

# THE INFLUENCE OF SCENE CONTEXT ON PARAFOVEAL PROCESSING OF OBJECTS

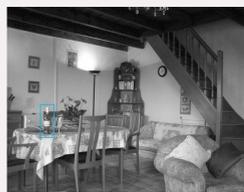
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## BACKGROUND

- Previous research has shown that visual information can be obtained from a parafoveal preview before an object is directly fixated (Henderson, 1992; Rayner, 1975).
- Studies on reading have shown that contextual constraints (such as the predictability of a word) lead to an increase in the information acquired from the parafovea (Balota, Rayner & Pollatsek, 1985; McClelland & O'Regan, 1981).
- Many contextual effects have been found during general object processing; for instance, object recognition is impaired when the object is incongruent with the context (Biederman, Mezzanotte & Rabinowitz, 1982; Davenport & Potter, 2004; Hollingworth & Henderson, 1998; Oliva & Torralba, 2007).
- In the present study, we explored whether scene context can constrain parafoveal processing and whether context modulates parafoveal processing of objects depending on information available.

## GENERAL METHODS

- Participants performed a target verification task:
  - After the scene was presented for 500ms, a red dot located 4° away from the target would onset. Participants were instructed to fixate on the dot once it appeared.
  - Once participants had fixated on the dot, the parafoveal preview would appear.
  - Once a saccade towards the parafoveal preview area was made, the preview would change to the target object.
- Eye movements were tracked using an EyeLink 2000 Eyetracker (SR Research) at a sampling rate of 2000Hz.
- Stimuli consisted of black & white photographs at an 800 x 600 pixel resolution, subtending an angle of 38.1° x 28.6°.
- The scene context was manipulated across two conditions:

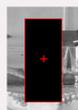


Consistent Scene



Inconsistent Scene

- The parafoveal preview was manipulated across four conditions:



Control



Different Category Different Shape



Different Category Similar Shape



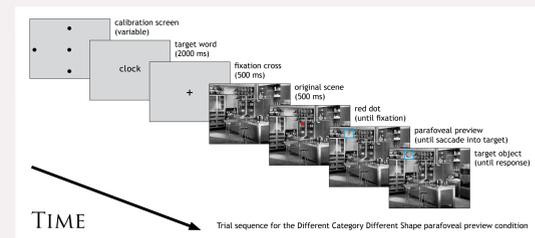
Target

## EXPERIMENT 1

DOES SCENE CONTEXT CONSTRAIN PARAFOVEAL PROCESSING OF OBJECTS?

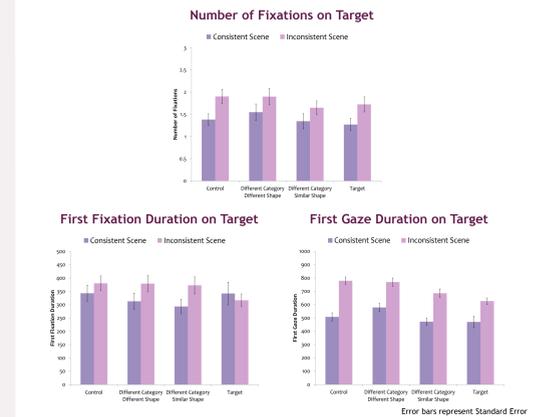
### METHODS

- 40 Queen's University undergraduates, with normal or corrected-to-normal vision.



### RESULTS

- Average accuracy across all conditions was 92%.



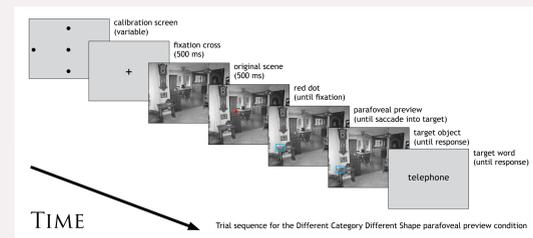
- No differences between scene context conditions were found in first fixation duration; however, participants had shorter first gaze duration when consistent scenes were presented.
- The pattern of results suggests that contextual scene information affects parafoveal object processing primarily during later stages of processing.
- Changing parafoveal preview information did not lead to a difference in object processing, suggesting that context affects processing equally regardless of target category and shape information.
- These findings indicate, as was found in reading studies, that scene context may act to constrain processing of object information when viewed in the parafovea.

## EXPERIMENT 2

DOES DEPENDENCE ON SCENE CONTEXT INCREASE WHEN THE TARGET IDENTITY IS UNCERTAIN?

