



A penalty kick simulator based on human-avatar interaction

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<http://unifr.ch/med/copelab>

Cognition Day 2016

Penalty kicks in international games

Proportion of missed penalties ::

Knockout phase of the
2016 UEFA championship

25%

Proportion of games
decided by penalty
shootout :

1/5

Knockout phase of the
2014 FIFA world cup

28%

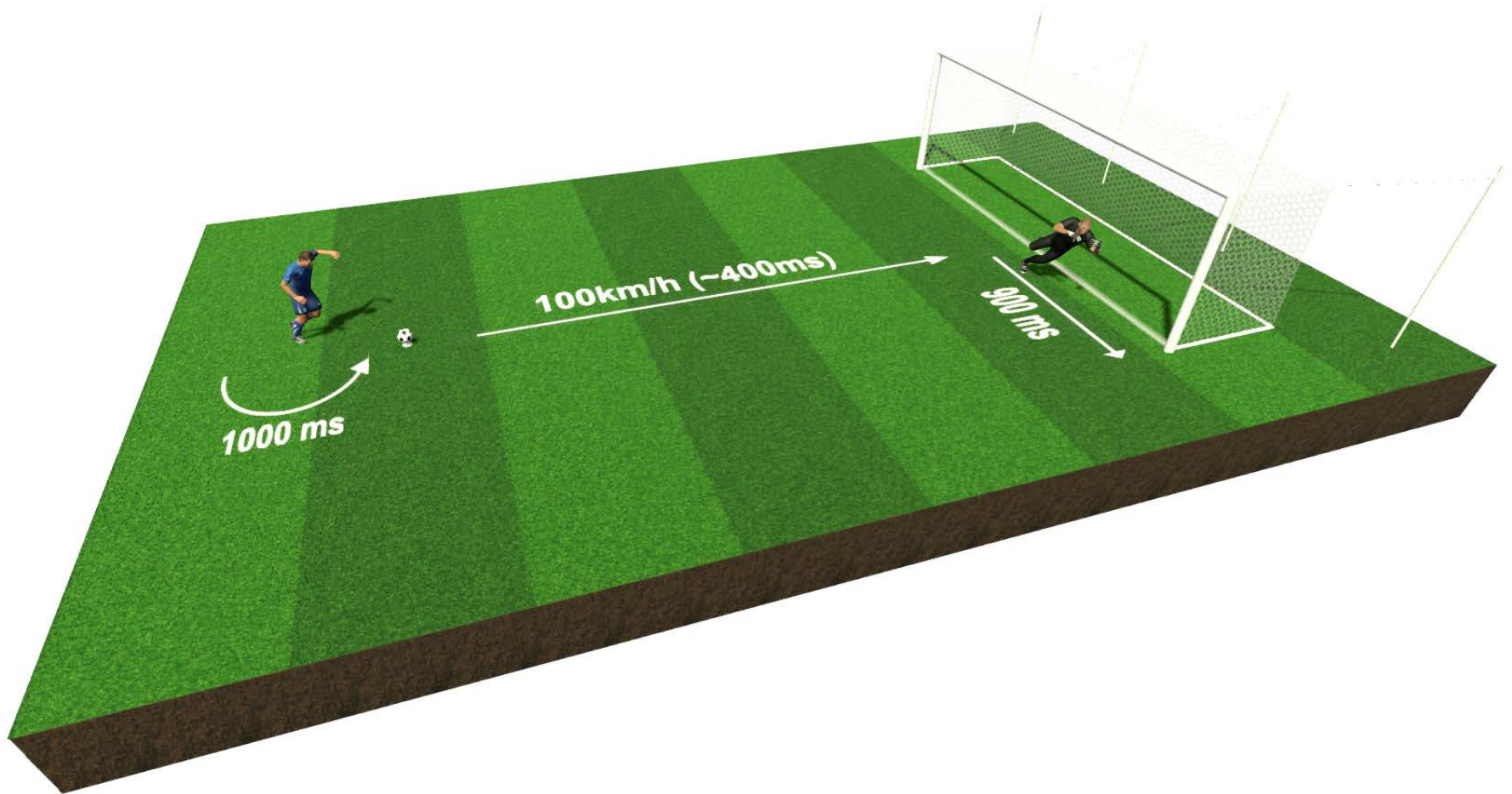
1/3

Last 15 UEFA
Champions League finals

35%

1/3

Penalty kick: Factsheet



Penalty kick: Factsheet 2



~500 ms



94%

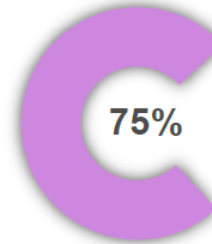
Penalty kick: The GK must anticipate!



