مجلة دجلة للعلوم الإنسانية • المجلد ٢ ،العدد ٢ (حزيران ٢٠٢٦)، ص: ٥٩٥ - ٦٠٦
E- ISSN: 3079-7861 • P- ISSN: 3079-7853

The Relationship Between Temporal Estimation Error and Visual Reaction Time Among Male University Basketball Players

Ali Abdullah Hamad Ahmed[1], Assistant Lecturer Ismael Hameed Saleh[2]

[1] Al-Kindi Secondary School for Boys, General Directorate of Education, Baghdad Al-Karkh II, Ministry of Education, Iraq

Alidms12@gmail.com

[2] College of Political Science, University of Baghdad, Iraq

ismail.h@copolicy.uobaghdad.edu.iq

Abstract

Background: Successful basketball performance depends not only on physical fitness and technical skills but also on cognitive abilities such as temporal estimation and visual reaction time. These perceptual skills are relevant to rapid and accurate decision-making in basketball, particularly in defensive situations performed under time pressure.

Objective: This study aimed to investigate the relationship between temporal estimation error and visual reaction time among male university basketball players and to determine the statistical association between the two variables.

Methods: A descriptive correlational research design was employed. The sample consisted of 40 male basketball players aged 18–22 years from university teams, with an average playing experience of 4.8 ± 1.9 years. Participants completed computerized tests assessing temporal estimation error and visual reaction time. Descriptive statistics, Pearson's correlation coefficient, one-way analysis of variance (ANOVA), and simple linear regression were used for data analysis.

Results: The findings revealed a statistically significant positive correlation between temporal estimation error and visual reaction time ($r = .61$, $p < .001$). Smaller temporal estimation errors were associated with shorter visual reaction times. Based on the reported group sizes, means, and standard deviations, visual reaction time differed significantly by playing position ($F(2, 37) = 14.08$, $p < .001$), with guards exhibiting the fastest responses and centers the slowest. Linear regression analysis showed that temporal estimation error explained approximately 37% of the variance in visual reaction time ($R^2 = 0.37$).

Conclusion: Temporal estimation error was statistically associated with visual reaction time among male university basketball players. Players with smaller temporal estimation errors tended to record shorter visual reaction times. However, the study did not directly measure zone-defense performance. The findings should therefore be interpreted cautiously and verified using the raw data and original statistical output.

Keywords: Temporal Estimation Error; Visual Reaction Time; Basketball; Male University Basketball Players; Playing Position; Perceptual-Cognitive Performance.

Received: 2/12 /2025 Accepted: 29/12/2025 Published: June /2026

مجلة دجلة للعلوم الإنسانية • المجلد ٢ ،العدد ٢ (حزيران ٢٠٢٦)، ص: ٥٩٥ - ٦٠٦
E- ISSN: 3079-7861 • P- ISSN: 3079-7853

العلاقة بين خطأ التقدير الزمني وزمن رد الفعل البصري لدى لاعبي كرة السلة الجامعيين الذكور

علي عبد الله حمد أحمد[١]، م.م. إسماعيل حميد صالح[٢]

[١] ثانوية الكندي للبنين، المديرية العامة لتربية بغداد، الكرخ الثانية، وزارة التربية، العراق

Alidms12@gmail.com

[٢]كلية العلوم السياسية، جامعة بغداد، العراق

ismail.h@copolicy.uobaghdad.edu.iq

المستخلص

يعتمد الأداء الناجح في كرة السلة، إلى جانب اللياقة البدنية والمهارات الفنية، على قدرات معرفية من بينها التقدير الزمني وزمن رد الفعل البصري، لما لهما من أهمية في اتخاذ القرارات السريعة والدقيقة، ولا سيما في المواقف الدفاعية التي تُؤدّى تحت ضغط الوقت. الهدف: هدفت الدراسة إلى بحث العلاقة بين خطأ التقدير الزمني وزمن رد الفعل البصري لدى لاعبي كرة السلة الجامعيين الذكور، وتحديد الارتباط الإحصائي بين المتغيرين.

