BEYOND ASSISTS – uncovering the DNA of Oranje

Emmy Dudok, ProcessChemistry

Data volumes are increasing by the minute. Within these data, a wealth of information and knowledge is enclosed. More and more techniques are becoming available to make sense of all these data.

Data-driven insight in football already covered player and match stats, but no team stats

In sports and football in particular, data-based analyses have really taken off over the last years. Stadiums – and players for that matter – are equipped with the latest technology to automatically gather data. Think of video, goal-line, and GPS technology. This enables real-time analysis and coaches can instantly take action based on a combination of their expertise and data. Team composition, line-ups, tactics, and training plans can all benefit from data-based analyses.

"What would you rather have? One good team of eleven, or eleven good teams of one?"
– Johan Cruijff –
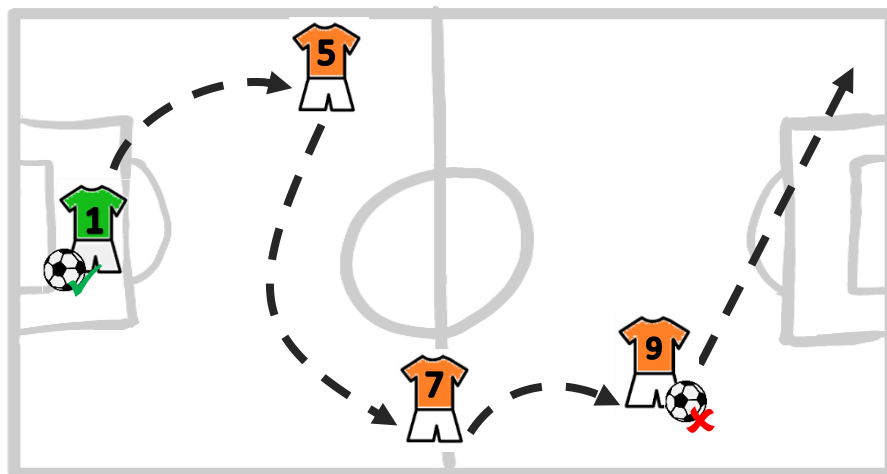
PASS SEQUENCE – SEQUENCE STARTS AT 1, CONTINUES TO 5, 7, AND ENDS WITH AN ATTEMPT OFF TARGET BY 9. THIS PASS SEQUENCE CONSISTS OF 3 PASSES AND 4 TOUCHES.

Besides match statistics such as ball possession, number of yellow/red cards, and fouls committed, more comprehensive analyses such as player and ball possession heat maps and attack origins are available these days. All mostly player or match statistics. But how about team performance? How does the team work together? How do individual players contribute to the team performance? As Johan Cruijff once said (translated): "What would you rather have? One good team of eleven, or eleven good teams of one?"

Eleven individual top players do not necessarily make a good team.

Are we able to capture the cooperation of a football team by looking at data? And if so, which new insights become available to football clubs, coaches and scouts?

