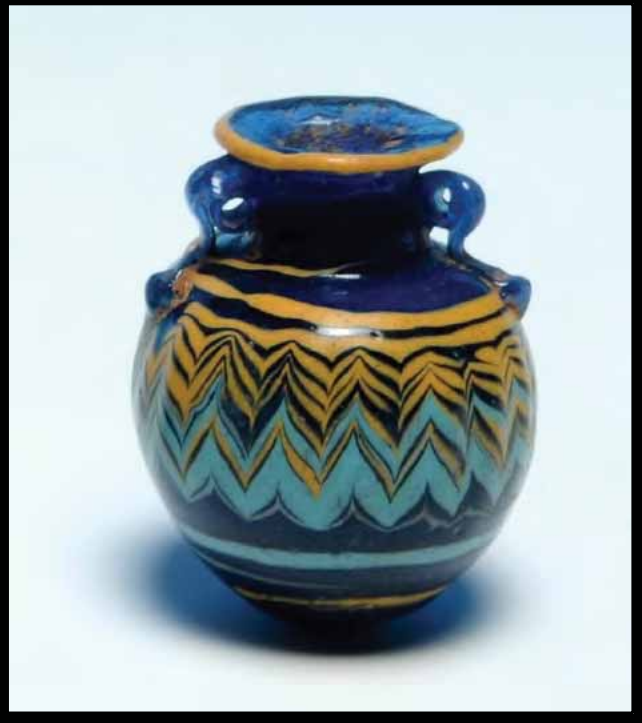
1965

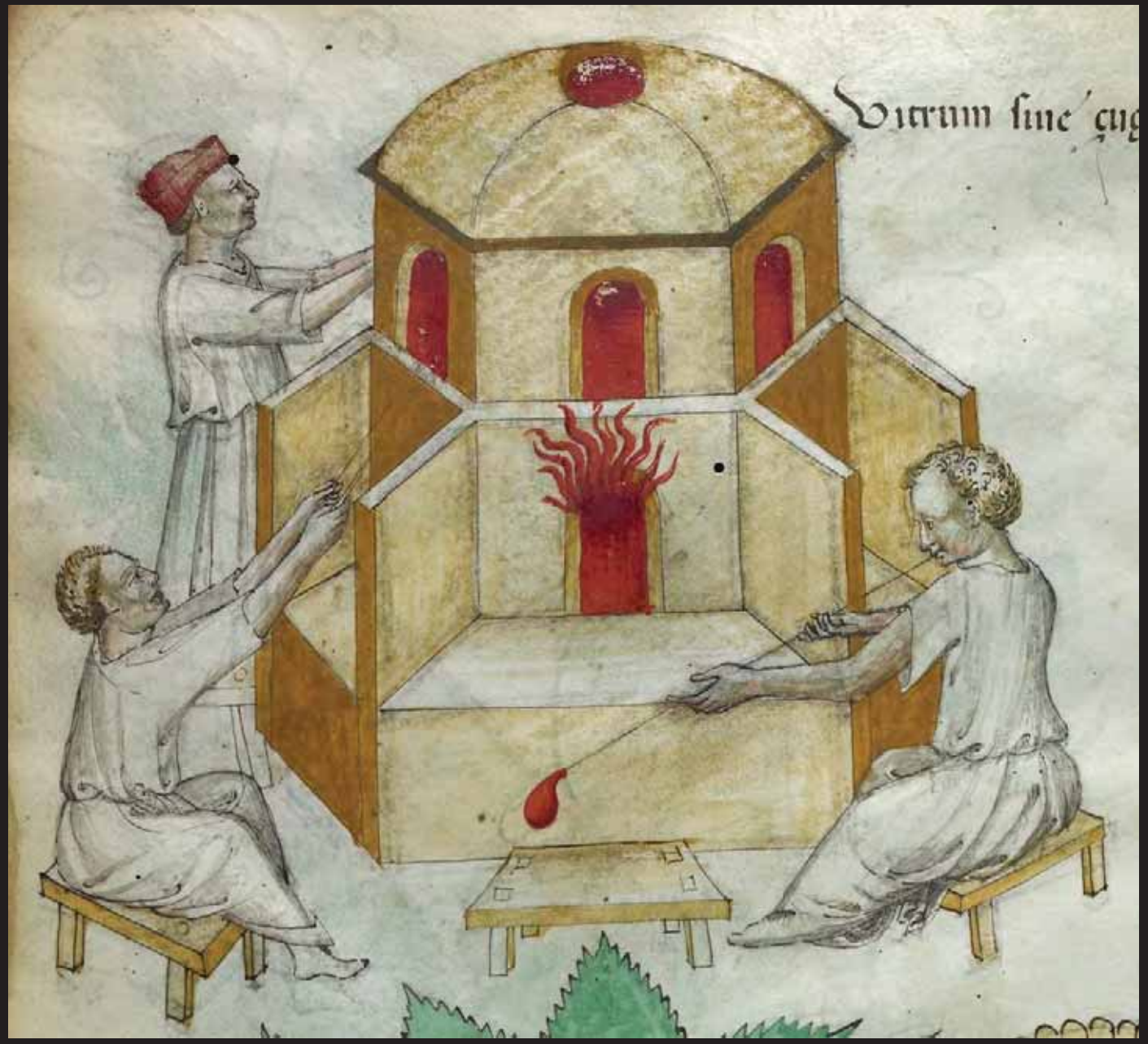


INTERIOR OF A CROWN-GLASS HOUSE.

