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Infinite Horizons¹: Le Corbusier, the *Pavillon de l'Esprit Nouveau* dioramas and the science of visual distance.

Abstract:

The *Pavillon de l'Esprit Nouveau* was a building central to the development of Le Corbusier's architecture and key to the role played by painting in his work. Significantly, as a prototype living space and as a setting for Purist art, it not only established Le Corbusier's vision for contemporary architecture and urbanism, it also served as a demonstration of principles developed in collaboration with Amédée Ozenfant through their joint editorship of *L'Esprit Nouveau*. In the pages of the journal are numerous references to the nature of visual sensation and to the science of vision, but to what extent do the paintings and other material displayed in the pavilion reflect these ideas? Concentrating primarily on the panoramic images of the city displayed in the pavilion's dioramas and on the contrasting nature of Le Corbusier's paintings at this time, this paper considers the influence of nineteenth-century science and visual culture on his work.

Introduction

The *Pavillon de l'Esprit Nouveau*, designed by Le Corbusier in 1925 for the Paris based *International Exposition of Modern Decorative and Industrial Arts*, was primarily an architectural prototype (Figs. 1, 2). Envisaged as “a house for everybody”² the pavilion was to be imagined as one dwelling in a series of much larger blocks. But although described by Le Corbusier in some detail, these apartments (known as the *immeubles-villas*) were also likewise just one component of two more extensive urban plans.³ Accordingly, the pavilion itself provided a backdrop both for a number of drawings and images, including a painting by Le Corbusier himself and also two panoramic cityscapes, painted by Le Corbusier and installed in purpose built displays.⁴ Described as ‘dioramas’, these installations are testament to the effort made by Le Corbusier to reconcile representation and the scientific analysis of visual experience. Importantly, they also describe the urban context in which the *immeubles-villas* were intended to sit (Figs. 3, 4).

Constructed as an annex to the main pavilion, the exhibition space containing the two dioramas served to illustrate Le Corbusier's urban plans as panoramic views: one of the *Plan Voisin* (a proposal for the redesign of central Paris) and another of the more generic *Ville Contemporaine* (a contemporary city of three million inhabitants) (Figs. 5, 6).⁵ Taking its name from the periodical founded by Le Corbusier and Ozenfant, the *Pavillon de l'Esprit Nouveau* not only therefore provided an all encompassing picture of the “new spirit” and life in a modern city, it also represented a critique of the historic centre within which the exposition was based.⁶ Extending from the Dome des Invalides along the banks of the Seine and across to the Petit-Palais the exhibition, for the most part, took full advantage of its location.⁷ Yet it was also an area just north and east of this site that Le Corbusier singled out for demolition in the *Voisin* plan (Fig.7):

*In our walks through this maze of streets we are enraptured by their picturesqueness, so redolent of the past. But tuberculosis, demoralization, misery and shame are doing the devil's work among them.*⁸

Le Corbusier's now familiar scheme, proposed the demolition and redevelopment of six hundred acres of central Paris. A major portion of the plan envisaged a commercial district of high-rise offices, occupying an area from the Place de la République to the Rue du Louvre, and from the Gare de l'Est to the Rue de Rivoli. Whilst to the west, a residential zone would extend from the Rue des Pyramides to the circus on the Champs Élysées, and

from the Gare Saint-Lazare south towards the Tuileries.⁹ Some sense of the streets targeted by Le Corbusier, can be gleaned from the work of one of nineteenth-century Paris' most accomplished panorama artists, Pierre Prévost. From as early as 1799, a panorama of Paris (as viewed from the Tuileries) had been on display in a rotunda somewhere in the vicinity of the Boulevard des Capucines.¹⁰ The portion of Prévost's panorama illustrated here is taken from the preliminary drawing for a later work (exhibited in 1814). But still roughly one hundred years before Le Corbusier's plan, this section of the painting nevertheless roughly correspond to the view depicted in Le Corbusier's diorama of the Voisin plan and gives some indication of the terrain across which Le Corbusier's plan was intended to cut (Figs. 8, 9).¹¹

Displayed alongside the *Plan Voisin* was the *Contemporary City of Three-Million Inhabitants*, and although not specifically referring to any particular location, this plan also to some extent had its origins in the vicinity of the pavilion. Initially exhibited in 1922 at the Salon d'Automne, its first public airing had been just a short distance from where the pavilion now stood.¹² A broader but equally uncompromising scheme, the *Ville Contemporaine* had also been displayed as a diorama in this earlier exhibition where it had, according to Le Corbusier, caused some dismay. Assuming a notional level site, the planned city is shown extending over a wide area with the business and residential centres (later adapted for the Paris plan), flanked by industrial areas and suburban "garden cities", all separated from the centre and from industry by a large protective zone of woods and fields.¹³ The proposals were clearly radical and ambitious but in terms of their presentation, the panoramic images displayed of these schemes were also nonetheless reminiscent of earlier Paris panoramas. And although much disparaged, these visions of the city have proved to be amongst the most significant urban images of the twentieth-century. Indeed, there is considerably more that might be said both of the origins of Le Corbusier's notions of the city and of the merits (or otherwise) of these proposals, but my concern here is not primarily with the content of these schemes, or even with the ideas of industrial production promoted by the pavilion, but rather with the visual experience associated with these images. In this context the devices employed by Le Corbusier to make his propositions visible and his tendency, in one way or another, to work through the medium of painting both prove significant. And it is precisely because the aim of the pavilion was to embody the ideas and qualities it promotes, that an analysis of the devices employed here by Le Corbusier prove revealing, particularly with regard to the role of painting and of pictorial representations. The most explicit examples of this are, of course, his images of the city, including some of the more conventional perspective views, but as already indicated the pavilion also provided the context for the display of a number of other works.

Amongst the paintings on display was one by Le Corbusier now known simply as the *Still Life from the Pavillon de l'Esprit Nouveau* (Fig. 10). Composed of a number of superimposed elements, it makes for a dense and object-filled space – a far cry from the openness and order of Le Corbusier's panoramic perspectives, perhaps even suggesting something of the chaos his city plan sought to eliminate.¹⁴ By contrast, although supposedly not lacking in activity or speed, his city with its elevated roadways has a kind of stillness and quiet. It is as if the scene is viewed from behind glass or perhaps more accurately as if from a great distance. The elements of the city in Le Corbusier's plan have been pulled apart and organised in distinct and separate zones. Likewise, the position from which all this is viewed is also one of separation.¹⁵ Often elevated and removed, the viewer in Le Corbusier's perspectives is drawn back to a vantage point from which the entire scene can be viewed (Fig.11). But for Le Corbusier the restrictive means of conventional perspective were clearly not sufficient to capture the sublime qualities of urban landscape he envisaged:

I wish it were possible for the reader, by an effort of imagination, to conceive what such a vertical city would be like; imagine all this junk, which till now has lain spread out over

*the soil like a dry crust, cleaned off and carted away and replaced by immense clear crystals of glass, rising to a height of over 600 feet; each at a good distance from the next and all standing with their bases set among trees.*¹⁶