Uncover team performance with process mining

In order to gain insight into the team's cooperation, the data analysis technique *process mining* is used. It is based on *pass sequences*, a sequence of passes that starts when the team takes and ends when the team loses ball possession. As long as the team maintains ball possession, the pass sequence is prolonged with every touch (see example above). When we look at all pass sequences and merge them, we obtain the *social network* of a football team (see example network on the left). It provides detailed insight into successful and less successful player cooperation and looks beyond mere assists.
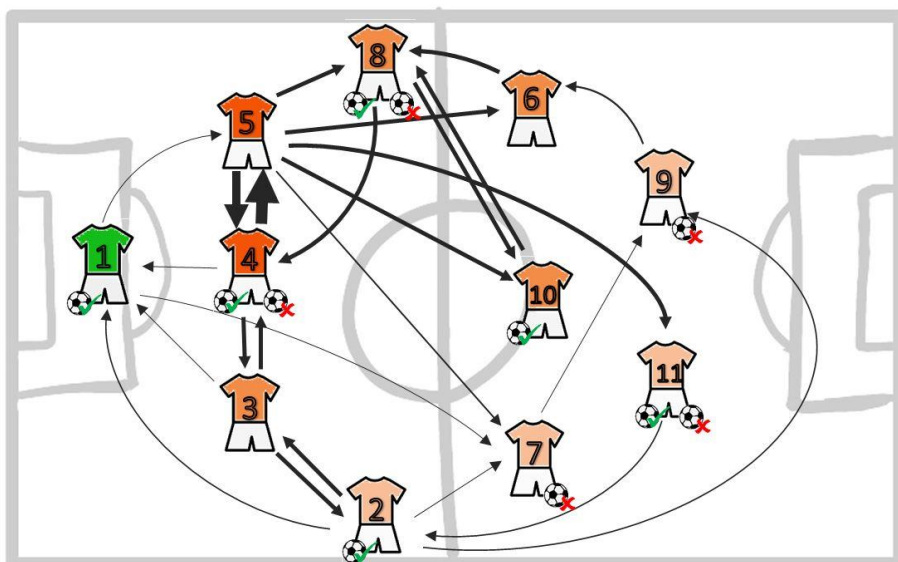
SOCIAL NETWORK OF A FOOTBALL TEAM – EXAMPLE.

SPAIN (1) – NETHERLANDS (5)	
WORLD CUP GROUP STAGE – JUNE 13TH 2014	
COACH	Louis van Gaal
LINE-UP	5-3-2
PASS SEQUENCES	154
PASSES	338
TOUCHES	492

CZECH REPUBLIC (2) – NETHERLANDS (1)	
EURO QUALIFIERS – SEPTEMBER 9TH 2014	
COACH	Guus Hiddink
LINE-UP	5-3-2 (4-3-3)
PASS SEQUENCES	156
PASSES	620
TOUCHES	776

In 2014, "Oranje" (the Dutch national team) reached as far as the semi-finals of the World Cup. In the months thereafter, however, they proved unable to qualify for the European Championship 2016.

From semi-finals
to unable to qualify

To show the added value of having insight in team collaboration, the highly successful match from the group stage in the 2014 World Cup of Oranje against Spain on June 13th 2014 is compared to the less successful Euro qualification match against the Czech Republic on September 9th 2014. With a similar team, similar line-up and only three months apart, it reveals interesting insights. The analysis is performed using Lexmark's Perceptive Process Mining software.

Although ball possession was 23% higher in the Euro match, and there were 83% more passes, Oranje did not manage to win the game. Apparently, more opportunities were created and utilised in the World Cup match. Can data tell us more about the characteristics of the strategy and created opportunities?

SKIPPING A STATION. In 2014, Louis van Gaal nicknamed his tactics "skipping a station", indicating skipping the midfield with passes directly to the frontline. The execution of this strategy is captured in *field position cooperation networks*. No

38% "skipped a station"
### during the World Cup

less than 38% and 22% of passes originating from goalkeeper and defense respectively, went straight to the frontline, bypassing the midfield altogether. An increase of 24% and 5% compared to the Euro match (see top network).