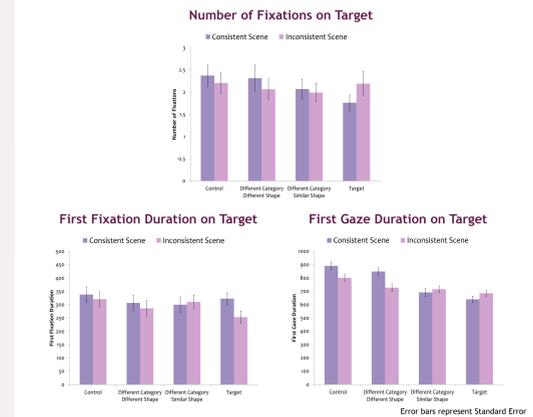
### METHODS

- 40 Queen's University undergraduates, with normal or corrected-to-normal vision. None participated in the other experiment.



### RESULTS

- Average accuracy across all conditions was 92%.



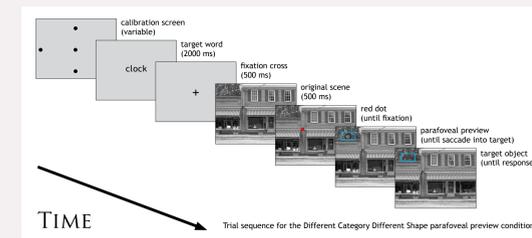
- No context effects were found when the target word was presented after the trial, suggesting less influence of context when the target identity was uncertain.
- When comparing Experiments 1 & 2, no differences were detected in first fixation duration; however, slower processing times (i.e., fixation count and first gaze duration) were found when the target was unknown prior to fixation, suggesting that prior knowledge of the target benefits later processing stages.
- These findings lend further support to an interaction between scene context and target information in parafoveal object processing, such that contextual information is more useful when the target is previously specified.

## EXPERIMENT 3

DOES THE BENEFIT OF SCENE CONTEXT DEPEND ON THE LOCATION OF THE TARGET?

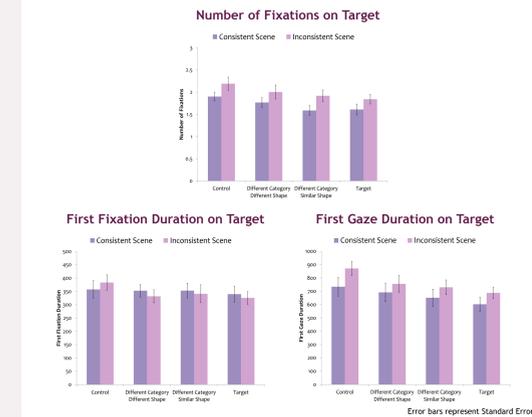
### METHODS

- 32 Queen's University undergraduates, with normal or corrected-to-normal vision. None participated in the other experiments.



### RESULTS

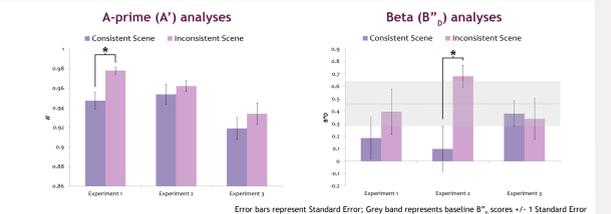
- Average accuracy across all conditions was 87%.



- No contextual effects were detected, indicating that scene context does not benefit processing for inconsistent target locations.
- When comparing Experiments 1 & 3, target location benefits were found in first gaze duration but not first fixation duration, supporting prior findings for late processing effects.
- No parafoveal preview differences were found when the target was moved to an inconsistent location.
- The results suggest that late object processing savings prior to fixation were primarily gained from congruent target location pairings, indicating that scene context is only beneficial when the object is found at an expected location.

## FURTHER ANALYSIS

DO CONSISTENT SCENES INCREASE THE PREDICTABILITY OF OBJECTS BY INCREASING "GUESSING"?



- A' analyses showed that discrimination performance across all experiments was high for consistent and inconsistent scenes.
- When compared to baseline scores (i.e., no scene context), B'p analyses indicated that contextual information appears to change response biases by causing a shift towards "yes" responses when there was uncertainty in target information.

## CONCLUSIONS

- Our findings suggest that scene context constrains parafoveal object processing when the target identity is both prespecified and located in an expected place within the scene.
- Similar to effects found in reading, when the target object is unknown, scene context does not lead to an increase in information extracted from the parafovea.
- Target uncertainty also results in more liberal responses suggesting that congruent context-target pairings play a large role in parafoveal object processing savings.
- Scene context affects late object recognition processing mechanisms suggesting that rather than affecting early extraction and parsing of object information, scene context seems to be having an effect at more conceptual levels of processing (Castelhano & Henderson, 2008; Hollingworth & Henderson, 1998).
- Our results also suggest that differences in the level of information available in the parafovea (e.g., object shape and category) does not modulate the influence of scene context on object processing.

## REFERENCES

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