

# Winter warmer

5th Studio's retrofit of Trinity College's New Court ups the temperature without raising heritage hackles

Words: Eleanor Young Photographs: Tim Soar

Standing in New Court Cambridge, the honey coloured walls enclosing you and the grand chestnut tree rising up in the centre, you can feel the weight of history, generations of Cambridge undergraduates, stretching back. Founded in 1546, Trinity is one of the richest Oxbridge colleges. The flow of bright young things continues but as these buildings get older, the expectations of undergraduates and the world around them increase. When these grade 1 William Wilkins buildings were done up in the seventies they didn't meet the then building regulations. The problem of pumping up the heating only to have stu-

dents leaving windows open was perennial. Meanwhile facilities like kitchens – 'gypts' in Cambridge language – and bath-rooms were squeezed into some most inappropriate places, such as at the top of stair wells. It was obviously time for a reworking.

The college naturally looked first to heritage architects, but then approached 5th Studio which had taken on its sixties Wolfson Building and with clear, deft moves and some extra glass, had lightened the character of the occasionally gloomy Architects Co-Partnership building. 'We thought long and hard about taking on New Court,' says 5th Studio

The challenge was not just in retrofitting the building but in persuading English Heritage that it could be done

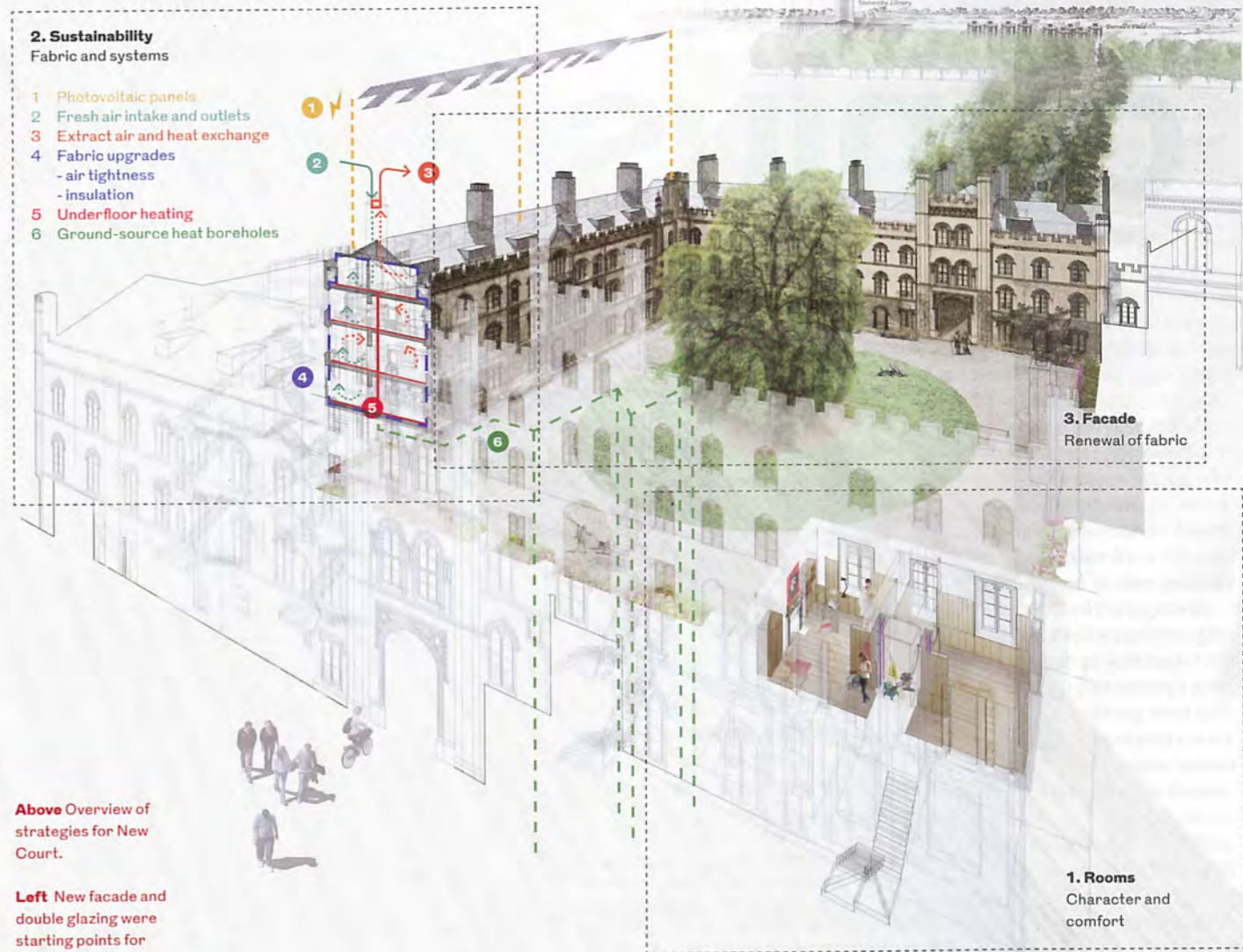
director Oliver Smith. 'It was a fascinating challenge.' What caught the firm's imagination was not an opportunity to add something eye catching (it was clear such a move would make everything far more complicated) but the chance to untangle the building physics and design it to perform in a way that might be thought impossible for heritage buildings.

