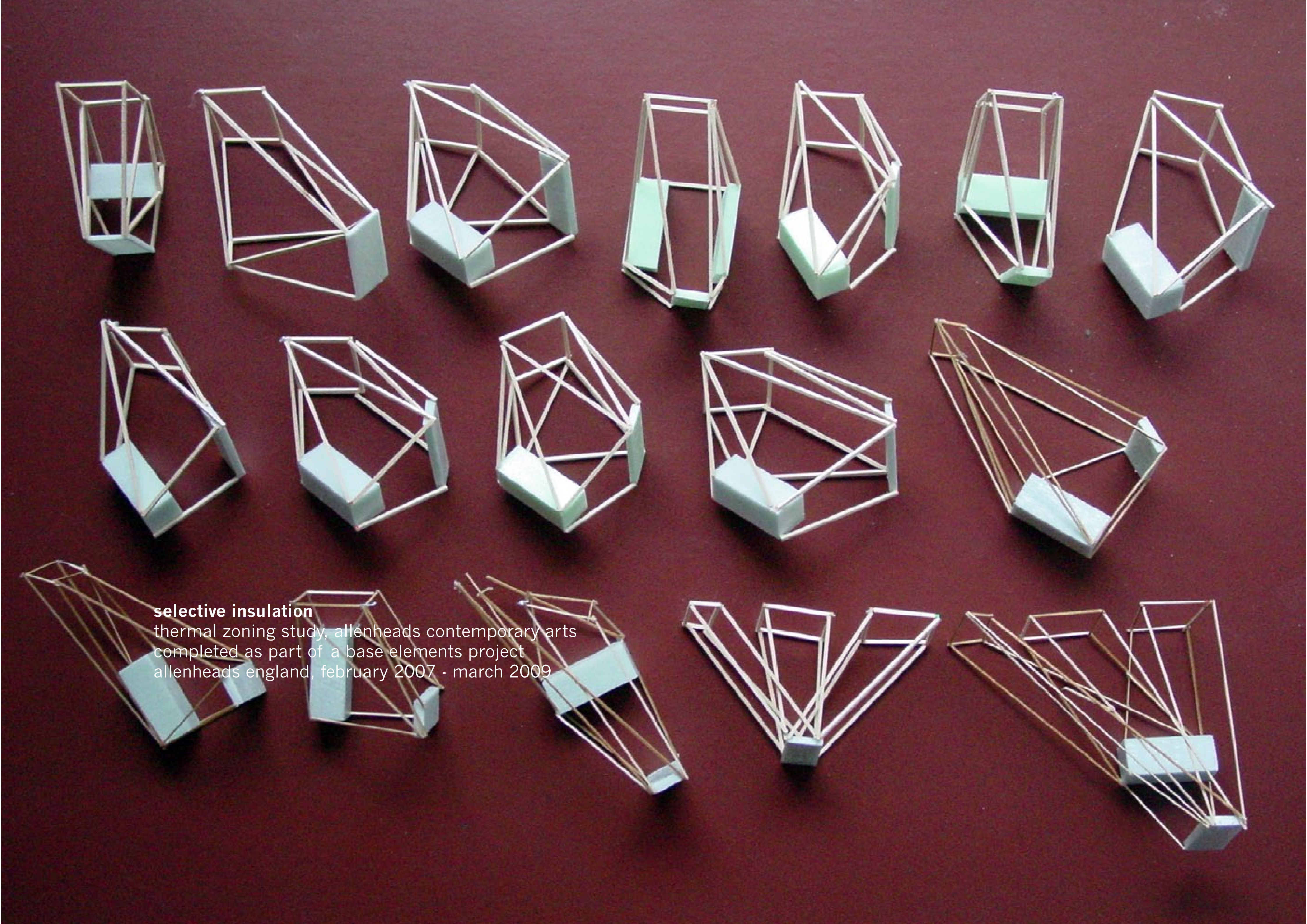


selective insulation
thermal zoning study, allenheads contemporary arts
completed as part of a base elements project
allenheads england, february 2007 - march 2009

selective insulation
thermal zoning study, allenheads contemporary arts
completed as part of a base elements project
allenheads england, february 2007 - march 2009

credits

selective insulation is part of the body of work done by stephanie davidson & georg rafailidis during a base elements residency at allenheads contemporary arts in allenheads england from february 2007 · march 2009.

with special thanks to: david spencer, environmental engineer at ryder architecture, newcastle upon tyne england.

allenheads contemporary arts
helen ratcliffe & alan smith
old school house, allenheads, hexham england ne47 9hr
t +44 (0) 1434685040 / +44 (0) 7966257276 headalan@aol.com / helenheads@aol.com
www.acart.org.uk

stephanie davidson & georg rafailidis
touchy-feely / davidson rafailidis
ossastr.15 12045 berlin germany / schildstr.25 52062 aachen germany
t +49 (0)3026343990 f +49 (0)3026343992 info@touchy-feely.net / info@davidsonrafailidis.net
www.touchy-feely.net / www.davidsonrafailidis.net

contents

1-1/introduction

right: photograph of a working set-up in the main working space of the old school house during a 10-day visit in november 2008. here, the need for warmth in a sedentary work situation can be seen very clearly. in the 66m2 room, a working set-up was placed within a 2m reach of the fireplace. even then, for work that required sitting at a computer, a small electric radiator was placed directly under a chair. these spatial decisions - to restrict the use of the generous space to a small fraction in favour of warmth - express the almost desperate need for warmth during sedentary work in the old school house.

introduction

it gets pretty cold up in allenheads. the old school house, as a working environment, while nestled in a breathtakingly beautiful landscape, is an old, uninsulated, masonry building. the potential thermal mass of the thick stone walls is untapped because of the lack of insulation on the exterior. the working spaces are generous in size and are costly and labour intensive to heat. the inconsistent use of the working spaces means that heating them up, during the cold months, takes extra time and energy because of the low, refrigerator temperatures that they reach.

but cool temperatures are comfortable for active work. the size of the main working space, our site for this installation, lends itself to active work · physical making, movement. the discomfort sets in when one is in the working space doing punctual, sedentary work · on the computer, working at a desk. it is precisely this type of work that we address and try to accommodate in our installation.

this project looks at how to increase the thermal comfort for people working in the old school house doing sedentary work. situated in the main working space, the installation *selectively insulates* a space for one or two people to work comfortably at a desk. the volume of the space is situated in such a way as to allow the main working space to still function as a large workshop for physical making or active work.

report

this report is a documentation of the process of generating both the idea and the design for the installation, spanning our first visit to allenheads in february/march 2008, to the month-long visit during which we constructed the installation in march 2009.

in the report, we took a survey of the types of heat sources used in the old school house in an effort to see whether they could inform the design of the *selective insulation* installation. each heat source was evaluated in terms of how it could or couldn't feed the form of the installation, and whether or not it could be used to heat the installation space. a model of the old school house was made to test variations of installation forms in the main working space and larger scale partial models were made to figure out how the installation would be constructed.


FIRE
⇦ EXIT
Toilets
this way

1-2/concept

right: images shown in the selective insulation concept presentation in february/ march 2008. 1. warmth has organized the layout of our living and working spaces since prehistory; 2. the hearth has also acted as a social hub over the centuries in both public and private contexts; 3. the design of some kacheloefen (literally translated, „tiled ovens“), suggests social gathering and the direct use by bodies. this example shows an oven skirted with what would be a warmed bench; 4. heat sources still take a prominant and often central place in the layout of our homes and work spaces; 5. this illustration shows a temperature gradient in a non-insulated room with a centrally-placed heat source; 6. modern building construction flattened the thermal gradient that used to be spread through a room, into one layer, the insulated wall; 7. this illustration shows the temperature gradient flattened into the layer of the insulated exterior wall; 8. this illustration shows a vision for selective insulation: small pockets of warm space in an uninsulated shell like the old school house; 9. & 10. precedent for selective insulation, the bed as a heat trap; 11. & 12. suggestions for how this principle could be expanded.

concept: selective insulation

the concept of selective insulation was one propsed at our first visit to allenheads in february/march 2008. the idea came out of a series of thoughts about how we make our own thermal comfort in the case that we either can‘t or don‘t want to just turn the dial on the thermostat. the simplest and most direct example that occurred to us, for how to selectively insulate a space for the body while leaving the larger volume of the room at a cool ambient temperature, was the bed. the bed, with a body in it, is essentially a heat trap wherein the body is a heat source and the heat produced by the body is trapped or insulated in a very small space. the question is, can we extend this principle of the bed as a heat trap to make larger warm spaces within otherwise cool rooms? how large can the selectively insulated space be before it requires an additional heat source to keep the body warm?

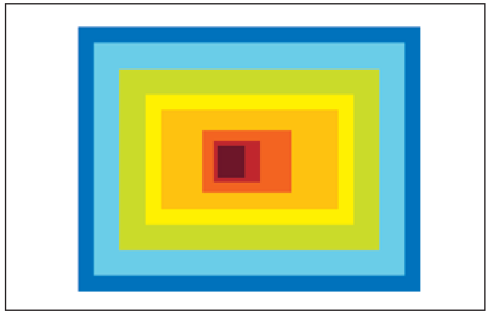
as a starting point, the principle is simple: selective insulation involves the enclosure of a space using insulating materials, within a non-insulated, cool space. the principle demands that one define how much warm space is really needed within the otherwise cool space, and then structure that space as an insulated volume. rather than heat being perpetually sucked out of the uninsulated walls and draughty windows, heat output would be lessened and efficiently trapped in the selectively insulated volume.


1.

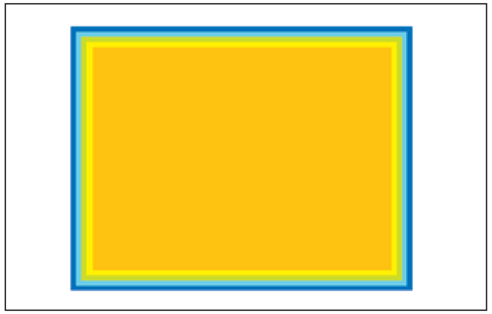

2.

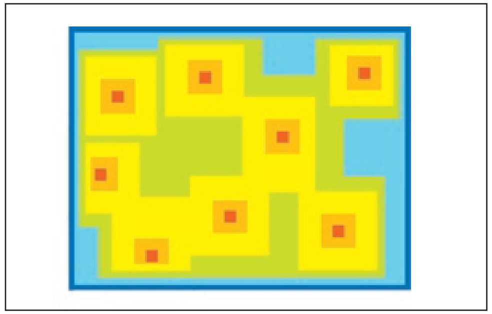

3.


4.

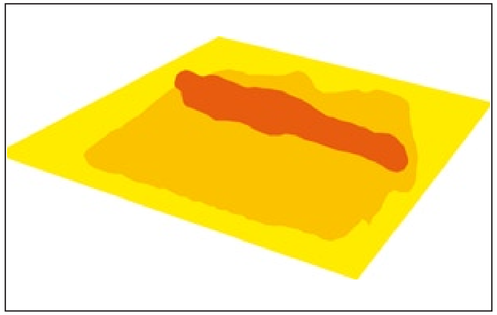

5.


6.

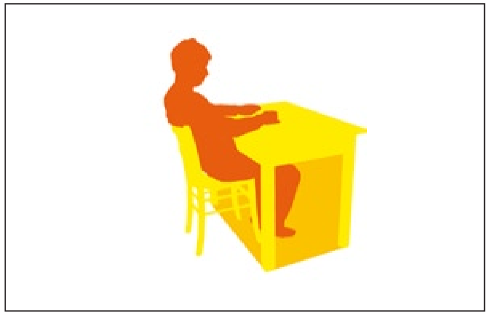

7.


8.


9.


10.


11.


12.

credits

right: photograph of the coal-burning fireplace in the main working space of the old school house.

fire as a heat source in the old school house

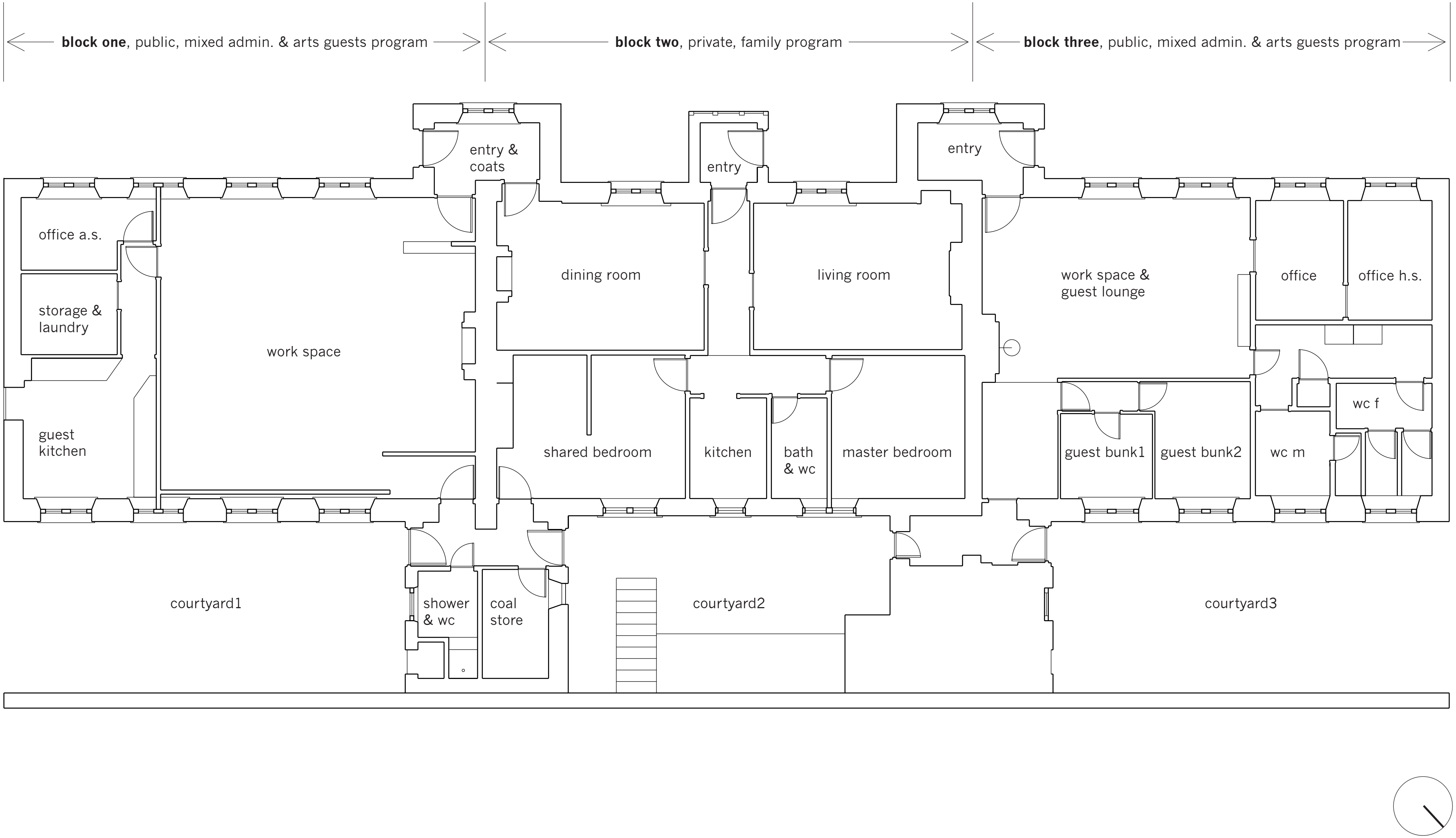
during the chilly months of fall and winter, coal-burning fires are primary heat sources in the larger rooms of the old school house, both in the private and shared blocks. there are three stoves and one open fireplace in the old school house. both the stoves and the fireplace require constant tending throughout the day. once central coal store is located in a back room in the central block.

the stoves and fireplace create a palpable heat gradiant throughout the large rooms in which they're located. in the case of the 21m2 living room in the residential block, the stove maintains a very high degree of thermal comfort in the room because 1. the scale of the room is well proportioned to the heat output capacity of the stove; 2. the door to the living room is kept shut; 3. the stove is kept burning constantly. in the case of the formal dining room mirroring the living room, the stove doesn't provide as effective a heat source because 2. and 3. are lacking. the stove is only used punctually and the dining room, unlike the living room, is a through-room, used as one possible entry into the residential block from the outside.

fire is the original planned heat source for the old school house. the placement of the fireplaces and chimneys are prominant figures in both the plan and elevation of the building. the fact that coal is a non-renewable resource, the rigidity in the positioning of the fireplaces, and the uncontrollability of fire made the fireplaces/stoves not very appropriate for use in our installation.

