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Neumann, Niklas

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Dynamic Performance Networks in Sports

Niklas D. Neumann¹, Nico W. Van Yperen¹, Carolin R. Arens¹, Jur J. Brauers², Wouter G.P. Frencken^{2,3}, Rens L.A. Meerhoff⁴, Ando C. Emerencia¹, Michel S. Brink², Koen A.M.P. Lemmink², and Ruud J.R. Den Hartigh¹



¹Department of Psychology, University of Groningen, Groningen, The Netherlands
²Center for Human Movement Sciences, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands
³Football Club Groningen, Groningen, The Netherlands
⁴Leiden Institute of Advanced Computer Sciences (LIACS), Leiden University, Leiden, The Netherlands



1. Background

- Research on **determinants of sports performance** is typically based on a) measurements at one point in time, b) a group of athletes, and c) a causal chain;
- Recent research suggests that psychological and physiological determinants rather **interact in individual-specific ways over time** [1-3];
- An important next step is therefore to address this complex, individual, and temporal process in sport psychology research and practice;
- We applied a novel analytical method, **Time-Varying Vector AutoRegressive (TV-VAR) modeling**, to capture the interactions of performance-related factors from individual athletes within the soccer context [4].

2. Methods

- Two male players of a Dutch major league (Eredivisie) club were measured **daily on 10 psychological and physiological factors during one season**;
- Players answered **self-report questions** before and after training/match (Figure 1) and they were measured with **sensors** during training/match;
- We assessed the temporal dynamics (i.e., **autoregressive and cross-lagged effects**) of the factors with (TV-)VAR models and **visualized the results in network graphs**.

