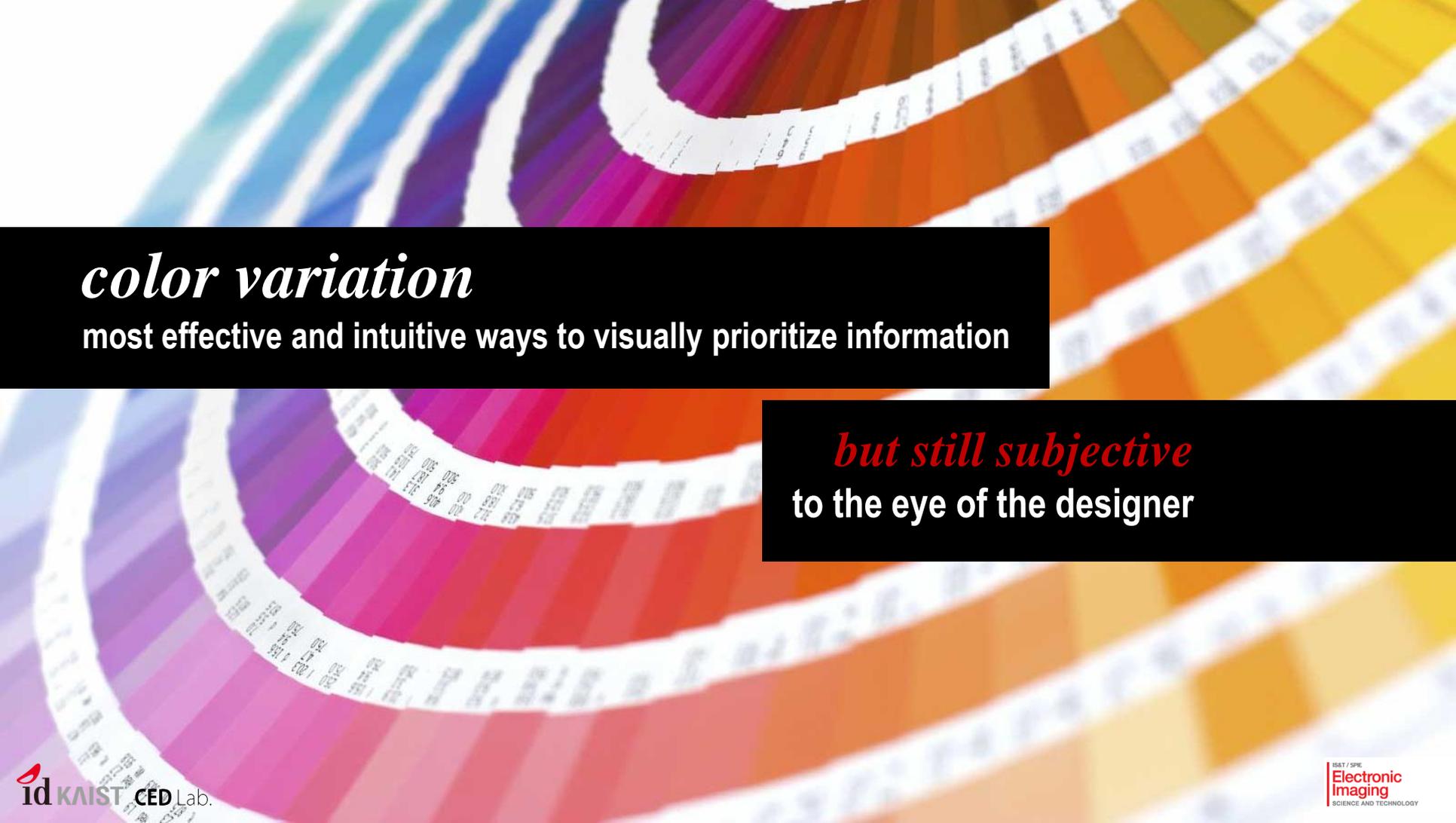




Investigation of eye-catching colors using eye tracking

Mokryun Baik, Hyeon-Jeong Suk, Jeongmin Lee, Kyung-Ah Choi



color variation

most effective and intuitive ways to visually prioritize information

but still subjective
to the eye of the designer

can be harmful

to perceiving visual information accurately
without an objective guideline

Purple is awesome!

Pink makes me want to exercise!

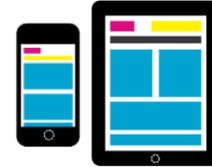
Green energizes me!



