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The Effect of Executive Function Load on Reaction Time in E-Sports Players

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ABSTRACT

Objective: This study examined the effect of executive function load on reaction time in e-sports players and compared their performance with an age-matched control group. **Materials and Methods:** This cross-sectional controlled study included 30 competitive e-sports players and 30 healthy age-matched controls. Reaction time was assessed using the BlazePod system under four conditions: simple reaction time (SRT), choice reaction time (CRT), motor dual-task reaction time (MDRT), and cognitive dual-task reaction time (CDRT). Group differences were analyzed using independent samples t-tests. A 2 × 4 mixed-design ANOVA was conducted with group (e-sports vs. control) as the between-subject factor and task condition as the within-subject factor. Bonferroni-adjusted post hoc tests were applied where appropriate. **Results:** E-sports players demonstrated significantly shorter reaction times than controls in all conditions: SRT (291.5±67.3 vs. 413.4±94.1 ms, $p<0.001$), CRT (443.3±173.6 vs. 618.4±199.3 ms, $p<0.001$), MDRT (446.4±115.0 vs. 616.2±251.6 ms, $p=0.001$), and CDRT (490.9±183.4 vs. 622.3±223.8 ms, $p=0.016$). A significant main effect of task condition was observed ($F(3,174)=31.726$, $p<0.001$), while the group × task interaction was not significant ($F(3,174)=0.641$, $p=0.590$). Post hoc analysis showed that SRT was significantly shorter than all other conditions ($p<0.001$), with no differences among dual-task conditions. Error rates did not differ between groups ($p>0.05$). **Conclusion:** E-sports players exhibited shorter reaction times than controls across all conditions. Increased task load prolonged reaction time similarly in both groups.

Keywords: E-sport, Reaction Time, Executive Function, Dual Task.

E-Spor Oyuncularında Yürütücü İşlev Yükünün Reaksiyon Zamanı Üzerindeki Etkisi

ÖZ

Amaç: Bu çalışma, e-spor oyuncularında yürütücü işlev yükünün reaksiyon zamanı üzerindeki etkisini incelemeyi ve performanslarını yaşa göre eşleştirilmiş bir kontrol grubuyla karşılaştırmayı amaçladı. **Gereç ve Yöntem:** Bu kesitsel kontrollü çalışmaya 30 rekabetçi e-spor oyuncusu ve 30 sağlıklı, yaş olarak eşleştirilmiş kontrol grubu dahil edildi. Reaksiyon zamanı, BlazePod sistemi kullanılarak dört koşulda değerlendirildi: basit reaksiyon zamanı (BRZ), seçici reaksiyon zamanı (SRZ), motor ek görevli reaksiyon zamanı (MERZ) ve kognitif ek görevli reaksiyon zamanı (KERZ). Grup farkları bağımsız örneklem t-testi ile analiz edildi. Grup (e-spor, kontrol) değişkeninin gruplar arası faktör, görev koşulunun ise grup içi faktör olduğu 2 × 4 karma tasarımlı ANOVA uygulandı. Uygun durumlarda Bonferroni düzeltmeli post-hoc testler kullanıldı. **Bulgular:** E-spor oyuncuları tüm koşullarda kontrol grubuna göre anlamlı oranda daha kısa reaksiyon zamanları gösterdi: BRZ (291.5±67.3 vs. 413.4±94.1 ms, $p<0.001$), SRZ (443.3±173.6 vs. 618.4±199.3 ms, $p<0.001$), MERZ (446.4±115.0 vs. 616.2±251.6 ms, $p=0.001$) ve KERZ (490.9±183.4 vs. 622.3±223.8 ms, $p=0.016$). Görev koşulunun anlamlı bir ana etkisi bulundu ($F_{(3,174)} = 31.726$, $p<0.001$), ancak grup × görev etkileşimi anlamlı değildi ($F_{(3,174)} = 0.641$, $p=0.590$). Post-hoc analizler, BRZ'nin diğer tüm koşullardan anlamlı derecede daha kısa olduğunu gösterdi ($p<0.001$); çift görev koşulları arasında fark bulunmadı. Hata oranları gruplar arasında farklılık göstermedi ($p>0.05$). **Sonuç:** E-spor oyuncuları tüm koşullarda kontrol grubuna kıyasla daha kısa reaksiyon zamanları sergiledi. Artan görev yükü, her iki grupta da reaksiyon zamanını benzer şekilde uzattı.