2-1/reference plan

right: floorplan of the old school house showing programmatic uses.


block one, public, mixed admin. & arts guests program
block two, private, family program
block three, public, mixed admin. & arts guests program
entry & coats
entry
entry
office a.s.
storage & laundry
work space
guest kitchen
dining room
living room
work space & guest lounge
office
office h.s.
shared bedroom
kitchen
bath & wc
master bedroom
guest bunk1
guest bunk2
wc m
wc f
shower & wc
coal store
courtyard1
courtyard2
courtyard3

2-2/thermal zones in relation to fire

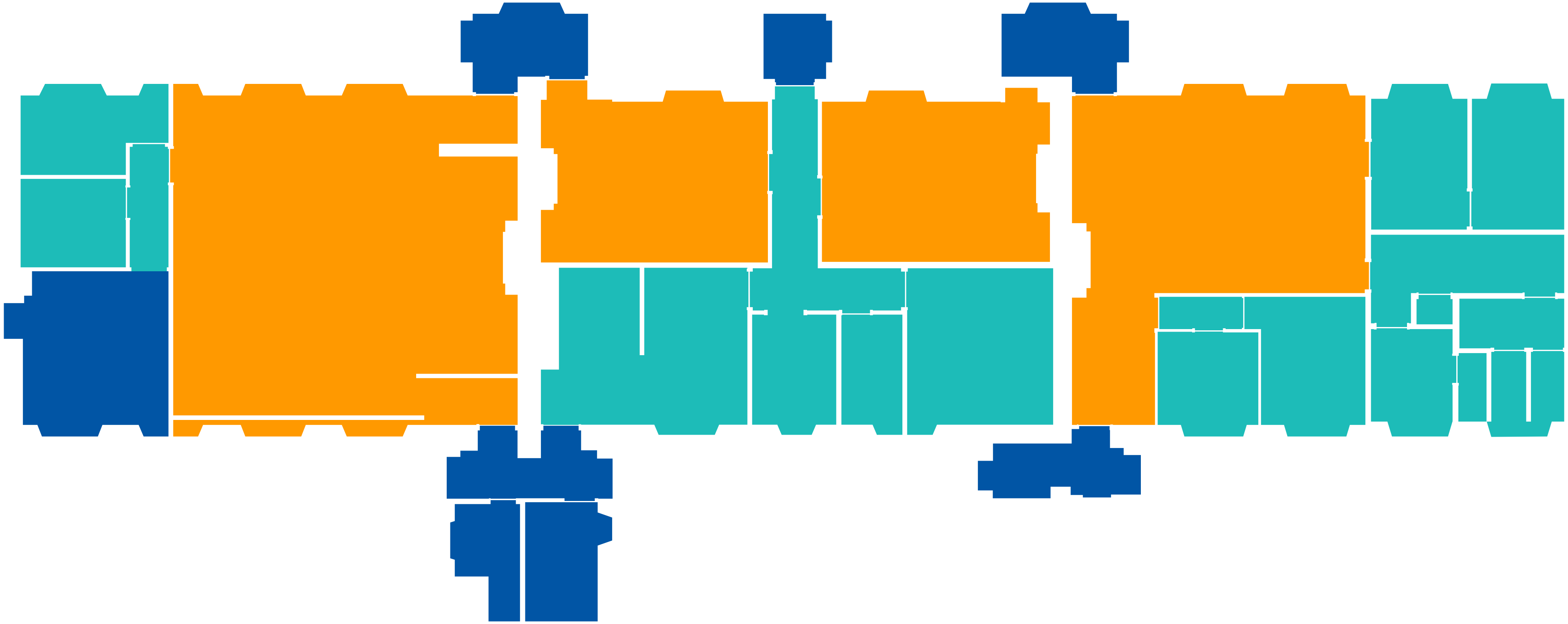
right: illustration showing warm,cool and cold zones of the old school house in relation to fireplaces/stoves. rooms with a fireplace/stove are warm, rooms without a fire-burning heat source are cool, and rooms without a heat source and with a door to the outside are cold.

2-2/thermal zones in relation to fire

block one, public, mixed admin. & arts guests program

block two, private, family program

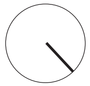
block three, public, mixed admin. & arts guests program



cold / either with or very close to external doors, no fireplace/stove

cool / no external doors, spaces tend to be for used for through-fare, for activities done in isolation or bedrooms, no fireplace/stove

warm / coal-burning fireplace/stove within the room, spaces are either used as work spaces (public), dining room or living room (private)



2-3/thermal gradation within warm zone

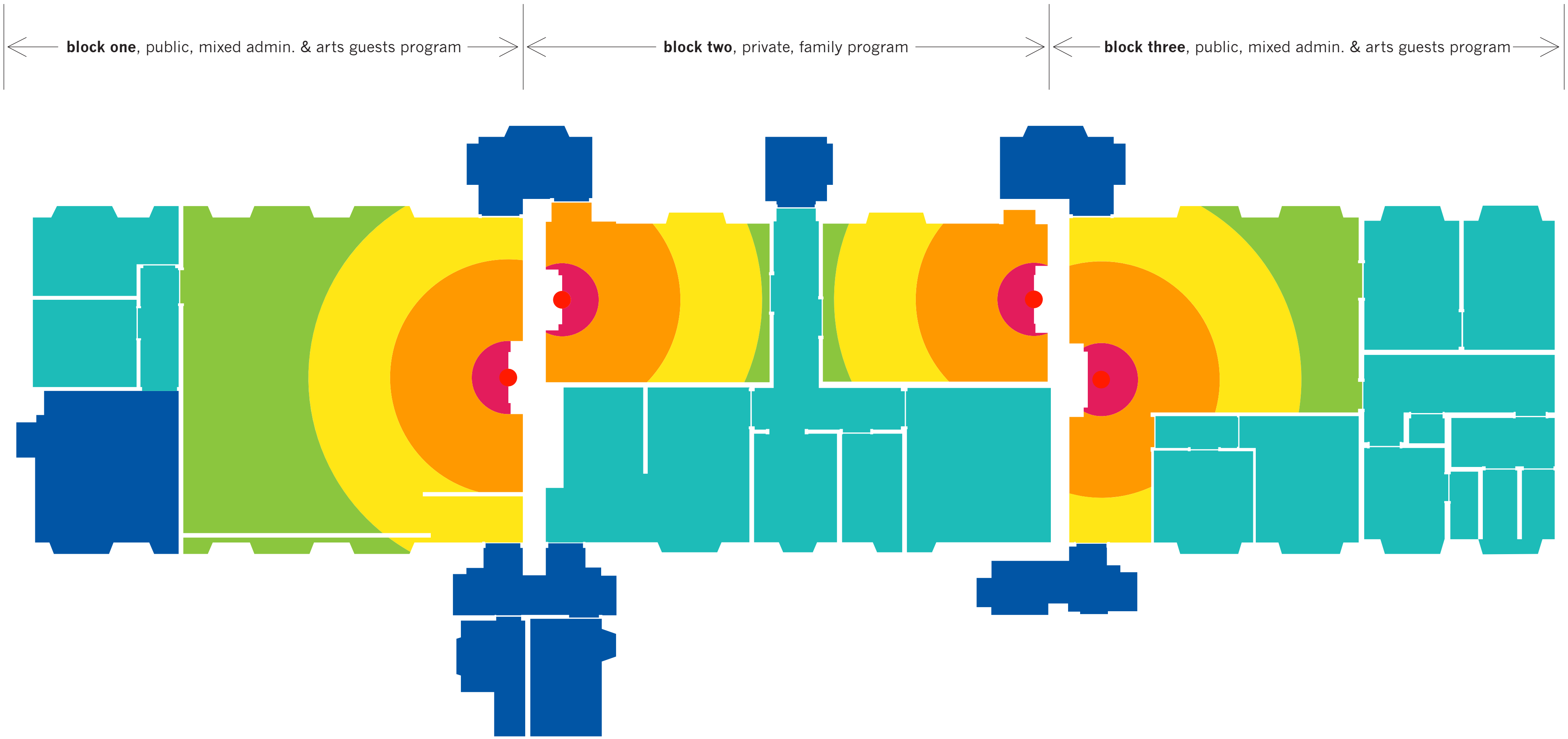
right: illustration showing the heat gradient through the rooms heated with fireplaces/stoves. how deep into a room a fire can heat depends on how large and how sealed the room is. as described in section 2, the living room in the residential block is the most efficient stove in the building because of three factors: 1. the scale of the room is well proportioned to the heat output capacity of the stove; 2. the door to the living room is kept shut; 3. the stove is kept burning constantly. in all other cases, one or more of the three factors described above are compromised, as is the heat efficiency of the stove/fireplace.

use ot fire in selective insulation installation

it became clear to us early-on that using a fireplace or stove as a heat source in our selective insulation installation would be unlikely for many reasons. an obvious reason is the form of heat, fire itself. the heat output from a fireplace/stove is too extreme for a tiny, temporary space. the fireplaces/stoves, as previously mentioned, are an integral part of the design of the old school house. as such, each fireplace/stove has a specific relationship to a specific room. we are not interested in tampering with this.

fire as a heat source does not inform the installation.

2-3/thermal gradation within warm zone



- **cool zone2** / either with or very close to external doors, no fireplace/stove
- **cool zone1** / no external doors, spaces tend to be for used for through-fare, for activities done in isolation or bedrooms, no fireplace/stove
- **warm zone4** / no external doors, spaces tend to be for used for through-fare, for activities done in isolation or bedrooms, no fireplace/stove
- **warm zone3** / fireplace/stove within a 5-meter radius, moderately warm
- **warm zone2** / fireplace/stove within a 3-meter radius, warm
- **warm zone1** / fireplace/stove within a 1-meter radius, very warm
- **heat source** / coal-burning fireplace/stove, block 1 has an open fireplace while blocks 2 & 3 have stoves

3/sun

right: photograph of mid-morning light condition taken in early november in courtyard 2 of the old school house.

sun as a heat source in the old school house

because of the extremely high altitude of allenheads (411.48 meters amsl), it is not a place bathed in sunshine throughout the year. in north east england, statistics for morpeth cockle park (95 meters amsl) were the closest that we could find for the breakdown of average sun hours per month (please refer to the appendix). in january, statistics for morpeth cockle park show just over 50 hours of sun on average. in december, the number is lowest, at just under 50 hours, or 1.5 hours per day of sunshine.

that being said, the front or representative side of the building is south-facing, and the south-facing windows allow a significant amount of sun into the corresponding rooms. this now doubt contributes to some passive heat gain, but the amount would be nominal because of the inability of the building to respond to the sun and use it more via storage (eg. photovoltaic, thermal mass, etc.).

in the following pages, we looked at the behaviour of the sun at pivotal times of the year: september 21, december 21, march 21 and june 21. using a sun chart and referring to charts that had recorded the times for sunrise and sunset throughout the year, we drew the movement of the sun within the old school house, with a specific focus on the main working space, the site of our installation.

3-1/daylight conditions 21.09/21.03

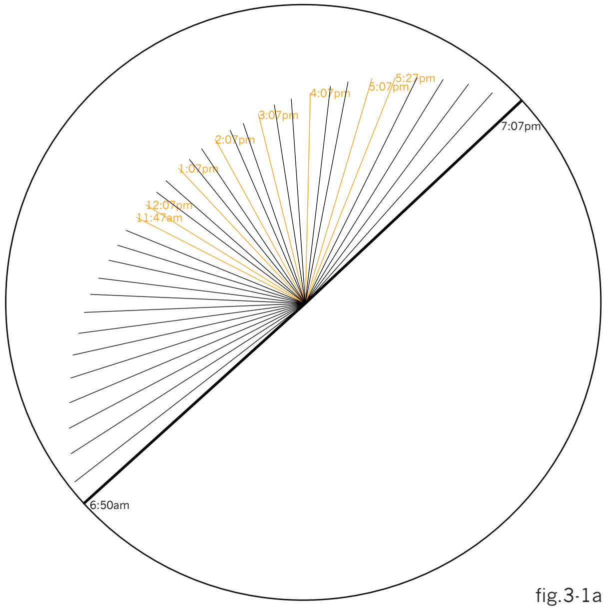
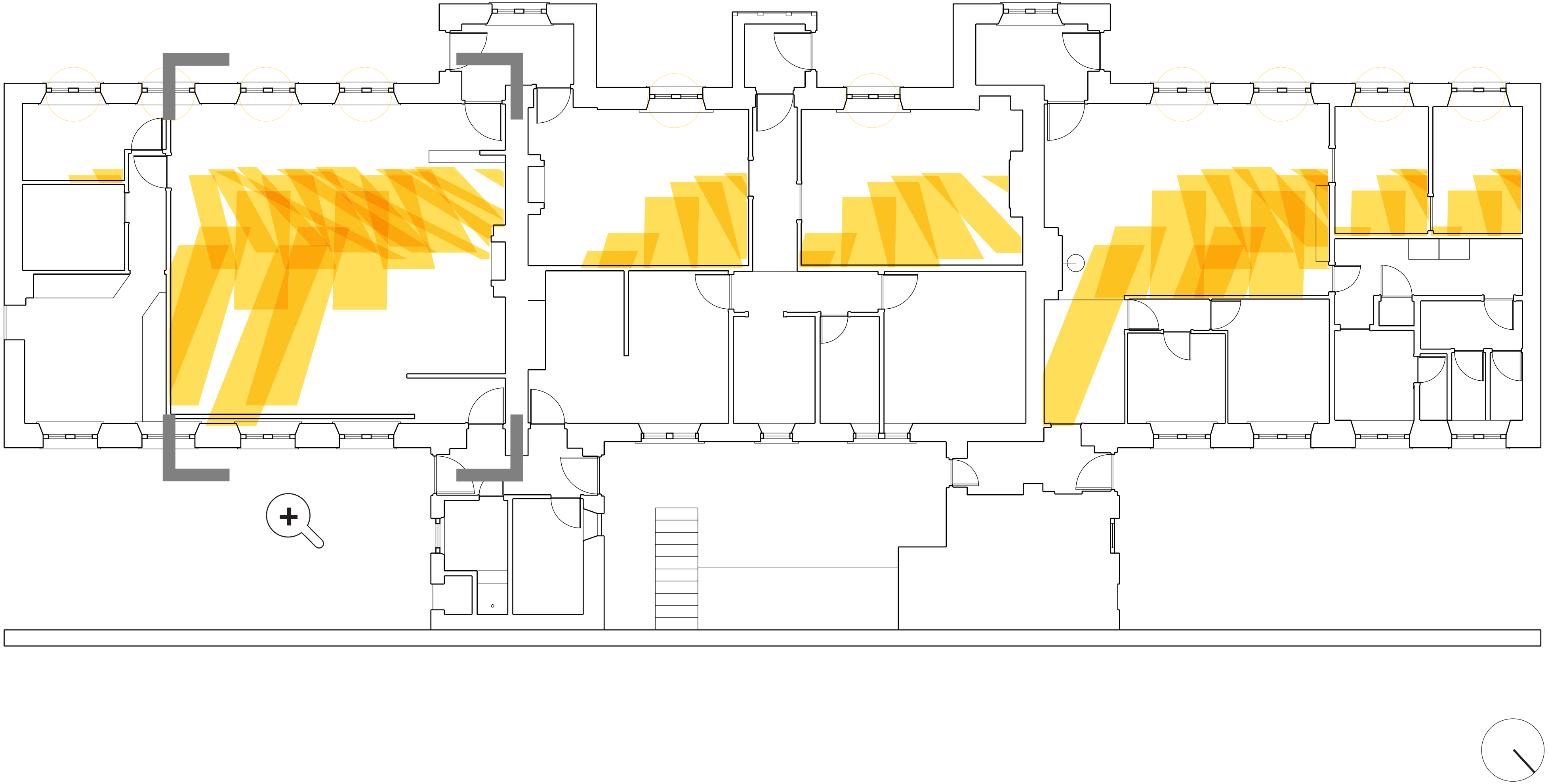


