The psychophysiology of visual perception

selected issues

Joanna Zabawa-Krzypkowska • Krzysztof Groń

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The foreword

This study within the selected range presents the basic issues included in the subject Psychophysiology of Visual Perception, illustrated with student work carried out as part of the practical lessons at the University. The purpose of the work is to familiarize the future interior architect with topics relevant to the didactic process. The study is the result of experience in didactic work as well as theoretical knowledge that relates to the educational process in the field of Interior Design.

The issues presented in the course of the subject are an attempt to better understand and study the reality that surrounds us. Architecture, which is at the intersection of science and art, is associated with sciences such as: psychology, physiology, physics (optics), psychophysics. Getting to know the rules, experiments and activities in the field of visual arts and architecture inspire and help shape the creative personality of future architects. The complementary areas of visual arts and architecture form a unity, which is evident in the actual actions of architects that constitute a part of their future professional architectural activity, in which the sensual, emotional - world of sensations, feelings and experience are combined with the physical dimensions of the material world.

The psychophysiology of visual perception in the didactic process

Subject Psychophysiology of Visual Perception is part of the didactic programme at the Faculty of Interior Design in the Department of Architecture of the Silesian University of Technology in Gliwice. It is implemented in the first semester of the first year of study. During the course, the students are provided with knowledge of cognitive science, a field of observation and analysis of the functioning of the senses, brain and mind, and semiotics, which includes the concepts of sign and symbol. During their studies, students gain the basics of knowledge about the physiology of perception, the psychology of vision, memory, senses, symbolism of colours and contrasts.

Lecturers conducting the course:

- familiarize students with selected principles of the functioning of the eye, which enables them to obtain a large amount of information about the environment;
- present the laws of perception and the possibilities of the sense of sight.

When viewing objects, we use many sources of information, except for those that reach our eyes directly when we look at something. This information comes from knowledge of the subject. They also include other sensations, such as: sensory observation, taste, olfactory, auditory, thermal or pain sensations, because „... objects are more than patterns of stimulation: they have their past and future; when we know the past or we can guess the future of an object, it becomes more than a stimulus that causes sensory experiences; it is the personification of knowledge and predictions, without which, life, even in its simplest form,

would be impossible"[1]. At the same time, as the psychology of character states, the recipient is willing to see the image in the simplest way. As Arnheim writes: „Seeing means grasping some of the most characteristic features of an object"[2]. He also adds that visual perception has nothing to do with camera fidelity.

The subject of Psychophysiology of Visual Perception helps in acquiring knowledge about the functioning of our body and, as a consequence, facilitates asking questions about its possibilities in the field of cognition, which are translated into art and design.

The course in Psychophysiology of Visual Perception includes practical classes based on individual corrections. During the conducted classes, graphic works are created showing the artistic interpretations of selected psychological topics. One of them is the possibility of experiencing optical illusions that rely on misinterpretation of the image under the influence of contrast, shadows and the use of colours that automatically put the brain into an incorrect pattern of thought.

Illusion results from the mechanisms of perception, which usually help in perceiving, but under certain conditions they may only cause seemingly real impressions. For students, it is significant to be able to become familiar with and understand the basic optical issues (colour contrasts, optical illusions), psychological, semantic and physiological (e.g. structure of the eye, sight) conditions, as well as the impact of other stimuli on humans.

Students carry out art exercises on their own, the purpose of which is to understand the discussed phenomenon. In their work, they use a set of experiences related to the sphere of psychophysiology of visual perception and to the sphere of influence, for example simple geometric figures, on our perception and well-being. Such experiences concern many issues. They include among others:

- Perception of lines, types of lines and way of presenting space, illusion of space – presenting space in the image. Creating impossible spaces, obtaining the impression of spaciousness.
- Spatial structures – mechanisms of perception of a solid figure, perspective systems, the impact of context on a figure or solid.
- Psychological mechanisms responsible for seeing the movement, the illusion of movement.
- Arrangement and composition, types and structure of composition on the plane and in space. Disorder and order.
- Psychological aspects of colour, the influence of colour on readability, visibility of visual information. Emotional effect of colour on the human psyche, reading colour in a symbolic sense.

[1] R.L. Gregory: "*Eye and brain. The psychology of seeing*" [*Oko i mózg. Psychologia widzenia*, PWN, Warszawa 1971, p 11-12.]

[2] R. Arnheim: "*Art and Visual Perception. A Psycholgy of the Creative Eye*". [*Sztuka i percepcja wzrokowa. Psychologia twórczego oka*, słowo/obraz terytoria, Gdańsk 2004, s. 62.]

Course content:

The programme is implemented based on a series of thematic exercises with a conscious use of psychological mechanisms regarding perception, optical illusions, visual illusions, colours, and semiotics issues.

Design exercises:

1. The first exercise has an introductory character – a square as a flat and then a spatial form, involves playing with the form, building a new quality. The flat form transforms into a spatial structure by cutting and bending.

   Compositions created on the basis of a square are used to solve problems (its surface is transformed into elements from which dynamic compositions are created).
2. Camouflage – an artistic arrangement whose purpose is to unify the object with the surrounding background, therefore the shape is camouflaged by the context, the proximity of other elements - the principle of choosing the simplest interpretation, 50/70 format, colourful composition.
3. Visual arts development – „impossible", illusory, fictional architecture - whose purpose is to study the relationship between the plane and space (shape of the object, solid, impossible figure, composition using elements of illusion). The study aims to create the atmosphere of the place using elements of illusion, deceived perspective, contrasting perspective convergences, space escape, or artistic compositions suggesting spatiality in the works described as impossible space. These are also representations of three-dimensional figures on a plane that are contradictory in their spatiality, i.e. it is not possible to construct their three-dimensional counterparts.
4. Ambiguous figure, figure and background, composition with complement – visual arts development, format 50/70.

In each semester of the academic year, students perform four exercises. Their implementation takes place after the presentation of the concept and preliminary projects for approval from the teacher conducting classes. The works are performed using drawing and painting techniques, the current format is 50/70 cm. Each time after completion of the assessment the students are graded. Exercises are complemented with final exams. One of the example exercises is the topic „save a square differently", it consists in presenting the form of a square without drawing the figure directly. Thus, students try to define the subject through context, background, surroundings or with the help of a synthetic, simplified message that is so suggestive that the viewer reads the square in the plane of the image. There are a small number of characteristic figures: a square, a triangle, a circle treated as closed figures.

For the task's realization, a square was chosen – a symbolic object which shape can be interpreted differently as a living space, limited by walls, roof, etc.[3]. The next exercise was to create a work using a symbol or sign that students recall from memory and to use it to create a composition drawing.

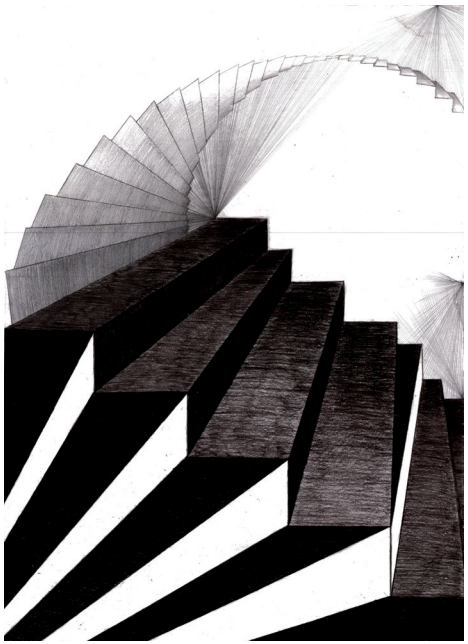
The presented works were created as part of the subject Psychophysiology of Visual Perception at the Department of Fine Arts and were made by the students of the first semester of the first grade of study in the academic years 2014/2015, 2015/2016 and 2016/2017 under the supervision of dr arch.engineer Joanna Zabawa-Krzypkowska and dr of art Krzysztof Groń. From among the performed works, there were some selected that present a diverse approach to the undertaken issues. Each concept is different, and the work is characterized by an interesting approach and way of dealing with the task. They are distinguished by their attractiveness, originality, manner of expression and often the author's bold vision. Technically, it was assumed that most of the tasks would be carried out by hand. The specific technique of work was selected individually for each study depending on the subject and author's concept. As a result, both painting and drawing works were created, and – in justified cases – created using graphic computer programmes. In solving individual problems, students used various perspective measures. Rhythmic, open, closed and report compositions were chosen. The accent or dominant mode was used, bearing in mind that composing is one of the most important creative processes organizing all the elements that build the image. A conscious combination of them in appropriate proportions and relationships (colour) allows the creation of a new artistic reality.

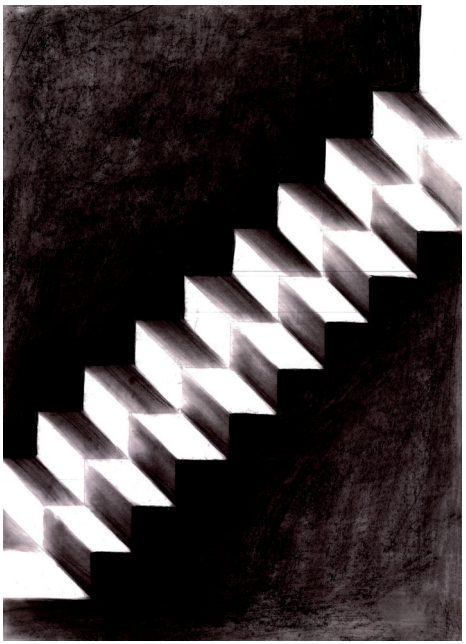
Conclusions

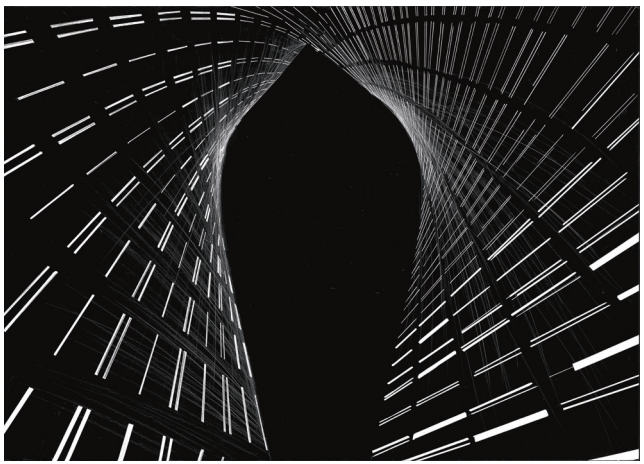
The lecturers are convinced that exercises aimed at familiarizing students with the basic issues of psychophysiology, perception in the process of seeing and their impact on the construction of a visual message, help them to more broadly and consciously understand how to use the basics of receiving visual stimuli and manipulation of image interpretation. Certainly, they also shape awareness of the meaning and the value of colour, and also make the students aware of certain laws governing the composition, e.g. the law of continuity, similarities or closing the composition. Everything is subordinated to making the recipient aware of the way the mind actively organizes the world seen, among others, through the stability of perceptions, the size of shape and colour. This knowledge is an essential experience for creating conscious spaces in the field of design, enabling a constant search for the best solutions.

[3] A. Frutiger: "*Der Mensch und seine Zeichen*". [*Człowiek i jego znaki*, Wydawnictwo Do, Wydawnictwo Optima, Warszawa 2005, s. 37.]

Student work







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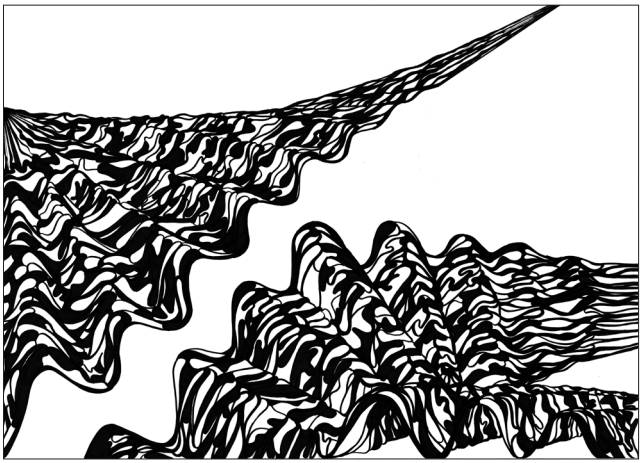
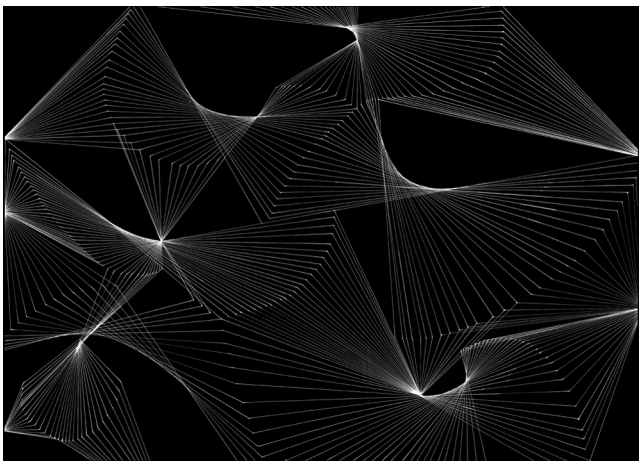
AGATA KOCUR
academic year 2014/2015

PAULINA JANUSZ
academic year 2014/2015





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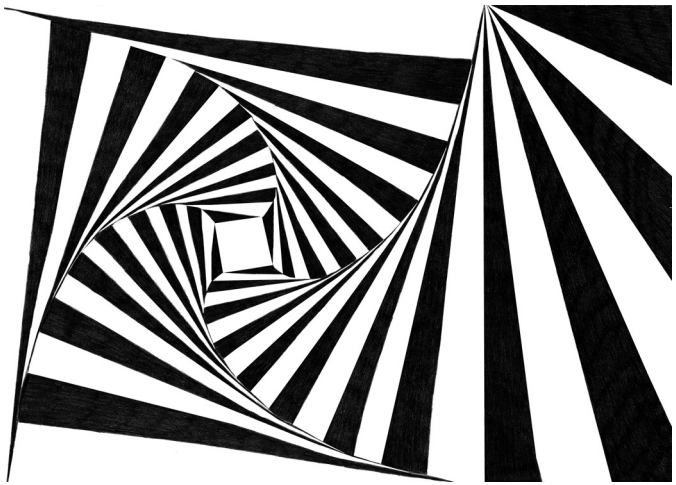
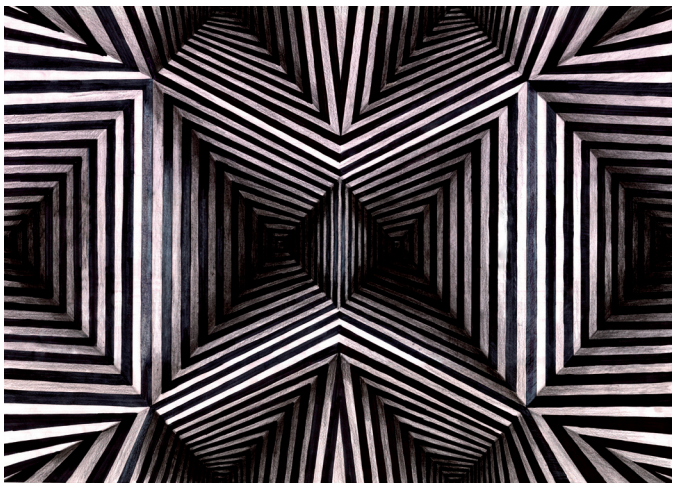
academic year 2014/2015

AGNIESZKA FEODORÓW
academic year 2015/2016





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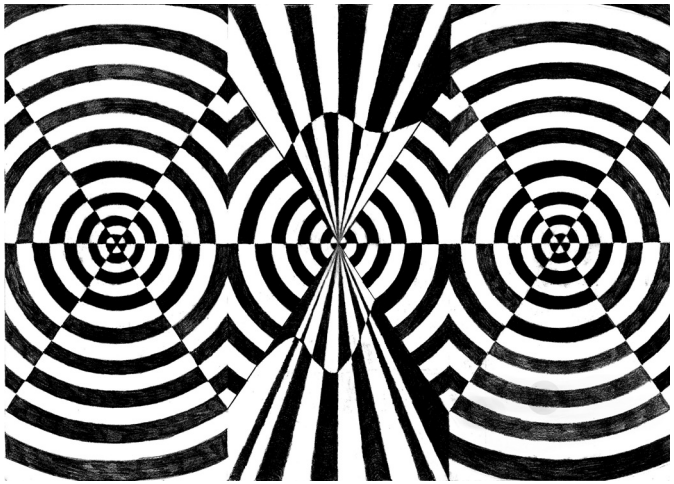
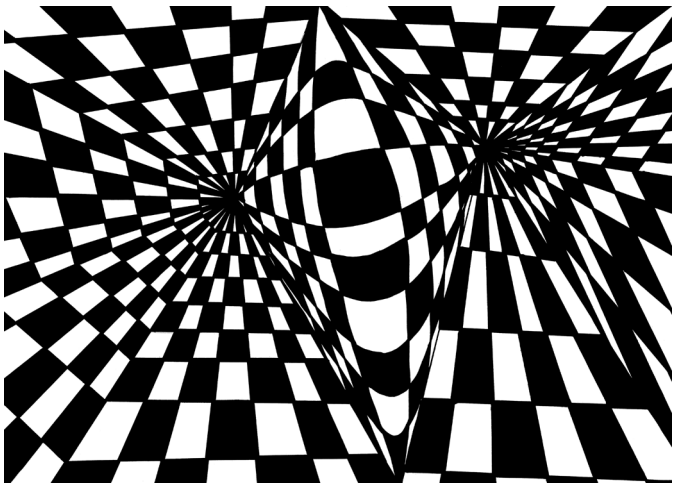
academic year 2014/2015

ANGELIKA CZUBASIEWICZ
Impression of space
academic year 2014/2015



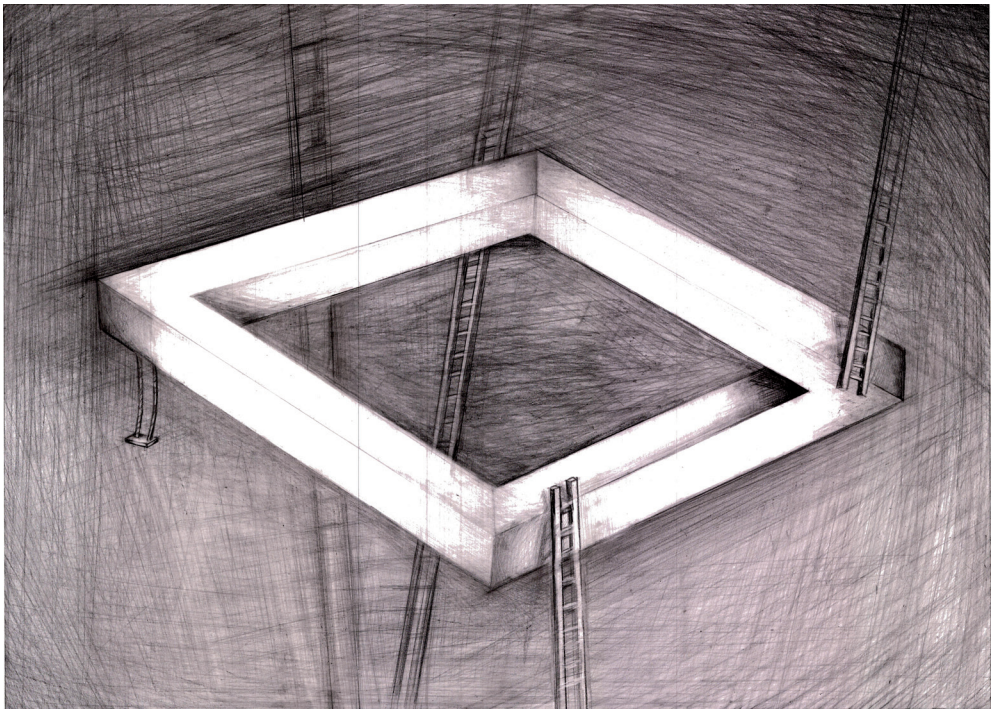


JULIA NOSIADEK
Impression of movement
academic year 2014/2015

NICOLE ZOGEL
Impression of movement
academic year 2015/2016

AMANDA KĘDZIERSKA
Impossible figure
academic year 2015/2016

ALEKSANDRA BRYL
academic year 2015/2016



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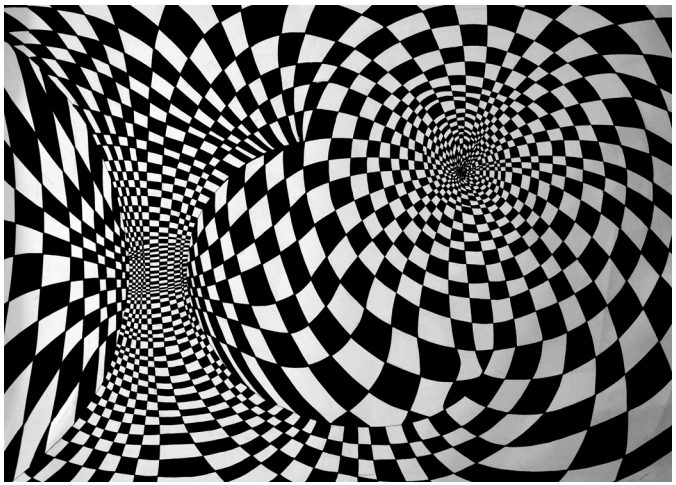
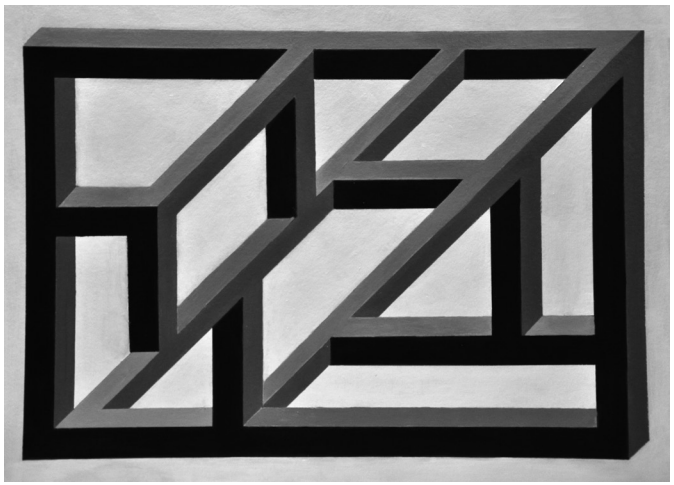
academic year 2014/2015





