Perceived Credibility of Light in Architectural Rendering

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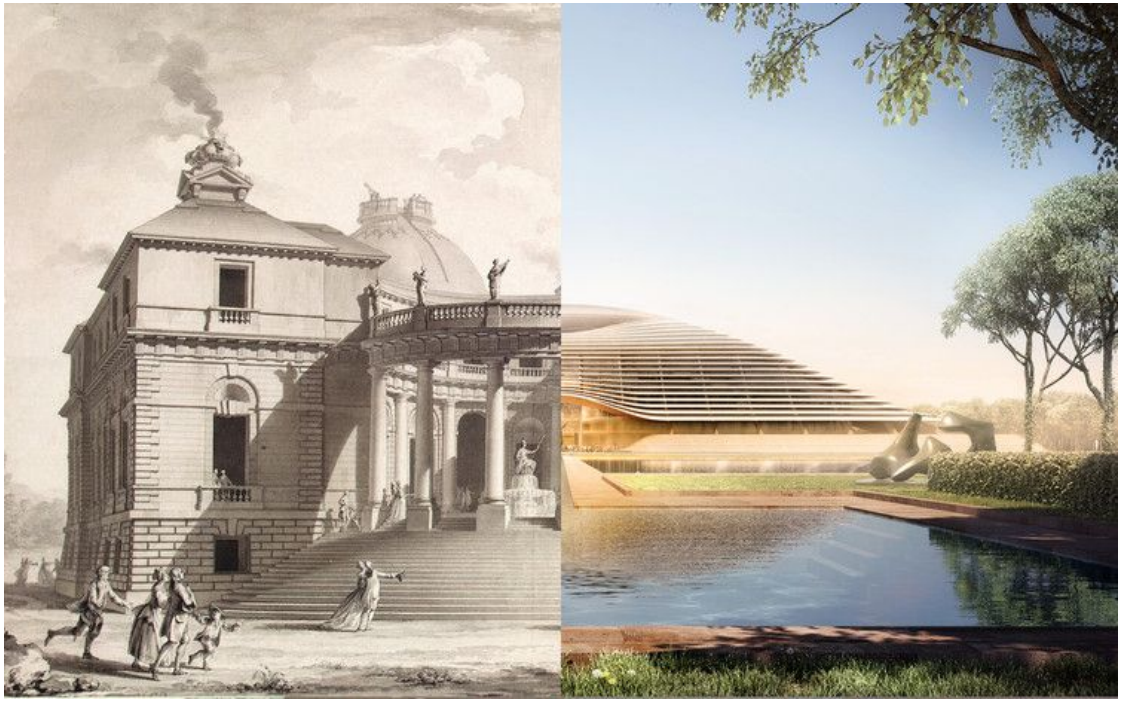
Architectural rendering has always been an important component in the understanding of a distant space.

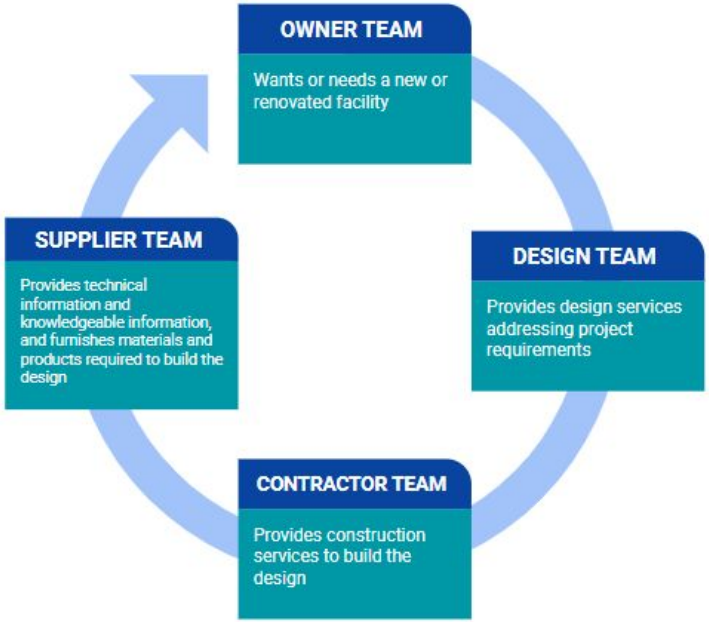


INTRODUCTION

We currently use architectural renders to make project decisions

and

To unify a team of people with different motivations.



INTRODUCTION

The use and development of architectural CAD programs is rapidly growing. These computer generated images make architectural rendering :

- Faster to compose
- More accessible through cheaper software
- Increasingly an expertise and service

INTRODUCTION

GIVENS

- Light as a material is different than other aspects that compose a rendering
- The credibility of the scene can be largely influenced by the lighting

THESIS

*By **establishing a framework** for perceived credibility as it applies to lighting in architectural renders, **we can evaluate and rank** different software's effectiveness for providing reliable representations.*

ESTABLISH
a framework for assessing credibility

RENDER
the same space with the same settings through different software platforms

EVALUATE
and analyze renders' credibility through defined qualities

METHODOLOGY

previous work:

"Assessing perceived credibility of traditional and computer generated architectural representations"

Nada Bates-Brklijac

Software Render **Watercolor** **Software Composite** **Drawing**

Examined credibility in architectural renderings of different medium.
Architects and laymen of various levels ranked qualities on a semantic differential scales.

ESTABLISH *a framework*

previous work:

"Assessing perceived credibility of traditional and computer generated architectural representations"

Nada Bates-Brklijac

Table 1 The criteria for the assessment of visual representations proposed by different authors

Appleyard	Sheppard	Pietsch	Radford
Realism	Accuracy	Abstraction	Abstraction
Accuracy	Representativeness	Accuracy	Accuracy
Comprehensibility	Visual clarity	Realism	Realism
Evaluability	Interest		
Engagement	Legitimacy		

Table 2 Semiotic bipolar pairs

Accuracy	Realism	Abstraction
Vague–precise	Imitation–authentic	Symbolic–descriptive
Incorrect–correct	Looking artificial–looking natural	Abbreviated–extended
Dishonest–honest	Illusion–lifelike	Simple–ornate
Deceptive–truthful	Not convincing–plausible	Expanded–dense
Ambiguous–clear	Dull–vivid	Loose–compact
Arbitrary–well considered	Intuitive–rational	Ordered–chaotic

ESTABLISH *a framework*

previous work:

"Assessing perceived credibility of traditional and computer generated architectural representations"

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CONCLUSIONS + CONCEPTS FOR DEVELOPMENT

- **Abstraction** was a difficult quality to define.

