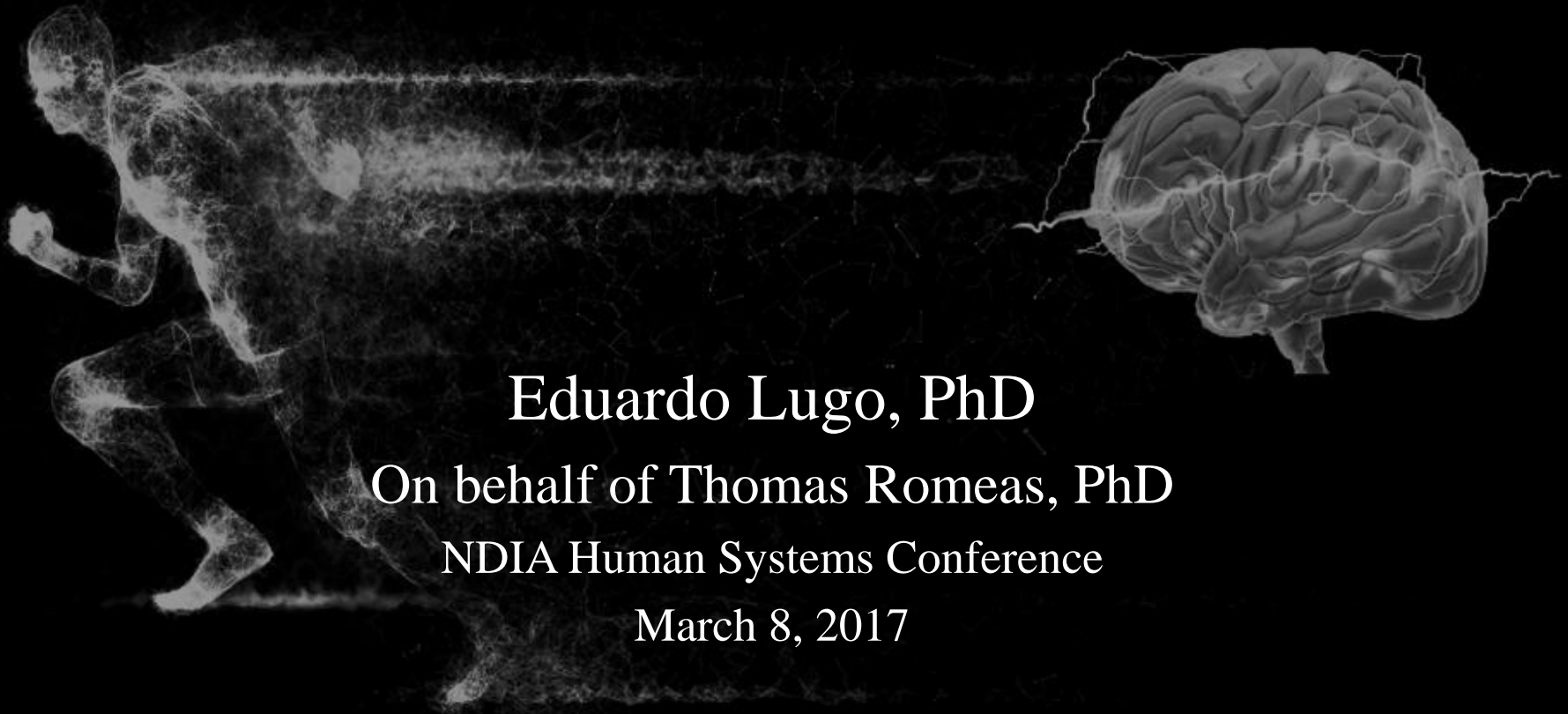


# Developing Human Performance through Perceptual-Cognitive Training



Eduardo Lugo, PhD

On behalf of Thomas Romeas, PhD

NDIA Human Systems Conference

March 8, 2017

# Summary

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- I. Training Perceptual-Cognitive Skills with NeuroTracker (NT)
- II. Scientific Evidence supporting NT
- III. Towards New Perspectives: Combined Training (dual NT task)

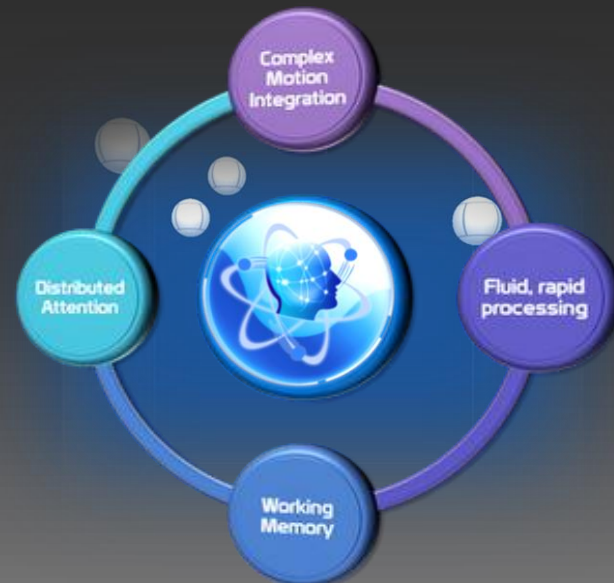
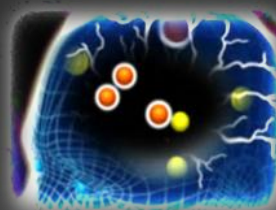
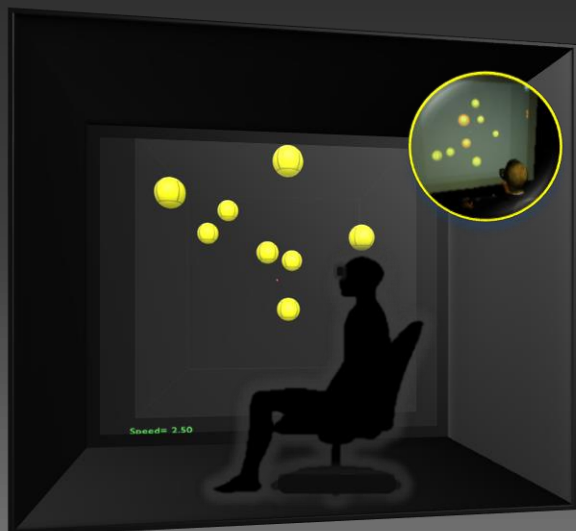
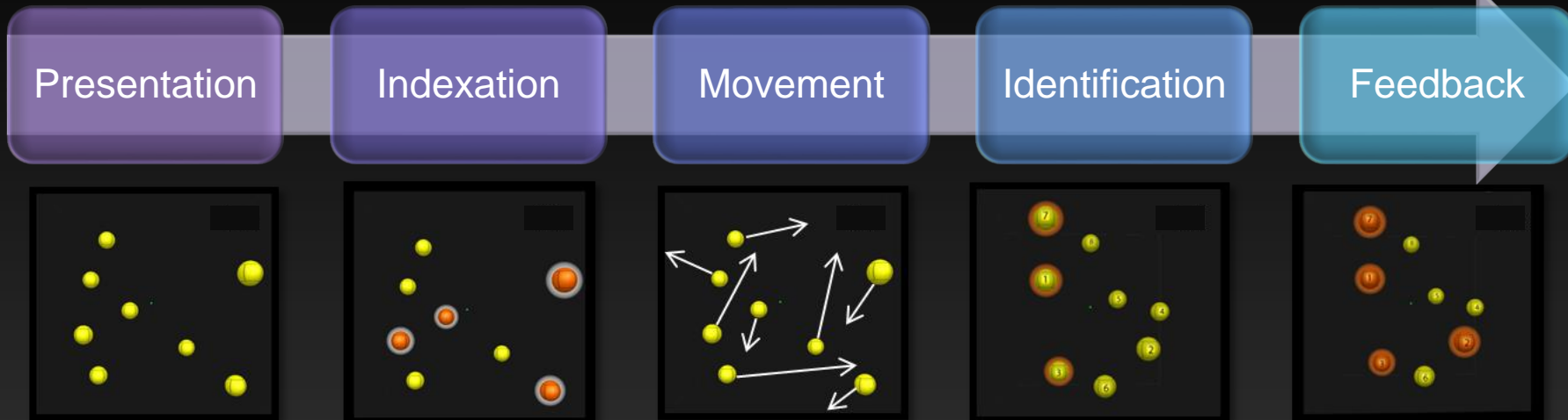
# Perceptual-Cognitive Capacity