Penalty kick: Problems

For the goalkeeper:

By anticipating, the goalkeeper gives the penalty taker the chance to kick the ball towards the empty side of the goal



of professional penalty takers wait for the goalkeeper to jump

For the kicker:

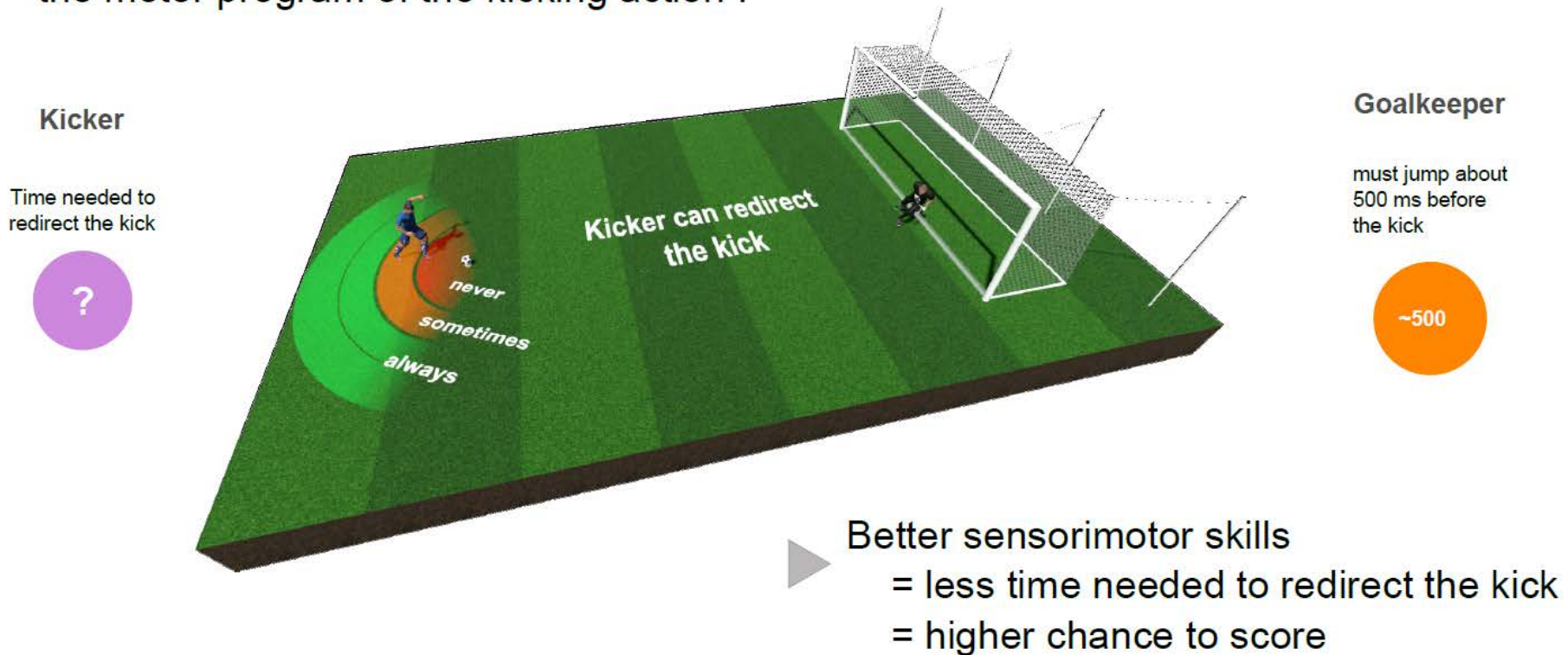
Redirecting the kick at the last moment requires sensorimotor skills



In spite of a huge advantage for the penalty taker, about 30% of penalty kicks are missed

