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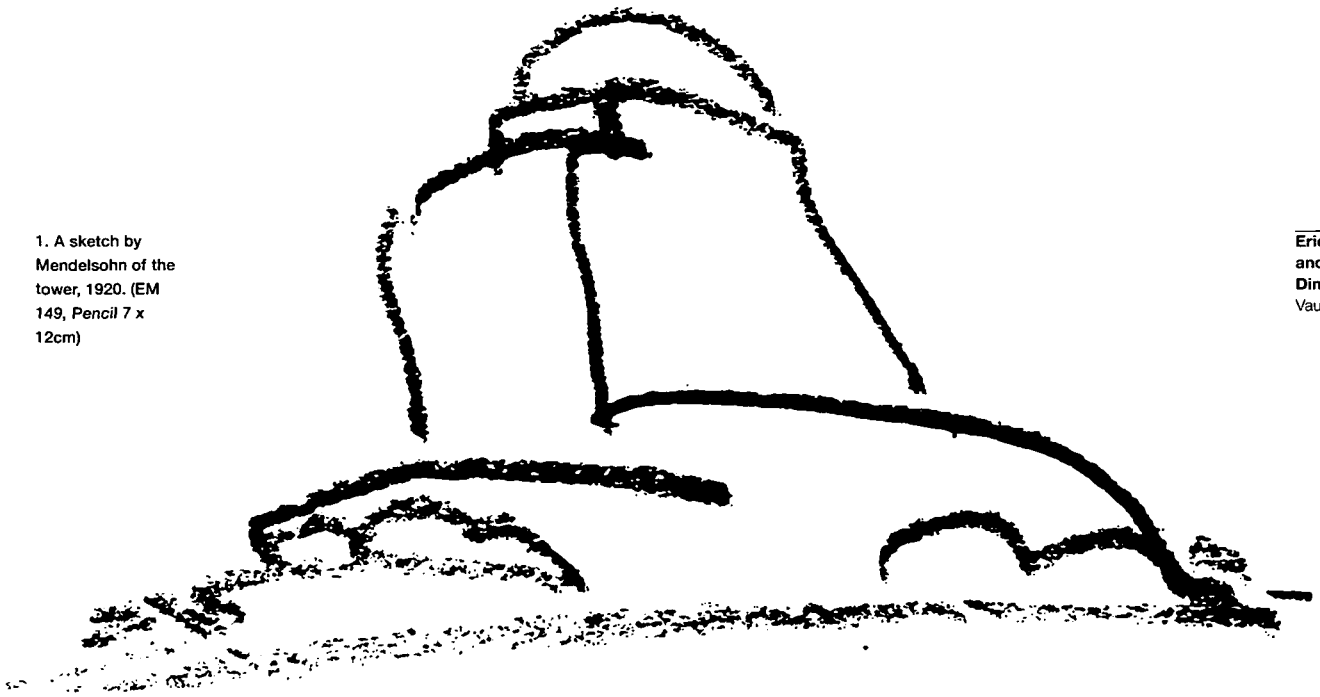
In this article the design of Mendelsohn's famous Expressionist tower at Potsdam is shown to have been shaped by the cosmology of Albert Einstein informed, however, by the apparently conflicting occult philosophy of Rudolf Steiner.

The Einstein tower designed by Erich Mendelsohn and built in the grounds of the astronomical institute at Potsdam in Germany between 1920-21, is frequently described as a unique monument to the brief movement in early twentieth-century art known as 'Expressionism' [Fig 2]. However, this description is despite Mendelsohn's own ambivalence to what was a loosely defined term. Indeed, commentators have made little attempt to explain what the tower's elegant curves are in fact expressing (Chaitkin, 1980; Banham, 1982; Zevi, 1950, 1985). An obvious explanation is that the tower's revolutionary form was related to the equally revolutionary science which informed the building's programme. For although Einstein never admitted the possibility of visualising the four-dimensional space-time continuum, it is unlikely that his observatory's design was uninfluenced by its spatial implications. Indeed, while the use of non-Euclidean geometry by late nineteenth-century artists was the most likely stimulus for the fragmentation of space so vividly represented by the cubists, the effect on painting of Einstein's non-Euclidean concept of space-time has been frequently noted since Sigfried Giedion's *Space, Time and Architecture* first appeared in 1941 (Waddington, 1969; Henderson, 1983). The influence of Einstein's science on the Futurists has also been recognised (Chaitkin, 1980).

More recently Kathleen James has interpreted the tower as a product of what she understands to be Mendelsohn's 'rational' view of relativity theory and the 'spirit of scientific enquiry', although James offers little detailed explanation as to how the tower's form represented this scientific outlook (James, 1994; Hentschel, 1994). James chooses to ignore Mendelsohn's more mystical reflections and their possible debt to Expressionism's esoteric core. In the following article Mendelsohn's tower is presented as a monument to the cosmology of Albert Einstein informed, however, by the apparently conflicting occult philosophy of Rudolf Steiner.