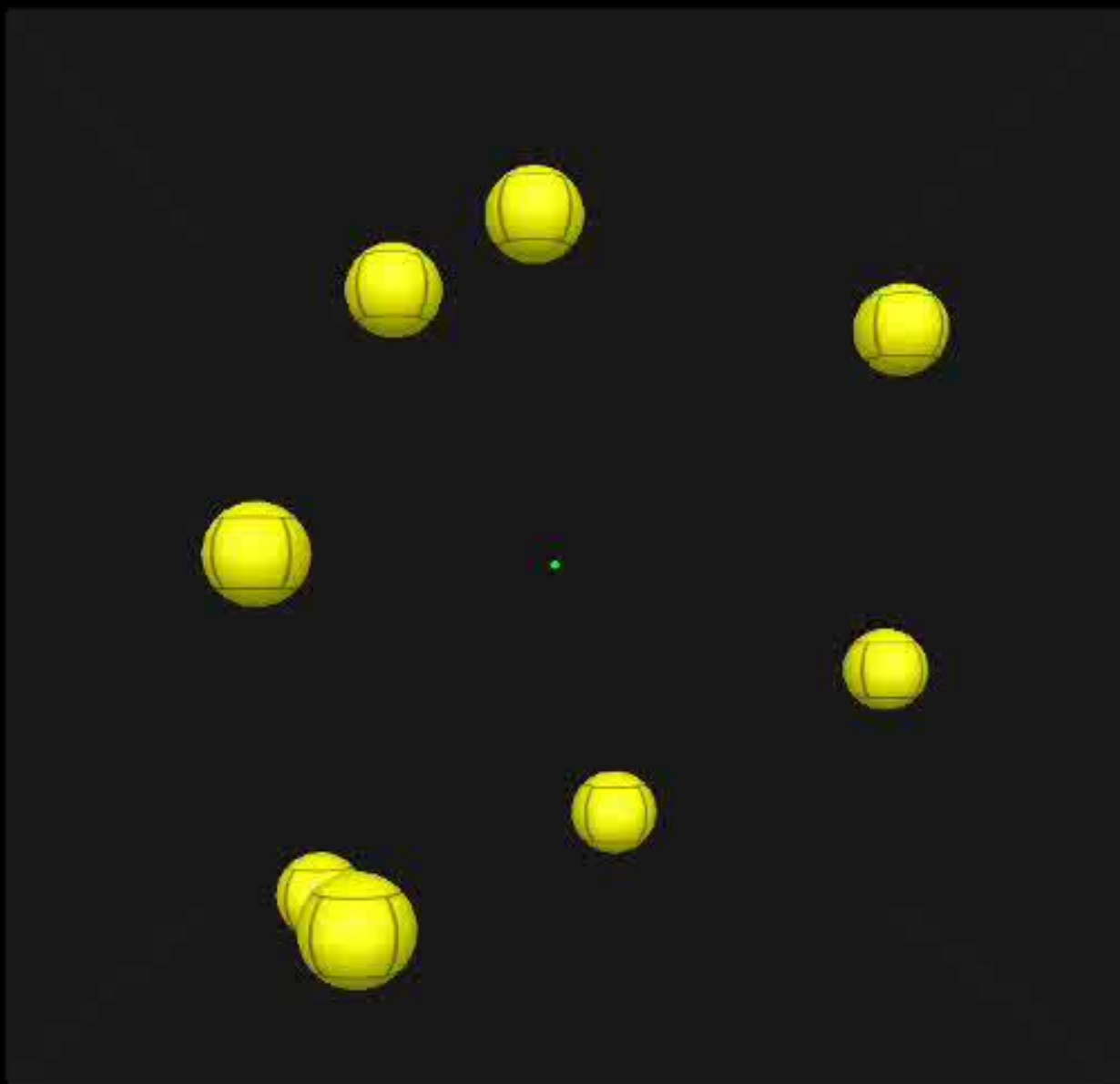
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# NeuroTracker

NeuroTracker





Trial 4

Speed= 3.00

# Evidence in Human Performance

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| Population                            | Finding   | Reference               |
|---------------------------------------|---|-------------------------|
| Pro & Semi-pro Athletes, Non-Athletes | Sensitivity to sport expertise (processing and learning)                | Faubert, 2013           |
| Pro Basketball Players                | Positive correlation with on-field sport performance ( $\approx 78\%$ ) | Mangine et al., 2014    |
| Surgeons                              | Time completion (29%) & efficacy (28%) of surgery                       | Harenberg et al., 2016  |
| Young Adults (Non-Athletes)           | $\uparrow$ brain executive functions (qEEG)<br>Transfer on Attention    | Parsons et al., 2014    |
| Military                              | Transfer on working memory  | Vartanian et al., 2016  |
| Older Adults (Non-Athletes)           | Transfer on biological motion perception                                | Legault & Faubert, 2012 |
| University Soccer Players             | Transfer on passing decision-making                                     | Romeas et al., 2016     |

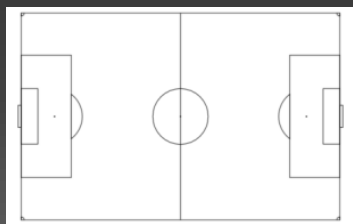
# Transfer to On-Field Performance

**Table 1**  
Players' information ( $\pm$ SEM).

| Group                   | n  | Mean age (years) | Started to play soccer (age in years) | Playing soccer in a club (duration in years) | Hours of training by week (game-free) |
|-------------------------|----|------------------|---------------------------------------|--|---------------------------------------|
| 3D-MOT                  | 9  | 21.27 $\pm$ 0.81 | 6.56 $\pm$ 0.59                       | 12.78 $\pm$ 1.63                             | 8.67 $\pm$ 1.32                       |
| Active control          | 7  | 21.39 $\pm$ 1.03 | 6.00 $\pm$ 1.31                       | 12.86 $\pm$ 1.79                             | 11.14 $\pm$ 2.97                      |
| Passive control         | 7  | 22.48 $\pm$ 0.71 | 8.17 $\pm$ 2.12                       | 11 $\pm$ 2.38                                | 8.33 $\pm$ 1.09                       |
| All of the participants | 23 | 21.67 $\pm$ 0.46 | 6.82 $\pm$ 0.71                       | 12.32 $\pm$ 1.01                             | 9.36 $\pm$ 1.04                       |

Pre

Small Sided Games



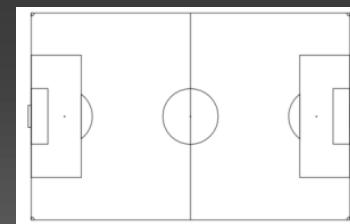
Training

Groups :

