Maria Curie Skłodowska University in Lublin
Faculty of Arts
Institute of Fine Arts

Li Xu
The Hidden Graphic

Description of the doctoral dissertation

Supervisor dr hab. Małgorzata Bałdyga-Nowakowska
Auxiliary supervisor Sebastian Smit PhD

Table of Contents

1.Introduction

The graphic is an essential and important element of my works. For a long time, I have been exploring various possibilities about the visual expression of graphics. The hidden graphic is an interesting visual phenomenon that I found in the process of graphics exploration practice, which is worth further exploring. Therefore, it has become my research topic at this stage, and it is the further depth and improvement of my research in the field of graphics.

The main problems of the research are to explore the concept of the hidden graphics, the advantages and functions of hidden graphics, the visual composition of the hidden graphics and how to broaden the expression space of the hidden graphics.

Since the distance is different when the viewers look at the work, the focus is altered as well. I put forward the concept of "hidden graphic" by knowing this, and it will analyze the advantages and functions of hidden graphics from the perspective of works and viewers. In response to questions about the visual representation of hidden graphics, I put forward the research ideas of spatiotemporal dimension thinking in plane, space and time dimensions, and exploring the manifestations of "hidden graphics" layer-by-layer from the three levels of two-dimensional, three-dimensional, and four-dimensional. By this way, hidden graphics will be displayed in the form of all-round, and three-dimensional, and it will also be showed by breaking through the limit of time and space.

In the first stage, the works are mainly printed graphic works, and mainly research the visual form of two-dimensional plane. I tried to create a visual magic effect with "hidden graphics" through changing quantity, size, direction, density, position, light and shade of the basic form, and arranging the basic form in dot matrix. I started creating works in the order of the basic form's from less to more and the arrangement from simple to complex. At the same time, I combined the method of composition, such as the repetition, gradual change, radial graphics, space to enrich the visual effect of the "hidden graph-

ic". I analyzed and summarized how visual effects influence the implicit relationship of graphics and the viewer's viewing experience.

In the second stage, based on the research of the first stage of the two-dimensional plane and from the perspective of physical space, it explores the three-dimensional form of the hidden graphics. The works are mainly installation works, showing the spatial form of hidden graphic. I probed into the impact of transparent materials and spatial composition on the viewing process and experience of the viewer.

On the basis of the first two stages, the third stage adds the concept of time. It explores the possibility of graphics in four-dimensional space in an aspect of interaction and dynamic.

2. The Hidden Graphic

The Hidden Graphic's method of expression is that the basic graphic will be used as a starter unit, and then the basic graphic will be moved and duplicated. Two or more shapes in different sizes can be obtained through the arrangement of dot matrix with changing basic graphic unit's density, size, direction, position and light and shade. The regular changes of dot matrix arrangement make the picture from a sense of visual rhythm and movement. The regular change of dot matrix that makes the visual rhythm and movement comes into being. It produces and obtains the shifting visual effect of changed graphics when we looking close and far. With analyzing the relationship between the whole image and the part of the basic graphic unit as well as depending on "visual rule" to discover hidden patterns. The viewer can get the whole image from the part of the basic graphic unit and observe the part from the whole image. Viewers can capture graphic information that is hard to see. The "invisibility" of graphics can inspire the viewer to think and actively mobilize the viewer's imagination. The "invisibility" of graphics enables the viewer to obtain the pleasure of discovery and obtain more information. Invisibility breaks the graph's inherent form, and makes one or more graphics exist at the same time. This unique visual effect enables the viewer to experience special stimuli in the retina, triggers positive physical and psychological thinking, stimulates imagination, and produces a pleasant artistic experience. At the same time, it can also enhance the artistic appeal of graphics, which can strengthen the theme characteristics that we want to highlight toward this unique visual effect, and then create new meaning.

3. Preliminary Research

In recent years, I have started to create the plane graphic works from different perspectives, such as point, line and plane visual elements, color, materials, printing techniques and so on. I have also explored the various possibilities of its visual expression from perspectives above as well. Hidden graphics are an interesting phenomenon in the course of graphics practice. My hidden graphic inspiration comes from the feeling I view the exhibition. We often focus on the shape and impression of the work when we looking at the work from a distance, so we will get the overall feeling in this case. On the contrary, when approaching the work, we pay more attention to the details and content of the work, and obtain a small partial viewing experience. It gave me a kind of philosophical thinking from the relationship between integral and overall, big and small, outlines and details, far and near. The duality of things is a universal phenomenon in the world. It is a meaningful thing to show the characteristic of duality, if we could integrate philosophical thinking into the form of graphic expression. So I began to try some graphical visual explorations which has this hidden characteristic.

《After victory》 is a series of work that I created when I started experimenting with hidden graphics. In the first work, the picture is comprised of a victory gesture through repeating the basic graphic that is the skull. When looking from a distance, the first thing people see is the sign of victory. The skull is concealed in it, and you can only find it when you come closer. As the victory gesture faded away, leaving a skull and crossbones all over the picture. As showed in this series of work, the skull slowly swallowed up the hand of victory, and this is exactly what I expressed that the threat of death has not gone away. People's mental wounds will last for a long time and it will be indelible after the joy of victory in the war had faded. A series of 5 posters are placed together, which makes people feel intense how its triumph has faded. It also helps individuals understand the information is transmitted by graphics well.
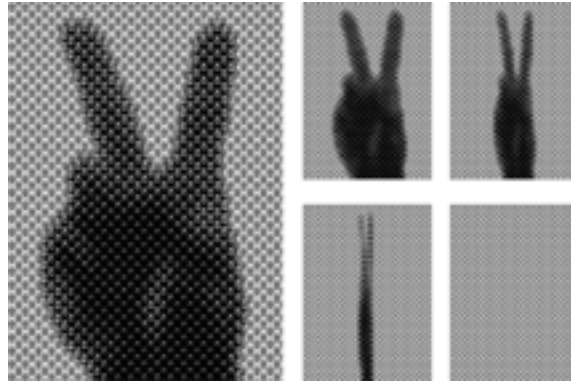
《Full Of Love》 was invited to participate in the Wuhan "2020 Fighting Against Covid-19 Poster Exhibition" during the crown epidemic. The work is based on the love pattern, it is naturally formed two series of posters with "Wu(武)" and "Han(汉）" by dot matrix arrangement with a combination of perspective, size and density. Looking at it as a whole, there are two Chinese characters for "Wuhan / 武汉", and if you observe them locally, you will find the graphics of love and viruses. The expanding power of love squeezes the virus into the corner of the picture, which gives an indication that love is on the rise but the virus is decreasing. This was also the theme of Wuhan's victory. The work attempts to create a feeling of spaciousness on a two-dimensional plane by changing the size and density, which makes the picture to produce a bulging visual effect of movement. The three graphics that are virus, love, Chinese characters skillfully expressed the theme.
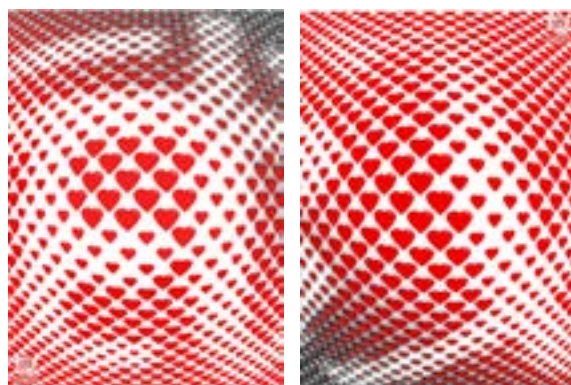
The concept of the "Hidden Graphics" in my early works that is based on a plane figure is the preliminary exploration and practice of the graphics' visual expression. Therefore, I have accumulated a certain amount of experience in the size, density, and color arrangement of graphics, which also laid a certain foundation for subsequent research. However, the preliminary works are only limited to the preliminary practice in plant composition of two-dimensions, and

a complete research system has not been formed yet. Thus, in the next phase of my research I will further explore more possibilities that the representation of hidden graphic. This research will be initiated with the simplest changes from 1 to 2, and it will gradually go deep into the changes from 1 to 3. It can also continually spawn changes from 1 to N and constantly expand the visual expression space of "hidden graphics".

4. Practical methods for solving the research problem

In my previous works, I conducted a preliminary practical exploration of the visual form of hidden graphics. Aiming at the question of how "hidden graphics" can broaden its expression space, I proposed the research ideas of

space-time dimensions, thinking in the dimensions of the plane, space and time. To explore expressions of "hidden graphics" layer by layer from the three levels of two-dimensional, three-dimensional, and four-dimensional, and display the hidden graphics in an all-round, three-dimensional manner, breaking through the limitations of time and space.
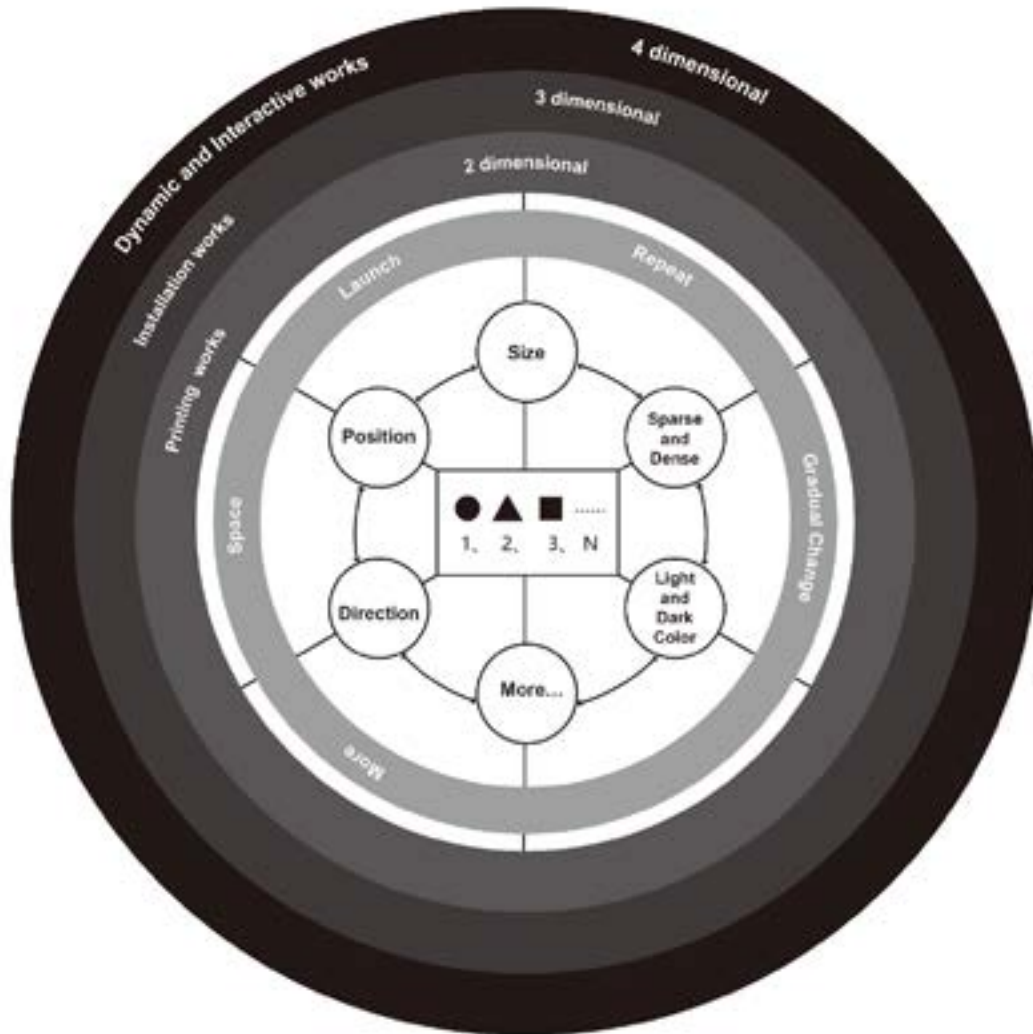
4.1 Two dimensional - Plane

In the early stage, my exploration of hidden graphics was based on plane graphics research that is focusing on Chinese characters. Therefore, in the first stage of work creation, I continued my previous research and continued my graphical exploration of Chinese characters. At this stage, I chose the female (女) character and the male (男) character for creation. These two words are pictographs with which distinct graphic characteristics. These two characters can be seen that they are Intuitively convey the message of men tilling

the farm and women-weaving through visual form in oracle bone inscriptions.

（Female /女   Male /男   ）It reflects the division of labor between men and women in traditional society. The improvement of productivity, mobility, and openness in modern society has changed this pattern of the gender division of labor. Today, the pace of life is increasing, struggling for life is increasingly competitive, with the change of social relations. This makes the problem of modern more and more prominent such as work, family, health and so on, people are also under increasing pressure. Compared to the traditional society, men and women are facing more complex social issues in modern society. The sources of problems are also more diverse. The female (女) character and the male (男) character should carry more information content. Therefore, I carried out a graphical study of these two Chinese characters. It shows the current living conditions and social problems faced by men and women in a graphical language to cause everyone's attention and thinking. The female character's (女）structure is simple, with only 3 strokes (the first stroke is the apostrophe. The second stroke is down to the left, and the third stroke is horizontal). These strokes of the female character's (女）crosswise formed a rhomb, the male (男) character is more complex, and it is formed a square by 6 strokes. These two characters have the aesthetic feeling of their forms, and the picture composition is formed by them is stable and lively, which produces a stable sense of balance and comfort visually. Therefore, I chose the female (女) character and the male (男) character as the main figure of the work and placed them on the full of the picture as the mainframe of the composition of the work. I expanded the visual exploration of hidden graphics under this frame. If we use the same font for visual exploration, it could maximize the visual expressiveness of hidden graphics under the limited frame, and it is also easier to observe changes in the hidden order of the graphics. After the frame was determined, I chose to use one or more related images as the basic type according to the content of each work and formed feminine characters with different shapes through dox matrix with the change of size, position, direction, density, plus the composing method likes repetition, gradation, emission, space, and so on. It will form the different

forms of the female (女) character and the male (男) character in this way, to explore the visual representation content of hidden graphics.

4.1.1 Repetition

Simply speaking, repetition is that pluralizes the basic pattern (cell type) at a point on the plane to form a regular arrangement, and it is the simplest composition method. If the basic units are arranged regularly and repeatedly to form a new pattern, it would produce two different size patterns. The hidden figure is made up of permutation and combination of dot matrix. Repetition is the most basic form of dot matrix arrangement. Therefore, I first did some visual experiments that are about permutation with repetition.

In Fig. 1, magnifying glass as a basic pattern is repetitively and straitly arranged along the stroke of Chinese female character（女）, thus the visual effect of two different shapes is produced. The first thing we observe that is the magnifying glass, and the female character seems to hide when we take a closer look at it. When you look at it from a distance, you will see the female character firstly, and the small magnifying glass is hidden. Although this simple arrangement makes up the basic hidden form, but the visual effects are monotonous and lack of expressiveness due to the simplicity of the arrangement, and it is also relatively ineffective in invisibility.
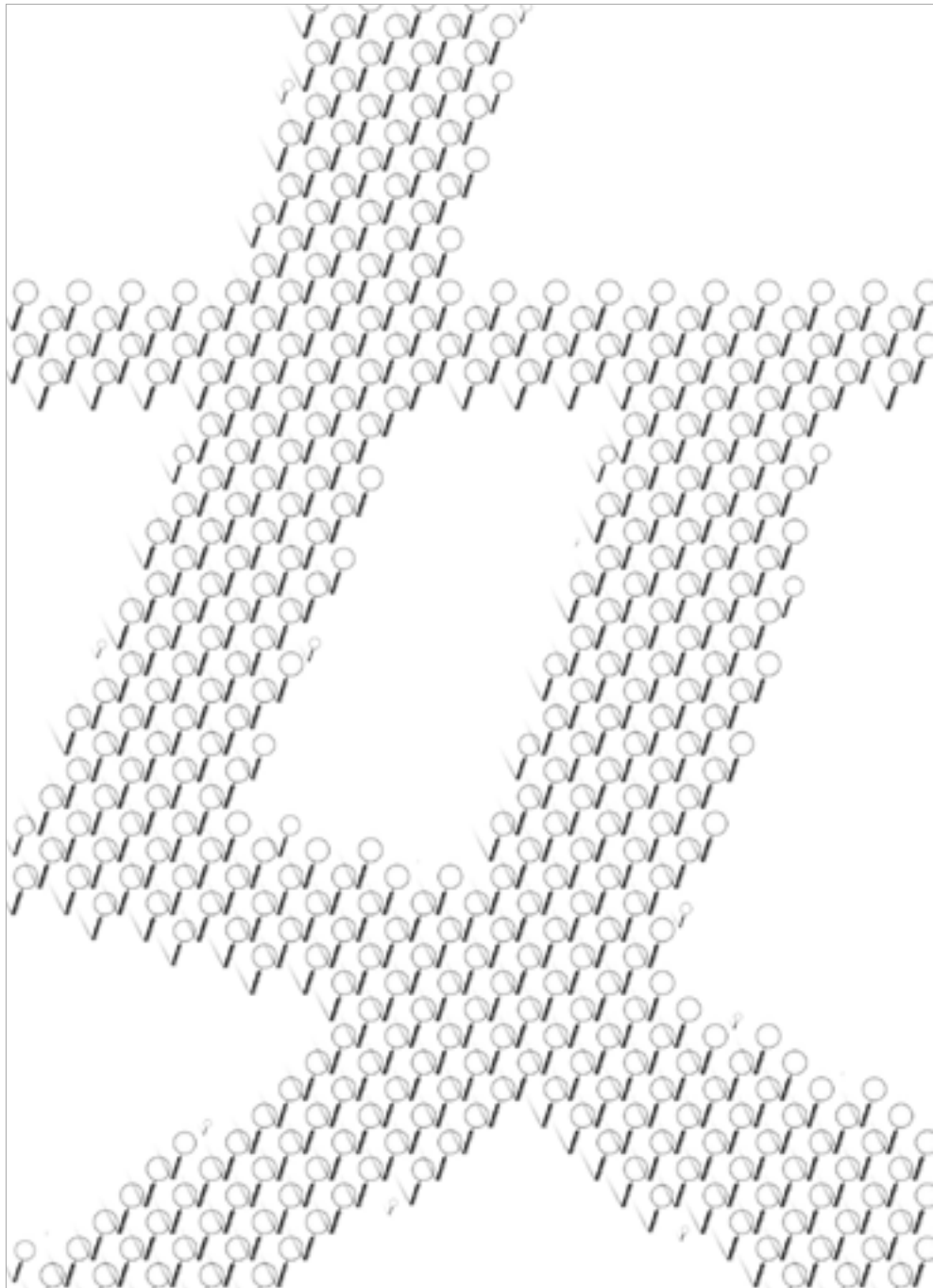
Fig. 1

On this basis, Fig. 2 breaks through the font frame of female character(女). The magnifying glass is still pluralized in a straight line and covered the whole picture. The basic figure becomes a magnifying glass with the word that is "Job" in the strokes of female （女）character's area, so a hidden female （女） character's outline is formed ingeniously and naturally. The basic pattern of the picture has been altered from 1 to 2. It makes the subtle difference of two basic patterns more hidden and the visual effect of the picture is also plump.
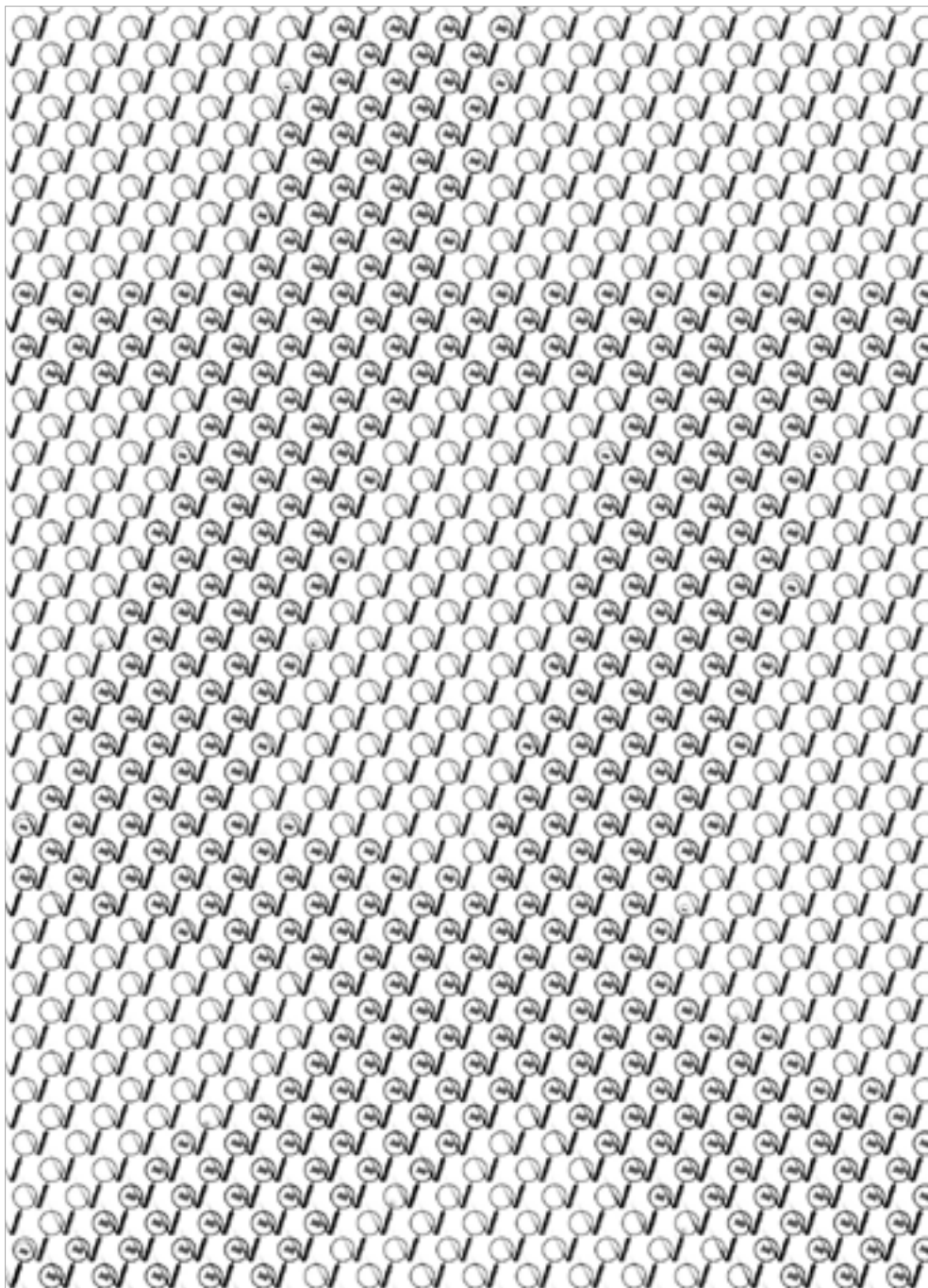
Fig. 2

Next, I carried out a further experiment. Figure 3 changes the arrangement of the basic types based on Figure 2 in density and size. The difference between the two basic patterns is increased, and the picture forms a stronger contrast. This makes it easier for viewers to pay more attention to the female （女） character, and the attention of the magnifying glass with the text Job is correspondingly weakened. Compared with Figure 2, the order in which the viewer observes the hidden figure has changed because of the changes in visual effects.
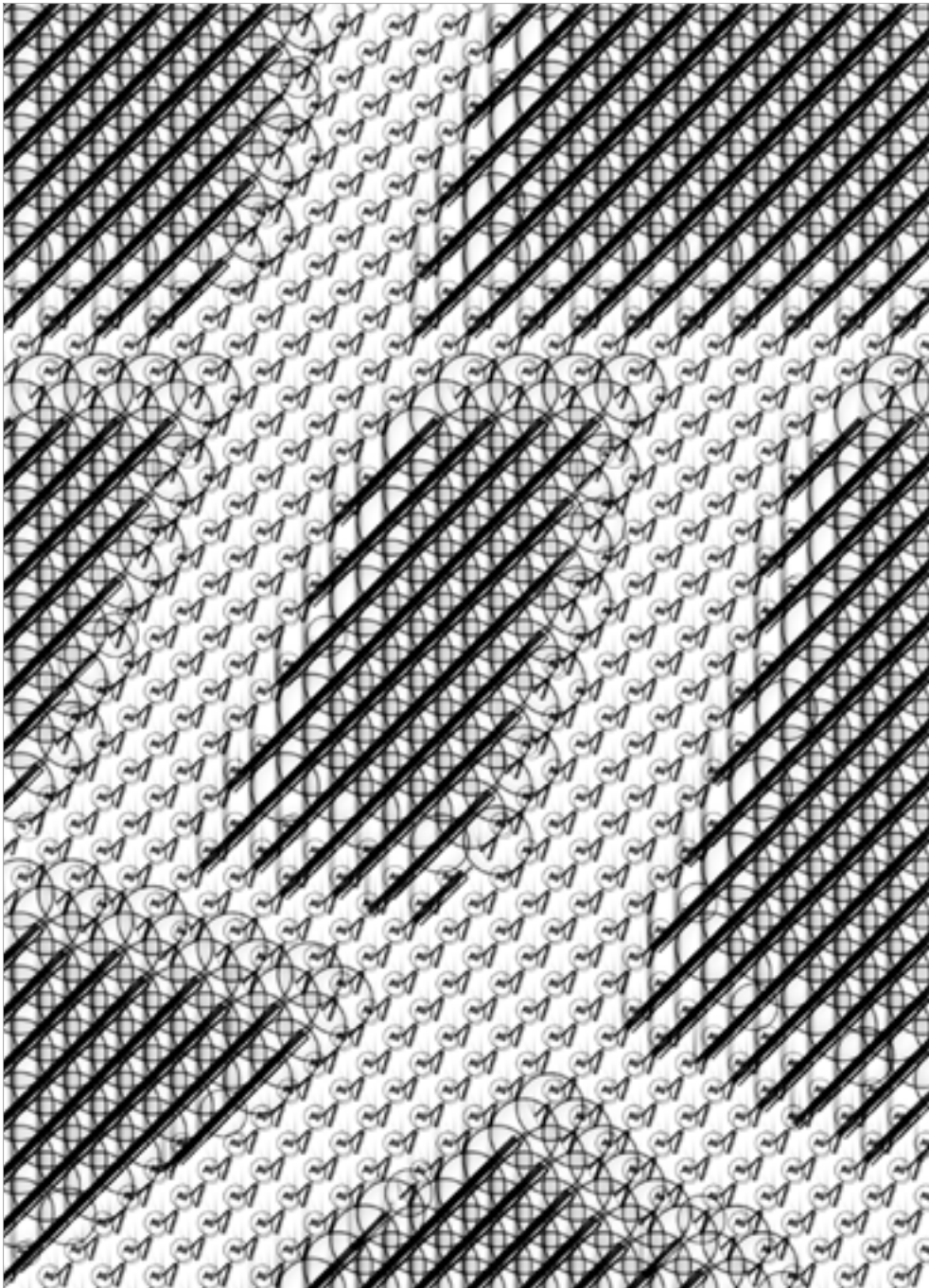
Fig. 3

I used the needle as the basic model in my second experiment. I continued to explore how different arrangements affect the hidden graphics' visual effects. In Figure 4, as the basic pattern, the needles are evenly arranged in the whole picture with the same size and direction. There will be some subtle variations on light and shade after I add another layer of the same needle patterns to the female （女）font's area, which skillfully produced a high invisibility female （女）character.

Fig.4

The size and direction of the basic pattern in Fig. 5 are the same as in Fig. 4，but the difference is that the basic pattern is not arranged all over the picture in Figure 4, it is only arranged in the stroke area of female （女）character and left the copy space outside the stroke. The relationship between black and white in the patterns makes the picture produce strong contrast. Then the needle's changes in density further enhanced the change of light and shade, it highlights the sense of power and forms a strong visual effect.
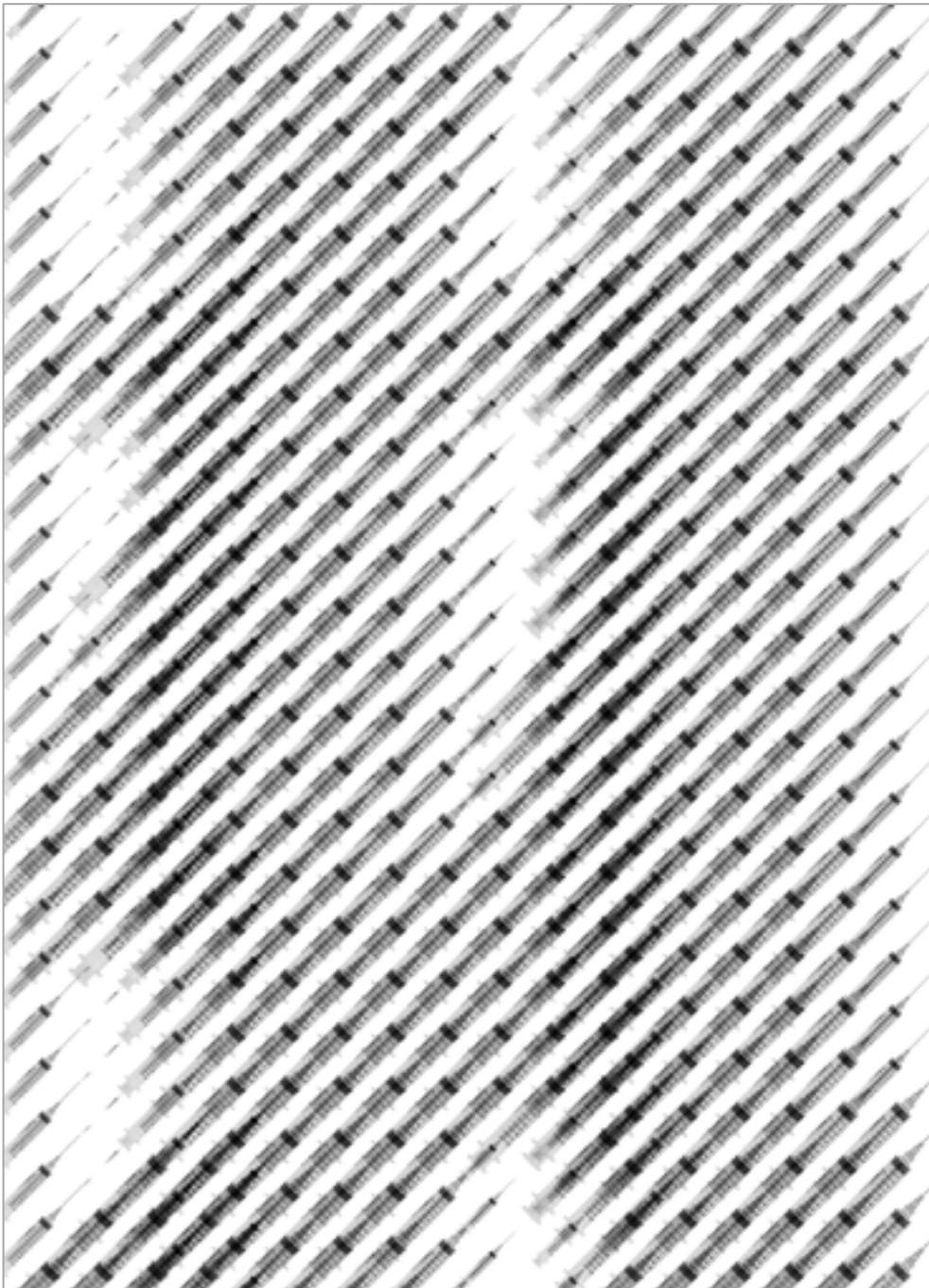
Fig.5