The 'building value of Einstein's Theory of Relativity'

The Potsdam tower was designed to test the theory of relativity which Einstein had outlined in 1905 and which he restated in a more developed form in November 1915. According to this theory, gravity is not a force, as Newton had maintained, but a curved field in the space-time continuum created by the presence of mass. This notion could be proved or disproved, Einstein suggested, by three observable tests: the first, the movement of the perihelion of Mercury's orbit, had already been made by 1919; the second, the displacement of Fraunhofer lines in the spectrum of the sun, was underway; the third test, involving the measurement of deflections of starlight as it travelled close by the sun, was possible only during a total eclipse. It was to carry out the latter two tests in



1. A sketch by Mendelsohn of the tower, 1920. (EM 149, *Pencil* 7 x 12cm)

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particular that the observatory was required. From the dome, through the coelostat, a light beam from a star is transmitted down the tower into a vibration-proof basement laboratory (Freundlich, 1969; James, 1994). The observatory's orientation is linked to that of the heavens, with the principal axis of the tower aligned north-south following the plane of the meridian. For it is only through interpretations of the movement of celestial bodies in relation to the fixed point of the north star that astronomers can map the heavens.

Mendelsohn not only came to know Einstein well, but, since 1914, had been a close friend of the scientist's first assistant, Erwin Findlay Freundlich. Indeed Freundlich was the initiator of the tower project, following Einstein's approval of Mendelsohn's sketches (Whittick, 1956; Chaitkin, 1980). Both Einstein and Freundlich published popular expositions of the theory of relativity around the time of the tower's design, and Mendelsohn must have seen these works (Einstein, 1917; Freundlich, 1917). Here Einstein spelled out the spatial implications of his theory in noting at the outset the demolition of, 'the noble building of Euclid's geometry' (Einstein, 1917). Something of the excitement surrounding relativity theory is conveyed in Freundlich's statement of 1917 that 'an experiment should be possible which alters our whole conception of what happens in the profounder depth of space known to us' (Freundlich, 1917). The astronomer clearly communicated this excitement to the architect during their many discussions and correspondences on relativity and the tower design (Beyer, 1967). Freundlich influenced Mendelsohn's terminology, for in a letter to the astronomer in 1917, Mendelsohn noted that: 'My sketches are data, the contour lines of an instantaneous vision... Until I am given the opportunity to demonstrate the practicability of my work through its execution, I can only express myself in basic terms' (Beyer, 1967).

During this period in the trenches Mendelsohn noted that 'architecture determines its own standard... that scientifically tests, measures, divides and serves to resolve mysterious secrets into predestined law and order.' Architecture and science thus both became symbols of order in the context of wartime chaos, and the future tower would itself evidently stand opposed to what Mendelsohn referred to as 'the extra-human and inconceivable... from the building blocks of the child to the tower spawned by chaos' (Mendelsohn, 1914-17a). In 1923 Mendelsohn reflected that rarely 'has the order of the world been revealed so clearly' (Mendelsohn, 1923). In a lecture of 1948 he reminisced that on 'many nights in 1918, under the open sky of France, I play with astronomic cupolas and meridians until an astronomer, a friend of mine, recognises the building value of Einstein's

2. The Einstein Tower at Potsdam, 1920-21

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Theory of Relativity and sends me – still in the trenches – the commission for the Einstein Tower' (Mendelsohn, 1948). And so what was the 'building value of Einstein's Theory of Relativity' which the tower clearly reflected?

A feeling of vital force

In a lecture delivered in 1923, shortly after the construction of the tower, Mendelsohn rivalled the Futurists in his enthusiasm for the dynamics of the machine as an expression of natural forces (Waddington, 1969). The dynamic spirit was justified with reference to Einstein's science, Mendelsohn observing that: 'Since the realisation that the terms energy and matter, which had once been separated by science, are just different conditions of the same fundamental material, and that nothing in the order of the world happens except in relation to the cosmos, the engineer has forsaken mechanics, the theory of dead matter, and has returned to the dutiful service of nature... The machine, previously the obedient handyman of deadly exploitation, becomes a constructive element of a new living organism... We have seemingly freed ourselves from gravity... Contemporary man, in the excitement of his fast life, can only find balance in the stress-free horizontal... Then the rotating earth will stand still!' (Mendelsohn, 1923).

Mendelsohn here clearly reflects the excitement surrounding Einstein's conception of a stationary earth relative to the cosmos and his reappraisal of the Newtonian concept of gravity. In this lecture Mendelsohn made clear that the 'dynamic' quality he wished for in his architecture was to be achieved not so much through a sense of movement as it was 'a feeling of vital force'. This force was identified with technology, although the machine was always subservient to the human spirit and was not the form giver itself (Mendelsohn, 1928). In a lecture of 1942 Mendelsohn lamented that 'the functionalists mistook mechanics for architecture; the dynamicists idolised technique' (Mendelsohn, 1942b).

Following Einstein's relation of energy, mass and light in the famous formula $E=MC^2$, Mendelsohn sought to express the energy latent within architectural mass through new dynamic forms arising from the structural possibilities of steel, concrete, and glass. He reminisced in 1953 that: 'as a student in Munich in 1907 I rebelled against the then prevalent teaching of historical styles because I recognised that the elastic qualities of the new structural materials, steel and reinforced concrete, must by necessity produce an architecture entirely different from anything known before... my first building (the Einstein Tower) which had been conceived in the trenches under the impact of the war and Einstein's theory – both happenings foreboding great changes – tried to express my idea in form rather than in structure' (Mendelsohn, 1953).

