PATTERNS OF PLAY TO SCORE GOALS IN URUGUAYAN PROFESSIONAL FOOTBALL

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ABSTRACT: The aim of this investigation was to analyse the actions ended in goal in the professional football championships of the First Division of Uruguay. Observational methodology was used, 578 goals scored in 233 games were analysed through theory of graphs and sequential analysis. The graphs and the descriptive analysis reflected that most of the passes were registered in the creation area located on the central lane of the playing field, with a prevalence of the right lane over the left. Most of the goals were scored inside the penalty area through shots. Two sequences were highlighted: 1) pass-shot-goal and 2) shot-rebound-shot-goal. Conducting and dribbling are actions that were inhibited in the sequential analysis.

KEY WORDS: Football; Patterns of play; Observational methodology; Theory of Graphs

PATRONES DE JUEGO CON FINALIZACIÓN EN GOL EN EL FÚTBOL PROFESIONAL URUGUAYO

RESUMEN: El objetivo de esta investigación fue analizar las acciones finalizadas en gol en los campeonatos de fútbol profesional de la Primera División de Uruguay. El abordaje metodológico utilizado fue la metodología observacional, 578 goles convertidos en 233 partidos fueron analizados a través de la teoría de grafos y el análisis secuencial de retardos. La teoría de grafos y el análisis descriptivo reflejaron que la mayoría de los pases fueron registrados en la zona de gestación localizada en el carril central del campo de juego, con una prevalencia del carril derecho sobre el izquierdo. La mayoría de los goles fueron convertidos dentro del área penal a través de remates. Dos secuencias se destacaron: 1) pase-remate-gol y 2) remate-rebote-remate-gol. La conducción y el dribbling son acciones que estuvieron inhibidas en el análisis secuencial.

PALABRAS CLAVE: Fútbol; Patrones de juego; Metodología observacional; Teoría de Grafos

PADRÕES DE JOGO PARA MARCAR GOLS NO FUTEBOL PROFISSIONAL URUGUAIO

RESUMO: O objetivo desta investigação foi analisar as ações terminadas em gol nos campeonatos de futebol profissional da primeira categoria do Uruguai. A abordagem metodológica é baseada na metodologia observacional. Foram analisados através de teoría dos grafos e análise sequencial de transições, 578 gols marcados em 233 jogos. Os gráficos e a análise descritiva refletiram que a maioria dos passes foi registrada na área de criação localizado na faixa central do campo de jogo, com uma prevalência da faixa da direita à esquerda. A maioria dos gols foi marcada dentro da grande área, através de chutes. Duas seqüências foram destacadas: 1) passe-chute-gol e 2) chute-rebote-chute-gol. Condução e drible são ações que foram inibidas na análise sequencial.

PALAVRAS-CHAVE: Futebol; Padrões de jogo; Metodologia observacional; Teoria dos Grafos

Goal is the greatest expression of the game within football, since the winner of a game is defined by the team that scores the most. Thus, understanding how goals are scored, their frequency and the context is relevant, especially considering their low occurrence. Only 1% of offensive sequences end in goal (Lago, Cancela, Fernández, & Veiga, 2003; Tenga, Ronglan, & Bahr, 2010; Vivés, 2012).

Sequence is defined as successive occurrences of conducts (Anguera, Blanco, Hernández Mendo, & López, 2011). In this case, the offensive sequences are composed by individual technic-tactic actions performed before a goal: passes, shots, conducting, dribbling and rebounds. These actions have a concrete relevance for scoring goals. The pass, as motor communication between the members of a team; the shots, as the final action to score the goal; the conducting and the dribbling, for the transport of the ball and "getting rid" of rivals; and the rebounds, as a casual action to continue or finish the play (Castellano & Hernández Mendo, 2000; Silva, Sánchez Bañuelos, Garganta, & Anguera, 2005; Armatas & Yiannakos, 2010; Camerino, Chaverri, Anguera, & Jonsson, 2012; Vivés, 2012; Barreira, Garganta, Castellano, Prudente, & Anguera, 2014; Barreira, Garganta, Machado, & Anguera, 2014; Michailidis, 2015; Santos, Mendes, Nuno, Furtado, Válter, & Malico Sousa, 2016). At the same time, the areas of the playing field where these actions are carried out are important too, influencing the paths to reach the goal (Castellano & Hernández Mendo, 2000; Silva, et al., 2005; Armatas & Yiannakos, 2010; Camerino, et al., 2012; Vivés, 2012; Barreira, Garganta, Castellano, et al., 2014; Barreira, Garganta, Machado, et al., 2014; Sarmento, Anguera, Pereira, Marques, Campaniço, & Leitão, 2014; Michailidis, 2015; Teixeira, Chequini, Pereira, & Aguiar, 2015; Santos, et al., 2016; Diana, Zurloni, Elia, Cavalera, Jonsson & Anguera, 2017; Vivés, Martín, Hileno, Torrents, & Ric, 2018).

