



Stirling's Arrows

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The ins and outs of James Stirling's career – and private life – are well known: his studies at the school of architecture in Liverpool; his initial immersion into the London architectural scene through an AA exhibition in the early 1950s;¹ his first jobs in London, with the London County Council and then Lyons, Israel & Ellis; his participation in the ground-breaking exhibition 'This Is Tomorrow' in 1956; his membership of CIAM; and, not least, his work as an independent architect, which spanned almost 40 years, from 1956 until his death in 1992.² His oeuvre, from student projects to those completed posthumously, has been collected, discussed, examined and exhibited down to the very last detail.³

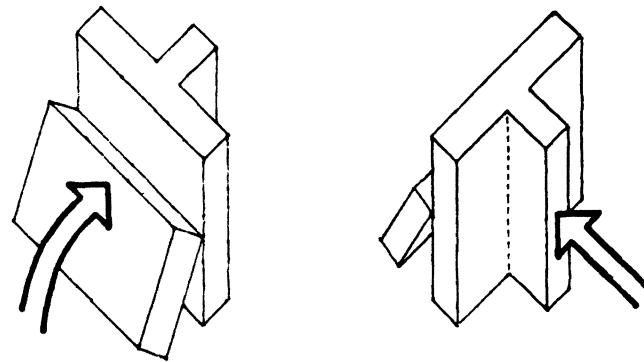
From the very start – and not without Stirling's own active encouragement – the architectural press kept track of his projects, buildings and competition entries, from the first houses in London to his international breakthrough with the large university complexes designed in the 1960s, and, later, the pioneering projects of the 1970s. In addition to the seemingly continuous coverage his work enjoyed in specialist journals and the daily press, many of his buildings were discussed even more thoroughly in dedicated monographs. Stirling himself would pursue this obsession for the modernity of documentation and the postmodernity of celebrity by publishing his own work in his famous 'Black Book' and later 'White Book', heavily illustrated tomes directly referencing the format, design and rhetoric of Le Corbusier's *Oeuvre Complète*. Stirling, one might say, personifies the success of the attention-seeking economy so characteristic of postwar architecture, which engendered the mediatization not only of architecture and its image, but also of the discipline's leading exponents.⁴ It is no coincidence that he was the third ever Pritzker Prize winner in 1981, coming hot on the heels of Philip Johnson and Luis Barragán.

Stirling's architectural works are generally discussed in terms of their distinct phases, and therefore read like a kind of chronological guide to postwar form or style. The first phase – his student projects in particular, except for the handful he designed after a sojourn to the US, which attest more strongly to the influence of Frank Lloyd Wright – is usually defined as Corbusian. The second phase – comprising most of his work in the 1950s – could consequently be considered as updated-Corbusian or even brutalist, the former because, as in Ham Common, certain motifs are oriented towards the postwar architecture of Le Corbusier, the latter because the sheer plasticity and highly visible structure of these projects, as well as their use of 'as found' materials, epitomised a similar strain in the brutalist British avant-garde, above

Stirling's Arrows

Laurent Stalder & Moritz Gleich

all, in the work of Alison and Peter Smithson. For their part, the large buildings which followed at the universities of Leicester, Cambridge and Oxford – the red trilogy – tend to be attributed to a more constructivist bent, while subsequent projects, such as the residential district of New Town in Runcorn or the Olivetti Training Centre in Haslemere, could be seen to derive from an English pop tradition, albeit one with certain Italian undertones (an Anglo-Latin connection that seems even more convincing when one remembers that these designs were initiated only a few months after the launch by Olivetti of the Valentine – Ettore



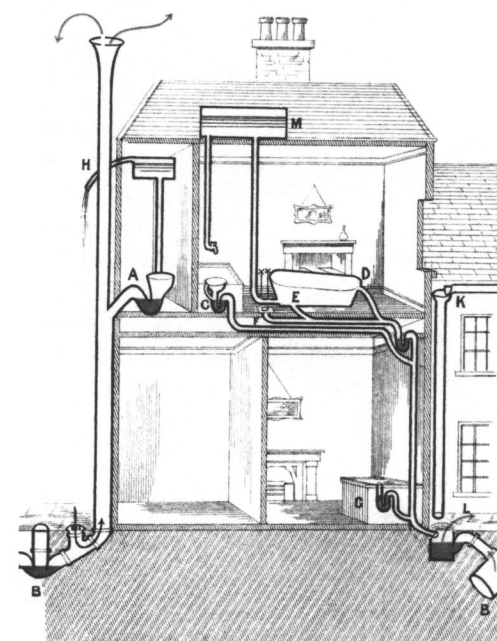
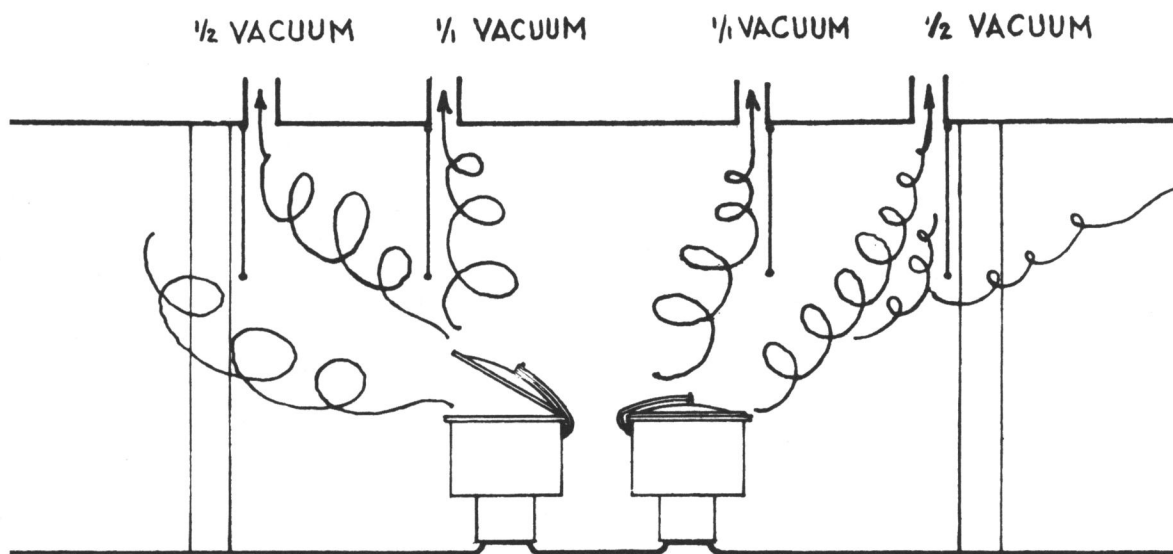
Sottsass and Perry King's celebrated red, white or green plastic typewriter). From the late 1960s onwards the Stirling office then went through an even more mannered classicist phase. Depending on the on-looking critic, this period began either with his design for Siemens in Munich in 1969, for Derby city centre in 1970 or for the arts centre at the University of St Andrews in 1971. Yet one thing these critics do agree on is that all of these projects are too early for postmodernism, which instead characterises the next, and final, phase of Stirling's work: the major museums in Germany, for example, or the Clore Gallery extension to the Tate in London.⁵ It is hardly surprising, therefore, that these readings overlap and contradict each other – that some consider Stirling an early postmodernist, while for others he is an eternal modernist.⁶

James Stirling & Partner,
detail of structural concept for
Dorman-Long HQ, 1965

Another approach has been to assess the different phases of Stirling's oeuvre not so much in stylistic but biographical terms, by tracing them back through his various professional collaborations.⁷ The defining and perhaps most regarded of these was the 'fractious relationship' he enjoyed with James Gowan, his former colleague at Lyons, Israel & Ellis, which characterises the first phase, and whose best exemplar was the Faculty of Engineering building at Leicester University, a 'gothicist' *parti pris*, in the words of Gowan, in contradistinction to Stirling's own 'classicism'.⁸ A second phase would then be the collaboration with Léon Krier,⁹ who helped make manifest a certain classical sensibility until then more latent.¹⁰ A third one, lastly, would then be the 'good partnership'¹¹ he enjoyed with Michael Wilford, characterised by the museum, institutional and corporate projects they completed in the 1980s and 1990s, mostly in Germany and the United States.

