

Mobile Embedded Projector Metrics

Optimizing Mobile Projection:
An Academic Approach

Compiled by Mezmeriz, Inc.

Summary

Mobile Projection has a different set of requirements. Mezmeriz has taken an academic approach to determining the key factors that matter for this new class of projector

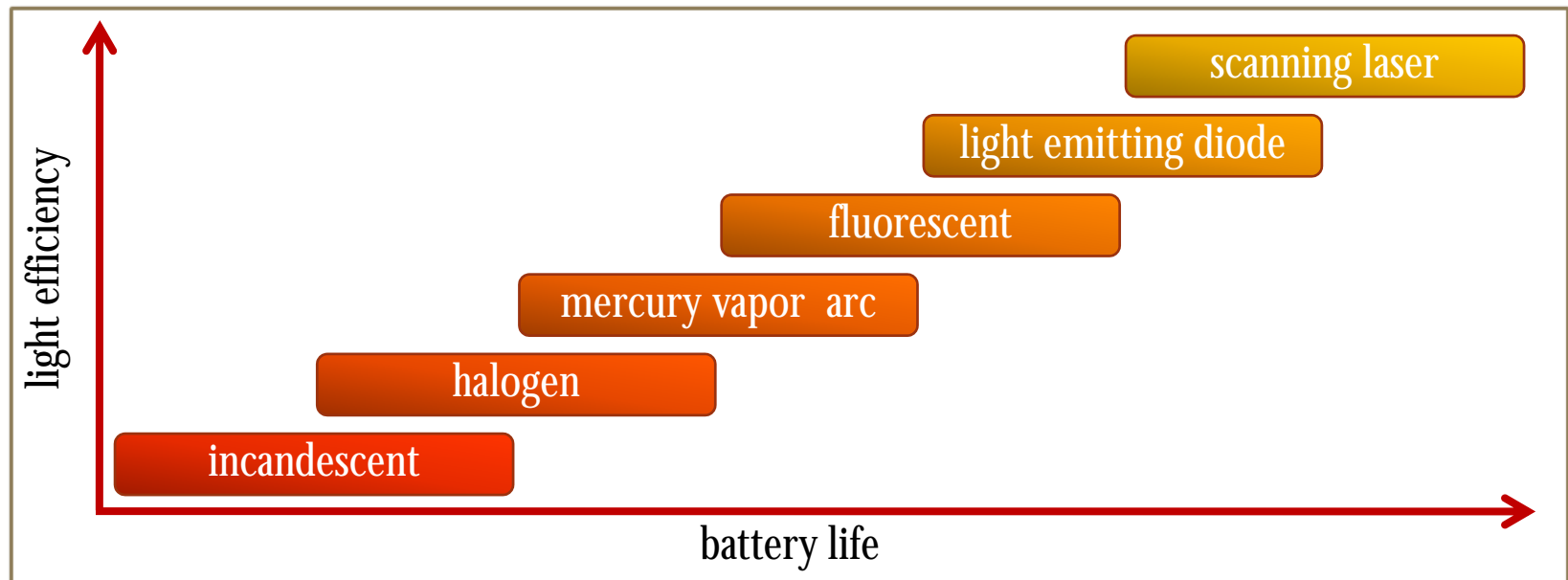
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- Light Efficiency
- Resolution Range
- Spatial Integration
- Size of Color Gamut
- Weber's Law
- Speckle

Light Efficiency

- Description: Amount of light produced for the amount of power used:

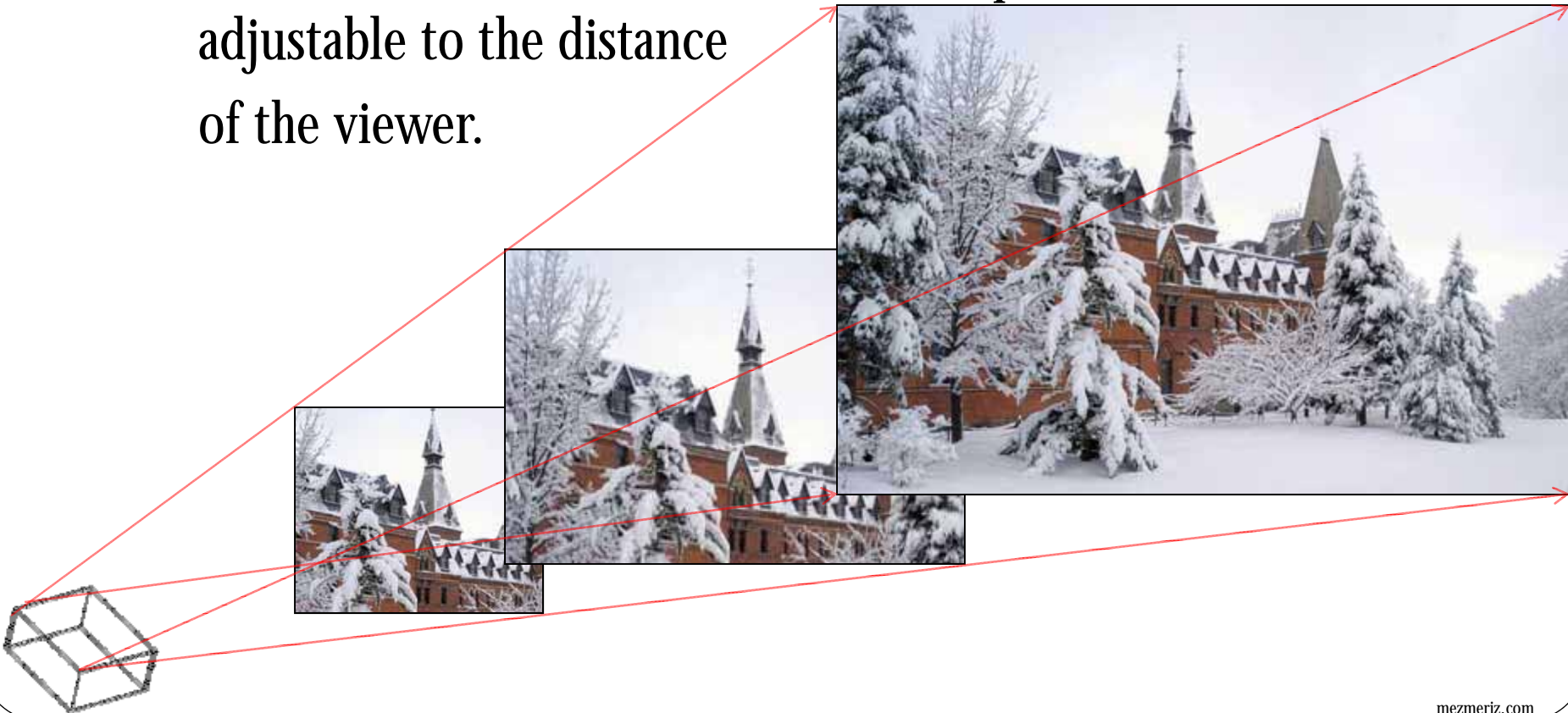
$$\frac{\text{Amount of Light}}{\text{Watts}} = \text{Candelas per watt}$$