From this there can be no doubt that Mendelsohn saw the form of his tower as expressive of Einstein's theory.

A clear architectural organism

In his lecture of 1948 Mendelsohn observed on the elastic potential of these new materials that 'the Principle of Elasticity is dictated by Nature. Upon it Nature works in all

her organisms... This is the structural meaning of "organic" architecture' (Mendelsohn, 1948). This justification of architectural form against natural organisms echoed Einstein's reaction to his tower: for when recalling the scientist's first visit to the tower on its completion, Mendelsohn reported in this lecture that: 'When the tower is finished – with every instrument specially invented and the plans fitting their intricate functions – Einstein in person pronounces his scientific judgment: "organic"!' (Mendelsohn, 1948). In scientific terminology 'organic' principally refers to the organised physical structure of natural systems, instruments and machines (Chaitkin, 1980; Rykwert, 1992). As such Einstein clearly understood the tower as a precise mechanical form, thereby accepting Mendelsohn's work in his own scientific terms. Mendelsohn himself interpreted that, ; 'as a man close to nature I understand what he means: that you can't change or take away a part without destroying the whole' (Mendelsohn, 1948). Indeed in 1923, shortly after the tower's construction, Mendelsohn had also observed that: 'the Einstein Tower, without question, is a clear architectural organism... one cannot take any part away from it, neither from its mass, nor from its motion, nor even from its logical development, without destroying the whole' (Mendelsohn, 1923). Joseph Rykwert has pointed out that Mendelsohn's interpretation echoed Leon Battista Alberti's famous definition of beauty in the *De re aedificatoria* (Book VI, Chapter 2) which has the body-image at its root (Rykwert, 1992). The tower's symmetrical skin certainly efficiently encases and thereby reflects the telescope lattice as the spine around which the building is sculpted. Mendelsohn himself made reference to the tower's skin as a 'membrane' (James, 1994).