Finally, still others – the majority, in fact – have explained Stirling's work through reference to a broad range of role models. For example, through Colin Rowe, the friend and historian whose knowing asides accompanied Stirling his whole life, and which in turn prompted subsequent references, from Palladio to Aalto, from Melnikov to Le Corbusier, from peculiar rock formations on the Yorkshire moors to the glasshouse at Kew, from local Liverpoolian influences to global ones. Rowe was complemented by many others, who echoed his reading of Stirling's architecture as a collage of referential horizons that of course shifted with the advent of each new phase of his work. Likewise, Stirling himself played the same game, explicitly offering up a panoply of ever-changing allusions as keys to the interpretation of his architecture: on machines, ruins, churches, courtyards, and so forth.¹²

Yet all these different approaches are in some sense as flawed as they are fruitful. True, the stylistic perspectives bring a certain order to the vast catalogue of works; the historical references illustrate what a great visual archive the architect held in his mind's eye; and the different partnerships make it easier to identify the shifting office structure in which Stirling, as Wilford once put it, acted as 'editor', simultaneously taking charge of content, metaphorically proofreading and publishing.¹³ But at the same time, all of them also further consolidate the tendency to a periodisation, and thus to a fragmentation of his work and ideas, meaning we keep aggregating multiple and different Stirlings rather than ever seeming to comprehend a more singular Stirling.



Top row: Alvar Aalto, Paimio Sanatorium, 1932;
Thomas Pridgin Teale, *Dangers to Health*, 1880;
Drysdale & Hayward, *Health and Comfort*
in *House Building*, 1872

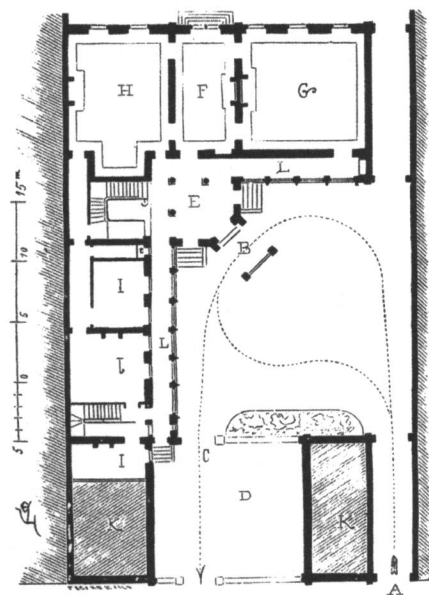
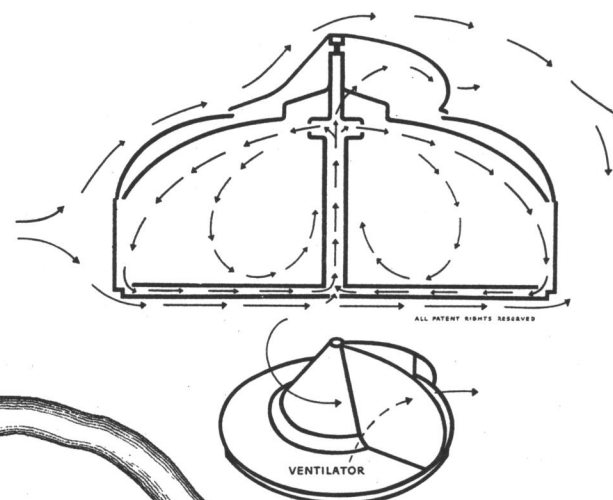
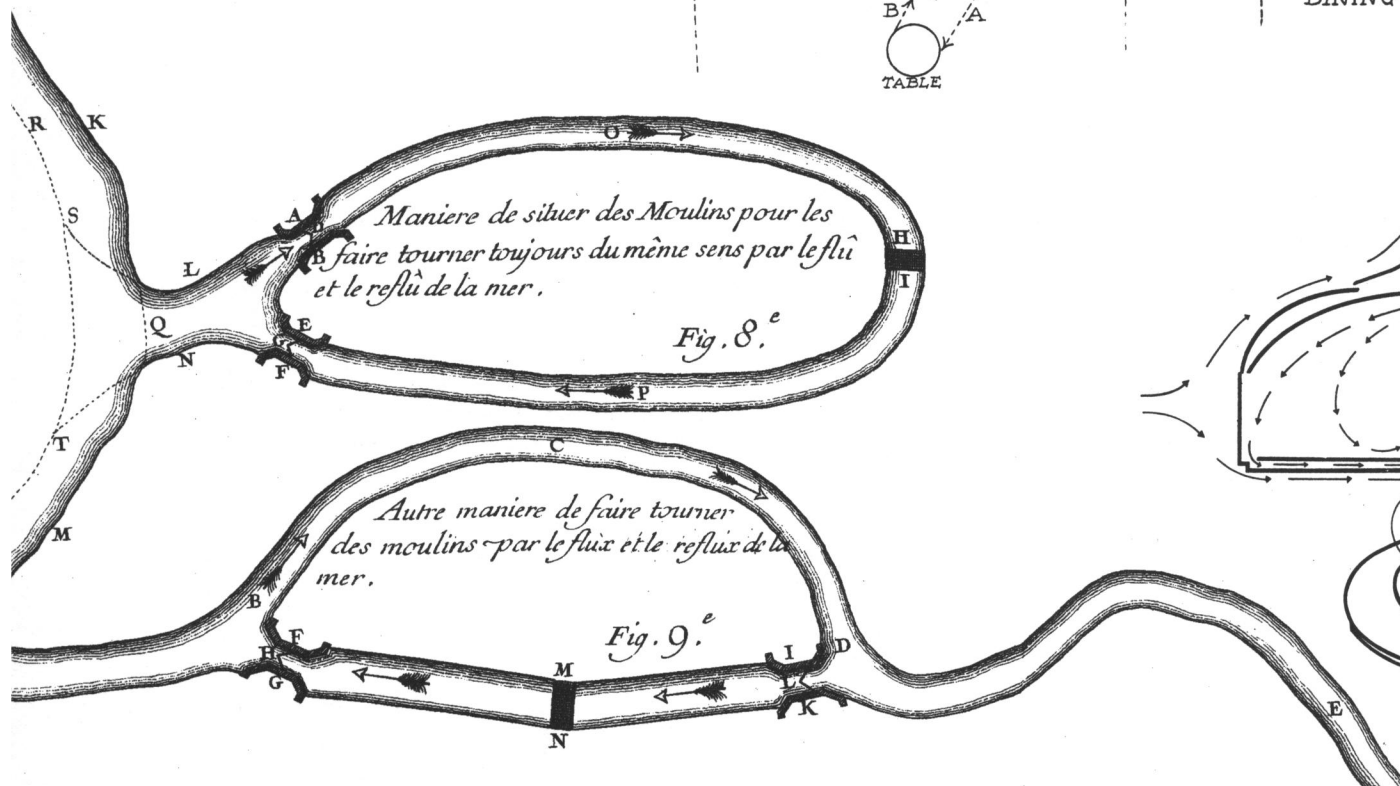
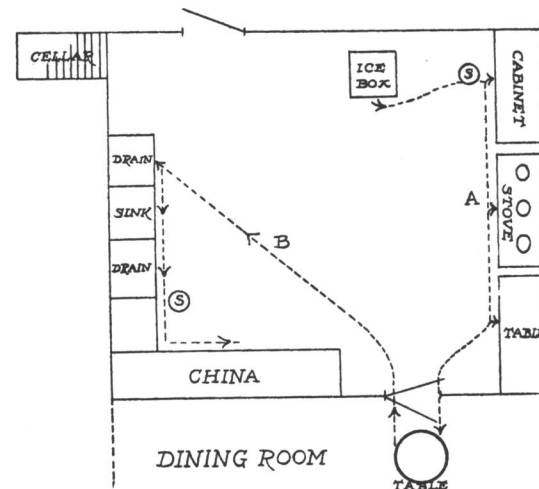
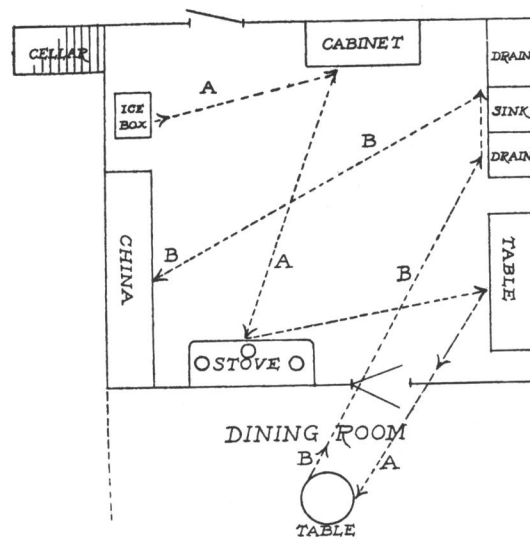
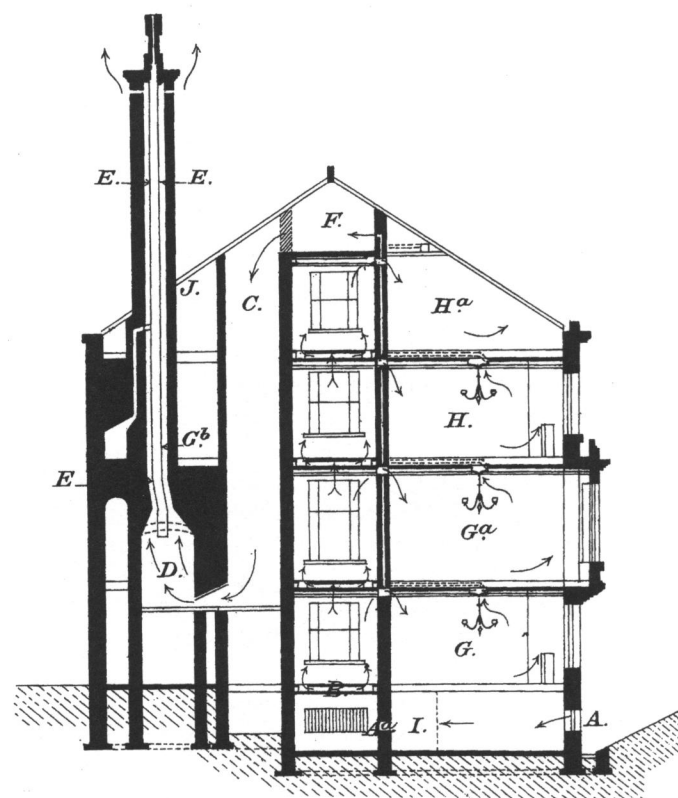
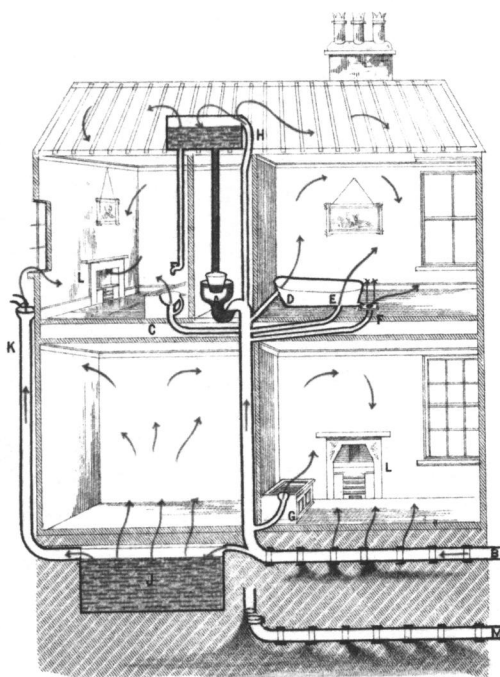
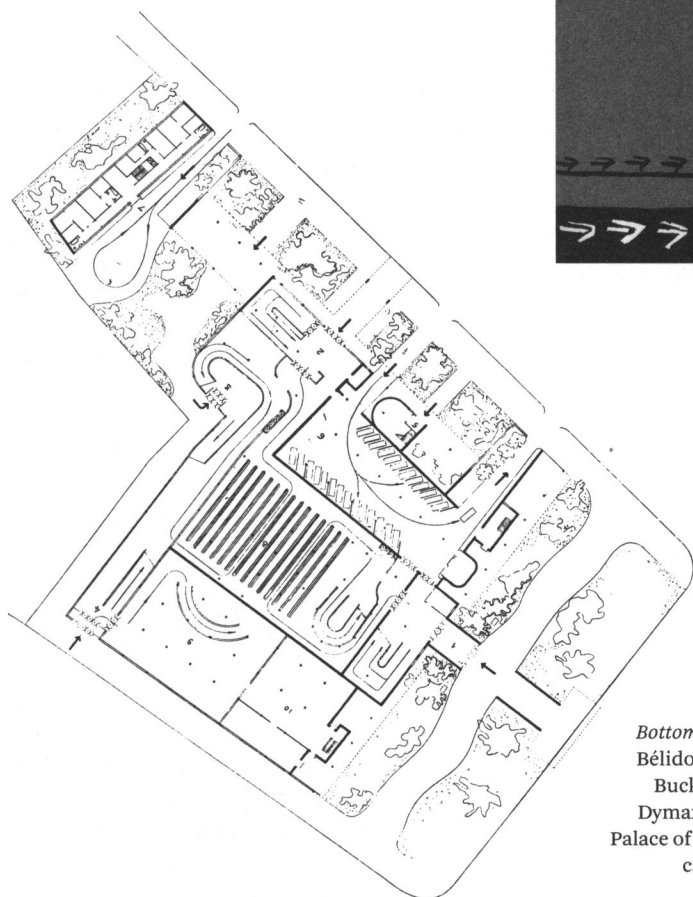
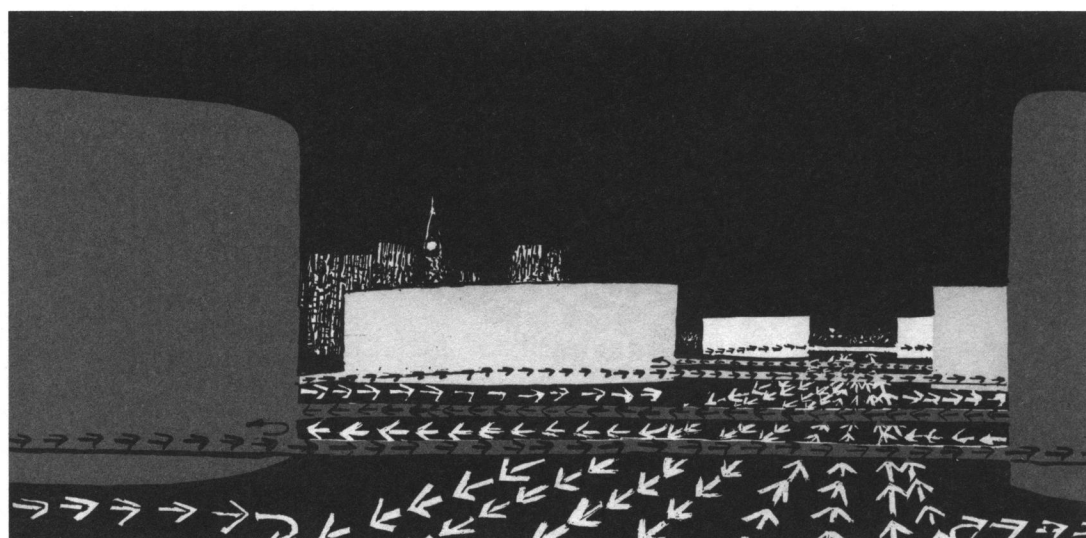


