

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.
<https://doi.org/10.17979/sportis.2025.11.2.11517>

**The attacker-defender's spatiotemporal relationship affects the dribbling outcome
in futsal but not in soccer**

**La relación espacio-temporal entre atacante y defensor afecta el resultado del
regate en el fútbol sala, pero no en el fútbol**

Silvia Letícia Silva¹, Flávio Henrique Bastos¹, Go Tani¹, Alexandre Moreira¹, Umberto
Cesar Corrêa¹

¹ Escola de Educação Física e Esporte, Universidade de São Paulo, São Paulo, Brazil.

*Correspondencia: Umberto Cesar Corrêa. umbertoc@usp.br

Editorial schedule: Article received 12/21/2024 Accepted: 02/06/2025 Published: 04/01/2025

<https://doi.org/10.17979/sportis.2025.11.2.11517>

To cite this article use the following reference:

Silva, S.L.; Bastos, F.H.; Tani, G.; Moreira, A.; Corrêa, U.C. (2025). The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. *Sportis Sci J*, 11 (2), 1-15 <https://doi.org/10.17979/sportis.2025.11.2.11517>

Authors' specific contribution: The authors have participated equally in the work.

Funding: There was no funding for this project.

Informed consent study participants: Informed consent was obtained.

Conflict of interest: The authors report no conflict of interest.

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.
<https://doi.org/10.17979/sportis.2025.11.2.11517>

Abstract

This study investigated the influence of spatiotemporal interpersonal coordination information on soccer and futsal dribbling outcomes. For this purpose, the following relative measures were analysed: distance travelled in dribbling performance, time of dribbling, velocity of dribbling, and interpersonal distance in the beginning of dribbling. Participants included ninety-five amateur athletes who played matches of the Municipal (under-16 futsal category, $n = 59$) and National (under-17 category, $n = 36$) Championships in 2020. The sample consisted of 27 soccer dribbles and 77 futsal dribbles, which were selected from matches recorded by two digital cameras. Results showed that successful futsal dribbles were performed when interpersonal distances were smallest and dribbling velocities were highest. It also showed that successful dribbles involved an optimum range of relative time of movement. No difference was revealed regarding soccer dribbles. It was concluded that spatiotemporal interpersonal coordination affected the dribbling outcomes in sport of futsal but not of soccer. These findings suggest that the attacking futsal players should stay close to their markers and perform dribbles as quickly as possible; conversely, defenders should maintain greater distance from their marking attackers and synchronize their movements to counter dribbles at the same velocity.

Keywords: motor skills; team sport; interaction; decision-making.

Resumen

Este estudio investigó la influencia de la información de coordinación interpersonal espaciotemporal en los resultados del regate en fútbol y futsal. Para ello, se analizaron las siguientes medidas relativas: distancia recorrida en el rendimiento del regate, tiempo de regate, velocidad de regate y distancia interpersonal al inicio del regate. Los participantes incluyeron noventa y cinco atletas amateurs que jugaron partidos de los Campeonatos Municipales (categoría de futsal sub-16, $n = 59$) y Nacional (categoría sub-17, $n = 36$) en 2020. La muestra consistió en 27 regates de fútbol y 77 regates de futsal, que fueron seleccionados de partidos grabados por dos cámaras digitales. Los resultados mostraron que los regates exitosos en futsal se realizaron cuando las distancias interpersonales eran más pequeñas y las velocidades de regate eran más altas. También mostró que los regates exitosos involucraron un rango óptimo de tiempo relativo de movimiento. No se reveló ninguna diferencia con respecto a los regates de fútbol. Se concluyó que la coordinación interpersonal espaciotemporal afectaba los resultados del regate en el fútbol sala, pero no en el fútbol. Estos hallazgos sugieren que los jugadores de fútbol sala que atacan deben permanecer cerca de sus marcadores y realizar regates lo más rápido posible; por el contrario, los defensores deben mantener una mayor distancia de sus atacantes que los marcan y sincronizar sus movimientos para contrarrestar los regates a la misma velocidad.

Palabras clave: habilidades motrices; deporte de equipo; interacción; toma de decisiones.

