Age-related effects on selective processing of horizontal structure in a whole-face context

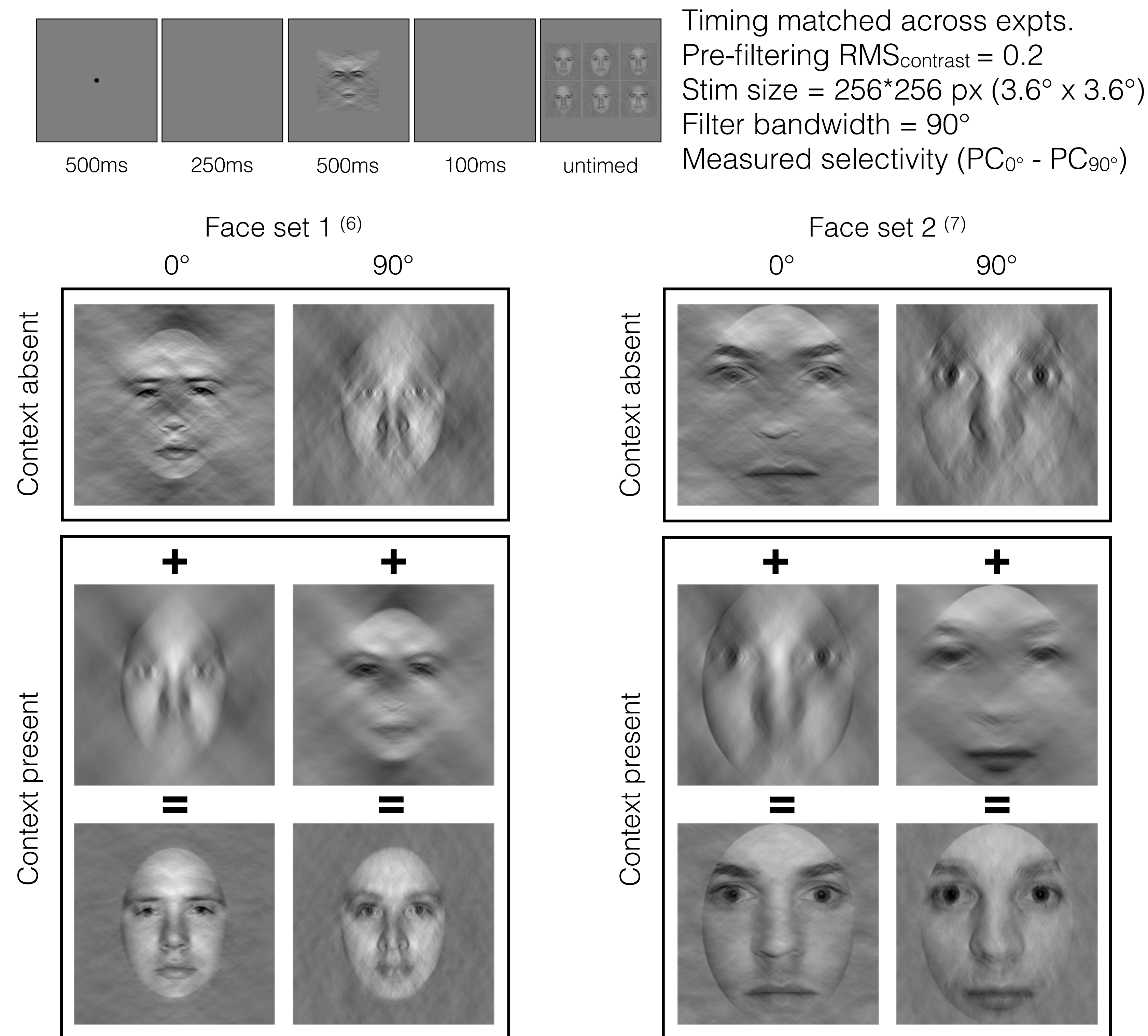Allison B. Sekuler, Matthew V. Pachai, Sarah E. Creighton, & Patrick J. Bennett

Department of Psychology, Neuroscience & Behaviour, McMaster University, Hamilton, Ontario, Canada

Introduction

- Younger observers use horizontal structure in the eyes to identify faces[1,2] and the extent to which they do so is correlated with overall identification performance and the face inversion effect[3].

