

THREADRIX
ANNIKA NEMLANDER

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Webpublished by Annika Nemlander on www.annikanemlander.com

2014

London, Great Britain

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THREADRIX

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Annika Nemlander was born in Finland and grew up in Helsinki as well as in Saudi Arabia. She completed her Bachelor's degree in Interior Architecture with a concentration in Computational Design at the American University in Dubai, United Arab Emirates. Coming from a family of engineers, doctors and business people she has developed a passion for geometry, logic and systematic design. She draws inspiration from mixing Middle Eastern and Western elements, such as the symmetry and serialism of Middle Eastern arabesque as well as the simplicity and edginess of modern minimalism. Also, juxtaposing handcrafts and computer design in her work is an examination of production process as well as contrasting traditional versus contemporary.

To my parents who have always supported my dreams and given me the tools to fulfill them.

To Dr. Kenneth Wilder and Mr. Peter Maloney who have inspired and guided me through the year.

To the staff and fellow students of University of Arts for providing resources and sharing ideas with me.

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PROLOGUE

What seems to be empty space is actually a tumultuous ocean of strings vibrating at the precise frequencies that create the four dimensions you and I call height, width, depth, and time.

-Roy H. Williams (Gestalten 2012, p. 95)

As today's society is moving towards a 'third industrial revolution', computers are used for organizing, categorizing and calculating many aspects of our world today. Designers and architects of the 21st century rely heavily on software to produce quick and accurate 2D drafts, 3D models and perspective renderings, etc. My project, *Threadrix*, is a geometric thread installation, which aims to create a bridge between architecture and handcrafts, while relating to notions of wireframe construction. The focus is to bring architectural drawings to life by giving them a sense of dimension, material and movement. To do this, the work will interact with existing architecture by contouring the geometry of the environment to generate 3D drawings in space. The work also highlights contrasts in the processes of making by hand versus computer such as time, accuracy, effort and the possibility of humane errors.

PART 1: RESEARCH

The Geometry of Environment

Ever since the ancient times man has always been curious of making sense of their environment by organizing, categorizing and counting. People from all interdisciplinary fields such as science, math, philosophy, engineering and construction pitched in by forming standardized measure units and formulas, analyzing and naming shapes, studying the correlations between them but also came up with significant discoveries while solving recurring practical problems.

Considered to be one of the greatest mathematician of all time, is Archimedes of Syracuse (c. 287 BC-212 BC). He was responsible for inventing the infinity series formula (Figure 1), giving an accurate estimation for pi and computing the parabola segment among several other accomplishments. Not only was he genius in mathematics but also in physics, in which his advances are the foundations of hydrostatics, statics and the explanation of the principal of the lever. Archimedes' written work

was thought to be lost but it survived through the Middle Ages and became an important source for scientists during the Renaissance (14th-17th century). At this time, the focus in architecture became mathematical structure – a logical pattern of entities and relationships (March 1974, p. 8). This is when philosopher and mathematician, René Descartes (1596-1650) introduced the Cartesian coordinate system, which used the X, Y and Z-axes to specify the location of a point on a plane by using a pair of numerical coordinates.

In the 1920's and 30's it was becoming clear to architects and constructors that using the principles Henry Ford's 'production line' of mass-production was needed to manufacture standardized building components, such as doors, windows and roof paneling. This method simplified the constructing and made it faster and more cost-efficient. The components could also be used in various buildings and in a plethora of different combinations (March 1974, p. 199).



Figure 1 - Visualization of Archimedes' infinity formula

Minimalism and Conceptualism in the 60's and 70's

In the 1960's and 70's an artistic movement called 'Minimalism' spread throughout postwar America and also to Europe. Minimalists made exceedingly refined objects and installations, usually abstract, which raise questions about how art depends upon its viewer. Geometry was highly emphasized and expressive technique avoided. This was because many artists noticed how industry was controlling the aesthetic physics of objects so much that no single artist could, so they began using mass-production services in the making of their art to free themselves from the control (Baker 1988, p. 8). There was a growing urge to revolt against 'vulgar prosperity' and yearning for simplicity (Baker 1988, p.14).

A famous British philosopher, Richard Wollheim, wrote in his 1966 essay 'Minimal Art' that he saw various artists disrupting the notion that what transformed raw materials into works of art was their own skilled labor. Many artists responded by saying they want to redirect viewer's attention and make them question what is it that makes something art. Does the art have to be made by the artist themselves or can it just be commissioned according to the artist's written directions and drawings? This is when Conceptualism arose as another artistic movement next to Minimalism. Conceptual art was not so much concerned with material or aesthetic concerns, but the focus was primarily on the idea and concept itself.

Sol Lewitt

The founder of both Minimalism and Conceptualism is considered to be American artist, Sol Lewitt (1928-2007). In his essay 'Paragraphs on Conceptual Art' LeWitt wrote:

When an artist uses a conceptual form of art, it means that all of the planning and decisions are made beforehand and the execution is a perfunctory affair. The idea becomes a machine that makes the art (Paragraphs on Conceptual Art, Sol Lewitt).

Once he had chosen the basic form and rules, Lewitt entrusted the development of his thought to self-generate objective systems. He strongly believed in detailed preparation and figuring out logistics before

execution. Although not always making the art himself, he believed the cycle of an idea is not complete if the work is not produced at the end. If there were errors in the execution it was important not to delete it, as it was part of work (Gross 2012, p. 10). In the art pieces, each line functions as an element of the system meaning that each line is as important as the other – they are equal and independent. LeWitt's two and three dimensional works were based on simple geometry and basic colors but always required specific diagrams (Figures 2-3) and guidelines with a systematic execution method.

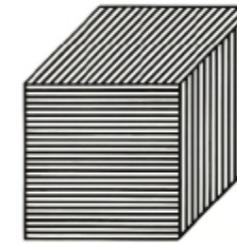


Figure 2 - From Five Forms Derived From a Cube, Sol Lewitt, 1982, watercolor and woodcut on paper

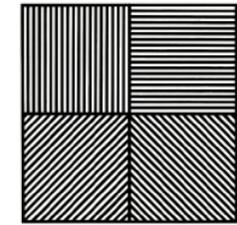


Figure 3 - A Square Divided Horizontally and Vertically into Four Equal Parts, Each with a Different Direction of Alternating Parallel Bands of Lines, Sol Lewitt, 1982, watercolor and woodcut on paper

An intricate lattice installation by Sol Lewitt named All Variations of Incomplete Open Cubes (Figure 4), has been interpreted in various ways by many critics. The 122 incomplete variations of cubes are made of painted white wood and are systematically laid on a gridded table. Many see the work as the mind's power of reasoning - ticking off logical possibilities and being connected to Cartesian way of thinking in which the mind is considered the center of true knowledge. Others analyze the open cubes as 'a symbol of mentality, what they evoke is a kind of neurotic logical faculty that runs compulsively over all the structural possibilities of the grid in panic at recognizing its own relation to reality as indeterminate' (Baker 1988, p. 93). Even though he made serial and modular art which requires lots of reasoning and planning, Lewitt is not very interested in mathematics or philosophy. He uses mathematics only as a "discipline for consciousness... setting up order and then disturbing it into growth, trying things out when an idea occurs to him, not knowing what the result will be" (Gross 2012, p. 31). The art developed organically as he was continuously overturning between simplicity and complexity, time and space, change and continuity as well as order and disorder. He preferred to keep the systems basic, so the art would speak for itself and could be enjoyed by everyone, not just experts.

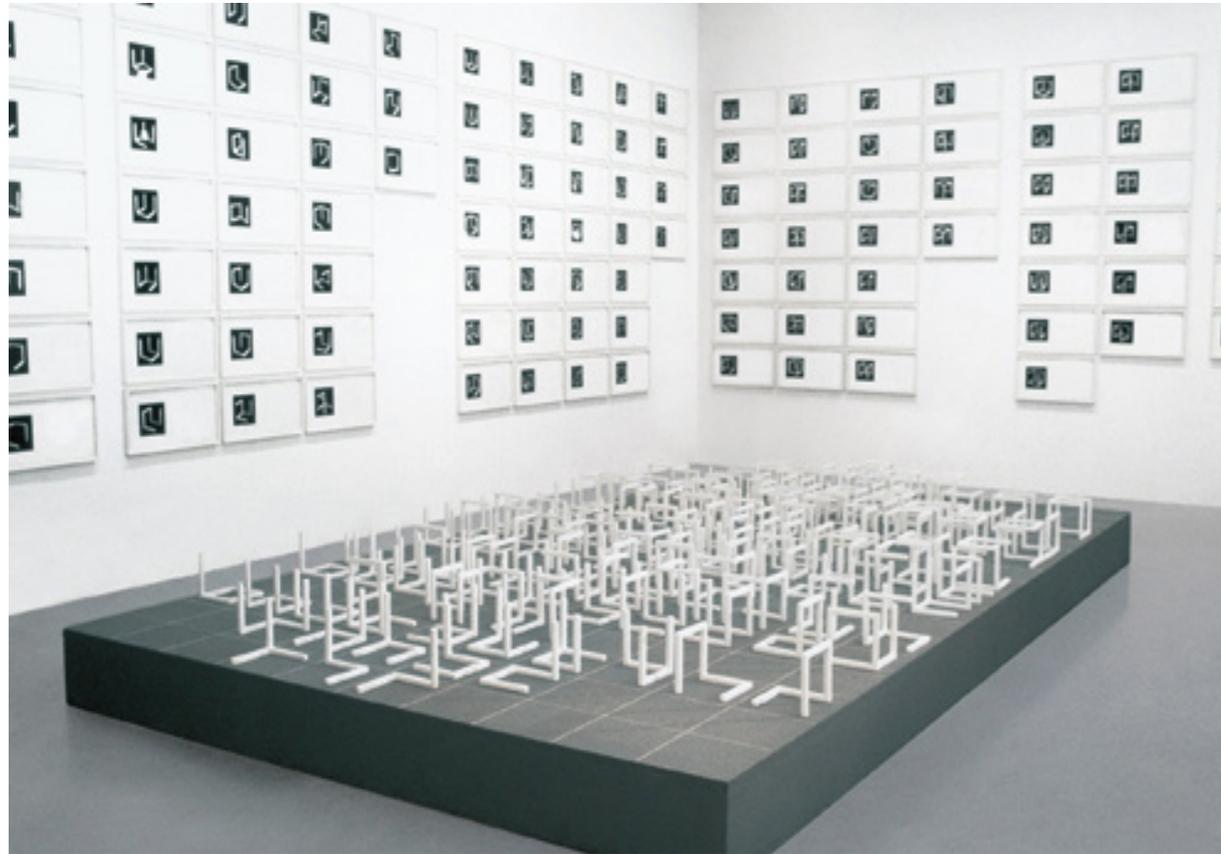


Figure 4 - All Variations of an Incomplete Open Cubes, Sol Lewitt, 1974, wood structures painted white

Eva Hesse

A close friend and colleague of Sol Lewitt's was the younger female artist Eva Hesse (1936-1970), who also made minimalistic but also abstract-expressionistic installation art. Her style was much softer than Lewitt's industrial-looking pieces as she used organic forms and handcrafts, which broke down the rigidity of Minimalism. She used pliable, everyday materials (e.g. rope, string, rubber and fiberglass) that she found lying around. Hesse was fascinated in studying themes such as the 'absurdness' of repetition, order versus disorder and psychological moods such as obsessiveness and blankness (Minimalism 2000, p. 292). In 1966, she made an installation called *Metronomic Irregularity II* (Figure 5) showcasing painted grey wood panels with grids on them and holes in every intersection. Out of some of those holes came out cotton-covered wire that connected loosely to another panel presumably in a logical pattern. The works maintain a free and airy feel to it, even though it is made on a planar surface (Lippard 1976, p. 79). The controlled labyrinth of wires create regular waves and their effect is both fixed and potentially changeable. Recently having endured many losses and disappointments in her life, the pieces became her outlet to release anxiety through the repetitive and obsessive process of trying to organize the unorganized wires. It could be considered as an attempt to make sense of the disarray of around her, as one of her most famous quotes was: "chaos can be structured as non-chaos" (Osborne 2014).

