Looking back: Individual regression rates during reading covary with returns during scene viewing

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Returns and regressions

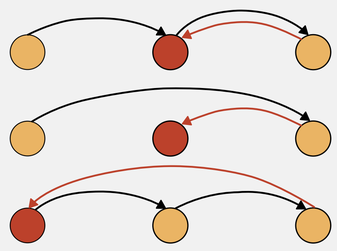
- **Returns:** saccades back to a previously fixated object in scene viewing
- **Regressions:** leftward saccades in reading (left-to-right scripts)
- There are **stable individual differences** in the frequency of returns (e.g., *Linka & de Haas, 2026*) and regressions (e.g., *Staub, 2021*).

→ ***What drives these differences and do people with higher return rates also show higher regression rates?***

Immediate regressions are saccades back to the word fixated right before.

Skipped regressions are leftwards saccades to a word the reader did not fixate before.

Delayed regressions are saccades back to a previously read word, but not the last one.



Methods

Research questions:

Do return and regression frequencies covary? Do they correlate with individual differences in occulomotor dynamics, (dis-)inhibition and semantic salience (e.g. the tendency to fixate faces or more memorable image patches)?

Study 1 (N=121):

1. Free Viewing:
   - 200 OSIE images
   - 3 sec presentation time
2. Reading:
   - short sentences from a German children encyclopedia

Study 2 (N=85):

1. Free Viewing:
   - 200 OSIE images
   - 3 sec presentation time
2. Reading:
   - German scene descriptions of OSIE images
3. Anti saccade task

OSIE images (*Xu et al., 2014*):

Text stimuli (presented line by line):

Examples translated from German

Study 1:

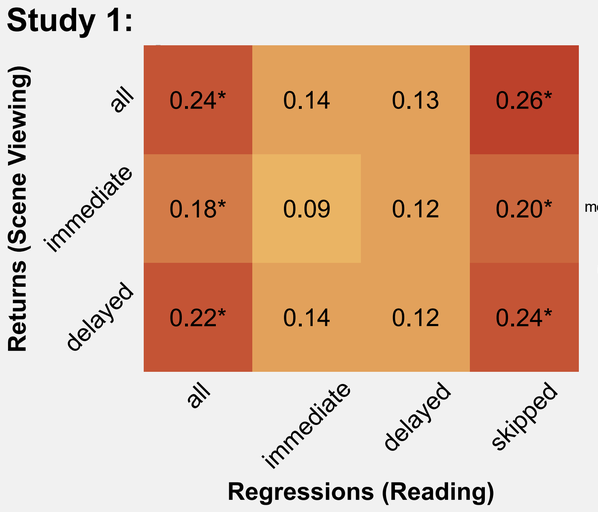
+ One of mankind's oldest tools was the hand axe.

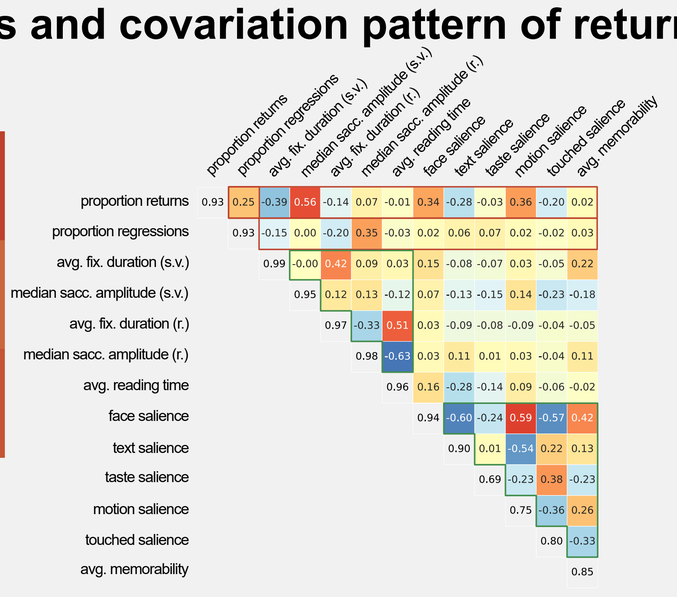
Study 2:

+ Two laughing children are standing in a living room.

