

# External and Internal Modelling of Space in Pictorial Representation

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Picture is a means of objects' representation and inter-subject communication, where various ways of spatial modelling interact. Unlike arbitrary signs, picture not only represents something different from itself, but shows the represented objects for viewer's perception. Therefore, the external modelling in form of a material bearer is connected always with internal modelling of depicted objects. Not only perceptual images, but also internal models of other psychical levels participate in creation and interpretation of the pictures. These are, on the one hand, images of the apperceptual and conceptual levels, where schemes of represented objects and their verbal interpretations are formed. On the other hand, the images of sensorial level participate also in the internal modelling. All these mental models interact differently by artists and viewers and influence organization of external pictorial models mediating their contacts.

*Keywords:* spatial modelling, mental levels, perceptual images, schemes of vision, interaction

## Introduction

The aim of this article is to study the links between external and internal models of space involved in the creation and perception of pictures. The article continues a series of the author's papers on space and spatial modelling in various aspects of human activity published previously in *Philosophy Study* (see Tchertov, 2022; 2023). The first of the articles deals with the general concept of space and possibilities to consider in its frame diverse autonomous and separated spaces. The second paper is concerned on the spatial modelling in processes of thinking and communication with using of schemas common for diverse fields of human activity. The current paper contains an application of the general concepts of the space and spatial modelling to a particular but very important case of pictorial representation.

Such kind of representation is understood as a way to show some objects that are absent in a current situation but can nevertheless be perceived by viewers due to a certain configuration of lines and colour spots on a surface. *The picture* in this sense is such a means of objects' representation and inter-subject communication, which connects the heterogeneous ways of modelling: creation of internal spatial models in author's mental activity, their embodiment in some external models (drawing, painting, etc.), and the evoking of corresponding internal spatial models in mind of viewers. How are these diverse models related between each other? Although similar questions have been discussed by the classics of aesthetics and art theory during the entire history of these disciplines, the general concepts of separate spaces and spatial modelling open new possibilities for answering them and allow describing the pictorial representation with a new set of concepts.

## **Connections Between Internal and External Models of Spaces**

### **On the General Concepts of Autonomous and Separate Spaces**

Ernst Cassirer creating the *Philosophy of Symbolic Forms* had supposed an idea that space exists in different *modalities*—as space of perception and its interpretation in physical theories, as geometrical space, as space threatened in language or in myth, as space interpreted in art works, etc. (see Cassirer, 1923, pp. 30-31). The modes of space considered by Cassirer can exist not only as alternative ways of the structuring and interpretation of spatial relations, but they can also co-exist and interact—as it is in cases of pictorial representation.

All spaces included in such interaction can be described as particular cases of autonomous and separate spaces in frame of a general philosophical category. Both physical and psychical complexes of spatial relationships are covered by the general concept of *space* understood as a complex of changeable relations between coexisting configurations of objects, if this complex contains a constant set of properties. The qualities of isotropy or anisotropy, discreteness of continuity, openness or closeness, a certain dimensionality and so on can be combined in diverse ways and characterise the *autonomous spaces* of different types. The spaces of one the same type of autonomy can nevertheless be *separated*, if they do not have a unite order of relations between their parts, a unite scale of their measurement, or if diverse their conditions do not belong to a unite series of events (see Tchertov, 2022).

### **On the Relation of Modelling**

The autonomous and separated spaces can enter in different relations between each other. One of them—the relation of modelling—is especially important for the pictorial representation. The polysemantic concept of *modelling* will be considered here in a certain sense, which is connected with a combination of two more simple relations: (1) the binary and reflective relation of *similarity* between two objects—a “pattern” and its “reproduction” and (2) the ternary relation of *representation* between the represented object, representing model and a subject, who interprets the model of the object in a certain way.

There is also a difference between the *productive models* that serve as patterns for their copies and *reproductive models*, which are replicas of their originals. The functions of productivity and reproductivity are relative, and the same structure can serve as the productive model in one relationship and as the reproductive model in another one.

A difference also exists between external and internal models of space. The *external models* of space are the physical objects used as means of cognition, planning, and communication due to their similarity to the represented objects. Some reproductions of objects can be formed as results of natural processes—as, for example, prints of hands or foots, mirror reflections in water, genetic reproductions, etc. However, the modelling is a conscious activity that gives as result of various kinds of artificial models, such as make out, globe, map, picture, photo, etc.

Each external model can be used only as far as it is viewed and interpreted in a certain way; it always is co-related with some *internal models* that are formed in the mind of subject (see Tchertov, 2015; 2023).

### **On the Levels of Internal Modelling**

These internal models of any visible objects are created at diverse levels of cognitive and projective mental activity with different spatial organization. A difference of these levels is not given directly to viewing subject, but it can be specified analytically.

The optical signals receiving at *sensorial level* of vision are fixed in the visual field of a viewer. This field is ordered according to the main axes of human body, where top and bottom, left and right sides, centre and periphery are unchangeable. All stimuli enter in certain parts of this field as changeable configurations of forms and colours. At the same time, the flexibility of these elements does not change its constant structure included in internal schema of human body with the basic set of anthropological axes—top and bottom, left and right, forward and back. The last pair differs from the first, because only optical signals in front of eyes can be received. So, the *space of the visual field* belongs to the type of autonomy that is characterized by a set of qualities: two-dimensional, anisotropic, heterogeneous, continual, and closed.