Blue soles makes me look taller!



various types of content
on a *more* small-sized display



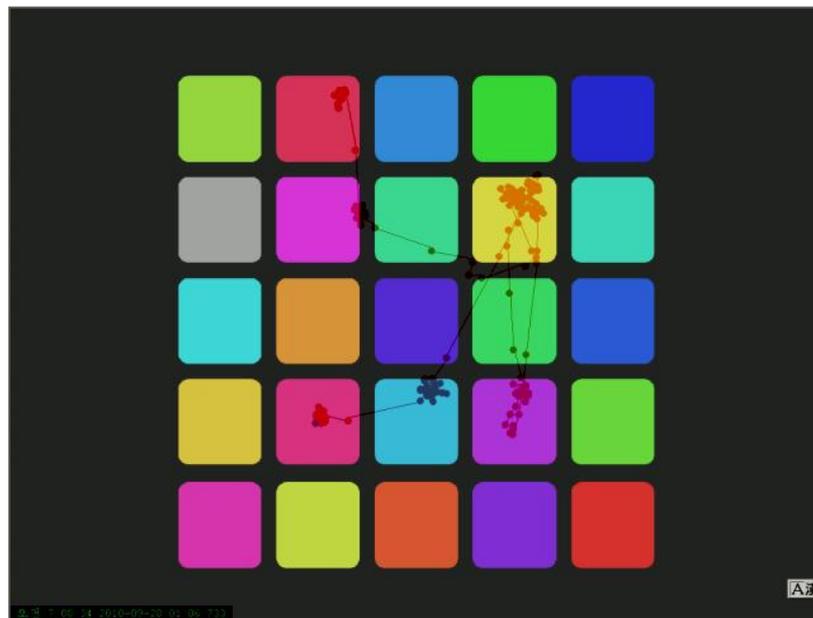
our objective

is to provide empirical grounds for strengthening
mobile visual information structure



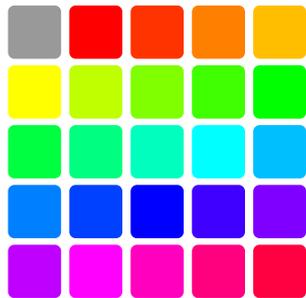
empirically investigate

which colors are most eye-catching in a mobile communication context

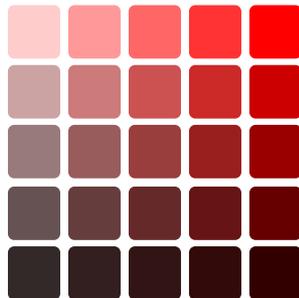


divided into 3 parts *to investigate*

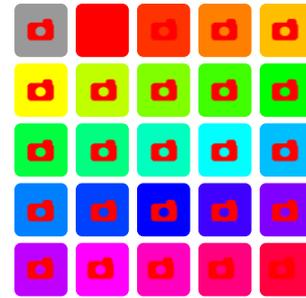
whether hue, tone and color combination has effects on color saliency