Different studies have analyzed tactical and technical performance in European and World Championships (Castellano & Hernández Mendo, 2000; Castellano & Hernández Mendo, 2002; Lago & Anguera, 2002; Lago, et al., 2003; Silva, et al., 2005; Robles & Castellano, 2012; Barreira, Garganta, Castellano, et al., 2014; Barreira, Garganta, Machado, et al., 2014; Castelão, Garganta, Afonso, & Da Costa, 2015; Santos et al., 2016; Diana, et al., 2017; Vivés, et al., 2018). As far as our knowledge is concerned, a few researches have analysed competitions at South American level, as is the case of Teixeira, et al. (2015).

Therefore, scientific studies within the South American context, which analyse the actions taking part in football matches, are necessary. In particular, those ones that make possible to recognize the way to score a goal and the zones in which they take place, taking into account the diachronic analysis of the game. Considering that coaches take into account technical-tactical inputs in order to modify their training sessions (Abad, Giménez, Robles & Castillo, 2013) we consider that the results of the research will give significant information to professionals related to Uruguayan football, in a particular way, and the South America's football in a general way.

According to the research problem of knowing the way to score goal, the objective of this investigation was to analyse the actions ended in goal in the professional football championships of the First Division of Uruguay. Thus, the relationship between technical-tactical actions and the zones of the playing field was described, and the sequence of actions that derive in the conversion of the goals was analysed.

METHOD

Design

Methodological approach is based on observational methodology, with an ideographic, punctual and multidimensional observational design. This

Revista Iberoamericana de Psicología del jercicio y el Deporte. Vol. 14, n° 2 (2019)

179

allowed the development of the proposed sequential analysis (Anguera, Blanco, Losada, & Hernández Mendo, 2000; Anguera, et al., 2011).

Sample

The sample selection was no probabilistic. 578 goals scored in 233 games during the 2016 calendar year in the Uruguayan First Division championships were analyzed. A total of 240 matches were played in these tournaments, but 7 games were excluded for reasons of un-observability. The criterion of inclusion used was that the matches were belonged to the Uruguayan league. The league format used was the double round-robin tournament, with 16 teams participating. This championship was chosen because it was the last one before this investigation was carried out to get the most updated data.

All the observations and data collections were based on material derived from public TV broadcasted videos, therefore it was not necessary to have the informed consent of the athletes.

Observational instrument

An ad hoc instrument was designed taking as a reference the ZASOF (Soccer Observational System of Zones and Actions) (Vivés, 2012), which is used to know the actions that occur in the different areas of the playing field; and the OSMOS-soccer player (Observation System for Motor Skills in Soccer) (Castañer, Barreira, Camerino, Anguera, Fernandes, & Hileno, 2017), which allows the analysis of motor skills of professional football players. The instrument here used was designed to study all the offensive sequences ended in goal, taking into account the situations created in open play and from dead-balls.

It is composed by 60 categories distributed in 6 criteria, fulfilling the conditions of exhaustiveness and mutual exclusivity. The six criteria used to fulfil the purposes of this research were: Teams, Result, Start actions, Field zone, Progression and ending actions, and Sequential.

Figure 1. Zones of the pitch (adapted from Castañer, et al., 2017).

Recording instrument

The registration was taken in a continuous way. A statistical sampling event was used (Anguera et al., 2000). The LINCE software v1.2.1 (Gabin, Camerino, & Anguera, 2012) was used to record the data, and it can be combined with SDIS-GSEQ 5.1.16 (Sequential Data Interchange Standard and General SEquential Querier) to make the sequential analysis (Bakeman, Quera, & Gnisci, 2009).

