Background:

Is what we see just reflection of what's out there?
No! Visual perception is a process of inference.
Can visual perception be influenced by memory?

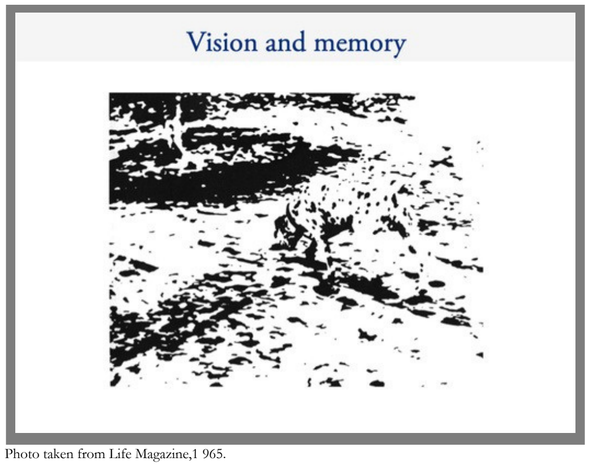


Photo taken from Life Magazine,1 965.

Hypothesis:

Perceptual decision-makingisin fluenced by the contents of workingmemory.

Approach:

* Subjects were asked to decide the color of an image by comparing itto the color of two images held in memory.
* Using methods from psychophysics, I tested if their decisions vary as a function of the similarity of the images held in memory.

Prediction:

Decisions about what is being seen becomes worse when the images in memory are more similar.

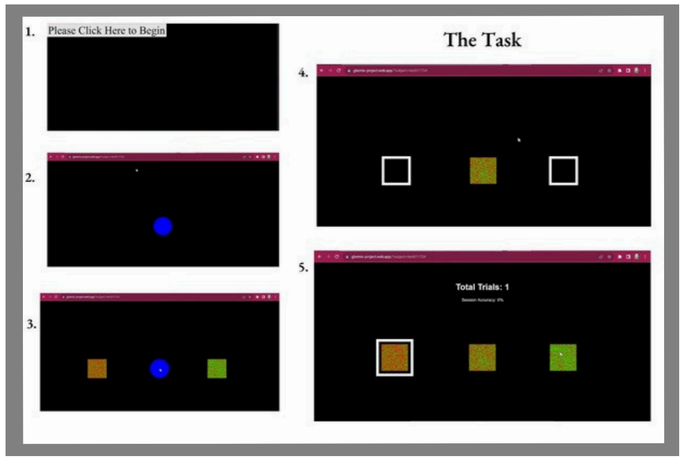
Glossary:

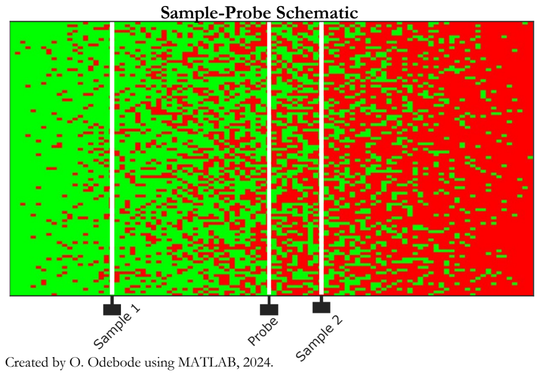
Samples: the first two red/green pixel images shown.
ΔS: the difference in percent redness between the two samples.
Probe: the third red/green pixel image.
Probe location: the distance of the probe redness from the average redness of the samples (positive values imply probeis closer to the sample with more red pixels).

Procedure:

* An example of the task presented to subjects on a web-based browser.

Images of Javascript program taken by O. Odebode, 2024.