The challenge was not just in retrofitting the building but in persuading English Heritage that it could be done – and overcoming a problem common in historic buildings, in which solid insulated walls create cold damp areas where mould can flourish. An expert



## 2. Sustainability Fabric and systems

- 1 Photovoltaic panels
- 2 Fresh air intake and outlets
- 3 Extract air and heat exchange
- 4 Fabric upgrades  
- air tightness  
- insulation
- 5 Underfloor heating
- 6 Ground-source heat boreholes



**Above** Overview of strategies for New Court.

**Left** New facade and double glazing were starting points for retrofitting New Court.

team was assembled: including environmental engineer Max Fordham, which had recently run a knowledge transfer partnership developing and testing moisture modelling software; Archimetrics, which has led on research for SPAB into retrofitting older buildings; and some of those who forged a path on performance and sustainability, Bill Bordass, Bill Gething and Bill Watts. Smith says of that early period: 'For a few years it was almost a research project.'

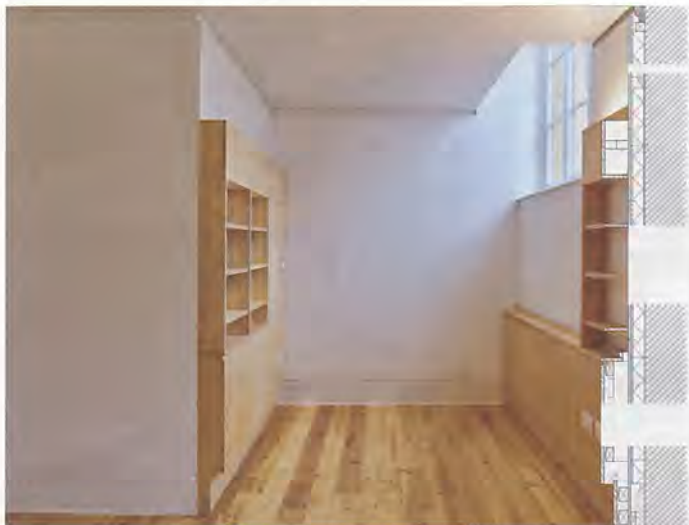
The design started with modelling. No great surprises there. But the standard hygrothermal model, WUFI, was written with German standards as the norm. Not British – never mind 18th century walls and staircases. To ensure it was getting the most ac-

curate predictions Archimetrics installed monitoring equipment to check temperature and relative humidity levels. This and data from an on-site weather station fed into the model to calibrate it for this building. 5th Studio needed to prove to itself that the model's predictions would be accurate. And once the assumptions on the weather settings had been changed the model started to prove itself in parallel with the live measurements. With a tool it could rely on, the strategy could be explored in more detail. The heat had to be kept inside but the team could not allow water vapour to be trapped anywhere. The building had to be breathable and insulated, but not so much that it retained moisture as well as heat. At the same time the designs and perfor-

mance had to convince English Heritage and ensure the plans secured listed building consent. The model, checked by BRE, was excellent in proving the larger case of the strategy. But individual elements also had to be justified. It took three years to win approval.

The first big move was to ensure that the external layer could breathe. The cracking and unreliable concrete render was already slated for renewal. 5th Studio decided to replace it with layers of lime, the oft-cited wonder product on heritage buildings for its breathability and its chemistry, which is distinctly unfriendly to mould growth. This was not a hard sell. With the facade's stripped back colour scheme (white window frames and grey transoms both renewed in black) it is





**Above** Drylining the external walls from the inside – the panel conceals cabling.

not difficult to see why. It looks natural here.