Part I. Hue

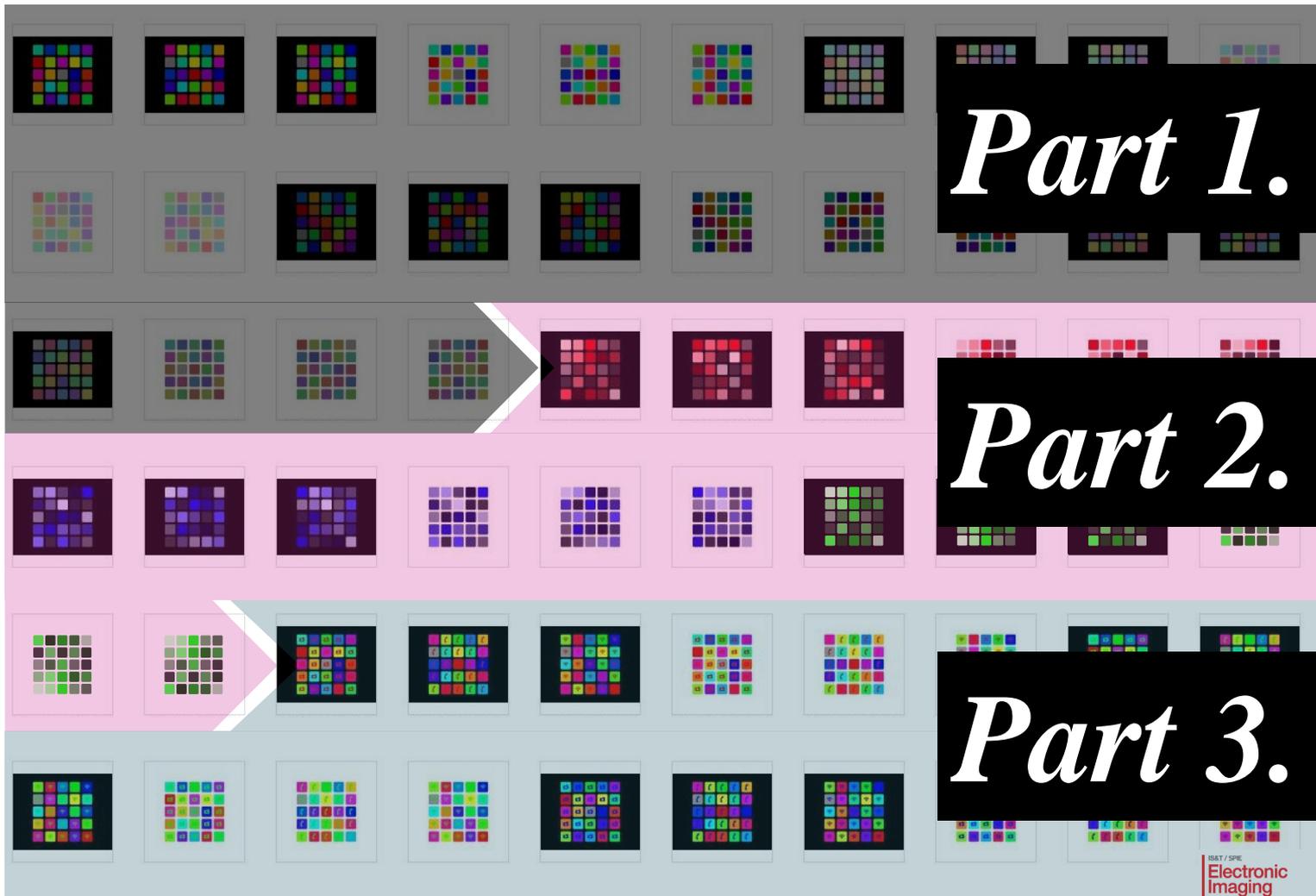


Part II. Tone



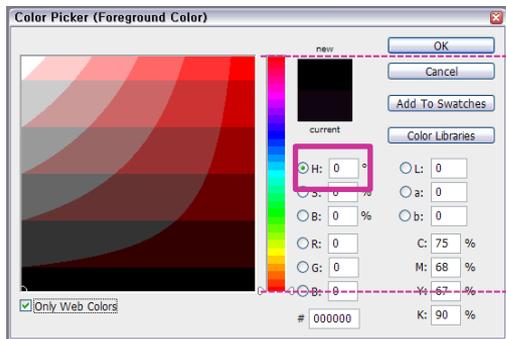
Part III. Combination

outline



part 1.

to determine
which color *hue* catches the attentions of the eyes first



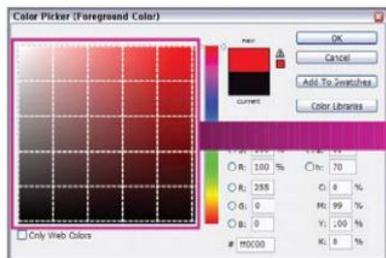
- The hue circle was divided by 15° in HSB color system from Photoshop software to extract 24 different hues
- Gray has no hue, but was added because it is usually recognized as color
- Total of 25 hues were made up

25 Hues in Vivid Tone

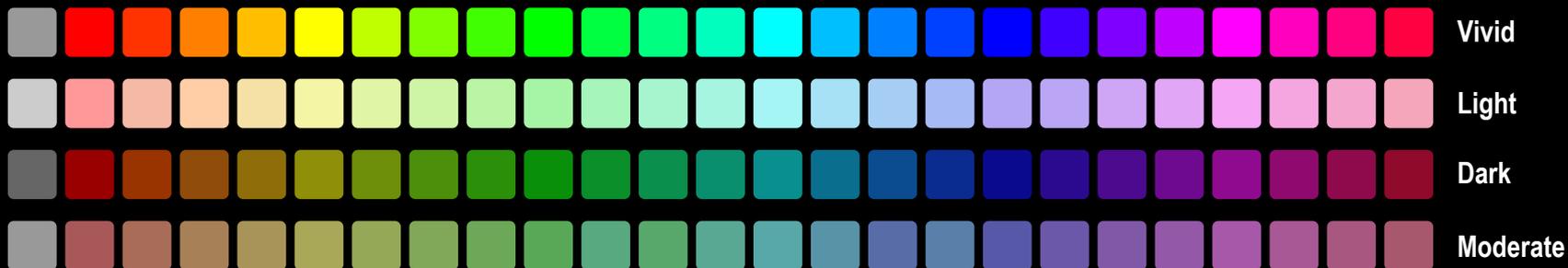


part 1.

to determine
which color *hue* catches the attentions of the eyes first



- Three more stimulus sets were produced with variations in tone - light, dark, and moderate - by controlling the saturation as well as brightness

