

# When the Inducing Grapheme Changes and When the Induced Synesthetic Color Changes

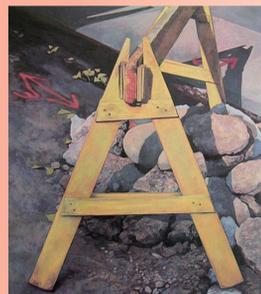


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VSS 2010  
Abstract # 439

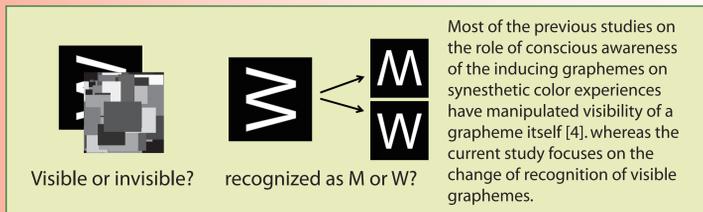
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## Background & Design



Will color-graphemic synesthetes experience their synesthetic colors when viewing this picture?

- Color-graphemic synesthete experience achromatic words and alphanumeric characters in vivid, reliable colors [1]. It has been shown that conscious awareness of an inducing grapheme is necessary for synesthetic color experience [2][3]. However, whether grapheme recognition should precede synesthetic color perception has not been addressed.



### Experimental Conditions

**Symbol Task**

W/M (alphabet letter)    6/9 (digit)    곱/문 (Korean word)

**Synesthetic Color Task**

W/M    6/9    곱/문

A case of synesthete HWP (21, female, associator)

Perceived as "W" (blue) / Perceived as "M" (green)

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### Inducing Letter/Word in Korean

ㄱ [g] [n] [d] [r] [m] [b] [s] [a,ŏ] [k] [t] [p] [h] (Consonant)  
 ㅏ [a] [ya] [ɔ] [ya] [yɔ] [u] [yu] [i] [i] [æ] [e] (Vowel)

**Korean grapheme**

How Korean letter/word sounds

ㄱ [g] 곱 [gom]    ㅏ [o] 곱 [mun]  
 ㅓ [m]    ㅓ [m]    ㅓ [m]    ㅓ [m]  
 ㅓ [u]    ㅓ [u]    ㅓ [u]    ㅓ [u]  
 ㅓ [n]    ㅓ [n]    ㅓ [n]    ㅓ [n]

synesthete YMK (24, female, associator)    synesthete SKK (26, female, associator)

ㄱ [g] 곱 [gom]    ㅏ [o] 곱 [mun]  
 ㅓ [m]    ㅓ [m]    ㅓ [m]    ㅓ [m]  
 ㅓ [u]    ㅓ [u]    ㅓ [u]    ㅓ [u]  
 ㅓ [n]    ㅓ [n]    ㅓ [n]    ㅓ [n]

synesthete YMK (24, female, associator)    synesthete SKK (26, female, associator)

colors Korean synesthetes experiences who performed the experiments

## Key Questions

- Is recognition of inducing grapheme necessary for synesthetic color experience?
- Does the type of inducing grapheme matter in synesthetic color experience?

## Conclusions

- For the most synesthetes tested, grapheme recognition precedes synesthetic color judgement.
- For the most Korean synesthetes tested, Korean grapheme/word recognition and synesthetic color judgement happen almost at the same time. The RT difference between grapheme recognition and color judgement was the biggest for Alphabet letters, there for digits, and almost nothing for Korean.

## 1. Discrete presentation of rotated grapheme

### Methods

**Experiment 1.**  
Stimuli - 3 achromatic, inducing character pairs W/M, 6/9, 곱/문  
Rotation angle - 0, 30, 60, 90, 120, 150, 180° in CW, CCW direction