FIG. 9

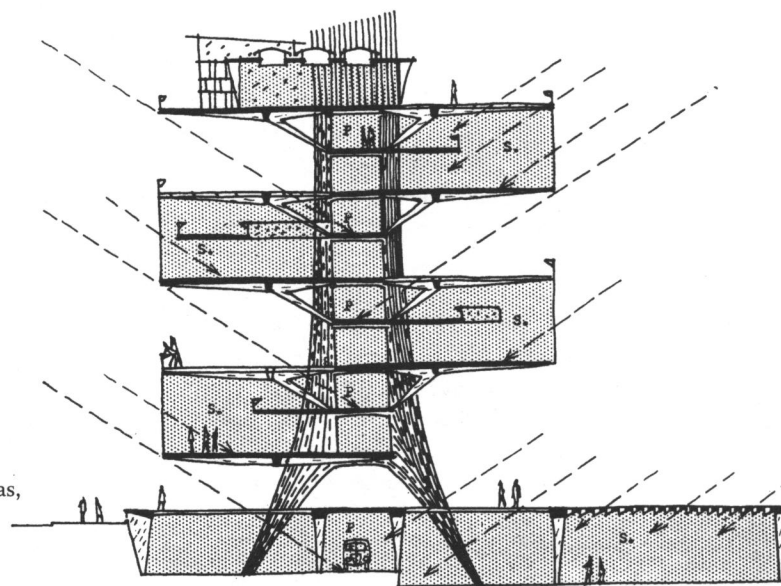




Middle row: Eugène Viollet-le-Duc, townhouse, 1872; Christine Frederick, studies in home management, 1913; Louis Kahn, Toward a Plan for Midtown Philadelphia, 1953



Bottom row: River flow, from Forest de Bèlidor, *Architecture hydraulique*, 1737; Buckminster Fuller, airflow in the Dymaxion House, 1946; Le Corbusier, Palace of the Soviets, 1931; Rodney Thomas, cantilevered structure, 1953



However, one seemingly nondescript motif counters this fragmentation, and allows us to target more precisely Stirling's work and better grasp its trajectory. This motif is the arrow. In contrast to the changes offered by building type or clients, or the shifts one sees in a formal language, collaborators or art and architectural conventions, the arrow is ever-present in Stirling's work. For example, a close inspection of his plans and presentation drawings reveals north arrows, of course, in site plans, as well as arrows marking an entrance or the direction of a staircase. But keep looking, and you will notice many more: arrows that trace a mechanical operation, such as the opening or closing of a window, arrows that represent the various stages of a construction process, from the laying of foundations to the tiling of a roof, and arrows that trace pedestrian or motorised routes, both straight and circuitous. Arrows indicating the minimum water level in a tank can also be found, along with arrows in a ground plan or in section showing the sun's rays and their angle of incidence. Then there are the arrows that highlight intersecting – both critical and contemplative – perspectives, that illustrate a structural concept – pressure and resistance, for example – and, finally, those arrows that mark paths a leisurely visitor may pursue, or the direction of travel of passing ships or trucks.