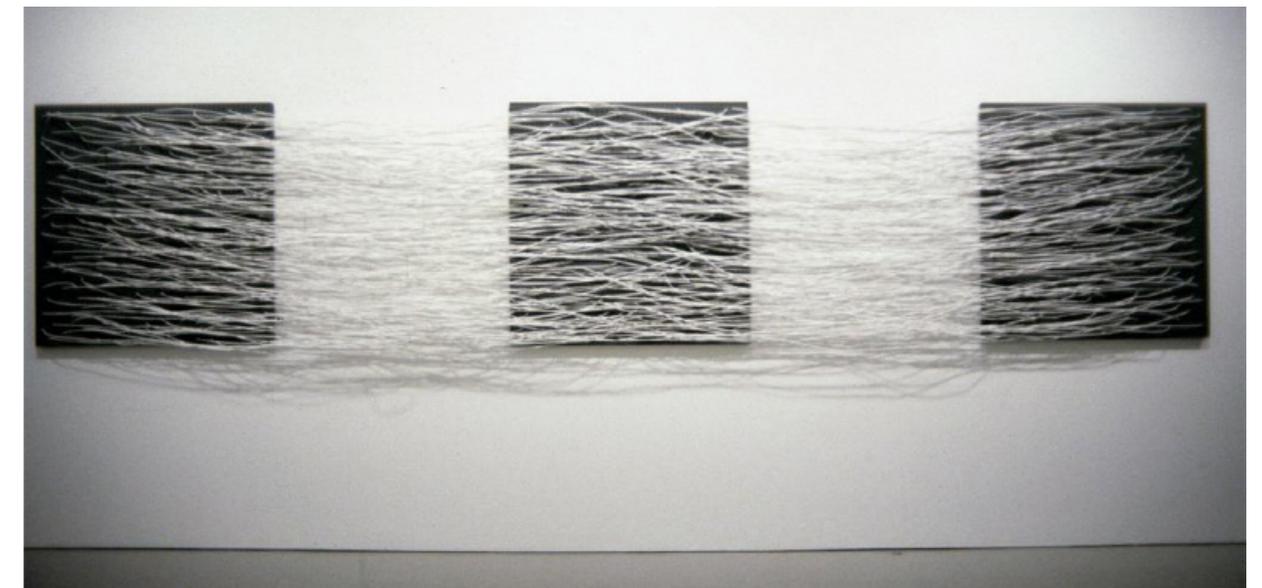


Figure 5 - Metronomic Irregularity II, Eva Hesse, 1966, painted wood and cotton-covered wire

Mel Bochner

A mutual friend of Lewitt and Hesse was Mel Bochner (1940-), who was also a fellow conceptual artist. His work focused on the abstract systems that rule the physical world so he used logical methods of expression, such as words, numbers and photographs, to re-examine the nature of art. A series that Bochner began already in 1969 is called Measurement: Room (Figure 6). The work uses black tape and Letraset to mark out all measurements of every architectural element in the space, almost like an architect's technical drafts had come alive from paper. The viewer is made very aware of their surroundings and may feel that they are being sized-up. The roles have been flipped – the room acts as a frame for the subject, the viewer. 'Measurement is one of our means of believing that the world can be reduced to a function of human understanding. Yet, when forced to surrender its transparency, measurement reveals an essential nothingness,' explains Bochner in an interview with Tate Museums. The font of the numbers and the perfection of the lines give a sense of the digital yet the execution is analogue. The contrast between computers and hand-made materializes drawing in space but also conveys a feeling of being inside a computer designed model.



Figure 6 - Measurement: Room, Mel Bochner, 1969, tape and Letraset

'String Invaders' of the 21st Century

Gabriel Dawe

Much like Eva Hesse, Mexican artist Gabriel Dawe found serenity in the process of repetitive organizing. He is famous for his large, colorful thread installation series called Plexus (Figures 7-9), which means an interwoven combination of parts or elements in a structure or system (Merriam-Webster Dictionary). He aims to combine fashion and architecture and how they relate to human needs of shelter. The use of thread is also a statement against the machismo of his native country, where textiles is considered a female specific industry. It is also important to him, as it was for Sol Lewitt, that the work can be enjoyed as it is – no concept or background information should necessarily be needed to appreciate the installations. In a 2012 short documentary he describes his concept:

I sort of see them this in between space between material and immaterial, because when the thread is used in such a large scale it sort of immaterializes...when I have to do a new installation I have this dialogue with the space, I take into consideration what the space is offering me and what its limitations are (Gabriel Dawe: Plexus no. 10, 2012).

One of the reasons I like using thread, I really like seeing it as this subversive act of taking a material that a man is not supposed to be using and using it to create something that's this large scale (Gabriel Dawe: Plexus no. 10, 2012).

Using tens of thousands of kilometers of thread and nails or hooks, he carefully plans each installation out. The use of colors of the spectrum is related to the materializing of light, so to achieve a gradient look, the placement of each specific colored thread is calculated. All nails are numbered and color coded in very high detail before the actual threading can even begin. Dawe completes the threading with a loop ended pole that he swings up and down, side to side and sometimes even passing it on to assistants to be passed on to another helper, depending on the architecture. All of his installations are made in situ. For him the works become very much about the process of making, the end result but also about the deconstruction process. After the take down, he stores the used threads in a clear acrylic glass box where all the colors swirl together randomly and take only a fraction of space as supposed to the large negative space they once took.

I think I'm a very obsessive person so I think it's a way of dealing with my obsessiveness. It is a very conscious thing to do something that's so repetitive and labor intensive (Gabriel Dawe: Plexus no. 10, 2012).

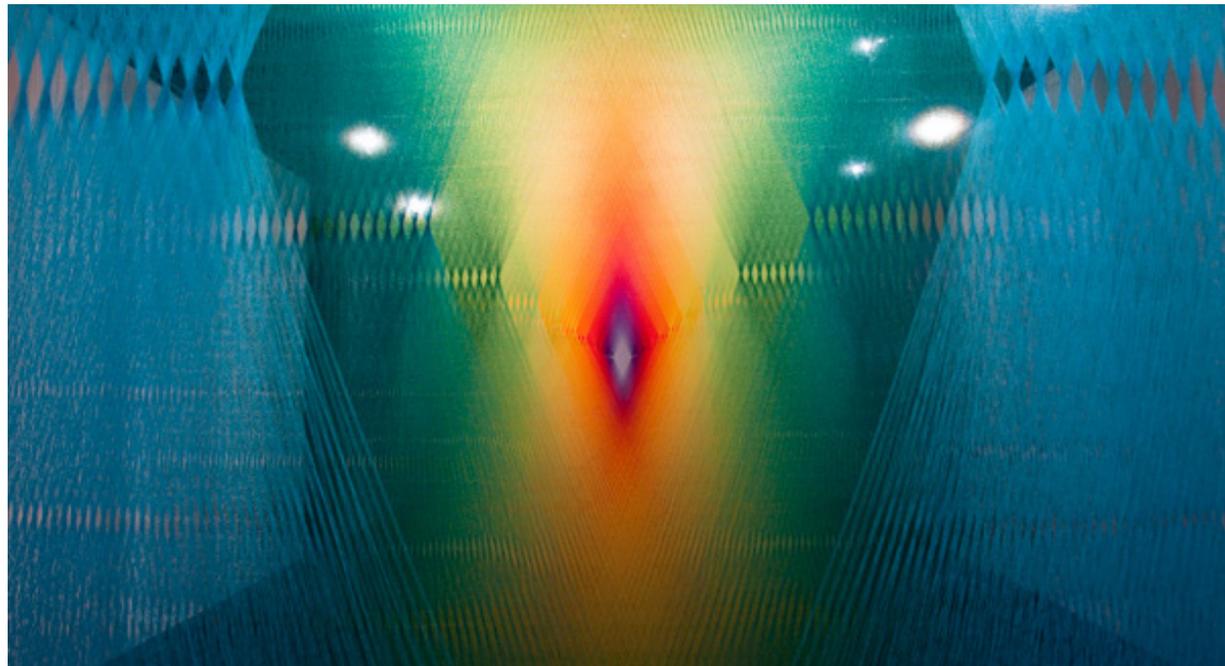


Figure 7 - Plexus 3 , Gabriel Dawe, 2010, Guterman thread, painted wood and nails