fig.3-1a

right: fig.3-1a, sun shart illustrating the angle of the sun throughout its daily movement on september 21st and march 21st.
opposite page: plan showing how the sun impacts the space throughout a day on september 21st and march 21st.

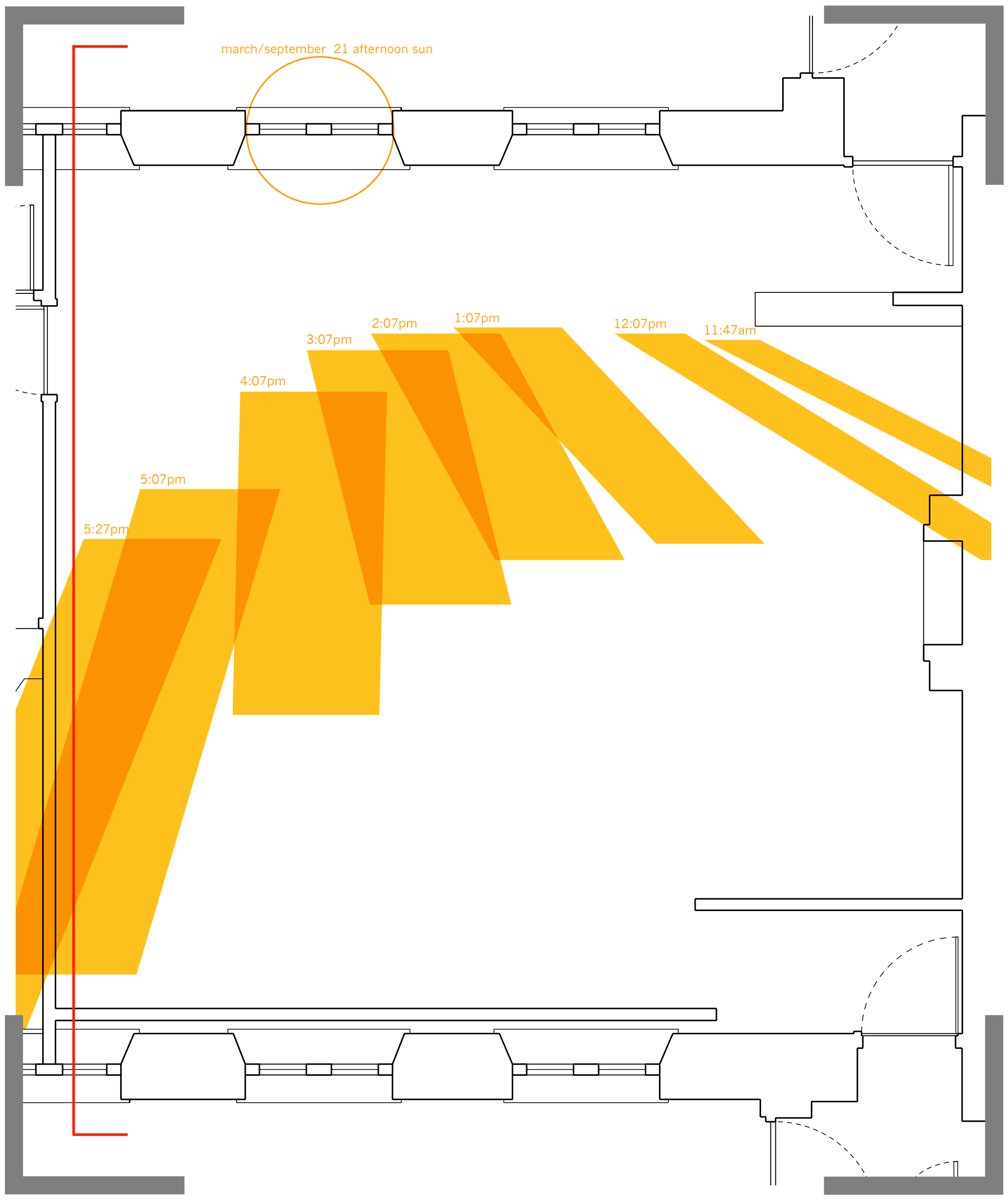


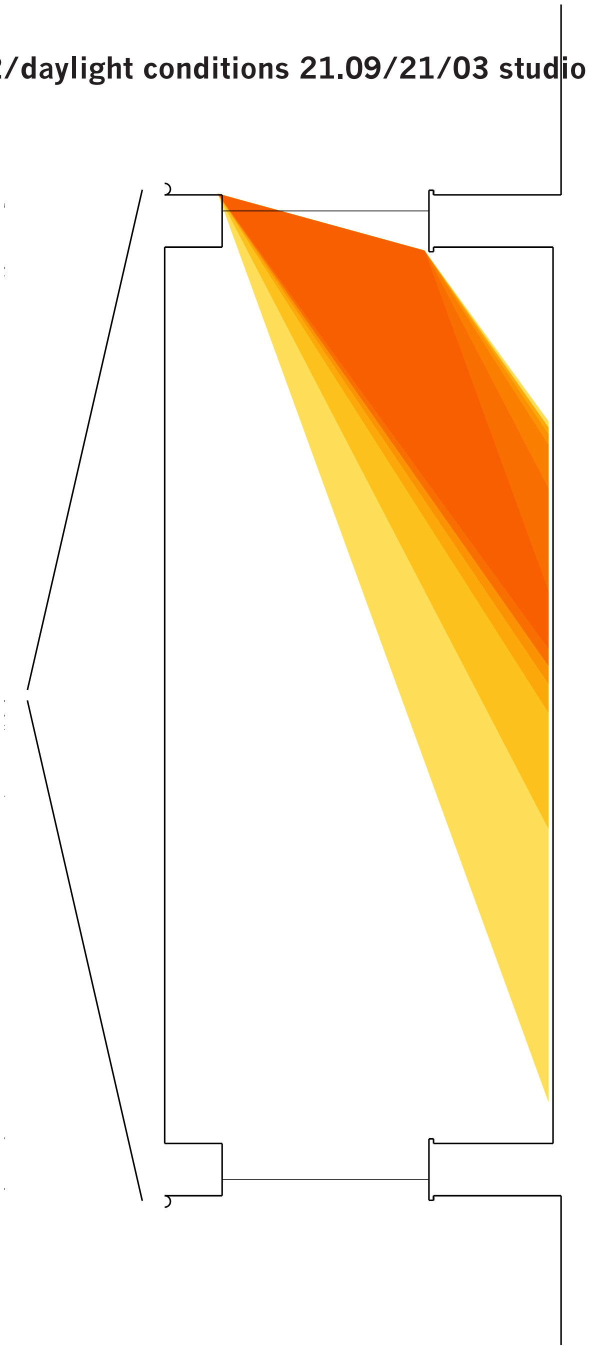
3-2/daylight conditions 21.09/21/03 studio 1

right: fig.3-2a, general shape of the area on the floor of the main working space that is bathed in sun throughout the span of one day, september 21st and march 21st.
opposite page: zoomed-in plan and section of the main working space showing the spatial character of the sun in the room both as a horizontal sun patch and as vertical sun rays or beams.

fig.3-2a

3-2/daylight conditions 21.09/21/03 studio 1





zoom-in of studio 1 plan illustrating the daylighting conditions through one sw-facing window

3-2a/sun volume 21.09/21/03 studio 1

right: the space that the sun occupies in its entry through the window marked on the previous page was built as a framed volume.

3-3/daylight conditions 21.12

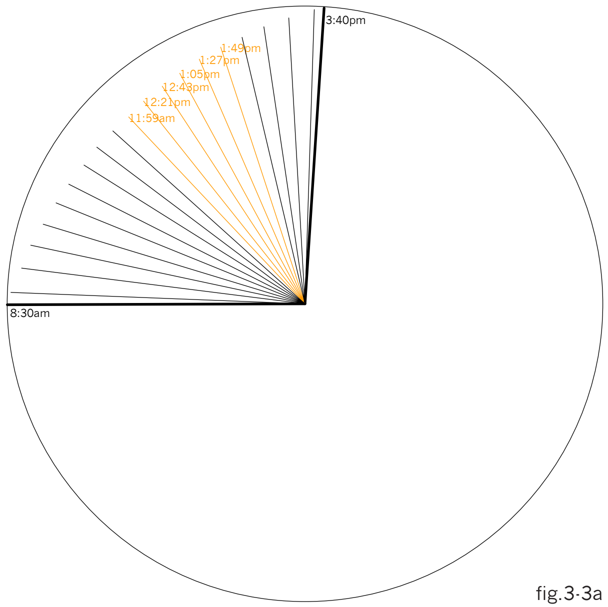
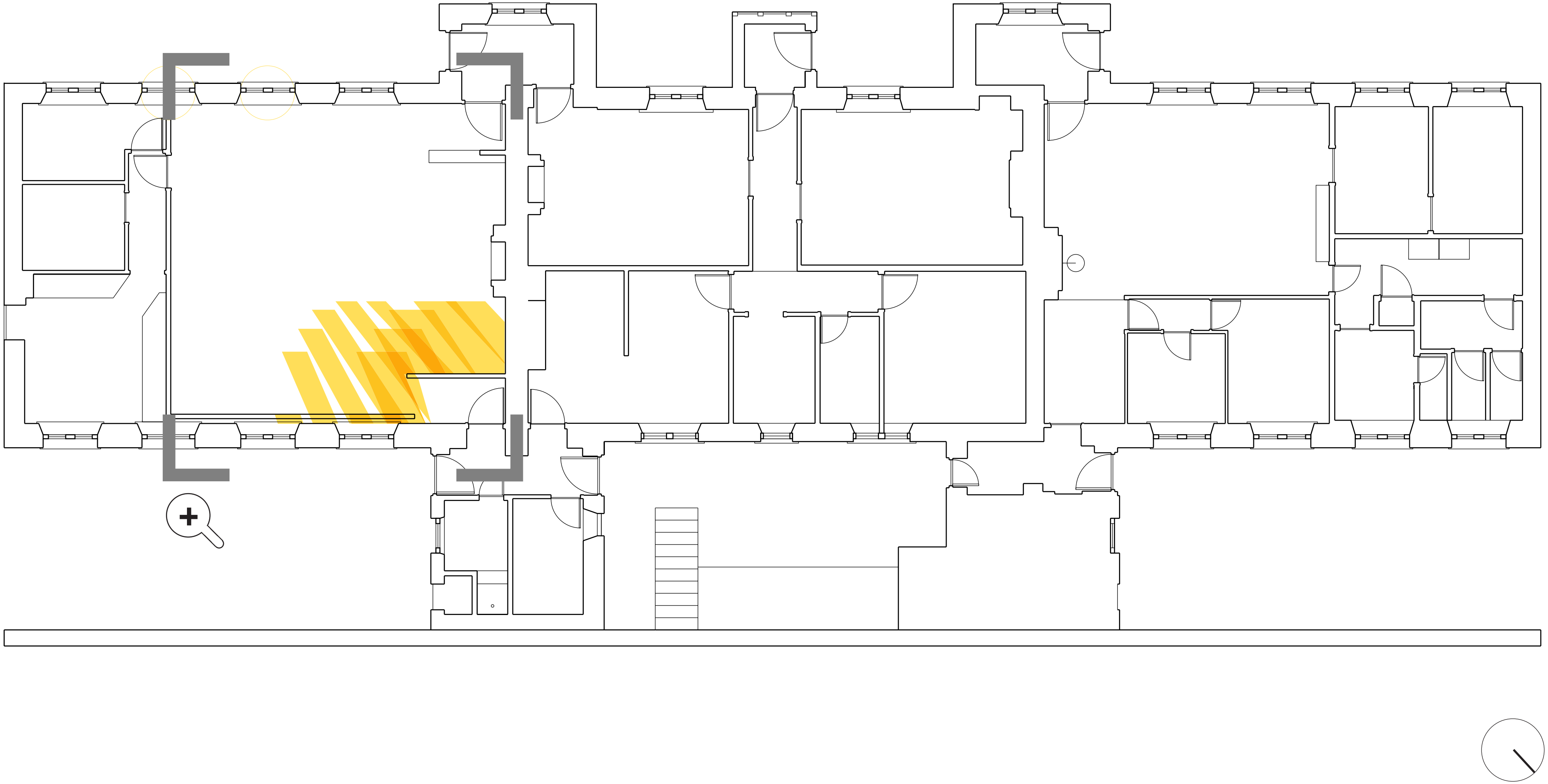


fig.3-3a

right: fig.3-3a, sun shart illustrating the angle of the sun throughout its daily movement on december 21st.
opposite page: plan showing how the sun impacts the space throughout a day on december 21st.

