Examination of individual differences in eye movement dynamics during mouse-and gaze-foraging

Jérôme Tagu, Árni Kristjánsson

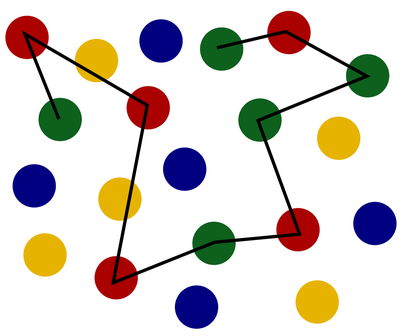
Examination of individual differences in eye movement dynamics during mouse- and gaze-foraging

Jérôme Tagu[1] and Árni Kristjánsson[1,2]

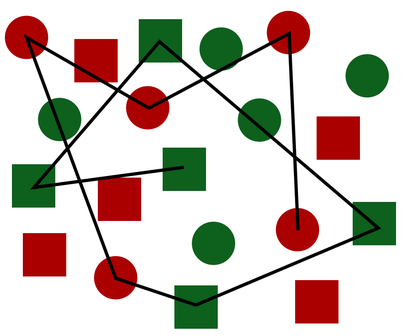
[1] Icelandic Vision Lab, School of Health Sciences, University of Iceland, Reykjavik, Iceland
[2] School of Psychology, National Research University HSE, Moscow, Russia

Introduction

During multi-target visual foraging, most observers change their strategy when target crypticity is increased (Kristjánsson et al., 2014):



7 runs: GRRRGRGGRG



2 runs: GGGGGRRRRR

Although this behavior is observed for most individuals, some of them - so called "super foragers" - continue to frequently switch between target types during conjunction foraging.

Two modes of visual exploration can be distinguished:

Ambient mode:	Focal mode:
Short fixation durations	Long fixation durations
Large saccade amplitudes	Small saccade amplitudes

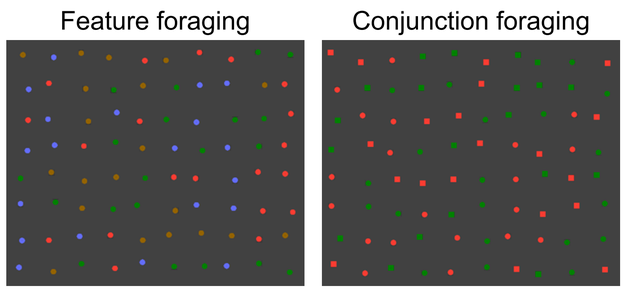
The exploration mode is assessed by calculating the K-coefficient (Krejtz et al., 2016) based on the z-scores of a given fixation duration (d_i) and of the subsequent saccade amplitude (a_{i+1}):

$$K = \frac{1}{n}\sum_{n} K_i \quad with \quad K_i = \frac{d_i - \mu_d}{\sigma_d} - \frac{a_{i+1} - \mu_a}{\sigma_a}$$

- Are the different foraging strategies associated with different eye movement dynamics?
- Do observers modify their strategy when foraging with eye gaze?
- Are individual differences in foraging reflected in oculomotor behavior?

Methods and Results

"Select all the targets in the display as fast as possible, without selecting any distractor"



Target types: ●● (Feature) & ●■ (Conjunction)

Two tasks: Mouse foraging & Gaze foraging

80 stimuli on screen (40 targets, 40 distractors)

Selected targets disappeared. Disctractor selection led to an error-message and renewal of the trial.

Stimuli equalized in size (0.5° diameter) and luminance (7 cd/m²).

Eye movement recordings during all tasks (EyeLink 1000 Plus, SR Research).

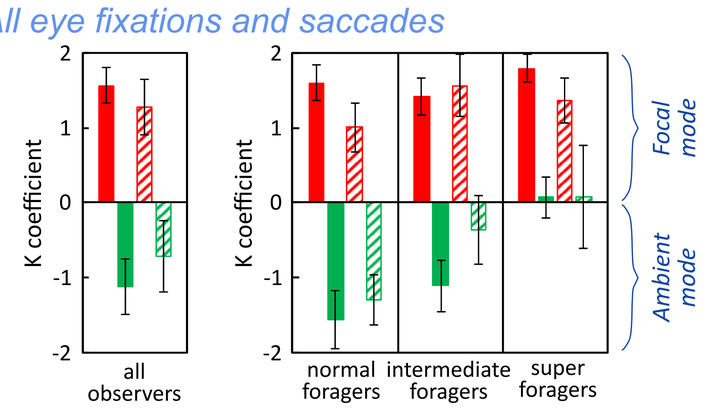
Average results (24 observers)