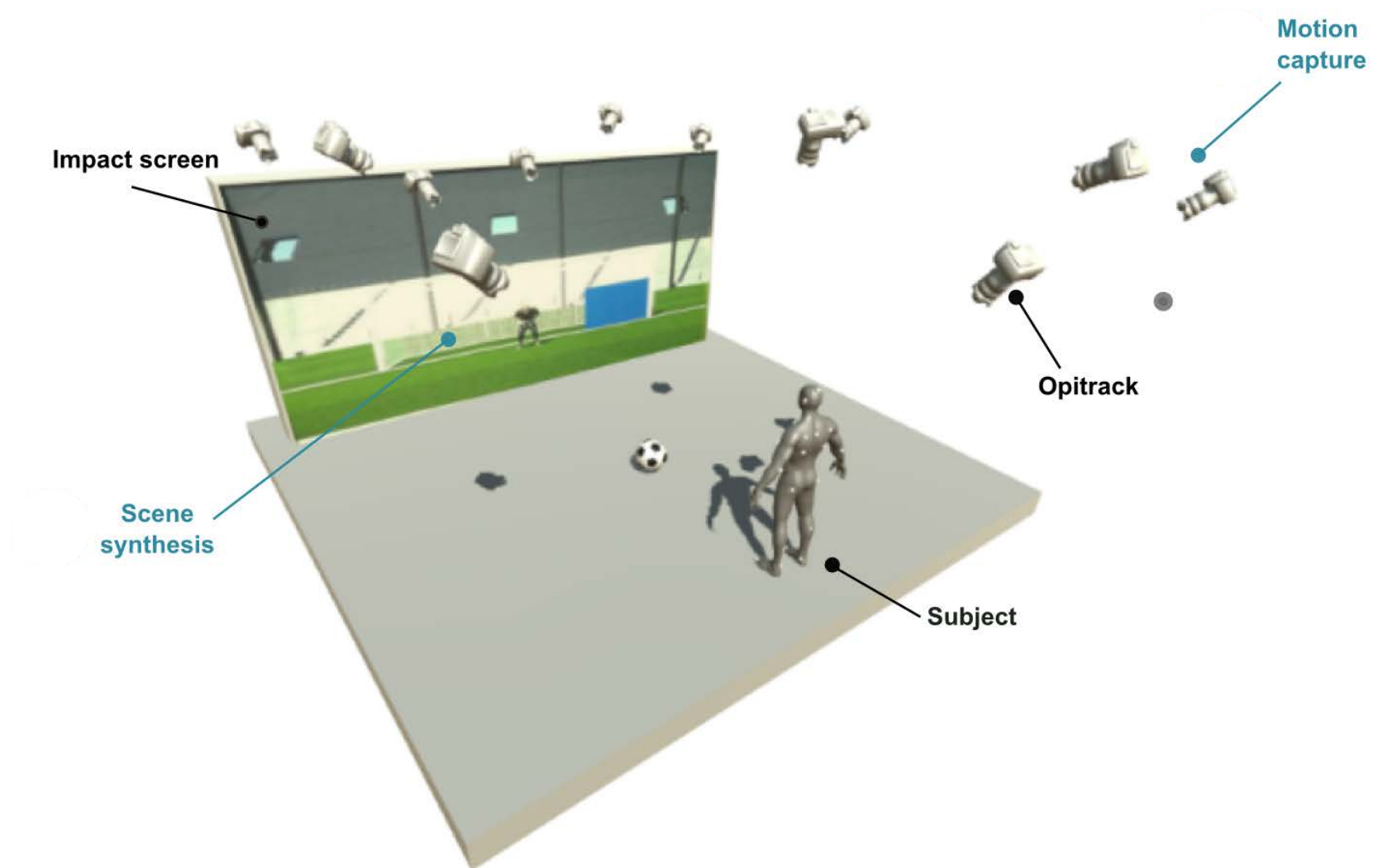
Penalty kick: Questions

- ▶ Redirecting the kick requires enough time (before ball contact) to modify the motor program of the kicking action :

