Your Geometric Engagement

Carol Diehl and Terry Perk

How do we construct our environment, how does it affect us, and how else might we imagine it? These are three key questions posed by Olafur Eliasson's work. Inherent in his investigation is the need for a heightened sensory awareness of what's around us, and the acknowledgement that our experience and understanding of everything in our world, including nature, is of human construction. Most of the time, Eliasson allows the means of his work to remain evident, with the understanding that knowing how things are constructed leads us to consider how they might be configured otherwise – and what the concomitant impact on our experience might be – all of which leads to the utopian promise that alternative platforms for engagement might allow for other kinds of being in the world and enable us to relate to each other in new ways.

From the beginning, much of Eliasson's work has challenged us to question how our spatial environment is organised and to consider how it might be organised differently. More often than not we take our surroundings for granted, unquestioning of the effect conventional configurations of forms might have on determining our cultural interactions.

One particular feature of our surroundings that we take for granted, due to its persistent use and presence, is the cube, the dominant form of Euclidean geometry with which most of our manmade world is constructed. The cube is a certain kind of space filler that has many advantages for building in our world: it tessellates in three dimensions, stacks together efficiently to make maximum use of space, and is easy to transport. It is not, however, a very dynamic form, and its predictable and familiar nature could lead, one imagines, to predictable behaviour in relation to its structure.

It is no surprise, then, that Eliasson, in exploring forms that might question such behaviour, would look for inspiration outside the confines of Euclidean geometry. Towards this end, Eliasson, who finds it most productive to work collaboratively, sought out the expertise of Einar Thorsteinn, a geometer, mathematician, and architect who had worked with R. Buckminster Fuller. Eliasson met Thorsteinn for the first time in April 1996, at Thorsteinn's studio in his home in Álafoss, on the outskirts of Reykjavik. An Aladdin's cave of geometric models and a visual precursor to their later *Model room* (2003), Thorsteinn's Constructions Lab housed multifarious spatial experiments. Trained as an architect in Hanover in the nineteen-sixties and with Frei Otto at the Institut für Leichte Flächentragwerke in Stuttgart in the early seventies, Thorsteinn had cultivated an interest in tensile structures and geodesic domes, which in later years would expand to include studies of symmetry within geometric structures. Eliasson hoped Thorsteinn could help him 'crunch the Fuller mathematical principle' that would allow him to express his ideas 'with greater precision'.[1] It was the beginning of a long and fruitful partnership.

On his spatial experiments with Thorsteinn, Eliasson has said:

> For me it is . . . interesting to use alternative spatial phenomenon or languages to show that what we take for granted as being reality is not at all real. A geometric language or principle or phenomenon can have a highly productive impact on the surroundings and . . . someone who has a non-Euclidean way of saying things, such as Einar, [can present] consequences that go beyond geometric questions. The next question is how does one then put it in the world?[2]

Originally conceived for a derelict green space in Hvidovre, on the outskirts of Copenhagen, *8900054* (1996) was Eliasson's first project developed with Thorsteinn, and it marked an emerging concern with the structures and forms that frame our engagement with the landscape. Now located outside the Arken Museum of Modern Art, the main geodesic scaffold they developed for *8900054,* the larger component of a two-part structure, is a hexagonal lattice punctuated with six pentagons, which enable the dome's specific curvature and, as with all tensile geodesic structures of this kind, create a local rigidity that distributes stress across the entire domed section of the partial sphere. It appears as an impromptu alien landing and is suggestive of a playground climbing frame or horticulture trellis. The sculpture extends the potential space of the museum into its surrounding grounds and acts as an architectural counterpoint to the design of Søren Robert Lund's museum. Comparatively inert, the work presents itself as both a stage and a staging post for engaging the museum and the landscape – a structure in between things. This idea of form as a vehicle for negotiating and reframing our experience of the familiar, made manifest in *8900054,* reflected a growing concern with the possibility of structures to operate as spatial experiments rather than simply being understood as concrete forms.

Where the geometric meshed framework of *8900054* has no specified function, the geodesic domed exterior of *By means of a sudden intuitive realisation* (1996), which Eliasson developed with Thorsteinn in the same year, serves a more explicit purpose in housing a strobe-lit vertical fountain of water. The effect of the strobing light gives the impression of momentarily solidifying the spray of liquid, like dancers in a rave, so that each pulse presents a new sculptural iteration of the fountain.

The specific housing of *By means of a sudden intuitive realisation* and the interior image of nature's dynamism functionally and metaphorically echo the igloo-like geodesic domes that house geothermal wellheads in Krafla, a caldera in the Mývatn region of northern Iceland. Originally developed by the German engineer Walther Bauersfeld in the early nineteen-twenties, the geodesic dome was popularised by Buckminster Fuller, who, in the late nineteen-forties, formalised the mathematic principles underlying the structure and gave it its name. As with all geodesic domes, the exterior of *By means of a sudden intuitive realisation* is developed around the form of an icosahedron, a twenty-sided polyhedron constructed of uniformly sized equilateral triangles and one of only five Platonic solids (the others being the tetrahedron, cube, octahedron, and dodecahedron). This underlying form acts as an abstract template against which the design of the geodesic structure is mapped.

