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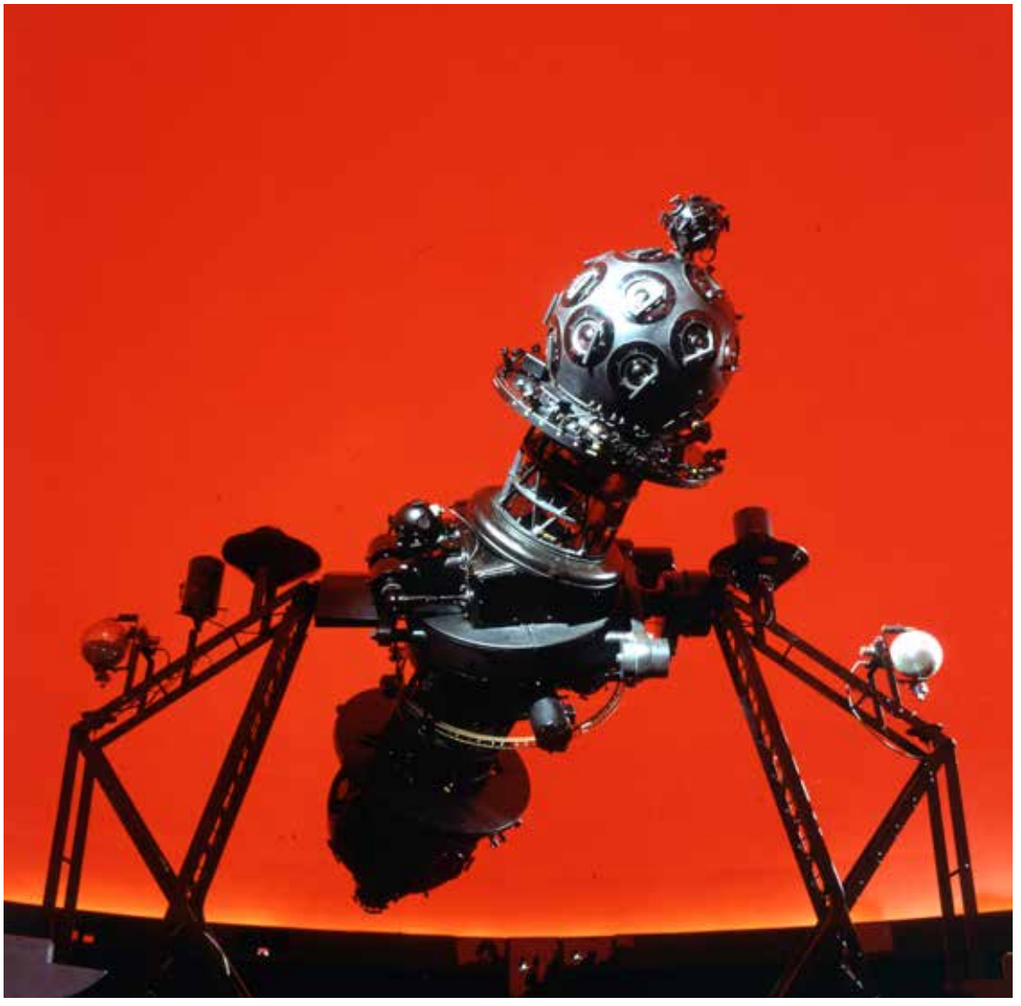
A Note on the Display Initials
The two display fonts in this issue, drawn by Adrien Vasquez from the John Morgan studio and featured within the essays by Helen Thomas and Ilaria Abbondandolo, are a reconstruction of two alphabets developed by Carlo Scarpa between 1969 and 1978 for the Brion family tomb in San Vito di Altivole, Treviso (the same 'calligraphy' Scarpa admitted to having 'invented many times before'). The original version of the lower-case Thomas face was constructed as a tubular lead lettering, while the horizontal slats of the upper-case Abbondandolo face were designed to mirror the material qualities of ivory inlaid into ebony. Here, both versions appear in this issue's secondary green colour (itself a reference to the preponderance of greens, both muddy and bright, in the texts by Irénée Scalbert and Laurent Stalder).

The Missing Planet

William Firebrace



Zeiss mark IV dumbbell projector,
London Planetarium

Missing

My office sits directly opposite the building once known as the London Planetarium, located beside Madame Tussauds on Marylebone Road. From my window I can see its green dome, and the planet mounted on a slender pole that crowns it. The planet is whitish in colour, about one metre in diameter, and surrounded by a flat white disc, representing its ring of cosmic dust. At night, up in the sky, it glows softly with a yellowish light, quietly ignoring the hubbub of traffic on the road below. I have always found this planet rather reassuring, a sign that all is well in the solar system. So when the planet suddenly vanished, sometime during the summer of 2012, I was gripped by feelings of worry and anxiety. Planets are meant to be reasonably constant in their elliptical paths around the sun, a reassuring celestial register of the stability of the solar system as a whole, including our own circulating planet. The case of the missing planet? Sherlock Holmes, consulting detective resident in nearby 221B Baker Street, would perhaps have been intrigued. His nemesis, Professor James Moriarty, the Napoleon of Crime, was well known for his volume *The Dynamics of an Asteroid*, which coincidentally explored a missing planet located somewhere between Mars and Jupiter. A case in a detective story often starts with a simple clue, a disappearance or unexpected event, but leads to a mass of individual, entangled threads which happen to come together into a knot, often without any means of resolution. Sometimes the original clue becomes irrelevant as more complex matters evolve.

The Marylebone Road planet reappeared on the roof of the dome in December 2012, returning as unexpectedly as it vanished. According to the owners of the building, Madame Tussauds, it had been 'undergoing standard maintenance'. But its temporary disappearance was a sign of some greater absence, and the wandering of the illuminated planet had raised certain questions about the planetarium itself, about its original intention, operation, antecedents and its curious connections with the neighbouring waxworks. I decided to investigate.

Dome

The London Planetarium opened in April 1958 and is credited to the architect George Watt, together with the engineers Travers Morgan & Partners. The site had previously been occupied by the Madame Tussauds cinema, which was so badly damaged during a wartime bombing raid that it had to be hastily demolished. Watt himself remains a bit of a mystery, a Scot who had emigrated south, and who specialised in bomb-damaged sites, which is possibly how he got the planetarium job in the first place. Nothing he built before or after has quite the same elegance or refinement, so it's possible he was just a job-getter, while some other talented architect in his employment designed the actual building.

In any case, the planetarium was as much an engineering project as it was a piece of architecture. The most prominent part of the building is formed by the dome, constructed of reinforced concrete but clad in copper, now weathered to a lustrous green. This dome forms a hemisphere, slightly extended vertically, and sits on a raised concrete platform, in turn supported by a ring of concrete columns with special foundations to reduce vibration from the tracks of the London Underground, whose Circle, Metropolitan and Hammersmith & City lines run underneath most of the length of the Marylebone Road. Seen in section the building resembles an oversized serving dish enveloped by its own ornamental metal dome, and perched a little awkwardly on its ring of columns. At 20m, the diameter of the dome was determined by the requirements of the standard planetarium projection equipment of the period, and is rather too large for its site, squeezed between a small side street and the bulk of the main Tussauds building. But seen from the Marylebone Road the whole effect is strong and simple compared to the heavy-handed neo-classicism of its neighbours, Baker Street underground station and Madame Tussauds itself. The building suggests its function, resembling the top hemisphere of a green planet, with the horizontal plane as its ring. Above is the smaller white planet of its rooftop, as though the main planet had arrived as an alien object in the Marylebone Road, accompanied by its celestial familiar.

On the original building, at street level, an illuminated sign used to run around the base of the dome, its letters spelling out in clear typography THE LONDON PLANETARIUM. A thin horizontal plane projected out from the dome, acting as a kind of canopy, its underside inscribed with the 12 figures of the zodiac, the astrological signs which also form the astronomical divisions of celestial longitude. Behind the dome itself is a small 1950s-style office block, part of the original development, providing offices for the planetarium staff, alongside other facilities such as a workshop, lecture room, control suite, film and audio lab. There were also at one time three flats on the top floor reserved for planetarium staff, so that the whole complex provided a self-contained entity for the institution.

Entry to the planetarium was direct from the street into a foyer below the domed space. This lobby was designed in the stripped down modernist style of the period, with vertical fins faced in Perlato and Napoleon marble, a mosaic floor and a rather elegant free-standing pay-kiosk. The ceiling was originally painted sky-blue: the day-lit foyer, horizontal and open, prepared the visitor for entry to the night-sky auditorium above, which remained dark, vertically orientated and enclosed. A grand stairway, at the rear of the foyer, linked the two levels.

