#### Illusory motion induced by a printed static image under flickering light environment. Tomoaki KOZAKI

### **Introduction 1**

Illusory motion can be generated by still images such as Fig.1

> *\*You can feel stronger sensation of illusory motion, when you see Fig.1 with blinking.*



The sensation can also be enhanced by Figure 1 flickering images (Seno et al., 2013), eye movements (Murakami et al., 2006), and eye blinks (Otero-Millian et al., 2012).

The earlier studies indicates that flickering condition (alternating bright and dark) on the retina can enhance illusory motion in static images. Humans can detect flickers at rates below 50–80 Hz, as the critical flicker frequency (CFF)(Watson, 1986).

However...

Cone receptors in human can respond to flickering light at a rate around 100 Hz (Alexander et al., 2000). The steady-state visual-evoked potential, which mainly results from the primary visual cortex (V1) is evoked by flickering light up to 90 Hz (Herrmann, 2001).

Therefore…

Can flickering ambient light above CFF enhance illusory motion?

Purpose of this study

We evaluated illusory motions in a printed static image under flickering ambient light at rates of up to 100 Hz

### Method 1

Participants: 26 females aged between 21 and 23 years

## Experimental design:

Dark	Non-Flickering	Dark	Flickering
Rest	See the image	Rest	See the image
3 min	20 sec	30 sec	20 sec

#### Figure 2. Experimental schedule for each light condition



Figure 3. Experimental condition



Figure 4. Illusory image

# Light conditions:

## Non-flickering light: White-LED, 100lx(on the table)

#### Flickering light: 3 frequencies (50Hz, 75Hz, 100Hz) White-LED, 100lx(on the table), Duty-rate 50%





#### Visual Analog Scale (VAS)

Write down a line as your sensation of the motion on the vertical line



62 mm = Score of illusory motion

Figure 7. VAS

#### Data collection and analysis

The strength of the generated illusory motion was rated from 0 (no motion) to 100 (very strong motion) The differences in illusory motions were determined using a Friedman test with the Bonferroni-Holm correction. Result



on each light condition

#### Discussion

For all flickering ambient light conditions, the median scores were substantially higher under flickering light than under nonflickering light. These findings suggest that flickering ambient light up to 100 Hz can enhance illusory motions in an image. Notably,

the present findings indicate that flickering ambient light even above the CFF can influence illusory motions.

Because

human cone receptors and V1 are sensitive to flickering light at rates around 100 Hz

(Alexander et al., 2000; Herrmann, 2001).

#### Acknowledgment

This study was supported by the Japan Society for the Promotion of Science (22K18651) and Fukuoka Women's University

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