Then the building had to up its U-value. The model had highlighted a better than expected performance from the existing building with its walls an unpredictable mixture, thick and thin, some rubble with concrete render onto the court, stone facing the river and brick on another facade. 5th Studio could have specified eight different depths of insulation, one to deal with each condition, but the risk of a mistake on site and resulting moisture issues was too high. 'No-one had dry lined a grade 1 listed building before,' says Smith. They chose a single 72mm wall insulation thickness, but where to put it? It had to go inside the student rooms. After hundreds of maquettes the practice set a datum below the cornice to protect the sense of the original space in the rooms – and tried it out on a full scale mock up. And there was more: vented panels concealing cabling, lighting and services to avoid chasing new services into the historic fabric every time there was a change in wiring. And the windows.

Windows are always sensitive. In 2011 English Heritage published Energy Efficiency and Historic Buildings, which makes much mention of heavy curtains and shutters in reducing heat loss from windows. Secondary glazing is also recommended while advice on installing double glazing is supplied with a heap of caveats. It was certainly not English Heritage's first choice for New Court. Nor was it 5th Studio's, whose early prefer-

#### IN NUMBERS

**5,340m<sup>2</sup>**

gross internal area

**£20m**

gross cost

**£119,000**

cost per room

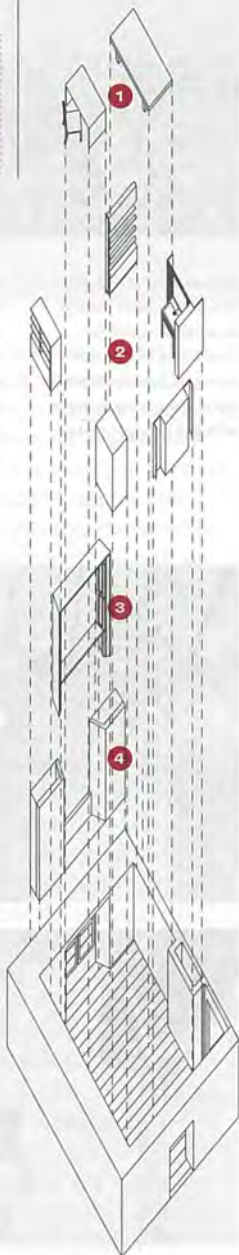
**£3,745**

cost per m<sup>2</sup>

#### Axonometric

- 1 Loose furniture
- 2 Fitted furniture
- 3 Window cases
- 4 Insulation

**Suppliers**  
Client Trinity College  
Cambridge  
**Architect** 5th Studio  
Darkroom  
**Planning and heritage consultant** Beacon  
planning  
**Project manager**  
Bidwells  
MEP Max Fordham  
**Building physics modelling** Bill Watts,  
James Freeman  
**Modelling** Carl Brooks  
**Acoustics** Anthony  
Chilton  
**Structural engineering**  
Cambridge  
Architectural Research  
**Building physics monitoring**  
ArchiMetrics  
CDMC Gleeds  
**Cost consultancy (from Stage G)** Richard Utting  
Associates  
**Archaeologist**  
Cambridge Archaeology  
Unit



ence was for new triple-glazed windows. But repairing and refurbishing the existing windows with an extra layer of glass – and repairing extant timber shutters – was most compelling. To overcome concerns about quite how unpleasantly obvious that double layer would look, the team installed one of the new units and EH officers were invited to spot the difference. They couldn't – without close examination.

English Heritage's officers were concerned that the project was destroying the interiors. Though distinctly lacking twiddly bits and having been messed about with over the years, they were precious. 5th Studio and its consultant Beacon Planning argued that the building's main heritage asset was keeping it in use for its original purpose. And they used what was then the new National Planning Policy Framework's argument for other public benefits to offset heritage issues. Cambridge City Council gave consent despite a nine page letter of objection from EH, and then referred this decision to then minister Eric Pickles, who confirmed the approval.

Of course, the build itself wasn't straightforward. Techniques such as waiting for the layers of lime plaster to dry, ensuring a good level of air tightness, and working with lime paring rather than taping to seal joints, were new to the contractors, says Smith, which had to bring on more 'black hats', or managers, than they had expected. And 5th Studio came in every day from its Cambridge office. But walking around the college today, with the lime render dry, the glass of the windows rippling slightly (even where new), and the MVHR drawing out moisture from showers and kitchens in logical, safe, places, it is hard to see why anyone would object to these changes. The college of course footed the £20 million bill but it has the most to gain from a trouble-free building and the significant reduction in running costs. Looking out of the reconditioned windows, shutters alongside, cushioned by invisible insulation, pleasure in the old building seems very clear. And it is predicted to save 75% on heating. Will it all perform at the predicted level? The computer says yes and the monitoring will stay in place just to check. Happily the first readings seem to show that everything is in order. And even if students still prefer to inhabit their rooms at 25° in T-shirts, then at least when they open their windows the heating is now designed to turn off. ●