Anahtar Kelimeler: E-spor, Reaksiyon Zamanı, Yürütücü İşlev, Çift Görev.

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INTRODUCTION

E-sports is an inclusive sport that allows people from different parts of the world to come together through the internet and participate in large organizations to play games, requiring substantial physical and mental effort as well as competition (Aras & Algün Doğu, 2025; Argan et al., 2006; Mustafaoğlu, 2018). This sport, which is based on online digital games, has shown rapid global growth with its increasing audience. It has also become increasingly popular in Türkiye in recent years (Argan et al., 2006; Aslan & Çimen, 2025; Mustafaoğlu, 2018).

Due to the dynamic nature of the game being played at a fast pace, the continuous encounter with changing situations, and the requirement for rapid responses and decision-making skills, success in this sport requires good reaction time, hand–eye coordination, reflexive movements, as well as cognitive abilities (Evren et al., 2019; Jonasson & Thiborg, 2010; Ziv et al., 2022). E-sports players' ability to react quickly and accurately affects their performance in the game. Factors such as perceiving the opponent more quickly, aiming rapidly, and responding swiftly and accurately to strategic actions clearly demonstrate the determining role of reaction time on performance in e-sports players (Bányai et al., 2019; Stewart et al., 2020). Reaction time is the interval between perceiving a stimulus and initiating a voluntary response. It is an indicator of coordination between the central nervous system and the neuromuscular system (Balakrishnan et al., 2014; Bickmann et al., 2021; Kosinski, 2008; Nitin Khajotia et al., 2025). In e-sports, reaction time is typically defined as the time it takes a player to respond to a warning or event in the game. For instance, the interval between a player seeing an enemy and firing a shot is considered reaction time (Ersin et al., 2022). Reaction time is usually measured in milliseconds (ms) because events and responses in e-sports games happen so quickly (Argan et al., 2006; Ersin et al., 2022; Jonasson & Thiborg, 2010; Mustafaoğlu, 2018).

In fast-paced and strategic games such as e-sports, executive functions need to be used effectively together with reaction time. Executive functions are defined as the set of skills required to achieve a specific goal, including planning, problem-solving, goal setting, attention, focus, impulse control, flexible thinking, and decision-making (Bányai et al., 2019; Diamond, 2013; Kaya & Çetin, 2019). These functions are important in daily life, education, work and activities such as sport (Diamond, 2013; Kaya & Çetin, 2019; Miyake et al., 2000). In fast-paced and strategic games such as e-sports, executive functions must also be used effectively. Reaction time and executive functions play an important role together in e-sports performance. These two concepts can be considered complementary components (Bavelier et al., 2012; Green & Bavelier, 2003; Kaya & Çetin, 2019). E-sports players use methods such as specific training, strategic planning, and gaining in-game experience to develop these skills. Reducing reaction time and improving executive functions can help players perform better and gain a competitive advantage (Bavelier et al., 2012; DiFrancisco-Donoghue et al., 2019; Green & Bavelier, 2003). Accordingly, considering that e-sports performance is shaped not only by rapid motor responses but also by higher-level executive processes such as attention, response selection, and inhibition, examining the relationship between reaction time and executive functions under multitasking conditions becomes important. From all these perspectives, it can be considered that e-sports players are advanced in terms of reaction time and executive functions; however, the number of studies on this topic in the literature is limited.