Figure 6 shows the arrangement of needles with the same size and density relationship, It only changes in direction and angle that to make all the needles point toward the center of the picture, and it makes the needles form a shape of the female （女）character. The negative space shows the female （女）character that is created by needles. It's obvious in the center of the picture and presents a completely different visual effect is from Figure 4 and Figure 5.
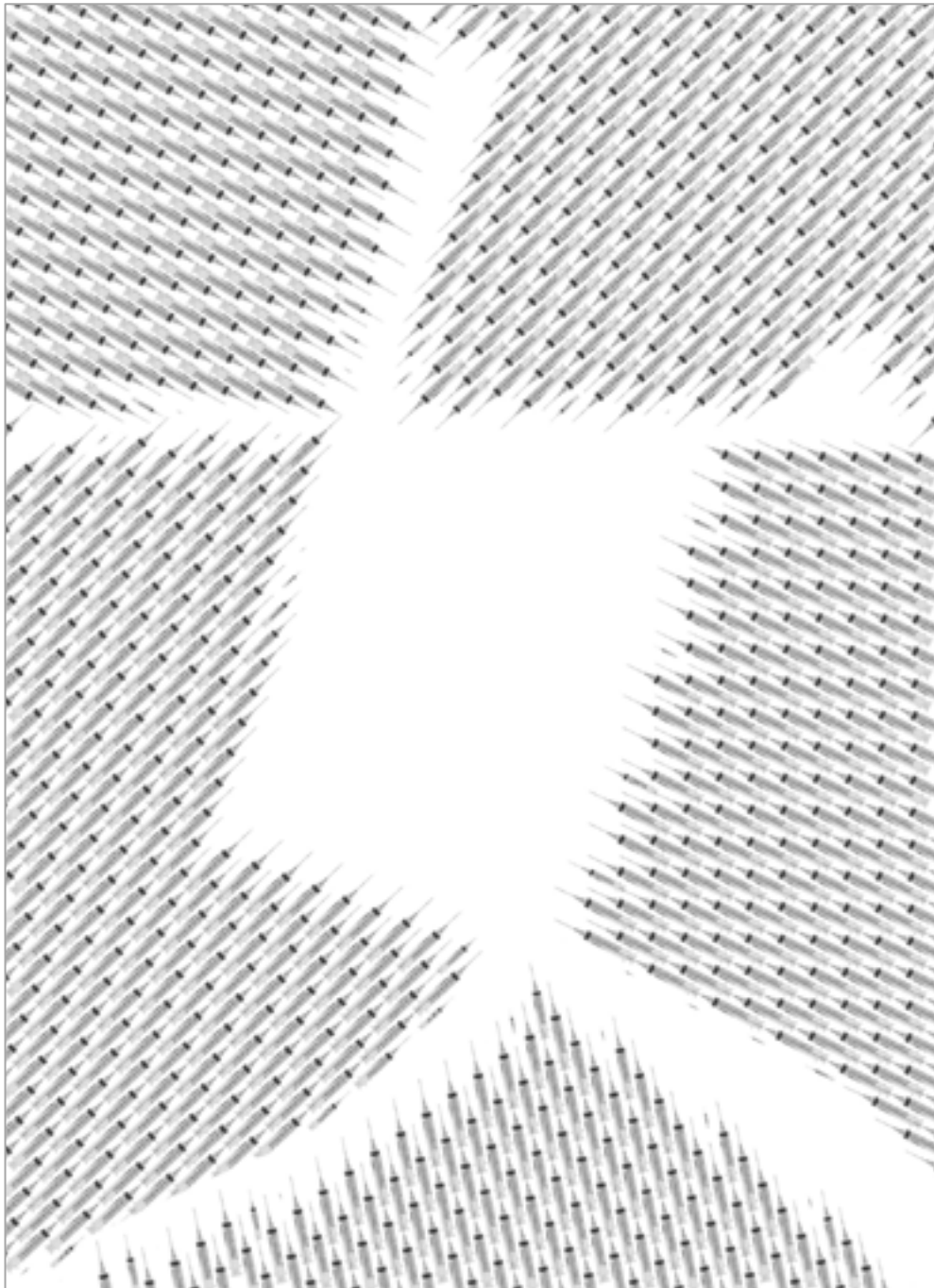
Fig.6

Figure 7 shows needles as the basic pattern in the same direction, they are arranged in concentric circles along the outline of the female （女）character. It generates the effect of spreading outward in circles like water waves. The concentric circles change light and shade from inside to outside that to establish a sense of space and hierarchy. The female （女）character is more prominent and attracts an audience more attention to it.
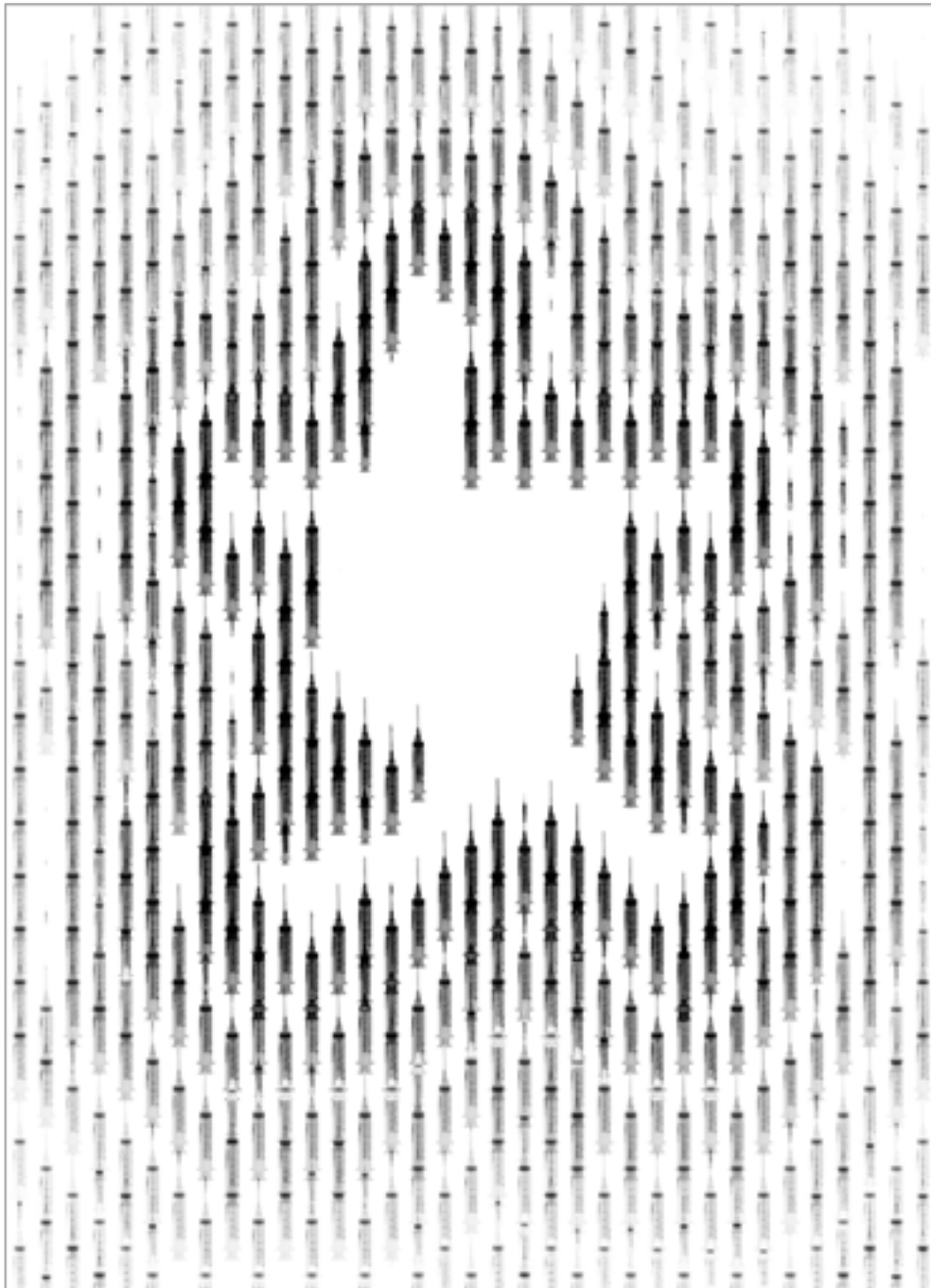
Fig.7

In the same way, I also tried a series of experiments on male(男) characters, as shown in Figure 8-11.
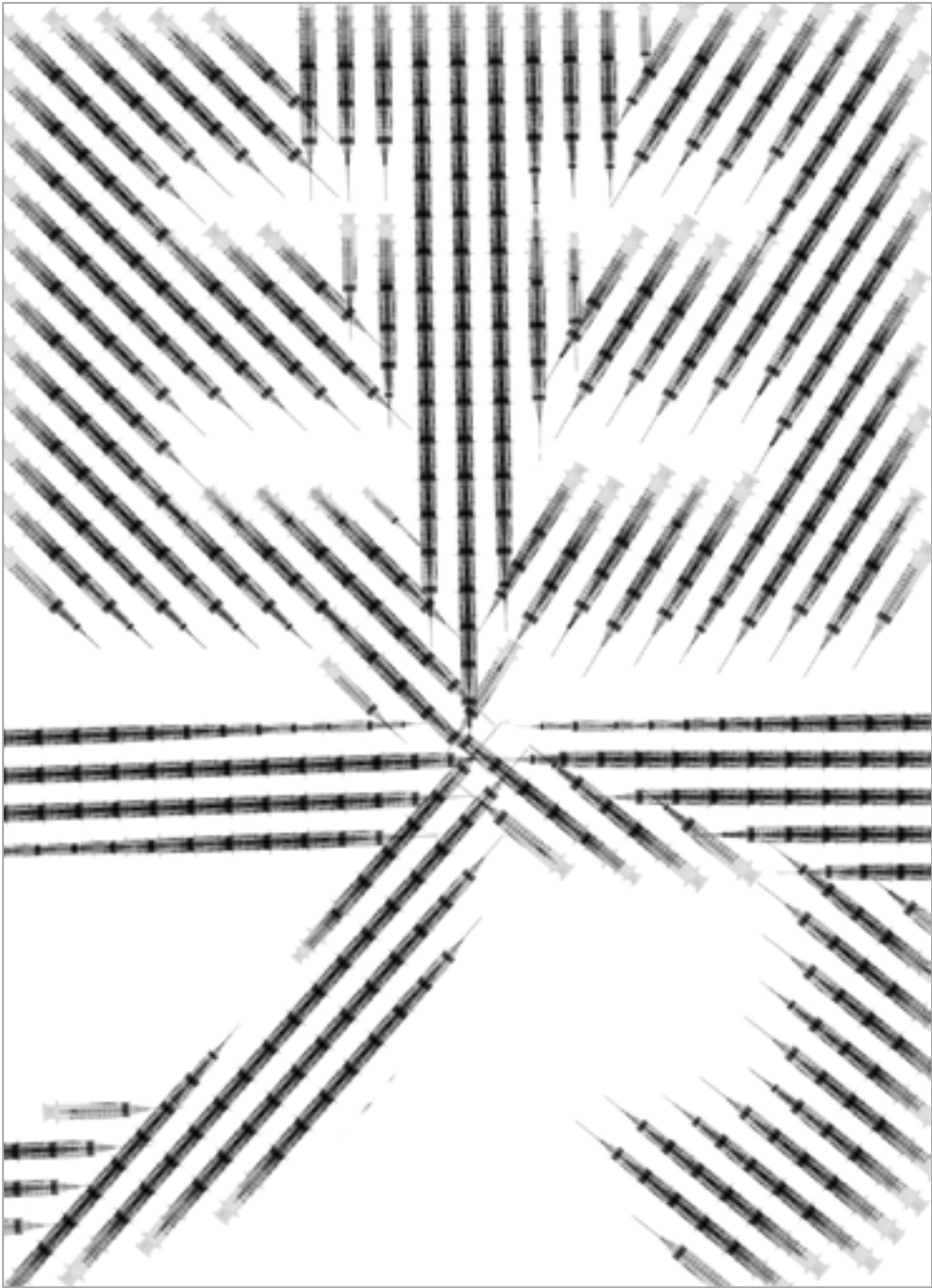
Fig.8
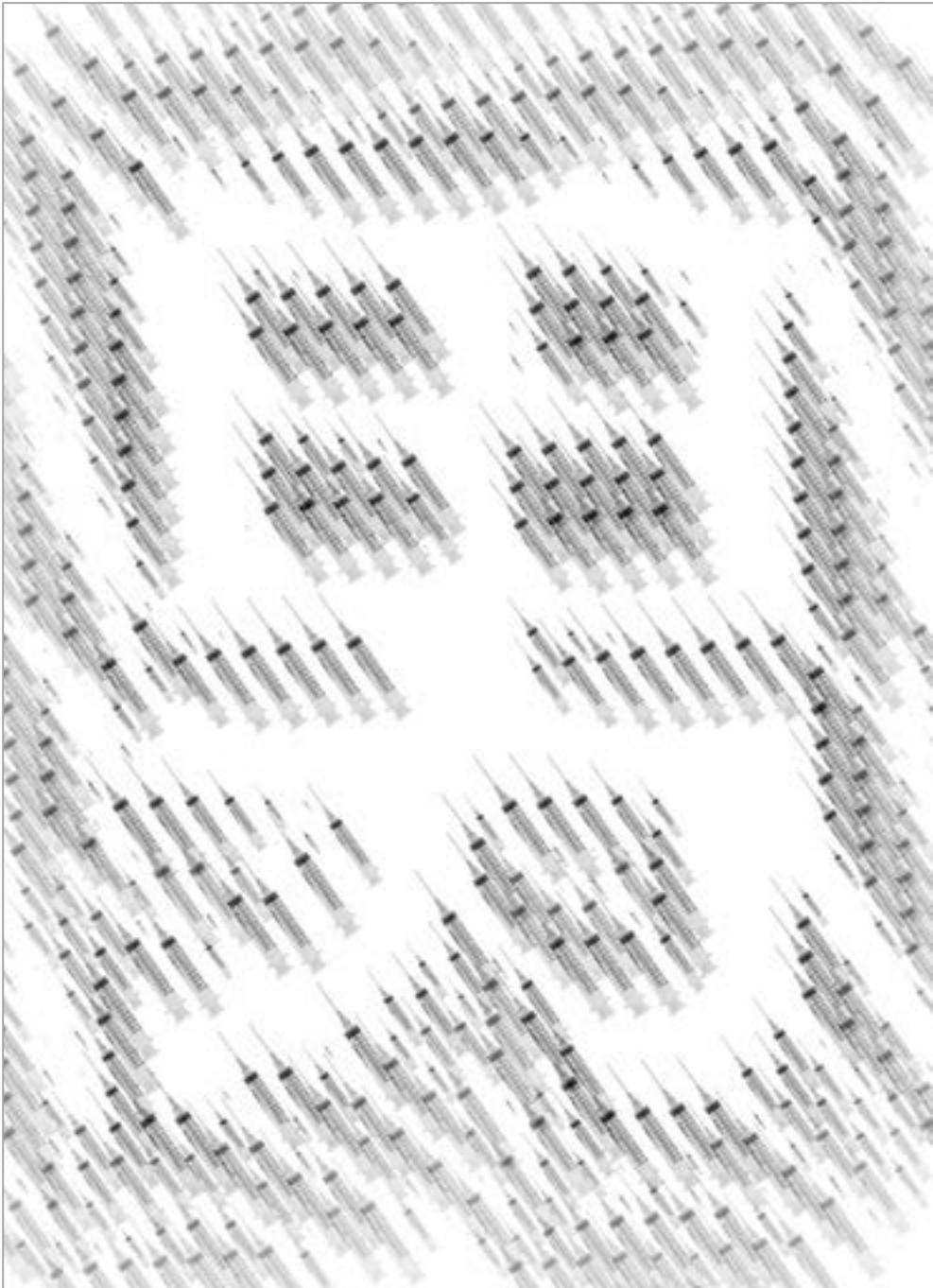
Fig. 9
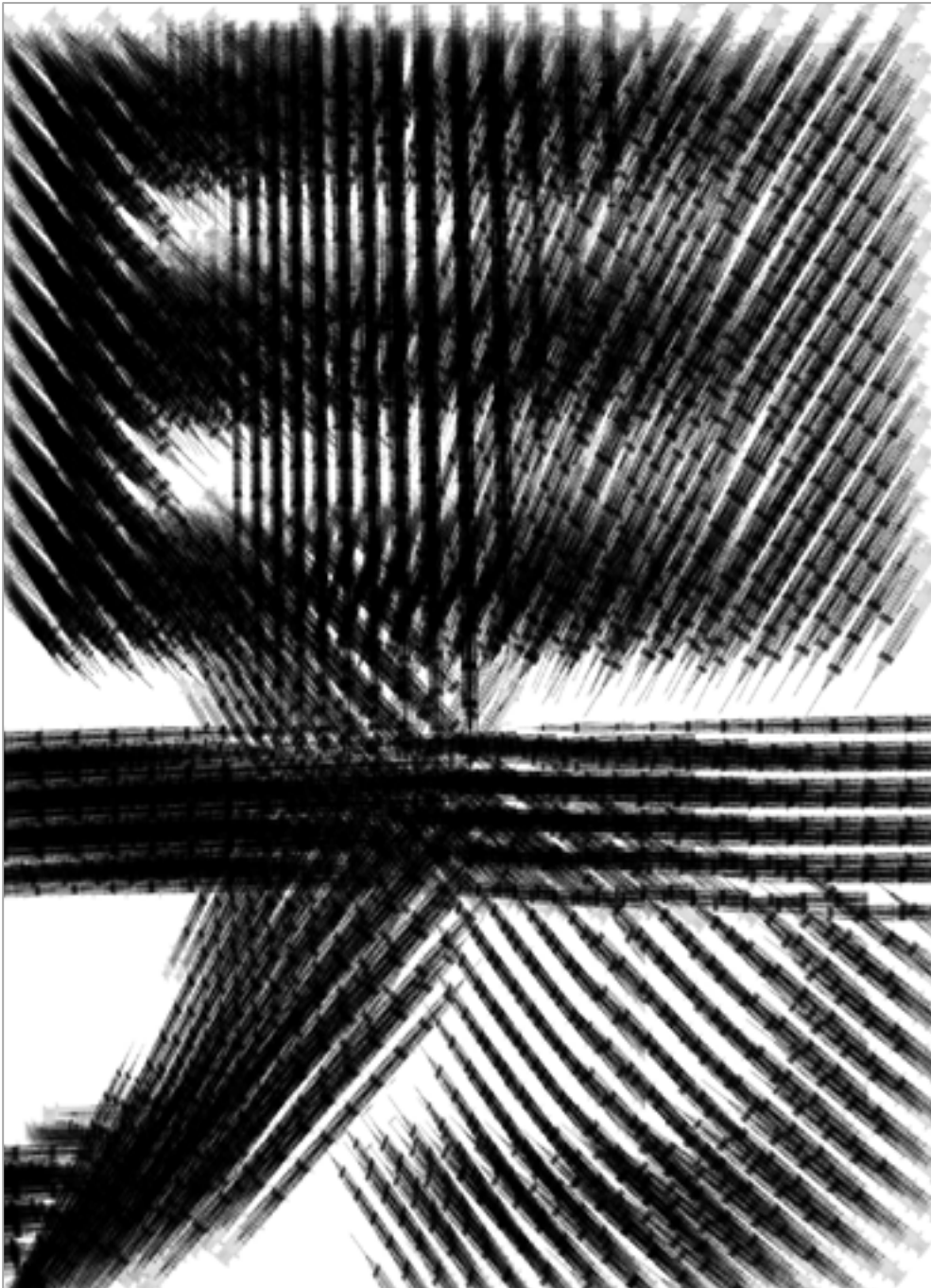
Fig.10
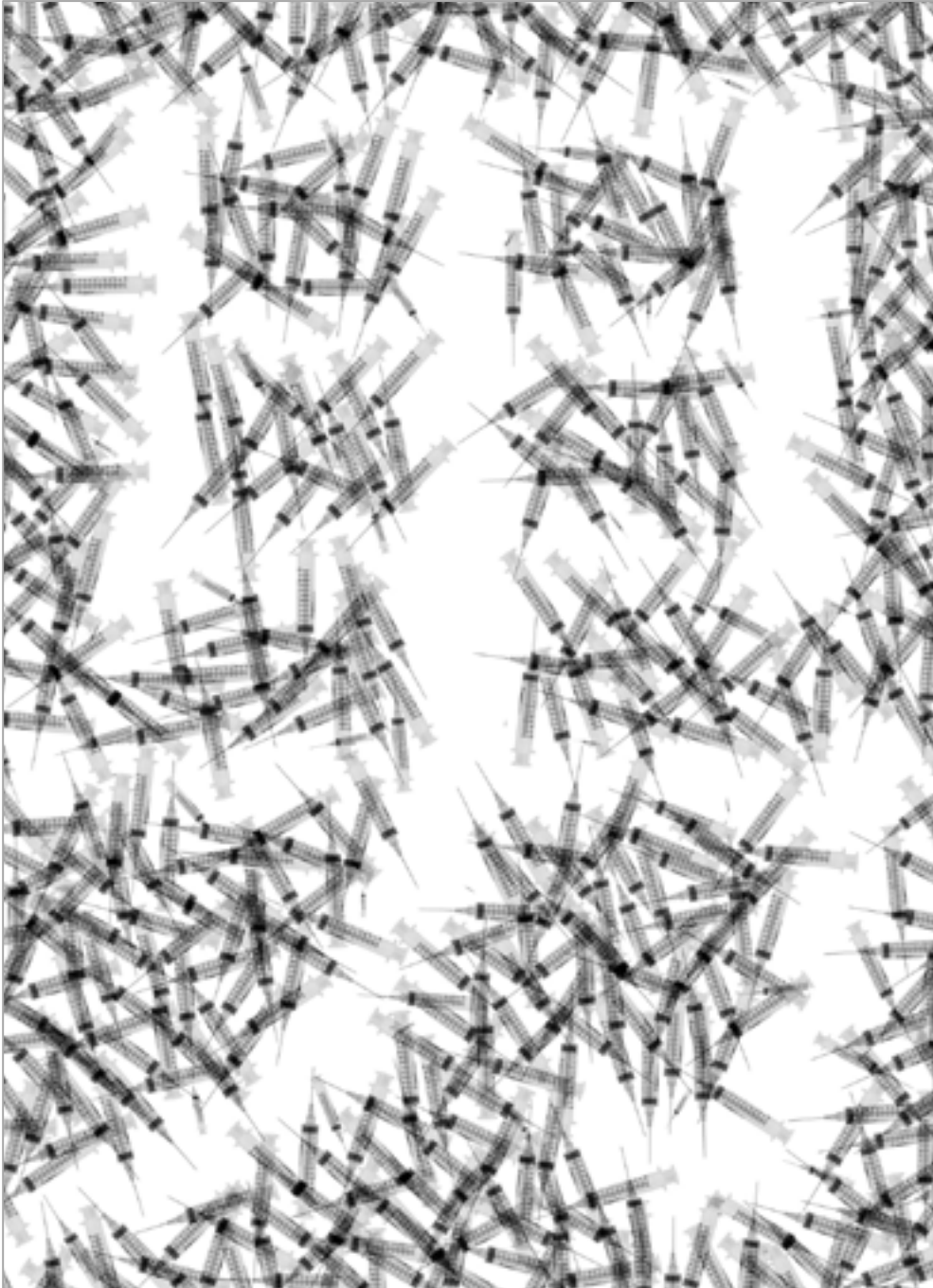
Fig.11

Four different arrangements create four female （女）character and four male (男) character with different styles and produce different visual effects. According to the unique visual effects, the hidden relationships between graphics are also different. When the character（女/男） has strong invisibility, the audience's attention will be attracted by the basic pattern firstly, and then the viewer will see the character（女/男） appear indistinctly. On the contrary, viewers observe character（女/男）at first, after that viewers might discover the needles that are hidden inside.

From the above two experiments, we can see that the different arrangements produce different visual effects. The different visual effects influent the viewers' observation sequence and experience. The above experimental work is only a simple variation of the arrangement and it produces a variety of visual effects. If I can make more changes in the arrangement and have all-around tries and exploration from various angles, it would make richer visual effects on the hidden graphics, and also bring richer visual experience for the viewers. Certainly, the selection of the basic graphic, the arrangement of the form and the visual effect depend on the content and theme of the work. Therefore, I combined specific themes and content to further expand the visual exploration of hidden graphics in my following works.

The work that 《Sexual Harassment》 reflects the common problems are sexual harassment. The work uses the hand as the basic pattern that is formed an indistinctly visible female（女）character by the basic pattern's dot matrix which has the changes of the size, density, and angle. But unlike the previous experimental work, the angles of the basic patterns in this work have also changed, the angle and direction of each hand are different as showed in the work. These changes make the layers of the picture seem richer. As a whole, it is a big female（女）character figure. The hands are small shapes in the local of the picture. When viewers are looking at the whole picture, the female character （女）appears, the basic pattern is ignored by us, and it's hidden. When the viewer's eyes are on the hand and pay attention to the details, the female character （女）is hidden. It seems to be a kind of visual magic that switches between the whole and parts, big and small. It would give you the shifting visual feeling. The stroke structure of female （女）character expands to all sides, so that to create a strong sense of power, it strikingly and shockingly highlights the theme.
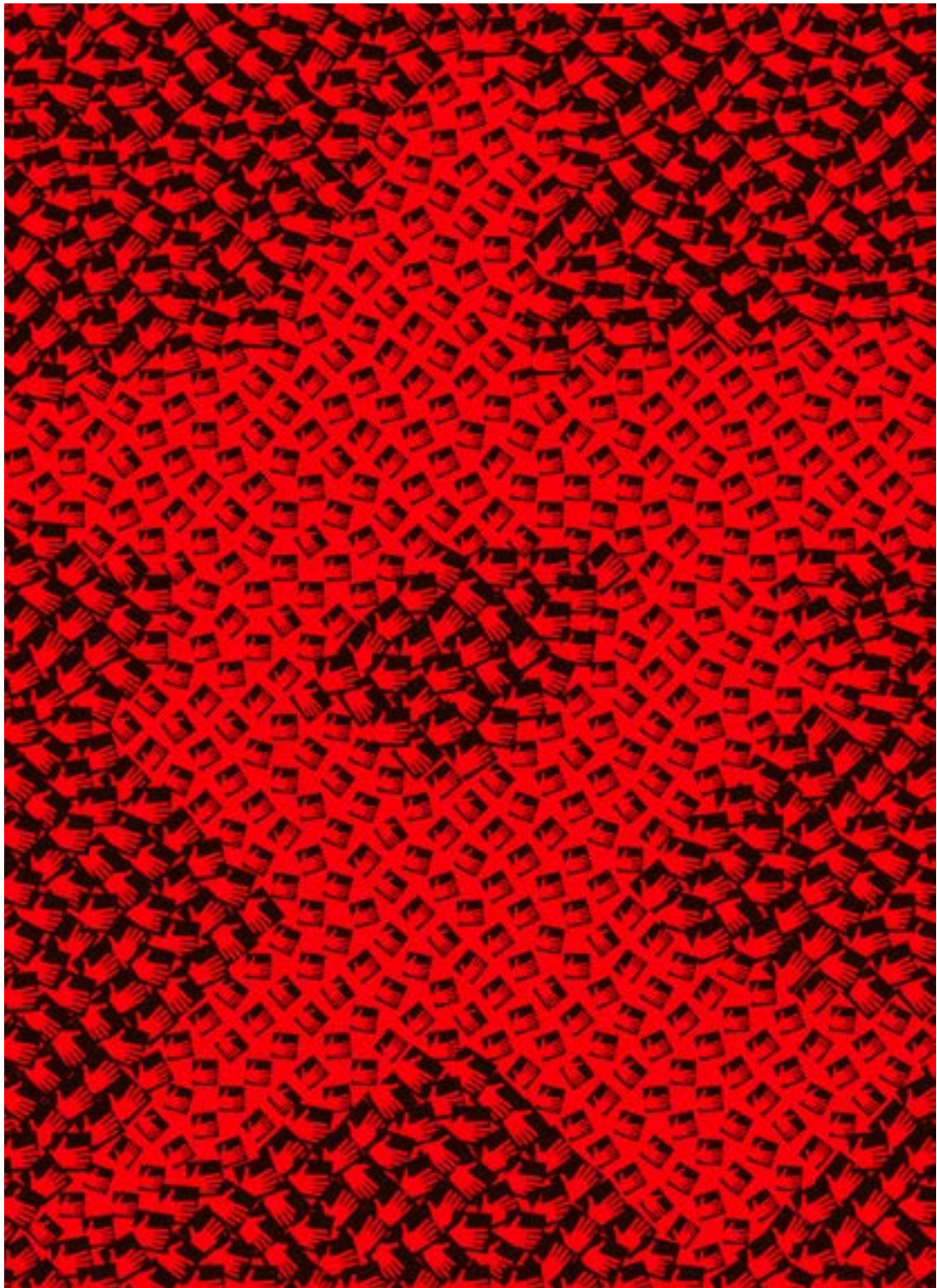
Sexual Harassment

《Monitoring Everywhere》 and 《Against Domestic Violence》 are further trying out with greater changes and aiming to produce a richer visual effect. These two works were based on a true story. A girl stays home with her baby every day. Her husband installed a camera in the house to monitor her. The camera not only recorded every move of this girl, but the camera also recorded the violence when her husband commits domestic violence, it became legal evidence as well. In real life, the majority of full-time homemakers still have a low status in the family, and their economy and freedom are restricted. 《监控》 takes the camera as the basic pattern. It's arranged in a curved way, and it breaks through the straight arrangement of 《Sexual Harassment》 that to skilfully form a the female （女） character. The female （女） character is hidden in the camera at a closer view. The camera is hidden in the female （女） character when it is viewed from a distance. Each camera is arranged at a different angle. The direction of the camera's arrangement is also arranged according to the direction of the strokes. The change of camera's angle stands for surveillance is everywhere. The shape of the female character was squeezed out of shape by the cameras. It makes the person intuitively feel the living condition of a full-time homemaker. The picture gives the people a feeling of depression and anguish through mixing with red and black and fulling of cameras. The visual form of the work is an appropriate expression of the theme and it makes content and form get perfect unity.
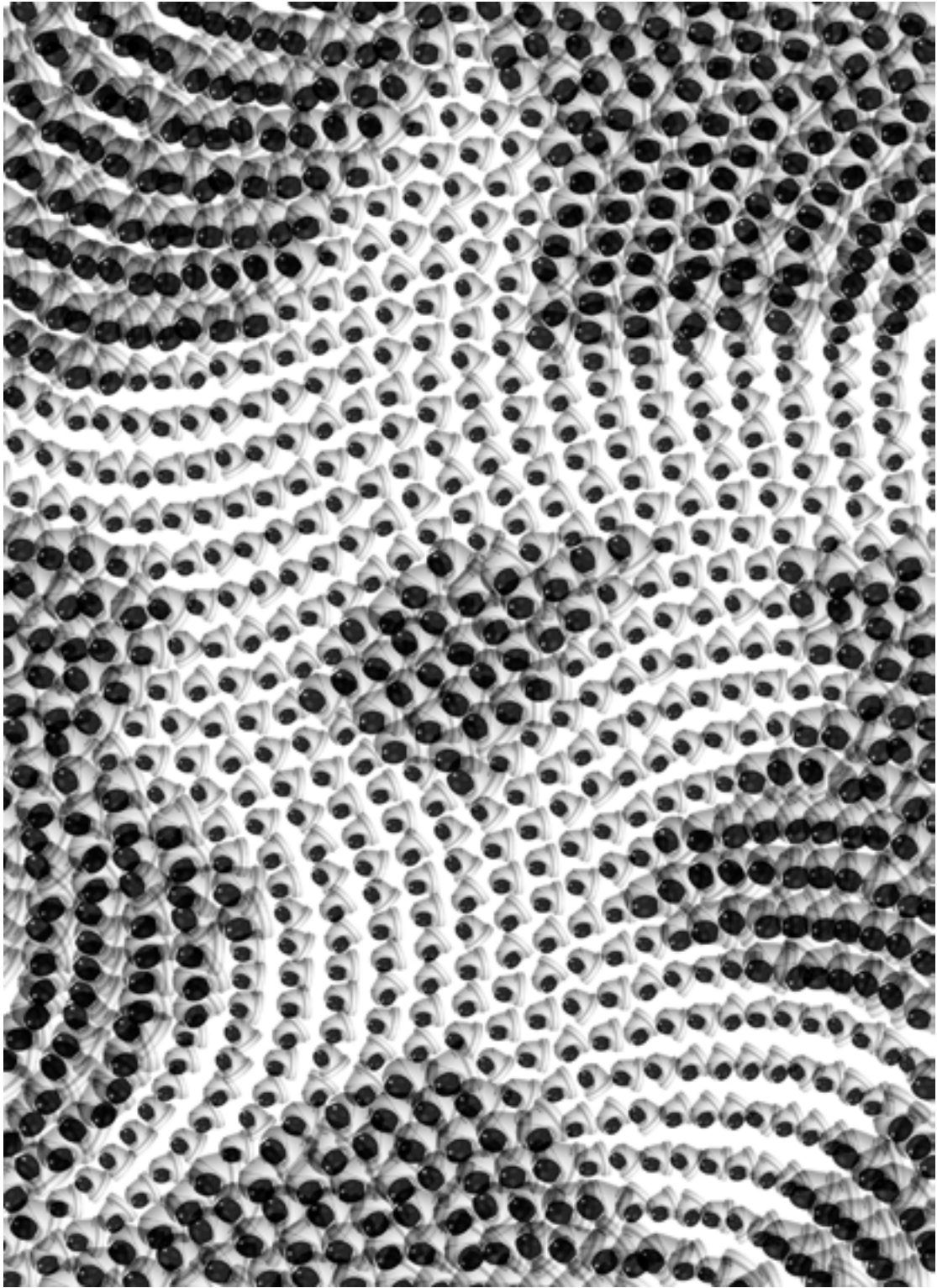
Monitoring Everywhere

