Anisotropy and Visual Structures

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Modern studies of perception and cognitive sciences distinguish between bottom-up and top-dawn cue processing. In the first one the stimuli drive the workings of visual awareness, whereas in the second one cognitive operations drive visual awareness. As to this distinction, the *universal* perception factors may all be considered as belonging to the bottom-up cue processing, before interpretation as top-down processing relying on cumulated information and so, at least partly, possibly relying on *cultural* factors. Mere knowing a cube from a sphere is a clear case of bottom-up cue processing free from cultural determinants, but interpreting a cube as a box is a clear case of top-down processing, that supposes a culture in which box are known. Arnheim seems to consider the *dynamics* of *visual structures* as based on universal perception factors. But a main factor in grasping the dynamics of a visual structure is the *anisotropy* of physical space, yet it seems to cover both mentioned kinds of cue processing. The aim of this paper is to briefly consider universal and cultural factors related to anisotropy in perceiving the dynamic visual structures.

Culture Relative and Culture Independent Visual Information

Several authors like R. Arnheim, E. H. Gombrich, J. J. Gibson, or R. L. Solso, refer to universal, the human species specific factors in seeing objects or arrays of them, but on the other hand, the mentioned authors recognize in one or other way relative, cultural determined factors in seeing. Such non-universal or cultural determined factors in seeing undoubtedly rely always on some kind of previous, stored information the beholder possesses. But it were false to think that any somehow stored *visual* information must depend on culture. Also inferior animals store visual information, which depending upon varying environments may or may not be dependent on culture. A kind of bird can recognize natural enemies, which vary depending on natural environment, but for a given bird species men become enemies only in some cultural settings but not in others. Thus, reactions of birds usually menaced by men rely on visual recognition processes and imply cultural determined visual information the birds have stored, even if we would not say that birds are cultural beings.

Surely, the last was an extreme example, but at any rate, there is a dimension in perceiving, which depends on learning processes and whose content is not a universal, neutral one, but on the contrary, such content implies cultural relative information. Let us consider the following two examples.

Example 1. Shaded circles on a plane are interpreted differently depending on which half of the circles is shaded. If the shaded part is the lower half, the circles are interpreted not as plane but as convex (fig. 1), yet, if the shaded part is the upper half, then the circles are interpreted not as plane but as concave. That is, in this example shadowing has the effect of a depth cue, and the correspondent interpretation of depth (convex or concave) seems to rely on stored visual information. According to it, “light” can only “come from the above”, thus, the shadowed circles must be interpreted either as a half spherical figure illuminated from above and so getting a clear top, or as a half spherical cavity also illuminated from above and thus getting a clear bottom.

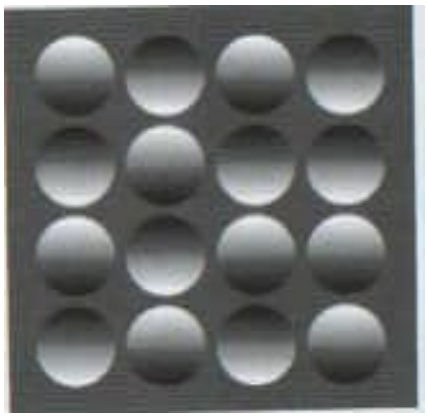
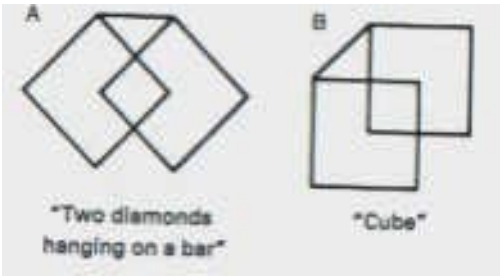


Figure 1

We may suppose that both interpretations rely on stored visual information, but we cannot think of this information as it were merely cultural relative. We can concede that not all men are acquainted with seeing and interpreting forms on a plane, but once such skill has been acquired, the interpretations must go the same way, because for all men around the world light “(normally) comes from above”.

