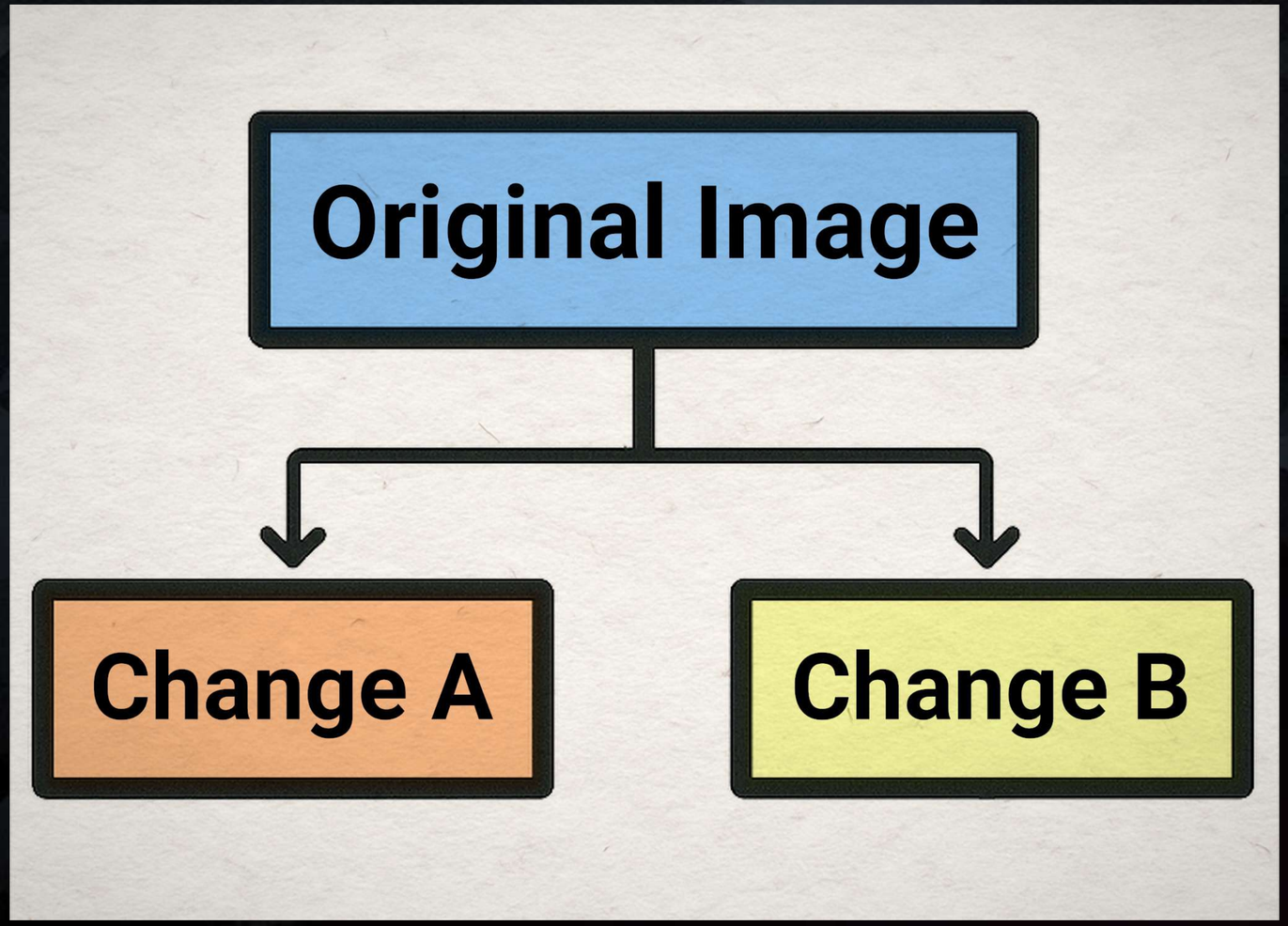
CG Compositing Series

LightGroup / AOV Paradox

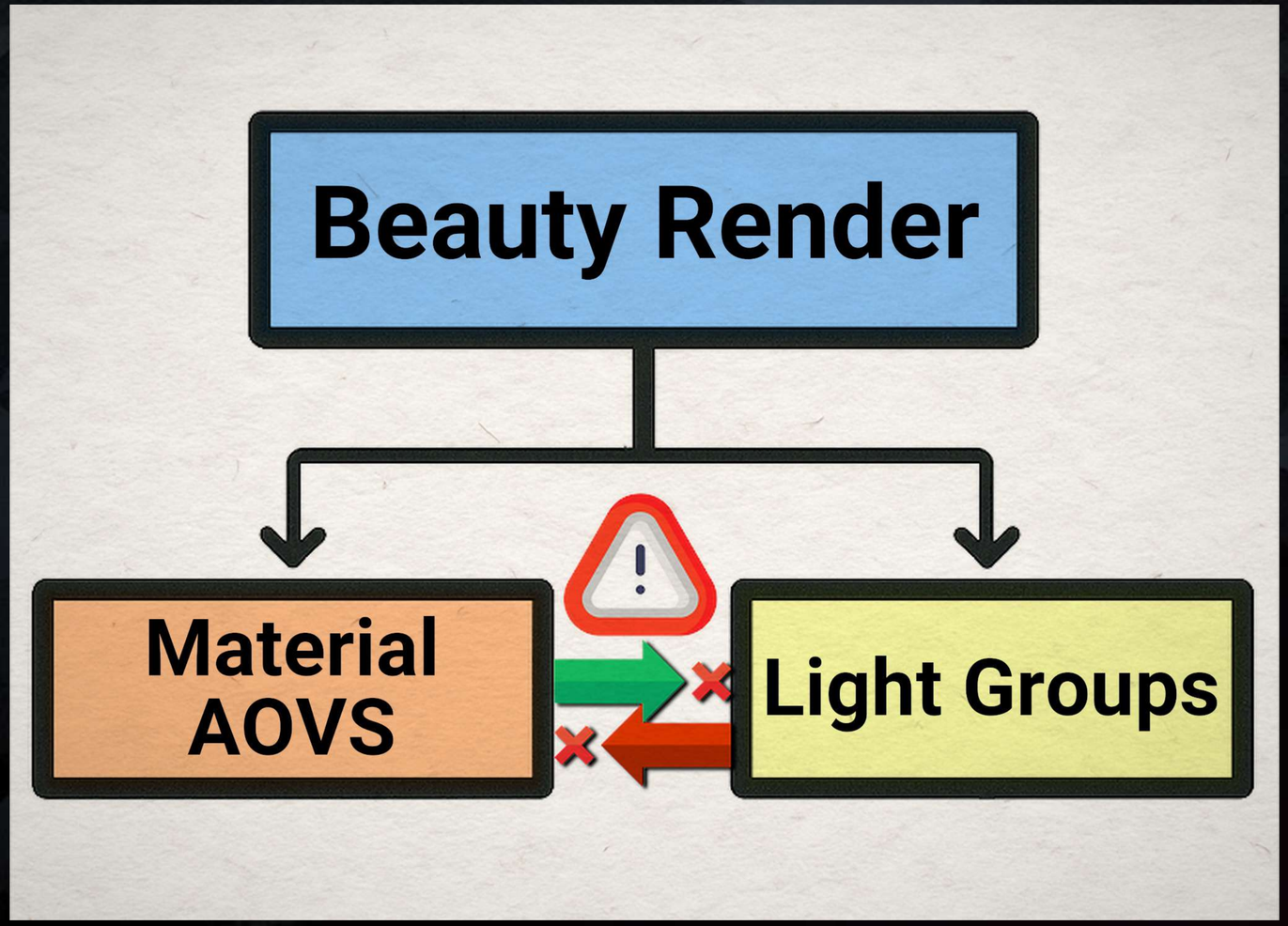
CG Compositing Series

2 Separate Change Setups



CG Compositing Series

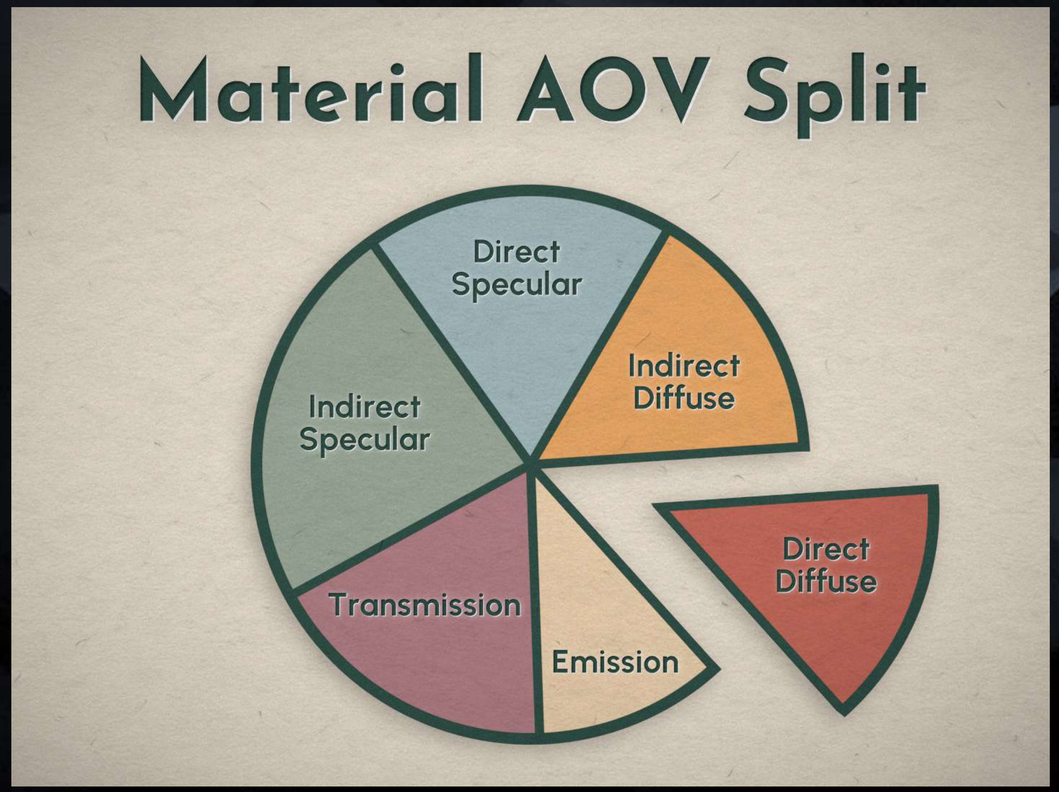