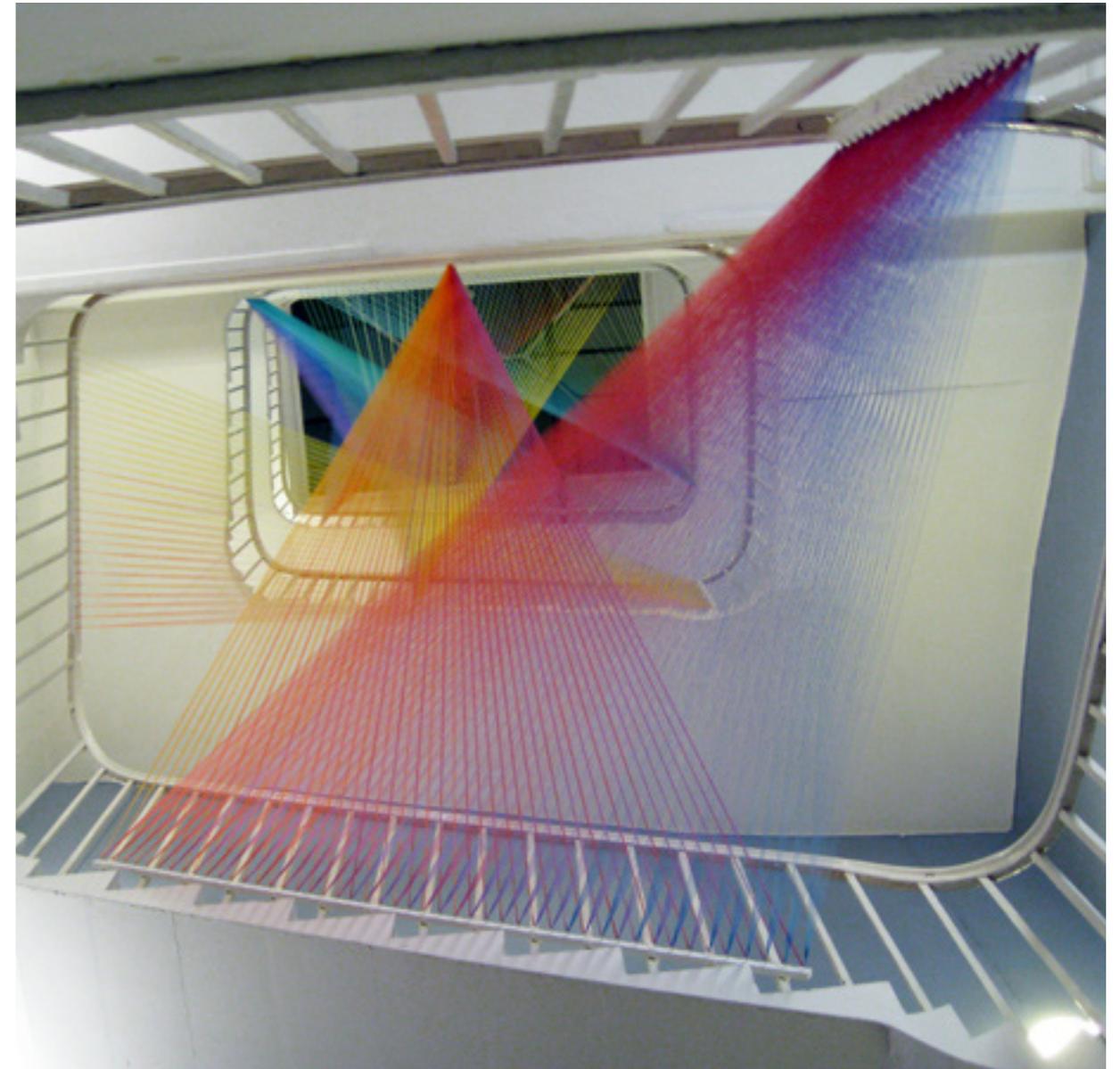


Figure 8 - Plexus 11, Gabriel Dawe, 2011, Guterman thread, painted wood and hooks



Figure 9 - Plexus 19 , Gabriel Dawe, 2012, Guterman thread and nails

Seon-Ghi Bahk

Another artist who uses strings is Seon-Ghi Bahk (1966-), a Korean installation maker. He uses transparent nylon threads to suspend small pieces of charcoal in the shapes of architectural elements, such as arches, pillars, windows and stairs (Figure 10). He spent a lonely childhood in a remote rural area and says to have had only trees, wind and mountains to play with. Now living and working in central Seoul as an adult, he has aspired to connect the nature and human culture in his art work. The charcoal, which comes from wood, has a slight movement to it due to air conditioning and the wind created by viewers passing by. The forms he chose to depict, architectural elements, are what Bahk believes to be one of the most important aspects of urban people as they are what people interact most with on a daily basis. He uses a different convention of drawing in space as Gabriel Dawe – the forms have a fluidity and manual movement to them as the bottom ends of the strings are not attached to fixed points. In strong air flow the dangling charcoal may look abstract and disorganized but always recovers its representational and orderly form when the surroundings calm down. Bahk's work seems to hint at a narrative as it has a sense of melancholy and history that burnt wood and incomplete architecture suggests. Perhaps these structures have once situated there in the past and a tragic incidence swept them away.

ART+COM

A more technological approach to string design is taken by ART+COM, a group of mainly German artists, architects, hackers and designers who are specialized in media-based communication. In 2008 they were commissioned by the BMW Museum in Munich to make an installation and they came up with Kinetic Sculpture BMW (Figure 12). It consists of 714 metal spheres suspended from the ceiling by thin wires in a grid pattern and each sphere is individually animated by stepper motors. The entity is controlled by electronics and code to form a seven minute mechatronic narrative visualizing the process of form-finding in art and design. It begins with chaotic, random shapes but slowly recognizable forms can be distinguished. Finally, clear representations of old and new car models can be seen. The project represents the evolution and history of BMW (ART+COM: Kinetic Sculpture).

Order and disorder becomes a reoccurring theme as with the works mentioned previously. The grids and matrices in the BMW project create a perfectly accurate frame for vertices to move around on a



Figure 10 - An Aggregation, Seon-Ghi Bahk, 2014, charcoal and nylon threads wood and hooks

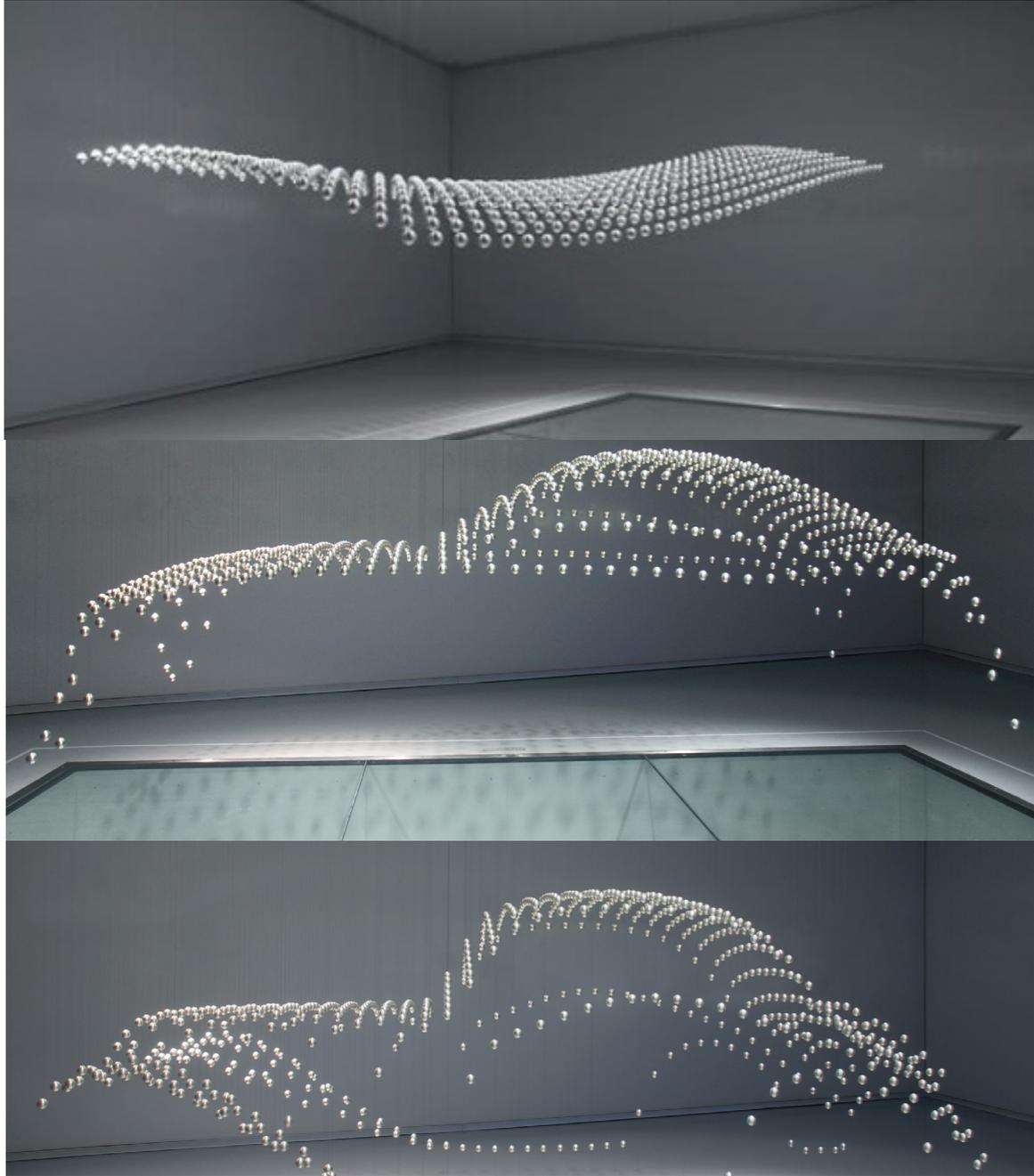
vertical axis in different controlled speeds to form orderly shapes. This order can be disrupted with a click of a mouse but can also be reversed just as easily. The existence and function of every sphere matters for the entity to work as intended, as was the case with every line drawn by Lewitt (or his draftsman) or every thread inserted by Dawe.

The form-finding process of the metal spheres seems to be interacting more with the air around it or the 'thinking' of a computer. The form is not dependent on its surrounding or the architecture, unlike Gabriel Dawe's work. It begins with a more liberal, organic and random set of form trials and positions, much like Eva Hesse's *Metronomic Irregularity II* which has an aerial freedom and ever-changing aspect to it.