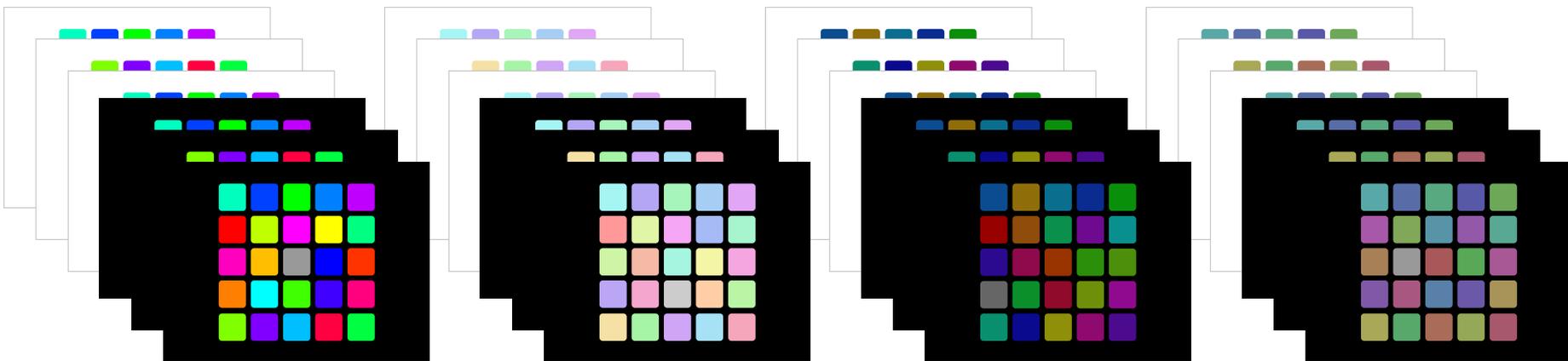


part 1.

to determine

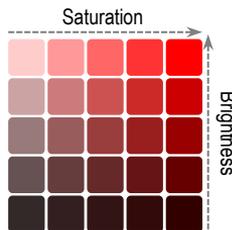
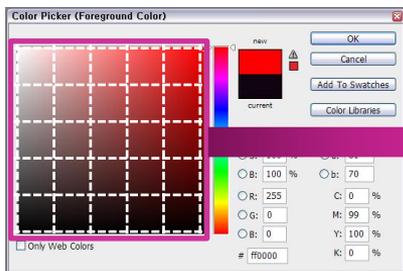
which color *hue* catches the attentions of the eyes first

- Each hue set was randomly arranged in a 5 by 5 matrix (an icon array structure) in 3 different ways to avoid position bias
- The stimuli were placed over a black and white background
- Total of 24 sets (4 tones * 3 positions * 2 backgrounds)

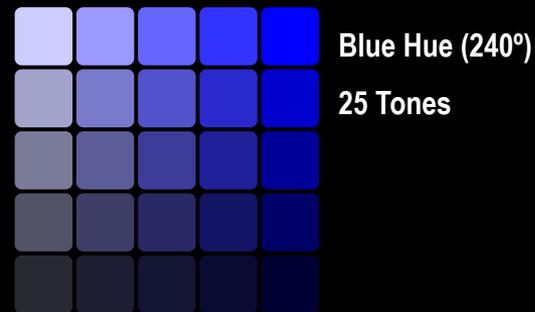
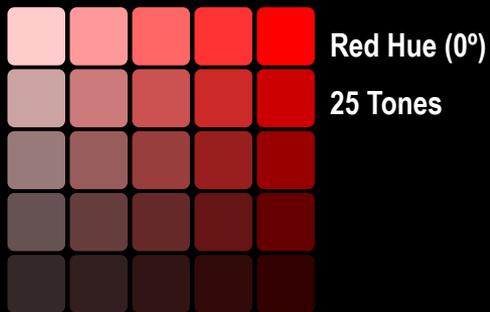


part 2.

to examine
whether certain *tones* attract the eyes more



- 25 tones for red hue were extracted by dividing the saturation (100%) and brightness (100%) levels by 5
- The process was repeated for green and blue

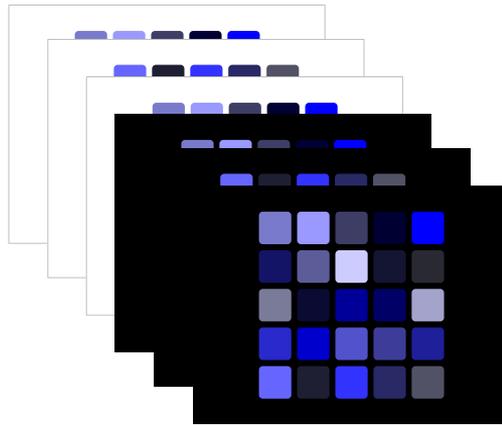
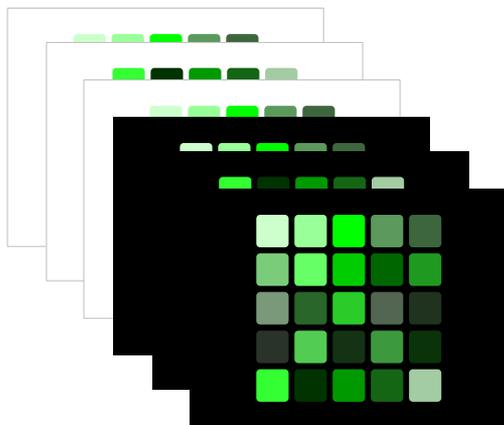
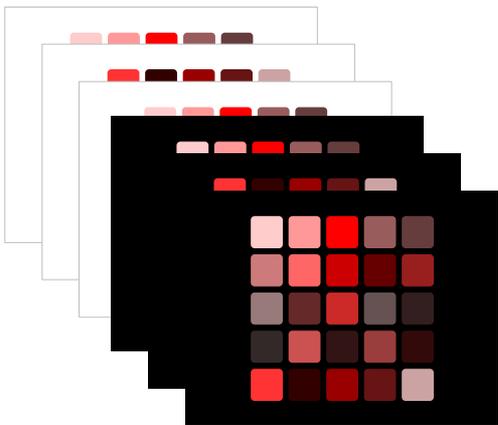


part 2.

