



*Happy
Champions*



Eye tracking as a practical tool for performance enhancement

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Types of gaze behavior

- **Fixations** (> 60 ms; fixated on an object from the visual field); e.g., average duration of fixation and average number of fixations
- **Saccades** (and microsaccades more recently); e.g., average number of saccades
- **Tracking movements**
- **Blinks** (e.g., blinking duration is increased in concussed athletes)
- **Search rate** (i.e., number of fixations/duration of fixations)
- **Other: locations** of the fixation (where is the athlete looking?); **pupil dilation** (as an indicator of cognitive load)
- **Quiet Eye** (i.e., the last fixation before initiating a motor movement)



Volunteer needed

What do we know so far about Quiet Eye?

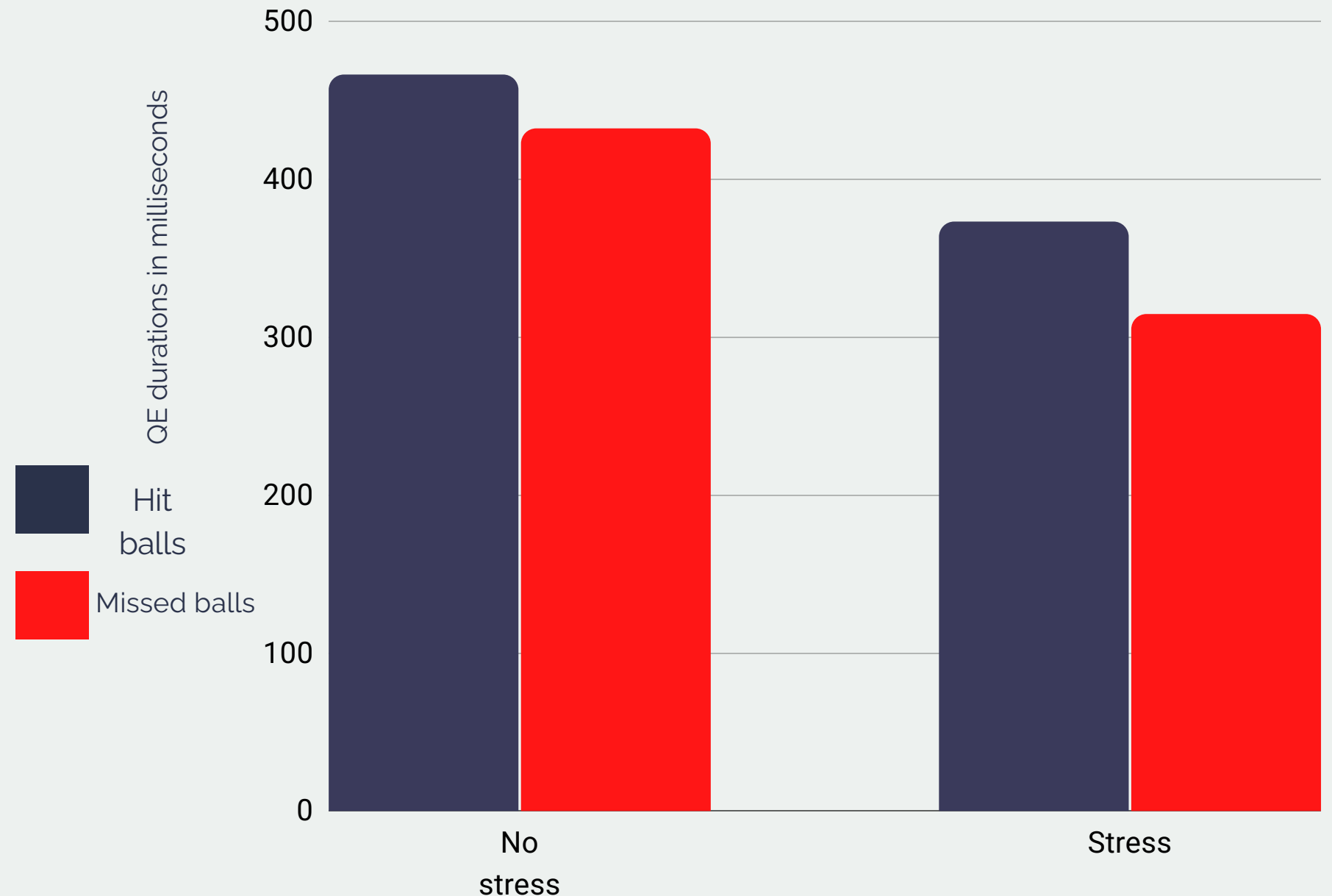
- Longer duration of QE are associated with greater athletic expertise (Vickers & Williams, 2007)
- Athletes display longer QE before successful compared to missed shots (Vincze et al., 2022)
- QE plays a more important role in performance under anxiety-provoking situations (Vincze et al., 2022)
- QE decreases under fatigue conditions (Vincze & Jurchiş, 2022)
- Training of QE leads to more effective performance enhancement compared to other types of trainings (Vine et al., 2014)