Example 2. Figures 2.A and figure 2.B show each two parallel overlapped squares linked at one corresponding edge by a segment. The figures are congruent, and thus, convertible the one in the other by a mere rigid (rotational) movement. For instance, one can rotate figure 2.A counter-clockwise 45 degrees to obtain figure 2.B Despite of such geometrical equivalence, the two figures can be interpreted in wholly different ways. For example, figure 2.A may be interpreted as “two diamonds hanging on a bar”, whereas as to figure 2.B nobody would “see” any diamonds but rather a

box resting on a side. Clearly, in the figure 2.B nothing is “hanging”, and relating to it we can “see” a resting box because cubes are like some boxes, and boxes normally rest on a side.



Figures 2

In the first example it seems not to be any kind of cultural determined information guiding the interpretation. Likewise, in the second example, information about “hanging of” and about “resting on” are universal, too, but information about boxes is culture relative, for not every culture has known boxes.

Anisotropy as Universal Factor

In speaking of “light coming from above” or of “hanging of” in our two examples we tacitly referred to that, what is known as the anisotropy of environmental or even merely physical space. Otherwise than the abstract geometrical space, the physical one, and even more the environmental space, is not homogeneous, but possesses orientation due to gravity force. There are noticeable and, to great extent, striking ways to see this. A noticeable one is the fundamentally different role of the horizontal plane and the vertical line as dimensions for living man. Horizontal surfaces or directions are the primary orientation of unaided moving, whereas the vertical is the primary orientation of seeing as looking at. Thus, buildings to bee seen, such as churches, pyramids, etc., tend to be toll; and even a height familiar house symbolically displays richness or power in virtue of its height – if not alone through it. On the contrary, merely functional buildings like storehouses, bunkers, hangars, or railroad stations are mostly wider than higher. There is not too much to bee looked at them but there are many thing to do within them.

A striking way to become aware of the anisotropy of physical space is the variability in the perception of symmetry. Certainly, symmetry depending upon a geometrical center or radial symmetry is only little sensitive to orientation. For

example, a star with only four rays, when rotated 22 degrees any away is relatively sensitive to the vertical axis; but a star with six rays would be not too sensitive, an the more the rays the star has, the less sensitive to the vertical axis it will be; it approaches to truly radial symmetry. On the contrary, symmetry along a main axis is highly sensitive to orientation. Think of the contour of a violin, or of the human body, when the symmetry axis stands vertical and when it lies horizontally (fig. 3).

