





Social Distancing in football

Analysis commissioned by the Dutch Football Association (KNVB)

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Introduction & Methodology

This report is commissioned by the Dutch Football Association (KNVB). We have analysed '*close encounter exposure*' between all players on the pitch using position tracking data from players in 474 Dutch Eredivisie matches, 8 EC qualification matches from the Dutch national team, and 7 youth matches from the U17 WC in Brazil.

This report provides a first indication of the risk for close encounter exposure during professional matches.

Inmotio is available for further enquiries about the report as well as for future research on this topic.



Methodology



Conditions & Assumptions

This analysis is conducted according to the following conditions and in line with the following assumptions:

1. For every match, the dataset contains the positions of all players on the field, tracked 10 times per second (exc. Half-time). *See the attachment for a specification of included datasets.*
2. A "Close Encounter" is defined as: any moment where the inter-player distance between 2 players falls below a given threshold.
3. Inmotio used five 'distance thresholds', 30, 50, 100, 150 and 200 cm.
4. The analysis is conducted for all possible pairs of players, for which we studied the cumulative time (in seconds) they were exposed to distance that fall below the thresholds.
5. "Critical Exposure" is defined as a cumulative close encounter exposure time > 30 sec.

Methodology



Features

We used the following features in our analysis:

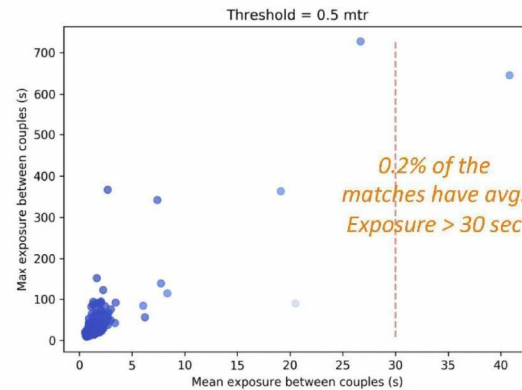
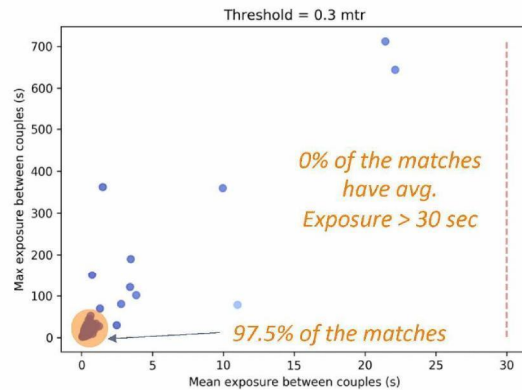
- **Close encounter exposure time** → The cumulative time per match in which the distance between 2 specific players fell below the threshold (e.g. 0.5m).
- **Max exposure between couples** → The highest close encounter exposure time measured between any couple in 1 match.
- **Mean exposure between couples** → The average close encounter exposure time between players in 1 match.
- **No. Of couples with > 30s exposure** → the number of couples who had > 30 sec exposure in 1 match.

Analysis Eredivisie Matches



Visual overview close encounter exposure 482 eredivisie matches (thresholds 0.3 & 0.5 mtr.):

- Minimal risk for critical exposure in matches, assuming a threshold of 0.3 - 0.5 mtr.
- An average of < 2 koppels exceed critical exposure limit (---) in a match.
- 97.5% of the matches can be deemed as a minimal risk for exposure for all players on the field.
- Only 12 matches (2.5%) can be defined as outliers. During these matches, couples had an increased risk for exposure.