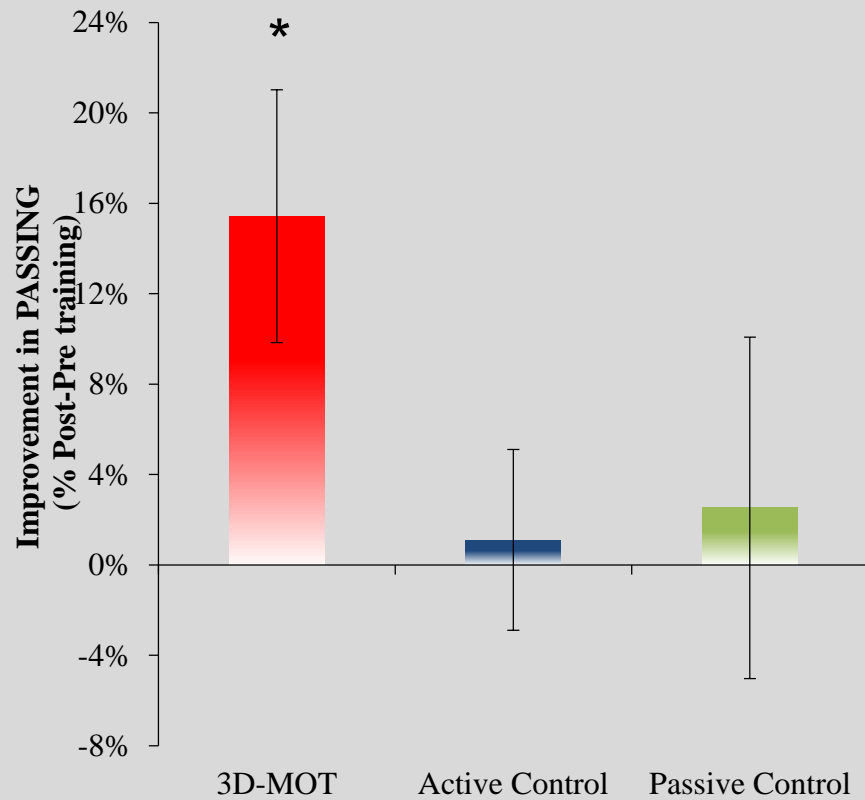
- **NeuroTracker x10**
- **Active Ctrl x10**
- **Passive Ctrl**

Post

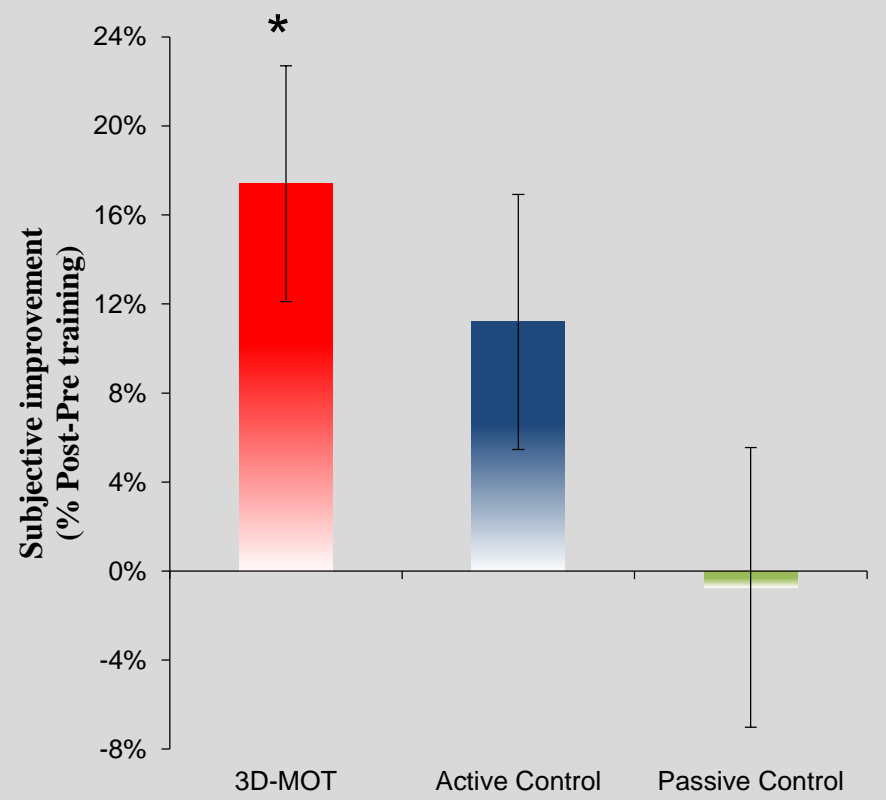
Small Sided Games



# Transfer to On-Field Performance



*External coach evaluation*



*Players' evaluation*

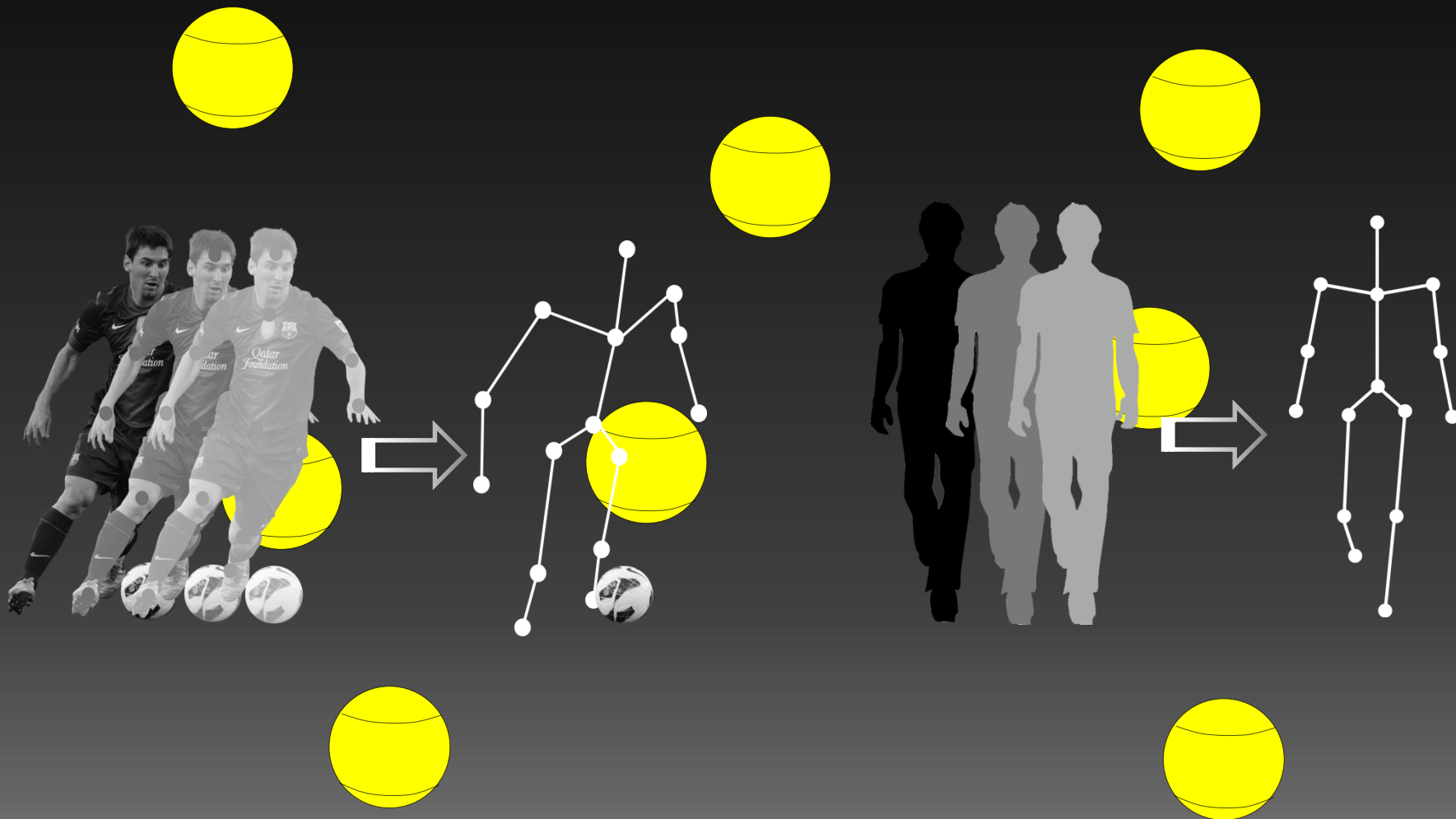
\*  $F(1, 17) = 4.708, p = 0.044, \eta^2 = 0.162$

