Second Stage of Visual Perception and Picasso's Cézannian Cubism

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Abstract

Palmer (1999) describes a sequence of four basic stages for visual perception: an im-age-based phase that deals with extracting image structure (primal sketch), a surface-based level which concerns itself with recovering surfaces in depth (2.5-dimensional—henceforth two*-dimensional—sketch), an object-based stage that covers the description of three-dimensional objects (volumetric descriptions), and a category-based phase that handles the identification of objects in terms of known categories. Each of these levels is defined by a different kind of output representation and by the processes that are required to compute it from the input representation. This article points at an interesting parallelism between the surface-based and object-centered stages of vision, and Picasso's two different phases of Cézannian Cubism. In general terms, it is fascinating to see how an artist's intuitive approach to pictorial representation appears to mirror scientific research on vision. Cézanne's influence becomes clear in the spring of 1908 when the Spaniard started applying the familiar Frenchman's postulates to his work. Despite the fact that the compositions were strictly inscribed on the picture's flat surface, none of the object's corporeality was lost, so that one can often speak in terms of "flat relief." A change occurred between the end of 1908 and the beginning of 1909 when depicted objects became more solid and roundly modeled, and when pure surface representation yielded to attempts at presenting objects in the round. To that extent, we may speak of an object-based stage in Picasso's output.

Keywords: visual perception 1, Cézannian 2, Cubism 3

1. The Second Phase of Visual Processing

Palmer (1999, pp. 85–93) divides visual perception into a sequence of four basic stages: an *image-based* phase that deals with extracting image structure (*primal sketch*), a *surface-based* level which concerns itself with recovering surfaces in depth (*2.5-dimensional*—henceforth *two*-dimensional—sketch*), an *object-based* stage that covers a volumetric description of three-dimensional objects, and a *category-based* phase that handles the identification of objects in terms of known categories. Each of these levels is defined by a different kind of output representation and by the processes that are required to compute it from the input representation. In this article, I will concentrate on the transition from surface-based to object-based, two-dimensional representation as intuitively depicted by Picasso in the so-called Cézannian Cubism period as discussed in Mallen (2003).

It is the second phase of visual processing, the *surface-based* stage, that is concerned with the recovery of the intrinsic properties of the visible surface in the environment that produced the features at the image-based level. In other words, while the image-based representation refers to image features in the two-dimensional pattern of light falling on the retina, the surface-based representation encodes information about the outside world in terms of the *visible surface layout* of objects. The notion that the visual system is fundamentally concerned with perceiving the spatial distribution of two-dimensional planes within the three-dimensional environment was first proposed by Gibson (1950). Since then, surface-based representations have received different denominations. Marr and Nishihara (1978) referred to them as the *two*-dimensional sketch*, as they lie somewhere between the straight two-dimensional structure of image-based representations and the three-dimensional structure of object-based representations. Barrow and Tennenbaum (1978), on the other hand, named them *intrinsic images* since they represent inherent properties of surfaces in the external world rather than properties of the input image.

In general terms, as Palmer (1999, pp. 88–90) indicates, since the surface-based representation includes only the visible portions of surfaces, it can be conceived as one single, extremely flexible rubber sheet that has been shrink-wrapped to cover just those surfaces in the environment that reflect light into the perceiver's eyes. Current visual theories, however, treat surfaces in this representation as being composed of many small, locally flat fragments. More specifically, surface-based representation are encoded in surface primitives which are local *patches* of two-dimensional areas placed at some particular *slant* and at some *distance* from the viewer within three-dimensional space. Each such patch of surface can also be specified by its *color* and *texture*. Consequently, although the surfaces themselves are locally only two-dimensional, their spatial distribution may be represented in an abstract three-dimensional geometry. The coordinate system within which the resulting three-dimensional layout of surfaces is represented is specified within a *viewer-centered* reference frame (i.e., in terms of the direction and distance from the observer's station point to the particular surfaces rather than in terms of the retinal image). Since it is dependent on the viewer's reference point, the representation of surfaces is constructed from the information provided by several additional sources: *stereopsis*, *motion parallax*, *shading* and *shadows*, and various other pictorial properties such as *texture*, *size*, *shape*, and *occlusion*. It
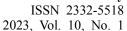
is posited here that most of the pictorial notions examined by Picasso during early Cézannian Cubism is analogous to this particular stage of vision.

The conception of surface perception as determined by its distance and orientation was originally formulated by Gibson (1950) and later reformulated by Marr and Nishihara (1978). This *surface-based representation* is what was identified earlier as the *two*-dimensional sketch*. A representation of visible oriented surfaces in depth is indispensable to vision and is required to understand many higher-level perceptual phenomena (Nakayama, He and Shimojo 1995). Visible surfaces are the entities that actually interact with light to determine the optical information that is projected onto the retina. Because most environmental surfaces are opaque, one actually gets no visible information about what they cover. Thus surfaces are the only direct source of visual information about the three-dimensional structure of the three-dimensional environment. After perceiving the structure of visible surfaces, the observer may make additional inferences, such as the nature of occluded surfaces. However, anything beyond visible surfaces is by necessity removed from the retinally available information. To that extent, vision after this stage is mental.

As the term indicates, the two*-dimensional sketch is somewhere between the two-dimensional properties of an image-based representation and the three-dimensional properties of an object-based representation. It summarizes the many converging outputs of different processes that recover information about the depth and orientation of local surface patches in the environment into a convenient representation of orientation at a distance. There are many processing modules computing depth information from separate sources. Each module processes a different kind of information, which then provides independent constraints on the final depth interpretation in the two*-dimensional sketch. The information may concern the state of the eyes (ocular information) or the structure of the light entering the eyes (optical information). It may involve both eyes (*binocular information*) or just one (*monocular information*). It may be available in a motionless image (*static information*) or it may require movement of the observer and/or the object (*dynamic information*). The information may specify the actual distance to objects (*absolute information*) or merely how far objects are relative to each other (*relative information*). Finally, the information may provide numerical (*quantitative information*) or merely ordinal distance relations (*qualitative information*). In summary, the sources of depth information can be organized in terms of four categories: *ocular information* (convergence, accommodation, gradient of focus, and eye elevation) *stereoscopic information* (binocular disparity and Da Vinci stereopsis), *dynamic information* (motion parallax and accretion/deletion of texture), and *pictorial information* (linear perspective, outline shape; relative size; texture gradient; height in the picture plane; occlusion, overlay, interposition, or superposition; Illumination and reflectance edges; Shading and shadow; and atmospheric perspective).