استُخدم المنهج الوصفي الارتباطي، وتكوّنت العينة من ٤٠ لاعب كرة سلة من فرق جامعية، تراوحت أعمارهم بين ١٨ و٢٢ سنة، بمتوسط خبرة لعب بلغ ٤.٨ ± ١.٩ سنة. وأجرى المشاركون اختبارين حاسوبيين لقياس خطأ التقدير الزمني وزمن رد الفعل البصري. واستُخدمت الإحصاءات الوصفية، ومعامل ارتباط بيرسون، وتحليل التباين الأحادي، والانحدار الخطي البسيط لتحليل البيانات وأظهرت النتائج وجود ارتباط موجب ذي دلالة إحصائية بين خطأ التقدير الزمني وزمن رد الفعل البصري($r = .61, p < .001$) ، إذ ارتبط انخفاض خطأ التقدير الزمني بقِصَر زمن رد الفعل البصري. كما ظهرت فروق دالة في زمن رد الفعل البصري تبعًا لمركز اللعب $F2, 37 = 14.08, p < .001$)، وكان لاعبو الارتكاز الأبطأ، في حين كان لاعبو الحراسة الأسرع) وفسّر خطأ التقدير الزمني نحو ٣٧٪ من التباين في زمن رد الفعل البصري ($R^2 = 0.37$) حيث يرتبط خطأ التقدير الزمني إحصائيًا بزمن رد الفعل البصري لدى لاعبي كرة السلة الجامعيين الذكور. ومع ذلك، لم تقِس الدراسة أداء الدفاع بالمنطقة بصورة مباشرة؛ لذلك ينبغي تفسير النتائج بحذر والتحقق منها بالرجوع إلى البيانات الخام والمخرجات الإحصائية الأصلية.

الكلمات المفتاحية:

خطأ التقدير الزمني، زمن رد الفعل البصري، كرة السلة، لاعبو الجامعات الذكور، مركز اللعب، الأداء الإدراكي–المعرفي.

تاريخ الاستلام: ٢/١٢ /٢٠٢٦ تاريخ القبول: ٢٩/١٢ /٢٠٢٥ تاريخ النشر : حزيران /٢٠٢٦

1. Introduction

Modern basketball requires players to integrate physical fitness, technical proficiency, tactical awareness, and cognitive abilities to achieve optimal performance. Among these cognitive abilities, temporal estimation and visual reaction time are relevant to defensive situations, in which players must rapidly interpret visual information, anticipate opponents' movements, and execute appropriate responses (Alemanno et al., 2025; Jin et al., 2023; Li et al., 2023).

Temporal perception refers to an individual's ability to estimate short time intervals and synchronize motor responses with environmental events. In the present study, it was operationalized as absolute temporal estimation error, for which lower values represented greater accuracy. Visual reaction time reflects the time required to detect, process, and respond to a visual stimulus, with lower values representing faster responses (Mańkowska et al., 2015; Perrone et al., 2023).

Previous studies have demonstrated that athletes generally exhibit superior perceptual and cognitive abilities compared with non-athletes. Research has also shown that visual perception and reaction time are associated with decision-making quality, movement accuracy, and overall sport performance. In basketball, these abilities become increasingly important because defensive situations frequently occur under severe time constraints requiring immediate cognitive and motor responses (Guo & Wang, 2025; Jin et al., 2023; Nian et al., 2023).

Basketball defense requires players to perceive spatial and temporal information while coordinating their movements with teammates. Consequently, examining the relationship between temporal estimation error and visual reaction time may provide information about perceptual-cognitive characteristics relevant to basketball performance. However, laboratory measures should not be treated as direct measures of game-specific defensive performance (Bourgeais et al., 2025; Guo & Wang, 2025).

Although several studies have investigated visual perception or reaction time independently, limited research has examined the relationship between temporal estimation error and visual reaction time among male university basketball players. Therefore, this study aimed to investigate this relationship and evaluate the statistical association between the two variables (Alemanno et al., 2025; Guo & Wang, 2025).

مجلة دجلة للعلوم الإنسانية • المجلد ٢ ،العدد ٢ (حزيران ٢٠٢٦)، ص: ٥٩٥ - ٦٠٦
E- ISSN: 3079-7861 • P- ISSN: 3079-7853

2. Materials and Methods

1. Research Design

This study employed a descriptive correlational research design to investigate the relationship between temporal estimation error and visual reaction time among male university basketball players. The design was selected because it allows examination of the strength and direction of an association without manipulating the study conditions; it does not establish causation.