The most readily identifiable element of the London Planetarium, its great dome, is constructed from vertical ribs tied together by concrete ring beams at the base and crown, then filled in with two layers of precast concrete panels, curved in two directions to take the form of the dome. The engineer for Travers Morgan & Partners, GW Kirkland – a former army engineer and expert in shell-roof construction – was responsible for the simple construction and its pragmatic approach to the problems of a difficult site and the requirements of the interior performance. Inside it was important to achieve total darkness, absolute quiet and a dust-free environment for optimum projection. To ensure this, the exterior was lined with sound-proofing materials to cut out the noise of the traffic along Marylebone Road. Within the concrete dome itself was hung an inner aluminium shell, carefully assembled and painted so that the joints between the panels were invisible, forming a smooth surface for projection. This shell was pierced by many small holes to allow dust to be sucked out of the interior space in order to secure clean air, vital for the projection room, and also to reduce the acoustic echoes within the dome. There was an accessible space between the concrete and aluminium shells, very similar to those often found in buildings with one dome inside another, for instance at St Paul's Cathedral – a space between the projected sky of the interior room and the actual London sky outside. Around the horizon of the auditorium ran a frieze showing the skyline of London, returning this interior, with its cosmic pretensions, firmly back to its English site. This feeling of Englishness was reinforced by the plummy voice-over by the original director of the London Planetarium, John Ebdon – self-taught astronomer, former actor and future radio commentator – who gave to the grand celestial movements a comfortable, slightly whimsical, Home Counties feel. There is in all this something reduced and compact and microcosmic about the London Planetarium. It seems to suggest more than it reveals. It appears unexpectedly, as a kind of simple, domed temple for the worship of a now forgotten deity. And it has unconscious echoes of the most ancient notions of cosmology: the earth as a flat disc, unmoving, raised up on columns, which in turn stand on some uncertain firmament, surrounded by an endless sea of other matter, while the sky is a slowly rotating projection of stars, finite in its dimensions, and all set in motion by some seemingly divine force.

Exterior views of the London Planetarium, *c* 1958–60
© Madame Tussauds, London

Zeiss

The most important element of the London Planetarium, however, was not the building itself but the Zeiss mark IV dumbbell projector used to project the night sky, a magnificent machine, a real beast of an astronomical device, standing over 3m high and resembling an enormous insect on spindly metal legs. Whereas in a cinema no one cares much to look backwards towards the source of the film, in the planetarium the projector was the main actor, and the building was really only the backdrop for the show.

The maker of the projector, the German firm Carl Zeiss, was a producer of optical instruments of renowned quality that had been divided up by the Cold War so that one half of the company remained in Jena in the East while the other, which supplied the projector to the London Planetarium, relocated to the West German city of Oberkirchen. The Zeiss projector was an instrument of extraordinary complexity and mechanical ingenuity, capable of casting some 70,000 beams of light up onto the interior of the dome. Simultaneously, it had to perform any number of individual tasks, projecting the complex movements of the Earth, Sun, planets and stars, and making these heavenly movements understandable to the seated audience. In carrying out this complicated mechanical task the instrument needed to combine two incompatible astronomical systems while giving the illusion of working to one system. Firstly, it presented a view of the stars as they moved across the night sky to an audience in a fixed position, thus reverting to the old Ptolemaic system where the Earth is considered fixed and the heavens revolve around it. Secondly, it had to cope with the movements of the planets, which can only be demonstrated by the later Copernican system, where the planets, including the Earth, move in slightly elliptical orbits around the Sun, along paths that become complex to calculate if shown to an audience on an Earth which is assumed to be motionless. In addition to matching these two systems of movement, the projector had various other tasks. For example, in spite of the frieze which located it specifically in London, it had to illustrate both northern and southern hemispheres,

Top: Publicity photograph of the Zeiss mark IV dumbbell projector, London Planetarium, *c* 1960
Bottom left: Arrival of the Zeiss projector at the London docks, *c* 1958
Bottom right: Audio booth, London Planetarium, *c* 1960

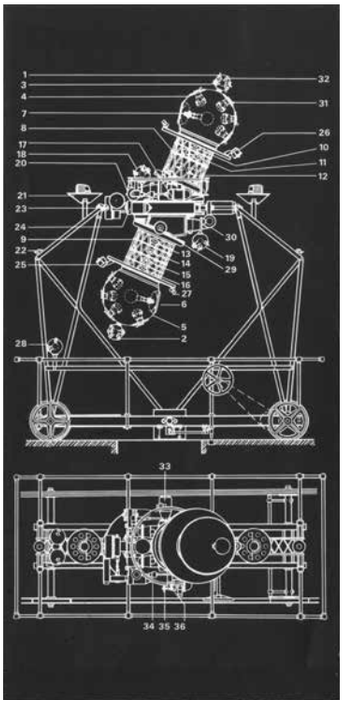
offering a view of completely different parts of the night sky. It also showed irregular celestial objects such as asteroids, comets and meteorites, which move in a very different way to either stars or planets. It needed to recalibrate itself to show the night sky from any moment either in the past or in the future, for instance from the time of the birth of Jesus, or a time many years in the future. And as if this wasn't enough, it needed to be able not only to alter the light intensity so as to create the effect of either dawn or dusk, but also to speed up time, so that the stellar movements of a whole night, year or even longer could be demonstrated in a show lasting just 30 minutes. It was a true space-time modulator.

Today we are familiar with digital systems that can achieve such effects through computer software linked to one single projection system and which require no moving parts. But the Zeiss projector carried out its functions mechanically: each movement needed a motor to determine the path and angle of an individual projector, and each corresponding projector had to have its position and intensity calculated in relation to the position and intensity of other projectors. As its name suggests, the Zeiss projector resembled a great dumbbell, supported on a steel frame, and controlled electrically from a console beside the lecturer's podium. Each of the two spheres at either end of the dumbbell contained projectors capable of displaying either northern or southern hemisphere star systems, while a separate system of individual projectors mounted on the stem recreated the individual planets of our own solar system, moving according to paths first worked out by Nikolaus Copernicus and Johannes Kepler. Other distant features of the galaxy which required a more generalised effect rather than individual points of light had their own ingenious devices: photo-engraved plates recreated the Magellanic clouds of deep space, and the Milky Way was beamed through a double-sided glass cylinder, half-filled with mercury, which was used to cut out the light at the correct point. Special mercury-filled eyelids were also used to create the effect of stars

Interior view of the London Planetarium, looking down into the auditorium from the top of the dome, *c* 1960

becoming brighter and then fading, and to shut off stars that fell below the line of the horizon and which might therefore shine into the faces of the audience. A special ring allowed for the adjustment of the year in which the stars were projected, and additional devices projected the signs of the zodiac into their appropriate location.

The projector was originally mounted on a lift, partly so that it could be moved out of the way if the interior was used for some other function, and also partly so that it could be seen in the foyer before the show began. Visible in its glass container at the centre of the foyer on the ground floor, it would have appeared to the arriving audience as if it were a mechanical deity awaiting to rise up into its own self-created heavens. Once everyone had taken their seats in the auditorium, shutters would descend around the lift to prevent light filtering in from the foyer, while upstairs the lights would be dimmed to allow the spectators' eyes to gradually adjust to the darkness. On cue, the projector would then slowly rise up into the auditorium, the night sky would be illuminated and the half-hour narrated show would begin. This ascent of the projector into the auditorium was a spectacular start to the show, but the lift system was abandoned only a few years after opening because of problems with aligning the star systems onto the dome each time it rose up – and the machine remained fixed at the upper level.



The Zeiss projector remained in the auditorium for almost 40 years. It was reliably constructed and performed almost faultlessly, but its myriad of projectors and motors were expensive and time-consuming to maintain. Dating back to an original Zeiss design from the 1920s, it was becoming old-fashioned by the 1990s, and audiences brought up on Hollywood's spectacular astronomical effects wanted something more. During the 1990s the London Planetarium was repeatedly renovated to fit into Tussauds' plans to maximise profit. A mezzanine was inserted into the upper portion of the foyer, while its ground floor was taken over by the London Taxi Ride – a Tussauds attraction, complete with automata representing typical London figures such as Queen Victoria and Admiral Nelson – which cut off direct access to the planetarium from the street. An external blue tower containing stairs and a lift for the disabled was also added to the northwest of the dome. At the same time the seating in the auditorium was changed: the previous arrangement – the classical system of concentric circles used in all planetariums – had the visitors gazing up into the illusion of the night sky, moving their heads to view different positions of the sky. However, as the show tended to speed up, and more movements were compressed into a shorter period, tilting the head to gaze at large numbers of stars swirling in the heavens often induced motion sickness, with unfortunate consequences for the hygiene of the seats and floor. A raked floor was now installed, with new seats individually orientated towards a point away from the zenith of the dome – a piece of design which involved complicated geometry worked out by one of the first parametric CAD programmes. In the process, the great mechanical Zeiss projector was replaced by a digital system, the Digistar 2 (later upgraded to Digistar 3) developed by Evans & Sutherland of Salt Lake City, USA – a company which specialised in early digital simulation systems, including flight simulators for the US military. In London, the Digistar operated from a flat-screen computer using pre-programmed software, casting its image up onto the dome through one single powerful projector. The digital system thus did away with the need to have individual lenses powered by individual motors to show each

Left: Projector console, London Planetarium, *c* 1960
Above: Elevation and plan diagrams of the Zeiss mark IV dumbbell projector, London Planetarium, *c* 1958
Opposite: Diorama of the London skyline within the dome of the London Planetarium, *c* 1960
© Madame Tussauds, London

planetary movement. It also had the advantage of being able to project anything shown on the computer screen, and could thus roam through the universe according to the will of the lecturer, projecting stars from any calculated position at any particular time. More thrilling special effects could also be employed as required, such as a virtual ride through a black hole, or cosmic collisions and stellar supernovas. A new interior shell, more suitable to the light of the digital projector, was constructed within the dome, replacing the original aluminium shell and its thousands of small holes.