The aim of this study was to examine the effect of executive function load on reaction time in e-sports players and to compare the reaction time performance of e-sports players with that of an age-matched control group that did not play video games. Accordingly, it was hypothesized that increasing task load (choice task, motor dual-task, and cognitive dual-task conditions) would prolong reaction time in both groups. In addition, it was anticipated that the simple reaction time, choice reaction time, motor dual-task reaction time, and cognitive dual-task reaction time performances of e-sports players would be shorter than those of the control group. Furthermore, it was hypothesized that there would be no difference in reaction time between the motor and cognitive dual-task conditions.

MATERIALS AND METHODS

Study type

This study was designed as a **c**ross-sectional, controlled, comparative study.

Study group

This study included 30 e-sports players who regularly trained at the Balıkesir Metropolitan Municipality Youth and Sports Center and actively participated in competitions as members of e-sports teams. In addition, 30 healthy individuals with no habitual computer or video game playing were included as a control group and were age-matched with the e-sports players. The data for the study were collected between February 2025 and August 2025.

Dependent and independent variables

The independent variables of this research are age, height, weight, body mass index, dominant hand, e-sports experience, their health, and sport-related history. The dependent variables are simple reaction time, choice reaction time, motor dual-task reaction time, and cognitive dual-task reaction time.

Procedures

Prior to the study, individuals who met the inclusion criteria were informed about the study procedures, and those who volunteered to participate signed a written informed consent form before the study commenced. The study was conducted in accordance with the Declaration of Helsinki.

The inclusion criteria were as follows: (1) being between 15 and 30 years of age; (2) for the e-sports group, having played e-sports for at least six hours per week for the past six months; and (3) volunteering to participate in the study. The exclusion criteria were as follows: (1) presence of any neurological, visual, or hearing impairment; (2) history of upper extremity surgery; (3) use of medications known to have stimulant effects; and (4) for the control group, regularly playing competitive digital games.

Demographic characteristics of all participants, including age, height, body weight, body mass index, dominant hand, and e-sports experience, as well as their health- and sport-related history, were recorded. Reaction times of all participants were assessed under simple, choice, motor, and cognitive dual-task conditions. All assessments were conducted under the supervision of an experienced physiotherapist in a clinical setting. First, a simple reaction time test was administered to all participants. Subsequently, choice, cognitive, and motor dual-task tests were performed. To minimize potential learning effects, the order of these tests was determined using simple randomization through a computer-based program.

Outcome measurement

Assessment of simple reaction time

Participants' simple reaction time (SRT) was assessed using the BlazePod system (Play Coyotta Ltd., Tel Aviv, Israel). This system is a measurement and training tool designed to evaluate and improve reaction time. It consists of LED-equipped pods and a mobile application that records measurement results. The pods are capable of producing light in eight different colors and can be clearly perceived even under bright lighting conditions. Additionally, the device has a durable structure that is resistant to high impacts.

For the measurement, participants were seated in an ergonomic chair with the trunk stabilized and the shoulders relaxed. During the reaction time assessment, the pod was positioned on a table in front of the participant at a distance of approximately 30 cm. During the test, participants were instructed to quickly extend their dominant hand and touch the surface of the pod as soon as a visual stimulus appeared (i.e., when the pod light illuminated) following the countdown and start command provided by the application. Contact of the hand with the pod surface deactivated the stimulus and was recorded as a valid response. After each touch, the hand returned to the starting position while waiting for the next stimulus.

Reaction time data upon contact with the device were measured via an application installed on a tablet. The application generated results based on the timing and frequency of contacts with the device. Initially, participants were allowed to perform a 30-second trial. Participants were then allowed a brief rest period. Subsequently, the actual test was conducted for 1 minute, during which the light stimulus appeared randomly at intervals of 2–4 seconds. The average reaction time and the number of missed touches were recorded (De-Oliveira et al., 2021; Polechoński et al., 2025).