As unremarkable, even expected, such arrows may seem to us now, it is worth noting the contrasting infrequency with which they appear among the published drawings of the pre-Stirling generation of architects. Few can be found in the widely read monographs of the period: in the published work of Alvar Aalto, for instance, they make only a rare appearance, in the carpark of the Aalborg Museum and once again in a drawing of the ventilation system in the kitchen of the tuberculosis clinic in Päämies.¹⁴ Le Corbusier, whose work was one of the major references around 1950 and who devoted much attention to questions of light, ventilation and circulation, mostly got by without any arrows at all, with the exception of a handful in his plans of the Mundaneum, and one or two more in drawings for his Palace of the Soviets project.¹⁵ Alone among this generation, only Louis Kahn appears to have implemented the liberal use of arrows, notably in his acclaimed studies of Philadelphia in the early 1950s, even if these were restricted to rough sketches and large urban-scale drawings, and never presentation images.¹⁶

Allied to its scarcity among the modern masters, precedents to the arrow are similarly patchy, and its history in architectural drawings therefore comparatively brief. Ever since the emergence of architecture as its own professional discipline, architectural and technical drawings have mainly been of an illustrative or figurative nature – their primary purpose has

been to depict the structure of an object, not how it worked – and this purpose remained predominant until well into the second half of the nineteenth century.¹⁷ There are consequently very few arrows in this period. An exception in terms of literature broadly concerned with the built environment is the first use of the arrow in the mid-eighteenth century, largely in relation to treatises that touch upon hydraulics (which in turn parallel their use in the cartography of the time, especially mappings of rivers and streams). By the turn of the nineteenth century, instances of the arrow become more common, particularly in regard to illustrations concerning the natural sciences, with arrows typically helping to convey the idea of direction and momentum in an otherwise static drawing.¹⁸ The arrows themselves were usually depicted not as an abstract shape but as an archer's arrow, complete with head, shaft and fletching, before being simplified into a more graphic register of direction – no longer a projectile but a symbol.¹⁹ Feathered or not, these arrows have since served to reveal a movement in time and space that could not be otherwise represented – initially the flow of fluids such as water, then air, steam or gas, later of people, goods or vehicles and, more recently, abstract entities such as energy or information.

It is therefore no coincidence that the arrow found its way into architectural drawing courtesy of experts such as doctors, social reformers and engineers, who were the first to attempt to map in their designs the ephemeral flow of fluids into, within and out of an architectural object. Exemplary in this regard are two houses built in Liverpool in around 1860 by the medical doctors, Dr Drysdale and Dr Hayward, and described in detail more than a century later by the architecture critic Reyner Banham. Writing in 'A Dark Satanic Century' in *The Architectural Review* in 1968, a prelude to his subsequent book, *The Architecture of the Well-Tempered Environment*, Banham shows how the plan, section and construction of these houses was designed to ensure good ventilation, from the intake of air beneath each structure, and its technologically driven circulation through the individual rooms, to the thermal pull of the kitchen chimney, leading to its final disposal via the 'foul air shaft'.²⁰ Air circulation, not only in the pipes and chimneys, but also within the various rooms, was meticulously noted with an abundance of arrows.

One of the first trained architects to use this representation technique was Charles James Richardson, a sometime collaborator of John Soane. After receiving first-hand experience of the introduction of several central-heating systems in Soane's office at Lincoln's Inn Fields, Richardson authored a pamphlet, *Popular Treatise on the Warming and Ventilating of Buildings* in 1837, designed to summarise recent developments in this field in layman's terms,

and which indicated the different flows of warm air or hot water with meticulous little arrows in all of his illustrative plates.²¹

Around the same time the arrow also began to be used in ground plans to map non-fluid entities. Thus in drawings for Pentonville Model Prison, published in 1844, feathered arrows plot routes prescribed for inmates through the prison chapel and network of corridors.²² This innovative practice of marking human movement in the architectural plan was to be eagerly adopted for other, non-penitentiary typologies, such as the townhouses of Eugène Emmanuel Viollet-le-Duc, as well as in the early ergonomic studies of the 1910s, in particular those by Christine Frederick.²³ For both fluids and people, therefore, the arrow first served to map movements that were too volatile, ephemeral or fragile to be otherwise visible or legible. And it did this not just in terms of movement as an abstract condition, but in direct relation to the buildings that contained this movement. Moreover, besides being an effective tool for visualisation, the arrow registered the possibility of investigating the potential operation of whatever was being represented on the drawing board.²⁴ In this way, the arrow pointed the way for greater insights into flow and movement within buildings for the purpose of systematic planning, notably those demands at the end of the nineteenth century for better hygiene, security and comfort. Nowhere is this more apparent than in the multiple editions of the successful 'pictorial guide' *Dangers to Health*, published by the British surgeon Thomas Pridgin Teale in around 1880, and which highlighted the most common sanitary defects in building (and their remedy) in over 50 plates and a plethora of coloured arrows, thus giving the arrow the leading role in the definition of better domestic design.²⁵

Whether Stirling was aware of such pioneering prototypes is debatable. But the essay about Drysdale's and Hayward's two houses – which were still standing in Liverpool, Stirling's birthplace and university – was written by his friend Banham in the same year *The Architectural Review* would also publish his detailed appraisal of Stirling's library in Cambridge.²⁶ While Banham was investigating, on paper, historical instances of attempts to control the architectural climate, Stirling was therefore busy attempting to control the same thing in bricks and mortar, steel and glass, with the underfloor and ceiling heating, insulated double-glazing and ventilation systems (both mechanical and natural) of his History Faculty inducing the same well-tempered environment Banham was championing. But as the various arrows in the plans and sections of Cambridge reveal, 'environment' in Stirling's building implied not merely technologically controlled climatic parameters, but the more ambitious,

and architectonic, control of circulation through various ramps, corridors and staircases, which structure the plan and which decrease in density the further up the building. Furthermore, with its annular, slightly recessed complex of reading room, stacks and central lending desk – a feature evidently crucial to Stirling's success in the competition²⁷ – the History Faculty library implements a visual arrangement that enables the entire space to be monitored at a single glance – as in a prison, as one Cambridge don sniped.²⁸ Indeed, just like a panopticon, the assortment of shelves in the library are separated from each other by a corridor and are back-lit, allowing them to be viewed from a central desk, which again, true to Bentham's ideal prison, lies in the darkest area, its occupant seeing everything without ever being seen by the reader.²⁹

But if the library can be read as a device or apparatus which is determined by its concentrated disposition of figures, volumes, gazes and light around a quarter-circle, it also differs in a significant way from the disciplinary dimension of the prison. For the central lending desk is not only the preserve of the librarian, but also houses the technical controls for the building's lighting, ventilation and heating (as in the Staatsbibliothek, built in Berlin by Hans Scharoun that same year). In Cambridge, then, what is at stake is less the distribution of bodies in space, but the control of a multi-layered visual, climatic and spatial environment, whose borders are blurred by a combination of the white light of the ceiling, the atmospheric conditions of the reading room and in the open plan of the floor.

