Industry and Ideas

George Palmer

Explanations of Color, Light, and Vision, Sometimes Complementary, Sometimes Just Perverse

> *Johnson*: Our three first principles are almost conformable to those of many other authors; as is likewise the greatest part of your theory on vision.
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> *Palmer*: I have not the foolish idea, that I can reform all that has been done on this matter; but I intend to produce a system agreeable to the experiments, and that shall defy contradiction . . .
>
> George Palmer, *Theory of Colours and Vision* (London, 1777), 7.

George Palmer was drawn to publication and pamphleteering about physics and the arts. In the later 1770s and 1780s, he issued two books on light and color and several shorter pieces on those subjects, on color vision, and on practical objects such as lampshades. In his writing, Palmer proposed theories about the physics and chemistry of light, theories through which he attempted to resolve the differences between the color of light and color in objects. His discussion of color and color vision suggests that his interest in their scientific grounding was part of an effort to validate his own and others' moneymaking endeavors.

In the 1950s, Gordon L Walls wrote about his frustration when attempting to trace Palmer.[1] Since then, revised catalogues and new indexing methods have turned up a little more information, but not much. George Palmer may not have been his real name, but perhaps it wasn't Giros von Gentilly, another name by which he was known, either. By any name, he is implicated in questionable activities that range from mercenary warfare to patent violations—although to what degree is always unclear. There are hints, in references to a school and students, that Palmer may have offered public or semiprivate lessons in chemistry, painting, the sciences, some other artisan practices, or all those subjects.

> *Johnson*: Well, Mr. Palmer, how do you manage with regard to light?
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> *Palmer*: I observe, I analyse, and I draw consequences.
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> George Palmer, *Theory of Colours and Vision* (London, 1777), 1.

If that is true, then the first-known of Palmer's publications, *Theory of Colours and Vision* (1777), may have served as an *aide mémoire* or manual, and it may have served the same purpose in its French translation (made, soon after the English version appeared, by Denis-Bernard Quatremère d'Isjonval). [2] In this book Palmer uses the format of a dialogue to present a theory of color, including what he described as new experiments with prisms and new explanations for the results. "Johnson," the straw man of *Theory of Colours and Vision*, is made to call him a chemist several times; whether this is to acknowledge a credential or to establish one is unclear.

The appearance of a second book by Palmer, *Théorie de la lumiere, applicable aux arts et principablement à la peinture* (1786), coincided with his involvement with Antoine Quinquet and his promotion of an Argand-style double air-current lamp.[3] Palmer's involvement in Quinquet's venture is uncertain, and may have been limited to the invention of a special glass shade for the lamp.[4] A pamphlet published a year earlier and initially a letter to the *Journal de Paris*, describes that invention: The shade adjusted the color of the light emitted so that it resembled natural light (day or night). The advantage was obvious for artisans, especially painters. One could keep working in the studio after dark and, Palmer suggested, relying on these lamps alone for illumination would provide a working light of constant intensity and color unavailable to those who depended on sunlight for illumination. In each publication, Palmer hints at other texts in preparation, including a treatise on chemistry and one on "geometrical proportions of colored rays." Neither book can be traced today.

Palmer's Ideas about Color

Even with so little information on which to build a context for Palmer's work, the scientific ideas offered in both *Theory of Colours and Vision* and the *Théorie de la lumiere applicable aux arts* merit consideration. Not Newtonian, not Cartesian, but certainly opportunistic, Palmer's approach is like that of many of his contemporaries. He seems to take what he likes—this idea, that experiment—and from that build a reality that explains science as he sees it, almost literally.

The *Theory of Colours and Vision* opens with a list of the seven general principles of color plus a further six principles governing vision. These first seven, as "Johnson" notes, match those of other authors. The basis of Palmer's concept is a three-color, red-yellow-blue system, where all rays of light contain different proportions of those colors. Objects appear colored by the absorption of the rays relating to their color and by their reflection of the other rays. A white surface indicates the rejection of all light. Blackness occurs when the three coloring principles absorb the rays of other colors, creating an intensity that exceeds the proportion of the color. There is no color in light. Instead, colored surfaces absorb rays and white surfaces reflect rays. Palmer concludes, then, that purple, green, and orange must not be primary colors but rather the result of mixtures of the three others.

