

# ***DATA SCIENCE IN SPORTS***

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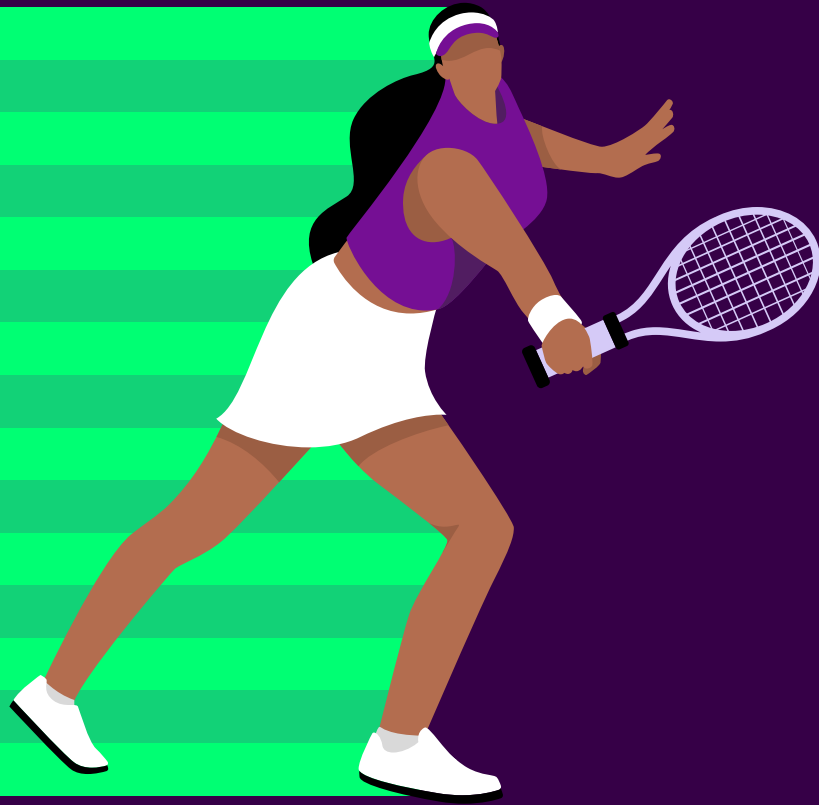


# ***Domain Area***

## ***Sports Analytics***



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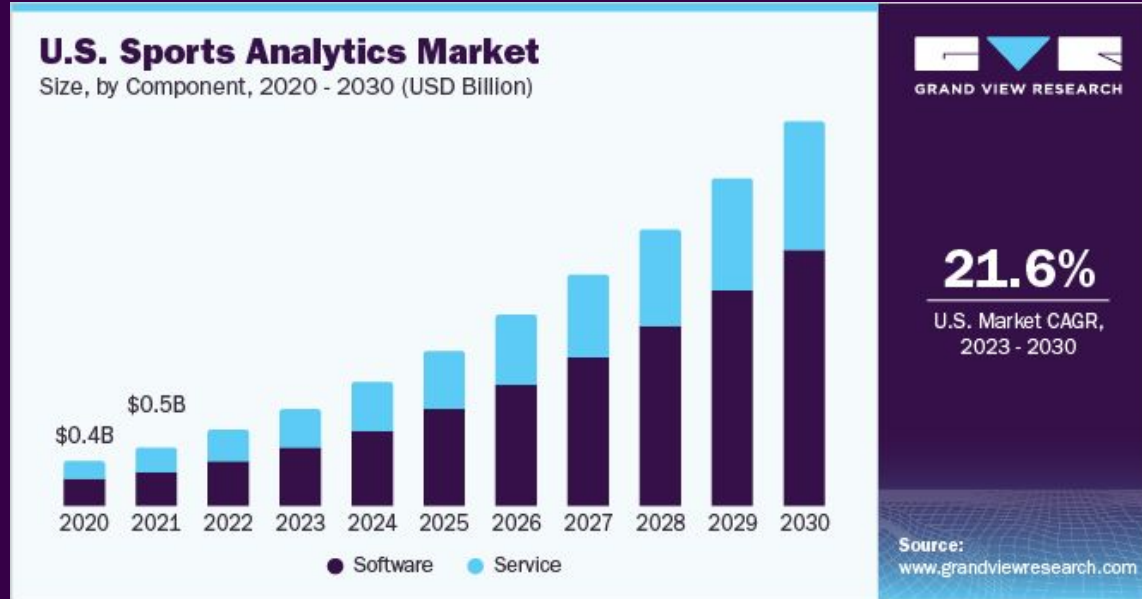
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# ***Domain Area: Sports Analytics***