2. Participants

The study sample consisted of 40 male basketball players representing university basketball teams in Iraq. Participants were between 18 and 22 years of age (M = 20.1 ± 1.2 years) and had an average playing experience of 4.8 ± 1.9 years.

The participants were classified according to their playing positions as follows:

- Guards (n = 16)
- Forwards (n = 14)
- Centers (n = 10)

All participants were right-handed, actively competing during the university basketball season, and free from neurological disorders, visual impairments, or musculoskeletal injuries that might affect test performance. Before participation, all players provided informed consent, and the study procedures conformed to the ethical principles for research involving human participants.

3. Instruments

Two computerized tests were used to assess the study variables.

4. Temporal Estimation Test

Temporal estimation was assessed using a computerized task designed to measure participants' ability to estimate short time intervals ranging from 400 to 800 milliseconds. During each trial, a moving visual stimulus disappeared before reaching a target point, and participants were required to estimate the moment at which the stimulus would have reached the target.

Each participant completed three familiarization trials followed by ten recorded trials. The average absolute temporal error (milliseconds) was calculated. Lower values indicated greater temporal perception accuracy.

5. Visual Reaction Time Test

Visual reaction time was measured using a computerized reaction-time system that presented random visual stimuli on a monitor. Participants were instructed to respond as quickly as possible by pressing a response key immediately after the appearance of the stimulus.

Reaction time was recorded in milliseconds, and the mean value of ten valid trials was used for statistical analysis. Shorter reaction times indicated faster visual responses.

6. Testing Procedures

Testing was conducted in a quiet laboratory under standardized environmental conditions. The room temperature was maintained at approximately 22–24°C, and all assessments were carried out between 9:00 a.m. and 12:00 p.m. to minimize the influence of fatigue and circadian variation.

Participants first completed a standardized warm-up lasting approximately ten minutes. They then received detailed instructions regarding the testing procedures and completed familiarization trials before the actual measurements.

The temporal estimation assessment was performed first, followed by the visual reaction time test after a five-minute passive recovery period. For each test, participants completed the stated familiarization trials followed by ten recorded trials, and the mean of the valid recorded trials was used for statistical analysis.

7. Variables

The study included the following variables:

8. Independent Variable

- Temporal estimation error (ms)

9. Dependent Variable

- Visual reaction time (ms)

10. Classification Variable

- Playing position (Guard, Forward, Center)

11. Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics (Version 27.0).

The following statistical procedures were applied:

- Descriptive statistics (M and SD)
- Shapiro–Wilk test to assess data normality
- Pearson’s correlation coefficient to determine the relationship between temporal estimation error and visual reaction time
- One-way analysis of variance (ANOVA) to compare playing positions
- Tukey’s post hoc test for multiple comparisons
- Simple linear regression analysis to model the statistical association between temporal estimation error and visual reaction time

The level of statistical significance was established at $p \leq 0.05$.

3. Results

Descriptive statistics were calculated for temporal estimation error and visual reaction time. Pearson's correlation and simple linear regression were used to examine their association, and one-way ANOVA with Tukey's post hoc test was used to compare visual reaction time across playing positions.

12. Descriptive Statistics

Table 1 presents the descriptive statistics for the study variables.

Table 1. Descriptive statistics for temporal estimation error and visual reaction time (N = 40).

Variable	M	SD
Temporal Estimation Error (ms)	112.4	18.9
Visual Reaction Time (ms)	297.7	26.0

The mean temporal estimation error was 112.4 ms (SD = 18.9), and the mean visual reaction time was 297.7 ms (SD = 26.0). The visual reaction-time values were reconstructed from the position-specific summary statistics in Table 3 and should be verified against the raw dataset.

13. Normality of Data Distribution

The Shapiro–Wilk tests were reported as nonsignificant ($p > .05$), providing no evidence of substantial univariate departures from normality. Exact W and p values should be inserted from the original SPSS output.

14. Correlation Between Temporal Estimation Error and Visual Reaction Time

Pearson's correlation coefficient was calculated to examine the association between temporal estimation error and visual reaction time.

Table 2. Pearson correlation between temporal estimation error and visual reaction time.

Variables	r	p
Temporal Estimation Error × Visual Reaction Time	.61	< .001

A statistically significant moderate-to-strong positive correlation was found between temporal estimation error and visual reaction time ($r = .61$, $p < .001$). Because smaller values represented better performance on both measures, this positive association indicates that players with smaller temporal estimation errors tended to have shorter visual reaction times.