2 Incompatible Beauty Rebuild Setups

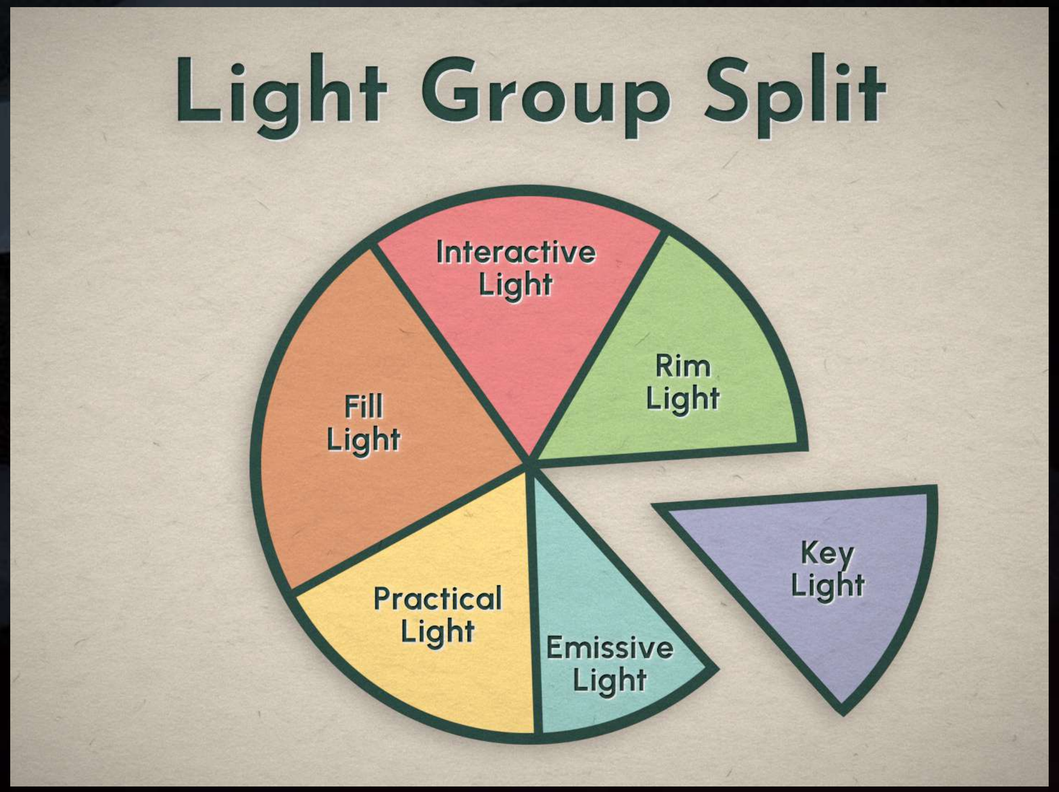


CG Compositing Series

What is the Light Group / AOV Paradox?

- Both the Light Groups and the Material AOV Rebuilds are different ways to Slice the CG Beauty Render