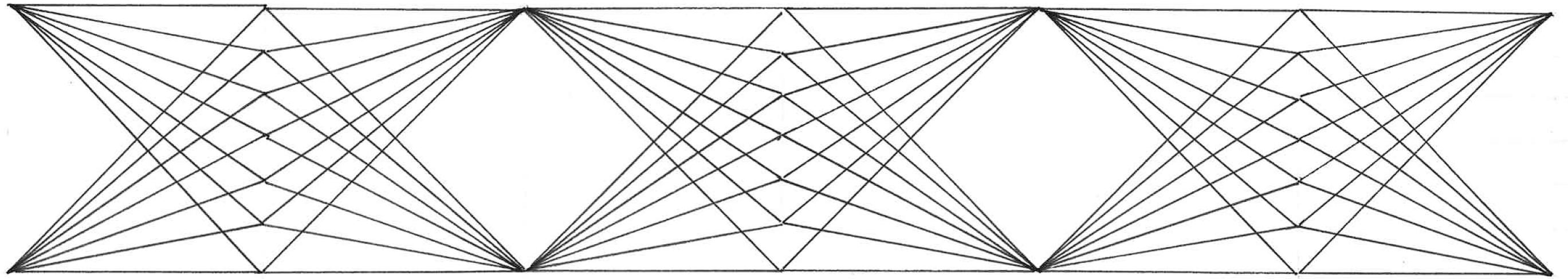
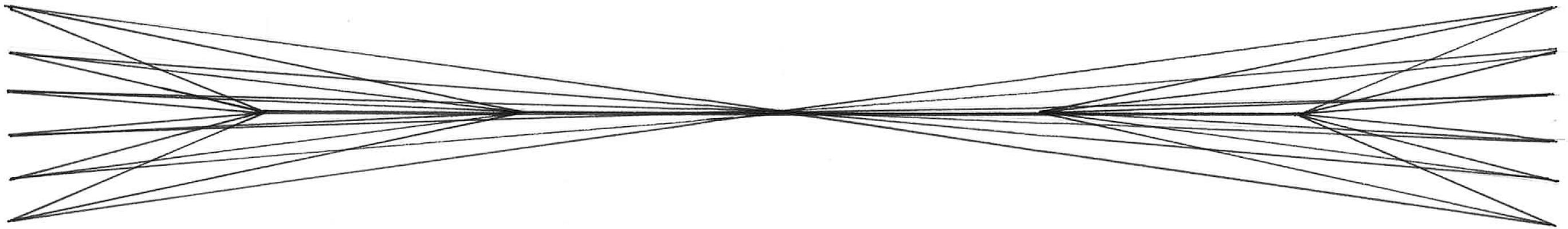
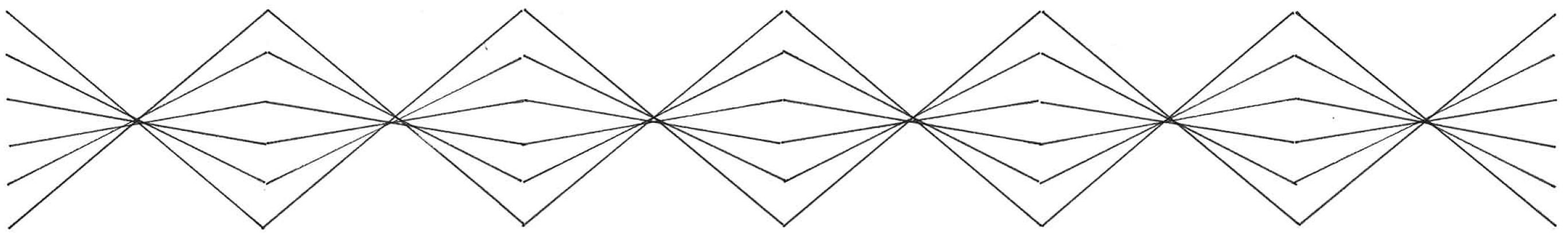
ART+COM has succeeded in bringing out computer design into the real world by giving it a material dimension. All though, as perfect as the design is on computer and the physical execution looks industrial and robotic, it is installed by hand and anything hand-made will have its humane errors (Figure 11). This project, or any work made by hand for that matter, may look perfectly symmetrical and polished from a distance but small variations will inevitably occur if examined closely. It may be something as small as a finger print on one of the metal spheres, slight miscalculation or variation in the ceiling grid system or a complete failure of an individual motor due to weakly connected wires. This raises the question, is anything 'brought into reality' truly perfect?

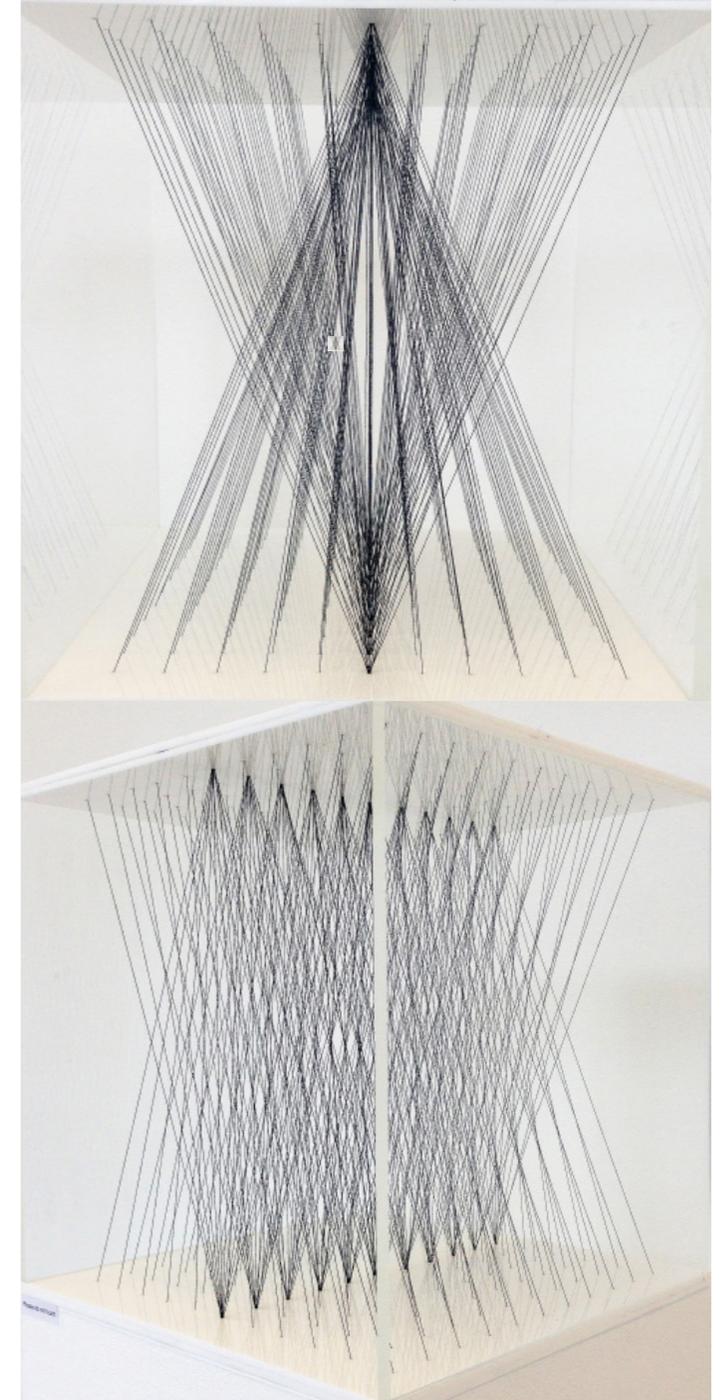
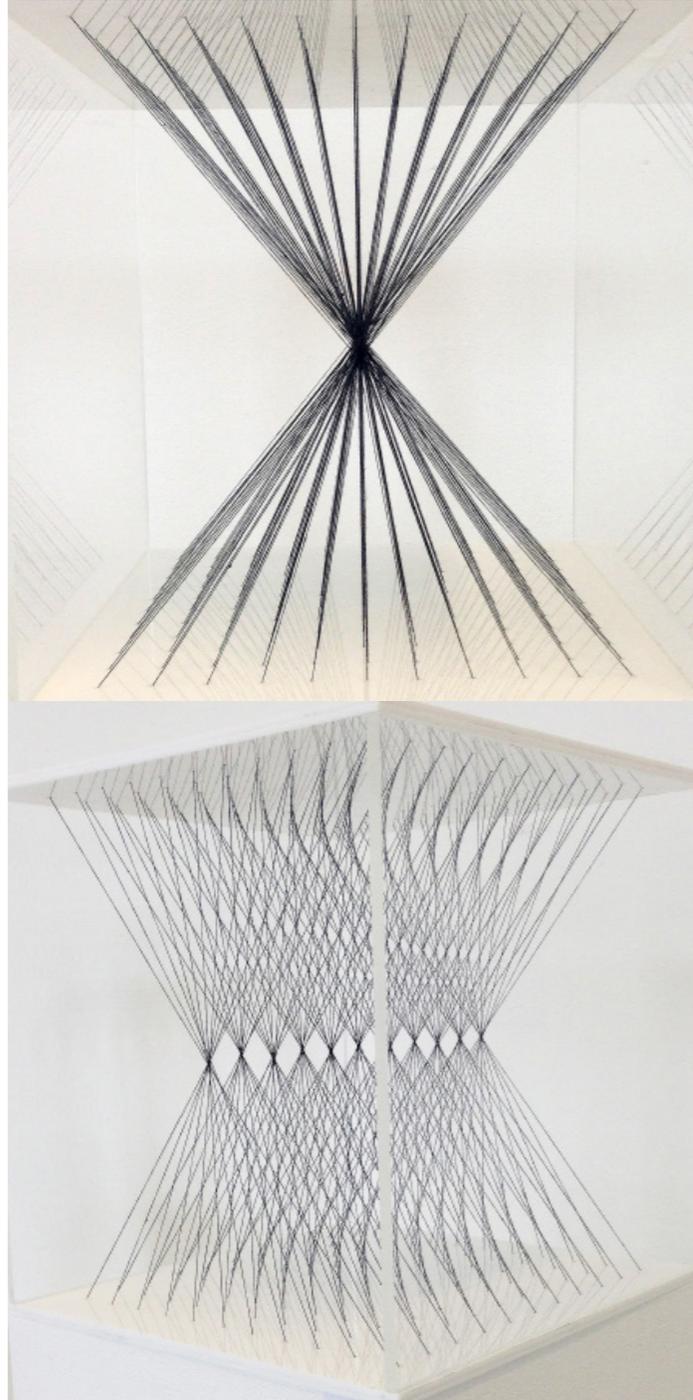


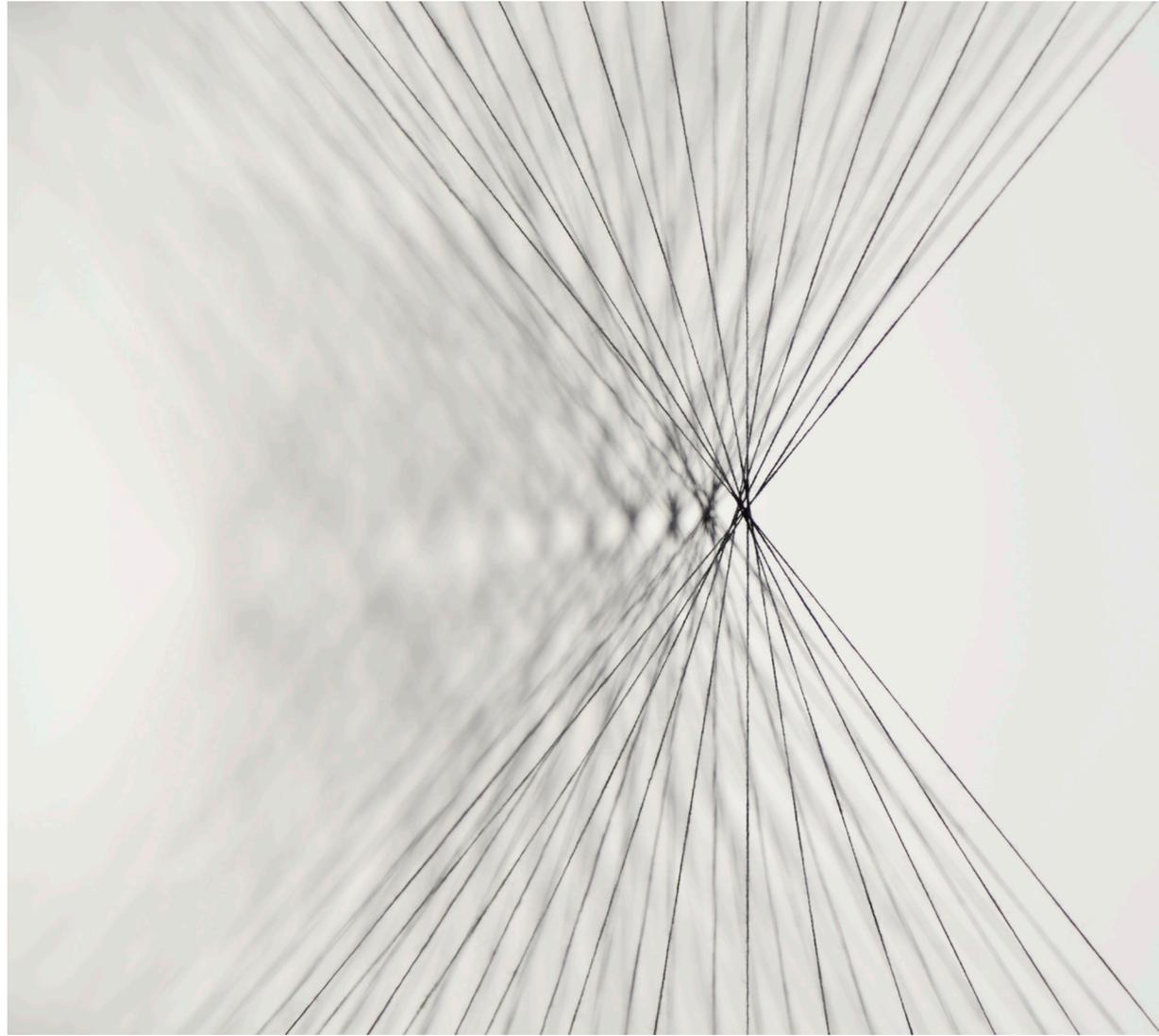
Figure 11 - Kinetic Sculpture BMW, ART+COM, 2008, steel wire, metal spheres, stepper motors, code