《Against Domestic Violence》 arranges 6 patterns that are the forbidden symbol, fist, cross, band-aid, dialog box, needle, and a female （女）character loomed out in with the change of the size of them. This work breaks through the limit of a single basic pattern, and the number of the basic pattern increases from 1 to 6. The number of basic types in the pattern increased, the number of hidden graphics has increased accordingly, the information carried by the graph increases, and the visual effect of the picture becomes richer. The unique rhythm is formed by the collision with different shapes in the picture with the addition of a black tone that to express the theme of domestic violence against women.
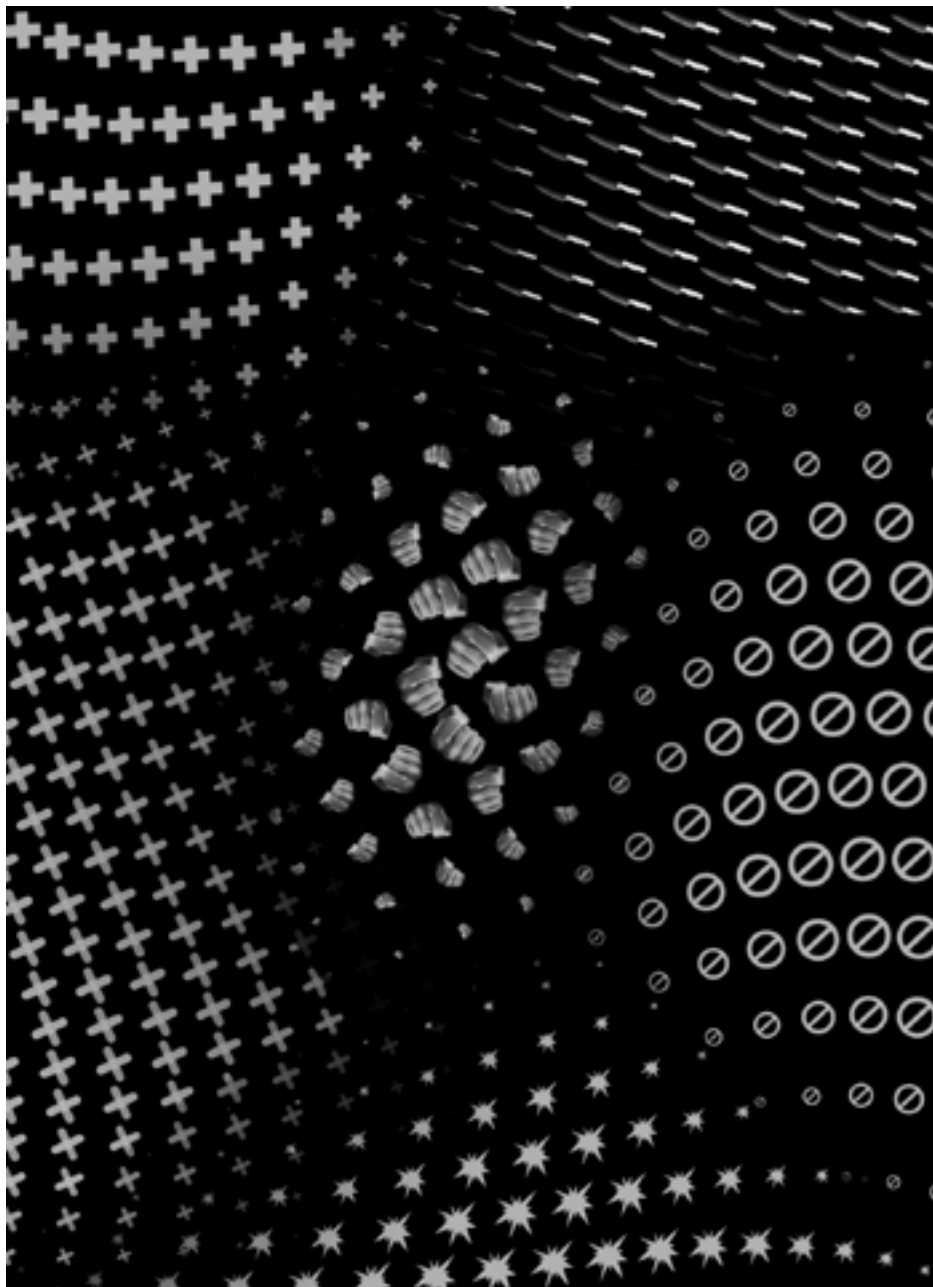
Against Domestic Violence

《labor force》focuses on the theme of male migrant workers in modern society. In a traditional agricultural society, men and women supplied most of the labor in agricultural production. In modern industrial society, the nature of men's work has changed because a large number of male farmers went to cities for work, and they became city builders. I chose safety helmets, pliers, bricklaying shovels, and other construction tools as the basic patterns. They are formed a stacked and arranged visual effect through size variation and cross-arrangement. It reflects the increasing intensity and stress in work from male construction workers, in order to arouse people's thinking and attention. The basic pattern of this work has been increased from 1 to 4. The Chinese characters are composed of several basic patterns in the same way as 《Against Domestic Violence》. But the difference is that they are arranged in a slightly different way, basic patterns in 《Against Domestic Violence》 form the female （女） character with a negative form, but basic patterns form a positive form of the male （男） character. These two different arrangements also create a very distinctive visual effect.
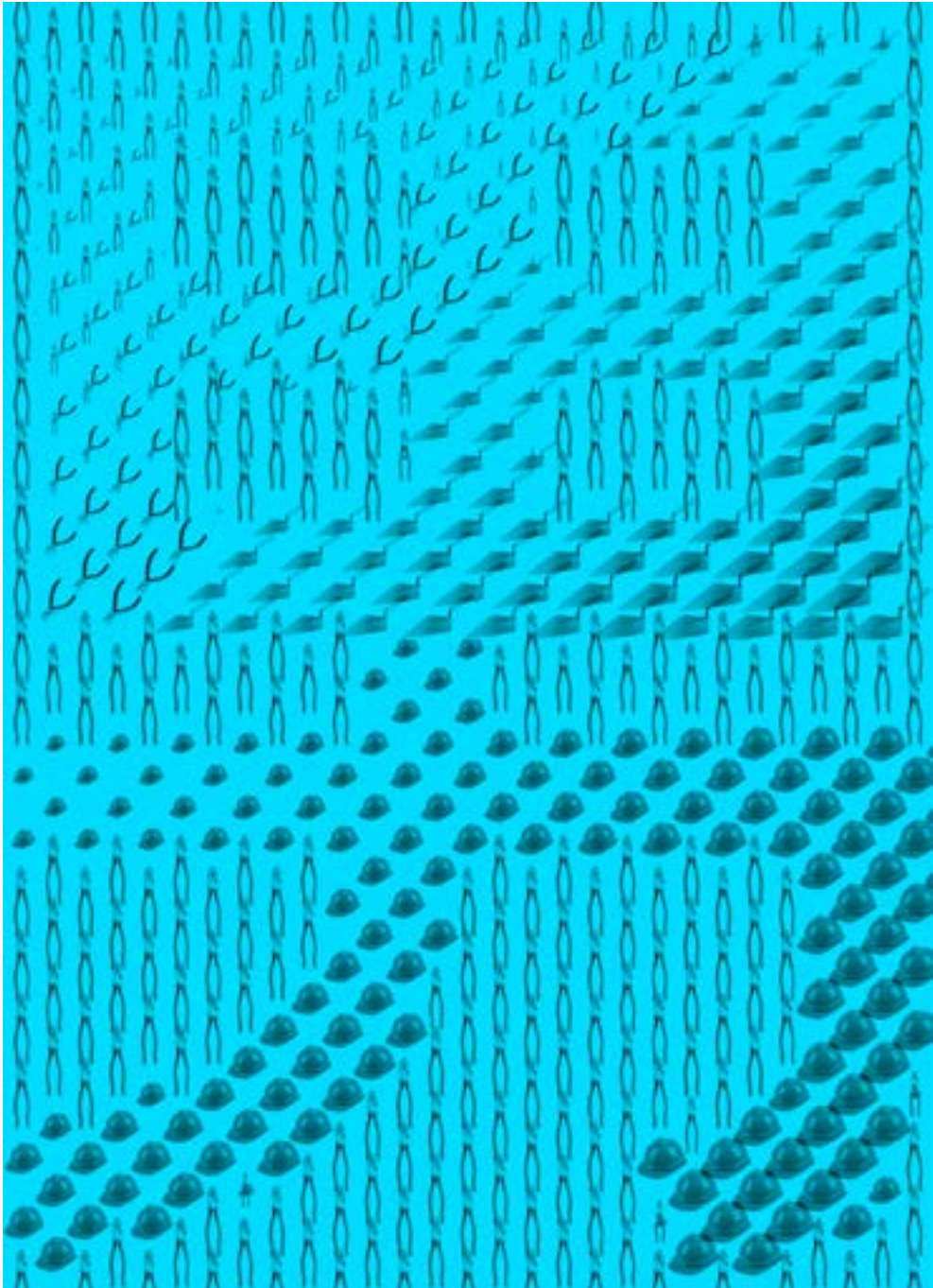
Labor force

4.1.2 Gradual Change

Gradual change is a regular change. It gives a strong sense of rhythm and aesthetic appeal and creates a dazzling visual effect.

《Sudden Death》 reflects the health problems of the modern. With the increase of work intensity and pressure, the rate of sudden death is also increasing. Men are under a higher rate of sudden death in particular. This work chooses ECG as the basic pattern. It creates a gradual Change effect from strong to weak by arranging the basic pattern from front to back. So as to alert people to focus attention on health.
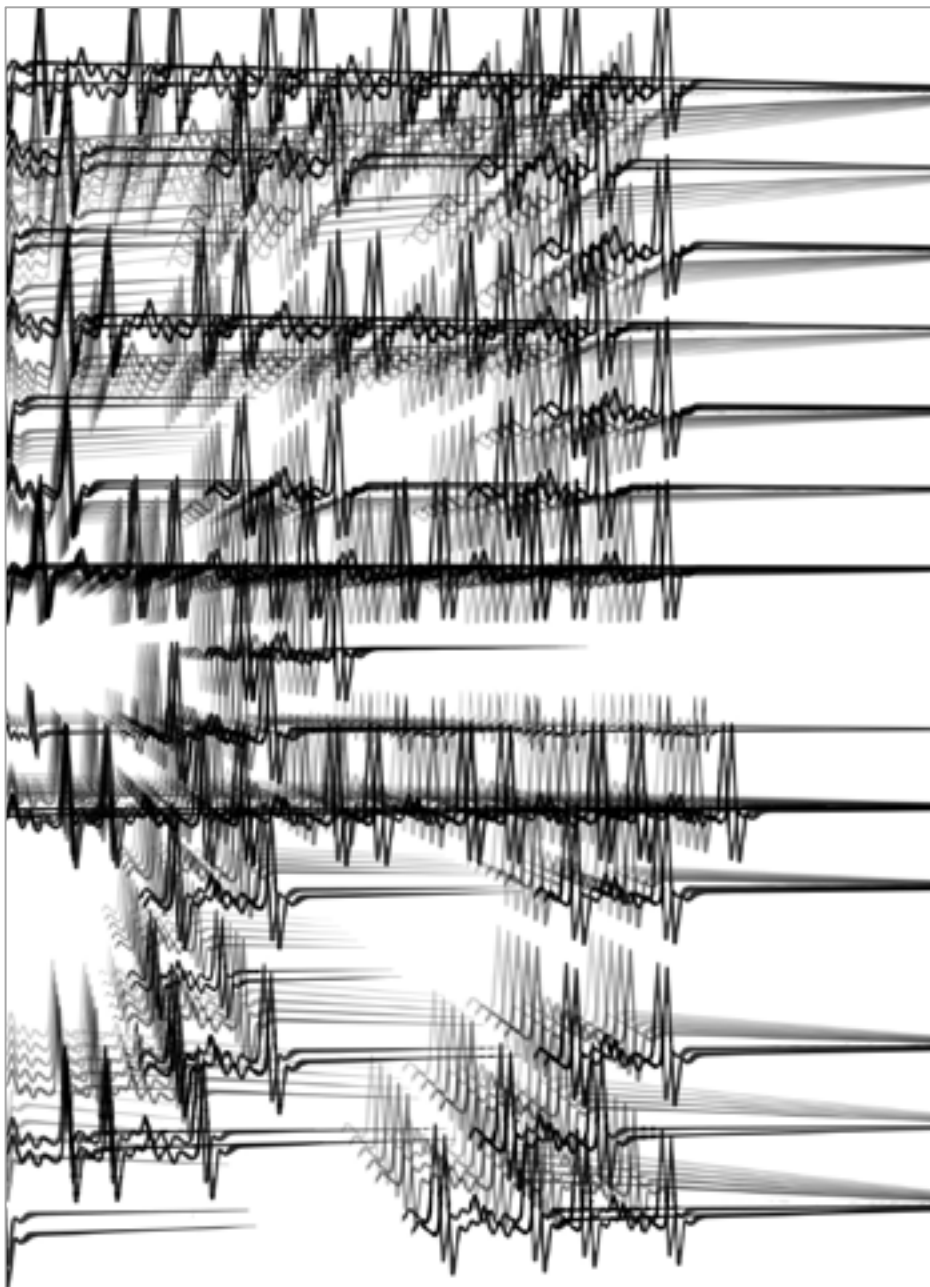
Sudden Death

Life is a flower, and a flower is like life. We always describe a young girl as "as young as a flower." It represents that the young girl is experiencing the best years of her life. The process of a flower from its bud to its bloom can also represent a woman's life. 《Life Is Fleeting》 uses flower bud, blooming flowers, withered flowers as the basic patterns. The three patterns form a natural gradient transition through arranging different sizes of them, and the three patterns constitute a female （女）character. Through the natural connection with the three states of the flower, the female （女） character naturally forms a whole picture, which indicates that a person's life that is just like the lifetime of a flower, of which every stage is worth remembering and considered valuable. As the basic patterns of the work developed into three from one, it creates a change from 1 to 3. Compared with 《Against Domestic Violence》 , The naturally gradual transition between the three patterns in 《Life is fleeting》 blends in with the whole picture. Hidden graphics are more difficult to find, which requires the viewers to actively motivate their observation and imagination because of the stronger invisibility.
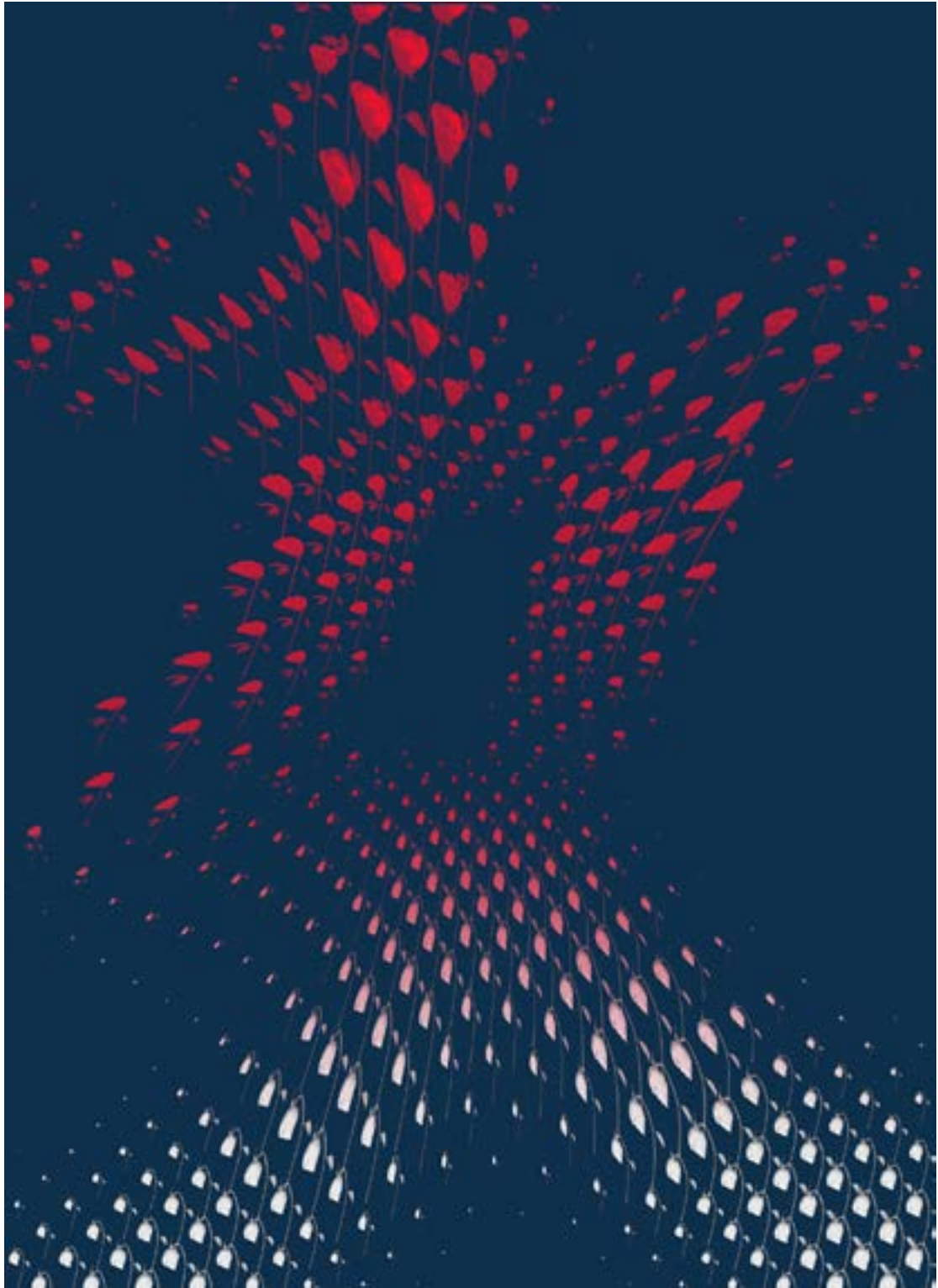
Life Is Fleeting

《Pressure》takes pressure gauges as the basic pattern and arranges them through the dot matrix of perspective, size and density, and it naturally consti-tutes a hidden female（女）word. In this work, each of the pressure gauges has different shapes, sizes and angles.

The work forms a sense of space from near to far visually and produces a dazzling visual effect that is the same as kaleidoscope with variations in the size of the basic patterns and its skilful match with gradual changes in shapes. The theme of stress is vividly expressed in this way. The in-depth, wiggly and extensional space is created by the bulge that comes from the gradual change and movement, this kind of which makes picture to produce a sense of jumping, fluctuation and extension. The changes generated by the gradual change also make the details of the picture more delicate，abundant, and memorable. The basic pattern is enlarged and placed in the center of the picture, which is also the center of attention. And female characters are hid-den and invisible that requires careful observation to find it out. The order of viewers' observation has changed because the basic pattern becomes the visual center. At the same time, the gradual change and movement makes every pattern in the picture different, and the hidden patterns have evolved from one to countless. It forces the viewers' eyes to constantly discover the hidden details in the picture. therefore, it improves the audience's participation and enriches the visual experience of the viewers.
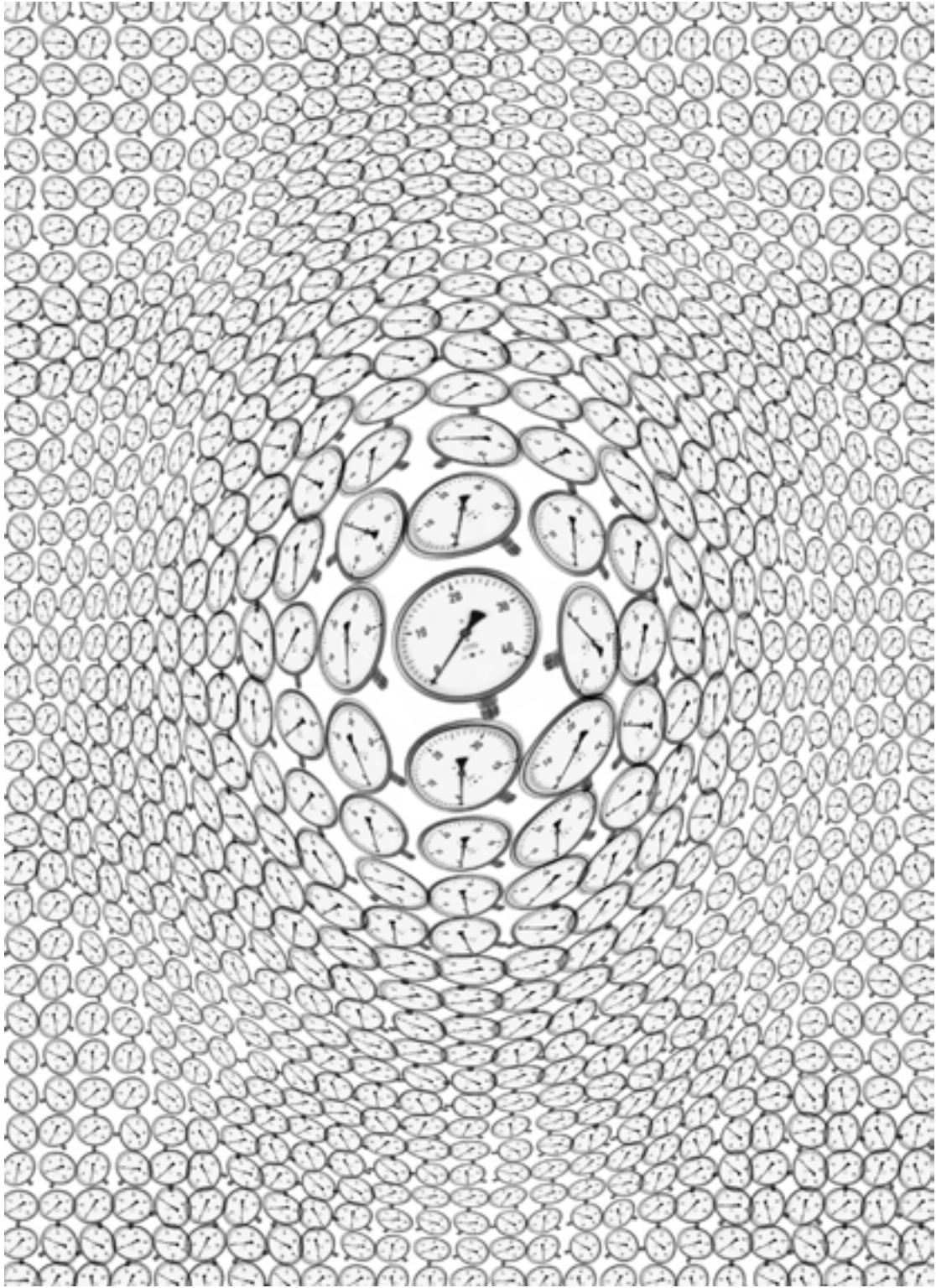
Pressure

The common methods used in gradual change are shape change, quantitative change, and color gradient. I tried a new approach of gradual change in 《Heavy pressure》. The female （女）character produces textural effect power with gradual changes and selective focus, thus it brings the multi-layered and different visual feeling to viewers. This effect of light and shade is the result of visual power, The strong visual pressure relevantly reflects the real life of women who are under all kinds of pressure. The composition of the overlay gradient makes the picture present a more hierarchical impression and enriches the visual expression of hidden graphics. The color's relationship between black, white, and gray produces a pure and unique ink visual effect and shows the oriental artistically as well. The viewer's attention is first attracted by the unique visual effect, and then they will look for the hidden graphics layer by layer. The unique artistic effect stimulates the viewer's interest in discovering the hidden graphics.
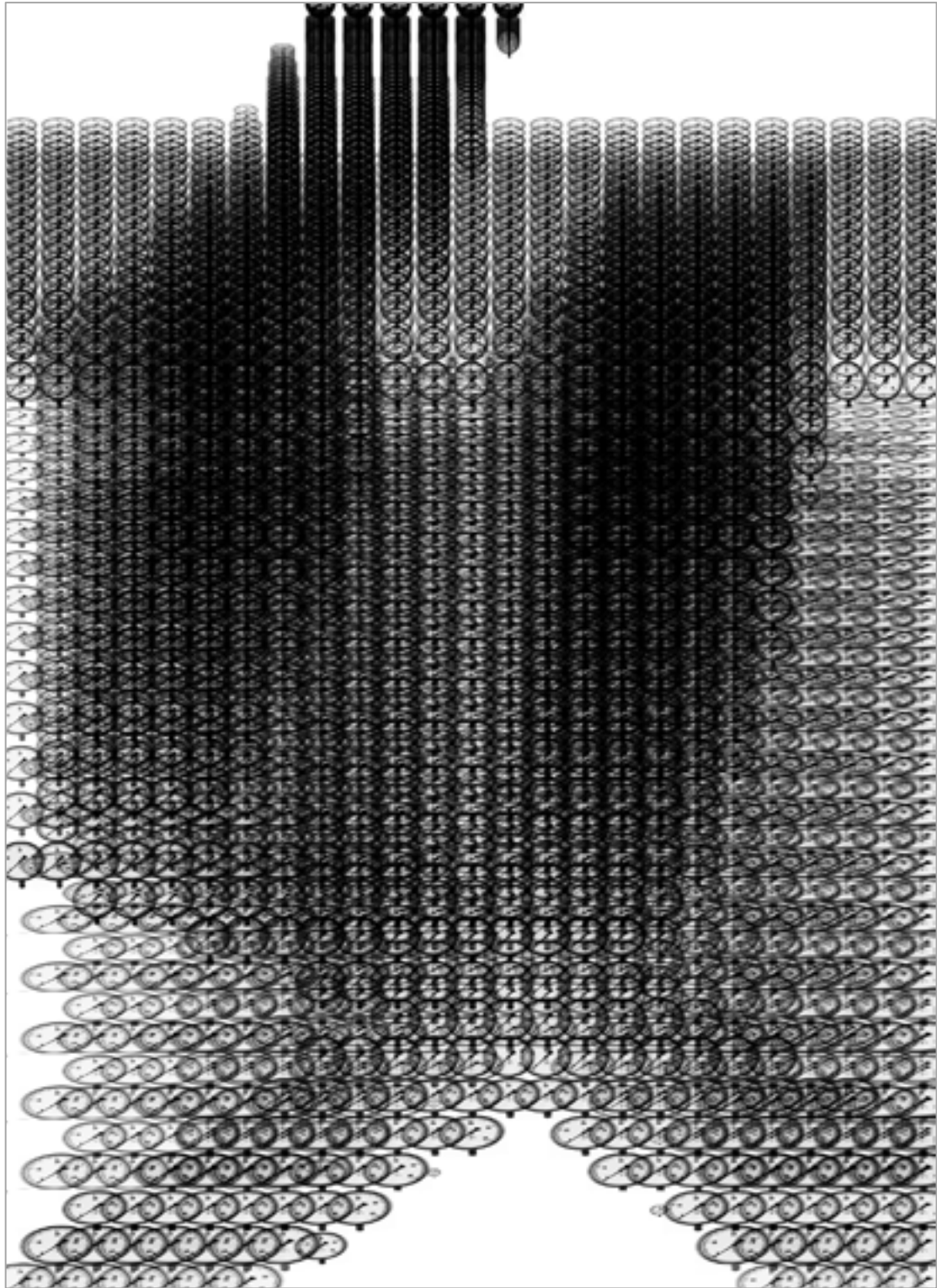
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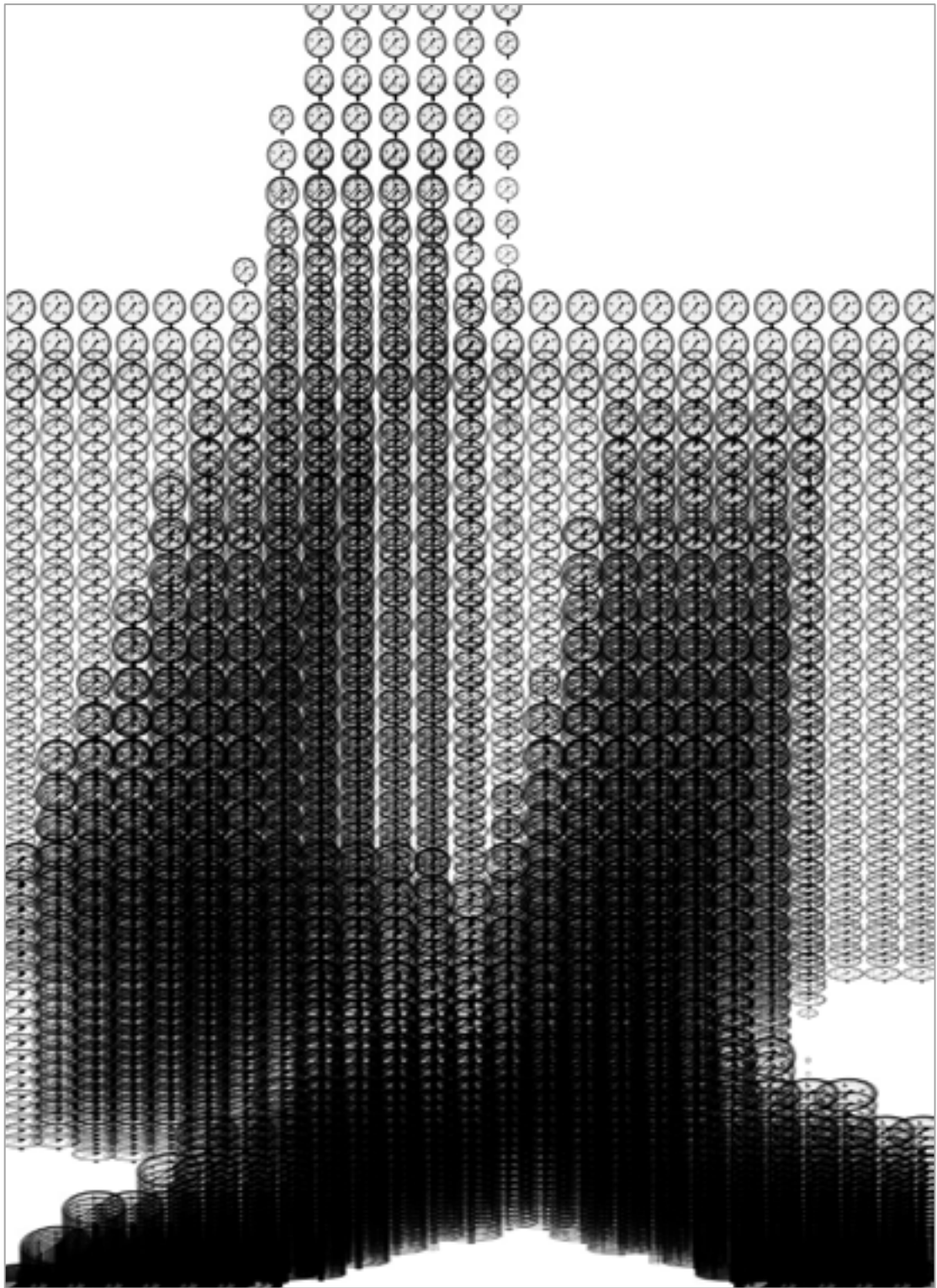
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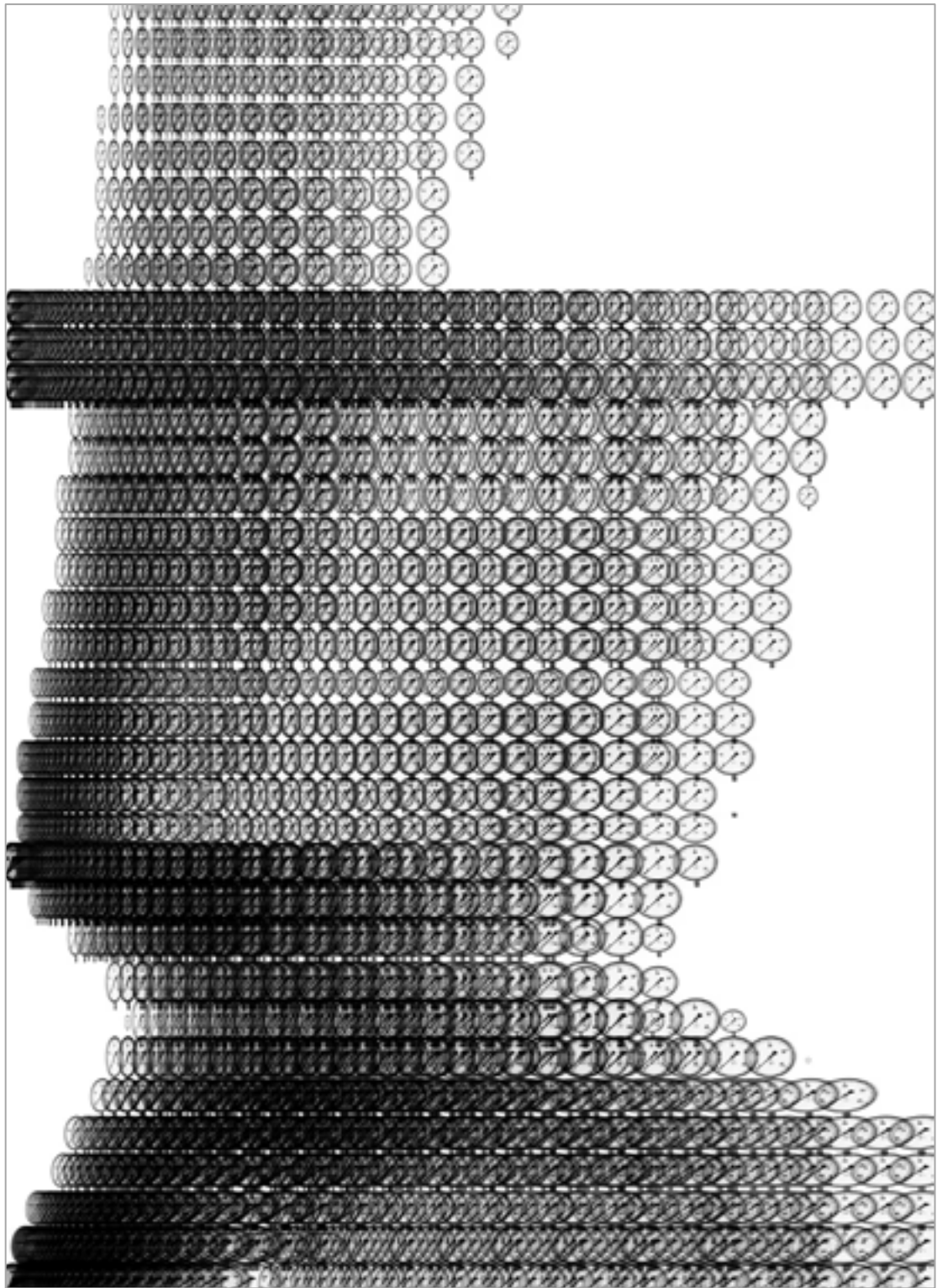
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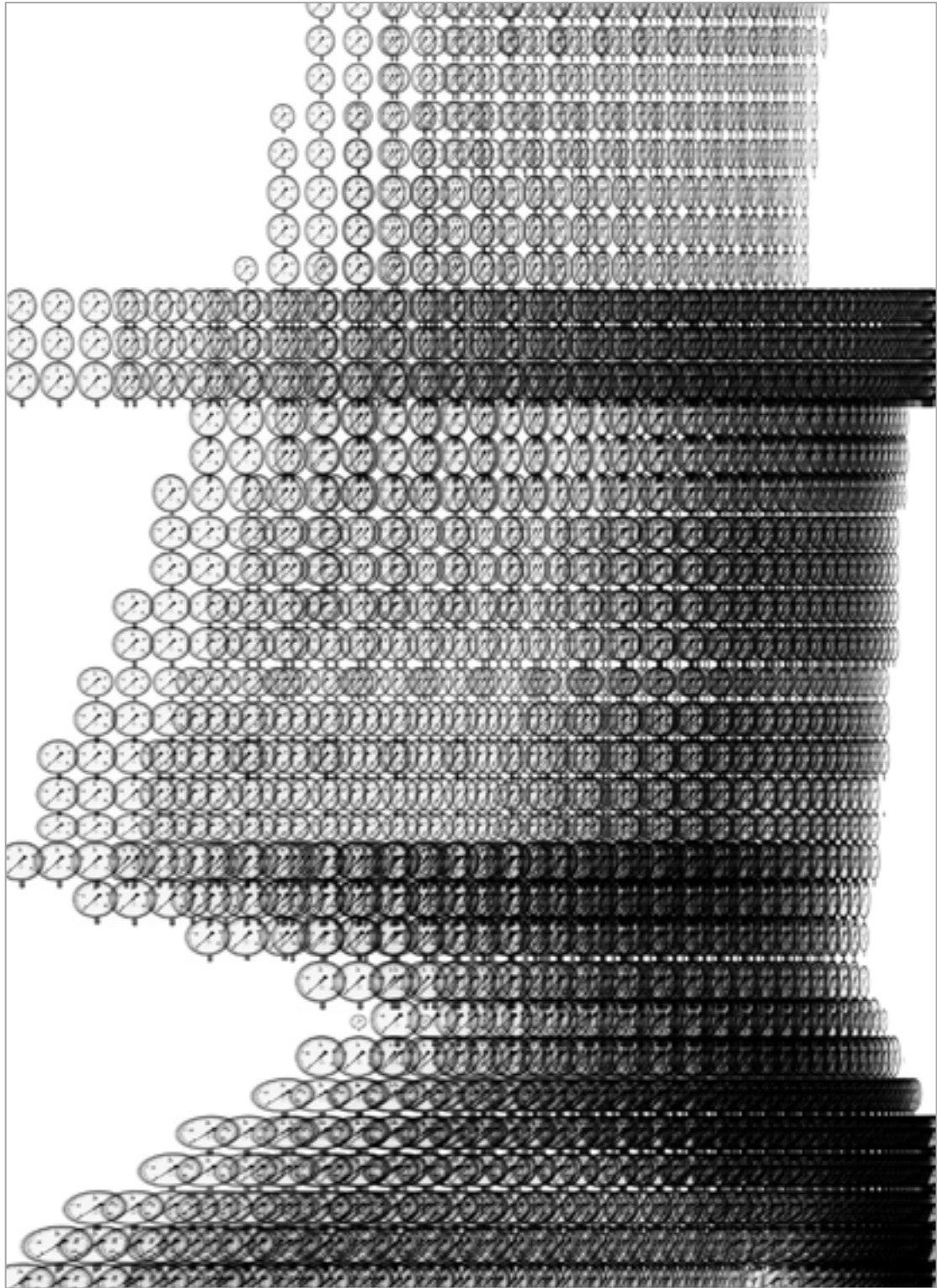
Heavy pressure 4