The *perceptual* images constructed on the next cognitive level are not fixation of optical data in structure of own body, but they become the internal models of external space. The spatial relations between the objects are treated at this level as independent on movements of the subject. A property of *constancy* gives a possibility to see forms and sizes of objects relatively unchanged and independent on distance and angle of viewing. This perceptual space is already three-dimensional, although it is still limited by the optical material and retains anisotropy that depends on the constancy of the main axes of the human body.

The next *apperceptual* level of internal modelling contains schemas that participate in organization of perceptual space too, but they can be actualized separately in *memory* and *imagination*. At this level, various formations of autonomous spaces with different properties and structures are possible. For example, both visual schemes of the three-dimensional, unclosed, and continual space of Euclidean stereometry and of the two-dimensional, closed, and discrete space of chess board are equally possible at this apperceptual level of internal modelling.

Even higher, *conceptual* level of cognition contains *theoretical models of space* that are formed in various domains of science—geometry, physics, etc. At this level, unlimited manifold of spaces with distinct properties can be modelled. In particular, the scientific theories can give ground to various perspective constructions. At the same time, their exact expression needs means of verbal language and special mathematical signs, whereas visible constructions can only illustrate them (See more details on the logical and infralogical levels of the space modelling in Tchertov, 2023; 2024).

### **On Homogeneous and Heterogeneous Modelling of Spaces**

Thus, the spatial modelling deals with configurations that can belong to different modes of existence. The spaces involved in it can include real physical objects and ideal psychical images.

The relations between the modelling and modelled spaces are *homogeneous*, when both of them belong to one same mode of existence—as for example, when a building and its reduced layout both are the three-dimensional physical objects, or when the perceptual image of the same building and its apperceptual image in memory both are the psychical images.

The relation of spatial *projection* is also homogeneous modelling in both physical and mathematical treatments, because in each of these cases spatial configurations of original and model coexist in a unite space. For example, processes of photo or cinema projections in both directions (shooting and showing) occur in a homogeneous space of physical objects with one same mode of existence. Various ways of projection studied in descriptive geometry belong to another mode of existence, because they take place not in material physical objects, but are formed as ideal mathematical constructs, which also can be described as relations of projection.

This relation is homogeneous too, because both three-dimensional original and its two-dimensional model are considered as parts of unite conceptual space that can be transformed into itself.

The relations of modelling can also connect the components with different ontological status. In this case, the spatial modelling has the *heterogeneous* character, because both external and internal spatial models here are combined. So, unlike physics or mathematics, psychology of visual perception deals with heterogeneous ways of space modelling, when it compares internal psychical models with external physical models of an object. For example, in research of optical illusions, a psychologist should compare the results of subjective viewer's valuation of sizes in visible figures with objective data received as result of their measurement by a ruler as a physical tool and their external quantitative model. In a similar way, philosophy of art should take into account the heterogeneity of spatial models participating in the pictorial representation.

### **Picture in the Subject-Object and Inter-Subject Relations**

#### **Pictorial Representation as Heterogeneous Modelling**

Indeed, pictorial representation necessarily involves both types of models, and it occurs as an interplay between separate spaces of different modes. The viewer needs an *external model* (a painting, a drawing, a photo, etc.) for creation of a perceptual image of the depicted objects, because he or she does not have any such image *a priori*, but should receive it as result of communication with an author through the picture. At the same time, any picture cannot perform its function of the external model without *internal modelling* and evoking at least perceptual image by a viewer.

Therefore, the word *picture* can be applied to spatial formations of distinct nature and qualities. It can be related to both external bearers existing even if nobody looks at them (as paintings in a closed gallery) or—to viewer's perception, which takes place only insofar an optical contact with the external bearer remains. Only the first of these formations belongs to physical space, whereas the second of them can appear only in psychical space as a perceptual image.

The perception of picture itself supposes a complex structure of the internal space modelling. A viewing subject receives not only a perceptual image of a physical object serving as a bearer of picture with a surface of painted canvas, but also a perception of other objects depicted on them.

Both perceptual images of a depicting means and of depicted objects belong to the same modus of ideal spaces, whereas their sources can have different modes of existence. The depicted object can be an original in relation to its picture—as in cases of portrayed persons. It can be also a product of imagination—as in case of a depiction of phantasy beings (gryphon, unicorn, etc.). Although in this case, some parts of the depiction can have real sources, the whole has as its original only another internal model.

In all cases, the depicting surface of picture, the space of depicted objects, and the perceptual spaces created in mind of viewers are separated from each other, belong to different modes of existence and types of autonomy; they have thereby distinct structures and functions. Therefore, the pictorial way of space modelling has principally *heterogeneous* nature.

#### **Modelling Functions of Picture**

The picture in the described above sense can be considered as an elaboration in culture device, which mediates, on the one hand, the connections of subjects with the *represented objects*, and on the other hand, the connections between *subjects* themselves, who use the picture as a communicative means. In both these relations,

the picture takes a place, like each sign and also serves as a “tool” of objects representation and inter-subject communication (cf. Bühler, 1934). At the same time, the picture differs from a conventional sign as more “transparent” for the meaning: it can not only evoke a thought about something else, as still by Augustin (1995, I.2.2) was defined for any sign, but also it opens this object for the perception.

A possibility to show a represented object for the viewer’s eye takes place due to a combination of the mimetic and coding means, when a similarity with the represented object in certain relations is connected with using of various spatial codes. These codes participate not only in the interpretation of the depiction, but also in its formation.

In another dimension of the information connection, the picture is a mediator between communicating subjects, who can transmit between each other the ideas that they have at different levels of their mind. So, the picture contains together with an external model of represented object also some traces of its internal modelling by the picture creators as well as some stimuli that determine internal modelling of this object by the viewers.