In the 1990s, as computer technology became more sophisticated, planetariums in different cities began utilising special software for the digital displays, developing their own shows which they would then sell on to other planetariums, partially replacing the more individual system where lecturers would control individual talks. The digital projectors were undoubtedly more flexible and capable of many more effects than the old Zeiss machines, but the constellations were nowhere near as sharp, and close to the horizon stars would be drawn out into lines rather than points – a result of the projection system having to deal with the information on the two-dimensional flat screen being projected through a large lens onto the three-dimensional dome. Due to the colour of the computer screen the stars also acquired a greenish tint. These problems have now mostly been remedied as digital projectors have evolved, but for all its mechanical complexity the Zeiss was a better instrument for traditional planetarium displays: it had its own style and presence, as opposed to the anonymity of digital projectors. Perhaps in recognition of this, Zeiss have continued to develop analogue projectors, and today produce miniaturised versions of the dumbbell, with its own scaled-down projection systems.

After its decommission, the Zeiss projector on the Marylebone Road was meant to be handed over to the London Science Museum, where it would have been a magnificent exhibit. But the management company of Tussauds, who owned the planetarium and all of its equipment, were unwilling to simply let it go, so it was dismantled and moved to the Alton Towers entertainment park in Staffordshire, owned by the same company. Until 2004 it stood at the entrance of their Black Hole ride, where visitors travelled on a roller coaster through flashing lights, simulating what they imagined as the chaos of passing through a black hole. In such entertainment parks astronomy has become participatory. Rather than sitting and watching a display, the visitor is thrown around physically in an imitation of an outer space experience. But after the ride closed the Zeiss projector seems to have disappeared. At any rate no information is currently available from the management of Alton Towers, who appear to have little interest in its history, qualities or importance. After many enquiries I was sent a photograph of a rough wooden tower positioned beside another of the rides, Nemesis, out of which protrudes a vertical shaft surmounted by a globe, perhaps the last sad remains of the great machine. Former astronomy lecturers from the London Planetarium have disputed that this could in any way be the Zeiss projector, so its fate remains unresolved. It seems appropriate that the last verified sighting of the machine placed it beside an artificial black hole. Perhaps it is now standing in some Staffordshire field, quietly disintegrating into the English landscape.

Bauersfeld

The firm of Carl Zeiss, nineteenth-century specialists in the production of optical instruments, had become involved in the design of planetariums through their skills in designing some of the earliest film projectors. Resisting the appeal of the cinema screen, in the early decades of the twentieth century the founding director of the Deutsches Museum in Munich, Oskar von Miller, was developing an interest in constructing a machine that would show the movement of the planets and stars. In 1913 he approached Zeiss for assistance in designing two astronomical rooms, one heliocentric – ie, Copernican, with the planets rotating around the Sun, the other geocentric – ie, Ptolemaic, with the Earth in the centre of the solar system. The heliocentric room was purely mechanical and involved a complex set of machinery, a bit like an orrery, mounted on the ceiling, with the various planets attached to radial arms which would circulate around the Sun. The visitor would move with the planets, standing on a simple platform which ran along tracks on the floor imitating the path of the Earth while lightbulbs in the walls gave a vague imitation of a starry background. Despite the complexities of its mechanics, the room was visually rather unsatisfactory – it was in effect just an abstraction, showing only the movement of the planets while giving no actual impression of the appearance of the night sky. Von Miller therefore asked one of the Zeiss optical engineers, Walther Bauersfeld, to design the second room with an astronomical projector, built along the same lines as a Zeiss cinema projector. Bauersfeld was an ingenious engineer with a wide range of skills who had earlier invented the sterioplanigraph, a device for converting aerial photographs into two-dimensional plans, so that such images might be used as a basis for cartography. From photographing the earth from the sky, he now moved to projecting an image of the sky in three dimensions from the earth. Bauersfeld himself described his invention:

The great dome will be set up, its white interior surface shall be used as the projection surface for a multitude of projection apparatuses

Above: View of Jena's domes amid the city's rooftops, 1923
Left: Walther Bauersfeld, *c* 1940
© Madame Tussauds, London
Opposite: Construction photographs of the Zeiss rooftop planetarium, 1925
© Carl Zeiss Archiv, Jena

arranged at the centre of the dome. The interconnected position and movement of the smaller projectors will be linked by appropriate gears, so that images produced by the projectors on the dome will show our eyes the visible stars in their position and movement, just as we are accustomed to see them outside in nature.

This room needed to be geocentric since both spectators and projector would be fixed in place while the projections of the night sky moved around them. As a highly inventive optical, mechanical and structural engineer, Bauersfeld turned out to be exactly the man for the task. Over a period of five years he and his colleagues at Zeiss worked out the complex geometry, delicate mechanics and variety of lenses needed to imitate the effects of thousands of stars. Their earliest Zeiss prototype, with one star-globe showing the stars and planets as seen from the latitude of Munich, was installed at the Deutsches Museum in 1923, occupying a small dome 10m in diameter. It worked well and was immensely popular, attracting large numbers of visitors to what was seen as a completely new phenomenon: the night sky, presented not as an abstraction, but in the form of a three-dimensional view, similar to that obtained standing out in the countryside on a clear starry night.

The first-ever purpose-built planetarium, with a larger 16m dome and a projector very similar to the one developed for Munich, was constructed, appropriately enough, on the roof of the Zeiss factory in Jena the following year. Again designed by the ever-inventive Bauersfeld, its dome was also an extraordinary piece of construction, the first-ever geodesic structure, based on a pattern of triangulated icosahedra and designed many decades before Buckminster Fuller's own experimental domes of the 1950s. The function of the planetarium – known as the *Sternentheater* (star-theatre), or sometimes *Sternenschau* (star-show) – took place alongside that of the *Sternwarte* (observatory) that was already on top of the factory. The early name 'star-theatre', which quickly gave way to the more limited term 'planetarium', implies that the dome had ambitions beyond merely showing planets; instead its show was concerned with the whole galaxy. A contemporary photograph shows the rooftops of Jena with the domes of the observatory and planetarium popping up into the sky like the twin cupolas of city churches.

The Jena planetarium immediately matched the popularity of its sister in Munich as 50,000 visitors made the trip up to the roof in the first weeks of its opening. A more permanent version followed, constructed in Jena's Prinzessinnengarten, with a larger dome, now 25m, and featuring the first Zeiss mark II dumbbell projector – very similar to the one installed in the London Planetarium 30 years later – with individual star-globes for each hemisphere. Like the dome that housed it, this projector was considerably larger than its predecessor and was fixed to a great steel frame, with wheels that enabled it to be moved around. The planetarium in the park was a more formal affair than Bauersfeld's dome on the factory roof, this time developed only for pure science. The responsibility for its design passed from engineers to the Jena architects Schreiter & Schlag, who equipped it with a small classical entrance porch and a row of columns around the exterior at ground level. The construction of this planetarium had been preceded by considerable discussion on the architectural form of this new building type, with modernists from the Bauhaus proclaiming the need for a new technological architecture, and traditionalists arguing instead for the planetarium to be integrated into a range of existing building types. For the most part the traditionalists won. A modernist design, without decoration, by the architect and teacher at the Bauhaus Adolph Meyer, was rejected as lacking the architectural qualities needed for a public, scientific building. However, the dome was once again designed by Bauersfeld, another geodesic system which refined his original version on the factory roof to produce a shell of extraordinary delicacy, its thickness so reduced as to be thinner in proportion to the interior space as the shell of an egg is to its own interior. The minimal elegance of Bauersfeld's dome rather contrasts with the half-hearted gesture of the stripped down classicism of the porch.