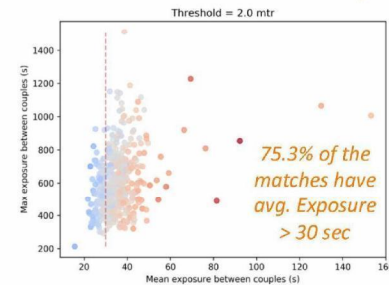
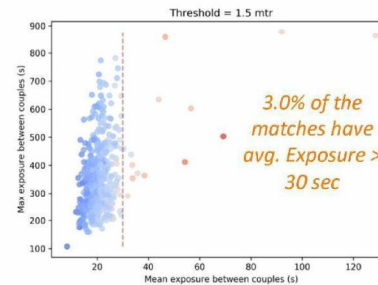
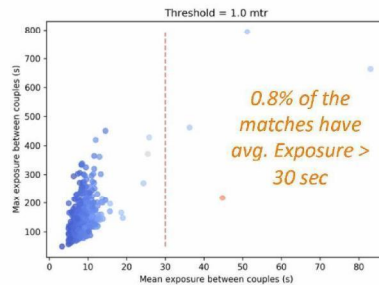
0 exposed couples (min) 237 exposed couples (max)

Analysis Eredivisie Matches



Visual overview close encounter exposure 482 eredivisie matches (thresholds 0.3 & 0.5 mtr.):

- For thresholds of 1.0 - 1.5 mtr. there is a slightly increased risk for close encounters, yet exposure for 80-90% of the players remains below the critical exposure limit (---).
- For thresholds of 1.0 - 1.5 mtr. Only 0.8 – 3.0% of the matches were characterized by elevated risks.
- Only at a threshold of 2.0 mtr one could say there is a structurally increased risk for critical exposure.
- >75% of the matches would provide elevated risks at the threshold of 2.0 mtr.



0 exposed couples (min)



237 exposed couples (max)

Analysis Eredivisie Matches

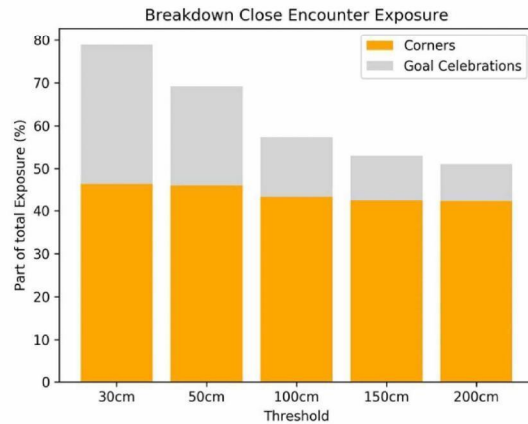


	Max exposure between couples (s)	Mean exposure between couples (s)	No. of couples with >30s exposure
Threshold = 0.3 mtr	18.4 (1.9 – 711.7)	0.5 (0.1 – 22.1)	0.4 (0 – 62)
Threshold = 0.5 mtr	38.2 (8.5 – 727.2)	1.7 (0.5 – 40.8)	1.5 (0 – 108)
Threshold = 1.0 mtr	156.5 (49.0 – 793.6)	9.2 (3.3 – 83.0)	28.2 (4 – 181)
Threshold = 1.5 mtr	356.8 (107.5 – 877.4)	21.0 (8.2 – 128.6)	76.3 (24 – 218)
Threshold = 2.0 mtr	596.7 (213 – 1513.8)	35.3 (15.7 – 153.1)	121.1 (49 – 237)

Eredivisie Close Encounter Benchmarks:

- Average values including range (min – max) over 474 eredivisie matches.
- No to minimal risk at thresholds of 0.3 – 0.5 mtr.
- Slightly elevated risks at thresholds of 1.0 – 1.5 mtr.
- Structurally increased risks at thresholds of 2.0 mtr.