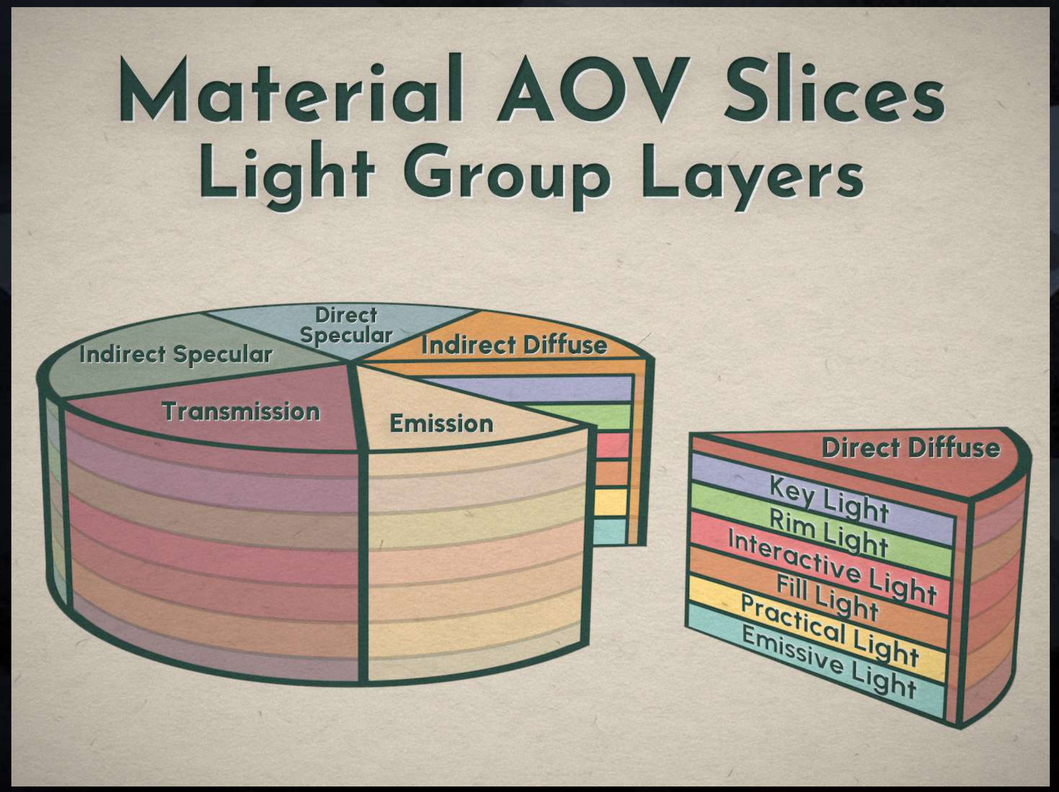


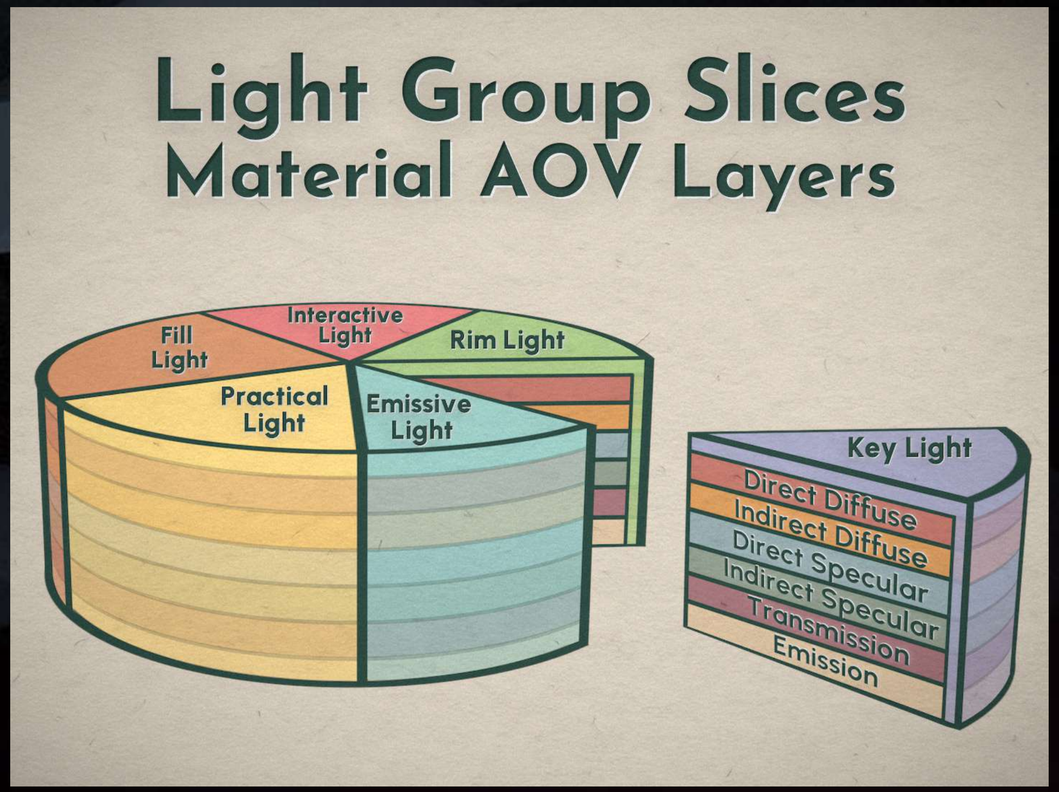


CG Compositing Series

What is the Light Group / AOV Paradox?

- The Passes of the Opposite Rebuild exist within each slice of the Current Rebuild

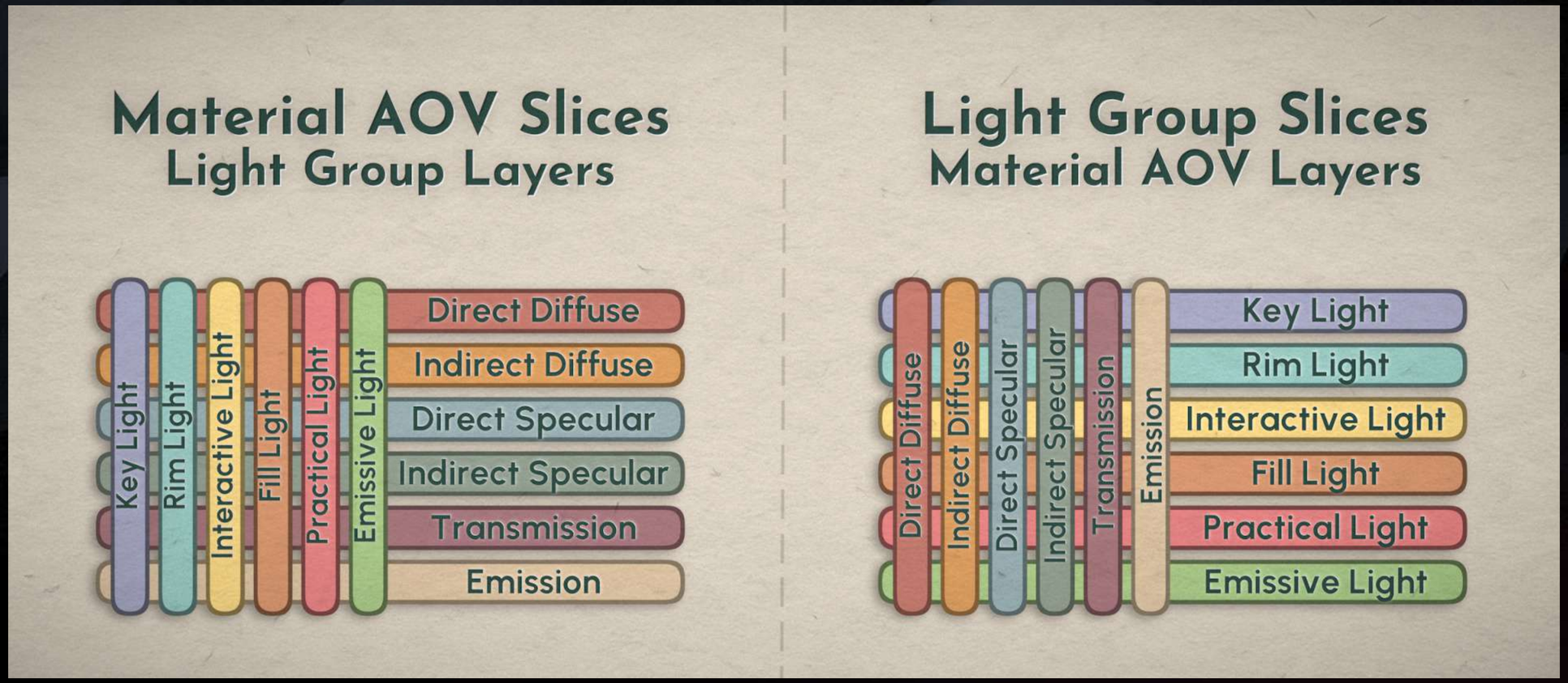




CG Compositing Series

What is the Light Group / AOV Paradox?

- The Paradox: How do you make changes to both Rebuilds if the Passes are already embedded within each other?



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Possible Solutions to Paradox

1. Brute Force: Split out Material AOVs per LightGroup
2. Transfer Changes from the 1st setup over to the 2nd setup
    a. Apply Subtractive Difference
    b. Apply Division Difference