3-3/daylight conditions 21.12



3-4/daylight conditions 21.12 studio 1

right: fig.3-4a, general shape of the area on the floor of the main working space that is bathed in sun throughout the span of one day, december 21st.
opposite page: zoomed-in plan and section of the main working space showing the spatial character of the sun in the room both as a horizontal sun patch and as vertical sun rays or beams.

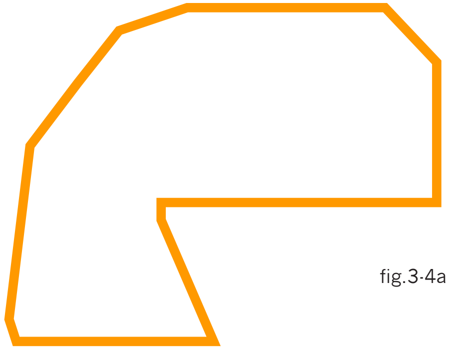
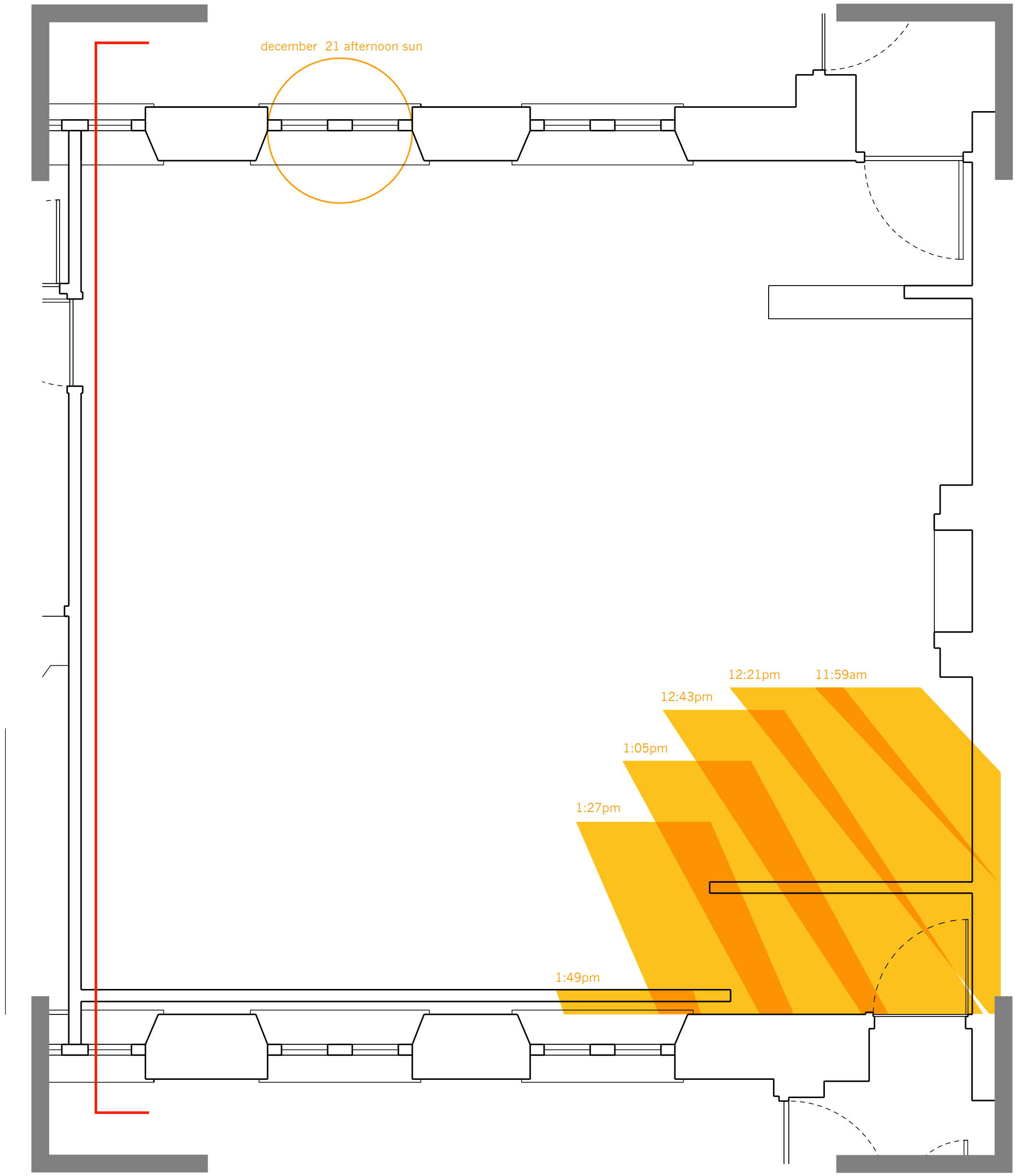
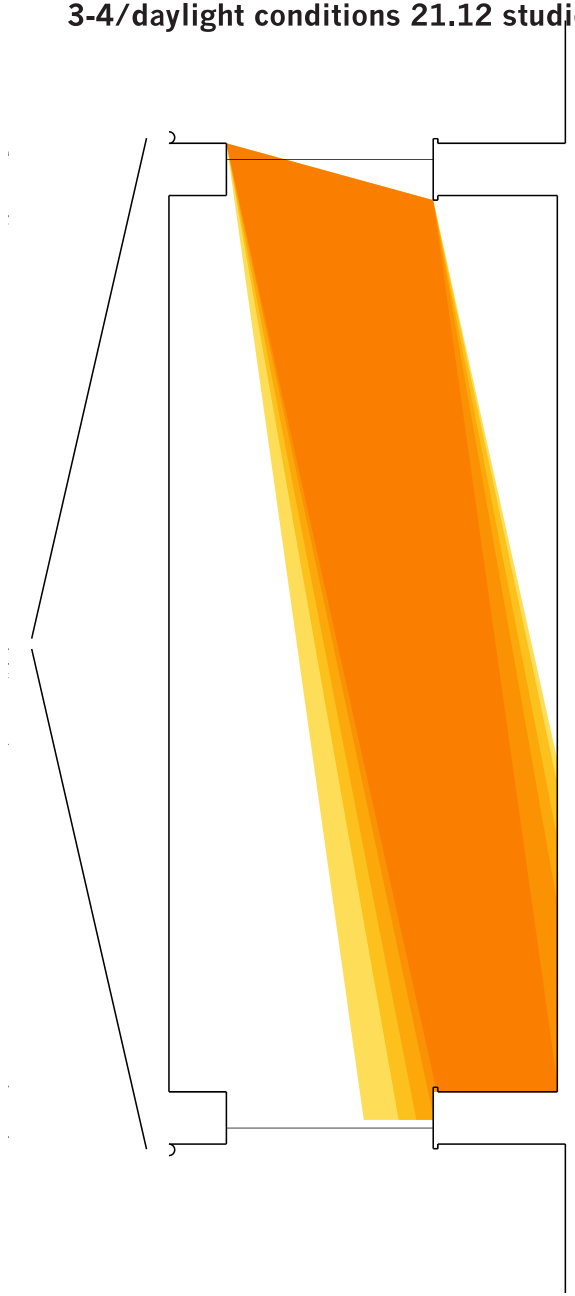


fig.3-4a





zoom-in of studio 1 plan illustrating the daylighting conditions through one sw-facing window

3-4a/sun volume 21.12 studio 1

right: the space that the sun occupies in its entry through the window marked on the previous page was built as a framed volume.

3-5/daylight conditions 21.06

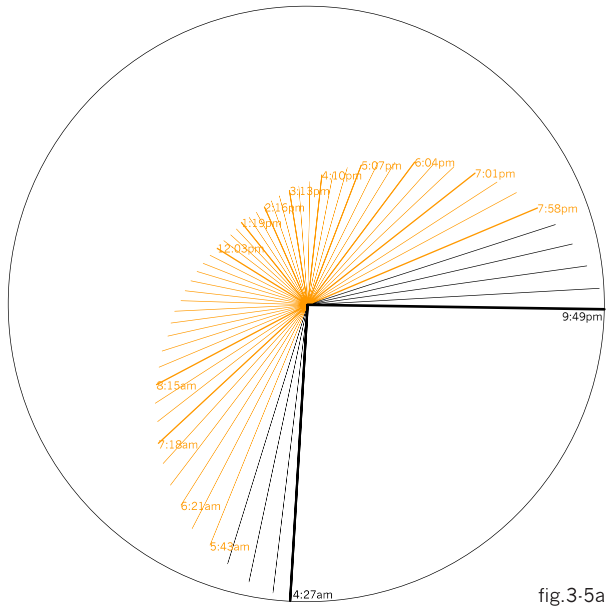
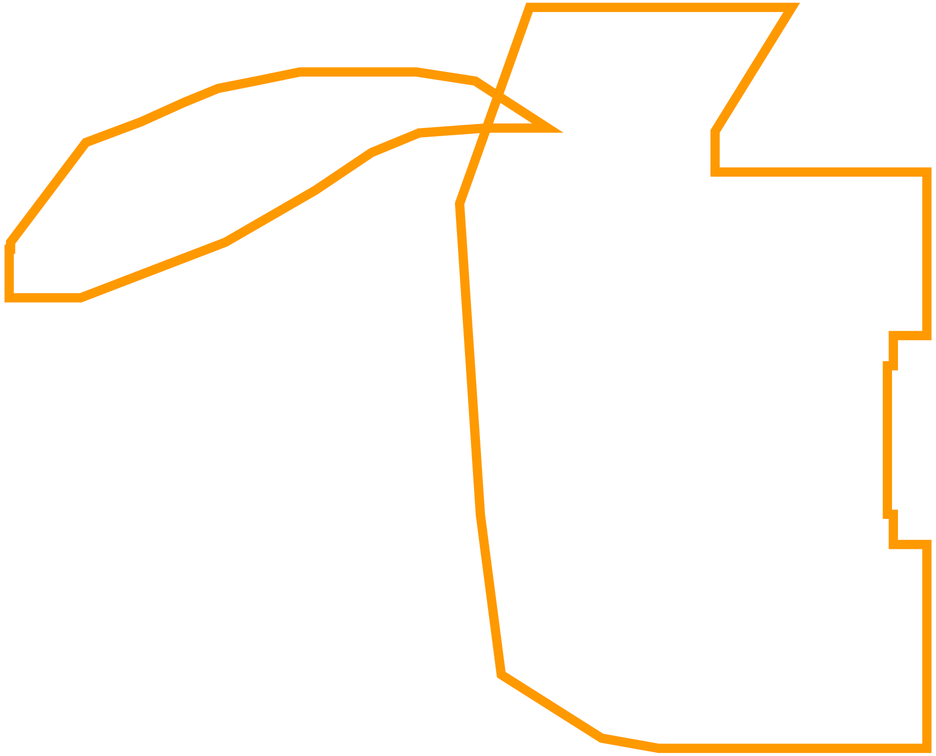


fig.3-5a

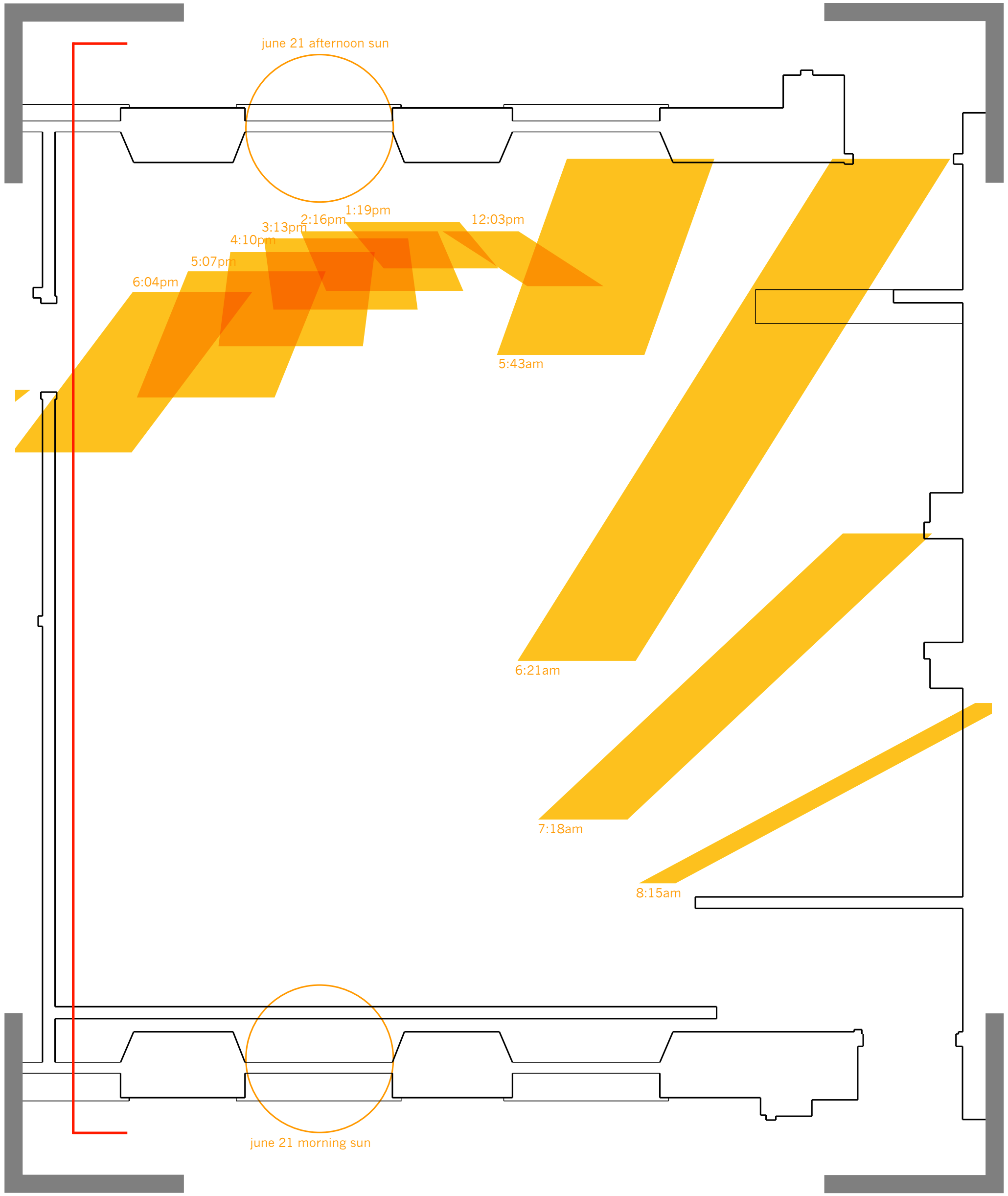
right: fig.3-5a, sun shart illustrating the angle of the sun throughout its daily movement on june 21st.
opposite page: plan showing how the sun impacts the space throughout a day on june 21st.