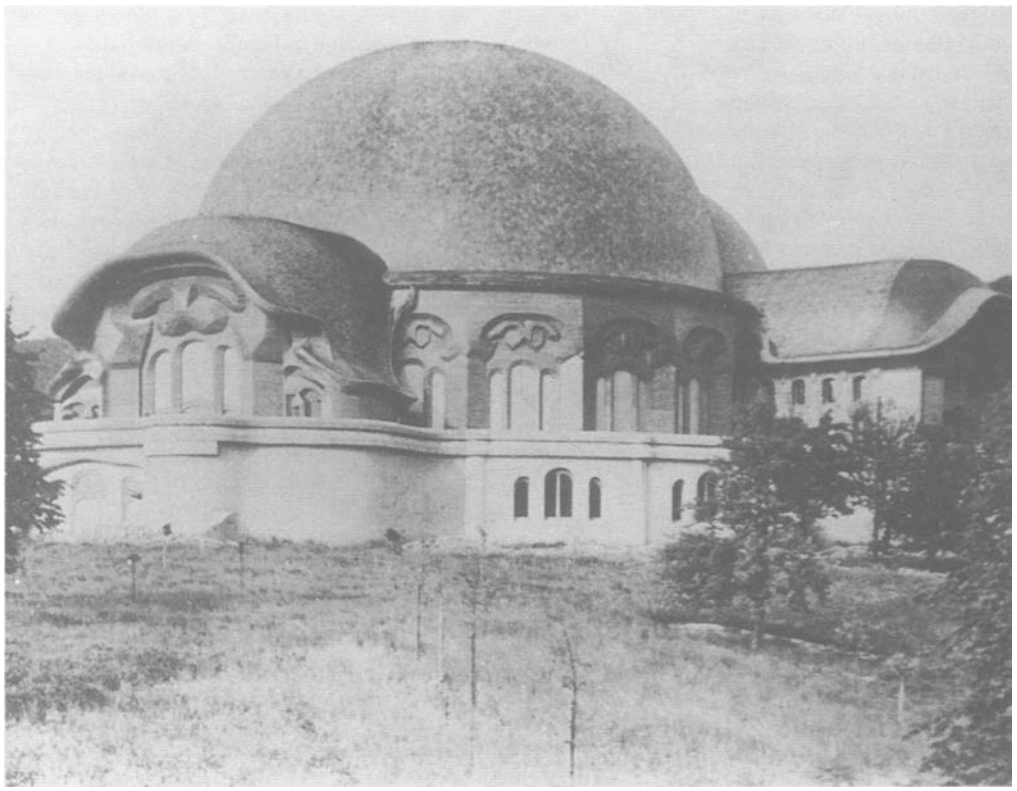
The breakdown of the cube

It would have been natural for Mendelsohn to see the dynamic form-giving possibilities of new materials as expressive of the theory of relativity in which absolute rest – represented by the 'either' of Newtonian physics – has no meaning. Space and motion were now inseparable, and the tower's aerodynamic form might be seen readily to express the transitory nature of mass in motion in the space-time continuum. The Newtonian concept of infinite space in three dimensions, represented by linear perspective, was rejected by Einstein in favour of a four-dimensional, 'finite and yet unbounded universe' which curved back upon itself (Einstein, 1917). Beaux-Arts buildings had reflected Newtonian space, as an architecture of Euclidean forms symmetrically arranged around a central axis and an ideal point of view necessarily aligned with the centre of the principal elevation (Zevi, 1974). Mendelsohn's tower, with its curvilinear non-Euclidean form and, as a consequence, its non-rectangular rooms, its curved windows and lack of frontality – in short, with its dynamic form – was a radical departure from this traditional conception of a frontally viewed Euclidean object. Indeed in Mendelsohn's famous sketch, the tower is seen from a point of view well to one side of the frontal perspective and the sketch is far from a celebration of Euclidean forms [Fig 1]. The tower's recessed windows serve to destabilise the solidity of the corners and to emphasise the breakdown of the cube, the principal form of Euclidean perspectoidal space. For since the cube had symbolised the stability of Neoplatonic and Newtonian cosmology, so the tower's curvilinear form sought to express Einstein's replacement of Euclid's 'noble building' with a non-Euclidean curved universe. The novelty of the tower's internal spaces, in which the walls even curve into the ceiling, was further emphasised by the non-rectangular furniture and by the absence of traditional details such as architraves. Indeed Freundlich reported that, in contrast with the tower's smooth unornamented external surface, the individual bricks of the older buildings in the institute at Potsdam were seen to epitomise the Euclidean and atomic structure of Newtonian science (Freundlich, 1969; Clark, 1973). In a lecture of 1942, Mendelsohn condemned the Beaux-Arts as 'the lifeless ornamental features of a bygone society' and described perspective as merely 'a three-dimensional impression', but defined Expressionism retrospectively as 'a new form of an emotional conception of life leading to artistic revolution' (Mendelsohn, 1942a). He compared this movement with the contemporary revolution in science, noting that 'science also took a new lease on life... Einstein's theory of relativity reorganised the previous conception of gravitation and space with the help of space-time as the fourth dimension' (Mendelsohn, 1942a).

Problems of symmetry

Einstein's universe was ultimately in equilibrium, a fact expressed in his principle of the 'cosmical constant'. The scientist noted in his popular exposition of relativity that 'an elliptical universe can thus be considered to some extent as a curved universe possessing central symmetry' (Einstein, 1917). As an 'architectural organism' it was evidently important to Mendelsohn that the tower's spaces and its wall mass be organised symmetrically around the (practically) straight ray of light reflected by the telescope. Indeed the speed of light was constant but related to the variables of mass and energy in Einstein's formula. On the tower's symmetry as a design discipline Mendelsohn commented in 1917 that 'problems of symmetry, and of the elasticity of the building components... concern me at every line and act as discipline, self-criticism and a universal rule' (Mendelsohn, 1923; Beyer, 1967).

However, while the plan, form and materials of the tower can thus be interpreted with reference to Einstein's theories, the tower's construction and planning in fact owe an equal debt to tradition. In his lecture of 1942 Mendelsohn charted the development of contemporary art and science and noted that, for a period, 'two worlds stood side by side... The old world of unproductive canons stood in contrast to the new world of creative perceptions' (Mendelsohn, 1942a). The observatory itself stands between these worlds. Despite the tower's concrete appearance and Mendelsohn's aim of expressing force through the elastic potential of this material, due to shortages of cement most of the work above ground was in fact built of brick and rendered to



3. Rudolf Steiner's Goetheanum at Dornach in Switzerland: second concrete building (commenced 1923)

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resemble concrete (the entrance was, however, constructed out of reinforced concrete). Mendelsohn's sketch and his tower thus anticipate, rather than express, the reality of reinforced-concrete construction. The thick walls are a long way from the de-materialisation of space implicit in Einstein's concept of a fourth dimension, and these walls were still by necessity set out by Euclidean geometric constructions. Further, the tower's symmetrical plan and minor axes, its curved staircase and apsidal end all clearly reflect Beaux-Arts principles (Banham, 1954; Rykwert, 1992). Hence the tower is not a direct translation of Einstein's physical world, which would have been impossible, but is rather a poetic or metaphorical expression of it, albeit moulded from plan conventions and traditional materials.

Rudolf Steiner and the plan of the Einstein Tower

Mendelsohn was not blind to the poetic force of a philosopher's tower built to observe light during the traditionally portentous moment of a solar eclipse. In one of his letters dated 1918 he made reference to 'sketches for Freundlich's mystical building' (Beyer, 1967), while in 1948 Mendelsohn would note on the tower that the 'mystic around Einstein's Universe produces a piece of architecture which even its author cannot fully explain by retrospection' (Mendelsohn, 1948). These thoughts are curiously akin to the mystical aims for architecture aspired to in the so-called Crystal Chain letters, which were written by fellow Expressionist architect Bruno Taut and 11 correspondents and commenced in December 1919, that is during the period of the tower's design (Boyd Whyte, 1985). Mendelsohn had seen Taut's 'Monument of Iron' in Leipzig in 1913 and met the Taut brothers shortly before the tower opened in 1924 (Beyer, 1967). In his desire for a 'mystical building', Mendelsohn's primary influence could well have been the occult concept of art advanced by the contemporary Spiritual Science of Theosophy, which had much influenced Taut. Founded in 1875, Theosophy was certainly one of the main influences on the early cubists in their exploration of non-Euclidean space. Its philosophy opposed the scientific view of nature, but Theosophy and Einstein's cosmology held in common the idea of a fourth dimension. While for Einstein this dimension was time, for Theosophists it was a spiritual realm of life-after-death (Williams, 1977; Henderson, 1983).