to examine

whether certain *tones* attract the eyes more

- Each tone set was randomly arranged in a 5 by 5 matrix in 3 different ways to avoid position bias
- The stimuli were placed over a black and white background
- Total of 18 sets (3 tones * 3 positions * 2 backgrounds)

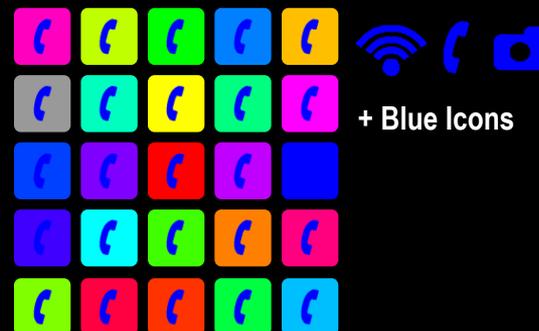
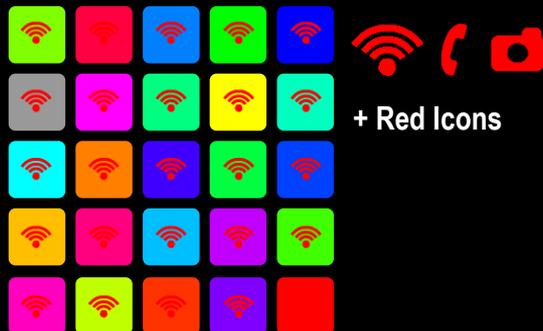


part 3.

to test

whether *color contrast* has an effect on saliency

background: 25 hues of Vivid Tone (part I)

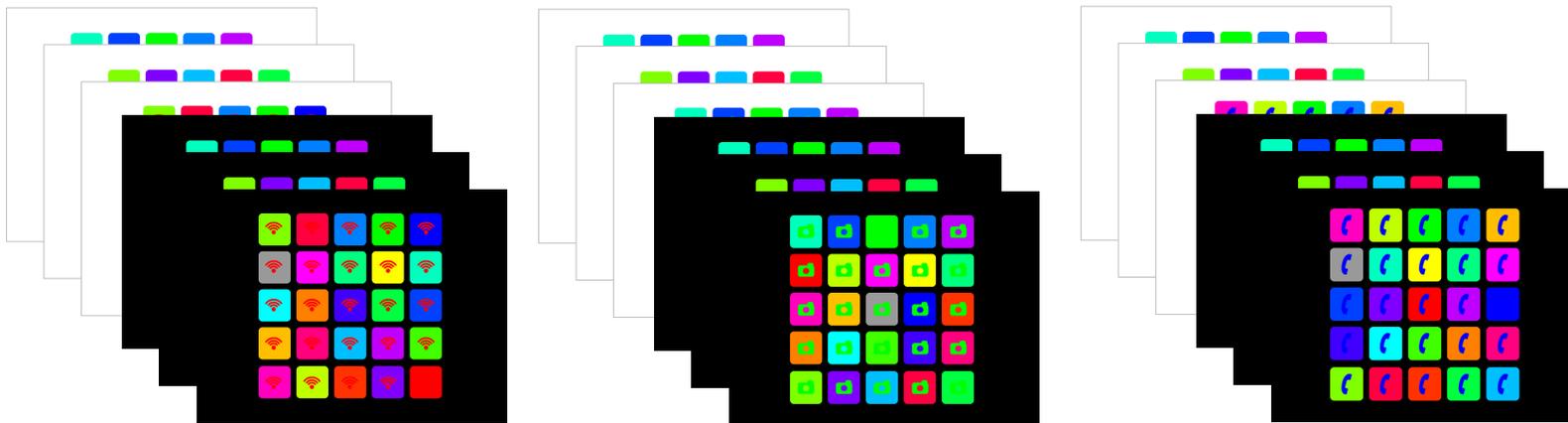


part 3.

to test

whether *color contrast* has an effect on saliency

- Each color combination set was randomly arranged in a 5 by 5 matrix in 3 different ways
- The stimuli were placed over a black and white background
- Total of 18 sets (3 icon colors * 3 positions * 2 backgrounds)



procedure

Part I. Hue (24 sets)

1-1. 25 Hues of Vivid Tone

2 Background x 3 set

1-2. 25 Hues of Light Tone

2 Background x 3 set

1-3. 25 Hues of Dark Tone

2 Background x 3 set

1-4. 25 Hues of Moderate Tone

2 Background x 3 set

Part II. Tone (18 sets)

2-1. 25 Tones of Red Hue

2 Background x 3 set

2-2. 25 Tones of Green Hue

2 Background x 3 set

2-3. 25 Tones of Blue Hue

2 Background x 3 set

Part III. Color Combo (18 sets)

3-1. Vivid Tone BG. + Red Icon

2 Background x 3 set

3-2. Vivid Tone BG. + Green Icon

2 Background x 3 set

3-3. Vivid Tone BG. + Blue Icon

2 Background x 3 set

procedure

approx. total of 9 min.