4.1.3 Radial

Radial distribution is that the visual elements are arranged radially around one or more central points, which can make the picture show a strong sense of movement and extensity. The radial distribution gives the viewer a strong visual stimulus, which is impressive. 《Men and women》are two series of works. One of them is a male（男） character that is composed of female（女） characters as the basic pattern. The other one is a female（女）character that is composed of male（男） characters. The basic patterns are radially arranged by centralizing patterns from the outside towards the middle and gradual changing from large to small. Naturally, the male （男）and female （女） characters are formed in the center of the picture, and it forms a strong visual effect as well. Take "Men and women-女" as an example, male（男）character is the basic type that constitutes a female （女）character. hidden in the male （男） characters that are set in radially, The female（女）character is the launching point of the picture. in contrast to that female（女）characters are made up of male （男）characters, the male （男）word is hidden in the female（女） character. The male （男）character and the female（女） character cunningly concealed in the picture, and that there is male （男）character inside the female（女） character and vice versa creates hidden visual effects with multiple layers. It relevantly shows the philosophical relationship between men and women.
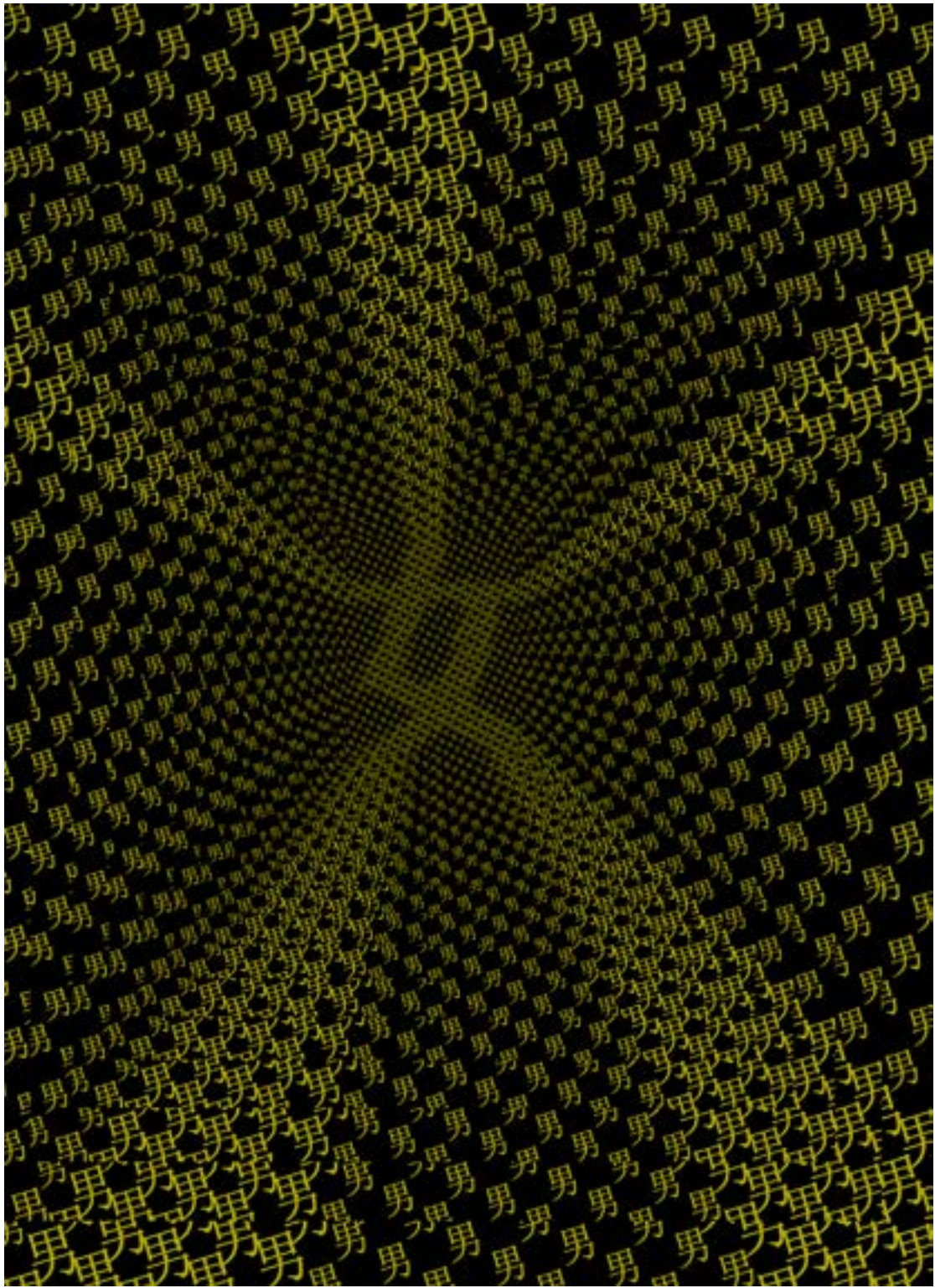
Men and women-女
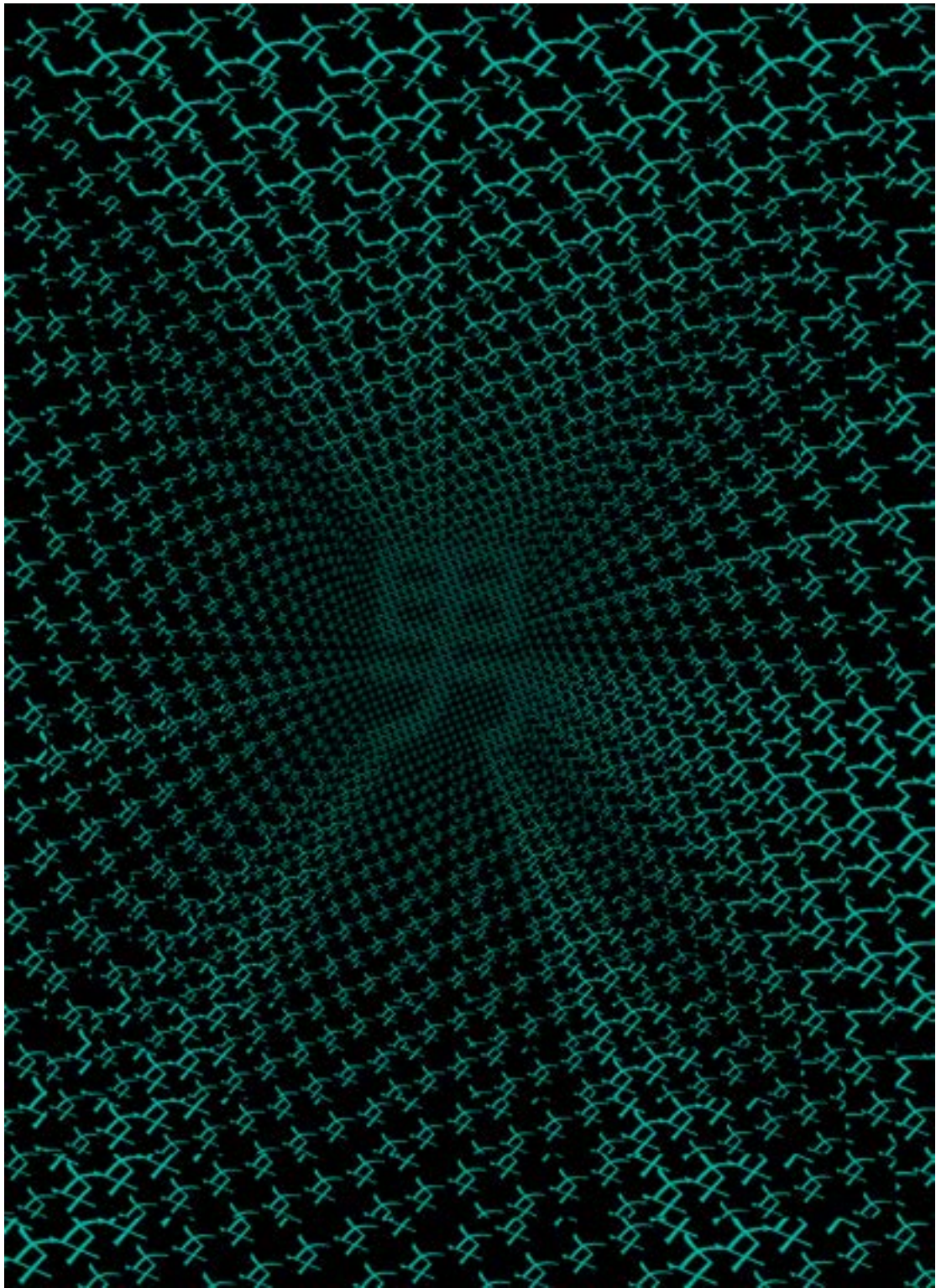
Men and women-男

《Drug abuse》 uses a variety of ways such as emission and dislocation superposition to comprehensively express a female（女） character. This work takes lines as the basic pattern, and it is structured by concentric circles. The picture produces a is the radial visual effect that diffuses outward with progressive layers after misplaced and changed size of concentric circles. On this basis, I add the third graphic element that is the pill. By modifying the density of pills, it makes the superposition of the picture and produces a richer variation. The simple color in black and white plus annular dislocation arrangement makes the female character（女） hid the radial circle, and the pills were hidden among the female （女）character. It triggers off the viewer to think about the abused drugs. The strong contrast and dense lines strike the viewer's vision and cause the illusion effects. The viewer's vision is pulsated between three hidden figures of optical illusions. It creates a unique visual experience.
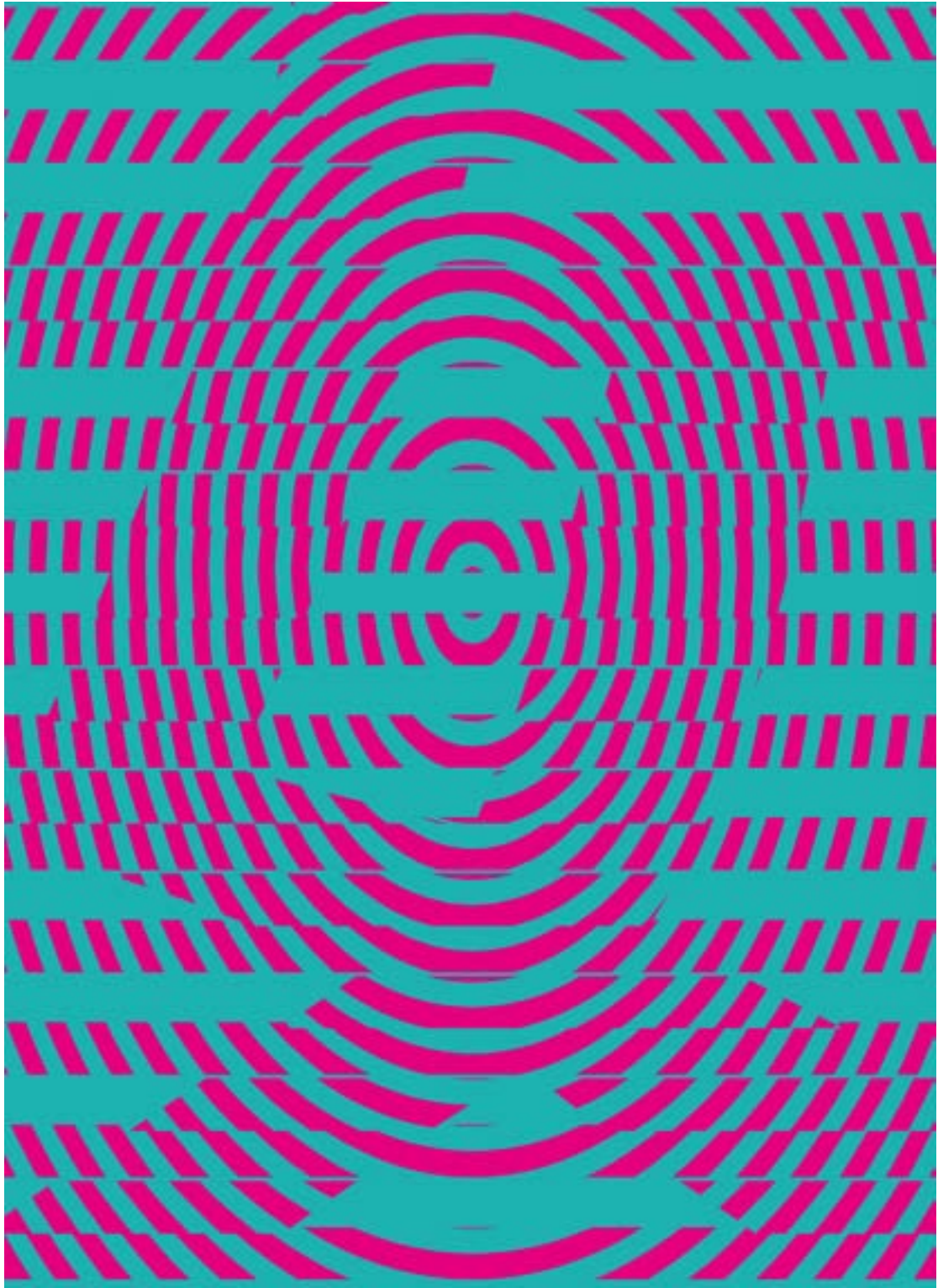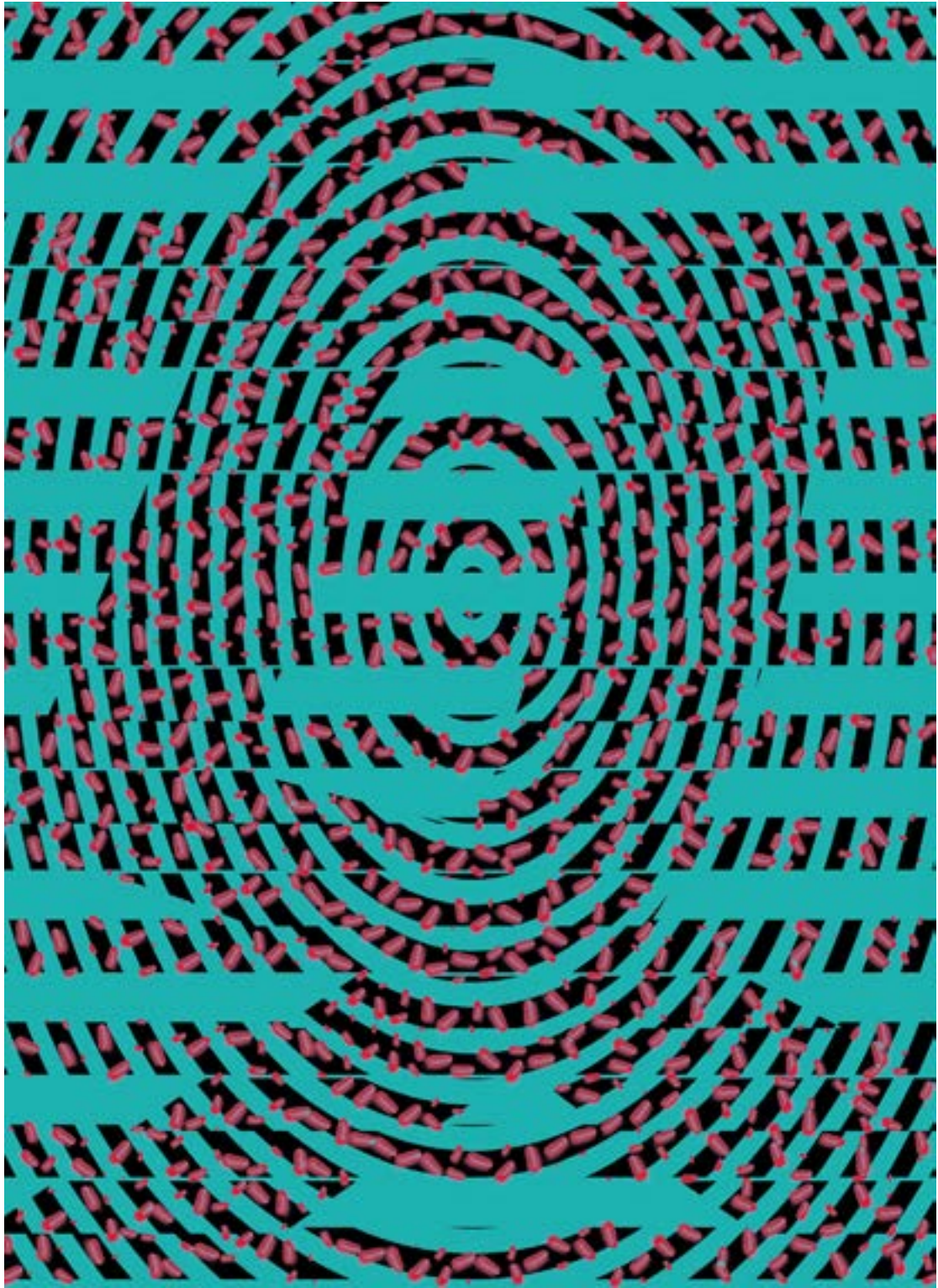
Drug abuse

4.1.4 Space

According to the principle of perspective, I first did some visual experiments that try to create a three-dimensional sense of spaciousness in a two-dimensional plane. Figure 12 uses a dot matrix arrangement of bricks that are put along the perspective lines of female（女） characters, then through the changes of density, depth and angle, the female （女）character will be shaped into a three-dimensional effect with a sense of perspective to create a far-reaching spatial relationship for picture. Figure 13 uses the basic pattern tacked as point to forme a three-dimensional female （女）character with a sense of spaciousness by arranging the size, direction, color, and gradually changing the tacks. The tack's variations in size and depth of color create each 3D faces, and the front face and side face of female character are intensified by tacks that are distributed in different directions. Slight changes in the size, color and perspective will bring unique visual effects. The stereo space with perspective effect created by the two graphics is simple and common.