The human visual system has evolved to easily detect edges, regions, objects, groups, and patterns from the structure of luminance and color in optical images. The perceived object is somehow reconfigured from a wide array of such features. The question is what determines the particular organizations that visual experience obtains. One possibility is that it simply reflects the structure of the external world. Under this account, the physical environment

actually consists of edges, regions and objects arranged in space. Such arrangement would then be reflected in the organized perceptions. But obviously, the visual system does not have direct access to such facts about the external world; it has access only to those features of the image which are projected onto the retina, and this optic array actually contains an infinite number of possible organizations, only one of which is attained by the visual system. In other words, some analysis and structuring of perceptual objects is required. The organization of visual input includes at least three processes: perceptual grouping, region segmentation and parsing.

If the goal of perceptual organization processes (region segmentation, perceptual grouping, and parsing) is to construct a hierarchy consisting of parts, objects, and groups, these must necessarily follow the process of figure/ground organization, since image-based regions do not normally correspond directly to objects. Of the factors involved in figure/ground organization the most important are: surroundedness (if one region is completely surrounded by another, the surrounded region is perceived as figure and the surrounding region as ground), size (the smaller region is perceived as the figure), orientation (a vertical and horizontal set is perceived more frequently as figure than does the oblique set), contrast (the regions with greatest contrast to the surrounding area are taken as figural), parallelism (the regions with parallel sides are perceived as figure rather than ground), convexity (convex regions tend to be taken as figure and concave ones as ground) and symmetry (symmetrical regions are viewed as figure).

Even after regions of similar visual properties have been segmented and figures have been discriminated from grounds, the visual system may still encounter difficulties in determining experienced objects. One of the complicating factors is *visual interpolation*. The visual system often automatically perceives partly occluded surfaces as complete, usually including their shape, texture, and color. In fact, if the occluded portion of the contour is relatively small, the perception of its completed shape can be as certain as if it were viewed in its entirety. Visual interpolation may even occur with the perception of illusory contours. This is generally accompanied by amodal completion of the inducing elements behind the illusory figure (Kanizsa 1979; Kellman and Loukides 1987; Kellman and Shipley 1991). Visual completion is amodal since the completed portion is not supported by local sensory experience in any modality, and it is visual in the sense that the completed portion is confirmed indirectly by visible information elsewhere in the image.

Picasso made a creative use of may of these visual properties, which clearly indicates that, at least at an intuitive level, he was aware of how visual perception works. Judkins (1976) provides a partial list of the pictorial devices he employed: (a) planes may represent at once transparency and opacity; (b) tones of objects may bleed out and become background tones so that the object is part of, and at the same time in front of, the background; (c) outlines may coincide with other outlines so that the continuity may be read around either one or across both; (d) surfaces may recede behind other surfaces and project over them simultaneously; (e) shadow, mutually excluded by each other's light sources, may stand side by side; (f) parts of objects shifted away from the whole may then change in tone so that the recognition of the original will be constantly elusive; (g) shadows may become substance; (h) flat planes my

disappear behind themselves; (i) shapes created by arbitrary changes of tone may compete with the shapes of the recognizable objects within which they are developed; (j) forms whose contours pass over other forms may have their local tones disappear beneath them; (k) interlocking light and dark forms may alternatively be seen as the object or background; (l) parts of an object may be displaced from the whole so that its recognition is made elusive, fugitive intermittent; (m) objects may be seen from two (or more) directions at once; (n) sections of objects may be shifted and adjusted so that they become either involved in other continuities or new forms in their own right. As Judkins (1976, 1–32) specifies, what all these arbitrary devices have in common is a deliberate manipulation of the elements of representation leading to a multiplicity of readings.

2. The First Phase of Cézannian Cubism

During the spring and summer of 1908, the painter had begun to concentrate on surface-based (depth) relations over everything else. This tendency can be detected in the extreme planar stylization of *Paysage*,[1] *Paysage*,[2] and *Femme nue assise*.[3] As Penrose (1981, pp. 148–149) wrote, by the time the Spanish artist moved to the village of La Rue-des-Bois-par Creil in August, his "background and foreground ... merged together in a play of surfaces which seem to touch each other. The eye is invited to travel among them and enjoy the definite though subtle way in which it can be led into the depths of the picture, exploring paths as they disappear into recesses and returning over angular planes that push forward into the light. In the three-dimensional pattern made up of definite planes, the eye is never allowed to lose itself in awkward holes which could break the continuity of the surface of the picture and destroy the coherence of the composition." Golding (1968, p. 71) observes that the landscapes Picasso painted at Rue-des-Bois have much in common with Braque's contemporary works. Neither painter relies entirely on the use of a single, consistent light source to model forms; instead, they began to create volume by "arbitrarily juxtaposing lights and darks rather than by using shading in a naturalistic way." Picasso had restricted his color palette to browns, grays and greens. The forms show a radical simplification: cylindrical tree-trunks, stylized masses of foliage, cubic houses, etc. Picasso's approach is more sculptural than Braque's. The contours of the objects remain unbroken and their modeling gives the impression of being aggressively three-dimensional.

Daix and Rosselet (1979, pp. 50–53) argue that Picasso might have left for La Rue-des-Bois precisely to confront nature, making full use of the cerebral interpretation of depth in landscapes. Drawing on the powerfully articulated space, first he strongly illuminated the distances and darkened his foregrounds; then he reversed the normal techniques of perspective, enlarging distant objects to form the surface of the picture while simultaneously pulling the other volumes out towards the viewer. The painting presented "a stylized world, filled to

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[1] *Paysage*. [La Rue-des-Bois]. Spring–Summer/1908. Watercolor and gouache on paper. 64 x 49,5 cm. Kunstmuseum Bern. Online Picasso Project 08:114

[2] *Paysage*. Paris. Spring–Summer/1908. Gouache over pencil on panel. 26,9 x 21,2 cm. Christie's. #48, 1900, 11/06/07. Online Picasso Project 08:155.

[3] *Femme nue assise*. Paris. Late-Spring–Summer/1908. Oil on canvas. 150 x 99 cm. The State Hermitage Museum, Saint Petersburg. Online Picasso Project 08:112

overflowing with bulky volumes," "a world in which distances are arbitrarily compressed." In the sequence *Maison dans le jardin,*[4] *Maisonnette et arbres*[5] and *Paysage,*[6] Picasso imitated Cézanne's practice of taking objects from real life and redistributing them in his pictures as required by the demands of the composition, rather than according to the outside world. In this system, the volumetric space between the objects is created by superimposing one plane upon another. The overlaying of these planes allows the viewer to mentally construct depth in spite of the rich surface appearances which seem to deny it. But it was particularly in the last of the three above mentioned canvases that Picasso had recourse to Cézanne's technique of *passage* in the setting up of visual communication between the solid bulk of an object and the external space surrounding it, between figure and ground.