CG Compositing Series

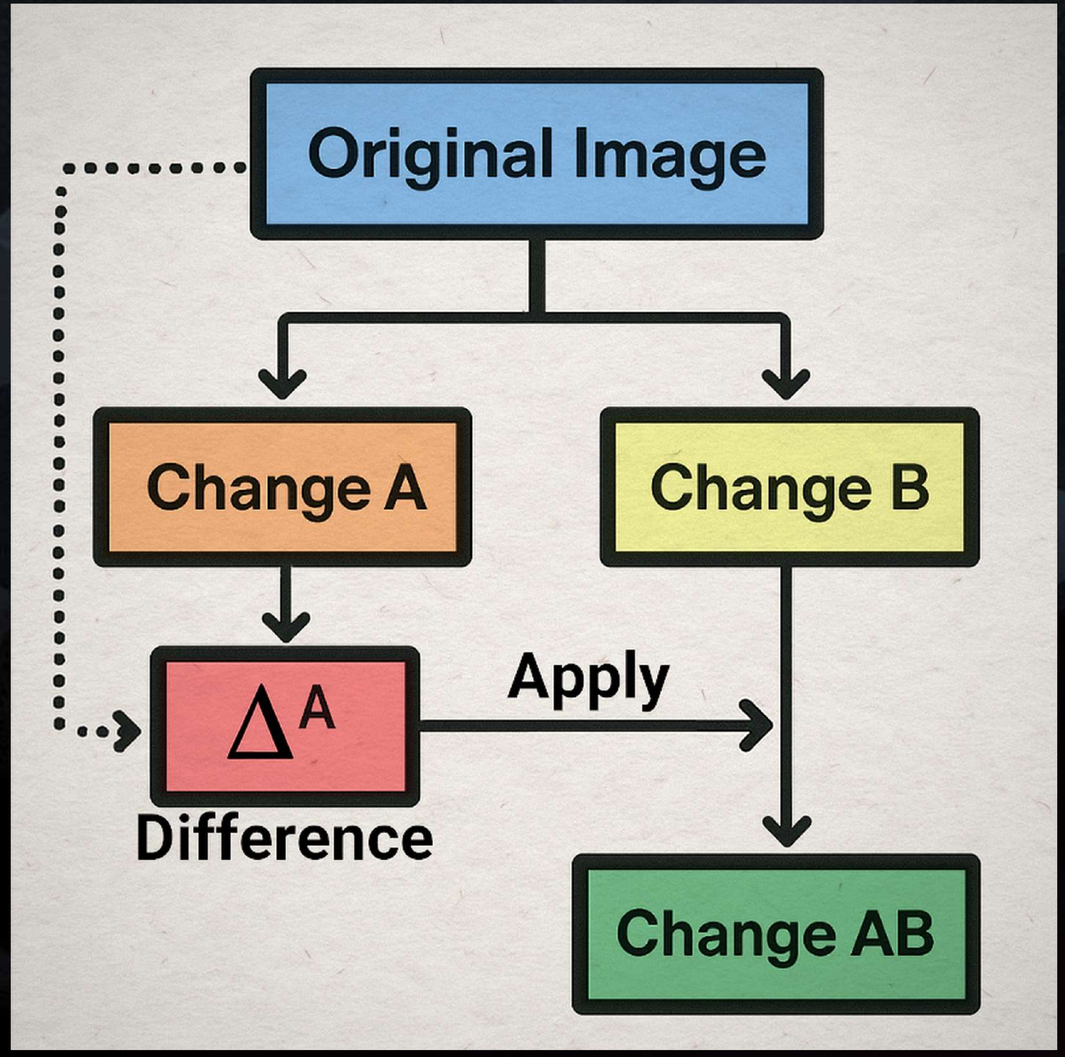
Material AOV Divisions per LightGroup

There are serious issues and downsides to this approach:

- Larger File Sizes for CG Renders
- Longer Render Times
- Slower I/O Speed in Nuke
- More Layers and Channels: # of Material AOV × # Light Groups
- Heavier Setup to Process - Slower to work with in Nuke
- Complicated Setup for User Experience, both in Lighting and Compositing
- More Prone to Human Error

CG Compositing Series

Combining Changes Workflow



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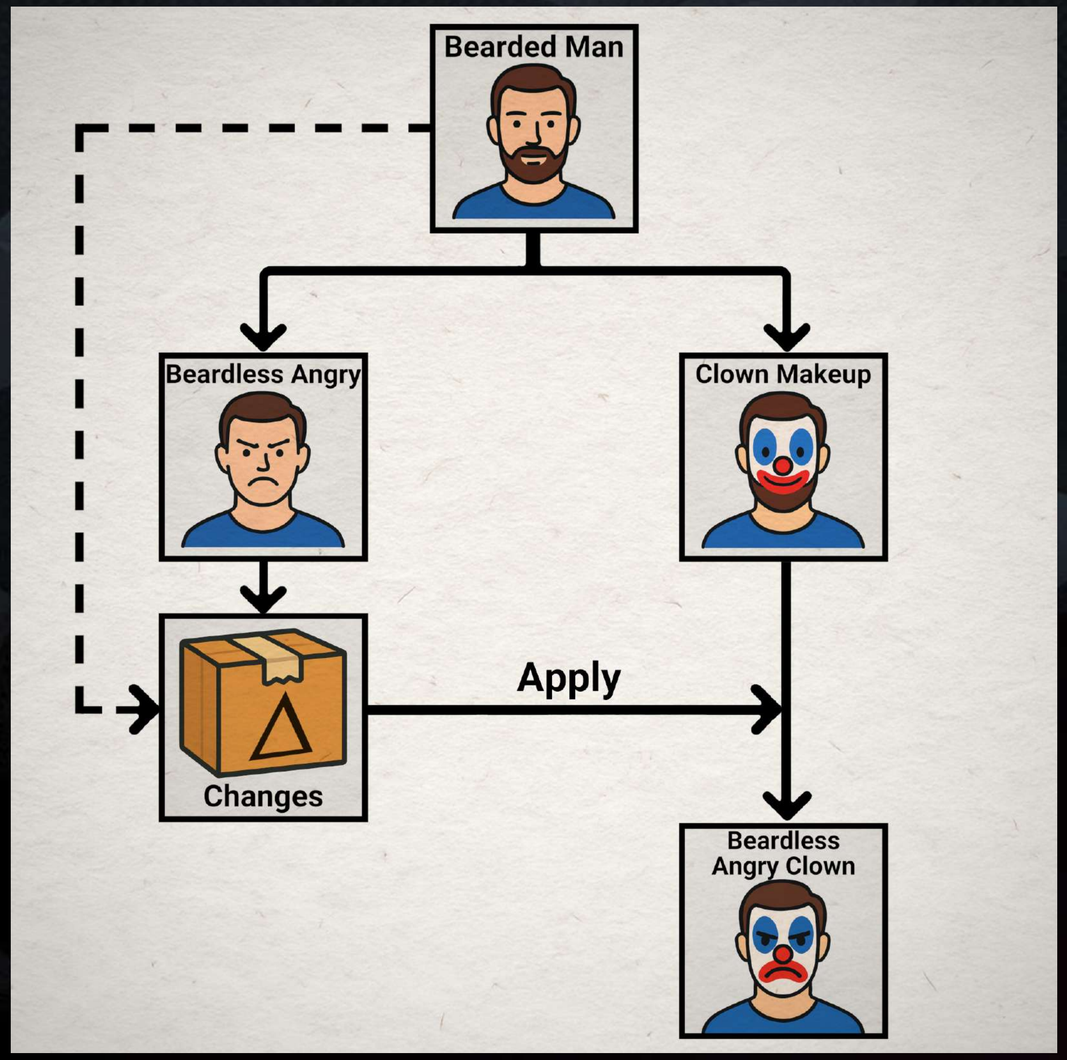
Style Transfer Example



CG Compositing Series

Subtractive Method (Absolute Difference)

- Find the difference between the 1st Rebuild and the Beauty Render using Subtraction
- Temporarily store the Changes in a Subtractive Difference Map
- Apply the 1st changes to the 2nd Rebuild Setup

CG Compositing Series

Subtractive Difference Map

- How much do I need to add or subtract to each pixel of the Beauty Render, in order to end up with my Rebuild Changes?
- We can get this by taking the 1st Rebuild and Subtracting the Beauty Render from it
- The result is an difference map of positive or negative values

Material AOV Rebuild

−

Beauty Render

=

Subtractive Difference Map

CG Compositing Series

Subtractive Difference Map (Absolute Delta)

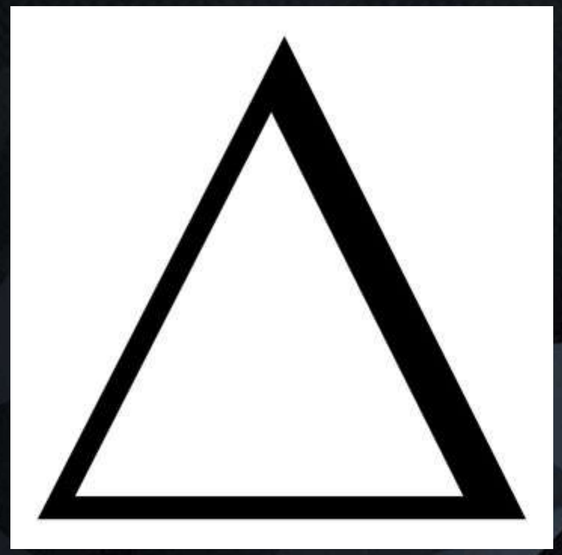
- Values of Zero will have No Change
- Positive Values will get Brighter
- Negative Values will get Darker

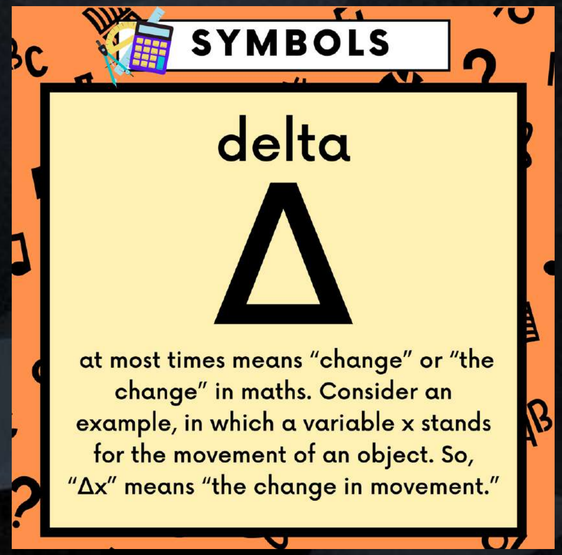
Example of different pixel values in the Subtractive Difference Map

0	3	-1
-2	0	2
0	1	-3

CG Compositing Series

Delta Δ





MATH:RIIX

- Delta is a Math Symbol that represents “The Change” or “The Difference”
- We can use it to represent just the changes required to go from the Original Beauty to the Changed Rebuild Result.