Stress responses & Coping with distractors

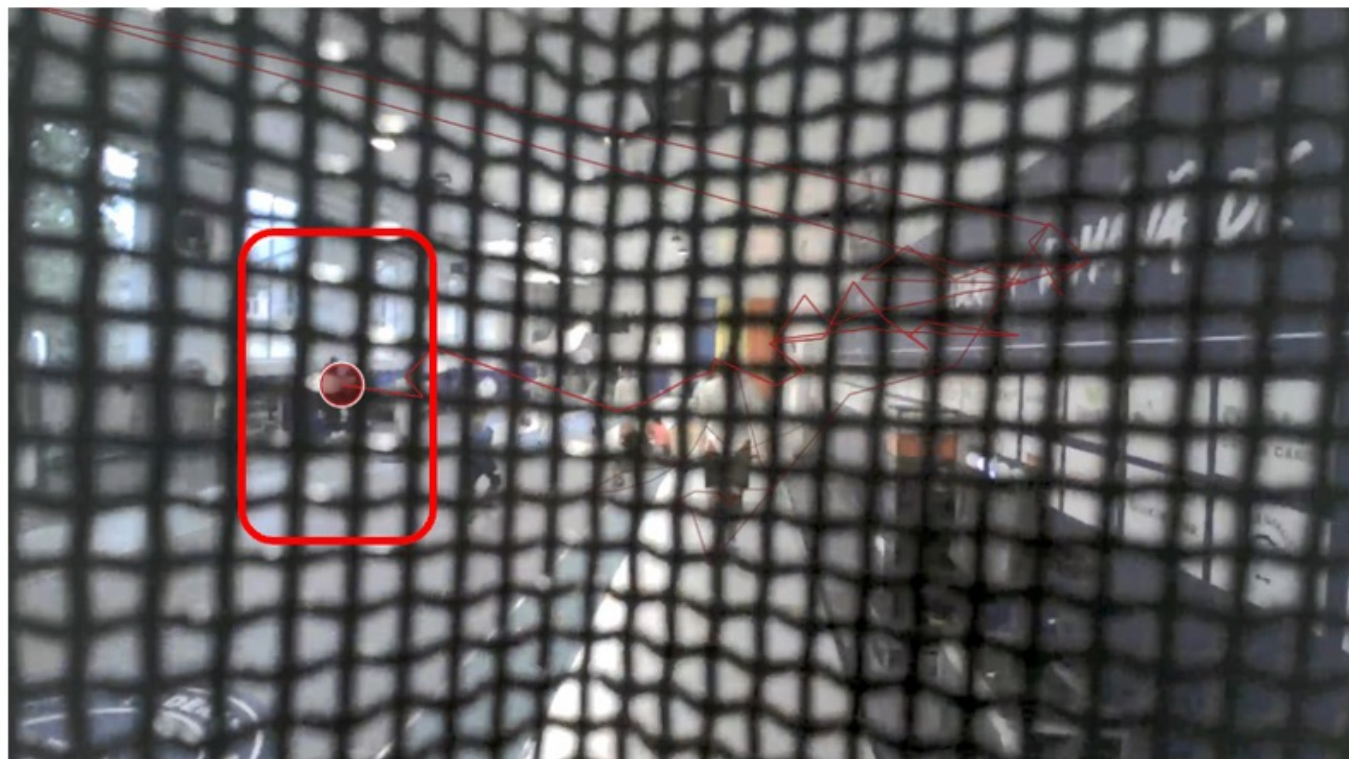
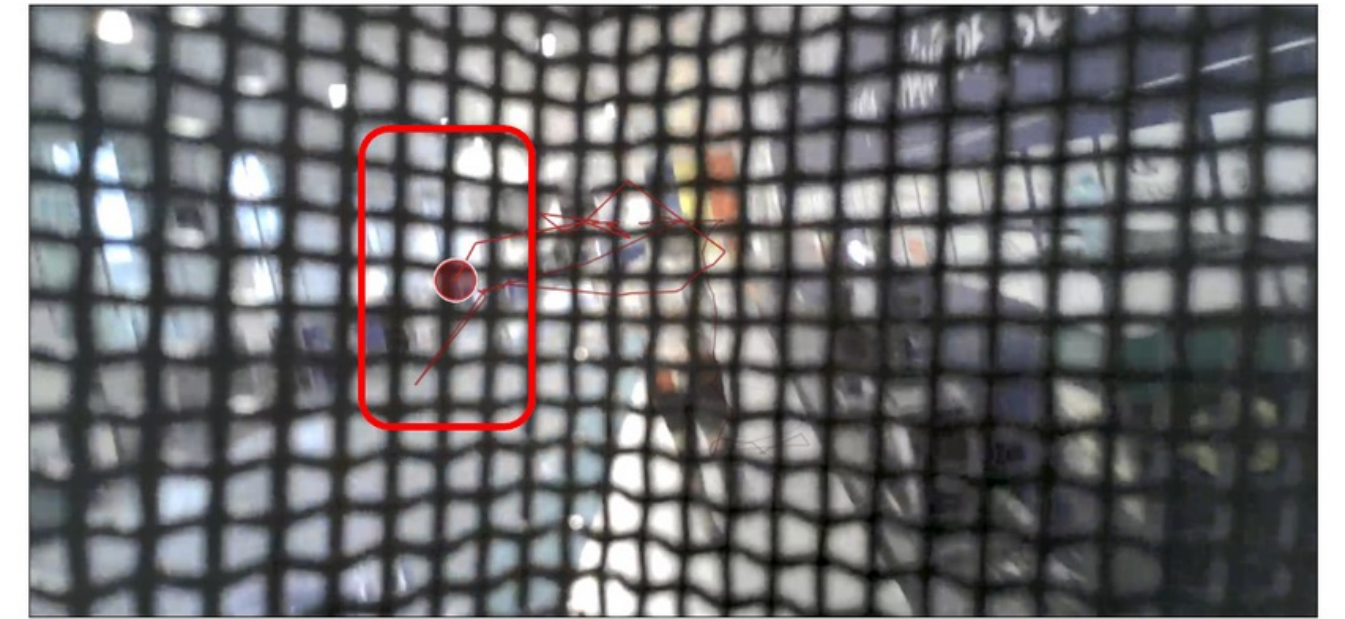