According to Wadley (1970, pp. 29–30), the French artist had found himself torn between these two apparently irreconcilable poles: the fragmentary, inconstant nature of visual sensations (*external reality*), and an art of constancy and composite finality (*pictorial composition*). Painting for him was a question of the retina and the brain working together to organize visual perception into a coherent, permanent structure which differed substantially from mere impressions. While using the Impressionist technique of small brushstrokes, he created an ordered system of uniform marks which gave the whole textured surface a conceptual homogeneity of form. Objects in Picasso are approached with similar intuitive ideas of form, as Gray (1953, pp. 55–90) has established. As in the Cézannian framework, the object itself still plays a major role in the treatment of the picture. There is a logic behind the execution but there is also an outside reality to which the logic is applied. The referential entity is analyzed and interpreted, but it still retains its objective value. I would argue that at this stage in the development of Cubism Picasso attempted to approximate the *physical* surface of the object. Shapes are carefully analyzed from the point of view of their optic and tactile features before being absorbed, reduced to their essentials and condensed into a symbolic design.

The influence of Cézanne becomes clear when we compare Picasso's work from 1907 and 1908. As Gray (1953, pp. 51–54) notes, the figures in *Les demoiselles d'Avignon,*[7] though abstracted in an angular fashion, give the impression of being cut out flat planes with a poor sensation of volume. There was no attempt to create modulation, and the outlines of the figures remained hard and linear. This contrasts with the work of Cézanne where line was only used sporadically to counteract or enhance the contrasts and analogies of color and tone. If earlier the contour was something that he could adhere to, or choose to disregard it in favor of the color area it contained, now it became more significant as a marker of color edge. Line would be even avoided later on in the artist's attempt to build space by means of color modulation,

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[4] *Maisonnette dans un jardin*. La Rue-des-Bois. August/1908. Oil on canvas. 73,6 x 60,5 cm. The State Hermitage Museum, Saint Petersburg. Online Picasso Project 08:005.

[5] *Maisonnette et arbres*. [La Rue-des-Bois]. [Early-August/1908. Oil on canvas. 92 x 73 cm. The Pushkin State Museum of Fine Arts, Moscow. (Inv 3350). Online Picasso Project 08:013.

[6] *Paysage: La Rue-des-Bois*. La Rue-des-Bois. Early-August/1908. Oil on canvas. 100,8 x 81,3 cm. The Museum of Modern Art, NYC. (Inv 1413.74). Online Picasso Project 08:007.

[7] *Les demoiselles d'Avignon.* Paris. June–July/1907. Oil on canvas. 243,9 x 233,7 cm. The Museum of Modern Art, NYC. (Inv 333.1939). Online Picasso Project 07:001.

with only occasional coincidences of line and color margins. The simultaneous presentation of several alternative edges was actually one of Cézanne's ways of expressing the impermanence of appearances (Wadley 1970, pp. 29–30).

Cézanne had intuitively evolved a new means of explaining the nature of solid forms. He generally studied the objects in his still lifes from slightly above eye-level, so that the observer saw them in their most informative aspect. The object's solidity was insisted upon through intense modeling and enhanced texturing. Indeed, as the artist moved from one section of his canvas to another, he unconsciously altered the structure of objects in an effort to relate rhythmically each *passage* of painting to the areas around it. This was in fact a clear step in the direction of viewer-independent object perception. Through the aesthetic emphasis on the two-dimensional plane, the tipping forward of certain objects, and the sensation of having adopted conflicting viewpoints, the painter manages to synthesize into a single representation quite a bit of information on the specific configuration of the object. Cézanne's unequivocal influence on Picasso can be sensed both in the general construction of his canvases and in the technique of small, flat, rhythmically applied brush strokes which build up the forms. The outlines of walls of buildings are often continued at slightly different levels or angles as they appear at intervals behind the objects in the foreground. By coupling this conflict in viewpoints with an insistence on the material constitution of the object, the artist successfully detaches the object from the viewer, making advances towards artistic representation within a more object-centered framework.

In the autumn of 1908 Picasso applied his constructive approach to the figure. The nude in *La dríade (Nu dans une forêt)*[8] is more subtly integrated into the surroundings by the way her shapes defining her body are highlighted (Daix and Rosselet 1979, pp. 64–66). The geometrical volumes are brilliantly faceted and their references are entirely mental and without descriptive allusion, approaching the Cubist ideals. The sculpturally abstracted and thoroughly integrated volumes and the Gothic structure of the composition clearly owe something to Cézanne: the sense of vibration of his solid forms and the presence of a tenuous surrounding space, which, far from interrupting the plastic rhythms, links them to the atmosphere around them. In Rubin's assessment, this effect is produced by a multiplicity of *passages* together with variations in the lighting which cause the planar surfaces to pivot. This important transformation in his pictorial idiom will eventually lead to the abandonment of the former primarily large angled planes and the introduction of smaller facets as the primordial constructive element.

Cubism for the Spaniard was at this point a pictorial language which dealt primarily with solid forms. To his interest in the external properties of plastic volumes we must ascribe the consistent use of simultaneous angles (i.e. combining into an image various views of one single object), as already mentioned. Nevertheless, Picasso gradually grew more interested in presenting in each image, not just details about outside appearances, but also information on the essential nature of the depicted subject. Thus, as he now subdivided forms, it was to try to

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[8] *La dryade (Nu dans une forêt)*. Paris, [Fall]/1908. Oil on canvas. 185 x 108 cm. The State Hermitage Museum, Saint Petersburg. (Inv GE.7704). Online Picasso Project 08:001.

break through to their inner structure, in an attempt to get to the ultimate pictorial truth, and the absolute representation of reality. In the half dozen portraits of Fernande—for instance, *Femme aux poires (Fernande),*[9] *Tête de femme sur fond de montagnes*[10]—Picasso managed to conjure up in the face the essential idea of the cone, inspired by the mountain of Santa Bárbara. He created mute spaces, making the colors appear illuminated from behind, so that the inner structure of the figure now emerges through the translucent surface. Walther (1997, pp. 40–42) proposes that it is at this juncture that Picasso's study of primitive sculpture began to bear fruit. He had examined their formal principles, coming to the conclusion that they consisted of a number of shapes added together side by side.