<https://www.grandviewresearch.com/industry-analysis/sports-analytics-market>

01

# *How is Data Science helpful in Sports Analytics?*





# ***THREE MAIN GOALS***

***01***

## ***Player & Game Performance***

Performance evaluation of player with the goals of:

- Best possible players
- Best possible line-up
- Best decisions on field

***02***

## ***Player Health & Injury Analytics***

Injury prevention to overcome:

- Team performance cost
- Financial cost

***03***

## ***Business Analytics***

Analytical operations concerning:

- Strategically adapt the ticket prices
- Increase fan engagement



# 01 *Player & Game Performance*

Performance data allow us to:

- Appropriately evaluate players
- Identify the required skill set
- Quantify player's relative importance to team's success
- Develop data-based models for player scouting
- Simulate games or by analyze game tactics





# ***Game Strategy & Decision-Making Impact***



***Performance  
Analysis***

***Game Situation  
Analysis***

***Injury  
Prevention***

***Substitution  
Strategies***

***Pitch  
Selection***

***Situational  
Awareness***

***Play  
Calling***

***Fan  
Engagement***

***Strategic  
Timeouts***





## Example



**Thomas Tuchel,**  
*Former Chelsea Football  
Club Manager*

“ So we had some statistics, we were well prepared, that Kepa is the best in percentage in saving penalties. ”

***Kepa saved two  
penalties!***



**Kepa Arrizabalaga,**  
*Chelsea Football  
Club Goalkeeper*



# ***Analytics in Player Scouting and Recruitment***



## ***Scouting***

- Performance Analysis
- Advanced Metrics
- Video Analysis
- Scouting Reports
- Opponent Analysis
- Comparative Analysis

