How We Look at Photographs–As Indicated by Contrast Detection, Preference and Eye-Movement Patterns

S. Gershoni and H. Kobayashi, Graduate School of Science and Technology, Chiba University, Chiba, Japan

Abstract

The research applied image evaluation methods to examine visual perception theories with photography, through investigation of the relationship between the aesthetic experience of looking at photographs and the ability to actually discriminate the photographic language building blocks- luminance contrast and spatial configuration, at different regions of the characteristic curve. The relationship between contrast discrimination performance and preference of contrast in photographs was investigated and eye-movement tracking methods revealed the effect of contrast over fixation patterns and aesthetic experience.

Introduction

In order to examine the roles and interferences of local and global elements in lightness perception and object recognition processes when looking at photographs with meaningful contents, we examined whether contrast discrimination is a response to spatial configuration properties of photographs, or also a function of conceptual contents. In three experiments we compared contrast discrimination performances of observers, when presented with contrast increments applied to discrete tonal regions in grey-scales vs. photographs.

Experimental

Procedure

In Experiment 1, observers performed contrast discrimination in grey-scales by rank-order tasks. In Experiments 2, trained and novice observers performed contrast discrimination of photographs by sorting-tasks. In Experiment 3 observers performed a one-scale (from 1- most dislike to 5- like most) preference evaluation task for the photographs.

Stimuli

Grey-Scales Rank Order Task (Experiment 1)

Kodak Scientific Imaging Systems Gray Scale. Sample size was 20cmX3cm, with a 3cm wide neutral grey masking.

Photograph- Sorting Task (Experiments 2 & 3)

Nine black-and-white photographs by the photographer Ansel Adams[1] belonging to three major themes in photography:

Landscape, *Portrait* and *Architecture* Sample size was 25 cm × 30 cm with a 3 cm wide neutral grey masking.

Stimuli Reproduction Process

The photographs and grey-scales were scanned in an "Epson" scanner GT-9700F. For each stimuli a sample set composed of two prints with original tones and three sets of 10 prints, for each of the three curves was composed: "**OR**" – 2 direct reproductions without contrast increment. (1) "**SH**" - contrast was increased in the shadow region (toe) and compressed the highlights. As a result the visual impression is that the images look lighter. (2) "**HI**"- contrast was increased in highlight region (shoulder) and compressed the shadows. The resulting visual impression is the overall darkening of the images. (3) "**MT**"- contrast was increased in the mid-tones region (straight line), while compressed both highlights and shadows. Contrast increment ranged between 1% and 10% in increments of 1%. Samples were named 1 to 10 accordingly. Prints were produced by Lambda system in a silver gelatin process, on a photographic black-and-white paper.

Subjects

Subjects belonged to two groups: (1) 18 observers who were skilled in image evaluation tasks, named: "trained" group. (2) 15 inexperienced observers, named: "novice" group. Average age was 25 and 27.50% of the trained subjects and 10% of the novice were familiar with Ansel Adams work and 28% of the trained and 5% of novice reported to have previously seen the photographs used as stimuli.

Results

We found substantial differences in response to contrast increments, depending on the region: mean discrimination ratios for HI and SH, between 20% to 30%, were significantly lower than for MT 75~85%, but there was no significant effect of category as shown in figure 1. Trained and novice subject discrimination rates were similar for MT, but showed opposite discrimination for HI and SH regions (trained: HI-low, SH-high: novice: HI-high, SH-low, which could account for the effect of training and skill over interpretation of the term 'contrast'.

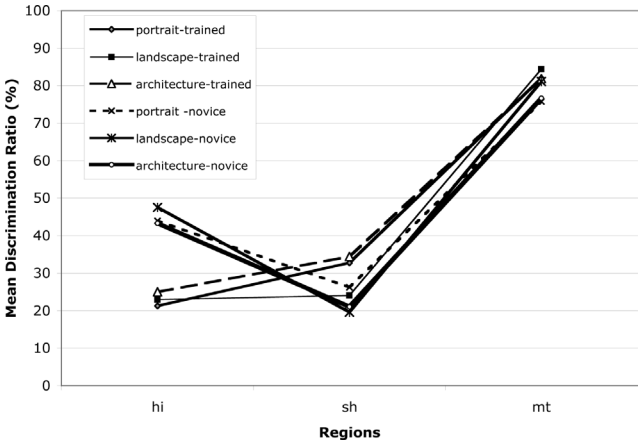

Figure 1. Effect of region and category over contrast discrimination ratio in photographs (Experiment 2)

Nevertheless, low performances in SH region of grey-scales 8.6%, significantly improved in photographs due to complexity of configuration. Yet Ratios in HI were better for grey-scales 61.2% and shown in Figure 2.