\* $t[6] = 3.547, p = 0.012$



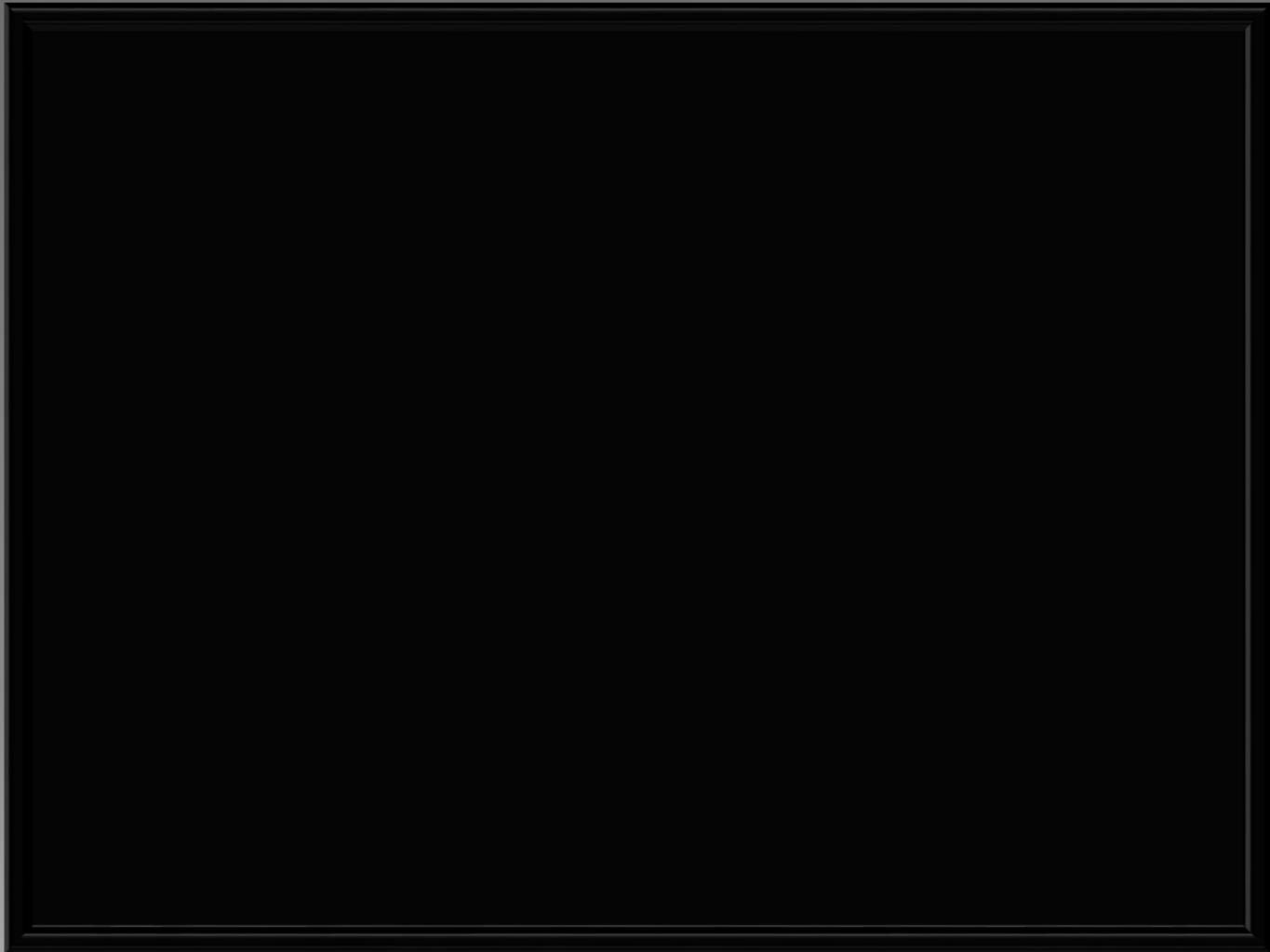
# Combined Training

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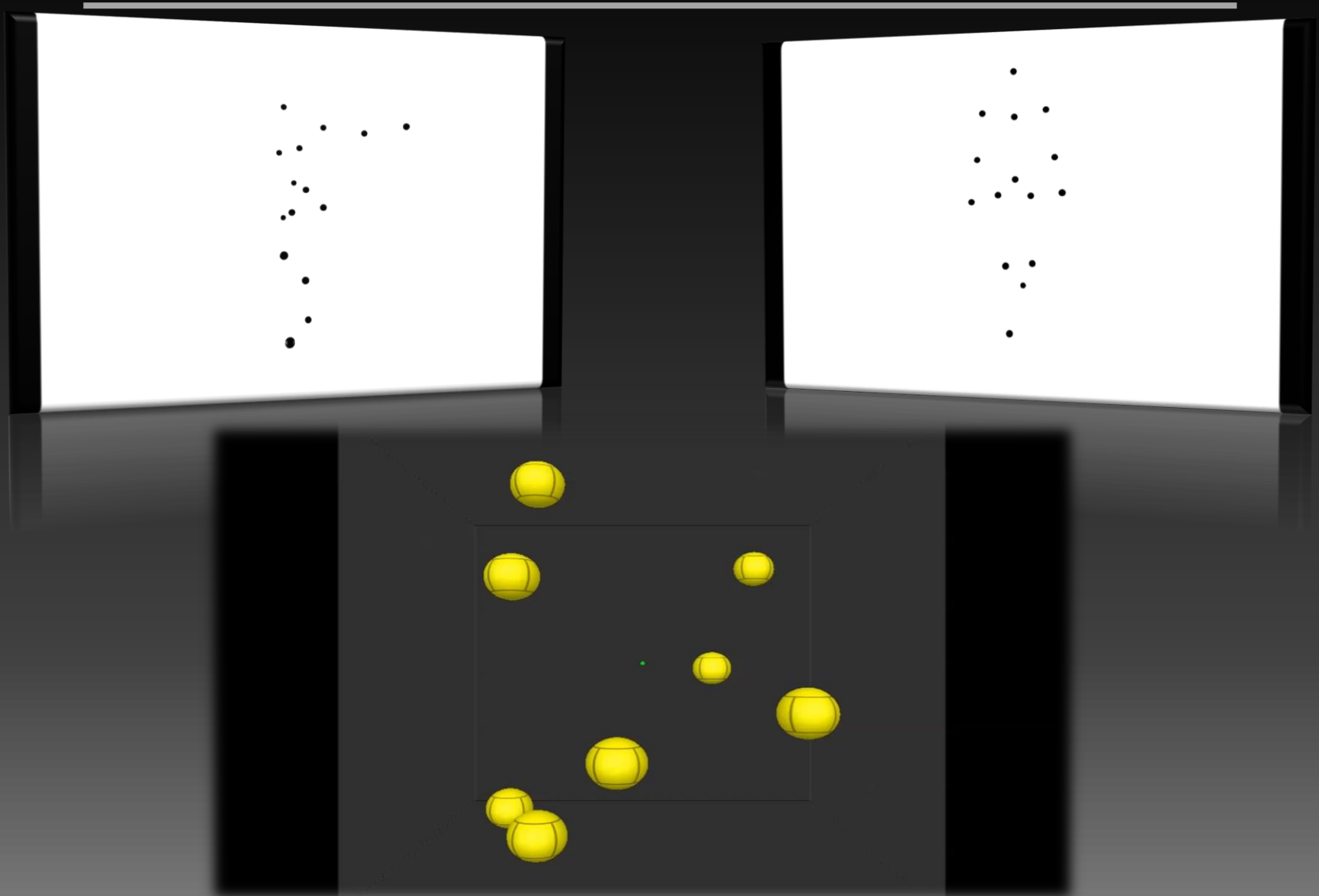