Meanwhile, planetarium fever gripped Germany, becoming a must-have for any respectable city of the Weimar period. Eleven new buildings were planned in 1926 alone, including in Leipzig, Düsseldorf, Dresden, Berlin and Hamburg. These planetariums,

Left from top: Planetariums in Berlin, Düsseldorf, Hamburg, Hannover, Jena and Wuppertal
Right from top: Planetariums in Chicago, Katowice, Milan, Moscow, St Petersburg and Volograd

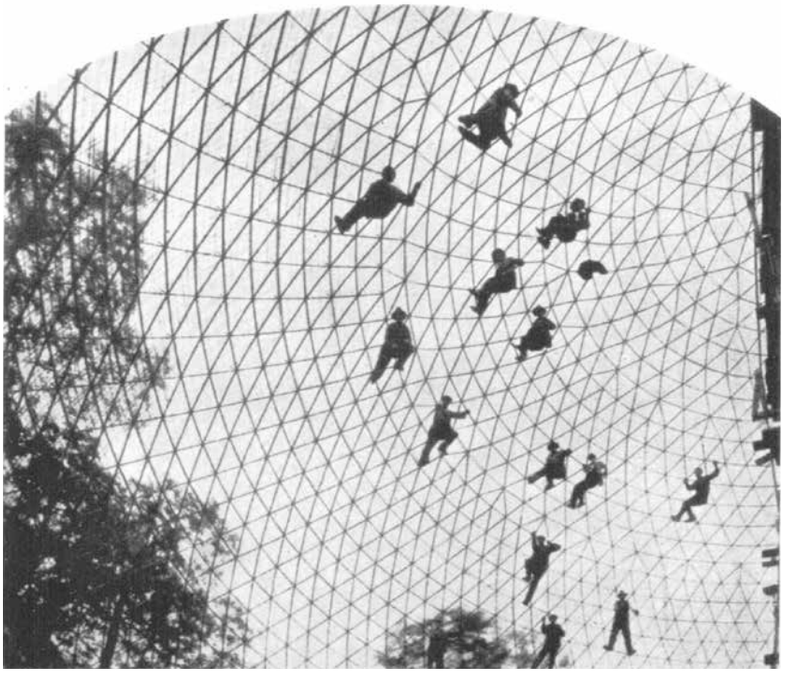
all substantially the same inside because of the need to conform to the technical requirements of the Zeiss projector, were finished in a variety of architectural styles. Barmen, near Wuppertal, was actually first off the mark in 1924 with a moody temple surrounded by trees, the building reached by a flight of steps and the entrance doors flanked by statues of Mars and Venus. In Düsseldorf a vast circular hall, inspired by Etienne-Louis Boullée's *grand projet* for an opera, was erected beside the Rhine as part of a large complex of buildings emphasising the modernity of Weimar Germany. This planetarium was reached by a monumental flight of steps with statues of the planetary deities, Mars, Venus, Saturn and Jupiter, while the dome was surmounted by a large star, a distant predecessor of the planet on the roof of the London Planetarium. In Dresden a delicate *Neue Sachlichkeit* temple was erected, its plan based on a 16-cornered star. The Berlin planetarium, located beside the city zoo, resembled a classical mausoleum, while Hanover went for a large bunker-like edifice in the centre of town. Most of these early German planetariums come with a certain melancholic atmosphere, usually placed in parks, places to go and meditate on the grandeur of the cosmos. During the Nazi period planetarium building stopped, the new Germany had more earthbound concerns. Earlier, however, in the late 1920s and early 1930s, cities overseas had picked up on the Jena initiative with planetariums equipped with Zeiss projectors opening in Milan, Chicago, Tokyo, New York and Los Angeles, mostly based on the Jena notion of a domed temple with a classical portico. Uniquely, the 1929 Moscow planetarium, which still stands though now much altered, was the only non-German planetarium with a dome designed by Bauersfeld, rather vertically extended to resemble a Russian church dome, and using cement manufactured from crushed mussel shells due to a shortage of building materials in the USSR. While many of these other planetariums still exist, the German planetariums had a short lifespan: almost all were destroyed in the bombing raids of the Second World War, leaving only Hamburg, Düsseldorf and Jena still standing.

After the war, the East German part of Zeiss continued to provide planetariums for the communist world, with a hefty neo-classical construction in Stalingrad, topped by heroic Soviet statuary, a rather John Lautner-ish creation in Kattowitz, and a large sphere in Beijing. No planetarium was constructed in Great Britain until the building on the Marylebone Road, presumably because of a complete lack of interest in astronomy on the part of both the state and the country's population as a whole. It was only the marketing enterprise of Tussauds, rather than any scientific initiative, that finally brought a planetarium to London. When the London Planetarium was eventually constructed, it related back surprisingly directly to the very first constructions in Jena. While Jena has the classical porch, and is single-storey, the London auditorium is raised up due to the restricted size of the site. In all other ways the two buildings are remarkably similar – elegant dome surmounted by a rooftop element; columns around the exterior; external building with support facilities; and dumbbell projector which could be moved if required. By the time the London Planetarium was constructed, Bauersfeld himself had moved to Oberkirchen with that half of the Zeiss company that supplied the projector for London. Indeed, it may have been the Zeiss engineers of Oberkirchen who were responsible for much of the London design, reconstructing in the London of the 1950s a memory of the 1920s building in Jena.

Cosmic Ecstasy

One of the interesting things about Weimar Germany's planetarium craze was the fascination it aroused outside purely astronomical circles. Teachers and students from the Bauhaus, for example, then based just 20km from Jena, were among the first visitors to the rooftop Zeiss planetarium. Lázló Moholy-Nagy, fascinated by its construction technique and the potential of an architecture created from lightweight nets, even placed a photograph of the steel skeleton of the Zeiss planetarium, which he himself took during a Bauhuas visit, in his book *Von Material zur Architektur* (1929). The triangulated structure seen from below, with the small figures of the construction workers suspended in the sky, offers a demonstration of an architecture defying the forces of gravity. Other photographs in the same book show the night sky as an inspiration for an architecture composed of light. 'Light', declared Moholy-Nagy, beside an image of the stars, 'is a border zone, it creates volume and space'. The great Zeiss projector also appears to have had some influence on Moholy-Nagy's famous light-space modulator of 1930, a device constructed of various metal meshes and machines through which lights were projected – a kind of Zeiss projector with an artistic rather than a scientific purpose, producing an early version of a lightshow in which light replaces physical material as the source for art and architecture. A few years later Moholy-Nagy produced a film of the light effects produced by the machine, *Lichtspiel Schwarz-Weiss-Grau*, with flickering patterns of illuminated shapes and forms. Through this, part of Bauersfeld's legacy seems to have spread out from a purely scientific exposition into the light shows and light installations of contemporary art.

The influence of the planetariums was also picked up by Walter Benjamin, whose *Einbahnstrasse* (*One-Way Street*) – a 1928 collection of aphorisms, incidents and observations based on the elements of the modern city – finishes with a chapter on the newest building type in town, 'Zum Planetarium' (To the Planetarium'). In this text, Benjamin highlights the problems of a purely optical link to the cosmos.

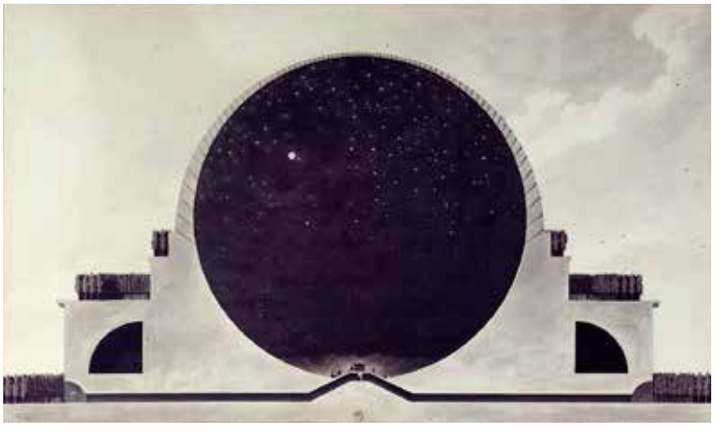


Above: Lázló Moholy-Nagy, Light-space Modulator, 1930 © Theatre Museum, Cologne
Right: Lázló Moholy-Nagy, frontispiece to *Von Material zurArchitektur*, 1929

The exclusive emphasis on an optical connection to the universe, to which astronomy very quickly led, contained a portent of what was to come. The ancients' intercourse with the cosmos had been different: the ecstatic trance [Rausch]. *For it is on this experience alone that we gain certain knowledge of what is nearest to us and what is remotest from us, and never of one without the other. This means that man can be in ecstatic contact with the cosmos only communally. It is a dangerous error of modern man to regard this experience as unimportant and avoidable, and to consign it to the individual as the poetic rapture* [Schwärmerei] *of starry nights.*

For Benjamin *Rausch* involves something much greater and more intense than the simple reverie of *Schwärmerei*, implying instead a deep feeling of being part of the universe. It also cannot be satisfied by an artificial recreation, but needs the aura of the original. Earlier, Bauersfeld, in his proposal for the first planetarium, had described nature as a location from which to see stars, but for Benjamin the term applied to something much greater than simply the natural forms of the planet, and was expanded to accommodate new scientific thinking and the elucidation of both the microscopic and cosmic. Benjamin, rather dependent on a myth of an ancient cosmic ecstasy, even hints at a link between the dependence on the creation of a virtual optical cosmos – a cosmos in the age of mechanical reproduction – and the social and political disasters of the time. This loss of nature, alongside our ability to celebrate a connection with the greater cosmos, is seen as leading to our predicament today, ever more isolated from the natural world by our increasing dependence on the power of technology.

