

Originals

Crossed laterality and performance in fencing: an analysis of ocular dominance, handedness, and reaction times in fencers



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Introduction: Fencing is a sport that demands precise visuomotor coordination, rapid reaction times, and a high level of perceptual-cognitive ability. In this context, laterality—understood as the functional preference for one side of the body—may play a critical role in athletic performance. While the influence of handedness has been widely studied, the contribution of ocular dominance, and particularly its interaction with handedness (i.e., crossed or uncrossed laterality), has received limited attention in this sport.

Objective: to examine the relationship between their laterality profiles (dominant eye and hand) and reaction times in tasks of increasing complexity.

Methods: This study evaluated 97 fencers of varying competitive levels and weapon types (épée, foil, and sabre). Tests included simple reaction, choice reaction, Go/No-Go, and decision-making tasks, with response times measured precisely in milliseconds. Additionally, the analysis examined the distribution of laterality profiles across competition levels and weapon specializations.

Results: Findings indicated that fencers with crossed laterality (dominant eye and hand on opposite sides) exhibited significantly faster reaction times in complex tasks, particularly those involving decision-making and motor execution. Furthermore, this profile was more prevalent among national and international-level athletes, especially in foil and sabre disciplines. In contrast, uncrossed laterality was more common among épée fencers and those at regional or amateur levels.

Conclusion: These findings suggest that crossed laterality may represent an optimal perceptual-motor profile in fencing, potentially enhancing sensorimotor integration and reducing cerebral processing time. This knowledge may be crucial for optimizing training programs, enhancing talent identification, and developing personalized strategies for achieving high performance.

Keywords: Visuomotor Coordination; Sensorimotor Integration; Talent Identification; Cognitive Load; Fencing.

Palabras clave: coordinación visuomotora; integración sensoriomotora; identificación de talentos; carga cognitiva; esgrima.

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Lateralidad cruzada y rendimiento en esgrima: análisis de la dominancia ocular, la lateralidad manual y los tiempos de reacción en esgrimistas

RESUMEN

Introducción: La esgrima es un deporte que exige una coordinación visuomotora precisa, tiempos de reacción rápidos y un alto nivel de capacidad perceptivo-cognitiva. En este contexto, la lateralidad —entendida como la preferencia funcional por un lado del cuerpo— puede desempeñar un papel crítico en el rendimiento deportivo. Aunque la influencia de la lateralidad manual ha sido ampliamente estudiada, la

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contribución de la dominancia ocular, y especialmente su interacción con la lateralidad manual, es decir, la lateralidad cruzada o no cruzada, ha recibido una atención limitada en este deporte.

Objetivo: Examinar la relación entre los perfiles de lateralidad de los esgrimistas, ojo y mano dominantes, y los tiempos de reacción en tareas de complejidad creciente.

Métodos: Este estudio evaluó a 97 esgrimistas de diferentes niveles competitivos y modalidades de arma, espada, florete y sable. Las pruebas incluyeron tareas de reacción simple, reacción de elección, Go/No-Go y toma de decisiones, con tiempos de respuesta medidos con precisión en milisegundos. Además, el análisis examinó la distribución de los perfiles de lateralidad según el nivel competitivo y la especialidad de arma.

Resultados: Los hallazgos indicaron que los esgrimistas con lateralidad cruzada, ojo y mano dominantes en lados opuestos, mostraron tiempos de reacción significativamente más rápidos en tareas complejas, especialmente aquellas que implicaban toma de decisiones y ejecución motora. Además, este perfil fue más frecuente entre deportistas de nivel nacional e internacional, especialmente en las disciplinas de florete y sable. En cambio, la lateralidad no cruzada fue más común entre esgrimistas de espada y en aquellos de nivel regional o amateur.