So although there are several architectural precedents for his city plans, it was also therefore to the spectacle of the panorama that Le Corbusier turned.¹⁷ In 1925 some panoramas and dioramas reminiscent of the nineteenth-century examples did still exist, notably as museum and exhibition displays.¹⁸ Indeed, the word, ‘diorama’ is now perhaps most commonly associated with exhibits such as those containing zoological specimens in natural history museums. Its literal meaning, however, derived from the Greek *dia-* meaning ‘through’ and *-horama* (that which is seen) implies the sense in which such displays often constitute an expanded scene, as if as a view out from the museum interior, to an imagined landscape beyond.¹⁹ This definition also holds true for the visual spectacle to which the word was originally applied. To a nineteenth-century audience, ‘diorama’ would primarily have meant the large scenic paintings and mechanical effects orchestrated by Louis Daguerre.²⁰ As such, the diorama at this time was typical of a drive to master and control visual experience, a defining feature of the mechanised world that Le Corbusier’s generation would later inherit, and to which they would turn for inspiration.²¹ The aim of Daguerre’s diorama was to construct a highly compelling and realistic experience and to replicate as closely as possible the impression produced by real-world locations. Visitors to the diorama were thereby transported to distant places and picturesque views, or rather; it was as if the places were brought to them. It was, as one contemporary commentator explained, “not a vain representation” but “reality itself.”²² Significantly, it was the illusion of depth that many viewers found most convincing. Largely, however, by the early years of the twentieth century the diorama had given way to other kinds of entertainment. Nevertheless, there is much, even in some of the more extreme later nineteenth-century examples that characterises the spirit of the machine and the qualities of view that are central to Le Corbusier’s vision of the city. But for Le Corbusier in 1925, the challenge was to present an experience that could not simply be reproduced. The two dioramas were intended to assist visitors with what Le Corbusier clearly believed to be the difficult task of imagining such a radical new scheme, or more precisely, of appreciating its visual qualities. The images in their original context were displayed on the curved surfaces inside the diorama and were viewed from the centre of the rotunda through wide openings, essentially forming windows into each of the enclosed display areas. With the images presented in this way, Le Corbusier’s claim was to be able to “objectify” or “to make evident to the eye” a new and as yet unfamiliar vision of the city.²³ Somewhat awkwardly attached to the main body of the pavilion, everything about the dioramas speaks of their purpose as devices to simulate a particular kind of visual experience (Fig. 12). Indeed, the pavilion as a whole can be seen as a demonstration predicated on bringing Le Corbusier’s vision to life.

*I have used two kinds of argument: first, those essentially human ones which start from the mind or the heart or the **physiology of our sensations** as a basis; secondly, historical and statistical arguments.*²⁴

But although to some extent integrated with the rectilinear form of the villa-flats, the dream-like spaces created by the dioramas are clearly set apart. The purpose of the diorama was not as prototype, but to simulate a visual experience; to capture something of the breathtaking grandeur of the scheme. Its claim upon the “physiology of our sensations” is not therefore like the domestic interior, a physical reality, but instead as a representation that by carefully manipulated viewing conditions, is made as tangible and as close to real experience as possible. The role of the diorama was, of course, to illustrate Le Corbusier’s plans for the city but was also to conjure up the context in which the apartment was envisaged and the setting which was otherwise absent from the scenario Le Corbusier had

contrived to present. The dioramas then, although not exactly in a literal sense views from the window, are nevertheless constructed such that they appear to extend out onto the wide vistas of the proposed contemporary city (Fig. 13). The vantage point in Le Corbusier's images is clearly higher than even the highest storey of the *immeubles-villas* but in the dioramas visitors were transported to a position from which they could look out over Le Corbusier's creation. In the case of the *Voisin* plan, the scene described is one in which the Grand Palais and pavilion site itself might well have featured.

*For the pavilion of the Esprit Nouveau at the International Exhibition of Decorative Art held in Paris, and in which the "Voisin" plan was on view, I painted a panorama whose aim was to make evident to the eye this new conception, so unfamiliar to us as yet. The panorama was most carefully executed and showed Paris as it is to-day, from Notre-Dame to the Étoile, including those monuments which are our imperishable heritage. Behind it rose the new city.*²⁵

In this sense, the relatively closed nature and interior focus of the pavilion can be seen as turning its back on the current city outside in order to replace it with a new vision based on Le Corbusier's rationalising plan. In the case of the dioramas, the existing city, which surrounds the pavilion and which is the subject of Le Corbusier's criticism, is explicitly shut out in favour of the artificially simulated alternative. A similar condition was to be found in many eighteenth-century panoramas, which rather than display alternative locations, often depicted the city in which they were actually located. Indeed Prévost's views of Paris from the Tuileries were typical of this desire to present the city back to itself. It has been suggested that in the nineteenth century this was in part a reaction to the loss of legibility in the newly industrialised city, and a desire to get above the street and see the city as a whole.²⁶ Le Corbusier's interest in this kind of view was also clearly in the potential for presenting the large-scale order of his plan, but as with nineteenth-century panoramas, there is also a sense that this vantage point is associated with mastery over the city and of collective space. Significantly early panoramas, although not the kind of radical reinvention of the city that Le Corbusier proposes, were nevertheless also to some extent idealised views which brought the countryside into the town, emphasising the surrounding countryside and green spaces within the city:

*Panoramas are the expression of a new feeling about life. The citizen, whose supremacy over the countryside has been claimed a thousand times in the course of the century, has attempted to bring the countryside into the town. In panoramas, the town takes on the same dimensions as the landscape...*²⁷

The problem with proximity

That there is a marked difference between Le Corbusier's dioramas and the selection of still-life paintings displayed alongside is almost too obvious to warrant remark. The two kinds of painting seemingly serve very different purposes. One is supposedly an exploration of Purist philosophy and art, the other, simply a vehicle through which to represent, as compellingly as possible, a proposal for the rational planning of cities. However, Le Corbusier's reliance on perspective for the illustration of his city plans inevitably creates a somewhat uneasy relationship between his theoretical ideas and the practical techniques he employs, especially given that representation is allied so closely with architecture in his accounts of painting.²⁸

Published in 1920, *Le Purisme* was one of a number of essays in which Amédée Ozenfant and Charles-Édouard Jeanneret (soon to be known as Le Corbusier) set out their vision for an art born of universal laws. For painting, this meant harnessing the logic and natural order that underpins human perception, and particularly, those mechanisms that determine our experience of pictorial space. Purism, they claim, will "address itself above all to the universal properties of the senses and the mind."²⁹ Accordingly, an important

feature of their paintings and of Le Corbusier's architecture at this time is therefore the manner in which the experience of depth is controlled and manipulated in representation, in physical space, and in the various cases of slippage between the two. A painted composition, we are told, is the relation of "purified" architectural elements and that we should think of the painting "not as a surface, but as a space."³⁰ It is not surprising then that comparisons made with painting have in one way or another formed the basis for numerous accounts of Le Corbusier's architecture. One of the more notable of which was Colin Rowe and Robert Slutzky's essay, *Transparency: Literal and Phenomenal*, published in 1963.³¹ Their analysis, which calls upon paintings such as Juan Gris' *Still Life* of 1912, hinges on the ambiguities of figure and ground, (or of proximity and distance) as addressed by Gestalt psychology. Derived from György Kepes' *Language of Vision*, "phenomenal transparency", is defined as the organising principle for a space characterised by the kind of fluctuating readings found in Cubism.³² But whilst there are many compelling similarities between Cubism and the spatial qualities found in Le Corbusier's architecture, it is important also to recognise that Cubism was the critical target for many of Ozenfant and Jeanneret's early publications. The first of these, entitled *Après le Cubisme* (published in 1918) accuses Cubism of being too dependent on ornament, composed as they describe it, "like carpets." At once appropriating and refining those aspects of Cubism that they sought to make their own, Ozenfant and Le Corbusier also criticise its lack of discipline and hierarchy. Cubism, they suggest, offers "visual ravishment" but a superior art (namely Purism), would come as a result of organising these raw sensations.³³ In January of 1921, a series of paintings by Ozenfant and Le Corbusier were exhibited at the Galerie Druet in Paris. Typical of their work at this time these early paintings (all of which were still life) already indicated a close relationship between Purist painting and architecture (Fig. 14).³⁴ They also included many of the spatial qualities that are now associated with Le Corbusier's architecture and which exploit the mechanisms by which we perceive spatial depth within the work.³⁵