- Computer Generated Images were deemed *more credible* across all audiences.

ESTABLISH *a framework*

previous work:
"Rendering"
Clog Publishing

Architectural Renderings have two roles

as a means of conveying a phenomenological feeling or design intent

as an exact representation of actuality

ESTABLISH *a framework*

“Development and Evaluation of Immersive Lighting Representation”
Eby Mathew

previous work:
PARSONS
LIGHTING DESIGN

New Tectonics of Virtual Reality: Stories of Light and Empathy
Will Eatough

Examined the gap between our experience of light in a virtual environment vs. a real environment.

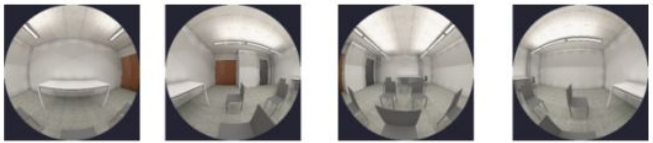
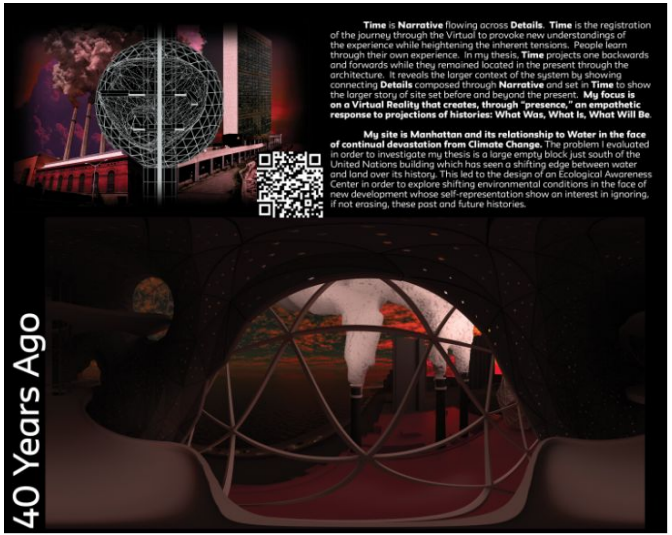


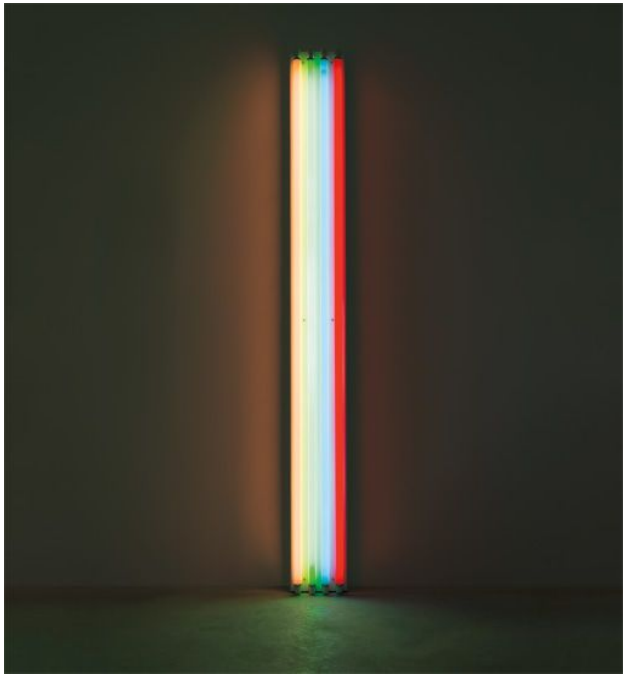
Figure 2. 180° fisheye images generated from AGi32

Figure 3. Equirectangular image generated from Hugin

By using features such as time simulation, representation is better lent to storytelling.



ESTABLISH *a framework*



Lighting poses a particular challenge, as it both **material** and **immaterial**.
With light, we don’t try to imagine an object, but rather a perception of objects.

LIGHT

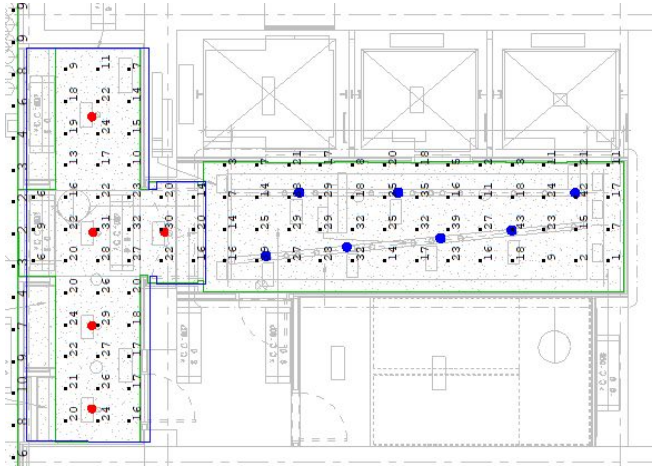
ACCURACY IS

how verifiable the representation is

- For objects, we rely on materiality, scale and detail

*How do we assess if **LIGHT** is accurate?*

- Light is quantifiable and can be measured
- Requires knowledge of the types of fixtures used



Accuracy
Vague—precise
Incorrect—correct
Dishonest—honest
Deceptive—truthful
Ambiguous—clear
Arbitrary—well considered

Light as a perception is hard to verify, particularly without a side-by-side comparison. Generally our understanding of light in a render will rely on our intuitive knowledge of how light works.