Conclusión: Estos hallazgos sugieren que la lateralidad cruzada puede representar un perfil perceptivo-motor óptimo en esgrima, al favorecer potencialmente la integración sensoriomotora y reducir el tiempo de procesamiento cerebral. Este conocimiento puede ser clave para optimizar los programas de entrenamiento, mejorar la identificación de talentos y desarrollar estrategias personalizadas orientadas al alto rendimiento.

Palabras clave: coordinación visuomotora; integración sensoriomotora; identificación de talentos; carga cognitiva; esgrima.

Lateralidade cruzada e desempenho na esgrima: uma análise da dominância ocular, da lateralidade manual e dos tempos de reação em esgrimistas

RESUMO

Introdução: A esgrima é um desporto que exige coordenação visuomotora precisa, tempos de reação rápidos e um elevado nível de capacidade perceptivo-cognitiva. Neste contexto, a lateralidade —entendida como a preferência funcional por um dos lados do corpo— pode desempenhar um papel crítico no desempenho desportivo. Embora a influência da lateralidade manual tenha sido amplamente estudada, a contribuição da dominância ocular, e particularmente a sua interação com a lateralidade manual, isto é, a lateralidade cruzada ou não cruzada, tem recebido atenção limitada neste desporto.

Objetivo: Examinar a relação entre os perfis de lateralidade dos esgrimistas, olho e mão dominantes, e os tempos de reação em tarefas de complexidade crescente.

Métodos: Este estudo avaliou 97 esgrimistas de diferentes níveis competitivos e modalidades de arma, espada, florete e sabre. Os testes incluíram tarefas de reação simples, reação de escolha, Go/No-Go e tomada de decisão, com os tempos de resposta medidos com precisão em milissegundos. Além disso, a análise examinou a distribuição dos perfis de lateralidade de acordo com o nível competitivo e a especialização da arma.

Resultados: Os resultados indicaram que os esgrimistas com lateralidade cruzada, olho e mão dominantes em lados opostos, apresentaram tempos de reação significativamente mais rápidos em tarefas complexas, especialmente aquelas que envolviam tomada de decisão e execução motora. Além disso, este perfil foi mais prevalente entre atletas de nível nacional e internacional, especialmente nas disciplinas de florete e sabre. Em contraste, a lateralidade não cruzada foi mais comum entre esgrimistas de espada e entre aqueles de nível regional ou amador.

Conclusão: Estes resultados sugerem que a lateralidade cruzada pode representar um perfil perceptivo-motor ótimo na esgrima, podendo favorecer a integração sensoriomotora e reduzir o tempo de processamento cerebral. Este conhecimento pode ser crucial para otimizar programas de treino, melhorar a identificação de talentos e desenvolver estratégias personalizadas para alcançar elevado desempenho.

Palavras-chave: coordenação visuomotora; integração sensoriomotora; identificação de talentos; carga cognitiva; esgrima.

INTRODUCTION

Fencing, as a high-speed combat sport, demands exceptional visuomotor coordination, ultra-fast reaction times, and superior perceptual-cognitive abilities to anticipate and execute precise actions [1, 2]. In such a dynamic context, laterality—understood as the functional preference for one side of the body over the other [3, 4]—emerges as a potentially critical factor in shaping athletic performance [5].

While handedness (right- or left-handedness) has traditionally been recognized for its tactical impact in fencing [6], influencing fighting style and both offensive and defensive strategies, the influence of ocular dominance and its interaction with handedness remains underexplored in this elite sport.

Research on ocular dominance suggests that this preference is not merely an anatomical curiosity but may have significant

implications for tasks requiring visual precision and hand-eye coordination [7, 8].

Understanding and leveraging the preference for one eye over the other is essential for achieving optimal positioning in sport in general, and in fencing in particular. Given that fencing requires precise coordination and rapid decision-making, identifying laterality profiles may be key to optimizing training and performance.

Studies in this area have shown a notable prevalence of left-handed fencers at the highest levels of international rankings, with most of them exhibiting right-eye dominance. Similarly, researchers have observed a relatively high proportion of right-handed athletes who are left-eye dominant.