Procedure

The data was taken by three observers, who were trained to perform this task. Quality of data was proved through the validity and reliability of the observational instrument (Anguera, et al., 2000). Validation of the instrument was done through the authority criterion. For this, four experts were consulted, showing their agreement with all the criteria and categories. This instrument was validated and for this reason it is adapted to the context, also the graph theory could be considered as a novelty. Intra and inter-observer reliability concordance was verified using Cohen's Kappa coefficient (Cohen, 1960) registering values rated as good ($K \geq 0.75$).

Statistical analysis

A sequential analysis was implemented (Castellano & Hernández Mendo, 2002; Chaverri, Camerino, Anguera, Blanco-Villasenor, & Losada, 2010; Hernández Mendo & Anguera, 1999), which included the last 5 actions prior to scoring the goal (Castellano y Hernández Mendo, 2002, 2003; Sarmento et al., 2014). The objective of sequential analysis is to study, through a set of techniques, the probability of occurrence of some behaviours based on the previous occurrence of others. By the technique of lags it is possible to identify which behaviours maintain activation or inhibition relations at an "x" number of transitions. It is considered that a criterion behaviour turns on an object behaviour when there is a statistically significant dependency ratio and also acquires a value of adjusted residuals greater than 1.96; or that inhibits it, when it takes values less than -1.96 (Bakeman, et al., 2009).

Graph theory was used for the graphic analysis, which through a set of nodes and vectors allows modelling the motor communication network, generating the graph of a sports game whose nodes represent the zones and vectors symbolize the motor communication allowed by the rules of the game (Parlebas, 2008).

RESULTS

Descriptive analysis

Within the five actions prior to scoring the goal, a total of 1939 actions were registered, 33.3% were passes (PASS), followed by shots with the foot (REMP) with 19.8%, and conducting (COND) with 17.4% (Table 2).

It was possible to observe the relationship between the actions and the areas of the field where they occurred. 9.1% of the actions were passes that were carried out within the offensive centre lane and 3.1% in the offensive right lane, in both cases outside the area. 10.5% of the total of the actions were shots with the foot from the frontal part of penalty area. Conducting and dribbling (DRB) actions were recorded in areas considered as "goal´s creation zones", highlighting in a similar way to the pass, the centre and right lane. Finally, the occurrence of rebounds (REBOT) within the penalty area excelled being 8.6% of all actions (Table 2).
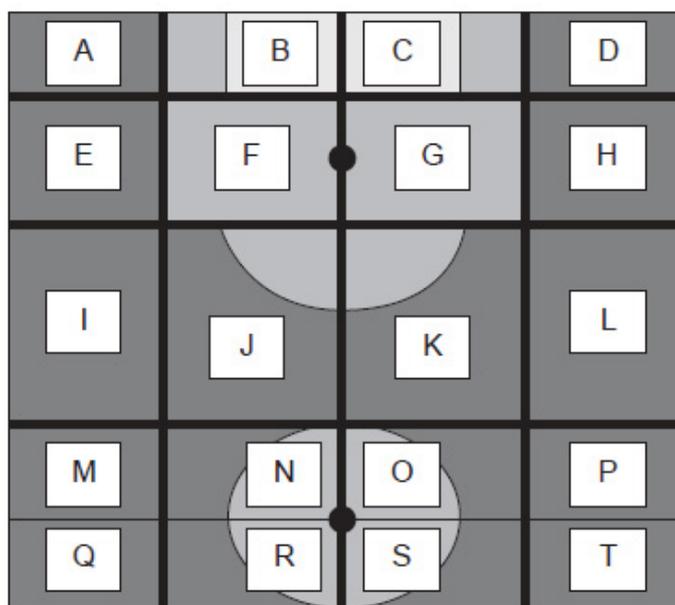
Table 1. Observational instrument (adapted from Vivés, 2012).