KAMILA WRONKA
Movement impression
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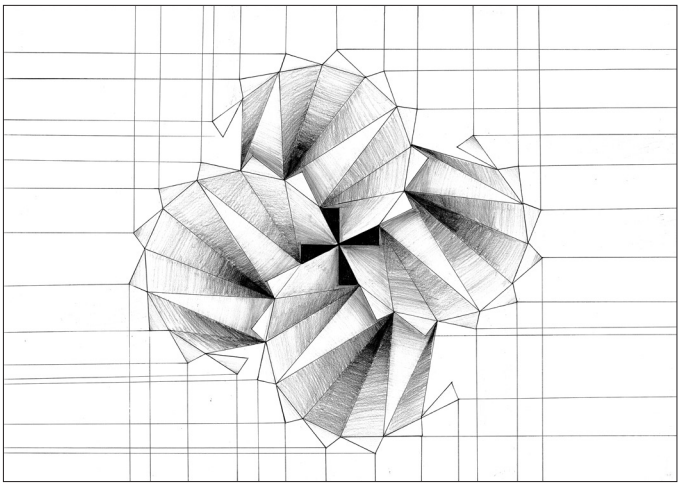
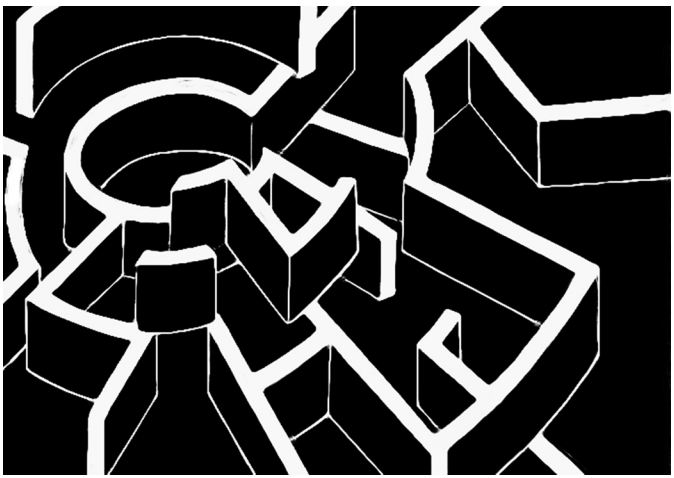
NATALIA STANKIEWICZ
Impossible figure
academic year 2015/2016





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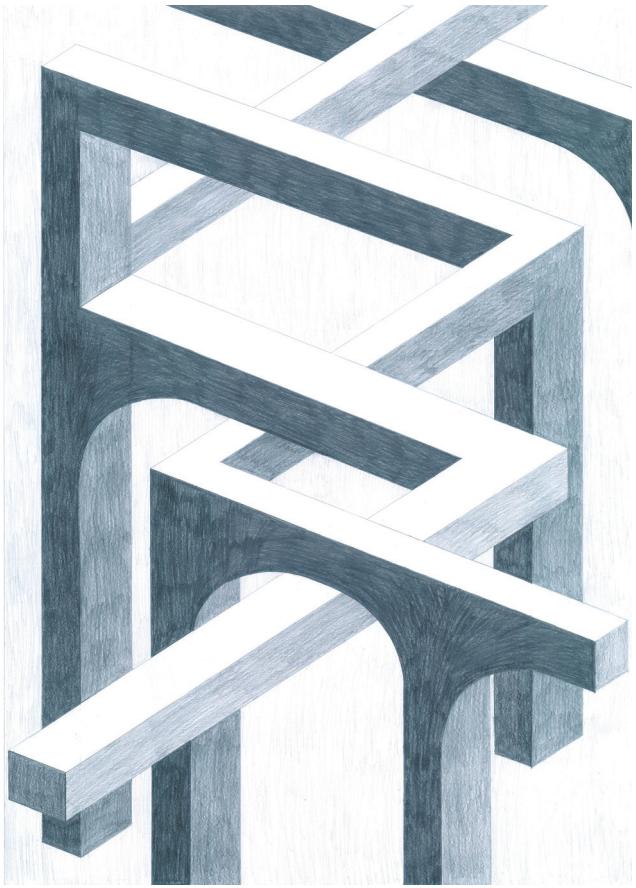

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KLAUDIA PRZYBYŁA
Impossible figure
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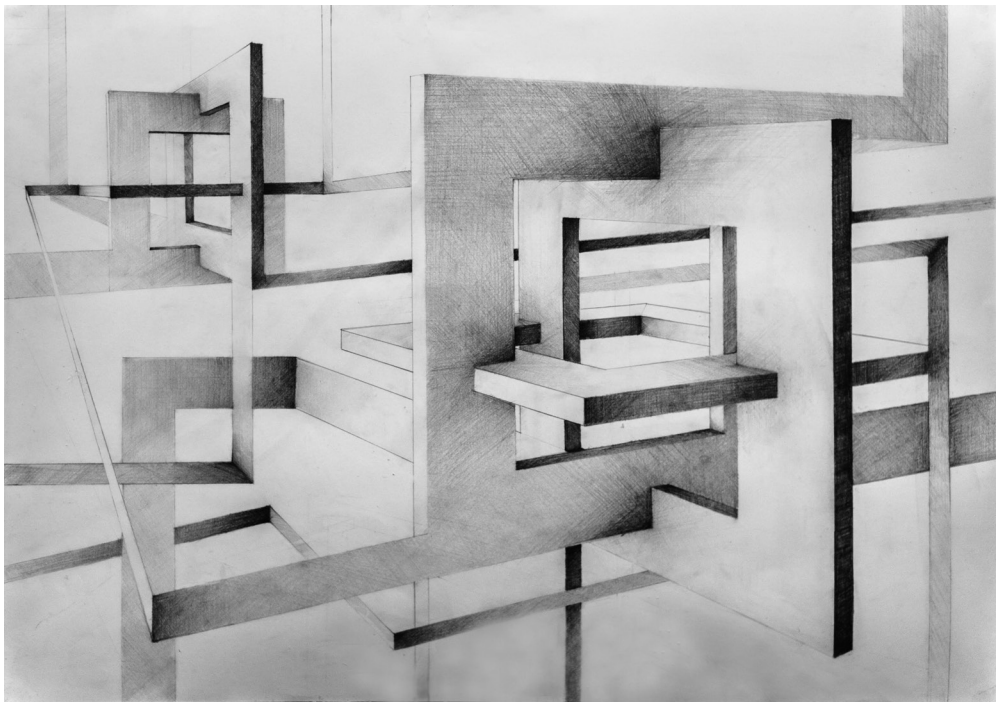

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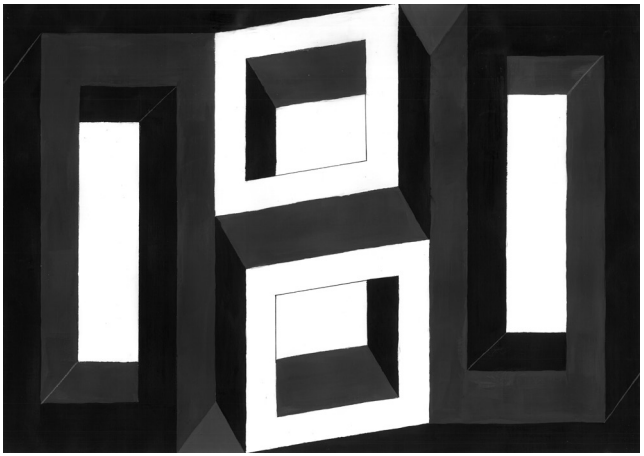

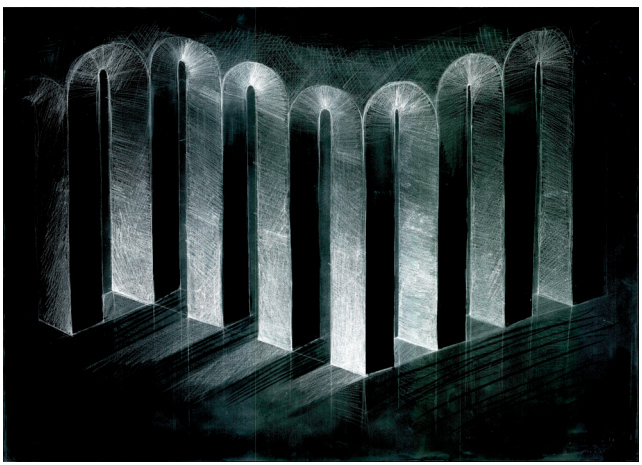

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MARTA KAŹMIERSKA
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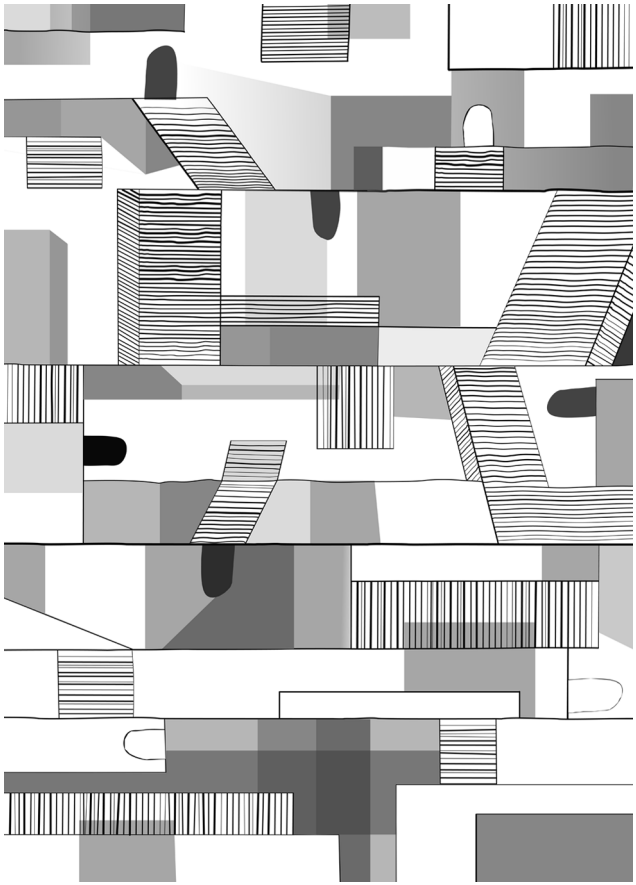

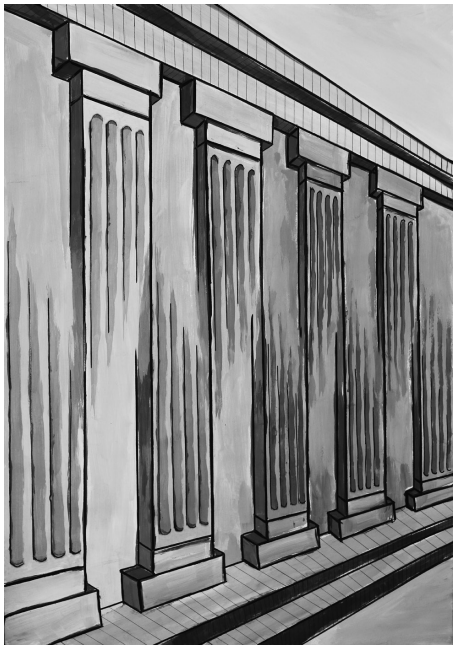

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NATALIA PANDZIOCH
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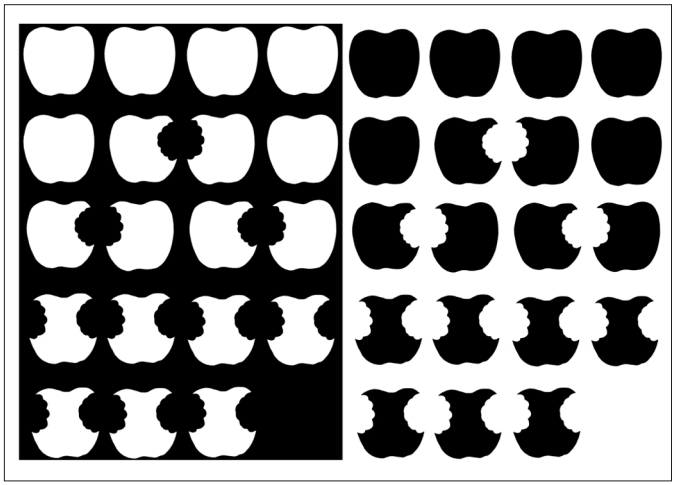

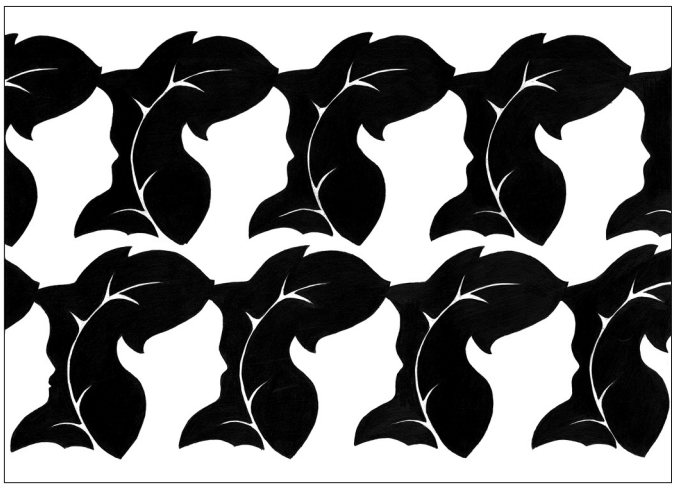

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DOMINIKA LECH
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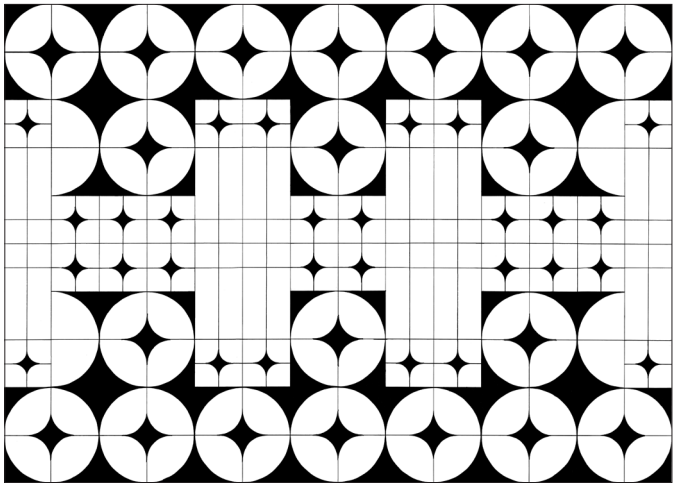

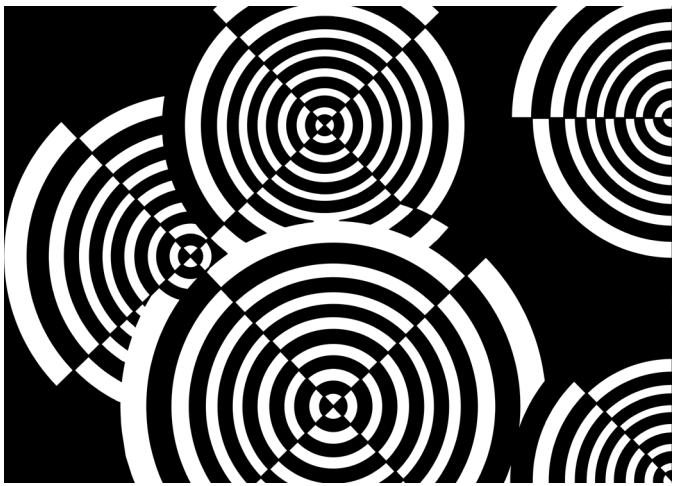

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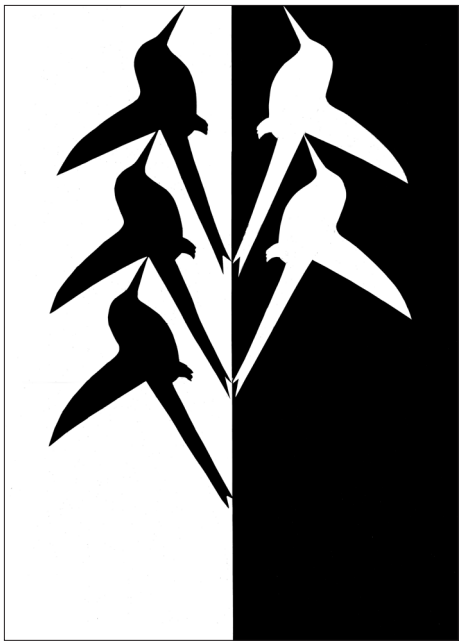

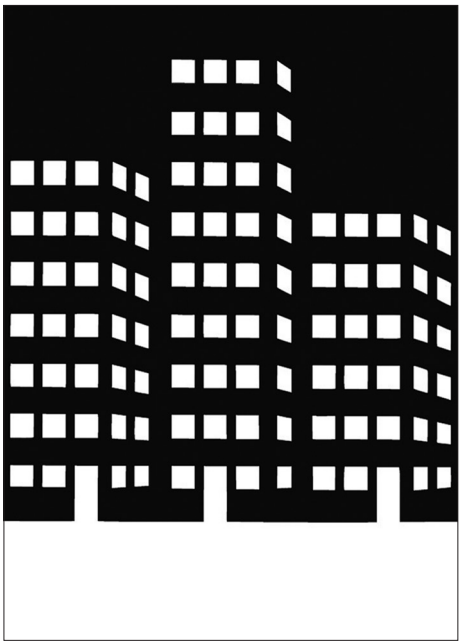

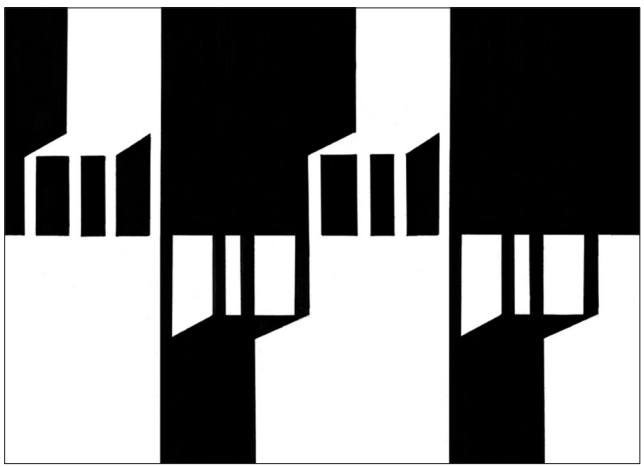

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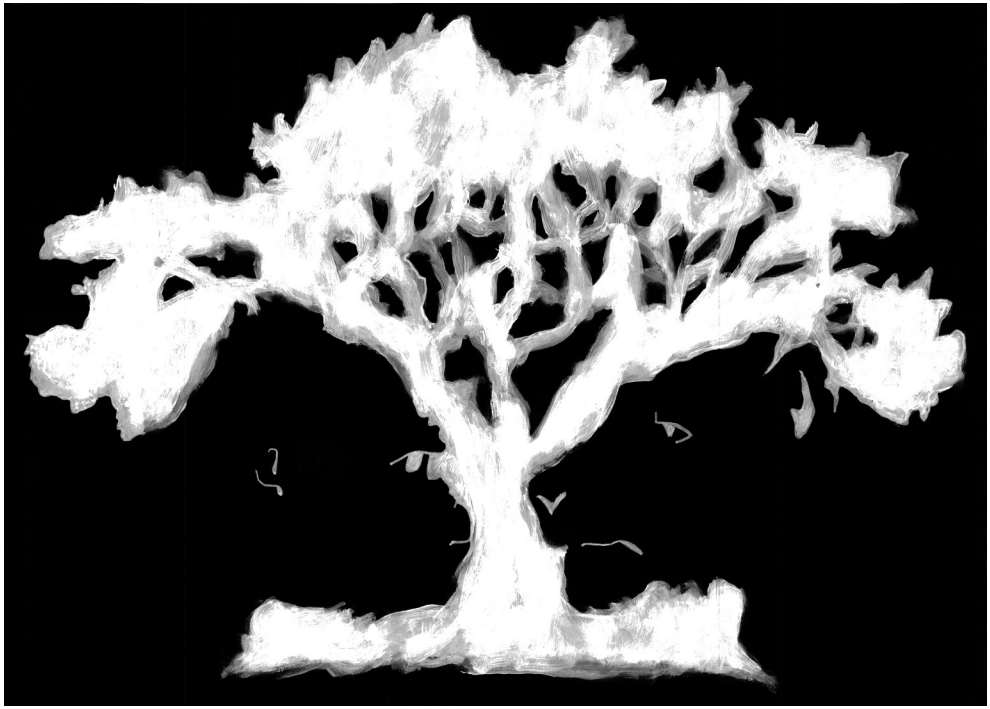

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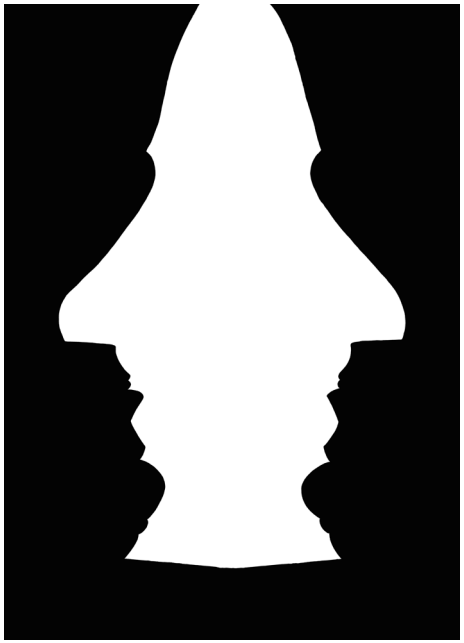