Thus, the picture mediates both types of connections: between depicted *objects* and *subjects* viewing them with help of this medium, and between the communicating *subjects*—its *creators* and its *viewers*. The modelling functions of picture are different in these relations. The picture functions as a *reproductive external model* in relations to *represented objects*. At the same time, it is a *productive model* in relations to its spectators, because their perceptions depend on this picture. Meanwhile, the relation of picture to an artist creating it is another. Picture is an *external model that reproduces* some *ideas* appearing in mind of its creator. Therefore, already these ideas are *productive models* in this relation, and picture more or less reproduces them.

So, the modelling functions of picture can be considered at least in three relations: (1) as a *reproductive model* in relation to its *original*; (2) as a *productive model* in relations to *viewer’s* spatial modelling at diverse levels, and (3) as a *reproductive model* in relation to *artist’s ideas* at diverse mental levels.

### **Picture and the Painted Surface**

A picture always is limited by a surface, where it is situated. This painted surface of a certain size and form is a necessary bearer of the picture, due to which it can be considered as an external model. The surface can be flat, concave, or convex (as by painted vessel or dish), and the deviations from flatness can be in different degree taken into account by the painter (cf. Gabrichevsky, 2002).

The painted surface has a duality: it is, on the one hand a border of an *unpenetrated material*—a part of a wall, a sheet of paper, a wood desk, a canvas, etc.; on the other hand, it is a *space penetrated for gaze*, where a depiction of other spatial forms and materials is situated.

Unlike the sculptor, who works with a material piece of the wood or marble, which is initially contraposed to external space, the painter deals with the surface, where a contraposition of not-penetrated objects and penetrated space still should be created for visual perception. At the same time, some similarity in their works can be seen in a “liberation” of a represented object from an unformed milieu. Whereas the sculptor frees the figure to be created from redundant material, the painter contraposes a drawing shape to an unshaped background using linear contours and contrasts between light and dark spots.

This contraposition can be manifested more or less definitely. In ancient black-figure painting on ceramic objects, figures are sharp divided from background. On the contrary, in the Impressionists’ painting, differences between the depicted figures and space surrounding them can be reduced to a minimum. In a similar way, the painter may emphasise more the corporeality of the paint strokes and the surface on which they are placed or

inversely, following Leonardo's advice, try to hide these spurs of material and made depicting surface as much as possible "transparent" for the view into the depicted three-dimensional space.

In any case, unlike the sculptor, who always manifests the corporeality of the work being created, the painter should always, to a greater or lesser extent, transform the body of the handled surface into the space where the depicted objects are located.

### **Picture and Its Original: Relation of Projection**

The picture considered in the object-subject relationship as a spatial model of some original (for example, a portrait of a known person) is a mediator included in both relations: to the represented object and to the viewing subject. Correspondingly, its spatial organization is revealed, first of all, in relation of *projection* between the modelled original and its reproductive model at the picture.

There are many various ways of such projection, according to which a two-dimensional configuration of lines on a surface is correlated with a three-dimensional form of depicted original. In particular, the *orthogonal projection* takes place, when all the points of this original are projected on the plane perpendicularly. The *axonometric projection* brings them onto the plane at the one same angle. At the same time, the *linear perspective* connects all of them to the horizon line imagined behind pictorial surface, where vanishing points for all lines are located, which represent deepening parallels.

The difference between these ways of projection can be seen in diverse cultural and historical domains of pictorial representation. So, the pictorial culture of Ancient Egypt was intended on orthogonal way of projection of separate body parts combined in a unite depiction; the painting of the Far East had used mostly the means of parallel perspective based on axonometric way of projection; the Medieval paintings used "reverse perspective", called so in contrast to "direct" linear perspective developed in the Renaissance, although some elements of the linear perspective were known partially still in Ancient Classics (see Panofsky, 1998; Mochalov, 1983). In the contemporary culture, these ways of projection coexist with its other types. In particular, the orthogonal and axonometric projections are dominated in technical drafts and plans, which need an exact messing, whereas the linear perspective is more attractive for pictorial arts, where the perception of depicted objects by the viewer is more important.

### **Picture and Viewer: An Optical Tool**

The relation of the depicting surface to viewer's perception is a reverse side of the projection as relation between this surface and represented object. In its relation to an eye, the picture serves as a special *optical instrument* that opens for a beholder view into the represented object.

Insofar as the picture is essentially included in both relations at the same time—to the depicted object and to the viewing subject—it combines the functions of window and mirror (two favoured metaphors of Renaissance). Like the window, it opens a view into another space that is more or less distanced from the spectator. Like the mirror, it shows the viewer some of own features.

A framed painting as a special tool of pictorial representation is only in XV century established—in contrast to Medieval icons and other alternative forms, as paintings on walls of rooms, of vessels, of tapestry, etc. Unlike icon serving as a *curtain*, through which the transcendent world shines, where the vertical axe dominates, the framed painting was formed as a *window* opening a horizontally oriented view "behind" it into the depth (see Danilova, 2004).

The picture serves also as a *mirror*, where the viewer finds such own features, which are correlated with main anthropological axes from the scheme of human body, first of all—differences between the axes' top-bottom

and left-right. These vertical and horizontal directions form the structural invariants of the visual field that are fixed in the rectangular frame of the picture and in its *regular field* that is similar in this relation to windows, mirrors, and other “openings-in-barrier” (see Schapiro, 1969; Daniel, 1990).