DEFENSIVE STRATEGY. In the same network, the initially highly defensive strategy during the Euro match is visible in the number of passes directed towards
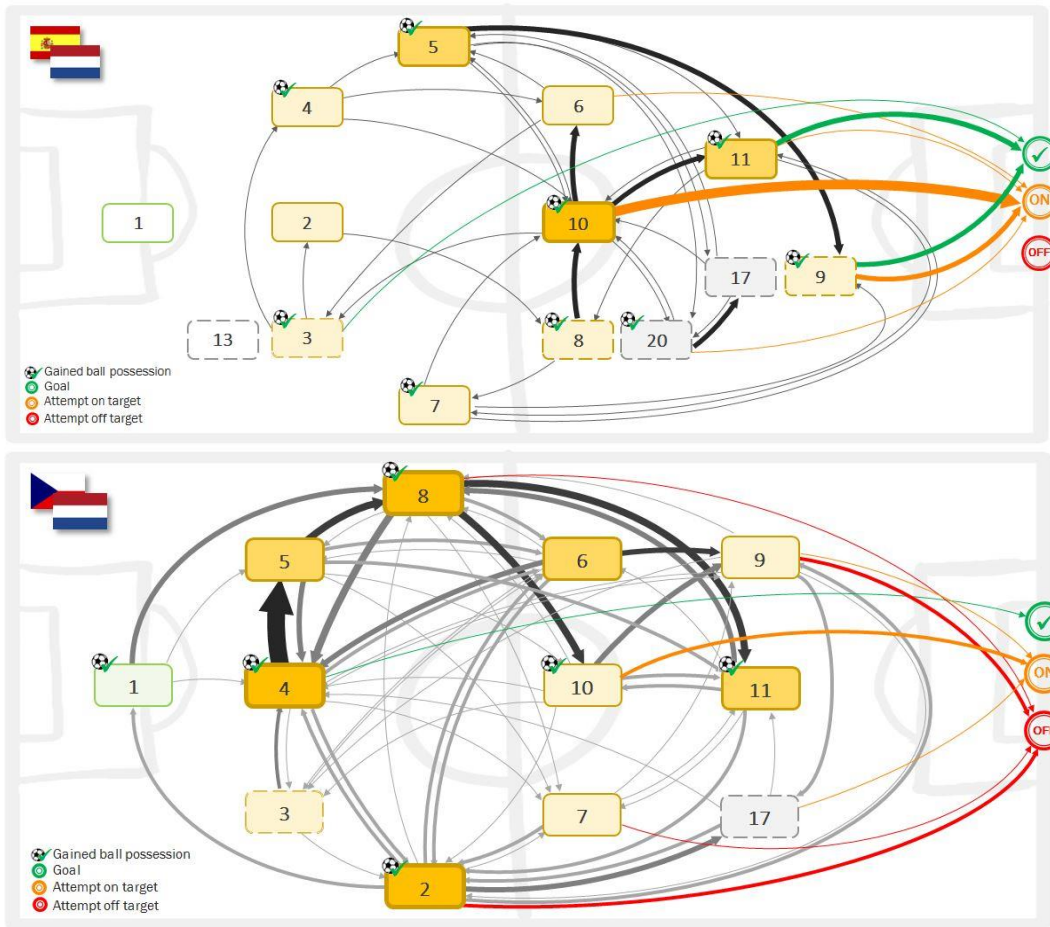
In this cooperation network, pass sequences are visualised by passes from, to and across field positions.

Positive percentages indicate an increase in comparison to the baseline; negative percentages a decrease. E.g. in the top network 18% additional passes went from Goalkeeper to Defense positions during the Euro match; 12% additional passes went across Defense positions; and 24% fewer passes went from Goalkeeper to Forward.

