



# Out-of-the-Box Brightness for Life™

A viewer's guide to Q-lumens and why the  
Runco QuantumColor™ products outperform their  
specifications

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Runco

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## Introduction

### Not All Lumens are Created Equal

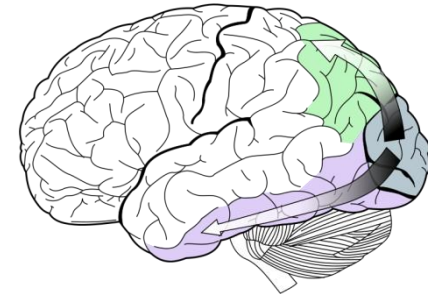
In this eBook, we explore the powerful effect that color saturation has on perceived brightness, as evidenced in the Runco QuantumColor™ products.

As the Vice President of Marketing for Runco International, a leader in home theater and video technologies, Ms. Jennifer Davis has unique insights into the importance of brightness. Mr. Ben Clifton, Vice President of Technology, offers a unique perspective to the science and engineering behind perceived brightness. You will find more information about Jennifer and Ben at the Author page toward the end of this book.

*“The most powerful test and measurement instrument is the human’s capacity for sight.”*

*We can see things that the most sophisticated and expensive measurement tools will never discern.”*

*-Jennifer Davis*



## Runco QuantumColor™



### Q-Lumens: Fact or Fiction?

When Runco launched the QuantumColor™ product family, we were not prepared for the incredible market response. We were proud of the architecture, the color performance and personalization of our projectors and knew that customers would have incredible experiences watching movies, sports, and other content.

Shortly after we launched the Q-750, we noticed something in our engineering labs and received feedback from Runco dealers as people started demonstrating the Q-750 projector and installing it into client homes: **the projector appears brighter than the specifications indicate.**

As a result, dealers and their clients felt comfortable putting this product on larger screens that we had specified and enjoying it in brighter rooms than we thought possible. Since the launch of the product in September 2009, we have been on the hunt for Q-lumen: the explanation of why the Q products were performing so remarkably.

This eBook is Runco's response and will describe the science behind the phenomenon. The bottom line of this investigation, however, is that the Runco QuantumColor products more versatile than we once believed and we are now encouraging broader uses and applications.



## Your Eye: The Ultimate Photometer

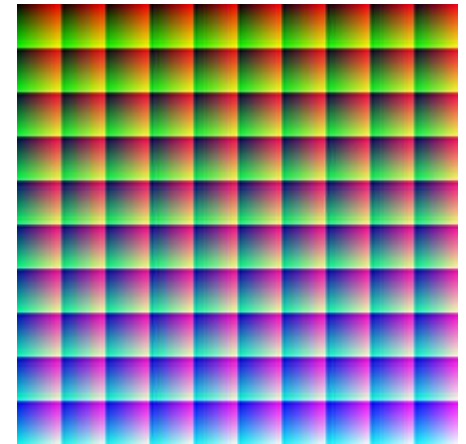
The picture to the right is one million pixels. When viewed at full size (1,000 x 1,000 pixels) each pixel is a different color. And you can perceive the difference in all of them. In fact, the average human can see 10 million colors.

These colors, however, are figments of our imagination. All colors are mixtures of light that are absorbed by color-sensitive cones in the eyes that are tuned to either blue, red, or green (this trichromatic color vision theory is the basis of our RGB display technology and was the discovery of Hermann Von Helmholtz, about whom we will talk more about in a moment). These pulses are then processed in the ventral and dorsal parts of the brain and give rise to the perception of color...and as we will discover, the perception of brightness.

Because both color and brightness are properties of light, the incredibly-sophisticated human capacity to see is highly-sensitive to the interplay between the two. Much more so than any piece of photometry or colorimetry equipment ever invented.

***“Color is a sensation in the viewer’s mind, not a property of the light itself or of the materials illuminated by the light.”***

*-Isaac Newton*



## Helmholtz-Kohlrausch Effect



Before we dive into a discussion about the Helmholtz-Kohlrausch (H-K) effect, there's an important note about Hermann Von Helmholtz. He was a genius and possibly made more contributions to our understanding of human sight physiology than anyone else in history. At the age of 31 in 1851, he invented the ophthalmoscope, which is still used today to examine the inside of the human eye. And he didn't stop there.