The axes of the anthropological space are exteriorized in the painting’s structure, which is intended to catch the optical features of depicted objects and coordinate them in most direct sense with the structure of the viewer’s visual field. Because the picture links the viewer with the third anthropological axe between front and back, its frame serves as a tool for the coordination of these axes outside and inside viewers.

Besides its similarity with windows and mirrors, the picture can be put in a series of various optical instruments mediating connections between viewed objects and viewing subjects. This series contains also *lenses*, *glasses*, *binoculars*, *telescopes*, *microscopes*, *camera obscura*, etc. All of these mediating tools, on the one hand, adapt the optical material from an object for the viewing subject, and on the other hand, they exteriorise some internal qualities of a viewer’s visual field working as “projections” outwards of human organs—in accordance an idea of “organ projection” that still in XIX century was suggested (cf. Kapp, 1877) and stayed popular in XX century as well (see, in particular, Florensky, 2000). So, various kinds of the picture, whether it is a drawing or an engraving, painting or photo, with their regular field can be considered as such combination of two functions—an outward projection of internal structure of the human’s visual field and a capturing of object’s outlines in a “viewfinder” of a picture’s frame.

### An Auxiliary Space Between a Painter and a Depicted Object

Sometimes the painters can create one more kind of spaces, if a *mediating frame* is placed between the object and their eyes. This framework is an adding construction of glass’ piece or a net of quadrangles, which should more exactly fix a configuration of points and lines that appear as a result of projection of the depicted volumetric object onto the plane. This way of drawing was described by Albrecht Dürer, who had considered a transparent flat between object and painter’s eye as a surface intersecting “all rays that fall from the eye onto the viewed objects” (Dürer, 2000, pp. 159, 179-180; see also Figure 1). It is interesting not only practically for artists of Dürer’s time, but also theoretically in the context of reasoning about spaces in pictorial modelling. Like the picture itself, this auxiliary space is a tool intended for creation of the *external models* of depicted objects relating also to the *internal models* of space formed in visual field of viewers. The rectangular format of both the frame and the picture serves not only to adapt external optical streams to the anthropological features of the viewers, but also, conversely, as a means of exteriorising the structure of the subject’s visual field.



Figure 1. Albrecht Dürer. An artist using a mediating frame to draw in perspective. Engraving. 1525.

### **Picture as a Stimulus for Perceptual Interpretation: Projection vs. Prospection**

Every painting is such an object that is intended to show not only itself, but also something else. The perception of the represented space is evoked by the configuration of the coloured spots on the surface of the painting, like the configuration of the rays reflected from the mirror. Optical projection is necessary in the relationship between the surface of the painting or mirror and the retina, which receipts the effects of the light rays reflected from it. This projection is carried out by light rays within the same physical space, which is common for both the surface and the eye that also functions here as an optical instrument.

However, between the retinal pattern and the perceptual image there are no longer optical projections. The formation of visual perception needs not only physical processes giving its condition, but also psychical processes, where an *interpretation* of the optical data occurs. This interpretation on a perceptual level of mental activity is produced by the subject as a transformation of a two-dimensional surface into a three-dimensional space.

Such visual penetration “through” the flat depicting space into the three-dimensional depicted space is an action in some sense reverse to the acts of projection. In this perceptual interpretation, on the contrary, a configuration of lines and spots at the flat picture turns out into three-dimensional image of a represented object. A viewer seeing “through” the depicted surface as if through window reconstructs in this act volumetric objects in the perceptual image of the depicted space.

Taking into account Dürer’s translation of Lat. *perspicere* into German as *durchsehen* and its interpretation of perspective as a “vision through” the flat surface into three-dimensional space, this act may be labelled *prospection* (see Tchertov, 2019, pp. 350-352).

### **Picture as Means of Inter-subject Communication**

The connection between represented objects and viewing subjects with the help of picture is one of two main directions of information processes. Another direction connects the viewers of pictures with their creators. As a mediator between communicating subjects, the picture is a means, due to which some ideas of authors can be embodied in it, on the one hand, and on the other hand, it serves for evoking of corresponding ideas by viewers. The ideas that an artist embodies in picture can be considered as a complex of its productive models, whereas the ideas evoking by viewers are reproductive models not only of the reproduced objects, but also of the picture itself.

In another words, one mental models of objects and their pictures can influence creation of similar internal models by viewers of the pictures in virtue of their special organization. Such communication between author and viewer occurs as externalization by authors of their certain internal models, and as an activity of recipients, who intend to internalize these models.

Obviously, a dialectics takes place in relations between authors and viewers. An artist could not create a conceived work without constant looking on it as a viewer. On the other hand, a viewer should in a certain degree reconstruct a course of the artist’s thinking for the adequate understanding of this work. Nevertheless, the productive and reproductive ways of modelling in the pictorial communication are not identical and need a separate analysis.

### **Productive Internal Modelling by Authors**

#### **“Idea” as an “Internal Drawing” Produced in the Mind of Artist**

Unlike the material bearer of picture that serves as an *external reproductive model* of both represented object and artist’s ideas, these ideas themselves can be considered conversely as *internal productive models* for the



picture. *Idea* is a complex concept, which has various interpretations in its long history (see Panofsky, 2002). It can be understood objectively, in Platonic and Neo-Platonic traditions, as some essences existed extra human, or subjectively, as a product of psychical activity, for example, in John Lock conception. This concept can be included in discourse of ontological, logical, psychological, culturological, and other considerations, where it may be related to abstract thoughts as well as to visual images.

