



Do Expert Fencers Engage the Same Visual Perception Strategies as Beginners?

by

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An effective visual perception strategy helps a fencer quickly react to an opponent's actions. This study aimed to examine and compare visual perception strategies used by high-performance foil fencers (experts) and beginners. In an eye tracking experiment, we analysed to which areas beginning and expert fencers paid attention during duels. Novices paid attention to all examined areas of interest comprising the guard, foil (blade and tip), armed hand, lower torso, and upper torso of their opponents. Experts, however, paid significantly less attention to the foil, picking up information from other areas, mainly the upper torso and the armed hand. These results indicate that expert fencers indeed engage different visual perception strategies than beginners. The present findings highlight the fact that beginner fencers should be taught already in the early stages of their careers how to pick up information from various body areas of their opponents.

Key words: perception strategies, foil fencing, experts, beginners, eye tracking.

Introduction

Fencing is a combat sport where actions are very quick. A quick and adequate reaction to an opponent's actions is one of the main determinants of effectiveness in fencing (Roi and Bianchedi, 2008). Di Russo et al. (2006), in an event-related potential study, analysed neural mechanisms responsible for the fast behaviour of fencers and non-fencers in a discriminative reaction task (the Go/No-go paradigm) and a simple reaction task to visual stimuli. Fencers showed a better reduction in response time and a greater ability to adequately inhibit their reactions. However, they did not differ from non-fencers on a simple reaction task. Di Russo et al. (2006) concluded that thanks to enhanced response inhibition advanced fencers are better able to deal with their opponent's fast actions compared to non-fencers.

The importance of a simple reaction task in fencing was also demonstrated in studies comparing reactions of expert and novice fencers (Borysiuk and Waskiewicz, 2008; Williams and Walmsley, 2000) and in studies that looked at how fencers compare with athletes of other sports (Dogan, 2009; Guizani et al., 2006). In a study by Gutiérrez-Davila et al. (2017), choice reaction time to visual stimuli increased, whereas the mean horizontal force decreased under dual-task conditions with respect to simple reaction time. Dual-task conditions, however, did not affect the time required to initiate a defensive action when the stimulus was an opponent's movement. The authors observed changes in reaction time when stimuli were real movements, suggesting that reaction time to visual stimuli was not a good predictor of performance in fencing. The authors also concluded that perceptual and attentional

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processes play a major role in a fencer's performance in real competition.

High-performance fencers reduce the time of their sensory-motor responses, mainly during the phase of identifying and selecting adequate responses, a phase which significantly correlates with the motor phase of specific technical activities (Borysiuk, 2009). In this process, the context of neuropsychological determinants of control and movement control appears to be crucial. The advantage of the world-class over less experienced fencers may be associated primarily with their ability to anticipate the intended target area of their opponent's attack, by observing the opponent's preparatory actions (Azémar, 1999).

Borysiuk and Waśkiewicz (2008) note that the effectiveness of a fencer's technical and tactical actions depends on both the way they pick up information from the surrounding environment and perception times of their various senses. Borysiuk and Sadowski (2007) point to the need to analyse cognitive processes in terms of the speed of processing visual, auditory, and tactile information, as well as to analyse the efficiency and quality of acquiring motor habits. Early recognition of an opponent's intentions gives more time to prepare and execute appropriate responses (Williams et al., 2004). It is mostly high-performance athletes who develop such skills in sports (Williams et al., 1999).

Since vision plays a key role in the human sensory system (Causer et al., 2012; Williams et al., 1999), to date a number of visual perception studies have been conducted on athletes of various sports disciplines (Hagemann and Strauss, 2006; Krzepota et al., 2016; Milazzo et al., 2016; Piras et al., 2014). Deary and Howard (1989) use the term "optical anticipation" to refer to the phenomenon of predicting an opponent's actions based on visual stimuli. If accurate, such predictions make it possible to program motor activity and adapt it to external disturbances (Ward et al., 2002). High-performance athletes know on which areas of interests (here, areas a fencer fixates on and picks up information from during a duel) they should focus during fencing bouts (Williams et al., 1999). They also exhibit high perceptual-cognitive skills such as effective use of memory and attention (Causer and Williams, 2013).

Thanks to their experience and many years of training, experts know how to save limited cognitive resources and strategically control their visual system in order to maximise their information pick-up and make their movements more precise (Land, 2009). Expert athletes are more adept at extracting perceptual cues than beginners; they also produce fewer fixations of longer duration and a longer quiet eye period (Mann et al., 2007).

This paper aims to verify the hypothesis that during duels high-performance fencers (hereafter referred to as experts) assess their current situation based on different visual perception strategies than beginners. To achieve this aim, we studied visual perception strategies that foil fencers exhibit during duels. With the use of an eye tracker, we registered fencers' eye movements during fencing bouts, analysed their perception strategies and visual fixation activity.