PART 2: TESTING



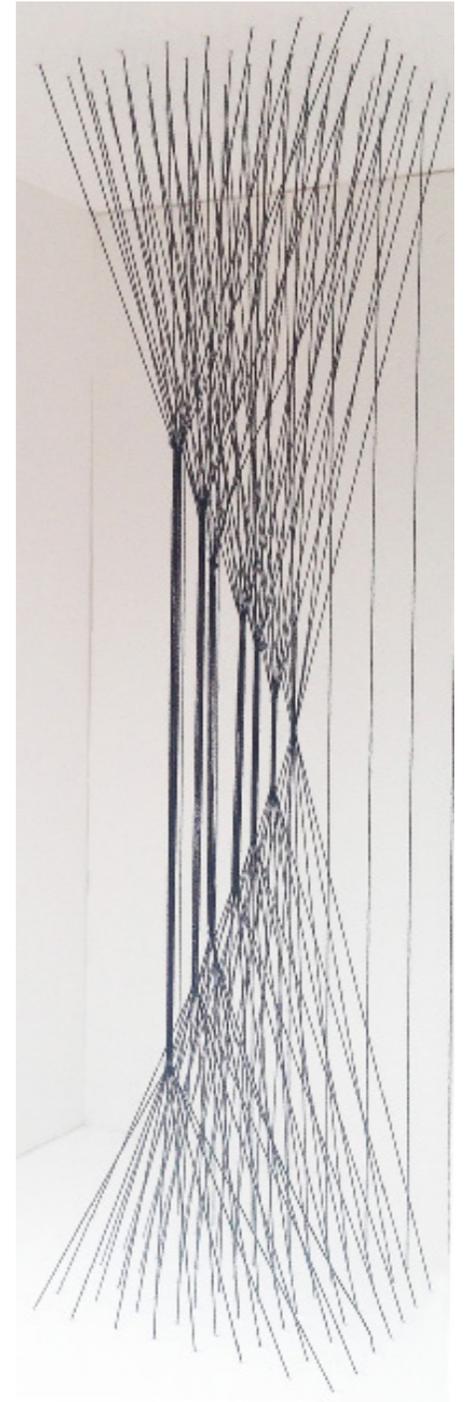


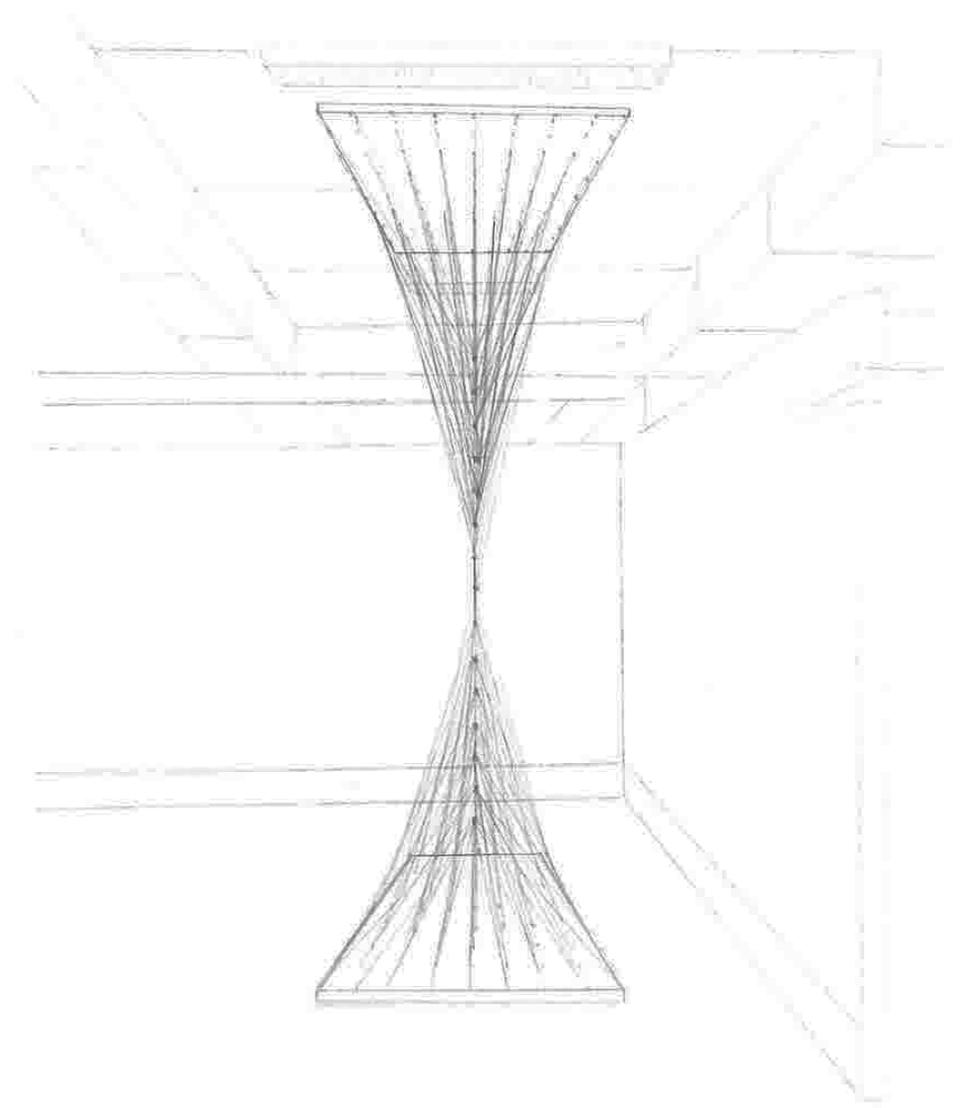
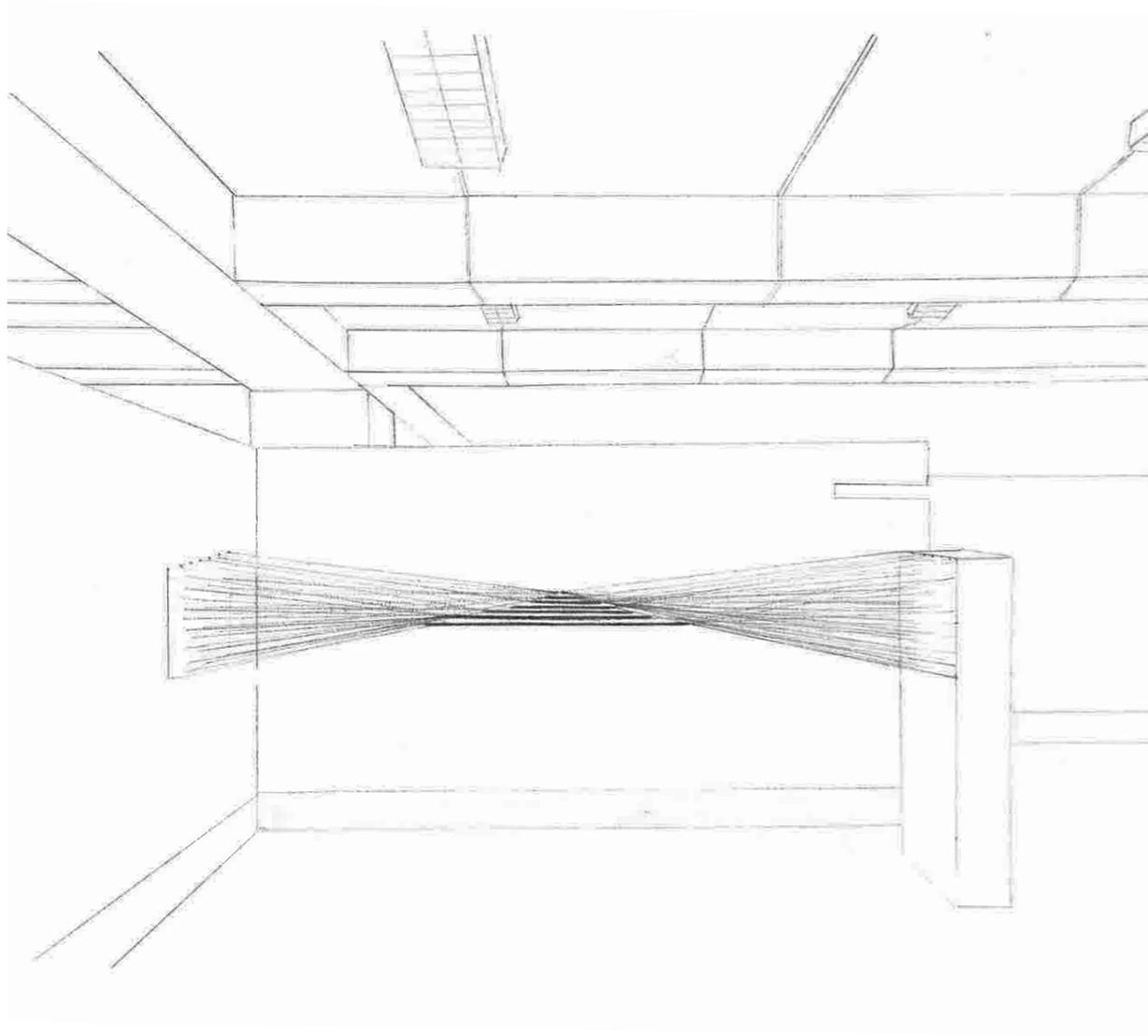


Detail of the threads crossing and overlapping.