Assessment of executive function

The choice reaction time (CRT) assessment test was used to evaluate executive function. This test was also performed using the BlazePod™ system, and the participants were positioned in the same manner. During the test, participants, while in a seated position, were asked to touch only with their right hand the four colors defined for the right hand (yellow, pink, green, red) and only with their left hand the four colors defined for the left hand (white, purple, blue, orange) among the colors that illuminated in a random sequence on four pod units placed in front of them. Participants were initially given a 30-second trial period. Subsequently, within a 1-minute period, the average reaction time to lights that flashed randomly at intervals of 2–4 seconds, the total number of touches to the pods, and the number of incorrect touches were recorded. The same test was repeated with cognitive and motor dual tasks. To measure motor dual-task reaction time (MDRT), participants were asked to perform the touching action by transferring an object (ball) with a diameter of 10 cm from one hand to the other; when a color defined for the right hand illuminated, they transferred the object to the left hand, and when a color defined for the left hand illuminated, they transferred the object to the right hand. To measure cognitive dual-task reaction time (CDRT), during the same test procedure, participants were asked to complete the test by counting backward by threes from any number between 300 and 600 given by the evaluator, and the average reaction time, along with the total and incorrect number of touches, were recorded (De-Oliveira et al., 2021; Polechoński et al., 2025). In addition, the percentage of incorrect hits during the test was calculated as (incorrect hits/total hits) × 100.

Statistical analysis

An a priori power analysis was conducted using G*Power 3.1.9.7 for a mixed-design repeated-measures ANOVA (within–between interaction) with two groups and four measurements. Assuming a moderate effect size ($f = 0.25$), $\alpha = 0.05$, power $(1-\beta) = 0.80$, and a correlation among repeated measures of 0.5, the required total sample size was calculated as 28 participants. To account for potential data loss during measurements, 30 participants were included in each group, resulting in a total sample of 60 participants.

All statistical analyses were performed using JASP software version 0.19.1 (JASP Team). Descriptive statistics were expressed as mean ± standard deviation (SD). The normality of the data distribution was assessed using the Shapiro–Wilk test. To examine the effects of group and task condition on reaction time, a 2 × 4 mixed-design repeated-measures analysis of variance (ANOVA) was conducted with group (e-sports players vs. control) as the between-subject factor and task condition (simple reaction time, choice

reaction time, motor dual task reaction time, and cognitive additional task reaction time) as the within-subject factor. The main effects of group and task condition, as well as the group × task interaction, were analyzed. When significant main effects or interactions were detected, Bonferroni-adjusted post-hoc comparisons were performed. Additionally, independent samples t-tests were used to compare the reaction time performance of the e-sports and control groups separately for each test condition. The level of statistical significance was set at $p<0.05$. Effect sizes were reported using partial eta squared (η^2p) for ANOVA analyses and Cohen's d for independent samples t-tests.

Ethical approval

Ethical approval for the study was obtained on 1 October 2024 from the Non-Interventional Ethics Committee of the Institute of Health Sciences at Balıkesir University (2024/169), in accordance with the Declaration of Helsinki.

RESULTS

The study included 60 participants (30 e-sports players and 30 controls). Demographic characteristics were similar between groups ($p>0.05$) (Table 1). The mean gaming experience of individuals in the e-sports group was 5.1 ± 2.73 years, and their average daily gaming duration was 3.9 ± 2.2 hours.

Table 1. Demographic characteristics of the groups.

Variables	Group	N	Avg.	SD (±)	P
Age (year)	E-Sports	30	18.8	2.3	0.7
	Control	30	19.03	2.4	
Height (cm)	E-Sports	30	176.4	5.8	0.3
	Control	30	174.4	9.5	
Weight (kg)	E-Sports	30	74.9	14.5	0.3
	Control	30	71.2	15.05	
BMİ (kg/m²)	E-Sports	30	23.9	3.8	0.4
	Control	30	23.2	3.5	

N: number of individuals, Avg.: average, SD: standard deviation, P: statistical significance value, BMİ: body mass index.