TO define **ACCURACY** within architectural rendering, I focus on terms that have both subject and object means of evaluation:

VAGUE - PRECISE

INCORRECT - CORRECT

ACCURACY

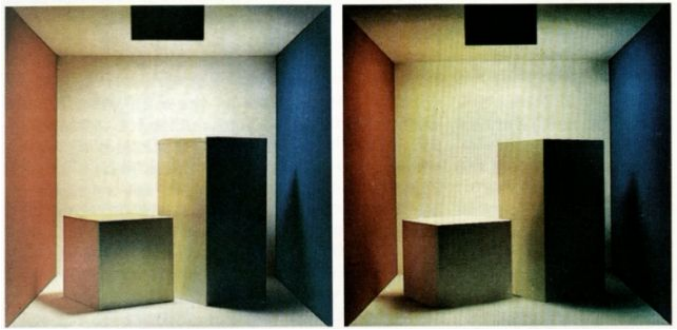
REALISM IS

how plausible the representation is

- For objects, we rely on materiality, scale and detail

*How do we assess if **LIGHT** is realistic?*

- Whether brightness and material reflectance seem plausible



Realism
Imitation–authentic
Looking artificial–looking natural
Illusion–lifelike
Not convincing–plausible
Dull–vivid
Intuitive–rational

Light is not static, it's always in flux and dependent on its environment. We use electric light, which deviates from how we experience light in nature.

TO define **REALISM** within architectural rendering, I focus on terms that relate to our expectations of reality:

ILLUSION - LIFELIKE

NOT CONVINCING - PLAUSIBLE

REALISM

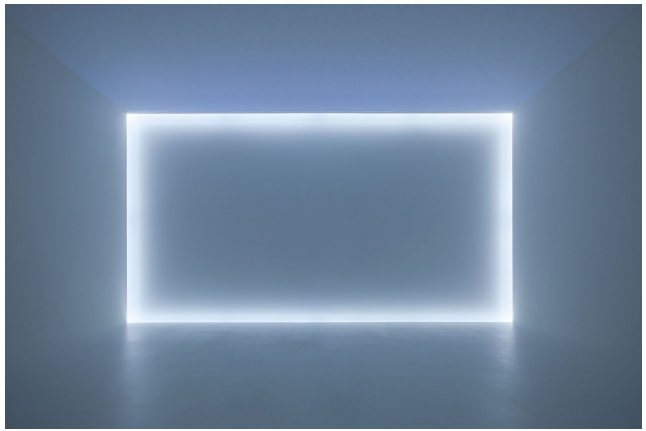
ABSTRACTION IS

The amount of detail provided in the rendering

- For objects, we rely on our ability to read the material and spatial relationships.
- Traditionally poised as opposed to “accurate” or “realistic”.

*How do we assess if **LIGHT** is abstracted?*

- Light is inherently abstract.
- Shadows, contrast, reflectance are all realistic accuracies that can obscure or abstract objects, scenes or light sources

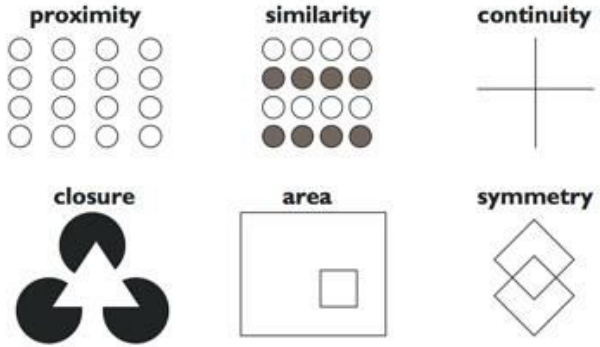


ABSTRACTION

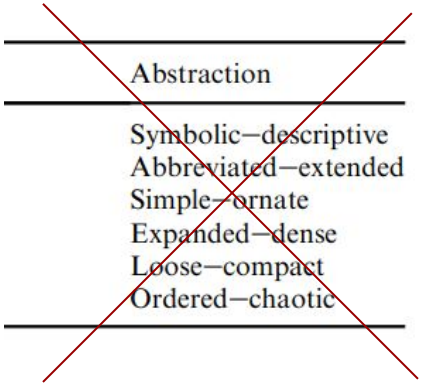
Light, space and material are so closely wrapped together that we rarely see them as individuals.
Instead, we are viewing the **Gestalt** of a space, or a whole that is more than it's organized parts.

Inherently, our brains tend to make perceptual shortcuts in order to supersede the compartmentalizing of the individual components.

In comprehending a space, lighting activates and drives many of the psychological principles below.



ABSTRACTION + LIGHT



I believe the term **“Abstraction”** is equated with a phenomenological sensibility: how well does the render convey how the space should *feel* or the *kind of energy* it has. The credibility comes from an empathetic relationship in which an emotional expression resonates.

Or to put it more succinctly, how well do we understand and acknowledge the presence of the space.

ESTABLISH *a framework*

Architectural lighting design is generally a key to understanding the function of a space. At the same time, we rarely actively engage with lighting in the same way we notice other physical objects.

When examining the light in an architectural rendering, the phenomenological indicators have much to do with our **AWARENESS** of the light within the scene.

How does the lighting define the functionality of the space?
How does the light help us envision the “feel” space?