Behavioral data

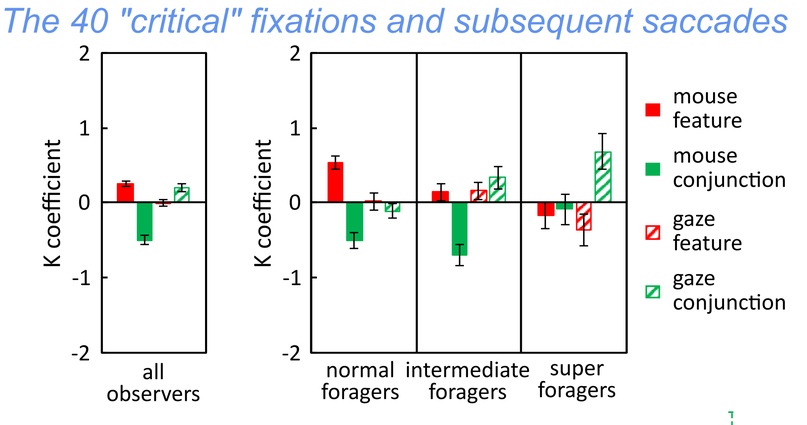
Eye movement data

Organization of the visual exploration

All eye fixations and saccades

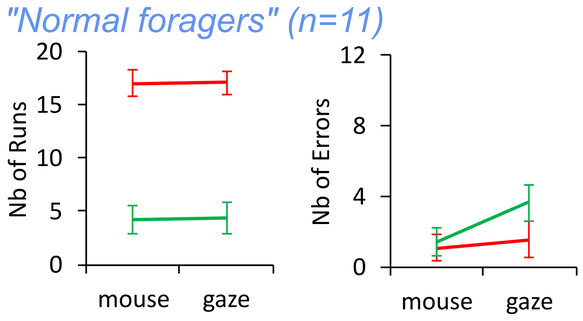


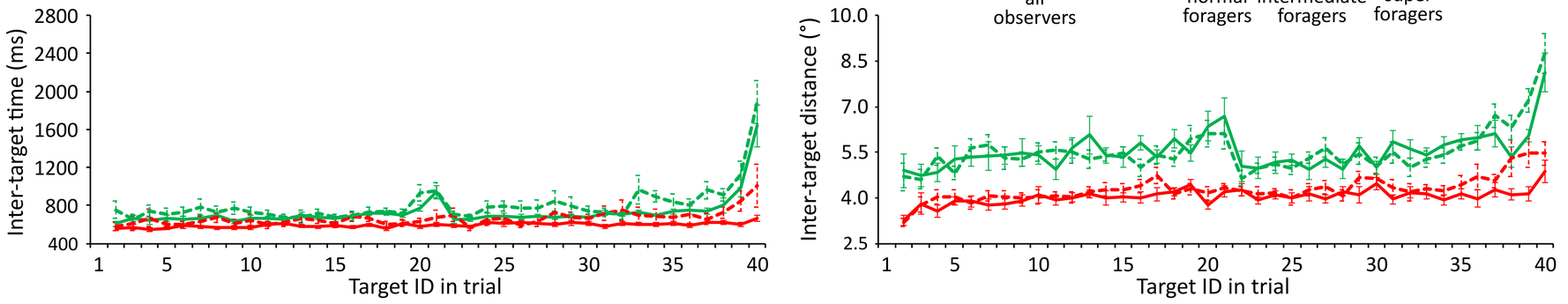
The 40 "critical" fixations and subsequent saccades