In referencing the sum of a set of environmental features, the arrows therefore mark architecture's various potentials to perform. And their scope, at least in Stirling's early work, ranges from visual dispositions in St Andrews (where the rows of the student rooms open to the wider landscape), to structural information (as in the Dorman-Long Headquarters in Middlesbrough, where the arrow uncovers structural forces otherwise not visible), and then later to infrastructural provisions in Leicester (a building that could also be read as a circulation diagram) and, finally, to a notational device indicating strolling visitors (as in the galleries at Stuttgart). The arrows in such drawings not only denote virtual movements in space and time that would otherwise not be legible, but also make it possible to plan and organise them. Accordingly, they are as much a design tool as they are a medium of representation.³⁰

In this dual role, the arrow therefore enables a building to be conceived, not only in terms of its static volume, but also as the outcome of its spatial relationships. Stirling pursued this topic implicitly from the mid-1950s on, most evidently

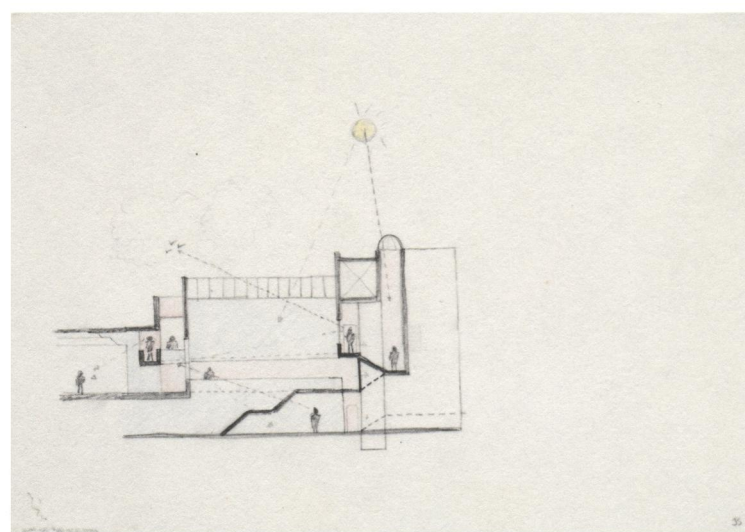
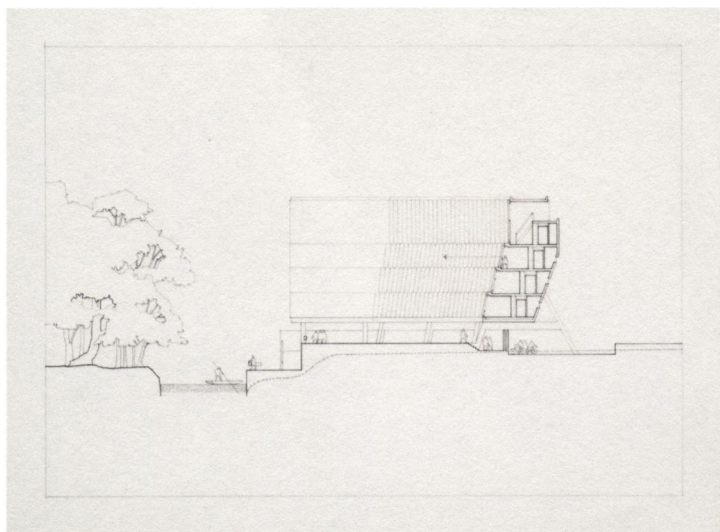
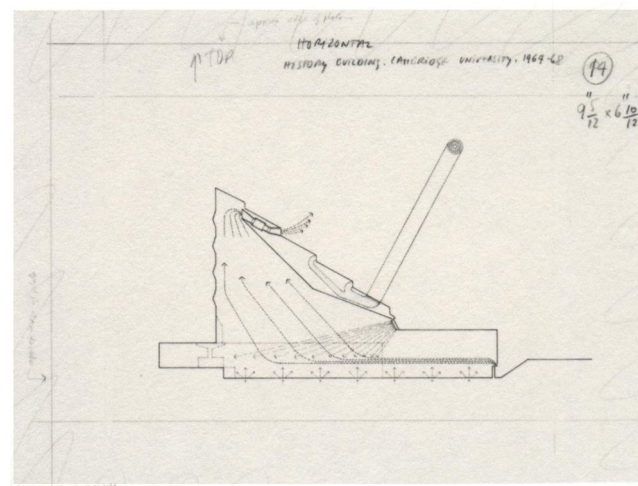
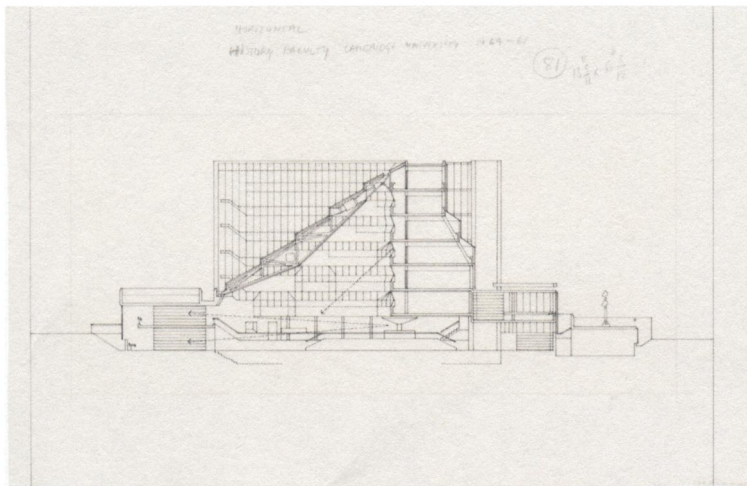
in the sculpture he helped produce for the 1956 exhibition 'This Is Tomorrow' whose form was derived from soap bubbles.³¹ Its structure can hardly be described through its geometry, but only topologically – ie, in terms of the position of its various points to each other. What distinguishes the soap bubble is the fact that its surface constantly changes owing to the action of external forces. This characteristic is evident in his later designs, for example in the successive steps made towards the plan of the Florey Building, a student residence in Oxford. The building's geometry changes constantly on the drawing board yet its topological disposition remains the same: the previously regular block shifts shape, becoming an asymmetric yard so as to open up a view towards the river, park and city of Oxford beyond. In turn, the section also opens up over the course of the design process, taking a staggered upwards direction in order to better accommodate the sun's angle of incidence.³² Similarly, the fan-shaped arrangement of the reading room in Cambridge describes the librarian's panoptic outlook while the steep angle of the glass roof simultaneously guarantees good interior day-lighting, the flow of natural air along its sloping surfaces and facilitates a view of the hall from the upper galleries. In the same vein, one might say that the gradually narrowing staircase at Leicester is a response to the decreasing number of users from floor to floor. This approach also explains the fundamental significance attributed in Stirling's built work and publications to infrastructure and other circulation facilities, be they chimneys, ventilation pipes or stair cores – either closed or transparent, single or double flight – in Leicester, Cambridge, Oxford and Camberwell, through to the rhetoric of the long ramps and stair arrangements in his late work; all of which is illustrated through arrows.

However, the arrow not only represents aspects of performance in architecture, but is also an expression of new spatial concepts. The theoretical implications of this were addressed in numerous articles throughout the 1950s under the catchword 'transparency'.³³ In its most literal sense, transparency denotes see-through materials and structures, such as patent glass or the curtain wall, which – as in drawings of the glass roof at Cambridge, the facade at Leicester or even the large glass-vaulted passage of the Derby project – are pierced by arrows denoting diurnal and nocturnal sightlines and rays of light. But for Stirling transparency can also be understood in its 'phenomenal' dimension (to pursue Rowe's line of thought), ie, in terms of the overlap, overlay or interpenetration of individual spatial sequences or structures whose arrangement becomes palpable and legible only by striding down those routes marked in the plan by circulation arrows. For example, the stairs in the

Florey Building, which lie in front of as well as within the facade, and therefore explain the cantilevering structure of the complex; the circulation tower at Leicester, whose form can be grasped only by climbing to the very top of it; the spatial sequences at Cambridge, whose gradations can be detected only by traversing the whole building; or, lastly, the paths plotted in Düsseldorf and later Stuttgart, which can be fully appreciated only by penetrating the entire breadth and depth of each building.