Since the 1920s, in cities permanently flooded by artificial light, the natural night sky has become increasing invisible. At night in a large city one can only see the moon, perhaps a few of the brighter stars and the lights of airplanes. This perhaps explains the success of the planetarium – its ability to substitute, with increasing sophistication, a virtual sky in place of the actual sky that has now become lost to view. The technological removal of the celestial bodies we know to be above our heads may be a comparatively recent phenomenon, but the construction of an alternative virtual sky has a long architectural history, extending back well beyond the growth of permanently illuminated cities. Although the Zeiss planetarium, as devised by Bauersfeld, was effectively a new building type, it was also clearly indebted to any number of other building typologies with varying links to astronomy and the stars. At its core, the planetarium combines one of the most ancient architectural forms – the dome – with the most highly sophisticated machinery – the projector. The domed form of the typical planetarium clearly refers not only to the functional nature of the building, but also to notions of the sky and to buildings relating to the heavens. Certain domed buildings from classical times, such as the Pantheon in Rome, effectively create a vast artificial sky, with an oculus at the crown through which the actual sky is visible. In the example of the Pantheon, as illustrated by Piranesi's famous etching and in countless contemporary photographs, the oculus acts as a kind of projector, shining a controlled beam of sunlight into the interior as the only source of illumination. The Jena park planetarium imitates the Pantheon, perhaps deliberately, with the large dome fronted by a classical portico. Conversely, the interiors of the domes of many baroque buildings are often decorated to suggest the sky – at Granada Cathedral, for instance, the interior of the dome is decorated with golden stars on a green background.



Early attempts to model the solar system took the form of orreries – simple mechanical machines which imitated the movements

of the planets. One of the greatest of these stands in the Museum of Science in Florence, a sixteenth-century armillary sphere almost 2m high, completely filled with metal rings that describe the intertwined movements of the planets, in this case following the erroneous geocentric system. One can only admire the incredible industry required to produce such a fantastic object and to demonstrate an argument which is completely wrong. The viewer always stands outside such machines, whether geo- or heliocentric, entirely divorced from the planetary system which is being revealed. The orrery or armillary sphere can only explain an idea of the solar system; it attempts no illusion and does not seek to show what the night sky is like as visual experience. One of the earliest versions of an actual planetarium that placed the viewer within the system dates from the seventeenth century – the Gottorfer Globus, a 3m-diameter sphere built specifically for Duke Frederick III in his palace at Gottorf near Schleswig. This was a small personal galaxy, with seating for up to ten people. The exterior was decorated with a map of the world, while the interior, accessed by a small door, was covered with a map of the heavens. The constellations of this map were made from highly polished bronze nails, whose star-shaped heads marked out the positions of the individual stars and planets. The visitor could sit on a small fixed platform inside, equipped with a table and a few glasses of wine to facilitate the imagination, while the interior was lit up by candles shining onto the nail heads. The globe could then be rotated, while the platform remained still, giving the visitor the impression of the stars moving around him. After half a century, however, the globe itself was moved – carried off as war booty by tsar Peter the Great to St Petersburg, where it was destroyed in a fire. A copy, made soon after the fire, now stands in St Petersburg's Lomossow Museum.

Above and left: The Gottorfer Globus of Duke Frederick III, *c* 1650
Below: Karl Friedrich Thiele, after Karl Friedrich Schinkel, set design for *The Magic Flute*, 1849
© The Elisha Whittelsey Collection, Metropolitan Museum of Art, New York

Opposite above: Giovanni Battista Piranesi, *Interior View of the Pantheon*, 1768
Opposite below: Étienne-Louis Boullée, *Cenotaph for Newton*, 1784

The notion of being within a domed building which represents the heavens is also suggested by the building conceived by Étienne-Louis Boullée in his famous 1784 cenotaph for Sir Isaac Newton, the physicist credited with discovering the laws of planetary movement and of light. Boullée proposed this unconstructed cenotaph as a vast sphere, 150m in diameter, at the base of which would be located Newton's sarcophagus. The upper half of the sphere was pierced with small holes, through which light from the exterior could penetrate, giving the impression of a starry sky, but unlike the Gottorfer Globus, the position of both the viewer and star system was fixed, with no attempt made to represent a moving sky. In a curious inversion of reality, the stars would only shine during daylight, while during the hours of external darkness, artificial light would shine onto an inner planetary orrery located at the centre of the building sphere. This orrery was to be composed of a physical representation of the planets, able to move mechanically along their correct celestial paths, the central light beaming the shadows of the planets onto the interior of the building sphere. The night effect is therefore similar to that of a planetarium, with the orrery assuming the position later taken up by the Zeiss projector.

The night sky as a dome of sparkling stars appears as a theatrical background in the great theatre set designed by Friedrich Schinkel for a performance in 1816 of Mozart's *The Magic Flute*. In this stage set, regular columns of stars rise up out of the clouds to form a dramatic backdrop above the lunar chariot of the Queen of the Night, inducing a three-dimensional effect – a *trompe-l'oeil* domed interior – accompanied by Mozart's rapturous music. Looking in from the

other side of the proscenium, the spectator remains outside, in their own world. A further series of nineteenth-century buildings led gradually to the planetarium in its present form. One such precedent is the panorama, typical of the early nineteenth century and deriving from precisely those theatre sets produced by Schinkel. The panorama was formed within a large room, typically entered from below, in which is set out the illusion of a much greater three-dimensional space, such as a city, landscape or battle scene. Like the planetarium, the panorama creates the illusion of depth, with the spectator occupying a space part actual, part imaginary. These panoramas were generally painted scenes with perspectival effects. In the 1850s, however, exploiting new advances in technology, astronomy entered the new world of photography, with the first photographs of the eclipse of the sun by the brothers Frederick and William Langenheim, followed in the 1880s by extraordinary pictures of the night sky, showing untold numbers of stars, made by another pair of photographer brothers, Paul and Prosper Henry, working at the Paris Observatory. Such long-exposure photography was able to reveal stars and galaxies invisible to the human eye, a universe which was only now hinting at being much larger than traditional astronomy had proposed. If one were to project such star photography into the illusionary three-dimensional space suggested by the panorama, and then to make the images move through the late-nineteenth-century techniques of the cinema, and then to add the traditional orrery sphere as a machine showing the individual elliptical movements of the planets, then the Bauersfeld planetarium appears almost inevitable. What it needed, though, was Bauersfeld himself, and his vision, mechanical and optical skill, and an obsessive attention to detail, for this assemblage of component parts to become a singular reality.

Above: William and Frederick Langenheim, *Eclipse of the Sun*, 26 May 1854
Right: Paul and Prosper Henry, *A Section of the Constellation Cygnus*, 1885
© Gilman Collection, Metropolitan Museum of Art, New York

Wax

The London Planetarium must be the only planetarium in the world linked to a waxworks. The connection is certainly rather arbitrary – two very different money-making activities which happen to be run by the same entertainment company. But between the wax and the stars there are actually a surprising number of connections and a certain logic to their being placed together.

Tussauds waxworks had always been considered a curious mix of respectable and seedy, real and illusionary, morbid and life-giving. Madame Marie Tussaud herself had begun her career making wax copies of heads guillotined during the French Revolution. She arrived in Britain in 1802, with a miscellaneous set of heads, including Robespierre, Carrier, Marat (complete with what was claimed to be the original murder knife and bath), Louis XVI and Marie Antoinette, but also other distinguished Frenchmen who had died of natural causes, such as Voltaire, Rousseau and Napoleon himself. It was important that at least some of these wax heads were thought to be derived from the actual death-masks taken from the heads shortly after guillotining, because they were offered as exact and scientific rather than being simply imaginative recreations. However, their direct link to the moment of death also lent them a special tinge of morbid fascination. During the nineteenth century the waxworks attempted to become respectable – Tussaud modelled the English royal family and heroes like Admiral Nelson, and created tableaux of famous scenes from English history, including the execution of Mary Queen of Scots and the murder of the Princes in the Tower. These historical scenes were accompanied by the even more gruesome Chamber of Horrors, featuring depictions of execution and torture, all the while showing off a comprehensive collection

of actual instruments, such as the Gressaille Handcrusher and the Mask of Ignominy. In 1884 Tussauds, then owned by an entertainment company but still employing members of the original Tussaud family, moved to its present site in a purpose-made building with a determinedly respectable facade, becoming in the process an important attraction for visitors to the city and a permanent London institution. The scenes of Grand Guignol and the instruments of torture were balanced by tableaux of typical English life, such as a hunt with a pack of hounds, the Oxford and Cambridge boat race and a scene from Charles Dickens. These were presented as educational, as visitors would learn about a life beyond their immediate place and time.