The bar charts within the field positions show the change in percentage of pass sequences started and ended at the field position (i.e., team gained/lost ball possession respectively), and change in number of touches. E.g. 4% additional pass sequences started at Midfield positions; and 8% fewer pass sequences ended at the Goalkeeper in the Euro match.
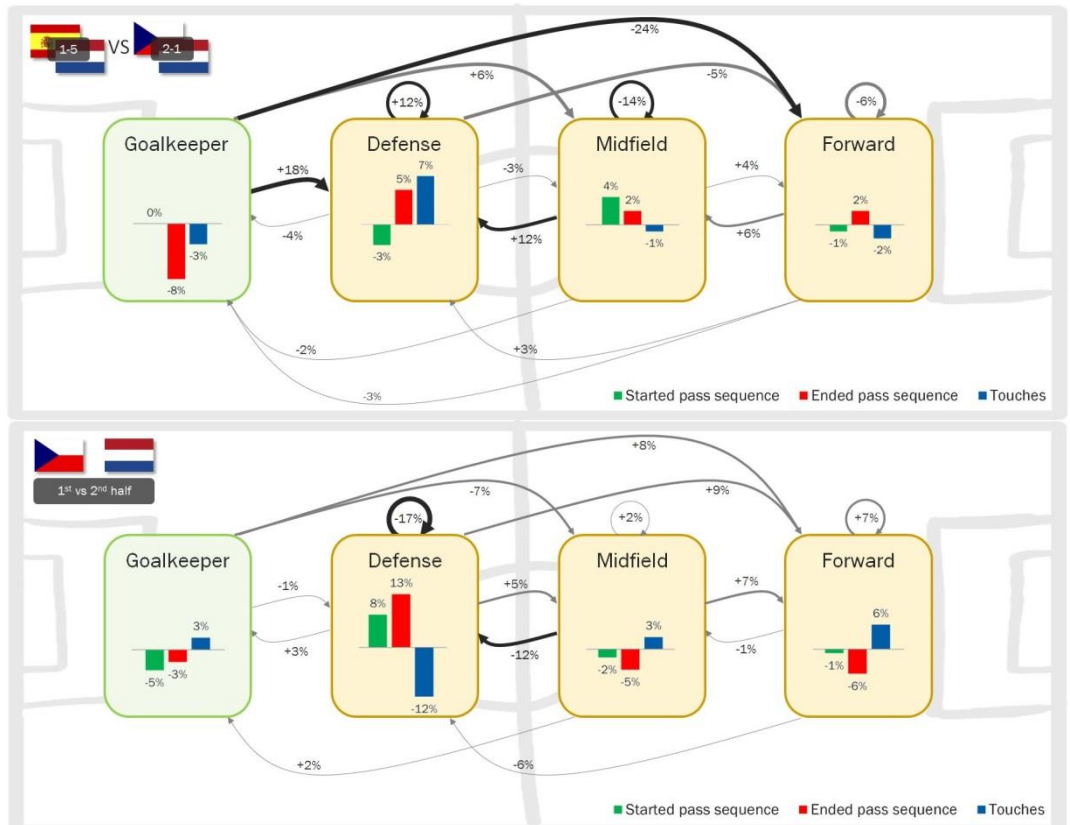
FIELD POSITION COOPERATION NETWORKS – COMPARISON BETWEEN THE WORLD CUP (BASELINE) AND THE EURO MATCH (TOP); COMPARISON BETWEEN THE 1ST (BASELINE) AND 2ND HALF OF EURO MATCH (BOTTOM).

TEAM COOPERATION NETWORKS – SUCCESSFUL PASS SEQUENCES IN THE WORLD CUP MATCH (TOP); SUCCESSFUL PASS SEQUENCES IN THE EURO QUALIFICATION MATCH (BOTTOM).

defense. The goalkeeper passed 76% towards defense, whereas this is only 58% in the World Cup match, a difference of no less than 18%. Midfielders also passed the ball back to defense 12% more, and defenders ping-ponged the ball to each other an additional 12%.

SUBSTITUTES. Do substitutes live up to expectations? In the Euro match, the line-up changed from a defensive 5-3-2 to a more offensive 4-3-3 line-up just before half-time, after a defender was substituted by a forward. The effect is visible in the bottom network on the previous page. As

Additional forward, less opportunities?

expected with an additional forward, num-ber of touches at the frontline increased

accordingly. Interestingly enough, fewer pass sequences ended at midfield and for-ward positions (red bar), suggesting fewer opportunities were created and utilised.

59% of completed passes bounced back directly

PASS QUALITY. A completed pass is not necessarily a good one. How successful are passes from defense to midfield really? The cooperation between midfield and defense reveals that in the Euro match from 101 completed passes to


BOUNCE-BACK BEHAVIOUR BETWEEN DEFENSE AND MIDFIELD

midfield, 60 (i.e., 59%) were bounced back directly to defense. 15 of these were bounced back directly to the same player. In the World Cup match only 46% of this bounce-back behaviour was present.