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.
<https://doi.org/10.17979/sportis.2025.11.2.11517>

Introduction

Dribbling is one of the most unpredictable, indescribable, and admired motor skills in the sports of soccer and futsal (Braz et al., 2021). This is the act of a player in ball possession deceiving and overtaking the opponent while maintaining the ball control (Corrêa et al., 2016; Leal et al., 2022; Sturgess, 2017; Travassos, 2014; Wesson, 2019).

In recent years, studies have been developed to comprehend the dribbling performance by considering some of its spatial, temporal, and spatiotemporal characteristics. For instance, Amaral and Garganta (2005) analysed 853 dribbles in sport of futsal to identify where they were performed and why. For this purpose, the court was divided into two defensive and two attacking zones. The results showed that most of the dribbles were performed in the intermediate attacking zone with the objective of progressing towards the goal.

Although it was not the subject of measurement, Amaral and Garganta (2005) suggested that most dribbles were performed when there was a clear possibility of passing, which was investigated by Corrêa et al. (2016). Specifically, they considered the players interactions characterized by spatial (angle and distance) and spatiotemporal (velocity) measures to verify why futsal players decided to dribble instead of passing or shooting. The results revealed that players decided to dribble instead of passing or shooting when variability of relative angles afforded risk of passing and shooting be intercepted. Therefore, it was verified that it is not the existence of a passing line *per se*, but the way it interacts with the interception line that constrains the decision-making on dribbling. In addition, while variability of interpersonal distance constrained the decision-making on dribbling by increasing the risk of ball recovery, it also created uncertainty in the defender's response and, therefore, was linked to successful dribbling.

Regarding the sport of soccer, a study by Duarte et al. (2010) investigated whether interpersonal distance and relative velocity influenced the phase transition in a 1 vs. 1 dribbling situation. They verified whether different initial distances between the attacker and defender (1.0, 1.5, 2.0, and 2.5 m) would constrain the attacker to explore the free space behind the defender to create a shooting opportunity or the defender to prevent it. Results showed that these expected outcomes were not affected by the initial

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.
<https://doi.org/10.17979/sportis.2025.11.2.11517>

distances. However, they revealed a tendency for the attacker-defender relationship to change when the highest relative velocity and lowest interpersonal distance values were reached. Despite the knowledge produced by this study, unlike previous ones, the 1 vs. 1 situation was analysed in isolation, without interaction with other 1 vs. 1 situations that typically occur in the game. Furthermore, in this setup the players already knew what would happen, contradicting the creative and improvisational nature of dribbling.

Recently, both soccer and futsal dribbling were investigated by considering the temporal dimension of dribbling performance (Silva et al., 2022). It was examined whether (i) the success of dribbling would be related to the defender's reaction time, and (ii) the success of not being dribbled would be linked to the defender's anticipation. In sporting contexts, reaction time has been investigated to understand the internal mechanisms and processes that develop from a given stimulus to the onset of the motor response to it (Ersin et al., 2022; Greco et al., 2024; Negi et al., 2021; Ramon Suárez & Arabia, 2020). On the other hand, anticipation has been studied in order to comprehend the mechanisms and processes involved in the predicting an event that is about to happen in the performance environment, as well as when and where it will happen (Andrew & Causer, 2022; Huesmann & Loffing, 2024; Loffing & Cañal-Bruland, 2017; Kung et al., 2020; Poli, 2018; Zhu et al., 2024). The analyzed dribbles were selected from an official soccer and futsal matches. Results showed that only reaction time influenced successful dribbles in soccer. Therefore, the temporal dimension (reaction and anticipation) did not affect successful or unsuccessful futsal dribbles, nor unsuccessful soccer dribbles.

Based on the above, this study aimed to contribute to the existing findings by investigating the information that influences the soccer and futsal dribbling outcomes (success and failure). Specifically, we considered spatial (relative distance traveled during dribbling performance), temporal (relative time of dribbling), and spatiotemporal (relative velocity of dribbling) measures of players interactions. Additionally, the interpersonal distance at the start of the dribble was also analyzed. Importantly, these measures characterized the interpersonal coordination variables that provide the sources of information necessary for team sports players to respond to stimuli that emerge in

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.

<https://doi.org/10.17979/sportis.2025.11.2.11517>

dynamic and unpredictable ways throughout the game (Denardi et al., 2024; Oliveira et al., 2023; Passos et al., 2016).