CG Compositing Series

Subtractive (Absolute) Difference

Equation:

$A - B = \Delta^A$

$B + \Delta^A = A$

Example:

$8 - 5 = 3$

$5 + 3 = 8$

$B = 5$

$A = 8$

Material AOVs - Beauty = Difference

Beauty + Difference = Material AOVs

CG Compositing Series

Subtractive (Absolute) Difference

Equation:

$A - B = \Delta^A$

$L + \Delta^A = T$

Example:

$8 - 5 = 3$

$9 + 3 = 12$

$B = 5$

$A = 8$

$L = 9$

Material AOVs - Beauty = Difference

Light Groups + Difference = All Changes

CG Compositing Series

Subtractive (Absolute) Difference

Equation:

$L - B = \Delta^L$

$A + \Delta^L = T$

Example:

$9 - 5 = 4$

$8 + 4 = 12$

$B = 5$

$A = 8$

$L = 9$

LightGroups - Beauty = Difference

Material AOVs + Difference = Total Changes

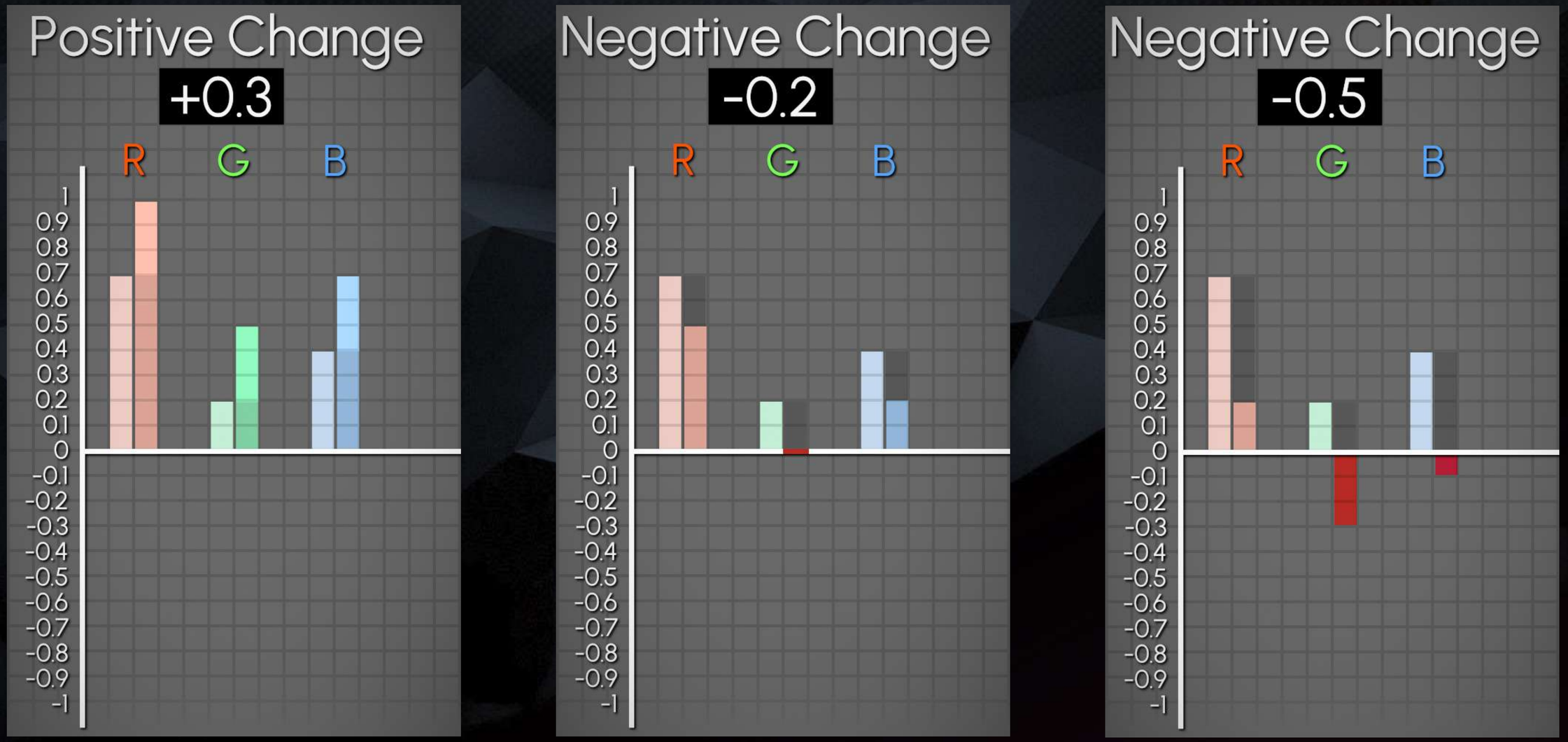
CG Compositing Series

Subtractive (Absolute) Difference Problem

- The Subtractive Difference Map represents Absolute Values
- This tells you the exact values to add/subtract to bring the Beauty Render to the Changed Rebuild
- The Subtractive Method (Absolute) only works well if you Brighten values in the Rebuilds, or only Darken them slightly

CG Compositing Series

Subtractive Method Problem



CG Compositing Series

Absolute vs Relative

How can I go from 8 to 4?

8 —> 4

CG Compositing Series

Absolute vs Relative

Addition/Subtraction (Absolute)

8 - 4 = 4

2 - 4 = -2

Introducing Negatives

CG Compositing Series

Absolute vs Relative

Division/Multiplication (Relative)

$$8 \div 2 = 4$$

$$2 \div 2 = 1$$

both are halved

CG Compositing Series

Absolute vs Relative

Division/Multiplication (Relative)

$$8 \times 0.5 = 4$$

$$2 \times 0.5 = 1$$

both are halved

CG Compositing Series

Absolute vs Relative Inverse Operations

~~Absolute~~

~~Add / Subtract~~

Relative

Multiply / Divide

Inverse Operations
they "undo" each other

CG Compositing Series

Division Difference Map (Relative Delta)

- How much do we need to Multiply the Beauty Render by in order to end up with the Rebuild Output?
- What Percent do I need to increase or decrease this Beauty Render by to get to the Rebuild Output?
- Multiplication / Percentage will not get us Negative values

Material AOV Rebuild

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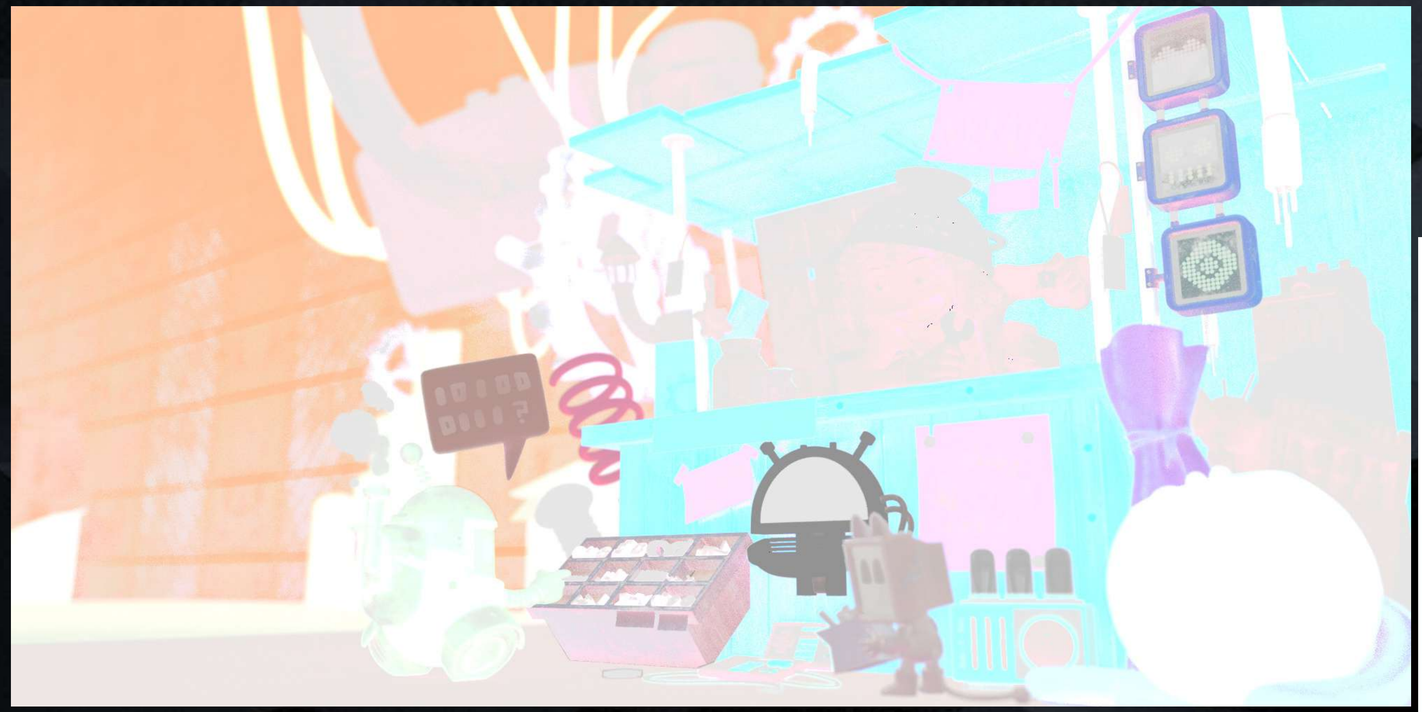
Beauty Render

