

Undergraduate Research Opportunities Programme in Science Perspective in Mathematics and Art – Vermeer’s Camera

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ABSTRACT

Realism in art has been one of its main goals until the invention of photography in 1839, and it is not an easy feat. Art historians see a general shift towards greater naturalism in art beginning from the 15th century and debate on the methods, techniques that the artists employed. This is important as by the nature of their studies, they are exerting that the methods artists use – be it the materials, tools, techniques, insights - have a profound, direct and instant influence on the nature of the work they produce. To achieve realism really require not only great drawing and painting skills to put images down on paper, but accurate observation must precede it. A painting will only look real if the artists could transcribe what he sees of the world onto a piece of paper or canvas accurately. Encapsulated in the idea of seeing with accuracy are knowledge of optics and perspective, both of which are what the Renaissance scholars called the ‘mixed sciences’. The ‘mixed sciences’ integrate mathematics - the language of accuracy - with theories in natural science was an important aspect of arts. In this paper we will look at the work of two people that reflect this spirit of the ‘mixed sciences’ - David Hockney and Philip Steadman. The first section will focus on artist David Hockney’s work to confirm that use of optics in paintings. The second section examines art historian Professor Philip Steadman’s work using perspective geometry to ascertain that Vermeer used an optical device called the camera obscura in his painting.

1. Student
2. Supervisor

Distinction of David Hockney's work

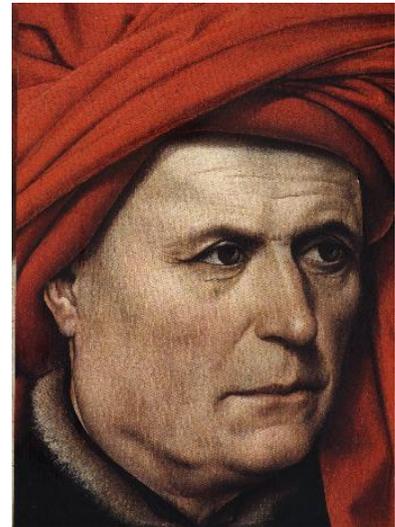
Although art historians has long debated on whether artists used optical devices prior to that as a method to paint, David Hockney demonstrated they must have done so as early as early as mid 1420s. He analysed optical effects of paintings with a pictorial gallery spanning from early 1300s to late 1900s. Illustrated here is one example:



1300



1425



1430

He pointed a sudden emergence of realistic looking paintings, which suggests a new innovation that provided a new way of looking. The analysis of these optical looks (imposed by the limitation and benefit of the mirror and lenses) could be broadly classified into the following categories:

1. Curved Surfaces
2. Lighting and shadows
3. Clothing and armour
4. Errors in perspective
5. Evidence of mirror and lenses in picture
- 6. Technique revealed: Concave Mirror method**
7. Dark Background
8. Groping
9. Collage

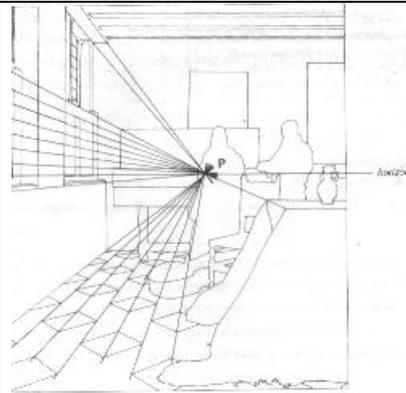
10. Technique revealed: Mirrors to lens

11. Left-hand drinker
12. Lighting: soft focus and shadows
13. Wider angle
14. Smiles
15. **New instrument: Camera Lucida**

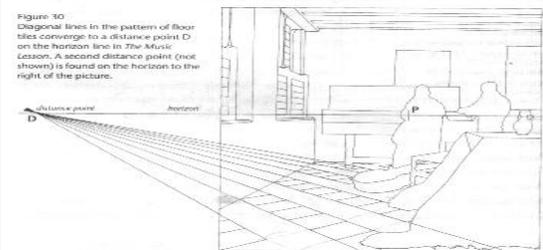
Distinction of Steadman's Work

One optical device we will learn about in Hockney's work is the camera obscura. Philip Steadman supported his argument of Vermeer's use of the camera obscura by a splendid display of reverse construction of interiors by geometry. Although he included visual evidence in his finding, he substantiated his conjecture using perspective construction to recreate the space in Vermeer's paintings.