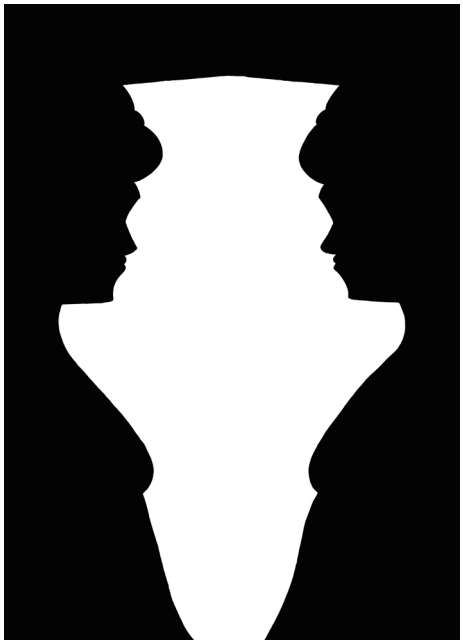

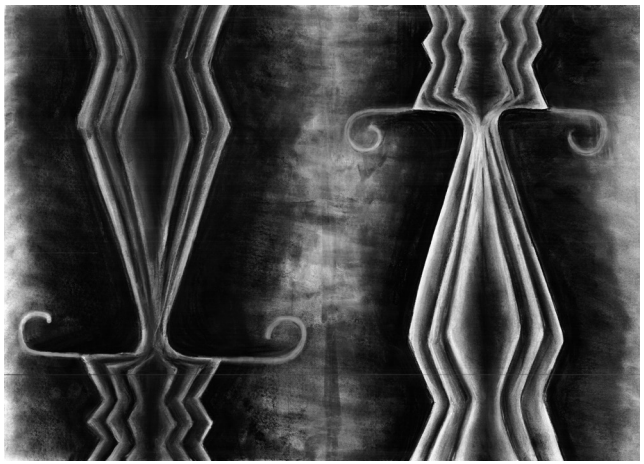

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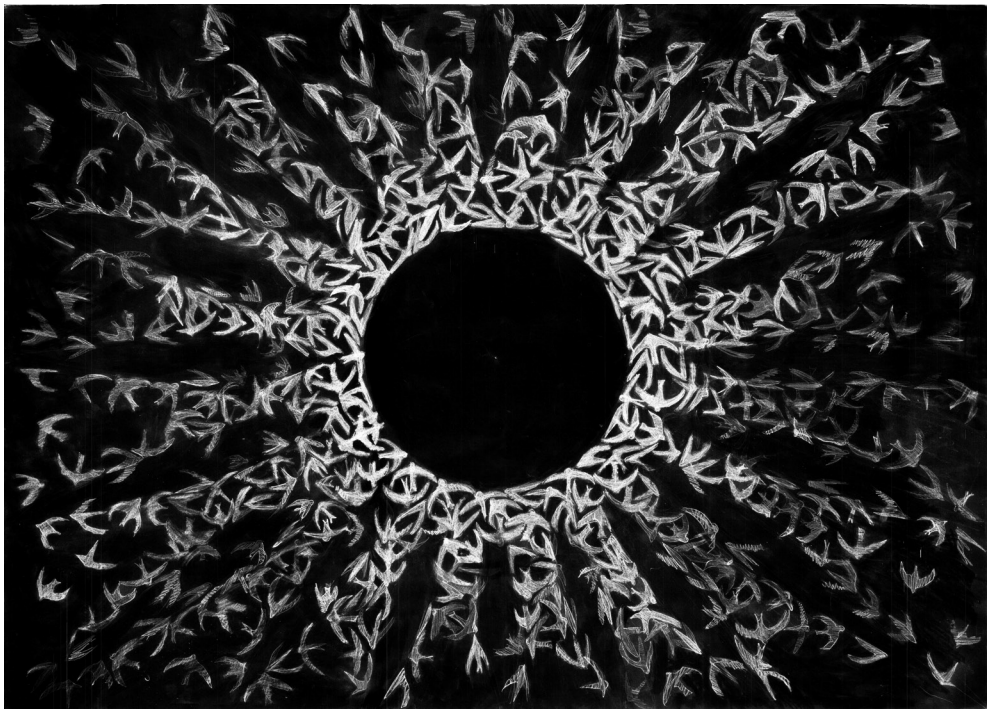

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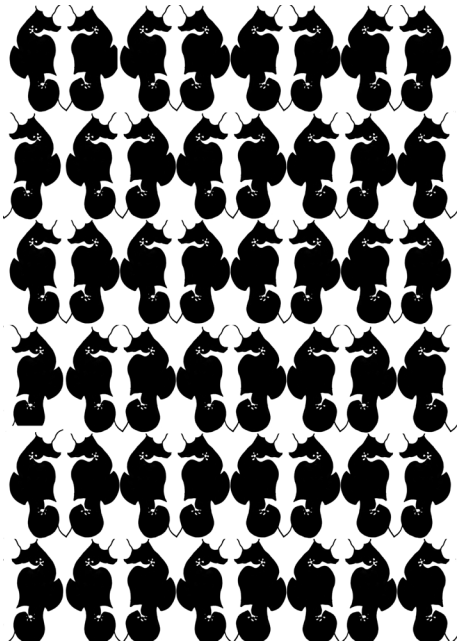

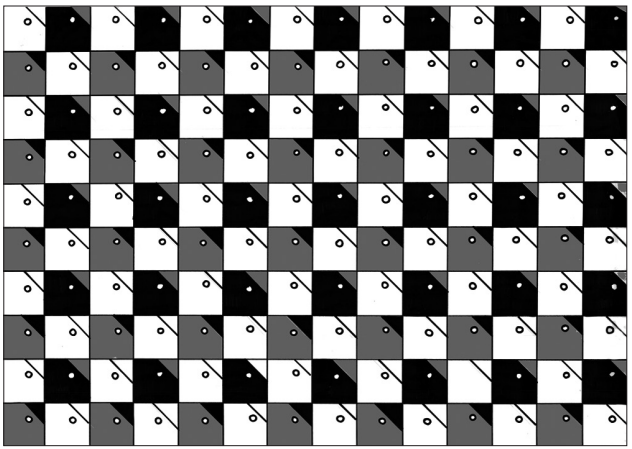

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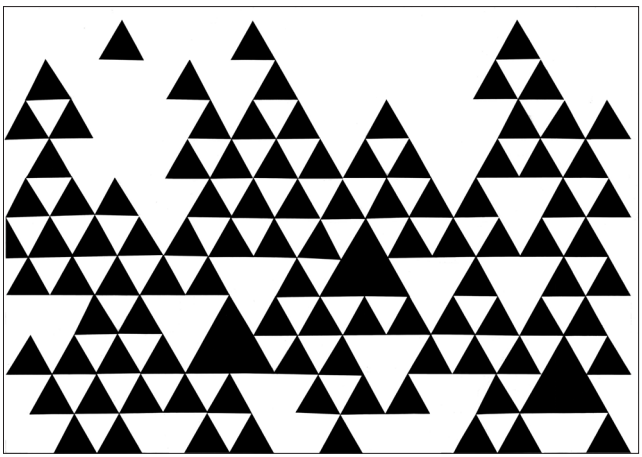

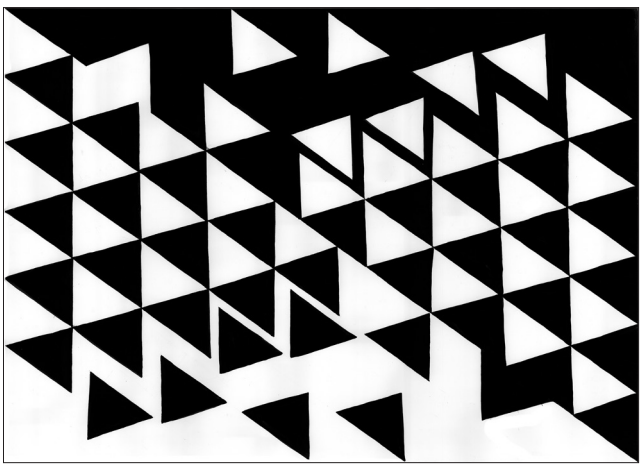

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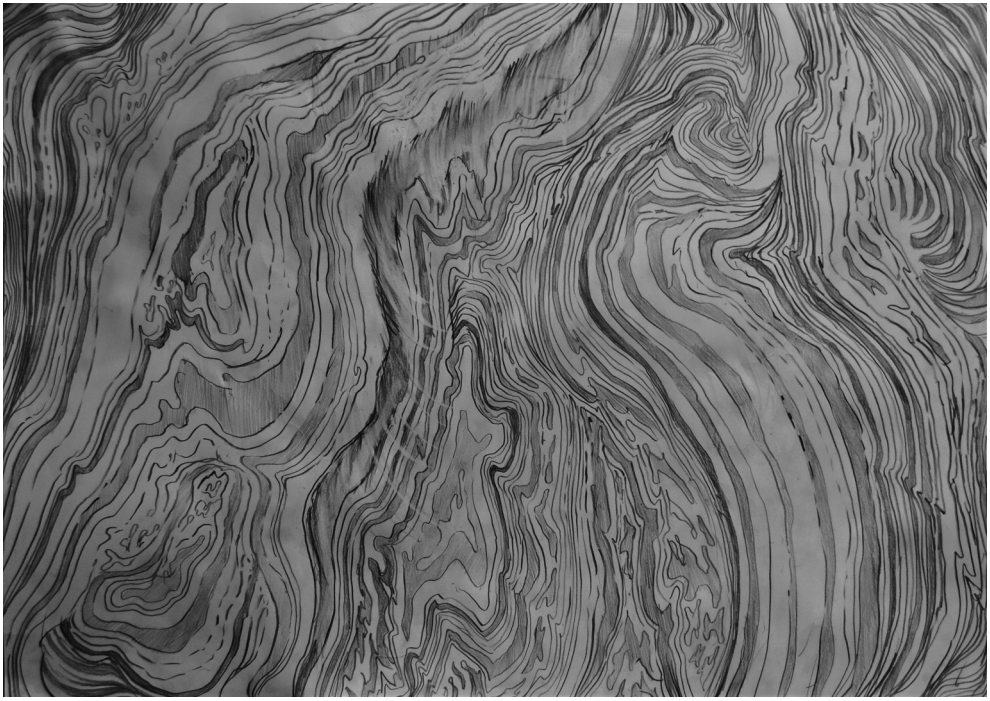

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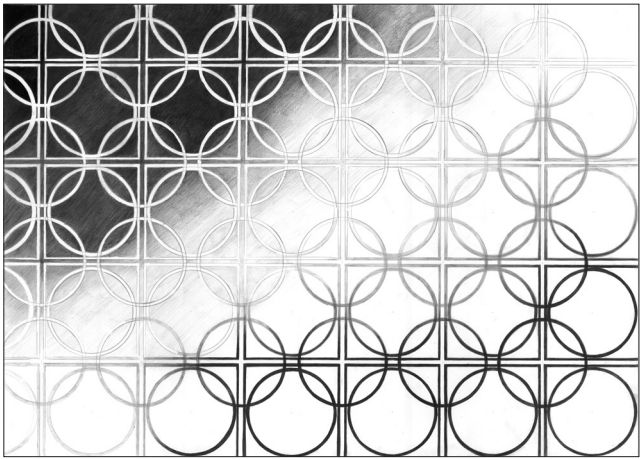

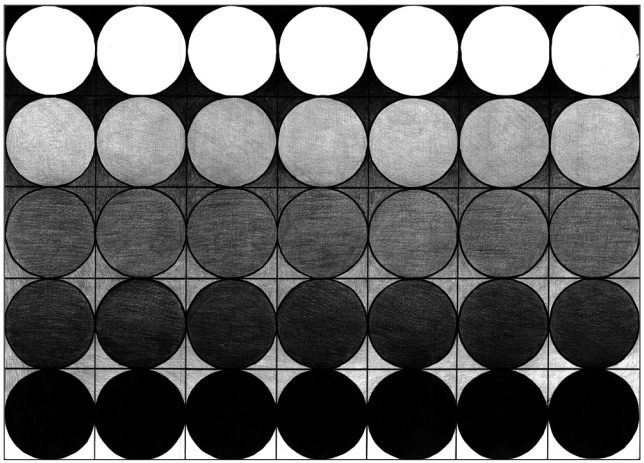

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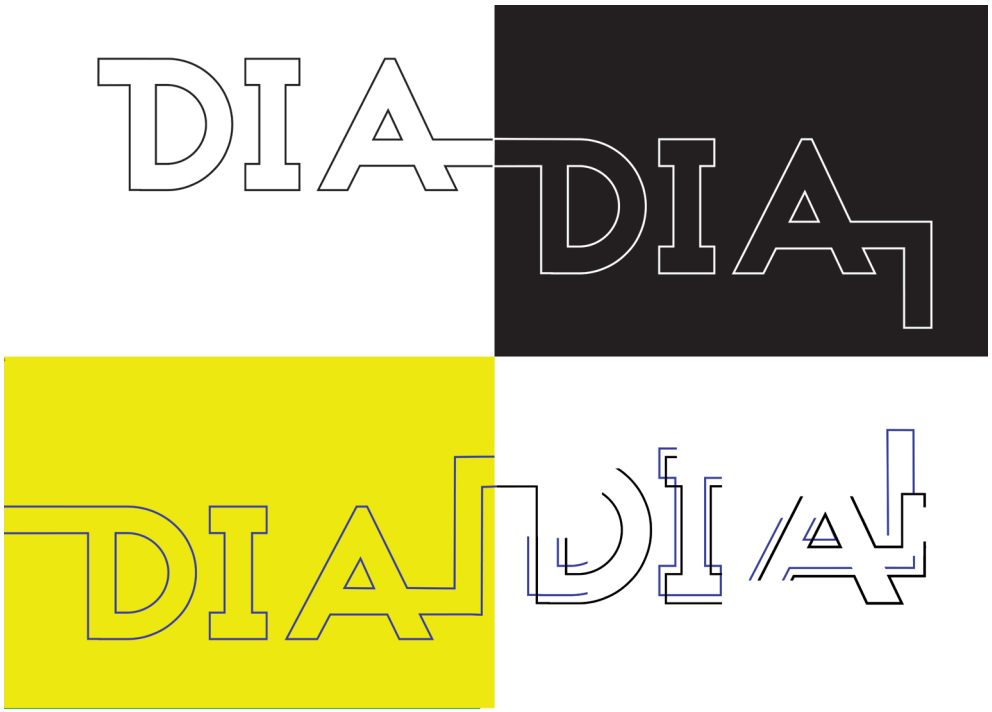

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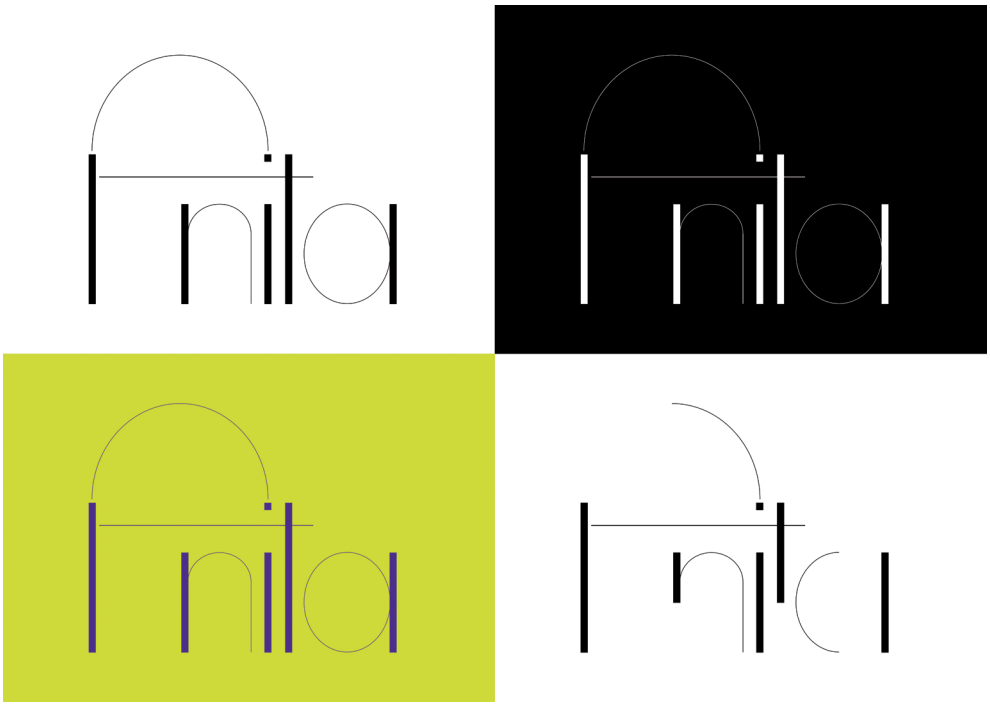

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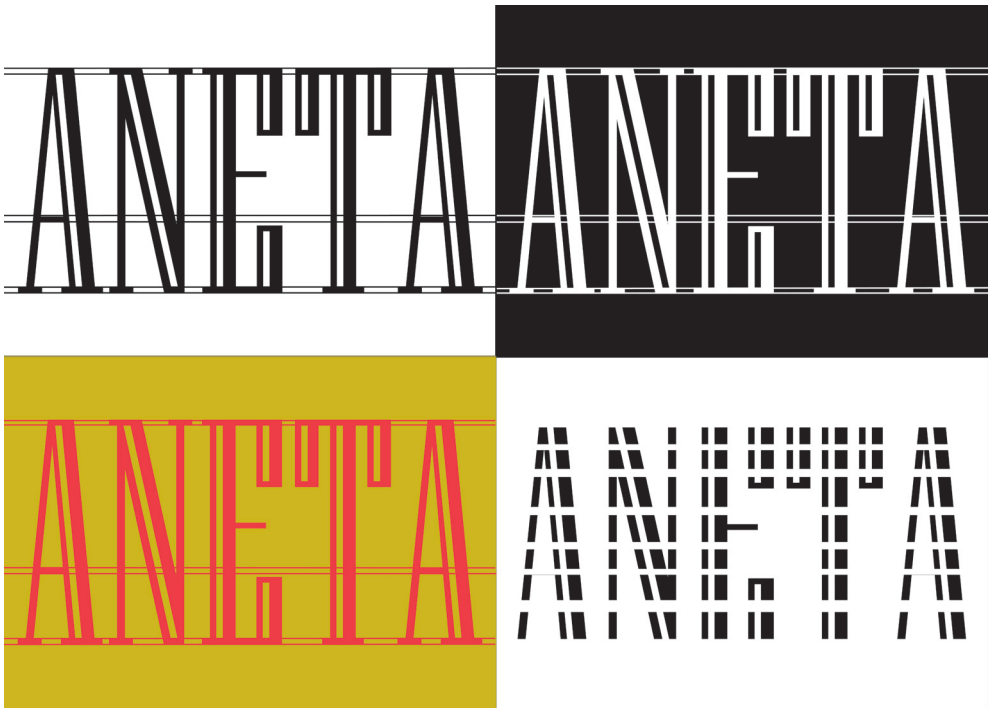

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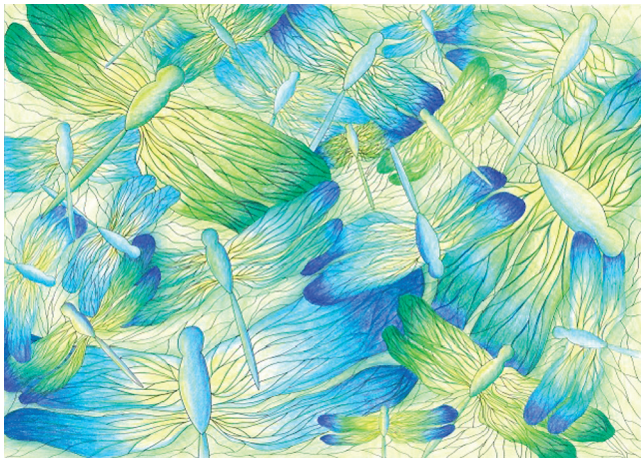

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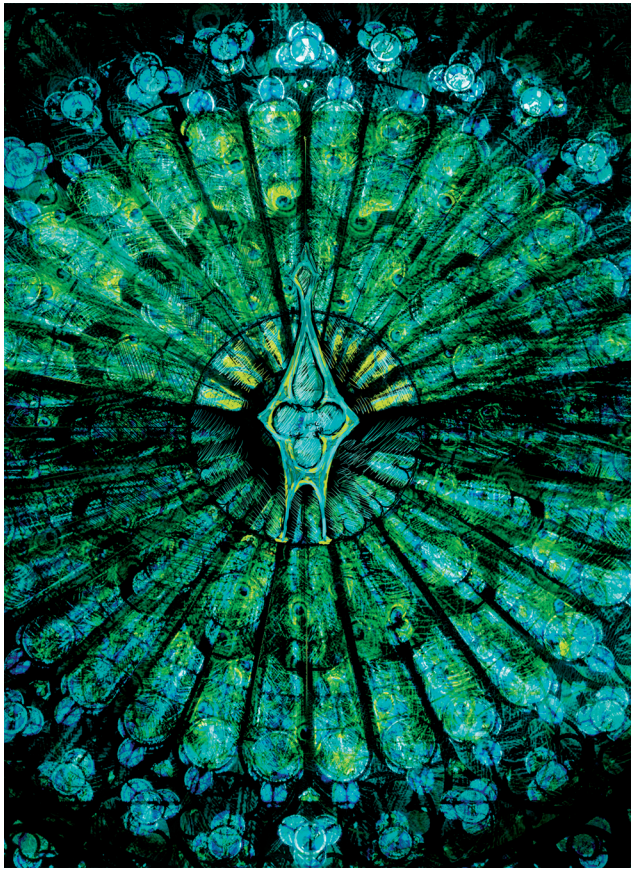

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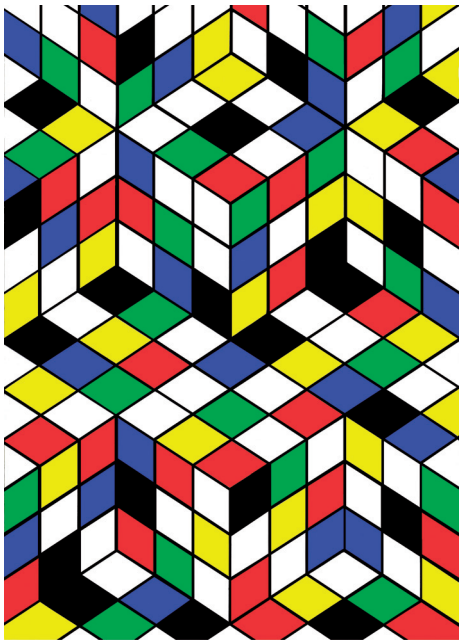