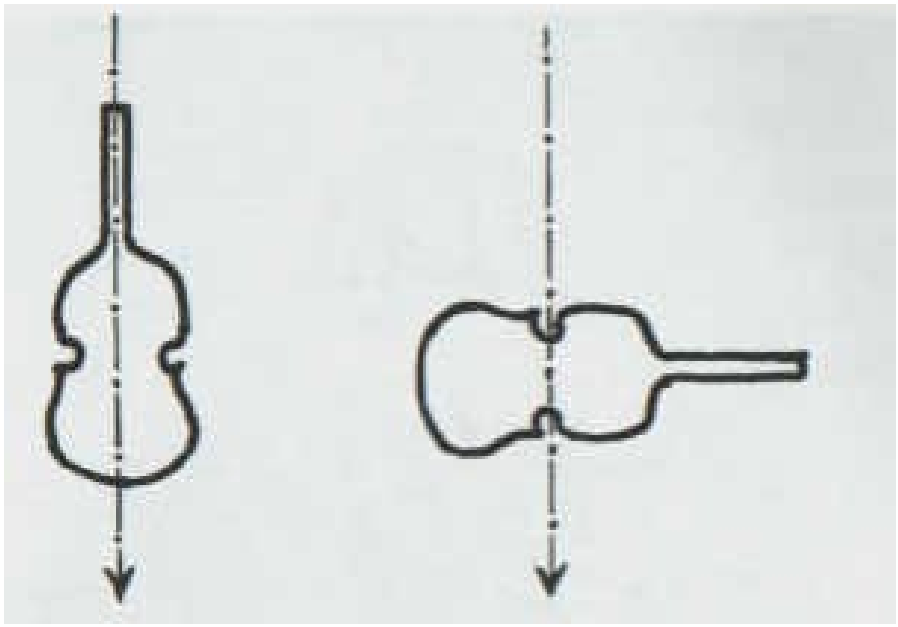


Figure 3

The horizontal orientation may even turn difficult to perceive symmetry itself. Symmetry around a main axis is, thus, highly sensitive to the anisotropy of physical space, and we become at best aware of it when through rotation the axis of symmetry does not more coincide with the vertical.

The previously discussed example of the shadowed circles on a plane and the corresponding interpretation as convex or concave depending on what half of the circles should be illuminated by light coming from above, is an other striking example of the anisotropy of physical space as to perception. A further striking example is the perception of a shadowed conical form on a plane surface (fig. 4). According to the direction of the tapering shadow the conical form is interpreted either as a crater or as a hill. If the shadow tapers downwards one “sees” a crater, but turning the figure upside, we “see” a hill, for by now the shadow tapers upwards.

Figure 4

A last striking example of the anisotropy of physical space is the effect or appearance of a regular cross drawn on a plane. If the plane is set vertical in front of us, we have the accustomed image of a regular, symmetrical cross. But if the plane lies horizontally, then the image becomes completely different, for radial symmetry is now destroyed, and this the more the height of the horizontal plane with the cross on it approaches to the point of view of the beholder. The cross resembles more and more a merely horizontal segment (fig. 5).

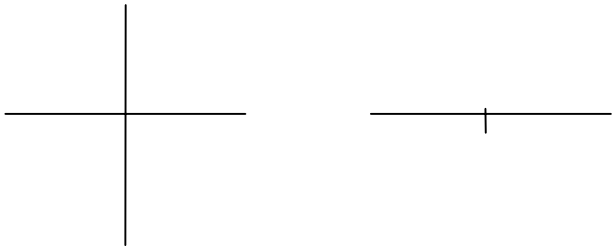


Figure 5

We can suppose that the different perceptual outcome in all the discussed examples involves stored visual information, for example, “hills produce an upwards tapering shadow”, or “(spherical) bodies are (normally) lightened from above”. Even information as acquaintance with symmetry may be supposed. Nevertheless, these are “pure visual” but by no means “cultural” cues – even if some training in seeing of abstract figures may be needed.

Universal and Cultural Factors

If we consider interpreting in the sense of "seeing as", we may think of three stages of this phenomenon.

At first we have seeing as grasping or recognizing of contours, forms, shapes, contrasts, colors, and movements.

Second, we have the organization of the basic inputs coming from the first stage in definite forms against a background.

It may be stages 1 and 2 go without prior learning or information of any kind.

Third. Definite *forms* are *interpreted* through association with previously stored information. Such information may or may not be cultural relative. Obviously, this stage corresponds to the top-down cue processing.

The discussed case of interpreting a conical form either as a hill or as a crater, according to the anisotropy of physical space, could be considered from a cultural relativistic point of view. It is not unthinkable that some human group conceives of hills not merely as hills but as the breasts of mother Earth. Yet, such breasts must be directed upwards in order of being breasts and not cavities. Thus, as to the anisotropy of physical space the cultural load of the conical form either as hill or as breast does not matter. The *basic* interpretive component in the given form recognition depends only upon anisotropy. It is a conical form either directed upwards or directed downwards, and this before any semantic interpretation may be given.

The last discussion shows that the interpretation of visual cues, that is, seeing in the sense of "seeing as" may contain culture relative but also universal dimensions. By now let us consider interlaced factors in interpreting visual cues determined by the anisotropy of physical space.