Method

Participants

Ninety-five amateurs players participated. They played in matches from the Municipal Championship in Carapicuíba, São Paulo, Brazil (under-16 futsal category, $n = 59$) and the National Brazilian Championship (under-17 category, $n = 36$) in 2020. Participation required written consent from the adolescents' parents or legal guardians. The experimental protocol was approved by the local Institutional Review Board (CAAE: 10850513.0.0000.5391).

Procedures

The sample consisted of all dribbles performed in the matches: 27 soccer dribbles and 77 futsal dribbles, which were selected from matches recorded by two digital cameras (GoPro HEROS3; frequency = 120 Hz). In order to record the futsal matches, one camera was positioned above and behind the court baseline and the other above in the middle of the court. For recording the soccer matches, the cameras were positioned laterally to the field. The soccer dribbles varied from 91 to 367 ms, and the futsal dribbles ranged from 59 to 775 ms.

In both sports the dribbling sequence of play were edited using the KINOVEA 0.8.15 software (<http://www.kinovea.org>), from the moment the player in possession of the ball began the first dribbling movement until the moment the defender began the first response movement. To verify the reliability of the analysis criteria, two soccer and futsal experts analysed the foregoing sequences in slow motion (5% of normal speed) using the computer's forward or rewind keys. Significant reliabilities were obtained for the identification of the dribbling stimuli ($r = 0.92$), beginning ($r = 0.89$), and end of the dribble ($r = 0.78$).

The following kinematic measures were considered:

- (1) Relative time of movement - difference of the attacker's movement time (time between the beginning and end of dribbling) and the defender movement time (time between the beginning and end of dribbling response)

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.
<https://doi.org/10.17979/sportis.2025.11.2.11517>

(s), which was obtained through $RMT = (Amt - Dmt)$, where RMT referred to the relative movement time, Amt was the attacker's movement time, and Dmt referred to the defender's movement time. Positive RMT meant that the attacker's movement time was greater than that of the defender. Conversely, negative RMT meant that the defender's movement time was greater than that of the attacker;

- (2) Relative displacement – difference between the distances traveled by the attacker and the defender during the dribbling (m). It was obtained through $RD = (Ad - Dd)$, where RD referred to the relative displacement, Ad was the attacker's displacement, and Dd was the defender's displacement. Positive RD meant that the attacker moved more than the defender. Conversely, negative RD meant that the defender moved more than the attacker;
- (3) Relative velocity - difference between the attacker's and defender's movement velocities (m/s), which was calculated using $RV = (Av - Dv)$, where RV referred to the relative velocity, Av was the attacker's velocity, and Dv was the defender's velocity. Positive RV meant the attacker was faster than defender; conversely, a negative and negative meant that the defender was faster than attacker;
- (4) Interpersonal distance - distance (m) between the attacker and defender in the beginning of dribbling.

Statistical analyses

First, the values of each kinematic measure were ordered separately, from the lowest to the highest values, and divided into four groups based on quartiles as cutoff points (Altman & Bland, 1994). Second, the absolute frequencies of successful and unsuccessful dribbling in soccer and futsal were distributed in each quartile. Successful dribbles were those in which the attacker overcome the opponent without losing possession of the ball. When the defender could avoid the dribble or the attacker lost the ball control, the dribbles were considered unsuccessful (Corrêa et al., 2016; Silva et al., 2022). Finally, the Chi-square test was conducted to compare the frequencies in each quartile. For all comparisons, the level of significance was set at $p \leq .05$, using STATISTICA® 13.0 software - Stat Soft Inc., Tulsa, USA.

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.
<https://doi.org/10.17979/sportis.2025.11.2.11517>

Results

Futsal

Figure 1 presents the absolute frequencies of successful and unsuccessful futsal dribbles by quartiles of interpersonal distance, relative velocity, relative movement time, and relative displacement.