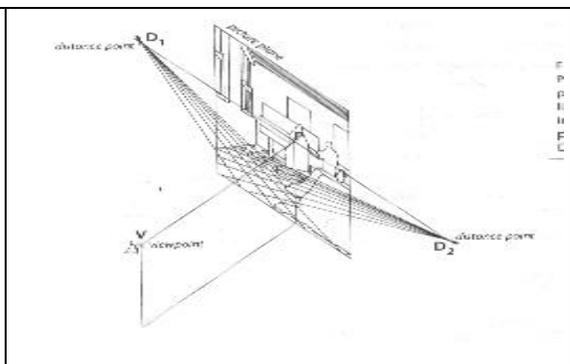
First, let's locate the central vanishing point of the picture. By drawing the lines of direction provided by the window sills, the wall, the ceiling and especially the tiles which act as orthogonals, we could join all of these lines of direction to one point. This is the central vanishing point. In *The Music Lesson*, this point of convergence is at P, the position of the girl at the virginal. Next, we draw a horizontal line through this point to denote the theoretical horizon.



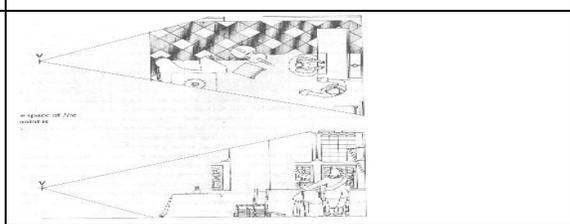
Using the grid provided by the floor tiles, we do step 1 again in two directions outside of the picture. This will locate the distance points that lie to both sides of the picture. These two points will lie on the horizon and are equi-distance from the central vanishing point.



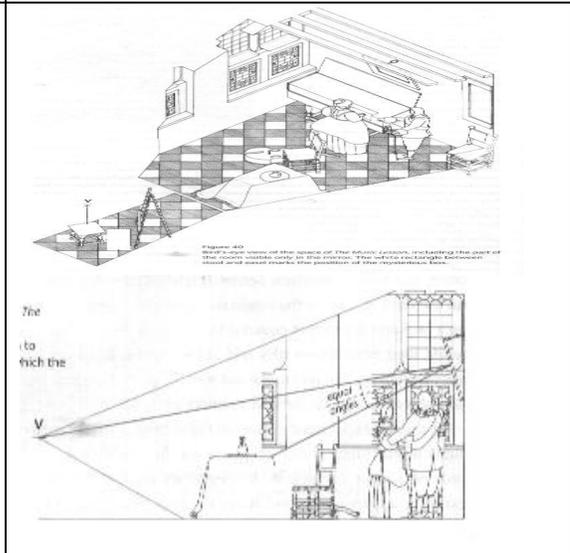
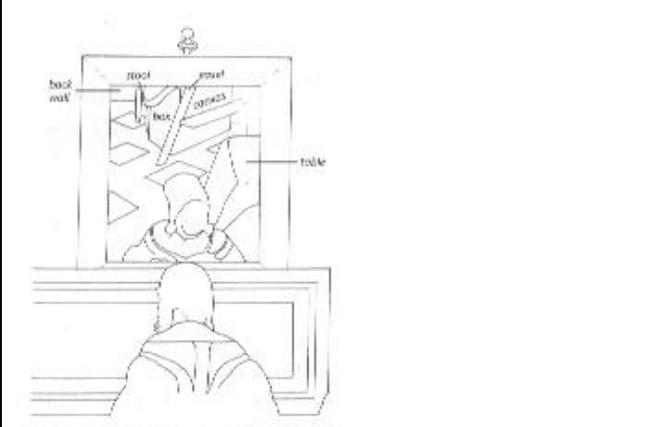
From the distance points we could locate the picture's theoretical viewpoint. This is the perpendicular distance to the picture plane and is the same distance as either of the distance points from the central vanishing point. This viewpoint is the distance at which Vermeer would have had put his eye in order to see the scene in the precise perspective view represented in the picture.



With Step 1 – 4 in place, we could proceed to construct, first the plan view (step 5-6), and afterwards the three-dimensional side view (step 7), of the room in which The Music Lesson is painted.



Moreover, using the mirror image in The Music Lesson, we could obtain in addition, the back wall of the room.



The result shows that at least 6 of 11 interior-tiled-floor paintings were done in the same room; all of them have viewpoints that cluster around a particular area of the room. If we further extend the line of projection (equivalent to the light rays in optic diagrams) to the end wall to obtain the size of each picture, we find that the projection have similar sizes as that of the actual paintings as they stand today. These support the conjecture that Vermeer used a camera obscura of the booth type.