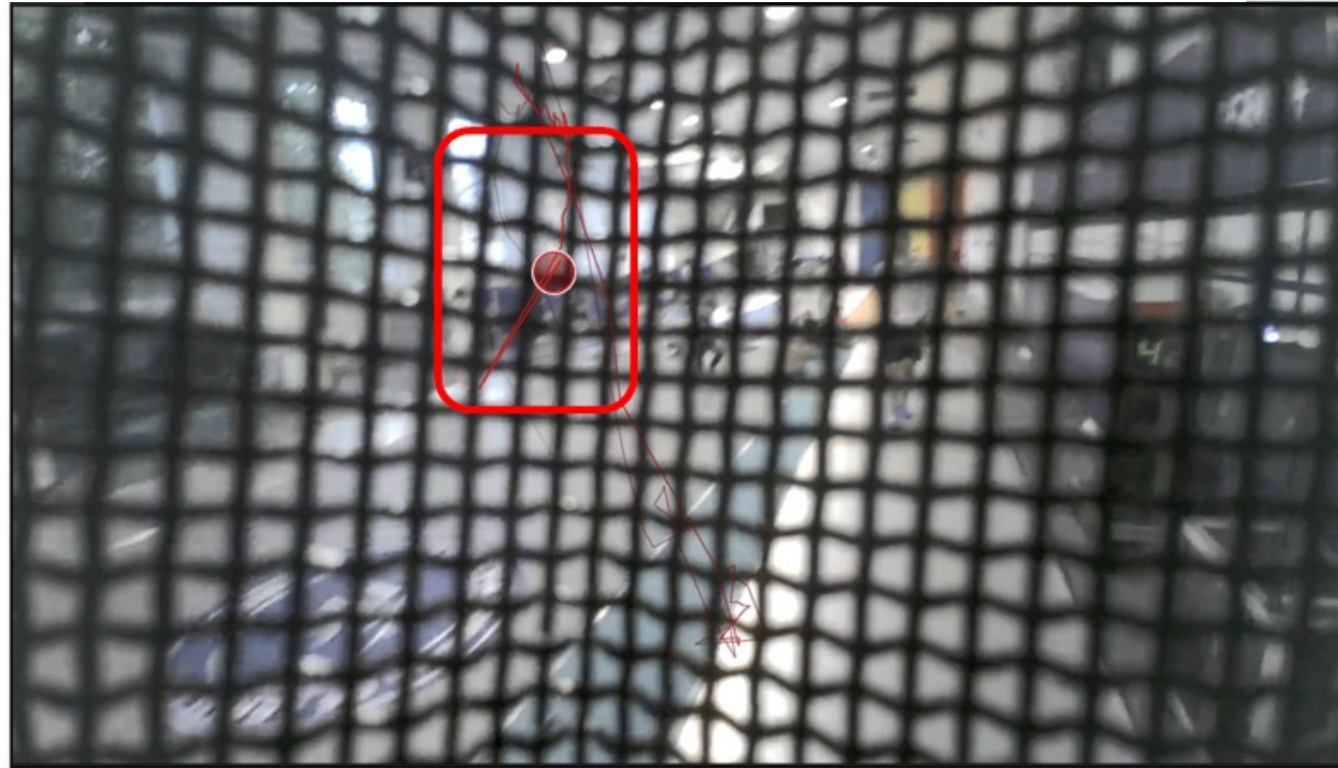
Results from two different paradigms: table tennis and fencing