Criteria	Categories
Teams	Team that score the goal (PEÑ, NAC, DEF, DAN, etc.).
Result	Ties (EMP); Winning by difference of 1 (G1); Winning by difference of 2 or more (G2); Losing by difference of 1 (P1); Losing by difference of 2 or more (P2).
Starting actions	Throwing (SB); Foul kick (SF); Corner kick (SE); Recovery (RECUP); Continuity (CONT).
Pitch zone	Place of the pitch where the analysed actions are carried out (ZCA, ZCB, ZCC, ZCD, ZCE, ZCF, ZCG, ZCH, ZCI, ZCJ, ZCK, ZCL, ZCM, ZCN, ZCO, ZCP, ZCQ, ZCR, ZCS, ZCT, ZCU). Penalty (PENAL).
Progress and ending actions	Pass with the foot (PASS); Pass with another part of the body (PCAB); Conducting (COND); Dribbling (DRB); Rebound (REBOT); Shot with the foot (REMP); Shot with another part of the body (REMC).
Sequential	Continuity (.) and Ending (/) of the action.

Sequential analysis

In the analysis of lags, an excitatory relation was found between scoring a goal and the shot with the foot (p<0,01) and another part of the body (p<0,01), the majority of these last ones are performed with the head, in the lag minus one; and with the shot with the foot in the lag minus three. It also appears an excitatory relationship between scoring and the rebound (p<0,01) and the pass (p<0,01) in the lag minus two. Conversely, an inhibitory relationship with dribbling and conduction was found. From the previous statements, it became visible the importance of the sequences pass-shot-goal and shot-rebound-shot-goal to obtain a goal. Likewise, the inhibition of individual actions, like conducting and dribbling, appeared (Table 3).

From the study of the graphs (Figure 2) a high frequency of events of the connections between the nodes of the central zones (ZCJ, ZCK, ZCF, ZCG, ZCB and ZCC) was observed (Figure 1), and in a lesser extent in the lateral zone right (ZCL), which was graphically manifested through the thickness of the vectors. The importance of the shots from the inside of the penalty area was also manifested, with a greater relevance of the left lane (ZCF and ZCB over the right lane, and ZCG and ZCC) was also appreciated. Referring to passes, a prevalence of the right lane (ZCL) over the left lane (ZCI) was observed in the entrance to the penalty area from the central creation zones (ZCJ and ZCK). Finally, conducting and dribbling also reached their maximum values in the central lane of the creation area (ZCJ and ZCK).

DISCUSSION

Referring to the aim of relating technical-tactical actions and the areas of the field where they took place, passes (which are associated with collective game) predominated. In less way appeared conducting and dribbling, actions associated to an individual tactical approach of the game (Table 2). This is in accordance with the current football trends, which give importance to the associated game in order to obtain a good performance. Due to the particular study of goals, it is normal that shooting has an important role (Silva, et al., 2005; Barreira, Garganta, Castellano, et al., 2014; Michailidis, 2015).

Most of the passes were registered in the creation area located on the central lane of the playing field, with a prevalence of the right lane over the left. This affirmation was supported both by the descriptive analysis (Table 2) and by the study of graphs (Figure 1). The vectors add direction and meaning to the actions studied, which helps to visualize in a better way the motor communication networks to build the offensive game. This behaviour of the passes in the central lane is coincident with the studies carried out in elite teams, such as Manchester United and the teams of the Brazilian League, as well as with another research carried out in the semi-finals of the World Cup 2010 (Barreira, Garganta, Machado, et al., 2014; Sarmento, et al., 2014; Teixeira, et al., 2015). Uruguay was one of the semi-finalists of the World Cup 2010, having had a very good performance in that edition of the tournament. It would be appropriate to estimate that at that time of the game´s evolution, the use of

Table 2. Frequency of the totality of progression and ending actions (%). References: Pass with the foot (PASS); Pass with another part of the body (PCAB); Conducting (COND); Dribbling (DRB); Rebound (REBOT); Shot with the foot (REMP); Shot with another part of the body (REMC).