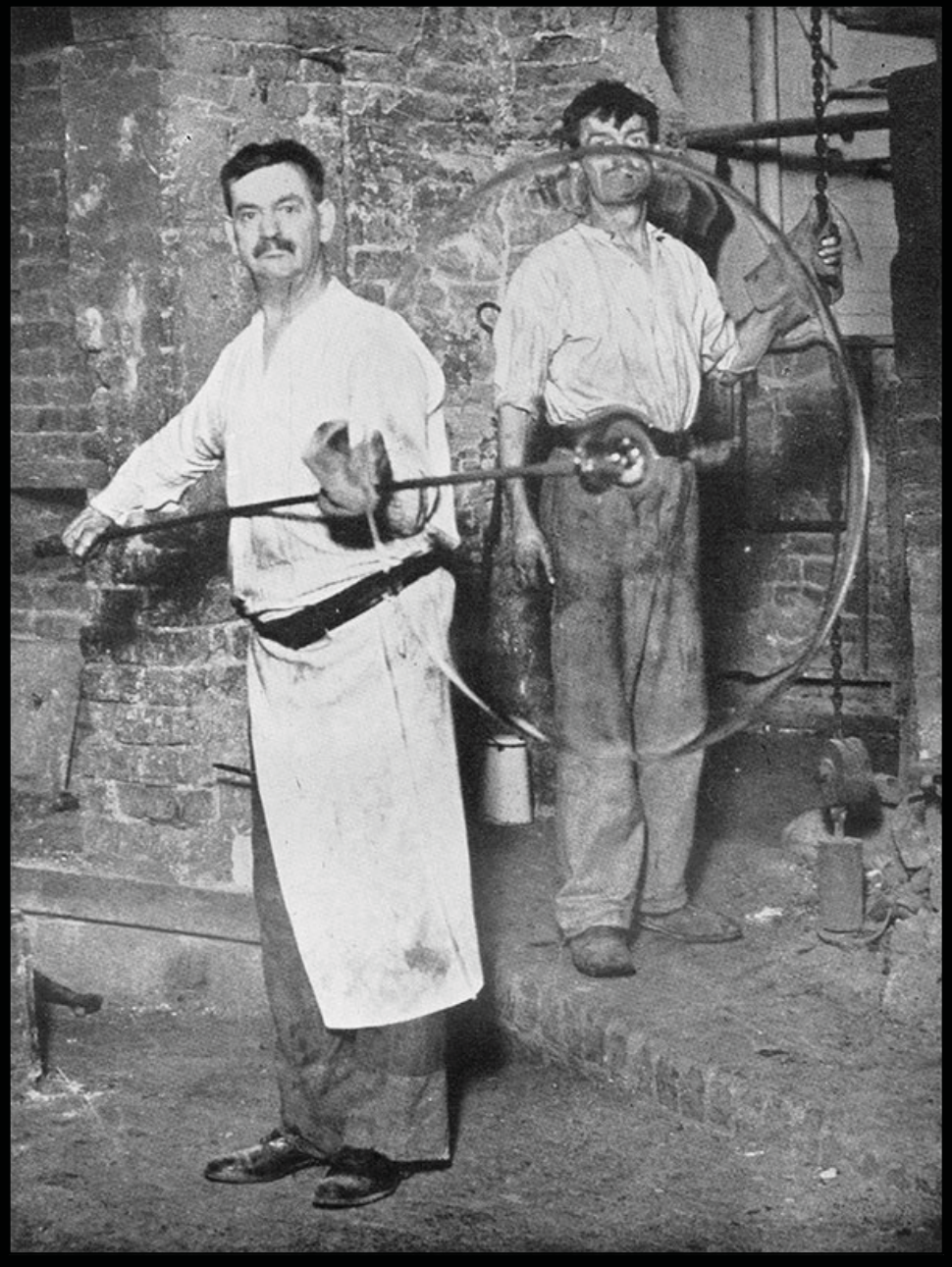




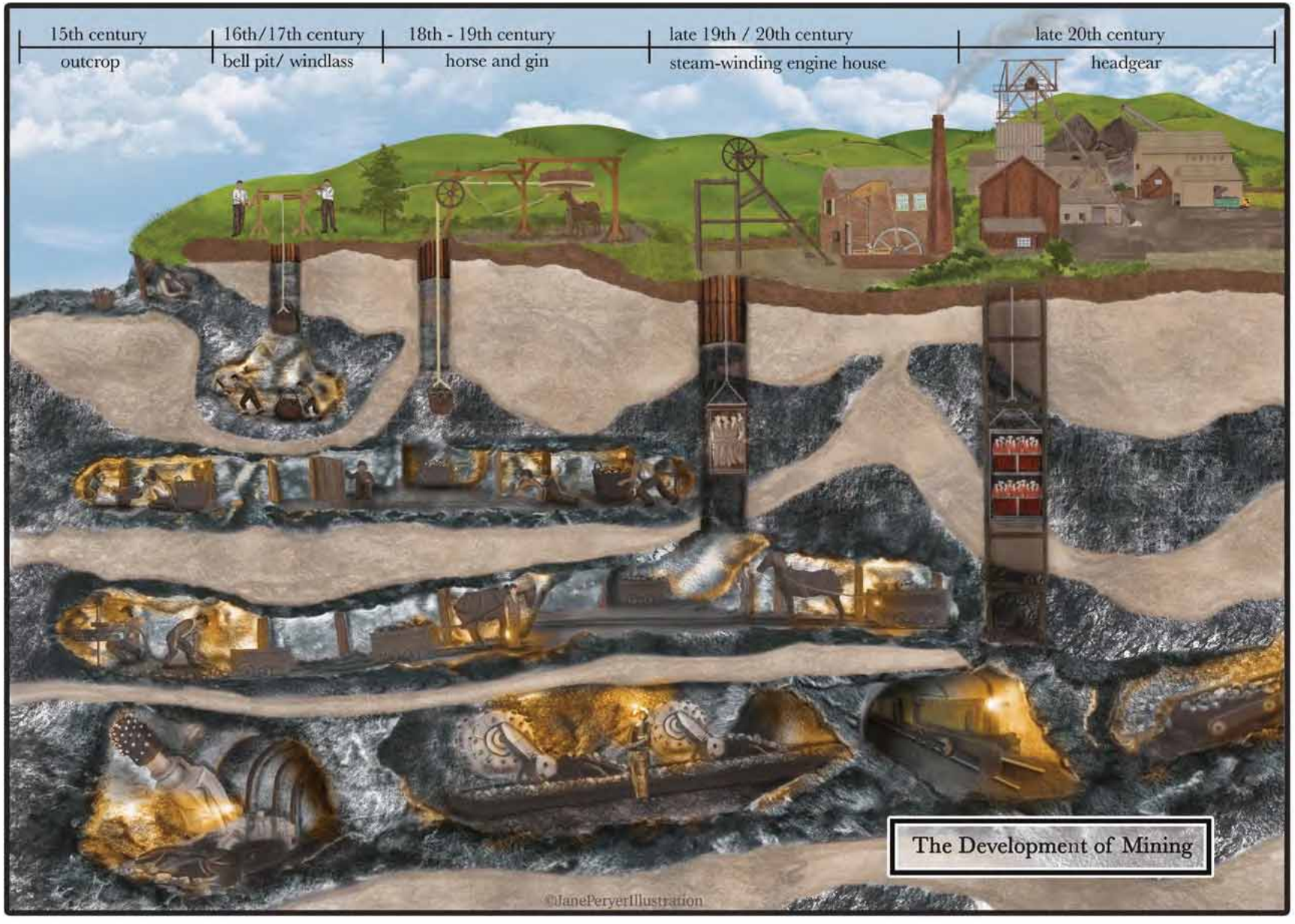



Vitrum sine cu

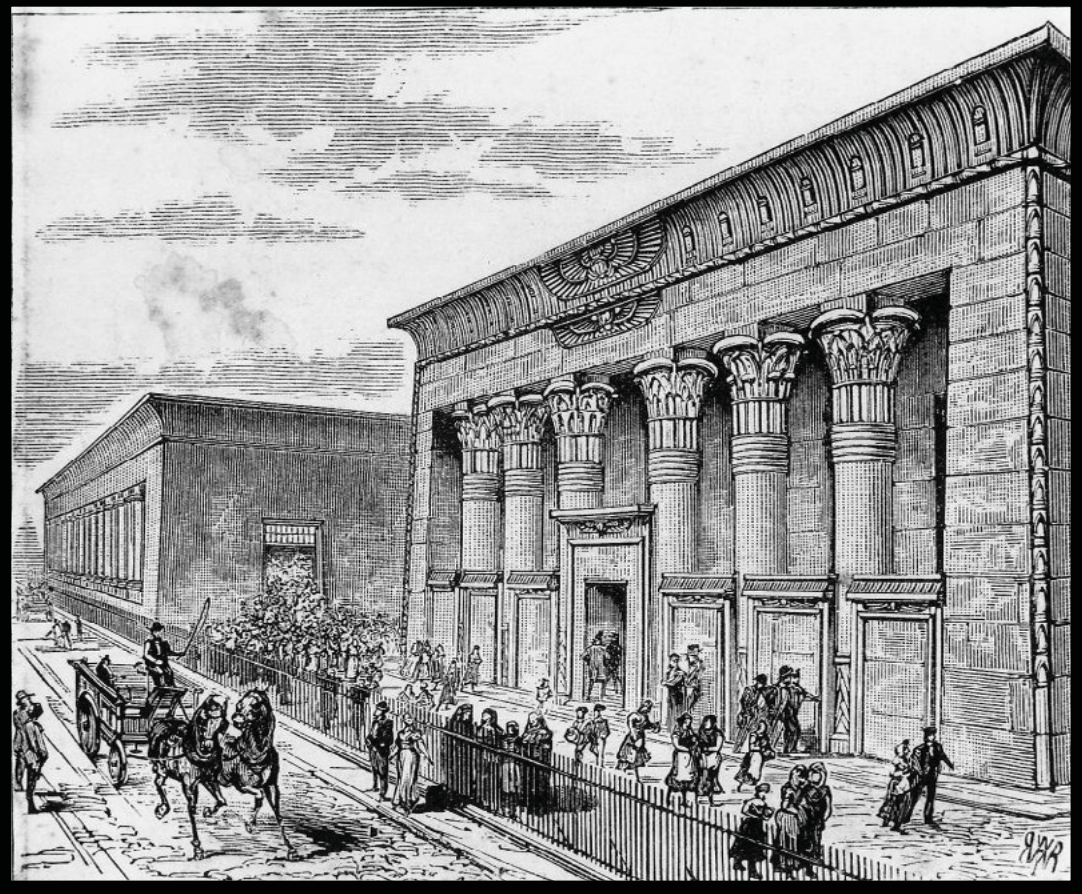
EARLIEST KNOWN STAINED GLASS

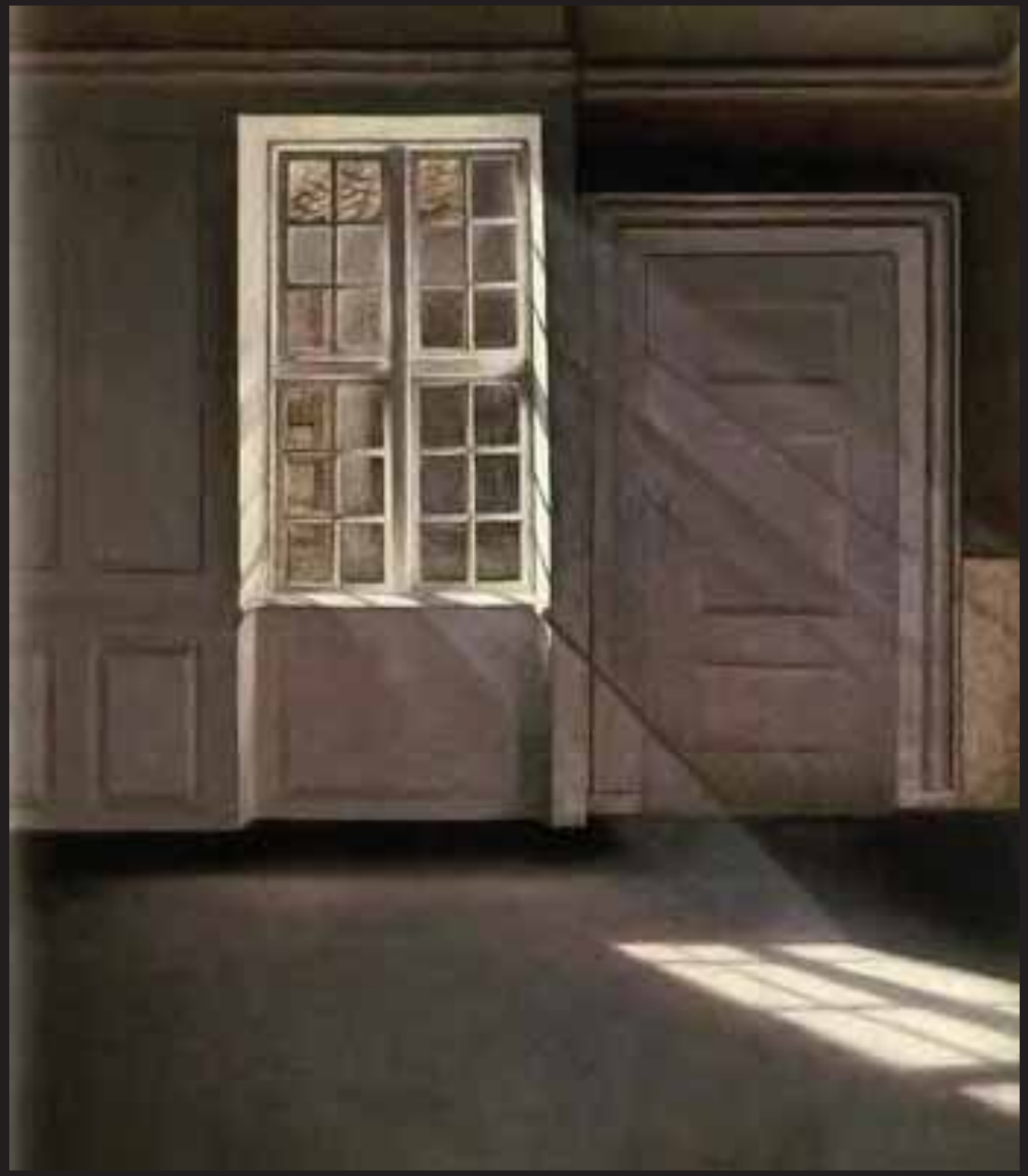


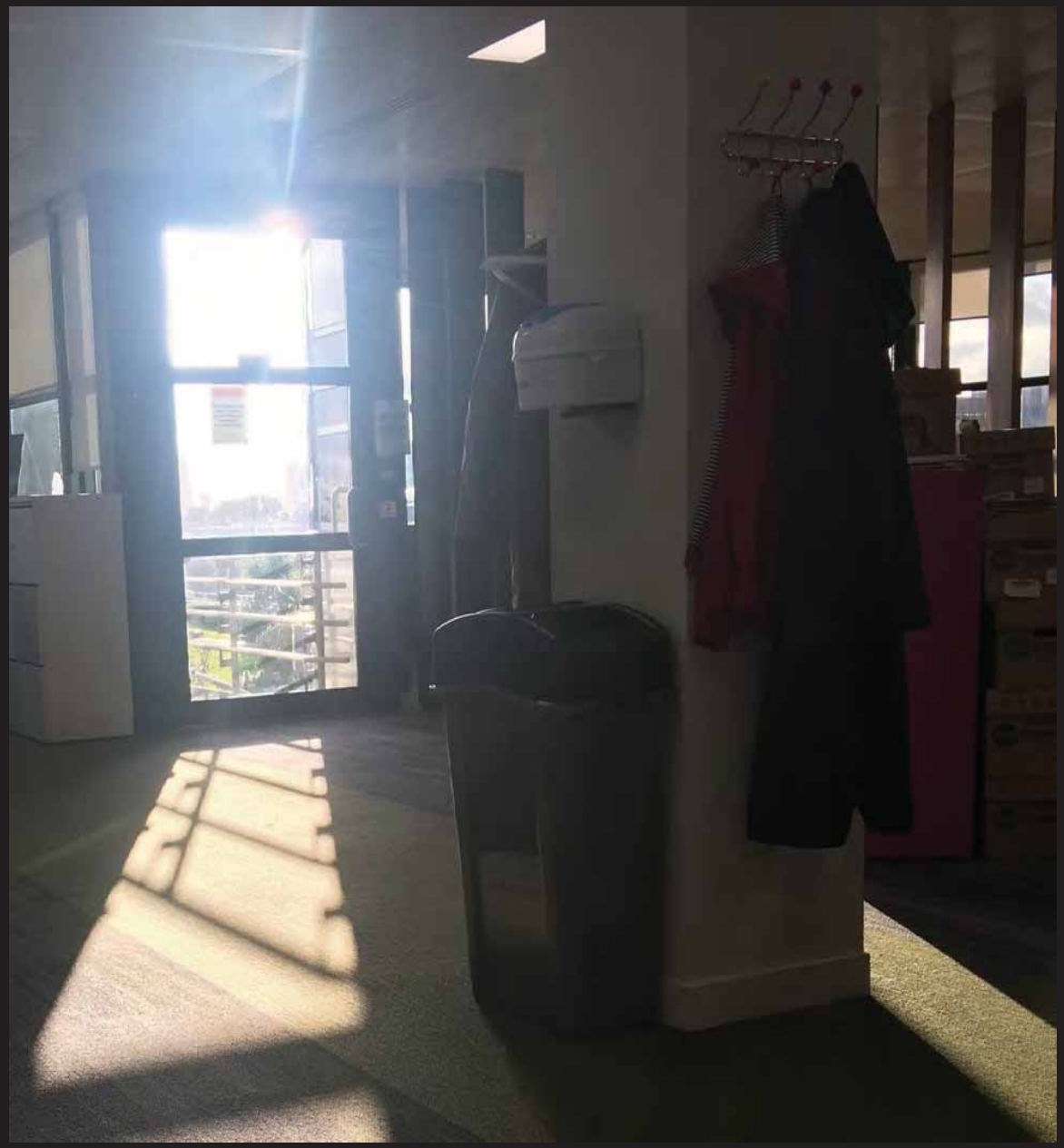

RYCHARDE DALE CARPĒDER·MADE
THIES WINDOVS BY THE GRAC OF GOD


15th century
outcrop
16th/17th century
bell pit/ windlass
18th - 19th century
horse and gin
late 19th / 20th century
steam-winding engine house
late 20th century
headgear
The Development of Mining
©JanePeryerIllustration