100 msec presentation followed by a pattern mask until response

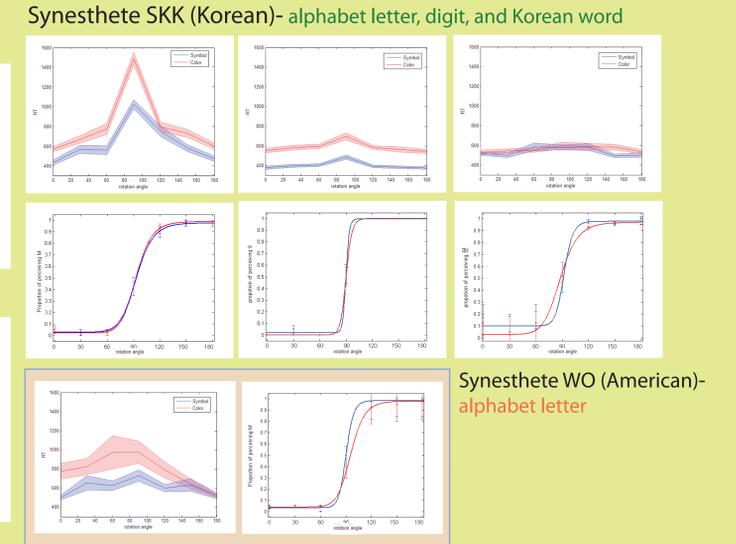
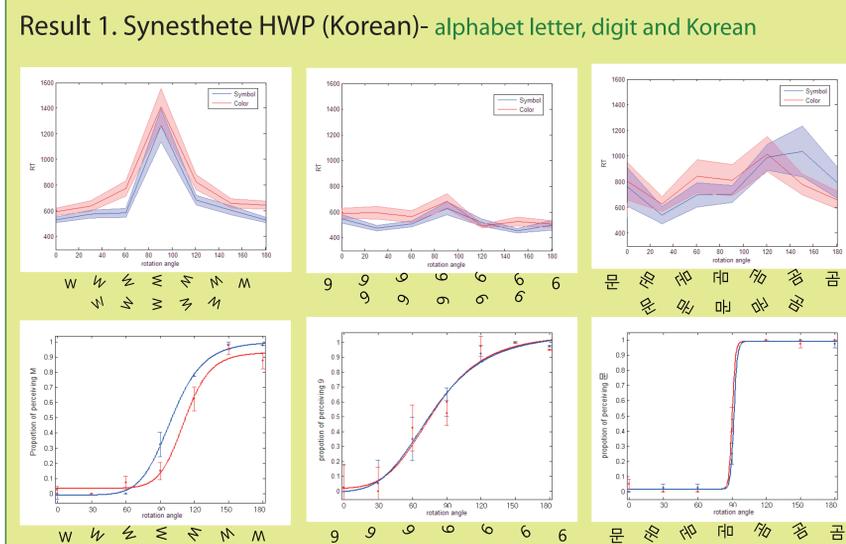
2 kinds of 2-AFC Tasks were separated in blocks  
- symbol task: 'W' or 'M' ?  
- synesthetic color task: 'purple' or 'green' ?

Some synesthete did not perform some of the tasks because of the individual difference in color perceiving

**Experiment 2.**  
Other aspects of the methods were similar to those reported for methods 1 except stimuli and instruction:

Stimuli - 4 achromatic, inducing character R, 2, Korean letter ㅏ [b], and Korean word ㅏ [bu:t]

2 kinds of 2-AFC tasks were separated in blocks  
- symbol task: 'R', or not perceived as letter?  
- synesthetic color task: 'red', or not perceived as color?



**Result 1.** For the most Korean synesthetes tested, the difference between grapheme recognition and synesthetic color judgement was the biggest when the stimulus was grapheme. However, there was no significant difference in RT between grapheme recognition and synesthetic color judgement when the stimuli were Korean grapheme/word.

**Result 2.** For the most Korea synesthetes tested method 1 & 2 yielded the same pattern of results.

## 2. Continuous presentation of rotating grapheme

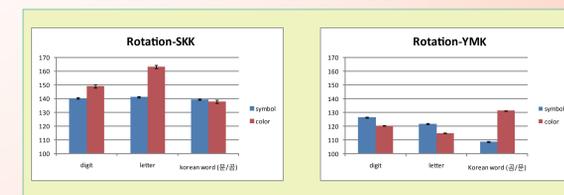
### Methods

Stimuli - 3 achromatic, inducing character pairs: W/M, 6/9, 곱/문

Task: press 'f' key at the point when the recognition changes while the stimuli is rotating from 0 to 180/ 15 to 195/ 30 to 210 degree in CW, CCW direction

- symbol task: when does 'W' change into 'M' ?  
- synesthetic color task: when does 'purple' change into 'green' ?

## Results



Synesthete SKK showed similar result as in the discrete presentation paradigm, however, overall differences in RT between grapheme recognition and synesthetic color judgement were decreased in case of other synesthetes. To measure the perceptual latency, discrete presentation paradigm seems better method than current paradigm.

References:  
 [1] Palmeri, T., J et al. (2002) PNAS 99, 6, 4127-4131  
 [2] Mattingley, J et al. (2001) Nature 410, 580-582.  
 [3] Rich, A. & Mattingley, J. (2005) Cognition 98, 53-84.  
 [4] Hong, S. & Blake. R (2008), Vision research 48, 8, 1018-1026

Supported by Korea Research Foundation (KRF-2009-332-H00011)