Fig.12
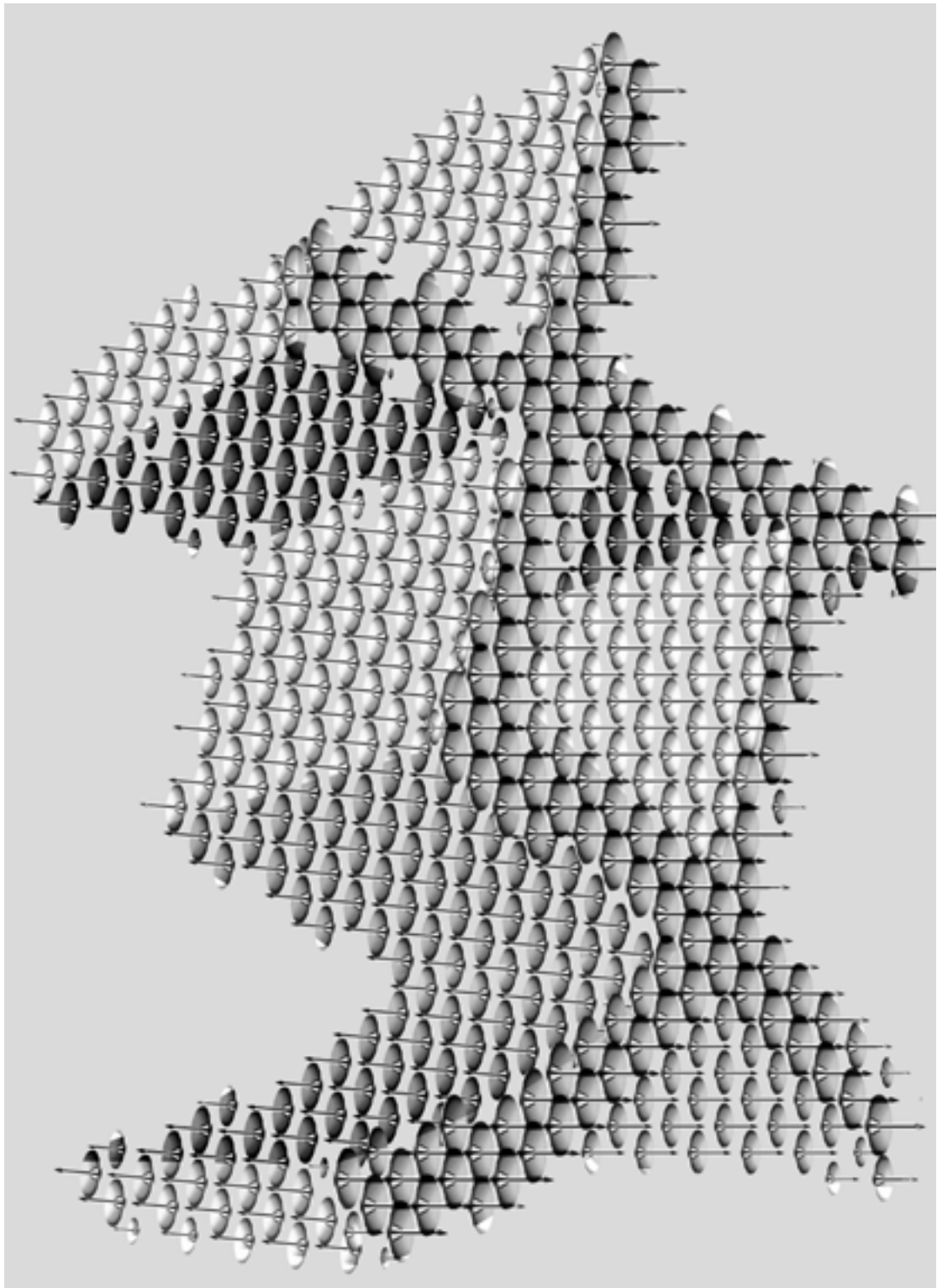
Fig.13

On this basis, I further tried more experiments with spatial variations in 《Bricklayer》. Moving bricks is a symbol of laborers, and further perceived as jobs being laborious, mechanical and unprofitable, which can be regarded as the extension of the work. The brick as the basic pattern of which changes in size and density naturally forms a female （女）character and a male （男）character, reflects the theme of hard work. Based on dot matrix, I try to change the space of planimetric position. By stretching and squeezing the visual attraction of perspective, the picture produces a twisty and folded visual effect in space while stretching the female （女） font and the male （男） font. The chequered space reflecting that human life is full of twists and turns further strengthens the theme. Compared to a graph that you can capture the theme clearly at a glance, the twists and turns of the space can make the viewer's sight swim, jump and stay in the pictures following the variation in space, and it also creates a sense of visual rhythm. Through the ups and downs of the space, the viewer forms the visual illusion and creates a sense of pleasure in the process of discovering hidden graphics. The viewers will have a different visual experience as well.
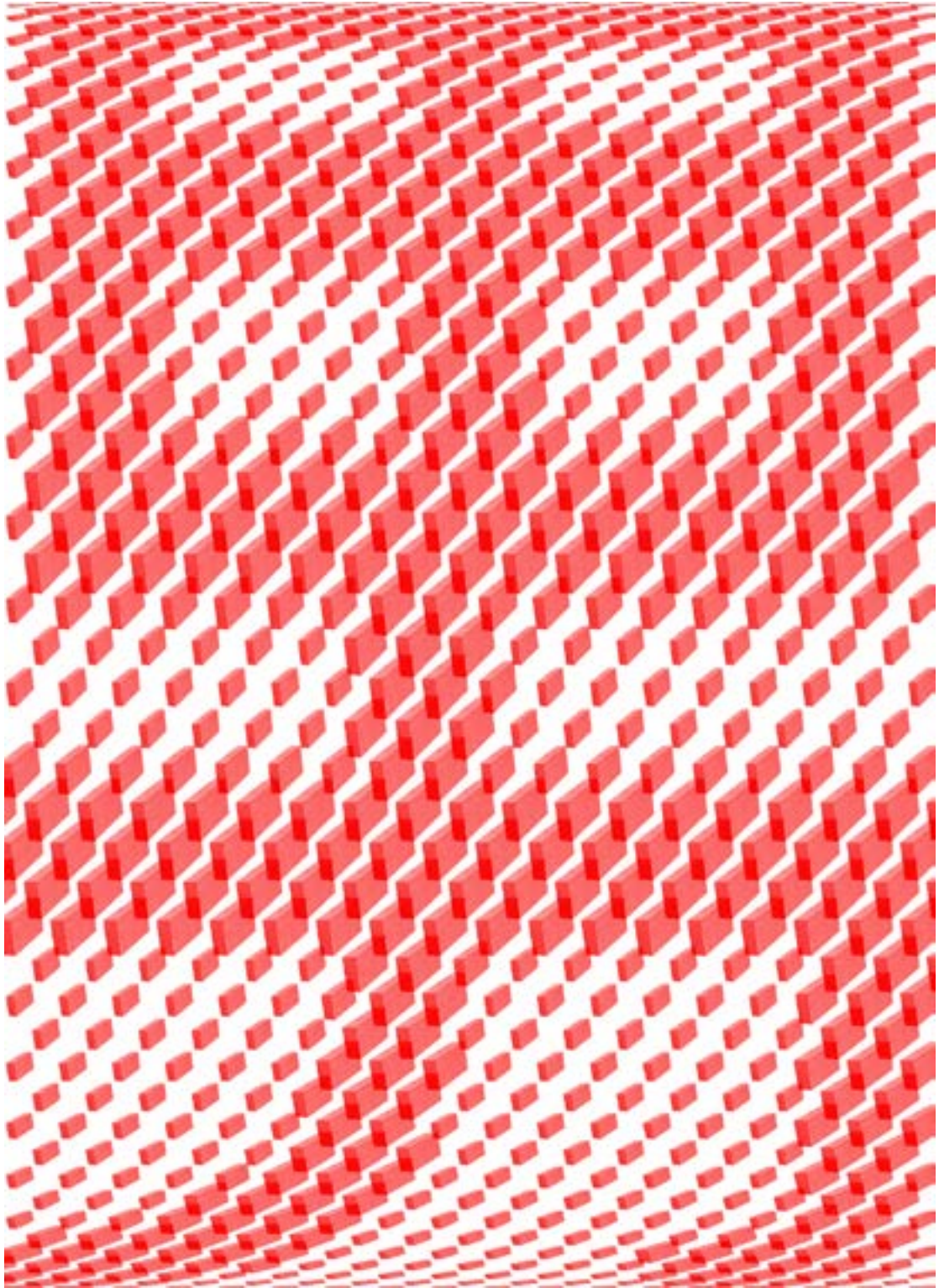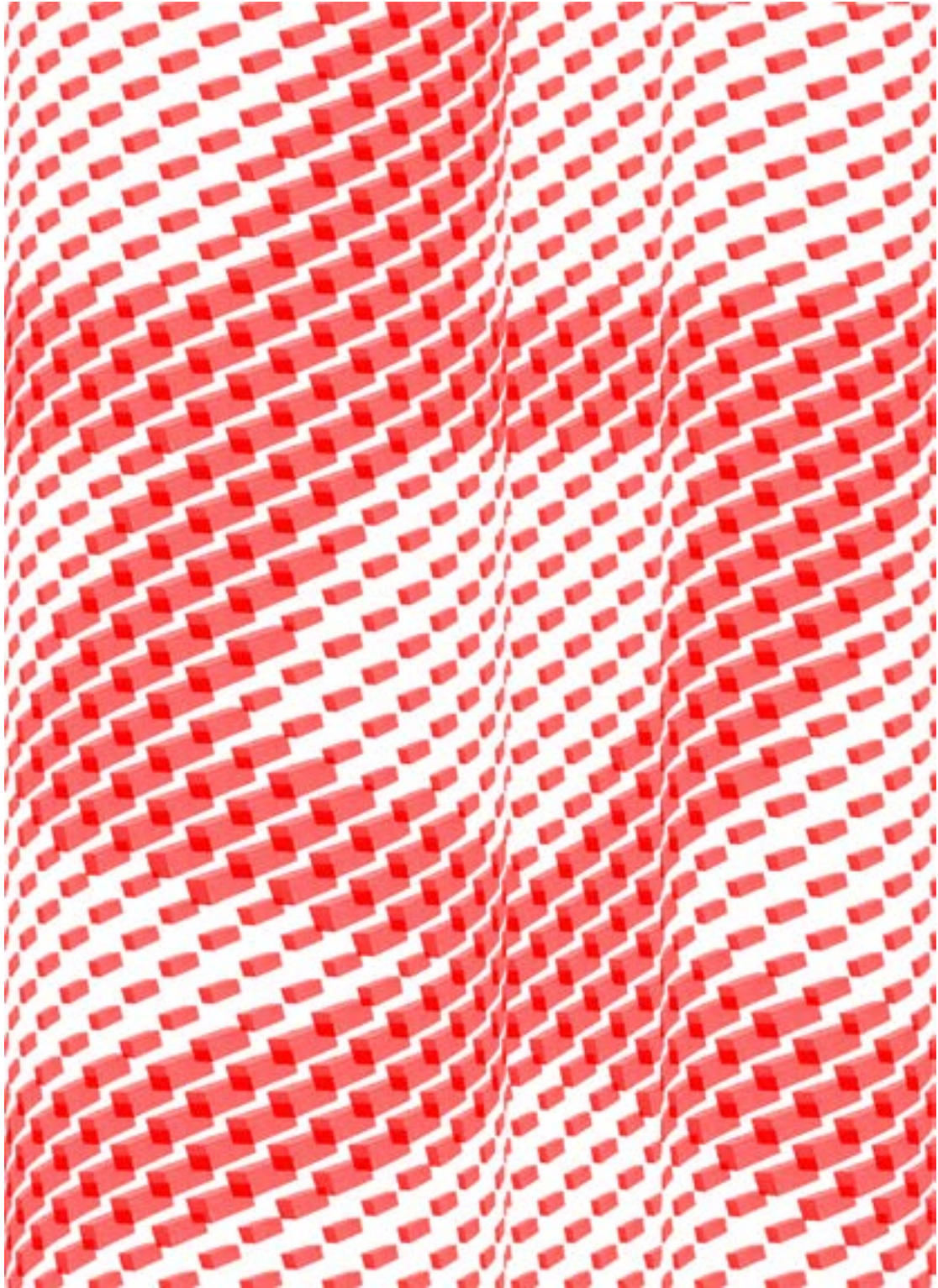
Bricklayer-Male（男）
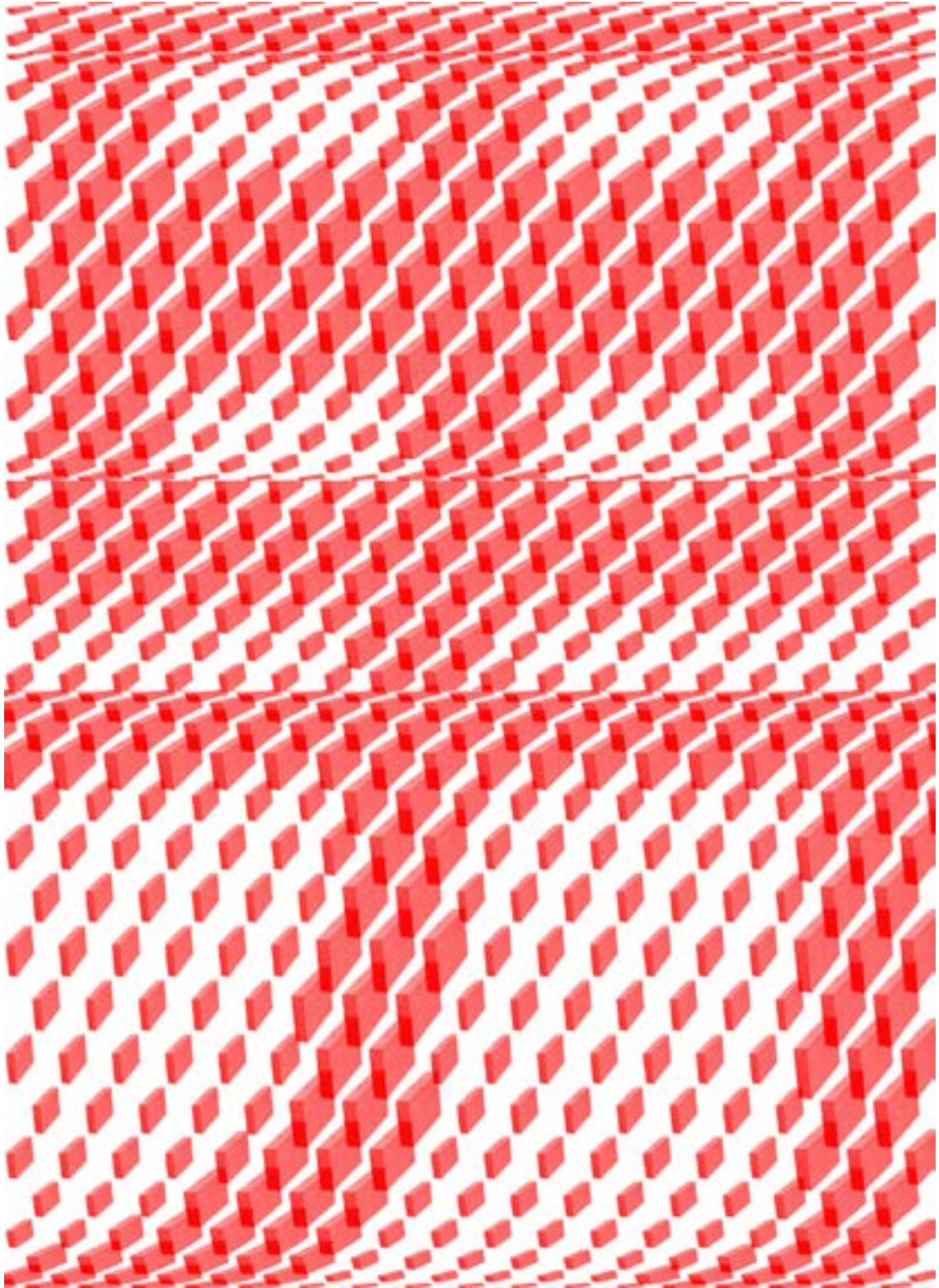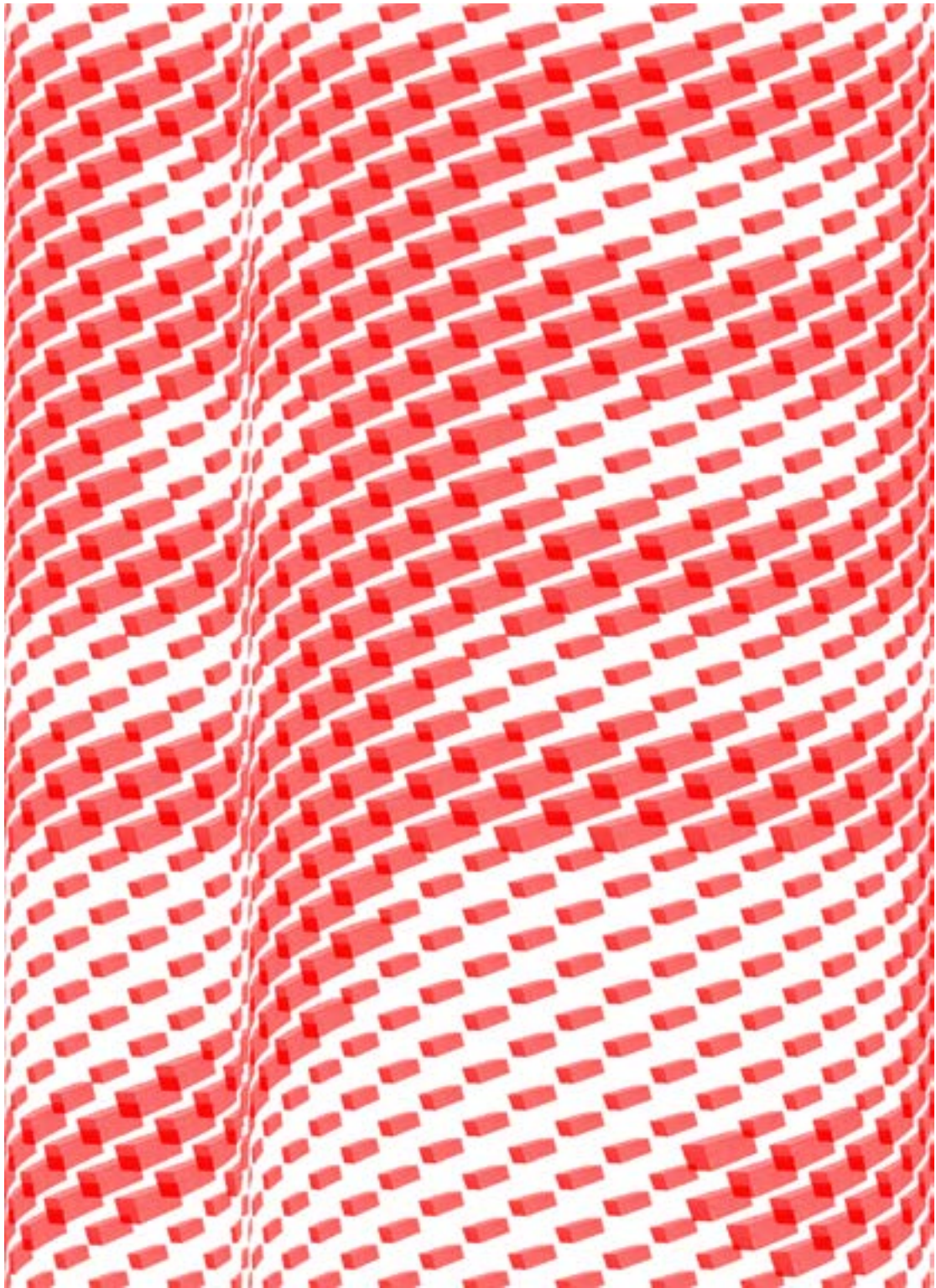
Bricklayer-Male（男）
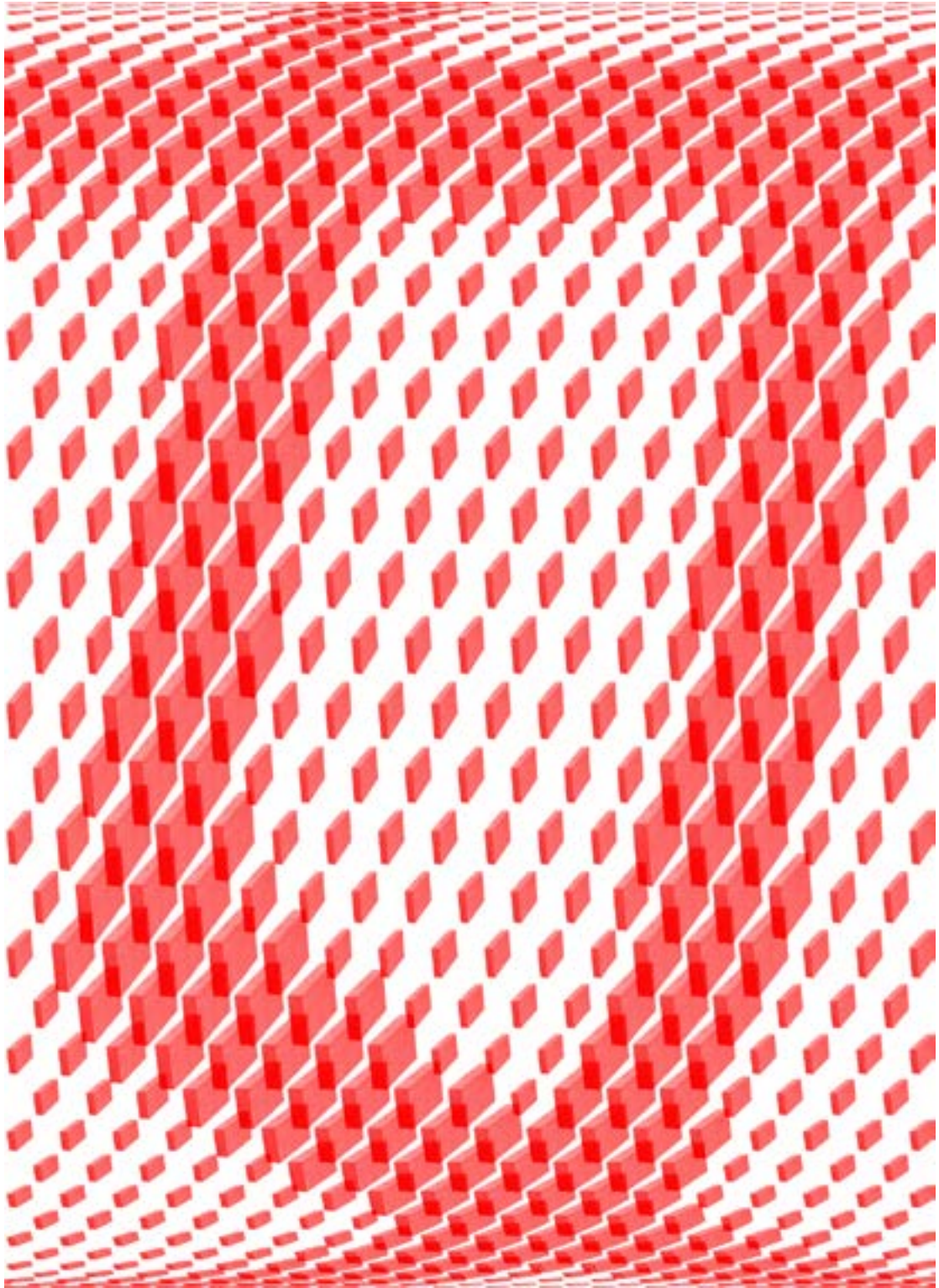
Bricklayer-Male（男）

Bricklayer-Female（女）
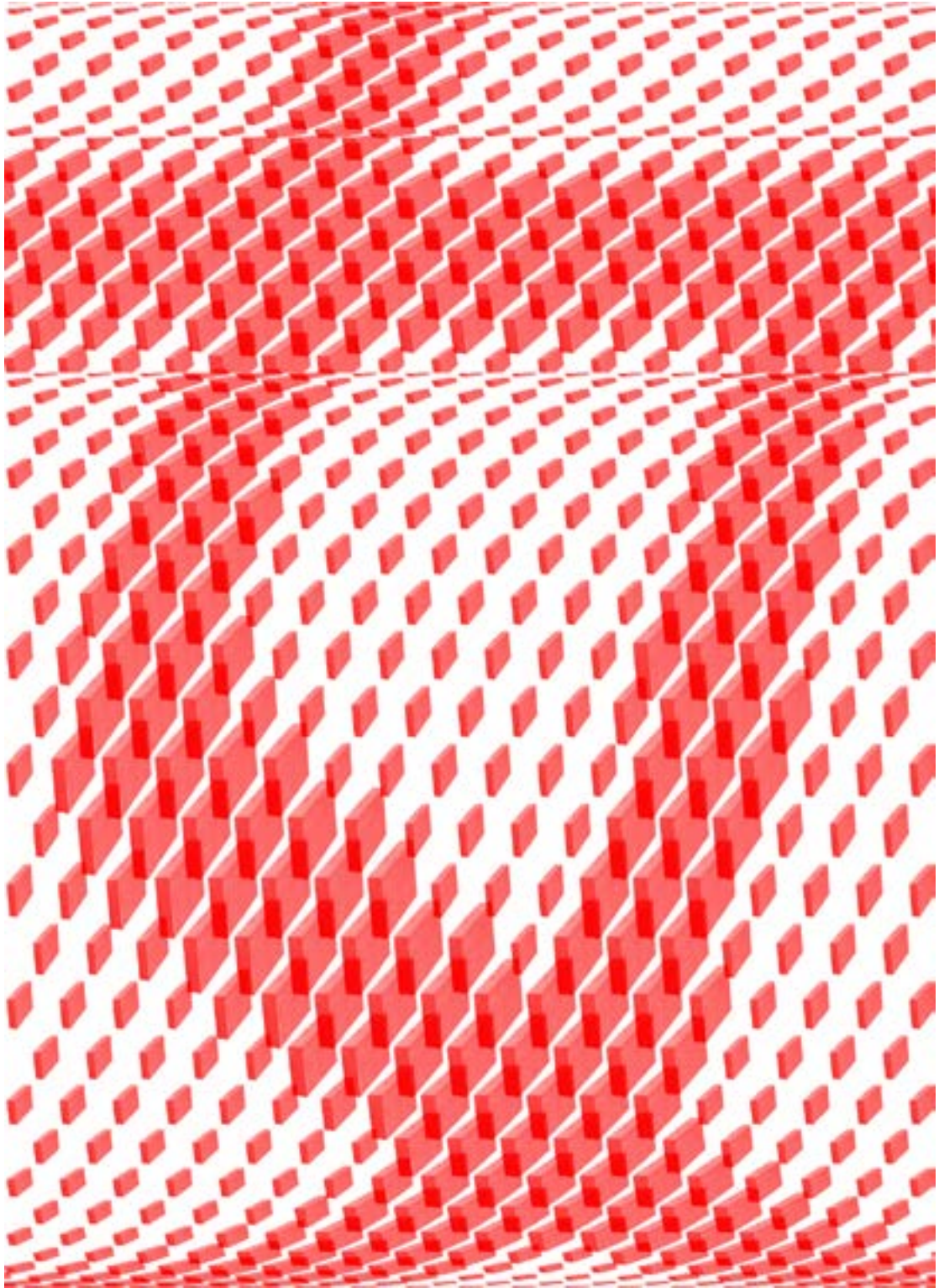
Bricklayer-Female（女）

Bricklayer-Female（女）

The space formed by lines is another attempt of mine. 《Being Fettered》 is arranged by lines that change in density according to the shape of female （女） character. Specifically, that the outline of the female（女） character gradually becomes denser and tighter as space bulges outwards, while it thins out the lines in the middle of the female（女） character, combined with the changes in local bump forms a wrapped female （女）character. Women seem to have a lot of restrictions and fetters in life and thought, and this work expresses women's desire to get rid of imprisonment and find themselves. That the raised space of the female（女） character looks more like a human shape than a character reduces the unambiguous identification of the text but enhances its graphical character, which fully stimulates the viewer's imagination and inspiration for it is also more interesting to find the hidden graphic.
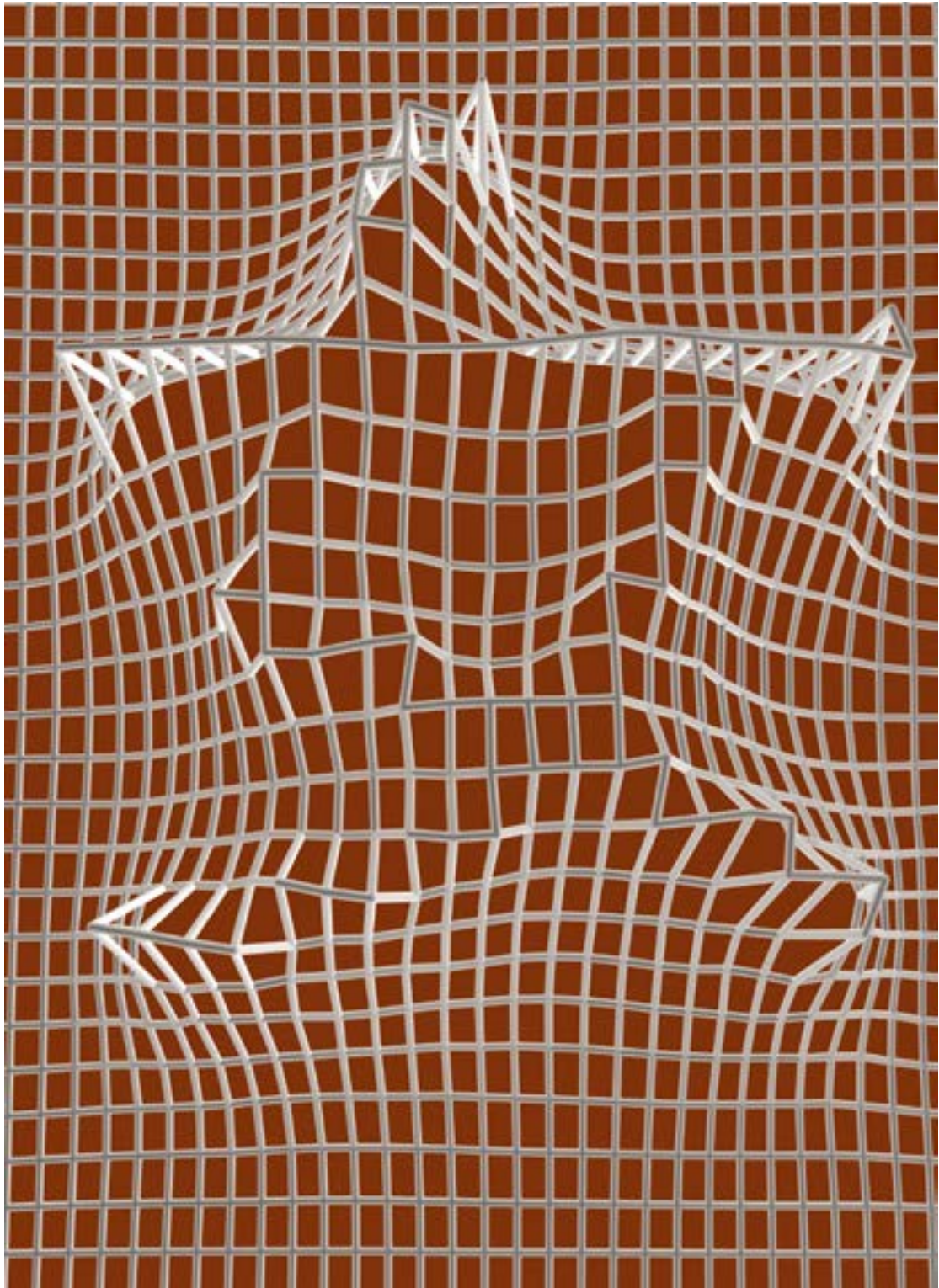
Being Fettered 1
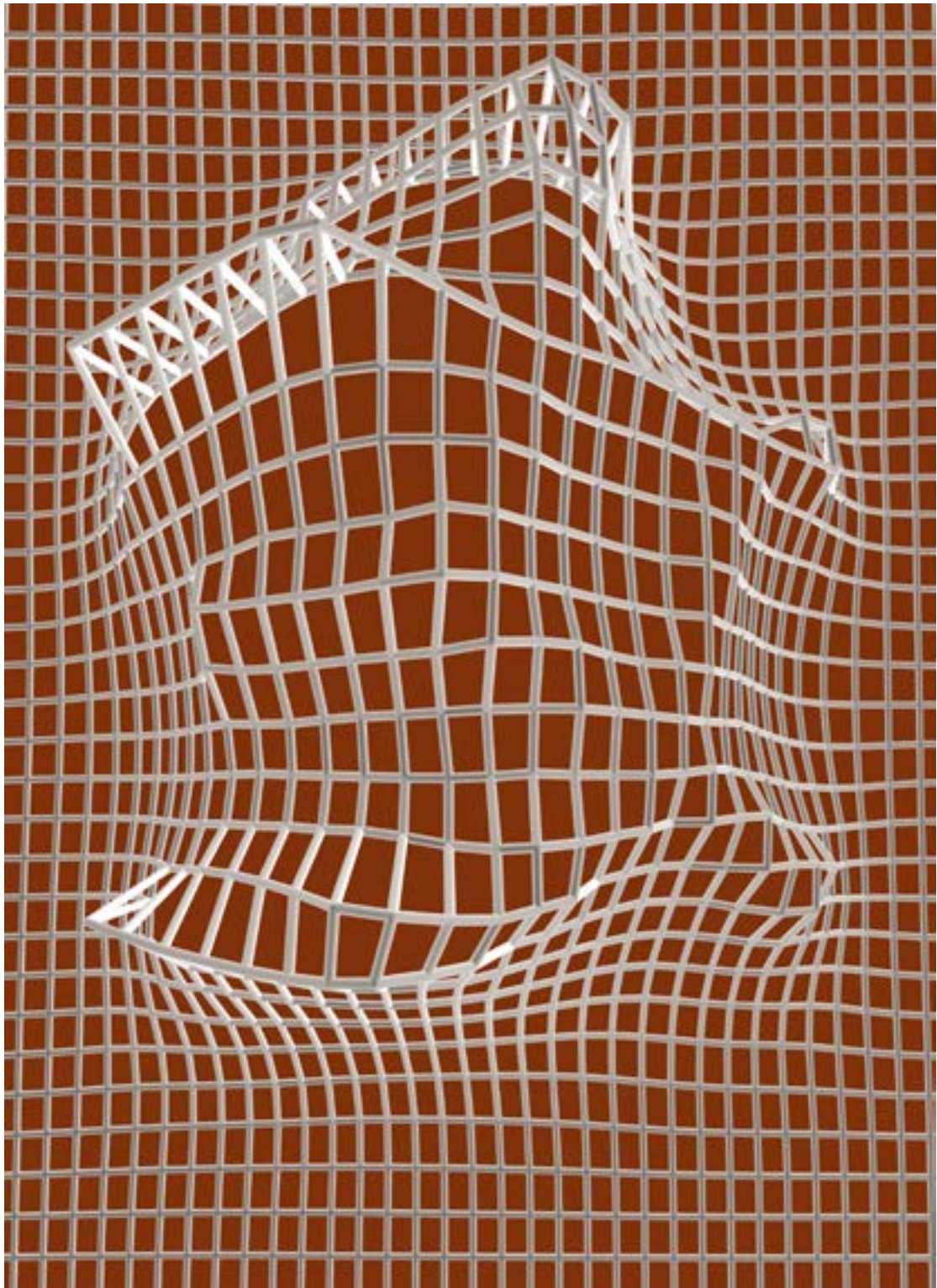
Being Fettered 2
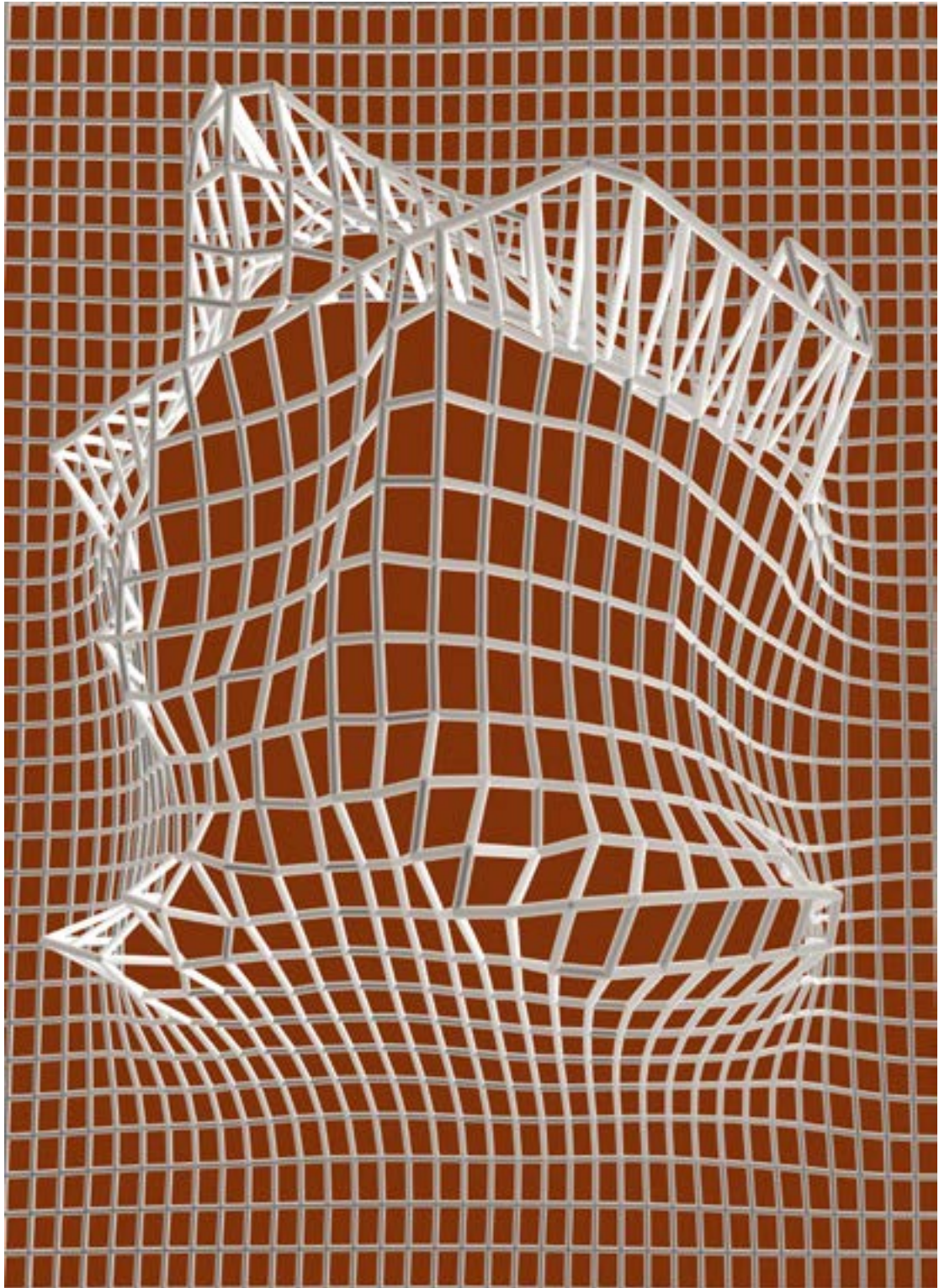
Being Fettered 3