- Older observers show poorer discrimination of horizontally filtered faces than younger controls when the target band is specified precisely[4,5].

- Here, we examined horizontal selectivity in younger and older observers under more ecologically valid conditions using: multiple face sets, intact faces, and stimuli from different viewpoints (i.e.)

Methods

Timing matched across expts.
Pre-filtering $RMS_{contrast} = 0.2$
Stim size = 256*256 px (3.6° x 3.6°)
Filter bandwidth = 90°
Measured selectivity ($PC_{0°} - PC_{90°}$)

500ms   250ms   500ms   100ms   untimed

Creation of *context absent* and *context present* stimuli in the 0° and 90° conditions. Sample identities from face set 1 and the *same viewpoint* condition of set 2 shown.
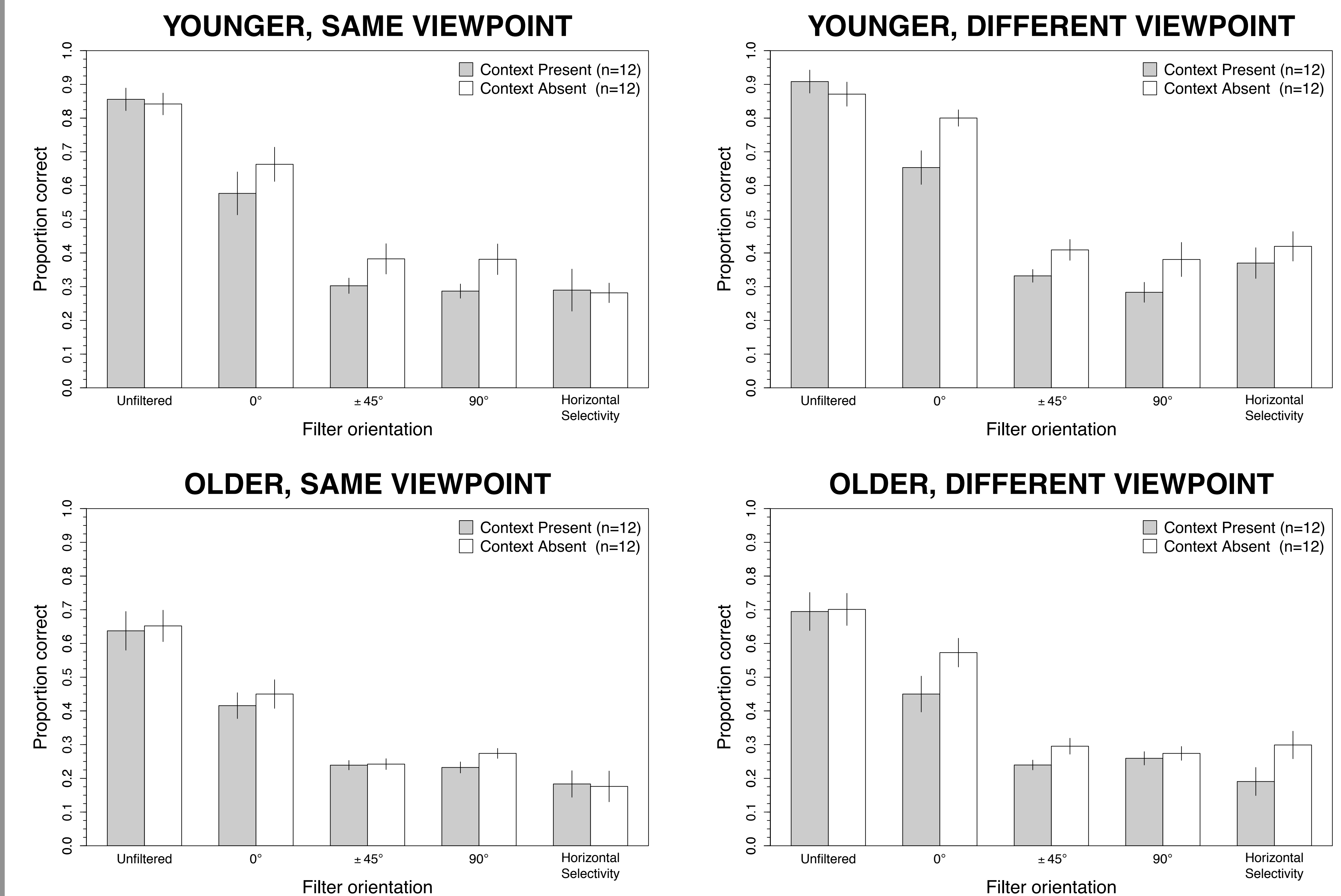
Results