So what then should we make of the distinction between the panoramic scenes of the city and these tightly controlled architectural compositions? As previously observed, Le Corbusier's contribution to the paintings on display, *Still Life from the Pavillon de l'Esprit Nouveau* (Fig. 10), offers perhaps the most striking contrast to the highly ordered and expansive perspectival space of the city dioramas. Almost devoid of any hint of perspective, its dense structure of overlapping profiles describes a space in which elements sit parallel with the surface of the painting. Space opens up, not by virtue of perspectival recession but in the slippage between planes that appear to extend orthogonally forward and back.

*Ordinary perspective with its theoretical rigor only gives an accidental view of objects: the one which an eye, having never before seen the object, would see if placed in the precise visual angle of this perspective, always a particular and hence an incomplete angle. A painting constructed with exact perspective appeals nearly exclusively to sensations of a secondary order and is consequently deprived of what could be universal and durable.*³⁶

For Ozenfant and Le Corbusier, painting was about giving order to sensation, or as Rosalind Krauss puts it, "wresting an object from the matrix of sense data."³⁷ And although differences in approach were already beginning to emerge, both artists at this time represent the objects of still life as sharp-edged contours; layered planes suspended in a somewhat unstable visual space. Bruno Reichlin notes how the "objects seem to float, compressed and driven out towards the viewer", forcing, as he describes it, "the viewer to become cross-eyed in order to decipher the overall effect."³⁸ This is a technique that knowingly plays on the mechanisms that determine our sense of depth, and which capitalises on a certain kind of knowledge and understanding of vision. Thanks to Rowe and Slutzky, a number of these spatial qualities (which can also frequently be found

elsewhere in early twentieth-century art) have come to be associated with Gestalt psychology, and although subject to criticism on the basis of their understanding of the psychology, Rowe and Slutzky's essay offers a valuable insight into some of the qualities explored by this discipline and which can be used to discuss Le Corbusier's manipulation of space.³⁹ But it is not perhaps to Gestalt psychology but rather to the work of earlier nineteenth-century scientists that we should look – particularly concerning the role of physiology and optics in determining the nature of aesthetic experience.

Le Corbusier and Ozenfant's desire to employ the conclusions (and perhaps even the methodology) of experimental psychology was clearly articulated from the outset. The introduction to the first edition of *L'Esprit Nouveau* describes their intention to find a scientific basis for painting and architecture but this intention is expressed more in terms of the physiological conditioning of aesthetic experience than as Gestalt order.⁴⁰ Somewhat later in 1924 they were to also to publish (again in *L'Esprit Nouveau*) a more extensive account of the "Formation de l'optique moderne"⁴¹; and tellingly in 1926 two separate articles one by Le Corbusier, the other by Ozenfant, were published in a special issue of the *Journal de Psychologie Normale et Pathologique*.⁴² It is also interesting to note that in the early 1920s, at the time when the Galerie Druet paintings and the *Ville Contemporaine* were conceived, Le Corbusier was reputedly suffering from problems with his vision. The condition, which caused the loss of sight in his left eye, would no doubt have given him reason to ponder the role played by stereopsis in vision.⁴³ It is also conceivable that this experience had an impact on his attitude towards questions of space and representation. It has, for example, been suggested that being deprived of binocular vision at this time caused Le Corbusier to foreshorten the perspective in his representations of the city – bringing the vanishing point nearer than it might actually appear.⁴⁴ But even discounting the fact that perspective is always a monocular view, it is not in any case in distance vision that the effects of this condition would be felt. In an analysis of the representational devices employed by Le Corbusier in the *Pavillon de l'Esprit Nouveau*, it may therefore be necessary to distinguish between the sensations experienced when gazing towards a distant horizon (as might be experienced in the diorama) as opposed to the immediate proximity of still life.

Before the nineteenth century, the study of space perception had been based primarily on philosophical investigation but as the nineteenth century progressed experimental devices and methods, borrowed from the physical sciences, began to be employed in the examination of visual space. By the turn of the century an experimental approach to the study of vision, explored through the physiology and optics of the eye and through the closely related discipline of *psychophysics*, would contribute to the foundation of what we now know today as psychology.⁴⁵ In vision, the complex interplay of cues through which we gauge our sense of space had, of course, been the subject of study for many centuries but with the nineteenth century came a uniquely instrumental approach, and with it, a multitude of new discoveries – including the significance of binocular vision. At this time, devices such as the stereoscope, invented by Charles Wheatstone in the 1830s, provided the opportunity to explore vision through the analysis and controlled manipulation of specific viewing conditions. Significantly with regard to painting Wheatstone's account of his experiments with stereopsis is primarily directed towards the inadequacy of conventional two-dimensional representation.⁴⁶

Central to Wheatstone's analysis is the gradually varying set of conditions surrounding the experience of vision from close proximity to the far distance. In many situations these sensations contribute significantly to our perception of visual space. As Wheatstone points out, when we direct our eyes towards a near object, a very different image is formed on the retina of each eye. With increased distance, however, the disparity between the views from the left and right eye decreases until, when looking into the far distance our eyes become parallel and the two images become identical (Fig. 15). It is from this varying disparity that Wheatstone derived the nature of stereopsis, and to some extent redefined our understanding of vision. And it was thus, by changing the way vision

and perception were understood, that scientific accounts of this kind contributed to a shift in artistic practice and, as the nineteenth-century diorama exemplifies, made perception itself the subject of artistic exploration.⁴⁷

To sustain the illusion, Daguerre's diorama, like earlier panoramas, was contrived to eliminate those factors which might draw attention to the reality of the painted surface, and as with Le Corbusier's later reinterpretation, the architecture is an integral part of the spectacle (Fig. 16).⁴⁸ In this, as in other respects, the illusion was primarily maintained by controlling the limits within which the picture could be viewed. In each case, the spectators were held in a position sufficiently removed from the painting as to make it difficult to judge their distance from the painted surface. By creating distance between the viewer and the canvas Daguerre also (no doubt unwittingly) ensured that the viewer's eyes were directed almost as if in a distant gaze. In this regard the effects of binocular vision to some extent contribute in the nature of the experience. The majority of diorama paintings depicted a distant scene (often of spectacular Swiss landscapes) and in viewing such a scene, both in the painting as in reality, the effects of stereopsis will be minimal. Here, both the distance suggested by perspective, the physiological, and the psychological aspects of vision are all more or less in accord. The same cannot be said of looking at a conventional depiction of an object at close proximity. Indeed, the implications of this fact for the sense of depth and therefore for the realism experienced in painting, contributed significantly to Charles Wheatstone's discovery of stereopsis and form an important part of his argument for the role of binocular vision. Wheatstone's *Contributions to the physiology of vision*, actually begins with a reference to the Diorama:

*When an object is viewed at so great a distance that the optic axes of both eyes are sensibly parallel when directed towards it, the perspective projections of it, seen by each eye separately, and the appearance to the two eyes is precisely the same as when the object is seen by one eye only. There is, in such case, no difference between the visual appearance of an object in relief and its perspective projection on a plane surface; and hence pictorial representations of distant objects, when those circumstances which would prevent or disturb the illusion are carefully excluded, may be rendered such perfect resemblances of the object they are intended to represent as to be mistaken for them; the Diorama is an instance of this. But this similarity no longer exists when the object is placed so near the eyes that to view it the optic axes must converge; under these conditions a different perspective projection is seen by each eye, and these perspectives are more dissimilar as the convergence of the optic axes becomes greater.*⁴⁹

The problem is one both of distance and proximity. Visitors to early panoramas apparently reported a sense of dizziness, which is understood to have been caused by the relatively small diameter of the drum – presumably at least in part as a result of the extreme disparity between what seemed to be a distant scene and the binocular effects of a surface located just a short distance away. As panoramas increased in size, this unpleasant sensation diminished. Equally, however, the lack of solidity made it very difficult to make convincing representations of foreground elements and in many cases panoramas were designed with real three-dimensional objects introduced to provide the necessary relief at close proximity. This, so called, “false terrain” served both to obscure the lower edge of the painting and counteract its apparent flatness.⁵⁰ On one well documented occasion, in which Daguerre borrowed this technique for his Paris diorama, parts of an actual Chalet with a barn, outhouses and even a live goat, were imported to form something like a stage set in front of the seating platform. The diorama painting in question was *The Valley of Chamonix*, one of a number of popular alpine scenes.⁵¹

All of this was, of course, fifty or so years before Le Corbusier was even born, but the legacy of Daguerre's diorama evidently lived on. Coincidentally, the scene Daguerre depicted was one with which Le Corbusier would have been familiar, growing up not so very far away, across the Swiss border in Chaux-de-Fonds. Indeed, Stanislaus von Moos

has speculated that this landscape may have informed the sensibilities of the young Charles-Édouard Jeanneret and exerted their influence in his preference for wide horizons.⁵² Certainly, many of the issues concerning the viewing condition relevant to Daguerre's diorama (and indeed the nineteenth-century Panorama) were also important to Le Corbusier in designing his own scenic displays. In its format, the *Esprit Nouveau* diorama was perhaps rather more like a panorama than Daguerre's dynamic paintings. For example, unlike Daguerre's canvas, the painted surface in Le Corbusier's diorama is curved. Similarly, the framed opening, like the canopy of the panorama, prevents the edges of the painting from being seen without actually containing the image. But although the *Esprit Nouveau* pavilion displays depart in a number of ways from their nineteenth-century predecessor, ultimately the pavilion shares just as much with Daguerre's device as with the fully immersive environment of the panorama. Le Corbusier's painting does not extend all around and although each view certainly encompasses a wide angle, it is nevertheless limited to a particular viewing direction. In the panorama, the railing served to limit the visitor's viewing angle only vertically, but here the view is carefully restricted horizontally as well. The curved flanking walls bulge out into the space and ensure that wherever the viewer stands along the length of the rail, the curve of the wall prevents the right or left hand edges of the painting from being seen. Combining aspects of both panorama and diorama, it is the framing of Le Corbusier's images that is most significant. Uniquely in the *Esprit Nouveau* diorama, this is a window opening through which the viewer looks out to the painted space beyond.

The nature of the experience that Le Corbusier sought to construct is perhaps most explicit in his drawings for the earlier *Salon d'Automne* installation – several versions of which are preserved in the archives of the *Fondation Le Corbusier* (Figs. 17, 18).⁵³ This diorama, as previously indicated, was designed to exhibit Le Corbusier's scheme for the *Ville Contemporaine* and it was the painting from this installation that was later displayed in the *Esprit Nouveau* pavilion. The drawings show the zone intended for the observer, flanked by enclosing walls. This intermediate space creates a tangible sense of depth, defining a foreground against which the view beyond can be measured. It therefore functions in this respect somewhat like the panorama's "false terrain", providing a solid focus for vision at close proximity in contrast to the stereoscopically distant landscape. The painted scene was not exactly at infinity, but the separation was perhaps sufficient to make the experience that much more convincing. This added sense of depth and extension is derived both from parallax and from the stereoscopic separation of the frame from the image. In one of Le Corbusier's drawings, we can see evidence of him exploring the way the changing position of the observer will alter the visible limits of the painting beyond (Fig. 19). Like this separation, the difference in view afforded by the left and right eye is also most significant at close proximity and where there is the greatest distance between the foreground and background. Early in his account of binocular vision, Charles Wheatstone cites an observation (made first by Leonardo da Vinci), which relates directly to the difference between binocular and monocular vision. It is impossible Leonardo records, that a picture "copying outlines, shade, light and colour with the highest perfection can appear to possess the same relief as that which appears in an object in nature, unless this natural object is looked at over the long distance and with a single eye."⁵⁴ The explanation offered by Leonardo hinges on the slightly different perspectives provided by each eye in binocular vision (Fig.20):

*...let the eyes be a and b, looking at an object c, with the converging central axes if the eyes as ac and bc, which converge on the object at the point o. The other axes, lateral to the central one, see the space gd behind the object, and the eye a sees all the space fd, and the eye b sees all the space ge. Hence the two eyes see behind the object and all the space fe. On this account, this object c acts as if transparent, by the definition of transparency, according to which nothing behind it is concealed. This cannot happen with someone who looks at an object with one eye...*⁵⁵

In Leonardo's observations, we can begin to identify the significance of the physical separation found in Le Corbusier's dioramas, between the frame and the painting beyond. Leonardo's text also offers some possible explanations for the very different nature of Le Corbusier's still-life paintings. In particular, with regard to the depiction of objects at close proximity and in their sacrifice of perspective in favour of a kind of transparency or overlapping of separate views. Not to be confused with "phenomenal transparency" as defined by Colin Rowe and Robert Slutzky, this is potentially a form of transparency originating in our experience of stereoscopic vision. Le Corbusier's paintings are not, of course, a literal overlay of stereoscopic image pairs. Neither Leonardo's observations on vision and painting, nor Wheatstone's discoveries regarding stereopsis, are likely to have so literally shaped Le Corbusier's work. Nevertheless, like Leonardo, Le Corbusier's approach to painting appears to be grounded in the experience of vision. In their 1918 essay *Après le Cubisme*, Le Corbusier and Ozenfant emphasise their view that art should not attempt to represent the ideas of science but that artists should instead use science to inform their understanding of nature and of the senses.⁵⁶ Thus, whilst much about early twentieth-century art is about radical reinvention, the scientifically minded Positivist tendency, evident in the work of artists such as Ozenfant and Le Corbusier was also reliant on a visual culture derived from discoveries made in nineteenth-century science. Similarly seeking absolutes, the claim made in the name of Purism, is that through scientific principles, it too can harness the natural laws that dominate our senses and determine aesthetic sensibilities. So although by the 1920s many of the more significant advances made in the science of vision were already over eighty years old, they may nevertheless have contributed significantly to Le Corbusier and Ozenfant's thinking. This influence is evident both directly, in their appropriation of ideas derived from the science of vision, and indirectly through the legacy of nineteenth-century art. In *L'Elan*, a periodical founded by Ozenfant during the First World War, he cites Ingres, Cézanne and Seurat as artists who sought the essential properties of the visible.⁵⁷ And when in October 1920, Le Corbusier and Ozenfant together began publishing *L'Esprit Nouveau*, concern with the science of vision remained a dominant theme.⁵⁸