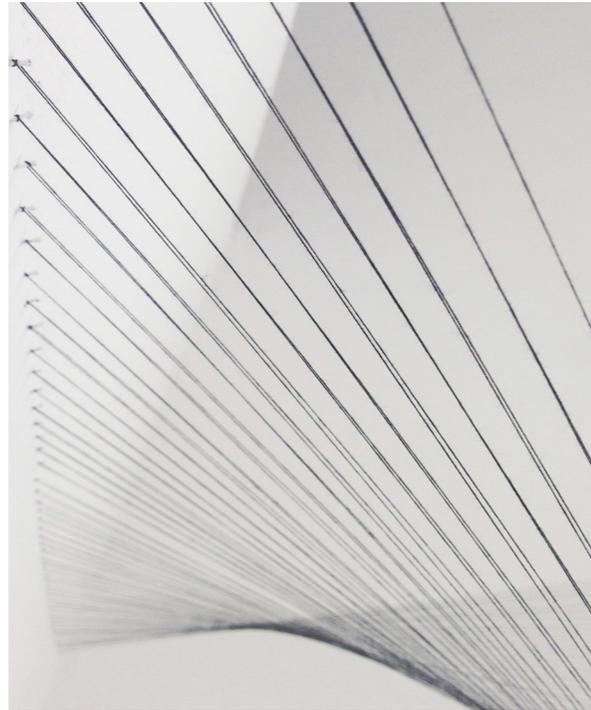
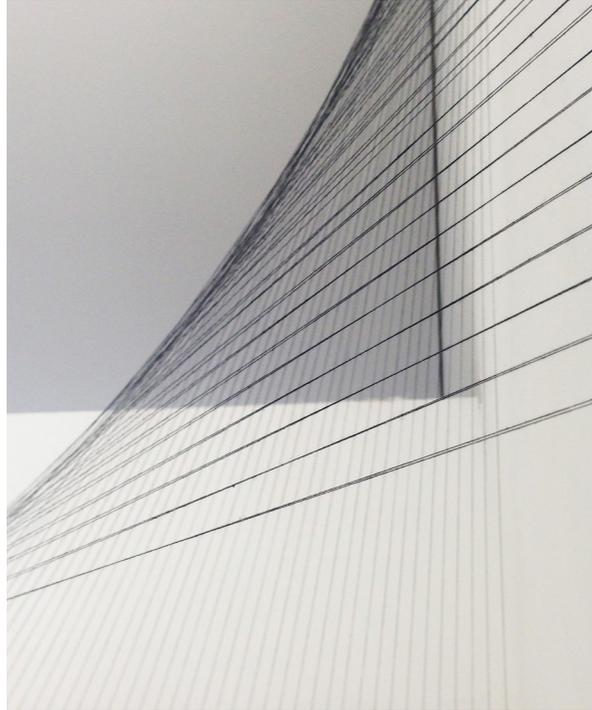


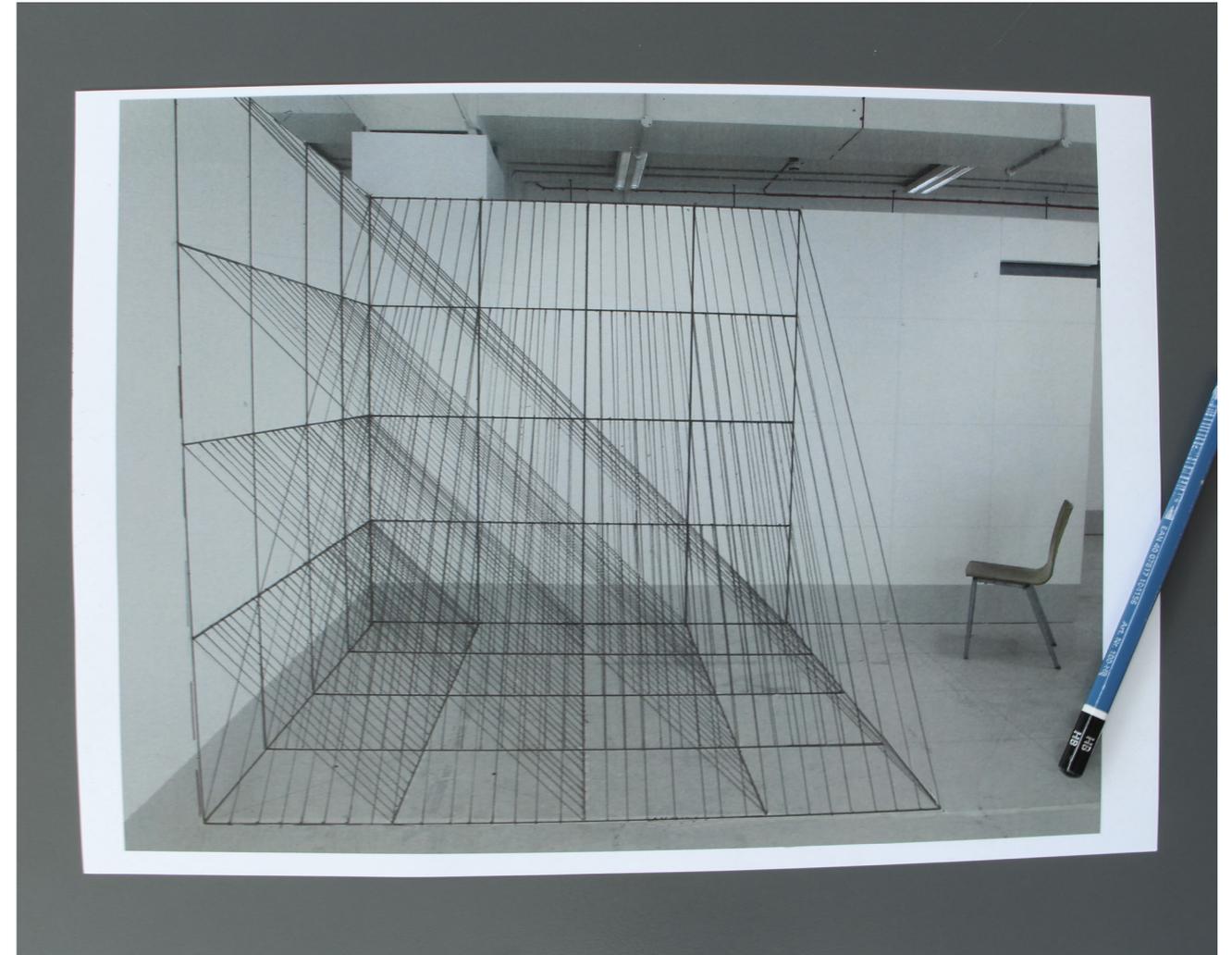
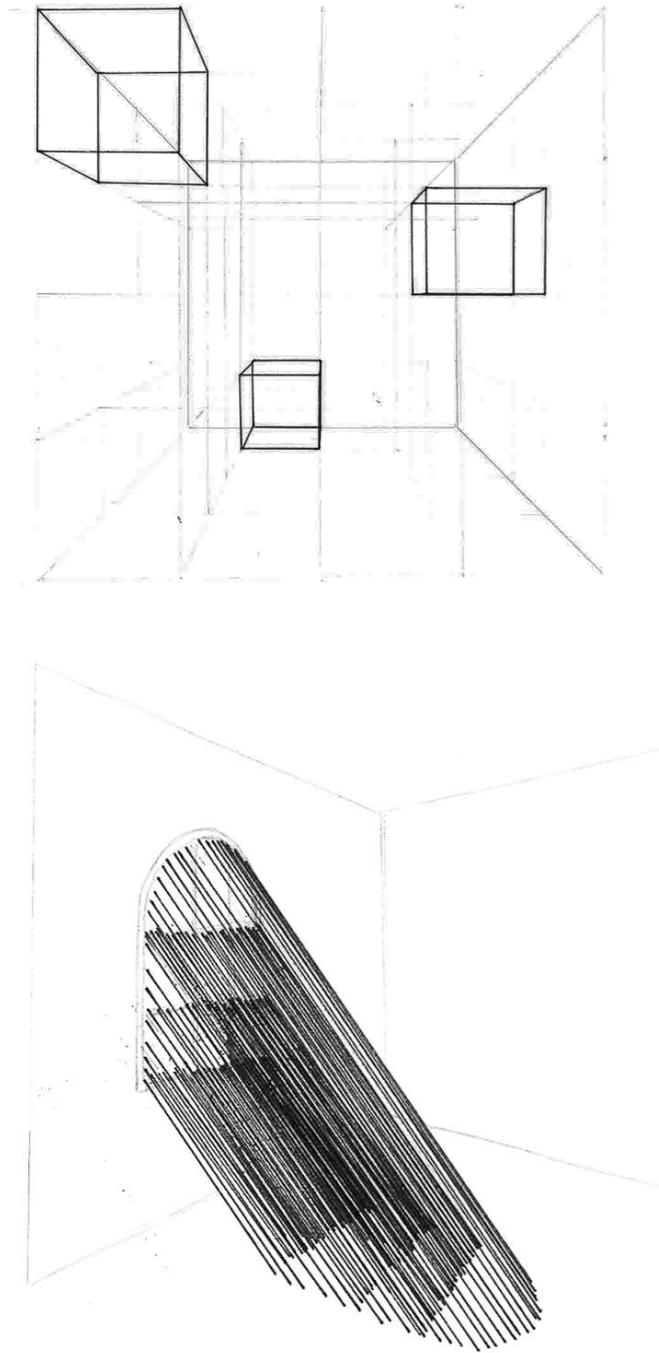
Testing 'drawing in space' by grouping threads with knots to create movable control points.