# Motion Capture

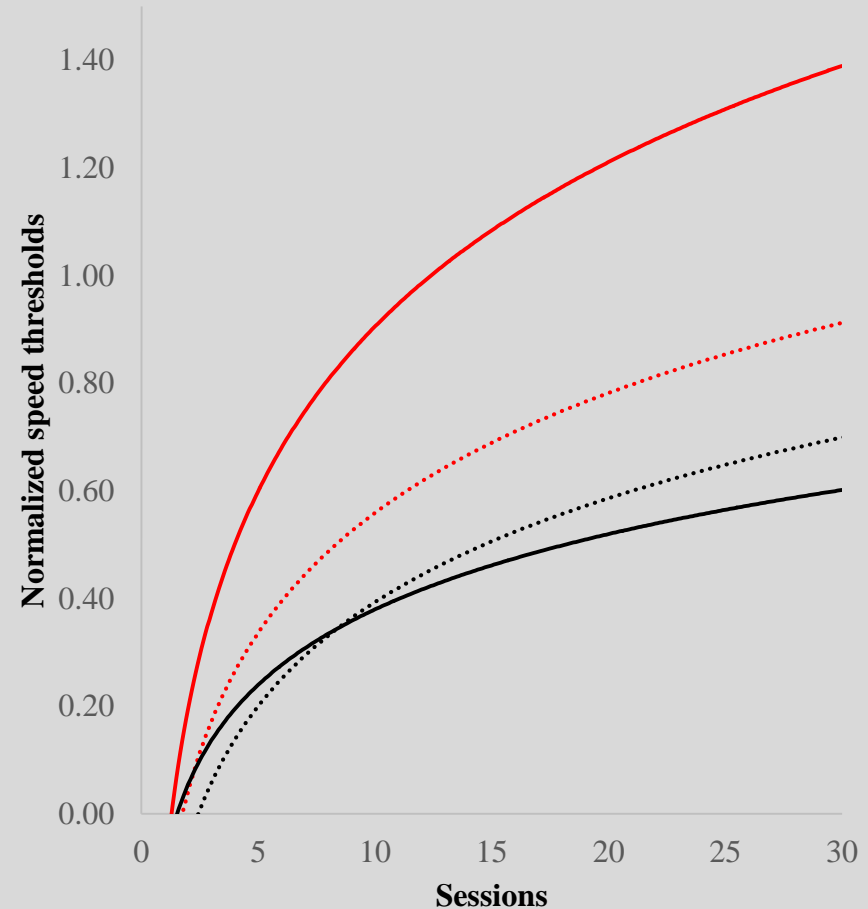
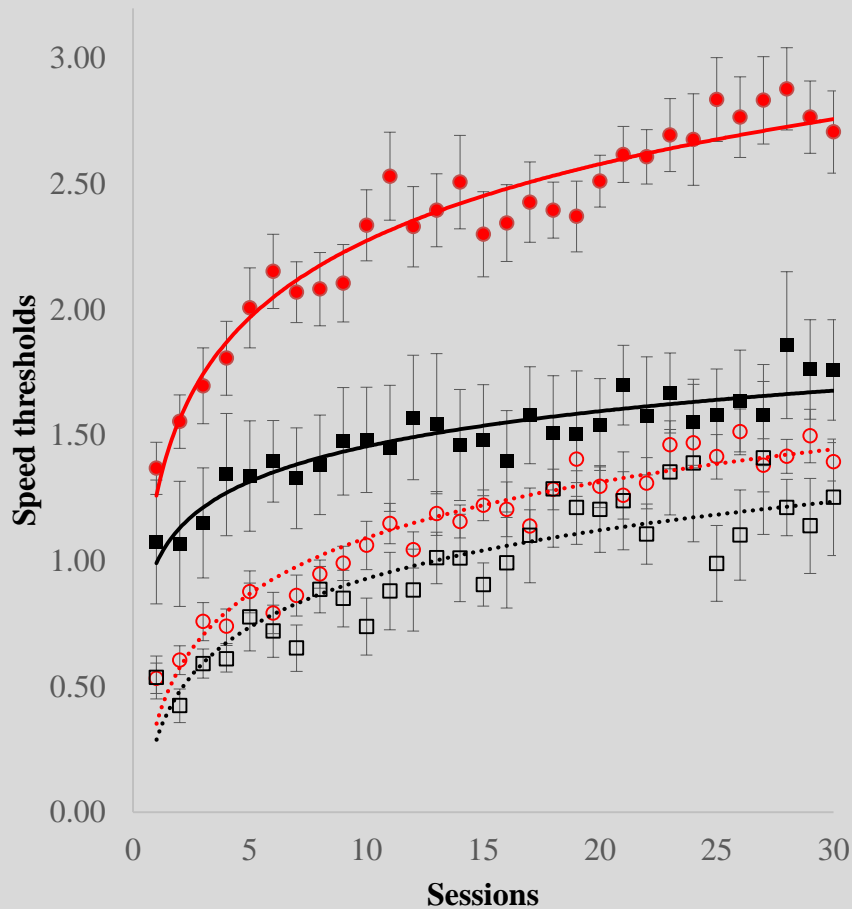
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# NeuroTracker x Tactical Awareness



# Preliminary Results

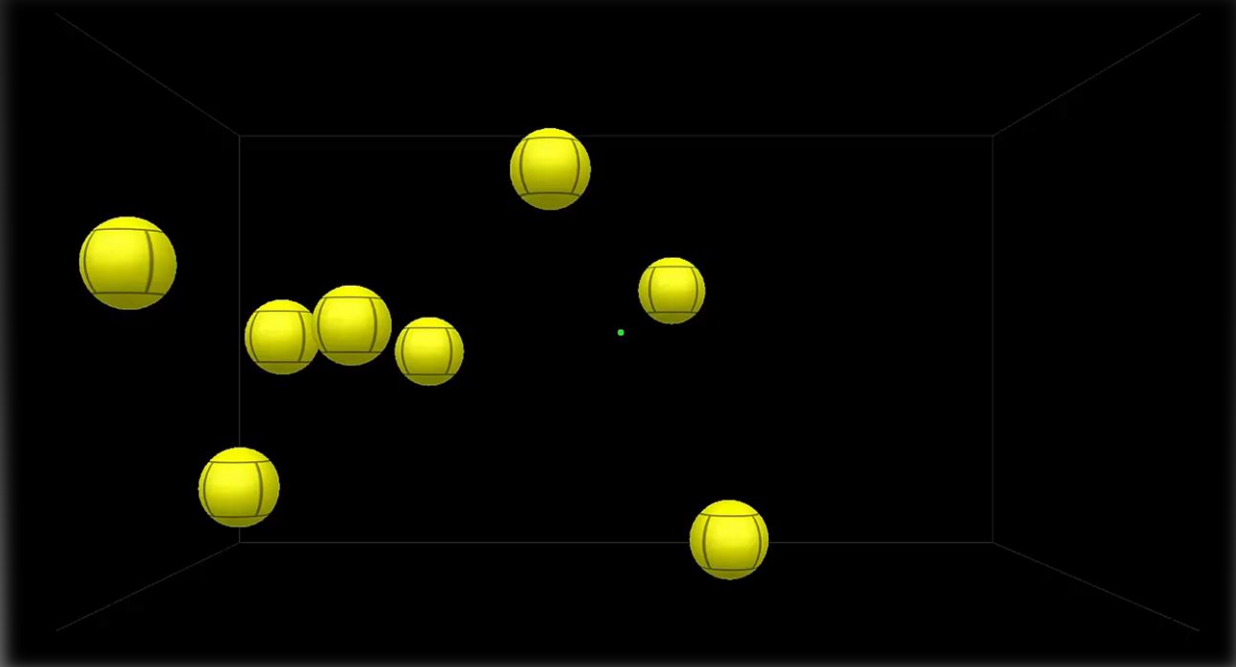


— Athletes NT (n=17)