In context of this paper, the concept *idea* will be considered as an *internal model* of some spatial configuration that is formed on a certain mental level of a subject (artist or viewer) and is determined by ways of vision elaborated in culture and mastered by this subject. The notion “idea” understood in such a way preserves its ancient pre-Platonic sense of a spatial scheme that contains any configuration of visible forms and differs from more abstract and non-visible meanings.

This connection of the word *idea* with visible spatial configurations takes place in considerations of Giorgio Vasari, who understood it as an “internal drawing” (*disegno*) that an artist creates in mind for expression of concepts and transposes into external drawing by certain skill (see Vasari, 1956, p. 87; cf. also an opposition of *disegno interno* and *disegno esterno* by Federico Cuccari [1607]—in: Panofsky, 2002, p. 77).

The ideas of an artist may represent some narrative constructions—as mythological or historical stories. These *stories* are narrations existing in verbal form, which can be expressed in picture by manifold visible versions. All history of paintings shows, as differently these narrations can be represented in pictures. For example, the versions of “The Last Supper” by Giotto, Ghirlandaio, Leonardo, Tintoretto, and many other treat the same story in different way for viewers distinguishing their compositions, drawing of figures, colour organization, etc. They have different “ideas” in Vasari’s sense understood not as general verbal narrations, but as internal visual models of created pictures, where certain configurations of visible objects will be situated in the depicted space.

### **Productive Models of Apperceptual Level**

Spatial models created in artist’s imagination as such ideas are formed on the *apperceptual level* of internal modelling, where not only various spatial schemas are saved in memory, but also their imaginary combinations by spatial thinking can be created. There are two types of such combinations. Ones of them are schematic figures—some meaningful and recognizable *units* comparable to lexical units of verbal language. These visible “lexemes” of pictorial modelling can be exemplified by *pictograms* of different types and degrees of detailing—from human and animal figures in paintings of Ancient Egypt to laconic figures of a pigeon or a bull at some drawings by Picasso.

Another type of the spatial schemata built and used on this apperceptual level of spatial modelling is related not to elements, but to *structures’* organizing relations between them. A good example of such schemas is given by the rules of linear perspective that are developed in the Renaissance visual culture and mastered by artists educated in corresponding schools. Masters of other cultures had used other apperceptual schemas—as parallel perspective in the Far East painting or “reverse perspective” in some Medieval painting.

Various “forms of vision” and visual thinking described by Wölfflin (1915) also belong to this apperceptual level of internal modelling. This is related as well to diverse composition schemes of pictures—frontal and sideways configuration of depicted figures, their ordering in triangles, circles, S-formed placement, etc. (cf. for example, Hogarth, 1997 [1753]).

Such *compositional concepts* created at the apperceptual level of modelling should be differed from *logical concepts*, which also have grounds to be noun “ideas” in a broader sense. However, these ideal models built at

logical level of mental activity can be expressed in graphic form of communication rather through written words or ideograms and hieroglyphs.

### **Creation of Perceptual Model by Artist and Its Expression in the Perceptogram**

The schemas of vision formed on the apperceptual level are used not only in cases of depicting pure imaginal ideas, but also when the artist works “from life”. In this case, a perception of a depicted object is especially important for creation of its depiction.

A feature of the perceptual level of space modelling consists in combinations of two contrasting moments. On the one hand, the perceptual models represent spatial relations between visible objects maximally exactly in their forms and sizes. On the other hand, this way of modelling depends maximally on peculiarities of subject’s features of seeing.

This dependence is especially clear in case of painter’s perception, which is connected with a certain point of view, wherefrom some objects are open more, other lesser, ones nearer, other farther away, etc. Only part of their surfaces is open for optical contact with viewer, whereas all reverse surfaces are closed. These limitations are compensated partially by movements of body and eyes in real life, by constancy of perception, by its connections with memory (“cognitive cards” and other, see Neisser, 1976). Nevertheless, a connection of perception with position of the perceiving subject is its necessary quality.

This quality can be differently represented in cultural-historical systems of depictions. The parallel perspective of the Japan’s traditional painting is more independent from a definite point of view, than the Western paintings beginning from Renaissance. Meanwhile, even they cannot show the reverse sides or insides of the depicted objects. Especially, the paintings created in systems of the direct linear perspective suppose principally vision by one eye, from a fixed place—as it is showed at the engraving of Dürer (Figure 1).

A painter working with this method can carry on the picture not the natural perception of real objects, which is embedded into a stream of changeable optical data, but only a fixed *view* of the depicted objects that “stops” this stream in a certain point of space and time (cf. Ingarden, 1989). This view is a configuration of coloured surfaces of depicted objects that a painter can open for a viewer from a fixed position.

However, the painter cannot simply “copy” the perception, like one can outline a stencil, without a visual analyse of the perception and a new synthesis of the depicted forms. For an external reconstruction of the depicted object on the picture, the artist should internally reconstruct it in an image of the future depiction. As A. Hildebrand (1907) had formulated, the artist depicting an object transforms its “form of being” into “form of expression”, which is specially intended for viewer’s perception.

The ways of such visual analysis and new synthesis of a depicted object are mastered in the long time of special learning. Depending on the “school” in large cultural-historical sense and on their own modifications of the pictorial means, diverse painters are differed by the “forms of vision” and create different external models even the same object.

Therefore, even a perception of artist, who works “from live”, is not a usual reproductive model of the viewed object, but rather a mental material, from which his own productive model of depiction is created according to schemas of vision that are mastered by the artist in own professional development. These internal models should be exteriorized into surface of picture and be open for perception of other people.