Experiments involving tasks with spatiotemporal uncertainty have confirmed a visuomotor advantage in response time among individuals with crossed eye-hand laterality. It appears that the dominant eye operates the geniculostriate pathway — in which temporal retinal fibers project ipsilaterally and nasal retinal fibers project contralaterally, resulting in each hemisphere processing

the contralateral visual field. Moreover, studies have shown that the specific effects of ocular dominance on hand–eye coordination emerge only when spatial uncertainty exceeds a certain threshold [9].

There are two primary laterality profiles: ipsilateral or uncrossed (where the dominant eye and dominant hand are on the same side), and crossed or contralateral (where the dominant eye and dominant hand are on opposite sides). In the general population, between 10% and 30% exhibit a crossed laterality profile, while 70% to 90% display an uncrossed profile. However, in certain sports, the proportion of athletes with crossed laterality is higher than in the general population, suggesting a potential advantage in specific performance contexts [8].

In sports that require rapid processing of visual information to guide motor responses—such as baseball, cricket, or shooting—a correlation has been identified between eye dominance and performance [10–13]. Within this framework, clarifying the precise effects of these laterality conditions is a critical research priority. Specifically, the question remains whether crossed laterality (e.g., left-eye dominance with right-hand dominance) or uncrossed laterality (dominant eye and hand on the same side) provides an advantage or disadvantage in fencing—a sport defined by lateral movements and complex feints [14, 15]. To date, this issue remains largely unanswered in the current literature.

Crossed laterality is present in a considerable proportion of athletes and may influence performance in fencing and other sports. Identifying whether a fencer exhibits a crossed or uncrossed profile could assist coaches in tailoring physical, technical, tactical, and psychological training to the athlete's strengths and limitations. Furthermore, it could support the development of training programs that promote more effective athletic development and facilitate talent identification by aligning training strategies with individual motor preferences [16].

This study aims to investigate the distribution of ocular and manual dominance among fencers, examining how these lateral preferences relate to athletes' performance levels and reaction times. Specifically, it compares the reaction times of fencers grouped according to hand and/or eye dominance (right- or left-dominant), as well as into two broad categories: ipsilateral and crossed laterality. The goal is to establish direct links between laterality profiles, reaction time results, and fencing performance.

Such findings will offer valuable insights into elite fencers, helping determine whether an optimal laterality profile exists that contributes to faster and more effective decision-making during bouts. Understanding these relationships will not only enrich knowledge of the perceptual-motor foundations of fencing performance but also inform more personalized and efficient training.

MATERIALS AND METHODS

Data Assessed

The study included 97 fencers (53 males, 44 females; mean age 24.53 ± 12.54 years) from various competitive levels (12 international, 25 national, 42 regional, and 18 amateur) and disciplines (48 épée, 28 foil, and 27 sabre). All participants, or their legal guardians when applicable, provided written informed consent in accordance with the Declaration of Helsinki [17].

Fencers were classified based on their dominant hand (used to hold the weapon—73 right-handed and 24 left-handed), as well as their motor and sensory dominant eyes.

Motor eye dominance was determined using the Miles test, in which the participants extended both arms and forms a small triangle with the hands. The participants were instructed to focus on a distant object through the triangle with both eyes open. Then, each eye is

closed alternately. The object remains centered when viewed through the dominant eye (Ojo et al., 2017).

Sensory eye dominance was assessed using the +2.00 lens test (also known as the binocular rivalry or blur sensitivity test), in which a +2.00 dioptre lens was alternately placed in front of each eye [18]. The dominant eye is the one for which the induced blur most strongly affects visual perception. Each measurement was repeated three times, and participants without a clearly defined ocular dominance were excluded from the study.

Once participants were classified, the evaluation proceeded with reactive tasks. Four Queling Sport (Queling, China) reaction-time light devices were used, synchronized via Bluetooth 5.0 with the ReactionX app on an Android tablet, which also recorded the reaction times. Each device, measuring 9 cm in diameter, was mounted vertically using Velcro, and participants used their own fencing weapons during testing. Four exercises were specifically designed to assess reaction time and decision-making under fencing-specific conditions [19].