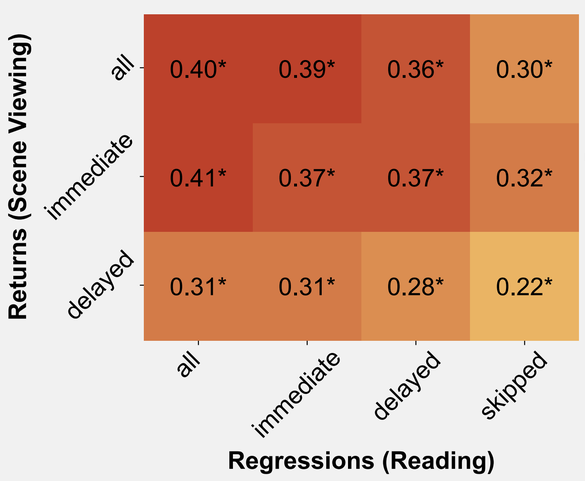
Stable individual differences and covariation pattern of returns and regressions

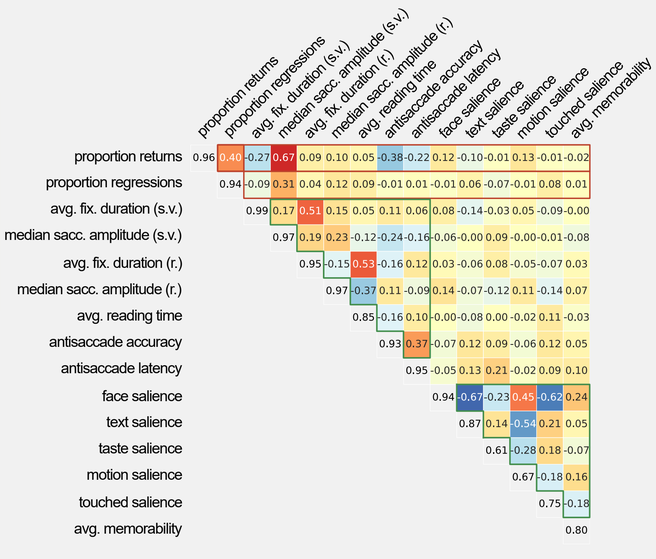
Study 1:





Study 2:



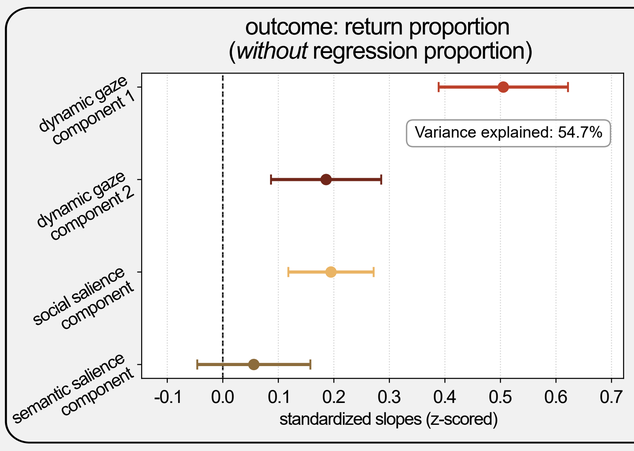


We find **stable individual differences in the proportion of returns and regressions** with a significant positive correlation between returns and regressions.

What does (and doesn't) drive individual differences in returns and regressions?

Step 1: fit Partial Least Squares regression model for occulomotor variables and semantic salience variables separately to reduce the number of predictors
Step 2: fit linear regression model using the extracted components as predictors

Study 1



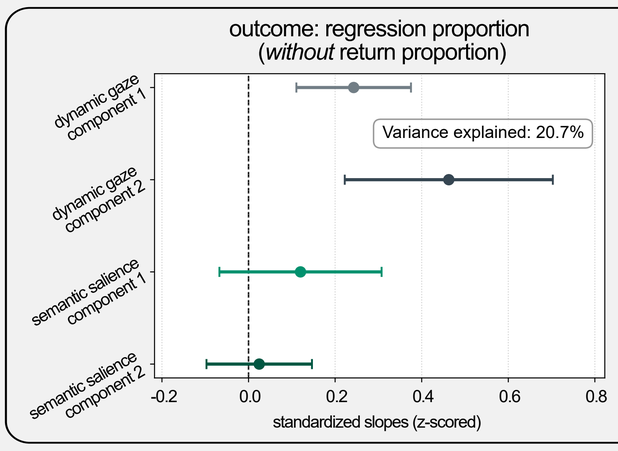
Predictor weights on components:

dynamic gaze component 1:
+ median sacc. amplitude scene viewing
- mean fixation duration scene viewing

dynamic gaze component 2:
+ mean reading time
+ mean fixation duration reading
+ median sacc. amplitude scene viewing
- median sacc. amplitude reading

social salience component:
+ face salience
+ motion salience
- text salience
- touched salience

