

Rebuttal to:  
“Questions of Optical Evidence: A Response to Tyler” by  
Charles M. Falco and David Graves  
on the ArtandOptics website (2001)

Christopher W. Tyler, Ph.D., D.Sc.

[Falco & Graves]

Elsewhere within this site Christopher Tyler and David Stork stated various objections to our evidence. However, it is easy to show that all of their objections arise from their errors in logic, lack of historical knowledge, or misunderstanding of perspective.

Although Christopher Tyler lists six objections, only two address in any way our optical evidence.

[Rebuttal]

This characterization is incorrect. The presentation addressed the claims of Hockney’s book, that the use of optics became widespread after 1420 and accounted for the sudden level of realism that pervades early Renaissance painting. All six objections address this claim. Four of them directly address problems with Falco’s optical evidence, while two point out aspects of realism in Renaissance paintings that could not have been achieved with optics.

[Falco & Graves]

Below we show that these two objections are based on him having an elementary misunderstanding of optical perspective, which in turn directly resulted in his incorrect conclusions. His other four points are logical red herrings, having no bearing on either the scientific or the visual evidence. . . . As we show below, these two objections are based on an incorrect understanding of optical perspective, which in turn results in his conclusions being in error. His other four points are logical red herrings, having no bearing on either the scientific or the visual evidence. Tyler states:

[Tyler]

I show several lines of contrary evidence, implying that Renaissance artists constructed their compositions purely through artistic intuition, without optical aids (or accurate geometric methods).

1. Most Renaissance artists show perspective discrepancies **within local regions**, refuting an accurate use of optics.

[Falco & Graves]

Irrespective of what "most" artists might have done, this point has no logical connection with evaluating our optical evidence on certain specific artists.

[Rebuttal]

Falco and Hockney adduce the optical evidence on specific artists to support the general claim that “from the early fifteenth century on many artists used optics . . . and before long this new way of depicting the world became widespread“. Evidence that most artists show deviations inconsistent with the optical claims addresses this general point. In my talk, I list such deviations in 27 of the most famous Renaissance and Baroque artists, those with the most compelling realism in their works. Obviously, one cannot develop such a thesis without years of work, but the deviations I report cast serious doubt on the generality of the claims

[Falco & Graves]

Aside from this error in logic, Tyler's statement implies that our discoveries are inconsistent with the existence of perspective discrepancies. Quite the opposite. Discussed at length at various places in Reference 1 are the important clues multiple perspectives within local regions provide for our discoveries.

[Rebuttal]

This response completely misses the point of the objection. As its elaboration on the website makes clear, the statement specifically emphasizes the application “within local regions”, and is framed in recognition of the Hockney/Falco idea that multiple perspectives are expected with the use of optics. The point is that, with each choice of lens (or ‘mirror-lens’) placement, an artist copying the details of that local region would automatically get the perspective correct. It seems obvious that the artist would point the lens to specific objects, such as a book, a globe or a planimeter in Holbein’s ‘Ambassadors’. Perspective inconsistencies *within* the construction of each of the objects therefore imply intuitive construction (and fail to support the accurate use of a lens).

Conversely, Falco’s main argument is that the occurrence of different vanishing points in different regions of a painting is “proof” that the artist used local optical projection. Given that the perspective of most paintings seems to have been constructed entirely by intuitive means, the alternatives are far more likely. The artists could achieve a visually acceptable result by keen observation far more quickly than either by a geometric perspective construction or an optical lens set-up.

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[Tyler]

2. Construction lines reveal the use of geometric perspective.

[Falco/Graves]

There are many examples of Renaissance artists who used geometric perspective, intuitive perspective, diagonal perspective, and atmospheric perspective, to name some of the possibilities. However, the fact that many artists used geometric perspective, while obviously true, is logically unrelated to evaluating our optical evidence that demonstrates certain artists used lenses to project portions of images starting as early as c1430.