For the evaluation, several types of reaction times were measured: Simple Reaction Time (SRT), defined as the time to react to a known and predictable stimulus; Election Reaction Time (ERT), the time to respond to a randomly activated device; Go/No-Go Reaction Time (G/NG), requiring a response only to specific light colors; and Decision-Making Time (DM), which involved performing different fencing movements (lunge, advance, retreat) depending on the color of the light.

Each exercise consisted of two repetitions, with a 30-second rest between them, and the total duration for each participant was approximately 14 minutes. Anticipated responses (<100 ms) and excessively delayed responses (>1000 ms relative to the participant's best time) were excluded from the analysis. All participants completed a familiarization session in the days before data collection.

Statistical Analysis

This study aimed to examine the distribution of different laterality profiles (crossed or ipsilateral) within a sample of fencers across various competitive levels and to investigate how these configurations relate to variables such as dominant hand, weapon type, and performance in reaction time tasks.

Through various statistical tests, both distribution patterns and differences in motor and cognitive performance were analyzed, with particular focus on tasks simulating the perceptual demands and decision-making processes typical of fencing combat.

To analyze contingency tables, the chi-square test was employed, which is appropriate for comparing non-continuous categorical variables, such as ipsilateral versus crossed laterality in relation to dominant hand or dominant eye. A p-value less than 0.05 was interpreted as evidence of a statistically significant association between variables, indicating they were not independent.

To assess mean reaction times, the Shapiro–Wilk test for normality was applied to determine whether the data followed a normal distribution. In all analyzed groups, p-values were below 0.05, leading to the rejection of the normality hypothesis. Consequently, the non-parametric Kruskal–Wallis test was used to compare mean reaction times across the different groups of the studied variables. The tasks assessed reaction time under increasing levels of complexity, ranging from simple responses to those involving decision-making and movement execution.

RESULTS

The results of the chi-square tests, as shown in Table 1, indicate a significant association between laterality and all the studied variables.

Particularly, the results regarding the relationship between crossed laterality and higher competitive level, specific weapon type,

Table 1. Chi-Square Test Results for the Association Between Laterality and Other Variables.

Variable Association	N	df	χ^2	p
Laterality and Eye	97	1	26.48	< .001
Laterality and Hand	97	1	7.65	.006
Laterality and Competition Level	97	3	19.83	< .001
Laterality and Weapon	97	2	10.46	.005

Table 2. Relationship between dominant eye and type of laterality in fencers.

Dominant Eye	Contralateral	Ipsilateral	Total
Right-eyed	18	42	60
Left-eyed	31	6	37
Total	49	48	97

Table 3. Relationship between dominant hand and type of laterality in fencers.

Dominant Hand	Contralateral	Ipsilateral	Total
Right-handed	31	42	73
Left-handed	18	6	24
Total	49	48	97

Table 4. Relationship between laterality type (crossed or ipsilateral) and highest competitive level achieved by fencers in the study.

Competition Level	Contralateral	Ipsilateral	Total
International	9	3	12
National	18	7	25
Regional	17	25	42
Amateur	5	13	18
Total	49	48	97

Table 5. Relationship between weapon type (épée, foil, or sabre) and laterality (contralateral or ipsilateral) in fencers.

Weapon	Contralateral	Ipsilateral
Épée	15	27
Foil	21	7
Sabre	13	14

Table 6. Reaction time test results for ipsilateral and contralateral laterality groups.