Correlation residuals and regression proportion: r = 0.21, p < 0.05



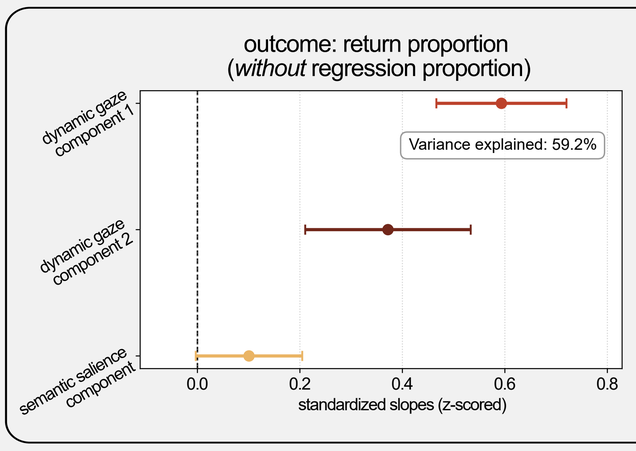
Predictor weights on components:

dynamic gaze component 1:
+ median sacc. amplitude reading
- mean fixation duration reading
- mean fixation duration scene viewing

dynamic gaze component 2:
+ mean reading time
+ mean fixation duration reading
+ median sacc. amplitude reading

Correlation residuals and return proportion: r = 0.19, p < 0.05

Study 2

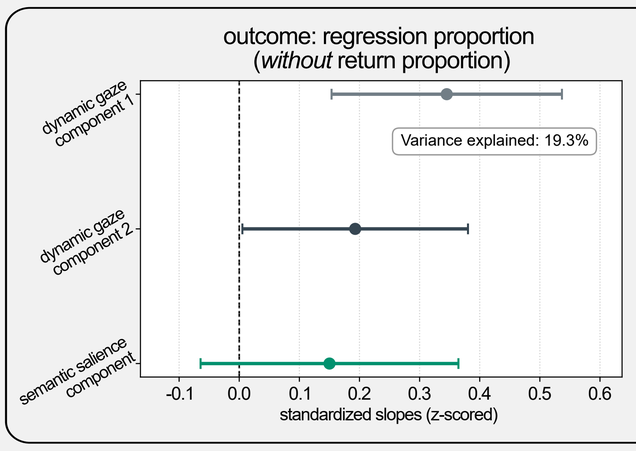


Predictor weights on components:

dynamic gaze component 1:
+ median sacc. amplitude scene viewing
- mean fixation duration scene viewing
- antisaccade accuracy
- antisaccade latency

dynamic gaze component 2:
+ antisaccade accuracy
+ antisaccade latency
- mean fixation duration scene viewing

Correlation residuals and regression proportion: r = 0.20, p > 0.05 (n.s.)



Predictor weights on components:

dynamic gaze component 1:
+ median sacc. amplitude reading
+ mean reading time
+ mean fixation duration reading

dynamic gaze component 2:
+ antisaccade accuracy
+ antisaccade latency
- mean fixation duration scene viewing
- mean fixation duration reading

Correlation residuals and return proportion: r = 0.15, p > 0.05 (n.s.)

Dynamic gaze behavior (shorter fixation duration and larger saccade amplitudes) predicts return and regression rates. **Performance in the antisaccade task and social salience** (the tendency to fixate faces and motion) predict returns but not regressions.

Conclusion

- **stable individual differences** in the frequency of returns and regressions
- Participants with **more dynamic gaze behavior** show **higher return and regression rates.**
- Participants with **lower inhibition** (higher error rates in antisaccade task) show **higher return rates.**
- **Social salience predicts return** but not regression rates.
- Our predictors do not fully explain the shared variance between return and regression rates.

References

Linka, M., & de Haas, B. (2026). Detection, Inspection, Return: An Object-Based Classification and Metric of Fixations in Complex Scenes. Open Mind, 10, 47–65. https://doi.org/10.1162/OPMI.a.319

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