ZONE	COND	DRB	PASS	PCAB	REBOT	REMC	REMP	TOTAL
ZCA	0,1	0,1	1,7	-	-	-	0,1	1,8
ZCB	0,3	0,1	0,8	0,1	**2,3**	1,3	2,3	7,2
ZCC	0,1	0,1	0,7	0,2	**1,9**	0,9	2,4	6,2
ZCD	0,1	0,2	2,4	-	-	-	-	2,6
ZCE	0,8	0,4	1,9	0,2	-	-	-	3,3
ZCF	1,6	1,1	1,9	0,6	**2,4**	1,9	**5,9**	15,3
ZCG	1,5	0,7	2,2	0,5	**2,1**	1,7	**4,6**	13,3
ZCH	0,6	0,4	1,7	0,2	-	-	-	2,9
ZCI	1,5	0,3	1,9	0,5	0,3	-	-	4,5
ZCJ	3,2	1,7	**4,4**	0,5	0,8	0,1	2,7	13,4
ZCK	2,6	1,9	**4,7**	0,2	1,0	-	1,8	12,1
ZCL	1,9	0,7	**3,2**	0,6	0,2	-	0,1	6,6
ZCM	0,3	0,1	0,5	-	0,1	-	-	0,9
ZCN	0,9	0,1	1,1	0,2	0,1	-	-	2,3
ZCO	0,5	0,2	1,0	-	0,1	-	0,1	1,9
ZCP	0,1	0,1	0,4	0,1	-	-	-	0,6
ZCU	1,3	0,1	3,0	0,4	0,3	-	-	5,2
Total	**17,4**	**7,9**	**33,3**	**4,1**	**11,7**	**5,9**	**19,8**	**100,0**

Note: All dates are in %.

Table 3. Sequential lags. References: Pass with the foot (PASS); Pass with another part of the body (PCAB); Conducting (COND); Dribbling (DRB); Rebound (REBOT); Shot with the foot (REMP); Shot with another part of the body (REMC).

Lag -5	Lag -4	Lag -3	Lag -2	Lag -1	Lag 0
		REMP	REMP	**REMP**	
		6.03	-2.74	**31.96**	
				REMC	
				17.26	
			REBOT	REBOT	
			5.54	-5.44	
			PASS	PASS	
			2,70	-17.51	
			DRB	DRB	
			-2.20	-7.54	
		COND	COND	COND	GOAL
		-2.82	-4.55	-11.11	
		PCAB		PCAB	
		-2.44		-5.05	

Note: All dates are in adjusted residuals.

Revista Iberoamericana de Psicología del jercicio y el Deporte. Vol. 14, nº 2 (2019)
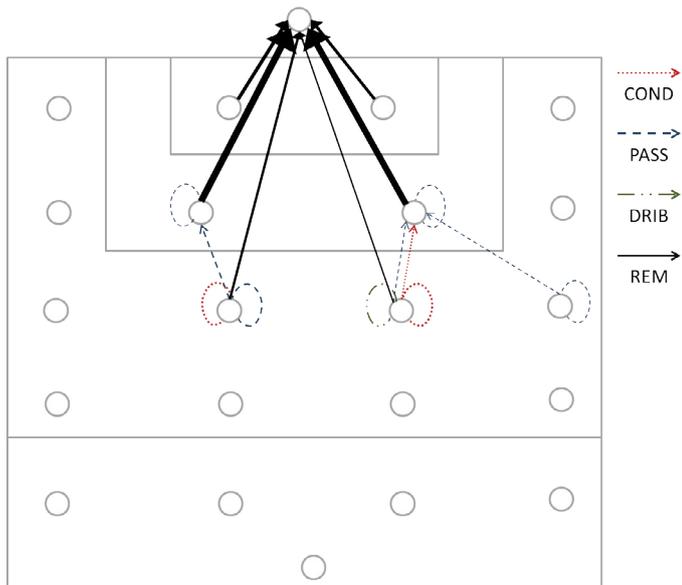
181

Figure 2. Progression and ending actions graphs. Pass (PASS); Conducting (COND); Dribbling (DRB); Shot (REMP).

the centre lane through fast defence-attack transitions was effective. However, it contrasts with the evolution of the game in recent years observed in later world cups and other high-level European competitions where the creation of the game in the sides through the pass predominated (Vivés, 2012; Barreira, Garganta, Castellano, et al., 2014; Sarmento, et al., 2014; Santos, et al., 2016; Diana, et al., 2017; Vivés, et al., 2018).