We can find an interesting case in Gottfried Semper's idea of *Richtungschmuck*, that is, directional ornament. Such ornament accentuates a particular dimension in accordance with the laws of gravitation, that is, with the anisotropy of physical space. For example a plumed helmet stresses the vertical and its aesthetic effect is, at least partly, to make the bearer to appear taller. Likewise, a towering coiffure makes for greater height. Possibly, the Mayas were fond of elongated heads for the same reason. And the effect one looks for may also be slimness. So, women show a great skill in using fabrics with patterns, which stress the vertical axis, or long pendants in order their faces to look slimmer. On the contrary, a woman with a (very) slim face may wish to accentuate roundness, and in this case she will use earrings or other ornament that moves and sways and thus emphasizes slant in order her face to look wider. We can here remember of an

additional anisotropic effect, namely the appearance of colors. Vivid o stark colors look “heavier”, thus weighty persons may wish to avoid them; on the contrary, slim persons may wish to us colorful cloths.

In all the discussed cases of ornament or cloths the effects rely on the same and universal factor, namely, the anisotropy of physical space, and in fact such anisotropic effects has been exploited in one or other way for all cultures. In remembering the great variety of war helmets, it becomes obvious that anisotropy is interlaced with culture relative exploitations of it in order the warriors to appear formidable.

The architecture is a privileged field of interlaced anisotropic effects and cultural factors. We wish here only to very briefly mention some examples. Especially important here is the difference top – bottom but also the difference center – periphery. The last one is a kind of anisotropic factor we first here consider.

We have already said that the horizontal dimension is the primary field of human action, this action emanates from each individual, and the acting individual becomes a kind of perceptual center. Likewise, the other individuals become related foci of action and thus privileged perceptual foci, too. The individual and all such other action foci become, on the same footing, possible, interchangeable perceptual centers. For this reason, the center and the periphery of each enclosed or open space become predestinate bearer of deep symbolic values. Power, goodness, beauty, truth, etc., in one word, all the highest positive values are symbolized by “the center” in virtue of a primary anisotropic relation proper of physical or environmental space.

The *concrete materializations* in all kind of buildings of the mere *formal* priority of the center are legion. The general layout of most buildings pays due attention to the center in some way. And not only profane and sacred furniture and objects are always arranged as to the center, but also merely ornamentally items are mostly ordered as to or even accentuating the center. Of course, items of importance tend not only to occupy the center but also not to lie on the floor, for the floor is on its part endowed with a negative or, at least, with a minor symbolical value. In a more neutral sense, the anisotropy of physical space motivates very especial features in buildings. For example, it is usual a radial arrangement of ornamental or pictorial motifs on ceilings and floors, but not on walls.

In ritual, and also in public buildings invested with a symbolical function, it is common to stress the vertical axis by means of height beyond the usual – of course, putting aside the case of modern skyscrapers, some of which are from the very

beginning intended to carry a symbolical value, too, and for this reason they become specially high.

At any rate, anisotropy of physical space makes out a universal feature that essentially determines the appearance and the interpretation of visual configurations. It could be considered as a basic layer or *formal* fundament, upon which a variety of further, *material*, culture specific visual layers are laid. Anisotropy seems, thus, to determine both kinds of visual cue processing. The case of anisotropy as factor determining the ease or uneasiness of the perception of symmetry seems to be merely the case of anisotropy as a factor in bottom-top cue processing. On the other hand, anisotropy as determinant of symbolic meaning in buildings belongs to the kind of top-down cue processing. And to be sure, it acts within this processing as universal factor that permits the symbolic, and thus, culture specific interpretation of a visual array.

Anisotropy and Plastic Arts

There are several anisotropic factors not yet mentioned, particularly those playing a role in the structural dynamics of plastic works of art. We mentioned already the case of pictorial works as ornament on ceilings and walls; they demand each a different kind of balance. In general, the balance of a work of art depends very strongly from the anisotropy of physical space. For instance, not only the orthogonal axes but also diagonals as well as serpentines have a great influence in the visual appearance of a given painting, sculpture, building, or garden.