From these early geometric experiments, it seems clear that Eliasson's intention is not to enhance or idealise the natural world but to use it simply as a site of mediation. This structural dialogue with nature is implicitly and explicitly embodied in another of Eliasson's early works, *5-dimensionel pavillon* (1998), the first in a series of pavilions developed with Thorsteinn. Commissioned for a garden in Holbæk, Denmark, the work echoes the configuring of nature found in French formal gardens of the seventeenth century, in which certain geometries were imposed to order lines of sight and frame moments of contemplation. The specific geometry of *5-dimensionel pavillon* continued to expand the geometric vocabulary of Eliasson's practice and incorporates the geometry of Ammann lines, which present a non-periodic pattern determined by the regular spacing of two sets of parallel lines. These identical sets of lines are opposed at angles of 108 and 72 degrees to create the visual effect of a simultaneously ordered and chaotic lattice. Formed into the three-dimensional arbour of *5-dimensionel pavillon,* the Ammann lines frame and complicate the relationship between the space inside and outside the structure.

The use of Ammann lines is geometrically significant. They are a particular example of fivefold symmetry and represent a specific structuring of space found in nature. In order to understand fivefold symmetry in three-dimensional space, it's probably easiest to begin by thinking of two-dimensional symmetries, such as the three lines of symmetry in an equilateral triangle or the four lines of symmetry in a square. It was long believed that only shapes with certain numbers of symmetries could tessellate exactly to completely fill space when aligned or stacked together. Equilateral triangles (threefold symmetry), squares (fourfold symmetry) and regular hexagons (sixfold symmetry) are all able to do this, but it was thought shapes with fivefold symmetry, such as pentagons, were impossible to tessellate. In the early nineteen-seventies, however, Roger Penrose, a mathematical physicist, discovered that a surface can be completely tiled in fivefold symmetry, using two shapes rather than one, in a non-repeating asymmetrical pattern. These shapes became known as Penrose Tiles, and Ammann lines are a related example of such symmetry.

In 1984, the point at which Thorsteinn became interested in the mathematics and geometry of such symmetries, a tessellating three-dimensional structure with fivefold symmetry was discovered by Dan Shechtman, a material scientist, whilst X-raying an alloy of aluminium manganese. Up to that point, it was believed that the formation of atoms inside all solid matter was symmetrical. However, what these X-rays showed was a semi-crystalline fivefold structure that tessellated asymmetrically, like the Penrose tiles, but in three dimensions. The principles of this crystal structure were later developed by Thorsteinn to form what he has called the quasi brick, a twelve-sided stackable module that has been used extensively in a number of Eliasson's works.

It was only a matter of time before Eliasson and Thorsteinn's early spatial experiments segued into architectural function and a utilitarian use was found for their fivefold symmetry. This is exemplified in Eliasson's project with Henning Larsen Architects to design Harpa Concert Hall and Conference Centre, built on the redeveloped Austurhöfn harbour site in Reykjavik. The structural geometry of the building's windowed facade employs Thorsteinn's quasi brick and presents a transparent interface between inside and out in which our relationship to the building and the world beyond its material structure is constantly reframed by our movement through it.

This invitation to renegotiate our environment has been present throughout the development of Eliasson's practice. Existing somewhere between the suggested and the literal, proposition and reality, the early collaborative works of Eliasson and Thorsteinn present a kind of utopia that is not an overtly descriptive vision of the future but an opportunity to reconfigure the present. Rather than proposing some right or truthful way of living, they allow for a consideration of our surroundings in actual, rather than speculative, organisations of space, enabling us to rethink our relationships beyond our conventional spatial geometry.

This foregrounding of alternative geometries is premised on the idea that our social engagement with the world is, in part, conditioned by our interactions with particular forms of spatial language, each of which has the potential to reinforce or undermine particular cultural, and therefore political and ideological, relationships.

As such, Eliasson's unfamiliar geometric structures are capable of suggesting new spatial rules and performative ideas as a form of criticism, to demonstrate that what we take for granted as being reality is always relative to our engagement. Rather than being purely instrumental, however, these alternative spatial languages offer a way of breaking a paradigm of spatial tolerance, proposing alternatives by allowing us to understand that the values with which we live and relate to each other, through the structuring of our spatial environments, could be other than what they are and might be something we have a say in.

Notes

1 Olafur Eliasson interviewed in *The Model Room,* directed by Terry Perk (Tericar Productions, 2011), available online at https://www.soe.tv/video/the-model-room-a-film-by-terry-perk

2 Ibid.

[Reference images see next pages]

Images

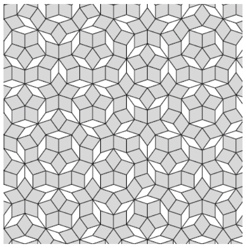

Einar Thorsteinn in his studio

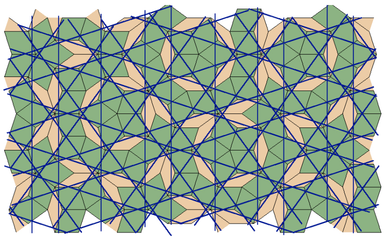

8900054, 1996

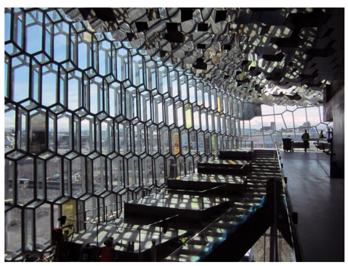

By means of a sudden intuitive realisation, 1996


Wellhead in Krafla


5-dimensionel pavillon, 1998

 Penrose tiles

 Ammann lines over Penrose tiles

Quasi brick and Harpa Reykjavik Concert Hall and Conference Centre