=

Division Difference Map

CG Compositing Series

Division Difference Map (Relative Delta)



- Above 1 Values will get Brighter
- Zero to 1 Values will get Darker
- Value of 1 means No Change

Example of different pixel values in the Division Difference Map

1.0	3.0	0.5
0.25	1.0	1.5
1.0	1.25	0.1

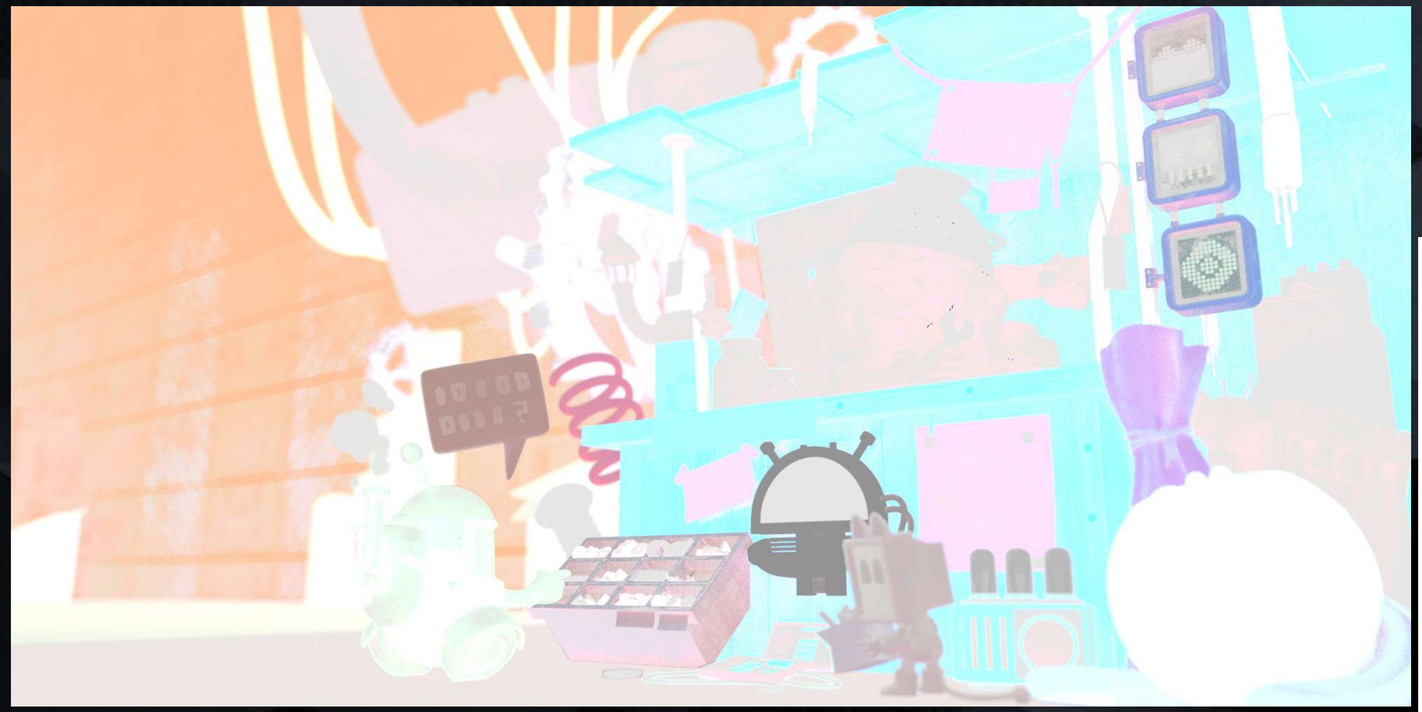
CG Compositing Series

Multiplication Represented in Percentage

Multiplication		Percentage		Meaning
×1.0	=	100%	=	No Change
×3.0	=	300%	=	Brighter
×0.25	=	25%	=	Darker
×0.0	=	0%	=	Not Visible

CG Compositing Series

Percentage Difference Map (Relative Delta)



- Above 1 Values will get Brighter
- Zero to 1 Values will get Darker
- Value of 1 means No Change

Example of different pixel values in the Percentage Difference Map

100%	300%	50%
25%	100%	150%
100%	125%	10%

CG Compositing Series

Division (Relative) Difference

Equation:

$$A \div B = \Delta^A$$

$$B \times \Delta^A = A$$

Example:

$$8 \div 4 = 2$$

$$4 \times 2 = 8$$

$$B = 4$$

$$A = 8$$

Material AOVs ÷ Beauty = Difference

Beauty × Difference = Material AOVs

CG Compositing Series

Division (Relative) Difference

Equation:

$$A \div B = \Delta^A$$

$$L \times \Delta^A = T$$

Example:

$$8 \div 4 = 2$$

$$6 \times 2 = 12$$

$$B = 4$$

$$A = 8$$

$$L = 6$$

Material AOVs ÷ Beauty = Difference

Light Groups × Difference = Total Changes

CG Compositing Series

Division (Relative) Difference

Equation:

$$L \div B = \Delta^{L}$$

$$A \times \Delta^{L} = T$$

Example:

$$6 \div 4 = 1^{1/2}$$

$$8 \times 1^{1/2} = 12$$

$B = 4$

$A = 8$

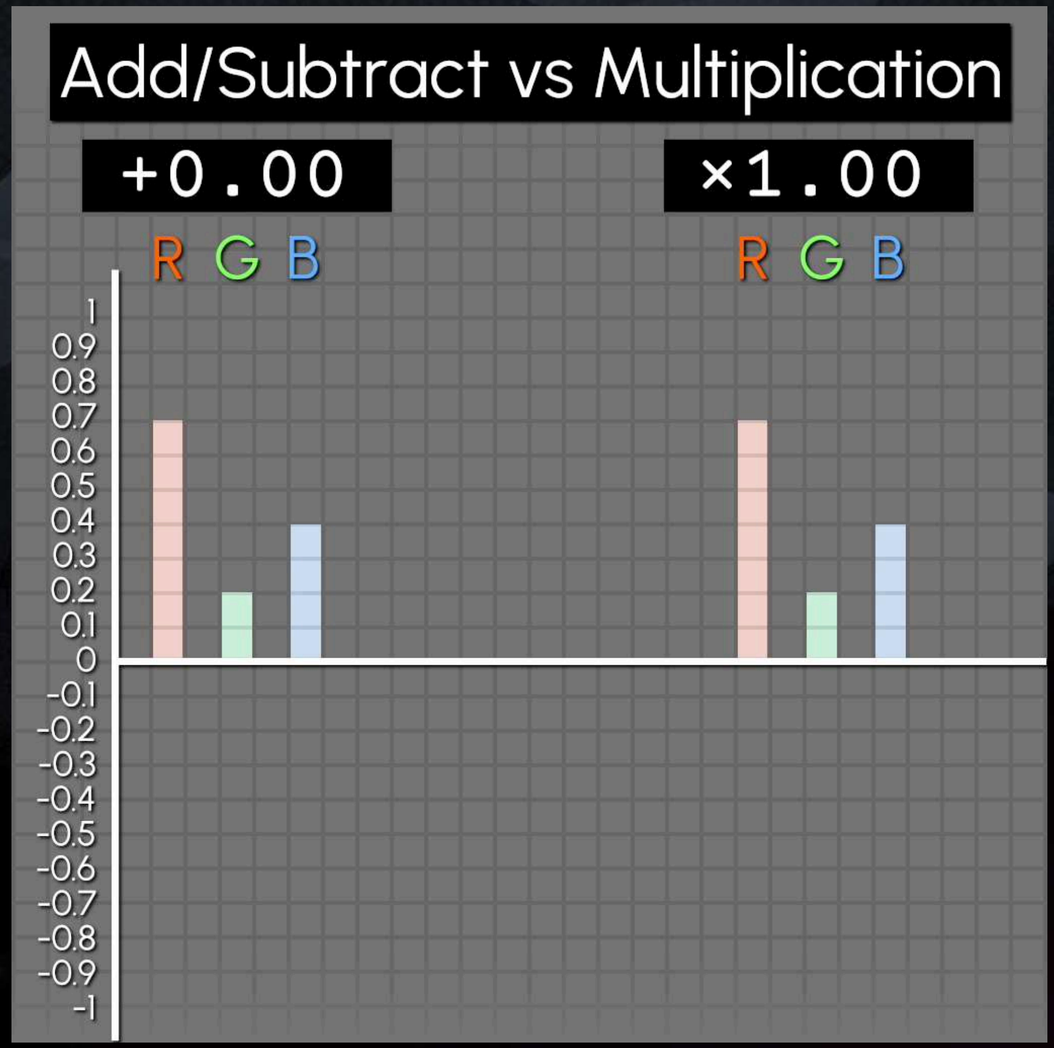
$L = 6$

Light Groups ÷ Beauty = Difference

Material AOVs × Difference = Total Changes

CG Compositing Series

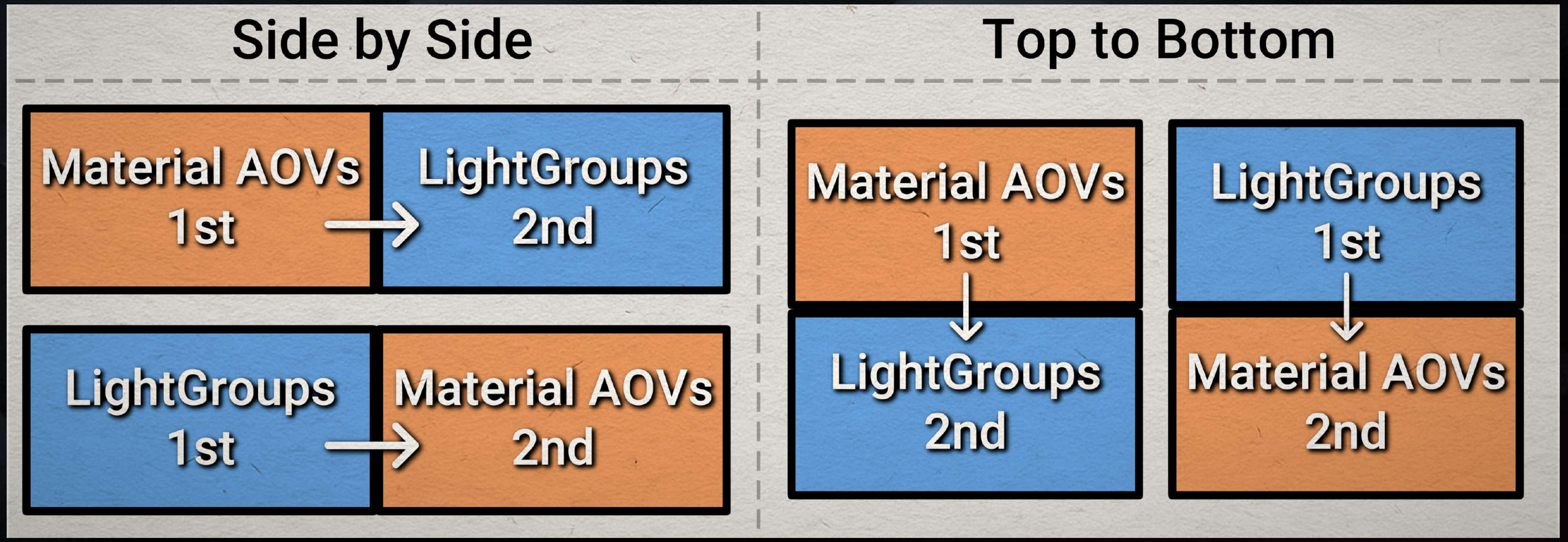
Add/Subtract vs Multiply/Divide



CG Compositing Series

Possible CG Template Layouts

1. Layout Direction?
2. Which Rebuild is first?



CG Compositing Series

Possible CG Template Layouts

1. Layout Direction?
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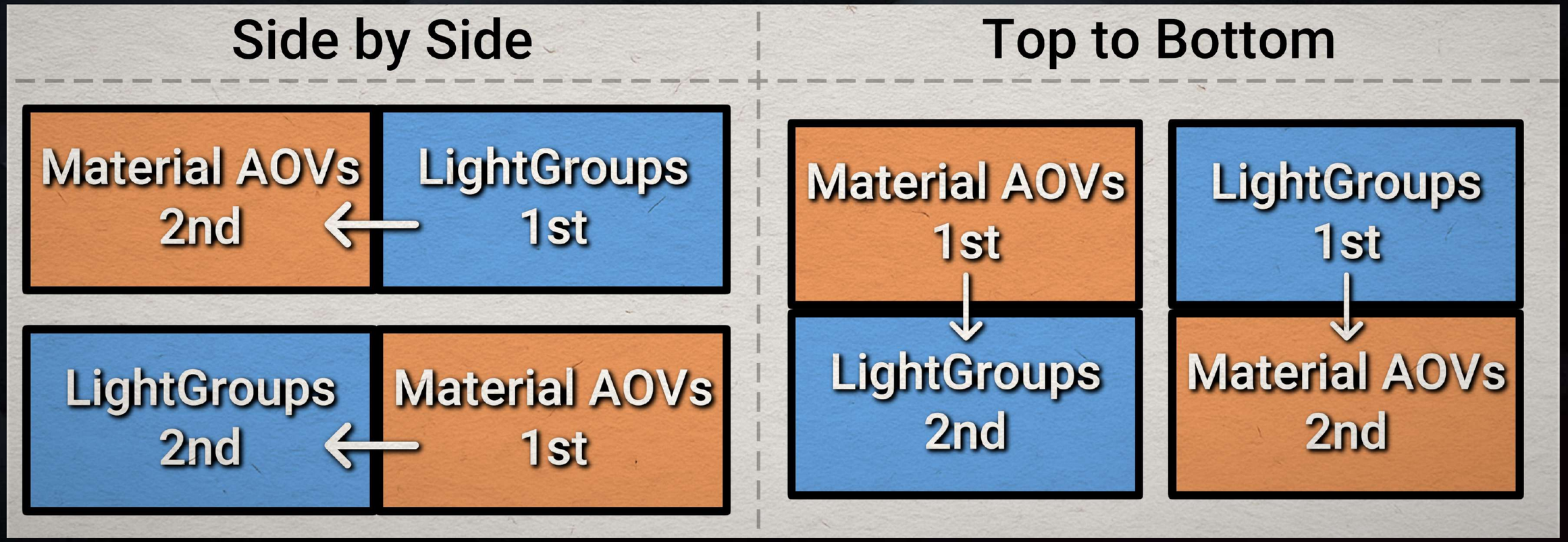
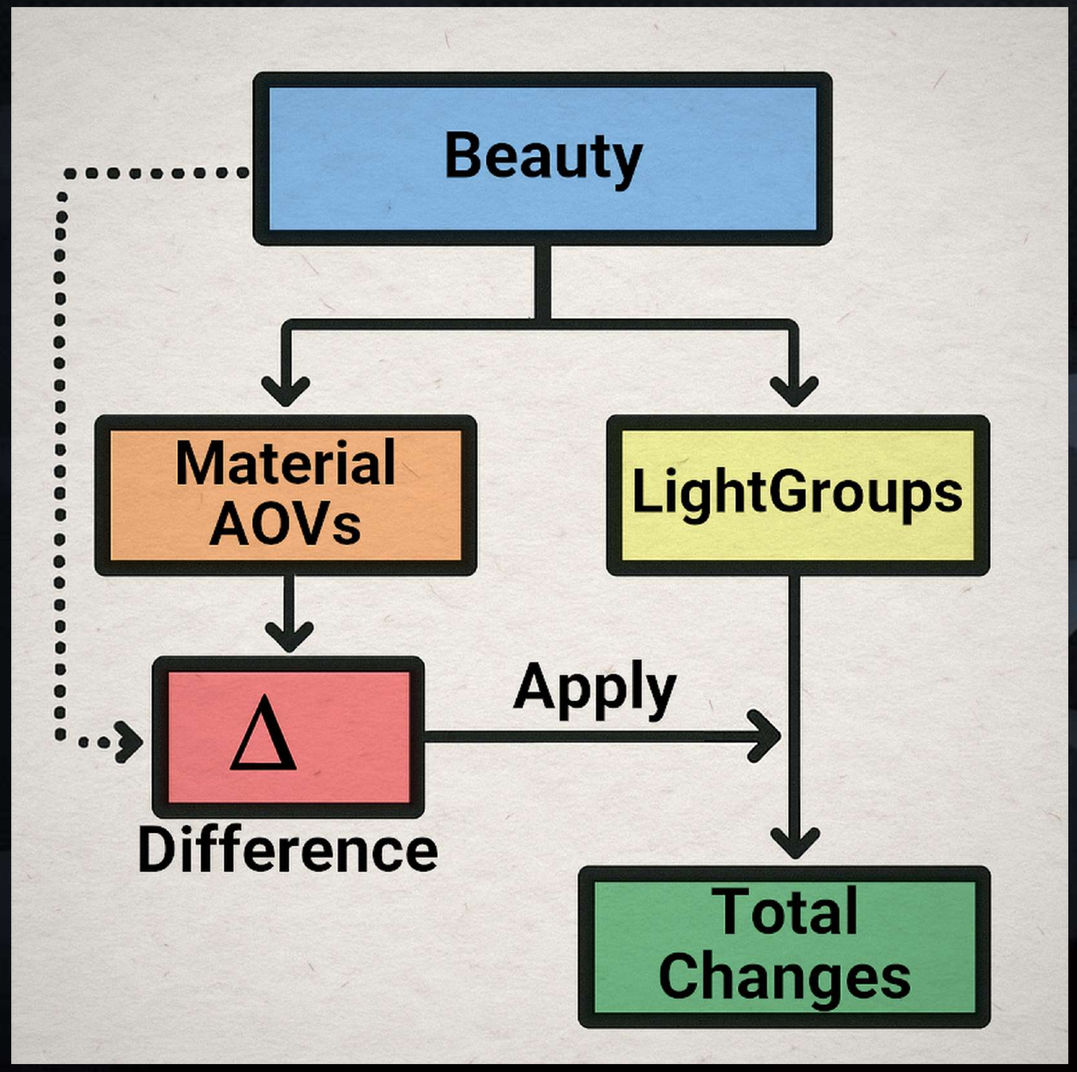
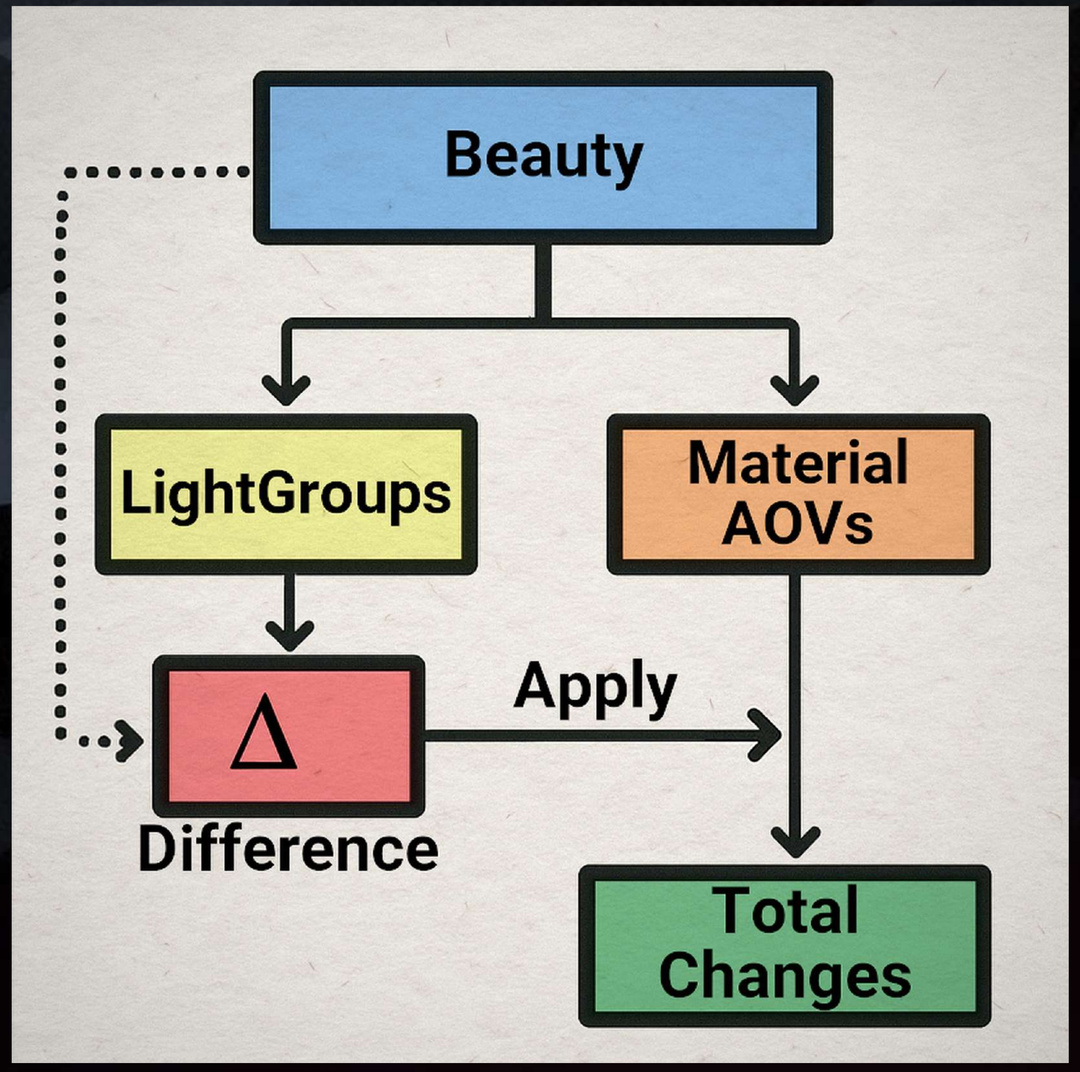


CG Compositing Series

Need to Decide a 1st and 2nd



or



CG Compositing Series

Multiplying Across Sections

Beauty (Whole)

CG Compositing Series

Multiplying Across Sections

Beauty (Light Group Split)

CG Compositing Series

Multiplying Across Sections

$$6 \times 2 = 12$$

$$(2+4) \times 2 = 12$$

$$(2 \times 2)+(4 \times 2) = 12$$

$$(4 + 8) = 12$$

CG Compositing Series

Multiplying Across Sections

$$\text{Material AOVs} \times \Delta = T$$

$$(\text{diffuse}+\text{spec}) \times \Delta = T$$

$$(\text{diffuse}\Delta) + (\text{spec}\Delta) = T$$

CG Compositing Series

LG / AOV Workflow Rules & Caveats

- Material AOVs passes must add up to equal Beauty
- Light Groups passes must also add up to equal Beauty
- Do not do color corrections that introduce negative values (saturation)
- Treat the CG Template as a glorified Color Correction
- On the 1st Rebuild side (The Captured Change side) avoid:
  - Transforms / Warps
  - Filters: Blur, Defocus, Median, Glow
  - Chromatic Aberration
  - Replacing / Merging a totally different image on top
    - Texture changes should happen at the albedo level

CG Compositing Series

Provided Example Templates

Renderers:

- Blender
- Redshift
- Arnold
- Octane

Layouts:

- Side by Side
- Top to Bottom
- Interactive Change

CG Compositing Series

Template Ideas and Inspiration

- Managing Div-Map with Exposed Pipes
- Using Stamps or Hidden inputs for Div-Map
- Storing Div-Map in a Layer / Channel for later use
- Grouping Sections for less clutter
- Template Controller, pick which parts are in use:
  - Beauty
  - Material AOVs Only
  - LightGroups Only
  - Combined LG / AOV
- Reversed Direction