Seeing represented

In *Le Purisme*, Le Corbusier and Ozenfant lament the tendency of perspective to record an "accidental" view of the object depicted. "Our concept of an object", they claim, comes from "knowledge acquired by the experience of our senses."⁵⁹ Perspective, conversely, is the view the eye would see if placed in a particular position, observing the object from a particular "visual angle". The eye should instead, they say, be confronted with an impression of the whole scene.⁶⁰ Read in this context Le Corbusier's dioramas inevitably present some difficulty. They can certainly be said to depict the whole scene but they are also fairly typical examples of linear perspective.⁶¹ The character of such a space is thus not only that typical of linear perspective but also potentially reinforces a fixed and essentially frontal point of view.⁶²

Le Corbusier's decision to adopt perspective in the representations of his architecture was no doubt to some extent simply a question of expediency and there is, after all, no reason to expect his response to the requirements of architectural drawing to be consistent with his approach to painting. But in the case of the dioramas, more significance may perhaps be attached to the means by which these images were presented. Not necessarily in the use of perspective itself but in the particular visual conditions created by a space designed to accommodate these images. The insight provided by Wheatstone into the nature of binocular vision begins to suggest that, at least with regard to the distant view, perspective and sensory experience might be intuitively understood by Le Corbusier to be in accord. Whilst depictions of objects at close proximity might demand a complex interplay of profiles in order to capture the visual sense, for the distant

cityscape the single perspective viewpoint may, on the other hand, be considered a suitable substitute for the real scene. Given the particular context in which Le Corbusier's panoramic paintings are presented it is possible then to imagine the physical disposition of viewer, framed opening and perspective scene as if as a model of conventional perspective; one in which the picture is itself understood to be a window and the observer one who looks in towards objects within its space. In a frequently quoted passage of text by Alberti, for example, the limits of the view defined by a rectangle in the drawing surface is compared to that of an open window, through which the subject to be painted is seen. And yet, whilst emphasising the sense in which the painting is something to be seen through, in Alberti's account there is also considerable importance placed on the position of the plane in which the imaginary window sits. Described as the "intersection", this is the surface that intervenes between the viewer and the scene, and upon which the perspective view is captured. As such, the position of the viewer in relation to this plane is crucial to the construction of a perspective scene.⁶³ But tempting as it is, to compare the physical frame in Le Corbusier's diorama with the notional window in Alberti's model of perspective, it is clear that the relationship between viewer and frame in Le Corbusier's diorama is in fact one step removed from that between observer and painting in conventional perspective. The *intersection* in Alberti's account is after all, not actually a plane through which we look, but rather a surface on which the linear traces of the scene beyond are captured and held. The equivalent in Le Corbusier's diorama is not therefore the framed opening at all but rather the curved painted surface beyond (Fig. 21).⁶⁴ Far from being a window the diorama paintings as represented in Le Corbusier's working drawings are clearly the point at which the spectator's view is terminated. Perspective in this context is set against the depthless quality of a surface that fills the observer's view.

Le Corbusier's own knowledge of perspective was no doubt derived from his early education at the art school in Le Chaux-de-Fonds where texts such as John Ruskin's *Elements of Perspective* may well have shaped his practical application of this technique.⁶⁵ And for Ruskin, as for Le Corbusier, truth in painting lay in the optical functions of the eye – much of Ruskin's writing on perspective is concerned with the practical mastery of techniques that facilitate a replication of the visual field.⁶⁶ Indeed, like a number of earlier commentators including the French perspectivist Sébastien le Clerc, he dismissed binocular vision as an obstacle to correct perspective, yet from the outset draws attention to the difference in view afforded by each eye.⁶⁷ Ruskin's example, like that of Alberti, is a window but he is careful to point out that an image traced on the glass will appear in different positions if viewed with the left and right eye (Fig. 22). In separating the frame from the image Le Corbusier's diorama, although produced using conventional perspective, might therefore be understood to explicitly acknowledge the full extent of vision; from the material relief of the foreground to the distant image. There is a sense perhaps in which the image can be read as extending beyond the arbitrary rectangle and the fixed viewing angle to which Le Corbusier and Ozenfant objected. Significantly, the vantage point is also some considerable distance away from the depicted city, a feature particularly evident in the diorama of the *Voisin* plan, in which indeterminate parkland dominates the foreground, emphasising the city and horizon beyond. The opening provides a frame, but significantly, by its forward position, this serves to imply that the space behind extends in all directions beyond the frame. By emphasising the expansive nature of the view, the observer is encouraged to look not **into** the painting, but **out** from the edge of the frame towards the distant scene.⁶⁸ Under conditions such as these, the eyes would normally remain parallel, focussed at infinity and thereby relaxed into an almost vacant stare.⁶⁹ Here, however, although the tendency would undoubtedly have been to draw the eye to the horizon, the expectation of distance might well have seemed at odds with the relative proximity of the image surface. Distant perhaps, but also close enough to create something of the sense of dizziness experienced in early panoramas.⁷⁰

On the face of it the situation when looking at the objects featured in still life could not be more different. Here opposing viewpoints construct a complex aggregate of

images, the separation facilitating an almost paradoxical condition in which the rules of occlusion are seemingly confounded by binocular disparity. Yet the two sets of conditions are, in fact, just the opposite ends of a gradually shifting scale extending from infinity to close at hand. As such, the visual experience constructed in the dioramas is no less a reflection on the nature of vision and experience than the apparently more challenging space depicted in Le Corbusier's other paintings at this time. Each is, however, characterised by the uniquely different kinds of experiences to be found in vision. And so whilst as far as Le Corbusier's interest in scientific principles is concerned, it would be foolish to claim that his paintings were the result of a rigorous application of science, his work may nevertheless be characterised by a tendency (borne out by the dioramas) to bring visual experience to account; to harness the "physiology of sensations". In this sense, it is not in fact scientific understanding that is represented but those aspects of visual perception that it reveals.

□

Notes and references:

¹ Le Corbusier, *L'art decorative d'aujourd'hui* (Paris, 1925). "On Sundays we often gathered at the summit of the highest mountain. Peaks and gently sloping banks; pastures, herds of large animals, infinite horizons, flights of crows. We prepared for the future." Cited in Stanislaus von Moos, *Le Corbusier: Elements of a Synthesis* (Cambridge, Mass.: MIT Press, 1979), p.6.