There was a statistically significant difference between the groups in the SRT, CRT, MDRT, and CDRT test results ($p<0.05$). Individuals in the e-sports group demonstrated statistically significantly better performance in all tests compared with the control group (Table 2).

Table 2. Comparison of the SRT, CRT, MDRT and CDRT test results for the groups.

Variables	Group	Avr.	SD (±)	Cohen's *d*	P
SRT (ms)	E-Sports	291.5	67.3	1.48	<.001*
	Control	413.4	94.1		
CRT (ms)	E-Sports	443.3	173.6	0.93	<.001*
	Control	618.4	199.3		
MDRT (ms)	E-Sports	490.9	183.4	0.64	0.016*
	Control	622.3	223.8		
CDRT (ms)	E-Sports	446.4	115	0.86	0.001*
	Control	616.2	251.6		

Avg.: average, SD: standard deviation, Cohen's d: effect size, P: statistical significance value, ms: milliseconds, SRT: Simple reaction time, CRT: Choice reaction time, MDRT: Motor dual-task reaction time, CDRT: Cognitive dual-task reaction time.

A mixed-design ANOVA (2 groups × 4 task conditions) was conducted to examine the effects of group (e-sports players vs. control) and reaction time condition (simple reaction time, choice reaction time, motor dual-task reaction time, and cognitive dual-task reaction time) on reaction time performance.

The analysis revealed a significant main effect of task condition, $F_{(3,174)} = 31.726$, $p < 0.001$, $\eta^2p = 0.354$, indicating that reaction times differed significantly across the four task conditions. However, the group × task condition interaction was not statistically significant, $F_{(3,174)} = 0.641$, $p = 0.590$, $\eta^2p = 0.011$, suggesting that the pattern of change in reaction time across the different task conditions was similar in both groups (Figure 1).

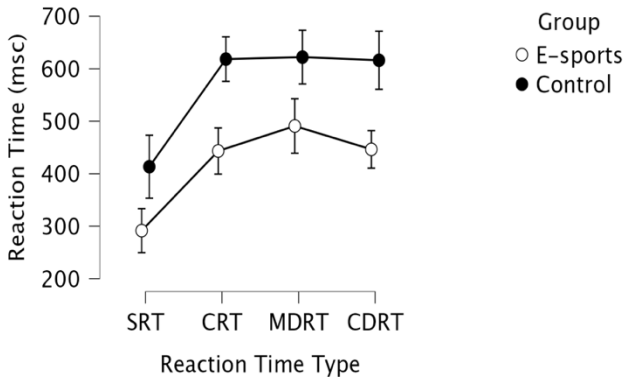

Figure 1. Changes in reaction time of the groups during simple and different dual-task conditions.

Post-hoc analyses with Bonferroni correction revealed that reaction time during selective, motor dual-task, and cognitive dual-task conditions was significantly longer than during the simple reaction time condition ($p<0.001$) (Table 3), whereas the magnitude of these changes did not differ between the e-sports players and the control group.

There was no statistically significant difference between the e-sports and control groups in terms of error percentages during the tests: CRT (6.1 ± 5.6 / 7.1 ± 4.3, $p=0.18$), CDRT (8.3 ± 5.08 / 9.4 ± 5.2, $p=0.31$), and MDRT (5.09 ± 4.8 / 7.3 ± 4.3, $p=0.08$).

Table 3. Post hoc analysis results of reaction time during different dual-task conditions.

		Mean Difference	SE	t	p_hoc
SRT	**CRT**	-178.406	23.101	-7.723	<.001
	CDRT	-178.867	24.786	-7.216	<.001
	MDRT	-204.150	25.594	-7.976	<.001
CRT	**CDRT**	-0.461	20.582	-0.022	0.982
	MDRT	-25.744	23.578	-1.092	0.838
CDRT	**MDRT**	-25.283	24.161	-1.046	0.838

SRT: Simple reaction time, CRT: Choice reaction time, CDRT: Cognitive dual-task reaction time, MDRT: Motor dual-task reaction time.

