Mapping of combinations of spatial attributes to responses

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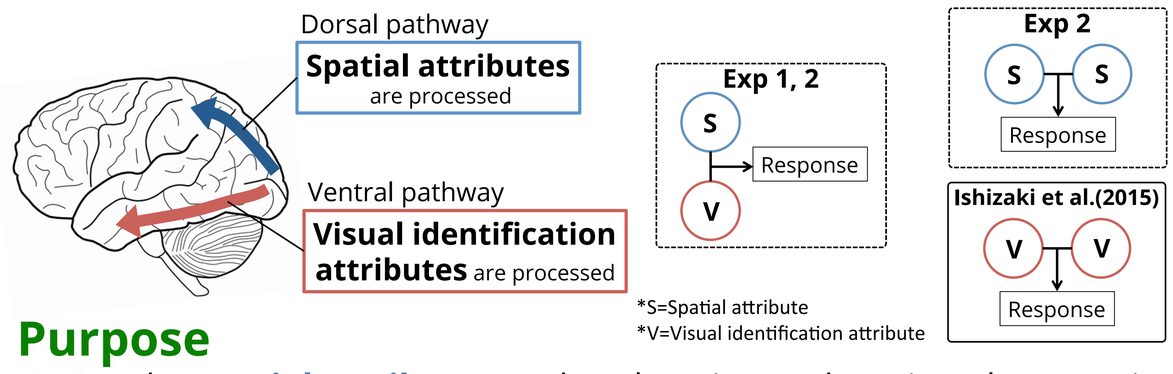
INTRODUCTION

In the human visual system, different attributes are processed separately. Then attributes of an object are integrated to elicit a response.
According to the **paired-attribute model** (Morita et al., 2010), these attributes are written to the object file in the form of multiple feature-pair representations.

The results of **stimulus-response mapping experiments** (Ishizaki et al., 2015) showed that a pair of features is directly associated with a response in contrast to a triplet of features represented by multiple feature-pairs which are associated with a response together. In these experiments **visual identification attributes** such as shape, color, and texture of objects defined the responses.



Purpose

(1) Are the **spatial attributes** such as location and motion also associated with a response by forming feature-pairs?

(2) Are there any differences between spatial attributes and visual identification attributes in the manner of associating feature-pairs to responses?

METHOD

Participants learn the mapping of eight stimulus items to four response keys.

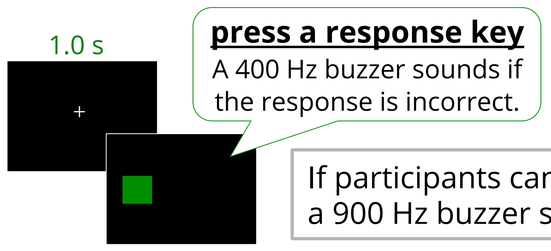
Stimulus

Eight types of items, made by combining one of two values of three attributes.

Response keys

Four keys arranged in vertical on the numeric keypad

Procedure



If participants cannot respond to the target within the time limit, a 900 Hz buzzer sounds and the next trial start.

Design

14 learning blocks with time limit
2 test blocks without time limit
■1 block comprises 80 trials

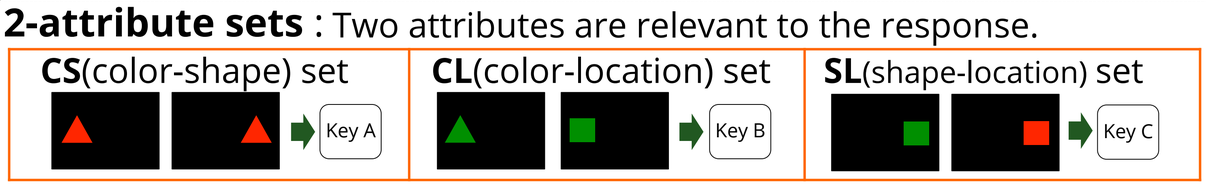
Participants

28 students aged 18-28 (Exp 1) and 29 students aged 18-24 (Exp 2) with normal or corrected vision.

Mapping between stimuli and responses

Exp 1: Color, Shape and Location

2-attribute sets : Two attributes are relevant to the response.

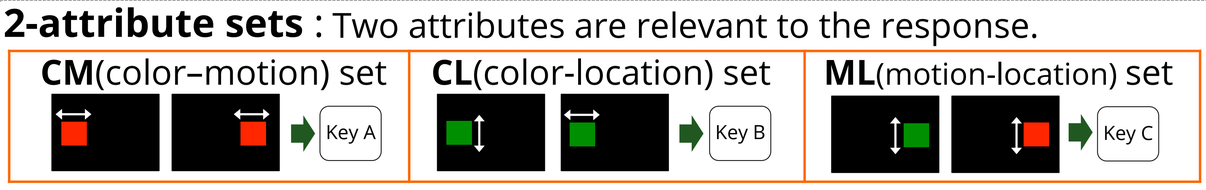


3-attribute set: All attributes are relevant to the response.

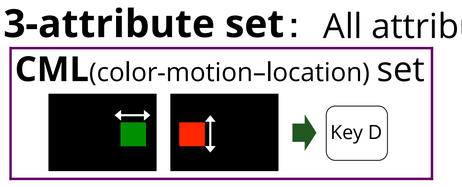
We presented the results of Exp 1 at APCV2015.