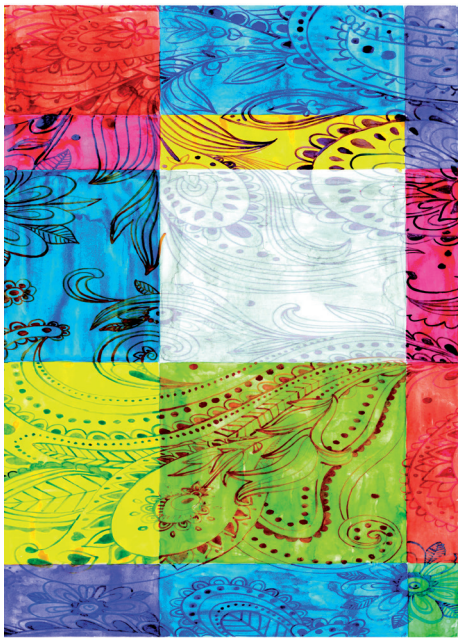

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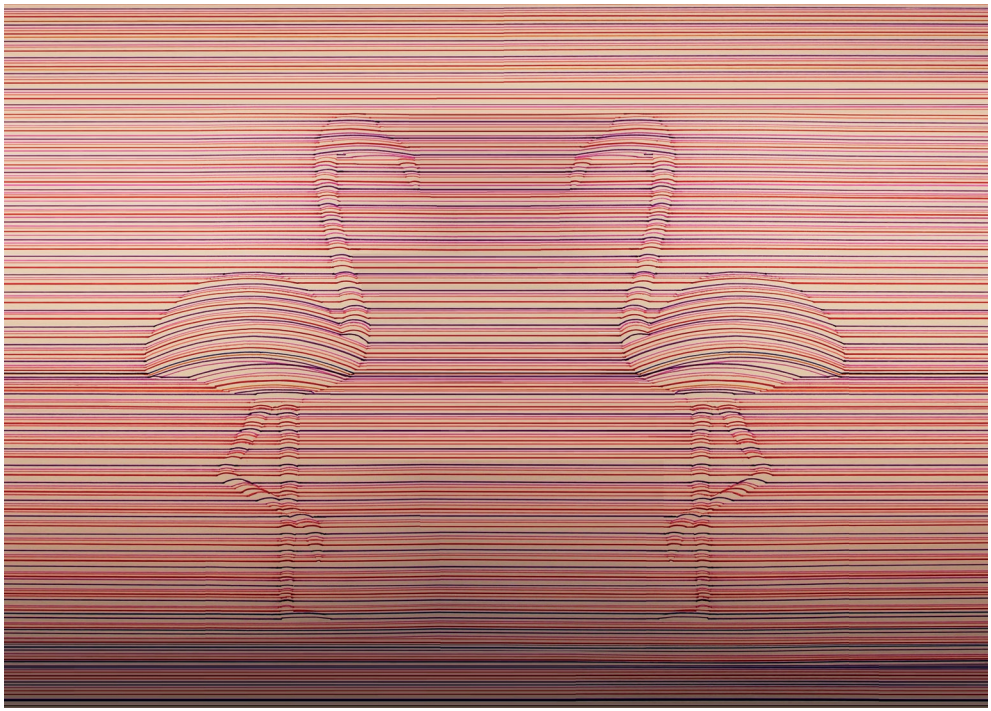

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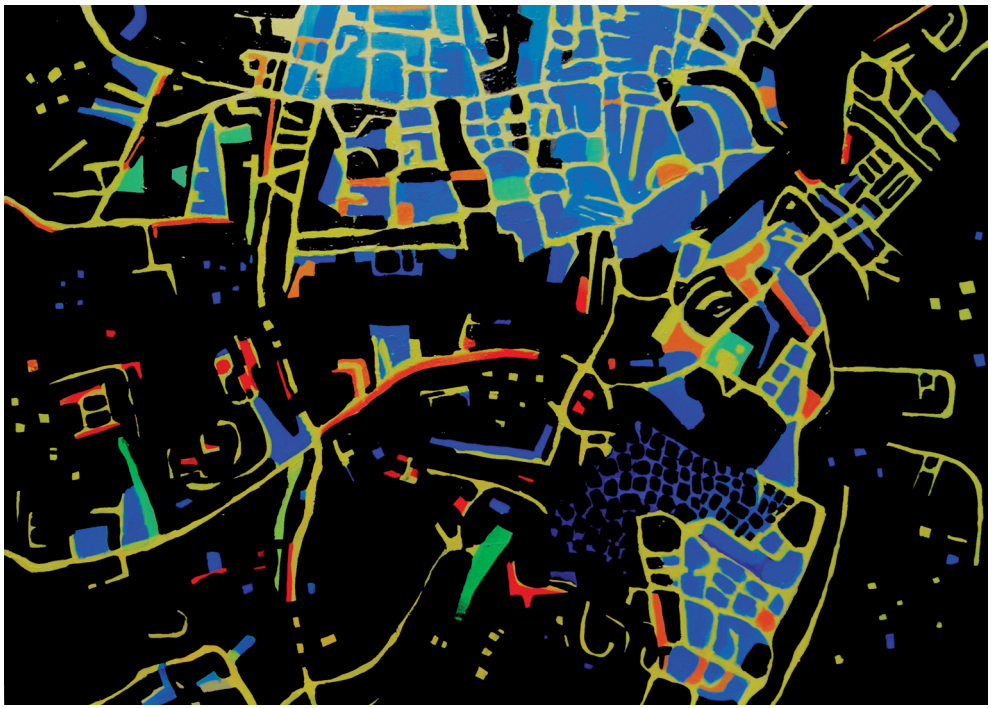

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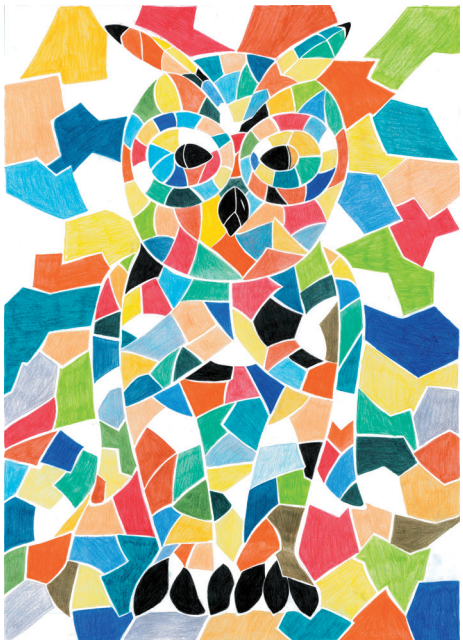

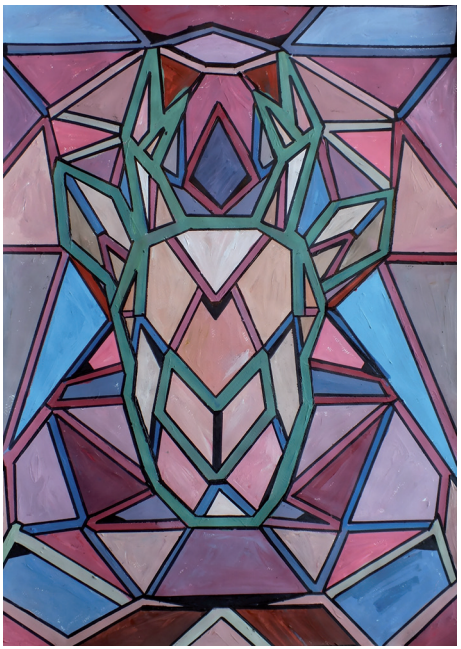

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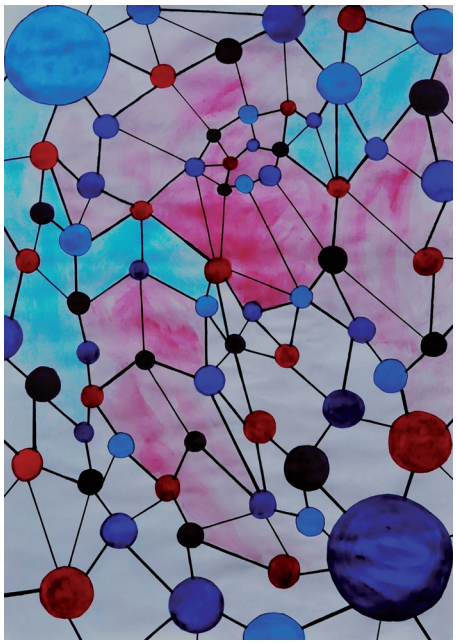

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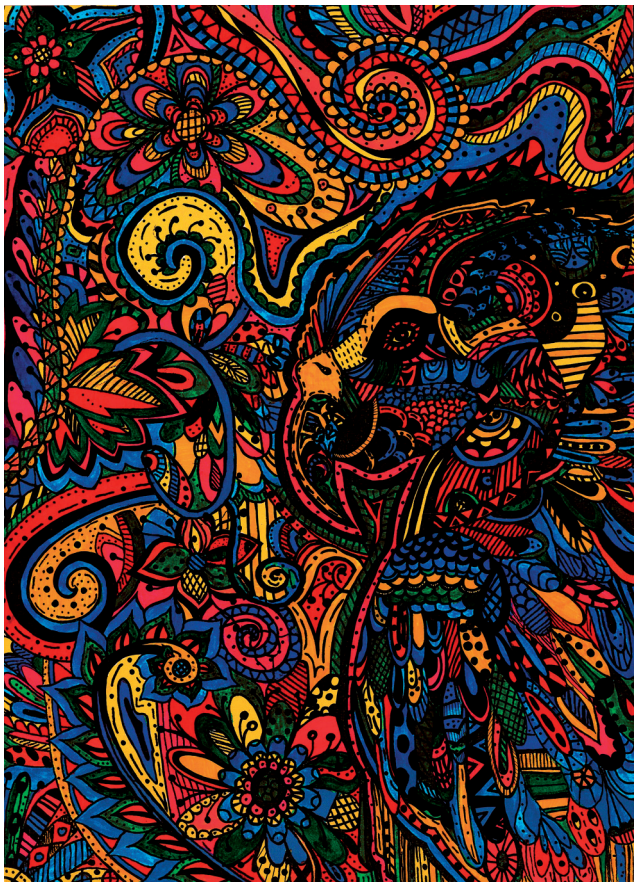

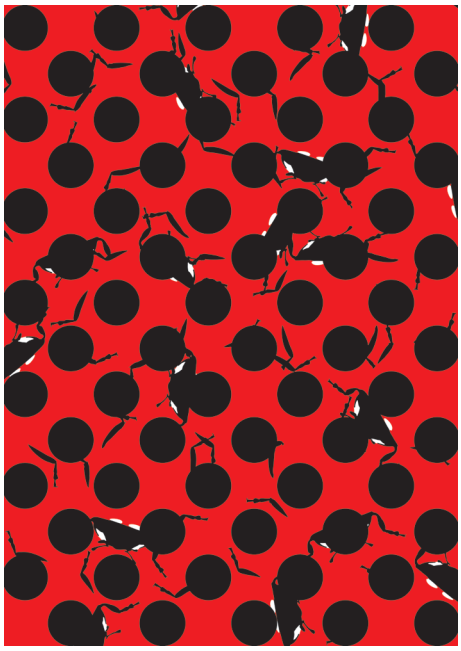

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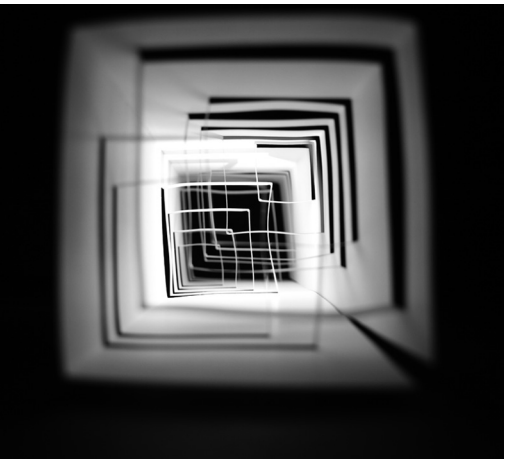

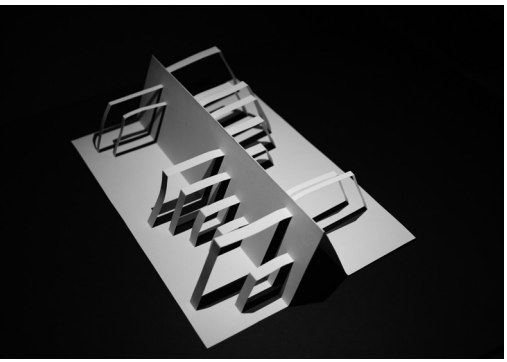

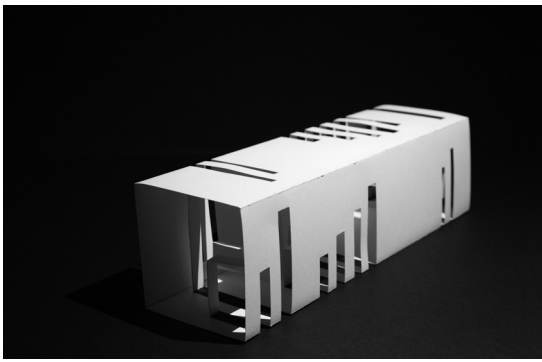

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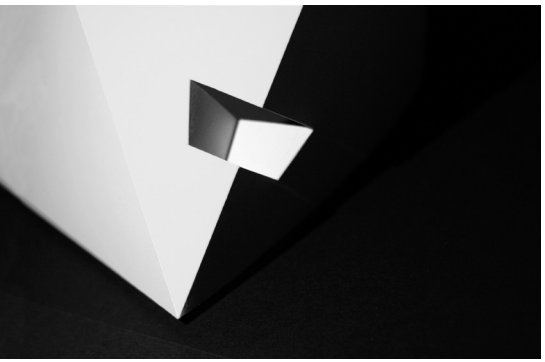
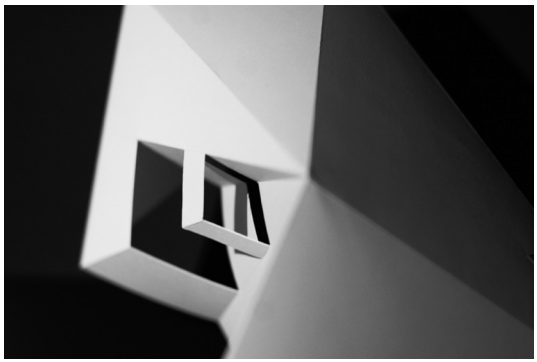
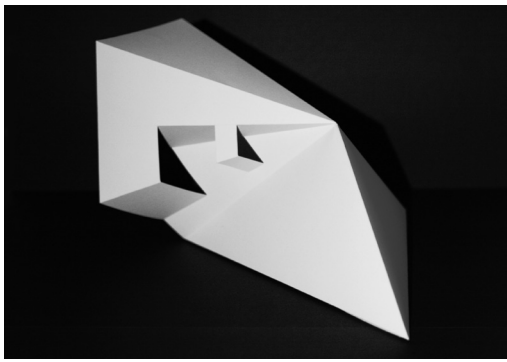

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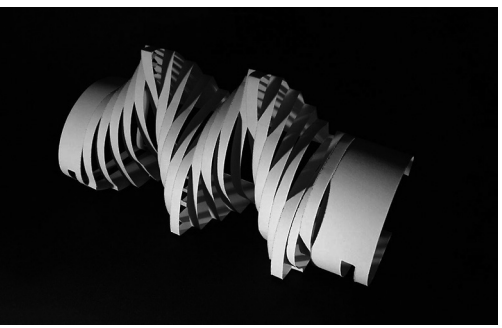

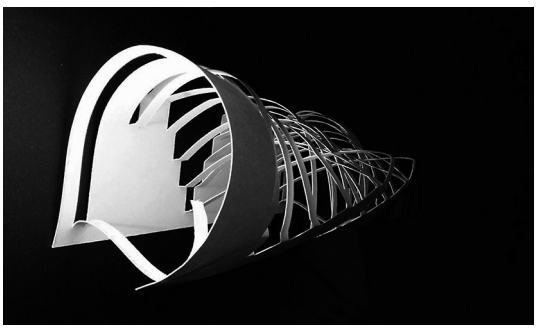

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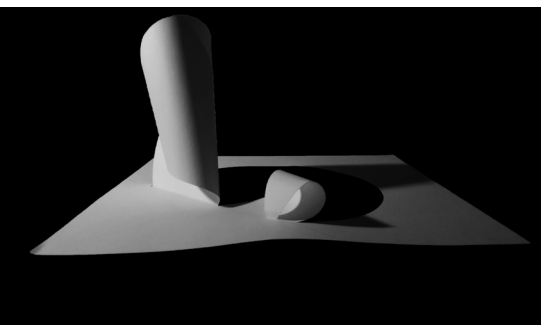
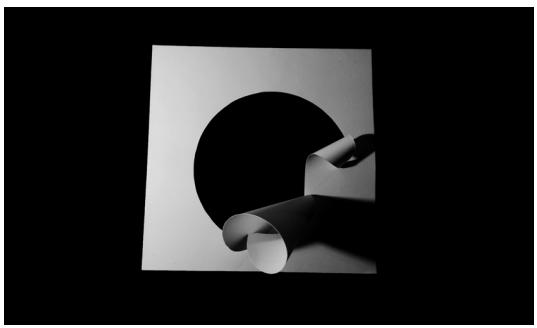
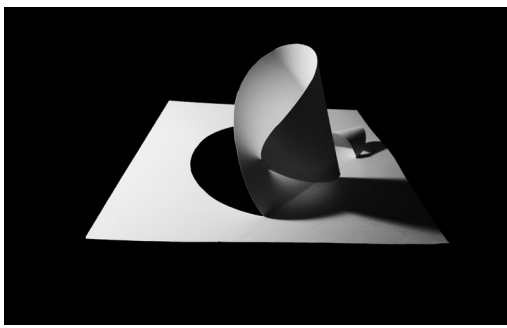

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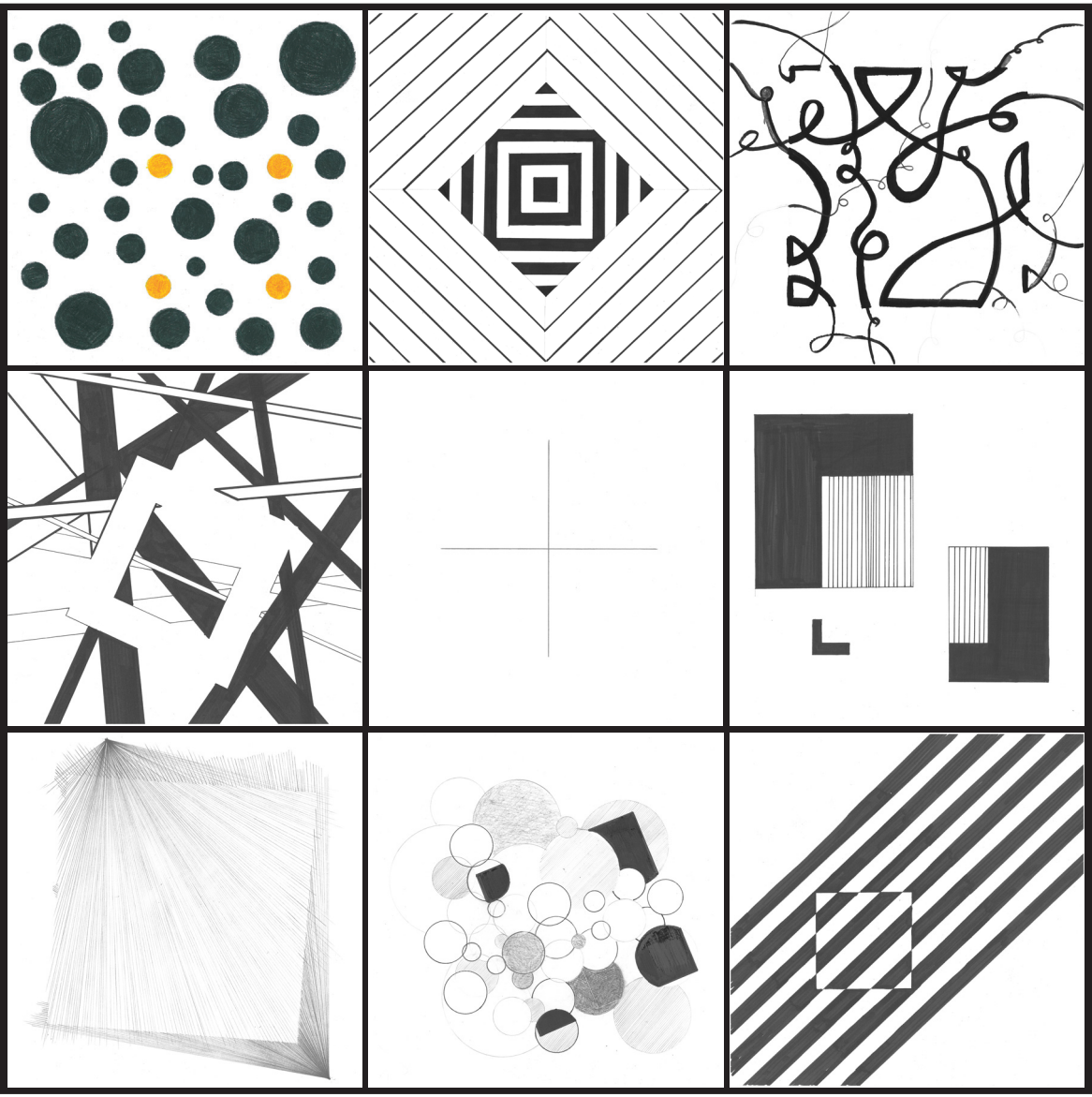
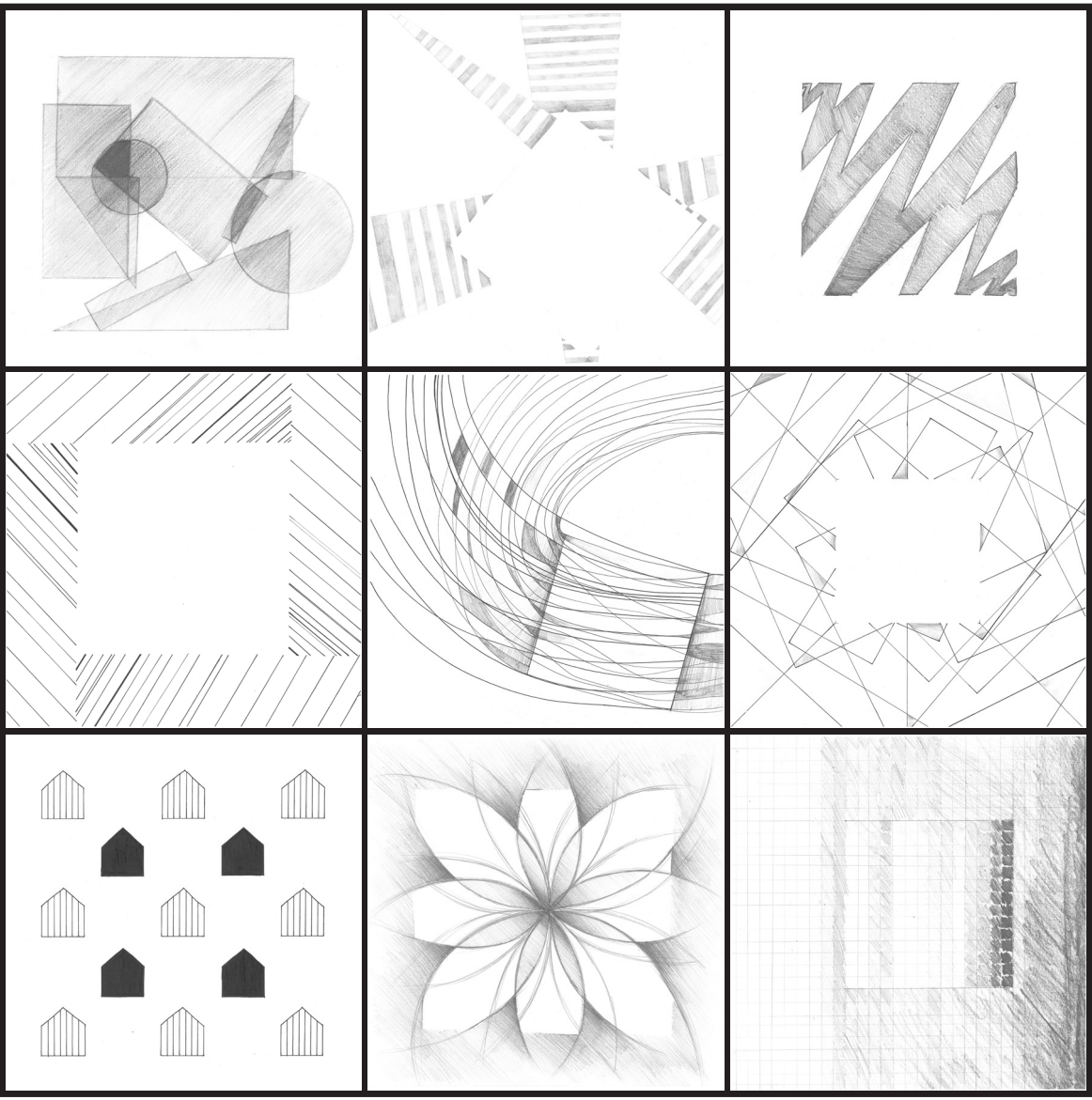




Psychophysiology of visual perception – selected issues

Visual system

The organ of sight enables us to gather a lot of information about the world which surrounds us. We can analyze the observed space, so that we are able, for example, to move safely around in it. The analysis of information collected by the organ of vision leads to the recognition of the world.