Although not statistically significant, individuals in the control group had higher error percentages compared with those in the e-sports group. In addition, reaction time tended to increase during cognitive tasks, although this increase was not statistically significant.

DISCUSSION

In this study, e-sports players responded significantly faster than the control group in simple, selective, motor dual-task, and cognitive dual-task reaction time tests. However, the similarity in reaction time changes associated with the type of additional task between the groups indicated that executive function load affected both groups in a similar manner. These results demonstrate that although overall reaction performance is superior in e-sports players, the relative effect of cognitive and motor dual tasks on reaction time is independent of the group.

In the study, the significantly shorter simple reaction times of e-sports players compared with the control group are consistent with the nature of e-sports, which requires rapid visual stimulus perception and motor responses. Previous studies have reported that individuals who regularly play video games have improved visual information processing speed and motor response initiation capacity (Argan et al., 2006; Bavelier et al., 2012; Dye et al., 2009; Evren et al., 2019; Green & Bavelier, 2003; Jonasson & Thiborg, 2010). In the e-sports environment, where milliseconds are decisive, players continuously optimize the perception–decision–response chain, which provides an advantage in basic reaction time (Campbell et al., 2018; Dye et al., 2009; Green & Bavelier, 2003; Himmelstein et al., 2017).

Choice reaction time results more clearly reveal the effect of executive functions on reaction time. Since choice reaction time requires not only responding to a stimulus but also inhibiting inappropriate stimuli and selecting the correct motor response, it is considered an important component of executive functions (Diamond, 2013; Kaya & Çetin, 2019; Logan & Cowan, 1984; Miyake et al., 2000). The faster performance of e-sports players in this test compared to the control group suggests that experience of e-sports positively influences attentional processes, response selection, and inhibitory processes (Bavelier et al., 2012; Bejjanki et al., 2014; Green & Bavelier, 2003).

The significant prolongation of reaction time observed in both groups upon the addition of motor and cognitive secondary tasks provides clear evidence of dual-task cost (Al-Yahya et al., 2011; Pashler, 1994). This finding indicates that executive functions are sensitive to task load and that the combination of cognitive-motor tasks complicates information processing (Al-Yahya et al., 2011; Miyake et al., 2000). Regular exposure to digital games is thought to contribute to the development of executive function components such as attention processes, decision-making mechanisms, and response speed (Bavelier et al., 2012; Green & Bavelier, 2003). These cognitive advantages observed in e-sports players may be associated with the processes of adapting to the frequent requirements for rapid decision-making and simultaneous multitasking demands during gameplay (Chang et al., 2017; Vestberg et al., 2012). However, the non-significance of the group × task interaction indicates that the relative effect of additional tasks on reaction time was similar in both groups. This finding suggests that although e-sports players generally exhibit shorter reaction times, performance outcomes dependent on the allocation of central cognitive resources under increased cognitive and motor load do not differentiate between the groups (Pashler, 1994; Wickens, 2008).

These results support the hypothesis that executive functions prolong reaction time in e-sports players. However, the lack of a significant difference between cognitive and motor dual tasks indicates that the presence of executive function load, rather than its type, is decisive for reaction time. This finding demonstrates that, while executive functions play a critical role in e-sports performance, whether these functions are motor or cognitive does not affect reaction time across levels.

The limited number of studies in the literature directly linking the executive functions of e-sports players with reaction time indicates that cognitive performance mechanisms in this field have not been sufficiently elucidated (Bediou et al., 2018; Campbell et al., 2018; Pedraza-Ramirez et al., 2020). While current studies primarily focus on perceptual speed or general cognitive performance outcomes, the specific contribution of executive functions to reaction time and how this relationship changes under cognitive or motor task load has been largely overlooked. Therefore, the current study fills a significant gap in the literature by evaluating the effect of executive function load on reaction time in e-sports players through simple, choice, and dual-task paradigms.