Experiment 1 (Face Set 1)
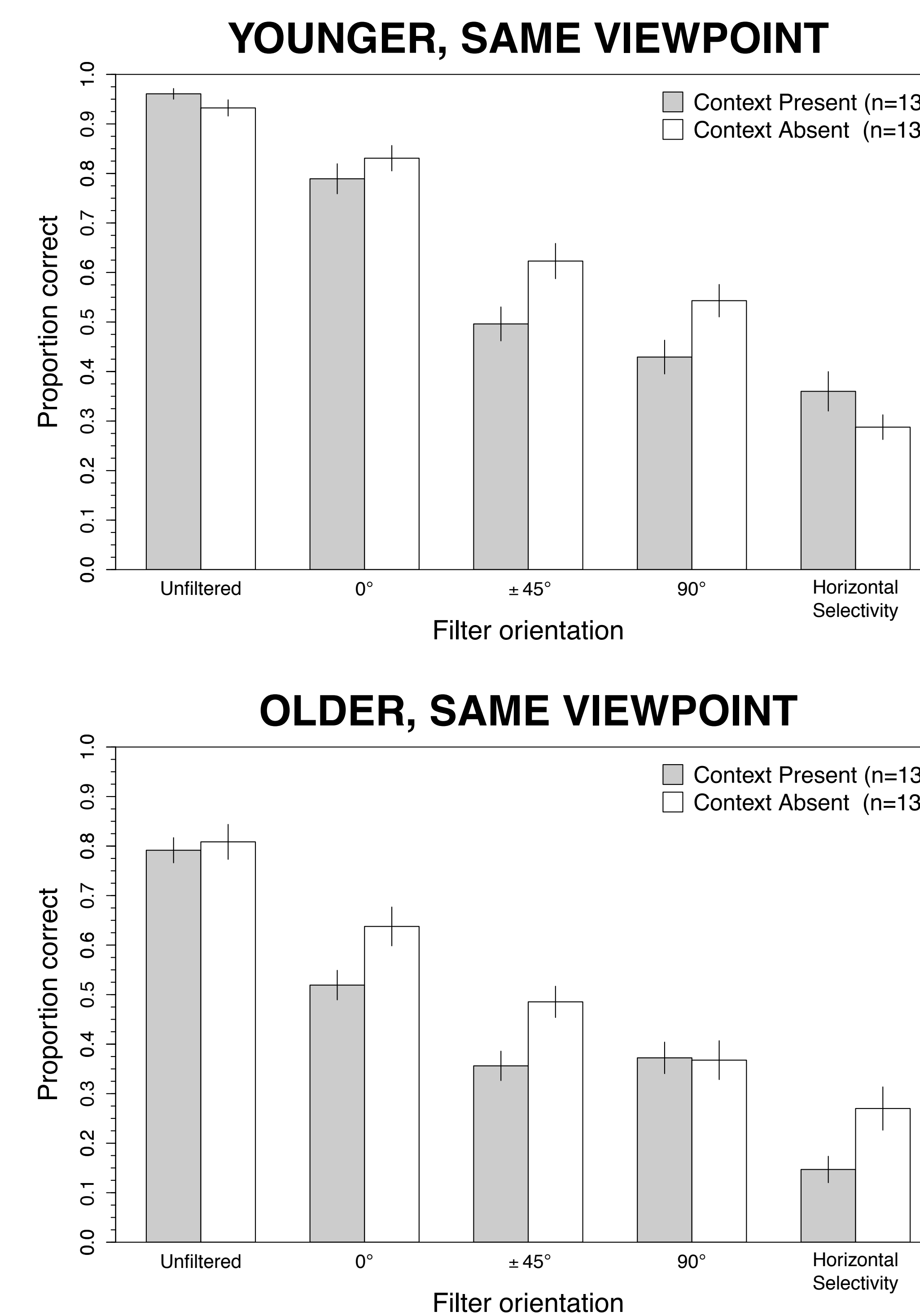
2 (age) X 2 (context) between-subjects ANOVA on horizontal selectivity scores