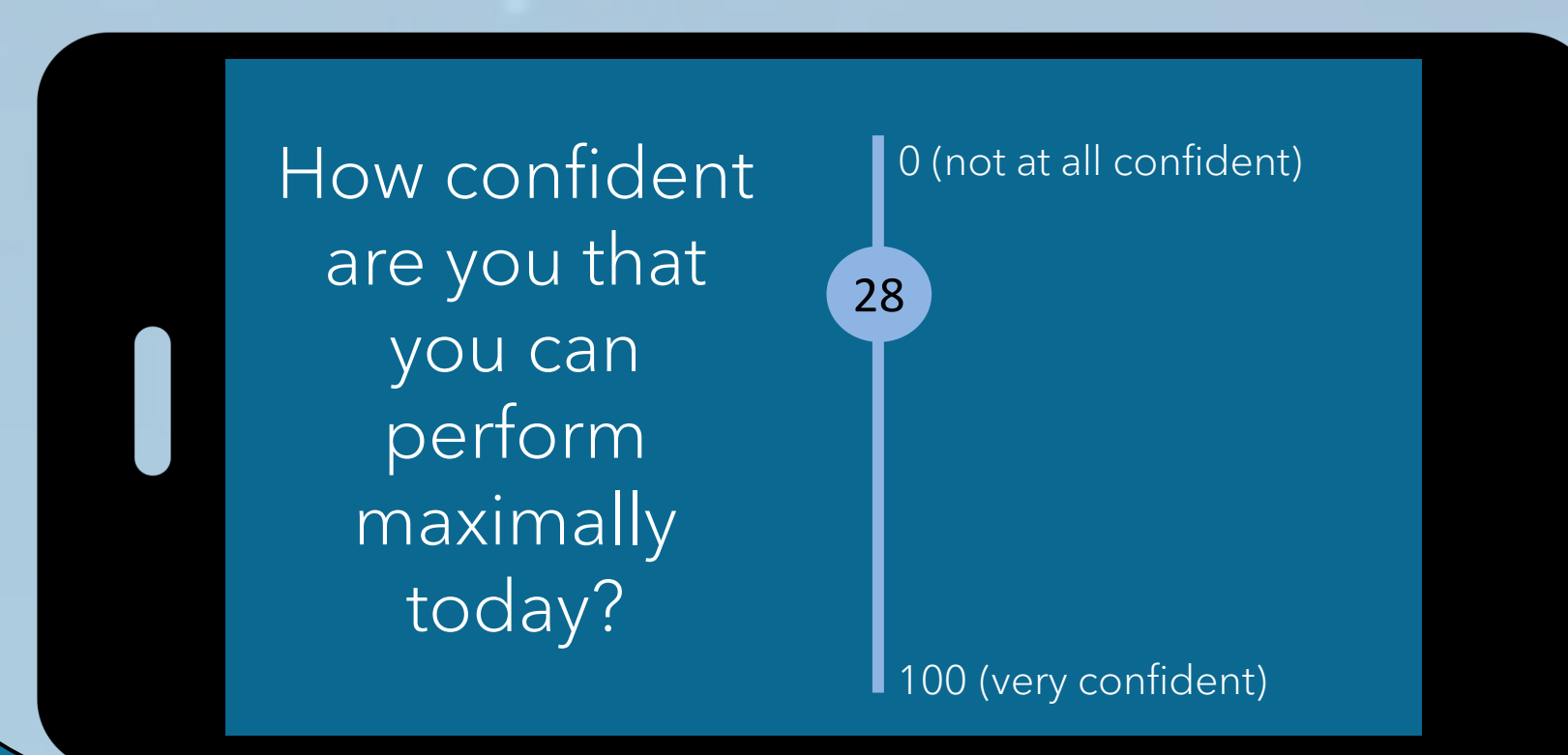


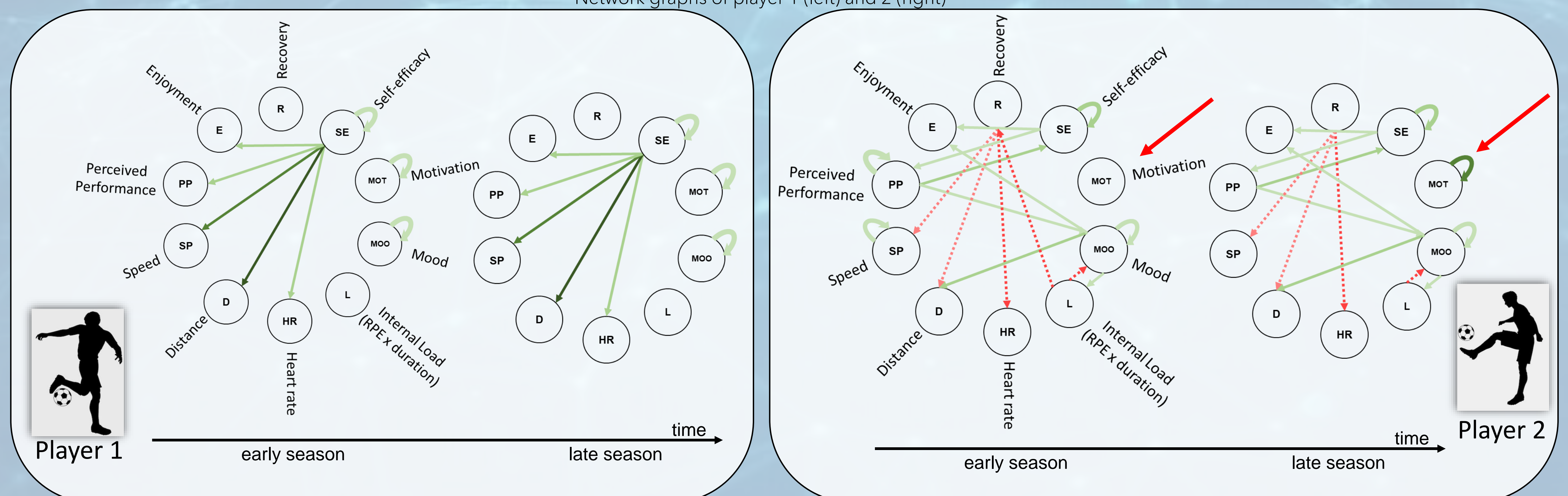
Figure 1
Data collection through our tailor-made app on a tablet computer.

3. Results

- The results reveal **individual-specific network graphs** with either stable (left) or changing (right) dynamics over the course of the season (Figure 2);
- The **self-efficacy** of player 1 (left) appeared to play a **central role** in his network, whereas for player 2 (right) multiple factors had effects on each other.

Figure 2

Network graphs of player 1 (left) and 2 (right)



Note. The green/solid edges represent positive effects, the red/dashed edges represent negative effects and the transparency reflects the magnitude of the effect (more transparent edges display weaker effects and less transparent edges display stronger effects). The self-loops show the autoregressive effects and the direct edges represent cross-lagged effects. The loose red arrows indicate changes in the dynamics over time (for the factor motivation in this case).

4. Conclusion

- TV-VAR modeling is a novel technique to capture the individual-specific interactions of performance-related factors over time;
- The model may help researchers and practitioners to **better understand how the factors of an individual athlete are related**, and when those relations change;
- This may be informative about **which factors to intervene on, and when**, to maintain optimal performance;
- Future research should study **network patterns** of individual athletes, which typically occur before **performance gains and losses** [5, 6].

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More Information



Niklas D. Neumann



n.d.neumann@rug.nl

The Project