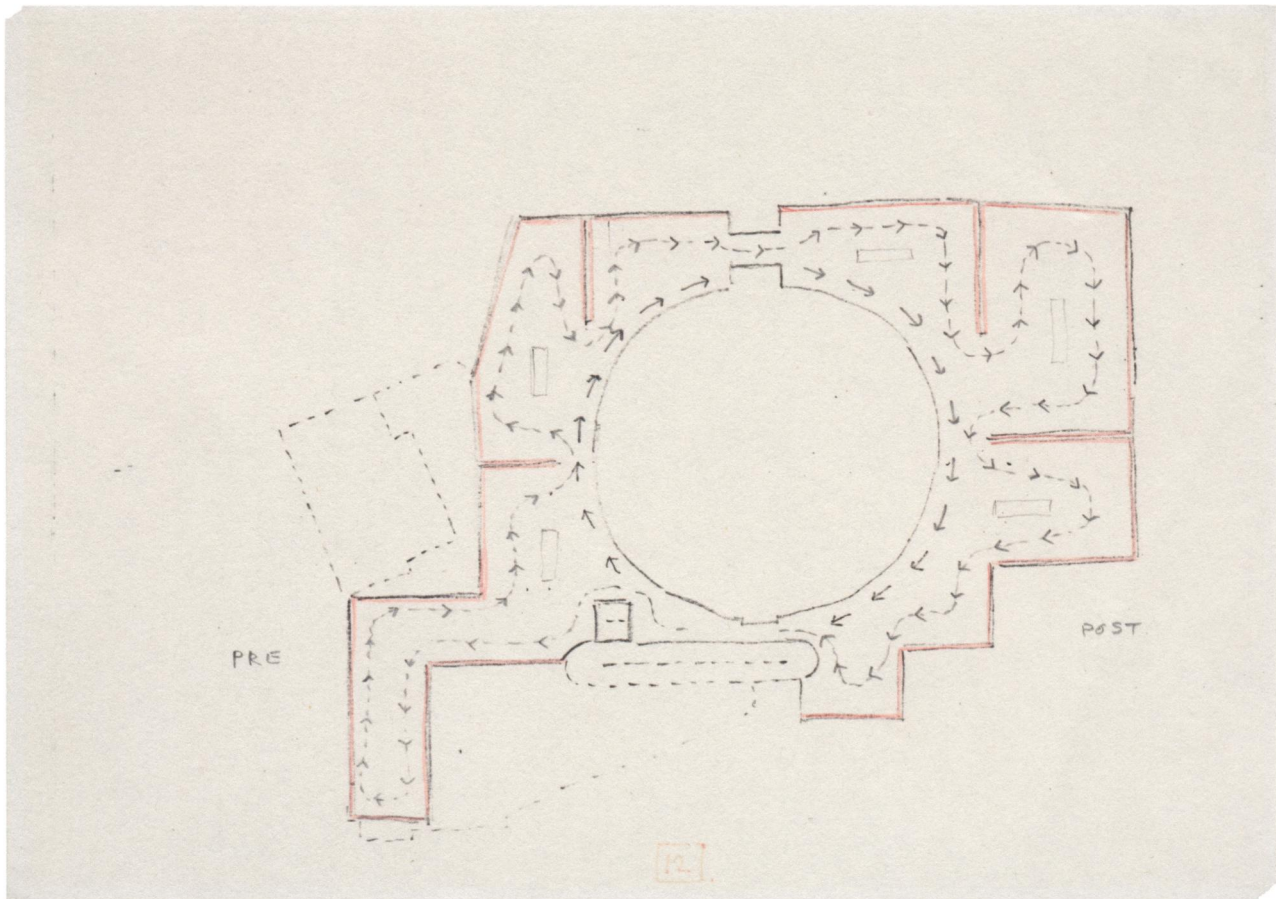
Arrows, then, are all over drawings of Stirling's early projects, but disappear almost completely from his presentation-drawings by the late 1960s. Yet to see in this a break in Stirling's architecture would do little to further understanding of his work. It would imply opting either for a formal or a functional reading of it, for a reading of his early buildings as mere stylistic baubles or technical objects, not as devices, which is to say, as structures that synthesise the knowledge of an era and participate in the conditions of their own production and are therefore never arbitrary. Besides, there is ample evidence of continuity in Stirling's work. On the one hand, arrows remain in the sketches a privileged symbol for all kinds of movement. A prime example is their use in the late 1970s in the sketch of a section through the entrance area of the Clore Gallery, where they indicate both the interrelationship of sightlines and sunlight incidence in relation to circulation, not unlike in the drawings for Cambridge; another is their use in the Stuttgart and Düsseldorf museum projects, where they plot in detail the prescribed public routes through the exhibition galleries and outdoor areas. On the other hand, Stirling also relied on other forms of representation to pursue his exploration of movement in time and space, first and foremost through the worm's-eye-view axonometrics that were to become so characteristic of his later work.³⁴ According to Krier, Stirling discovered this representation technique in the work of Auguste Choisy, and first adopted it in 1969 – which is to say, just as the major projects of his 'second phase' were drawing to a close – and thereafter used it systematically, even if the projections published in volume one of the *Collected Works* were actually produced retrospectively (as were a number of the plans featuring arrows).³⁵

Yet axonometric projections were nothing new by this point in Stirling's career. He had used them often enough in some of his earliest projects – in his CIAM study of an expanding village, for instance, or his design for Ham Common, both from 1955 – essentially for the purpose of showing a building in its general layout. Axonometric projections were likewise his tool of choice for his studies of private residences in 1956, which he presented as a montage of varied geometric volumes; and,

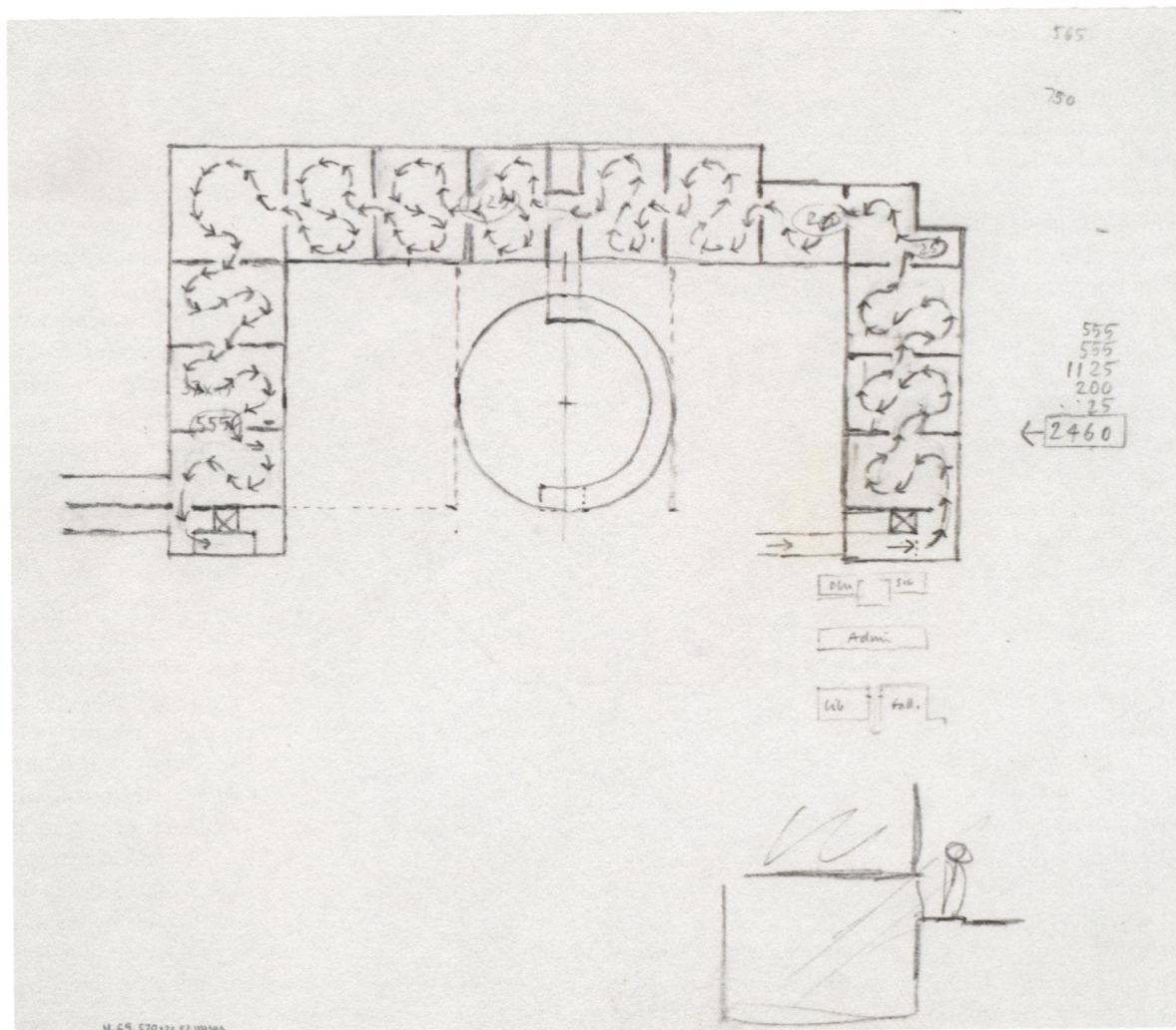


Above: James Stirling,
Cambridge University History
Faculty Building, 1964-68
Below left: James Stirling,
Queen's College, Oxford, 1966-71
Below right: James Stirling & Michael Wilford,
Clore Gallery, Tate, 1978-86

© Canadian Centre for Architecture, Montreal



James Stirling & Partner,
Nordheim-Westfalen Museum, Düsseldorf, 1975
© Canadian Centre for Architecture, Montreal