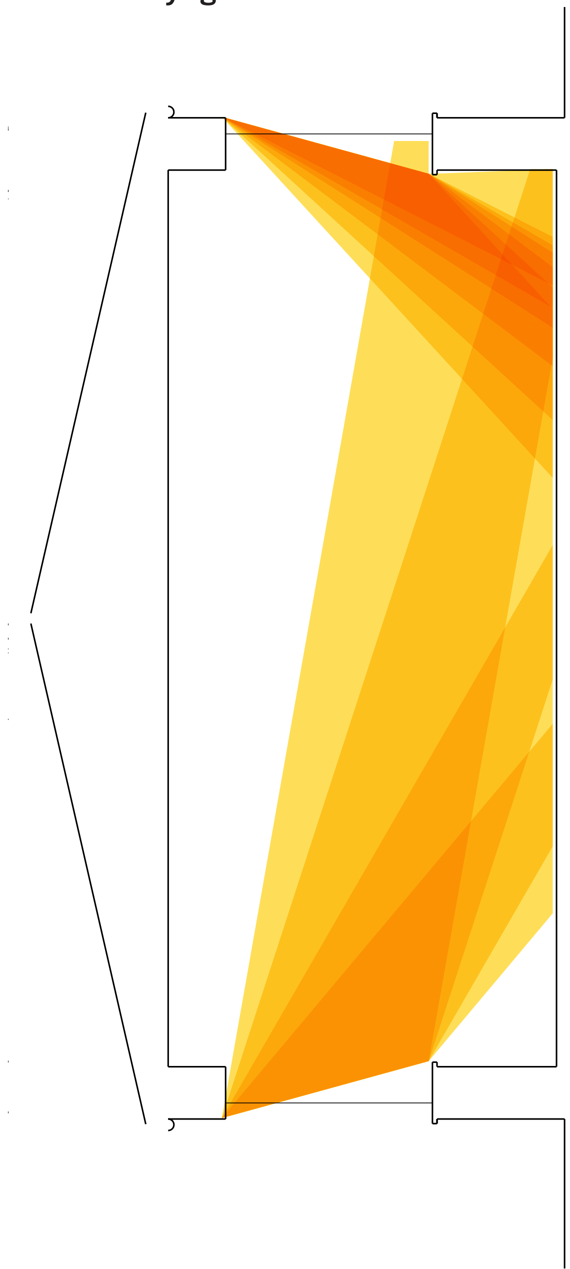
3-6a/sun volume 21.06 studio 1



right: fig.3-6a, general shape of the area on the floor of the main working space that is bathed in sun throughout the span of one day, june 21st.
opposite page: zoomed-in plan and section of the main working space showing the spatial character of the sun in the room both as a horizontal sun patch and as vertical sun rays or beams.

fig.3-6a





zoom-in of studio 1 plan illustrating the daylighting conditions through one sw-facing window

right: the space that the sun occupies in its entry through the window marked on the previous page was built as a framed volume.

4/radiators

right: photograph of the main working space and the use of radiators as clothes dryers.

central heating in the old school house

the old school house was at some point retrofitted with a central heating system. for such a large house with inconsistant occupancy, it‘s not financially feasible to use the central heating system consistantly. it is used during the cold months, during the night and is turned off again in early morning. with skyrocketing energy costs, the central heating system is not a particularly sustainable way of heating the uninsulated old school house. because of their use only during night time and their placement, fitted tightly beside or on walls, we weren‘t able to see ways for the radiators to inform the design of the installation.

4-1/radiator placement plan

right: plan showing the placement of the radiators throughout the old school house.

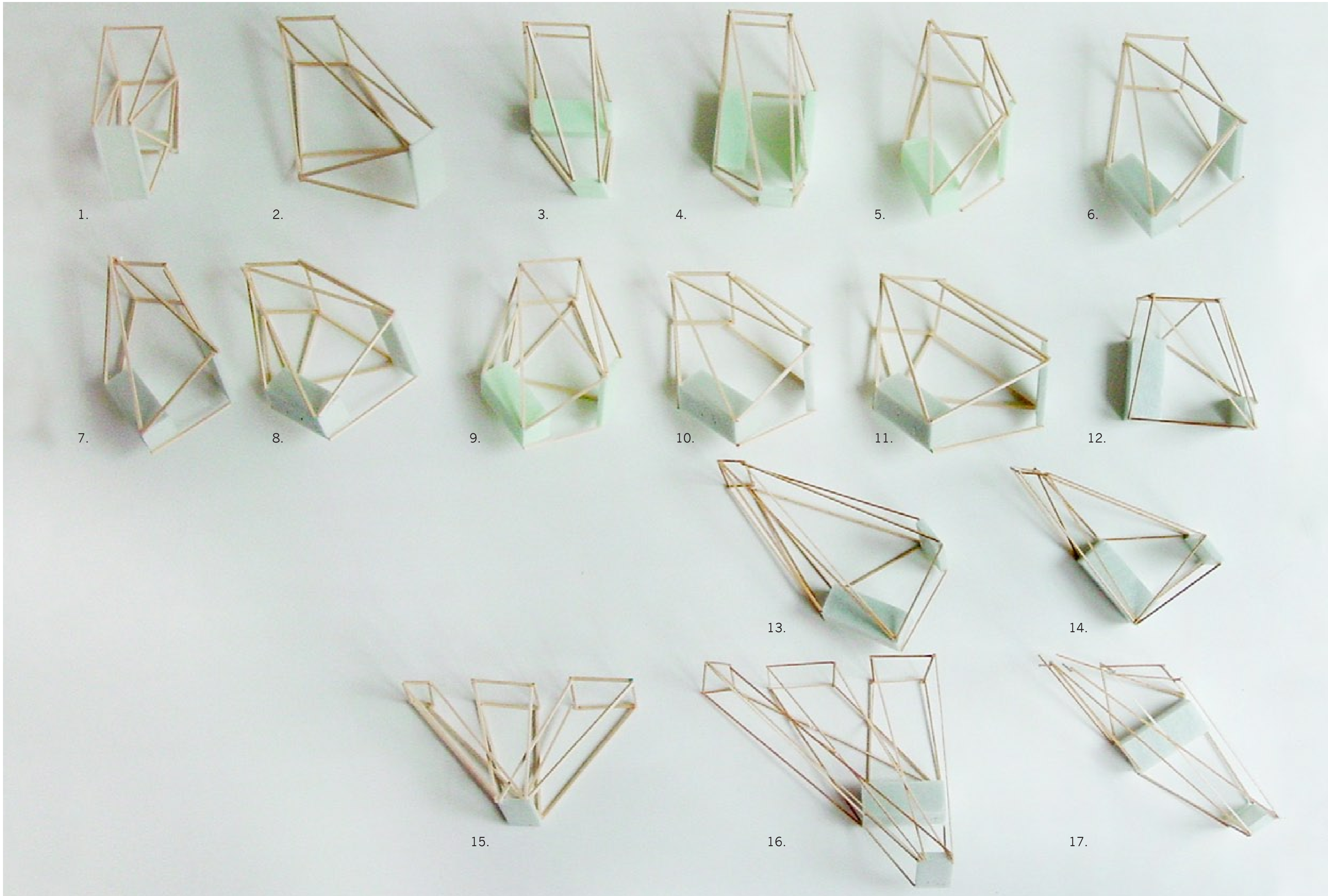
4-1/radiator placement plan

5/installation

right: photograph of 17 variations of possible installation volumes, built in scale 1:50.

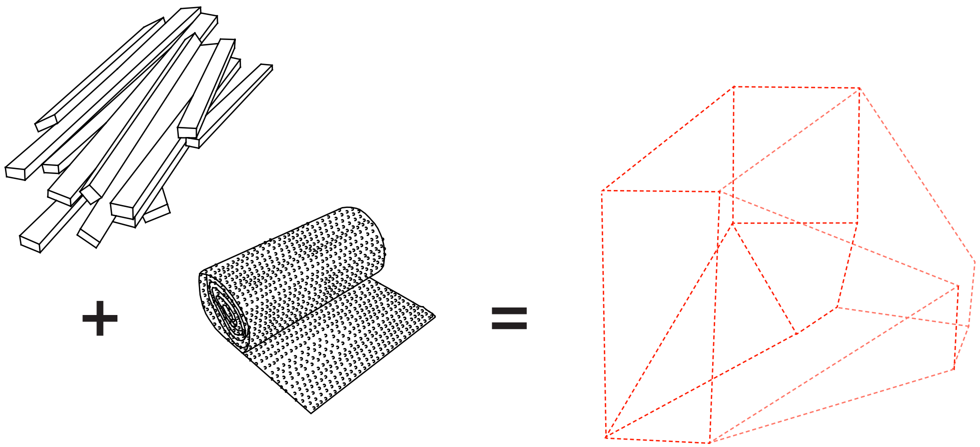
installation

our strategy for defining the volume of the installation was informed greatly by 1) the daylighting study that we conducted as well as 2) our continued interest in the concept of selective installation. the studies shown on the following pages look at variations of a selectively insulated volume to be built in the main working space of the old school house.


1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.

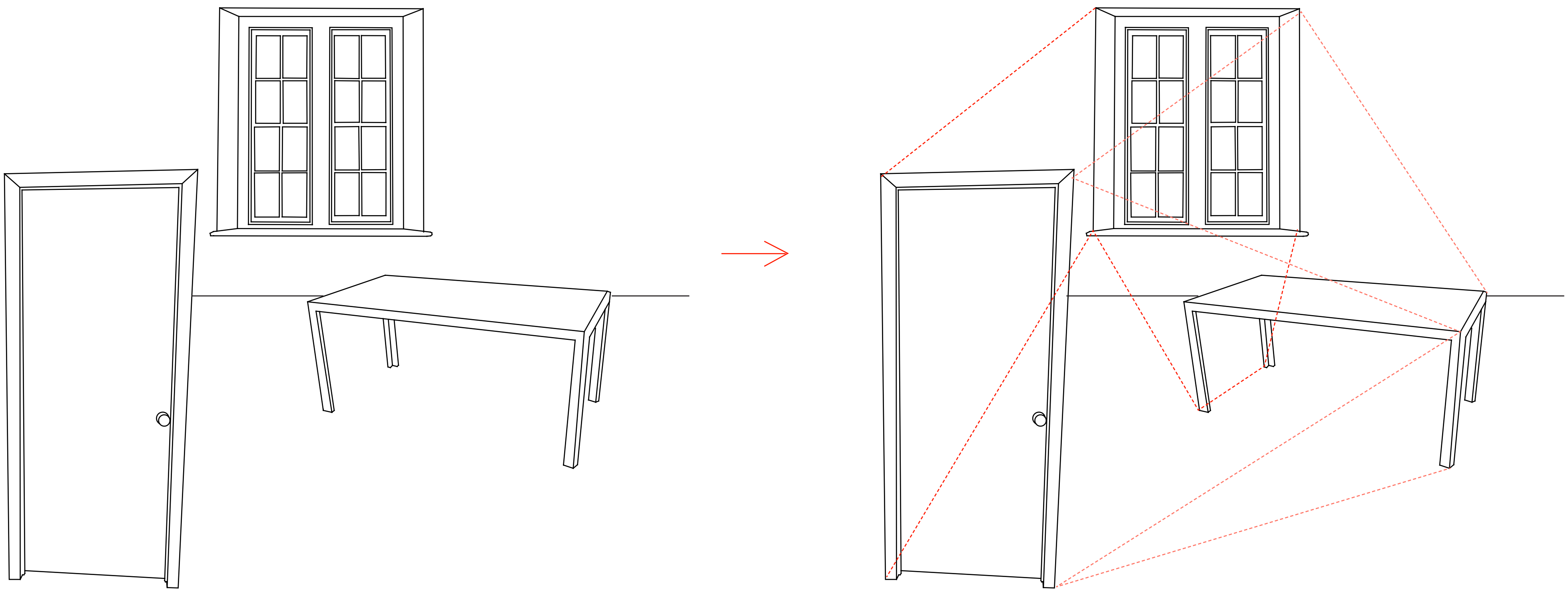
5-1/installation design parameters

right: illustration of the elements required in the fabrication of the insulated framework and skin wherein timber would be used as the framwork and double-layer bubblewrap as the insulating skin. the insulating capacity of bubblewrap is referred to in the appendix.
opposite page: illustration showing the basic principle used in designing the form of the installation. three fixed elements are used as structural anchors, a window, desk and standard interior door. these three elements are connected with triangulated framework to ensure stability. over the framework, bubblewrap is spanned as the insulating skin.



installation design parameters

to design the form for the installation, we had to define some parameters;
· the volume should be warm
· the volume should be large enough for one or two people to sit at a desk
· the volume should contain a desk
· the volume should be naturally lit
· the volume should be effectively insulated using basic principles of how to insulate
from these parameters, we started to work on the form. first we took elements listed in the criteria that could provide structure, like a desk, a window and a door. with these three static, structural elements, we looked at how space could be defined. with these three elements as anchors, a framework was constructed in a connect-the-dots fashion to further define potential volumes that would turn into the enclosed, insulated space. as a temporary installation, the structure should be inexpensive to build, using ready-made and versatile materials. the door and the desk should be standard pieces available at any diy shop. the frame will be made out of timber and the insulating skin will be high-spec, double-layer bubble wrap used in greenhouse construction.

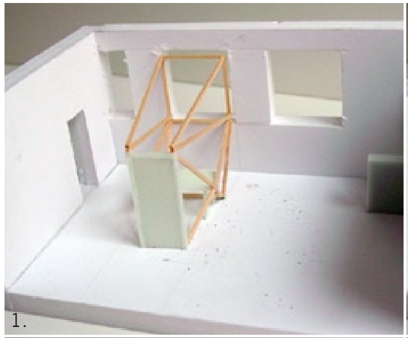


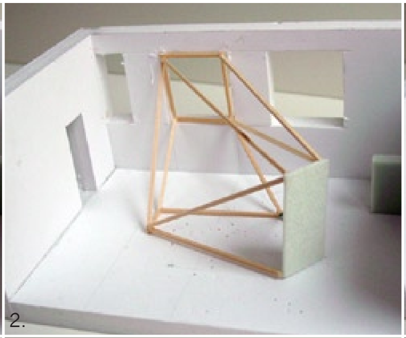
5-2/installation model studies

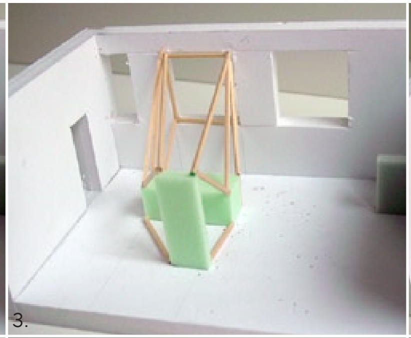
right: photographs of the 17 model variations made to look at various possibilities of defining the installation form. each installation uses, as a starting point, the same window on the south side of the main working space, as the primary structural „anchor.“ with the window as the single fixed element, the door and table and in one case a bookshelf are tested in different positions to see what enclosed volume can be created and what impact the volume has on the use of, and circulation through, the main working space. the models are made at scale 1:50 and situated in a model built of the main working room.