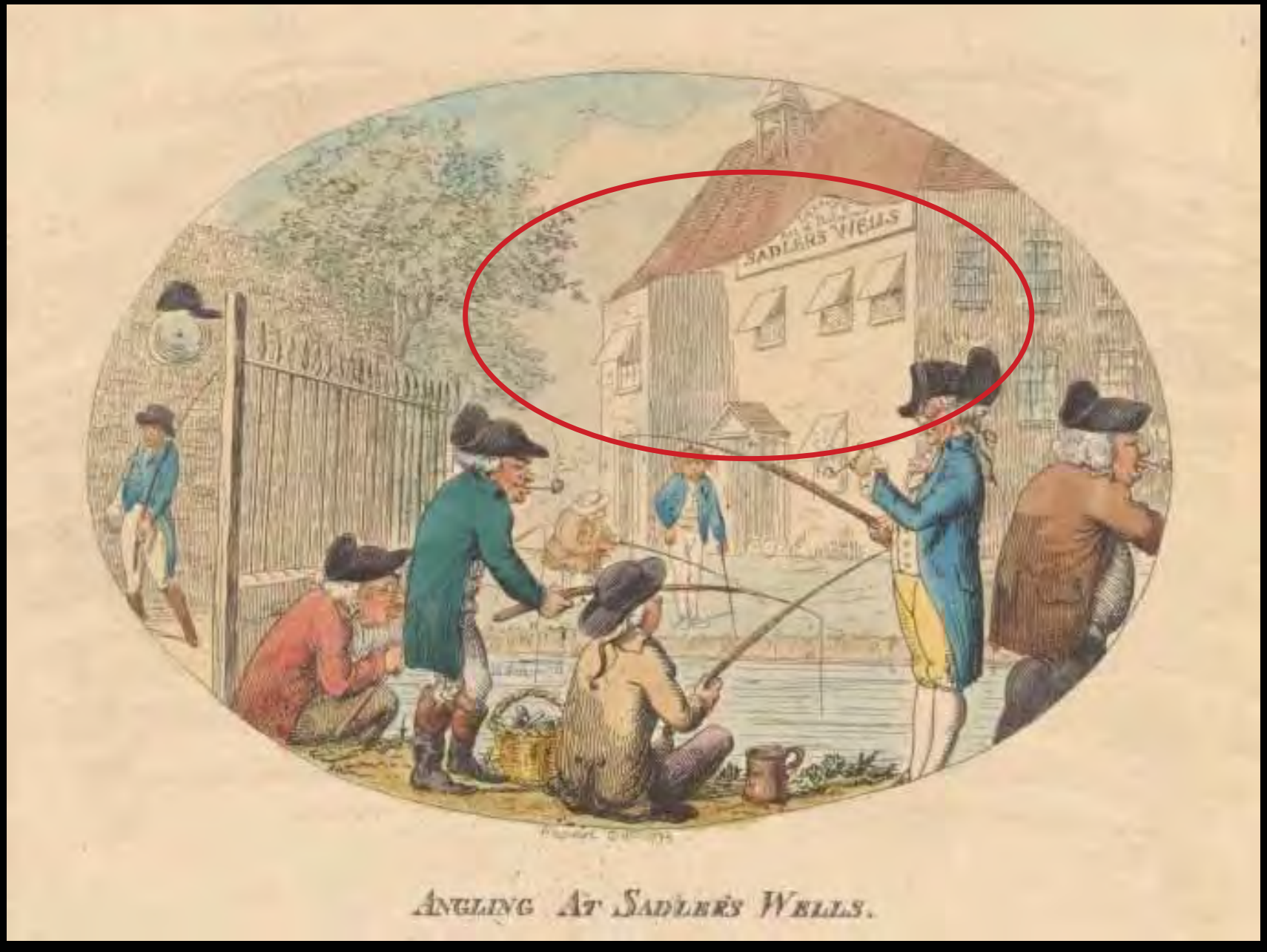

21
GETTY IMAGES








21
23
F4104

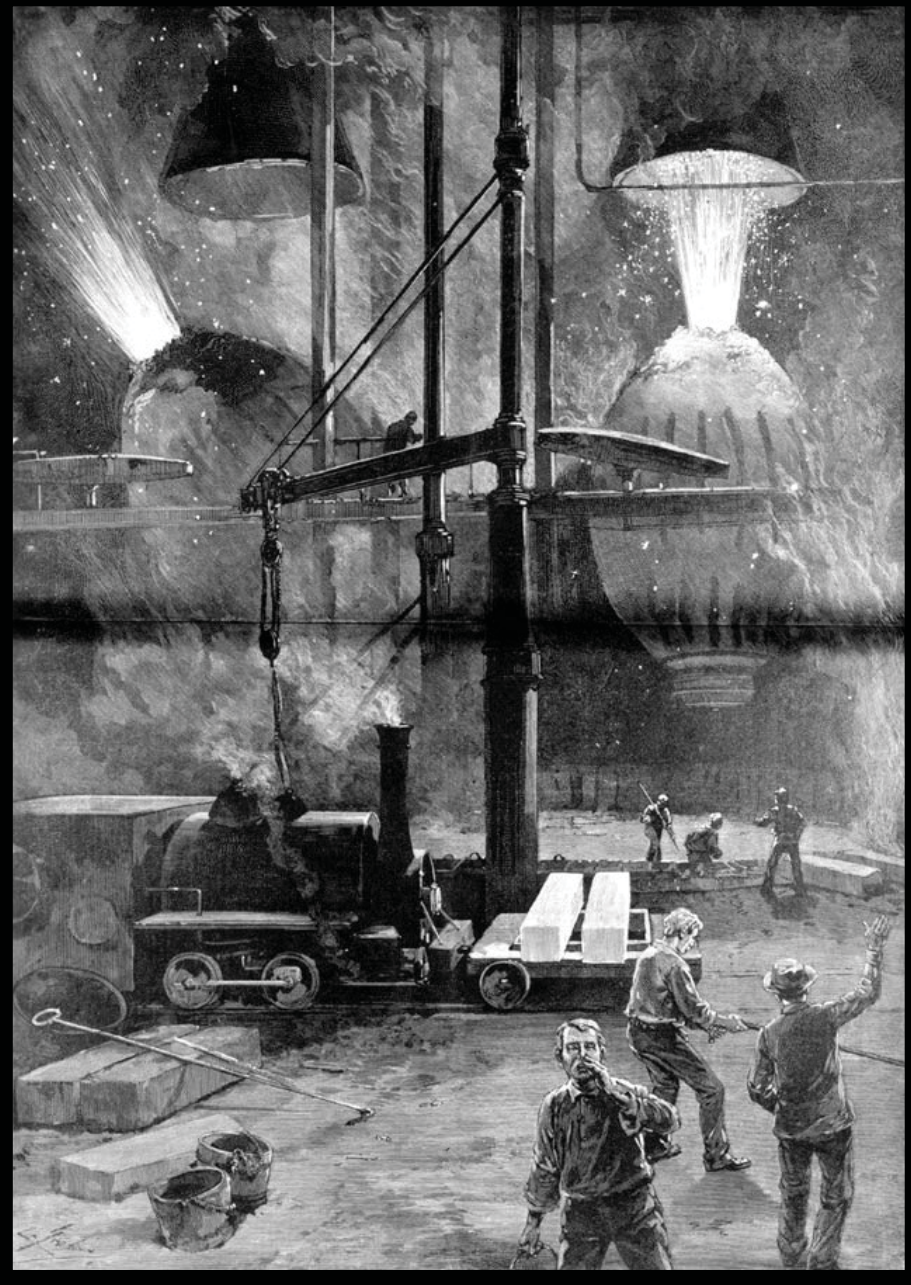


ANGLING AT SADLER'S WELLS.


BUCKINGHAM PALACE 1897


SPORT 2000


volos-t.livejournal.com



Experienced Fitters of all kinds of OUTSIDE AND INSIDE BLINDS.

For Town and Country Mansions, Institutions, Houses, Business Establishments of all kinds.

Venetian. Painted or Stained and Varnished.

The Universal is the cheapest Hooded Blind extant, and can be packed in small compass for transit.

Festoon Blinds in Satteens, Silks, and other Materials.

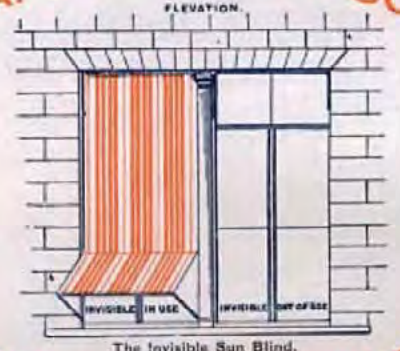
The Florentine combines Shade and Ventilation.

The Spanish can be raised with head extended for Shade and View.

The Heliuscene combines Shade, Ventilation & View

G. A. WILLIAMS & SON,

Spring Blind in Box.



The Invisible Sun Blind.

Art Printed and Brocaded Blinds in newest patterns, mounted either upon English spring rollers, single line flange rollers, or rollers with lines and rack pullies.

Swiss Striped Embroidered and Lace Blinds mounted either on English spring rollers, single line flange rollers, or wood rollers, with lines & rack pullies

21 QUEEN'S ROAD, BAYSWATER.

The Shutter Blind, combines Shade, Ventilation, and Security.

Blinds for Doors, Casements, Shops, &c.

Extended Hood Blinds for Doors, Casements, &c.

The Oriental Outside Blind for semi-heated window.

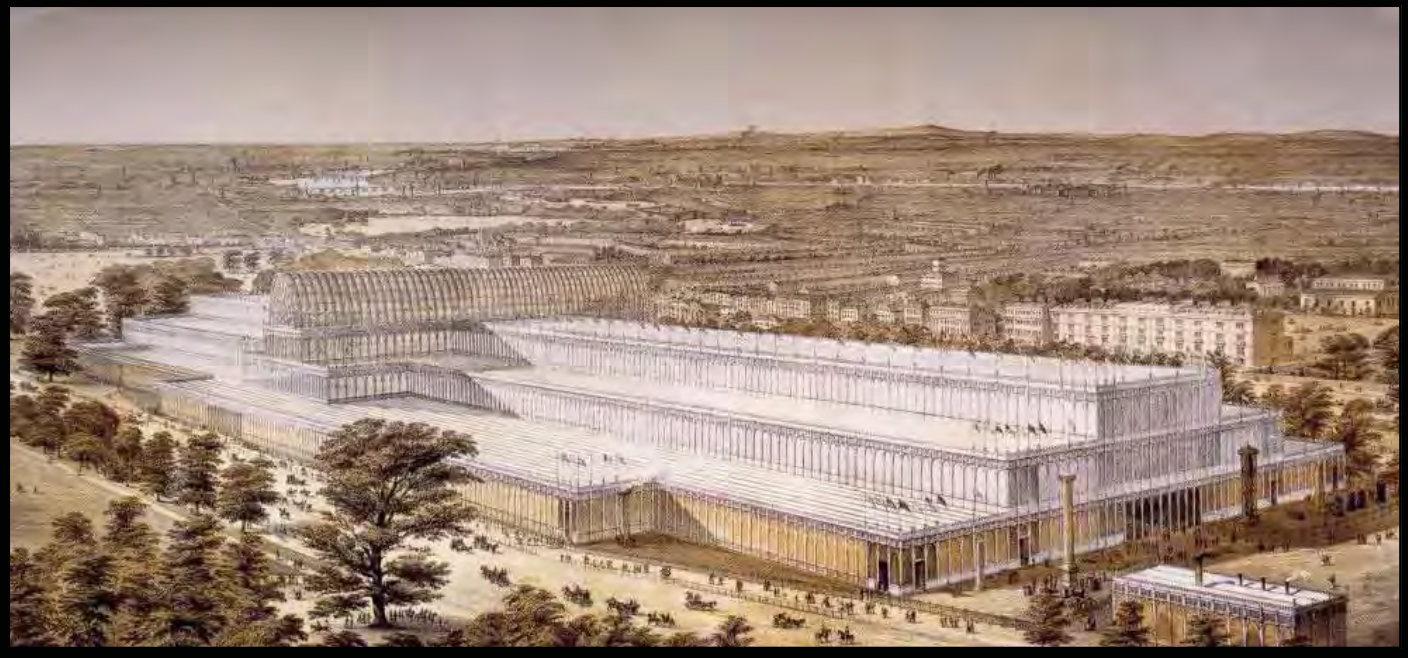
Japanese Panels in many designs.

ESTABLISHED OVER 30 YEARS.

Estimates and suggestions readily given.

OLD BLINDS REPAIRED AND RENOVATED.

Wire Blinds (Plain or Ornamental).