> Then I perceived very soon, that the authors who had worked upon this matter took the coloured rays upon the specus out of the prism; but none of them minded how they could get in . . .
>
> George Palmer, *Theory of Colours and Vision* (London, 1777), 9.

Theory of Colours and Vision, like any good eighteenth-century explanation of a new theory, includes experiments and some of Palmer's are quite marvelous. The Newtonian-style manipulations of the prism caused misconceptions, he suggests. Authors of those studies are too concerned with the manner that color emerges from the prism, and not concerned enough with how light enters it. Palmer offers an experiment to demonstrate the different results, once this deficiency is considered. Place a prism on a rooftop or "one of the towers of St Paul's church" and examine the broken light from this source, light presumably untainted by reflections from surrounding buildings or other light sources. At a distance of six inches, you will see a shadow of the prism with one edge blue-violet and the other red-yellow. While claiming that this phenomenon was key to disproving Newton, Palmer declined to explain further. More work must be completed before he could pronounce absolutely on this subject.

> 7. Any one of those three colouring principles is capable of becoming black, without any alteration of its substance by absorbing the rays which are not analogous to it, when its intenseness exceeds the proportion of its own ray.
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> George Palmer, *Theory of Colours and Vision* (London, 1777), 5–6.

Palmer also incorporated chemical analogies as well as physics and geometry into his description and experiments. To explain the formation of black, for example, he outlined a set of trials to color a white cloth with indigo, then cochineal and finally weld. The color of the test cloth changes from blue to purple to black. Each stage should include a reference standard, an undyed cloth, to prove the color added. Palmer's conclusion is that, while it may seem that an abundance of light (i.e., the three kinds of light that comprise it) produces darkness, this does in fact come from the absorption of the three rays. In the second part of his trial, Palmer removes the colors, dipping the cloth first in hot vinegar and then in dilute oil of vitriol. Because each coloring particle absorbs its own ray, Palmer explains, the cloth absorbs all the rays that compose light and so yields darkness. The reversal shows that the colors continued to exist even when the color they made was black. Combination did not create a chemical (i.e., permanent) alteration.

Palmer's theory counters Newton while supporting the Newtonian description of compound colors offered by Charles Dufay and Jean Hellot for textiles. That theory suggested that different coloring particles were in specific places within the fibers: The eye mixed the two or three colors in their varied proportion to create the color. Palmer describes the cloth as containing discrete points where the coloring particles can attach. Dyeing the cloth blue leaves white the spaces that might reflect red and yellow colors—that is, where those coloring particles might have lodged. Adding those two shades means the cloth absorbs almost all light, that which escapes creates the reddish or bluish cast to the black.[5] In another series of experiments Palmer used red-, yellow-, and blue-colored glasses and finely ground pastels to demonstrate the constancy of his principles of mixture and color vision in other branches of the color-dependent arts.

The *Théorie de la lumiere applicable aux arts* continues Palmer's theories with a few changes in terms and acknowledgment of some objections by others. To counter the objections, Palmer is clear that his is an effort to create a single description of color, one that will explain color and light for the arts, chemistry, and physics, with an emphasis on the first. As in the writing of Mauclerc and Watin (and in that of William Lewis, Robert Dossie, and others), a stated goal in Palmer's work is to improve the arts by introducing and solidifying connections to the sciences. As part of the proof of his system, Palmer again turns to the work both of painters and of dyers to assess and explain. Unlike many other scientist-writers, or artisan-writers, Palmer includes color vision or color perception as part of the explanation.

Palmer's Explanation

> Une surface colorée est une surface d'un corps quelconque qui, par sa disposition; & l'arrangement de ses molécules, détruit en tout ou en partie un ou plusieurs rayons, & donne à l'œil des sensations modifiées de la lumiere.
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> George Palmer, *Théorie de la lumiere applicable aux arts* (Paris, 1786), 14.