The design and form of Tai Chi diagram contain rich and profound connotation. Tai Chi diagram uses the contrast of Yin and Yang to express that the world is divided into two parts, and contains the opposite and united relation between Yin and Yang. The existence relationship between the universe and life is summarized through this simple graphics, which contain the beauty of harmony. Taiji diagram and five-pointed star are the basic pattern in the female (女) character of 《Taiji》. Taiji diagrams are repeatedly arranged with size changes gradually turn into a five-pointed star, and a five-pointed star gradually turns into a Taiji diagram, the process of which forms circulative changes between the two basic patterns. With the changes of density, size, and color, two basic patterns naturally form a curved, disconnected, and the turning space, and further constitute a hidden female （女） character together. These three graphics interact and blend that forms the up-and-down and wave-like effect in the picture's space. The male (男) character uses Tai Chi diagram and the moon as the basic pattern, they borrow from each other so as to form the male (男) character that has the bulgy effect. Expansion tension makes the picture produce the visual effect of ups and downs. Viewers' sight circulative moves in the picture and constantly discovers hidden graphics, it forms a multi-layered and rich visual experience. By combining stars, moon, Taiji diagram and the male (男) character, the female (女) character, it highlights the vision of harmonious coexistence between human and nature, society in nature, society and life.
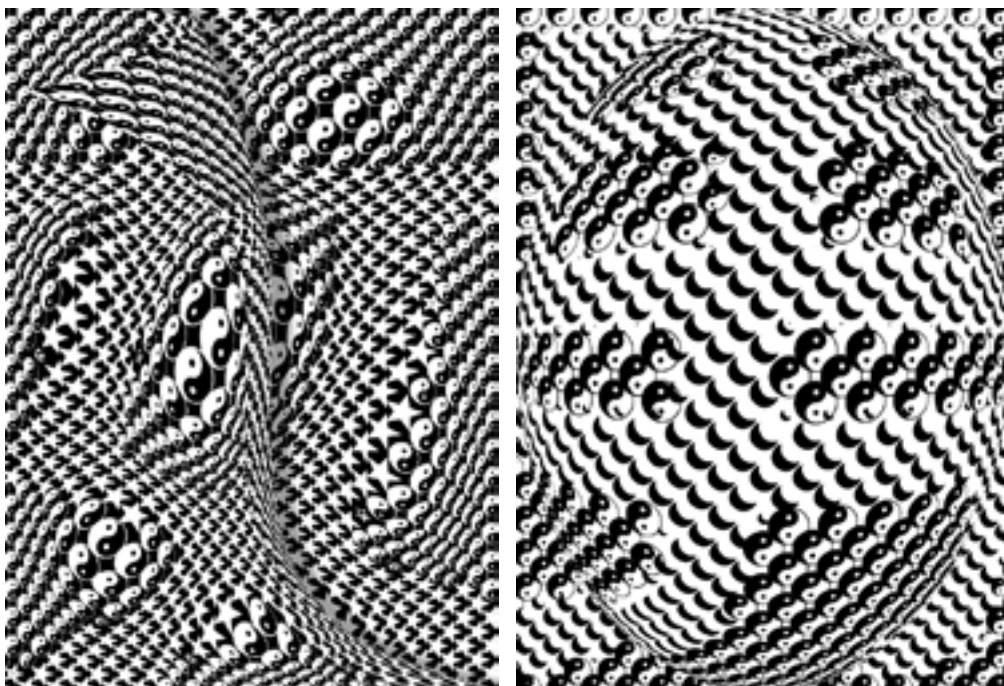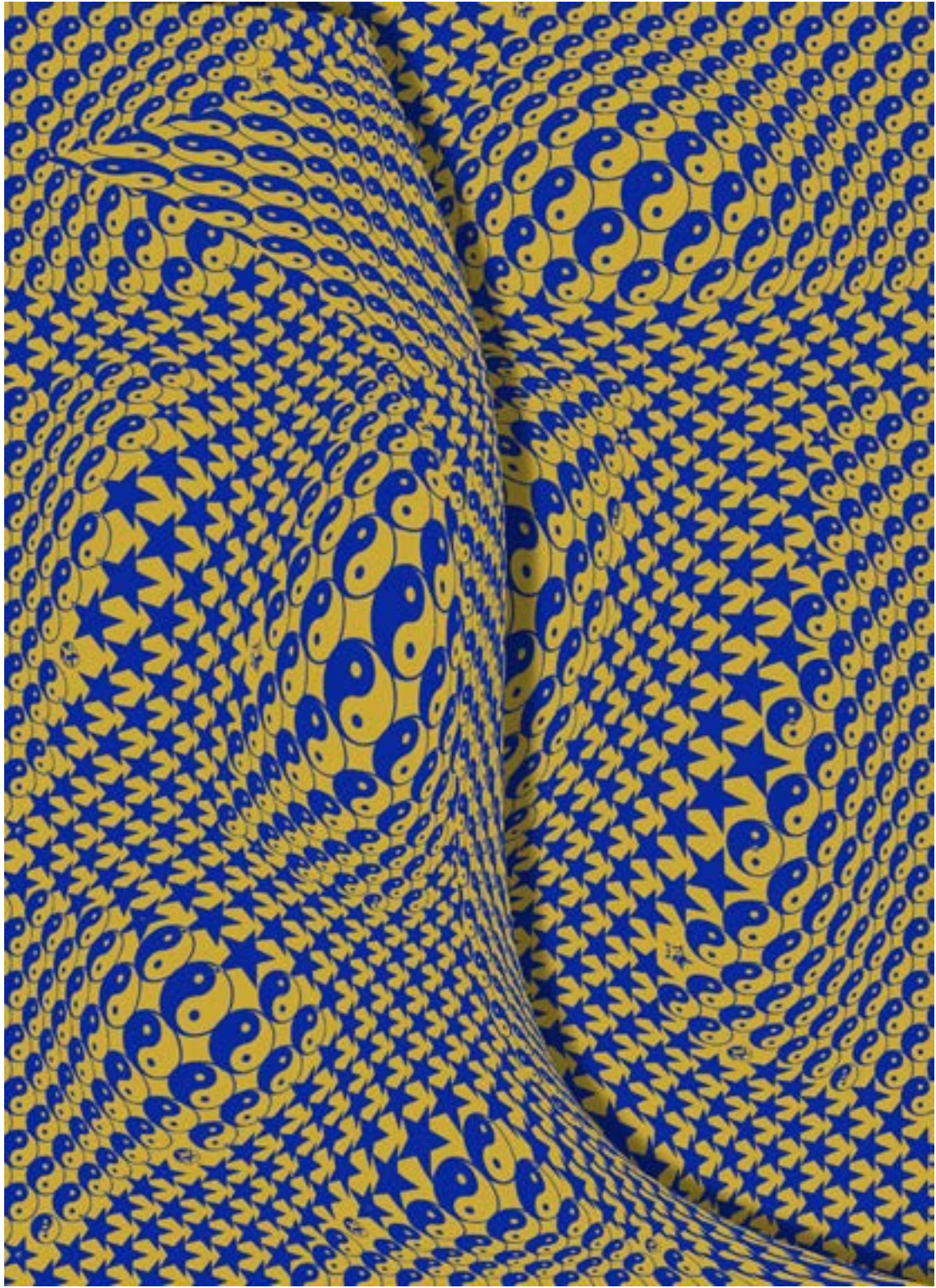
Taiji- female （女）
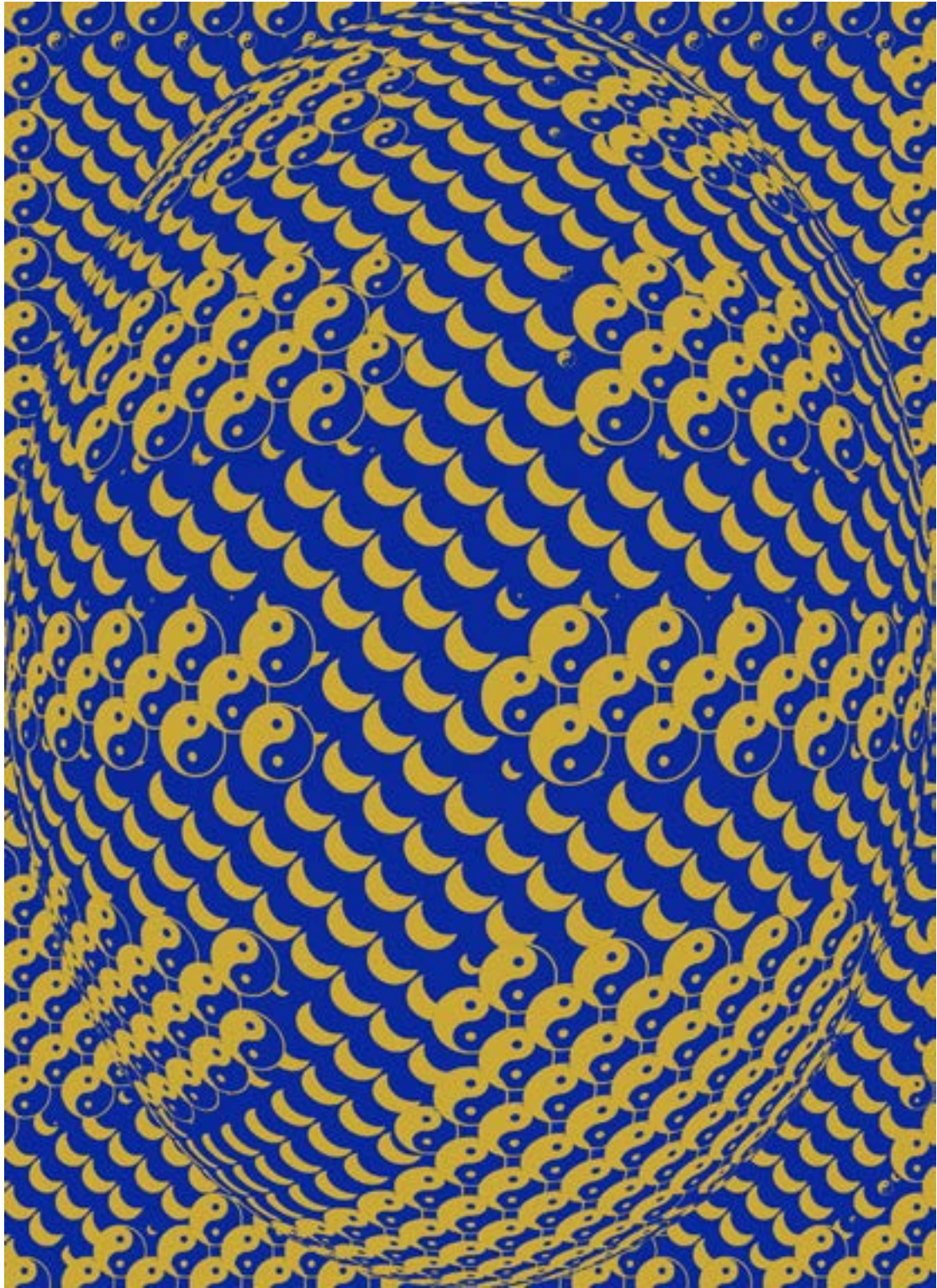
Taiji - male (男)

The experimental creation of female（女） character and male(男) character by visualization makes the abstract literal symbol become a pun containing both character and graphical feature, The picture and the character show the visual image of the text's information, and creates an artistic conception that characters intermingle with pictures.

The exploration of the above two-dimensional plane works is a process witnessing the increasing number of the basic pattern and the increasing complication of the arrangement. The visual effect of the picture is getting richer and richer when the number of basic patterns increases or the basic patterns' direction, size, position and density changes. By combining the ways of repeating, gradually changing, radial distributing, spatial arrangement and other construction methods, the visual impact of the picture is becoming more and more stronger, and the final hidden graphic is arranged that is also ingenious. The hidden relationship of graphics changes with the strength of the visual effect, the order of viewer's observation also changes accordingly. Visual exploration on which   the two-dimensional plane makes the hidden graphics present a unique artistic attraction, it also gives the viewer a pleasant visual experience.

4.2 Three-Dimensional - Space

The two-dimensional figure is a series of shapes that can be separated by contour in two dimensions, and it is a part of space but does not have the malleability of space. In the first stage, I tried to create a virtual sense of space in the graphic works by methods of composition. In the second stage of my research, form composition changed from two-dimensional plane to three-dimensional solid space after I added spatial elements, as a result of which creates hidden graphics with spatial attribute, and also have explored the new visual forms and application rule.

Space is the physical object that exists objectively, which has the characteristics of length, width and height, and is presented as a three-dimensional visual state. Installation art is a new form of space construction. The most important feature diversifying the installation from traditional graphic art form is the spatial attribute, which can put the viewers in three-dimensional space. The use of material, place and emotion in installation breaks the viewer's cognition of the hidden graphics in the plane and inspire viewers to contemplate on the tradition, reality and the future.   Based on this idea, I created the installation work 《O_2》.

The installation 《O_2》 is a perspex display stand using organic glasses, with the top of the display stand being set with 5 equidistant grooves and 5 organic glasses, each of which is 100cm in length and 70cm in width, being inserted into grooves. The basic pattern on each piece of glass is masks that form a circle with the changes of the size and the density. Every circle looks like a letter "o", but we can see the numbers and letters under the letter "o" with close examination, and they constitute the hidden chemical symbols O_2 and so on together with the letter of "o". The 5 concentric circles on the 5 glasses that are arranged from small to large and are superposed from inside to outside, constitute a large hidden graphic portrait which is my portrait. I tried to create a three-dimensional space to make hidden graphic felt in space but not just be seen in the plane. I combine the figures, process, material and space into one entity to make the audience think of that polluted air can bring to us through directly visually communication and indirect feeling.
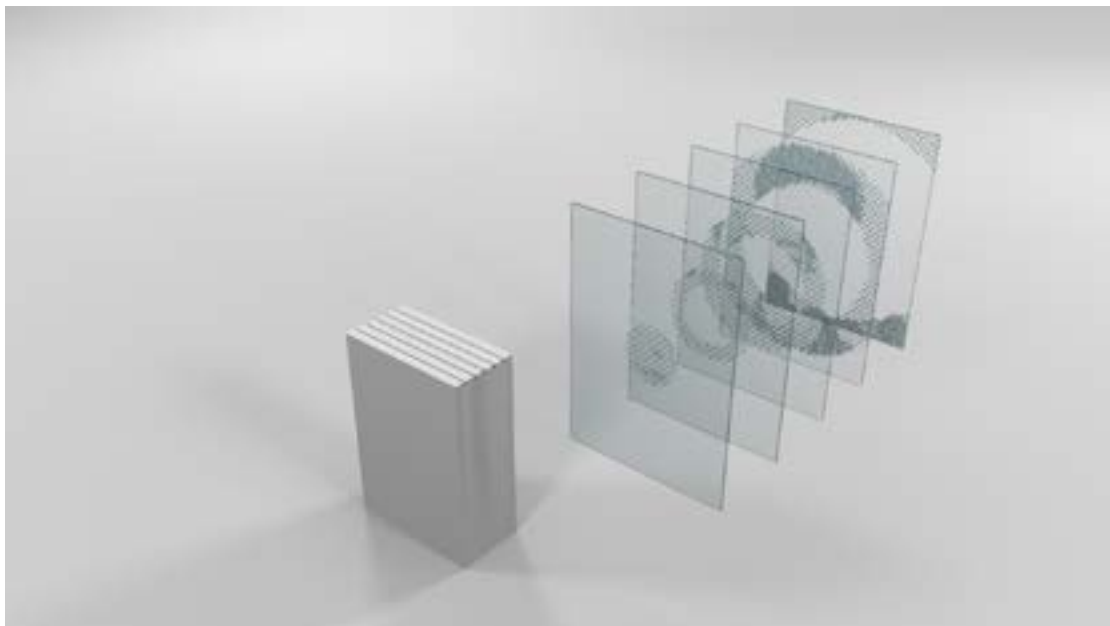
O_2

This installation uses transparent organic glass as the material. The spatial reconstruction of transparent material provides a new method for the morphology construction of the hidden graphics. Light penetrates transparent materials that are juxtaposed, and creates a translucent visual effect. Each overlapped and transparent figure borrows from each other to complete itself. The hidden graphics are generated by the overlapping of transparent materials, while the integrity and independence of the individual pattern on each glass can be maintained. This transparency makes the viewer to perceive changes

in the depth of the space and it creates a vague and hazy artistic conception. Viewers will see different graphics from different perspectives. It can be said that the hidden graphics in the work are the result of observation in different angles and reorganization.

Capps mentioned in his visual language that if a person sees two or more shapes superimposed. Each graph tries to take the common part as its own. This equivocal state of visual sense fully embodies the characteristics of hiding, and it also allows people to enjoy autonomy in the space. Viewers can obtain the hidden information according to the angle of viewing form which their own visual and psychological feelings choose.

The use of transparent materials in the work creates three spatial relationships: juxtaposition, superposition and inclusion. In the spatial relationship of juxtaposition, the 5 graphics appear at the same time and represent a successive relation among anteroposterior graphics, but they are relatively independent. The juxtaposed space allows hidden figures to be expanded on a spatial level. In an overlapping spatial relationship, The 5 planes are superimposed and interwoven with each other, and the overlapping areas, which change spontaneously as people moves in space, represent the interlacing of spaces. . The viewer can experience the complex and blurry hidden graphics that are formed by more than one spatial interwoven with each other. In the spatial relationship of inclusion, the graphics on each transparent board are the first layer of hidden graphics, which is a small independent space that is subordinate to the larger space of the entire installation but still maintains a relatively independent attribute in the large space. In the transparent space, the ambiguity, complexity and variability emerging from the relation of juxtaposition, superposition, inclusion and transformation brings richer forms and connotations for hidden graphics.

The transparent space makes the graphics to show different layers and different space states, which enables viewers to discover and perceive hidden graphics through layer by layer, thus acquire insight and multiple perceptual experience. In 《O_2》 , basic pattern of each layer is masked, 5 circles, the chemical symbol of the gas, a portrait composited of five patterns respectively. Transparency equipped graphics with unique representative ways using different spatial perspectives or structures, and provides viewers with a compressed overview containing numerous information and spatial elements. Whether it is a panoramic hidden graphic, or a local hidden graphic, the viewer can be triggered to dig into the process of discovering space and perceiving insight in the graphics. It expands the cognitive style and perspective of the viewer, and promotes the audience to initiatively communicate with the work as well.

4.3 Four Dimensional -Time

With the continuous development of science and technology, the way which people get information is more and more dependent on digital technology. If the figure depends only on static representation in the manner of 2D and 3D, it would be tedious and might be overwhelmed by tons of information. Therefore, connecting the traditional media with digital media to integrate into a new artistic style has become a recent trend. So I incorporated the element of time into the works in this stage, and further explore the visual representation of hidden graphics in time and space.

4.3.1 Dynamic

Compared with static graphic, dynamic graphic can carry and transmit more information, which is more vivid and more attractive to the audience. Dynamic graphics have the time attributes, and the motion characteristics of motion graphics can trigger off the viewer's dynamic awareness. Wondering if it is possible to break the traditional static graphics format and give interests and strong dynamic visual effects to the hidden graphics relying on digital technology which enable viewers to obtain different information in hidden graphic at different time and get richer dynamic visual experience, I tried to create dynamic graphics on the basis of static graphics.

The following dynamic works focus on the epidemic using elements such as masks and viruses, which reflects changes in people's physical and psychological life the unexpected epidemic has brought, and the work intends to trigger people to think about that.

In the dynamic projection works 《Coronavirus》, the huge virus graphic is placed in the center of the picture with portraits in different sizes hidden in the virus settled as dot-matrix array, which reveal themselves only when the audience gets closer and careful examination. As the video playing, the image on the virus begins to rotate,twist and continually convert to a different variant, indicating that people's mentality has changed with the changes of the epidemic situation. The exaggerated twisty and ever-changing visual modality

vividly indicates the psychological impact on people epidemic has brought and how people's psychological pressure changes. This influence and change is invisible and hidden, coincident with the feature of hidden graphics. The present approach of dynamic graphics that graphics transform as time flowing realised a sense of time dimension which is rarely possible for plane works and spatial works. The hidden graphics discovered by the viewer change dynamically on the timeline, the process of which enriches the viewer's visual perception.
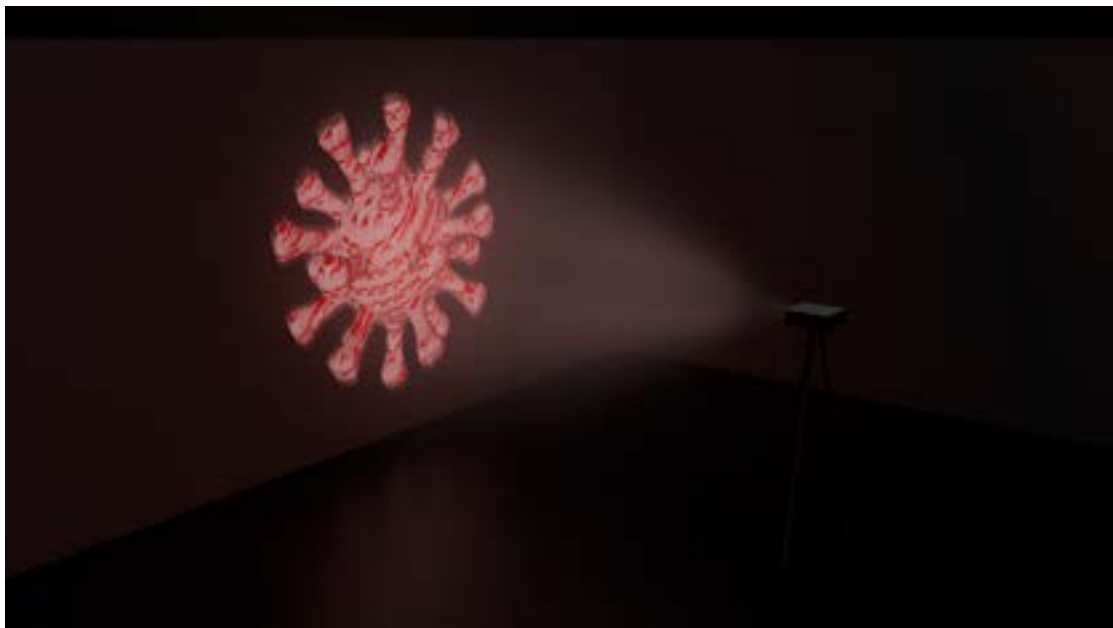
Coronavirus

Dynamic work 《Virus Variation》 unfolds the process of a virus' evolution. The figure is constantly increasing in number during the constant shaking and fluctuation, symboling the propagation and replication of the virus. The three-dimensional dynamic form of a virus is derived from a simple basic pattern, the punctuation "?". With reproduction of the basic patterns and its number increase, the figure of basic pattern multiplies, evolving dynamically from the punctuation "?" to the character "病", the character "毒", the letter "Help", and the number indicating date, and it suggests the trend that the dim outline of the virus goes clear as a three-dimensional shape. The complete evolu-tion, from less to more and from unknown to clear identification, shows how people perceive virus, that is, a psychological shift from unknown to fear, and from awareness to prevention. Virus initially emerged as secretive and un-known, and understanding the virus is progressively going deep. Dynamic de-duction is the best way to interpret this dynamic process. The hidden virus appears and fixed at the end of the dynamic process. The hidden graphics are given the time attributes, and show more in-depth information. By properly ar-ranging the order of the information presented, information has a freer distrib-ution space. Dynamic graphics have brought a creative new visual technique to hidden graphics, and it also has more diverse forms of expression.

Virus Variation

4.3.2 Interactive

In the above creation of graphics, the viewer's viewing process is still unidirectional, there is still not enough interaction and communication between the viewer and the work. The graphics that the viewer has seen were all designed in advance, the basic patterns and hidden graphics were shown directly to the audience, and what the viewer needs to do is just to discover them. Therefore, I wanted to create hidden graphics that could interact with the viewers, viewers can give play to their own activeness to operate and control the work directly, and even create it by themselves.

New technology like AR, VR makes it possible to achieve my idea. AR is short for Augmented Reality, an augmented reality technique. As the name suggests, augmented reality enhances reality. AR superimposes virtual digital information into a real scene in real time, and enhance people's perception of the real world by improving the sight, hearing, tactility, and other sensory experiences. AR and VR technique enable graphics to break the limitations of space, time and other conditions, and gives the audience a real-time interaction so that the audience to obtain a wonderful visual experience.

I adopted AR(augmented reality) technology in 《 Day After Day》 in the manner of interaction plus dynamic graphics. The matrix arrangement of my portrait, the basic pattern in this work, stands for a day. It will reveal a new hidden motion graph by scanning a flat graph with phone, and portrait is automatically turn to the next page from a different angle, the same way as turning the calendar's pages, reflecting time has changed day after day. This illustrate the situation that we wore masks every day during the epidemic and how psychological changes during isolation. The hidden graphics are not presented directly to the viewer, but require the audience to actively use the mobile phone and scan works to find the hidden graphics. The interaction behavior of scan complicates the process of generating hidden graphics, which fully mobilizes the viewer's expectation to the result, and viewers will get a sense of psychological pleasure while seeing the hidden graphics. Thus, the information was delivered effectively. The use of AR interactive technology expands

and enriches the expression ways of graphics, so that the hidden graphic works can shift from 2D or 3D static form to the pluralistic, dynamic and inter- active 4D form. It presents a new visual form that integrates science and technology with art, bringing new life to hidden graphics.

Day After Day

According to the level of participation, we can divide the degree of interaction between the viewer and the hidden graphics into two levels: mildly and highly involved.

The interaction of this work does not trigger much behavior but only displays the AR dynamic hidden graphics directly after the scanning, which can be classified as a mildly involved interaction. Interactive works with mildly partic- ipation requires rich and strong visual effects after scanning to attack audi- ence's attention. If the hidden graphic is not appealing enough after they scan this kind of work, it would be easy to disappoint audience and the information transmission effectiveness of the graph would be greatly reduced. Only the audience gets a good visual experience, the application of AR technology can achieve a better result in interactive graphic works which the audience mildly involved.

On this basis, I think about how to increase the audience's participation and create interactive graphics with highly audience participation. 《Wear or

not Wear》 is an attempt to make the audience to explore greater initiative in the process of participation. During the Coronavirus epidemic, whether wearing masks can control the spread of the epidemic is a hot topic of discussion. Someone believes that wearing a mask is the most effective preventive measure against respiratory diseases and they call on everyone to wear masks, while others argue that wearing masks is not effective in reducing the risk of infection so they in favor of not wearing masks but to achieve herd immunity. The inspiration for the work came from the discussion. For the question how are the opinions of wearing or not wearing reflected in the work, I choose interactive devices to let the audience think and judge during the interaction.

Wear or not Wear

Using my portrait as basic pattern that will be arranged in the manner of dot matrix, and interactive technology, the portrait is touchable, and mask will appear on works with a click, one of which masks will automatically fall off and cannot be put on while the mask will stay on the face. If you keep clicking, the generated masks will become a serie of basic pattern and form a new pattern. This figure is a self-created hidden figure which is arranged by the audience with their own participation. In this work, I don't in charge of the production process of the hidden figure anymore but leave space to audience's participation. Both the audience and I work together to create the final effect of the hidden graphics. Viewers no longer passively receive information, but they can actively participate in the creation of graphics. Creator and viewer are no

longer opposites, but can switch roles. As an audience, they are not only a viewer but also a participant of creation, so they can control the autonomy of watching, therefore, the image that the audience can touch and click is an unfinished work that can be done by viewers themselves using the interaction technique. The audience needs to have a deep understanding of the information conveyed by the graphics, plus their own understanding of the theme to complete the creation. Due to people's diverse understanding, the graphic effect presented is also unique.

The above hidden graphics works with the theme of epidemic come from the angle of how the audience involve in the work. On this basis, I want to continue my exploration in hidden graphics from the perspective of broadening the information hierarchy.

《Fast Dying Out》focuses on elimination phenomena of things because of the development of time or technology. This work is formed by CDs, rolls of film, BB machines and other eliminated goods in the manner of dox matrix. If viewers scan the graphics through their mobile phones, the dot matrix pattern will constantly rotate, smear by the circular track, expands outward and disappears, and eventually form a character "0" with dynamic visual effect on the screen of the mobile phone, which brings a new visual experience that would induce meditation about the deeper meaning of technological development and culture behind this phenomenon. In this work, the number of hidden figure is far beyond one, the first level of which is concealed in the static screen with the dox matrix of basic patterns make up the hidden character and the second level of which is hidden in the dynamic graphics arising after the audience interaction. In the process of this interaction, hidden information is discovered layer by layer by viewers, and the hierarchy of information transfer is more clear and the visual perception is also more intense.

Fast Dying Out
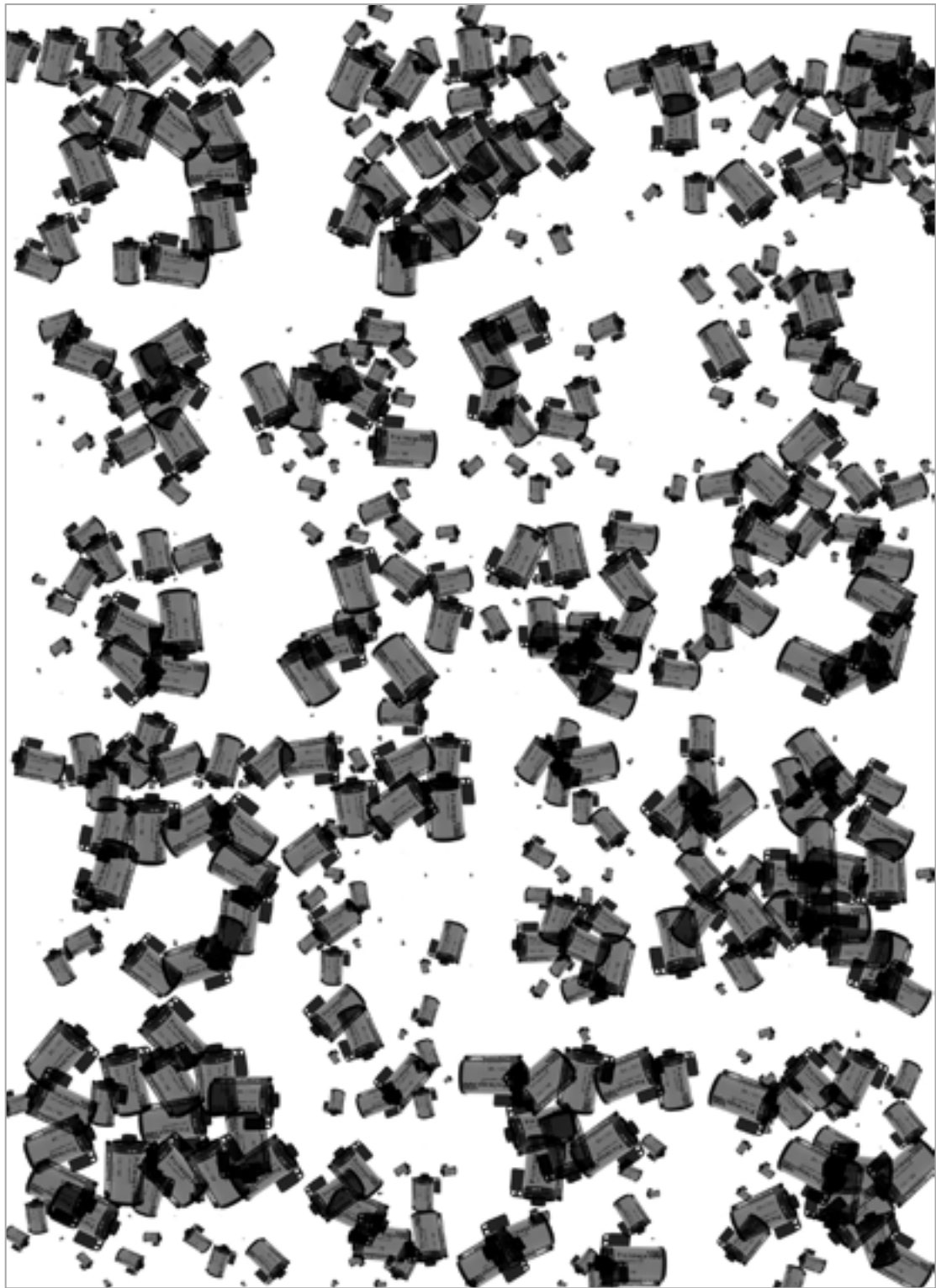
The value of interactive hidden graphics is that increases the duration of the process of generating hidden graphics. The hidden figure formed by the traditional composing method of two-dimensional plane is presented in front of the viewer at the same time and space while the hidden figure formed by the three-dimensional space is the result of superimposed different spaces at the

same time so that the process of discovers hidden information is instanta-neous. The interactive process requires active participation of the audience, which process stimulates the viewer's thinking and imagination, and the process the audience gradually discovers the hidden graphics in different time enriches the viewer's perception experience and brings a different space-time experience to the viewer.

5. Summary

I have created hidden graphic works that includes graphic works, installations, and dynamic and interactive works from different dimensions, I systematically studied hidden graphics. I explored the visual representation of hidden graphics from the perspective of creation, and explained the unique visual experience of hidden graphics from the perspective of viewer.

The hidden graphic is shown in front of the viewer at the same time and space in the two dimensional plane, the viewer's eye moves through the picture and captures hidden graphics. Therefore, the key exploration in the graphic works is how to create an illusion of magic through the form of visual composition, it tries to attract and guide the viewer to discover and savor hidden graphics, so that to realize the information effectively transmit, and make the audience get a good visual experience.

The hidden graphic is transmitted to the viewer in different spaces at the same time in three dimensions. It adds spatial elements, the viewer can not only look, but also walk while looking, and discovering hidden figures in the process of movement. The viewer can experience a complex and obscure hid graphic that is woven together in several space. The method of composing in spatial dimension can expand the viewer's cognitive mode and the perspective to the hidden graphic, and promote the audience to take the initiative to communicate with the work.

