The Role of Memory Colour in Visual Attention

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Abstract

In the memory colour effect (MCE), the expected colour of an object influences how it is perceived. For example, a banana in a greyscale photo may appear tinted yellow because bananas are expected to be yellow. To date, most evidence for the effect is based on subjective reports which are vulnerable to participant and researcher expectations. As such, there is some debate about whether the effect is real. In this study, I examine the memory colour effect using an indirect change detection method that does not rely on subjective report. To do so, I designed a series of change detection tasks where one object out of several repeatedly appears and disappears as two images alternate. Participants need to report which object is appearing and disappearing, a response that is known to require attention to the changing object. The target object may have a memory colour (e.g., a banana) in which case, it has its expected colour (yellow) on some trials or an unnatural colour on others (blue). There are also control trials with objects that may have any colour, like hats or mugs. I measure each participant's speed and accuracy at detecting the changing object. I predict that unnaturally coloured memory colour objects will, because of their unexpected colour, attract attention more quickly, resulting in greater speed and accuracy. The study is ongoing at this time.

Introduction

Background

- Memory colour: the colour that an object is known/expected to have
- Some objects have a memory colour (e.g., bananas are yellow) but not all objects (e.g., mugs can be any colour)
- Memory colour effect (MCE) occurs when memory colour affects colour perception
  - Grey photo of a banana looks tinged yellow, pale red heart looks more saturated (Figure 1)
- Theorized to help in recognizing objects in diverse scenes and lighting conditions (Gegenfurtner & Rieger, 2000; Granzier & Gegenfurtner, 2012)
- Theorized to be a top-down effect of cognition on perception (Valenti & Firestone, 2019)
  - High-level process (colour knowledge) affects low-level process (sensory perception)
- Most evidence for MCE is based on subjective report methods - report what colour you see (e.g. Hansen et al., 2006)
  - Vulnerable to bias

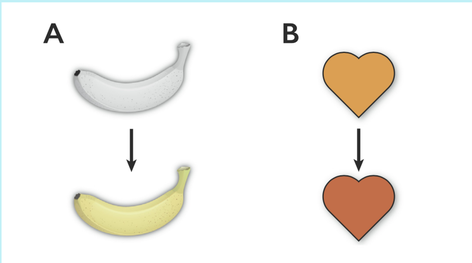


Figure 1: Exaggerated memory colour effects
(Valenti & Firestone, 2019)

Present study

- Goal 1: provide evidence for MCE that does not rely on subjective report
- Goal 2: provide evidence that memory colour affects perception near the sensory level (top-down processing)
- Using a change detection task to assess how memory colour affects sensitivity to changes
  - Participants do not report the perceived colour
  - If colour does have an effect, it is pre-attentive because it speeds the arrival at the changing target
- Hypothesis: speed and accuracy in the change detection task will be greater for objects that have a memory colour when presented in unnatural colours

Method

Flicker paradigm

- Well-established change detection task
- Two images alternate back and forth rapidly
- Images are identical except for 1 object which is present in one panel and absent in the other - other objects remain in place
- Participant must find the appearing and disappearing object as quickly as possible

Panels

- 28 objects on a panel
- Half have a memory colour, half of which are presented in their expected colour, half in an unnatural colour
- Half do not have a memory colour (controls), and are presented in colours matching the memory colour objects