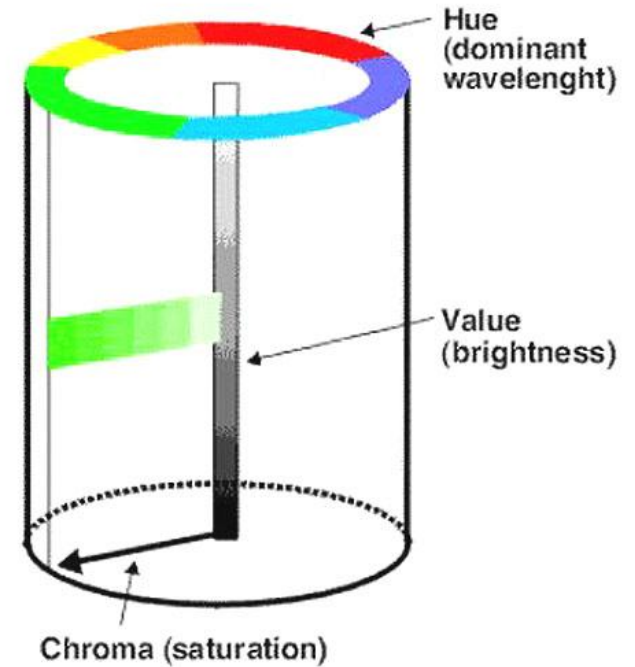
He went on to make contributions in optics, physics, electromagnetism, and music. He has several breakthrough equations, theorems, theories, and inventions on his resume, and a very relevant entoptic phenomenon in the color sciences known as the Helmholtz-Kohlrausch effect.



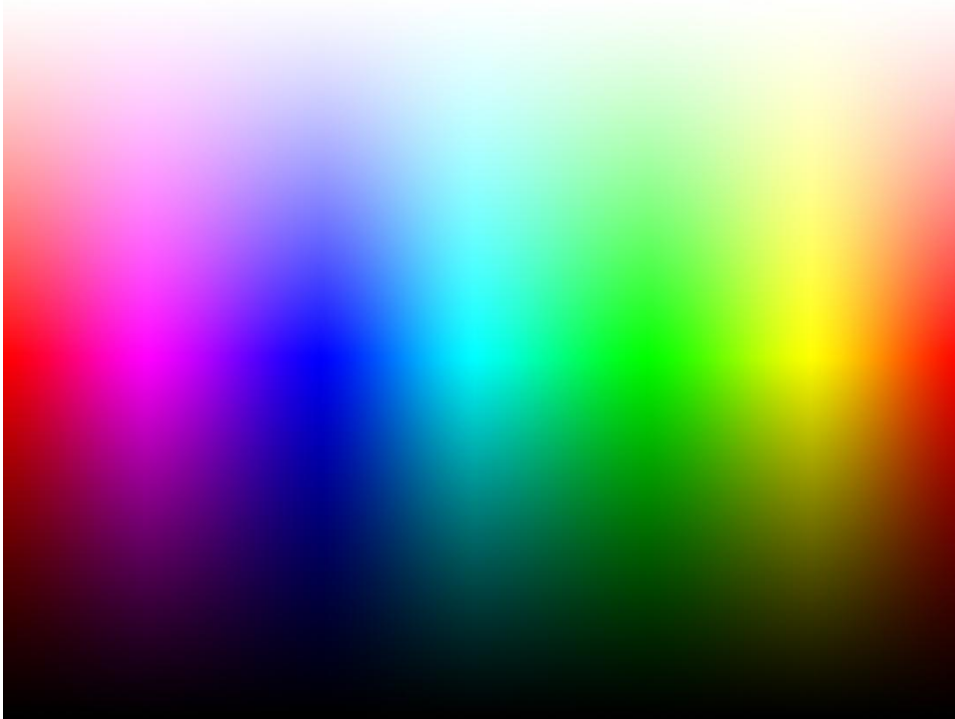
## Helmholtz-Kohlrausch Effect

Stated plainly, the effect describes how **brightness increases by saturation**. This means that perceived brightness is a function of not only luminance, but also chromaticity. More saturated colors are perceived as brighter than pastel versions at the same measured brightness levels.

The diagram to the right (which illustrates the Munsell color system) is representative of the concepts. No matter the hue (whether red or purple), colors toward the outside of this model cylinder are more saturated and, as this diagram shows, are seen a substantially brighter even if they contain the same value and even if the reflected measurement of that color off a screen surface is the same. The lumens of the light and the darker green would be the same, but there is a missing unit of measurement: the Q-lumen.



## ColorContrast



When we announced the QuantumColor product line, we sought to explain the Q-lumen with the concept we called Runco ColorContrast™. As this Granger Rainbow illustrates, the colors right in the center of the spectrum (fully saturated red, magenta, blue, cyan, green, yellow) appear to glow and appear brighter than the white (at the top of the rainbow) when compared to black (at the bottom of the rainbow). We encouraged dealers and clients to experience for themselves the benefits of our proprietary Runco Native color space, which was developed to fully take advantage of the H-K effect. But we can go further.



## Lab Results and Implications

We have tasked some of our leading scientists and engineers to aggressively test the performance of the QuantumColor projectors, with the R-G-B InfiniLight™ LED illumination architectures and color management electronics, against others using lamps and our results are confirming the anecdotes we hear from the market.