In his schematic still lifes, Picasso applied the familiar Cézannian postulates. Despite the fact that the compositions are strictly inscribed on the flat surface, none of the corporeality of the objects is lost, so that, as Palau (1990, pp. 104–106) has indicated, one can speak here in terms of "flat relief." For Rosenblum (1976, pp. 27–28) these still lifes are important in that they indicate a turning point from his earlier preoccupation with the human figure. Abandoning subjects that evoked human compassion, he focused now on "the representation of objects in the environment." Thus, *Fruits et verre*[11] continues the study of pictorial figuration in general, the same issue that had preoccupied Cézanne. What the older artist had explored was in good part the difficult reconciliation of the demands of nature with the exigencies of representation. The question was how to establish the illusion of volume and solidity without destroying the flat fabric of paint that constitutes the essential truth of the picture surface, how to record both the specific textural qualities of an object and its more fundamental structural components, and how to describe the fugitive passage of light while respecting "the enduring massiveness of objects." In this respect, Picasso opts for more neutral textures than Cézanne's. The tremulous color planes that define Cézanne's surfaces are replaced by forms that alternate more simply in hue and value. These variations clarify the surfaces and edges more precisely, and suggest a light that is far more abstract.

The interplay between organic and inorganic forms becomes—in Rosenblum's words—"a means of equating the irregularities of nature with the disciplined control of geometry." The three-dimensionality attained by chiaroscuro is inconsistent, being often contradicted by the punctuated presence of the picture plane. In relation to his landscapes, the transformation is evident. The compositions are stripped of detail and energetically compressed into a primitive pictorial architecture. Again the artist asserts the flat continuity of the painting's surface, for, despite the seeming bulk of objects, such solids are ultimately subordinated to an interweaving of planes that is never intended to perforate the canvas. Braque, like Picasso in 1908, had resolved the precarious tension of Cézanne's dual homage to optically recorded nature on the one hand and mentally perceived art on the other, in favor of the latter. By doing so, the artist

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[9] *Femme aux poires (Fernande)*. Horta d'Ebre, Summer/1909. Oil on canvas. 92,1 x 70,8 cm. The Museum of Modern Art, NYC. (Inv 827.96). Online Picasso Project 09:024.

[10] *Tête de femme sur fond de montagnes (Fernande)*. Horta d'Ebre, Summer/1909. Oil on canvas. 65 x 54,5 cm. Städel Museum, Frankfurt am Main. (Inv 2110). Online Picasso Project 09:022.

[11] *Fruits et verre*. Paris. Fall/1908. Tempera on wood panel. 26,7 x 21.6 cm. The Museum of Modern Art, NYC. (Inv 279.83). Online Picasso Project 08:012.

highlights that these constructions must be elaborated in the viewer's mind. Just as the description of surfaces becomes remote from any possible subject-oriented viewpoint, so, too, do the colors take leave of retinal encoded nature and tend toward an ever more severe monochrome that permits the study of a new spatial structure without the interference of a complex chromatic organization. The light also follows the dictates of pictorial rather than natural laws. Houses, for instance, appear to be illuminated from contradictory sources in order to define most distinctly the planar constituents of their architecture and their surrounding landscape.

These are paintings of solid forms stripped of all their inessentials and reinterpreted with almost geometric exactitude. As he worked on *Trois femmes*,[12] Picasso discovered that facets could indeed be imposed on the figures without breaking up the interlocking curves of the composition. Steinberg (1978, pp. 114–133) has declared that *faceting* may be considered the first of a series of Cubist devices that allowed Picasso to evoke the three-dimensional character of his figures without resorting to conventional chiaroscuro. As Karmel (1993, pp. 34–35) has also stated, the sculptural definition of individual form through faceting appears here as an alternative to modeling. The surface pattern created by "flat shapes and interlocking curves," as well as the superimposition of facets on the interconnected shapes, introduces a variation on the conventional pattern of crossing diagonals and linear perspective. The resulting composition appears as a single, continuous surface molded into advancing and receding planes. The singularity of each canvas stems from the coordination between architectural drawing, color depth and directional brushstroke, in an effort to convert all three into one sole language.

3. The Second Phase of Cézannian Cubism

The human figure has always played an important part in Picasso's work. The Spaniard looked with particular interest at Cézanne's figural work. Some of his studies of single heads executed during the autumn and winter of 1908 still show the earlier, more sculptural, African type, but is now reinterpreted in a new idiom. The severe outlines of the facial mask are retained, but the treatment of the face is more complex, subtler and more empirical; it is no longer divided into a few clearly defined sections, and eyes and mouth are not so precisely stylized and deliberately emphasized as they had been before. By the late winter of 1908 and the spring of 1909 the African element is eliminated completely, while the empirical aspect is accentuated. Forms become much more generalized; and they are no longer thrown into relief by the use of a single, consistent light source. The lines are generally thin, but there is a marked tendency to distend the trunks of the bodies so that they become unnaturally broad as in *Femme nue assise*.[13] For Palau (1990, pp. 126–128), the gigantism of the end of the year seems to be derived directly from the Cézannesque bathers theme as in the already cited *Baigneuse* from the winter of 1908. As mentioned earlier, the point was to make it possible for the observer to see simultaneously opposite parts of the same character without at the same time betraying the two-dimensional quality of the painting. This necessarily obliged the artist to distort the image. This same

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[12] *Trois femmes*. Paris. Spring~Summer [Fall]/1908 [–January/1909]. Oil on canvas. 200 x 178 cm. The State Hermitage Museum, Saint Petersburg. Online Picasso Project 08:009.

[13] *Femme nue assise*. Paris, Spring/1909. Oil on canvas. 100 x 81 cm. The State Hermitage Museum, Saint Petersburg. Online Picasso Project 09:056.

distortion will in fact continue into early 1909 in works such as *Buste de femme*[14] and *Tête de femme.*[15]

The transition to the more sculptural forms can be traced back to the two types of African masks that according to Golding (1968, pp. 76–77) influenced the Spaniard's initial steps towards Cubism. The first type is flatter, more abstract and remote from European art, with the basic planes of the face being differentiated not by relief but by "the directions of the striations" with which they are covered. The second type is more solid, sculptural, with a more volumetric and naturalistic figuration. His admiration for these two different kinds of masks is indicative of the instinctive pull which he simultaneously felt between "an increased interest in solid, sculptural forms and an awareness of the need to depict them in a manner that did not violate the flat, two-dimensional plane on which he was working." A new treatment of volumes required, naturally, the formulation of new techniques to reconcile it with the demands of the flat picture surface. The first type of African painting is more purely pictorial and is represented in such works as *La danse au voiles (Nu à la draperie).*[16] The various forms of the body are distinguished from each other by heavy black outlines. The strong linear flavor evinces, of course, the flatness of the picture plane and this effect is further strengthened by the fact that the entire picture surface is broken down into angular forms of almost equal size, and dealt with in the same technique. Later Picasso approached Cubism, however, primarily through his interest in analyzing the nature of solid forms. It is this more sculptural approach, based perhaps on the second type of African mask that can be seen in the intensive investigation of simple forms which culminates in his works of the winter of 1908.