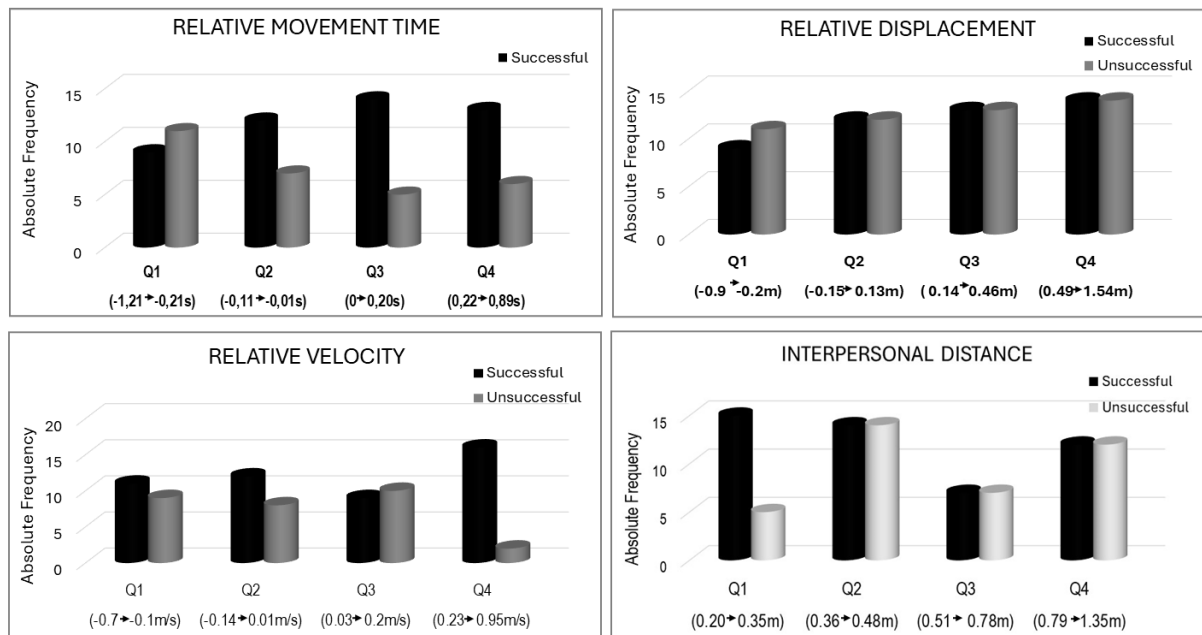


Figure 1. Frequencies of successful and unsuccessful futsal dribbling in the first (Q1), second (Q2), third (Q3) and fourth (Q4) quartiles of interpersonal distance, relative velocity, relative movement time, and relative displacement.

Regarding the interpersonal distance, the Chi-square test revealed difference in the first quartile, that is, in the smallest interpersonal distances the frequency of successful dribbles was significantly greater than that of unsuccessful dribbles ($\chi^2 = 5.00$, $df = 1$, $p = 0.02$). For relative velocity, the Chi-square tests revealed that in the highest relative velocity (Q4) the frequency of successful dribbles was significantly greater than that of unsuccessful dribbles ($c^2 = 10.89$, $df = 1$, $p = 0.001$). Concerning the relative time of movement, the Chi-square tests revealed that the frequency of successful dribbles was significantly greater than that unsuccessful dribbles in the third quartile ($c^2 = 4.26$, $df = 1$, $p = 0.04$). Finally, regarding the relative displacement, the

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.
<https://doi.org/10.17979/sportis.2025.11.2.11517>

Chi-square tests revealed no significant differences between successful and unsuccessful futsal dribbles in any of the quartiles.

Soccer

Figure 2 presents the absolute frequencies of successful and unsuccessful soccer dribbling by quartiles of interpersonal distance, relative velocity, relative time of movement, and relative displacement. No significant difference was revealed by the Chi-square tests.