SUCCESSFUL PASS SEQUENCES. Which players are involved in (un-)successful attempts on and off target? In the *team cooperation networks* above we zoom in on successful pass sequences. There is a noticeable difference in the way attacks are built up between the two matches: deep versus wide. In the World Cup match, attacks are built up deeper, with a central role for midfielder no. 10. In the Euro match attacks are built up wider, mainly from the left defense wing, with central roles for defenders nos. 2, 4, and 8. On average, defenders were involved 30% more during attempts in the Euro match.

30% more involvement of defense in attempts

On average, 7 additional passes were required to make the attempts during the Euro match. Not surprisingly, on average it took 22 seconds longer to complete the attempts. Nevertheless, the only goal was scored faster than in the World Cup match.
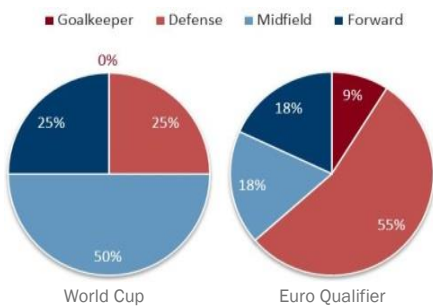
AVERAGE PERCENTAGE OF TOUCHES PER FIELDPOSITION IN ATTEMPTS

GO-TO COMBINATIONS. Often, players revert to solid pass or "go-to" combinations. See for example the most frequent player triplet combinations of both matches on top of the page, i.e., combinations of three players receiving the ball in succession. Since both matches have a similar line-up, it is not surprising that they reflect a similar foundation at the mid-left-wing of the field with
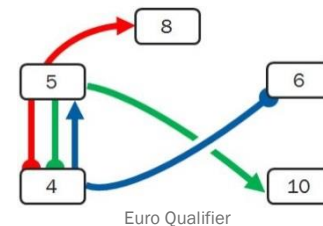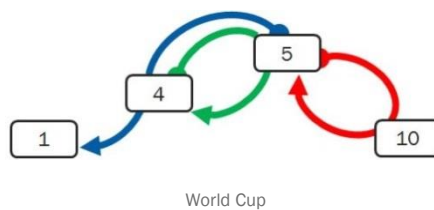
MOST FREQUENT PLAYER TRIPLET COMBINATIONS – WORLD CUP (LEFT) AND EURO QUALIFICATION MATCH (RIGHT).

## "Go-to" combinations in World Cup short and deep across field

corresponding players (i.e., player nos. 4 (5), 5 (8), and 10). In the World Cup match, the go-to combinations are mostly short, between two players, and distributed deep across the field. In contrast, during the Euro match combinations are centred more on the heart of defense, wide across the field, and include more players.

NEW PLAYER STATS. Next to the team statistics, new statistics on individual players become available. As an example, player statistics of player no. 10 are displayed in the networks below. During the World Cup match the pass distribution of player no. 10 centres around players on the centre-left wing, whereas during the Euro qualification match the distribution is spread out more evenly on the left wing and forward part of the field. Player no. 10 took ball possession 8 and 9 times during

the World Cup and Euro match respectively (e.g., successfully defended), and lost ball possession (e.g., to an opponent, or out of bounds) 9 and 16 times respectively. In comparison, he was involved in 10% more pass sequences during the Euro match, but had 1% less touches.