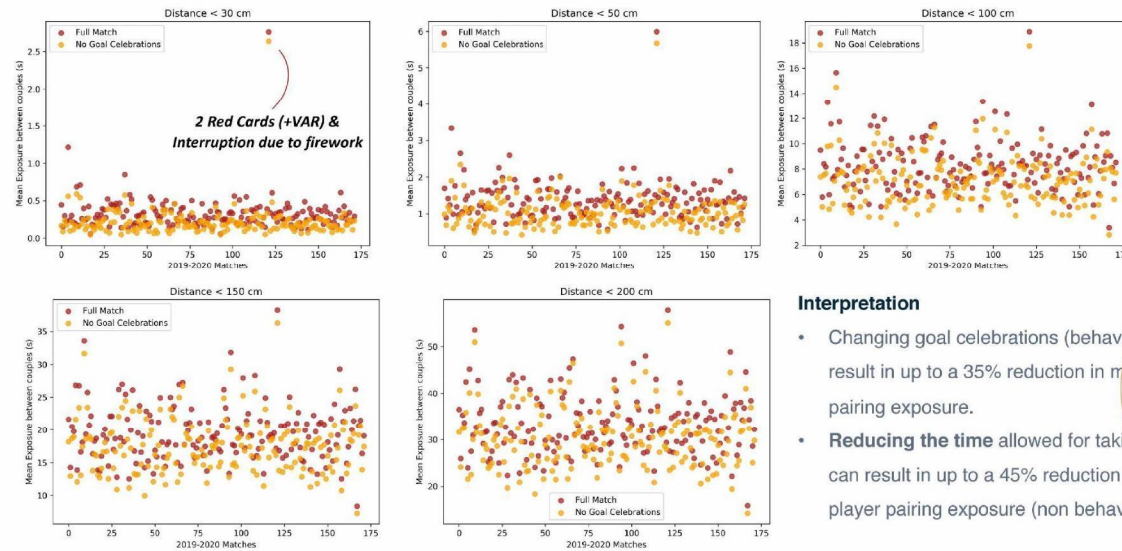
Corner- and goal-celebration exposure



Interpretation

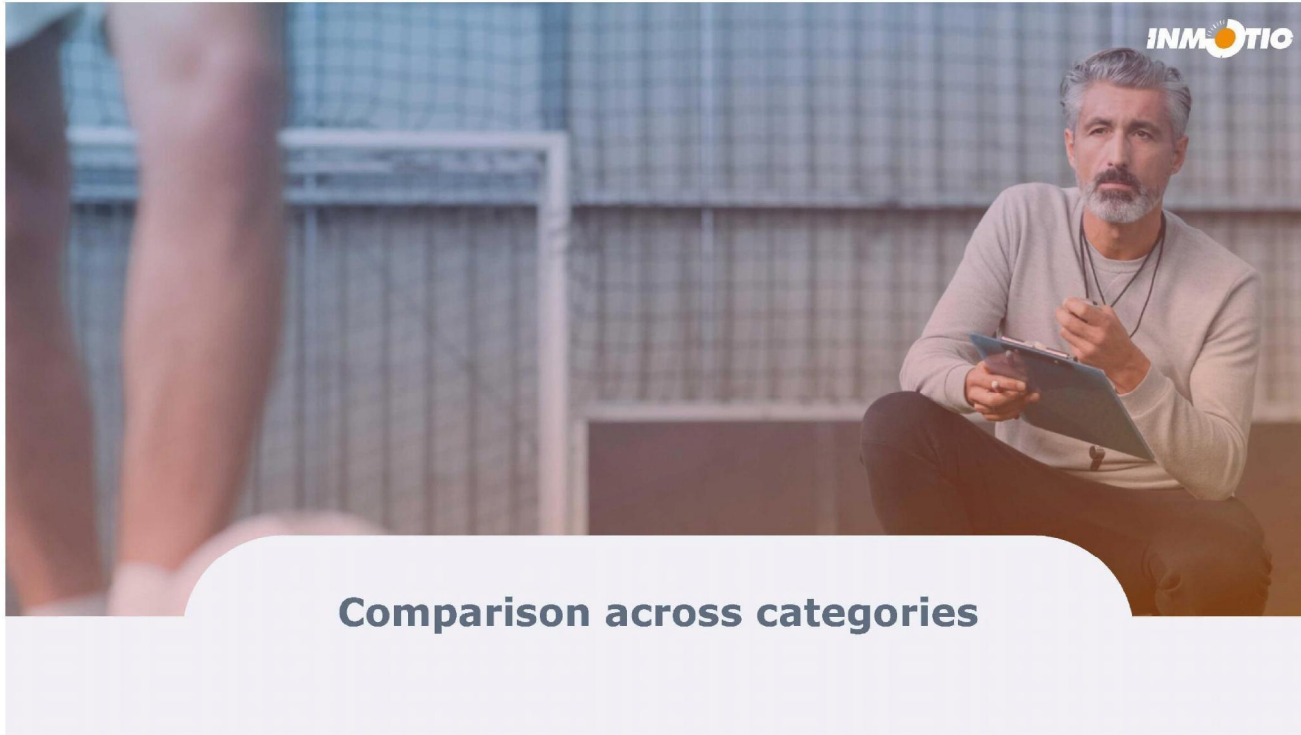
- 50-80% of the total exposure can be attributed to **corners** and 'goal celebration'.
- **Corner exposure** is mainly driven by the **duration** of the event, while goal celebration exposure is mainly driven by the **number of players** involved.
- Other high exposure events are **VAR moments, game interruptions and red cards**.