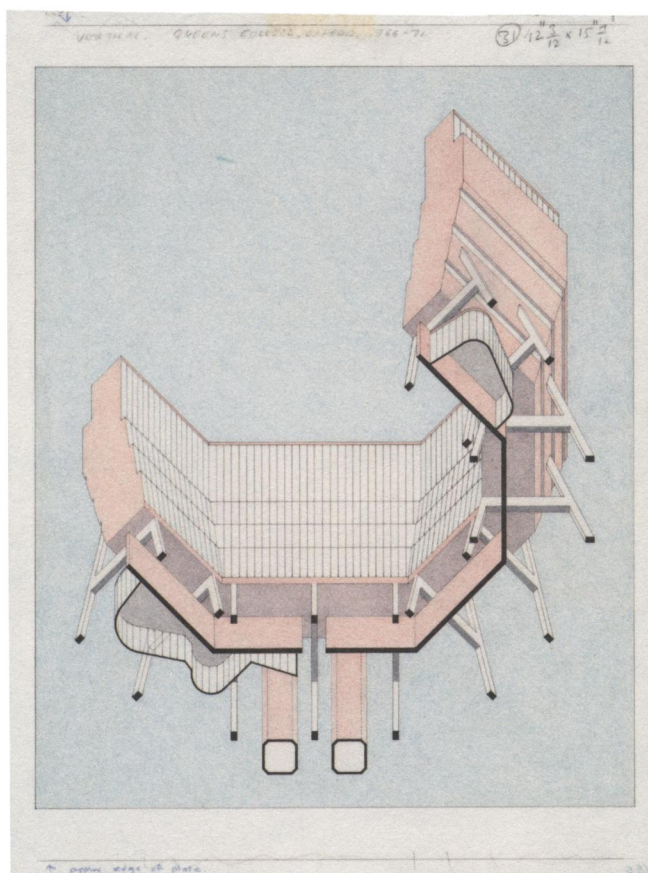
James Stirling & Michael Wilford,
Staatsgalerie, Stuttgart, 1977-84
© Canadian Centre for Architecture, Montreal

in similar manner but on a larger scale, for his Churchill College competition entry. An axonometric presentation drawing of the entire complex at Leicester was made too, along with studies of individual structural details. Precedents for the use of this means of representation were common enough. Le Corbusier and Gunnar Asplund had used axonometric projections, and so too had Alberto Sartoris,³⁶ from whom Stirling could also have adopted the hatching technique as a means to prevent a drawing flipping over into its negative form. And, as Reyner Banham remarked, most architects would have been familiar with axonometric projections at the latest by the 1940s, since these were commonly used in military manuals.³⁷

Two instances in the history of axonometric projections serve to better understand their properties. Firstly, there are the reasons the military chose this means of representation when planning fortifications, namely to simplify calculation, to standardise foreshortening and to avoid blind spots.³⁸ Stirling was similarly motivated to use it in early drawings, such as the house studies, to simultaneously illustrate the bird's-eye and the lateral view. Secondly, its use was highly recommended as of the early nineteenth century for representations of machinery. As Yve-Alain Bois has noted, the 'sameness of scale for all three dimensions of a space' was much acclaimed,³⁹ for it was this particularity which made it possible to represent transition mechanisms between individual links in a functional chain, true to scale. The drawings for Leicester attest this same benefit, since they illustrate the complex interrelation of parapet and wall, and the complex construction of the patent glass roofing in the stairwell; and so too those of the construction process at St Andrews, which show the various steps to completion of the student residence.

However, what distinguishes the axonometric projections with their characteristic worm's-eye perspective from more traditional forms of representation is the fact that they enable the building hitherto divided into abstract plan, elevation and section to be read as a single whole. Like the arrow, yet on a decidedly different vein, this makes them a most apt technique for illustrating virtual movement in a building. They allow a building to be represented not only in terms of the sequential steps that go into its making, but also – and this is decisive in this context and represents a further step in Stirling's interest for movements in buildings – in terms of the temporality of any perception of it. For what essentially distinguishes axonometric

projections from perspective drawings is that they replace the viewer's single fixed viewpoint with a range of potential viewpoints, namely, as Yve-Alain Bois notes in an essay on Sergei Eisenstein,⁴⁰ by uniting all the important elements of a building in order to represent it quasi in a single frame. Likewise in the work of Stirling, axonometric projections actively foster kinetic perception of a building. This is evident in the axonometric projections for the museum in Düsseldorf, in which the two prescribed routes into and within the building are illustrated in their entirety: the sequence running from the entrance pavilion, with its portico, through a revolving door – an architectonic



device par excellence – and along a wall as far as the ramp that leads to the upper floor on the one side; and, on the other, from the pavilion, along the wall and through the entrance into the cylindrical inner courtyard, and from there beneath the exhibition space and on into the city. Axonometric projections facilitate the 'single-frame' representation of all the perspectives that may possibly be gained from an experience of a building. The numerous photo series featured in Stirling's later publications are retrospective proof of this: photos of the ascent of the stairs in Leicester, for example, or of the prescribed route through the inner courtyard in Stuttgart.

James Stirling, worm's-eye view,
Queen's College, Oxford, 1966–71
© CCA, Montreal

The historiographers' aforementioned insistence on historic role models in Stirling's work must accordingly be considered in a different light. Certainly, various referential horizons can be identified in his forty-year career, from the machine aesthetic of the 1960s to the classic formal repertoire of the 1970s and 1980s. But if we are to foreground the technique of 'collage' in reference to Stirling's work – whereby 'montage' would perhaps be the more appropriate term, given that he presents reality as a series of sequences, not as fragments – then not so much in the sense of a recollection of historical motifs but, rather, as a continuous interrogation of the potential of these motifs.⁴¹

Thus the glass roof in Cambridge references the glasshouse in Kew only insofar as it highlights the potential of transparency; the cylinder of the museum in Stuttgart references the central hall of Schinkel's Altes Museum in Berlin – biographically perhaps more accurate would be John Foster's Liverpool Custom House⁴² – only insofar as it highlights the spatial potential of picturesque circulation routes. Indeed, the historical motifs in Stirling's work provide potential figures, not just forms. This performative demand to architecture runs like a thread through all of Stirling's oeuvre. If axonometric projections gain such currency in the later work, then only because they illustrate the buildings' performative potential in spatial terms whereas arrows in the early work primarily revealed the functional and topological properties of a design. What changes, however – and this is visible in the axonometric projections for the later work, for the music school and theatre academy in Stuttgart, or the Poultry in London for example, which always portray the building through its surfaces – is that the focus shifts from a, in the

broadest sense, technological understanding of environment to a perceptual reading of it, from the building's use (and its typified user), to the building's individual perception (visually but also bodily) – from a linear trajectory of the arrow in the early drawings to the winding one in the later ones.

It would be tempting at this point to draw connections between Stirling's arrows and the emergence of other arrows in the 1940s and 50s, from the innumerable arrows which appeared on the asphalt of the streets and on the signage along the streets, to the arrows in the Situationists' psychogeographic maps, to the arrows in scientific and especially communication studies, which would find their way for instance in Richard Hamilton's, John Voelcker's and John McHale's catalogue entry to the 'This Is Tomorrow' exhibition in 1956,⁴³ where the

different organs of perception of the environment – eye, nose, mouth – are similarly illustrated with arrows. Although the temporal concurrence of these different types of arrows is striking, the polar instances of form and content, original and reference, signifier and signified involved in these examples bear the risk of getting entangled in the too intricate problems of signification and representation. Instead, it seems more rewarding to relate the arrows in the work of Stirling – as well as in that of a series of his contemporaries in Great Britain, like Alison and Peter Smithson in their famous London Road Study of 1959, or in America, like Buckminster Fuller in his mapping of the aerodynamic behaviour of the roof of his

Dymaxion house in the early postwar years – to what Félix Guattari has called ‘a-signifying semiotics.’ These semiotics make up the realm of diagrams, schemes and plans, that is, the realm of signs, that do not only produce signification but cross the borders of different types of signs and productively bring together signs with other material. A typical example would be the building plan, that puts physical and mathematical descriptions into a specific relationship to the construction materials. In Guattari’s thought such diagrammatic schemes stand in a particular relationship to his broader machinic concepts, as they effectuate, very much like real machines, the transformation of realities into a different state.⁴⁴

If therefore Stirling’s designs can be seen not only as buildings but in the broadest possible sense also as apparatus or devices that define different environmental conditions – if the library in Cambridge can be seen as a monitoring device, the student dormitory at the University of St Andrews as a device for viewing the landscape, the engineering building at Leicester as a circulation device, and the museum in Stuttgart as a device for the consumption of contemporary art – then it is the symbol of the arrow that forms the link between the semiotic machine of signs and the material machine of architecture. Stirling’s arrows do not only represent movement in architecture, like the archer’s arrows they were first modelled on, they create it.