It is a problem of vocabulary, Palmer suggests. Once you accept a few basic concepts—that there are three primary colors and that the same three basic colors exist as rays in prismatic light, that colors are seen because that portion of light is destroyed when it reaches a colored surface, that white (i.e., light) is necessary to see color and black—then you understand that, when the three true primitives are perfectly combined, all rays of light are destroyed and that therefore that combination is the negation of light. A colored surface is due to the modification of the arrangement of molecules at the surface. This can be seen in a traditional example: As an iron or steel bar is heated, its color changes from yellow through red and blue. But then, moving to an explanation that incorporates prevailing ideas about phlogiston without mentioning that substance, Palmer suggests that the addition of heat explains all color change, whether that of shellfish as it is cooked or the behavior of sympathetic inks, liquids that change color or disappear on heating or cooling.

> Une observation de Teinture qui se rapporte assez avec ce que je viens de dire; est que l'écarlatte qui semble ne devoir dire qu'une seule couleur, varie suivant le pays pour lequel on la teint. Pour le nord on la fait orange, en France rouge pur, & pour le midi on la fait tirer sur le cramoisi.
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> George Palmer, *Théorie de la lumiere applicable aux arts* (Paris, 1786), 50–51.

In *Théorie de la lumiere applicable aux arts*, Palmer repeats the experiments found in *Theory of Colours and Vision*, adding a theory of the prism that more clearly supports his concept of the destructive nature of light. Here, Palmer is also more explicit about the role of chemistry in the creation of color. Or, rather, he claims he is: In most of his statements he assures the reader that this relationship exists and that he is able to provide a chemical analysis of colors for any painter who might wish to know. That explanation is not included, however. The behavior of the prism and the qualities of light it produces are then returned to the subject of the arts, as he addresses the effect of light and the mechanism of vision. This is the portion where Palmer is at his most innovative. Describing a relationship between sight and color, he explains color blindness. But he also links the color of light and its angle of refraction to latitude, and hence the color preferences of different schools of art. The light in the north is more blue and, with the exception of Venice, which is affected by the water that surrounds it, the light in Italy is more yellow. You can see this not only in painting but also in dyeing, in the different colors assigned one name.

Art. 49. *Theory of Colours and Vision.* By G. Palmer. 8vo. 1s. Leacroft 1777.

A *visionary* theory without any *colour* of truth or probability.

[R---s] M*onthly Review* 57 (1777), 84.

Palmer's theories, then, are a not untypical combination of generally accepted ideas and personal interpretations presented in a scientific format and designed to reconcile the discrepancies between the colors of physics and the colors of the artisan world. Like many others in the later eighteenth century, he is willing to reconfigure the Newtonian dicta without drawing attention to that fact. Whereas Louis-Bertrand Castel and Jacques Fabien Gautier d'Agoty—and Goethe, for that matter—feel compelled to remind the reader of their disagreement with statements made by or attributed to Newton, Palmer, like Mauclerc, makes no acknowledgement of his divergences. Alan Shapiro has written of the differences between French and British approaches to Newton's ideas about color.[6] He suggests that these theories had a "fundamentally different" place in France than in Britain, where chemistry was more easily adopted into the sciences. Christoph Opoix's theories, read to—and rejected by—the Paris Academy of Sciences, fit with this French acceptance of chemical explanations and their integration into other sciences. We can see in Palmer's writing an attempt to achieve a similar fusion.

Notes:

Note 1: Gordon L Walls, "The G. Palmer Story (or, What It's Like, Sometimes, to Be a Scientist)," *Journal of the History of Medicine and Allied Sciences* 11 (1956): 66–96. Another recent discussion of George Palmer and his writing on color vision, is in Barry Lee, Die Universität Göttingen und die Entstehung der Farbenlehre," *MPG Spiegel* 3 (June 1991):11-15.

Note 2: George Palmer, *Theory of Colours and Vision* (London, 1777); George Palmer, *Théorie des couleurs et de la vision,* trans. Denis-Bernard Quatremère Disjonval (Paris, 1777).

Note 3: George Palmer, *Théorie de la lumière, applicable aux arts et principablement à la peinture* (Paris, 1786).

Note 4: [George] Palmer, *Lettre sur les moyens de produire, la nuit, une lumière pareille à celle de jour* (Paris, 1785).

Note 5: Palmer, *Theory of Colours and Vision*, 33–34.

Note 6: Alan E. Shapiro, *Fits, Passions, and Paroxysms: Physics, Method, and Chemistry and Newton's Theories of Colored Bodies and Fits of Easy Reflection* (Cambridge, 1993), 216.