Study Limitations

The study has some limitations. First, since the data were collected at a single time point, causal relationships regarding the effects of e-sports experience on executive functions and reaction time cannot be established. The obtained findings only reveal associations and differences between the groups. Additionally, executive functions were evaluated solely with reaction-based tasks, and different executive function tests such as Stroop or Go/No-Go were not used. In future studies, it is recommended to examine the effects of e-sports experience on cognitive and motor processes in more detail through longitudinal designs and multi-dimensional executive function assessments.

CONCLUSION

In conclusion, this study demonstrates that e-sports players exhibited better performance in terms of reaction time compared to the age-matched control group. However, it was observed that the executive function load prolonged reaction time in a similar manner in both groups. These findings reveal that e-sports performance is shaped by the interaction between motor speed and executive control processes. They also make an important contribution to the literature on the cognitive-motor demands of e-sports. This suggests that e-sports training programs should include not only in-game practice, but also exercises involving cognitive load, to improve performance.

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Conflict of Interest

The authors declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Author Contributions

Plan, design: SD, SY, UB, CD; **Material, methods, and data collection:** SD, SY, AA; **Data analysis and comments:** SD, UB, AA, ANA; **Writing and corrections:** SD, UB, CD, ANA.

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Ethical Approval

Institution: Balikesir University Non-Interventional Health Sciences Research Ethics Committee
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Approval no: 2024/169

REFERENCES

Al-Yahya, E., Dawes, H., Smith, L., Dennis, A., Howells, K., & Cockburn, J. (2011). Cognitive motor interference while walking: a systematic review and meta-analysis. *Neuroscience & Biobehavioral Reviews*, *35*(3), 715-728.

Aras, H., & Algün Doğu, G. (2025). Spor Psikologları Perspektifinden E-Spor.

Argan, M., Özer, A., & Akın, E. (2006). Elektronik spor: Türkiye'deki siber sporcularin tutum ve davranişlari. *Spor Yönetimi ve Bilgi Teknolojileri*, *1*(2), 1-11.

Aslan, T., & Çimen, Z. (2025). Esporun Tarihsel Gelişimi. *Yalova Üniversitesi Spor Bilimleri Dergisi*, *4*(1), 1-17.

Balakrishnan, G., Uppinakudru, G., Girwar Singh, G., Bangera, S., Dutt Raghavendra, A., & Thangavel, D. (2014). A comparative study on visual choice reaction time for different colors in females. *Neurology Research International*, *2014*(1), 301473.

Bányai, F., Griffiths, M. D., Király, O., & Demetrovics, Z. (2019). The psychology of esports: A systematic literature review. *Journal of gambling studies*, *35*(2), 351-365.

Bavelier, D., Green, C. S., Pouget, A., & Schrater, P. (2012). Brain plasticity through the life span: learning to learn and action video games. *Annual Review of Neuroscience*, *35*, 391-416.

Bediou, B., Adams, D. M., Mayer, R. E., Tipton, E., Green, C. S., & Bavelier, D. (2018). Meta-analysis of action video game impact on perceptual, attentional, and cognitive skills. *Psychological bulletin*, *144*(1), 77.

Bejjanki, V. R., Zhang, R., Li, R., Pouget, A., Green, C. S., Lu, Z.-L., & Bavelier, D. (2014). Action video game play facilitates the development of better perceptual templates. *Proceedings of the National Academy of Sciences*, *111*(47), 16961-16966.

Bickmann, P., Wechsler, K., Rudolf, K., Tholl, C., Froböse, I., & Grieben, C. (2021). Comparison of reaction time between esports players of different genres and sportsmen. *International Journal of eSports Research (IJER)*, *1*(1), 1-16.

Campbell, M. J., Toth, A. J., Moran, A. P., Kowal, M., & Exton, C. (2018). eSports: A new window on neurocognitive expertise? *Progress in Brain Research*, *240*, 161-174.

Chang, Y. H., Liu, D. C., Chen, Y. Q., & Hsieh, S. (2017). The relationship between online game experience and multitasking ability in a virtual environment. *Applied Cognitive Psychology*, *31*(6), 653-661.