Impact Behavioural Changes



Interpretation

- Changing goal celebrations (behaviour) can result in up to a 35% reduction in mean player pairing exposure.
- **Reducing the time** allowed for taking corner can result in up to a 45% reduction in mean player pairing exposure (non behavioural)



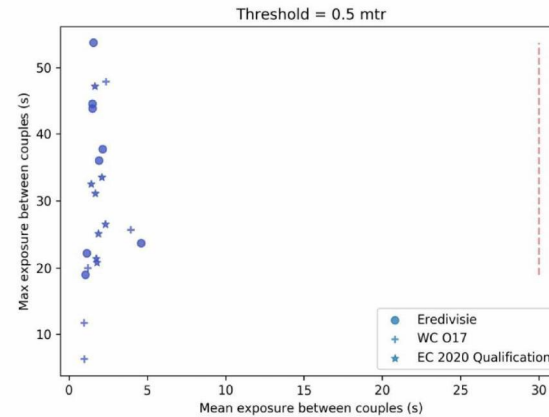
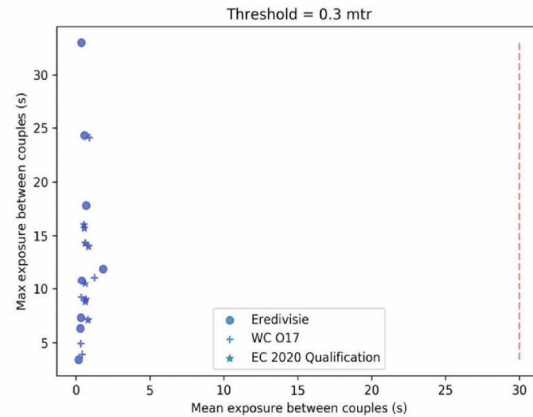
Comparison across categories

Comparison across categories



Interpretation

To analyze if our results could be generalized to football in different categories, we compared a representative selection of 7 eredivisie matches against EC qualification matches of the Dutch national team, and World Cup matches of the U17 team. *The results indicate that international games, as well as youth games, fit the trend identified in our larger dataset.*