The first set of qualities I chose to establish **AWARENESS** have been previously categorized under ACCURACY, but relates to our understanding of the space as a whole:

Accuracy
Vague–precise
Incorrect–correct
Dishonest–honest
Deceptive–truthful
Ambiguous–clear
Arbitrary–well considered

AMBIGUOUS - CLEAR

The second set of qualities has to do with how much attention we give to the lighting:

ENGAGED - INDIFFERENT

AWARENESS

AWARENESS

Does the lighting help you understand the spatial limits and function of the space?

ambiguous/clear
engaged/indifferent

REALISM

Does the lighting look like it could exist in real life?

not convincing/plausible
illusion/lifelike

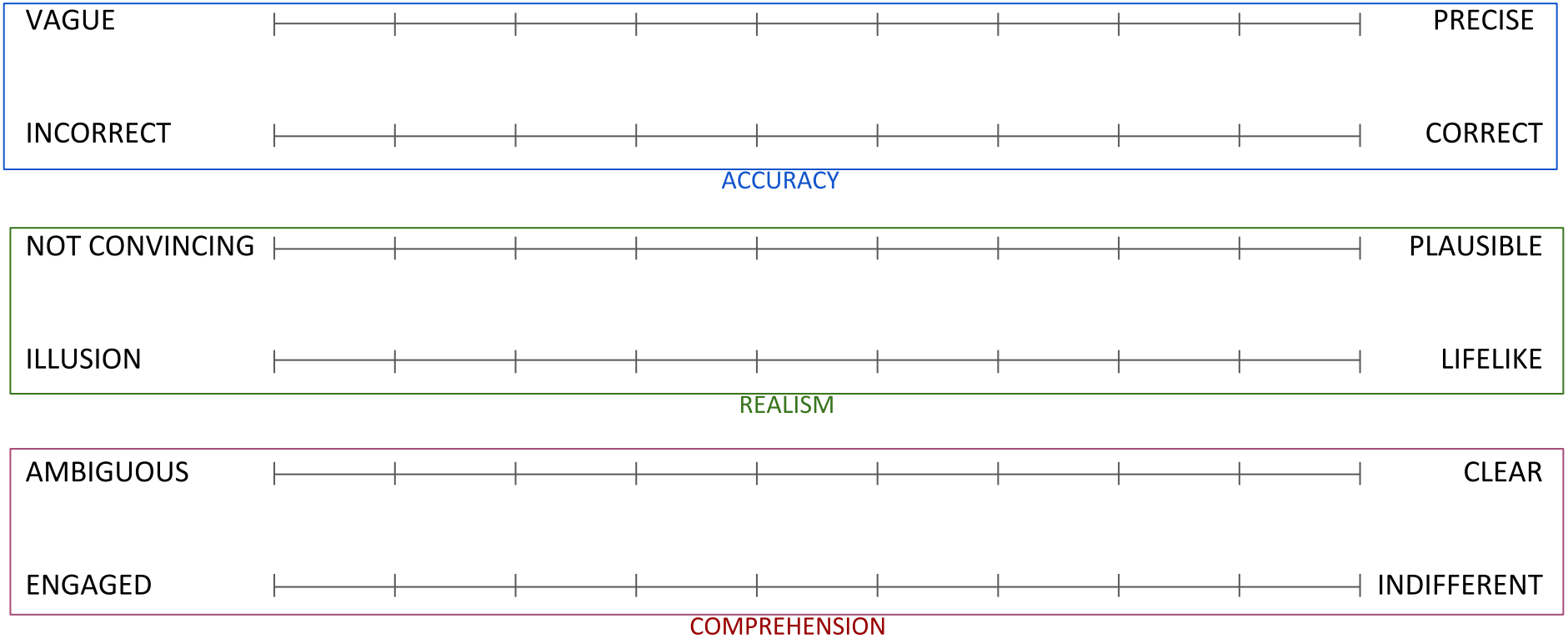
ACCURACY

Does it look like it does exist as the image portrays

vague/precise
Incorrect/correct

ESTABLISHED PARAMETERS

HYPOTHETICAL SURVEY



ESTABLISH PARAMETERS

SOFTWARE PROGRAMS

STANDARD WITHIN THE LIGHTING INDUSTRY

AGI32

DIALUX

RHINO/VRAY

RENDER

SAME DATE / LOCATION SETTINGS

New York, NY (40.718°N, 74.006°W)
June 21 @ 1PM

STANDARD MATERIALS

Concrete *(.63 reflectance)*
Glass *(window opening)*
Matte Paint *(standard RGB colors)*

SAME LIGHT FILES

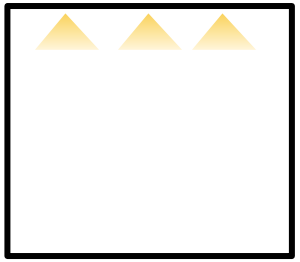
.IES files for

ALPHABET ECO NU
NU4-RDOT-SW-15LM-30K-80-D60-120-DIM10-NC-WH
(1200 lms)

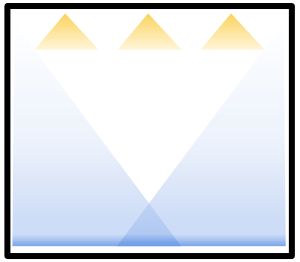
ALPHABET THETA3ET
731-3-XTM19-20LM-30K-83-SA20
(1700 lms @ 50%)

4 DIFFERENT MODEL VERSIONS

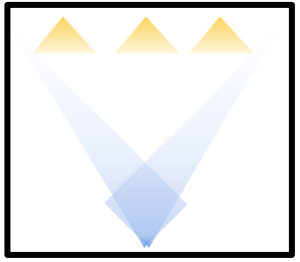
All with 20' x 60' x 10' dimensions.
Windows account for 15% of area.