During the mid-1920s Tussauds made an attempt to attract a higher class of customer, building a cinema and restaurant on what is now the planetarium site. The cinema was designed in what Tussauds described as a 'dignified late-eighteenth-century English style', which was effectively a continuation of the existing Tussauds facade, decorated with a neon sign. It showed only films with 'no objectional, sordid or unhealthy features', which must have rather limited the selection, and followed the precedent established by the original building by displaying wax figures of movie stars and other famous figures of the day. In the main Tussauds building visitors could stand alongside waxworks of the same stars they saw in the movies, such as Charlie Chaplin or Joan Crawford, with these waxworks often dressed in the actor's actual clothes. In the early 1930s Tussauds acquired the rights to the name 'London Planetarium Company', and so were clearly intending to move into the planetarium business. A small planetarium was planned for the interior of the Tussauds building, as an addition to the existing tableaux of historical and contemporary scenes, but this time expanded to a cosmic dimension. This planetarium, however, was never constructed due to a lack of space, and the cinema itself was destroyed by German bombing in 1940 – a direct hit which obliterated everything except, rather curiously, the wax figures of Adolf Hitler and other Nazis, which appropriately enough had been placed in the Chamber of Horrors in the basement. By the 1950s the whole idea of waxworks seemed increasingly dull and dusty, as popular entertainment became orientated towards television and cinema, and as people could see what celebrities looked like from photographs in magazines, as opposed to the often rather dubious waxwork likenesses. But with the destruction of the original cinema there was now enough space to develop the planetarium as an independent building – a bold move designed to raise the reputation of the waxworks as an institution, projecting a forward-looking scientific and educational image. The two buildings would balance one another, the planetarium recreating the stars and planets, and the waxworks recreating living celebrities and bringing the dead back to life – both, therefore, involved in a similar activity of creating a virtual world from what was originally natural, and both combining science and entertainment.

The London Planetarium functioned as a semi-independent enterprise, run by the British Planetarium Society and with its own separate entrance. However, as time went by the Tussauds waxworks began to infiltrate the planetarium. Wax figures of attendants were placed in the foyer to playfully confuse the visitor. These were followed by figures of famous contemporary astronomers such as Patrick Moore, eccentric presenter of the late-evening BBC series, *The Sky at Night*, which had launched in 1957, one year before the opening of the planetarium. In 1980 a permanent exhibition on the history of astronomy was set up in the foyer of the planetarium. A version of the historical tableaux located in the neighbouring building, it presented a vision of outer space that drew heavily on the popular TV series *Star Trek* and films like *Star Wars*, suggesting that astronomy was now a branch of cinematic fantasy. Life-size figures of the major astronomers, made by Tussauds' expert wax technicians, stood before explanations of their discoveries. Ptolemy was portrayed as an Egyptian priest out of a Hollywood epic, turning the wheels of a primitive cosmic machine; Copernicus, wearing

a theatrical sun-helmet plainly derived from a science-fiction fantasy, held up a glowing sphere; Kepler, gloomy and slightly baffled, sat in a Dalí-esque room beside his ingenious cup that combined the orbits of the planets with the platonic solids; Newton contemplated some planetary apples; and Albert Einstein posed like a university lecturer, marooned in a bend of space-time on a floating transparent disc beside a set of bent fluorescent light tubes. No astronomer followed on from Einstein, though rather later a very popular waxwork of Stephen Hawking in his wheelchair appeared in the main Tussauds building. The figure of the slightly crazed astronomer, a person not entirely inhabiting this world, has always had popular appeal – Vermeer's sixteenth-century portrait *The Astronomer* shows a bearded sage staring at a celestial globe, while an 1867 photograph by Julia Margaret Cameron portrays the astronomer John Hershel, his eyes staring wildly and his white hair standing on end, a prophet as much as a scientist, a precursor of the figures in the foyer of the planetarium. A similar eccentric astronomer, also with white flowing hair, appears in Hergé's Tintin book, *The Shooting Star*, in which an asteroid arrives on earth. Transported now into the foyer of the planetarium, visitors could feel at home with these distinguished astronomers of the past, just as they had previously sauntered amongst celebrity filmstars, and as today they pose beside the Queen, David Beckham and Michael Jackson. Somewhat removed, Neil Armstrong and Buzz Aldrin awaited in the main Tussauds building, where since

Left: Julia Margaret Cameron, *The Astronomer*, 1867
Right: the waxwork Albert Einstein at Madame Tussauds
© Madame Tussauds, London

1969 they had been standing on a rather diminutive moon, dressed in their space suits, but incautiously carrying their helmets under one arm. Astronomy was no longer presented as a science, but was now seen as part of an irrational new-age culture, where magic was as important as observation, and where astronomers were more conductors of dramatic planetary events than the everyday, earthly academicians that they actually were.

Predictably, it was these waxwork celebrities who would eventually defeat the real celestial stars. In 2006, the year the London Planetarium finally closed, the *Daily Mail* reported that its foyer now sported waxworks of Hugh Grant and Kylie Minogue, with large plasma screens presenting other celebrities. Visitors were encouraged to walk along a red carpet beside these stars and pose before wax paparazzi. Up in what had been the auditorium, a film on a 15-minute loop showed yet more celebrities, such as Tony Blair, Elvis Presley and George W Bush. In an 'interactive celebrity experience' – a vague imitation of Andy Warhol's 1968 statement that in the future everybody would be famous for 15 minutes – members of the audience could take turns parading on the stage. The night sky had been switched off. In the former planetarium everyone now had a chance to be a star.

Space Race and Apocalypse

In the 1950s the route to the stars had a rather different meaning. The building of the London Planetarium had coincided with a surge of interest in all things astronomical. This was the decade that witnessed the rapid development of the space race between the two sides of the Cold War, principally the US and the USSR, beginning with the immediate postwar absorption by both countries of German scientists involved in the development of the Nazi V2 rocket programme, and continuing on to the first Moon landing and beyond. The timeline for those principal events in the exploration of space in the years before and after the construction of the London Planetarium is as follows:

1949 US launches adapted V2 rocket, designed by former Nazi physicist Werner von Braun; first pictures taken from outer space
1951 First Soviet rocket with animals recovered alive
1955 US and USSR both announce they will launch satellites into outer space, marking the beginning of the space race
1957 *Sputnik 1* orbits Earth; later in the same year *Sputnik 2* orbits Earth with space-dog Laika, who does not return alive
1958 London Planetarium opens; and the first US satellite, *Explorer 1*, discovers the Van Allen radiation belts
1959 First view of the far side of the Moon from the Soviet spacecraft *Luna 2*
1961 First manned space flight, Yuri Gagarin orbits Earth
1963 First woman in space, Valentina Tereshkova
1965 Background radiation in space, considered to be remnants of the Big Bang, detected by US physicists; first spacewalks by Alexei Leonov and then Ed White
1966 Soviets crash-land *Venera 3* on Venus
1967 Discovery of pulsars – neutron stars emitting a beam of electromagnetic radiation – by British astronomers Jocelyn Bell and Anthony Hewish
1969 Neil Armstrong and Buzz Aldrin walk on the Moon
1971 USSR launches orbiting space station
1974 *Mariner 10* flies close to Mercury
1975 *Apollo–Soyuz*, a joint US–USSR mission that docked two space stations and featured the first US–USSR handshake in space, signifies a *détente* and end of the space race

In the figure of the rocket ship, the space race initiated the development of a new type of technology which stands in marked contrast to the prewar thinking that prompted the building of the London Planetarium. The early Sputniks were little more than boxes full of observation equipment, launched using technology derived from the Nazi war machine – basic but leading the way to more sophisticated vehicles. The Soviets were able to gain the upper hand by being bolder and more ruthless – sending up space-dogs in hastily constructed containers, barely more complex than washing machines or other domestic appliances, in which they could not possibly stay alive for more than a few hours. Yuri Gagarin's space capsule, *Vostok 1*, now on display in the RKK Energiya Museum in Moscow, is surprisingly small and primitive, but still it seems a major advance on the first Sputniks. The London Planetarium was thus constructed at a time when views about space travel and the possibilities of travelling to other planets were changing rapidly. In the early 1950s space travel was still science fiction, by the end of the decade it had become a reality. These voyages aroused a great popular enthusiasm for knowledge about space and for astronomy. The planetarium, far from being a dry educational building, acquired the potential to be a genuine entertainment attraction, bringing in large numbers of paying visitors. As a result, the planets and stars were no longer in a different sphere, unreachable and abstract, but were now part of daily life.