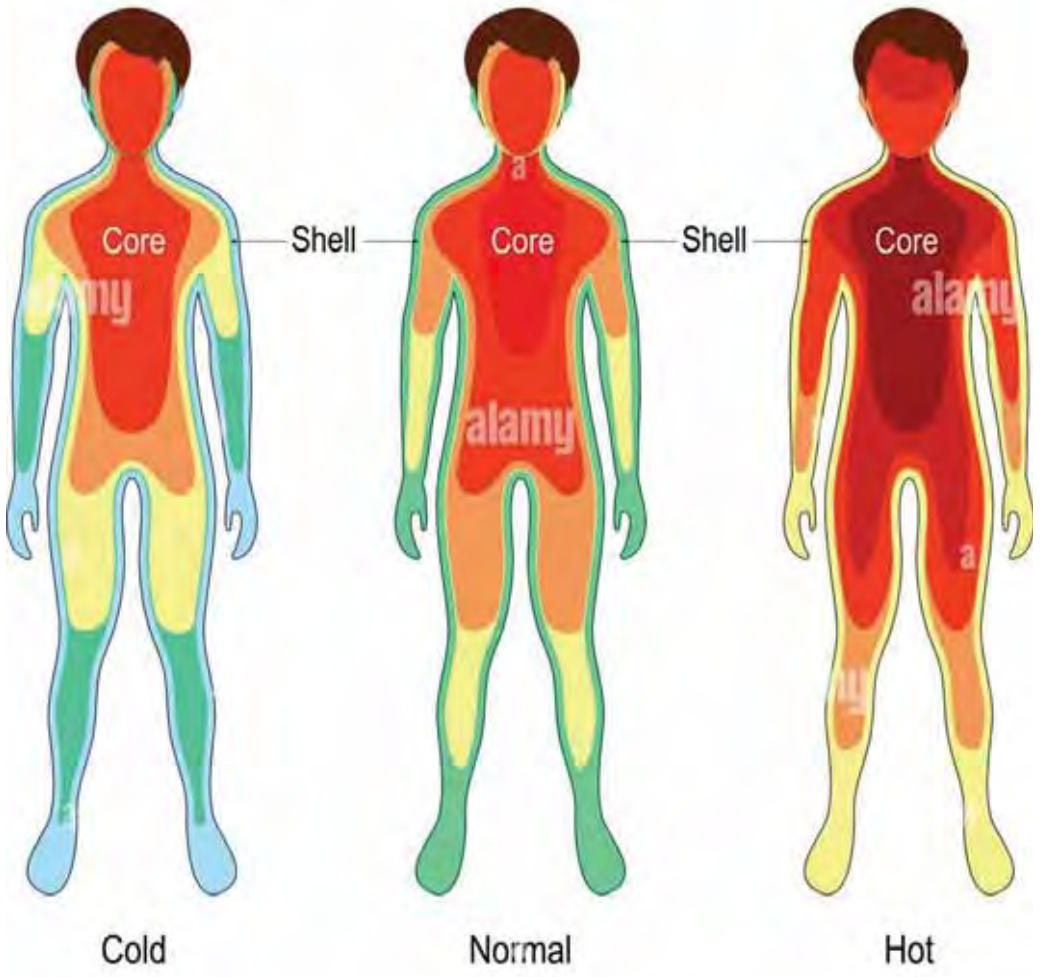



marie

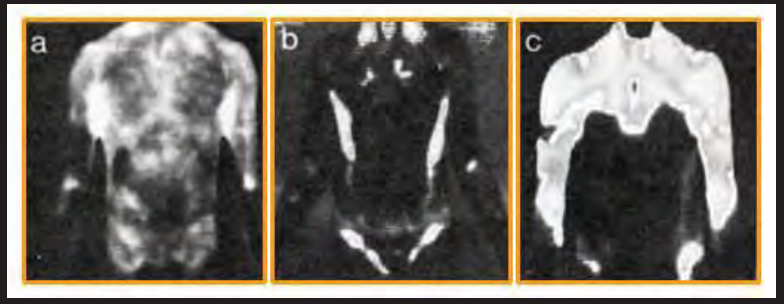

marie

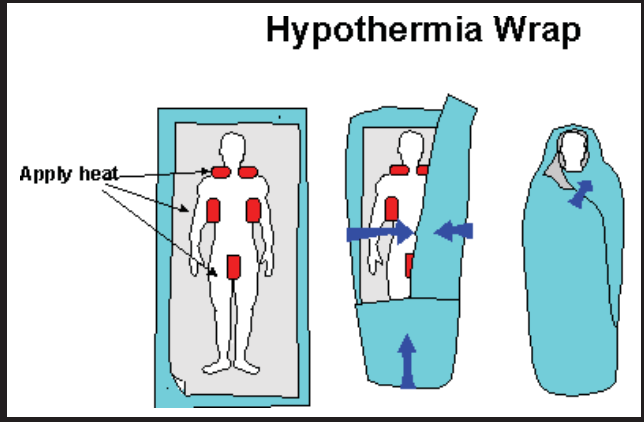

1stArtGallery.com
This watermark does not appear on the painting

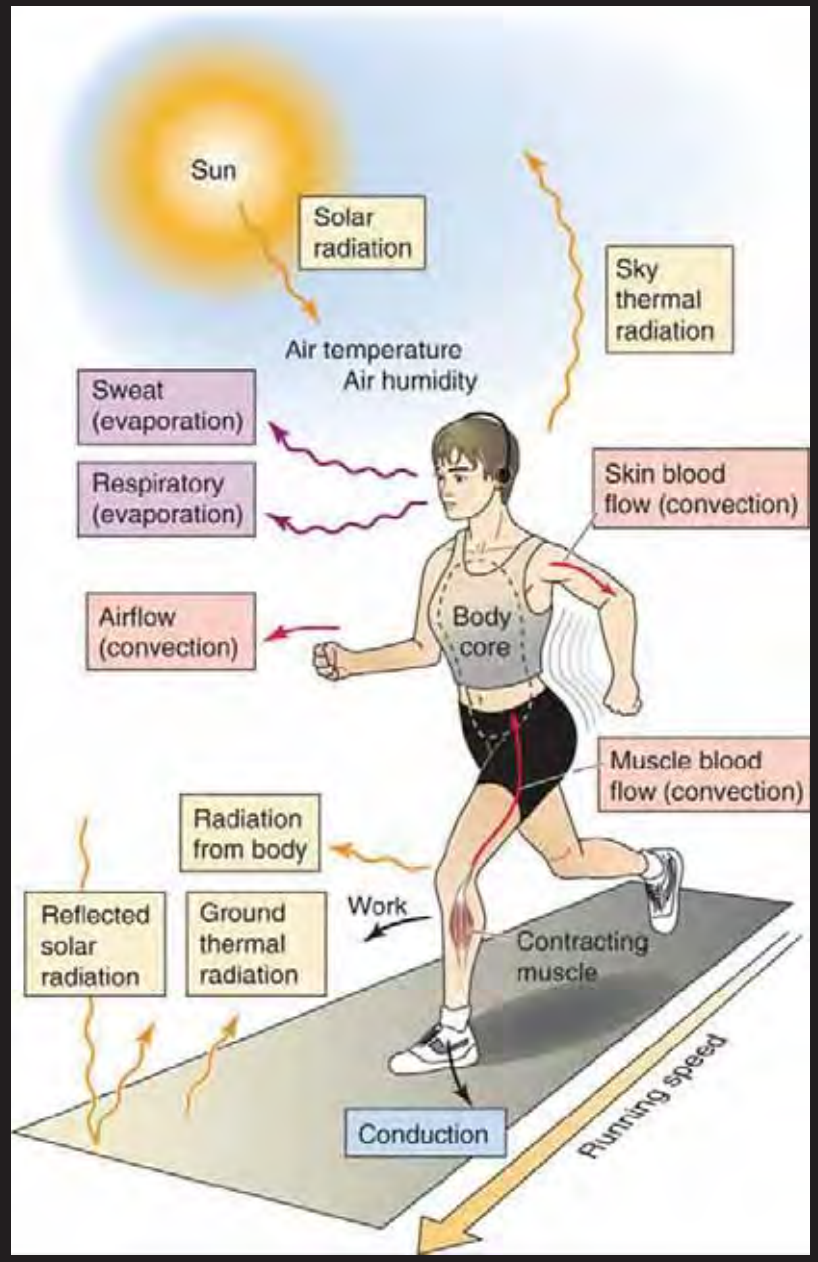
Body temperature




Respiration
Evaporation
Body heat lost by evaporation of perspiration
Convection
Body heat lost to air
Radiation
Body heat lost to nearby objects without touching them
Conduction
Body heat lost to nearby objects through touch


a
b
c

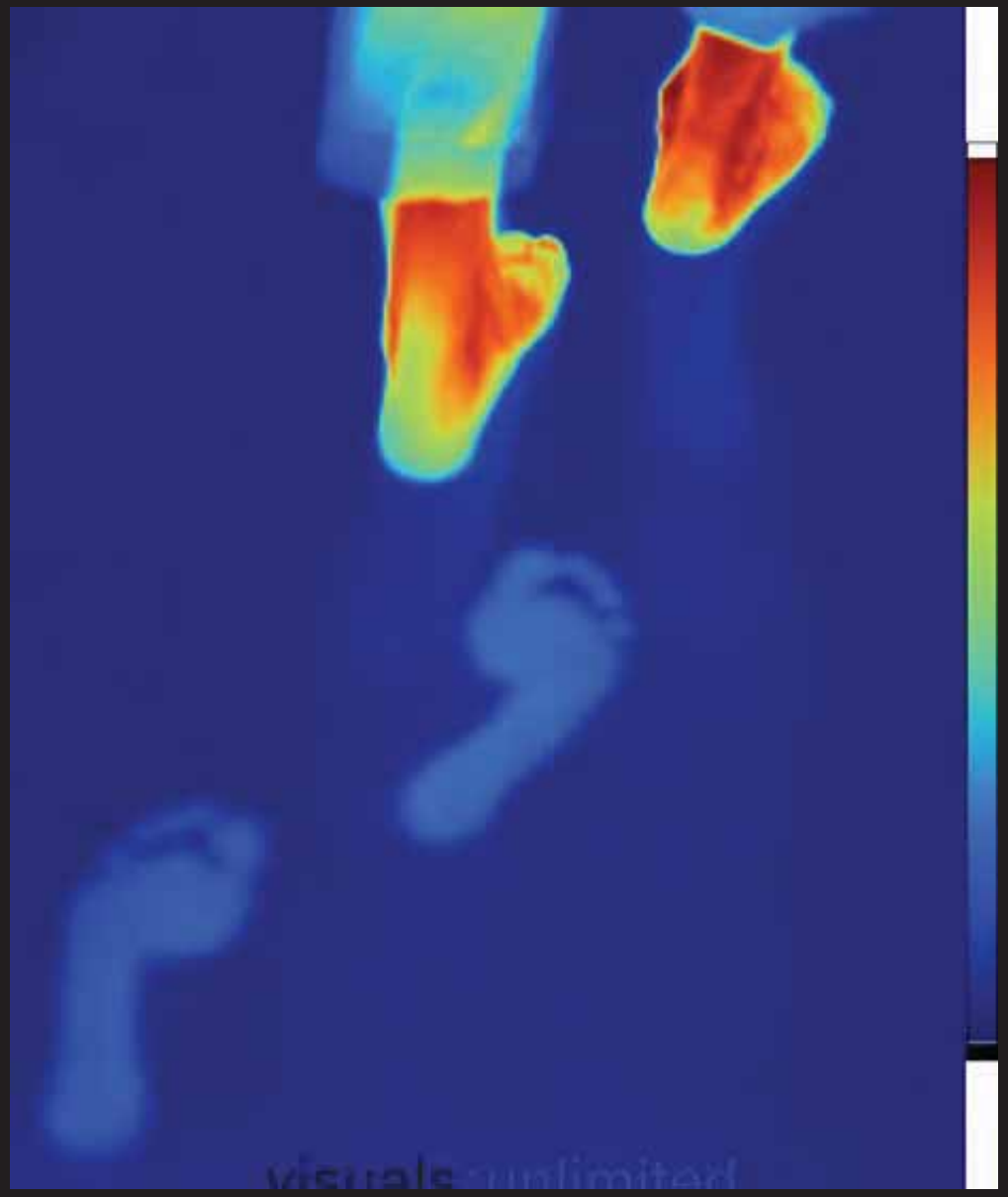

Hypothermia Wrap
Apply heat


Sun
Solar radiation
Sky thermal radiation
Air temperature
Air humidity
Sweat (evaporation)
Respiratory (evaporation)
Skin blood flow (convection)
Airflow (convection)
Body core
Muscle blood flow (convection)
Radiation from body
Reflected solar radiation
Ground thermal radiation
Work
Contracting muscle
Conduction
Running speed

HEAT LOSS INTO AIR:

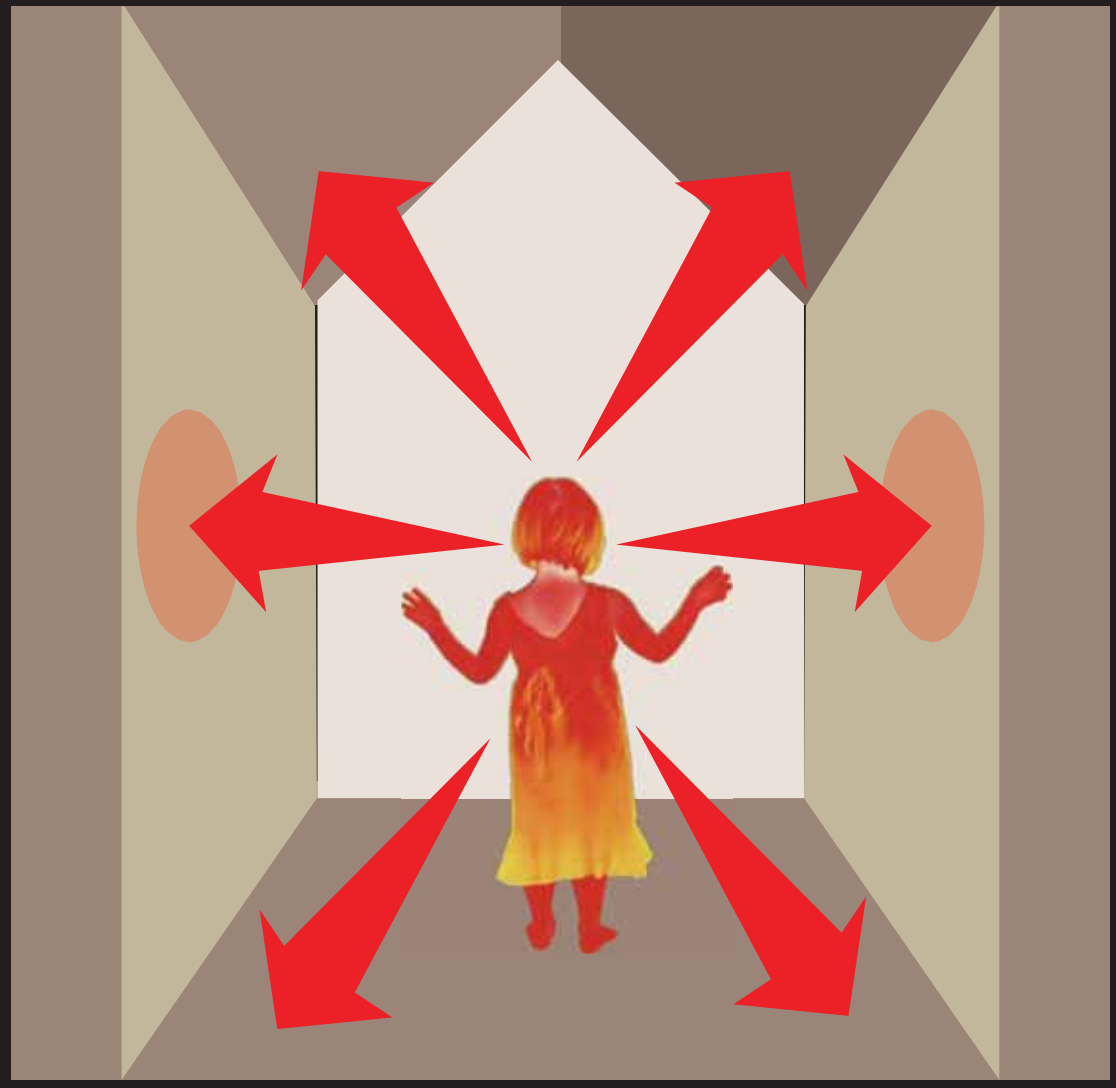
2 – 22%

HEAT LOSS BY DIRECT CONTACT



HEAT LOSS BY RADIATION:

60 – 65%



IS AIR TEMPERATURE THE RIGHT THING TO MEASURE?

THERMOMETER INVENTED BY FARENHEIT 1709


Jetzt noch ein
sten-Rekördchen.

IS OUR FOCUS ON AIR TEMPERATURE LEADING US TO OVERLOOK PASSIVE MEASURES FOR THERMAL COMFORT?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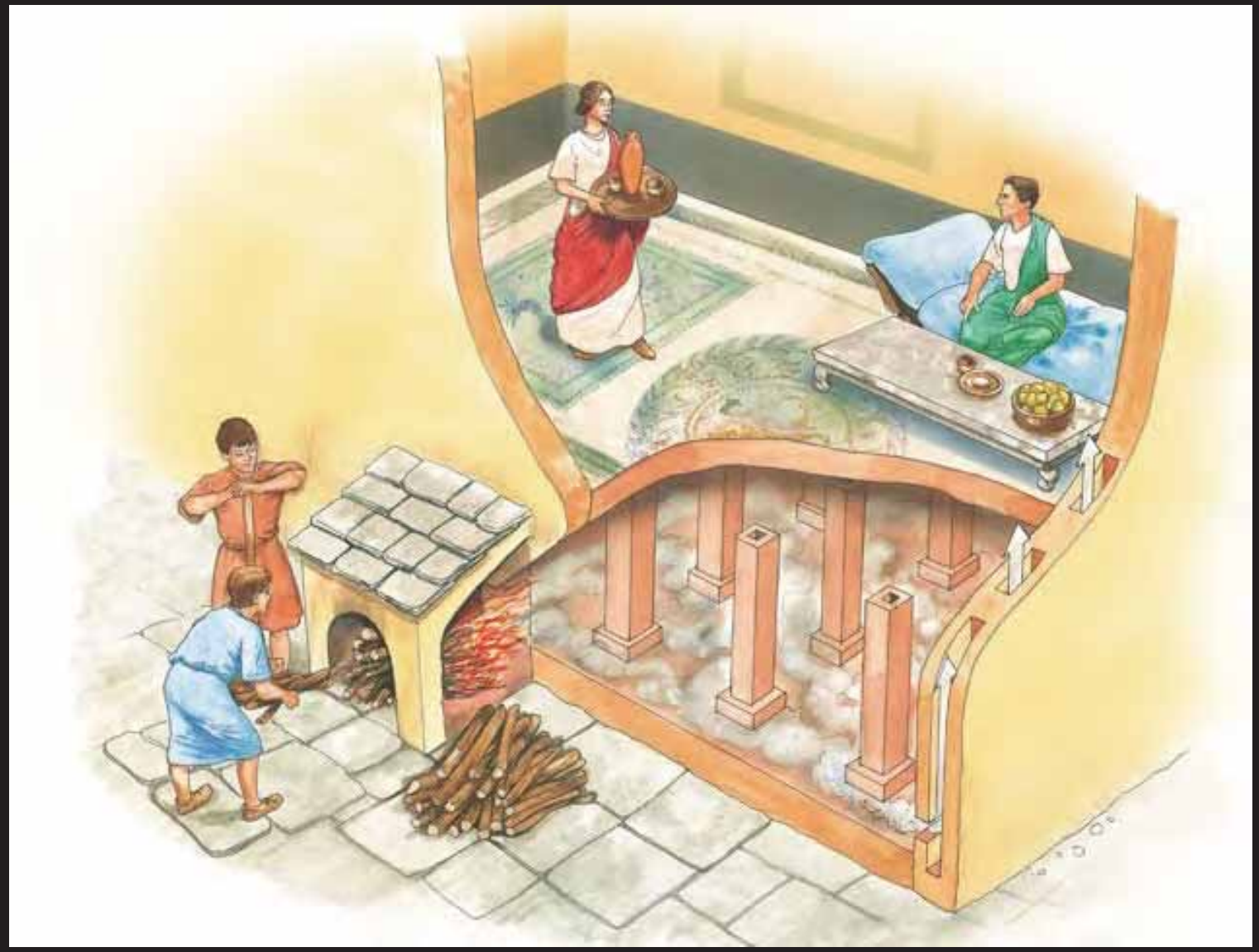
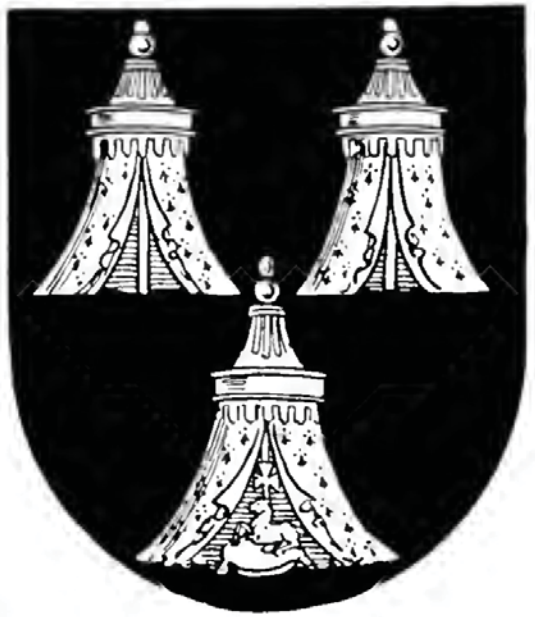
© newsteam

Emperor Jovian: died of carbon monoxide poisoning

Emperor Julian poisoned in Paris:

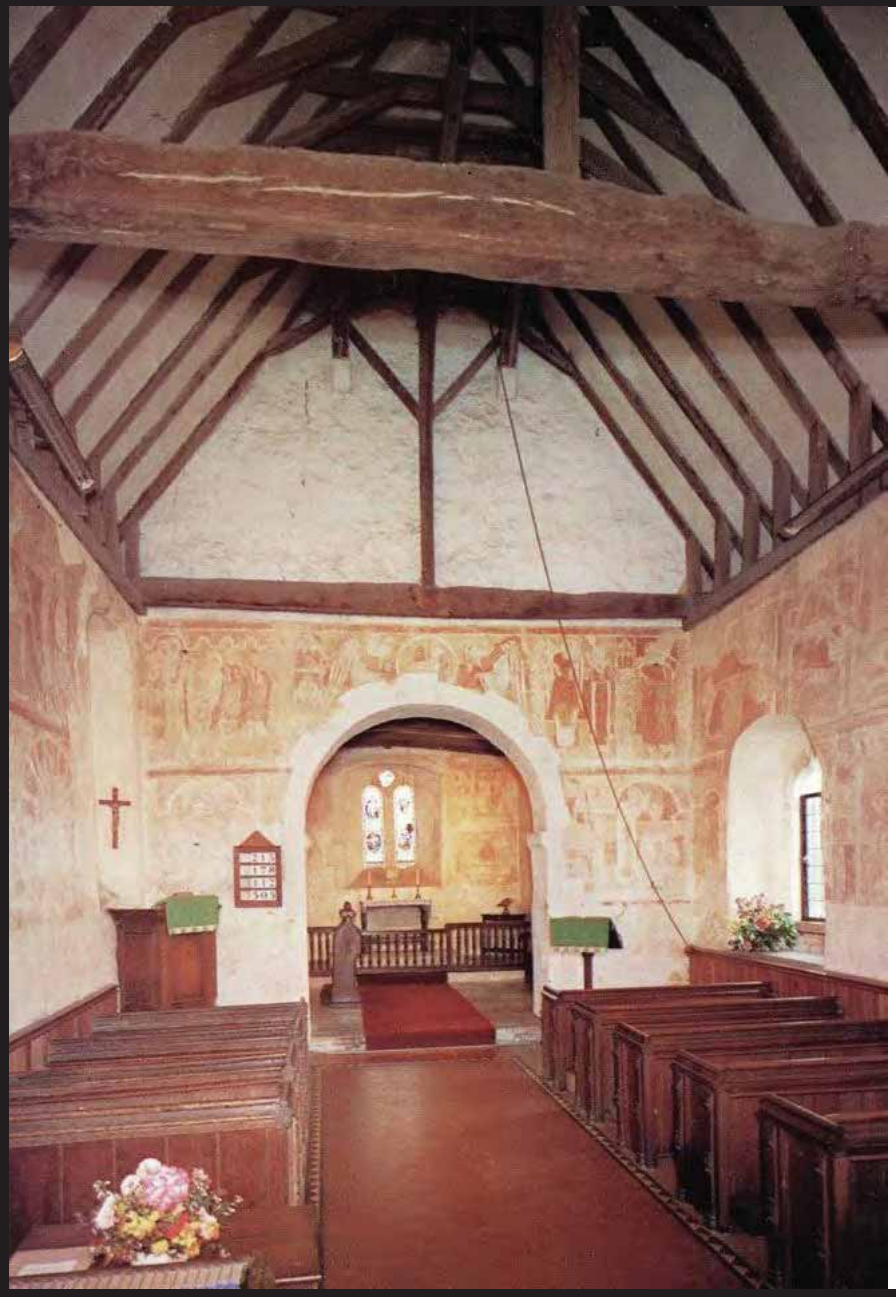
“I ordered [my servants] to carry in fire that had burned down and to place in the room a very moderate number of hot coals. But the coals, though there were not very many of them, brought out from the walls quantities of steam and this made me fall asleep.”

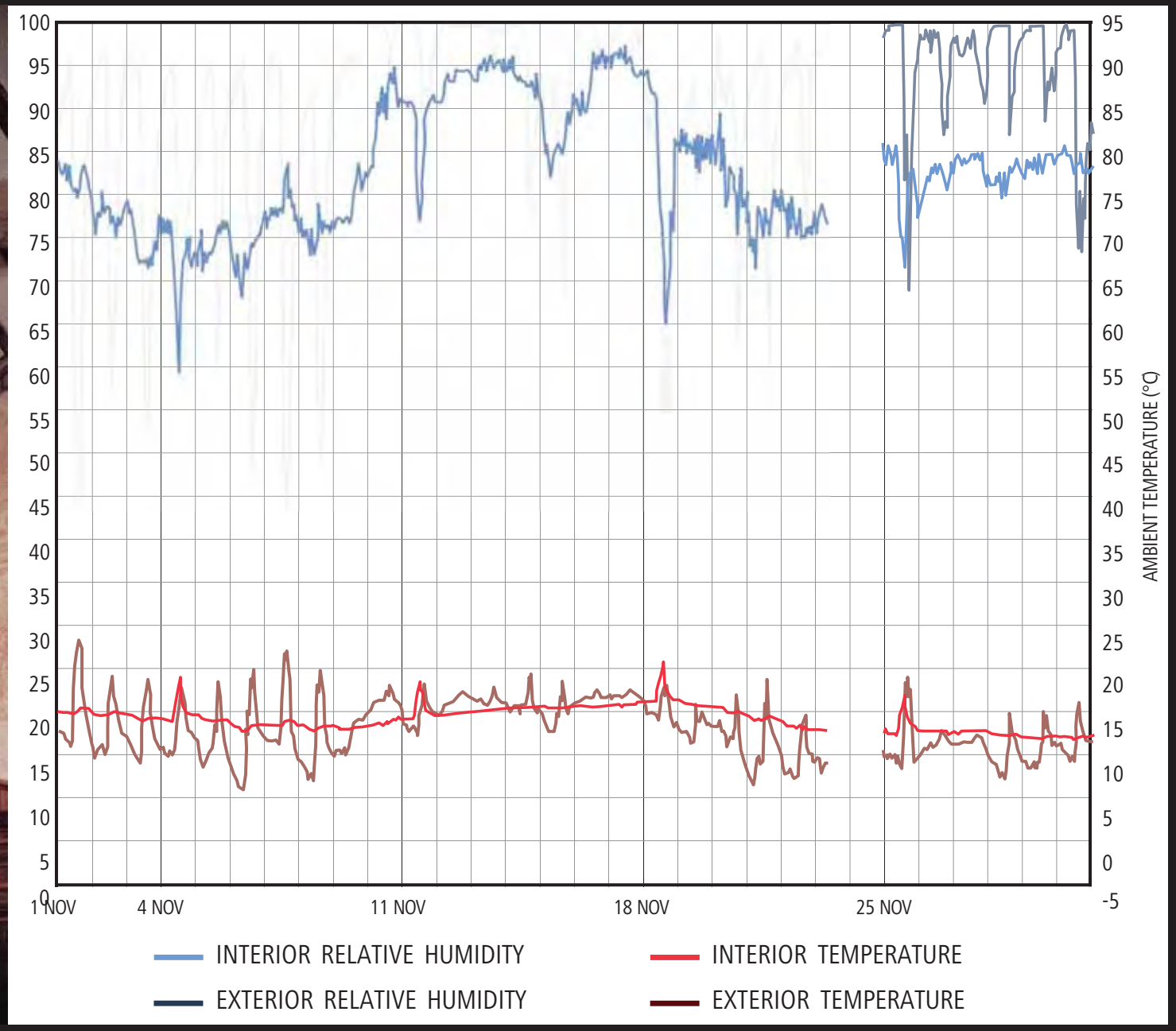


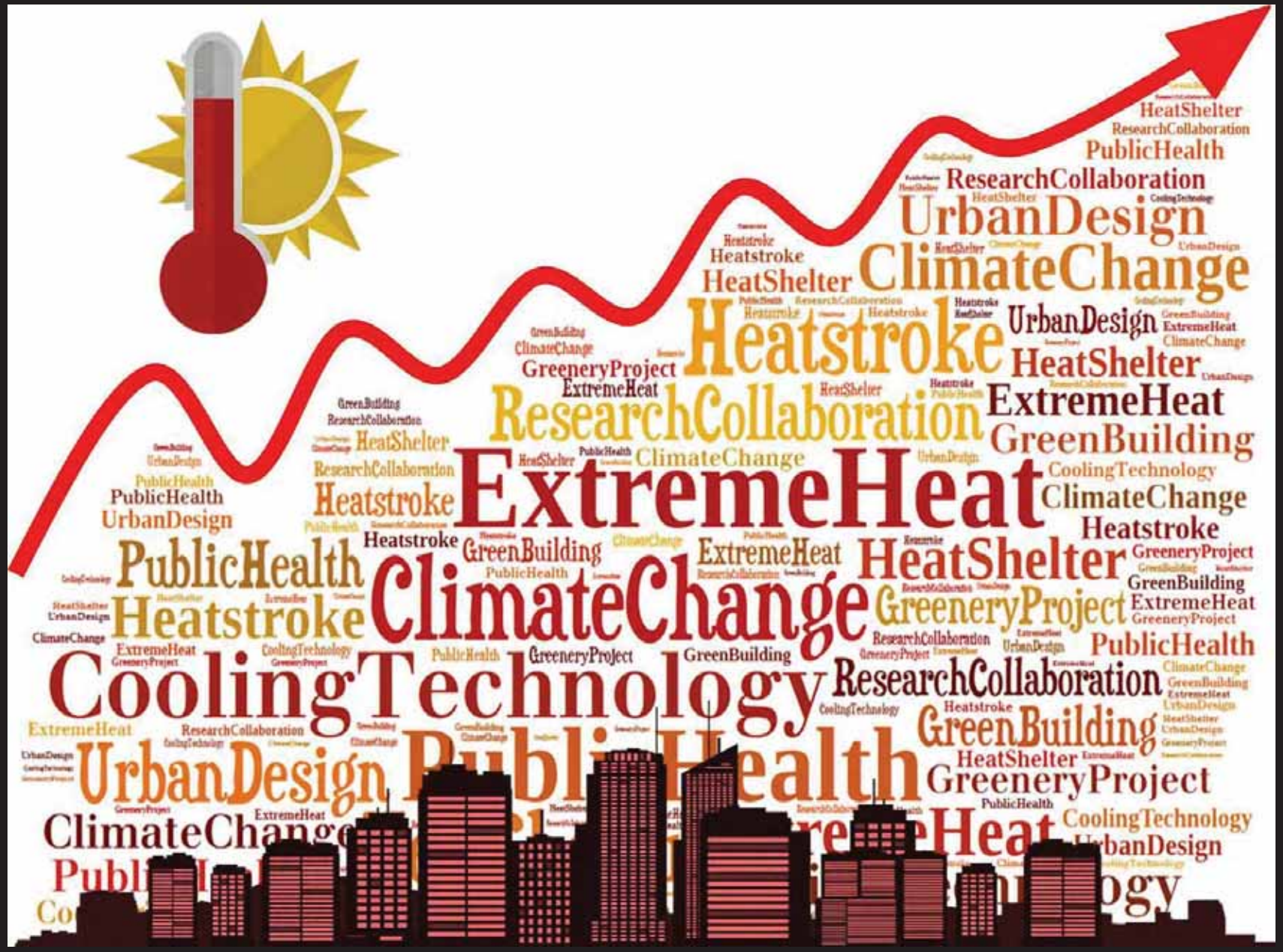


UPHOLDERS, COMPANY OF


LUXURY
or the Comforts of a Ruin'd Lord.