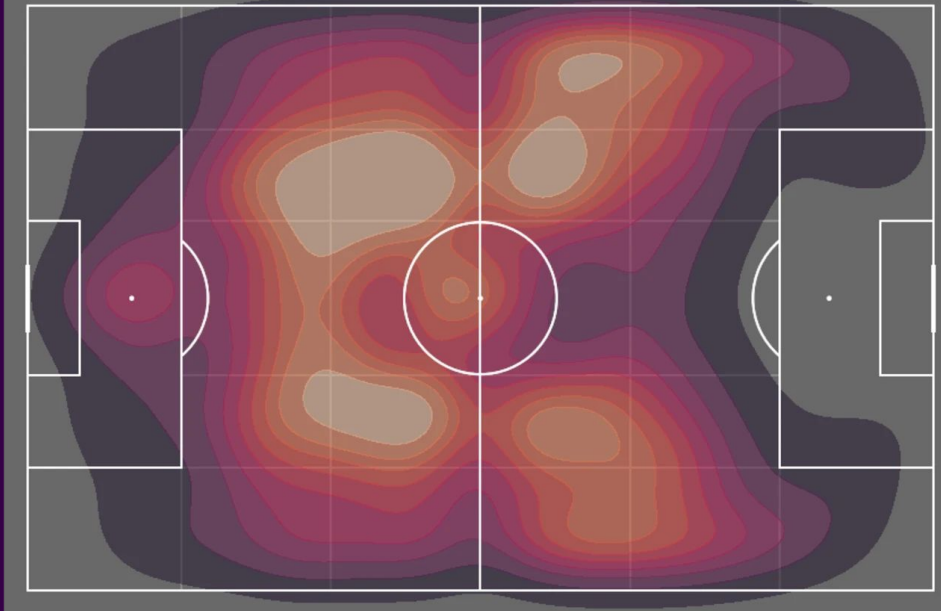


## ***Recruitment***

- Data-Driven Decision-Making
- Predictive Analytics
- Financial Analysis



## Arsenal Regular Play Heat Map



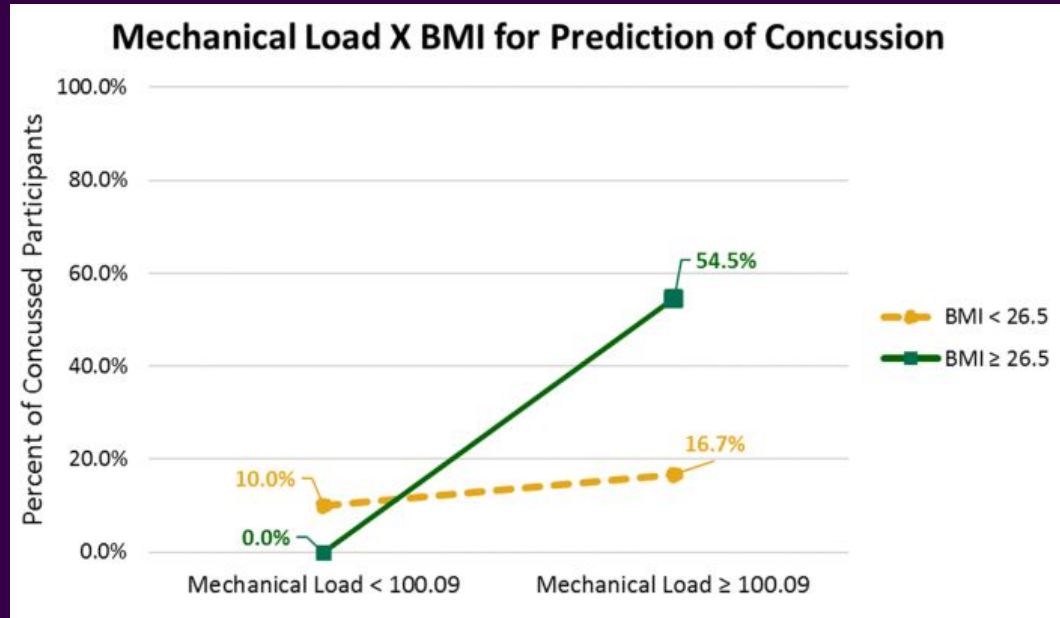
[https://www.reddit.com/r/Gunners/comments/nikh9o/arsenal\\_regular\\_play\\_heat\\_map\\_premier\\_league/](https://www.reddit.com/r/Gunners/comments/nikh9o/arsenal_regular_play_heat_map_premier_league/)

## 02 *Player Health & Injury Analytics*

- Using descriptive factors (heart rate, blood pressure...) from frontier technology to:
  - Measure athletes' physical condition (stress levels)
  - Analyze effect of different trainings
- This avoids:
  - Salary is paid, even when player is injured
  - Team performance decreases
  - Injury risk reduction and faster recovery process

## Example: Zephyr BioHarness Wearable Technology

→ Predict and prevent injuries based on overall mechanical load and BMI



### Results:

- Identify players with higher injury risk
- Balance overall exertion levels
- Enroll in conditioning programs

<https://link.springer.com/article/10.1007/s10796-020-10018-3>

# ***Sports Analytics: Player Development & Injury Prevention***

Ways in which analytics contribute to player development and injury prevention:

- Performance Monitoring
- Individualized Training Plans
- Load Management
- Biomechanical Analysis
- Injury Risk Assessment
- Player Tracking Wearables
- Video Analysis
- Rehabilitation Monitoring
- Nutritional Guidance
- Longitudinal Tracking



# 03 *Business Analytics*

- **Ticket Pricing models:** Static vs. Dynamic Pricing
- **Increasing Fan Engagement:**
  - Sport-related behaviors
  - Impression-management behavior
  - Relationship-building behaviors
  - Non-transactional extra role behaviors

**Inter Miami starting ticket price before Messi: \$31**



**Inter Miami starting ticket price after Messi: \$252**

<https://www.intermiamicf.com/news/inter-miami-cf-signs-seven-time-ballon-d-or-winner-world-cup-champion-lionel-messi>