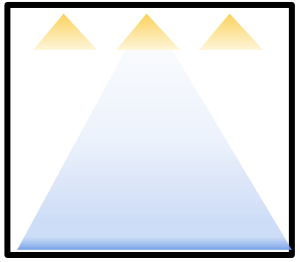
Electric Light only



Vertical Windows

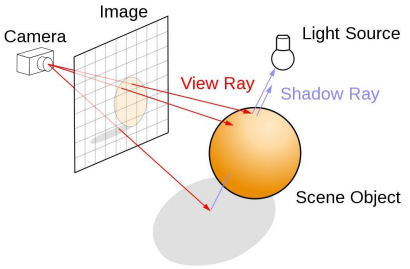


Horizontal Windows



Skylight

RAYTRACED



RENDER

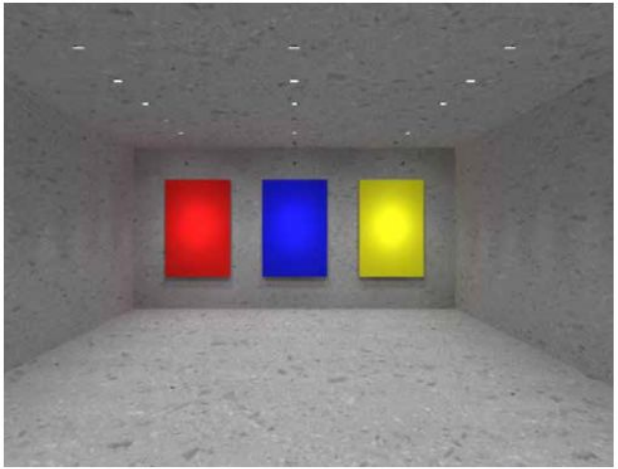
SOFTWARE LIMITATIONS

Dialux does not render with raytracing for scenes with daylight. Dialux also does not have a coordinate system to navigate the space. Shadowing on the ground where there would be direct light diminishes our credibility, only if we understand that it's supposed to be a day scene.

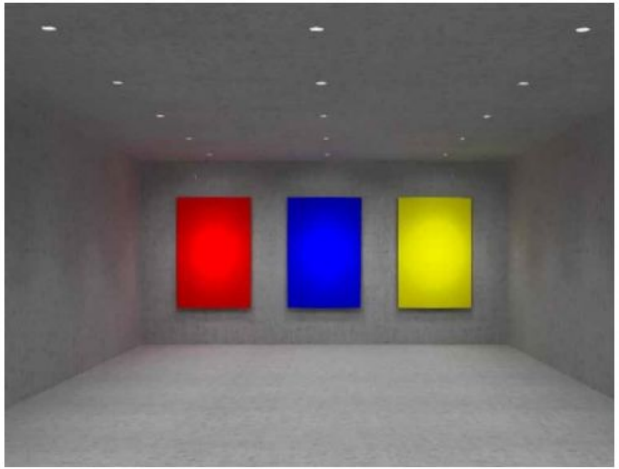
V-ray for Rhino utilizes the photometry design provided by IES files, but relies heavily on the user to define the lighting settings. Advanced photographic settings, such as exposure control are available (and at times, a necessity) to the user. Though there are plug-ins that allow for lighting calculations (such as Diva), they are unconnected in value to the v-ray render.

AGI32's comparatively inferior graphics lack subtlety in both radiosity and raytracing settings.

VERSION #1 / NO WINDOWS



AGI32



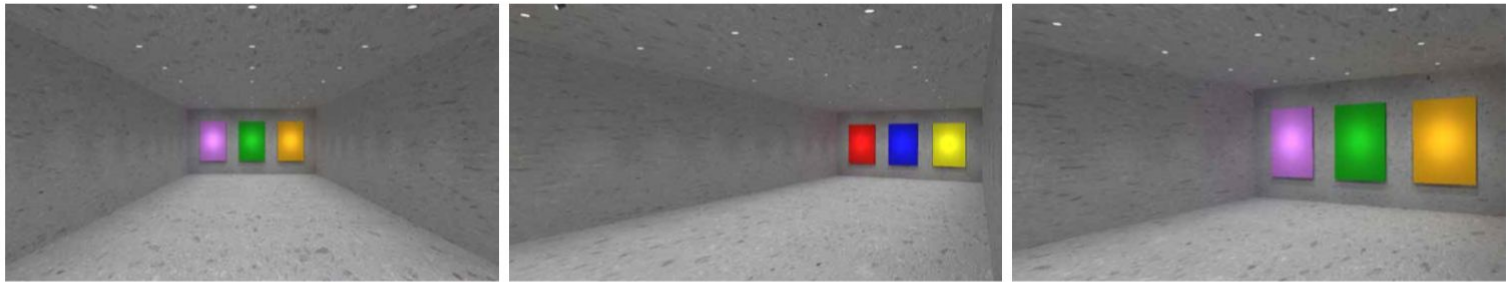
DIALUX

V-RAY FOR RHINO

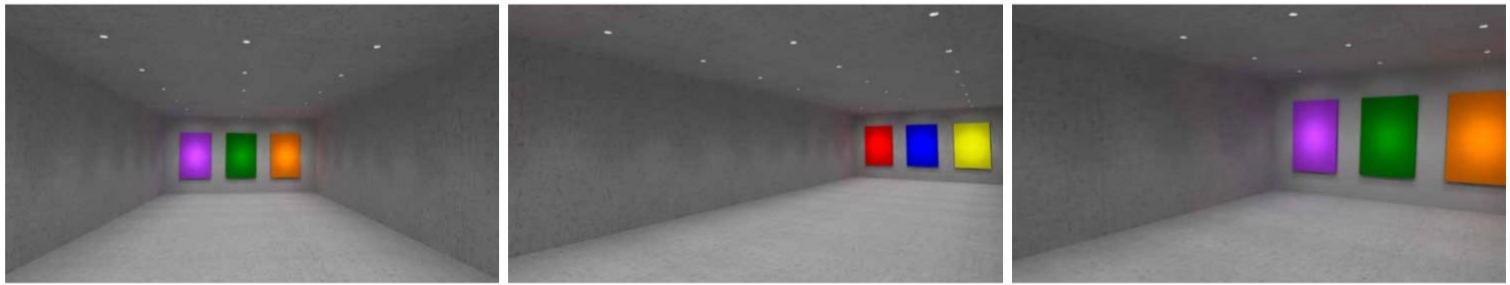
RENDER

VERSION #1 / NO WINDOWS

AGI32



DIALUX



V-RAY FOR RHINO

RENDER

ILLUSION			LIFELIKE
VAGUE			PRECISE
INCORRECT			CORRECT
AMBIGUOUS			CLEAR
INDIFFERENT			ENGAGED
NOT CONVINCING			PLAUSIBLE

DIALUX
RHINO
AGI32

ELECTRIC LIGHT

The electric light in the v-ray render looks too harsh and narrow for the type of light that's provided. The light from Dialux and AGI32 seems comparable in perception, but came up with a 10 fc difference in calculation.