However, turning the game towards the offensive right field, differs from what was observed in the actions of Barcelona during 2001 (Camerino, et al., 2012) and the Brazilian league, where the left lane prevailed (Teixeira, et al., 2015). Regarding the actions associated with the "individual game", such as dribbling and conducting, they had a behaviour that contrasts with the results of the experience carried out with Espanyol, where these actions were highlighted on the side lanes, especially in the case of conducting (Vivés, 2012). From the contrast between the old use of the central corridors of the field and the current trend of the circulation of the ball through the side rails to build effective plays, it is clear that perhaps the Uruguayan teams could evolve in their game with the use of the corridors side in order to be more competitive.

Most of the goals were scored inside the penalty area, through shots taken from the front side of it (Table 2 and Figure 1), coinciding with other studies carried out with teams from European leagues (such as Portuguese, Spanish, English, German), Brazilian league (among the South American context) as well as in the World Cups of 2006 and 2014 (Armatas & Yiannakos, 2010; Michailidis, 2015; Teixeira, et al., 2015 Santos, et al., 2016;). The fact that outstands is the occurrence of rebound within the area when it comes to scoring the goal (Table 2). These evidences are similar to the results obtained in elite teams (Sarmento, et al., 2014), such as Manchester United, which in the attack sequences presented a singular role of the rebounds as well as the use of the centre lane of the attacking midfield, outside the penalty area, to get to it. It seems that accessing by the central lane to the finishing area and its combination with the appearance of rebounds generate moves that could give a high chance to the random for converting the goals (Diana et al., 2017). The presence of a high number of rebounds highlights the importance in the studied championship of quickly introduce the ball into the penalty area to score goals, an effect that could be due to the density of players in the inner zones of the area and close to it, consequence of the defensive intensity. In the same way, in the study by Sarmento, et al. (2014), they pointed out that these In the same wayinterferences in the plays could be caused by defensive, as well as offensive defects.Regarding the second aim of studying the sequence of the appearance of the actions, it is found that the more they move away from the objective behaviour, which is the goal, the lower the probability of behaving in a regular manner (Silva, et al., 2005). In the sequential study of lags (Table 3) two sequences stood out: 1) pass - shot - goal and 2) shot - rebound - shot – goal. The first combination, evidence shows the preponderance of the pass in

the creation phase (Barreira, Garganta, Machado, et al., 2014; Michailidis, 2015; Teixeira, et al., 2015; Santos, et al., 2016; Vivés, et al., 2018) and the shot in the finalization phase (Silva, et al., 2005; Michailidis, 2015; Vivés, et al., 2018). In the case of the second combination, adds a new element that is the rebound, which curiously presents an unthinkable importance in the achievement of goals. Another fact to point out is the inhibition of individual actions, such as conducting and dribbling, which coincides with the results found in the World Cup Brazil 2014 (Michailidis, 2015); but in contrast with the offensive processes of the World Cup Korea - Japan 2002 (Silva, et al., 2005) where conducting in the creation phase and dribbling in the finalization phase, had a relevant role. Here it seems to stand out the tendencies of nowadays football to take advantage of the fast transitions defence-attack, either by band or central lane, and the decrease of the use of the individual actions to build effective plays. The highlight of the pass over the individual actions shows the importance of the associative game to obtain the success in the modern football. However, to have so short sequences, it could be the result of the use of the fast attack or counterattack as the predominant offensives systems.

CONCLUSIONS

Most of the actions observed were the passes, which were registered in the creation area located on the central lane of the playing field, with a prevalence of the right lane over the left. This evidenced tendency seems not to be in line with what it is shown today by elite and nationals teams. Nowadays football ponders the use of the associative game by the bands to create effective finalizations. This is a point to be considered by Uruguayan football. However, the occurrence of rebounds in the area when scoring goals was highlighted.

Two sequences were highlighted: 1) pass-shot-goal and 2) shot-rebound-shot-goal. Conducting and dribbling are actions that were inhibited in the sequential analysis. From this perspective it was possible to see the domain of the pass over individual actions, as well as the low number of appearances of the highlighted sequences seems to reflect the predominance of the use of fast attack or counterattack over other offensive systems within the researched teams.

Due to the analysed context, the results of the research cannot be generalized. In addition to this, the defensive actions were not studied. These two factors can be considered as ones of the major limitations of the study.

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182

Revista Iberoamericana de Psicología del jercicio y el Deporte. Vol. 14, nº 2 (2019)

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Revista Iberoamericana de Psicología del jercicio y el Deporte. Vol. 14, nº 2 (2019)

183