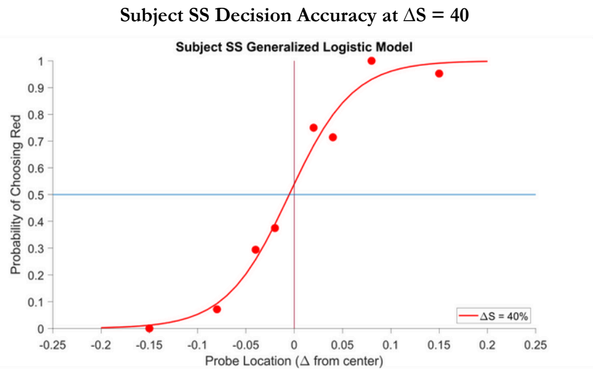




Created by O. Odebode using MATLAB, 2024.

* An example of the relationship between Sample 1 (S1), Sample 2 (S2), and the probe, where ΔS = 40%.
* Sample 1 has 20% red pixels, sample 2 has 60 % red pixels, and the probe has 50% red pixels.
* The probe location is +10% (distance from the midpoint of S1 and S2).

* I collected data from 29 subjects.
* An example subject's (SS) choice function for ΔS = 40 is shown here.
* The subject's choices are fit with a logistic regression model (a type of generalized linear model - GLM).



Created by O. Odebode using MATLAB, 2024.

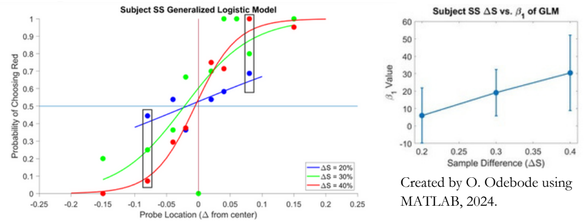
$$p(red) = (1 + e^{-(\beta_0 + \beta_1 * P_r)})^{-1}$$

* *p(red)*: probability of choosing the sample that is more red.
* β_0: bias towards red sample.
* β_1: sensitivity of the subject to the probe.
* P_r: redness of the probe.

Based on my hypothesis, I predict that sensitivity to the probe will increase as samples become more different
i.e
β_1 will increase as a function of ΔS.

Results:

Example Subject 1 (SS)



Created by O. Odebode using MATLAB, 2024.

* For same probe value, subjects made better decisions when samples were further apart (see boxes in the accuracy plot).
* In the GLM fits, β_1 increased in relation to ΔS in conformance with my hypothesis.

Example Subject 2 (KW)

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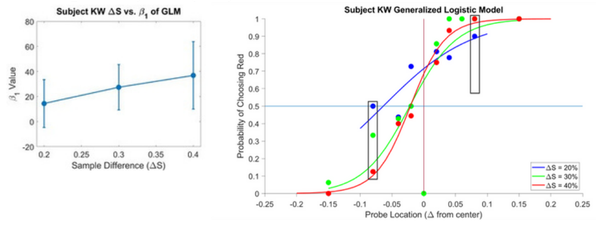

* The relation between between β_1 and ΔS was not always linear across subjects.
* This example subject showed a bias towards choosing red, decreasing decision accuracy.

Results Across All Subjects

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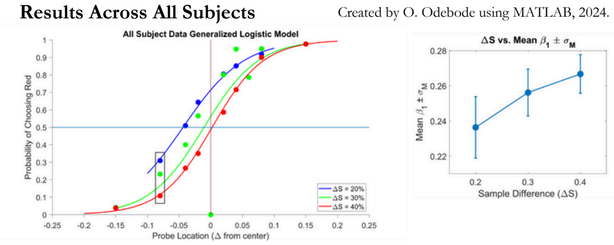

* The average β_1 across all subjects increased as a function of ΔS as hypothesized.
* But the trend did not meet the criteria for statistical significance (p = 0.17, repeated measures ANOVA).

Conclusion:

* The accuracy of perceptual decisions was influenced by contents ofm emory, but the trend was not statistically significant.
* Quality of data varied across individual likely masking the underlying trend.