DAYLIGHT

N/A for this model

MATERIAL

The luminance of the material seems more realistic with the v-ray, but I feel the

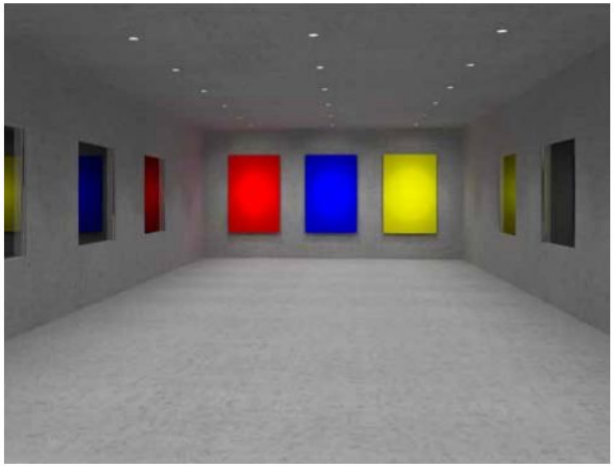
AMBIANCE

The v-ray for Rhino is a more engaging picture, with more detail -- including the shadowing details. Yet, the space feels unwelcoming and harsher than the AGI32 or Dialux render. The Dialux feels more contrasted, and slightly harsher, though this could be attributed to the material.

ANALYSIS - VERSION 1

VERSION #2 / VERTICAL WINDOWS

AGI32



DIALUX

V-RAY FOR RHINO

RENDER

VERSION #2 / VERTICAL WINDOWS

AGI32

DIALUX

V-RAY FOR RHINO

RENDER

ILLUSION			LIFELIKE
VAGUE			PRECISE
INCORRECT			CORRECT
AMBIGUOUS			CLEAR
INDIFFERENT			ENGAGED
NOT CONVINCING			PLAUSIBLE

ELECTRIC LIGHT

The electric light is most prominent in AGI32 rendering and barely noticeable in the Rhino v-ray. The distribution and intensity seems the most credible in the AGI32, where Dialux seems to render the space more diffuse.

DAYLIGHT

The highlights and shadows seem more credible in the v-ray: more realistic and more accurate in the way they disperse. The lack of daylight in the Dialux render is a problem.

MATERIAL

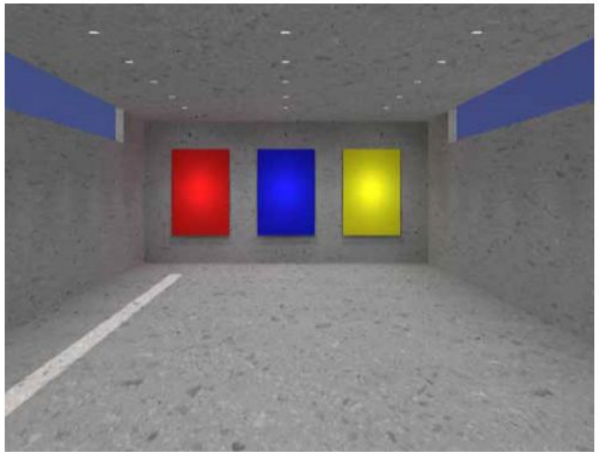
The material color and detail has the most feeling from the v-ray render, where I can make a relationship to a phenomenological feeling. The Dialux render seems quick and slightly cartoonish.

AMBIANCE

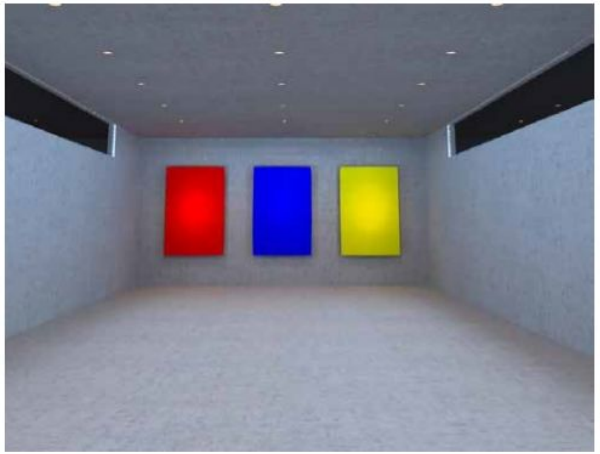
The ambiance in the AGI32 seems to be the most correct, and the most realistic. The feeling in the v-ray render, however, also makes me perceive it as much more credible.