[Rebuttal]

This argument is narrowly defined. The larger issue is, what methods did artists of the early Renaissance use to achieve their new realism? Examples of early construction grids reveal that some used construction lines, which they would not have needed if they could have easily copied with optical projection. Only a few such grids are known, however, so I would not want to claim that evidence was available in more than a few cases.

[Tyler]

3. Even if the optics were moved, all vanishing points should still lie in the horizon, a requirement violated among the discrepant vanishing points observed.

[Falco/Graves]

Tyler's understanding of perspective is simply wrong, as therefore are his conclusions based on the above incorrect statement. A very simple example will illustrate why Tyler is incorrect. Aim a camera down and take a photograph of the sidewalk in front of your feet. Now aim your camera at the horizon and take a second photograph. If you make a collage by taking a portion of the first photograph and pasting it over the second, obviously one set of vanishing points will be at the horizon, but the other will be somewhere overhead. Renaissance artists had complete freedom to raise or tilt their lenses as well as slide them sideways, and various examples are shown in Reference 1 where artists moved their lenses vertically.

[Rebuttal]

I am guilty here of a shorthand summary statement. In the context of the referenced website page, this statement that the vanishing points should lie on the horizon refers to the classic case of one-point perspective. For the purpose of the website, the analysis is applied solely to horizontal lines, for which the vanishing-point statement is valid. Now, how does it apply to the case of multiple lens positions?

Falco & Graves are correct that a camera pointed freely could show the horizontal vanishing points at any height. It is entirely implausible, however, that a Renaissance artist employing the notional new technology of a mirror lens to capture difficult regions of the scene would move it with the freedom of a hand camera. They could not have painted with the lens held in one hand – it would have to be built into a support of some kind. The first impulse would be to set the optics up on a lens-holder and slide it around on a table (or on an easel on the floor). In this situation, the lens (and the canvas) would both remain vertical and all horizontal lines would project to the same horizon height. In fact, even tilting the lens would not change the height of the vanishing point, it would merely introduce deeper aberrations (contrary to Falco & Graves implication).

[Tyler]

4. Optical aids such as mirrors and lenses are not photographs; they cannot explain the ability to capture elements in motion such as rearing horses.

[Falco/Graves]

This statement, while true, is another red herring. Actually, while incorrectly intended as an objection to our discoveries, in fact it actually supports our understanding of how the artists worked. A lens would have been used by an artist as an aid when it helped them accomplish his or her goals, but would not have been used when it did not. The complex shape and lighting of the chandelier in van Eyck's "Arnolfini Marriage" would have been much easier to produce with the aid of a lens, but the small dog would have been eyeballed. That is, both projected and eyeballed features are within a single painting.

[Rebuttal]

This response is typical of the selective logic often encountered in the Hockney book. Although it is plausible from the artists' perspective, this kind of logic means that any shred of evidence

consistent with their thesis may be seized on, but any point that is inconsistent with it may be dismissed.

A supplementary point that can be made is that the van Eyck chandelier is not, in fact, in accurate perspective. Mark de Mey, who worked with the BBC to reconstruct the physical shape of the chandelier, shows in his video that the left front prong does not fit the rest of the structure. The chandelier does not have the perfect accuracy implied in the Hockney book, and does not provide good evidence of the use of optics.

[Tyler]

5. The Hockney/Falco/Graves demonstrations reveal that optical projection has a very narrow depth of field. The 'optical look' therefore should include many regions being painted out of focus. No Renaissance paintings exhibit the literal optical look of such optics.

[Falco/Graves]

Here Tyler makes an incorrect inference that is at variance with what we would expect from understanding human vision. Since humans automatically refocus their eyes as they scan across a scene, an out-of-focus feature does not look at all natural, except to modern people who have been inundated with such images on TV, movies, magazines, and in the viewfinders of their own still and video cameras. In fact, out-of-focus features must have looked especially unnatural to people who had never before seen projected images. Only if patrons were interested in paying for paintings containing features that appeared to them unnatural would artists have deliberately left in such out-of-focus features. Like the actual Rosetta Stone, there is every reason to expect the Lotto example to be the exception, not the rule.