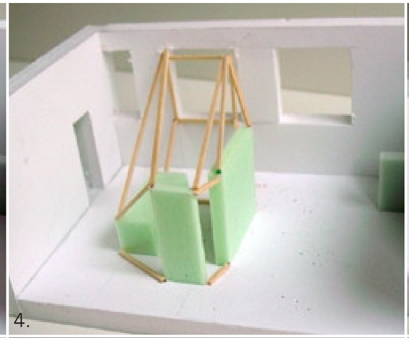
model studies

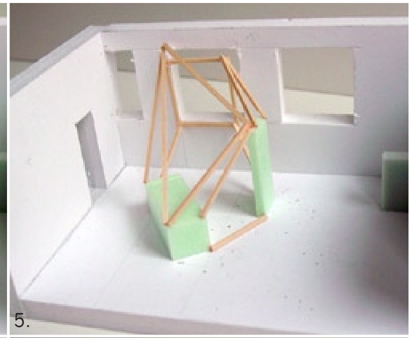
after defining our design objective and parameters, making models of possible variations of the installation volume helped us see 1. what kind of spaces the volumes could offer, and 2. what impact the volumes would have on the surrounding, main working space.

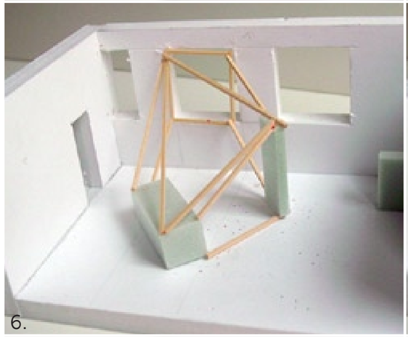

1.

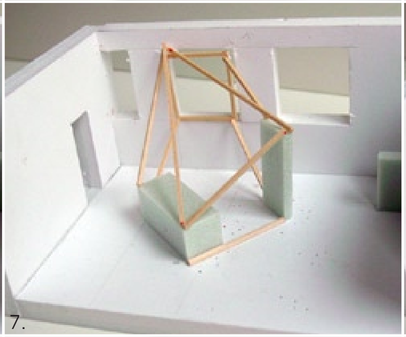

2.

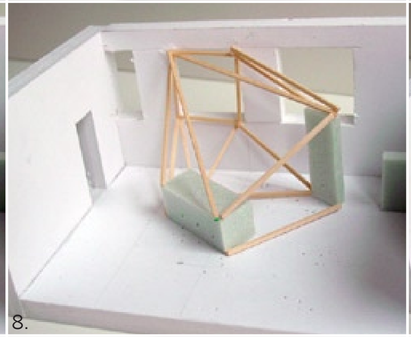

3.

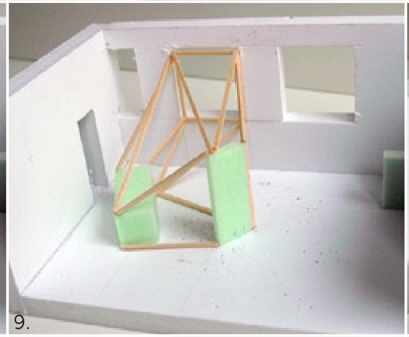

4.

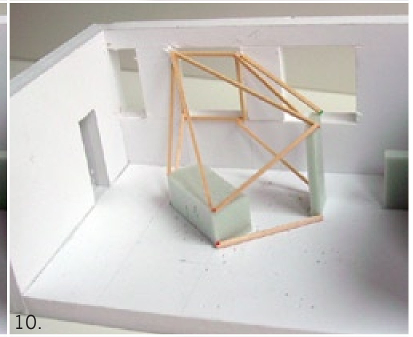

5.

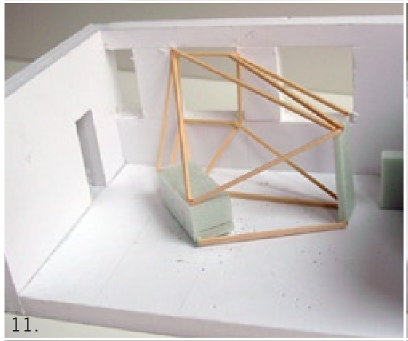

6.

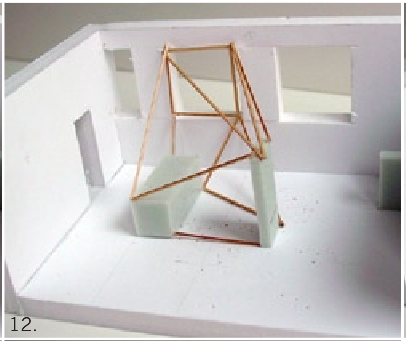

7.

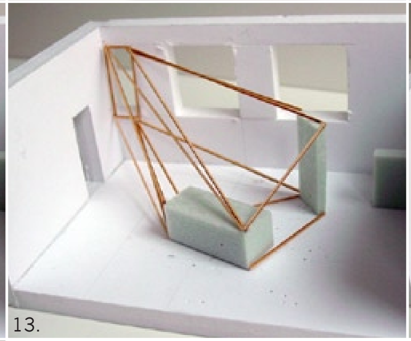

8.

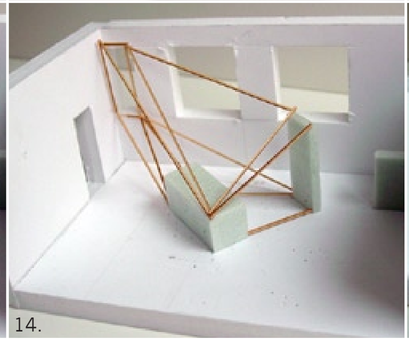

9.

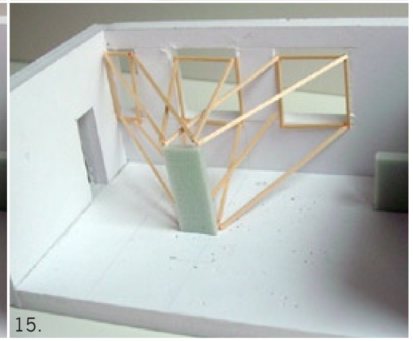

10.

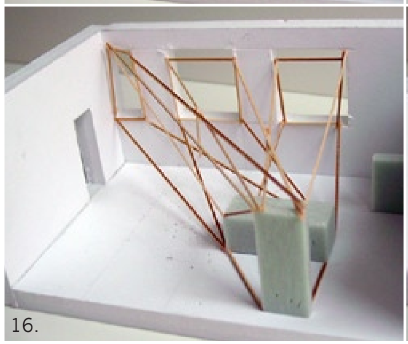

11.

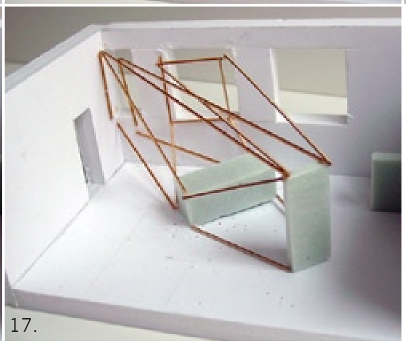

12.


13.


14.


15.

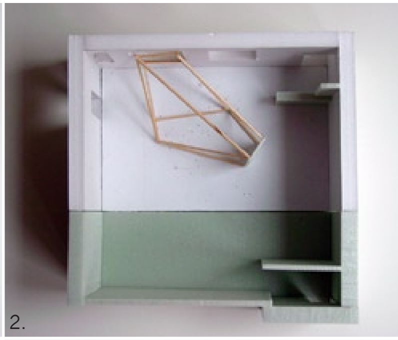

16.

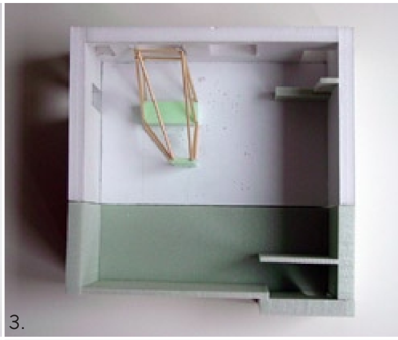

17.

5-2/installation model studies

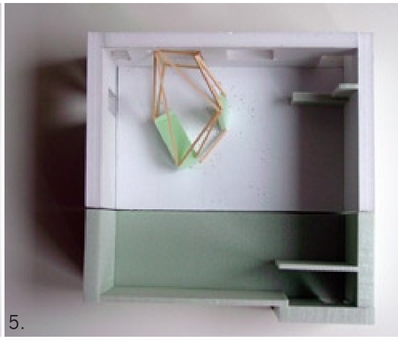
right: photographs of the 17 model variations from above within a model of the main working space.


1.


2.


3.


4.


5.

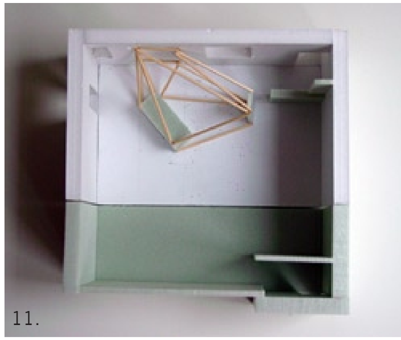

6.

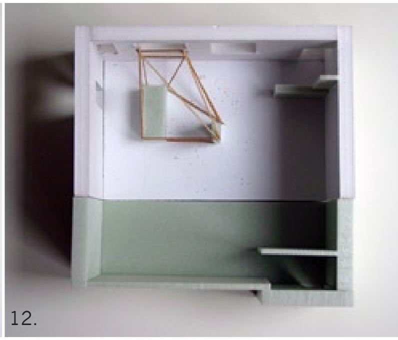

7.

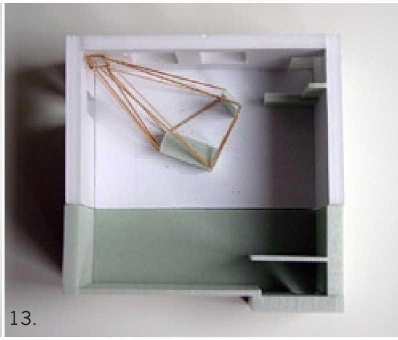

8.

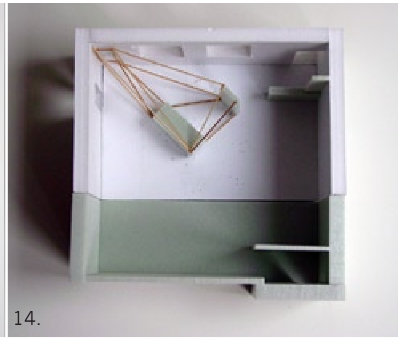

9.

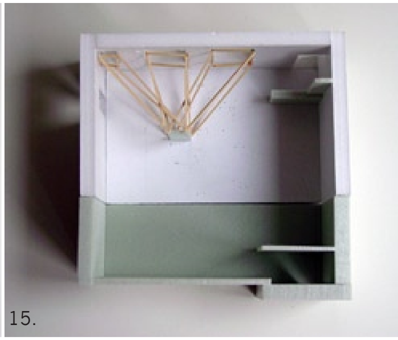

10.

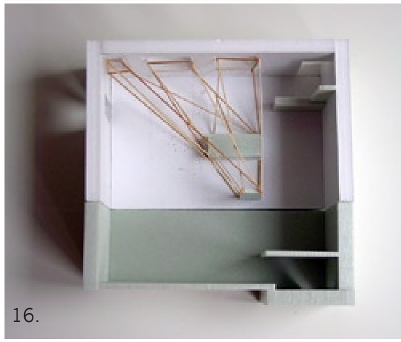

11.

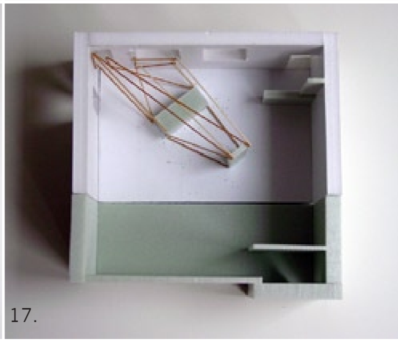

12.


13.


14.


15.


16.


17.

5-3/transparency test

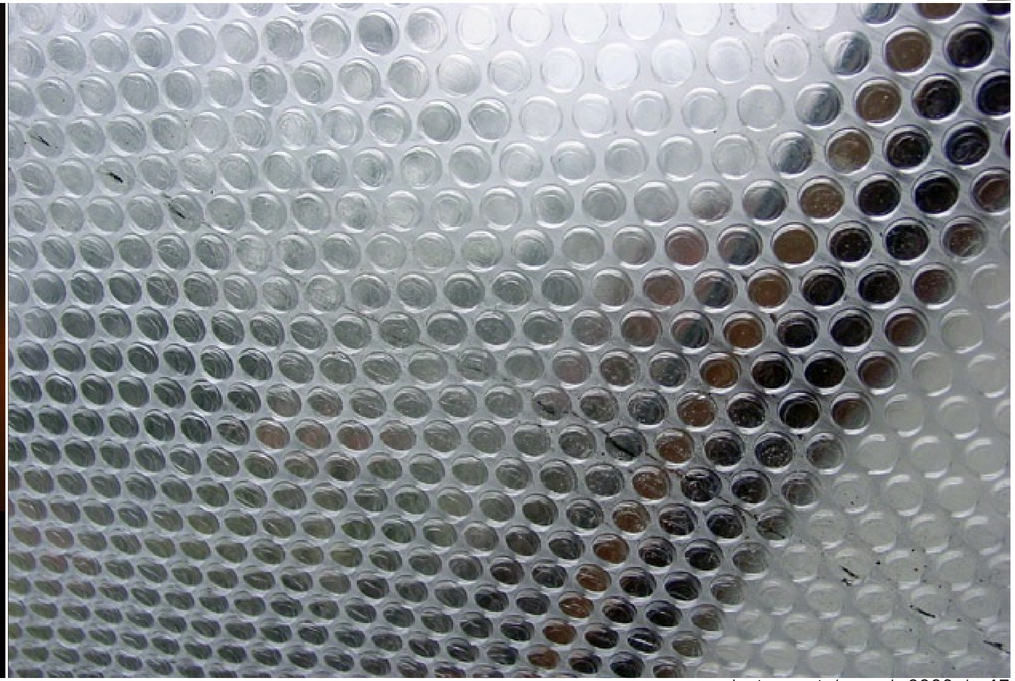
right: photographs of the 1:3 model of a timber frame sheathed with bubblewrap.

transparency test

to get a sense of the light quality in the insulated, bubblewrapped volume, we made a scale panel at about 1:3 to observe the behaviour of the material. the model also served as a test for how to fix the bubblewrap to the individual timber, triangulated frames. using double-sided tape to fix the bubblewrap taut over the frame proved successful.

the test showed that bubblewrap, although obsuring almost all detail, is entirely translucent and doesn‘t dim interior light conditions when placed over a window.



Skip Navigation • Accessibility • Help •

Met Office

Weather advisory issued

Weather | Climate Change | Science | Services | Media | Learning | About us | Search Met Offi

North East England: climate

REGION
North East England GO

This describes the main features of the climate of NE England, the area east of the Pennine watershed from the Scottish border southwards to South Yorkshire. It comprises the counties of Northumberland, Tyne and Wear, Durham, North, West and South Yorkshire and the unitary authorities in the former county of Cleveland.