<https://khelnow.com/football/2023-08-world-football-inter-miami-ticket-prices-before-and-after-lionel-messi>



## FC Bayern Munich Perfects the Fan Experience with Digital Solutions

- **Goal:** build a bond with supporters outside the stadium and create additional experiences for them
- **How?**
  - Through SAP HANA – customer data is combined in a 'Golden Fan Record' (+250 attributes)
  - Anticipating fan wishes and utilizing existing capacities



02

***What are some of  
companies/research  
groups working in  
sports?***





# *Companies*



## ***Prozone Sports***

Prozone Sports Ltd, a pioneer in performance analysis for 19 years, collaborates with top sports clubs and organizations to provide world-leading performance analysis services.



## ***Genius Sports***

London-based Genius Sports specializes in sports data, betting, and media tech. Trusted in 150+ countries, they partner with 400+ global sports organizations, such as NFL, EPL, and FIBA.



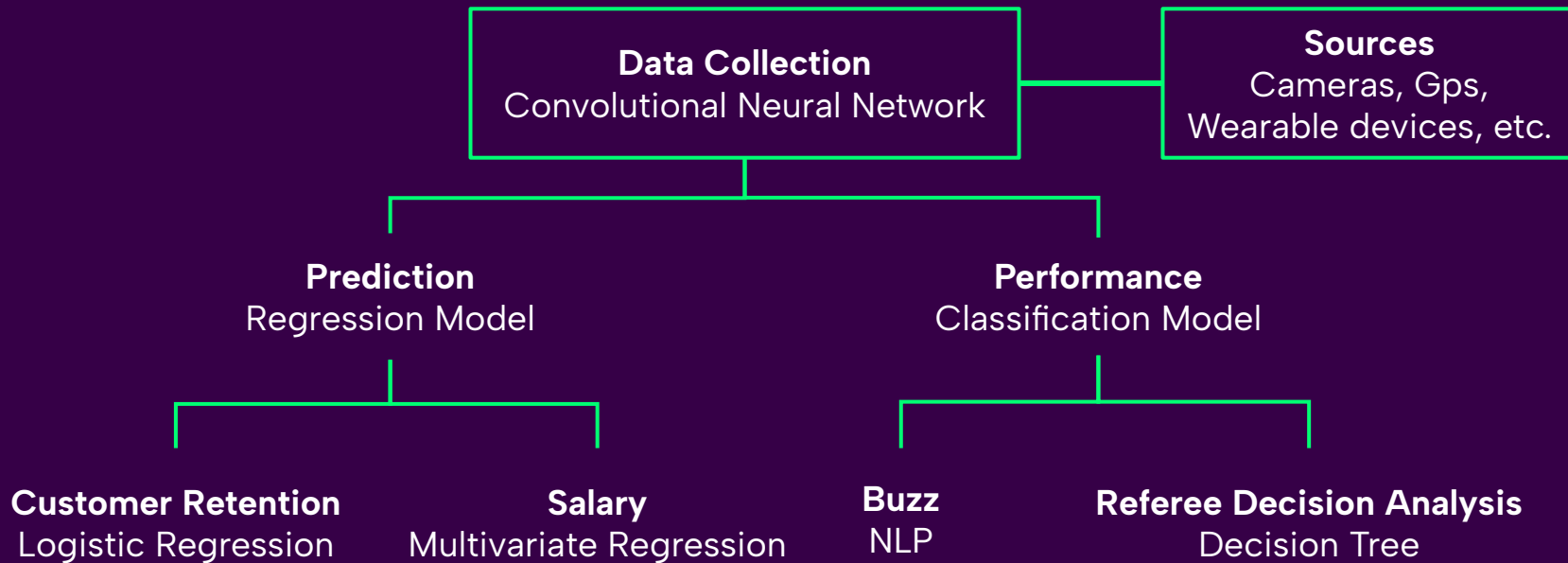
## ***Sportradar***

Sportradar is a Silicon Valley technology startup that developed an analytics platform to interpret the data and provide relevant, actionable information to the team staff.