In a table tennis task where athlete had to hit 100 balls on the table. They performed the same exercise in two randomized conditions (**stressful** (where they received negative feedback from their coaches) and **non-stressful** (where they received no feedback)).

Performance decreased by **4 %** in the stressful condition.



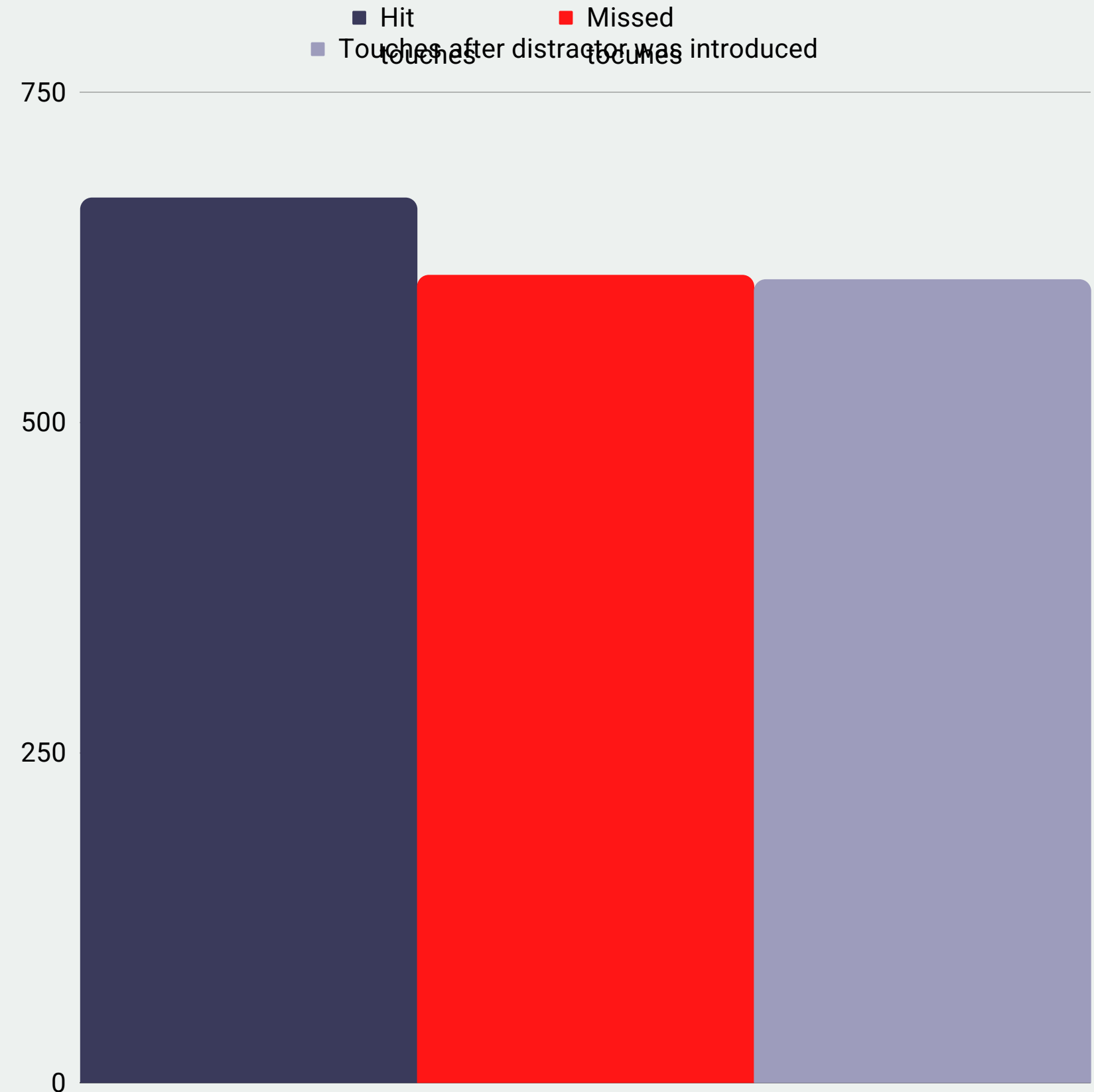
Coping with distractors



Coping with distractors

Practical applications

- In order to increase performance, introducing tasks that include realistic distractions and assessing gaze behaviour while performing (and how much gaze is assigned to the distractor) can be a focus enhancement exercise.
- Educating coaches on the possible harmful impact that negative feedback can have on an athlete's performance.