The topography of the northern half of the area is characterised by generally west to east sloping land, crossed by a number of eastwards-draining rivers including the Tyne, Wear and Tees. Further south, the River Ouse crosses the Vale of York, with tributaries such as the Wharfe, Aire, Nidd and Don. These all have their sources in the Pennines, a chain of rolling gritstone moors rising to well over 600 metres and reaching their highest point at Cross Fell (893 metres). The Pennines form a natural barrier to east-west communications, but there are the Tyne gap linking Carlisle and Newcastle and the Aire gap linking Lancashire and Yorkshire. The other significant area of high ground is the North York Moors, rising to over 400 metres.

The major population and industrial centres tend to be associated with the rivers and include Sheffield and Leeds in industrial South and West Yorkshire, Middlesbrough on Tees-side, Sunderland at the mouth of the Wear and Newcastle-upon-Tyne.

In contrast, the Vale of York is a farming area with cereals and the Yorkshire Dales are important for sheep farming. The Dales, North York Moors and cities such as York and Durham are also important for tourism.

The area's western and eastern boundaries are the main influence on its climate. The high altitude of the Pennines creates an environment that is frequently cool, dull and wet, but the Pennines also cast a 'rain shadow' across the area through the shelter they afford from the prevailing westerly winds. The North Sea exerts a moderating control on coastal districts where, especially, it can keep summer conditions relatively cool.

Printable view

Averages maps: North East England

Maximum temperature
Spring | Summer | Autumn | Winter | Year

Minimum temperature
Spring | Summer | Autumn | Winter | Year

Mean temperature
Spring | Summer | Autumn | Winter | Year

Days of air frost
Spring | Summer | Autumn | Winter | Year

Days of ground frost
Spring | Summer | Autumn | Winter | Year

Rainfall amount
Spring | Summer | Autumn | Winter | Year

Days of rain >=1 mm
Spring | Summer | Autumn | Winter | Year

Days sleet/snow falling
Spring | Summer | Autumn | Winter | Year

Days of snow lying
Spring | Summer | Autumn | Winter | Year

Sunshine
Spring | Summer | Autumn | Winter | Year

Climate: North East England

Temperature | **Sunshine** | Rainfall | Snowfall | Wind | Location map

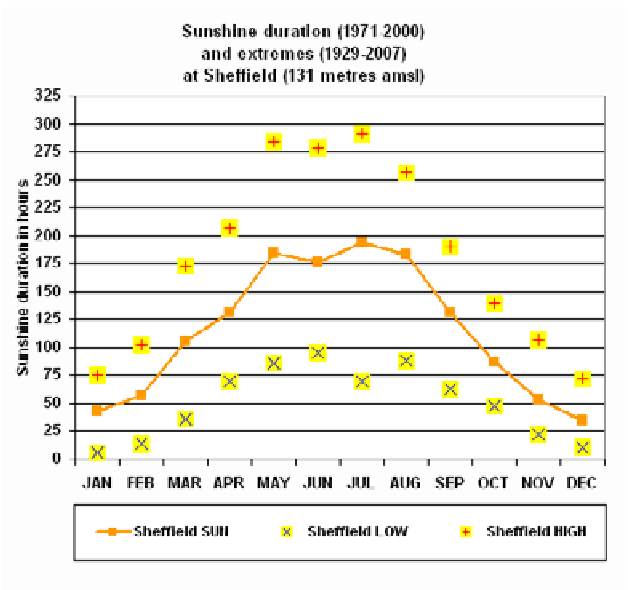
The number of hours of bright sunshine is controlled by the length of day and by cloudiness. The day is shortest in December and longest in June and so in general December is the dullest month and May, June or July the sunniest.

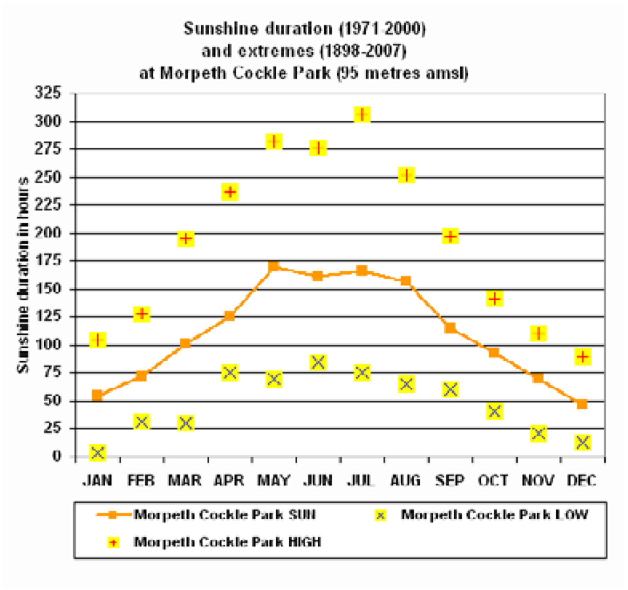
Sunshine duration decreases with increasing altitude, increasing latitude and distance from the coast. Industrial pollution and smoke haze can also reduce sunshine amounts but, because of the Clean Air Act of 1956 and a decline in heavy industry, there has been an increase in sunshine duration over the industrial areas of the north-east.

Overall, coastal sites are the sunniest because of the tendency for convective cloud to develop over inland areas in summer. However, day to day, changes can occur with wind direction and easterly weather often brings dull conditions to coastal districts, especially in spring and early summer when sea fog (known locally as 'fret') occurs.

Average annual sunshine durations over NE England range from almost 1500 hours on the coast to less than 1250 hours in the higher Pennines. These figures compare with values of less than 1100 hours a year in the Shetland Islands to over 1750 hours along the south coast of England and over 1900 hours in the Channel Islands.

The graphs show the average monthly sunshine totals for Sheffield and Morpeth Cockle Park, together with the highest and lowest totals recorded in the stated periods.





The highest known monthly sunshine totals in the region are 313.9 hours at High Mowthorpe in July 2006 and 308.3 hours at Catterick, N Yorkshire in June 1940. The highest UK monthly total is 383.9 hours at Eastbourne in July 1911. In the dullest winter months, less than 20 hours have been recorded - with only 3.6 hours at Morpeth in January 1901.

Boulmer 1971-2000 averages

Boulmer (23 m AMSL)							
	Max Temp	Min Temp	Days of Air Frost	Sunshine	Rainfall	Days of Rainfall >= 1mm	Wind at 10 m
Month	[deg C]	[deg C]	[days]	[hours]	[mm]	[days]	[knots]
Jan	6.7	1.3	8.9	62.6	59.0	11.4	12.0
Feb	6.9	1.5	7.5	79.4	41.4	8.8	11.7
Mar	8.8	2.5	4.8	121.5	46.7	9.5	11.4
Apr	10.1	3.7	2.4	152.7	49.2	8.8	9.6
May	12.5	5.9	0.5	194.1	48.0	9.5	8.3
Jun	15.6	8.6	0.0	193.8	53.4	8.9	7.9
Jul	17.9	10.8	0.0	186.3	47.6	9.0	7.3
Aug	18.1	10.8	0.0	178.9	62.1	9.3	7.6
Sep	15.9	9.1	0.1	135.6	54.7	9.4	8.9
Oct	12.8	6.7	0.5	105.7	58.1	10.8	9.7
Nov	9.3	3.7	3.1	76.5	67.2	11.9	10.8
Dec	7.4	2.2	6.7	53.3	63.6	10.8	11.6
Year	11.9	5.6	34.5	1540.4	651.0	118.1	9.7

Monthly averages			°F | °C
January	Avg Low: **4°**	Avg High: **7°**	Avg precip: **4.58 cm**
February	Avg Low: **4°**	Avg High: **8°**	Avg precip: **4.36 cm**
March	Avg Low: **4°**	Avg High: **10°**	Avg precip: **3.34 cm**
April	Avg Low: **6°**	Avg High: **12°**	Avg precip: **6.39 cm**
May	Avg Low: **8°**	Avg High: **14°**	Avg precip: **5.1 cm**
June	Avg Low: **11°**	Avg High: **17°**	Avg precip: **6.39 cm**
July	Avg Low: **13°**	Avg High: **19°**	Avg precip: **4.71 cm**
August	Avg Low: **13°**	Avg High: **20°**	Avg precip: **6.29 cm**
September	Avg Low: **11°**	Avg High: **17°**	Avg precip: **5.37 cm**
October	Avg Low: **8°**	Avg High: **13°**	Avg precip: **6.39 cm**
November	Avg Low: **6°**	Avg High: **10°**	Avg precip: **6.74 cm**
December	Avg Low: **3°**	Avg High: **7°**	Avg precip: **5.77 cm**

Sunrise and Sunset for U.K. – England – Newcastle upon Tyne – September 2008

Main World Clock | Large World Clock | Capitals | Custom Clock | Weather | **Search**
Meeting Planner | Converter | Fixed, Past, Future Time | **Personal World Clock**
Africa | North America | South America | Asia | Australia/Pacific | Europe

Time/General | Weather | Time zone | DST | **Sun & Moon**

Newcastle upon Tyne, England, United Kingdom

Modify parameters

Show full month: September Year: 2008 Body: Sun Columns: rise/set/noon time Show

Change location

Rising and setting times for the Sun

Date	Sunrise	Sunset	Length of day		Solar noon		
			This day	Difference	Time	Altitude	Distance (10^6 km)
Sep 1, 2008	6:13 AM	7:58 PM	13h 44m 47s	− 4m 21s	1:06 PM	43.1°	150.956
Sep 2, 2008	6:15 AM	7:56 PM	13h 40m 25s	− 4m 22s	1:06 PM	42.7°	150.920
Sep 3, 2008	6:17 AM	7:53 PM	13h 36m 03s	− 4m 22s	1:06 PM	42.3°	150.883
Sep 4, 2008	6:19 AM	7:51 PM	13h 31m 40s	− 4m 22s	1:05 PM	42.0°	150.845
Sep 5, 2008	6:21 AM	7:48 PM	13h 27m 16s	− 4m 23s	1:05 PM	41.6°	150.807
Sep 6, 2008	6:23 AM	7:45 PM	13h 22m 53s	− 4m 23s	1:05 PM	41.2°	150.769
Sep 7, 2008	6:24 AM	7:43 PM	13h 18m 29s	− 4m 23s	1:04 PM	40.9°	150.730
Sep 8, 2008	6:26 AM	7:40 PM	13h 14m 05s	− 4m 24s	1:04 PM	40.5°	150.691
Sep 9, 2008	6:28 AM	7:38 PM	13h 09m 40s	− 4m 24s	1:04 PM	40.1°	150.652
Sep 10, 2008	6:30 AM	7:35 PM	13h 05m 15s	− 4m 24s	1:03 PM	39.7°	150.612
Sep 11, 2008	6:32 AM	7:33 PM	13h 00m 50s	− 4m 24s	1:03 PM	39.3°	150.572
Sep 12, 2008	6:34 AM	7:30 PM	12h 56m 25s	− 4m 25s	1:03 PM	39.0°	150.532
Sep 13, 2008	6:36 AM	7:28 PM	12h 52m 00s	− 4m 25s	1:02 PM	38.6°	150.492
Sep 14, 2008	6:37 AM	7:25 PM	12h 47m 34s	− 4m 25s	1:02 PM	38.2°	150.452
Sep 15, 2008	6:39 AM	7:22 PM	12h 43m 09s	− 4m 25s	1:01 PM	37.8°	150.412
Sep 16, 2008	6:41 AM	7:20 PM	12h 38m 43s	− 4m 25s	1:01 PM	37.4°	150.371
Sep 17, 2008	6:43 AM	7:17 PM	12h 34m 17s	− 4m 25s	1:01 PM	37.0°	150.331
Sep 18, 2008	6:45 AM	7:15 PM	12h 29m 51s	− 4m 26s	1:00 PM	36.7°	150.290
Sep 19, 2008	6:47 AM	7:12 PM	12h 25m 25s	− 4m 26s	1:00 PM	36.3°	150.250
Sep 20, 2008	6:49 AM	7:10 PM	12h 20m 59s	− 4m 26s	1:00 PM	35.9°	150.209
Sep 21, 2008	6:50 AM	7:07 PM	12h 16m 32s	− 4m 26s	12:59 PM	35.5°	150.169
Sep 22, 2008	6:52 AM	7:04 PM	12h 12m 06s	− 4m 26s	12:59 PM	35.1°	150.128
Sep 23, 2008	6:54 AM	7:02 PM	12h 07m 39s	− 4m 26s	12:59 PM	34.7°	150.087
Sep 24, 2008	6:56 AM	6:59 PM	12h 03m 12s	− 4m 26s	12:58 PM	34.3°	150.046

Sunrise and Sunset for U.K. – England – Newcastle upon Tyne – December 2008

Main World Clock | Large World Clock | Capitals | Custom Clock | Weather | **Search**
Meeting Planner | Converter | Fixed, Past, Future Time | **Personal World Clock**
Africa | North America | South America | Asia | Australia/Pacific | Europe

Time/General | Weather | Time zone | DST | **Sun & Moon**

Newcastle upon Tyne, England, United Kingdom

Modify parameters

Show full month: December Year: 2008 Body: Sun Columns: rise/set/noon time Show

Change location

Rising and setting times for the Sun

Date	Sunrise	Sunset	Length of day		Solar noon		
			This day	Difference	Time	Altitude	Distance (10^6 km)
Dec 1, 2008	8:08 AM	3:43 PM	7h 35m 08s	− 2m 25s	11:56 AM	13.2°	147.499
Dec 2, 2008	8:09 AM	3:42 PM	7h 32m 49s	− 2m 19s	11:56 AM	13.0°	147.475
Dec 3, 2008	8:11 AM	3:42 PM	7h 30m 35s	− 2m 13s	11:56 AM	12.9°	147.451
Dec 4, 2008	8:12 AM	3:41 PM	7h 28m 28s	− 2m 07s	11:57 AM	12.8°	147.428
Dec 5, 2008	8:14 AM	3:40 PM	7h 26m 27s	− 2m 01s	11:57 AM	12.6°	147.406
Dec 6, 2008	8:15 AM	3:40 PM	7h 24m 32s	− 1m 54s	11:58 AM	12.5°	147.384
Dec 7, 2008	8:17 AM	3:39 PM	7h 22m 44s	− 1m 47s	11:58 AM	12.4°	147.363
Dec 8, 2008	8:18 AM	3:39 PM	7h 21m 03s	− 1m 41s	11:58 AM	12.3°	147.343
Dec 9, 2008	8:19 AM	3:39 PM	7h 19m 29s	− 1m 34s	11:59 AM	12.2°	147.323
Dec 10, 2008	8:20 AM	3:38 PM	7h 18m 02s	− 1m 27s	11:59 AM	12.1°	147.305
Dec 11, 2008	8:21 AM	3:38 PM	7h 16m 42s	− 1m 19s	12:00 Noon	12.0°	147.287
Dec 12, 2008	8:22 AM	3:38 PM	7h 15m 29s	− 1m 13s	12:00 Noon	12.0°	147.270
Dec 13, 2008	8:24 AM	3:38 PM	7h 14m 23s	− 1m 05s	12:01 PM	11.9°	147.254
Dec 14, 2008	8:24 AM	3:38 PM	7h 13m 25s	− 58s	12:01 PM	11.8°	147.239
Dec 15, 2008	8:25 AM	3:38 PM	7h 12m 35s	− 50s	12:02 PM	11.8°	147.225
Dec 16, 2008	8:26 AM	3:38 PM	7h 11m 52s	− 42s	12:02 PM	11.8°	147.212
Dec 17, 2008	8:27 AM	3:38 PM	7h 11m 17s	− 35s	12:03 PM	11.7°	147.200
Dec 18, 2008	8:28 AM	3:39 PM	7h 10m 50s	− 27s	12:03 PM	11.7°	147.188
Dec 19, 2008	8:28 AM	3:39 PM	7h 10m 30s	− 19s	12:04 PM	11.7°	147.178
Dec 20, 2008	8:29 AM	3:39 PM	7h 10m 18s	− 11s	12:04 PM	11.7°	147.168
Dec 21, 2008	8:30 AM	3:40 PM	7h 10m 14s	− 03s	12:05 PM	11.7°	147.158
Dec 22, 2008	8:30 AM	3:40 PM	7h 10m 18s	+ 03s	12:05 PM	11.7°	147.150
Dec 23, 2008	8:30 AM	3:41 PM	7h 10m 30s	+ 11s	12:06 PM	11.7°	147.142
Dec 24, 2008	8:31 AM	3:42 PM	7h 10m 50s	+ 19s	12:06 PM	11.7°	147.135