15. Differences According to Playing Position

A one-way analysis of variance (ANOVA) was conducted to compare visual reaction time among guards, forwards, and centers.

Table 3. Visual reaction time according to playing position.

Playing Position	M (ms)	SD
Guards	279.5	18.2
Forwards	301.2	20.4
Centers	322.1	22.7

The reconstructed ANOVA indicated statistically significant differences in visual reaction time among the three playing positions:

$F(2, 37) = 14.08, p < .001, \eta^2 = .43$

Tukey–Kramer post hoc comparisons based on the reported group summaries indicated that guards had shorter reaction times than forwards ($p = .015$) and centers ($p < .001$), and forwards had shorter reaction times than centers ($p = .043$). These reconstructed values must be checked against the original SPSS output before submission.

Playing position was associated with visual reaction time in this sample. The cross-sectional design does not determine whether positional demands produced these differences or whether players with different response characteristics were selected into particular positions.

16. Linear Regression Analysis

A simple linear regression analysis was used to quantify the association between temporal estimation error and visual reaction time.

The reconstructed regression equation was:

Visual Reaction Time = 203.3 + 0.84(Temporal Estimation Error)

Table 4. Reconstructed simple linear regression results.

Statistic	Value
R^2	.37
Unstandardized B	.84
Standardized β	.61
t(38)	4.75
p	< .001
95% CI for B	[.48, 1.20]

Temporal estimation error was significantly associated with visual reaction time, $B = .84$, $SE = .18$, $\beta = .61$, $t(38) = 4.75$, $p < .001$, 95% CI [.48, 1.20]. The model accounted for approximately 37% of the variance in visual reaction time ($R^2 = .37$).

The reconstructed coefficient indicates that each additional millisecond of temporal estimation error was associated with an estimated 0.84-ms increase in visual reaction time. This coefficient describes an association and should not be interpreted as a causal effect.

17. Summary of Findings

The principal findings of this study can be summarized as follows:

1. The players demonstrated a mean temporal estimation error of 112.4 ms and a reconstructed mean visual reaction time of 297.7 ms.
2. Temporal estimation error was positively associated with visual reaction time; smaller errors were associated with shorter reaction times.
3. Guards had shorter visual reaction times than forwards and centers, and forwards had shorter reaction times than centers.
4. Temporal estimation error accounted for 37% of the variance in visual reaction time, but the correlational design does not establish causality or direct game-performance effects.

4. Discussion

The present study examined the association between temporal estimation error and visual reaction time among male university basketball players. A statistically significant positive correlation was found, meaning that smaller temporal estimation errors were associated with shorter visual reaction times. The regression model accounted for approximately 37% of the variance in reaction time.

The association is theoretically plausible because both tasks require participants to process time-dependent visual information and produce a timely response. However, the tests were performed under controlled laboratory conditions and did not directly assess tactical decision-making, opponent interaction, or zone-defense behavior. The findings therefore concern the measured laboratory variables rather than complete defensive performance.

The moderate-to-strong positive correlation ($r = .61$) indicates that players who estimated temporal intervals with smaller absolute errors also tended to respond more rapidly to visual stimuli. This pattern is consistent with research linking perceptual-cognitive proficiency to anticipation and visual-response performance in sport, although the present study cannot determine the direction of influence (Jin et al., 2023; Li et al., 2023; Mańkowska et al., 2015; Perrone et al., 2023).

Temporal estimation error accounted for 37% of the variance in visual reaction time. The unexplained variance indicates that reaction time was also associated with unmeasured factors, potentially including selective attention, visual-search strategy, motor execution, fatigue, playing experience, and individual differences. Temporal estimation error should therefore be regarded as one correlate of reaction time rather than a comprehensive determinant of basketball performance (Liu et al., 2024; Nian et al., 2023).

Visual reaction time also differed across playing positions. Guards recorded the shortest mean reaction time, followed by forwards and centers. These differences may reflect positional demands, training exposure, player-selection processes, anthropometric differences, or other unmeasured factors. The present design cannot identify which explanation is responsible.

Although guards typically perform frequent ball-handling, transition, and perimeter decision-making tasks, and centers often perform more close-range positional actions, these role descriptions do not prove that positional experience caused the observed reaction-time differences. Longitudinal or matched-group studies are needed to test that interpretation.