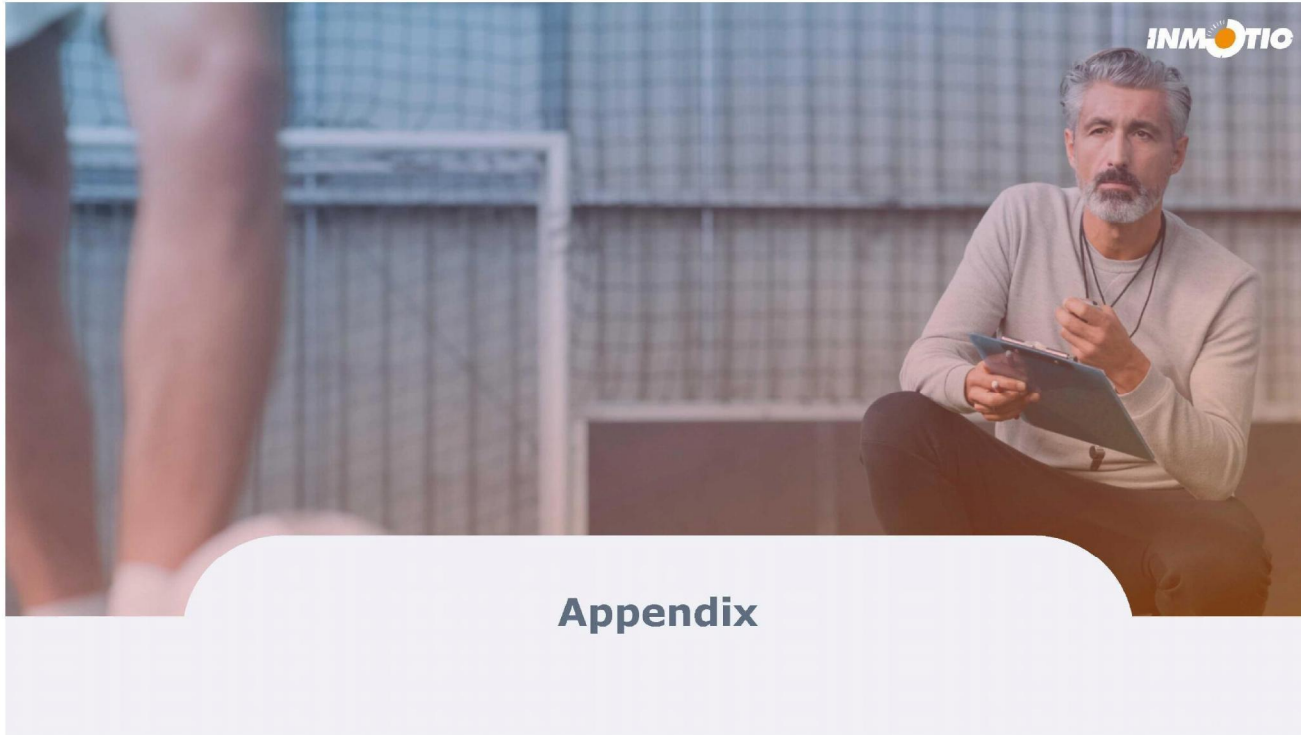
Conclusion on match data



Conclusion

Based on the assumption that a close encounter exposure time < 30 sec at a threshold of 50 cm can be deemed a safe limit, we conclude that:

- Professional matches do not harness increased levels of risk for close encounters;
- Only in rare exceptions (2.5%) we found elevated risks for several players on the field;
- Only at a threshold of 2.0 mtr. Players could be at increased risk for close encounters exceeding the safe limit.
- 50-80% of all close encounters can be attributed to Corners & Goal-celebrations
- Other high exposure events are VAR review moments, red cards and play interruptions
- There is no difference between the Eredivisie matches and 'other' matches analyzed.



Appendix

Appendix – Matches



Data

For the analysis we used 474 Eredivisie matches from the '18-'19 and '19-'20 seasons. Data was collected using a league-wide employed optical tracking system (ChyronHego TRACAB – 25 Hz). This system has proven to be highly accurate and reliable according to [FIFA](#). For the analysis of the EC Qualification & World Cup U17 data we used the Optical tracking System data from STATS. Training Sessions of the Dutch team are recorded by the LPM system of Inmotio.

In addition, we have used the following matches and training sessions for the comparisons across categories and

Eredivisie	EC Qualification	World Cup U17	Training Sessions Dutch Team
PEC Zwolle – FC Groningen	Wit-Rusland – Nederland	JapanU17 – NederlandU17	14-11-2019 (Training 1)
Vitesse – AZ	Estland – Nederland	NederlandU17 – Senegal U17	13-11-2018 (Training 2)
RKC Waalwijk – Heracles Almelo	Duitsland – Nederland	NederlandU17 – USAU17	
FC Emmen – FC Twente	Nederland – Duitsland	NigeriaU17 – NederlandU17	
PSV – Ajax	Noord-Ierland – Nederland	OranjeU17 – ParaguayU17	
FC Emmen – Sparta Rotterdam	Nederland – Noord-Ierland	NederlandU17 – FrankrijkU17	
FC Utrecht – VVV-Venlo	Nederland – Wit-Rusland		
	Nederland – Estland		