— Athletes NTTA (n=16)

— Non-Athletes NT (n=7)

— Non-Athletes NTTA (n=7)



# Acknowledgments

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CogniSens) A R C

Applied Research Centre | Centre de Recherche Appliquée

NeuroTracker  
YOUR PATH TO IMPROVEMENT



ÉTS

Le génie pour l'industrie



ACADÉMIE  
ACADEMY



Université   
de Montréal

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**Thank You for your Attention**

**Contact:**  
**[tromeas@c-arc.org](mailto:tromeas@c-arc.org)**

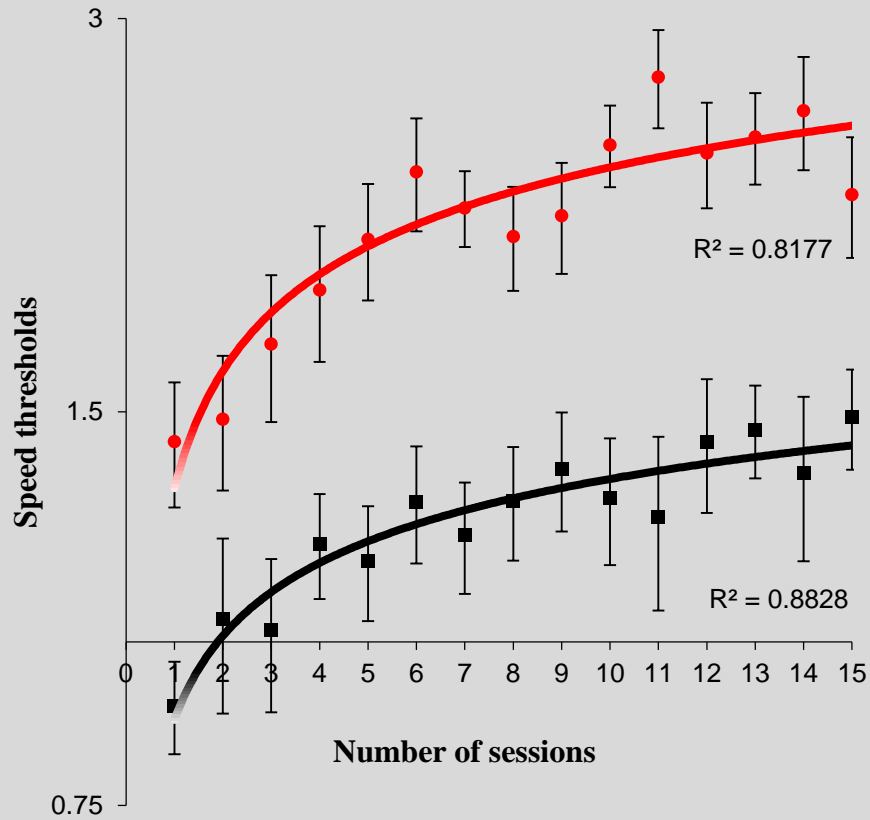
# References

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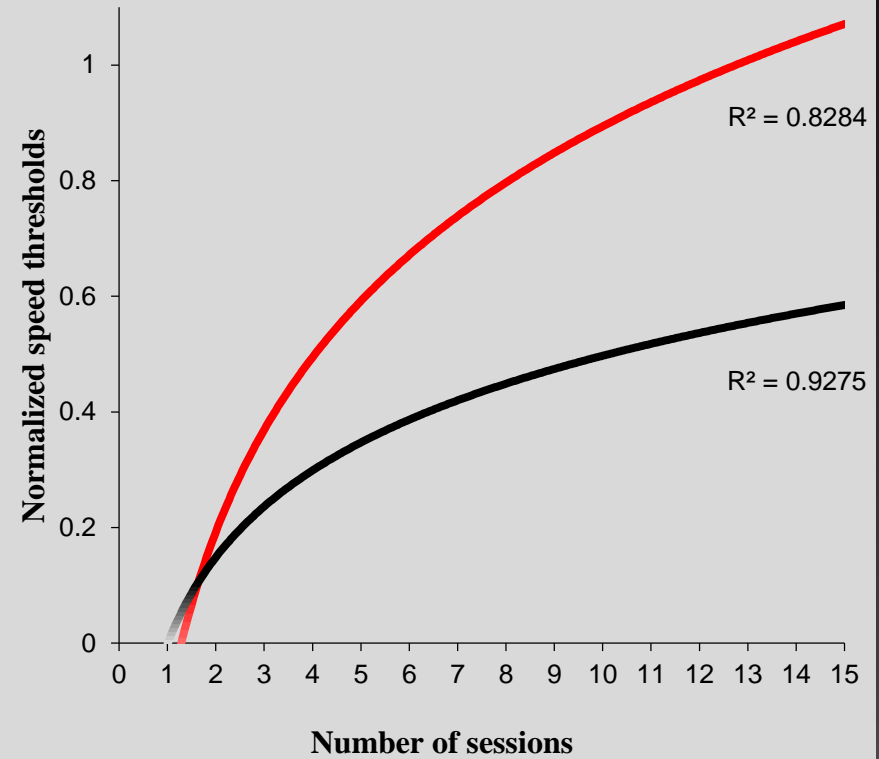
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# Elites vs Novices



— Soccer players (n=9)



— Novices (n=12)

# Decision-Making Coding

**Table 2**

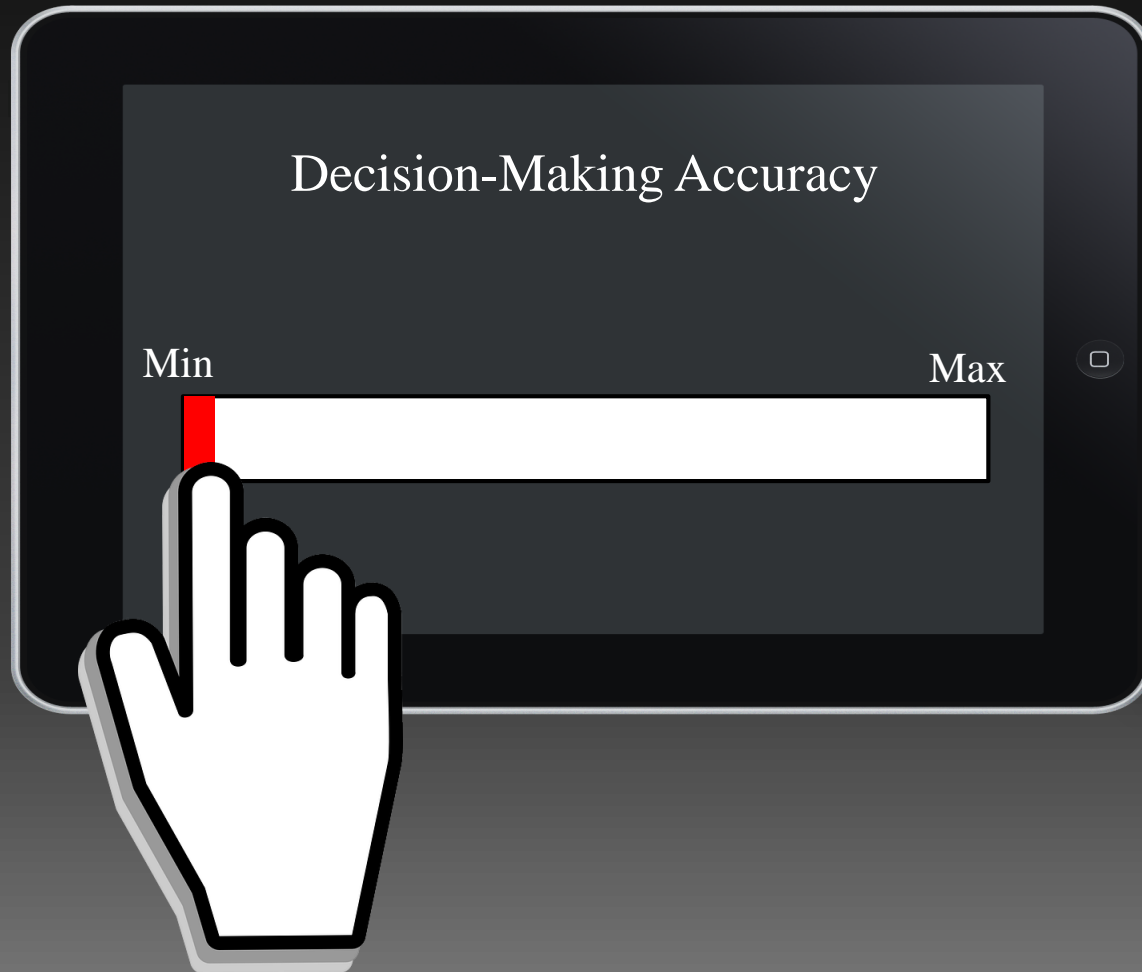
Decision-making coding instrument.