Task	Ipsilateral (n = 48)	Contralateral (n = 49)	p-value	η^2
SRT*	417 ± 143	333 ± 109	< .001	0.106
ERT	543 ± 114	504 ± 92	0.136	0.013
G/NG	555 ± 98	543 ± 80	0.466	0.000
DM (overall)*	1356 ± 336	1190 ± 264	< .001	0.061
DML (lunge)*	1118 ± 179	1013 ± 197	< .001	0.101
DMM (advance)*	1250 ± 251	1112 ± 187	0.005	0.072
DMR (retreat)*	1700 ± 242	1444 ± 189	< .001	0.259

Note Exercises that were statistically significant ($p < 0.05$) were marked with "*".

or more effective reactions under increasing motor and cognitive complexity are presented below (Table 2).

Among right-eye dominant fencers, most displayed ipsilateral laterality (42 out of 60), meaning their dominant hand was also the right. Conversely, among left-eye dominant fencers, the majority showed contralateral laterality (31 out of 37), meaning their dominant hand was the right. A chi-square analysis revealed a statistically significant difference between right- and left-eye dominant fencers regarding laterality type ($p < 0.001$). Specifically, left-eye dominant individuals had a significantly higher proportion of crossed laterality, whereas right-eye dominant fencers tended to have uncrossed (ipsilateral) laterality.

The table 3 show that with (75.26%) the dominant hand was right-handed. Of these, the majority (42 of 73, or 57.54%) had ipsilateral laterality, with both the dominant eye and hand on the right side. The remaining 31 right-handed fencers (42.46%) exhibited crossed laterality. Among left-handed fencers, crossed laterality was dominant: 18 out of 24 (75%) had this profile, while only 6 (25%) had ipsilateral laterality.

Overall, 49 had contralateral laterality and 48 had ipsilateral laterality (Table 4). At higher levels of competition (national and international), a greater proportion of fencers displayed contralateral laterality: among international-level athletes, 9 were contralateral and 3 ipsilateral; among national-level athletes, 18 were contralateral and 7 ipsilateral. In contrast, at lower competitive levels (regional and amateur), ipsilateral laterality was more common. At the amateur level, 5 fencers were contralateral and 13 ipsilateral; at the regional level, 17 were contralateral compared to 25 ipsilateral.

In foil, a high proportion of fencers exhibited contralateral laterality (21 out of 28), suggesting that this configuration may either be advantageous or more prevalent in this discipline. In contrast, in épée, ipsilateral laterality was clearly dominant (27 out of 42), which may be related to the technical or tactical demands of the weapon. Sabre showed a relatively balanced distribution between the two profiles (13 vs. 14), indicating no

clear preference in this weapon category. A chi-square test was conducted to examine whether there was a significant association between weapon type and laterality. The p-value (0.005) was below the conventional significance threshold ($\alpha = 0.05$), indicating a statistically significant association between weapon type and laterality.

The table 6 show the P-values from Kruskal-Wallis test and η^2 effect size estimates are included. Mean values and standard deviations are in milliseconds. In this sense, the fencers with contralateral laterality demonstrated significantly faster reaction times than those with ipsilateral profiles in several tasks. In the Simple Reaction Time (SRT) test, the contralateral group averaged 333 ± 109 ms, compared to 417 ± 143 ms in the ipsilateral group, with a statistically significant difference and a medium effect size.

In the Election Reaction Time (ERT) and Go/No-Go (G/NG) tasks, no statistically significant differences were found between the groups. However, contralateral fencers still showed numerically faster response times (ERT: 504 ± 92 ms vs. 543 ± 114 ms; G/NG: 543 ± 80 ms vs. 555 ± 98 ms), suggesting that the contralateral advantage may emerge more clearly under conditions of higher cognitive or motor demand.

In tasks requiring higher cognitive and motor complexity—such as decision-making reaction time—the differences between fencers were even more pronounced, favoring significantly shorter times for those with contralateral laterality (DM: 1190 ± 264 ms vs. 1356 ± 336 ms; $p < 0.001$).

In dynamic variants of the task, such as the retreat decision-making task (DMR), contralateral fencers recorded an average of 1444 ± 189 ms, compared to 1700 ± 242 ms in the ipsilateral group ($p < 0.001$), with a large effect size, the largest difference observed in the entire study.