² Le Corbusier, *The City of To-Morrow and Its Planning*, Trans. Frederick Etchells (New York: Dover, 1987), p.231n.2. Originally, *Urbanisme* (Paris: Les Éditions G.Crès Cie, 1925). See also, Carol S. Eliel, *L'Esprit Nouveau: Purism in Paris, 1918-1925* (Los Angeles: Los Angeles County Museum of Art/Harry N. Abrams, 2000), pp. 51-53 and Mary McLeod, *Urbanism and Utopia: Le Corbusier, from Regional Syndicalism to Vichy*. Princeton University PhD thesis (1985), p.13.

³ Le Corbusier, *The City of To-Morrow and Its Planning*, pp.215-231.

⁴ Most of the paintings displayed in the pavilion are still in existence. The notable exception seems to be the large diorama paintings, which, according to the Fondation Le Corbusier exist only as photographs. The pavilion itself was, of course, demolished soon after the exposition closed and although a reconstruction has been built in Bologna, this no longer contains the reproductions of the panoramic images installed for its opening. See, Giuliano Gresleri, *L'Esprit Nouveau. Parigi-Bologna: Costruzione e ricostruzione di un prototipo dell'architettura moderna* (Milan: Electa, 1979). For information on the planning and organisation of the exposition see, Kenneth Silver, *Esprit de Corps: The Art of the Parisian Avant-Garde and the First World War* (Princeton: Princeton University Press, 1989), pp.362-367. See also, Carol S. Eliel, "Purism in Paris, 1918-1925" in Carol S. Eliel (ed.), *L'Esprit Nouveau: Purism in Paris*, pp. 48-49.

⁵ W. Boesiger and O. Stonorov (eds.), *Le Corbusier et Pierre Jeanneret: Œuvre Complète 1910-1929* (Zurich: Les Éditions d'Architecture, 1929), pp.34-43; pp.92-121. The *Plan Voisin* takes its name from aircraft manufacturer Gabriel Voisin, whose company donated 25,000 francs to the construction of the pavilion. See, Le Corbusier, *The Decorative Art of Today*, "Preface to the 1959 Edition" (London: Architectural Press, 1987), p. xiv. See also Nancy Troy, *Modernism and Decorative Arts in France: Art Nouveau to Le Corbusier*, (New Haven: Yale University Press, 1991), p.219.

⁶ Amédée Ozenfant and Charles-Edouard Jeanneret (eds.), *L'Esprit Nouveau* (Paris: Éditions de l'Esprit Nouveau, 1920-1925). "About a dozen articles reflecting the forthcoming 'International Exhibition of the Decorative Arts' had appeared in *L'Esprit Nouveau* during 1924", Le Corbusier, *The Decorative Art of Today*, p.xiii. For an account of the origins of *L'Esprit Nouveau*, see Carol S. Eliel, "Purism in Paris", pp. 23-24. Completion of the pavilion also marked an end to the periodical and to Le Corbusier's collaboration with Ozenfant. See Kenneth Silver, *Esprit de Corps*, pp.372-373.

⁷ Le Corbusier, *The Decorative Art of Today*, p.xiii-xv. See also, Le Corbusier, *The City of To-Morrow and Its Planning*, p.280. On other issues concerning the siting of the exposition, see Tag Gronberg, "Making Up the Modern City: Modernity on Display at the 1925 International Exposition" in Carol S. Eliel (ed.), *L'Esprit Nouveau: Purism in Paris*, p.105.

- ⁸ Le Corbusier, *The City of To-Morrow and Its Planning*, p.284.
- ⁹ Le Corbusier, *The City of To-Morrow and Its Planning*, p.277-278. See also, Norma Evenson, *Le Corbusier: The Machine and the Grand Design* (London: Studio Vista, 1969), pp.19-20.
- ¹⁰ Bernard Comment, *The Panorama*, (London: Reaktion Books, 1999), pp.29-44.
- ¹¹ Pierre Prévost, Preliminary drawing of Paris in 1804 for the panorama of Paris exhibited in Vienna, 1814. Collection Galerie J.Kugel, Paris.
- ¹² The pavilion was located on a small site directly alongside the Grand Palais. See, Kenneth Silver, *Esprit de Corps*, p.372. The awkward nature of the site has often be attributed to Corbusier's acrimonious relationship with the exposition organisers. See Carol S. Eliel, "Purism in Paris", p.52.
- ¹³ Le Corbusier, *The City of To-Morrow and Its Planning*, pp.163-176. See also, W. Boesiger and O. Stonorov (eds.), *Œuvre Complète 1910-1929*, pp.34-39.
- ¹⁴ Some years earlier in 1919 Fernand Léger had also made an image of the city. Léger's painting is clearly not a proposition, but rather reflects, perhaps celebrates, the city as a complex and disjointed space. Fragments of buildings, signage and other structures crowd in. There are glimpses of more distant elements, but the city as depicted here is enveloping and distant views are always partly occluded by objects in the intervening space. Fernand Léger, *The City*, 1919. See, Carol S. Eliel, "Purism in Paris", p.29.
- ¹⁵ A discussion of the sense of separation and quiet implied by Corbusier's proposals can be found in, Simon Richards, *Le Corbusier and the Concept of Self*, (New Haven: Yale University Press, 2003), pp108-110.
- ¹⁶ Le Corbusier, *The City of To-Morrow and Its Planning*, p.281.
- ¹⁷ Precedents for Le Corbusier's urban planning include Tony Garnier's "Cité Industrielle" (1903) and Auguste Perret's "tower-city" (1922). See Stanislaus von Moos, *Le Corbusier: Elements of a Synthesis*, pp.189-191.
- ¹⁸ Stephan Oettermann, *The Panorama: History of a Mass Medium*. Trans. Deborah Lucas Schneider (New York: Zone Books, 1997), p.93.
- ¹⁹ Stephen Parcell, "The Metaphoric Architecture of the Diorama", Alberto Pérez-Gómez and Stephen Parcell (eds.), *Chora 2: Intervals in the Philosophy of Architecture* (Montréal: McGill-Queen's University Press, 1996), p.183.
- ²⁰ Helmut and Alison Gernsheim, *L. J. M. Daguerre: The History of the Diorama and the Daguerreotype* (London: Secker & Warburg, 1956), pp.13-18.
- ²¹ Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth-Century* (Cambridge, Mass.: MIT Press, 1992), pp.112-113.
- ²² *The Mirror of Literature* (2 October 1824). Cited in Helmut and Alison Gernsheim, *L. J. M. Daguerre*, p.23. See also, Stephan Oettermann, *The Panorama*, p.79.
- ²³ Le Corbusier, *The City of To-Morrow and Its Planning*, p.281. See also, Tag Gronberg, "Making up the Modern City", p.104.
- ²⁴ Le Corbusier, *The City of To-Morrow and Its Planning*, p.164 (emphasis added).
- ²⁵ Le Corbusier, *The City of To-Morrow and Its Planning*, p.281.
- ²⁶ Bernard Comment, *The Panorama*, pp.134-137.
- ²⁷ Walter Benjamin, *Paris, Capitale du XIXe Siècle : le livre des passages*, (Paris : Cerf, 1989). Translated in Bernard Comment, *The Panorama*, p.137.
- ²⁸ "A painting is an association of purified, related and architected elements.", Amédée Ozenfant and Charles-Edouard Jeanneret, "Purism", Trans., Robert L. Herbert (ed.), *Modern Artists on Art* (New York: Dover, 2000) p.59-60. See Kenneth Silver, *Esprit de Corps*, pp.383-384. Also, Carol S. Eliel, "Purism in Paris", p.28.
- ²⁹ Amédée Ozenfant and Charles-Edouard Jeanneret, "Le Purisme", *L'Esprit Nouveau* 4, (1920), pp.369-386. Trans., Robert L. Herbert (ed.), "Purism", *Modern Artists on Art*, p.65.
- ³⁰ Amédée Ozenfant and Charles-Edouard Jeanneret, "Purism", pp.59-60.
- ³¹ Colin Rowe and Robert Slutzky, "Transparency: Literal & Phenomenal [Part 1]", *Perspecta* 8 (1963). Republished in, *Transparency* (Basel: Birkhäuser Verlag, 1997).
- ³² György Kepes, *Language of Vision* (Chicago: P.Theobald, 1944).
- ³³ Amédée Ozenfant and Charles-Edouard Jeanneret, *Après le Cubisme* (Paris: Edition des Commentaires, 1918). Trans. John Goodman, "After Cubism" in, Carol S. Eliel (ed.), *L'Esprit Nouveau: Purism in Paris*, pp.134-139.
- ³⁴ Carol S. Eliel (ed.), *L'Esprit Nouveau: Purism in Paris*, p.25.
- ³⁵ "A painting is an association of purified, related and architected elements.", Amédée Ozenfant and Charles-Edouard Jeanneret, "Purism", p.59-60. See Kenneth Silver, *Esprit de Corps*, pp.383-384. Also, Carol S. Eliel, "Purism in Paris", p.28; 60-64.