De-Oliveira, L. A., Matos, M. V., Fernandes, I. G., Nascimento, D. A., & Da Silva-Grigoletto, M. E. (2021). Test-retest reliability of a visual-cognitive technology (BlazePod™) to measure response time. *Journal of Sports Science & Medicine*, *20*(1), 179.

Diamond, A. (2013). Executive functions. *Annual review of psychology*, *64*(1), 135-168.

DiFrancisco-Donoghue, J., Balentine, J., Schmidt, G., & Zwibel, H. (2019). Managing the health of the eSport athlete: an integrated health management model. *BMJ open sport & exercise medicine*, *5*(1).

Dye, M. W., Green, C. S., & Bavelier, D. (2009). Increasing speed of processing with action video games. *Current directions in psychological science*, *18*(6), 321-326.

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.

Evren, T., Kargün, M., Pala, A., & Yazarer, İ. (2019). Spora Yenilikçi Yaklaşım: E-Spor. *Journal of International Social Research*, *12*(66).

Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature*, *423*(6939), 534-537.

Himmelstein, D., Liu, Y., & Shapiro, J. L. (2017). An exploration of mental skills among competitive league of legend players. *International Journal of Gaming and Computer-Mediated Simulations (IJGCMS)*, *9*(2), 1-21.

Jonasson, K., & Thiborg, J. (2010). Electronic sport and its impact on future sport. *Sport in society*, *13*(2), 287-299.

Kaya, S., & Çetin, F. H. (2019). Teknoloji Kullanımının Yürütücü İşlevler Üzerine Etkisi. *Pediatric Practice and Research*, *7*(Ek), 110-110.

Kosinski, R. J. (2008). A literature review on reaction time. *Clemson University*, *10*(1), 337-344.

Logan, G. D., & Cowan, W. B. (1984). On the ability to inhibit thought and action: A theory of an act of control. *Psychological Review*, *91*(3), 295.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology*, *41*(1), 49-100.

Mustafaoğlu, R. (2018). E-spor, spor ve fiziksel aktivite. *Ulusal spor bilimleri dergisi*, *2*(2), 84-96.

Nitin Khajotia, Sangeeta Vyas, Rinki Hada, Minal Kachhawa, & Manzoor, A. (2025). Association between activity type and reaction time: e-sports, basketball, and sedentary lifestyles. *International Journal of Life Sciences, Biotechnology and Pharma Research*, *14*(9). https://doi.org/10.69605/ijlbpr_14.9.2025.37

Pashler, H. (1994). Dual-task interference in simple tasks: data and theory. *Psychological bulletin*, *116*(2), 220.

Pedraza-Ramirez, I., Musculus, L., Raab, M., & Laborde, S. (2020). Setting the scientific stage for esports psychology: A systematic review. *International Review of Sport and Exercise Psychology*, *13*(1), 319-352.

Polechoński, J., Pilch, J., Langer, A., Prończuk, M., Markowski, J., & Maszczyk, A. (2025). Assessment of the reliability and validity of simple and complex reaction speed tests in mixed martial arts athletes using the BlazePod system. *Baltic Journal of Health and Physical Activity*, *17*(1), 2.

Stewart, H. J., Martinez, J. L., Perdew, A., Green, C. S., & Moore, D. R. (2020). Auditory cognition and perception of action video game players. *Scientific Reports*, *10*(1), 14410.

Vestberg, T., Gustafson, R., Maurex, L., Ingvar, M., & Petrovic, P. (2012). Executive functions predict the success of top-soccer players. *PloS one*, *7*(4), e34731.

Wickens, C. D. (2008). Multiple resources and mental workload. *Human factors*, *50*(3), 449-455.

Ziv, G., Lidor, R., & Levin, O. (2022). Reaction time and working memory in gamers and non-gamers. *Scientific Reports*, *12*(1), 6798.