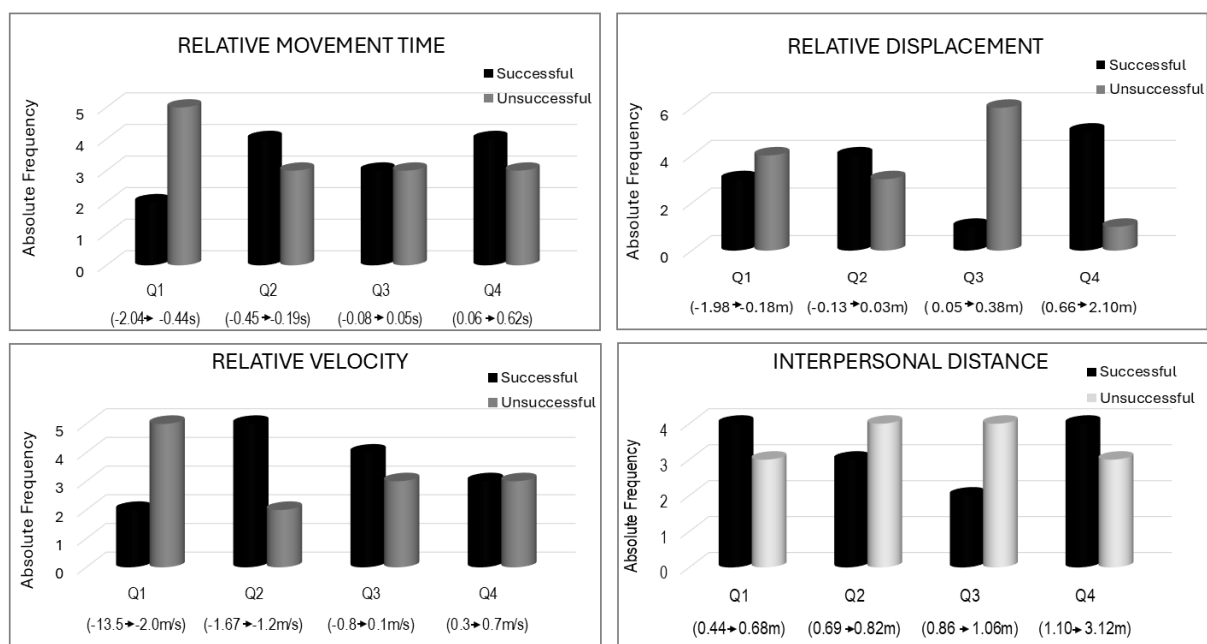


Figure 2. Frequencies of successful dribbling and unsuccessful soccer dribbling in the first (Q1), second (Q2), third (Q3) and fourth (Q4) quartiles of interpersonal distance, relative velocity, relative time of movement, and relative displacement.

Discussion

In futsal, results showed a higher frequency of successful dribbles compared to unsuccessful ones when attackers were very close to their marking defenders (smallest interpersonal distances/first quartile), and when dribbling involved the highest relative velocities (fourth quartile) and moderate relative movement times (third quartile).

It could be hypothesized that defenders being close to attackers would make it easier for them to prevent dribbles or recover possession of the ball (Corrêa et al., 2016). This might make sense if dribbling were simple. There are three types of

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.
<https://doi.org/10.17979/sportis.2025.11.2.11517>

dribbling: simple, choice, and sequential (Silva et al., 2022; Tani, 2004, 2016). Simple dribbles involve only one stimulus and one response. For instance, a dribble that involves a change in the direction during the attacker displacement (e.g., to the right side) requires an action in the same direction as a response. Choice dribbles are those with two or more simultaneous stimuli and respective response possibilities. In the “cow dribble”, for example, the attacker moves to one side while the ball moves to the other. Therefore, it requires the defender to choose to respond to the attacker or the ball. And, sequential dribbles are those involving two movements performed in a sequence in a short period of time, in a way of demanding a psychological refractory period (PRP) in the response organization.

The PRP refers to the delay in responding to the second of two stimuli presented in close succession (Coker, 2020; Logan et al., 2023; Magill & Anderson, 2020; Schmidt et al., 2019; Spittle, 2021). For example, an attacker may perform a body movement to the right side as a false movement (feint) and then immediately move to the left side (true movement). Based on this, we hypothesized that the dribbles were of choice and/or PRP type, such that the proximity between attackers and defenders (from 0.20 to 0.35m) did not allow the defenders to process all the informational demands necessary to make an adequate decision on response. To put it another way, being too close to the defenders may not have allowed them to capture all the attackers’ stimuli to identify the correct one for responding appropriately.