An important branch of this mysticism found powerful architectural expression in the form of the 'Goetheanum', the Anthroposophical Temple built by Rudolf Steiner at Dornach in Switzerland in 1913 (although rebuilt after a fire in 1922) (Steiner, 1914a; Rykwert, 1982) [Fig 3]. Mendelsohn's knowledge of Steiner's philosophy has been suggested through the architect's early friendship in Munich after 1910 with the Expressionist painters Franz Marc and Wassily Kandinsky, whose works were influenced by the movement of Theosophy from which Steiner had developed his ideas (Ringbom, 1970; Williams, 1977; Weiss, 1979). Munich was an important centre for Theosophical debate, and Mendelsohn could not have avoided its teachings during his time at the University of Munich and the Technische Hochschule before his graduation in 1912. Even in 1928 Mendelsohn would echo Theosophy when noting somewhat cryptically that: 'Only through mastery of [man's] totally altered

needs will his vision also become free again for the needs of the mystical elements in his nature that are turned towards the mystery' (Mendelsohn, 1928).

Steiner's Goetheanum, with its curved walls and domes, has been described by Rykwert as 'one of the most remarkable monuments of German Expressionism' (Rykwert, 1982). Given Mendelsohn's probable knowledge of Steiner's ideas informing this building, we might examine Mendelsohn's own Expressionist tower in their light.

The cultivation of light

Steiner outlined his architectural theories in a series of lectures delivered at Dornach during the construction of the first Goetheanum, between 7 June and the 26 July 1914. The purpose of these lectures is made clear in their subsequent collective title, 'Ways to a New Style in Architecture' (1927), in which Steiner reflected that 'a real advance in architectural conception must come to pass again in our times' (Steiner, 1914c). Like Mendelsohn, Steiner also rejected the 'qualities of lifeless, mechanical rest' of traditional architecture since 'behind the Spirits of Form stand the Spirit of Movement' (Steiner, 1914c). Steiner equally cultivated the plastic or organic potentialities of the new materials, describing the glass in his Goetheanum, for example, as 'a living member in the whole organism of our building' (Steiner, 1914b). Glass, used to build towers in particular, was held in special esteem by Expressionists as a form of crystal, a symbol of the five senses to Taut and some of the Crystal Chain correspondents. In his book *Glasarchitektur* (1914), Steiner's friend, Paul Scheerbart, proposed that: 'towns and other places should always be distinguished by towers. Every effort must be made to lend enchantment to towers by night. Under the rule of glass architecture, therefore, all towers must become towers of light' (Williams, 1977; Boyd Whyte, 1985).

The celebration of light was central to Mendelsohn's attempt to give expression to Einstein's cosmology – a fact evident in his sketches for a 'temple of light', for example, or in noting that 'the living quality of architecture depends... upon the terrestrial cohesion of mass, upon the super-terrestrial liberty of light. It is light that first gives movement to mass' (Mendelsohn, 1914-17a). While echoing Einstein's relationship between energy, mass and light, here again Mendelsohn's sentiments reflected the spiritual re-awakening facilitated through architecture aspired to by Taut and the Crystal Chain group. Planned around a central beam, Mendelsohn's own concrete version of a tower of light might be seen at Potsdam.

Expressing inner secrets

Spiritual Science saw itself as a rival to science in its understanding of nature's secrets. Steiner considered that true architecture was not a mere imitation of nature's forms, as maintained by Gottfried Semper and exemplified by the Classical language from which Expressionism had broken free, but he held that it was rather an embodiment of the sensory forces which underlay these forms. Steiner echoed the philosophy of Renaissance occultism in noting in 1914 that 'art is the divine child of clairvoyant vision' and he quoted from Goethe in commenting that 'art is the manifestation of secret laws of nature without which they could never find expression' (Steiner, 1914a, 1914e). Indeed, Mendelsohn observed in 1923 that 'it is our task to... master the interior pressure' (Mendelsohn, 1923), and in 1942 he recalled that, in Expressionist architecture, 'the inner expression became more important than the impression of the outer world' (Mendelsohn, 1942a). If in his design Mendelsohn sought to 'sculpt' the spatial implications of Einstein's science, then the tower did indeed transcend outer forms and express inner secrets. Steiner echoed Mendelsohn's interpretation of the term 'organic' in noting that 'all that is to be enclosed within the forms... must be in correspondence... we should feel the walls as the living negative of the words that are spoken and the deeds that are done in the building' (Steiner, 1914a). The form of the tower certainly reflected Einstein's instruments and therefore experiments, a fact the scientist himself observed. Again Steiner noted on the Goetheanum 'it is impossible that the form here should be other than it is... the whole is conceived in living, organic form' (Steiner, 1914a).