- ³⁶ Amédée Ozenfant and Charles-Edouard Jeanneret, "Purism", p.58.
- ³⁷ Rosalind Krauss, "Léger, Le Corbusier and Purism", *Artforum*, 10/8 (April 1972), p.52.
- ³⁸ Bruno Reichlin, "Jeanneret – Le Corbusier, Painter – Architect", Eve Blau and Nancy Troy, *Architecture and Cubism* (Cambridge Mass.: MIT Press, 1997), pp.196-199.
- ³⁹ Colin Rowe and Robert Slutzky, "Transparency: Literal & Phenomenal [Part 1]." See also, Yve-Alain Bois, "Cubistic, Cubic, and Cubist" in Eve Blau and Nancy Troy, *Architecture and Cubism*, pp.187-194. For the origins of Gestalt psychology, see amongst others, Edward Reed, *James. J. Gibson and the Psychology of Perception* (New Haven: Yale University Press, 1988), pp.33-37 and Nicholas Wade, *The Art and Science of Visual Illusions* (London: Routledge and Kegan Paul, 1982), pp.3-6. For a critique of Rowe and Slutzky's essay see, Rosemarie Haag Bletter, "Opaque Transparency", *Oppositions* 13, (Summer 1978), pp.125-126.
- ⁴⁰ *L'Esprit Nouveau*, 1 (1920). See, Judi Loach, "Le Corbusier and the Creative Use of Mathematics", *British Journal for the History of Science*, 31/2, (June 1998), p.197.
- ⁴¹ Ozenfant and Jeanneret, "Formation de l'optique moderne", *L'Esprit Nouveau*, 5/21 (1924). See Jean-Louis Cohen's introduction to John Goodman's translation of *Vers une Architecture, Towards an Architecture* (London : Frances Lincoln, 2008), pp.13-14.
- ⁴² *Journal de Psychologie Normale et Pathologique*, 23, (Paris:1926). See Reyner Banham, *Theory and Design in the First Machine Age* (London: Butterworth, 1988), pp.257-259.
- ⁴³ Le Corbusier's partial blindness is recorded in a letter to William Ritter: "I am a Cyclops in spite of myself, a nasty joke. And for this very reason things are quite complicated for me. You get used to it: it's been going on for two years." (7th April 1922). Cited in Nicholas Fox Weber, *Le Corbusier: A Life* (New York: Alfred A. Knopf, 2008), p.187. See also, Joseph Masheck, Review of an exhibition of Le Corbusier's paintings at the Denise René gallery in New York, 1972. *Artforum* 10/8 (April 1972), p.89.
- ⁴⁴ This remark is attributed to architectural historian Vincent Scully. Cited by Nicholas Fox Weber in *Le Corbusier: A Life*, p.186.
- ⁴⁵ Undoubtedly the most comprehensive account of vision as studied through the physiology and optics of the eye is Hermann von Helmholtz's three volume treatise on physiological optics which offers an encyclopaedic documentation of the scientific understanding of vision in the nineteenth-century. Hermann von Helmholtz, *Treatise on Physiological Optics*. 3 vols. Trans. and ed. James Southall. (Wisconsin: Optical Society of America, 1924-25). Originally, (Leipzig: Voiss, 1856-1866). The closely related discipline of psychophysics originates in the work of Gustav Fechner. Fechner's approach, which used the measurement of stimulus to gauge sensation, offered a way to bypass some of the uncertainty concerning the nature of the unconscious and claimed to provide quantifiable measures for sensation and experience. Fechner's ideas also formed the basis for the work by Charles Henry, (director of the laboratory of physiology and sensation at the Sorbonne), whose attempts to quantify and measure universal responses to visual stimuli relate directly to Purism's search for a visual language based on absolute constants, and were actually featured in a series of articles in *L'Esprit Nouveau*. Gustav Fechner, *Elemente der Psychophysik*, (Leipzig: Breitkopf & Härtel, 1860). See also, William Braham, *Modern Color/Modern Architecture: Amédée Ozenfant and the Genealogy of Color in Modern Architecture*, (Aldershot: Ashgate Pub. Co., 2002), pp.24-30; Jonathan Crary, *Techniques of the Observer*, pp.145-146 and Nicholas Wade, *A Natural History of Vision*, (Cambridge Mass.: MIT Press, 1998), pp.395-396.
- ⁴⁶ Charles Wheatstone, "Contributions to the physiology of vision – Part the first. On some remarkable, and hitherto unobserved phenomena of binocular vision", *Philosophical Transactions of the Royal Society*, 128 (1838), pp. 371-394. Republished in, *The Scientific Papers of Sir Charles Wheatstone* (London: Physical Society of London, 1879), pp.225-259. All subsequent page references given here relate to this later publication. It is now generally recognised that Wheatstone was the first to realise the full significance of binocular vision, but this is an issue that has been the subject of considerable debate. See, Nicholas Wade, *Brewster and Wheatstone on Vision* (London: Academic Press, 1983), pp.42-49. Also, Nicholas Wade, *A Natural History of Vision*, pp.300-304.
- ⁴⁷ William Braham, *Modern Color /Modern Architecture* , p.24.
- ⁴⁸ Louis Daguerre, *An historical and descriptive account of the various processes of the daguerreotype and the diorama* (1839). Trans. (New York: Winter House, 1971).
- ⁴⁹ Charles Wheatstone, "Contributions to the physiology of vision – Part the first.", p.225.
- ⁵⁰ Stephan Oettermann, *The Panorama*, p.49,59.
- ⁵¹ L. J. M. Daguerre, *The Valley of Chamonix*, (1832). See, Helmut and Alison Gernsheim, *L. J. M. Daguerre*, p.28. Also Stephan Oettermann, *The Panorama*, p.80.