Previous research supports the relevance of visual search, anticipation, and perceptual-cognitive assessment in basketball and other sports. Nevertheless, evidence that a training method changes a laboratory score does not automatically demonstrate improved competitive defense. Training studies should include transfer measures that represent actual basketball decisions and movement outcomes (Alemanno et al., 2025; Giancamilli et al., 2022; Jin et al., 2023; Lozzi et al., 2025; Ma et al., 2023).

From a practical perspective, temporal estimation and visual reaction-time tasks may be used as supplementary assessment tools. The present correlational findings do not establish that training either variable will improve the other or enhance game performance. Such claims require controlled intervention studies with basketball-specific outcome measures.

Potential interventions for future testing include reaction-light tasks, video-based anticipation exercises, small-sided games, and variable time-pressure drills. Their effectiveness should be evaluated using randomized or controlled designs and measures of transfer to real basketball performance (Giancamilli et al., 2022; Ma et al., 2023).

Several limitations should be considered. The sample was small and restricted to male university players. The laboratory tasks did not directly reproduce basketball decisions or zone-defense behavior. The test order was fixed, creating possible order effects. Hardware and software specifications were not fully reported, and potential confounders such as age, experience, team membership, and physical characteristics were not controlled. Finally, the correlational design precludes causal conclusions.

Overall, the findings indicate an association between temporal estimation error and visual reaction time in the sampled players. They support further investigation of perceptual-cognitive processes in basketball but do not independently demonstrate improved defensive efficiency or competitive performance (Alemanno et al., 2025; Guo & Wang, 2025; Ma et al., 2023).

5. Conclusion

The study identified a statistically significant positive association between temporal estimation error and visual reaction time among male university basketball players. Players with smaller absolute temporal errors tended to record shorter visual reaction times.

Temporal estimation error accounted for approximately 37% of the variance in visual reaction time. This finding describes an association between two laboratory measures and does not establish that one variable causes changes in the other or that either measure directly represents defensive performance.

Visual reaction time differed across playing positions, with guards recording the shortest mean time, followed by forwards and centers. These differences should be interpreted cautiously because potential confounding variables were not controlled.

Temporal estimation and visual reaction time may provide useful supplementary information in player assessment. Further studies should verify the statistical results using the raw data and examine whether changes in these measures transfer to basketball-specific decisions and movement performance.

6. Practical Applications

The findings have limited but potentially useful applications for basketball coaches and sport scientists when interpreted as laboratory assessment results rather than direct measures of game performance.

- Temporal estimation and visual reaction-time tasks may supplement, but should not replace, technical, tactical, and game-based assessment.
- Repeated testing should use the same calibrated equipment and standardized testing conditions.
- Game-specific drills may be combined with laboratory tests when evaluating whether perceptual-cognitive changes transfer to basketball performance.
- Position-specific comparisons should account for age, experience, anthropometric characteristics, team membership, and training exposure.
- Video-based and virtual-simulation methods may be evaluated as training tools, but their effectiveness should be established through controlled intervention studies.
- Periodic assessment may assist monitoring, provided measurement reliability and the smallest meaningful change are established.

7. Study Limitations

The study has several limitations that materially affect interpretation.

First, the sample of 40 male university players limits statistical precision and generalizability to professional, youth, and female populations.

Second, the temporal estimation and visual reaction-time tasks were laboratory measures and did not directly assess tactical decisions, movement execution, or zone-defense performance.

Third, the fixed task order may have introduced practice, fatigue, or carryover effects. The absence of fully reported hardware, software, calibration, reliability, and validity information also limits reproducibility.

Fourth, the analyses did not control for potential confounders such as playing experience, age, team membership, physical characteristics, or training exposure. Finally, the cross-sectional correlational design does not permit causal conclusions.

Future studies should use larger and more diverse samples, randomized task order, fully documented and validated measurement systems, multivariable analyses, and basketball-specific transfer outcomes. Longitudinal and controlled intervention designs are required to test training effects.