So, the pictorial means of communication between people on the *perceptual level* of modelling are created, due to which, on the one hand, a transformed artist’s perception is expressed in the external model of the picture,

and on the other hand, this external model stimulates perception of depicted objects by viewers.

A configuration of lines and colour paints created by artist at the surface of the picture has therefore grounds to be labelled *perceptogram*, which connects perceptual models of artists and viewers. The perceived objects communicated by the spatial models of perceptograms are more detailed, than the models transferred with simplified *pictograms* or with more conventional *ideograms*.

### **Productive Models of Sensorial Level and Their Exteriorisation in the Picture Space**

At the same time, the models of sensorial level can carry even more details, the multiplicity of which may prevent the perception of a whole. Whereas perception is a modelling of relations between the viewed objects relatively independent on a viewer, the *sensorial models* fix mainly the relations of viewed objects to the subject's visual field and its structure, whether the visible details are left or right to it, looks as larger or smaller, etc.

An attention to data of the sensorial level dominates, when a painter should find exact proportions and colour relations of the objects depicted from a certain point of view and standing therefore in definite configurations in front of the painter. For making up a correct drawing of the represented object, the painter should observe it in a special way and research the relations of its parts to own visual field (see, in particular, Dürer, 2000).

The result of artist's internal modelling should be embedded in the frame of the picture. Like a seeing of real objects is possible by condition of their sensation in frame of visual field, their depiction on a surface also needs certain correlation of depicted forms with rectangular borders of picture. Therefore, the "regular field" of its external model is directly connected with the sensorial level of the internal modelling. However, its structure is correlated already not with changeable elements of the visual field, but with its constant spatial structure. Thus, the structure of visual field is exteriorized in the rectangular form of picture, which connects both depicting and depicted spaces with objects environment as well with the main anthropological axes of subjects.

So, the picture becomes also a communicative means, where, on the one hand, sensorial images of the painter are expressed and connected with its regular field; on the other hand, this means can evoke similar images by the viewers. Such means connecting internal models of painter and viewer formed on the sensorial level of modelling can be labelled a *sensogram*.

### **Productive Models of Painter's Actions**

The picture is for a painter not only a space, which is viewed at different levels of vision, but also a *space of action*. Accordingly, the models that the artist should create are not only images of a desired result, but also the *plans of actions* with materials and instruments of working. These plans also can be formed at diverse levels of projective activity (see Tchertov, 2024).

As the created work has a double character containing both depicting and depicted space, the plans of the painter also are related to both and to their connections. Therefore, at least, two productive models can be joined in these plans. On the one hand, the painter should organize colour paints on the surface electing them and putting in certain places. On the other hand, by the same manipulations with materials, the artist organizes the shapes of represented objects and their relations in the depicted space. Accordingly, the plans of painter's actions should be formed in such a way, in which changes of paints at the picture surface would be at the same time relevant changes in the depicted space.

Although the painter, unlike the sculptor, does not penetrate physically behind the depicting surface, he or she organises its visual penetrating and a possibility for a looking eye to ingress into the depicted space. So, an artist mowing a brush along surface of a canvas, which prevents penetration into depth, at the same time visually

penetrates there forming some three-dimensional constructions in the depicted space. Thereby, the surface of picture remaining an *obstacle* for physical movements becomes an *aperture* for gaze advancement, and the *impenetrable body* of the picture bearer turns into an *empty space*, where anything other can be depicted.

The work of painter could be compared also with the work of a writer revealing both similarity and difference. Like a writer putting some letters on the surface of a page can imagine the described characters, the painter putting the colours at the canvas surface creates at the same time the figures of represented objects. But, unlike the writer, the painter creates not only imaginary, but perceived objects. Like two planes of expression and of content are correlated in the written texts, so painter's actions in both depicting and in depicted spaces are connected as planes of expression and content in a special *perceptographic code*. However, unlike verbal language of writer, the perceptographic code helps create *perceptograms*—the semiotic means stimulating not only abstract representation of an object, but also its perception as its specific internal model (see more details: Tchertov, 2005).

### **Reproductive Internal Modelling by Viewers**

#### **On Relations Between Viewer's and Artist's Ways of Internal Modelling**

The viewer interpreting the picture as a means of connection with internal models of an author, forms own internal models also on diverse levels of mental activity. An understanding between the creator and the receiver of the picture is possible as far as these internal models can be similar at both ends of the communicative chain.

Certainly, such understanding has some limits, because a viewer may perceive and interpret the art piece in a different way than the artist, value the work negatively, or at all reject it. However, even in the cases of sufficient understanding, there is a principal difference between viewers and artists in their relations to pictorial spaces. For a painter working under a picture, it is first of all a *space of actions* planed on diverse levels of mind and realised on its surface, although after ending of the work its author can displace to position of a viewer. This position differs from creator's point of view, because the picture becomes in this case only a *space of contemplation*, where no changes cannot be made. This does not exclude a mental activity of viewers, who should create their own internal models of depicting and depicted spaces as well as of connections between them. However, in cases of viewer's understanding, this secondary modelling is directed by internal models created by artist and has in relation to them principally re-productive character. This does not exclude that the viewer's internal models cannot fully repeat the artist's ideas, and they depend also on both individual and socio-cultural features of the beholder.

#### **Viewer's Modelling on the Sensorial Level**

A coordination of viewer's visual field with the regular field of the picture already at the *sensorial level* is a condition for any forthcoming its perception and interpretation at other levels of understanding. The rectangular frame serving for the painter as a means coordinating own visual field with external model of the picture becomes for the viewer a tool of a similar coordination between external and internal models. For example, the horizontal line of a depicted landscape, horizontals on the depicting surface as well as horizontal axes of the visual field in the sensorial models of the painter and viewers are coordinated due to common structure that is connected with the rectangle of picture.