However, the 1950s was also the decade in which the possibility of the destruction of the Earth, or at least of human life on Earth, was felt to be very near. Under the looming threat of nuclear

annihilation – whether accidental or a deliberate act of war – the immense cosmic destructions of the past suddenly took on a much greater contemporary relevance. This climate of fear was fuelled by developments in the science, and pseudo-science, of astronomy. In 1950 Immanuel Velikovsky, a Russian-Jewish psychiatrist and general scientific loose cannon, published the best-selling *Worlds in Collision*, in which he argued that catastrophic events in world history, such as the biblical flood and the parting of the Red Sea, had been caused by the erratic paths of comets approaching the Earth. Velikovsky claimed that the solar system was actually comparatively recent, and that both Mars and Venus had, in recent times, been comets before becoming planets. In later books he proposed that emissions from Jupiter had caused the destruction of Sodom and Gomorrah, and that Mars had influenced the collapse of the Tower of Babel. Velikovsky's claims were violently disputed by astronomers and other scientists, together with historians of the ancient world, although his response was to use this extreme antagonism to put himself in the position of the misunderstood genius, like Galileo, attacked and undermined by his mediocre colleagues. His supporters were equally adamant, and at one point there was even a proposal to construct a planetarium in New York based on his theories.

The strongest result of the Velikovsky affair, though, was to make astronomy more interesting to the general public. Rather than an abstract matter of star movements it became associated with dramatic changes on a cosmic scale, readily evoked through special effects linked to science-fiction films. Part of Nicholas Ray's *Rebel Without a Cause* (1955) is set in the planetarium of the Griffith Observatory in Los Angeles which dates back to 1935, to the time of the construction of the German planetariums, and still operates today with a contemporary Zeiss mark IX projector. In the film James Dean and other teenagers on a school trip watch an astronomical show projected on a dumbbell Zeiss projector, very similar to the one used in the London Planetarium. The show begins with a typical voiceover explaining the visible stars and the astrological star figures. The youths become restless and distracted. But then the drama is ramped up with a depiction of exploding stars and the violent death of the universe: the Earth is described as having no importance at all at a cosmic level – its disappearance, announces the voiceover, will simply not be noticed. The teenagers are terrified by this message, but before long exit the observatory past the giant projector to continue their gang feuds. The film shows how in the mid-1950s, before the construction of the London Planetarium, planetariums had already moved on from simply trying to be scientific and to present the night sky as seen from the Earth, to fulfilling a more cinematic function, delighting in the scale of the universe and its destructive potential. Such scenes of the thrills of cosmic apocalypse have appeared in many subsequent films, with varying effectiveness, and have recently been raised to an art of terrifying beauty in *Melancholia* (2011) with shots of a rogue planet crashing into the Earth to the accompaniment of Wagner's *Tristan and Isolde*, and Terence Malick's *The Tree of Life* (2011), where galaxies (actually made of milk, wax and paint) slowly spread, and vast clouds of stars flow freely, this time to the ethereal *Lacrimosa 2* by Zbigniew Preisner. Such cinematic scenes, with their combination of visual effect and ethereal music, are clearly artificial recreations of the cosmos, but they do attempt to achieve the transition from Benjamin's poetic reverie to his opposing *Rausch* or cosmic ecstasy, enjoyed by a communal mass.

The London Planetarium's own potential as a location for a fictionalised cosmic disaster was spotted early on. JG Ballard's *The Drowned World* (1962) appeared just four years after its opening. The novel is set some time in the future, when the world has been flooded due to the icecaps and permafrost melting – a latter-day Velikovskian scenario based not on errant comets but on the overheating Sun. According to Ballard, the climate has relapsed into a kind of Jurassic condition, conducive to oversize lizards and insects. The few remaining human inhabitants live in the upper storeys of luxury hotels and other tall buildings protruding above the swamp-like waters. All that remains of London are the towers; the rest of the city has been flooded. The dome of the planetarium is spotted, several metres below the surface of the waters. The narrator, Kerans, decides to enter the building, and descends in a diving suit to street level. The building looms up, covered with molluscs, bivalves and the fronds of marine flora. Kerans finds all the pieces of the interior in place – the ticket kiosk, the staircase to the auditorium, the manager's booth.

The dark vault with its blurred walls cloaked with silt rose up above him like a huge velvet-upholstered womb in a surrealist nightmare. The black opaque water seemed to hang in solid vertical curtains, screening the dais in the centre of the auditorium as if hiding the ultimate sanctum of its depths. For some reason the womb-like image of the chamber was reinforced rather than diminished by the circular rows of seats, and Kerans heard the thudding in his ears, uncertain whether he was listening to the dim subliminal requiem of his dreams... the deep cradle of silt carried him gently like an immense placenta ... far above him, as his consciousness faded, he could see the ancient nebulae and galaxies shining through the uterine night, but eventually even their light was dimmed and he was aware only of the faint glimmer of identity within the deepest recesses of his mind.

Ballard's description of the interior of the flooded planetarium is precise and clearly written from the memory of an actual visit or series of visits. The planetarium scenes form the centrepiece to the book, mixing many of Ballard's continuing concerns – star systems, the subconscious, flooding, decay, ecstatic states gained though extreme experiences of the cosmos. The planetarium is not just a scientific instrument, it is the place where one goes to experience a rhapsodic state before the wonders of the star systems, a state which pushes one back into a memory of pre-birth. The building is both tomb, filled with dead objects, and womb, nurturing the next stage of human existence.

The Drowned World is now sometimes categorised as a prediction of climate change, and in its more banal aspects it does anticipate some of the current concerns with a planet overheating and the inevitable rise of sea levels. Ballard, however, is not really interested in why the change takes place, and his overheated sun is little more than a plot device. He is much more concerned with the consequences of the change for our view of the city, and for the forced revealing of our unconscious self within the setting of the planetarium.

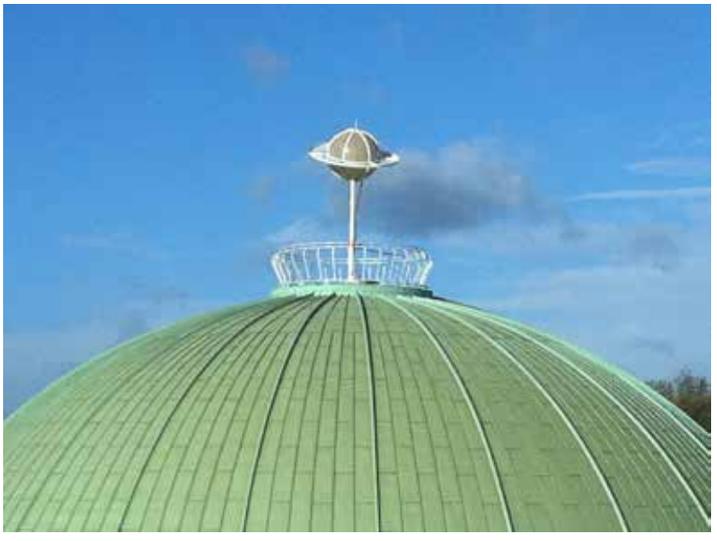
Barring planetary shifts on a Velikovskian scale, the London Planetarium seems safe from flooding, at least for the moment. The base of the building stands 36m above current sea levels. All of Greenland's ice and a large part of the Antarctic would need to melt to raise the waters to this level, let alone to place the top of the dome several metres underwater. So Ballard's 1960s vision of the drowned planetarium remains some way in the future, more psychic disturbance than environmental reality.

Slight Return

The London Planetarium was closed, at short notice, in 2006, after just under a half century of operation. Visitor figures were declining and the shows had been getting ever shorter, reduced from half an hour to just ten minutes. The management of Tussauds had lost interest in the educational aspect of the building, and were more concerned with the search for ever greater profits. A 1950s planetarium no longer seemed much of an attraction, compared to the expectations of an audience brought up on the spectacles offered by the cinema. Even at the time of its construction in 1958 it looked back to the planetariums of the 1920s, with their reconstructions of the night sky of the solar system. Our position now is no longer either geo- or heliocentric, as we realise our solar system is nowhere near any kind of centre. Instead, we are somewhere within a vast galaxy expanding away from an untold number of other galaxies. With this realisation, the concerns of astronomy have long moved beyond our immediate solar system, from simple planets and stars to pulsars, quasars and black holes and other cosmic phenonema, into an exploration of the universe through non-optical radio astronomy in which the telescope has been succeeded by the satellite dish. For many, it seems difficult to relate this wholeheartedly digital vision of the universe, where we are no longer central, to the traditional planetarium. Ironically, this move away from the centre and towards the edge has characterised the construction of what is currently London's only functioning planetarium, the Peter Harrison Planetarium in Greenwich, southeast London, which opened in 2007. Much smaller than the first planetarium on the Marylebone Road, it uses Digistar 3 projectors and software, but with a lecturer supplying the live voice-over. Its location immediately beside the Greenwich Observatory re-establishes the original Jena link between planetarium and observatory.