# ***How Data Science is Used***



03

***Data Scientist in  
Sports:  
Daily Role & Ethical  
Challenges?***





# ***Day-to-day Activities***



***Communication***



***Data-Driven  
Research and  
Analysis***



***Specialization  
in a Sport or  
Team***





# ***Day-to-Day in Sports***



## ***Golf and basketball***

- Analyzing data
- Setting up the infrastructure



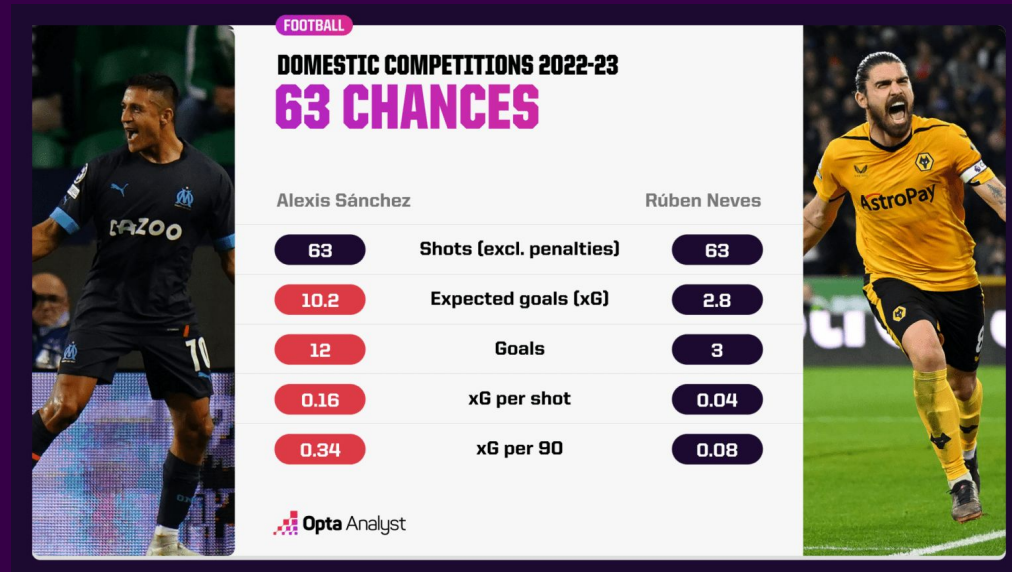
## ***Football company***

- Pipeline monitoring
- Scouting reports
- Explain Blackbox ML solutions to football experts