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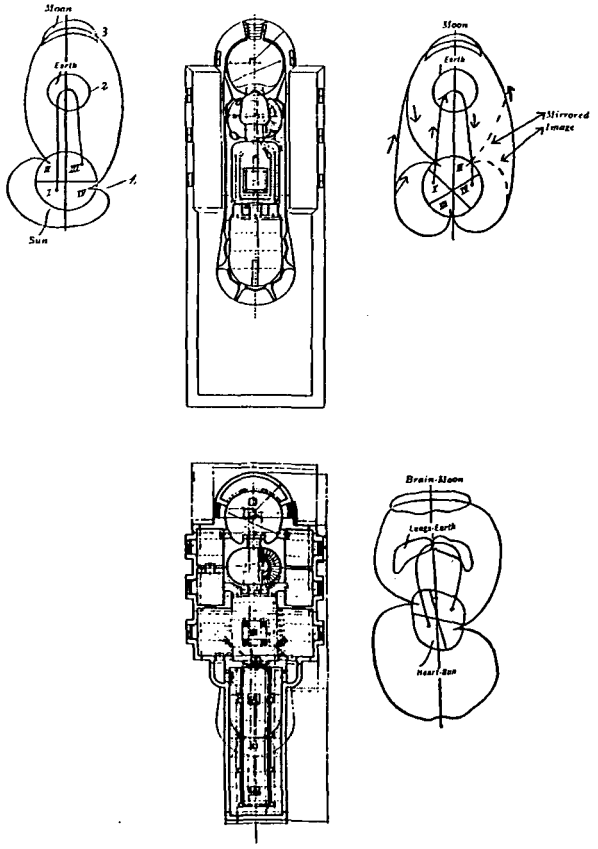
In his lecture entitled 'True Aesthetic Laws of Form', Steiner interpreted what he called a 'cosmological fact' comprising the sun, earth and moon which were related down a central axis and connected by curved lines of electrical current in the cosmos (Steiner, 1914d). This is presented as the key source for the new style of architecture aspired to in the Goetheanum, for, 'the forms in our building have been evolved from these deep cosmic laws' (Steiner, 1914d). Placing the groundplan of Mendelsohn's 'mystical building' by the side of Steiner's Expressionist hieroglyph, a speculative interpretation of the tower's plan is possible [Fig 4]. Appropriately enough, the domed telescope chamber occupies the position of the sun, the staircase chamber into the subterranean rooms occupies the position of the earth and the entrance crescent and stair occupies the place of the moon. The telescope chamber, with its equivalent cross axis, was clearly one of light, while the moon played its vital role in the observatory's work during the eclipse. The tower's curved walls might thus be seen to correspond with the electrical currents, much like the walls of the Goetheanum, and to match, as Steiner put it, the 'stream of spiritual being passing from a certain "chamber" of the sun to the Earth, penetrating the Earth and vitalising the Earth with solar essence' (Steiner, 1914d). Again appropriating Steiner's description of his hieroglyph, perhaps therefore in the plan or 'figure' of Mendelsohn's tower we also have: 'a marvellous combination of forms, a figure engraved in the cosmos representing the interplay between the forces of Sun, Moon and Earth... If a figure were made of this diagram – that is to say, a figure copied from the cosmos and expressed in some motif – we should have before us a profound cosmic mystery merely in the combination of form' (Steiner, 1914d).

Indeed understanding the relationship between the earth, sun and moon was clearly at the core of the tower's work, a study which even dictated its orientation.



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4. Above, ground plan of the tower compared with hieroglyph of the cosmos after Steiner. Below, basement plan of the tower compared with figure of the human body conceived as a microcosm after Steiner

This comparison is in no way to argue for a direct copy, however, but rather to point out the compatibility between Expressionist theory and the tower's form and purpose, a compatibility Steiner had certainly realised in the Goetheanum.

The human analogy

One further speculative analogy might be made, for Steiner's figure was also intended to represent the human body, that is to say the moon represented the brain, the earth the lungs and the sun the heart: the lines represented the blood circulation and, as Steiner noted, 'thus we can read from the cosmos what man is as a microcosmos' (Steiner, 1914d). The observatory's basement plan, moulded by Mendelsohn from a functional sketch supplied by Freundlich (Zevi, 1970; James, 1994), has an obvious resemblance to the human body prostrate, somewhat robotic in character [Fig 4]. When compared with Steiner's figure, not inappropriately the microphotometer laboratory below the entrance forms the brain and head; the twin semi-circular stairs form the lungs; the tower's cross axis, that is the light ray, forms the navel; while the long spectrographic chamber forms the legs. Indeed, it was noted earlier that as a body in motion the tower's symmetrical form above ground is stretched like a skin over the spine of the telescope gantry. We have also seen Mendelsohn make oblique reference to the body image in his interpretation of the term 'organic', and the body metaphor lies behind his observation made during the war that 'architecture demands freedom of space in order to stretch its limbs' (Mendelsohn, 1914-17b). Unlike Steiner, Einstein did not, however, hold that his cosmos was traceable in the body; he did not believe, in other words, in the concept of the microcosm, although he evidently approved of the use of human proportion in architecture (Le Corbusier, 1954; Chaitkin, 1980).