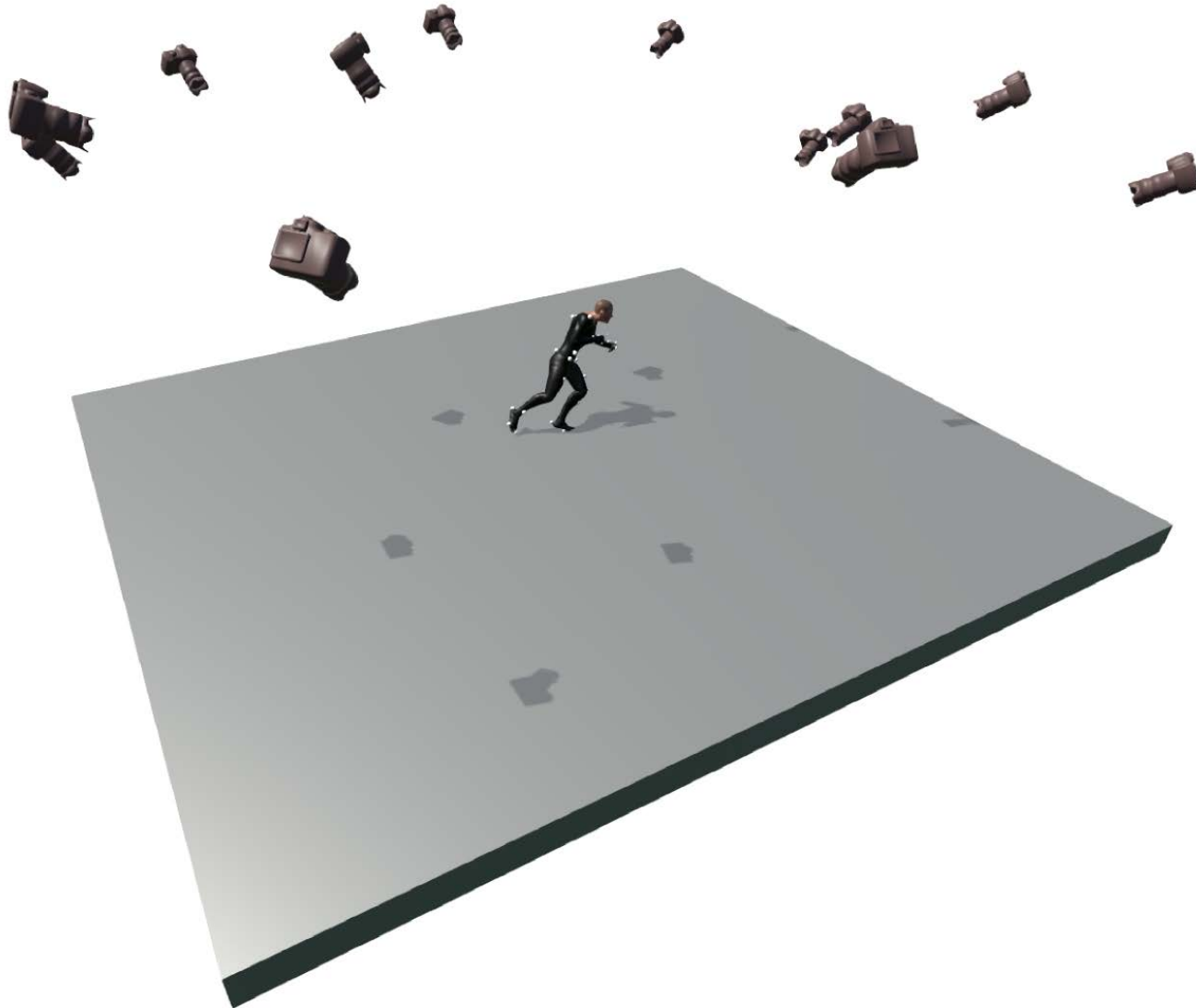


How much time is needed?
Are there inter-individual differences?
Is it trainable?

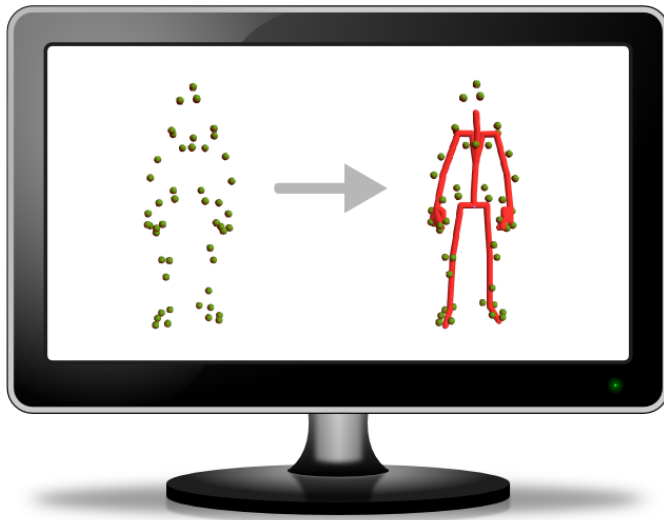
Penalty kick: Our simulator



Penalty kick: Virtual goalkeeper (avatar)

