Surface Color Perception 2
Color in 3D

Terrestrial Light Fields

Terrestrial Light Fields
complex
dynamic

Light Field Inference

- Pentland (1982)
- Koenderink et al. (2003, 2004)
- Khang et al. (2006)
Light Field Inference

Koenderink, Pont, van Doorn, Kappers, Todd, Perception, 36, 2007

The Mondrian Singularity

Piet Mondrian, Composition with Red, Yellow, Blue and Black
1921, Gemeentemuseum, The Hague

A Thought Experiment

Piet Mondrian, Composition with Red, Yellow, Blue and Black
1921, Gemeentemuseum, The Hague

Experiment 1

Perceived Orientation and Perceived Color of Matte Surfaces

**Task: Achromatic Setting**

Blue-Yellow Balance Settings

$\Lambda^B$

*Equivalent illuminant*

"How blue the light impinging on the test patch seems to be …"
Conclusions: Experiment 1

In scenes with a punctate and diffuse light sources differing in chromaticity,

• Observers partially discount illumination changes with orientation

• Observers effectively estimate information about the spatial and chromatic distribution of illumination in the scene (the light field).
Experiment 2

A dynamic analogue of lightness constancy

Foster, Nasolento

Stimuli: rendered scenes
observer's view
(stereo pair, binocular viewing)
rotated view

Light source moves

15°

Matched change in albedos
“scrambled light”

There's an ambiguity here...

Concavity counts!
Matched change in albedos
“scrambled light”

On every trial
Either the light moves or there is a non-light change
On half the trials a single surface in an unknown location Changes albedo
Your task: detect the surface change
Will your detection performance be better with light changes than non-light changes?

Thought Experiment
Detect single surface change

Methods
2 global light change conditions
light, scrambled light
3 albedo perturbation levels
±50, ± 75, or ± 100%
240 trials per level per condition
1440 total
Results: one subject

\[
\frac{d'_{\text{light}}}{d'_{\text{non-light}}} = 1.65
\]

\[t = 3.27, p < 0.001\]

Experiment 3: Summary

Observers detect changes in the Light field and can use this information to improve detection of simultaneous Changes in surface albedo.

Summary

The visual system can model the light field in space and time to some extent.

It can use this information to improve estimation of surface color and detection of surface color change.