Referring to the well-worn difference between classical and baroque stiles, the unbalanced dynamics of many baroque works depends frequently upon the pulling visual craft – to say it in this way – of diagonals. Obviously, the mere difference between orthogonal axes and diagonal lines is a pure anisotropic one. Consider the very simple case of the dynamic rendering of a windmill. The visual structure mere consisting of two orthogonal segments does not do the deed, and even two diagonal segments crossing at an angle of 90 degree does not do it, neither. The appearance of rotational moving is first achieved when the two orthogonal segments are unbalanced (fig. 6).

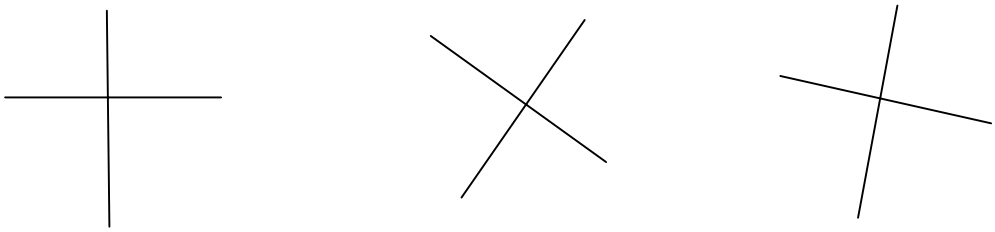


Figura 6

Likewise, the sublime grandeur of baroque gardens such as those of Versailles depends upon the strong dynamics of lines of view reaching the infinity at the horizon, and constituting a main, if not the principal visual theme of the gardens. Comparing with the English garden and its serpentines, it is evident, that the designers (André Le Nôtre and the Sun King himself) were aware of the completely different anisotropic effects of lines vanishing at infinity and serpentines, on the other hand.

In the case of architecture the ritual buildings are interesting as to the anisotropy and the culture specific factors interlaced with it. Pyramids and most Christian churches stress the vertical axis upwards. We can suppose that pyramid builders chose the diagonal contour not only for technical reasons but also in view of its ascending pull. Similarly, the builders of Christian churches added towers to the main body of the buildings in order to give them an ascending pull, too. They could have built pyramids, too, but they did not so. And the reason is not merely technical, but a “cultural choice”, for example, the wish to gather the believers inside of the church in order they can hear the priest, whereas the Egyptian or Mayas divinities did not need such a communication with the believers. In the same way, the more closed, cryptic, or almost intimate form of some Asian sacred buildings relies on a completely different cultural “choice” as to the character of the divinity. The divinity communicates only with a few intimates and, moreover, the divinity displays no power, she is not an active craft but rather the craft of passivity. Such cultural choice referring to the character of the divinity leads to construct buildings, which stress not the vertical but rather the closure.

Conclusion

Turning back to our example of the two parallel overlapped squares linked at one corresponding edge by a segment, we can now see, that interpreting them as a box is a cultural effect. But a member of a culture, in which there are no boxes, would have distinguished them from the “diamonds” array in some way, for both figures

have, in virtue of the rotation distinguishing them, completely different dynamic features. The figure 2.A possesses an unstable visual structure, whereas the 2.B possesses a balanced one. Certainly, the *material* interpretation would be different from culture to culture, but for all cultures one figure has a balanced *formal* structure, while the other figure an unbalanced one. Likely we can allocate the mentioned *dynamic difference* referring to balance or unbalance as belonging to the bottom-top cue processing, whereas the *material interpretation*, that is, the *meaning*, of such *visual difference* belongs to the top-down cue processing, insofar as such processing relies on cultural determined information. Any way, the case of anisotropy shows, that Arnheim is right in conceiving of dynamics of visual structures as universal, culture independent factor.

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