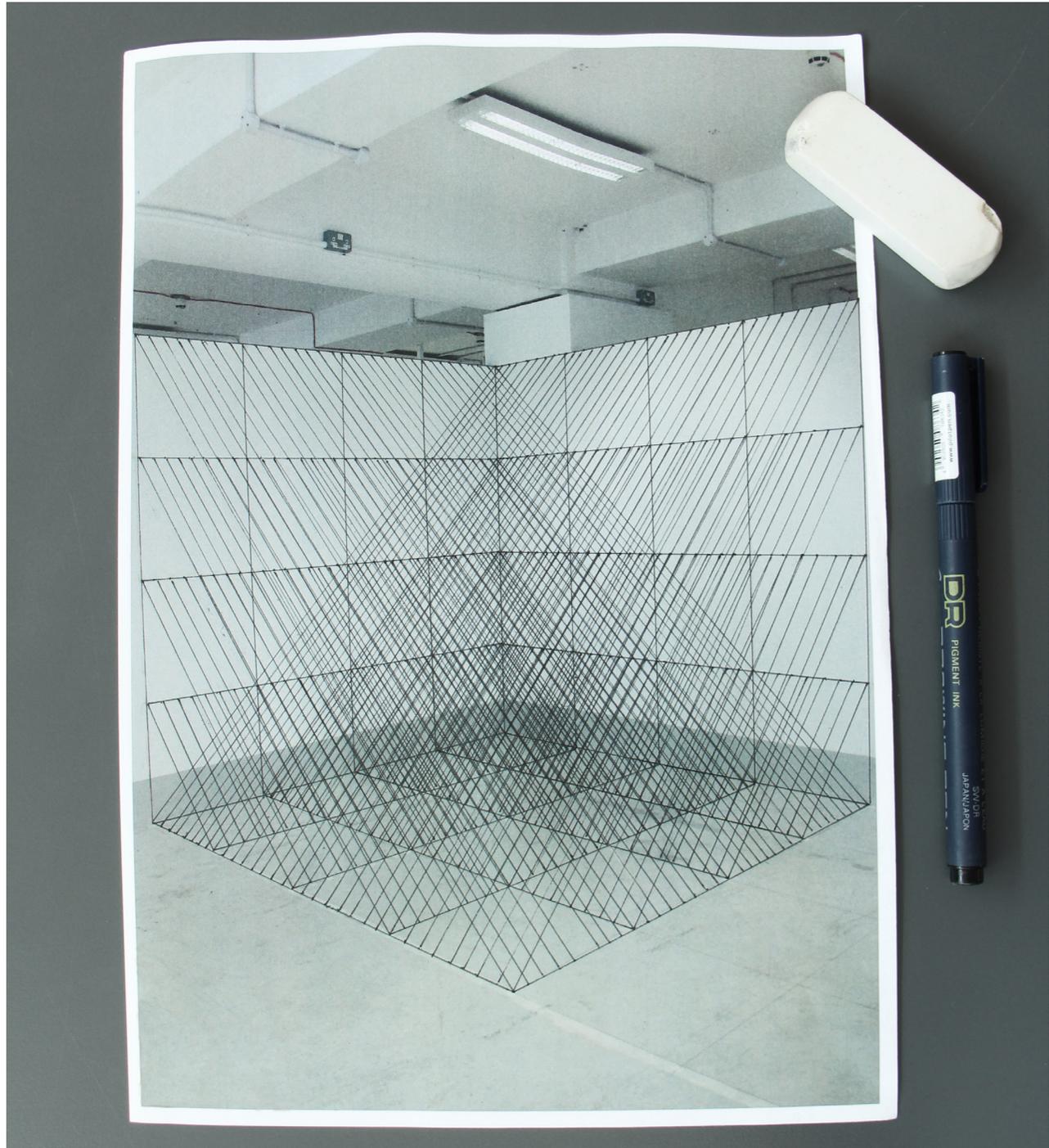












PART 3: FINAL PIECE

Threadrix

Hand vs. Machine

The hand is the window on to the mind...It is only through making – by trying and failing and repeating – that we gain true understanding...skills of manual labor – or indeed any craft – is one path to a fulfilling life.

- Immanuel Kant (Sennett 2008, p. 326)

Hand work can be directly connected the showcasing of human skill, energy, concentration and attention. To minimize “human error” the craftsman must develop their skill and precision and even then there will always be irregularities which make it one of a kind. In the industrial mass-production lines, the answer to minimizing variations is to also minimize the amount of human interference because even the level of workmanship is slightly different from one shift to another (Somogyi 2010). Magazines and boutiques, for example, have begun campaigning and writing articles of the makers of products to unveil methods and materials so people might appreciate hand skills more. “What’s new is the desire to reveal the process and not just the finished object. These are not-so-subtle messages reasserting the value of the handmade over the machine-made” reports The Guardian newspaper’s design columnist Justin McQuirck.

The name for my project, *Threadrix*, comes from combining the words thread and matrix, an arrangement of connected things. When looking at the installation up close small knots and irregularities can be spotted which could be seen as “imperfections”. No matter how precisely something is designed by computer, nothing brought from behind the screen will be without “human error” – not, for example, a skyscraper designed by an architect or even a 3D printed object. As Sol Lewitt once did, all the errors will be left on the installation as it is part of revealing the process but also acts as a reminder of humanity.

Like with Eva Hesse’s *Metronomic Irregularity II* and Seon-Ghi Bahk’s *An Aggregation*, the work

is a tug-a-war between order and disorder. Nature is organic and irregular, architecture is logical and orderly. My project accentuates and extends existing architectural elements, which could be considered as a tribute of the skills of the human hand and mind. It aspires to organize the environment, in perhaps in a slightly obsessive manner, by using grids and lines where every single strand is as important as the other in the entity of the system. This is a matter that is also essential in *All Variations of Incomplete Open Cubes* (Lewitt) and *Kinetic Sculpture BMW* (ART+COM) as every small unit has a role to play in the whole of the larger existence.

Form and Movement

When the viewer walks past the installation, the repetition and serialism end up creating forms that seem to transform and have a sense of movement in them. As Spanish architect Santiago Calatrava put it: “Movement gives an added dimension to form. It makes form a living thing. Instead of thinking of a building as something mineral, like a rock, we can start to compare a building to the sea, which has waves that move, or to a flower whose petals open in the morning” (Albornoz 2011). The movement of *Threadrix* is not electronic like in ART+COM’s project, but neither is it manual in the same way as in Bahk’s work. My installation plays with illusion and perspective to create a sense of movement – the form remains frozen until the viewer navigates past it, looking at it from different angles.

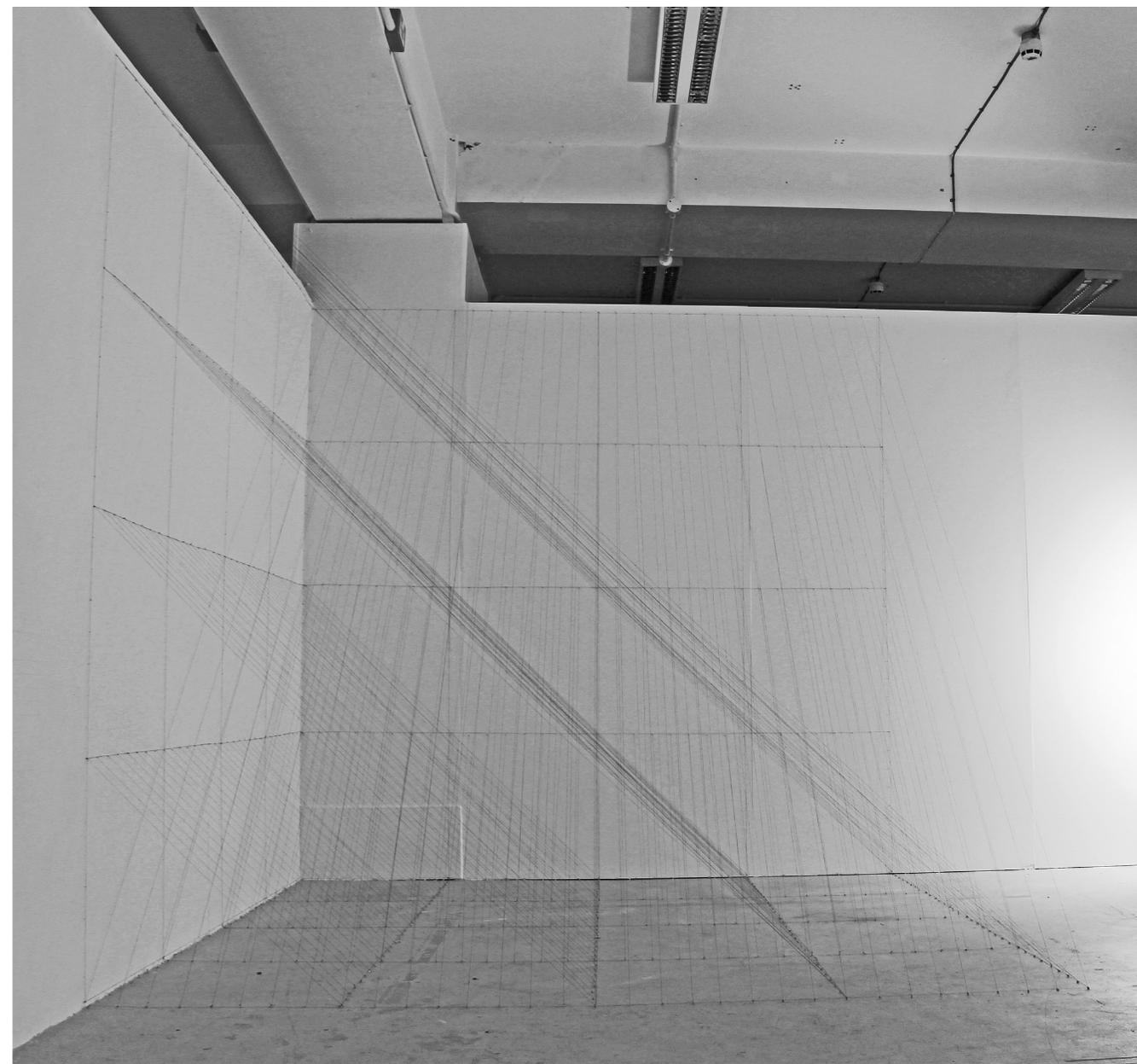
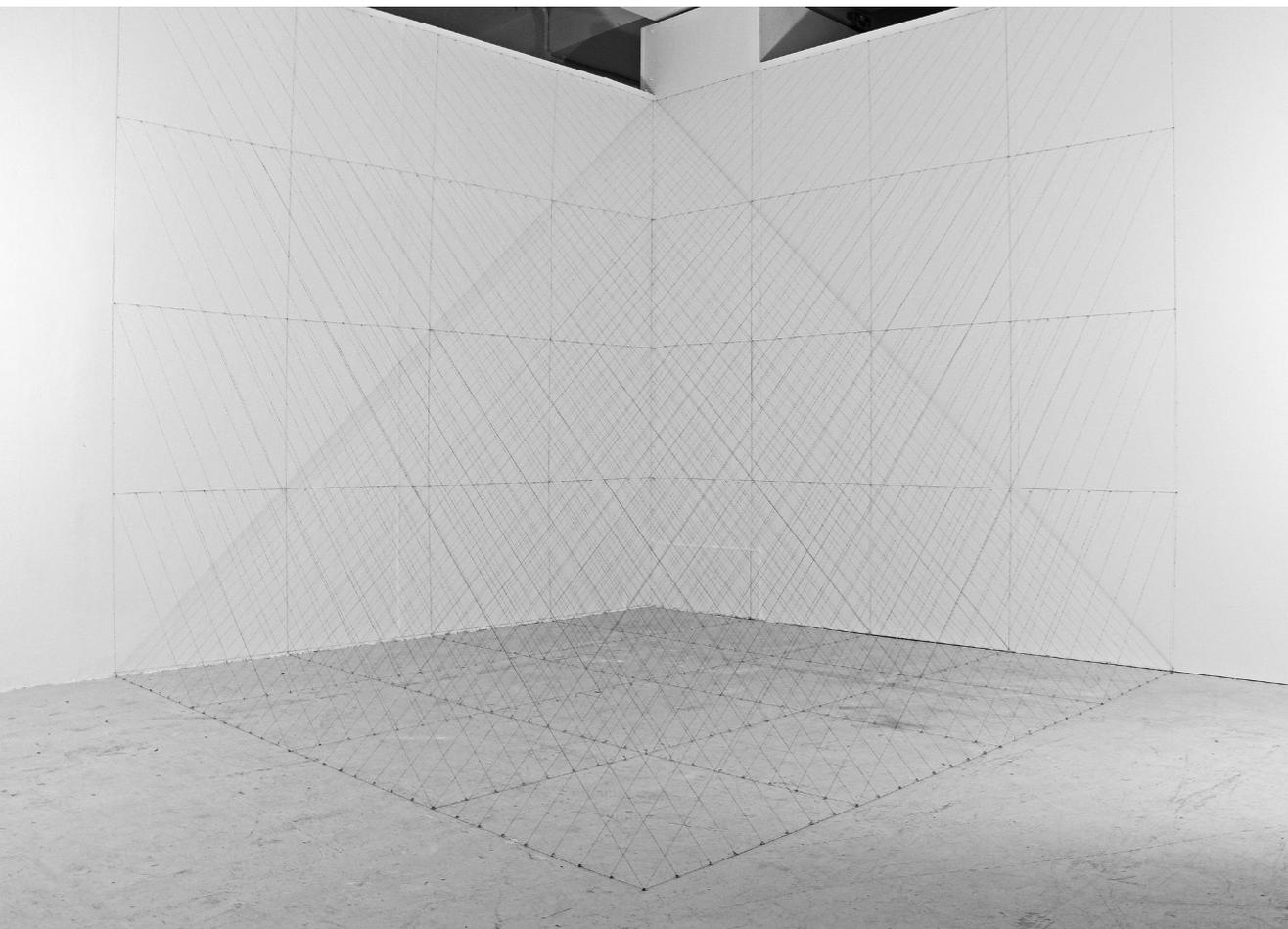
To test out the types of forms that could be generated, I performed several tests by building different kinds of frames from foam board and acrylic plastic sheet. The frames were simplified representations of general architectural geometry such as spheres, cubes and rectangles. By inserting threads in symmetrical patterns, I ended with the kind of abstract-expressionistic forms I expected. However, when trying out larger scale thread insertions on actual walls, ceilings and floors the initial idea of a form was radically modified due to the limitations and possibilities the architecture gave, such as surface material strength. The main difference in the two working methods is the amount of control. When making the frames myself the form is regulated and ‘synthetic’, but when using architecture as the frame the form develops organically and ‘authentic’ because it is a direct reaction to the geometry of the environment.