Picasso also accentuated the multiplication of the viewpoints in his *Femme nue au bord de la mer (Baigneuse),*[17] where the viewer appears to be led all round the torso and the back of the figure. A shifting mass, introducing the dimension of time, escapes from the contradiction implied by the application of flat paint onto a two-dimensional surface. The mass is never in exactly the same place twice. And the use of hatching becomes an efficient instrument for catching the very nature of the human forms as they are revealed by light. A contemporary series of very rapid studies—*Deux femmes nues,*[18] *Femme à la mandoline,*[19] *Femme assise (Femme au châle)*[20]—brought to a climax this simplification of the legibility of forms by

[14] *Buste de femme.* Paris, Spring [Summer]/1909. Oil on canvas. 73 x 60 cm. Tate Modern, London. (Inv N05915). Online Picasso Project 09:047.

[15] *Tête de femme (Fernande).* Paris, Summer/1909. Charcoal, black ink and gouache on paper. 62,5 x 48 cm. The Art Institute of Chicago. (Inv 1945.136). Online Picasso Project 09:048.

[16] *Nu à la draperie (La danse aux voiles).* Paris, August~September/1907. Oil on canvas. 152,1 x 101 cm. The State Hermitage Museum, Saint Petersburg. Online Picasso Project 07:025.

[17] *Femme nue au bord de la mer (Baigneuse).* Paris, Winter/1908~1909. Oil on canvas. 129,8 x 96,8 cm. The Museum of Modern Art, NYC. (Inv 786.95). Online Picasso Project 08:026.

[18] *Deux femmes nues.* Paris, Spring/1909. Oil on canvas. 100 x 81 cm. The Metropolitan Museum of Art, NYC. The Leonard A. Lauder Cubist Collection. Online Picasso Project 09:003.

[19] *Femme à la mandoline.* Paris, Spring/1909. Oil on canvas. 100 x 80 cm. Kunstsammlung Nordrhein-Westfalen, Düsseldorf. Online Picasso Project 09:064.

[20] *Femme assise (Femme au châle).* Paris, Spring/1909. Oil on canvas. 81 x 65 cm. Sotheby's. #20, PF1516, 12/10/15).

lighting effects. The ambiguous illumination produces an environment which is strangely unstable and shifting in its appearance. Thus the ostensible cubes were progressively to evolve into a pictorial language that rapidly discarded the preliminary reference to solid geometry and turned rather to further exploration of an ever more ambiguous and fluctuating reality, as Vallentin (1963, p. 85) pointed out. In these works, outlines become no more than the fragile outside membrane around a shifting inner structure. They enclose a mass whose fragmenting surface may be said to slip away elusively.
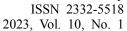
He had been dissatisfied with the limitations imposed on pictorial volumes by the conventional linear system of perspective. In *Les demoiselles d'Avignon* the noses of the full-face figures had been presented in profile, and the distended pose and dislocated head of the squatting figure violated the canons of traditional perspective. In the MoMA *Baigneuse*, Picasso accomplished the desired optical synthesis. Both buttocks and the far side of the back are visible in what is basically a simple three-quarter view of the figure; one leg is in strict profile, while the other is seen almost from a frontal position. The face, divided down the central axis, is a crude combination of a three-quarter and profile view, and the elongation of the mouth suggests even a purely frontal viewpoint. Each part of the woman's body is modeled into curved shell-like volumes, linked together at their joints. A new architectural view is offered in which, as Penrose (1981, 150) observes, the living units have been "torn to pieces and built up again into a statuesque image."

As Golding (1968, 72–73) comments, a change also took place in the still lifes that Picasso executed during this time and the early spring of 1909, for instance *Compotier.*[21] They are more solid, more firmly drawn and roundly modeled. The hatchings of the still lifes rapidly yield to a direct presentation of objects in the round. Daix (1965, 73) noted that they acquired a new solidity, articulating the colored surfaces to heighten the sculptural aspects with far greater decision. At the same time, the viewpoint adopted, clearly derived from Cézanne's perspective, dominates the depicted objects, revealing them, while simultaneously stressing the break with classic perspective and a new interaction between forms on a flat surface. The challenge of combining various aspects of an object into a single image had concerned Picasso for some time (Golding 1968, pp. 76–77). Daix (1993, pp. 81–92) asserts that Picasso's concentration on still lifes was conditioned by his interest in examining the value of pictorial rhythms and how these collaborate in the construction of a separate space. Using the fragmentation of surfaces as a device to refine rhythmic contrasts, the artist gave volume a physical sensuality. This involved a drawing closer to the material suggested by the object depicted while simultaneously maintaining a distance away from it, since fragmentation represented also a more mental and analytical approach.

In this respect, one may clearly see a contrast between Picasso and Braque. For Golding (1968, pp. 81–82), Braque was not so much interested in the formal, architectonic properties of individual objects as he was in their surface relations to each other and to the surrounding space. He wanted to paint distances between surfaces, to make them as concrete for the viewer as the

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[21] *Le compotier*. Paris, Winter/1908~1909. Oil on canvas. 74,3 x 61 cm. The Museum of Modern Art, NYC. (Inv 263.1944). Acquired through the Lillie P. Bliss Bequest, 1944. Online Picasso Project 08:027.

referents themselves. To accomplish this he tried to convey the sensation of having circulated around the depicted objects, of having seen or even felt the spaces between them. Every represented element is separated from surrounding ones by layers of visible space which enable the observer's eye to reach from one object to another, through a series of clearly defined pictorial *passages*. When an object is fragmented in these compositions, it is not in order to strip form bare or to isolate some essential structural quality of the object, but it is rather as a means of creating a new kind of overall tactile pictorial space. Through mastery of color resonances Braque provided objects with a flexible surface which at times eroded the intersection of volumes, and made the form of figures completely dependent on the spatial content of the composition. The artist himself recognized that his involvement with still lifes was conditioned primarily by his desire to find a kind of tactile, almost manual, space. What attracted Braque was the materialization of that new space he felt. In contrast, Picasso's painting focuses attention on the independent qualities of the object, the surrounding setting being often treated in a more cursory fashion. The Spaniard was anxious to introduce sculptural completeness into his paintings. He wished to give his canvases a dimension that already existed in free-standing sculpture, allowing the inspection of the object from multiple angles. In this case, this is accomplished not by stressing the physical aspect of the surfaces, but rather by focusing on the structural components that constitute the object in all its different views.