Trials

- 10 of each condition, 40 total

Participants

- 30 Glendon Psychology undergraduate students

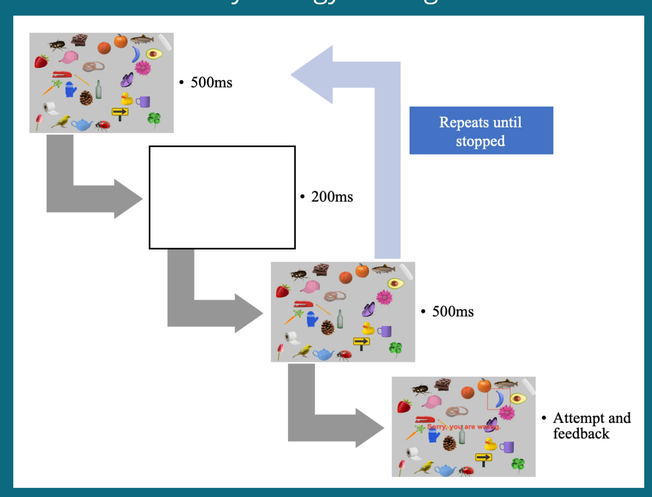
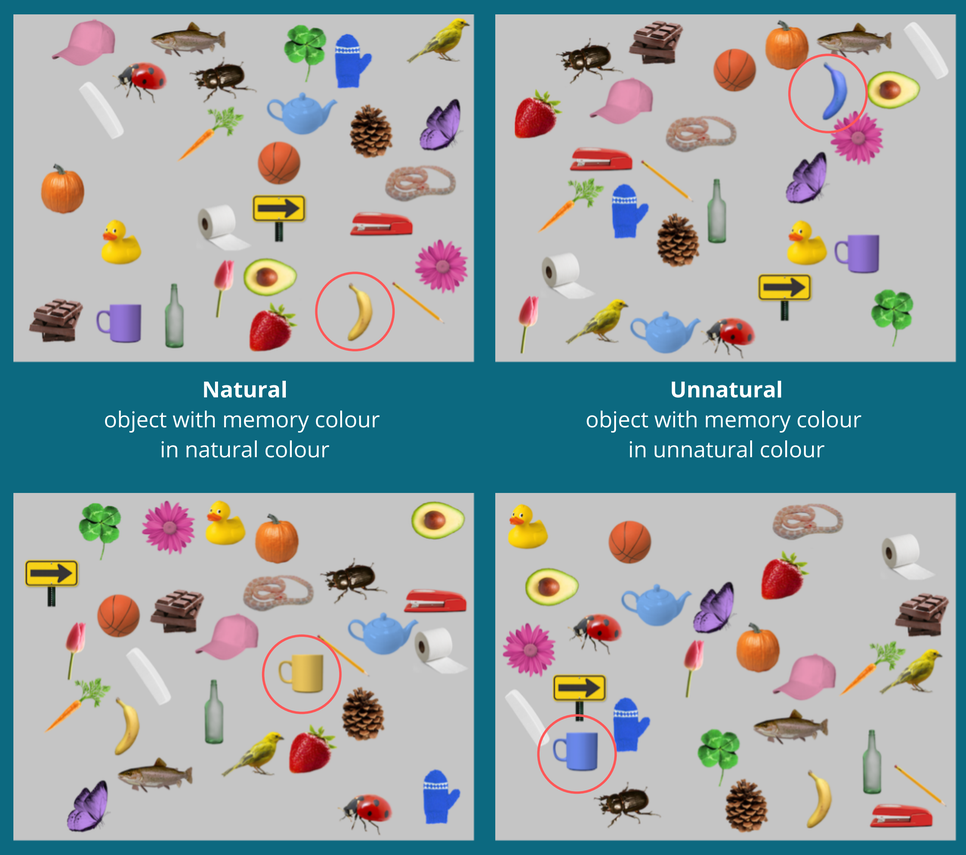


Figure 2: Diagram of how a trial in the task proceeds

Conditions



Natural
object with memory colour in natural colour

Unnatural
object with memory colour in unnatural colour

Matched Natural
object without memory colour in matched natural colour

Matched Unnatural
object without memory colour in matched unnatural colour

Figure 3: The four experimental conditions. The target object in each condition is circled.

Predictions

- Greater speed in detecting change in the **unnatural** memory colour condition
- Greater accuracy in detecting change in the **unnatural** memory colour condition
- No difference among the other conditions

The study is ongoing

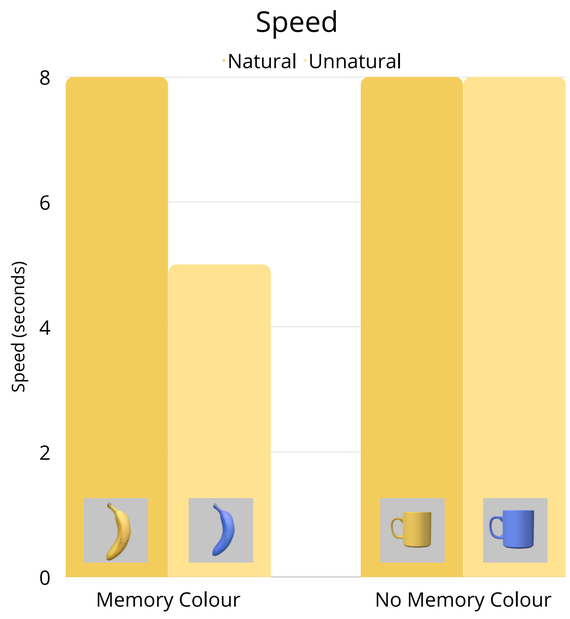


Figure 4: Expected results for speed

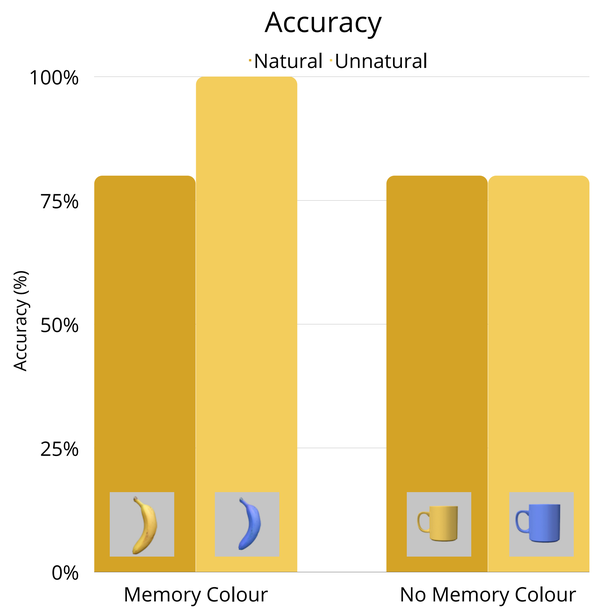


Figure 5: Expected results for accuracy

Discussion

- Greater speed and accuracy for unnaturally coloured objects that have a memory colour, indicating that memory colour has an effect on visual attention before the object reaches conscious awareness
  - Therefore colour knowledge (high level) affects sensory perception (low level) in a top-down process
- Effect is demonstrated without subjective report of colour perception

Acknowledgements

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