| Decision criterion | 1 point decision   | 0 point decision   |
|--------------------|--|--|
| Passing            | <p>The player made a good decision when the pass went to a teammate who was open and it:</p> <ul style="list-style-type: none"> <li>- directly or indirectly created a shot attempt, or</li> <li>- went to a teammate who was in a better position than the passer.</li> </ul> | <p>The player made a poor decision when the pass was:</p> <ul style="list-style-type: none"> <li>- made to a player who was closely guarded or when there was a defensive player positioned in the passing line, or</li> <li>- intercepted or turned over, or</li> <li>- made to an area of the field where no teammate was positioned, or</li> <li>- kicked out of the field of play.</li> </ul>  |
| Dribbling          | <p>The player made a good decision to dribble when dribbling if it created:</p> <ul style="list-style-type: none"> <li>- space for teammates, or</li> <li>- a scoring opportunity, or</li> <li>- space for the dribbler.</li> </ul>  | <p>The player made a poor decision to dribble when he dribbled:</p> <ul style="list-style-type: none"> <li>- when the defenders were in good defensive position, or</li> <li>- into a supporting defender that was in good position, and this did not create space for the dribbler or teammates, or</li> <li>- out of the field of play, or</li> <li>- and the immediate defender was in a good position to defend the dribble, or</li> <li>- without a purpose (e.g. not going anywhere).</li> </ul> |
| Shooting           | <p>The player made a good decision to shoot when he was open for the shot and it was uncontested.</p>  | <p>The player made a poor decision to shoot when the shot:</p> <ul style="list-style-type: none"> <li>- was blocked, or</li> <li>- was taken off balance, or</li> <li>- was taken when one or more defensive players were in good position, or</li> <li>- was taken when it was contested.</li> </ul>  |

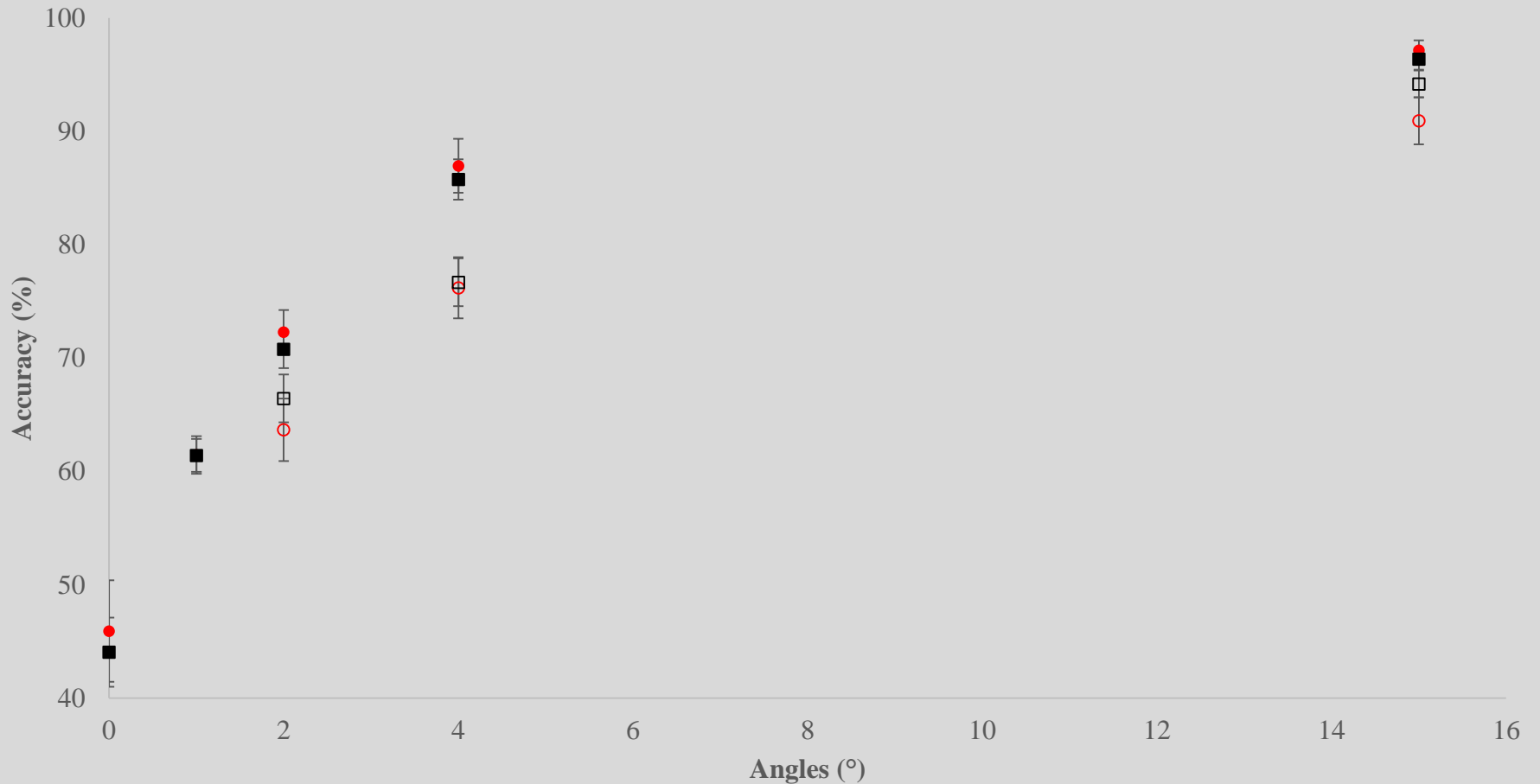
Adapted from: [French and Thomas \(1987\)](#), [Gabbett et al. \(2008\)](#).