⁵² Stanislaus von Moos, *Le Corbusier: Elements of a Synthesis*, pp.5-6; p.193. Von Moos, describes the enthusiasm Corbusier's father had for mountain climbing and Corbusier's childhood walks in the Alpine landscape. See also, Le Corbusier, *The Decorative Art of Today*, p.194.

⁵³ *Diorama d'une ville contemporaine*, Salon d'Automne, 1922. In particular three drawings all from 1922 indicate the sequential refinement of Le Corbusier's design for the diorama. In these drawings Corbusier appears to be exploring the relationship between the viewer and the depicted scene. Various lines of sight have been drawn and the position, extent and curvature of the display wall are gradually adjusted. Some marginal sketches also clearly emphasise the window-like manner in which the view is intended to be framed. The final form of the diorama is almost identical in dimension to that employed in the Esprit Nouveau pavilion. *Fondation Le Corbusier* catalogue nos. 30.826; 30.832 and 30.833. See, H. Allen Brooks (ed.), *Le Corbusier Archive, Vol.1: Early buildings and projects, 1912-1923*, (New York: Garland Publishing/Paris: Fondation Le Corbusier).

⁵⁴ Charles Wheatstone, "Contributions to the physiology of vision – Part the first.", pp.226-227. Various editions of Leonardo da Vinci's *Trattato della Pittura* would have been available to Wheatstone, but he cites a 1721 translation, presumably, Pierre François Giffart (ed.), *A Treatise of Painting*, (London: Senex; W.Taylor, 1721). The quotation used here is however taken from a recent translation by Martin Kemp and Margaret Walker. Martin Kemp (ed.), *Leonardo on Painting* (New Haven: Yale University Press, 1989), pp.63-64. It is worth noting that the word used by Leonardo is "relievo" which Kemp notes is literally translated as relief or modelling, but is also used to refer to the three-dimensionality of objects. See Kemp, *Leonardo on Painting*, p.315. Wheatstone also refers to Robert Smith's *Compleat System of Opticks* (Cambridge: Cornelius Crownfield/Robert Dodsley, 1738), which contains extensive references to Leonardo and to questions of binocular vision.

⁵⁵ Martin Kemp (ed.), *Leonardo on Painting*, p.64.

⁵⁶ Amédée Ozenfant and Charles-Edouard Jeanneret, "After Cubism", pp.136-139.

⁵⁷ Amédée Ozenfant, "Notes sur le cubisme", *L'Elan* 10 (1st December, 1916). Cited in, Carol S. Eliel (ed.), *L'Esprit Nouveau: Purism in Paris, 1918-1925*, p.12. The same artists are cited by Ozenfant and Corbusier in *Après le Cubisme*, "After Cubism" p.133.

⁵⁸ *L'Esprit Nouveau* (Paris: Éditions de l'Esprit Nouveau, 1920-25, twenty-eight issues. Articles relating to psychology and sensation include: Victor Basch, "L'Esthétique Nouvelle et la Science de l'Art", No.1 (1920) and Charles Henry, "La Lumière, La Couleur, et Le Form", Nos.6-9 (1921). In the pages of the journal there are frequent references to the nature of sensation and to the great nineteenth-century physiologists such as Wilhelm Wundt and Hermann von Helmholtz – but most notably, the *psychophysics* of Gustav Fechner. See also, William Braham, *Modern Color/Modern Architecture*, pp.24-30.

⁵⁹ Amédée Ozenfant and Charles-Edouard Jeanneret, "Le Purisme", p.58.

⁶⁰ Amédée Ozenfant and Charles-Edouard Jeanneret, "Le Purisme", p.60.

⁶¹ The two photographs of the *Ville Contemporaine* panorama (Fig. 6), show different parts of the painting viewed from slightly different angles. This may be responsible for the impression that the painting has been constructed using curvilinear perspective. However, based on the relation of the drawing to the edge of the paper, it is equally likely that the projection used was entirely conventional. It is interesting to note that a separate illustration depicting a similar view, published in *Urbanisme*, **did** include curvilinear distortion but it is conceivable that this was either an attempt to capture the curvature of the diorama in the drawing for publication, or was simply inspired by photographs such as these. Le Corbusier, *The City of To-Morrow and Its Planning*, pp.190-191. Since the diorama paintings reputedly no longer exist it is difficult to be certain which construction was used but even if one of the diorama paintings were in fact executed with some curvilinear distortion, this would not have changed the directional nature of the perspective view.

⁶² Rosemarie Haag Bletter, "Opaque Transparency", *Oppositions* 13, (Summer 1978), p.124.

⁶³ Leon Battista Alberti, *De Pictura*, (1435). Trans. Cecil Grayson, *On Painting*, (London: Penguin, 2004), p.56. See also, Svetlana Alpers, *The Art of Describing: Dutch Art in the Seventeenth Century* (Chicago: University of Chicago Press, 1983), pp.41-45. Also, Robin Evans, *The Projective Cast: Architecture and its Three Geometries* (Camb. Mass.: MIT Press, 1995), pp.110-111.

⁶⁴ Alberti's notion of the *intersection* is considered with respect to binocular vision by Penelope Haralambidou in "The Stereoscopic Veil", *Architectural Research Quarterly* 11/1 (2007), pp.36-51.

⁶⁵ John Ruskin, *The Elements of Perspective* (London: Smith, Elder & Co, 1859). Le Corbusier's education is outlined in Stanislaus von Moos, *Le Corbusier: Elements of a Synthesis*, pp.2-5. Le

Corbusier himself describes the significance of Ruskin on his education as an artist in *The Decorative Art of Today*, pp.132-133.

⁶⁶ For an account of Ruskin's attitude towards vision and optics see, Martin Kemp, *The Science of Art*, pp.242-243. Kemp also discusses Ruskin's understanding of perspective. Martin Kemp, *The Science of Art: Optical themes in western art from Brunelleschi to Seurat* (New Haven: Yale University Press, 1990), pp.254-256.

⁶⁷ Ruskin's *Elements of Perspective* was written at a time when the stereoscope was at the height of its popularity and there can be little doubt that Ruskin was aware of its role in vision, even if he chose not to see its use as appropriate to art. John Ruskin, *The Elements of Perspective*, p.2. Sébastien le Clerc, *Discours Touchant de Point de Vue, dans lequel il est prouvé que les choses qu'on voit distinctement, ne sont vues que d'un oeil*, 1679.

⁶⁸ A similar argument is made by Svetlana Alpers, in relation to seventeenth-century Dutch depictions of architectural space and landscape. Svetlana Alpers, *The Art of Describing*, pp.50-51; p.138-139.

⁶⁹ On the subject of attention and binocular vision, see, Jonathan Crary, *Suspensions of Perception: Attention, Spectacle and Modern Culture* (Camb. Mass.: MIT Press, 1999), pp.104-105.

⁷⁰ Stephan Oettermann, *The Panorama*, p.59.