Look beyond assists and uncover the team's performance

CONCLUSION. Now, using this new technology, we can look beyond assists and uncover the entire team's performance. Process mining provides detailed insight into the team's cooperation. From the extent of strategic game-plan execution, effectiveness, and characteristics, insight in how successful passes really are, to detailed insight in the foundation of successful pass sequences, go-to combinations, and much more. The analyses provide a purely objective representation of the team statistics.
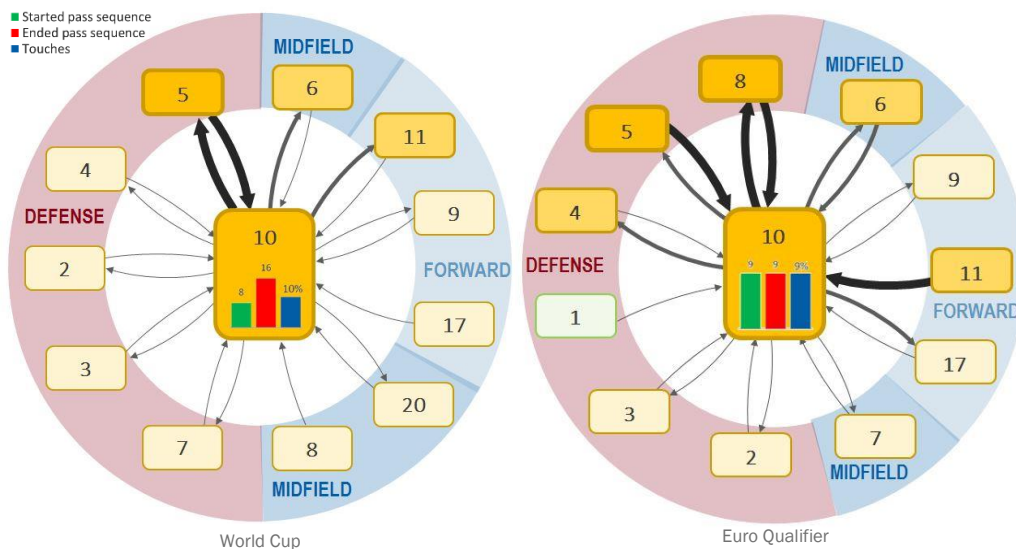
PLAYER NETWORKS – PLAYER NO. 10 IN WORLD CUP (LEFT) AND EURO QUALIFICATION MATCH (RIGHT)

The player networks visualise the pass distribution to and from, number of times ball possession taken/lost, and touches per player.

Players are arranged based on their position on the field relative to the player under consideration. The more frequent players and passes occur in the collaboration, the darker they are coloured.

Bar charts within the player show the number of pass sequences started and ended by the player (i.e., team gained/lost ball possession respectively), and percentage of touches in comparison to the total number of touches.

As with all analyses, external factors (e.g., field quality, opponent, player condition) do have to be considered during interpretation.

WORLD CUP VS EURO. We have put numbers to the highly successful "skipping a station" tactics of Louis van Gaal during the World Cup. Midfield was bypassed with almost 25% and 5% additional passes originating from goalkeeper and defense respectively. Successful pass sequences were built up deeper across the field during the World Cup match, and wider during the Euro match. We have also discovered that the substitution of a defender by a forward during the Euro match did not lead to more offensive gameplay, as fewer opportunities were created and utilised afterwards. We again urge the need to look beyond mere completed passes and consider their actual quality. Almost 60% of completed passes from defense to midfield bounced back directly during the Euro match. That this is not necessarily a bad thing either is apparent when a team masters Tiki Taka football. Finally, increased ball possession

during the Euro match led to an overall increase in mistakes, in this case a relative increase in loss of ball possession across defense, midfield, and forward positions. Also, the seven additional passes required to make attempts during the Euro match did not lead to success. The only goal scored required just two.

Fine-tune game plan during matches based on real-time performance information

APPLICATION. Based on real-time performance, the analyses' results can be used during matches to optimally fine-tune the execution of the game plan. It can also

benefit training plans, which may be altered and focussed to target certain problem areas. A comparison within and across multiple successive matches will reveal the effectiveness of the strategic game and matching training plans. It will even reveal whether individual player's and team's "DNA" and the desired strategic game plan match. It shows how well players work within a team and how successful certain line-ups are. Information invaluable to football clubs, coaches and scouts.

Do you coach a team in sports or business as well? Then lead your team to success using the novel insights of process mining. Don't wait any longer and discover today whether your team has the right DNA. Feel free to contact us:

Find out whether YOUR team has the right DNA

Phone: +31(0) 6 375 967 04
E-mail: info@processchemistry.nl
Website: www.processchemistry.nl

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