The human visual system is equipped with the following senses: sight, hearing, skin sensations, smell, taste and balance. The most important is the **sense of sight**, which consists of a stimulus, i.e. a **wave of light**. This sense organ is the eye in which there are receptors, **suppositories** and **rods**, it is here that impressions, **colour patterns** and **textures** are ultimately created[1].

The human process of seeing begins in the eye. The image captured by the retina is initially processed by it and directed via the optic nerve to the brain. There it is registered, processed and interpreted by respective centers. Thanks to this process, we obtain about 83% of information that reaches us from the environment and as much as 10% of the cerebral cortex is involved in the interpretation of this information[2]. The organ of vision uses both innate and acquired knowledge; the brain analyzes all information to process and interpret it, helping one to understand reality. The process of seeing is both a physical and psychological process.

Vision is a complex physical and mental process, which consists of three stages:

- reception of the stimulus,
- stimulus conduction,
- cognition of the stimulus.

[1] P.G. Zimbardo, "*Psychology and life*". [*Psychologia i życie*, Wydawnictwo Naukowe PWN, Warszawa 2005, s. 227].

[2] http://www.swiatlo.tak.pl/1/index.php/zasada_dzialania_oka-proces-widzenia/

Structure and basic functions of the eye

The light reflected from the viewed object passes through the cornea of the eye, then through the hole in the iris called **the pupil**, then through **the lens** and vitreous body and falls on **the retina**, comprised of light and colour sensitive receptors (cones and rods). Here, the light stimulus is converted into a nerve impulse and is transmitted through the optic nerve to the brain. The iris dilates or narrows the pupil to regulate the amount of light entering the eyeball. The lens focuses the light on the retina, inverting the image. It has the ability to focus on both close and distant objects.

The retina consists of over 100 million photosensitive nerve endings of two kinds. There are rods and cones. There are about 120 million rods, while cones number around 6 million. The rods are distributed throughout the retina, except for the yellow spot, in the center of the visual axis. They are highly photosensitive and mainly responsible for detecting shape and movement. They enable night vision. The yellow spot is a small area lying in the middle of the retina, where the cones are located. This is the area of the sharpest vision, both in terms of colour and detail. Cones are less sensitive to light, however, they have the ability to distinguish colours. They also allow us to perceive small details.

A number of different processes are associated with the eye, such as:

eye accommodation, which consists in the fact that the eye, by focusing the image of a similar object, increases the curvature of the lense. The accommodation of close objects is accompanied by the convergence of the eyes. Changing the shape of the lens, i.e. accommodation of the eye, allows us to see objects at different distances sharply. The lens changes shape, increases or decreases its angle at which light refracts;

convergence, i.e. turning the eyeballs towards the median plane and narrowing the pupils.

Analysis of the vision process – perception function

Human senses interpret reality. The relation between what exists and what we see, hear, touch, feel is not simple. The visual system is the most complex and at the same time the most developed and the most important of all human senses.

Getting familiar with the basic elements of the vision process, such as: light, the apparatus receiving information and the mechanism of processing information coming from the outside into a nerve impulse, is the basis for getting to know the path that information processed into a nerve impulse must overcome to cause a human reaction and stimulate one's mental and intellectual processes. At the first stage of the visual process, sensual sensations occur. This is the stage of processing

perceptions. Then the physical energy of stimuli is translated into nerve codes through transduction / transformation. Impression is a process in which a stimulated sense receptor gives rise to nerve impulses. The result is an elementary sensation. Impressions include the basic elements of experience.

Perception is the development, interpretation, and attribution of meaning to sensory experience. It is an extremely complex set of processes thanks to which we are able to recognize, organize and give meaning to the impressions we receive from external stimuli.

Most psychologists treat an impression as a primitive experience, driven by external data, resulting from receptor activity. However, perception is perceived to be based on brain activity, i.e. the interpretation of material provided by impressions. As Zimbardo notes, there is a secret in the very essence of the sensation, because the question arises: how does physical energy cause a mental experience?

Perception goes beyond sensory processing to understand the reality we experience. It consists of many mental processes. They include synthesizing parts in full, evaluation of size, shapes, distances, estimating the unknown with what is known on the basis of already known features, recalling old experiences. Therefore, the role of perception is to give sense to impressions[3].

Impressions and observations in connection with groups of visual phenomena

The division of types of impressions and perceptions is aimed at better showing the differences between them and linking them to groups of visual phenomena.

Adaptation processes and related impressions

The simplest mental processes include adaptation to light and dark.

Adaptation to brightness – if we leave a dark building in an illuminated space, too much light falling on the retina reduces its photosensitivity, protecting it from irritation.

Adaptation to darkness – if we enter a dark interior from an illuminated space, we see nothing in the first few seconds. There is an increase in eye sensitivity despite the fact that the amount of light is unchanged.

[3] P.G. Zimbardo, "*Psychology and life*". [*Psychologia i życie*, Wydawnictwo Naukowe PWN, Warszawa 2005, s. 225-227, s. 266-300].

The Purkinje effect – consists in changing the sensitivity to colours during the adaptation of the eye to darkness, that is, switching from full-light vision (phototopic, using cones) to vision in low-light lighting (scototopic, using rods); at dusk, the colour sensitivity of the eye shifts towards the blue waves of the spectrum. Blue objects at dusk are brighter than objects of the same brightness in a different colour, e.g. at dusk, red objects appear almost black, and blue ones appear bright; this is related to the transition from full-light vision to low-light vision and to the different sensitivity of cones and rods to different ranges of the solar spectrum[4].

Perception of short-lived and periodically variable lights – this is a merging and flickering of light – at higher frequencies, the phenomenon of merging light occurs. At a frequency of approx 0.1 sec, two glowing sources followed by the phenomenon of transition from one place to another.

Inhibition – delaying the perception process – consists in increasing the difference in brightness between the two values. The phenomenon is the basis of edge contrast.

Irradiation – optical illusion – light objects lying on a dark background seem to be larger. It consists in the spread of one value over another, the irradiation is greater the less sharp the retinal image is, and also when the brightness of the light field is higher or when you look for a longer time.

Glare – a phenomenon that disturbs vision due to the relative excess of luminance in part of the field of view. The eye does not immediately regain its sensitivity, darkness lasts for a split second.

Simultaneous induction – the Van Bezold phenomenon – consists of apparent dimming of colours outlined with a black outline or a black drawing on dimming colours and colours located on a black background. If instead of black there is white, there is an apparent brightening of colours.

Relative impressions in specific visual phenomena

In the group of simple impressions it is about determining the stimulus, noticing its presence without specifying quantitative or qualitative features. In the relative impressions group, however, qualitative features are compared.

Simultaneous, concurrent contrast – optical illusion in that the colour and brightness of the perceived object depends on the background on which the object is placed. In terms of colour, the viewed object tends to take on a complementary colour to the colour of the surroundings, and vice versa, for example, red appears stronger when placed against a green background. Each time we assess

[4]http://encyklopedia.pwn.pl/haslo/Purkyniego-zjawisko;3964617.html

the size and brightness of gray if it is observed simultaneously on two different backgrounds – darker and lighter. The values change in the inversely to the background; they appear lighter on a black background, darker on a white background.

Non-simultaneous contrast, consequent contrast – an optical phenomenon in which after gazing at a shape and then looking away / closing the eyes, the same blurred shape appears in complementary colours, e.g. red, will leave a green-blue image. When observing two surfaces of a different colour in turn, the colour of the next observed surface appears different than it is objectively.

Edge contrast – occurs when the difference between adjacent fields is clearly greater than the threshold value. Then, along the line connecting the fields, the white colour comes alive, and gray colour deepens. The difference between information received based on relative impressions and real information occurs regularly and repeats under the same conditions. The explanation of this issue based on a falsification of information during the transformation of a physical stimulus into a nerve impulse is not very well justified. Nevertheless, such a position is present in psychology textbooks[5].

Strategies of visual perception – unity and persistence of perceptions

Persistence of observations occurs when the perceived object is always the same, despite the fact that the image of the object on the retina of the eye changes depending on the size, shape and location. Repeatedly performed observations, supported by the analysis of features, structures, etc. are saved in memory. They are a kind of base that the mind refers to without the need for further detailed analysis. The lack of stability of perceptions would result in the need to remember changes in all the features of an object, its location, lighting, etc. In perceptive stability, general features recorded in the memory based on personal experience are important. Directional attention, will, memory, ability to associate and draw conclusions from comparing new impressions with previous experiences take part in the process of creating perceptive stability. We distinguish colour stability, brightness, shape, size, distance and position. *Persistence of observations* – concerns the inclusion of an object to the group of persistent observations according to significance – content. Important elements are: memory, ability to compare with a remembered pattern.

Unity of perception – observation of complex and diverse phenomena in terms of content leads to the formation of ways to facilitate the process of perception. Perception using unity occurs when there is no need for analysis. Unities (entirety) can be created based on meaning (ideas) or charac-

[5] Podano za http://pfwasp.blogspot.com/2007/03/psychofzjologiczna-analiza-procesu.html

teristics (colour, shape, size). Perception of an object is always perception of a certain structure[6]. The unity of insights is not dependent on past experience, and the main factor is the appearance of the object, its structural features. The condition for using perceived unities is the ability to think in an abstract way.

Perception is influenced by:

attention – this is a type of concentration that allows one to focus on selected stimuli. It depends on the relationship between the direction of human activity and the direction of one's mental processes,

preparatory attitude – appropriate preparation through acquired knowledge,

needs and values – the phenomenon of overestimating the value of an object,

personality – our attitudes, interests and desires can influence our perceptions.

The reception of visual information is influenced as well by internal conditions: needs, emotions, knowledge, gained experience, thinking and external conditions of the visual context.

The processes of integrating sensory information so that they form a coherent image are referred to as perceptual organization processes.

There are several rules related to perception derived from character theory[7]:

The principle of proximity – states that the elements lying close together are perceived as one whole. For example, the string of dots gives the impression of the line.

The principle of similarity – elements separated by the same distance are combined together based on one or more features: colour, shape, size. An example of this principle is a column of people.

The principle of continuity – elements moving in one direction are perceived as a homogeneous group.

[6] Podano za http://pfwasp.blogspot.com/2007/03/psychofzjologiczna-analiza-procesu.html

[7] The fundamental assumption of Gestalt psychology (*German: Gestaltpsychologie, Gestalt psychology*) is to treat mental life, and especially cognition, as an inseparable whole whose all components are interdependent and mutually conditioned; the „concept" is deemed the basic concept, meaning structure, in which the existence of each element justifies its significance in the construction of the whole.

The closing principle – also called the good figure principle. With incomplete figures – the sides in the square are not connected – we can see the closed figure. Cloud-shaped animals are seen on this principle. Gestalt's approach to shape perception – psychologists have stated that the whole is considered to differ from its individual parts, which is important for understanding how we perceive groups or parts of objects to create integral wholes. According to the law of desire, we tend to perceive each visual set in a way that simply organizes different elements. The principles of proximity, similarity of continuity, closure, and symmetry help us to perceive shapes.

Depth

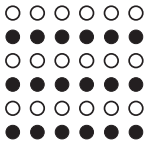
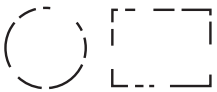
There are many sources of depth information. They all integrate into a uniform, three-dimensional interpretation of the environment. Our visual system uses them automatically[8].

Image indicators: relative size, surface gradient and linear perspective.

- Relative size – the closer object projects a larger image and the smaller one (the rule is called the ratio of size to distance) – depth indicator.
- The linear perspective is a depth indicator based on the relationship between size and distance. Lines parallel to each other that move away on the retina converge into one point on the horizon. This fact was discovered by Renaissance painters around 1400, from which point they were able to convincingly convey depth in the paintings. The application of Euclid's geometry to create the illusion of depth was first developed by Brunelleschi.
- Surface gradient is another type of visual depth indicator. Images that have the same texture tend to be smaller at a greater distance because they are projected onto a smaller retinal image. The gradient results from the ratio of size to distance, e.g. identical tiles on the floor – the elements lying further seem to be smaller than those lying close to us despite being the same.

[8] Ibidem, Zimbardo p. 294-95.

Table 1. Principles of visual perception and their illustrations (Gestalt theory)[9]

Figure – background	when perceiving a particular visual field, some objects appear to be extracted (figures) while others move backwards (background)..	
Proximity	when we perceive a set of objects, we tend to group them.	0 00 00 0 
Similarity	the view of a large number of elements leads to their grouping on the basis of similarity.	
Continuity	looking at several elements, we tend to perceive these gently changing or continuous ones, and skip intermittent, discontinuous shapes.	S+ / =& S / = + &
Closure	seeing objects that are not closed, we tend to close or complete them.	
Symmetry	seeing many objects, we tend to perceive objects as creating mirror images more or less in the middle, we integrate symmetrical elements into consistent objects.	{ [ ] } < ( ) >

[9] On the basis of: R.J. Sternberg, [*Psychologia poznawcza*, WSIP, Warszawa 2001, p. 107].

The perception of shape

Rudolph Arnheim describing the perception of shape notes that every visual sensation is set in a time-space context. What is important, therefore, is what we see next to the objects we are viewing, and what we have seen in the past. Our experience counts in this context. This shows how important the suggestion is. If we suggest something, the viewer will probably see it.

In the three-dimensional perception of the world, various rules help us, ie. one eye depth perception tips:

- larger objects appear closer, while smaller ones appear further away,
- coarse granularity seem more remote, smaller granularity seem closer together,
- linear perspective – parallel lines seem to diverge as they move away from the horizon, while as they approach it they tend to converge.

Some basic principles of perception are used by architects and artists who have the knowledge of how to look at two-dimensional images and lead us to three-dimensional perceptions. An example would be the perception of eternal stairs that are still climbing up. This is one aspect of the impossible figures. It consists in misleading the viewer through contradictory depth instructions from various parts of the picture. For sometimes we do not perceive what actually exists. Nevertheless, sometimes we perceive something that is not there. Visual illusions rely on suggestion - the mind receives sensory information and then manipulates it to create mental representations of objects, features and relationships in space.

The world is full of ambiguous data

When the senses deceive us by causing inaccurate sensations of the stimulus system, we experience illusion. Misinterpretation is shared in the same perceptual situation by most people because it is a function of distorting the information we receive from the sensory pattern. Illusions occur more often if the stimulus situation is ambiguous, so there is no key information, there are no known patterns, the ingredients are in unexpected relationships. The first scientific analysis of illusions was published in 1854 by the German physicist Johann Joseph Oppel.

compare with

The presented example shows an optical illusion - the string of lines seems to be longer when divided into parts than when only the stripes at opposite ends are shown. Illusions indicate a discrepancy between perception and reality[10].

Figure and background

In 1915, Danish psychologist Edgar Rubin published a drawing that later became popular as a face-vase illusion. Ruby's illusion consists in the ambiguity of the figure and the background.

Quickly distinguishing a figure from the background is relatively simple for the human brain under normal circumstances, however, in special circumstances, the brain may have a problem with that. The observer sees either a white vase against a black background (white becomes a figure) or two black profiles against a white background (black becomes a figure). The perception of a given shape depends on which part of the contour will be recognized by our perception system as part of the figure. The observer's point of view, his internal attitude or suggestion can also have an impact on the resolution of the ambiguity. There is no doubt that Rubin's illusion occurs through higher cortical processes. The observer's brain must associate the shape with knowledge of vases or profiles to be able to see them.

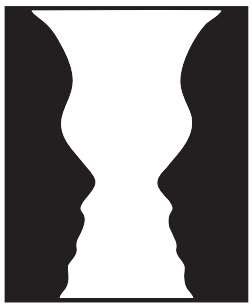


Fig. 1. Face-vase, ambiguity of the figure.

Source: Drawing by Zofia Romaszko based on http://semiomiks.blogspot.com/2011/05/gestalt-oraz-figura-i-to.html

[10] R.L. Sternberg, "*Cognitive Psychology*". [*Psychologia poznawcza*, WSIP, Warszawa 1999, p. 99].

Edgar Rubin stated that we are inclined to see the perimeter as a figure and the perimeter as a background. As a figure, we are also inclined to see a smaller area. The perimeter figure has a higher „density" than the background. If we divide the picture horizontally, this figure seems to be an area lying below.

Table 2. Figure and background – distinguishing features[11]

Figure	Background
has a certain shape	is perceived as something shapeless
seems to „stick out from the background"	seems to stretch behind the figure that does not „break" the background
is perceived as a thing	is perceived as a uniform mass
seems to be brighter, but in the case of black and white images, it is sought in dark elements	seems to be darker, but for black and white images, it is sought in bright elements
is more expressive, easier to remember and more „sensible"	

Among the organizing processes we can also distinguish:

- Reference framework
- Spatial and temporal integration;
- Movement perception
- Stability of observations.

Optical illusions

Optical illusion is a misinterpretation of the image by the brain under the influence of contrast, shadows, the use of colors that automatically put the brain into an incorrect pattern of thought. Illusion results from the mechanisms of perception that usually help in perception. Under certain conditions, however, they can make real impressions only by appearance.

We distinguish:

1. optical illusions deforming the shape, size, length, on the example of a cafe wall, Ponz and Poggendorff illusion,

[11] Principles of Gestalt visual perception R.L. Sternberg. [*Psychologia poznawcza*, Warszawa WSIP 1999, p. 107].

2. illusion caused by the physiology of the visual system: Mach band, Herman mesh, irradiation: visual illusions: geometric illusions, black and white systems causing the impression of movement,
3. illusions of brightness and colour, the colour and brightness of the perceived object depends on the background, in terms of colour the object tends to take on a complementary colour to the ambient colour and vice versa - red appears stronger on green, contrast is followed by contrast,
4. ambiguous figures: figure and background, Necker's cube,
5. impossible figures.

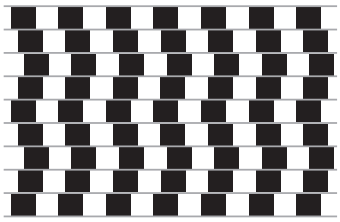
Examples of using optical illusions

The Parthenon.
Source: iStock; ID: 168312588

The Parthenon is the most famous temple of the Athenian Acropolis. During the erection of the Doric building, a number of innovative solutions were introduced, including visual effects that were applied - vertical and horizontal curvatures aimed at correcting optical illusions. The corner columns were slightly inclined towards the center of the building, at the same time the diameter of their drums was increased. In this way, the spacing between the columns in the upper part was reduced. Such a procedure made it possible to arrange triglyphs above the center of columns and intercolumns in accordance with the principles of Doric order.

The illusion of perfectly vertical columns was obtained, inter alia, by binding them at the corners with two triggering elements touching each other. To maintain the impression of a perfect vertical position of the columns, entasis was used, ie bulging at two-fifths of the height of the core structure (stem). This treatment eliminated the optical illusion causing the impression of concavity of columns and deflection of the entablature. Also used was the bulging of the entablature and the stylobath on which the temple was placed.

Café wall illusion (England, St. Michael's Hills, Bristol) was noticed and described by prof. Richard L. Gregory and Priscille Heard in 1979. All gray lines are parallel to each other.

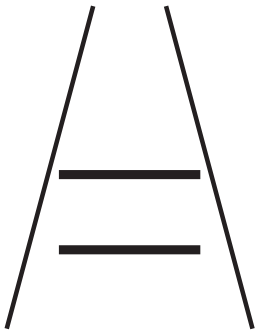


Source: Drawing by Zofia Romaszko based on https://pl.wikipedia.org/wiki/Z%C5%82udzenie_optyczne#Z.C5.82udzenie_.C5.9Bciany_kawiarni

Ponzo illusion – the upper horizontal line appears longer than the one below. This is because the drawing resembles a railway track distorted by perspective. The law of constancy of magnitude also works here, according to which we subjectively perceive objects lying at different distances from the observer and a similar shape as the same, although the objects lying further down are smaller on the retina.