Age: $F_{(1,48)} = 11.08$, p = 0.0017
Context: $F_{(1,48)} = 0.54$, p = 0.4676
Age X Context: $F_{(1,48)} = 7.94$, p = 0.007

Experiment 2 (Face Set 2)

2 (age) X 2 (context) X 2 (viewpoint) mixed ANOVA on horizontal selectivity scores

Age: $F_{(1,44)} = 11.09$, p = 0.0018   Age X Context: $F_{(1,44)} = 0.15$, p = 0.7003
Context: $F_{(1,44)} = 0.86$, p = 0.3591   Age X Viewpoint: $F_{(1,44)} = 0.99$, p = 0.3241
View: $F_{(1,44)} = 15.61$, p = 0.0003   Context X Viewpoint: $F_{(1,44)} = 3.87$, p = 0.0556
Age X Context X Viewpoint: $F_{(1,44)} = 0.43$, p = 0.5147

Conclusions

- Across all manipulations, older observers perform worse and show less selectivity; may use relevant identity information less efficiently. (also see poster 56.535)

- Context effect depends on face set. Set 1: context reduces selectivity for older; enhances for younger. Set 2: no context effect for same viewpoint; context reduces selectivity with different viewpoint.

- Currently exploring interactions of these effects with filter bandwidth and presentation duration (see poster 33.563)

References

1. Pachai, M.V., Sekuler, A.B., & Bennett, P.J. (2013). Masking of individual facial features reveals the use of horizontal structure in the eyes. *Poster presented at VSS.*
2. Goffaux, V., & Dakin, S.C. (2010). Horizontal information drives the behavioral signatures of face processing. *Front Psychol*
3. Pachai, M.V., Sekuler, A.B., & Bennett, P.J. (2013). Sensitivity to information conveyed by horizontal contours is correlated with face identification accuracy. *Front Psychol.*
4. Obermeyer, S., Kolling, T., Schaich, A., & Knopf, M. (2012). Differences between old and young adults' ability to recognize human faces underlie processing of horizontal information. *Frontiers in Aging Neuroscience.*
5. Yu, D., & Chung, S.T.L. (2011). Critical orientation for face identification in central vision loss. *Optometry and Vision Science.*
6. Gold, J.M., Bennett, P.J., & Sekuler, A.B. (1999). Identification of band-pass filtered letters and faces by human and ideal observers. *Vision Research.*
7. Gaspar, C.M., Sekuler, A.B., & Bennett, P.J. (2008). Spatial frequency tuning of upright and inverted face identification. *Vision Research.*