Interacting with this, futsal dribbles outcomes can also be explained by the relative velocity, since the frequency of successful futsal dribbles was significantly greater than the unsuccessful ones in the highest relative velocities. As described previously, relative velocity refers to the difference between the attacker's and the defender's movement velocities. If it were negative, it would mean that the defender would have been faster than the attacker, and whether it were positive, the attacker would have been faster. Nevertheless, it is important to note that being faster only influenced the success of futsal dribbling when the velocities differences between the attacker and defender were the greatest. It was also observed that the frequency of successful dribbles was significantly higher than that of unsuccessful dribbles in the third quartile of relative movement time. As previously mentioned, relative time refers

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.
<https://doi.org/10.17979/sportis.2025.11.2.11517>

to the difference between the attackers' and defenders' movement times. Similarly to the previous measure, positive values indicated that the attackers' movement times were greater than those of the defenders, whereas negative values indicated that the defenders' movement times were greater than those of the attackers.

The explanatory hypothesis here is that the dribbles were of the PRP type. In this case, the attackers first performed a movement to deceive the defenders (false stimulus) and, immediately followed it with another movement (true stimulus). Therefore, the fact the defenders completed their responses before the dribbles were finished may have because they perceived there would not be enough time to respond to the second one. This explains the higher incidence of successful dribbles in the third quartile; if it had occurred in the fourth quartile there would have been sufficient time for a second response. Based on this, it seems that there is an optimal range of positive relative movement time of movement favorable to successful PRP dribbles (from 0 to 0.2s).

Regarding the sport of soccer, no difference was revealed by the statistical tests. This result corroborates that of Duarte et al. (2010) who showed that interpersonal distance and relative velocity do not affect the dribbling outcome in sport of soccer. Therefore, as shown by Silva et al. (2022), it seems that the key variable for dribbling success may be the time it takes for defenders to start responding to the dribble. In sports of this nature, many actions are more difficult to perform, as players need to respond in a short period of time to the opponent's unpredictable actions (Gredin et al., 2023; Müller et al., 2024; Williams & Jackson, 2019).

The differences between soccer and futsal results can be understood when considering the game functioning. Futsal takes place on a pitch that ranges from 16 to 22 m wide and 25 to 42 m long, thus a significantly smaller space than soccer, which ranges from 45 to 90 m wide and 90 to 120 m long. Furthermore, in futsal the number of players (5 vs. 5) is smaller than in soccer (11 vs. 11). Therefore, it seems logical to expect that the smaller playing space and reduced number of players implied different spatiotemporal constraints on the actions of futsal players compared to those in soccer context.

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.
<https://doi.org/10.17979/sportis.2025.11.2.11517>

Conclusion

In summary, the results of this study suggest that spatiotemporal interpersonal coordination influenced the dribbling outcomes in futsal but not in soccer. Specifically, successful futsal dribbles were performed when interpersonal distance was smallest and dribbling velocity was highest. Additionally, the findings indicated that successful dribbles occurred withing an optimal range of relative movement time. While it is essential for these results to be replicated to ensure the robustness of knowledge developed through the scientific method, some practical implications can be drawn. Coaches and teachers are encouraged to instruct attacking futsal players to stay close to their marking defenders and perform dribbles as quickly as possible; conversely, defenders should be advised to maintain greater distance from their marking attackers and synchronize their movements to counter dribbles at the same velocity. In terms of limitations, although we identified three types of dribbling (simple, choice and sequential), they were not analyzed as such. Therefore, verifying what restricts success or failure in each of these types of dribbling requires future studies. Furthermore, understanding dribbling performance considering the players' individual characteristics of players such as experience, knowledge, skill, and gender also needs to be investigated. Finally, what information influences the dribbling outcome in sport of soccer still needs to be answered.

References

- Altman, D. G., & Bland, J. M. (1994). Statistics notes: quartiles, quintiles, centiles, and other quantiles. *British Medical Journal*, 309, 996.
<https://doi.org/10.1136/bmj.309.6960.996>
- Amaral, R. & Garganta, J. (2005). A modelação do jogo em Futsal. Análise sequencial do 1x1 no processo ofensivo. *Revista Portuguesa de Ciências do Desporto*, 298-310. <https://doi.org/10.5628/rpcd.05.03.298>
- Andrew, M., & Causer, J. (2022). Does anticipation of penalty kicks in soccer transfer across similar and dissimilar sports? *Cognitive Processing*, 23(3), 459-465.
<https://doi.org/10.1007/s10339-021-01073-y>

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.
<https://doi.org/10.17979/sportis.2025.11.2.11517>

Braz, J., Mendes, J. L., Rodrigues, E., Travassos, B., Azevedo, R., Conceição, L., Silvério, J., & Palas, P. (2021). *Futsal - os fundamentos do jogo [Futsal - the fundamentals of the game.]*. São Paulo: Cultura Editora.