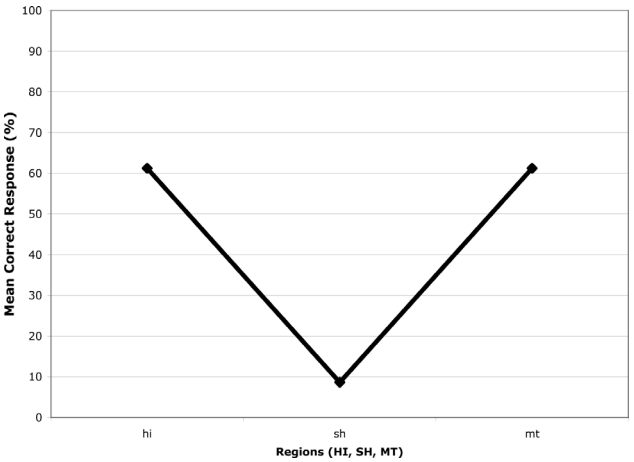

Figure 2. Effect of region over correct response in grey-scale (Experiment 1)

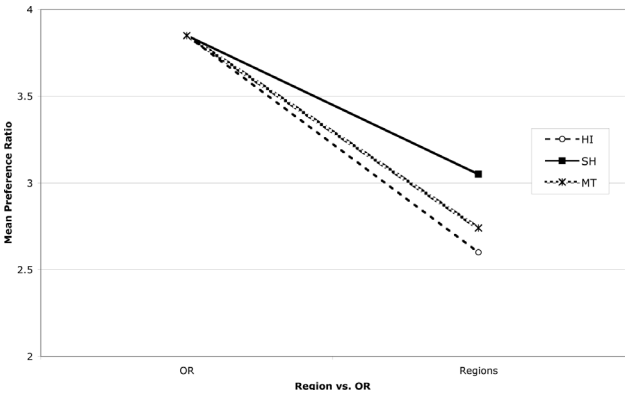

Figure 3. Effect of Region (OR vs. HI, SH and MT) over preference (Experiment 3)

We also found differences in performance at SH region (with no affect on HI or MT) between photographs of light vs. night scenes. These results can be explained with *'Anchoring Theory for Lightness Perception',*[2,3] according to which, in mapping luminance into a lightness scale, the highest luminance is anchored (assigned) to white, and the rest of the values are scaled relative to it. Other factors which influence anchoring are: configuration, articulation, insulation and gestalt grouping principles. The anchor can occur within a *local framework*, containing a group of patches or a *global framework* that could include even the entire visual field. While strong anchoring to local framework increase lightness constancy, when the global framework is stronger, it is decreased. Hence, in SH (see stimuli preparation) as the grey-scale is perceived as lighter, the assignment to white is enhanced and so does the strength of the global framework. In addition, simple configuration, low gradient, and no articulation cause a decrease in lightness constancy, and in effect lower response ratio in SH. In photographs, high articulation and insulation, complex configuration and a variety in gradients contribute to the strengthening of local frameworks and as a result to an increase in lightness constancy and a higher response ratio.

Preference ratios, similarly to detection ratios, were not affected by conceptual content but affected by region. Mean preference at SH (3.1) was higher than MT (2.7) and HI (2.1), although in all regions preference ratio decreased systematically with contrast increment, compared to OR (3.9), as shown in Figure 3. This suggests that preference is independent of spatial configuration. An interesting result is, that the stimuli OR were the most preferred. This suggests a match in preference between the photographer, and the observer. This is in line with recent theories in neural-aesthetics[4,5].

Contrast and Eye-Movement

At present we investigate how contrast changes at regions HI vs. SH vs. MT affect the fixation patterns for the above stimuli. These results will reveal the relationship between aesthetic experience and contrast.

References

1. Ansel Adams, 'Photographs of the Southwest', New-York Graphic Society, Boston Massachusetts, 1976
2. A. Gilchrist and C. Kossyfidis, 1999, 'An Anchoring Theory of Lightness Perception', Psychological Review 106(4), 795-834
3. A. L. Gilchrist, 'Perceived Lightness Depends on Perceived Spatial Arrangement', Science, 195(4274), 185-187
4. S. Zeki, 'Art and the Brain', Oxford University Press, 2000, ISBN 0-19-850519-1
5. V. S. Ramachandran and W. Hirstein, 1999 ,'The Science of Art- A Neurological Theory of Aesthetic Experience', Journal of Consciousness Studies, 6(6-7), 15-51

Author Biography

Sharon Gershoni received her B.a. degree in Fine Arts from the Bezalel Academy for Art and Design at Jerusalem in 1999, an M.a. degree in Engineering from Chiba University at Chiba, Japan in 2003 and is at present a candidate for PhD degree in Information and Image Sciences from Chiba University. Her work focuses on the investigation of the effect of elements in lightness perception and object recognition processes of photographs with meaningful contents over aesthetic experience.