As the title 'Goetheanum' suggests, Steiner had been much influenced by Goethe and his belief in an organic seed of all being from which life originates, and further that the true work of art emanates almost spontaneously out of the spirit of a people. This organic, or orgasmic, spirit easily describes Mendelsohn's tower, as a phallus-like object erupting from the earth. On the Greek temple Steiner had contended that 'the land is part of the Temple itself', and on Gothic architecture that 'all the forces of these edifices rest within the earthly element' (Steiner, 1914b). In primitive times, according to Steiner, 'it was a question of representing the relationship between the earthly force and the sun forces' (Steiner, 1914a). Mendelsohn echoed this idea of a fundamental accord between architecture and the earth and sky. In a lecture entitled 'The Problem of a New Architecture' of 1919 he noted that: 'the Gothic cathedral anchors its towers into the middle of the earth in order to thrust their spires into the beyond all the more securely' (Mendelsohn, 1919). Further, in this lecture Mendelsohn outlined the spiritual importance of the 'dynamic principle' in architecture and the need for its expression in a 'sacred building' (Mendelsohn, 1919). His tower might be seen as just such a building, with its self-contained 'priesthood' of astronomers and forest precinct in which, temple-like, it is rooted to the earth but orientated about the heavens to observe the sun. With its symmetrical plan and its section rising from a crypt-like laboratory to the telescope cupola focused on the 'beyond', the tower's form clearly resembles that of a Cathedral. This resemblance is emphasised by the tower's apsidal end which, in place of the altar and bishop's throne, contains the office and Einstein's study, the focal point to which all work in the tower is directed.

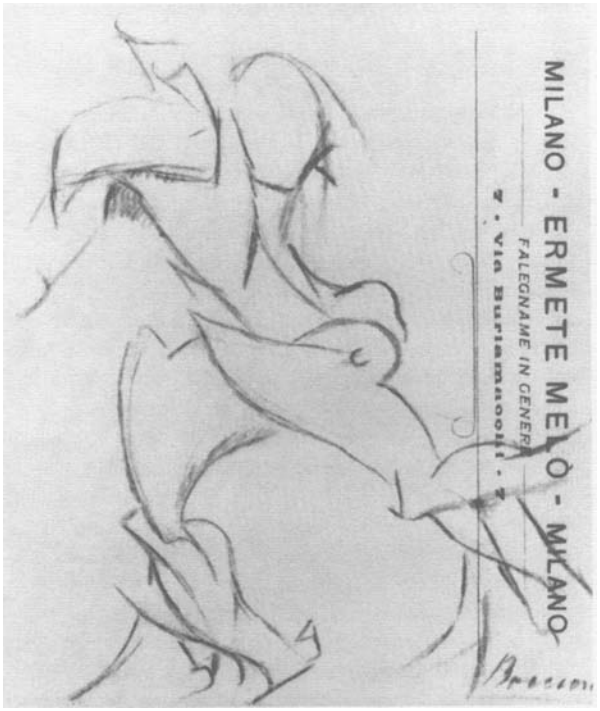
The Einstein tower is rooted in the primordial German soil but contains precise instrumentation focused skyward, just as its walls reflected both natural and mechanical forms in mirroring the twin definitions of the term 'organic'. Indeed, the observatory design followed a common theme of Mendelsohn's lectures in reconciling the opposites of cave and tower, dark and light, static and dynamic, and earth and sky. This union of apparent opposites is underlined when the tower's design is interpreted in the context of the scientific and the spiritual ideas of a fourth dimension as conceived by Einstein and Steiner. Despite their apparent incompatibility, these contemporary instrumental and metaphysical cosmologies easily explain Mendelsohn's aim to express in his tower 'the mystic around Einstein's Universe'. For

the opposites represented by Steiner's spiritualism and Einstein's science would seem reconciled by this interpretation of Einstein's universe, as a form of 'mysticism'. This dichotomy also echoed in Mendelsohn's conclusion in 1923, shortly after the tower's construction, that: 'for architecture, two components are necessary... the first component [is that of the] intellect, brain, the organising machine... .the second... is that of the creative impulse, the blood, the temper, the senses, and organic feeling. Only the union of the two components leads to the mastery of spatial elements' (Mendelsohn, 1923).

The will of an epoch

During the war Mendelsohn had written that architecture 'portends a transformation into the future, it becomes a great event governed by new laws. Architecture is the expression of the will of an epoch and of the spirit of that epoch' (Mendelsohn, 1914-17b). Following the war and a period of what he refers to as 'artistic exhaustion', Mendelsohn saw the Einstein tower as heralding a new age of peace and German cultural renewal (Mendelsohn, 1919; Chaitkin, 1980). To his future wife he wrote that: 'I believe that a new civilisation is beginning based upon the great conceptions of ancient times' (Whittick, 1956). Indeed these sentiments had led the Weimer authorities to celebrate Einstein's work and fund his tower, while Freundlich was to describe the tower as a 'memorial to the epoch making confirmation of the Theory of Relativity in the development of physics' (Freundlich, 1969). Theosophy had drawn on the spiritual aspiration of Renaissance occultism in its desire to unify mankind and heal national and religious divisions (Williams, 1977), and at both a practical and philosophical level science also cultivated this goal through its international character. Mendelsohn, too, shared this esoteric ambition; in 1923 he again echoed Theosophy in predicting that: 'a vertical orientation of beliefs and its conflict between the orthodox and the heretic will be replaced by the coexistence of religious elements: mysticism, secret doctrines, and miracles' (Mendelsohn, 1923). In his lecture 'The Problem of a New Architecture' given in 1919, a year before building work on the tower commenced, Mendelsohn observed that just 'as every epoch that is decisive for the course of human history has united under its spiritual purpose the whole of the known world, so what we long for will also have to bring happiness to all peoples beyond our own frontiers and beyond those of Europe... It is free humanity, which alone can create a universal culture once more' (Mendelsohn, 1919).