8. Recommendations

Based on the corrected interpretation of the findings, the following recommendations are proposed:

1. Verify all descriptive and inferential statistics against the raw dataset and original SPSS output before submission.
2. Report the ethics committee, approval number, recruitment period, participating teams, and informed-consent procedure.
3. Report the software, monitor refresh rate, response device, viewing distance, calibration procedure, trial-exclusion rules, and test-retest reliability.
4. Use temporal estimation error consistently throughout the manuscript and state that smaller values represent greater accuracy.
5. In future studies, counterbalance or randomize task order and control relevant covariates using multivariable analysis.
6. Include basketball-specific decision and movement measures before making claims about defensive or zone-defense performance.
7. Use longitudinal or controlled intervention designs to test whether perceptual-cognitive training produces meaningful transfer to competition.
8. Replicate the study in larger samples that include female, youth, professional, and different competitive-level players.

مجلة دجلة للعلوم الإنسانية • المجلد ٢ ،العدد ٢ (حزيران ٢٠٢٦)، ص: ٥٩٥ - ٦٠٦
E- ISSN: 3079-7861 • P- ISSN: 3079-7853

References

1. Alemanno, M., Di Pompeo, I., Marcaccio, M., Canini, D., Curcio, G., & Migliore, S. (2025). From gaze to game: A systematic review of eye-tracking applications in basketball. *Brain Sciences, 15*(4), 421. https://doi.org/10.3390/brainsci15040421
2. Bourgeais, Q., Charrier, R., Sanlaville, E., & Seifert, L. (2025). Temporal passing network in basketball: The effect of time pressure on the dynamics of team organization at micro and meso levels. *Psychology of Sport and Exercise, 80*, 102882. https://doi.org/10.1016/j.psychsport.2025.102882
3. Giancamilli, F., Galli, F., Chirico, A., Fegatelli, D., Mallia, L., Palombi, T., Cordone, S., Alivernini, F., Mandolesi, L., & Lucidi, F. (2022). When the going gets tough, what happens to quiet eye? The role of time pressure and performance pressure during basketball free throws. *Psychology of Sport and Exercise, 58*, 102057. https://doi.org/10.1016/j.psychsport.2021.102057
4. Guo, Z., & Wang, Q. (2025). The impact of time pressure on decision-making and visual search characteristics in basketball players. *Frontiers in Psychology, 16*, 1660732. https://doi.org/10.3389/fpsyg.2025.1660732
5. Jin, P., Ge, Z., & Fan, T. (2023). Research on visual search behaviors of basketball players at different levels of sports expertise. *Scientific Reports, 13*, 1406. https://doi.org/10.1038/s41598-023-28754-2
6. Li, Y., Feng, T., Zhang, F., Asgher, U., Yan, B., & Peng, T. (2023). Visual search strategies of performance monitoring used in action anticipation of basketball players. *Brain and Behavior, 13*(12), e3298. https://doi.org/10.1002/brb3.3298
7. Liu, M., Kong, A., Lau, N., Feng, Z., & Liu, X. (2024). Basketball self-evaluation matrix: Discrepancy between self-confidence and decision-making performance on psychological profiling of players. *Frontiers in Sports and Active Living, 6*, 1404701. https://doi.org/10.3389/fspor.2024.1404701
8. Lozzi, D., Di Pompeo, I., Marcaccio, M., Alemanno, M., Krüger, M., Curcio, G., & Migliore, S. (2025). AI-powered analysis of eye tracker data in basketball game. *Sensors, 25*(11), 3572. https://doi.org/10.3390/s25113572
9. Ma, Y., Ren, M., & Li, X. (2023). Application of virtual simulation technology in sports decision training: A systematic review. *Frontiers in Psychology, 14*, 1164117. https://doi.org/10.3389/fpsyg.2023.1164117
10. Mańkowska, M., Poliszczuk, T., Poliszczuk, D., & Johne, M. (2015). Visual perception and its effect on reaction time and time-movement anticipation in elite female basketball players. *Polish Journal of Sport and Tourism, 22*(1), 3–8. https://doi.org/10.1515/pjst-2015-0008
11. Nian, Q., Lu, W., & Xu, Y. (2023). Effects of object working memory load on visual search in basketball players: An eye movement study. *BMC Psychology, 11*, 446. https://doi.org/10.1186/s40359-023-01488-6
12. Perrone, S., Rinaldi, L., Gatti, D., & Girelli, L. (2023). Temporal perception in closed-skill sports: An experimental study on expert swimmers and runners. *Psychology of Sport and Exercise, 69*, 102500. https://doi.org/10.1016/j.psychsport.2023.102500