**For each ANSI lumen, the QuantumColor projectors deliver 1.6 Q-lumens in side-by-side perceived luminosity.**

In other words, the QuantumColor products are 60% brighter than the specifications would indicate and can be used in similar environments and in similar screen dimensions as other projectors that specify they are 1.6x as bright. This is out-of-the-box thinking about brightness, with huge implications to system applicability.

*“The Q-lumen effect is most pronounced and visually evident in low-light level environments, typical of home theater installations.”*

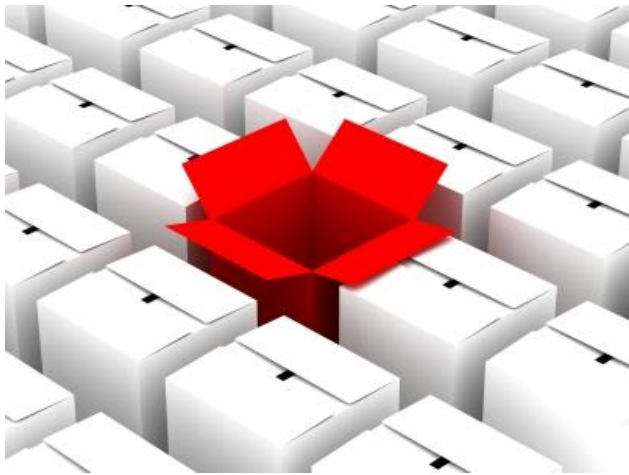
*- Ben Clifton*



Bright images with saturated colors (like the image above) show the effect of Q-lumens most dramatically, but it is evident in all content.



## Out-of-the-Box Brightness for Life



Our own test results confirm that Q-lumens are brighter than lamp-derived lumens. But that is not the only brightness advantage of the QuantumColor platform. The aging curve on the InfiniLight™ LED illumination system is much more stable than that of a traditional UHP mercury lamp. It is well understood that lamps lose significant brightness in their early hours of operation, falling to a plateau and then aging gradually to half-life, burn out, and replacement: starting the cycle all over again.

In contrast, Runco's InfiniLight system is calibrated at every start-up and has a more gentle brightness loss curve. So, the benefits of Q-lumens are even more pronounced after 1,000 hours, 2,000 hours and as the system continues to operate beyond 50,000 hours, the advantage is obvious. So, not only is it out-of-the-box brightness, but it is Out-of-the-Box Brightness for Life™.



## Summary

In conclusion, we have covered the color science behind the Helmholtz-Kohlrausch Effect, reviewed the architecture and advantages of the QuantumColor™ products from Runco, and explained the relative brightness of the Q-lumen. These combine to create Out-of-the-Box Brightness for Life™.

But an eBook can only tell you so much. In fact, the illustrations and diagrams in this presentation are not as vibrant or telling on your computer monitor or in high-quality print, as they would be on a QuantumColor product. Most displays are just not capable of replicating what we are showing here. Our dealers and their satisfied clients will attest: once you see it, you will be a believer. We encourage you to find a demonstrating dealer in your community at our authorized dealer locator at [runco.com](http://runco.com). Your local dealer will assist you in evaluating technologies and equip you to judge for yourself, using the most powerful piece of test equipment: your own eyes!



## About the Authors

### Jennifer Davis and Ben Clifton

#### Vice President, Marketing | Vice President, Technology



Ms. Davis has held leadership positions for over 16 years at technology companies. She joined Planar Systems in 1998 and has held operational, marketing, and strategic roles. Jennifer graduated summa cum laude and holds a Master's of Business Administration from Pepperdine University. A self-described geek with a belief that technology “with a point” can be a powerful part of people’s lives, she is proud to provide leadership to Runco’s product planning and marketing efforts.



Mr. Clifton is a big thinker whose deep understanding of display technologies drives the innovation engine for Runco and Planar. He was a founding technologist at InFocus, Motif, and Clarity Visual Systems and started his career at Tektronix after graduating from Washington State University with a degree in electrical engineering. After participating in the design and testing of the QuantumColor projector, he will never be able to look at the beloved CIE chromaticity chart in the same way again.

For further information on Runco’s industry-leading video technology, please visit [www.runco.com](http://www.runco.com).

Special thanks to Planar Systems’ display metrology expert Adi Abileah (Society of Information Displays fellow and chair of the International Committee on Display Metrology) and Bob Williams, Runco’s chief architect, and the entire Runco engineering team who contributed to this effort.



## Additional Information

Runco is a leading provider of premium video products for home theater and entertainment. Our expansive product line includes award-winning projection solutions, plasma and LCD flat-panel displays, as well as innovative product categories such as display walls and video processors.

Please visit us at [www.runco.com](http://www.runco.com) where you can learn more about Runco's video solutions that create an incomparable video experience, as well as to locate an authorized dealer near you, read our blog, and see a gallery of installations that might be useful to your own planning and design efforts.