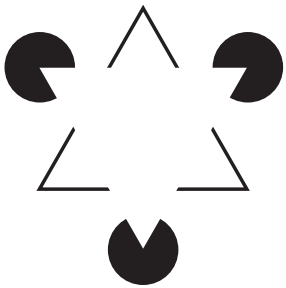
Converging lines add a dimension of depth. The distance indicator gives the impression that the higher line appears to be longer than the underlying line although they are the same length.

The closer object projects a larger image on the retina, and the further one a smaller one.



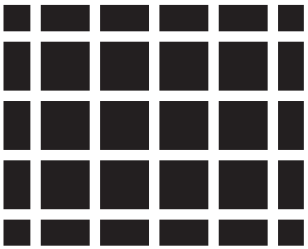
Source: Drawing by Zofia Romaszko based on https://www.google.pl/search?q=z%C5%82udzenie+ponza&client=firefox-b&tbm=isch&tbo=u&source=univ&sa=X&ved=0ah

The Kanizsa Triangle – an optical illusion described by the Italian psychologist Gaetano Kanizs. A white triangle appears in the middle of the figures (with the vertex pointing downwards), although in reality it is not drawn. Such an illusion is called a *subjective* or *illusory* contour. This triangle also appears to be brighter than the surroundings, however this is also a false impression, because the white in the drawing has a uniform brightness.

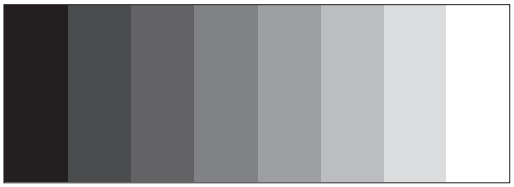


Source: Drawing by Zofia Romaszko based on https://www.google.pl/search?q=tr%C3%B3jk%C4%85t+kanizsy&client=firefox-b&tbm=isch&imgil=OzKKhtW0cBYVFM

Source: Drawing by Zofia Romaszko based on https://pl.wikipedia.org/wiki/Z%C5%82udzenie_optyczne#Z.C5.82udzenie_.C5.9Bciany_kawiarni



Source: Drawing by Zofia Romaszko based on https://pl.wikipedia.org/wiki/Z%C5%82udzenie_optyczne#Z.C5.82udzenie_.C5.9Bciany_kawiarni



Source: Drawing by Zofia Romaszko based on https://pl.wikipedia.org/wiki/Z%C5%82udzenie_optyczne

Irradiation. The white square against a dark background appears larger than the black square against a light background, although both are the same size. This is because the field of physiological irradiation on the retina occupies a larger area than the size of the perceived image in reality, and this is in turn due to the fact that the receptors on the retina are connected into groups.

Herman's grid. An illusion that works at the sensory level. When we look at the center of the grid, dark, blurry spots appear at the intersections of white stripes. When we focus on one of the intersections – the stain disappears. When we move our eyes, the spots jump, move and blink.

Gray dots appear at the intersections of white stripes. This is the result of collateral inhibition – a nerve fiber that conducts excitation from the intersection of white stripes.

Mach bands (Mach bands effect) – this is the property of human sight discovered by Ernst Mach in 1865, which is manifested in the perception of non-existent bands and changes in the brightness of neighbouring areas differing significantly in brightness. This effect was described in detail i n 1972 by F. Ratliff in the work *Contour and Contrast*.

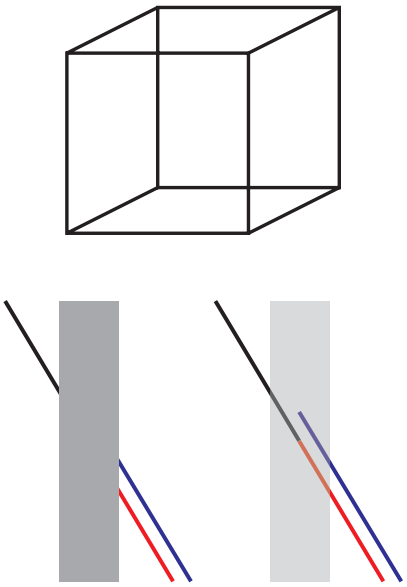
The physiological process explaining this phenomenon is collateral inhibition. The edge of the white surface adjacent to the black appears lightened, and the edge of the black darker. This is due to lateral inhibition on the retina – the

contrast between light and dark planes when they are adjacent is increased.

Necker's cube. In 1832 the Swiss scientist Louis Necker published engravings depicting a cube that changed its position when viewed. This stemmed from the fact that all depth guidance was removed from the illustration. Looking at Necker's cube, we can see the line layout, but we expect to see the cube. Our brain must therefore resolve a certain ambiguity - it must determine which corner of the cube lies closer. The solution to this problem may be different for different observers, as well as may change in time with one observer.

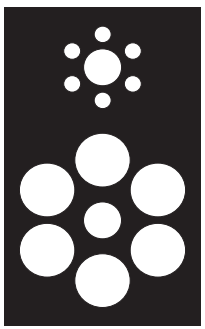
The ambiguity of the Necker's cube comes from a depth dilemma. It can be seen that depth perception requires interpretation of sensory input material, which may turn out to be wrong. The way the image will be interpreted is the result of many sources of information regarding distance, among others (image indicators, motion indicators, binocular indicators)[12].

Poggendorff's illusion occurs when the part inside the rectangle is removed from the line crossing the oblique rectangle. It appears then that both parts of the line do not lie on one straight line.

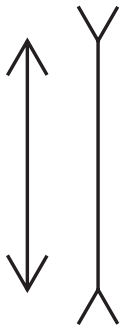


Source: Drawing by Zofia Romaszko based on https://pl.wikipedia.org/wiki/Z%C5%82udzenie_optyczne

Delusions caused by figures from the environment



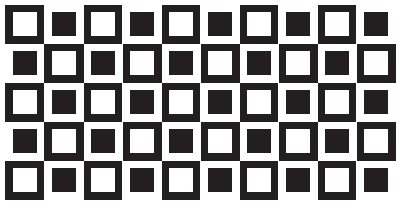
Ebbinghaus illusion



Muller-Lyer illusion

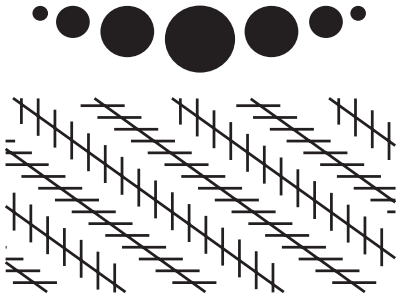
[12] S. Zimbardo, ibidem p. 293.

Illusions caused by colour contrast



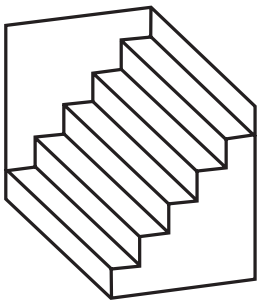
Source: Drawing by Zofia Romaszko based on https://pl.wikipedia.org/wiki/Z%C5%82udzenie_optyczne

Delusions caused by a special arrangement of figures

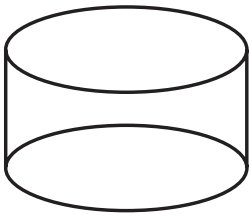


Zoellner illusion

Delusions caused by different interpretations of concavity and convexity

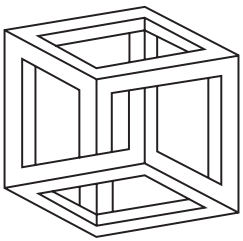


Delusions caused by different interpretations of the figure's transparency or opacity

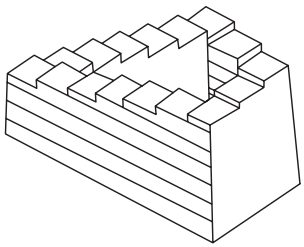


Source: Drawing by Zofia Romaszko based on http://www.matematyka.wroc.pl/book/z%C5%82udzenia-optyczne

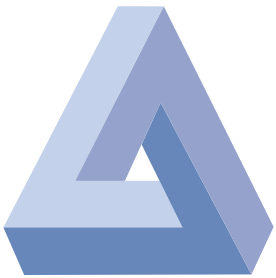
Impossible figures



Necker's cube



Stairs to nowhere



Penrose triangle

Colour perception

Colour „is an attribute of visual sensation that can be described by the amount of shade, intensity and brightness that it possesses"[13]. The author points out that this definition introduces a subjective element to the visual and objective experience because it quantifies the stimulus that this experience evokes. At the same time, it shows only to a small extent how these subjective and objective aspects of colour relate to each other. From the time of Newton, science and art were most often treated separately, and yet, as the author writes, this view overlooks many of the most intriguing aspects.

The phenomenon, which for most of us is an elementary sensory experience, has been considered for years from various points of view. It has been a topic of research and study and a number of colour theories have been created.

One of the most important features of the human visual system is the fact that the sensations of shape, location, colour and depth are based on the processing of the same sensory information. Colour is a feature of every object, as is its shape, weight, etc. However, it is specific because it is changeable, different on a cloudy day, different when the sun shines. We see it differently in artificial light and differently in natural light. These changes are sometimes very subtle and we do not even notice them, attributing to the object an already permanently remembered colour. There are many factors that affect how we perceive a given colour at a given moment and they have been included in certain rules, but actually seeing colours is a subjective process. Contrary to appearances, colours do not exist in objects that we only look at in our minds. Sir Isaac Newton proved this in 1671. Therefore, the light rays are not coloured. Colours are the psychological property of our sensory experiences, they are created when the brain processes information encoded in a light source. Seeing colour is one of the best-known aspects of our visual experience. The colours we see are the result of rays of a certain physical wavelength, eg violet and blue - shorter, and red and orange - longer. White sunlight combines these same wavelengths. The prism separates them into separate wavelengths. The colours are arranged in a similar way. Complementary colours were placed opposite each other. Mixing complementary colours gives neutral, gray or white light in the center. The most similar colors lie next to each other. Their order reflects the order of colours in the solar spectrum. Red, yellow, green and blue are pure colours. Directly opposite colours are complementary colours. An interesting aspect of complementary colours is the phenomenon that arises when we look for

[13] J. Gage: "*Color and meaning, art, science and symbolism*". [*Kolor i znaczenie, sztuka, nauka i symbolika*. Universitas, Kraków 2010, s. 11 za R.W. Burnham, R.M. Haines, C.J. Bartleson: *Colour A Guide to Basic Facts and Concepts*, 1963, s. 11].

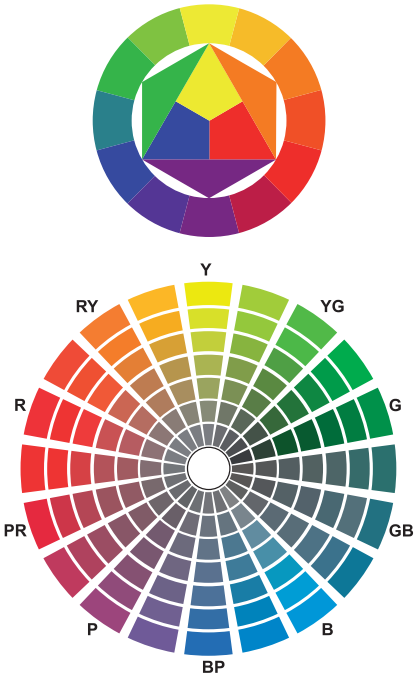


Fig. 2. Colour wheel.

Source: Drawing by Zofia Romaszko based on http://historiasztuki.com.pl/NOWA/30-00-01-KOLOR.php

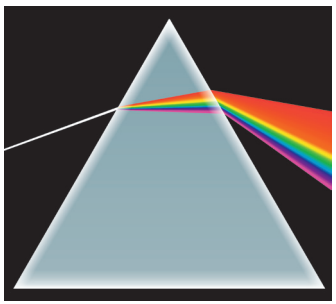


Fig. 3. Newton's prism, light splitting.

Source: Drawing by Zofia Romaszko based on http://historiasztuki.com.pl/NOWA/30-00-01-KOLOR.php

a long time at an object with a vivid colour, and then we move our eyes to an object with a natural colour.

Then we can observe the complementary colour, i.e. afterimages. We describe colour sensations in terms of three basic dimensions of light perception:

Quality – a dimension capturing the basic colour of light in terms of the wavelength acting on the eye. The mental experience of colour corresponds to the physical dimension of the wavelength of light.

Saturation – a psychological dimension capturing the purity and liveliness of a colourful experience. Non-mixed colours have the highest saturation. „muted" colours have a medium degree of saturation.

Brightness – a dimension related to the intensity of light. White has the highest brightness and black the lowest.

The human perception of the colour of a given object object depends on a comparison with the colours of other objects that are in the field of view as well as on the colours remembered and on the names by which the colours are determined.

The following terms are assigned to colour:

- Hue (shade, tone) which is what we colloquially refer to as colour (e.g. red, green or yellow);
- Saturation – when the saturation of the colour is reduced to zero, regardless of the colour tone, a white colour is obtained;

- Brightness - when the brightness is reduced to zero, regardless of the colour tone, black is obtained.

The colours are divided into chromatic and achromatic. Achromatic colours are white and black as well as all intermediate colours between them, referred to as degrees of gray. All other colours are referred to as chromatic colours.

How does it happen that we see objects in different colours? When light falls on an object, part of the light beam penetrates the body structure and the other part is reflected as diffused. The proportion of reflected light to the light absorbed by the object determines what colour we see and which waves from the spectrum are in the group of reflected waves and absorbed waves. Two factors affect this proportion - the type of material of the object and the type of light that falls on it.

Isaac Newton discovered in the 1660's that colours are simply the result of different refractions of white light. When a ray of light passes through a triangular prism, red is refracted to the smallest and violet to the largest extent. The scientist divided the prismatic spectrum into seven chromatic areas.

Colour is a carrier of a certain „power" through which it affects the recipient. However, this impact should be considered in the context of the environment in which this colour is located. Even at great distances of the viewer from the object, the strongest effect is yellow on a black background, which is often used in road communication signs.

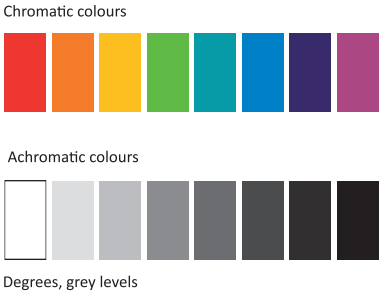


Fig. 4. Chromatic and achromatic colors.

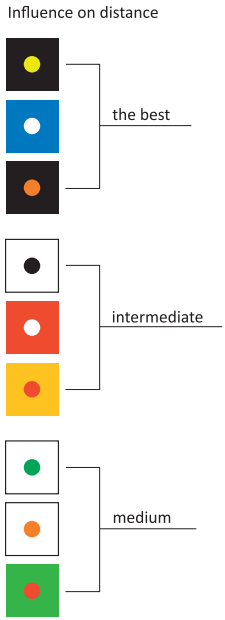


Fig. 5. Colour scheme according to their distance operation. Summary showing the influence on distance from the best to medium range.

Source: Drawing by Zofia Romaszko based on https://aspka-towicepsychofizjologia.wordpress.com/2014/12/18/barwa/

Division of colours

Colour-related problems concern two fields of art and science. The colour is considered as pigment or light. Studies of physicists have allowed for systematizing knowledge, describing mutual relations and introducing uniform terminology. Adopting the basic division, we distinguish three categories of colours: chromatic, achromatic and monochrome. Chromatic colours are divided into basics, as they occur in the visible light spectrum. They are so-called rainbow colours: purple, blue, green, yellow, orange, red.

For the painter, however, simple colours are yellow (lemon), red (carmine) and blue (ultramarine). In contrast, orange, purple, green are derived colours resulting from the combination of primary colours.

A mixture of colours:

- red and yellow make orange,
- red and blue make purple
- blue and yellow make green.

Simple colours belong to contrasting and pure colours. By mixing several colours we get broken colors. Each of the colors contains color, temperature and value transitions. The colours lying opposite each other on the colour wheel are complementary colours.

Therefore, the basic complementary colours are:

- yellow and purple,
- red and green,
- orange and blue.

At the same time, there are contrasting colours, also found in derivative colour systems. The widest palette of complementary colours belongs to complex colours.

We can distinguish:

- light colours - the range from bright greens to bright reds,
- dark colours - from green through purple to red.

This division is also a designation of warm (active) colours and cold (passive) colours.

Studies have shown that colour affects the perception of various features of an object, affects its size, weight, and distance. The assessment of the size of the object is affected by its brightness-

colours with greater specific brightness such as: white, orange, yellow, green optically „enlarge" objects and surfaces on which they occur, while red, purple, brown, black cause „reduction" . Warm colours bring objects closer, optically zoom them in, while cold ones zoom them out and make them smaller.

Colours significantly affect the human, the perception process, causing various optical illusions and secondary impressions. The influence of colour on the perception of distance has a very significant impact., e.g. yellow has the property of approaching the human eye, while blue has the property of distance Bright and intense colours have the property of zooming in, and dark colours have the property of zooming out. Red is a colour that is quickly captured by the eye, it also causes optical illusions[14]. Colours also affect weight assessment, and so too do darker colours: dark blue purple, brown and black are called heavy colours. In contrast, the colours white, blue, yellow and yellow-green are light, floating upwards. Warm colours are mentally „active", cool are „neutral", bright „serene" and „light". Heavy create the impression of seriousness. Due to these properties, we can distinguish wet and dry colours. Warm colours give a feeling of dryness and are yellow-brown, while cold colours give a sense of green-blue moisture. Colours can be combined statically by selecting colours from a close family or dynamically by contrasting colours.

The works of eminent painters Rubens or Titian prove that you can create wonderful works based only on your own intuition without knowing any theory of colour. However, the fascination with colour resulted in the theory of such painters as Klee, Kandinsky, Matisse and others. The colour used by the painter depends on such factors as: pigments used, types of binder, substrates, dilution levels. It is dependent on lighting, spot size, texture and combinations used[15]. Colour combinations have an impact on our well-being and health, have an effect on stimulating or calming the body – red stimulates, cool greens calm down. The colours affect the mood – red irritates, scarlet gives the impression of majesty or mourning, green calms down, yellow cheers up, purple depresses. Because of the important psychological aspect of colours, it is vital to be aware of their emotional significance and the impact of colours on the human psyche. This information is very important for people involved in the design of human surroundings.

[14] A. Mączyńska-Frydryszek, M. Jaskólska-Klaus, T. Maruszewski, *Psychophysiology of vision*, Academy of Fine Arts in Poznań [A. Mączyńska-Frydryszek, M. Jaskólska-Klaus, T. Maruszewski, *Psychofizjologia widzenia*, Akademia Sztuk Pięknych w Poznaniu, Poznań 1991, p. 160-161].

[15] Maria Michałowska, *The phenomenon of colour – scientific aspects and painting problems* in *Drawing and Painting, basic problems, selected issues*, [*Fenomen koloru – aspekty naukowe a problematyka malarska w Rysunek i Malarstwo problemy podstawowe wybrane zagadnienia*, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2001, p. 223].

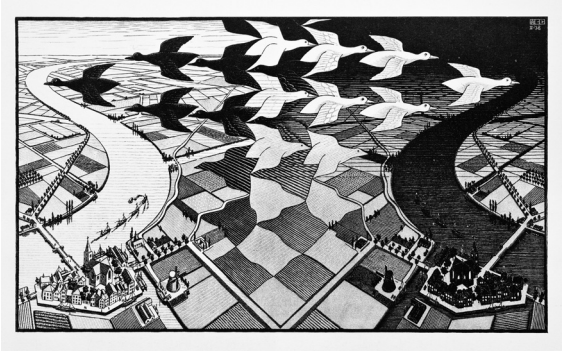


Fig. 5. M.C. Escher.
Source: iStock; ID: 157774399

Ambiguity in art

Creation in art and architecture can be based on consciously directing attention to objects or activities. Pablo Picasso had such creativity for the so-called „Perception games," or the ability to see new in the old, hiding figures on a familiar background.

Ambiguity of perception, possibilities of ambiguous figures, fascination with dynamic sensations have become an impulse to design and create unusual works of art and architecture. One of the most famous artists is the Dutch artist Maurits Cornelis Escher, whose graphics are often based on mathematical formulas. The artist was inspired by the work of the British physicist and mathematician Roger Penrose. He became interested in optical illusions and impossible architecture. In many of his graphics one can find basic impossible figures, e.g. impossible Penrose triangle, impossible Necker's cube or stairs leading to nowhere. The artist's work consists in reversing the figure-background relationship, using the influence of context on our perception or creating impossible architecture.

Escher created images that required exceptional spatial imagination. Sometimes the viewer has to carefully analyze the artist's graphics to find the answer to the question of what is wrong? The magic of these images introduces us to the almost real world, the almost correct,

yet it can still surprise. By playing with the created architecture, the whole complexity of perception, experience and remembered things are shown.

At the same time, we experience the relativity and subjectivity of our perception.

Works based on the use of perspective and impossible figures are created by contemporary Hungarian artist **Istvan Orosz**.

The Spanish artist Salvador Dali was fascinated by the possibilities of human perception. In his works, he often entered the game with a viewer who saw different stories / images in one work. The artist used Amorphosis[16] (the development of its principles is attributed to Leonardo da Vinci) consisting in the deformation of images on a plane in a way that allows for different points of view or using e.g. a lens to enable its reading. An example of this is the Mea West face. In the Dali Museum in Figueres in Spain there is a surreal apartment, whose furnishings create a face that we see from the right perspective (the best image is created when we look through the prepared lens). The fireplace becomes a nose, the mouth is a sofa, and the eyes are paintings hanging

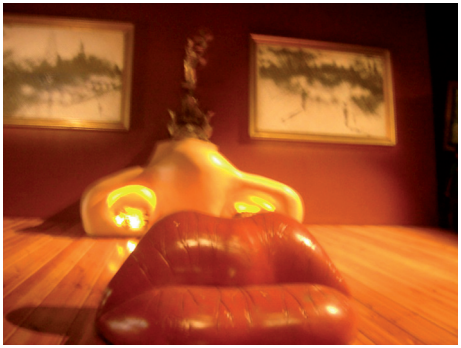


Fig. 6. Mea West room, face illusion, Dali Museum, Figueres Spain.