Other decision-making subtests also revealed a consistent advantage for contralateral fencers. In the left-lateralized movement (DML), the contralateral group scored 1013 ± 197 ms versus 1118 ± 179

Table 7. Performance Profile by Weapon Type and Laterality Characteristic.

Characteristic	Épée Fencer (Predominantly Ipsilateral)	Foil/Sabre Fencer (Predominantly Contralateral)
Laterality Profile	Tends to be right-eye and right-hand dominant (ipsilateral/homogeneous).	Higher prevalence of crossed laterality (e.g., left-eye dominant and right-hand dominant).
General Decision-Making Time (DM)	Generally slower in complex decision-making tasks, with high variability—possibly due to greater tactical analysis and multiple target areas.	Significantly faster in complex decision-making tasks, indicating superior agility in decision processing. This may be linked to fewer valid targets and thus fewer response options.
Leftward Movement Reaction Time (DML)	Slower, with lower variability in leftward responses. Suggests fewer perceived options or a more rigid, less prioritized strategy on this side. Since épée involves the whole body as target and typically uses direct counterattacks without parries, responses may focus more on precision.	Faster leftward responses. Accustomed to parrying and responding, foil and sabre fencers may have more internalized lateral actions.
Midline Reaction Time (DMM)	Slower, with higher variability in central responses. Possibly due to more decision-making options given the broad target area in épée.	Faster and more consistent in central responses, aligned with more defined frontal targets and fewer decision pathways in foil and sabre.
Rightward Movement Reaction Time (DMR)	Slower, despite using the dominant side, and with higher variability. May reflect the need for fine-tuned adaptation in épée.	Fastest responses in the study, with lower variability. Suggests superior optimization of dominant-side actions—critical in foil and sabre, where regaining or claiming priority quickly is essential.
Predominant Fencing Style	Based on test results, these fencers appear to favor patience, tactical analysis, distance control, and exploiting openings. They tend to prioritize precision and anticipation over raw speed, adapting to a broader set of target zones.	Based on the results, these fencers are characterized by speed, aggressive attacks, and rapid counterattacks. They excel in fast-paced exchanges and quick shifts of initiative, capitalizing on their mental and physical agility—crucial in foil and sabre, where the right-of-way rule and complex parries are key elements.

ms in the ipsilateral group ($p < 0.001$); in the central decision-making movement (DMM), times were 1112 ± 187 ms vs. 1250 ± 251 ms ($p = 0.005$), both with medium effect sizes. These results reinforce the idea that contralateral laterality may confer an advantage in tasks involving high perceptual and motor demands.

Combining the results from Tables 4 and 5, we can propose an interpretative analysis that outlines potential performance profiles by weapon type, based in the variables with the highest relation of laterality and reaction times:

DISCUSSION

The findings of this study confirm the relevance of visual dominance and laterality in fencing performance [9], offering new insights into the comparative advantages in reaction speed, agility, and perceptual-motor demands associated with different laterality profiles.

This pattern allows visual input (integrated across both hemispheres but functionally biased by the dominant eye) and motor output (coordinated by the hemisphere contralateral to the dominant hand) to be integrated within the same cerebral hemisphere. This configuration avoids the need for interhemispheric transfer, which has been shown to require additional processing time [8], potentially resulting in faster response times for crossed-laterality profiles.

These findings are consistent with previous research in other disciplines, where athletes with crossed laterality are overrepresented compared to the general population—particularly in sports requiring coordinated mobility and precision, such as golf and football [7, 8]. This suggests that crossed laterality may provide a specific competitive advantage in tasks demanding high levels of visuo-motor integration. In contrast, in disciplines without a direct opponent—such as gymnastics, archery, or pistol shooting—non-crossed profiles tend to be more prevalent or show no significant influence on performance [13, 16]. This reinforces the hypothesis that the functional utility of crossed laterality depends on the specific motor and tactical demands of the sport.