The transition from surface-oriented paradigm to an emergent concentration on object-oriented structure is behind the bipolarization that Palau (1990, pp. 130–133) detects in Picasso's production of the spring of 1909. On the one hand, he painted the Nordrhein-Westfalen *Femme à la mandoline*, which shows what might be classified as abstraction or simplification in a kind of new linear syntax; while on the other he also produces the well-known polyhedral structures of faces in such works as *Femme assise*[22] and *Femme à la mandoline,*[23] a technique soon to be further developed in Horta de Ebro. In the second canvas the head has been sculpted into the form of a mandolin, thus auguring the metaphoric reversals of Synthetic Cubism, as will be discussed later. Whereas the earlier work still encountered a certain atmospheric space, in the later one the plane begins to absorb the surrounding space.

Cooper (1971, pp. 52–53) noted that around this time Picasso's compositions introduced a linear scaffolding which anchors the viewer-oriented frame of reference and holds the composition together, while simultaneously allowing the associated structure of planes to define both the volume of the figures and to spatially integrate foreground and background. The artist was aware that planes can be oriented with respect to diverse directional forces so as to present the subject from several points of view. By providing a stable orthogonal reference, the divergent orientations of planes which constitute the surface of the object provide a sense of movement which progressively distances itself from the former domination of a single viewer. As Roskill (1985, pp. 11–32) indicates, this notion may be related to Léon Werth's concept of duration with respect to the turning of forms and the opposition of planes. As already stated,

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[22] *Femme assise*. Paris, Spring/1909. Oil on canvas. 100 x 79,5 cm. Nationalgalerie, Gemäldegalerie, Staatliche Museen zu Berlin. Online Picasso Project 09:031.

[23] *Femme à la mandoline*. Paris, Spring/1909. Oil on canvas. 92 x 73 cm. The State Hermitage Museum, Saint Petersburg. (Inv 6579). Online Picasso Project 09:010.

Cubism was interested in the idea of a more active multiple-view perception of the object. This mental movement allows the rotation around an object while at the same time maintaining a stationary place. It is this fusion of successive views into a single anchored image which Apollinaire refers to in his concept of a "reconstitutive condition" imposed on the observer by the various elements that define the object. In Cubism, the individual units that constitute the object take on a particular appearance not only because of the effort of the viewers who perceive their simultaneity, but also by being manipulated by the artist into a unified plastic arrangement on the canvas.

The main concern remains to capture as many views of the outside surface of the object as possible. In *Femme avec livre*[24] essentially two view angles of the female figure are combined to give more complete realization to the plastic concept of the form. Picasso works out a more subtle elaboration of multiple views in *Buste de femme au bouquet (Fernande)*.[25] Perhaps it is at this point that one finds the genesis of the idea of the combination of the profile with the full face view. The left side of the face in the picture is presented in profile, even to the roll of hair done up at the nape of the neck, while the right side of the face in the picture is presented almost frontally. Meanwhile the "less sculptural" Braque concentrated on providing an abstract, geometrical organization to the composition in which all parts would be cohesively integrated. Not only the positive forms, but also the space between them are to participate in this dynamic complex. From this perspective, the aesthetic effect of the picture would become more dependent upon pre-existent ideas which are then verified through their reference to natural objects. Particularly important in this phase of Cubism is the concept of the equivalence of form and space. The angular, faceted space between objects becomes as material as the objects themselves. The forms of space interpenetrate those of solid mass, making them dissolve. Solid form, surrounded by space, could at times be replaced by an equivalent space form surrounded by material form.

His work announces the total destruction of the illusion of delimiting surfaces. The shifting planar rhythms are more agitated. The balance between the reality of the particular scene represented and the very unreal vocabulary of shimmering planes is even more precarious. It becomes very difficult, especially in comparison with the 1908 landscape, to distinguish precisely the boundaries between distinct planes. The heavy solidity is now challenged by the extreme shallowness of the space and the greater frequency of sudden light contrasts. The vocabulary approaches an ascetic reduction to straight lines and clean-cut arcs, reasserting the interplay between the organic and inorganic. The colors, too, move in this austere direction. Thus, just as it evolved an almost homogeneous vocabulary of fragmented planes to describe the structure of the world, Picasso's Cubism produced a narrow chromatic range (hues of tan, gray, brown and green).

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[24] *Femme au livre*. Paris, Spring/1909. Oil on canvas. 92,1 x 73 cm. The Metropolitan Museum of Art, NYC. Online Picasso Project 09:008.

[25] *Buste de femme au bouquet (Fernande)*. Horta d'Ebre, Summer/1909. Oil on canvas. 62 x 43 cm. Kunstsammlung Nordrhein-Westfalen, Düsseldorf. (Inv 133). Online Picasso Project 09:023.

The impulse toward increasing fragmentation of mass will become clearer in Picasso's summer landscapes in Horta such as *Le réservoir (Horta de Ebro).*[26] Yet, Picasso seems to be unwilling to give up the depiction of a specific reality. Parsing the object does not yet lead to its radical disintegration. It has been claimed that the unique colors and irregularities of the topography of Horta de Ebro is what actually determines the unique uneven structure of the compositions at this time. The colors are mostly the bleached ocher, silvery-gray, and tawny of Horta, and the village required little more than simplification to coincide with Picasso's mind. The superficially amorphous rock is analyzed, broken down into geometrical planes, often prismatic in shape. The tilted planes sometimes slide over one another and sometimes meet in a ridge. In some cases the geometrication is carried further into the sky, whose faintly shimmering crystalline facets bind the whole into a rigorous plastic unity.

Schwartz (1971, pp. 44–46) pointed out that Picasso now "chose to exploit the structure of the object for its own sake, rather than integrate it into a harmonized whole, or transmute it through stylistic modification." He examined each mass from as many vantage points as possible, so that he was able to dislocate it and articulate its potentialities. In the landscapes done at Horta he pursued the study of volumes in a close transposition of Cézanne, with its fusion of terrestrial landscape and sky into a great architectonic mass, and its faceting of sky into other, equally crystalline areas. *Le réservoir (Horta de Ebro)* accentuates the power of volumes and also distributes them so that they interact towards an immediate harmony.