Source: fot. Joanna Zabawa-Krzypkowska

Fig. 7. A portrait of Lincoln or the character of Gala's wife? Dali Museum, Figueres Spain

Source: fot. Joanna Zabawa-Krzypkowska

[16] Anamorphosis is a deliberate image deformation that can show an undeformed image by, for example, reflecting it in a convex mirror, squeezing or stretching the deformed image. Anamorphosis in painting can show the original if you look at the canvas from the right angle.

Fig. 8. "Spain" 1938. Exhibition in Wadowice 2018.
Source: fot. Joanna Zabawa-Krzypkowska

on the wall[17]. Dali's created a lot of ambiguous paintings. One of them is the Slave Market, a picture in which we can see the bust of Voltaire. It is made up of two figures dressed in black standing against the background of an arcade. In architecture, the use of solid perception correction procedures has been known since ancient times. When the real object and its reception did not agree with the intended purpose of the creator, optical procedures were used, which „repaired" bad reception, optical deformations. The best example of such action is the Parthenon on the Acropolis, mentioned earlier, where a number of treatments correcting the image of the architectural body were used.

Architects in their works influence the visual message using artistic means, evoke certain impressions, and change the perception of the created space (e.g. something seems to be bigger or smaller than it is in reality). Through the use of colour procedures, using tricks of light, artists create unreal images that affect the viewer's mood and tension. We find various means of expression in many works of architecture from different periods. Illusionistic painting used in architecture usually presents fragments of architecture, often in combination with the landscape. Particularly popular was the use of this type of treatment in church and palace interiors, it appeared earliest in the Italian Renaissance (eg Leonardo da Vinci's Last Supper fresco). This art required of its creator

[17] These lips became a model for the sofa created later by Edward James.

an outstanding knowledge of the rules of perspective as well as mathematical knowledge. The vaults of baroque churches are covered with paintings that give the impression of three-dimensionality. The viewer is under the illusion of having a dome on the church vault or a niche in its wall. One of the greatest works of this trend is the dome in the Roman church of St. Ignazio Andrea Pozzo, in which the painting goes beyond physical limits, optically transfers space and delights the viewer with a view of the vault. Illusory activities are also observed in contemporary architecture, both in the scale of detail and building. We can notice them on the facades, in the interiors, they appear in floor designs (wallpapers, tiles) giving, for example, the impression of waving or three-dimensionality. Scale-related treatments are often used, e.g. scaling of elements, or perspective-related treatments to create an optical lengthening or shortening of space. Artificial light and solar reflections, colours, textures, appropriate materials and patterns are used.

E.T. Hall notes that the measure of the success of Frank Lloyd Wright's architecture was his excellent sense of how people can perceive space, so he consciously chose elements to build a specific mood and impressions. He also cites the skillful composition of Japanese gardens. The Japanese, deprived of extensive

Fig. 9. Fragment of the fresco (ceiling), Dali Museum, Figueres Spain.

Source: fot. Joanna Zabawa-Krzypkowska

Fig. 10. Floor – the impression of waving at La Rambla, Barcelona.

photo. Joanna Zabawa-Krzypkowska

Fig. 11, 12. Frank Gehry, EMP Museum, Seatle, hall: textures, colours and materials used change the perception of the interior.

Source: fot. Joanna Zabawa-Krzypkowska

Fig. 13. Daniel Libeskind Jewish Museum in Berlin, the influence of light and shadow on the perception of the interior

Source: fot. Joanna Zabawa-Krzypkowska

Fig. 14. Forum, Barcelona, forms, light and structures – reflections, views

Source: fot Joanna Zabawa-Krzypkowska

spaces, have learned to use a small space by expanding the visual space by means of kinetic sensations. Irregularly arranged stones cause slow walking and stopping, which gives you the opportunity to look at the garden every step from a different perspective[18]. The conscious use of illusions, optical illusions in shaping the architecture of interiors and buildings, as well as urban assumptions enriches the workshop and allows you to carry out targeted actions that change the real message by introducing additional values.

The presented issues are only part of the content that lies in the problems related to psychophysiology of visual perception. This work is an introduction encouraging further examination and exploration.

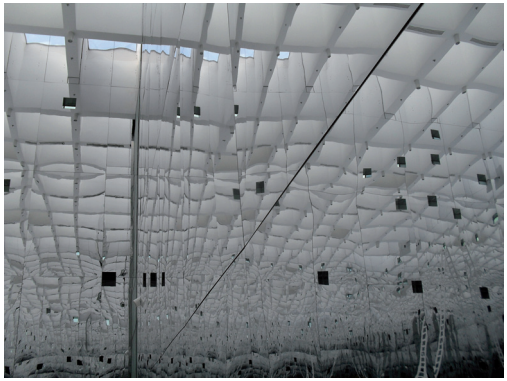


Fig. 15 i 16. Dani Karavan, Reflection (Exhibition in the Muzeum Śląskie)

photo: fot Joanna Zabawa-Krzypkowska

[18] E.T. Hall: *Ukryty wymiar*, Wydawnictwo Literackie Muza SA, Warszawa 1997, p. 72.

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Designing visual messages from the idea to the piece of work

Foreword and vision of the future world

"... How do I understand and define the design process? Another hour passed, a fulfilling part of life, brings the artist closer to the "end". Thus, if we fully realize the passage of time, then we consciously devote time to a work that materializes during intellectual and creative work. Designing is a process of permanent construction and materialization of a thought that seems worth it. It is an independent idea, which is usually opposed by the immediate environment and a large part of the world in which we argue with our existence on a daily basis. The objection in question appears when we have a specific observation to make. A piece of work; it is a sign that a unique thing is being created ..."[1].

When analyzing the meanders of visual messages determined by the content of perception and its mission in giving sense to impressions, one should become familiar with a few basic short definitions with which this text is associated.

Perception is a form of perceiving and building ideas about the reality that surrounds us.

Designing is a process consisting of several elements, culminating in a work of art, a product of a designer work.

Visual communication is communication between people through images using available media.

[1] *Interference. Art + science.* Multi-author monograph edited by Natalia Bąba-Ciosek, Publisher of the Faculty of Architecture of the Silesian University of Technology, Gliwice 2015.
[in: *Design for industry - opportunities and threats* author of the text Krzysztof Groń, p. 68].

The modern world is constantly "filled" with a huge amount of images – visual messages that represent a diverse aesthetic and qualitative level. I observe the Internet as a carrier and magazine for information / images, and I believe that over time, these contents will materialize, creating a real energy formula. To bring this idea closer, it is worth referring to a quote from the Bible, which may explain it in the following way: "And the Word became flesh and dwelt among us ..." (Jn 1:14). In other words, there is a real possibility of materializing the virtual image (word) into matter (body) that will bring an unknown condition to humanity.

The main culprit of an online information "dump" is human, and the Internet has become a basic platform for communication and storage of content created by people. Gathering as much knowledge as possible in a small space was the eternal dream of man. (traditionally libraries have always been scientific oases). Man invented the Internet and all devices for its distribution. Hence, at the moment, humanity is taking full responsibility for the effects of content posted on the web, not machines as it has become generally accepted. Unfortunately, this is not unambiguous, because Microsoft founder Bill Gates has made a radical statement, warning humanity with the words "I am in the group of people concerned about artificial intelligence"[2]. When the authority from new technologies appeared, the whole situation related to responsibility for storing knowledge gently gets complicated.

Nowadays, new media with the Internet and devices which man uses and is passionate about, have become the best form for communication between people. The power of the Internet is measured by the power of the image, which should oblige us to think about the quality of contemporary visual content. These are also the costs of publication, which in the era of the existing network have been practically reduced to a minimum. If sending information is potentially free, then societies assume that virtually anything can be published. The anonymity of published content causes various threats in the era of freedom of published material.

What is the current state of modern paintings? The images are created on two levels: as well thought-out projects, performed as an order and images created and published spontaneously, e.g. a series of photographs created by pressing the trigger in the camera. We are witnesses, participants and implementers of ideas that arise here and now. We can use these ideas and boast about them. Thanks to new technologies, emerging projects can be implemented very quickly. This is an important moment that can directly refer to the period of the Industrial Revolution taking place at the turn of the eighteenth and nineteenth centuries, when dynamic development was taking place in the eyes of the people creating it.

[2] http://nt.interia.pl/technauka/news-bill-gates-ostrzega-przed-sztuczna-inteligencja,nld,1599431 from 02.04.17.

"... We are currently living in a beautiful time, which is determined by the needs of a creative individual. People try to dynamically respond to social needs by designing and producing visual content, in fact, objects we need more or less. Some kind of wastefulness is noticed, according to the new idea of "we can afford" creative mistakes. Nevertheless, more and more wastefulness is replaced by rational thinking about the future. This thinking should be commended. I believe that in about two decades, or maybe a little faster, the current state of "creative, romantic wastefulness" will change irreversibly, in which there will be involved supercomputers gathering information, including successes and design or technical errors of humanity, which will translate into the practical elimination of erroneous decisions related to the emergence of new messages, products and services. Striving for maximum savings in materials, raw materials and time will lead to moving people away from design processes. Optimizations will make that what is allowed today will be impossible in the future. Legally defined and limited by a rational technology framework. The unit will not have the same capabilities as today. The designed products or messages will be scanned by a number of devices and computers that will decide on the demand for them. In the future, Man can be virtually eliminated from design processes. To avoid full elimination, it is necessary to design machines today with the assumption of making their operation dependent on the superior role of Man.

In the future, designing will probably not be done in the traditional way we know today"[3]. Future, yet unknown to us, forms of designing and publishing content will become a foundation in communication and give a new dimension to human life. Virtual presentations can fill a larger space of human life. Impressions, illusions, visual references to the organic and mental structure of people will be balanced on the border between truth and falsehood. Reality may turn out to be the perfect world for the "prince of lies." Devices, tools such as caves, virtual screens, glasses, helmets displaying virtual reality are some of the formulas of the future known today. The image will play a primary role in every area of life. Surreal images of analog artists will become real beings, neuro-images. The scope of the "new" includes 4.0 technologies and subsequent versions of the organic-technical symbiosis.

[3] *Feasibility study of research works in the field of industrial design*, University of Information Technology and Management in Rzeszów, 29.12.2016, authors Krzysztof Groń, Łukasz Szubart.

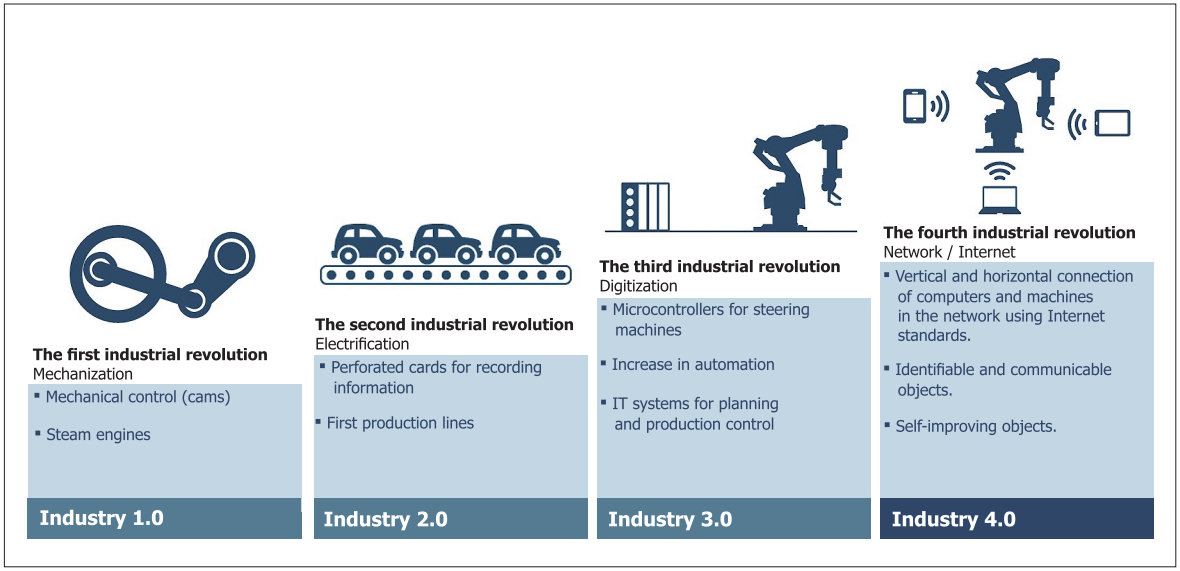

Fig. 1. Industry 4.0[4]

"New technologies and intuitiveness of devices are at the stage of trying to coordinate man with the machine. You should prepare for the establishment of a Center that will be oriented towards people as a user as well as a designer and producer. This idea has its reference to the content published by the founders and precursors of Bauhaus, which combined the work of intellectuals, architects, designers with artists and craftsmen. The Center will carry out a broadly understood design process, which will include: product design; communication design; information and interface design; designing the environment and designing the service taking into account the various stages of its duration"[5].

[4] https://www.google.pl/search?q=4.0+technologia&rlz=1C1AOHY_plPL708PL708&espv=2&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjft_zZ24bTAhWobZoKHfkxBPsQ_AUIBigB&biw=1280&bih=642#tbm=isch&q=przemysl+4.0&*&imgrc=JxuRJEf5H2bvoM: z dnia 02.04.17.

[5] *Feasibility study of research works in the field of industrial design*, University of Information Technology and Management in Rzeszów, 29.12.2016, authors Krzysztof Groń, Łukasz Szubart.

Design in balance with inspiration

Designing is a creative activity that requires the designer not only ability and deep knowledge, but also the ability to observe the world. The term 'design' is most often understood as an activity aimed at composing of generally known elements, a new, previously unknown or little known 'whole'[6].

Contemporary design cannot be understood without understanding the ability to communicate in the areas shown in Figure 2, as well as without knowledge of basic concepts and definitions.

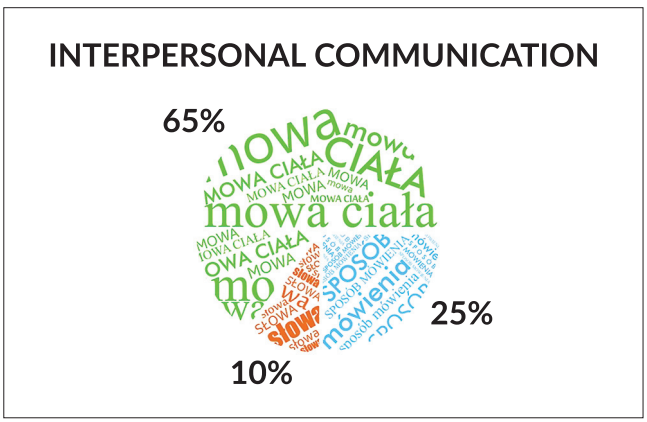

Fig. 2. Interpersonal communication[7].

To put it in the simplest way, design is a certain way of working implemented in practice using available and selected tools, which include a computer, software, pencil, drawing board. Whereas, the project usually consists of drawings, documentation made using classical methods and supported by modern devices such as a computer and a printer with the possibility of 3D printing.

[6] S. Dziegielewski, J. Smardzewski, *Furniture*, State Agricultural and Forestry Publishing House, Poznań 1995, p. 32 [in: *Interferencje. Art + science*. Multi-author monograph edited by Natalia Bąba-Ciosek, Publisher of the Faculty of Architecture of the Silesian University of Technology Gliwice 2015.
[in: *Design for industry – opportunities and threats*, author of the text Krzysztof Groń, s. 65].

[7] http://mojamotywacja.eu/jak-mowic-by-byc-zrozumianym.html [pobrano 29.07.2016].

In order for the project to be created, the designer prepares for work by introducing creative methods to the process, which include, among others, "brainstorming", which is defined as a "group work method to come up with as many ideas as possible to solve a given problem"[8]. In the context of communication, design is the generation by the designer of a message in the form of an idea – a product. Its basic elements are the form, content, color, function, ergonomics, culture being and use, and disposal of the product after the definitive end of its life function.

"... In the documentary film" Designers "product designer Katarzyna Okińczyc states that the designer must reach the consumer not only through a nice form, but also through the nice content that the product expresses. The product should have a "thought", innovation or new technology. The designer believes that analyzing the target market and existing technologies is very important. To create an original project, you need to have a very wide field of view, recognize the interdisciplinary nature of social life.

Italian designer Antonia Astori says about design as follows: *"This is a very easy process. I start with rational reflection in order to answer the problem, which in most cases is required by the company; but the project begins to take shape only after a long work on the exact proportions, choice of material, details"*[9]. So the "life" of the project does not start when the concept is transferred to a piece of paper, but much earlier: in the mind of the designer. Questions and practical actions posed by the creator are aimed at providing a comprehensive answer in the form of realizable concepts. The project over time becomes "material".

Bogna Świątkowska from the Bęc Zmiana foundation says that we live in a world that has been designed because the shape and value is given to it by the forms assigned by designers. *"Design creates new jobs. They can give results in the form of market success when the product pleases, or failures if something has been poorly designed. A badly designed car is a disaster for the car factory and several thousand of its employees"*[10].

The above statements lead us to design products that are intended for mass production, which has many relationships with abstract creativity, however at the same time requires from the designer

[8] R. Morris, *The Fundamentals of Product Design*. [R. Morris, *Projektowanie produktu*, PWN, 2009, s. 25].

[9] Correspondence with designers.

[10] *Interference. Art + science*. Multi-author monograph edited by Natalia Bąba-Ciosek, Faculty Publisher Architecture of the Silesian University of Technology, Gliwice 2015. [Interferencje. *Sztuka + nauka*. Monografia wieloautorska pod redakcją Natalia Bąba-Ciosek, Wydawnictwo Wydziału Architektury Politechniki Śląskiej, Gliwice 2015.] [in: *Design for industry – opportunities and threats*, author of the text Krzysztof Groń, p. 66]. [w: *Projektowanie dla przemysłu – szanse i zagrożenia*, autor tekstu Krzysztof Groń, str. 66].

to have practical skills and intuition. All this so that a person receives the message contained by the designer in the project, and at the same time can properly use his work in everyday life. Przemysław Dębowski and Jacek Mrowczyk write in the book *"See. Know. Selection of the most important texts about design"* that "a good design should be aesthetically satisfying and functional"[11].

Traditional design does not have to give way to new forms. Traditional forms of teaching and performing drawing, painting and photography are a very intimate, original formula.

Technology seeks to integrate the creator with the tool, hence the vision is created to shorten the path between the creator and an analog medium such as paper, canvas. Transmission of the author's thoughts can visualize and "materialize" the object into a 3D formula.

"... How do I personally understand and define design and inspiration? The most important elements in designing are faith and conviction about the rightness of the implemented idea. Thanks to such a level of thinking, inspirations arise among everyday joys and sorrows, among ups and downs. Spirit and matter coherently composed in the creator's life can indicate the multidimensionality of created works. The condition for designing good things is a reasonable belief that what you do is done well, that the author speaks consciously"[12]. In the realities of inspiration, not only metaphysical elements will be important, but also a rational approach to the design and presentation of works that will result in exhibitions and publications at the publishing level, but also publications of industrial designs and patents at the Patent Office of the Republic of Poland. 'A very valuable source of design inspiration is the artistic activity of the designer, motivating him to constantly search and dissatisfaction with knowledge. The pursuit of self-realization with the help of various types of art means that the designer draws on the world of art and by contacting the work of other artists can lead a polemic, in which later the works materialize. Another possible inspiration is participation in various types of art exhibitions, trade fairs and other presentations, during which it is possible to confront your own thoughts and implementations with the work of other designers. There is often a chance to learn the opinions of potential recipients of prepared projects. An old photograph found in a family album allows us to find more sources of design inspiration"[13].

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[11] P. Dębowski, J. Mrowczyk, *See, Know. A selection of the most important texts about design*. [P. Dębowski, J. Mrowczyk, *Widzieć, Wiedzieć. Wybór najważniejszych tekstów o dizajnie*, KARAKTER Kraków 2011, s. 9].

[12] *Interference. Art + science*. Multi-author monograph edited by Natalia Bąba-Ciosek, Publishing House of the Faculty of Architecture of the Silesian University of Technology, Gliwice 2015.
[in: *Design for industry – opportunities and threats* author of the text Krzysztof Groń, p. 68].
[*Interferencje. Sztuka + nauka*. Monografia wieloautorska pod redakcją Natalia Bąba-Ciosek, Wydawnictwo Wydziału Architektury Politechniki Śląskiej, Gliwice 2015.
[w: *Projektowanie dla przemysłu – szanse i zagrożenia* autor tekstu Krzysztof Groń, str. 68]].

[13] Ibidem.

Communication in commercial visual messages

Is it possible to develop one definition of communication? Probably not. Communication is a complex process that operates at many levels of social life, and the effects of information exchange are multi-threaded and can be difficult to clearly predict and define. For this reason, scientists are looking for a "golden formula" to understand the secrets of interpersonal communication. Within the definition of communication, there may be many translations that prove more or less convincing. Everyone thinking about communication mechanisms, based on individual life experiences, can create their own definition, describe their own understanding of the essence of communication. Scientists provide, among others, the following definitions of communication:

"Communication means the contact of man with man"[14].

"Communication is a special, formally coded or symbolic social event that makes it possible to infer about states, relationships and processes that are not directly observable"[15].

"Communication occurs when there is an effective transmission of information from one participant to another. Society not only lasts through communication, but in fact it can be said that it exists through the transmission of information and through communication"[16].

In the definitions presented, several important components of communication can be seen, described by phrases: human-human contact, coded; social event; sending information; transmission. Interpersonal communication is therefore a complex phenomenon and takes place at many levels. The most important of these are speech (verbal communication) and gestures, facial expressions and other elements of "body language" (non-verbal communication). Although the meaning of words is generally precisely defined, the sender and recipient may understand the message differently. Listening or reading comprehension is not common. Other types of "interference" are also at stake, such as non-verbal communication, cultural differences, complicated relationships between the sexes (after all, they are from Venus and they are from Mars), different interests, baggage of experience of communication participants, different characters and expectations. All this can result in misunderstandings.

[14] http://edukacja-medialna.wyklady.org/wyklad/436_definicje-komunikowania.html [downloaded 27.07.2016].

[15] Ibidem.

[16] Ibidem.

Communication is a process of exchanging information between individuals, groups or institutions. The purpose of communication is to exchange thoughts, share knowledge, information and ideas. This process takes place at different levels, using different means and causes specific effects[17].