Left-handed fencers with crossed laterality may benefit from more efficient sensorimotor integration, improved visuo-motor alignment toward the opponent, and faster reaction capabilities.

Moreover, manual dominance—widely recognized for its influence on combat style and tactical decision-making [6]—may be further enhanced when combined with a crossed laterality profile.

From a performance standpoint, the distribution of laterality profiles is not uniform across competition levels. Crossed laterality was significantly more frequent among athletes competing at the national and international levels, while ipsilateral laterality predominated in the regional and amateur levels. Statistical analysis ($p = 0.001$) confirms that this distribution is not random, suggesting a significant association between laterality type and the competitive level attained.

A relevant relationship was also identified between the type of weapon used and the fencer's laterality. Specifically, contralateral laterality was more prevalent among foil and sabre fencers, whereas ipsilateral laterality predominated in épée. This pattern may be linked to the specific technical and tactical demands of each weapon and presents a promising avenue for future research on optimal laterality profiles according to weapon type. When combined with existing knowledge on reaction time, physical preparation, and psychological factors [20, 21], these findings could contribute to the development of more tailored training programs for elite athletes, optimized for each fencing discipline.

In parallel, the analysis of reaction times revealed that fencers with contralateral laterality consistently outperformed their ipsilateral counterparts in the most demanding tasks—particularly those requiring decision-making and complex motor execution. These differences were statistically significant in tests with higher cognitive and motor load, such as decision-making with displacement (DMR), in which the contralateral group demonstrated substantially faster response times and large effect sizes. This finding aligns with studies in elite football players, which indicate that crossed laterality (hand-eye-foot) is associated with quicker reaction times in response and directional change tasks, particularly in unpredictable contexts [22].

This research demonstrates a significant relationship between ocular dominance and laterality type. Specifically, left-eyed fencers exhibit a significantly higher proportion of crossed laterality (left-eye dominance combined with right-hand dominance).

Higher levels of competition (national and international) are characterized by a predominance of fencers with contralateral

laterality, whereas ipsilateral laterality is more common at regional and amateur levels. This suggests that crossed laterality may confer an advantage in reaching elite performance levels in fencing.

Fencers with contralateral laterality displayed significantly faster reaction times in several tasks, particularly those involving greater cognitive and motor complexity. The most pronounced difference was observed in the DMR test, where contralateral fencers were substantially quicker. This suggests a performance advantage in processing speed and responsiveness under conditions requiring both mental and physical agility. Fencers with contralateral laterality displayed significantly faster reaction times in several tasks, particularly those involving greater cognitive and motor complexity. The most pronounced difference was observed in the DMR test, where contralateral fencers were substantially quicker. This suggests a performance advantage in processing speed and responsiveness under conditions requiring both mental and physical agility.

Although contralateral laterality was associated with faster responses in cognitively demanding tasks, no statistically significant differences were found between the ipsilateral and contralateral groups in the elective reaction time (ERT) or the Go/No-Go (G/NG) task. This indicates that the advantage of crossed laterality may be more pronounced in contexts with higher cognitive or motor load, rather than in simpler or less demanding situations.

A statistically significant association was also found between weapon type (épée, foil, or sabre) and laterality. Contralateral laterality was notably more prevalent among foil fencers, suggesting it may provide a specific advantage or represent a common trait in this weapon. In contrast, ipsilateral laterality predominated clearly in épée. In sabre, laterality distribution was more balanced, although a slight predominance of contralateral profiles—similar to foil—was observed. These differences may reflect the unique technical and tactical demands of each weapon.

CONCLUSION

Overall, the findings of this study suggest that crossed laterality—particularly the combination of left-eye dominance with right-hand dominance—may be linked to an optimal perceptual-motor profile in fencing. This configuration is associated with higher competitive achievement and faster reaction times, especially in situations requiring complex decision-making. Understanding this "optimal laterality profile" could be crucial for developing more personalized and effective training strategies aimed at enhancing speed and decision-making efficacy during bouts.

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