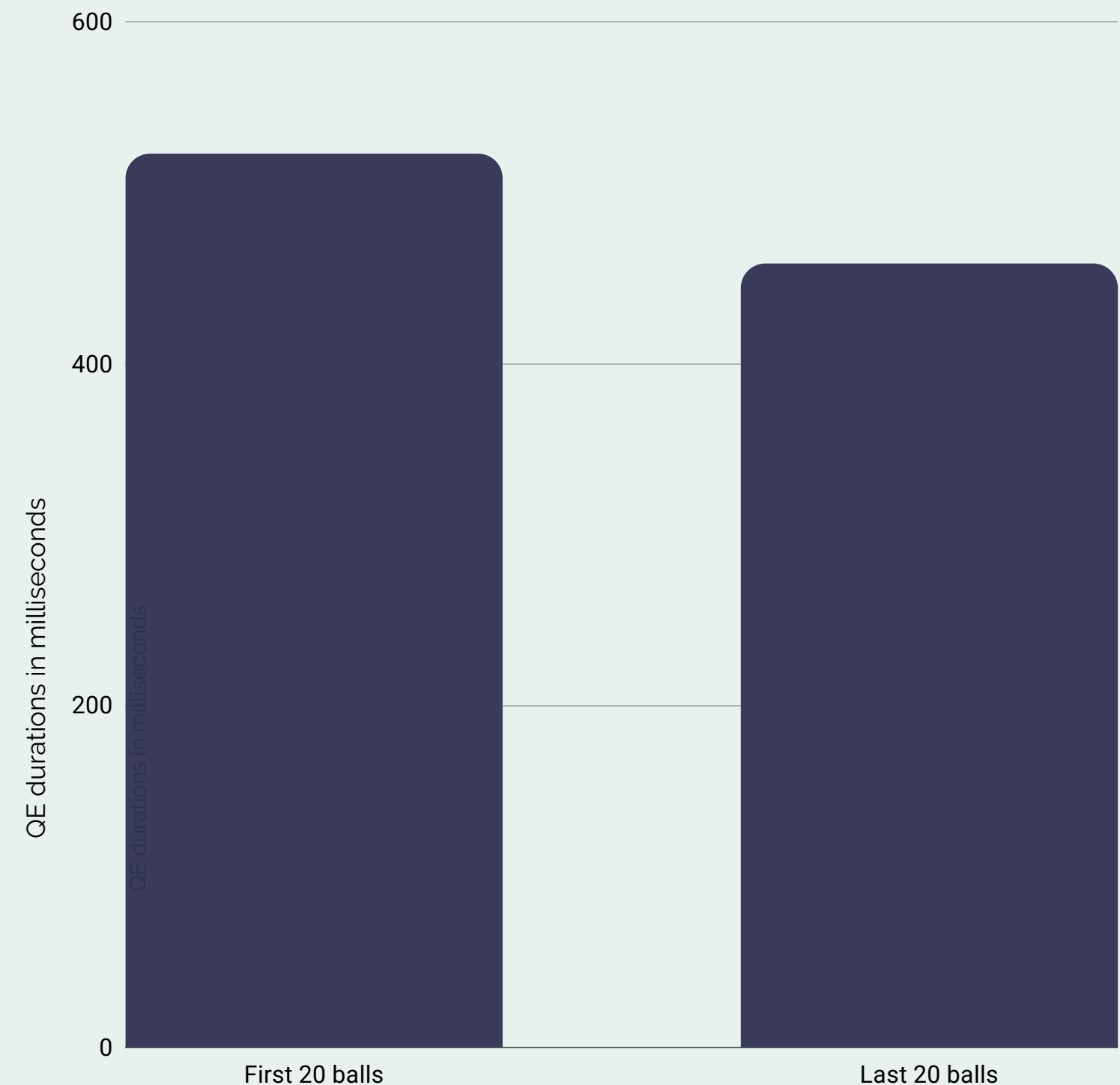
Tailoring exercises according to fatigue levels in gaze behaviour

- Can we identify the optimal duration of an exercise?
- Is it 10 minutes? Is it 2 minutes?
- Is it based on the number of mistakes?
- Is it based on other physiological indexes? (e.g., heart rate, lactic acid, mean amplitude of contractions)
- Is it based on “*this is how we do things*” here?
- What do your athletes implement as an **evidence based practice** for the optimal duration of an exercise?

Results from a table tennis paradigm

In a table tennis task where athlete had to hit 100 balls on the table. They performed the same exercise in four randomized conditions, where we manipulated two factors speed and prior information about the balls' placement, we identified that QE in the last 20 balls was shorter compared to the first 20 balls.

Performance decreased by **3,5%** in the last 20 balls.



Practical applications in relation to fatigue

- Determine individualized levels of fatigue
- For instance, in table tennis, even for expert athletes, the common rule of 100 balls doesn't fit for all players.
- Practicing with '*one size fits all*' approach can enforce suboptimal behaviors
- Gradually increase the duration of the exercise, once **performance and gaze behavior is maintained**, in order to develop resistance to a specific task.

Training of gaze behavior & QE

- In general, it has been asserted that modelling the gaze behaviour of 'expert' athletes can increase novice athletes' performance.
- The primary emphasis of QE training is on maintaining a stable gaze before performing a critical movement.
- However, depending on the athlete's goals (e.g., offensive and defensive phases), this approach may not be the best in all circumstances.
- Training smarter, not harder, can have a positive impact on injury prevention and athletes fatigue levels.

Types of exercises performed in gaze behavior training

- **Catching reaction ball** thrown against a wall
- **Peripheral catch:** A fixation point is marked on the wall and eyes must focus on this at all times. Throw and catch a ball against the wall without moving eyes away from the fixation point.
- **Vision juggling** (focus back and forth on things at different distances, with randomized instructions, also only with one open eye)
- In order to increase the **representativity** of the tasks, the exercises have to mimic closely the demands of the performed sport (e.g., simulating specific drills from the sport)



Other practical interventions

- Gaze behavior for 'liked/disliked exercises
- Correcting time related movement

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