There are two forms of hidden graphics in four-dimensional time: dynamic and interactive. Both of them highlight the characteristics of time. Dynamic graphics have presented more and more in-depth and hidden information content. It allows hidden information to be presented to the audience step by step by properly arranging the order in which information is presented. Let the viewer gradually discovers the hidden graphic at different time points and fully mobilize the viewer's thinking and imagination. Interactive hidden graphics break through the limitation of passive information reception. Viewers can autonomously control the generation of hidden graphics if viewers active participation in it, even they can participate in the creation of hidden graphics, and

communicate with the works more deeply. Dynamic and interactive technologies make the hidden graphics multidimensional interweave across real space and virtual space. Hidden graphics have more possibilities in "spatiotemporal presentation" and "spatiotemporal representation" with the support of digital technology.

Through analyzing the generation process of a hidden pattern in different dimensions, and exploring how to use hidden characteristics to stimulate the viewer's thinking and imagination, so that to maximize the expressiveness of hidden graphics, this is the meaning and value of the hidden graphics.

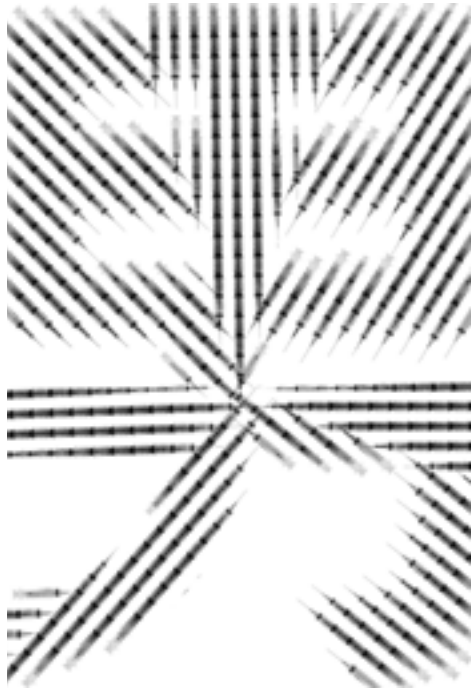# 6. Reproductions of the works presented at the exhibition
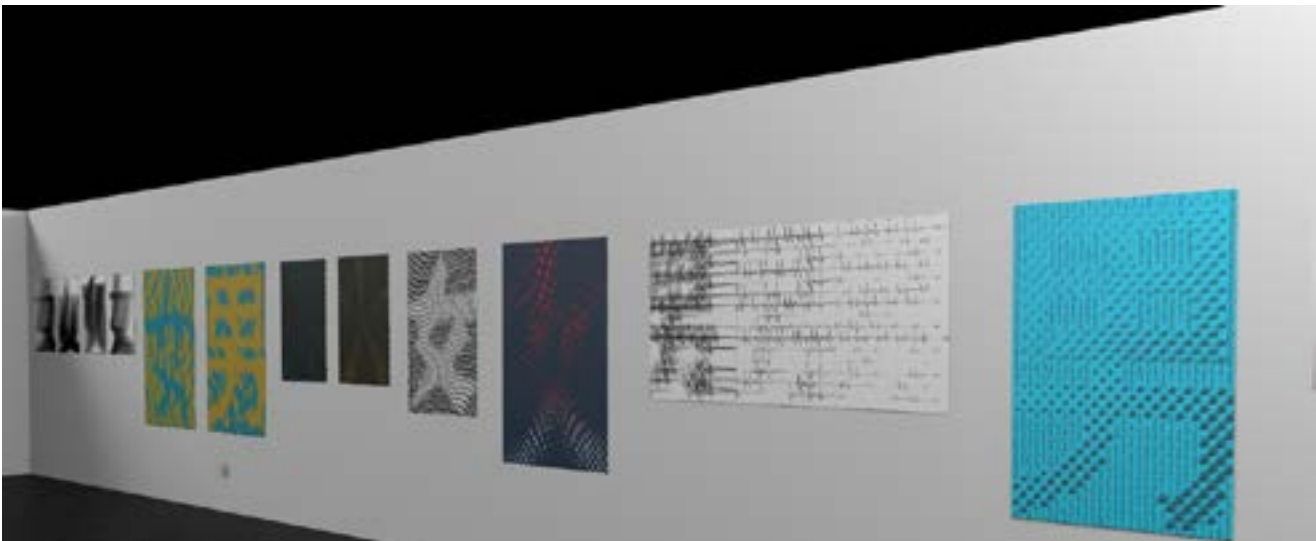