Coker, C. (2020). *Motor learning and control for practitioners*. London: Routledge.
<https://doi.org/10.4324/9781003039716>

Corrêa, U. C., de Pinho, S. T., da Silva, S. L., Clavijo, F. A. R., Souza, T. D. O., & Tani, G. (2016). Revealing the decision-making of dribbling in the sport of futsal. *Journal of sports sciences*, 34(24), 2321-2328.
<https://doi.org/10.1080/02640414.2016.1232488>

Denardi, R., Clavijo, F., Santana, T., Oliveira, T., & Corrêa, U. (2024). The interpersonal coordination constraint on the volleyball setter's decision-making on setting direction. *Journal of Human Sport and Exercise*, 19(3), 891-900.
<https://doi.org/10.55860/d5eepb18>

Duarte, R., Araújo, D., Gazimba, V., Fernandes, O., Folgado, H., Marmeleira, J., & Davids, K. (2010). The ecological dynamics of 1v1 sub-phases in association football. *The Open Sports Sciences Journal*, 3, 16-18.
<https://doi.org/10.2174/1875399X01003010016>

Ersin, A., Tezeren, H. C., Pekyavas, N. O., Asal, B., Atabey, A., Diri, A., & Gonen, İ. (2022). The relationship between reaction time and gaming time in e-sports players. *Kinesiology*, 54(1), 36-42. <https://doi.org/10.26582/k.54.1.4>

Greco, F., Quinzi, F., Chiodo, S., Cerulli, C., Tranchita, E., Bertollo, M., & Emerenziani, G. P. (2024). The effects of pre-task music on choice visual reaction time in elite taekwondo athletes. *Journal of Science and Medicine in Sport*, 27(4), 276-280. <https://doi.org/10.1016/j.jsams.2024.01.002>

Gredin, N. V., Bishop, D. T., Williams, A. M., & Broadbent, D. P. (2023). The use of contextual priors and kinematic information during anticipation in sport: toward a Bayesian integration framework. *International Review of Sport and Exercise Psychology*, 16(1), 286-310. <https://doi.org/10.1080/1750984X.2020.1855667>

Huesmann, K., & Loffing, F. (2024). Perception-action coupling in anticipation research: A classification and its application to racket sports. *Frontiers in Psychology*, 15, 1396873. <https://doi.org/10.3389/fpsyg.2024.1396873>

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.
<https://doi.org/10.17979/sportis.2025.11.2.11517>

- Kung, S. M., Suksreephaisan, T. K., Perry, B. G., Palmer, B. R., & Page, R. A. (2020). The effects of anticipation and visual and sensory performance on concussion risk in sport: a review. *Sports Medicine-Open*, 6(1), 54.
<https://doi.org/10.1186/s40798-020-00283-6>
- Leal, K., Pinto, A., Torres, R., Elferink-Gemser, M., & Cunha, S. (2022). Characterization and analyses of dribbling actions in soccer: a novel definition and effectiveness of dribbles in the 2018 FIFA World Cup RussiaTM. *Human Movement*, 23(1), 10-17. <https://doi.org/10.5114/hm.2021.104182>
- Loffing, F. & Cañal-Bruland, R. (2017). Anticipation in sport. *Current Opinion in Psychology*, 16, 6-11. <https://doi.org/10.1016/j.copsyc.2017.03.008>
- Logan, G. D., Lilburn, S. D., & Ulrich, J. E. (2023). Serial attention to serial memory: The psychological refractory period in forward and backward cued recall. *Cognitive Psychology*, 145, 101583.
<https://doi.org/10.1016/j.cogpsych.2023.101583>
- Magill, R. A. & Anderson, D. (2020). Motor learning and control: concepts and applications. London: McGraw-Hill Education.
- Müller, S., Morris-Binelli, K., Hambrick, D. Z., & Macnamara, B. N. (2024). Accelerating Visual Anticipation in Sport Through Temporal Occlusion Training: A Meta-Analysis. *Sports Medicine*, 54(10), 2597-2606.
<https://doi.org/10.1007/s40279-024-02073-6>
- Negi, K., Shahanawaz, S., Chauhan, P., & Rajbhor, B. (2021). Effect of distributed versus massed practice on reaction time in collegiate volleyball players: a pilot study. *Journal of Clinical & Diagnostic Research*, 15(9).
<https://doi.org/10.7860/JCDR/2021/49981.15367>
- Oliveira, T. A. C. de, Davids, K., Denardi, R. A., Zalla, S., & Corrêa, U. C. (2023). Interpersonal coordination tendencies and perception of visual information for decision-making in futsal. *Psychology of Sport and Exercise*, 102403.
<https://doi.org/10.1016/j.psychsport.2023.102403>
- Passos, P., Davids, K., & Chow, J. Y. (2016). *Interpersonal coordination and performance in social systems*. New York, NY: Routledge.
<https://doi.org/10.4324/9781315700304>