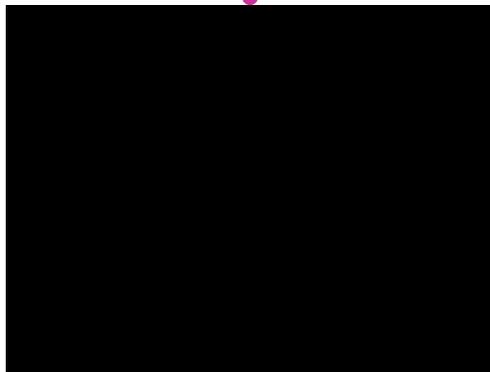
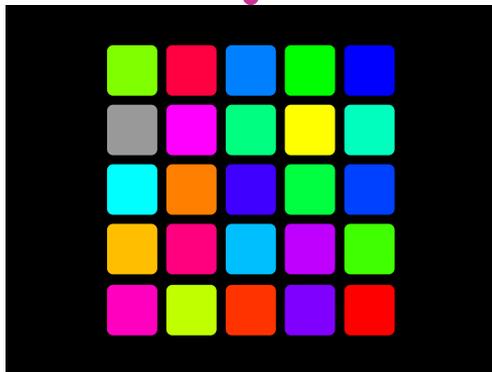
the subjects were asked to *select their preferred color* while viewing each stimulus

7-second
task

60 sets

2-second
break

to prevent an
afterimage effect



method

Eye gaze Analysis System

a table-mounted eye-tracking system developed by LC Technologies Inc.

15 college students made up of 8 males and 7 females were recruited with an average age of 25.00 years and a standard deviation of 3.64 years. All participated in all three parts.



Eye gaze Analysis System

a table-mounted eye-tracking system developed by LC Technologies Inc.

The lighting of the experimental room was lit in 100 lx.



1024 x 768 pixels

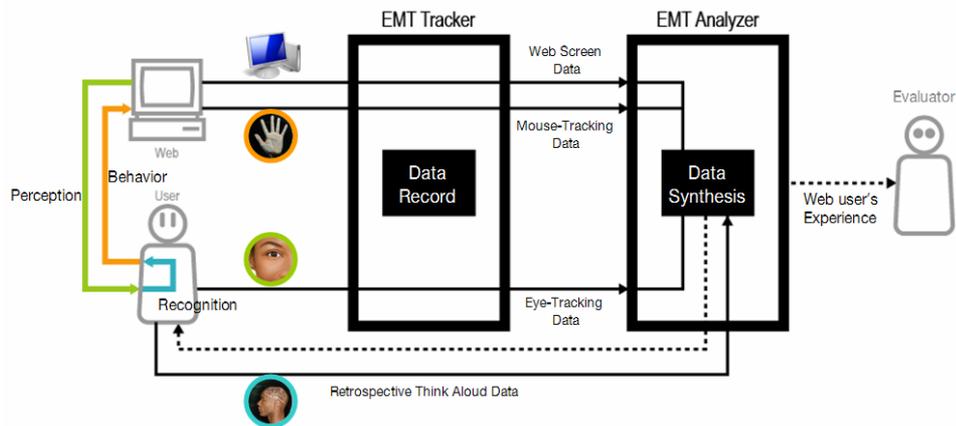
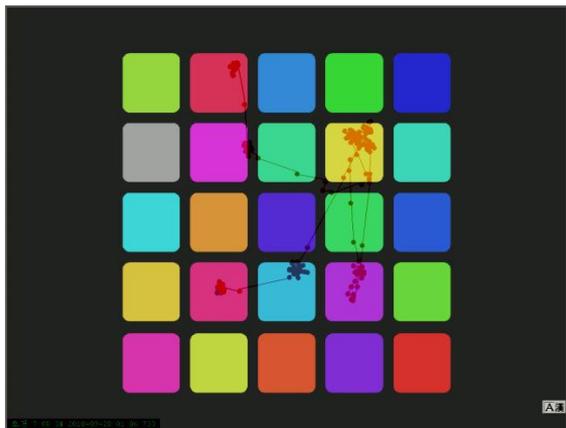
125 x 125 pixels

seated at an average of 60 cm
from the 17-inch monitor, creating
approx. 2 ° of viewing angle

EMT Tracker

an eye-tracking analysis software

- The fixated positions within the first 3 seconds were taken into consideration
- The initial fixation was removed from analysis as it was assumed that the initial fixation would generally be at the center of the screen or at a random point
- Positions were recognized as fixations only when the duration exceeded .25 second



part 1.