ANALYSIS - VERSION 2

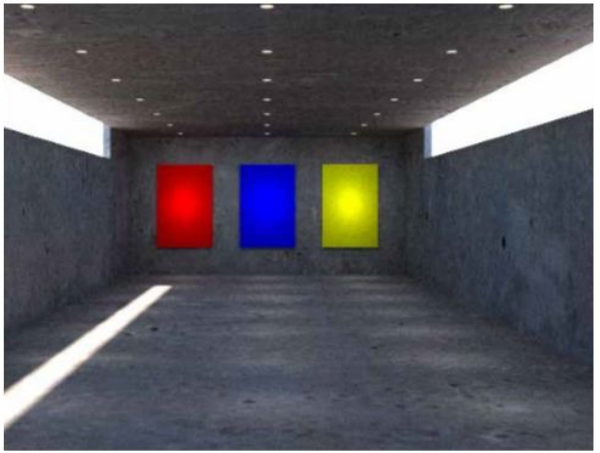
VERSION #3 / HORIZONTAL WINDOWS



AGI32



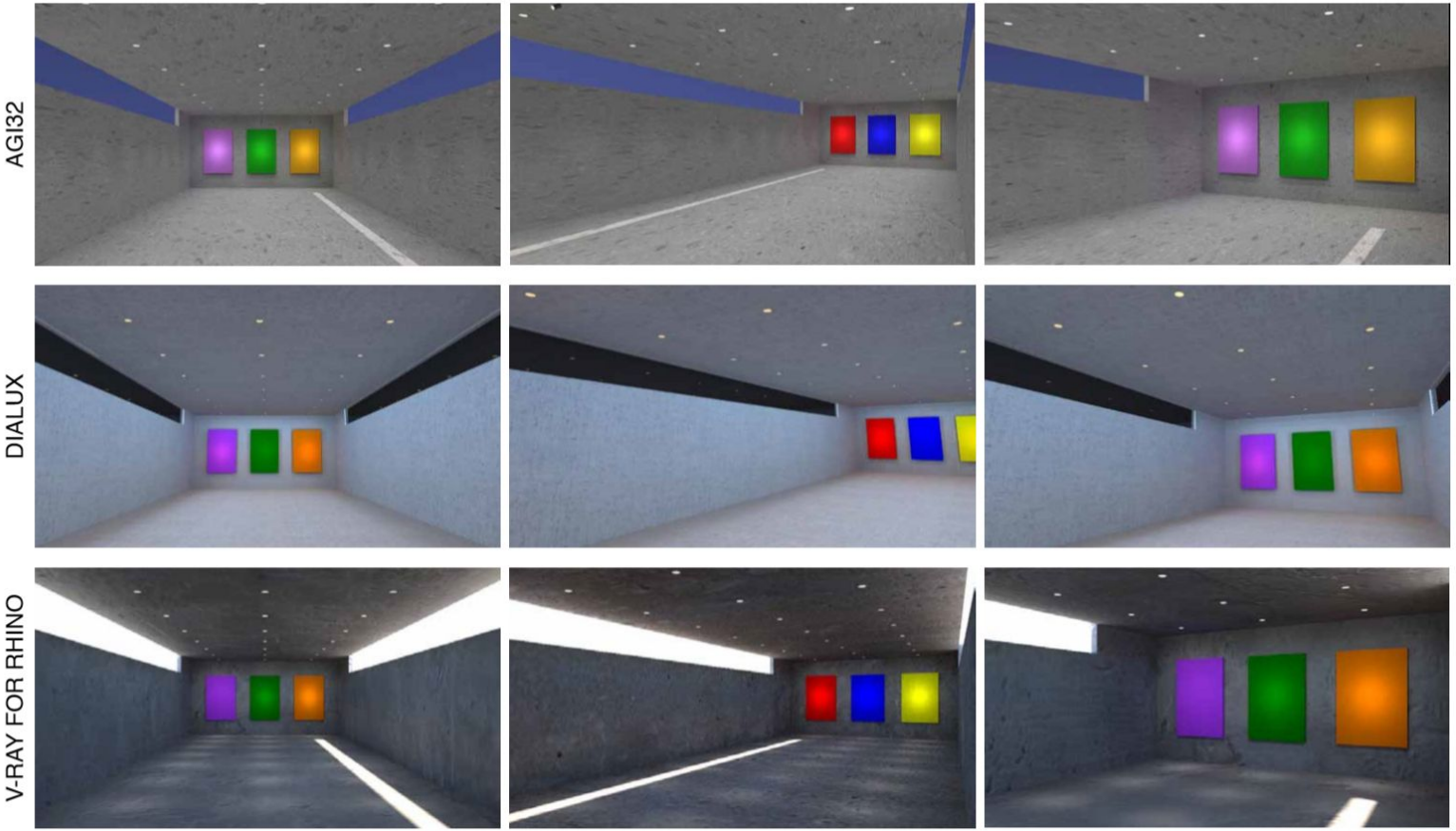
DIALUX



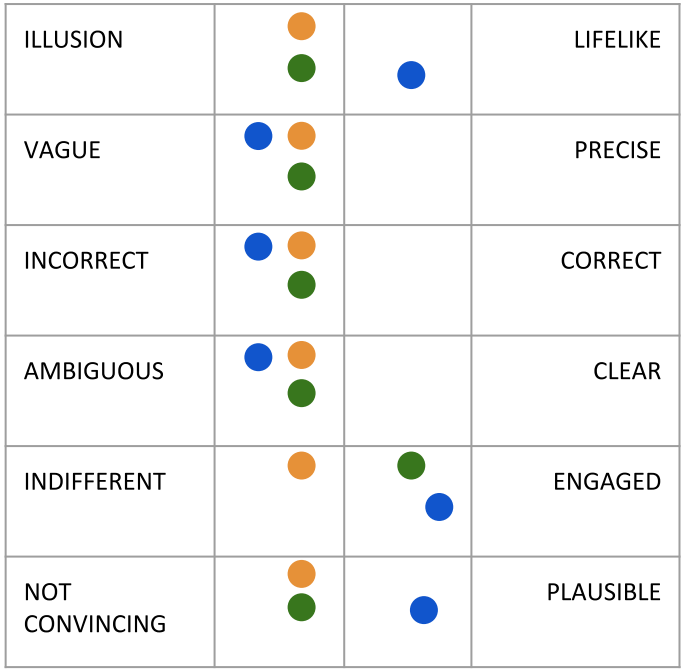
V-RAY FOR RHINO

RENDER

VERSION #3 / HORIZONTAL WINDOWS



RENDER



DIALUX
RHINO
AGI32

ELECTRIC LIGHT

The electric light in the AGI32 and Dialux renders are almost non-existent. The pools of light on the floor of the v-ray render are probably imperceptible in reality.

DAYLIGHT

The daylight in the v-ray render seems too bright and is missing the adaptive functionality that our eyes use. The projected daylight path in the AGI32 render seems correct, but the distribution and dispersion of the Rhino render are uncomparable. The contrast of the room brightness in the AGI32 render seems the most correct.

MATERIAL

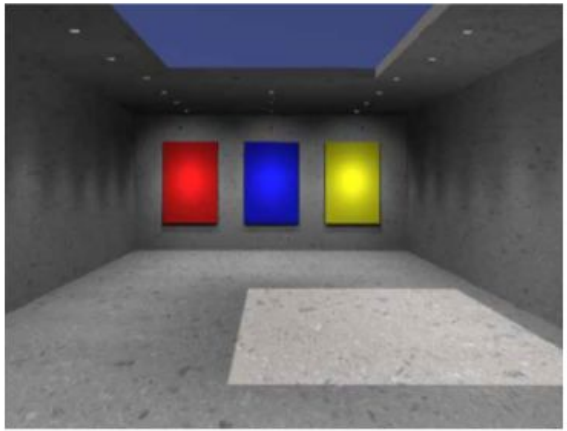
AGI32's materials have a warmer cast that the other two. This scene in particular accentuates the flatness and lack of realistic detail in the materials.