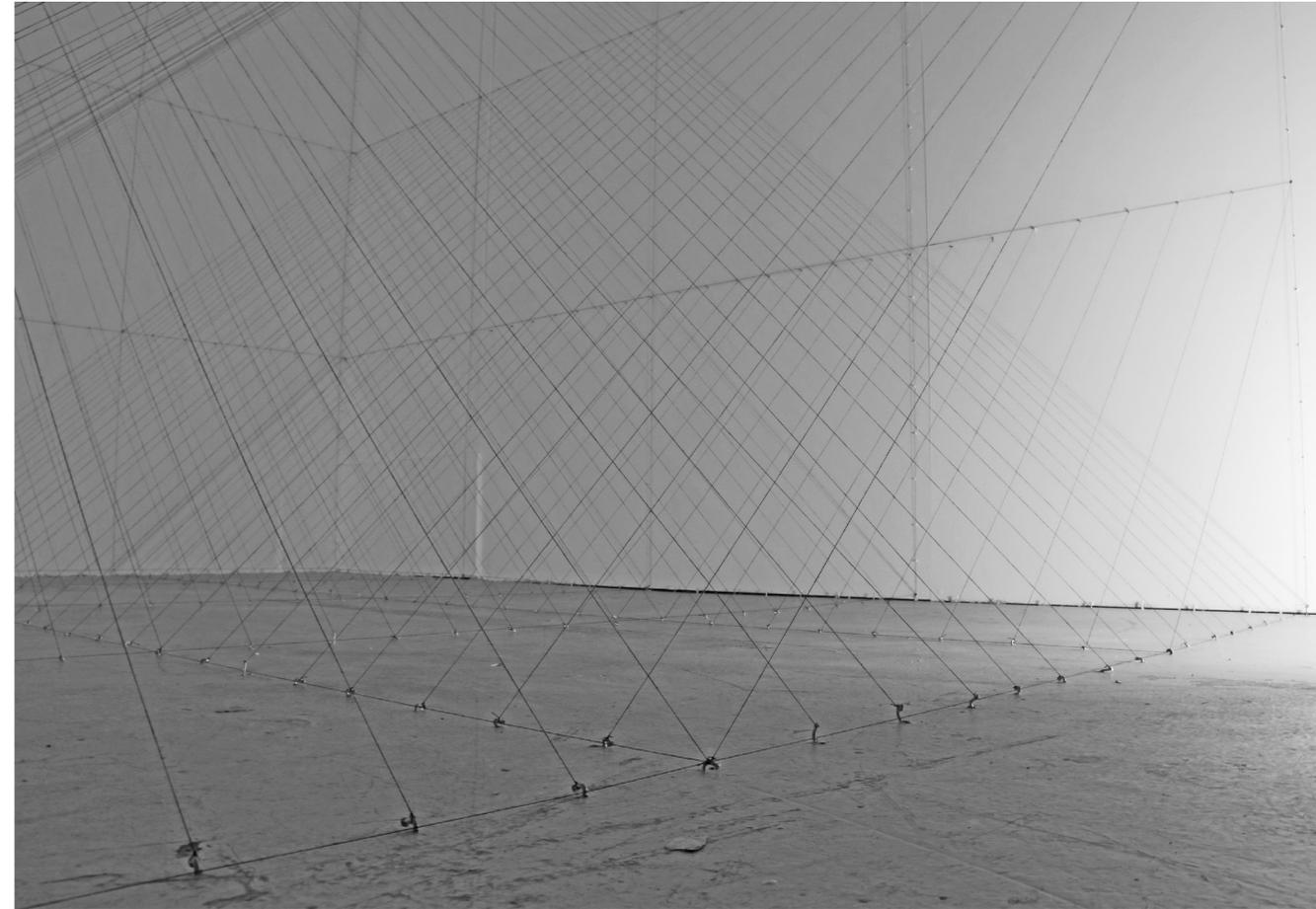
Material and Color

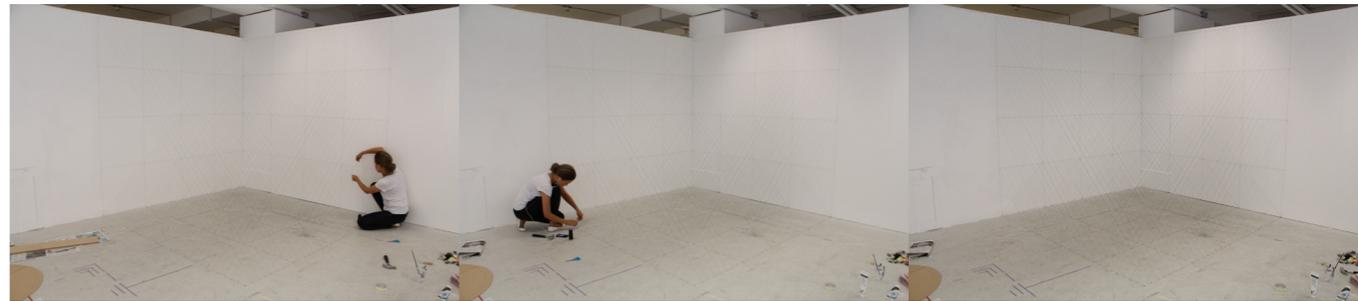
After testing multiple mass-produced materials that would emphasize the contrast between hand-made and industrial, the chosen material was black overlocking thread. It is a uniform material which symbolizes traditional handcrafts yet has a timeless, industrial look. The black thread also underlies a deeper personal meaning to me as it reminds me of my father, who as a cardiac surgeon taught me how to sew stitches with black suture when I was a child. It is quick to work with but it requires a high level of accuracy and coordination to get to the right tension and position. Also, it involves gentleness and patience to prevent snapping or tangling. Working with thread on a large scale offers many challenges because it is a material which is not intended for building structures. However, that is the charm in it – thread uses lots of negative space which is why the hard manual exertion begins to reveal its elegant and fragile form fairly quickly. The final shape is usually a surprise as drawing and computer drafting do not always tell the entire truth about the things that affect thread behavior, such as gravity, warping, quality of surface materials and accumulated tension on threads as well as attachments.

Threadrix differentiates from many other string artist, like Gabriel Dawe and Anne Lindberg who often examine color and light in their work, in that it uses only monochrome colors. The use of exclusively black string is a reference to printed architectural technical drawings. I wanted to translate the large white sheets of paper with endless obedient-looking stripes of black ink, into actual physical things that one could touch. The lines have a beauty of simplicity but also an underlying intelligence. The black color helps to draw attention specifically to the geometry of the piece as it creates a high contrast against the plain white walls of the studio and creates different line weights when strands overlap and intersect each other. Black on white combination forms a crisp, minimalistic look with a puritan element to it.

However, the color also gives a sense of personal detachment - so precise and neat, almost like a machine made it. Computer software, like Rhino and 3Ds Max are used by interior designers and architects for modeling everything from tiny objects to grand architecture. One begins modeling with primitive shapes which are then turned into editable objects, which can be subdivided into a greater number of planes to achieve a higher resolution model with finer detail. After manipulating all the vertices, edges, midpoints and corners, the digital model is then carefully examined by the contractor and built. In a way, *Threadrix* takes the existing, built architecture back to its early pre-natal state, a time before existing in real life.







CONCLUSION

My thread installation, *Threadrix*, is a new way of combining handcrafts and architectural computer design, which is a relevant topic in today's technology oriented world where the value of the hand is diminishing. The work offers a new way of seeing the disorderly environment and architecture around us by organizing and rationalizing it in mathematical terms. Through these functions a natural reaction to the architecture generates form-finding and drawing in space. Contrasting to the references mentioned previously, *Threadrix* has the technique of Gabriel Dawe, systematic logic of Sol Lewitt, harmony of ART+COM, time freezing aspect of Seon-Ghi Bahk, simplicity of Mel Bochner and obsessive repetitiveness of Eva Hesse. My minimalistic abstract-expressionistic piece is a reminder or revelation of the architecture's state before being constructed but also animates ideas of extended possibilities that could exist.

As with many profound things in life, understanding *Threadrix* depends on where and how you look at it. The work aims to engage with the audience by offering ever-changing views and perspectives that they themselves are in control of by the placement of their body. The details and overviews always offer something new to discover. Like many of the artists mentioned before, I believe in creating pieces that are timeless and can be enjoyed without being an art expert or necessarily even knowing the concept behind it, this way it speaks to a larger audience.

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