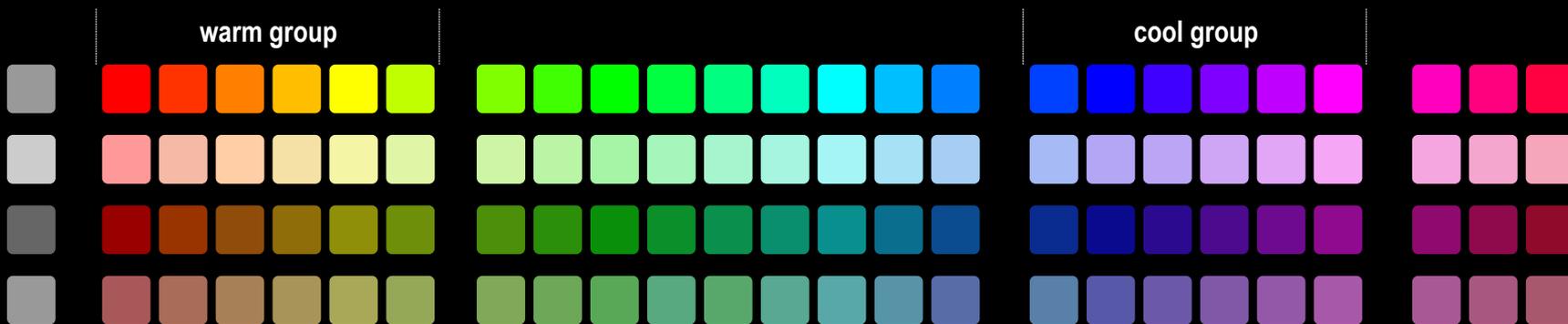
warm group grabs attention most effectively

warm group (6 hues) hues ranging from red (0 degree) to yellow (90 °)

cool group (6 hues) blue-green (225 °) to purple-blue (315 °)

neutral hue group rest of the hues

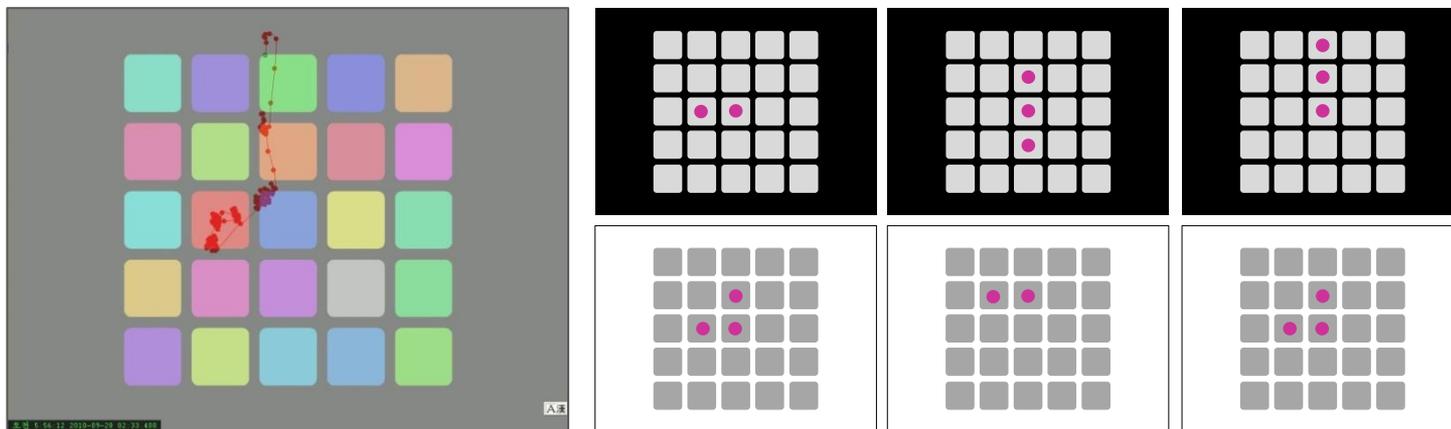
The fixation counts of the warm group were higher than the other two groups (Chi-square test, $p < .05$)



part 1.

and, a position effect

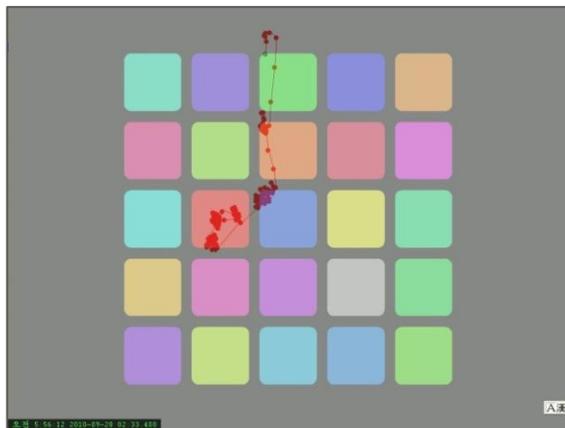
The color patches placed on the horizontal or vertical axes caught the eyes' attention more easily



part 1.