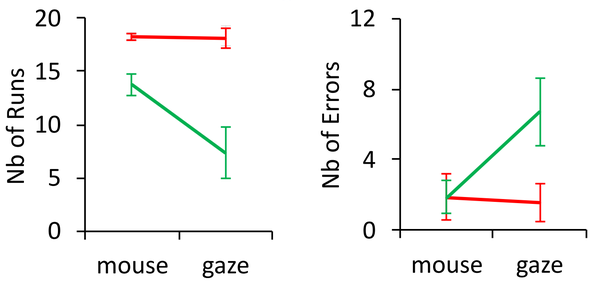
Number of Runs: 3 behaviors

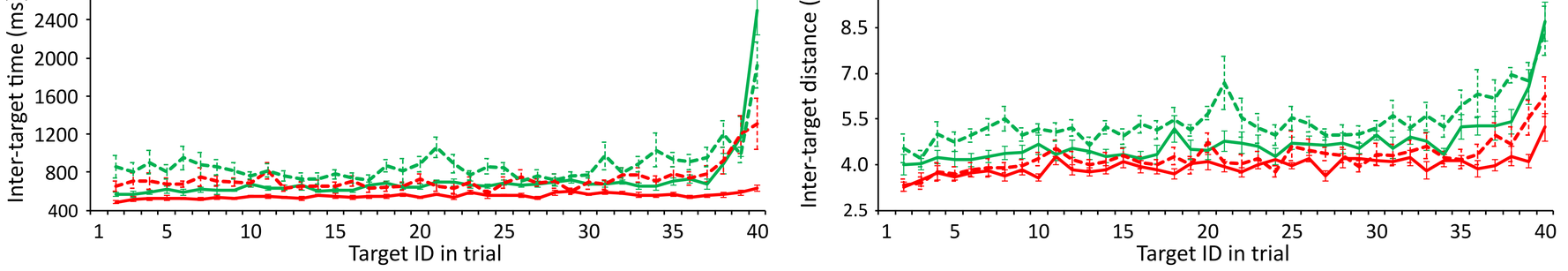
"Normal foragers" (n=11)



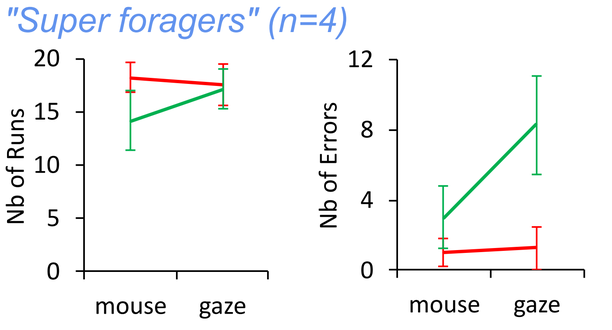


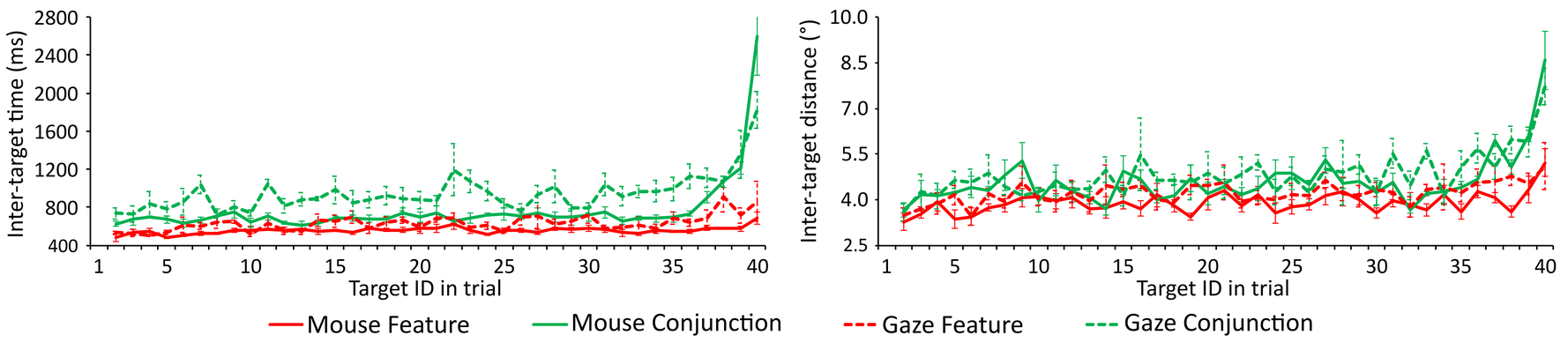
"Intermediate foragers" (n=9)





"Super foragers" (n=4)





Conclusions

- Humans adapt their foraging to target crypticity, both when foraging with a computer mouse and with eye gaze.
- Gaze foraging seems to be more demanding than mouse foraging (e.g., higher nb of errors, higher inter-target times).
- "Super foragers" may actually be "suboptimal foragers"
- Wihin-trial analyses during foraging tasks accurately capture the foraging strategy; analysis that cannot be performed in traditional single-target visual search tasks.

correspondence: tagu@hi.is

42nd European Conference on Visual Perception, Leuven, Belgium, 2019 August 25th-29th