100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
AMBIENT TEMPERATURE (°C)
1 NOV
4 NOV
11 NOV
18 NOV
25 NOV
INTERIOR RELATIVE HUMIDITY
INTERIOR TEMPERATURE
EXTERIOR RELATIVE HUMIDITY
EXTERIOR TEMPERATURE


HeatShelter
ResearchCollaboration
PublicHealth
ResearchCollaboration
UrbanDesign
ClimateChange
Heatstroke
HeatShelter
Heatstroke
UrbanDesign
GreenBuilding
ExtremeHeat
ClimateChange
HeatShelter
GreeneryProject
ExtremeHeat
ResearchCollaboration
ExtremeHeat
GreenBuilding
GreenBuilding
ResearchCollaboration
HeatShelter
ClimateChange
CoolingTechnology
PublicHealth
PublicHealth
UrbanDesign
ClimateChange
Heatstroke
ExtremeHeat
PublicHealth
Heatstroke
GreenBuilding
ExtremeHeat
HeatShelter
GreeneryProject
ClimateChange
PublicHealth
GreenBuilding
Heatstroke
ExtremeHeat
GreeneryProject
ClimateChange
ExtremeHeat
CoolingTechnology
PublicHealth
GreeneryProject
GreenBuilding
ResearchCollaboration
PublicHealth
CoolingTechnology
ResearchCollaboration
ClimateChange
GreenBuilding
ExtremeHeat
UrbanDesign
ExtremeHeat
ResearchCollaboration
CoolingTechnology
Heatstroke
GreenBuilding
HeatShelter
UrbanDesign
UrbanDesign
HeatShelter
GreeneryProject
ClimateChange
PublicHealth
CoolingTechnology
UrbanDesign

TIMELINE FOR SERVICES

1500s

SMOKE BAYS

1600s

GLASS FOR WINDOWS IN LARGE HOUSES

CHIMNEYS IN ORDINARY HOUSES

1670

SLIDING SASH WINDOWS

INDUSTRIAL REVOLUTION

1760

FIRST PRACTICAL WCs

SEWERS

WATER MAINS

1840

GAS LIGHTING

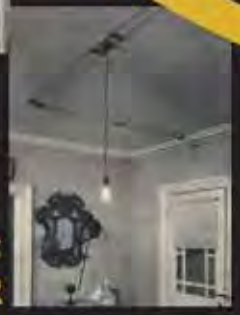
COAL-FIRED RANGES

ARTIFICIAL VENTILATION

1870

HOT WATER CYLINDERS

1900



ELECTRIC POWER

AIR CONDITIONING

CONNECTIVITY

2020


ROAD
CLOSED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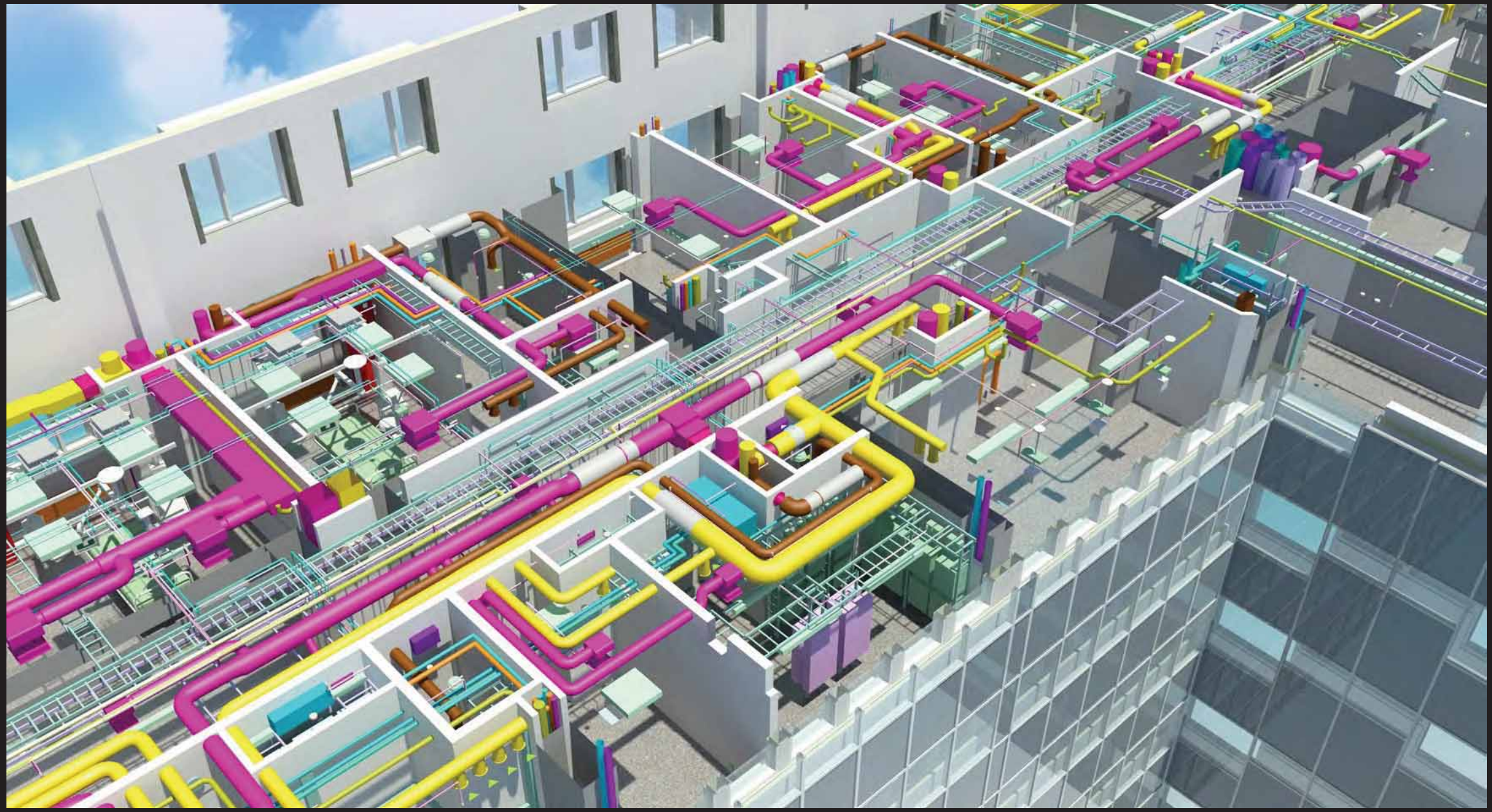


THINGS WE NEED TO DO

SPREAD THE WORD: FORM ONCE DID FOLLOW FUNCTION

THINGS WE NEED TO DO

TEACH VERNACULAR MATERIALS & SKILLS TO ALL

THINGS WE NEED TO DO

ABANDON LABELS (‘TRADITIONAL’ VS ‘MODERN’)

THINGS WE NEED TO DO

DRAW ON THE BIGGEST POSSIBLE BAG OF TRICKS

THINGS WE NEED TO DO

ALWAYS DESIGN FOR MAINTENANCE

THINGS WE NEED TO DO

ALWAYS DESIGN FOR MAINTENANCE

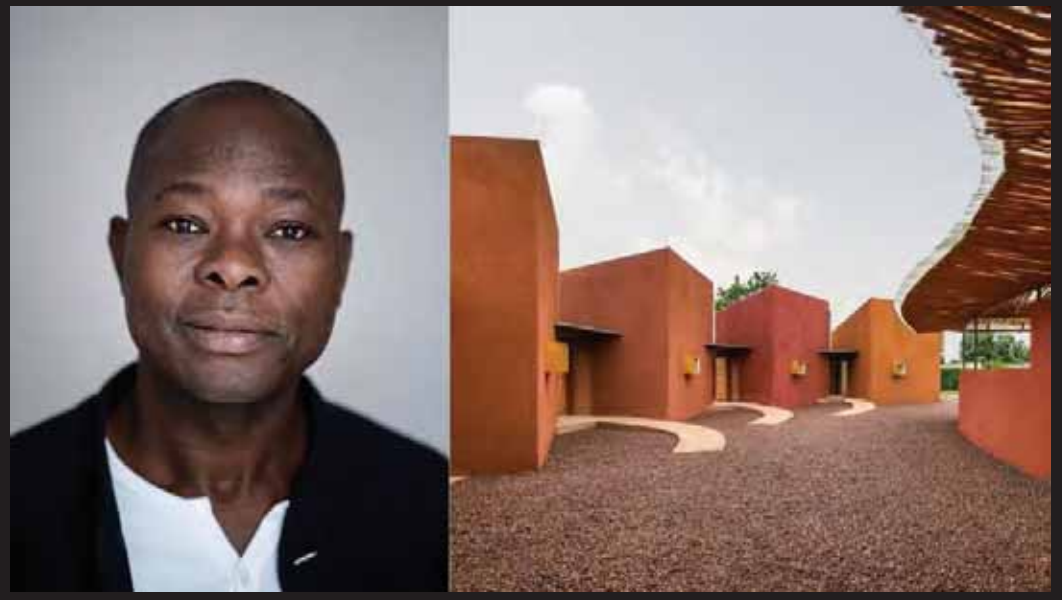
THINGS WE NEED TO DO

GET THE MESSAGES OUT TO POLICY MAKERS

THINGS WE NEED TO DO

REMEMBER THE CLIMATE IS CHANGING

THINGS WE NEED TO DO



LEARN FROM THE ‘GLOBAL SOUTH’


That's all Folks!