

# Did Lorenzo Lotto use optical projections while painting “Husband and Wife”?

Christopher W. Tyler and David G. Stork\*

Smith-Kettlewell Eye Research Institute, 2318 Fillmore Street, San Francisco, CA 94115

Phone: 415/345-2105; E-mail: cwt@ski.org

\*Ricoh Innovations, 2882 Sand Hill Road Suite 115, Menlo Park, CA 94025-7054

Phone: 650/496-5720; E-mail: stork@psych.stanford.edu

Departments of Electrical Engineering and Art History, Stanford University, Stanford, CA 94305

**Abstract:** We apply optical and perspective tests to the carpet in Lorenzo Lotto’s “Husband and Wife” (c. 1543) to test the claim that this painting was executed by tracing an optically projected image. While the perspective exhibits many inaccuracies consistent with this claim, such inaccuracies are equally consistent with non-optical explanations, such as artistic freehand for features that are peripheral to the theme of the painting. Further, a number of properties—specifically the perspective inconsistencies within some putative projection regions—are incompatible with the use of projections. We explore perspective in carpets in other Lotto paintings and find perspective incoherence that is unlikely due to refocusing or depth of field problems in a projection, the putative source in “Husband and wife.” Our analyses and the lack of supporting historical evidence lead us to reject claims for “proofs” that projections were used in the creation of this painting.

©2004 Optical Society of America

**OCIS codes:** 110.2960 Image analysis; 230.4040 Mirrors; 000.2850 History and philosophy; 330.5020 Perception psychology

Recently the contemporary artist David Hockney and thin-film physicist Charles Falco claimed that Renaissance painters as early as 1420 used optical projections from concave mirrors during the execution of their works [1], over a quarter millennium before the earliest dates securely established for such procedures. They adduce as evidence the carpet in Lorenzo Lotto’s “Husband and wife” (c. 1543), which they have called the “smoking gun” and “Rosetta stone” of their theory. We extend the analysis in [2] to test the claim that this work was painted using projections.

We explore a number of possible sources of the geometric features and anomalies in the rendering of the carpet: parameters of a putative optical projector (focal length, aperture, positions, orientations, ...), inherent asymmetries in the physical carpet, deformation of the stiff carpet cantilevered over table edge, rotation of the carpet on the table during execution, slight deviations from planarity of the table surface, repositioning of the artist or easel, execution “by eye,” slight scaling of horizontal bands in the canvas due to re-stretching (common for such works), and more.

Because the optical projection aperture would be limited to ~10 cm diameter, the optical hypothesis makes a strong prediction: the *global* perspective (involving multiple refocusing) will be *incoherent* while the *local* perspective (within a single “exposure”) will be *coherent*. We show, however, this prediction is contradicted by the visual evidence: the perspective within (local) motifs is *incoherent*. Likewise, there are large inconsistencies in the pattern on the carpet draping in front (also found in works such as Lotto’s “Mystic Marriage of St. Catherine,” 1521) that cannot be attributed to refocusing, the claimed source. Further, proponents’ claim that the central region is due to an out-of-focus projection is hard to reconcile with their claim that its geometry was due to this region having been refocused [2]. The number of free optical parameters (viz., focal length, facial area) proponents have adjusted to fit the image is not sufficiently over-determined by the visual evidence, and hence such fits are of little explanatory power. Moreover, such fits to a pre-determined model do not *distinguish* among competing explanations; alternate, non-optical, explanations are hard to reject on statistical grounds. Finally, there is no persuasive independent evidence that the scene was illuminated by direct sunlight, as is required for optical projection [3], nor is there documentary evidence anyone even saw an image of an illuminated object projected onto a screen by a mirror or lens by that time [4], including Lotto’s personal notebook of records, *Libro di Spese* [5].

Our results lead us to reject claims of “proof” that Lotto used projections when executing this painting.

## References:

1. David Hockney & Charles M. Falco, “Optical insights into Renaissance art,” *Optics and Photonics News*, **11**(7), 52-9, 2002.
2. Ch. W. Tyler, “Rosetta Stoned? Hockney, Falco and the sources of ‘opticality’ in Lotto’s ‘Husband and wife’,” *Leonardo*, 2004 in press.
3. David G. Stork, “Color and illumination in the Hockney theory: A critical evaluation,” *Proc. Color Imaging Conf.* (CIC11), 11-15, 2003.
4. David G. Stork, “Optics and the old masters revisited,” *Optics and Photonics News*, **15**(3), 30-37, 2004.
5. Peter Humphreys, *Lorenzo Lotto*, Yale U. Press, 1997, and personal correspondence, 2003.