Sunrise and Sunset for U.K. – England – Newcastle upon Tyne – March 2008

Main World Clock | Large World Clock | Capitals | Custom Clock | Weather | **Search**
Meeting Planner | Converter | Fixed, Past, Future Time | **Personal World Clock**
Africa | North America | South America | Asia | Australia/Pacific | Europe

Time/General | Weather | Time zone | DST | **Sun & Moon**

Newcastle upon Tyne, England, United Kingdom

Modify parameters

Show full month: March Year: 2008 Body: Sun Columns: rise/set/noon time Show

Change location

Rising and setting times for the Sun

Date	Sunrise	Sunset	Length of day		Solar noon		
			This day	Difference	Time	Altitude	Distance (10^6 km)
Mar 1, 2008	6:56 AM	5:43 PM	10h 47m 09s	+ 4m 27s	12:19 PM	27.7°	148.250
Mar 2, 2008	6:53 AM	5:45 PM	10h 51m 37s	+ 4m 28s	12:18 PM	28.1°	148.288
Mar 3, 2008	6:51 AM	5:47 PM	10h 56m 06s	+ 4m 28s	12:18 PM	28.5°	148.326
Mar 4, 2008	6:48 AM	5:49 PM	11h 00m 34s	+ 4m 28s	12:18 PM	28.9°	148.364
Mar 5, 2008	6:46 AM	5:51 PM	11h 05m 04s	+ 4m 29s	12:18 PM	29.3°	148.402
Mar 6, 2008	6:43 AM	5:53 PM	11h 09m 33s	+ 4m 29s	12:18 PM	29.6°	148.441
Mar 7, 2008	6:41 AM	5:55 PM	11h 14m 03s	+ 4m 30s	12:17 PM	30.0°	148.479
Mar 8, 2008	6:38 AM	5:57 PM	11h 18m 33s	+ 4m 29s	12:17 PM	30.4°	148.518
Mar 9, 2008	6:36 AM	5:59 PM	11h 23m 03s	+ 4m 30s	12:17 PM	30.8°	148.557
Mar 10, 2008	6:33 AM	6:01 PM	11h 27m 33s	+ 4m 30s	12:17 PM	31.2°	148.596
Mar 11, 2008	6:31 AM	6:03 PM	11h 32m 03s	+ 4m 30s	12:16 PM	31.6°	148.635
Mar 12, 2008	6:28 AM	6:05 PM	11h 36m 33s	+ 4m 30s	12:16 PM	32.0°	148.674
Mar 13, 2008	6:26 AM	6:07 PM	11h 41m 04s	+ 4m 30s	12:16 PM	32.4°	148.714
Mar 14, 2008	6:23 AM	6:09 PM	11h 45m 35s	+ 4m 30s	12:16 PM	32.8°	148.753
Mar 15, 2008	6:21 AM	6:11 PM	11h 50m 05s	+ 4m 30s	12:15 PM	33.2°	148.793
Mar 16, 2008	6:18 AM	6:13 PM	11h 54m 36s	+ 4m 30s	12:15 PM	33.6°	148.833
Mar 17, 2008	6:16 AM	6:15 PM	11h 59m 06s	+ 4m 30s	12:15 PM	34.0°	148.874
Mar 18, 2008	6:13 AM	6:17 PM	12h 03m 37s	+ 4m 30s	12:14 PM	34.4°	148.915
Mar 19, 2008	6:11 AM	6:19 PM	12h 08m 07s	+ 4m 30s	12:14 PM	34.8°	148.956
Mar 20, 2008	6:08 AM	6:21 PM	12h 12m 38s	+ 4m 30s	12:14 PM	35.1°	148.997
Mar 21, 2008	6:06 AM	6:23 PM	12h 17m 08s	+ 4m 30s	12:14 PM	35.5°	149.039
Mar 22, 2008	6:03 AM	6:25 PM	12h 21m 39s	+ 4m 30s	12:13 PM	35.9°	149.081
Mar 23, 2008	6:00 AM	6:27 PM	12h 26m 09s	+ 4m 30s	12:13 PM	36.3°	149.124
Mar 24, 2008	5:58 AM	6:29 PM	12h 30m 39s	+ 4m 30s	12:13 PM	36.7°	149.167

Sunrise and Sunset for U.K. – England – Newcastle upon Tyne – June 2008

Main World Clock | Large World Clock | Capitals | Custom Clock | Weather | **Search**
Meeting Planner | Converter | Fixed, Past, Future Time | **Personal World Clock**
Africa | North America | South America | Asia | Australia/Pacific | Europe

Time/General | Weather | Time zone | DST | **Sun & Moon**

Newcastle upon Tyne, England, United Kingdom

Modify parameters

Show full month: June Year: 2008 Body: Sun Columns: rise/set/noon time Show

Change location

Rising and setting times for the Sun

Date	Sunrise	Sunset	Length of day		Solar noon		
			This day	Difference	Time	Altitude	Distance (10^6 km)
Jun 1, 2008	4:35 AM	9:35 PM	16h 59m 39s	+ 2m 16s	1:04 PM	57.2°	151.714
Jun 2, 2008	4:34 AM	9:36 PM	17h 01m 49s	+ 2m 10s	1:04 PM	57.3°	151.737
Jun 3, 2008	4:33 AM	9:37 PM	17h 03m 54s	+ 2m 04s	1:05 PM	57.4°	151.759
Jun 4, 2008	4:32 AM	9:38 PM	17h 05m 53s	+ 1m 58s	1:05 PM	57.5°	151.780
Jun 5, 2008	4:31 AM	9:39 PM	17h 07m 45s	+ 1m 52s	1:05 PM	57.6°	151.800
Jun 6, 2008	4:31 AM	9:40 PM	17h 09m 31s	+ 1m 46s	1:05 PM	57.8°	151.819
Jun 7, 2008	4:30 AM	9:41 PM	17h 11m 11s	+ 1m 39s	1:05 PM	57.8°	151.838
Jun 8, 2008	4:29 AM	9:42 PM	17h 12m 44s	+ 1m 32s	1:06 PM	57.9°	151.855
Jun 9, 2008	4:29 AM	9:43 PM	17h 14m 10s	+ 1m 26s	1:06 PM	58.0°	151.872
Jun 10, 2008	4:28 AM	9:44 PM	17h 15m 29s	+ 1m 19s	1:06 PM	58.1°	151.889
Jun 11, 2008	4:28 AM	9:45 PM	17h 16m 42s	+ 1m 12s	1:06 PM	58.2°	151.904
Jun 12, 2008	4:28 AM	9:45 PM	17h 17m 47s	+ 1m 05s	1:06 PM	58.2°	151.919
Jun 13, 2008	4:27 AM	9:46 PM	17h 18m 46s	+ 58s	1:07 PM	58.3°	151.933
Jun 14, 2008	4:27 AM	9:47 PM	17h 19m 37s	+ 51s	1:07 PM	58.3°	151.947
Jun 15, 2008	4:27 AM	9:47 PM	17h 20m 21s	+ 44s	1:07 PM	58.4°	151.960
Jun 16, 2008	4:27 AM	9:48 PM	17h 20m 58s	+ 36s	1:07 PM	58.4°	151.973
Jun 17, 2008	4:27 AM	9:48 PM	17h 21m 27s	+ 29s	1:07 PM	58.4°	151.985
Jun 18, 2008	4:27 AM	9:49 PM	17h 21m 50s	+ 22s	1:08 PM	58.4°	151.997
Jun 19, 2008	4:27 AM	9:49 PM	17h 22m 04s	+ 14s	1:08 PM	58.5°	152.008
Jun 20, 2008	4:27 AM	9:49 PM	17h 22m 12s	+ 07s	1:08 PM	58.5°	152.018
Jun 21, 2008	4:27 AM	9:49 PM	17h 22m 12s	< 1s	1:08 PM	58.5°	152.029
Jun 22, 2008	4:27 AM	9:50 PM	17h 22m 04s	− 07s	1:09 PM	58.5°	152.038
Jun 23, 2008	4:28 AM	9:50 PM	17h 21m 49s	− 14s	1:09 PM	58.4°	152.047
Jun 24, 2008	4:28 AM	9:50 PM	17h 21m 27s	− 22s	1:09 PM	58.4°	152.056

BUILD IT SOLAR

Search

The Renewable Energy site for Do-It-Yourselfers

Home | Getting Started | Projects Hundreds of DIY Projects | References Design Information | "Half" Program Cut Energy Use in Half | Experimental | Site Map

Bubble Wrap Window Insulation

I've used bubble wrap on windows for ~~two~~ three years now, and I'm amazed how quick and easy it is. This year, we are even covering the windows in the guest room -- we just take the bubble wrap down when guests come, and put it back up when they leave -- 15 seconds a window.

This is a simple technique for insulating windows with bubble wrap packing material. Bubble wrap is often used to insulate greenhouse windows in the winter, but it also seems to work fine for windows in the house. You can use it with or without regular or insulating window shades. It also works for windows of irregular shape, which can be difficult to find insulating shades for.

Lots of other cost effective window insulating ideas ....

The view through the bubble wrapped window is fuzzy, so don't use it on windows where you need a clear view. But, it does let plenty of light through.

> Suggestion from Pat:
> *"Bubble wrap small bubble and large can be had for free by contacting furniture retailers or rental shops. They throw it away by the tons!"*
> *I've heard the same thing for places that sell canoes.*

I like the medium to large size bubbles. The larger ones appear (from surface temperature measurements) to insulate a little better, and you still get a nice artistic effect looking out of them. The small bubble warp totally obscures the view, but you still get light.

Installation

- Cut the bubble wrap to the size of the window pane with scissors.
- Spray a film of water on the window using a spray bottle.
- Apply the bubble wrap while the window is still wet and press it into place.
- The bubble side goes toward the glass.
- To remove the bubble wrap, just pull it off starting from a corner. You can save it and use it for several years. It does not leave a mess or stains on the window glass.

If you have trouble with the bubble wrap separating from the window when the film dries, you can try adding a little Glycerin to the water, but this probably won't be necessary.

The wrap can be installed in the fall, and removed in the spring. Judging by how mine looks after a year, it may last quite a while.

When you take the bubble wrap down, put a small number in on the upper right corner of each piece of bubble wrap, and write down which window that number goes with on a piece of paper. Save the paper for the installation next fall. This tells you instantly where each sheet goes, and which way its oriented.

The bubble wrap that I used is from Charlie's Greenhouse in Seattle. They claim that it is made for greenhouse service, and will stand up to the sun longer. I suspect that ordinary packing bubble wrap may do about as well (someone could do a test, and let us know). When buying bubble wrap, look for a company that specializes in packing materials. Places like UPS will sell you bubble wrap, but the prices are high.
(2/27/07 -- see note below on reported bubble wrap life)

Installation:

Click pictures to enlarge:

Spray water on glass with bubble side toward glass

Smooth bubble wrap out so that water contact holds it in place.

Here are the application instructions that Charlie's Greenhouse provided.

Double Bubble (added Nov 15, 2007)

I thought it might be worth a try to see if two layers of bubble wrap might be used.
This may be going a bit far, but it does seem to work.

I applied a 2nd layer of bubble wrap over the first layer in exactly the same way as the first layer was applied to the window glass. That is, spray the first layer of bubble wrap with water mist, and while its still wet apply the 2nd layer of bubble wrap to it and smooth it out.
For both layers, the bubble side face the glass.
It has been a couple days since I did this, and it is staying in place OK -- not sure if it will stay up with the added weight in the long term or not.

The two layers of bubble wrap fuzzy the view a bit more than one layer, but it still seems to transmit quite a bit of light.
The surface temperature on the 2nd layer is higher than the surface temperature on the first layer, so it is adding some insulation value.

Click on images to enlarge.

View through single and doubled bubble wrap.
Blue tape is to take temperature readings on with the IR thermometer.

Payoff

The bubble wrap has a short payback in cold climates. About 2 months for single glazed windows, and half a heating season for double glazed widows. Details on payback:

For an 7000 deg-day climate (northern US), and single glazed windows, the bubble wrap increases the R value from about R1 to about R2. This cuts the heat loss from the window in half.
Heat losses with and without bubble wrap for 1 sqft of window are:

Heat loss w/o wrap = (7000 deg-day)(1 ft^2) (24 hr/day) / (1 ft^2-F/BTU) = 168K BTU per season

Heat loss with wrap = (7000 deg-day)(1 ft^2) (24 hr/day) / (2 ft^2-F/BTU) = 88K BTU per season

If you are heating with natural gas at $1.50 per therm (100 CF) in an 80% efficient furnace, then the saving for 1 sqft of wrap for the season is:

Saving per sqft = ($1.50)(168K - 88K)/(100K*0.8) = $1.65 per season per sqft of window

The bubble wrap cost about $0.30 per sqft, so the payback period is about 2 months -- not to bad!

If you repeat the numbers above for double glazed windows, the saving is $0.60 per sqft per season, and the payback period is a about one half heating season.

If you use a more expensive fuel like propane, fuel oil, or electricity, the savings will be correspondingly more.

Performance:

Here is my Rough Performance Test

Some interesting work done by students at LIU on insulation value of packing materials. Probably not exactly applicable to windows, but interesting.

Bubble Wrap Life:

Doug reports that bubble wrap that he installed in 1999 has about had it. He thinks the life is around 5 to 7 years. In his application, the bubble wrap stays up year round.
He reports that at the end of its life, it tends to stick to the glass, so replacing it before this happens might save some cleanup work.
The bubble wrap he is using was intended for packaging, so this still leaves open the question of whether the bubble wrap intended for greenhouses will last longer. The greenhouse bubble wrap we installed is on its third winter, and is still doing fine.

2/27/07, 4/28/07, 9/4/07, Nov 18, 2007