# Metrics

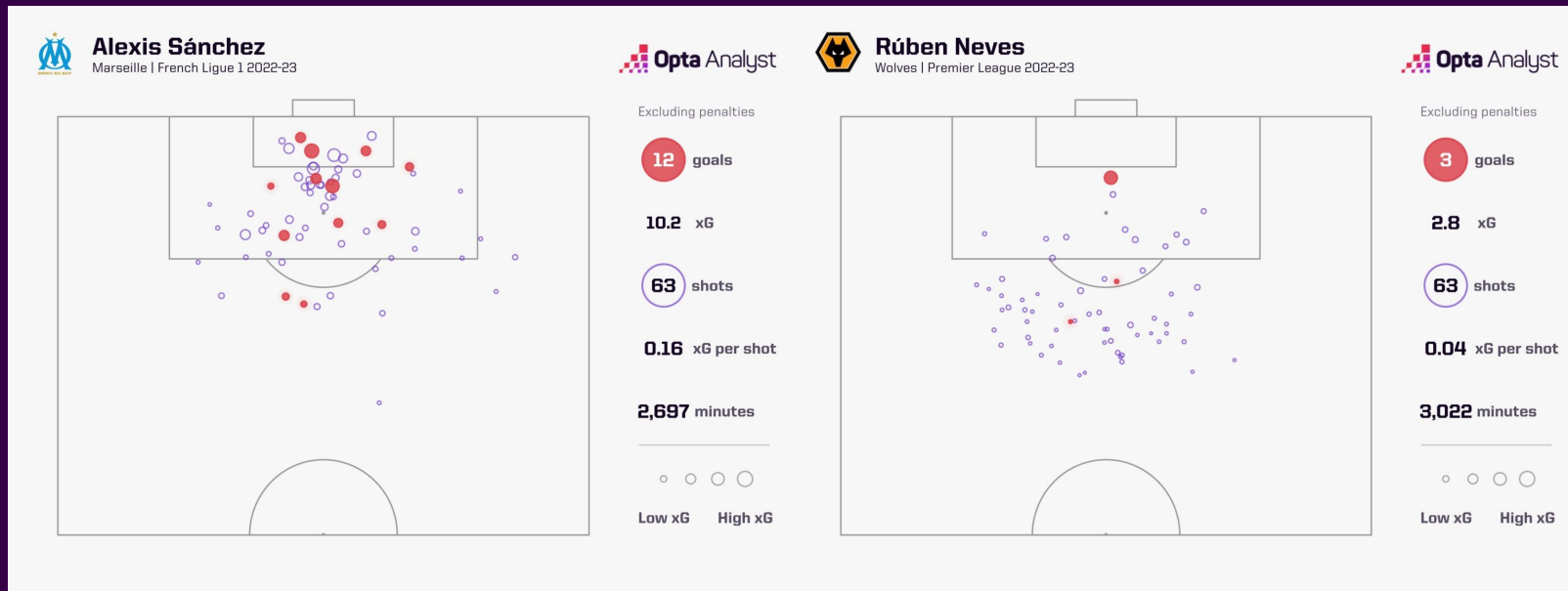
## XG – Expected Goals



<https://theanalyst.com/na/2023/08/what-is-expected-goals-xg/#:~:text=Since%20xG%20was%20introduced%20in.and%20insightful%20within%20football%20analytics.>



# XG – Expected Goals



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# ***Challenges & Ethics***



## ***Challenges***

- Privacy Concerns
- Informed Consent
- Data Security
- Data Ownership



## ***Ethical Considerations***

- Fair Use
- Transparency
- Data Retention
- Bias Mitigation
- Accountability



04

***What are the skills that a data scientist should have when working in this domain?***





# ***Essential Skills***



***Statistical Analysis***



***Machine Learning***



***Data Manipulation***



***Sports Knowledge***



***Data Visualization***



***Domain-Specific Metrics***





# ***Specialized Tools***



## ***Data Collection***

- Stats Perform
- Sportradar
- Opta
- FBref



## ***Analytics***

- Sports Insights
- Sportscube
- Catapult Sports



## ***Visualization Tools***

- Tableau
- Power BI
- QlikView

# ***How to get Involved?***



***Gain Sports Knowledge***



***Build Portfolio***



***Join Sports Analytics  
Communities***

Reddit Communities  
**Sports Analytics: for nerds who  
love sports**



***Attend Conferences  
and Workshops***

MIT Sloan Sports Analytics  
Conference



05

***What are some courses  
that you could take at CU  
or elsewhere?***





# ***COURSES AT CU***



## ***LEEDS SCHOOL OF BUSINESS***



Leeds School of Business offers a 9-credit "boot camp" for sports and recreation enthusiasts, covering topics like sports analytics.



## ***DIGITAL IMAGE PROCESSING***



Course teaches the fundamental techniques for image representation and compression.



## ***NEURAL NETWORK AND DEEP LEARNING***



Learn to design neural network architectures and training procedures



## ***MACHINE LEARNING***



The curriculum encompasses mathematics, statistics, machine learning, ethics, and societal aspects to provide a holistic education.







# ***OTHER COURSES***



## ***UNIVERSITY OF MICHIGAN***



This sports online analytics course uses real data from various sports leagues to teach predictive modeling, machine learning, and data analysis to sports enthusiasts, professionals, and Python learners.



## ***SYRACUSE UNIVERSITY***



Syracuse University's sport analytics program educates students on the principles of research methodology, sport economics, database management, finance, computer mathematics, statistics and economics.



## ***GEORGE MASON UNIVERSITY***



Courses in sport analytics provide students with a foundational understanding of the sport industry coupled with the study of how data can be used in the world of sport to enable teams, leagues, and other sports businesses to gain an advantage over their competitors.



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# THANKS!

*DO YOU HAVE ANY QUESTIONS?*



*Scan to get  
resources*



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