1. ‘John Miller in Conversation with Mark Swenarton and Thomas Weaver’, *AA Files* 70 (2015), p 127. It was Sam Stevens, an AA student then responsible for the AA gallery, who presented the work of recent graduates from Liverpool University to question the then somewhat professional orientation of the AA. Stirling’s own student designs were the standout work in this exhibition.
2. See Mark Girouard’s more than simply entertaining portrait of James Stirling, *Big Jim: The Life and Work of James Stirling* (London: Chatto & Windus, 1998).
3. In the last five years alone the following monographs have all been published: Anthony Vidler, *James Frazer Stirling: Notes from the Archive* (New Haven, CT: Yale Centre for British Art, 2010); Alan Berman (ed.), *Jim Stirling and the Red Trilogy: Three Radical Buildings* (London: Frances Lincoln, 2010); Geoffrey H Baker, *The Architecture of James Stirling and his Partners James Gowan and Michael Wilford: A Study of Architectural Creativity in the Twentieth Century* (Farnham: Ashgate, 2011); Mark Crinson, *Stirling and Gowan: Architecture from Austerity to Affluence* (New Haven, CT: Yale University Press, 2012); Amanda Reeser Lawrence, *James Stirling: Revisionary Modernist* (New Haven, CT: Yale University Press, 2013). See also *Oase* 79 (2009), special issue, ‘The Architecture of James Stirling 1964–1992: A Non-Dogmatic Accumulation of Formal Knowledge’.
4. See Georg Franck, *Mentaler Kapitalismus: Eine politische Ökonomie des Geistes* (Munich/Vienna: Carl Hanser Verlag, 2005).
5. See for instance Charles Jencks, *The New Paradigm in Architecture: The Language of Post-Modernism* (New Haven, CT: Yale University Press, 2002), p 110. In the first edition of *The Language of Post-Modern Architecture* (London: Academy Edition, 1977), Jencks still considers Stirling ‘modern’. A few years later, Heinrich Klotz identifies Stirling’s break with modernism already in his Leicester building. See Heinrich Klotz, *Moderne und Postmoderne: Architektur der Gegenwart, 1960–1980* (Wiesbaden: Vieweg, 1984), pp 330–36.
6. See, most recently, Amanda Reeser Lawrence, *op cit*, pp 1–2.
7. See Geoffrey H Baker, *op cit*, p 364; and on Stirling’s collaborators in general, pp 362–66.
8. On James Gowan’s account of the design of Leicester’s engineering department, see bdoonline.co.uk/james-gowan-on-designing-leicester-s-engineering-department/3114086. article, an extract of an interview with Ellis Woodman.
9. See Anthony Vidler, *op cit*, p 241.
10. See ‘Léon Krier in Conversation with Christopher Pierce & Thomas Weaver’, *AA Files* 60 (2010), pp 68–77.
11. See Mark Crinson, *op cit*, p 135.
12. See Geoffrey H Baker, *op cit*.
13. See Geoffrey H Baker, ‘Interview with Michael Wilford, October 1998’, *ibid*, pp 379–96.
14. Alvar Aalto, *Alvar Aalto: vol 1, 1922–1962* (Zurich: Les éditions de l’architecture Artemis, 1963), p 40.
15. Willy Boesiger and Oscar Stonorov (eds), *Le Corbusier und Pierre Jeanneret, Oeuvre complète, vol 1, 1910–1929* (Zurich: Girsberger, 1937), p 208.
16. Louis Kahn, ‘Toward a Plan for Midtown Philadelphia’, *Perspecta* 2 (1953), pp 10–27.
17. See Ernst Gombrich, ‘Pictorial Instructions’, in Horace Barlow, Colin Blakemore and Miranda Weston-Smith (eds), *Images and Understanding: Thoughts About Images, Ideas About Understanding* (Cambridge: Cambridge University Press, 1990), pp 26–45.
18. André Lavarde, ‘La flèche, le signe qui anime les schémas’, *Communication et Langages* 109 (1996), p 51.
19. Rebekka Ladewig, ‘Über die Geschichte des Pfeils’, in Jörn Ahrens and Stephan Braese (eds), *Im Zauber der Zeichen: Beiträge zur Kulturgeschichte des Mediums* (Berlin: Vorwerk, 2007), pp 17–30.
20. Reyner Banham, ‘A Dark Satanic Century’, *The Architectural Review*, vol 144, no 860 (1968), pp 257–60. See also Neville S Billington, ‘A Historical Review of the Art of Heating and Ventilating’, *Architectural Science Review* 2 (1959), pp 118–30.
21. Charles James Richardson, *Popular Treatise on the Warming and Ventilating of Buildings* (London: John Weale, 1837).
- On John Soane’s successive trials see Todd Willmert, ‘Heating Methods and Their Impact on Soane’s Work: Lincoln’s Inn Fields and Dulwich Picture Gallery’, *The Journal of the Society of Architectural Historians* 52/1 (1993), pp 26–58.
22. See Joshua Jebb, *Modern Prisons: Their Construction and Ventilation* (London: John Weale, 1844), plate 3.
23. Eugène Viollet-le-Duc, *Entretiens sur l’architecture*, vol II (Paris: Morel, 1872), p 823.
24. See Sybille Krämer, ‘The Mind’s Eye: Visualising the Non-Visual and the Epistemology of the Line’, in Richard Heinrich et al (eds), *Image and Imaging in Philosophy, Science and the Arts, volume II* (Frankfurt: De Gruyter, 2011), pp 275–87.
25. T Pridgin Teale, *Dangers to Health: A Pictorial Guide to Domestic Sanitary Defects* (London: J & J Churchill, 1878). Further editions appeared in 1879, 1881 and 1883.
26. Reyner Banham, *op cit*; Reyner Banham, ‘History Faculty, Cambridge’, *The Architectural Review*, vol 144, no 861 (1968), pp 328–32.
27. F E Heppenstall, ‘Some Notes on the Services’, *The Architectural Review*, vol 144, no 861 (1968), p 338.
28. See Hugh Brogan, ‘Cambridge Diary’, *Cambridge Review* (October 1968), p 15.
29. See Michel Foucault, *Discipline and Punish: The Birth of the Prison* (New York: Vintage Books, 1995), pp 195–228.
30. See Sybille Krämer, ‘The Mind’s Eye: Visualising the Non-Visual and the Epistemology of the Line’, in Richard Heinrich et al (eds), *Image and Imaging in Philosophy, Science and the Arts, volume II* (Frankfurt: De Gruyter, 2011), pp 275–87. On the multiple roles of the arrow – notably in the artistic work of Gordon Matta-Clark – see also Briony Fer, ‘The Beginning of Trees and the End: Drawings and Notebooks of Gordon Matta-Clark’ (New York, NY: David Zwirner, 2016), pp 10–18.
31. Regarding this sculpture, see Michael Pine and Richard Matthew, *This is Tomorrow* (London: Whitechapel Gallery, 1956), as well as David Robbins (ed), *The Independent Group: Postwar Britain and the Aesthetics of Plenty* (Cambridge, MA: MIT Press, 1990), pp 242–43.
32. See Mark Girouard, ‘Florey Building, Oxford’, *The Architectural Review*, vol 152, no 909 (1972), pp 260–77.
33. See Colin Rowe and Robert Slutzky, ‘Transparency: Literal and Phenomenal’, *Perspecta* 8 (1963), pp 45–54; and ‘Transparency: Literal and Phenomenal, part II’, *Perspecta* 13/14 (1971), pp 287–301.
34. Anthony Vidler, *op cit*, p 240.
35. Geoffrey H Baker, *op cit*, p 181. Indeed, Krier was to play a fundamental role in the shaping of the reception of Stirling’s work. He would not only introduce implicit classical references in the works and drawings of Stirling, but his return to the office in the early 1970s to oversee the publication of the ‘Black Book’, actively helped shaped Stirling’s public image. See ‘Léon Krier in Conversation with Christopher Pierce & Thomas Weaver’, *op cit*, p 72.
36. Amanda Reeser Lawrence, *op cit*, p 4.
37. Reyner Banham, ‘Introduction’ to the Heinz Gallery exhibition catalogue *James Stirling*, 24 April – 21 June 1974 (London: RIBA Publications, 1974), pp 5–14.
38. See Yve-Alain Bois, ‘Metamorphosen der Axonometrie’, *Daidalos* 1 (1981), pp 40–58.
39. *Ibid*, p 55.
40. Yve-Alain Bois, ‘Montage and Architecture’, *Assemblage* 10 (December 1989), pp 111–15.
41. Peter Bürger, *Theorie der Avantgarde* (Frankfurt: Suhrkamp, 1974), pp 98–111.
42. See Brian Hutton, ‘Situating Stirling’, *The Architectural Review*, vol 229, no 1370 (2011), pp 76–79. Biographical accuracy should not avoid the necessity of questioning the larger relevance of historical quotations.
43. Michael Pine and Richard Matthew, *op cit*.
44. Félix Guattari developed the idea of a-signifying semiotics in several texts, most comprehensively in *Molecular Revolution: Psychiatry and Politics* (London: Penguin, 1984). See Henning Schmidgen, *Das Unbewusste der Maschinen: Konzeptionen des Psychischen bei Guattari, Deleuze und Lacan* (Munich: Fink, 1997), pp 141–53.

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