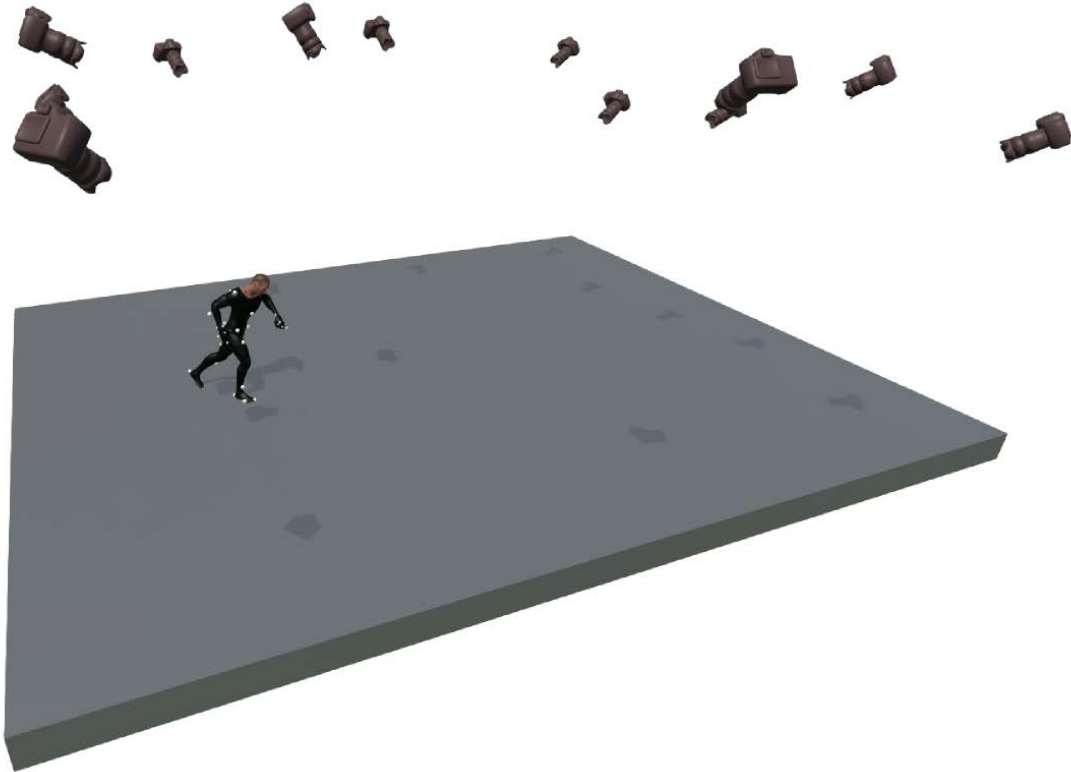


Virtual goalkeeper



Penalty kick: Simulation

Penalty kick: Kicker



Penalty kick: The simulator

Penalty kick: Results

**AFTER 3 HOURS
and
200 KICKS PER SESSION**

Before learning

After learning

**Swiss first
league**



**+12%
success rate**



Penalty kick: Results

**AFTER 3 HOURS
and
200 KICKS PER SESSION**

Before learning

After learning

**14-16 yo
(Elite)**



**+11%
success rate**



Penalty kick: Results

**AFTER 3 HOURS
and
200 KICKS PER SESSION**

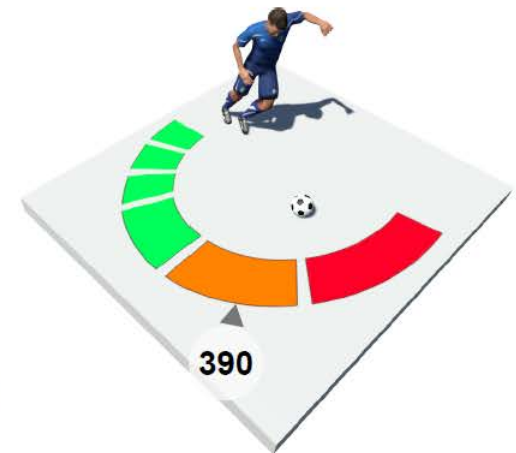
Before learning

After learning

**10-12 yo
(Elite)**



**+12%
success rate**



Penalty kick: Conclusion

Redirecting the kick at the last moment requires sensorimotor skills



These sensorimotor skills

- are not the same for all players
- are trainable

Our contribution

- **Detect which players have the best skills**
- **Improve these skills**

Penalty kick: the 'team'





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