When placed alongside the architect's early fantasy projects – free-flowing sketches made in the trenches for anything from railway stations to crematoria – the Einstein tower represented a bold attempt by Mendelsohn to inaugurate a new universal 'style' for architecture. Free of nationalism, this style would symbolise the universality of the new spatial conception of a fourth dimension, the scientific truth of which the tower was built to establish. This new architecture would equally be free of the academic revivalism of the previous century while embodying the dynamic spirit of architectural magnificence which history recorded. The expression of force in particular was seen as the distinguishing mark of what Mendelsohn defined in 1923 as 'all epochs characterised by an originality of construction' (Mendelsohn, 1923). Hence he noted that: 'after the load-equilibrium of antiquity, after the upthrusted loads of the Middle Ages, comes the dynamic tension of reinforced-concrete construction' (Mendelsohn, 1919). Mendelsohn observed in 1923 that 'we have had time to rid ourselves of prejudices and complacency' (Mendelsohn, 1923), and hence Beaux-Arts formality was to be replaced with considerations of a building's 'contours', its quality of 'the sensually appreciable mass' with reference to the 'transcendent mass of light' (Mendelsohn, 1914-17a). According to Mendelsohn the so-called 'inner wall... decomposition brings about the sliding of surface into surface', while the 'outer wall... acts upon the visible universe' (Mendelsohn, 1914-17b). In echoing Einstein's trinity of energy, mass and light, this represents a radical departure in the vocabulary of architectural theory put into practice at Potsdam. With no clear architectural precedent, the tower bore more resemblance to the contemporary sculpture of Alexander Archipenko or Umberto Boccioni with its dynamic interplay of negative and positive volumes and naturalness of form (Giedion, 1971) [Fig. 5]. In his 'organic' tower erupting from the earth in its forest clearing, Mendelsohn repeated the age-old attempt to re-define architectural principles against nature's laws, the exploration of which served as the very function of the observatory. When discussing Einstein's single-word interpretation of the tower's design, Mendelsohn had after all described himself as 'a man close to nature'.



5

5. Sketch by Umberto Boccioni for his sculpture, Unique Forms of Continuity in Space 1913 (Pencil 15.5 x 12.7cm)

Erich Mendelsohn and the Fourth Dimension.
Vaughan Hart

The Potsdam Sphinx

Mendelsohn was not, however, unaware of the power of iconography and the historical role of form as symbol. After visiting Egypt in 1935, for example, he observed that: 'Gizeh with the Sphinx in full beauty makes a grand and surprisingly new impression. Only now can one understand the pyramids as the central force of a superhuman design, as the tip of the long axis, as the entrance of which... reposed the mystery of the Sphinx, as the nineteenth century said: divine, because superhuman, no longer human, the primitive mother-symbol. *I was exceptionally moved and wished I could* spend many hours there alone' (Beyer, 1967).

Indeed, the Einstein tower is also strangely reminiscent of the Sphinx, while the tower certainly stood at the 'gateway' to a new cosmic order. For throughout his life Mendelsohn exuded optimism as to the progress of mankind sponsored by scientific discovery: in a lecture entitled 'Architecture in a Rebuilt World', delivered in America in 1942, he proclaimed that 'through its method, science has freed man from fear and superstition', and he concluded that man: 'has found once more his material and spiritual balance [through] the new certainty of his scientific outlook... man will have returned, once more, to the oneness of nature, to the secret of creation – the universal rules – from where he started' (Mendelsohn, 1942c).

This understanding of human development followed that of Steiner and fellow occultists in conforming to biblical narrative: that is to say that paradise had been lost but following the necessary upheavals of war (equivalent to the Apocalypse) natural unity was is in the process of being restored. Mendelsohn introduced his lecture with a vision of this paradise in which: 'confronting the unknown, man devoted himself to the good values of matter: shelter, food, and propagation... He faithfully tilled his fields, modestly built his houses... But in the course of time, ever and anon, man, though born naked and helpless, abandoned his modesty for arrogance; his sense of order for disorder' (Mendelsohn, 1942c).

True to this biblical scheme, Mendelsohn concluded his lecture with the apocalyptic prophecy that: 'in order to re-educate the people at large, beautiful *per se*, to that beautiful end, to rebuild their towns and dwellings... the people themselves must first experience the fight for existence... the turmoil of mechanised battles' (Mendelsohn, 1942c). Conceived during the greatest of these wars and realised during the subsequent peace, Mendelsohn's Expressionist tower was ultimately intended to herald this new universal order.

The triumph of the functional

However, as Reyner Banham first pointed out in 1954, Mendelsohn effectively abandoned Expressionism after the tower (Banham, 1954; Boyd Whyte, 1985). Despite the energy of Mendelsohn's early sketches and those by artists such as Fritz Levy, no Expressionist cities were ever built. Mendelsohn's subsequent inter-war buildings are characterised by flat, rectangular forms designed for urban sites and complex functions. These designs represent a triumph of the functional over the dynamic, and a tragic rejection by Mendelsohn of the organic spirit of his unique architectural experiment standing to this day in the forest at Potsdam.

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Figs. 2, 3, author.
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