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.

<https://doi.org/10.17979/sportis.2025.11.2.11517>

- Poli, R. (2018). Introducing anticipation. In R. Poli (Ed.), *Handbook of anticipation: Theoretical and applied aspects of the use of future in decision making* (pp. 1–14). Routledge. https://doi.org/10.1007/978-3-319-31737-3_1-1
- Ramon Suarez, G., Marquez Arabia, J. J., Gaviria Alzate, S., Teller, D., Calderon, M., & Vargas, L. (2021). Visual and auditory reaction time measurement scales in related sports. *Viref-Revista De Educacion Fisica*, 10(3), 1-48.
- Schmidt, R. A., Lee, T. D., Winstein, C., Wulf, G., & Zelaznik, H. N. (2019). *Motor control and learning: a behavioral emphasis*. Champaign, IL: Human Kinetics.
- Silva, S. L. Reis, M. A. M., Silva Filho, A. S., Benda, R. N., Moreira, A., & Corrêa, U. C. (2022). Success and failure of dribbling in futsal and football based on reaction time and anticipation. *Kinesiologia Slovenica*, 28(3), 16-29. <https://doi.org/10.52165/kinsi.28.3.16-29>
- Spittle, M. (2021). *Motor learning and skill acquisition: applications for physical education and sport*. Red Globe Press.
- Sturgess, P. (2017). *Futsal: training, technique and tactics*. Bloomsbury Publishing.
- Suárez, G. R. & Arabia, JJM (2020). Time of reaction and visual action in laboratory and field in karate and taekwondo athletes. *Educacion Fisica y Deporte*, 39, 2. <https://doi.org/10.17533/udea.efyd.v39n2a08>
- Tani, G. (2004). *[Art and science of dribbling]* A arte e a ciência da finta. In J. Garganta., J. Oliveira., & M. Murad (Eds.), *Futebol de muitas cores e sabores: reflexões em torno do desporto mais popular do mundo* (pp. 239–246). Campo das Letras.
- Tani, G. (2016). *[Art and science of not being dribbled]* Arte e ciência da habilidade de não ser fintado. In G. Tani (Ed). *Comportamento Motor: conceitos estudos e aplicações*. (pp. 262–266). Guanabara Koogan.
- Travassos, B. (2014). *A tomada de decisão no futsal [Decision making in futsal]*. Estoril: Prime Books.
- Wesson, J. (2019). *The science of soccer*. Boca Raton, Flórida: Crc Press. <https://doi.org/10.1201/9780429320095>

Original article. The attacker-defender's spatiotemporal relationship affects the dribbling outcome in futsal but not in soccer. Vol. 11, n.º 2; p. 1-15, April 2025.
<https://doi.org/10.17979/sportis.2025.11.2.11517>

- Williams, A. M., & Jackson, R. C. (2019). Anticipation in sport: Fifty years on, what have we learned and what research still needs to be undertaken? *Psychology of Sport and Exercise*, 42, 16-24. <https://doi.org/10.1016/j.psychsport.2018.11.014>
- Zhu, R., Zheng, M., Liu, S., Guo, J., & Cao, C. (2024). Effects of Perceptual-Cognitive Training on Anticipation and Decision-Making Skills in Team Sports: A Systematic Review and Meta-Analysis. *Behavioral Sciences*, 14(10), 919.
<https://doi.org/10.3390/bs14100919>