„The hidden graphic" general view
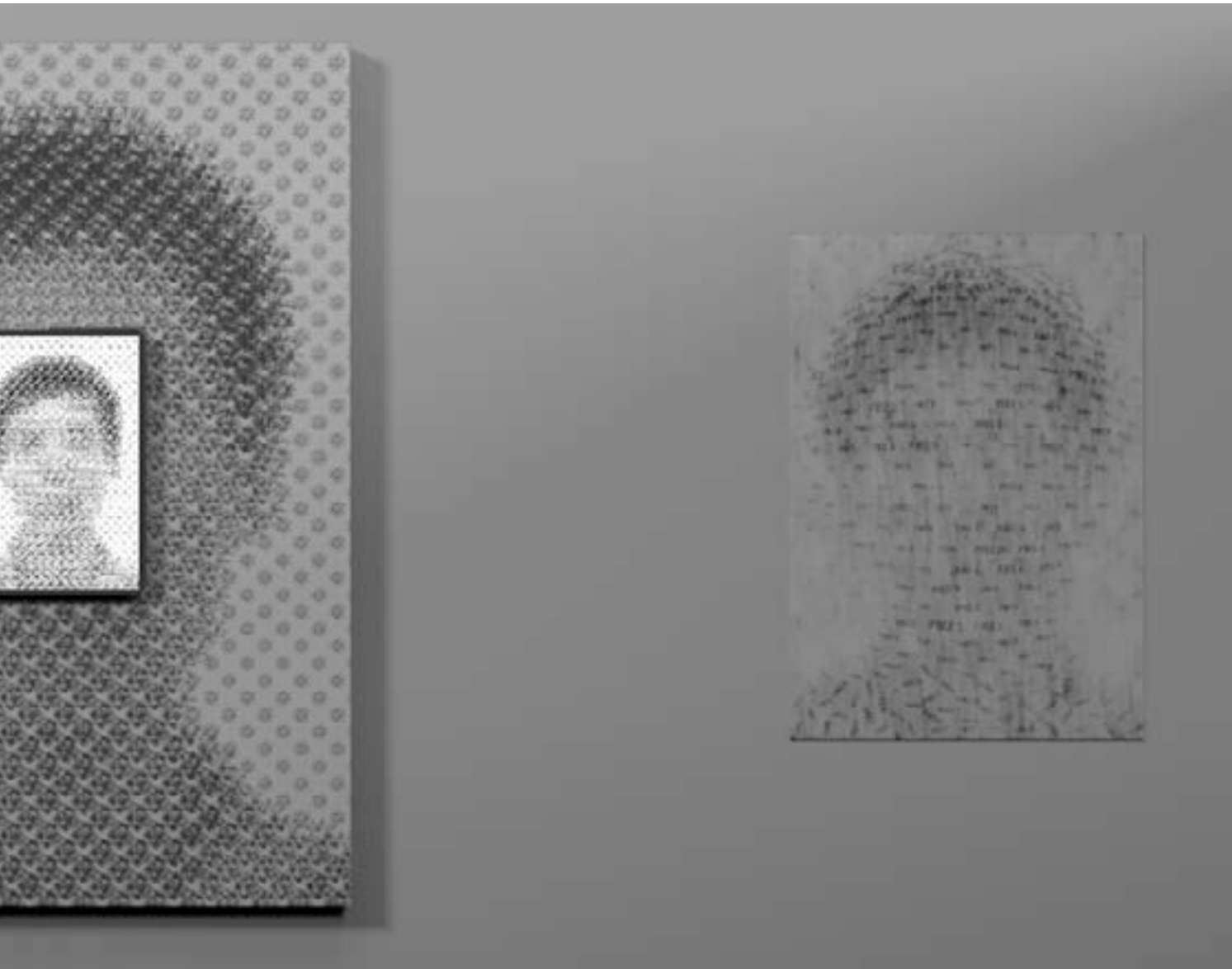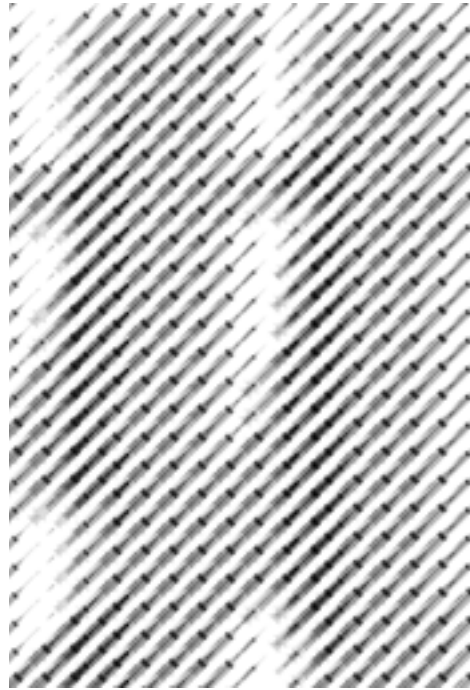
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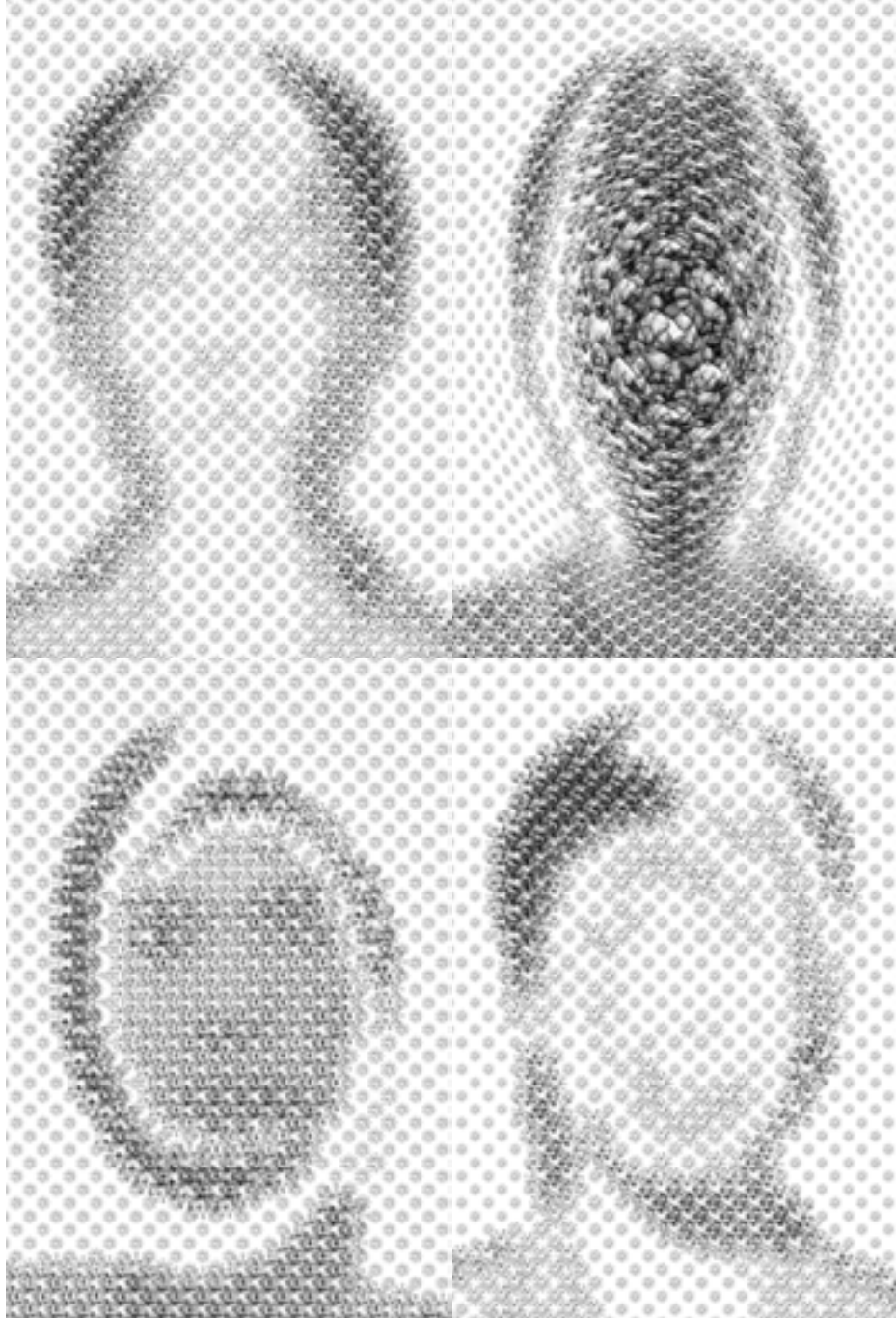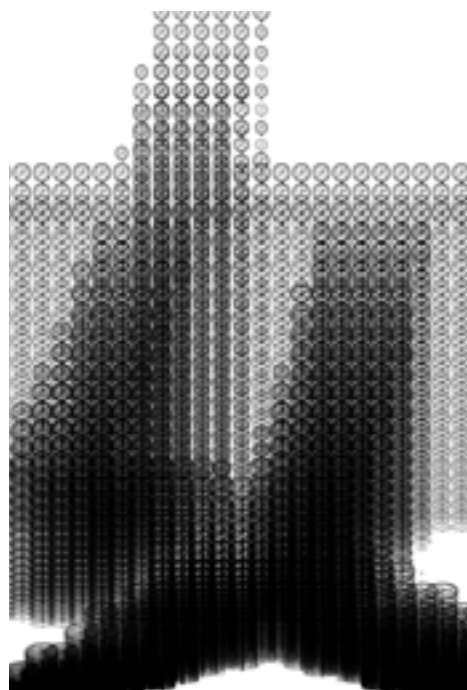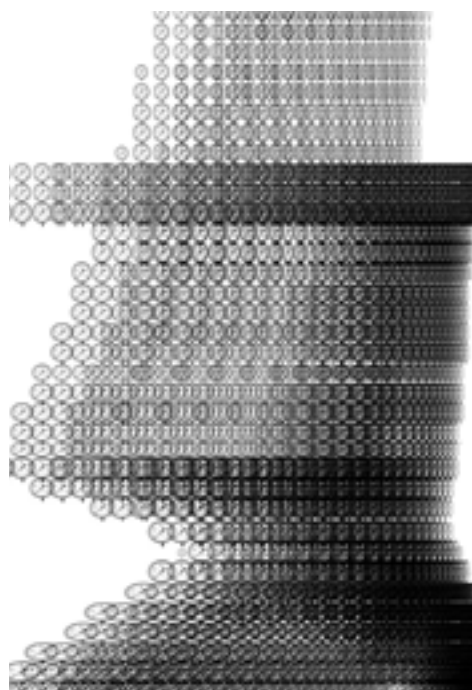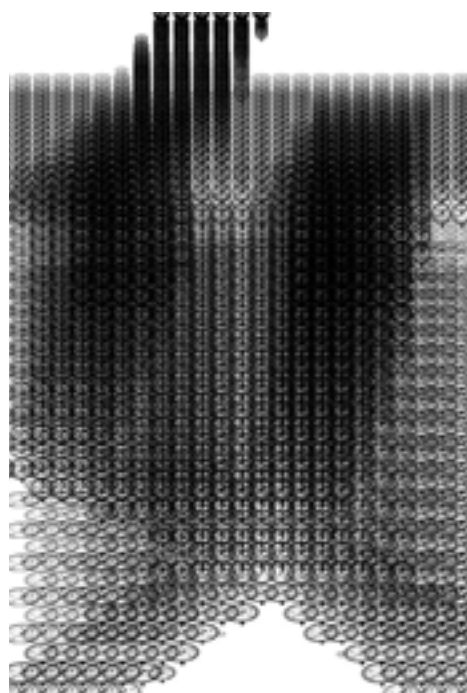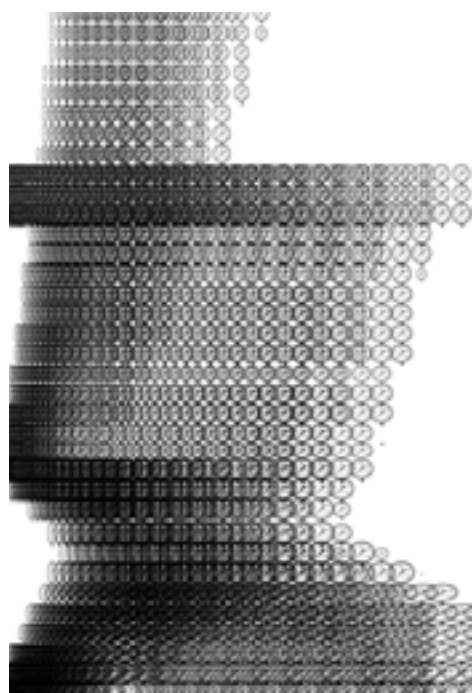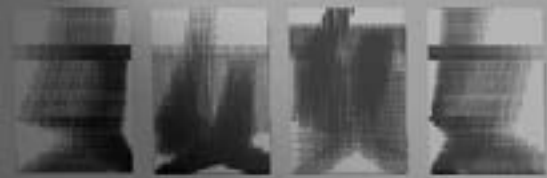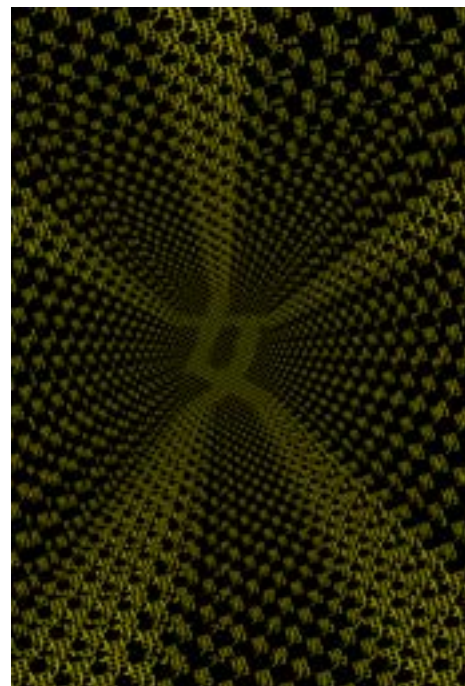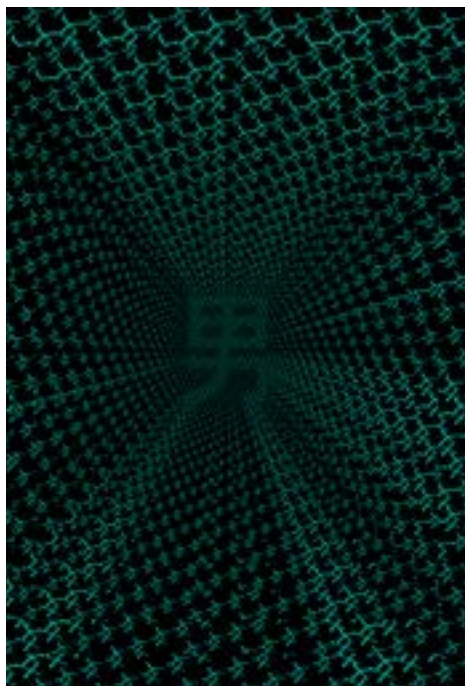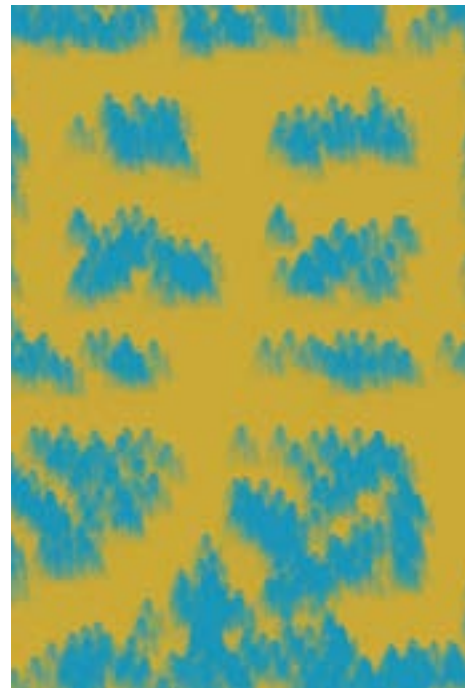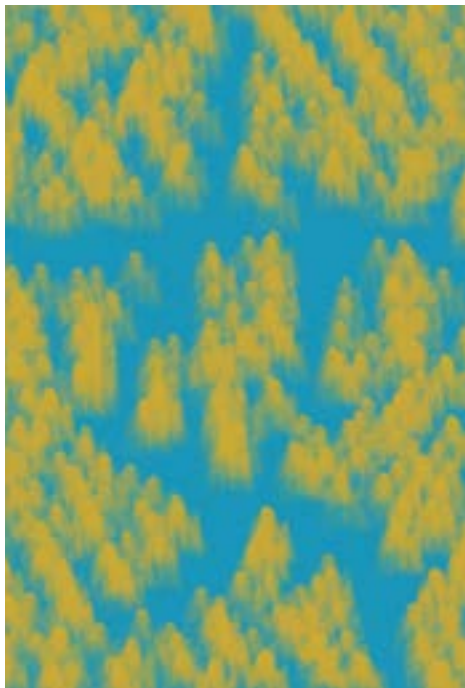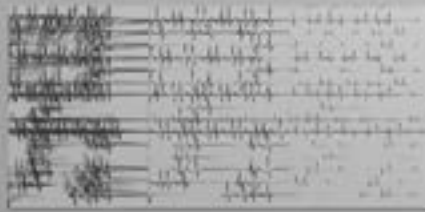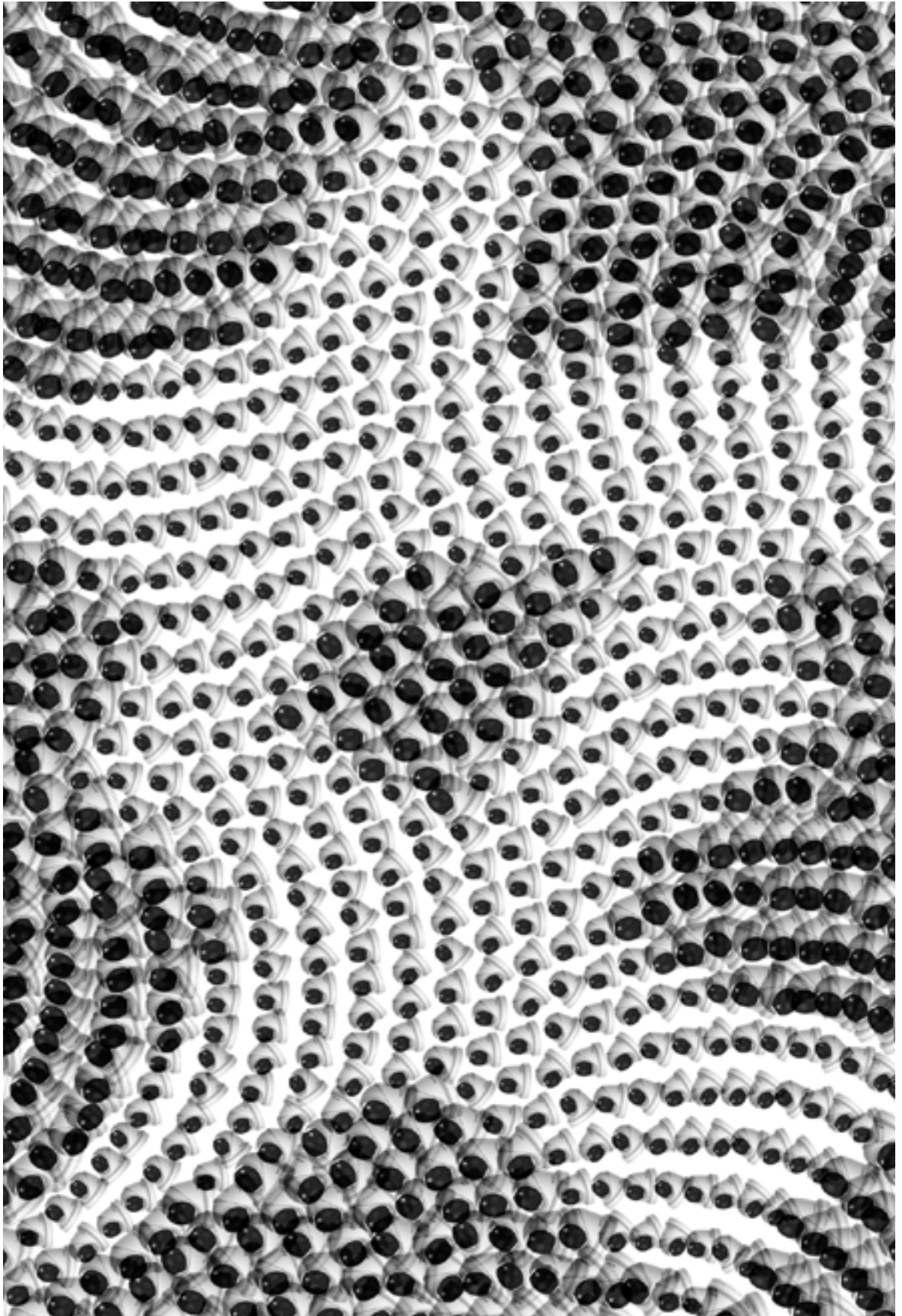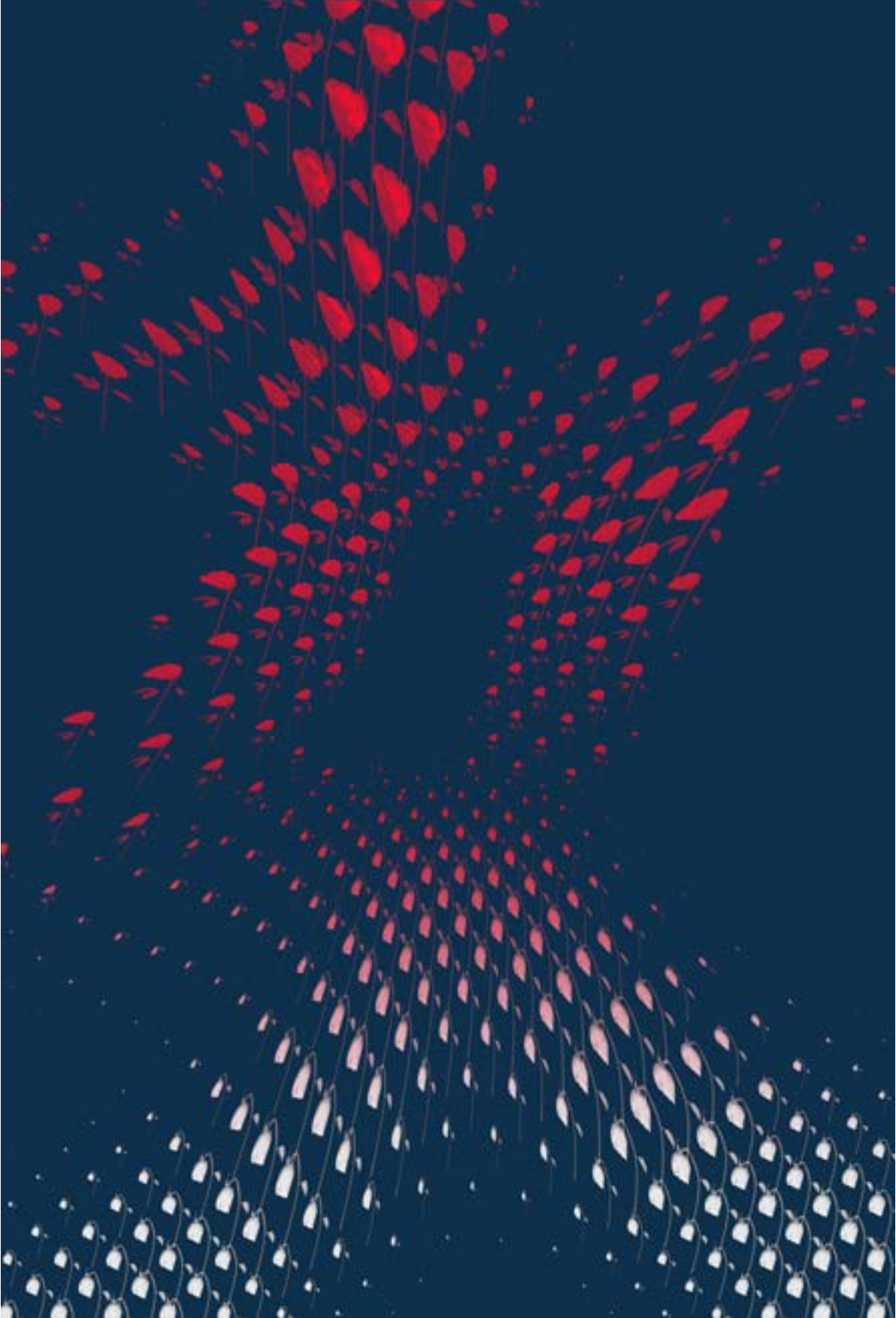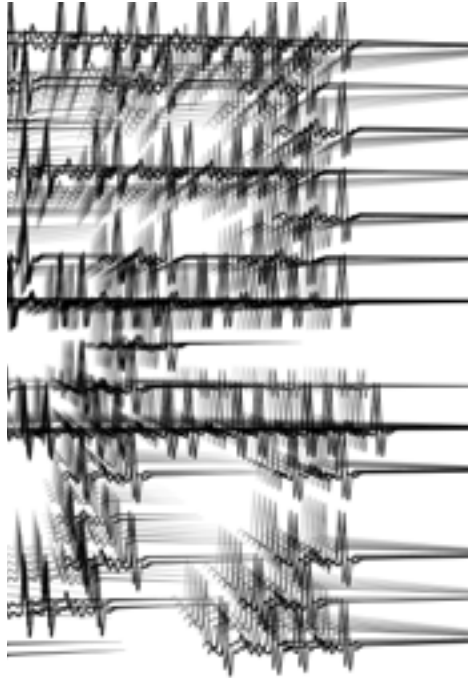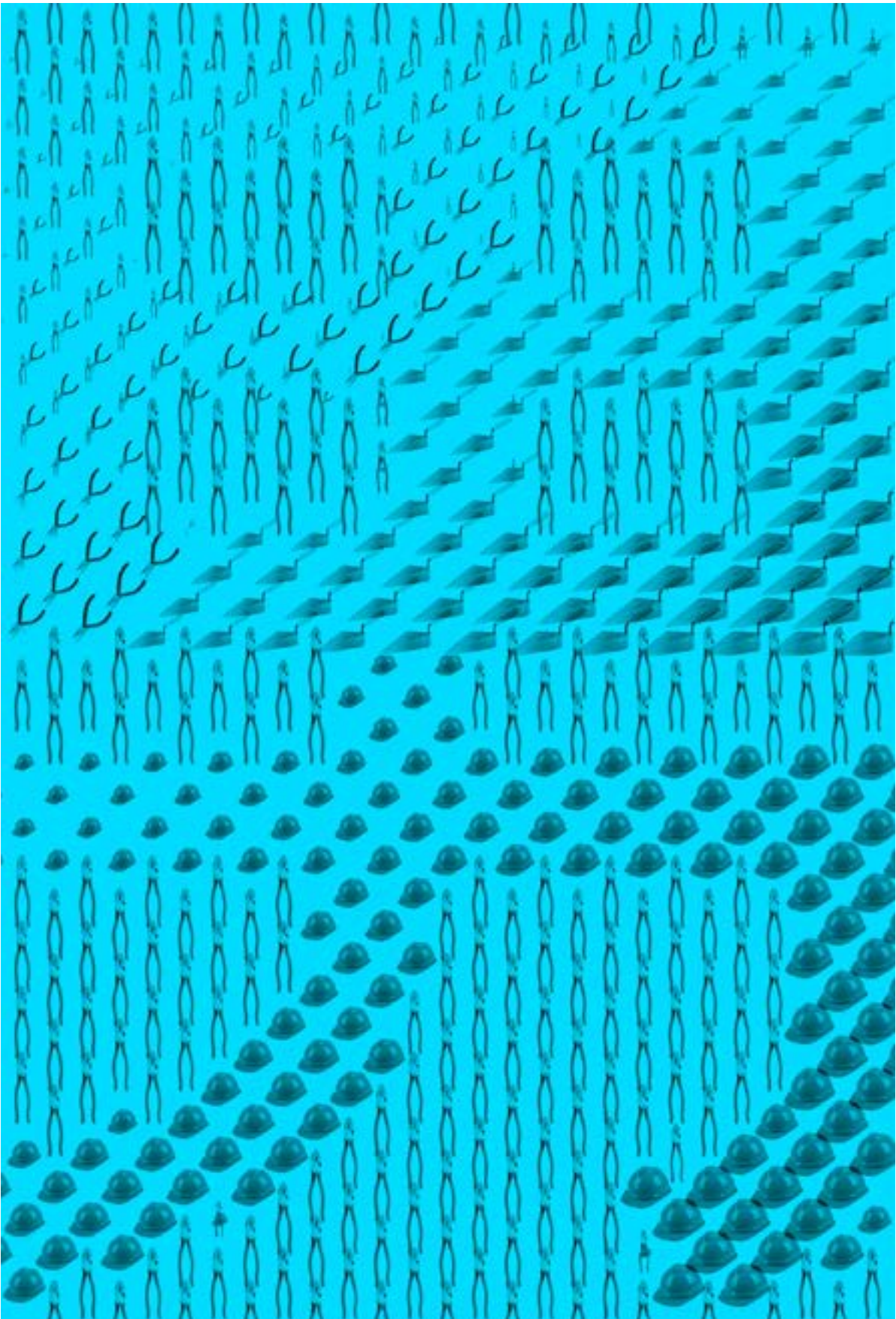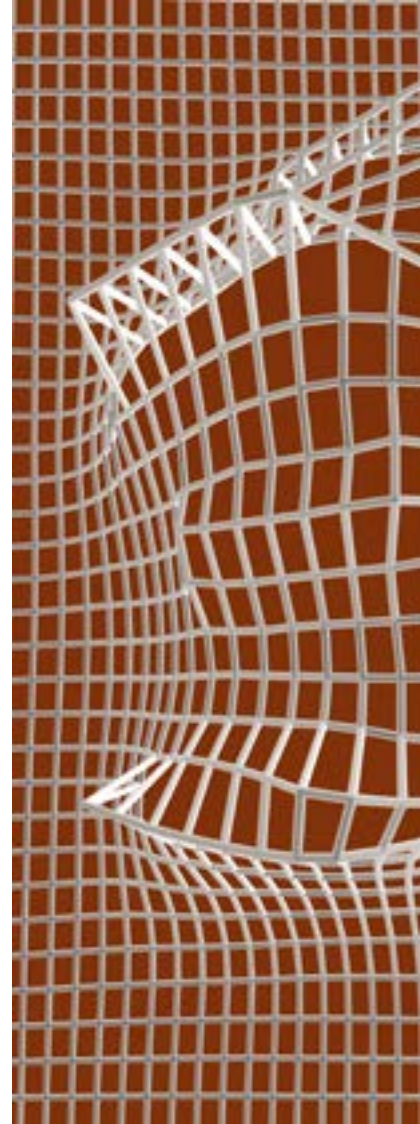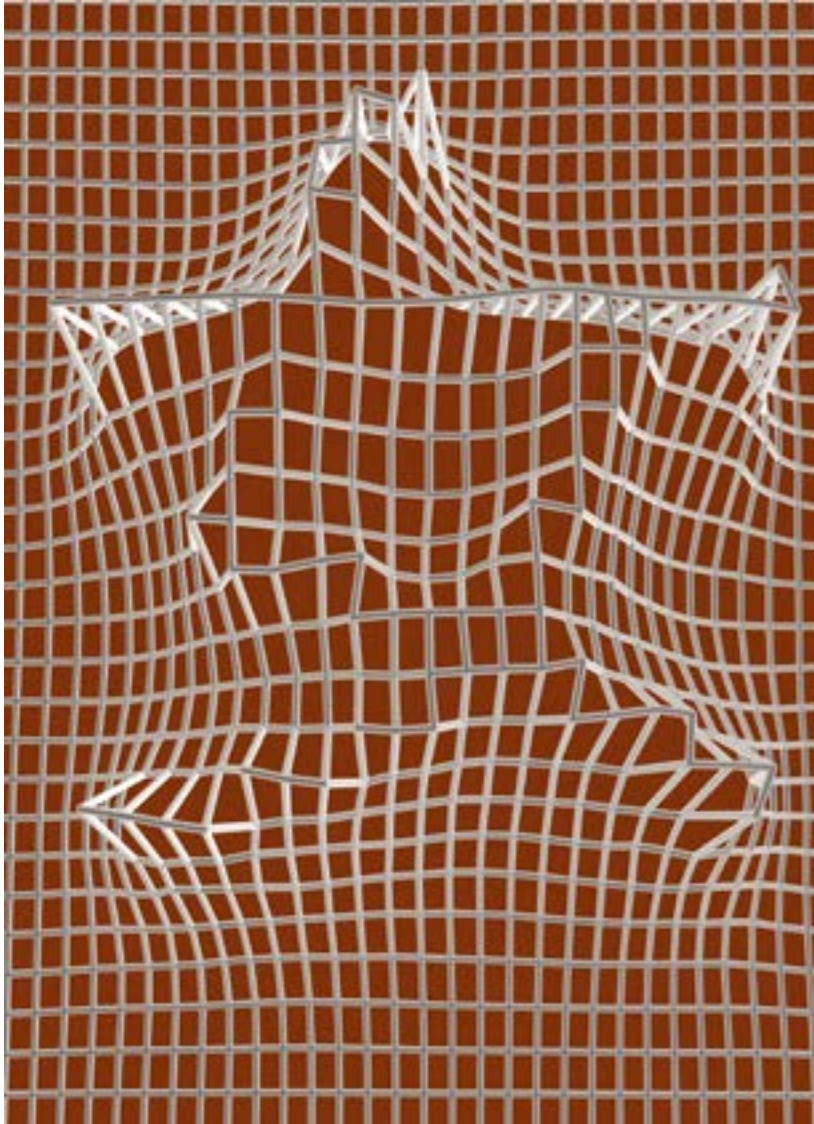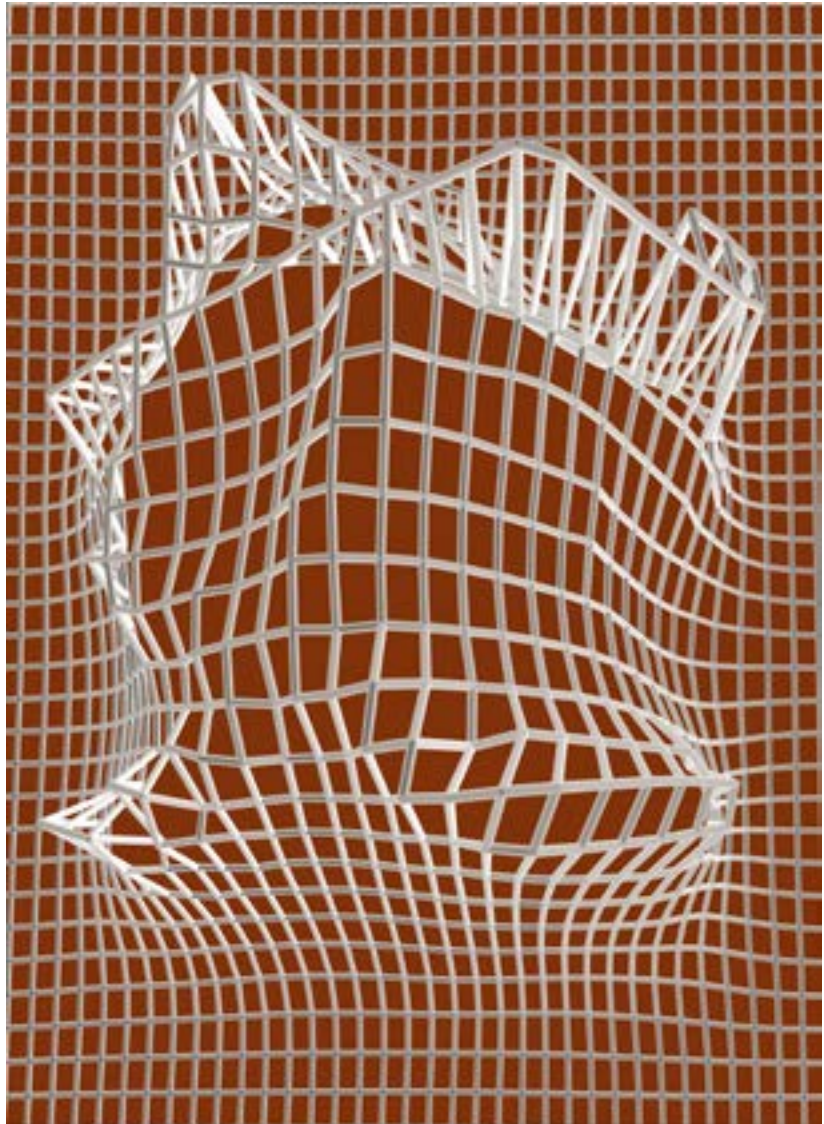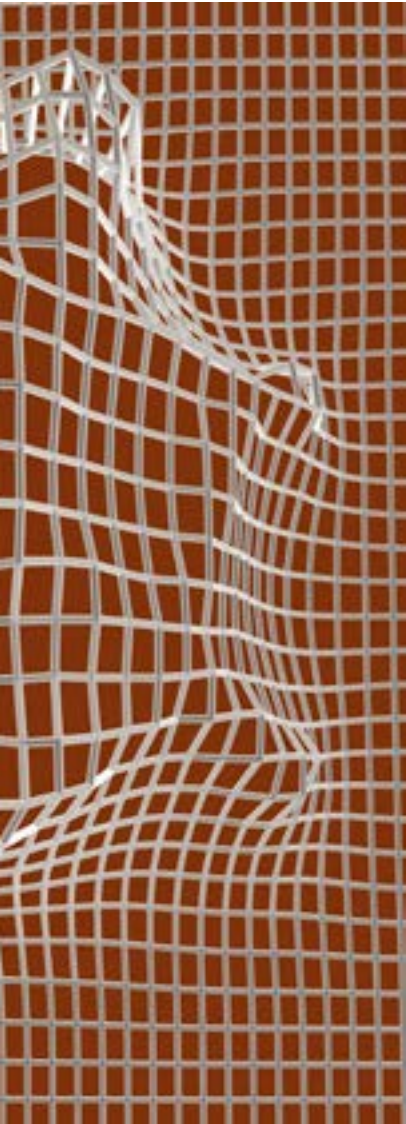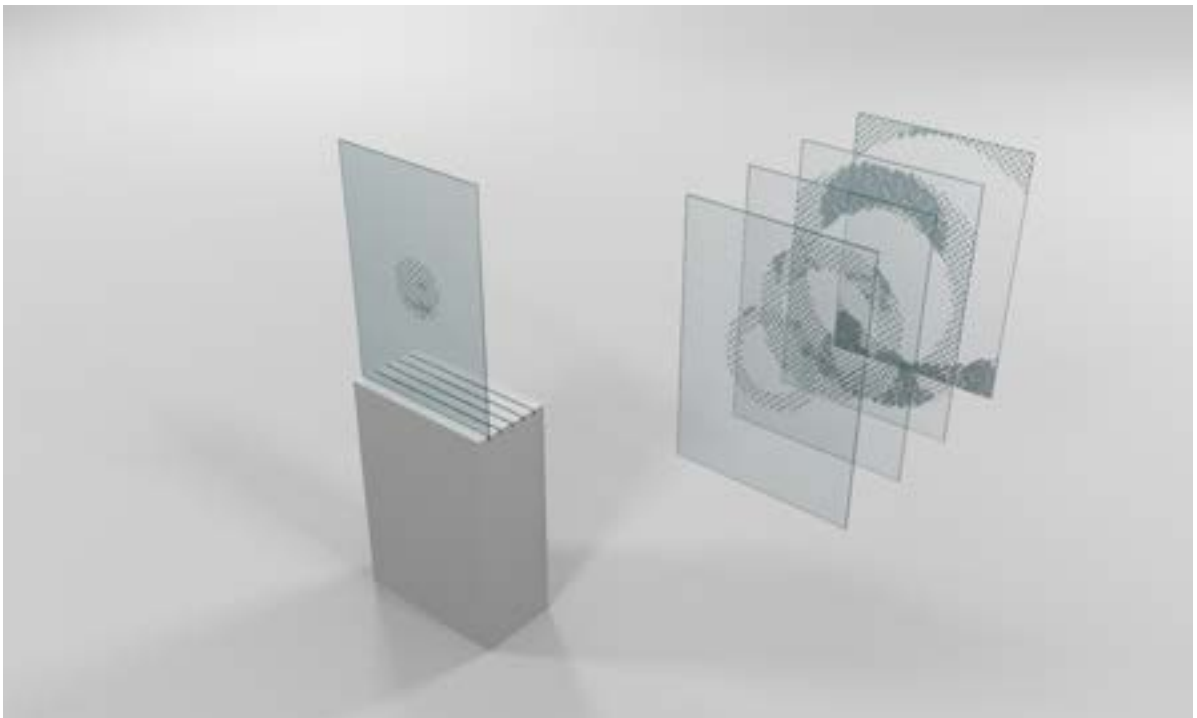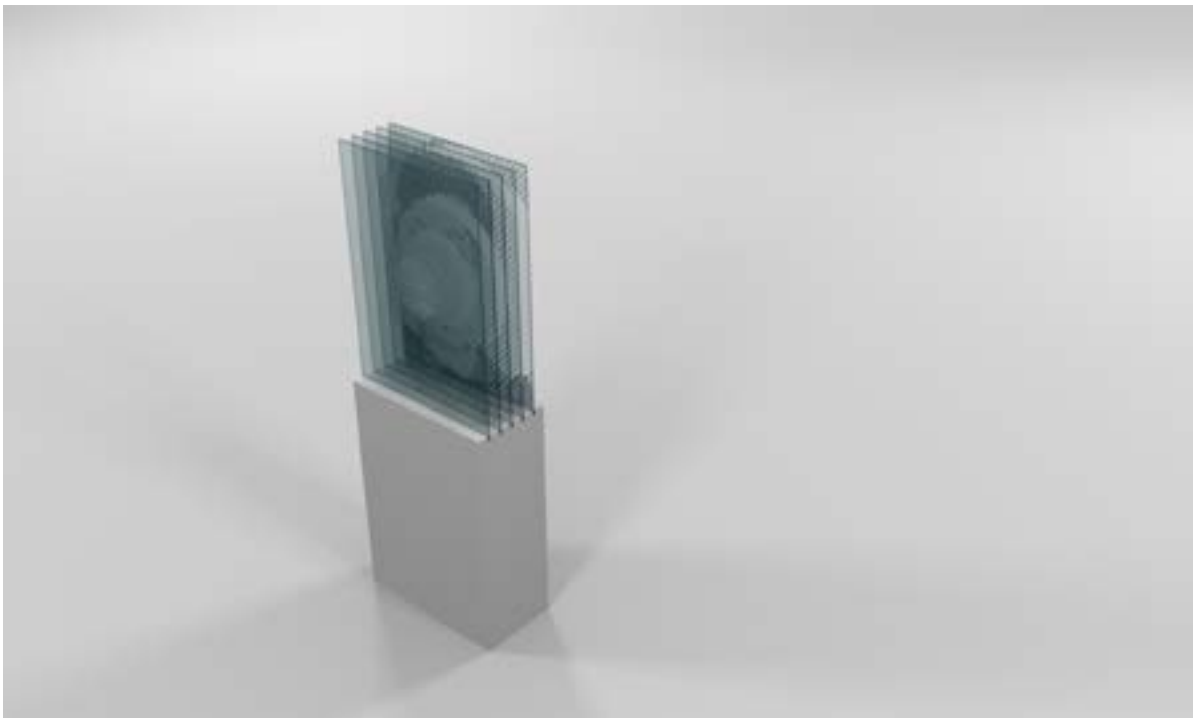
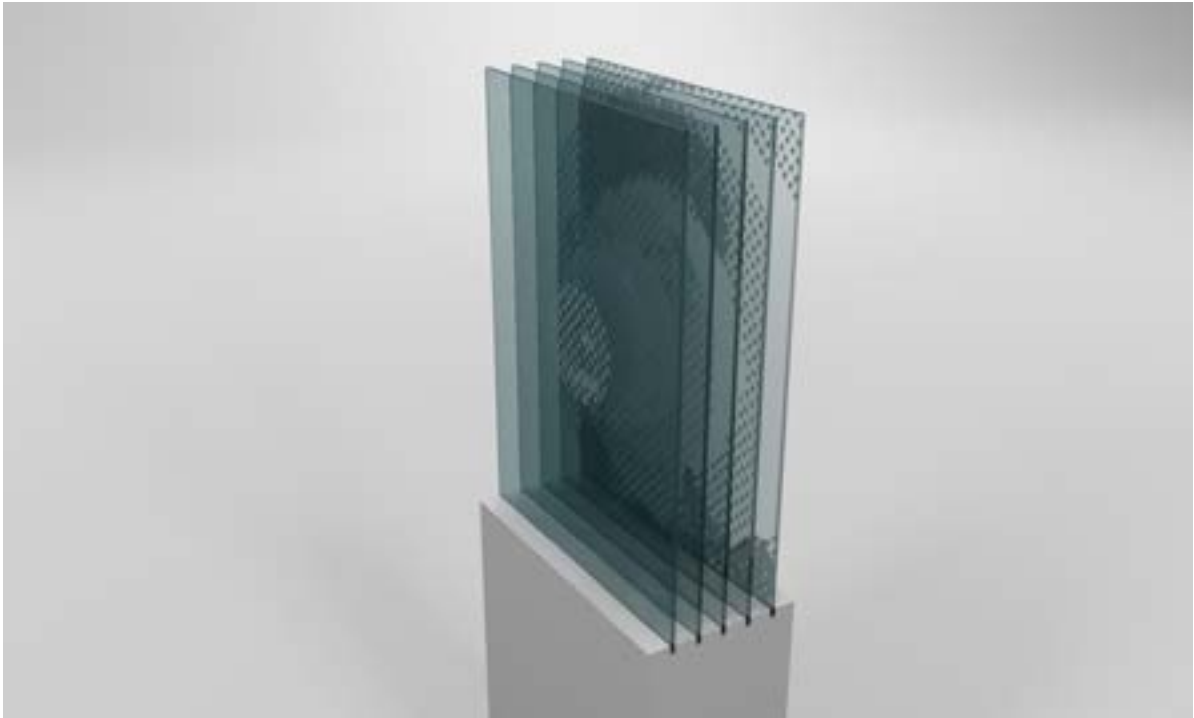„The hidden graphic", fragment
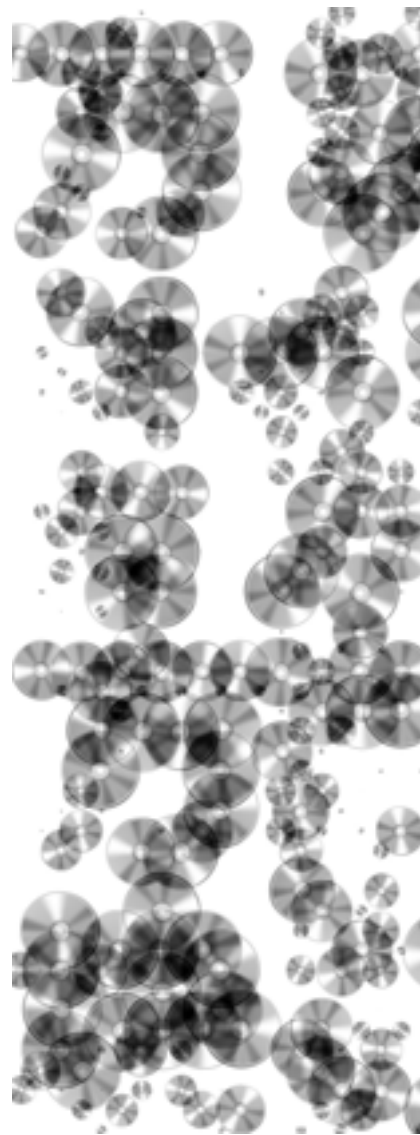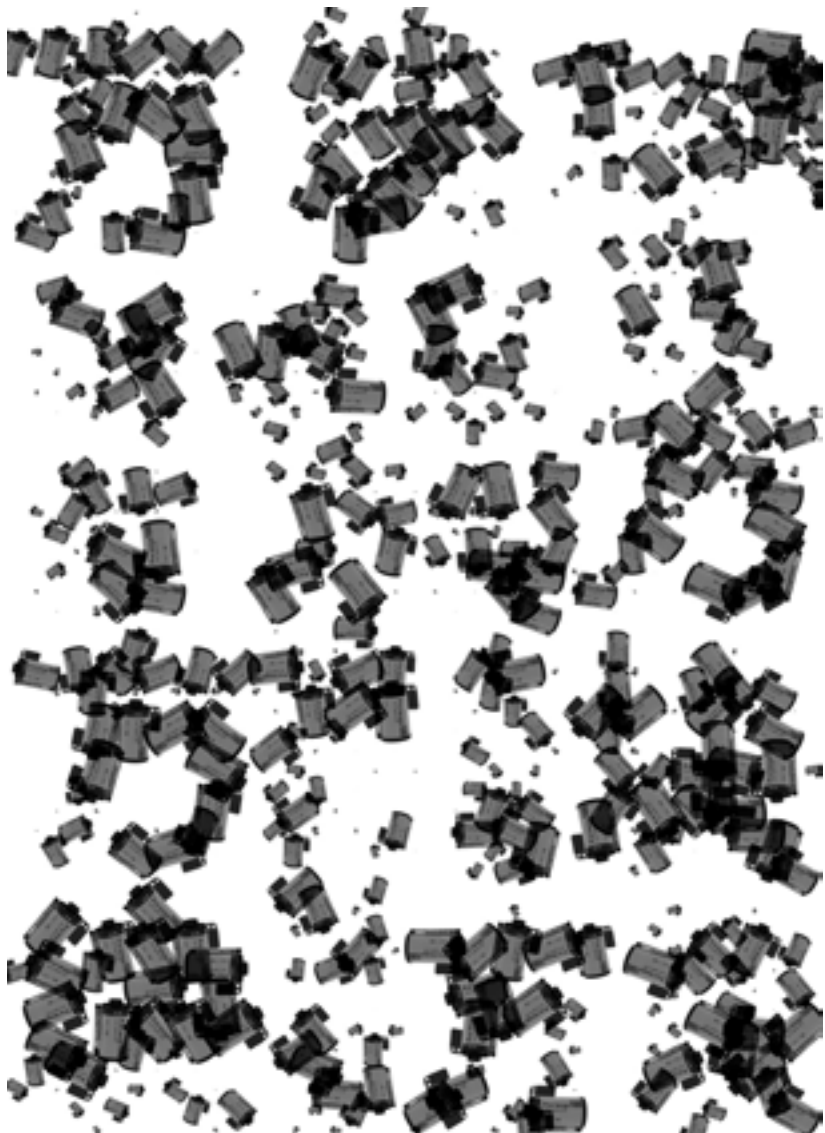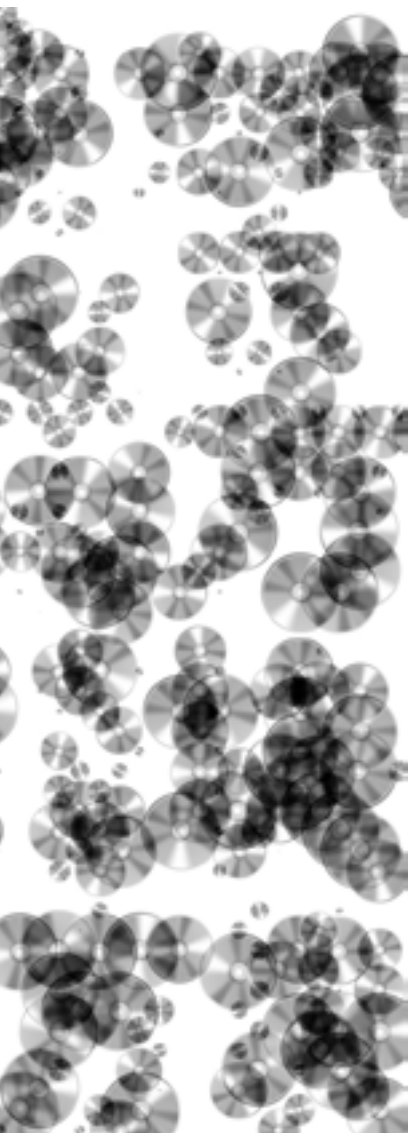
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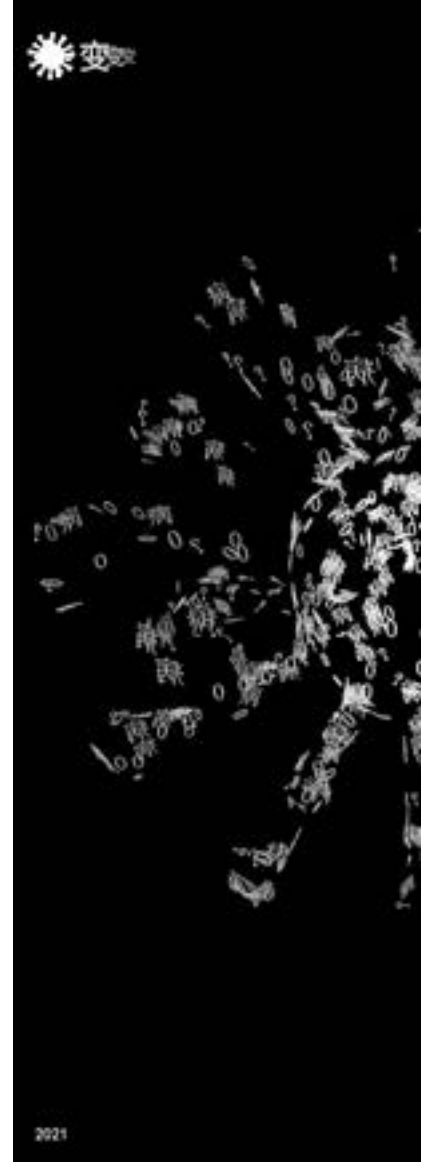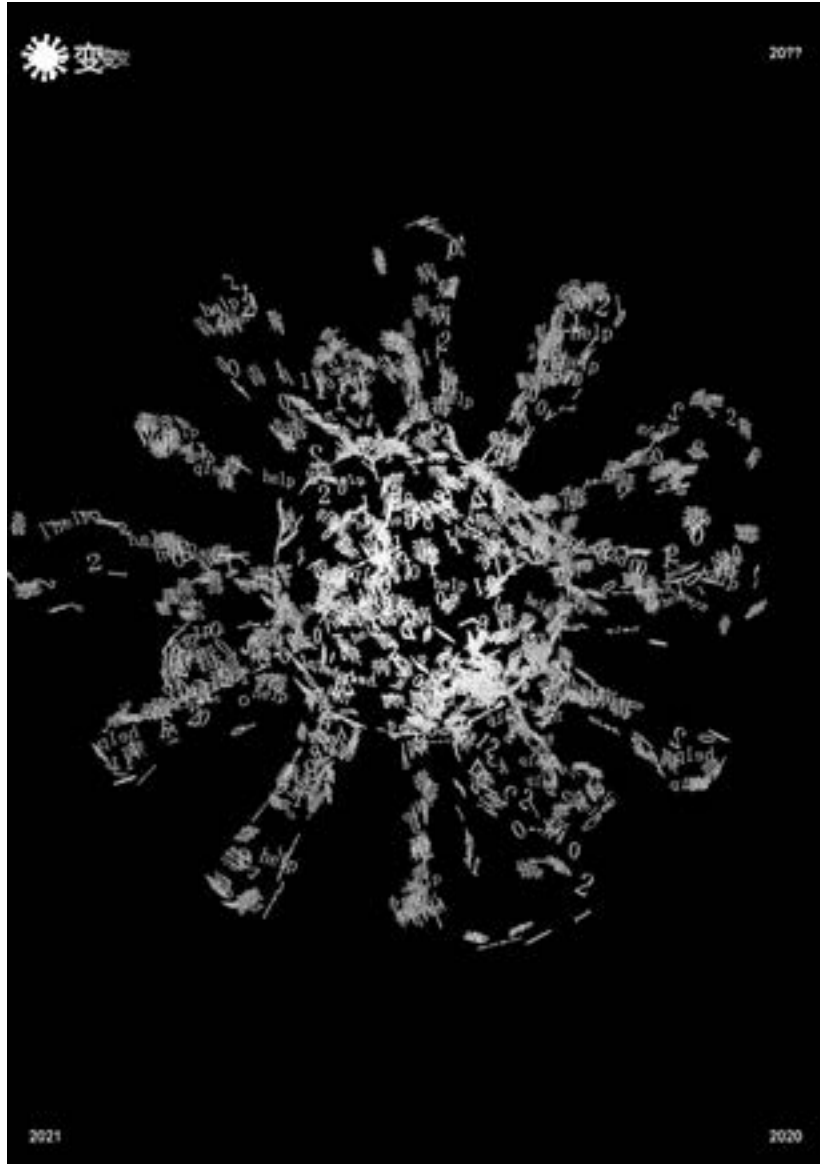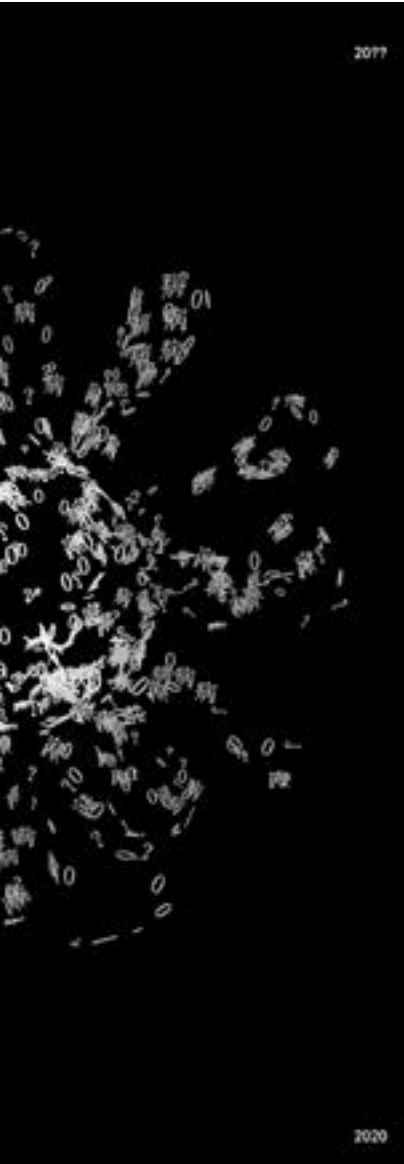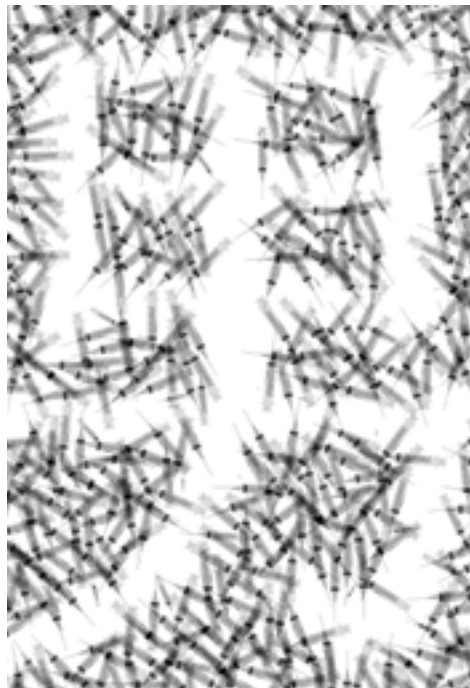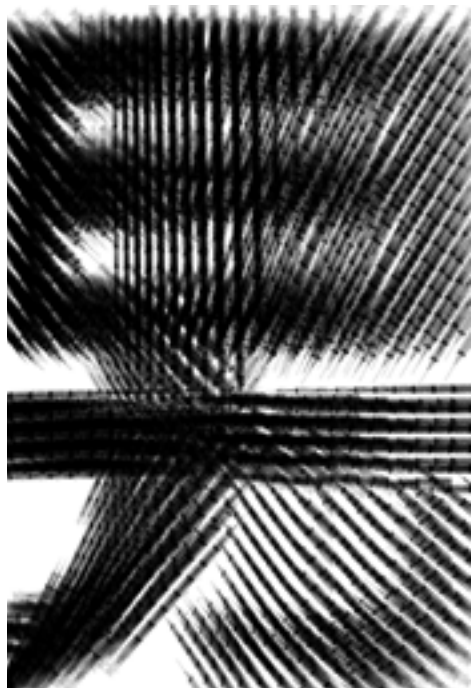
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