Picasso and Braque have been found to be actually developing two aspects of Cézanne at this time. Kozloff (1973, pp. 33–37) observes that in Braque's works the meetings of planes tend to be magnified, as they are stacked upward in a close rhythmic space. Planes executed in thinned washes of pale greens, ochers, and brown-grays are lighted by tints that have no natural source. Many internal contours bleach out so that the identity of images is almost destroyed. "The space is on its way to becoming a complete invention," defined by shading effects that respond to every discontinuity of the contour as if it were a welcome occasion for new contrasts rather than a means to articulate shape. As already stated, Picasso was interested in the monumentality of mass itself; for Braque, the emphasis on structure developed more by way of light than mass. The Spaniard modified his brushwork at Horta in deference to a geometric clarity. In the more sculptural, formal, African paintings of 1907–1908 the starting point for the investigation of form had been the rational division of the human form into their component surface planes. Picasso now began to treat solid forms in a more arbitrary, empirical or experimental fashion and to explore the possibilities of representing them without the aid of traditional perspective. Here the African and the Cézannian types of painting are fused. The concern expressed at Horta is with the relationships between the block-like buildings and the reconciliation of their obvious solidity with the picture plane. The deviations from conventional perspective are carried to new lengths. Not only is there no central vanishing point in the distance, but one actually finds inverted perspective. Picasso's use of light is by now also completely arbitrary: darks and lights are opposed to each other simply to accentuate the incisive quality of the outlines and to throw form more sharply into relief, and atmospheric

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[26] *Le réservoir (Horta d'Ebre).* Horta d'Ebre, Summer/1909. Oil on canvas. 61,5 x 51,1 cm. The Museum of Modern Art, NYC. (Inv 81.1991). David Rockefeller Collection. Online Picasso Project 09:030.

perspective is completely disregarded. As a result, distant buildings appear to be placed above rather than behind the ones in the foreground. The picture plane is further stressed by dropping the small openings below the bases of the buildings, and by opening up forms into each other. The sky, too, is treated as a series of planes extending up the composition, so that there is almost no suggestion of depth. As in Cézanne the sky is a complicated system of small, thickly painted planes inextricably fused, and having a quality of material existence.

As Golding (1968, pp. 74–76) shows, the series of Horta heads all have basically the same basic subdivision into several clearly defined areas, which seem to be independent of the particular model that inspired them. The forehead is usually divided by a central ridge. Two simple planes connect the sunken eye socket to the forehead, and a small disk or square extends below from cheekbone to the inside corner of the eye, while the jaw, the nose and the section from nose to mouth and from mouth to chin are each clearly delineated. These areas then become the starting point for further subdivision. In the structure of the entire figure, the basic pyramidal form recalls African sculpture. However while the deformation of the figure is more geometrical than in most of the Cézannesque paintings, it is also overall less rigid than in the 1907 African paintings. Forms are faceted in a more elaborate fashion, so that the viewer can move freely from one sculptural element to another. In works like *Femme assise*[27] the head is viewed from slightly above eye level but the undersides of the features are clearly seen. The side of Fernande's neck is swung forward in a great curving plane, while the knot of hair at the back of her neck is incorporated in an almost full-face view, and the back of the shoulder is tipped up into the picture plane. In works where three-quarter length figures are represented, the sides of the body are equally folded outwards to broaden and expand the trunk. In each image Picasso condenses information obtained from conflicting view angles. Relying on his intuitive knowledge of the structure of the human figure, he provides a complete analysis of the essential forms that compose it. Palau (1990, pp. 134–135) shares the same impression that the artist's drawings of this period show a progressive departure away from outside reality and toward mental configurations, arguably in order to reduce the representation of objects to formal constructions. The underlying principles of form are analyzed to reveal the imprecise surface of natural appearances. The shapes in nature become the hard glistening facets of an agglomeration of crystals. Light is no longer cast upon them from one arbitrary position, but rather radiates from beneath each surface. It is used not as a temporary illumination of the scene, but rather to accentuate the essential components of each object, shading one surface with a warm brown and contrasting it with an adjoining cool blue-green. This type of shading serves to enhance the relief by establishing a hard edge between them.

The figures in Horta de Ebro start with rhythms of geometrical lines as in *Tête de femme,*[28] but later curves begin to dominate. Picasso wanted to depart from the almost total exclusivity of straight lines that the appearance of polyhedra had brought about, giving now preference to curves. The landscapes produced a decisive evolution in Picasso's representation of human

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[27] *Femme assise (Fernande)*. Horta d'Ebre, Summer/1909. Oil on canvas. 81 x 65 cm. Sotheby's. #8, L16006, 06/21/16. Online Picasso Project 09:007.

[28] *Tête de femme*. Horta d'Ebre, Summer/1909. Pencil, pen and India ink on laid writing paper. 10,8 x 13,3 cm. Maya Widmaier Picasso Collection, Paris. (Inv 01172). Online Picasso Project 09:086.

faces, which went from being curved and oval to becoming more and more angular, until figure and landscape were treated similarly. The artist confronted representativity, and sought to make it compatible with his new language: He researched the natural world while attempting to accentuate the flat surface. In *Buste de femme (Fernande)*[29] he used multiple planes in concave and convex forms. This gave him a chance to study the problems of breaking down three-dimensional form into distinct planes. Up to this point he had tried to translate pictorial imagination into tangible substance during the two*-dimensional and subject-oriented proto-Cubism. Now he would attempt to translate optically, in two dimensions, effects attainable in three, i.e., he would move to the domain of three-dimensional, object-oriented Analytic Cubism (Daix 1993, pp. 96–99).

Tête de femme[30] is a consequence of the latest pictorial discoveries Picasso made in Horta: that of joining woman and landscape. If painting had obtained three-dimensional structure through chiaroscuro, which is typical of volume, the artist now courageously applied the same principle to sculpture, where one finds autonomous chiaroscuro per se. As Palau (1990, pp. 152–153) has stated, on coordinating the face and the light, it is the latter that allows one to see the former. Picasso makes full use of the play of light across the rough, irregular texture of the bronze in order to accentuate the dissolution of the face into sharp, angular and incisive planes. The distortion of the head in a sweeping spiral movement forces the viewer to move completely around it, and elaborate a complete perception of it. For Wadley (1970, pp. 119–123), Cubism was an intensive exploration of both figure and space conceptions. Certain sections, when they fall into deep shadow, give the effect of having been cut out in order to show the internal structure of the whole. Its revolutionizing revision of the ambiguities of the art of painting was undertaken in a medium where space was by necessity illusory, in an activity whose whole basis was the paradox of three-dimensional reality represented on a two-dimensional surface. Working on sculpture allowed Picasso to combine a sense of massive solidity while analyzing the effect of light on the tilted sequence of planes. The result is a plastic integration of substance and space, a sculptural reconstruction of Cézanne's painterly *passage*, linking foreground and background or object and surroundings.