As far as depicting surface is covered by spots of certain colours and configurations, the structural carcass of the viewer's visual field is filled with their sensorial images. They can attract a viewer by their decorative

qualities or by their synesthetic meanings that take place, when a sensitive viewer connects the colour spots and lines configurations with quasi-sensorial images of other modalities—hearing, touch, taste, smell, etc. In such a way, the picture can be interesting for the viewer not only as a perceptogram stimulating a prospection into depicted space, but also as a sensogram evoking the formation of a pertinent sensorial model by the viewer.

### Viewer's Modelling on the Perceptual Level: Formation of Shifted Perception

The sensorial data received by the viewer looking at the picture serve as optical material for creating of a *perceptual image*. This creation can proceed in different ways depending on the construction and testing of certain “perceptual hypotheses”—versions of the perceptual image that have more or less basis in the optical data (see Gregory, 1970; Neisser, 1976). Each perceptual hypothesis supposes a selection of relevant sensorial data, a choosing of ones of them and rejection of other. Therefore, the alternative perceptual hypotheses can compete with each other.

As it was said above, the perception of picture has always a duality. This means that at least two perceptual images can be evoked by the sensorial material that it gives. The picture can be viewed on the one hand, as an object among other objects that are visible around it at the same time. If the viewer will continue to perceive the picture in such a way, he or she will see the surface covered by paints—as the painted ceramics or textiles are usually seen. On the other hand, the viewer can perceive the depicted space “behind” the picture’s frame—as it is typical for the painting elaborated in Renaissance epoch as a special optical tool.

In this process, already not *direct* perception of presented objects and a painted surface among them but *shifted* perception of represented objects is formed. The painted canvas is treated in it as a more or less transparent window, behind which any depicted objects are viewed.

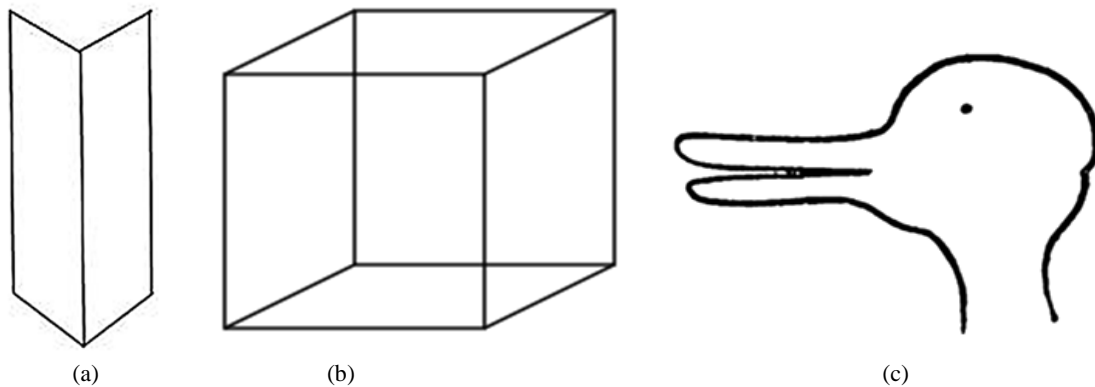


Figure 2. Examples of the double perception; (a) “Mach figure”; (b) “Necker cube”; (c) An example of the double recognition: “Rabbit or duck”, a drawing from L. Wittgenstein’s (1953) *Philosophical Investigations*.

There are cases, when some alternative ways of the shifted perception are possible—as it is, when the picture contains sensorial material for two or more perceptual hypotheses. These are well known cases of double figures—as “the Mach window” or “the Necker cube” (Figures 2a and 2b). This effect is used in paintings of several artists—Giuseppe Arcimboldo, Salvador Dal í and other.

Although this “competition” of distinct perceptual hypotheses in such cases of pictures has similar nature with relations between the direct and shifted perception of any picture, there is an important difference between them. Unlike the perception of a picture bearer embedded in the usual stream of visual stimuli from various things, the perception of the depicted space is outside these limits. The shifted perception is “taken out” from the stream

of optical data, which change constantly in space and time together with viewer's movements (see Gibson, 1979). The depicted space can be perceived only in the *view* that is imprinted by artist, where only such parts of the represented object can be shown, which are visible from a certain point of view in a certain moment of time. The viewer cannot see a reverse side of depicted surfaces. Thus, the viewer forming a shifted perception of the depicted objects should re-produce a perceptogram that is set by artist and interpret it at the perceptual level of internal modelling.

### **Viewer's Modelling on the Apperceptual Level**

Already the formation of the depicted space in the shifted perception needs schemas of spatial vision that are saved in memory and belong to apperceptual level of vision. These schemas are independent on perception of a certain painting and are rather some "lexical" and "grammatical" rules that can be used in various cases. The "lexical rules" are actualized by the *recognition* of depicted objects that can be more or less schematically depicted according to certain conventions, and approach in this relation to pictograms. Like the alternative perceptions of picture, it is possible also to present a competition between alternative ways of recognition. Both ways of alternative modelling can be connected, as for example in the case of famous Wittgenstein's drawing "rabbit or duck" (Wittgenstein, 1968, p. 194; see above, Figure 2c). In this case, unlike the "Necker cube" type examples, not only perceptual images are formed differently, but also different recognition schemes are involved, which also leads to different ways of verbal categorisation.