Currently the Marylebone Road building, renamed the Stardome but without any stars, is advertising a 4D extravaganza based on the Marvel Avenger Superheroes, following the recent success of the film *Avengers Assemble*. The publicity for this show presents the Incredible Hulk, Thor, Captain America and other Avengers fighting it out along the Marylebone Road. One can make out the buildings of the planetarium, Baker Street station and the late-modernist University of Westminster in the background. Within the former planetarium building a great statue of the Hulk now stands where the Zeiss projector once made its journey from the foyer up into the auditorium. Most of the rest of the former foyer is a chaos of partitions and corridors, so much so that it is difficult to make out anything of the former grandeur of the space. Dimly visible behind the cashier of the tourist shop is an old sign that continues to announce the rates for a planetarium visit. The future of the building, now owned by the international entertainment group Merlin, is uncertain.

The case of the missing planet was solved before it ever really began. Unlike the great Zeiss projector, and unlike the planetarium itself, the planet has returned. Once again it glows faintly against the sky, at a slightly different angle, with coloured light rather than white, but much the same as before. Holmes was not needed, and has anyway long since migrated into space as asteroid 5049, with Professor Moriarty on a nearby path as asteroid 5048. Holmes's statement – in Conan Doyle's 1888 story 'Scandal in Bohemia' – that 'You see, but you do not observe, the difference is clear' already neatly sums up the original difference between the planetarium and observatory up on the roof at Jena. A detective – or an astronomer – makes observations and then deductions from these observations. The rest of us, like Dr Watson, see but don't always observe, or understand what we are observing. It was the disappearance of the rooftop planet which drew attention to its existence and made it observed rather than simply seen. The reasons for the erratic movements of the little planet may appear to have been cleared up, but errant celestial bodies are well known to astronomers, who no doubt have a better explanation for their wandering.



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Contributors

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Mathew Aitchison is a postdoctoral research fellow at the University of Queensland's ATCH research centre and an architect and teacher. He is editor of *Visual Planning and the Picturesque* (2010), the first publication of Nikolaus Pevsner's treatise on Townscape, and is currently working towards a retrospective monograph on the movement. His recent research focuses on the architecture of industry, in particular the building and planning related to Australia's mining industry and the design and construction of prefabricated housing.

Pedro Ignacio Alonso directs the MARQ masters programme in architecture at the Catholic University in Santiago, Chile, and has also taught at the AA since 2005, currently as a visiting tutor in the History and Critical Thinking MA. He is the author of *Deserta: Ecology and Industry in the Atacama Desert* (2012), and recently exhibited his work in 'Cold War Cool Digital' (together with Hugo Palmarola) at the Pratt Institute in New York (2013) and 'Deserta' at the Chilean Pavilion at the 2012 Venice Architecture Biennale. A book on the research he and Palmarola have been conducting on prefabricated concrete housing systems exported into Chile in the 1970s from Soviet Russia will be published by the AA in 2014.

Hilla Becher is a photographer who was born in Potsdam in 1934. After six war years that saw her repeatedly evacuated across northeast Germany, in 1954 she managed to leave the East for Hamburg before moving again to Düsseldorf in 1957 to work in an advertising agency. There she met Bernd Becher (1931–2007) whom she married in 1961. Known collectively as 'The Bechers', the two of them proceeded to engage in a continuing project to photograph a whole series of industrial buildings. The resulting images have been exhibited all over the world and published in numerous titles by Schirmer/Mosel.

Tom Brooks is an architectural writer and historian. He studied the history of art at the University of Bristol and then the Courtauld Institute, where he specialised in twentieth-century British architecture, completing his master's thesis on Brian Housden's house at 78 South Hill Park. He currently works in the building conservation team at Alan Baxter & Associates.

H T Cadbury-Brown (1913–2009) was educated at the AA, where he later taught, in addition to academic positions at the Royal College of Art and Harvard University, and served as AA president, 1959–60. He worked with Ernö Goldfinger for a number of years and was also closely involved with the Modern Architecture Research Group (MARS). He is perhaps best known for the Turntable Cafe at the 1951 Festival of Britain and the RCA building on Kensington Gore with Hugh Casson and Robert Goodden, 1962–73.

Mark Campbell teaches history and design at the AA, where he also directs the 'Paradise Lost' research cluster. He will shortly defend his PhD dissertation on Geoffrey Scott's *Architecture of Humanism* at Princeton University. In addition to the AA, he has previously taught at the Cooper Union, Princeton University and Auckland University, and served as the managing editor of *Grey Room* and the Cooper Union Archive.

Ryan Dillon is an architect and currently teaches at the AA as the programme coordinator for the DRL and as a history and theory tutor in the undergraduate school. He studied at Syracuse University and the AA, and previously worked for Safdie Architects on projects such as the Peabody Essex Museum and the Khalsa Heritage Centre.

William Firebrace teaches design and theory at the University of Westminster, specialising in film and architecture. He is the author of *Marseille Mix* (2010), the first part of a planned trilogy of books published by the AA. The second part, *Memo for Nemo*, examines undersea inhabitation, and the final part, *Hop Baltic*, explores the architecture and culture of a number of Baltic cities. His extended essay here on the London Planetarium will also reappear as part of a forthcoming AA series of books on specific, unheralded buildings.

Adrian Forty is professor of architectural history at the Bartlett School of Architecture, UCL. He is president of the European Architectural History Network and the author, most recently, of *Concrete and Culture: A Material History* (2012).

Mathew Holmes studied at the AA and has been living in Mexico since 1991, where he runs a small architectural practice working on largely domestic and sustainability projects. From 2010, he has also been responsible for conservation work at Las Pozas, Edward James' sculptural garden in Xilitla, Mexico, in conjunction with the Fundación Pedro y Elena Hernández AC.

Joshua Mardell is an architectural historian, and recently completed his MPhil at Cambridge on the 'multiple modernisms' of certain key AA graduates practising in the immediate postwar period. His present research is concerned with the role played by antiquaries in the formation of neo-medievalism up to 1840. He currently works at the RIBA Drawings Collection cataloguing the papers of architects William Hayward Brakspear (1819–1898) and Rex Hawkesworth (1939–).

Ludwig Mies van der Rohe (1886–1969) was born Maria Michael Ludwig Mies in Aachen, Germany. He began his architectural career in 1908 as apprentice to Peter Behrens, leaving in 1912 to set up his own office. Over the next 25 years he progressively established his pioneering architectural aesthetic, moving from the neo-classicism of his first villas to his European masterpiece, the Villa Tugendhat in Brno in 1930. In 1937 he left Germany for the US, as head of the architecture department of the newly established Illinois Institute of Technology, and through his offices in Chicago went on to enjoy an even more productive American career, with buildings like the Farnsworth House (1946), Seagram Building (1958) and Neue Nationalgalerie (1968). His appearance at the AA in 1959 was on the occasion of his second visit to the UK to receive the RIBA Gold Medal.

Moshe Safdie is an architect, urban planner, educator and author. Born in Haifa, Israel in 1938, he went on to study architecture at McGill University in Montreal, and then moved again in the mid 1970s to Cambridge, Massachusetts, where he still lives. Embracing a comprehensive design philosophy, some of his most notable works include Habitat 67 in Montreal, Yad Vashem Holocaust Museum in Jerusalem, the National Gallery of Canada in Alberta, Marina Bay Sands Integrated Resort in Singapore and the United States Institute of Peace headquarters in Washington, DC. He also the author of *Beyond Habitat* (1970), *For Everyone a Garden* (1974), *Form and Purpose* (1982) and *The City After the Automobile* (1998).

Irénée Scalbert is an architectural critic based in London and a member of the *AA Files* editorial board since 1998. He taught at the AA between 1989 and 2006, has been a visiting design critic at the GSD, Harvard and currently teaches at SAUL in Ireland. In addition to his academic work and frequent guest lectures he has published articles and essays on a wide range of issues. In 2004 he curated an exhibition on Jean Renaudie and he is the author of *A Right to Difference: The Architecture of Jean Renaudie* (2004).

Laurent Stalder is professor of architectural theory at the ETH Zurich. His research focuses on the intersection of the history and theory of architecture with the history of technology. His publications include *Herman Muthesius: Das Landhaus als kulturgeschichtlicher Entwurf* (2008), *Valerio Olgiati* (2008), *Der Schwellanaltas* (2009, with Elke Beyer, Anke Hagemann and Kim Förster), *GOD & CO: François Dallegret Beyond the Bubble* (2011, with Alessandra Ponte and Thomas Weaver) and *Atelier Bow Wow: A Primer* (2013, with Cornelia Escher, Megumi Komura and Meruro Washida).

Helen Thomas studied architecture at Liverpool University and has a PhD in art history and theory from the University of Essex. A specialist in Latin American and post-colonial history, she has been an editor and lecturer at the Victoria & Albert Museum, Phaidon Press, the AA and London Metropolitan University.