- Rationale: Battery life is critical in mobile devices



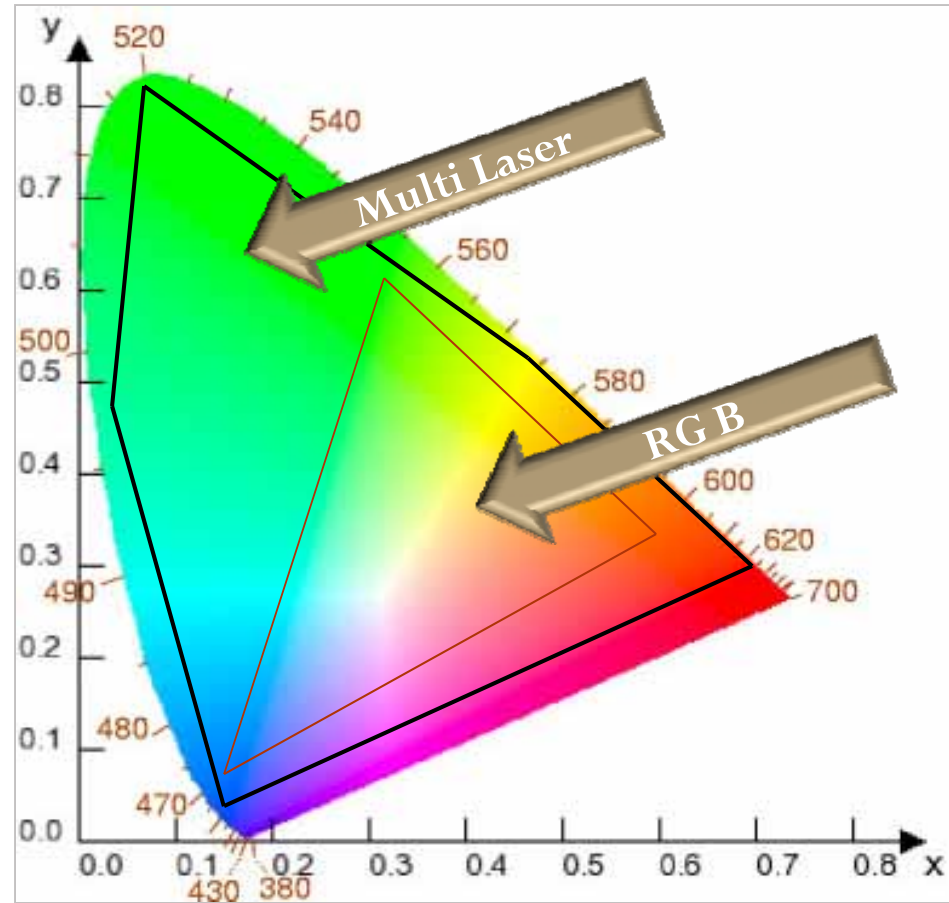
Resolution Range

- Description: The ability to dynamically vary resolution to match screen size and perceptual acuity.
- Rationale: Resolution should be size specific, as well as adjustable to the distance of the viewer.



Color Gamut Area

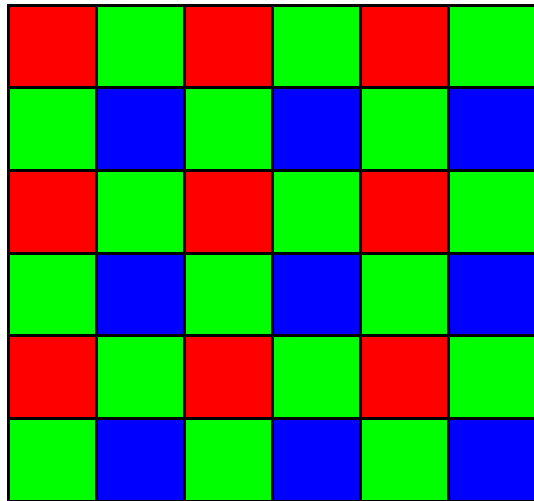
- Description: Using additional lasers to expand the color gamut.
- Rationale: By expanding beyond the constraints of R-G-B without adding a pixel edge, you can achieve a wider array of colors



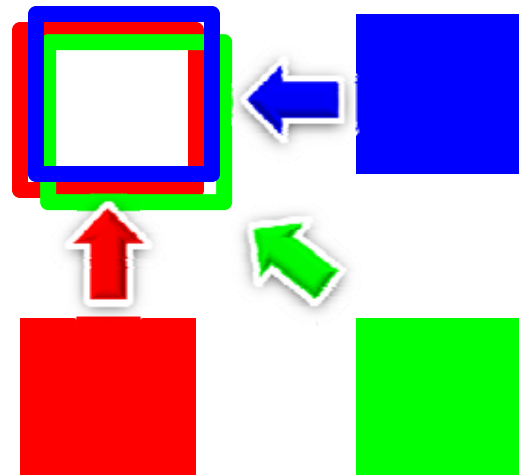
Spatial Integration

- Description: The eye spatially integrates the sum of similar colors located close together
- Rationale: The eyes sees the average of pixels, thereby reducing the true pixel density as seen by the human eye

Side-by-Side Pixels



Overlaid Pixels



Weber's Law of Just Noticeable Differences

- Description: Minor changes in color are more noticeable depending on the intensity of color.

$$\frac{\text{Difference Threshold}}{\text{Color Value}} = \text{Noticeable Difference Threshold Constant}$$

- Rationale: Subtle variations in blue are more noticeable than subtle variations in yellows and red. Therefore, the ability to manage deep hues, the “deep blues” and blacks, is critical.

< See next slide for image showing Weber's Law >

Demonstration of Weber's Law of Just Noticeable Differences for Deep Blues



Speckle

- Description: Coherent light projected on an imperfect surface created interference light that can both brighten or darken when the wavelengths interact

$$\frac{\text{Wavelength of Light} \times \text{Distance from Viewer}}{\text{Width of Projected Area}} = \text{Speckle Intensity}$$

- Rationale: Speckle is a threshold metric. The human eye cannot perceive speckle intensity of less than 10%. Therefore, any speckle with less than 10% is imperceptible to the human eye.

Conclusion

Mobile Projectors that will be embedded into mobile communication and entertainment devices will be graded on performance metrics for utility, richness, and perception. The research points to these metrics as the most crucial:

- Light Efficiency
- Resolution Range
- Spatial Integration
- Size of Color Gamut
- Weber's Law
- Speckle