[Rebuttal]

Falco & Graves here argue in the opposition to Hockney, who maintains strenuously that the compelling quality of the new optical image is what inspired the artists to change their style. This argument is quite different from the proposal that the optics were used as a tool to enhance the "visual look" of a scene viewed by the patrons. As one can see from the example on p. 104 of the Hockney book, the true 'optical look' would have been more likely to have inspired French Impressionism than the Renaissance precision!

[Tyler]

6. Falco's "Rosetta Stone" of Lotto's 'Santa Lucia' does not have a unified geometry of its central pattern element, even though **apparent blurring implies a single optical projection zone**. The perspective is locally haphazard, and is compatible only with intuitive construction.

[Falco/Graves]

This incorrect statement by Tyler follows from his earlier statement No. 3 about perspective, which we already have shown is wrong.[2] Lotto was free to raise, lower, rotate, and translate his lens as well as refocus it in his ultimately unsuccessful efforts to eliminate the unnatural out-of-focus feature. The resulting perspective in that region, while more complex than Tyler can understand by drawing a few simple lines on the painting, is far from "haphazard." In fact, it is quite "optical."

[Rebuttal]

How many lines do they offer us? Precisely two! But this comment completely ignores the logic of my claim (in bold). Not only would it be very implausible for the artist to change focus

in the middle of a coherent figure like the octagonal feature on the table-rug; even if Lotto *had* changed lens position then the octagon would not be out of focus. You can't have it both ways. Either it is out of focus because Lotto did not change lens position (and hence the perspective should be coherent) or the perspective is piecemeal because Lotto did change lens position, so it should be in focus. It is not the fact that the perspective is haphazard, but that it is haphazard within local features such as the octagon that makes the use of optics so unlikely.

[Falco/Graves]

Christopher Tyler has shown that had Lotto followed the steps claimed by Hockney and Falco then the carpet in the scene would have had to have had an asymmetric design for the carpet, as shown here.

We showed in Figure 6 [Fig. 1] of the 'Optics and Photonics News'[4] manuscript that Lotto shifted his lens when working on the central feature, resulting in two sets of vanishing points that differ considerably from each other. Unfortunately, Tyler's reconstruction of the perspective of this portion of the painting is simply wrong (see our earlier discussion of Tyler's point no. 3). This effect in the image, which Tyler's error has caused both of them to misinterpret as implying an apparent asymmetric design of the original carpet, instead comes directly from Lotto having shifted the position of his lens during production of that portion of the painting. Having had to reposition his lens when producing that portion of the painting is quantitatively consistent with our calculations of the limitations on the imaging properties of a simple lens due to its intrinsic optical aberrations.

[Rebuttal]

They show nothing of the kind! What Falco and graves show is that a minimal reconstruction of a few perceptive lines indicates that the detailed perspective was inconsistent. What is needed to provide evidence of the shifted lens hypothesis is to show zones in which **all** the perspective lines are consistent. As I show in Tyler (2004; Leonardo), the perspective of the central floret, which is the element most likely to have needed optical projection, was highly **inconsistent**, with as many as 6 incompatible vanishing points. This pattern of results is strong evidence against the use of an optical device for this purpose.

Of course, it is always possible that van Eyck did use an optical device, but did not use it carefully enough to obtain consistent results. But why would he have bothered to use an optical device at all, in this case? He was one of the most meticulous artists in history, so it seems obvious that if he had gone to the trouble of setting up the optics, he would have copied the result carefully. In any case, we have to remember that this is Hockey and Falco's "Rosetta Stone" of the optical hypothesis, their most solid evidence that optical projection was used in the art of this period. If the painting does not show consistent support of the hypothesis, their case essentially evaporates.