Exp 2: Color, Location and Motion

2-attribute sets : Two attributes are relevant to the response.



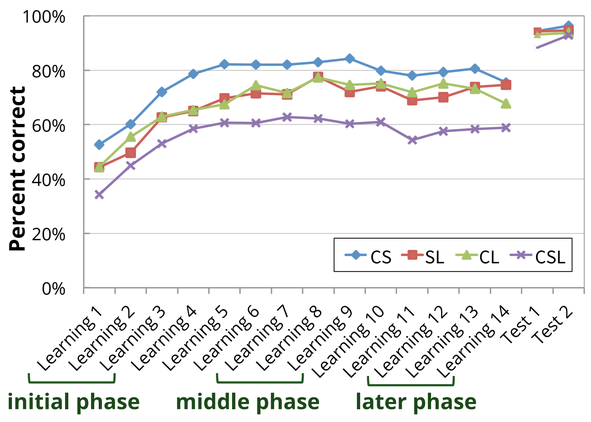
3-attribute set: All attributes are relevant to the response.

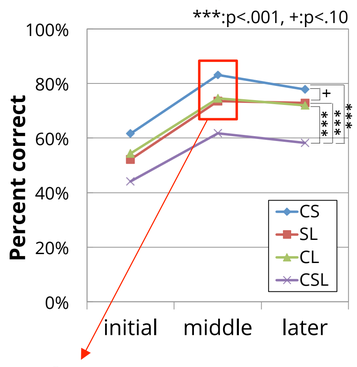


RESULTS & DISCUSSION

■Percent correct versus block number

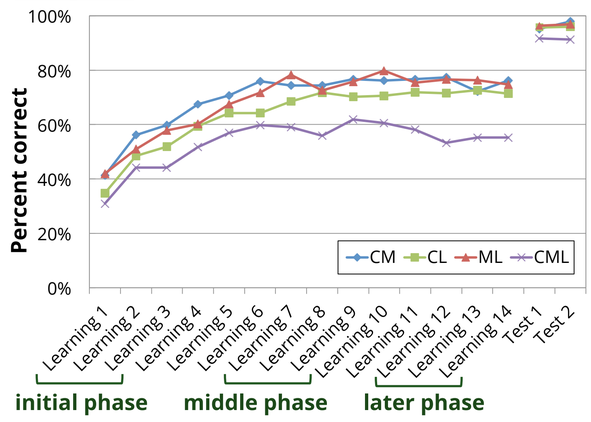
Exp 1

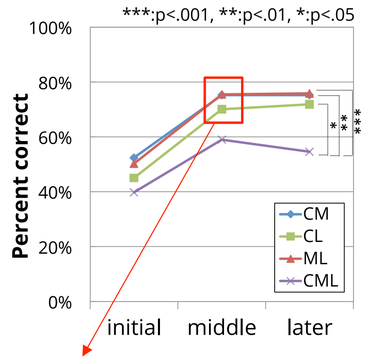




・**CL and SL sets are more difficult** to learn than **CS** set (p<0.05 in each case).

Exp 2





・**No significant difference** among **CM**, **CL**, and **ML** sets.

→ It is **difficult** for an attribute-pair **including a spatial attribute** to be associated with a response.

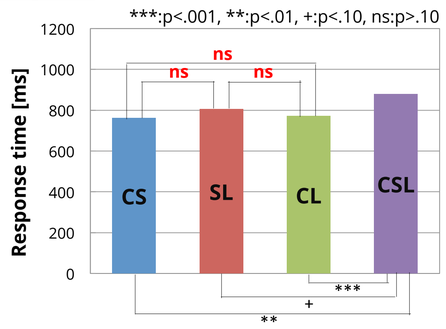
・Two-attribute items are easier than the three-attribute items to map to the responses when spatial attributes are included.

→ The association of **CM**, **CL**, or **ML** attribute-pair with the response is stored as the connection between **a single feature-pair and a response**.

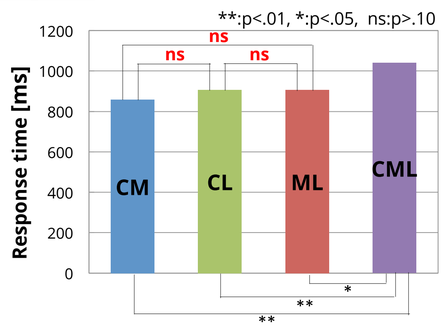
The mapping between **CML** attribute-triplet and the response is stored as the connection between **two or more feature-pairs with a response**.

■RT (Test blocks)

Exp 1



Exp 2



・**No significant difference** in the RT among the 2-attribute sets.

・Responses to the three attributes sets take longer time than that to the two attributes sets.

CONCLUSION

■Spatial attributes are also associated with a response by forming feature-pairs.

■However, it is difficult to form an association when spatial attributes are included.

The processing pathways of the cerebral cortex is considered to affect the forming of the association.

Why?

■**We pay little attention to spatial attributes** when we memorize and remember the appropriate reaction to an object.

■**Representation of spatial attributes in memory does not have enough discriminability** to associate different locations or motions with different responses.