Modern technologies give the opportunity to build an image and transform it. Communication with the image takes place on the basis of a certain relationship that arises between the image and its interpretation. The latter has a complex form, which consists of the recipient's experience, his emotional state, level of aesthetics. Visual communication through the image has become one of the most popular forms of communication / information in the modern world. According to Bo Bergstrom[18], visual communication has many components that include a narrative with its individual elements: what does the viewer see, how does the viewer see, what and how does the viewer hear? The narrative consists of three narrative techniques: dramatic narrative technique, non-dramatic narrative technique, interactive technique. Other important elements, such as strategy, media, message, influence, creativity, typography, images, medium, and colour are also needed.

Design and business communication

Business activity carried out to generate profits is referred to as business. In each field, not only in terms of design and art, individual goals are implemented, preceded by the preparation of a project, which includes the idea, finances, place of implementation, time, and human resources.

The functioning of a production company on the market means offering products / services for which there is a demand of recipients. In the case of manufacturing companies, this raises product (project) needs, which are usually implemented by designers. The structure of a well-functioning enterprise allows at any time to design and monitor the communication of individual project teams based on specific goals. This is not about employee surveillance and the introduction of full template activity, but about the effectiveness of providing information. It is important to establish communication channels, select a team and diagnose threats during project implementation. In the design and implementation processes, communication feedback is very important. Time and effort consumption of processes, as well as economic aspects to a large extent enforce the need for uninterrupted dialogue between individual departments cooperating with each other under the project.

[17] B. Dobek-Ostrowska, *Basics of social communication*. [B. Dobek-Ostrowska, *Podstawy komunikowania społecznego*, Wydawnictwo ASTRUM, Wrocław 1999, s. 13].

[18] Bo Bergstrom, *Visual Communication*, PWN, Warsaw 2009. [Bo Bergstrom, *Komunikacja Wizualna*, PWN, Warszawa 2009].

There is a perception that contemporary communication possibilities, exchange of experiences and views have improved the "quality" of communication, that interpersonal communication is facilitated. However, this is not unambiguous. Examples from everyday life point to a completely different situation. It is enough to look at global conflicts, which in the era of growing awareness and knowledge of human behaviour and needs, and mediation skills, should be resolved at the root.

How to prepare for the project from a communication point of view? There are many proven techniques in this area, but it turns out that no template, computer programme[19] will not guarantee success. The only safeguard is to try to anticipate any risks that may arise during the implementation of the project, and to "prophylactically" develop remedies. Indicated phrases in the communication definitions cited above: human-human contact; encoded; social event; sending information; handover can become the key to finding the best solution for forms and principles of communication within the project implemented by the team. When analyzing the selected design area, you should focus on the complexity of the design and implementation of the product for implementation, which is affected by procedures, however, not without significance, also the original concepts proposed by the designer, often working with a more or less numerous team. The existence of these relationships is indicated by the logic of the design methodology, which includes, among others, the skills to analyze and synthesize a design problem, as well as general principles for the functioning of production, eg in an advertising agency or printing house. One should also point to the authorship of the product, which is often subject to many tests for "strength" in relations with industry. Inquiring about the essence of the product's origin and origin, one should get information about its author, whose intellectual contribution in its creation has allowed the emergence (birth) of a new idea in the real world of social needs. The need to identify the origin of the project may lead the researcher to conclusions showing the character and style of the designer, as well as his work.

At this stage, appears a design (message) that can be read by a specific group of people who may be under the influence of the designer. Other, uninformed participants of communication process can probably only guess at what value the project is about. This is a significant mechanism because when selecting projects by employees of creative departments in the company tendentiousness may decide The ability to communicate efficiently – including listening to the client's expectations and expressing their ideas – is extremely important in the work of a designer. Not all expectations of the client are verbalized at the beginning of the design work.

[19] Large advertising companies use software that allows them to systematize individual stages of design and implementation work.

Those that have not been expressed explicitly, included in project brief[20], must be picked up by the designer from the client's statement. The designer should be able to read the intentions, even desires of the client (not necessarily made aware), for example regarding the degree of innovation or originality of the project, because this is of great importance in business relations and often determines the success of the project.

Referring to experiences and remembering the previously mentioned definitions of communication, we will notice that the phrases selected from them, including human-human contact play a huge role in direct business and communication relations. "Future success is conditioned by relationships during the joint implementation of the project. Then open or hidden questions like "how can I stop a customer from making unnecessary changes to my project?" may arise. Well, if the design has flaws, is ill-considered or poorly performed, the changes are justified. Let's assume that everything is all right. Then the only way to avoid unnecessary customer interference is to develop the appropriate relationship with him at the very beginning of cooperation. It is necessary to create a framework for a mature partnership consisting in hearing and thinking over the client's point of view and approaching the order so that the client understands that we also have an opinion that is worth knowing"[21]. There are no templates that would allow you to succeed in this regard; many designers have found this out. In Adrian Shaughnessy's book *"How to become a designer and not lose soul"* the author presents many valuable issues that allow a young designer to understand the terminology and methodology of building his own design studio from scratch. It also draws attention to the aspect of contacts with clients. He states that "there are no two identical customers. Everyone needs something different: one wants respect, the other is obsessed with cost effectiveness, the third is an enlightened, avid patron of design and designers. The fact that customers are different means that designers must be extremely sensitive to the needs of specific clients"[22]. The client who has education or experience in the field of design will probably be a more aware partner to talk to the designer about the project being implemented. This is not a norm or a condition for good communication, nevertheless it is worth probing who we are dealing with as well as if we will cooperate and whether this cooperation will be successful. The publication also contains an interesting statement by the designer of Russian origin Misha Black published in the article The Designer and the Client (after: Looking Closer 3. Critical Writings on Graphic Design, Allworth Press,

[20] Project brief – a general list of information on product expectations of a given industry, prepared by the contracting entities research units that can be used by the designer as additional sources of information during the implementation of the project.

[21] A. Shaughnessy, *"How to be a Graphic Designer Without Losing Your Soul"*. [*Jak zostać dizajnerem i nie stracić duszy,* Wydawnictwo KARAKTER, Kraków 2012, s. 95].

[22] Ibidem, p. 94.

1999), in which he stated that "no the customer's impact on the project is always harmful. It is often the opposite. When the client and designer live in harmony, they can jointly create a better job than the one that would be created if they worked separately"[23].

The dynamic development of modern media and technologies, which solve some problems (such as distance preventing personal contacts), and at the same time generate others, is of great importance for the quality of communication. Lack of agreement leads to conflicts, and often also reluctance. The fact that two sides of the communication process "are not on the same wavelength" is the cause of the failure of many relationships, leading to the abandonment of numerous projects or their failure. In the last decade, you can notice a strong emphasis on communication through the image (often referred to as visual communication or visual message). Nowadays, these issues are closely related to new media and are too complex to be clearly defined in the short description. It should be mentioned when considering the communication between the designer and the producer, due to the pictogram systems used in these relations. They allow unambiguous two-way communication in some areas. The attractiveness of the pictorial form of communication has always existed, as evidenced by, among others, drawings and paintings on the walls of the Lascaux cave, and today the image is carried to the recipients via a medium such as the Internet.

> Speaking about art, we are generally unanimous that its scope is created by: painting, sculpture, music, architecture, theater, poetry. Doubts arise with the question of photography, industrial design, interior architecture and handicrafts[24].

An important factor impeding communication in the design process is the need to build a bridge between Art – which is guided by emotions and is selfless – and a rational, result-oriented and profitable Business. Although the identification of design with art, and designer with artist arouses controversy, it is impossible to deny that "The attributes of art, talent, passion, versatile, free imagination, the ability to comprehensively analyze phenomena deepened by knowledge of the humanities, knowledge of industrial processes and trends in technical development, here are features that characterize an industrial form designer"[25], who shapes his own style of expression using formal

[23] A. Shaughnessy, *"How to be a Graphic Designer Without Losing Your Soul"*. [*Jak zostać dizajnerem i nie stracić duszy*, Wydawnictwo KARAKTER, Kraków 2012, p. 95].

[24] A. Lipski, K. Łęcki, *Perspectives of artistic culture sociology*. [A. Lipski, K. Łęcki, *Perspektywy socjologii kultury artystycznej*, PWN, Warszawa 1992, s. 38].

[25] Adam Miratyński, *Basics of design – an attempt at diagnosis. Work at the foundations*, Academy of Fine Arts in Gdańsk. [Adam Miratyński, *Podstawy projektowania – próba diagnozy. Praca u podstaw*, Akademia Sztuk Pięknych w Gdańsku, Gdańsk 2012, s. 10].

means of artistic language (composition, rhythm, repetition, scale, proportions, texture, value, light and shadow, showing things known in a new surprising aspect)[26].

Students should start their search for an original style of expression as early as possible. Art is associated with creativity, an abstract view of reality and the individual feelings of the creator. On the other hand, business is a "hard reality", specific plans, numbers and moves thanks to which we can earn, develop and fulfill dreams. It seems that these are completely different worlds on the border of which a designer - visionary, creator stands. His professional work consists in implementing projects that are initially just an idea, a vision expressed in the drawing, and only then become the object of everyday use, a product realized with a view to specific purpose and usefulness (functionality). According to Wacław Długosz from the Academy of Fine Arts in Gdańsk, generally speaking, the role of the designer is to "improve the quality, usability, aesthetics, availability, products and means of production, organize the human environment, care for environmental protection, care for disabled people and many other tasks". Designers creators "whose task is to change, or at least improve the beautification of the world.[27]" At this point it is worth asking yourself: can everyone be a designer and what is creativity? The first part of the question inclines me to say that not everyone can be a designer, because you have to go through the education process in this area, collect specific baggage of experience. What about creativity? "Creativity is about taking risks, giving up comfort, and making effort, sweating. It is not supposed to be cold sweat of fear but sweat of hard work. I admit that there is room for a sudden glare, but it can only happen if risk, discomfort and drudgery are also present. The author of publications on the preservation of the soul in the profession of designer proposes his own formula for creativity: risk + discomfort + drudgery (+ inspiration) = creativity[28].

Considering the above questions and statements, one can risk the statement that we are all designers specializing in specific activities and skills. As it happens in life, better and worse artists appear. The essence of understanding interpersonal relationships in the design process can be the presented risk formula at work combined with creativity and hard work, with the discomfort of making concessions to the client. It is important to what extent both parties are able to accept such a state, as well as their determination to achieve the jointly assumed goal. The process of communication between a designer and business representatives includes many elements related to visual arts, abstract concepts and artistic experiments, which the designer uses from the need for artistic expression of his ideas.

[26] Disscution: ibidem, p. 13.

[27] Wacław Długosz, *Free market reality and free market education. What were the assumptions of the Bologna reform?* Academy of Fine Arts in Gdańsk [Wacław Długosz, *Wolnorynkowa rzeczywistość i wolnorynkowa edukacja. Jakie były założenia reformy bolońskiej?* Akademia Sztuk Pięknych w Gdańsku, Gdańsk 2012, s. 169].

[28] A. Shaughnessy, *"How to be a Graphic Designer Without Losing Your Soul"*. [*Jak zostać dizajnerem i nie stracić duszy*, Wydawnictwo KARAKTER, Kraków 2012, s. 120].

Sometimes they may seem irrational, but they lead to the generation of code that allows the creation of socially acceptable messages and transferred to usable forms that producers as well as future users are interested in. Acting in the "productive reality", however, the designer also comes into contact with different methods of communication. These are structured concepts, documentation and standards. On the one hand, they help to organize cooperation, but unfortunately they can make the designer become one of the employees who abide by the rules in force in the industry, forget about bold ideas and create artistic sensitivity of the recipients. As a result, "polite", easy to implement projects will be created that will not contribute to industrial design or bring the expected profits from their sale[29].

The designer accomplishes the goals set for him by working in a production company under an employment contract or acting independently as a freelancer accepting orders from many clients. Each of these forms of cooperation entails different limitations and possibilities, brings different threats and facilitations. A freelancer[30] can work and cooperate with the client from every level. "However, this does not suit everyone and many people find the prospect of spending time at home every day as unpleasant"[31]. If an independent designer begins cooperation with a client, he should realize why he was chosen for this cooperation. It is likely that the awarding entity's decision was due to many factors, including its portfolio, but also other reasons.

"Creative reasons - Will this person do the job I care about?

Personal reasons - Will I get along we this person?

Financial reasons - Will hiring this person be cheaper than the studio's service?"[32].

These reasons are only an excuse to consider the quality of communication between the designer and the client (client, producer). The reasons for cooperation can be diagnosed, which will allow for better understanding and communication.

[29] At this point, the designer encounters dilemmas related to maintaining the credibility of his own design concept, or to submit to the pressure of company employees who do not necessarily understand the original strategy of the project. It is also the case that a person implementing a strategy to implement their own design concepts can change the perception of employees in the production environment of innovative activities for the company, which will allow future designers to implement bold design ideas and more efficient communication in the future.

[30] Freelancer, a person not employed under employment contract, most often a specialist who carries out customer orders in his specialty.

[31] A. Shaughnessy, *"How to be a Graphic Designer Without Losing Your Soul"*. [*Jak zostać dizajnerem i nie stracić duszy*, Wydawnictwo KARAKTER, Kraków 2012, s. 56].

[32] Ibidem, p. 57.

Regardless of the adopted model of cooperation between the client and the designer, there are numerous obstacles to communication. Their source can be various methods of enterprise management, adopted methods of internal and external communication as well as implemented organizational procedures, etc.

All these elements look different in a production company, in a different way in a commercial company than in a service sphere. However, they are always subordinated to implementing the company's strategy and achieving the set goals. It is impossible to develop a single, universal model of communication that works in every company, in every corner of the world.

> Communication involves the effective exchange of information between the parties and their understanding of this information. Effective communication is essential for the success of projects, programs and portfolios. The right information should be provided to the right parties in an accurate and consistent and consistent manner, meeting their expectations. Communication should be useful, clear and punctual. Communication may take various forms – oral, written – in textual or graphic form, static or dynamic, formal or informal, voluntary or forced, and may use various means of communication, such as printout or electronic form[33].

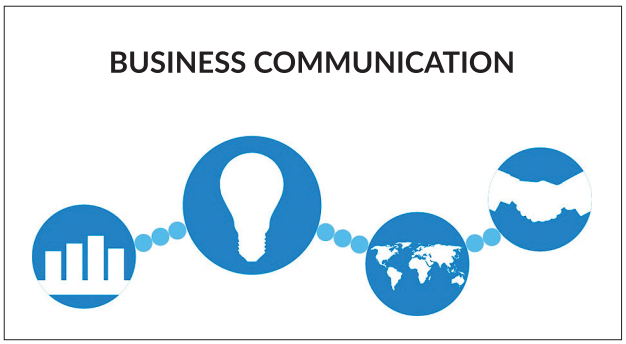

Fig. 3. Communication in business[34].

[33] *NCB Polish Competence Guidelines IPMA, version 3.0*, p. 82, edited by B. Dałkowski, L. Staśko, M. Zalewski, Project Management Poland Association, 2009. [*NCB Polskie Wytyczne Kompetencji IPMA, wersja 3,0*, s. 82, red. B. Dałkowski, L. Staśko, M. Zalewski, Stowarzyszenie Project Management Polska, 2009].

[34] Graphic author: Kacper Groń.

From my own experience, communication in business is governed by its own rules, not necessarily related to accepted principles. The first meeting with the designer is preceded by analysis and so-called checking the person's competence to complete the task. Information available on the internet is often used for this. Designers working in many industries pay attention to the so-called self-public relations. This is necessary and important in the context of acquiring subsequent orders. On the other hand, production and communication management systems lead to the standardization of behavior in the organization. It is not beneficial for designers working as free lancers, because it imposes too many template activities on them, which often prevent the search for unconventional design solutions for a given industry. It is not about the designer being an "untouchable person", but about leaving him some room for so-called design freedom. This area is certain values brought with a new design idea, as well as own creative experiences and inspirations characteristic of each individualist. Individuality is needed in designing. Standardization is harmful. This should be borne in mind at the education stage, as emphasized by Piotr Jędrzejewski and Piotr Stocki: "One should cultivate the individuality of the student while trying to eliminate schematism in thinking (...). This scheme disables or slows down the activity of the imagination. Instead, it proposes a specific set of keys – thought templates that have nothing to do with the search for creative solutions, also requiring intellectual involvement"[35]. When a company follows the "beaten paths", its offer resembles the products of competitors. The practice of marketing departments comparing their own product offer with those of competitors is widespread. From retailers in stores, you can get information quickly and without high costs, which products sell best. Afterwards, it's enough to include similar in your own offer to ensure a certain profitability. Nevertheless it "kills" creativity and courage to create completely new patterns. "If people were limited to copying the work of others, there would be nothing new. This way of thinking leads to the creation of new products that do not differ much from each other. However, innovative thinking is not always easy – because people have a natural instinct to follow the majority because of a sense of security"[36].

Communication can take place as part of conversations, meetings, workshops and conferences or by exchanging reports or meeting notes[37].

[35] P. Jędrzejewski, P. Stocki, *Preliminary design. Work at the foundations*, Academy of Fine Arts in Gdansk, [P. Jędrzejewski, P. Stocki, *Projektowanie wstępne. Praca u podstaw*, Akademia Sztuk Pięknych w Gdańsku, Gdańsk 2012, s. 29].

[36] R. Morris, *The Fundamentals of Product Design*. [R. Morris, *Projektowanie produktu*, PWN, 2009, s. 25].

[37] *NCB Polish Competence Guidelines IPMA, version 3.0*, p. 82, edited by B. Dałkowski, L. Staśko, M. Zalewski, Project Management Poland Association, 2009. [*NCB Polskie Wytyczne Kompetencji IPMA. Wersja 3.0*, s. 82, red. B. Dałkowski, L. Staśko, M. Zalewski, Stowarzyszenie Project Management Polska, 2009].

What is the role of a designer in a web of management systems, quality standards and communication? Where is his place in the extensive bureaucracy? How is he supposed to deal with corporations where nothing happens without a procedure, and as in small companies, where informal communication paths apply, all projects are manually controlled by the owner? Creative activity is not easy on any of these different models; it always requires mental resilience and determination, which is why "good designs usually seem fresh and passionate. It is necessary to be open to the world, not only to products, but also to the manifestations of everyday life. You should also accept that everything you know may be wrong, just like what they do, say or think other people. It is not about conducting constant disputes and permanent negation, but about the ability to question everything, express different views and opinions"[38].

Summary and positive picture of the future

The Man in history puts himself very often in crisis situations, which result in various consequences. There is also good content, which includes the transition to the next stage of development. Fine arts develop along with shaping humanity, hence natural attempts at creative expression through digital technologies that are shaped right before our eyes should be included. Technologies are other tools comparable to a brush, pencil, paper, canvas.

Humanity will cope with new opportunities and threats, because its roots are in nature, which it often refers to in crisis situations and benefits from it. Circumstances and surroundings change under the influence of evolution, but human nature and behavioral mechanisms, needs remain the same. The same motives as contemporary artists were guided by people from the time of Leonardo da Vinci, Picasso. The Center mentioned at the beginning of the text, which will be oriented towards people as a user, but also a designer and producer, can become an equivalent for man, nature and technology. The Center will carry out a broadly understood design process, which will include: product design; communication design; information and interface design; designing the environment and designing the service taking into account its individual stages.

[38] R. Morris, *The Fundamentals of Product Design*. [R. Morris, *Projektowanie produktu*, PWN, 2009, s. 25].

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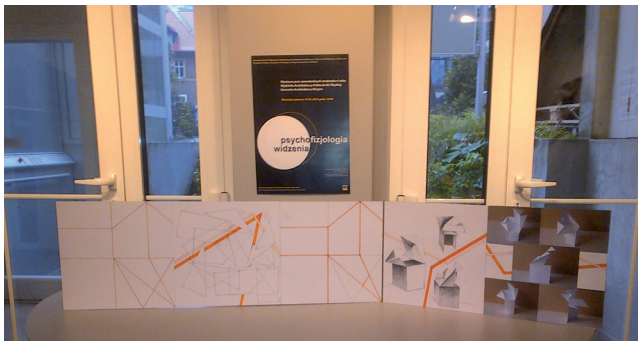
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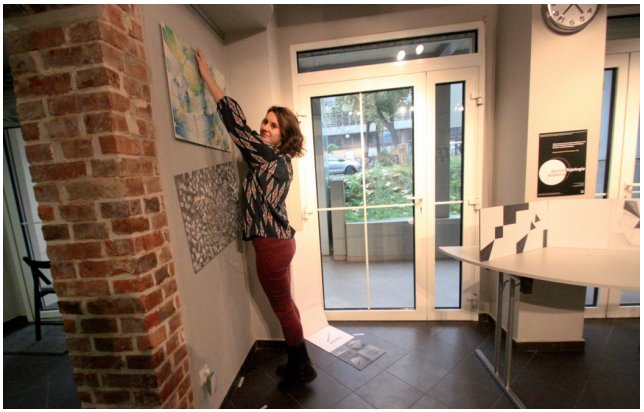

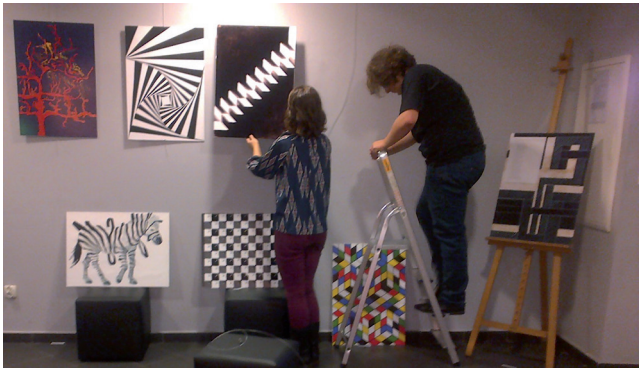

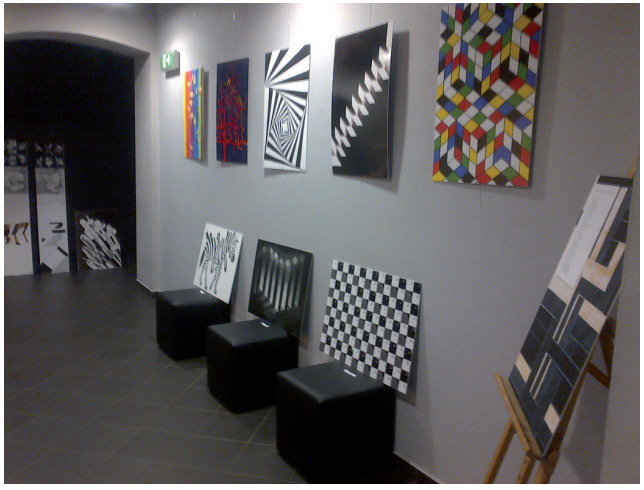

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