Works executed back in Paris in the autumn carry the geometrical analysis of form and its dissolution into separate planes much further than the Nationalgalerie *Femme assise*. The tensions set up are considerable and lead to reductions and reconstructions still more independent of appearance. Daix and Rosselet (1979) note how the rigors of the new Cubist discipline limit the range of color to subtle *passages* of ochre, brown and gray. In *Tête de femme (Fernande)*[31] he tried even more radical elisions. He again introduced asymmetry in the interplay of the facets. Shapes skid away, increasing their dynamic quality in *Homme au*

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[29] *Buste de femme (Fernande)*. Horta d'Ebre, Summer/1909. Oil on canvas. 93 x 74 cm. Hiroshima Museum of Art. Online Picasso Project 09:014.

[30] *Tête de femme (Fernande)*. Paris, 1909. Bronze. 40,6 x 26 x 25,4 cm. The Museum of Modern Art, NYC. Online Picasso Project 09:017.

[31] *Tête de femme (Fernande)*. Paris, Fall~Winter/1909. Oil on canvas. 61 x 50 cm. Museo Nacional Centro de Arte Reina Sofia, Madrid. (Inv AD.01811). Online Picasso Project 09:106.

chapeau [Portrait de Braque].[32] There is also a more supple delineation with modulation of the facets by color gradations in *Femme nue assise dans un fauteuil.*[33] A freer geometrication now began to emphasize the masses and the rhythms in the figures.

In its concentration on the structural configuration of the depicted object, Cubism became, even if unwittingly, the first conception of art explicitly twentieth century in outlook toward the visual world. Conceivably this innovative approach was triggered by the belief that the only universe that counted was man-made. As Kozloff (1973, pp. 1–6) has stated, nature, though still quite mysterious in its invisible workings, existed at this time only to be "surmounted and mastered" both physically and mentally. Nothing could be more symptomatic of this manipulative incursion than the fragmentations that predominate in Picasso's work, as if these could act as "monitors of perception" and not merely as the attributes of one single perceived category.

Upon analysis, the Cubist paradigm indicates structures whose openness revealed an implicit principle of vision. I am not suggesting that Picasso was fully aware of how vision works. The Cubists in general had a kind of intuitive approach to science. Their total faith in intuition and empiricism outweighed any real sense of a rationalized system. They seem to have admired primarily the creative idea of science, which probably seemed to them to symbolize a closer preoccupation with reality, distancing itself from all the artifice of conventions. Their stated objective was a greater reality in art, a reality that no longer depended on the artificiality of illusionism, that could reach beyond a depiction of surface appearances. Daix has affirmed that painting became for Picasso a form of thought (Daix and Rosselet 1979, pp. 181–182). What now interested the artist was to clarify the principles by which images are constituted, without ever losing sight of the fact that paint is merely a medium through which a three-dimensional reality passes into two dimensions.

References

Barrow, H. G., & Tenenbaum, J. M. (1978). Recovering intrinsic scene characteristics from images. In A. Hanson, & E. Riseman (Eds.), *Computer Vision Systems* (pp. 3-26). New York: Academic Press.

Cooper, D. (1971). *The Cubist Epoch*. New York: Phaidon.

Daix, P. (1965). *Picasso: The Man and His Work*. New York: Praeger.

Daix, P. (1993). *Picasso: Life and Art*. New York: Harper-Collins.

Daix, P., & Joan, R. (1979). *Picasso: The Cubist Years, 1907–1916: A Catalogue Raisonné of the Paintings and Related Works*. Boston: New York Graphic Society.

Golding, J. (1968). *Cubism: A History and an Analysis 1907–1914*. New York: Harper and Row.

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[32] *Homme au chapeau (Portrait de Braque)*. Paris, Winter/1909. Oil on canvas. 61 x 50 cm. Nationalgalerie, Museum Berggruen, Staatlichen Museen zu Berlin. (Inv MB.16.2000).. Online Picasso Project 09:121.

[33] *Femme nue assise dans un fauteuil*. Paris. Winter/1909. Oil on canvas. 91 x 72 cm. The State Hermitage

Gray, C. (1953). *Cubist Aesthetic Theories*. Baltimore: The Johns Hopkins Press.

Judkins, W. O. (1976). *Fluctuant Representation in Synthetic Cubism: Picasso, Braque, Gris, 1910–1920*. New York: Garland.

Kanizsa, G. (1979). *Organization in Vision: Essays on Gestalt Perception*. New York: Praeger.

Karmel, J. L. (1993). *Picasso's Laboratory: The Role of his Drawings in the Development of Cubism, 1910–1914*. New York: New York University, Ph. Dissertation.

Kellman, P. J., & Mike, G. L. (1987). An object perception approach to static and kinetic subjective contours. In S. Petry, & G. E. Meyer (Eds.), *The Perception of Illusory Contours* (pp. 151–164). New York: Springer-Verlag. https://doi.org/10.1007/978-1-4612-4760-9_16

Kellman, P. J., & Thomas, F. S. (1991). A theory of visual interpolation in object perception. *Cognitive Psychology, 23*(2), 141–221. https://doi.org/10.1016/0010-0285(91)90009-D

Kozloff, M. (1973). *Cubism/Futurism*. New York: Harper and Row.

Mallen, E. (2003a). *The Visual Grammar of Pablo Picasso*. New York: Peter Lang.

Mallen, E. (2023b). *Online Picasso Project*. Sam Houston State University.

Marr, D. (1982). *Vision: A computational investigation into the human representation and processing of visual information*. San Francisco: W. H. Freeman.

Nakayama, Ken, Z. J. He, & Shin, S. (1995). Visual surface representation: A critical link between lower-level and higher-level vision. In S. M. Kosslyn, & D. N. Osherson (Eds.), *Visual cognition: An invitation to cognitive science* (pp. 1–70). Cambridge, MA: MIT Press.

Palau i Fabre, J. (1990). *Picasso: Cubism 1907–1917*. Barcelona: Ediciones Polígrafa.

Palmer, S. E. (1999). *Vision Science: Photons to Phenomenology*. Cambridge, Massachusetts: The MIT Press.

Penrose, R. (1981). *Picasso: His Life and Work*. Berkeley: University of California Press.

Rosenblum, R. (1976). *Cubism and Twentieth Century Art*. New York: Harry N. Abrams.

Roskill, M. (1985). *The Interpretation of Cubism*. Philadelphia: The Art Alliance Press.

Schwartz, P. W. (1971). *Cubism*. New York: Preager Publishers.

Steinberg, L. (1978). Resisting Cézanne: Picasso's 'Three Women.' *Art in America*. LXVI, no. 6. (November-December). pp. 114–133.

Vallentin, A. (1963). *Picasso*. Garden City, N.Y: Doubleday and Co.

Wadley, N. (1970). *Cubism*. New York: The Hamlyn Publishing Group.

Walther, I. F. (1997). *Pablo Picasso*. New York: Thunder Bay Press.

Museum, Saint Petersburg. Online Picasso Project 09:019.

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