AMBIANCE

The cooler tone and floor shading of the Dialux render give it a more engaging presence. The detailing and material in the Rhino v-ray render evoke sensorial relationships.

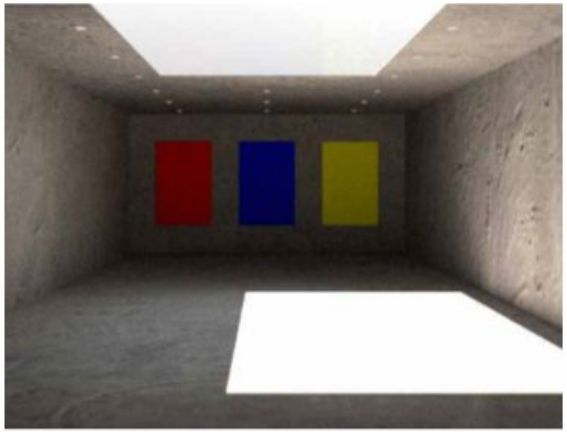
ANALYSIS - VERSION 3

VERSION #4 / SKY LIGHT



AGI32

DIALUX

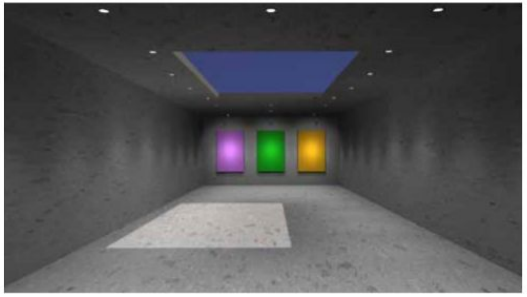
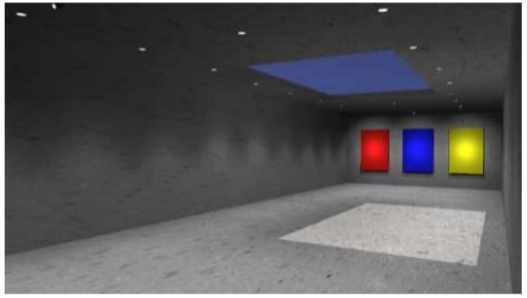


V-RAY FOR RHINO

RENDER

VERSION #4 / SKY LIGHT

AGI32

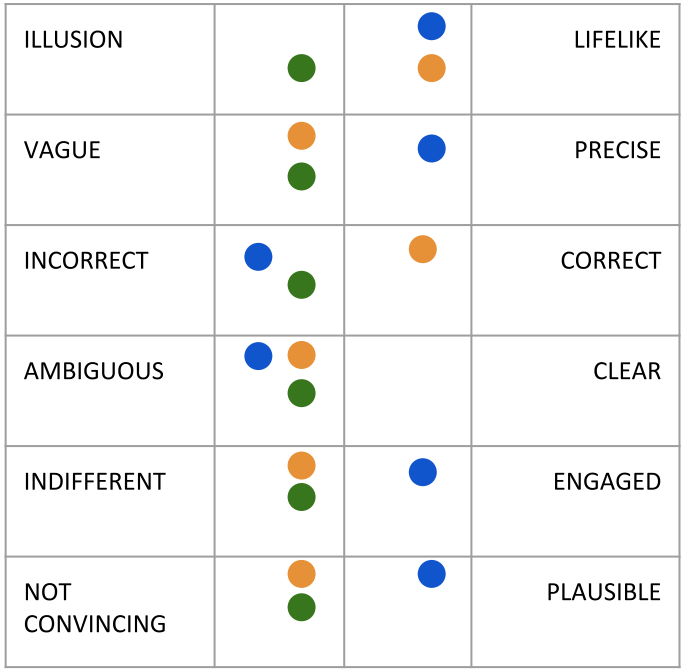

DIALUX



V-RAY FOR RHINO



RENDER



ELECTRIC LIGHT

The electric light in the AGI32 render is most prominent and most engaging. The electric light in the Rhino render doesn't look powered-on due to the high contrast from the skylight in the midday.

DAYLIGHT

Although the daylight looks the most realistic in the Rhino v-ray render, it doesn't look correct because of the contrast. The overall daylight scene in AGI32 looks the most accurate.

MATERIAL

The slight shadowing under the highlight in the AGI32 render doesn't seem plausible, as there is a massive amount of light coming through the opening. The spread of the light in the AGI32 render doesn't seem realistic on the material.

AMBIANCE

Although it's the most realistic and engaging, the v-ray render in this configuration is also the most unwelcoming and gives us the least understanding of the space.

ANALYSIS - VERSION 4

EXISTING CONSIDERATIONS

- Photography has a limited visible spectrum compared to what we can perceive, both in range and breadth.

- Light has a direct correlation with time, and doesn't lend itself to full representation with static images.

- Light is subjective in experience despite quantifiable units.

- Credibility is also a subjective experience that is based on the ability to mentally visualize.

FUTURE CONSIDERATIONS

- We are calibrating and designing for physical experiences, but increasingly, we are living and experiencing through a screen. Should we design for the photograph; and how does that change our understanding of the software programs.

- As lighting designers have the knowledge and access to the tools, should we also assume a role as renderer?

DISCUSSION

Through a quick analysis of three different rendering types of software, we see that Rhino V-ray appears to be the most plausible, engaging, clear, precise and lifelike -- even if they seemed the least correct in terms of lighting. Our understanding of the spaces depicted through Rhino V-ray draw more connections and evoke more sensation, which heightens our perceived credibility.

Anyone practicing in the architectural field that uses these software programs should be aware of the information given: the most credible looking renders could be the least correct.

Opportunities for further research

- Expand upon single analysis and apply to a survey-based experiment for general sentiments.
- Further study into differences in proprietary algorithmic calculations.

CONCLUSION