The "grammar rules" are used by a "reading" of picture according to rules of the linear perspective and light-and-shade modelling. This is an ability of such viewers, who have a skill of perceptual interpretation of pictures created according to these rules. A viewer, without these skills can wrong interpret the depiction.

An example of such misunderstanding was given by H. Wäfflin (1969) describing a case, when a Japan nobleman did not recognize himself on a portrait painted by an Italian artist with shadows usual for post-Renaissance painting: he understood the shadows as dirty spots on his clean face. In a similar way, an upper location of a figure in the depicting space can be differently understood by viewers depending on apperceptual schemas used by them (cf. Panofsky, 1955; Derogovsky, 1972; Cole & Scribner, 1974).

Diverse schemas of the apperceptual level are activated also for interpretation of the represented objects with the help of various spatial codes used for semiotization of depicted space. Figures of painted people, their faces and expressing movements, their dressing and object surrounding, their spatial relations, etc. are interpreted as meanings of manifold spatial codes. Each of these semiotic systems has its own grammar and schemas of connections between visible spatial forms and certain ways of interpretation (see more details: Tchertov, 2019).

### **Viewer's Modelling on the Conceptual Level**

The schemas of vision formed at the apperceptual level of modelling in its turn are included in more general system of a worldview elaborated in a certain culture—in philosophy and other modes of internal modelling on the conceptual level. The philosopher of symbolical forms (see Cassirer, 1923-1929) or researchers in field of iconology (see Panofsky, 1955; Gombrich, 1972) can open behind a variety of sensorial, perceptual, and apperceptual levels of spatial modelling diverse conceptual ways of thinking and describing of the world.

For example, the Medieval paintings were created and interpreted in such system of concepts, where vertical relations between top and bottom are dominated as symbols of hierarchical relations between values of different ways. Accordingly, the entire spatial order of these paintings was given by this system of ideas. On the contrary, the worldview of the Renaissance was transformed towards the dominance of horizontal directions (see Bakhtin,

1965, p. 395). This was manifested, in particular, in transformation of all spatial order of paintings in this epoch, first of all—in development of linear perspective as way to see the three-dimensional space through the two-dimensional surface of mural or canvas (see Panofsky, 1998; Florensky, 1993).

Obviously, all ways of picture interpretation that are based on verbalized knowledge—various narrations or allegories—cannot be understood by viewers, without this verbal form of interpretation. So, any paintings cannot replace Biblical stories for viewers, which are nowhere heard or read about—as some Medieval thinkers have supposed.

At the same time, the painting can represent in its spatial structure some non-spatial relations. For example, a depiction of tree with certain persons serves as a graph of genealogical relations between them—as it is in the painting of ceiling in the St. Michael Church in Hildesheim, where a spatial scheme of Christus origin is represented connecting him with kings Solomon and David and with Adam and Eva. Even more special knowledge is necessary for enciphering of many symbols and allegories that become a special subject of iconology (see Gombrich, 1972).

### Conclusion

The above confirms that the space of picture can be considered as an external model correlated with different levels of internal modelling carried out by both the artist and the viewer.

In particular, it can be understood as an exteriorization and a reproductive model of the subject's visual field with its anthropological system of coordinates. This is a modelling in an external object of a subject's idea taken at its *sensorial level*. The rectangular figure of the picture's "regular field" can be considered as a culturally elaborated spatial form of such exteriorization.

The depicting space of picture can be described also as a *perceptogram* correlated with the *perceptual level* of vision and spatial modelling. This space can be understood as an externalization of *view* given to the artist located in a certain point and an object of an internalization for the viewer reconstructing it in own perception.

The picture can be understood also as an external model of certain forms of vision, in sense of Wölfflin—the schemas that are elaborated in culture and can be mastered by individuals or changed by them. These schemes are related to both elements and structures formed at the *apperceptual level* of internal modelling, where also the images from memory and spatial imagination can be developed. Accordingly, both schemas of *shifted recognition* used in *pictograms* and schemas of *internal representation* of depicted objects ("internal drawings" by Vasari) modelled at this level are externally represented in pictorial space as well.

A picture can be interpreted also at the *conceptual level* of modelling, when it represents in spatial form some non-spatial relations or is treated as an encrypted text.

On the other hand, different viewers are oriented on these diverse levels of internal modelling and can be in relations of accordance or non-accordance with artist's intentions.

Various culturally historical epochs can be characterized by domination of difference from these levels of modelling. So, the "forms of vision" of Ancient Egyptians or Medieval viewers were more oriented at the *pictographic* ways of modelling—unlike painters and viewers of Renaissance, who made more important *perceptographic* level of space modelling and even more—unlike Impressionists that go further and made dominating the *sensographic* level of modelling.

Both forms and colours are related to these levels. In particular, the "polychromic" ways of the colours, unlike "colourful" painting, are related, accordingly, to pictographic or perceptographic levels of spatial

modelling. Some other forms of vision are popular by viewers, who are oriented on Impressionist's and Post-Impressionist's painting, where the sensographic way of modelling becomes more important.

Thus, the general philosophical concept of space gives a possibility to include into unite theoretical conception an interaction of diverse autonomous and separate spaces, which belong to distinct modes of existence and are functioning in physical and psychical reality together. Such interaction between separate spaces of these distinct modes is a condition for each pictorial representation. Every picture can serve as a model of something other only insofar, as its physical spatial organization can evoke psychical spatial images at diverse levels of mental modelling. Every of these internal models is formed in its own autonomous and separate space that can be compared by their qualities with the autonomous and separate spaces of the picture as an external model and of the depicted objects existing in physical reality.

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