and, a position effect

The participants fixated very little on color patches that were located on the right side of the screen

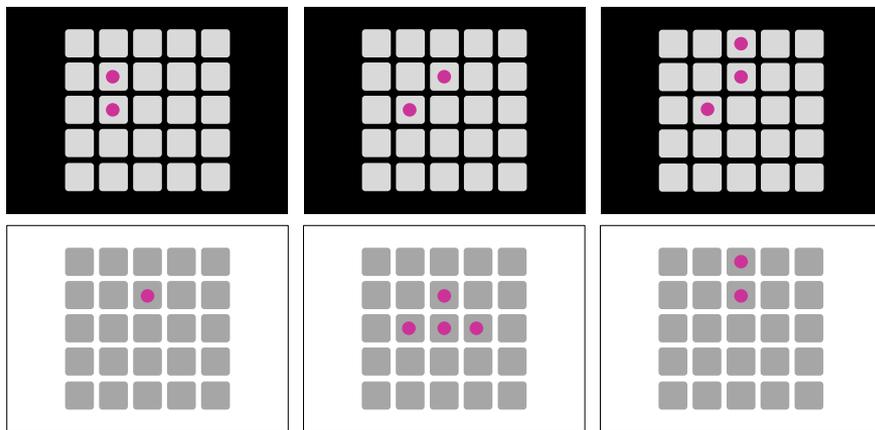


part 2.

no tendencies...

with regards to the tone difference

but, still a position effect



part 3.

high contrast group grabs attention most effectively

low contrast

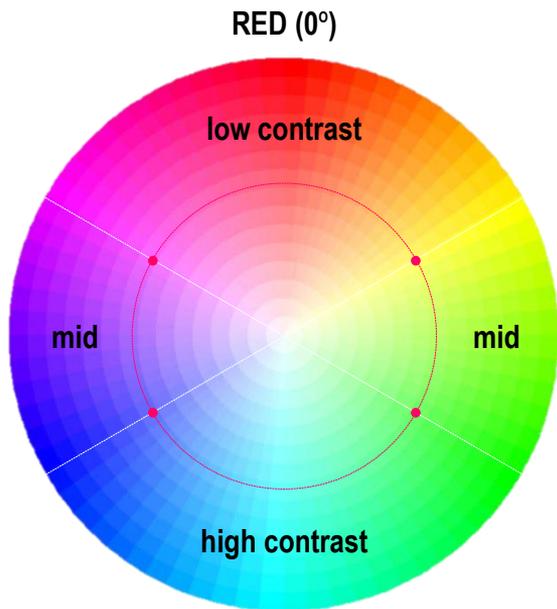
medium contrast

high contrast

$|\text{background hue} - \text{foreground hue}| \leq 60^\circ$

$60^\circ < |\text{background hue} - \text{foreground hue}| \leq 120^\circ + \text{gray}$

$120^\circ < |\text{background hue} - \text{foreground hue}| \leq 180^\circ$



part 3.

high contrast group grabs attention most effectively

low contrast

$$|\text{background hue} - \text{foreground hue}| \leq 60^\circ$$

medium contrast

$$60^\circ < |\text{background hue} - \text{foreground hue}| \leq 120^\circ + \text{gray}$$

high contrast

$$120^\circ < |\text{background hue} - \text{foreground hue}| \leq 180^\circ$$

The frequency of fixation counts was greatest for the high contrast group and lowest for the low contrast group (Chi-square test, $p < .05$)

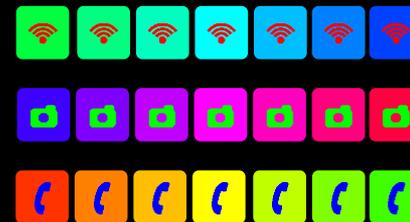
low contrast



medium contrast



high contrast



conclusion

The major findings are summarized into four aspects:

First, warm colors grab the eyes' attention;

Second, tone difference within the same hue has no effect on attention;

Third, for hue contrast, complimentary pairs are particularly more dominant;

Fourth, color patches located on axes have benefit.

In addition, it was revealed that the foreground-background color contrast does not play a decisive role.



appropriate use of color can help prioritize
visual information in each UI context to communicate effectively

*these empirical findings are expected to be
applied in practice straightforwardly*

The background of the slide is a photograph of a modern building with large windows, partially obscured by cherry blossom trees in full bloom. The scene is captured during sunset or sunrise, with a warm, golden light in the sky. In the foreground on the left, there is a black lamppost with several white, globe-shaped light fixtures. The overall mood is serene and aesthetically pleasing.

Color and Emotion for Design Lab.

Department of Industrial Design, KAIST

A circular logo with a purple-to-magenta gradient. The letters 'CED' are written in a white, bold, sans-serif font in the center of the circle.

CED