# Subjective Assessment

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# Combined Training - BM



● Athletes BM (n=16)

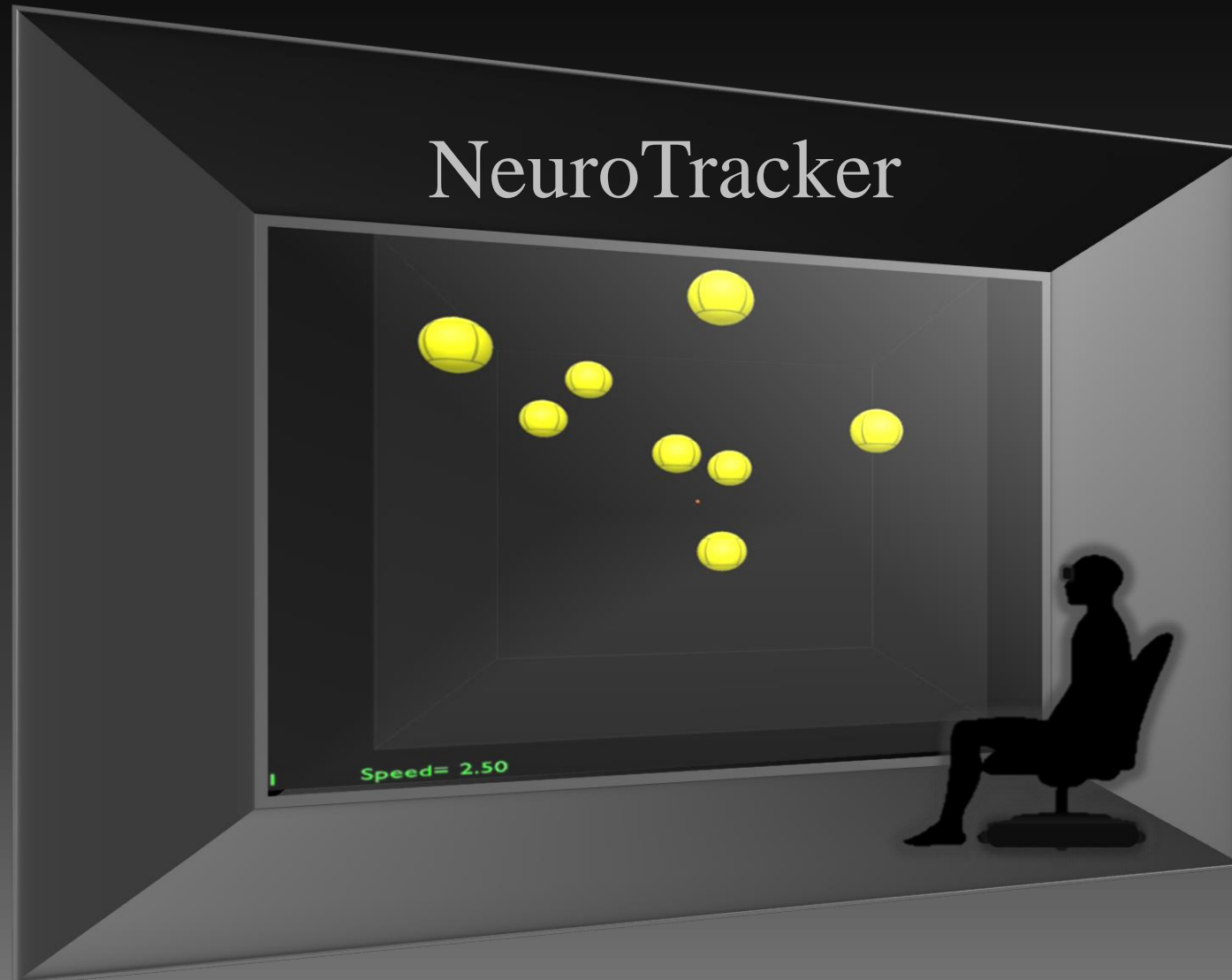
■ Novices BM (n=7)

○ Athletes BM+NT (n=16)

□ Novices BM+NT (n=7)

# Perceptual-Cognitive Training

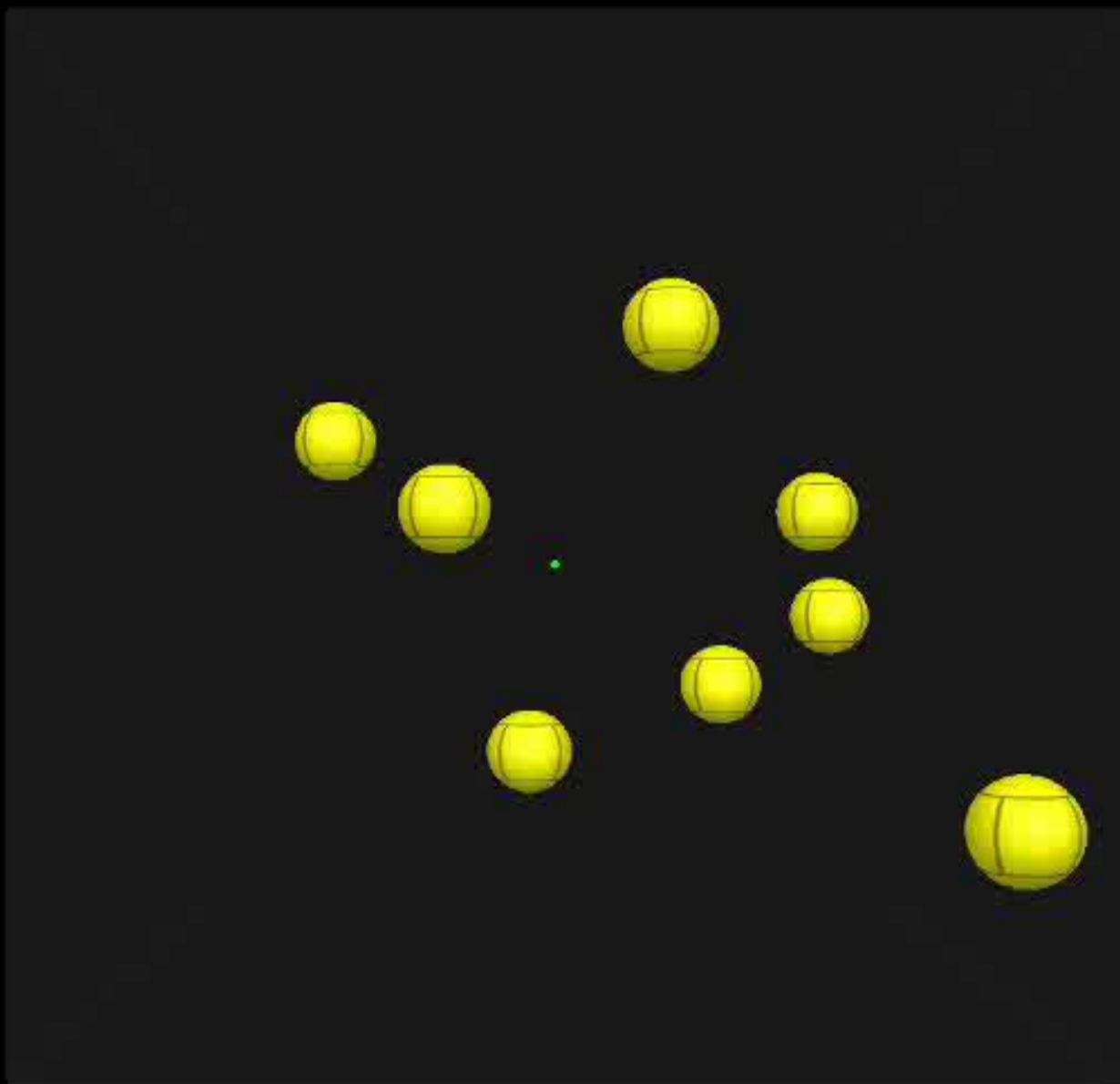
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# Transfer to On-Field Performance

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- ✓ Significant improvement in decision-making passing accuracy (15%) following the NeuroTracker training ('far transfer')
- ✓ Proportional quantitative increase in subjective decision-making accuracy
- ✓ Athletes' NeuroTracker speed thresholds are superior to novices



Trial 1

Speed= 1.00