To verify the above hypothesis, we set out to study how experts pick up signals from the surrounding environment, especially from the opponent's body and weapon. Such knowledge is crucial to understanding how expert fencers gain their perceptual-cognitive advantage over novices in sport-specific attention allocation and information pick-up (Causer and Williams, 2013; Mann et al., 2007). We are aware, however, that eye movement data collected during fencing bouts may be challenging to interpret, in particular due to the human ability to simultaneously extract and pick up information from central and neighbouring regions (peripheral vision), as well as the lack of certainty inherent in the relationship between the recorded eye fixation location and the extraction of information from this specific area (Hagemann et al., 2010; Poulter et al., 2005; Williams et al., 2004).

A better understanding of differences between expert and beginning fencers in their visual perception strategies could help develop specialised perceptual training programmes, which might be particularly useful in the early stages of training. While similar approaches have already been incorporated in other sports (Clark et al., 2012; Hopwood et al., 2011; Schwab and Memmert, 2012; Williams et al., 2002), the discipline of fencing is yet to witness implementation thereof. With this in mind, we believe our research makes an important step

towards achieving this aim.

Methods

Participants

The participants were assigned to one of the two groups (of 9 and 10 participants) based on two criteria: skill level and training experience. The first group comprised expert foil fencers (5 women and 4 men) who had practised fencing for at least 10 years (age range: 18-31) and had achieved successes (at least) at the national level. The other group consisted of beginning foil fencers (5 women and 5 men) who had practised fencing for fewer than 4 years (age range: 16-19). All the participants declared right-handedness, which we confirmed with the Edinburgh Handedness Inventory (Büsch et al., 2010; Oldfield, 1971). We conducted the study during two fencing camps organised by the Polish Fencing Association, as well as during the Polish University Championships.

Device and software

We used a mobile eye tracker (SMI Eye Tracking Glasses – ETG 2 Natural Gaze with a 60 Hz sampling rate). Automatic compensation for parallax error, which allows researchers to obtain accurate results at any distance without the need to manually adjust settings, is one of its advantages. The device is equipped with a high resolution (1280 x 960) camera enabling researchers to obtain an accurate and detailed record of an eye position in relation to objects arranged at various distances.

To manage and analyse the data, we used software developed by SensoMotoric Instruments – BeGaze™. Additionally, the Mobile Video Analysis Software was applied to (i) analyse the results of the ETG mobile eye tracker with Semantic Gaze Mapping, allowing for aggregation of the results and their group-wise analysis, and (ii) prepare reference images.

Research procedure

Prior to the study, each participant was instructed about the procedure employed in the study. After setting up the equipment, we performed a three-point calibration. The tests took place on a piste in a well-lit fencing hall. The athletes from each group fenced with a right-handed and left-handed opponent. Each participant fought against the same two opponents, who exhibited an average level of

fencing skills and had similar morphological characteristics (the right-handed opponent: body height = 175 cm, body mass = 72 kg; the left-handed opponent: body height = 177 cm, body mass = 73 kg). A moderator informed participants about the beginning and the end of each duel.

The research protocol was approved by the Bioethics Committee of Poznan University of Medical Sciences. Participants and legal guardians of those who were underage gave written consent to their participation in the study.

Reference image

During duels, we measured visual perception in the selected areas of interest (AOIs), containing elements of the outfit and armour of fencers. These areas were selected by several fencing experts (one of them being the coach of the Polish Women's Olympic Team in foil fencing), based on their knowledge and experience. Using those AOIs, we prepared two reference images, one for a right-handed opponent and the other for a left-handed opponent.

The following areas of interest (AOIs) were marked on generated images (Figure 1 shows one of the images generated for a right-handed opponent):

- **G – guard**
- **F – opponent's foil (blade and tip)**
- FR – athlete's foil
- M – mask
- **AH – armed hand**
- UH – unarmed hand
- **LT – lower torso**
- **UT – upper torso**
- FT – front thigh
- BT – back thigh
- FL – front leg
- BL – back leg
- FF – front foot
- BF – back foot

The areas listed above were pre-analysed after the study. For further analyses, we chose the areas at which our participants looked the most, based on two criteria: the number of participants who looked at an area and the number of their glances. Five AOIs (in bold) were found to be crucial for fencers. We used these for further statistical analyses.

Dependent variables

For each participant and each AOI, we

obtained the following eye tracking metrics:

- dwell time (%): the time devoted to an AOI, expressed in percentages,
- average fixation: the average duration of fixations on an AOI,
- fixation count: the number of fixations on an AOI, and
- glance count: the number of glances at an AOI.

Statistical analyses

The recorded eye tracking measures were analysed separately. Since the data did not follow a normal distribution, a natural log transformation was used. To verify the main hypothesis, a three-way analysis of variance was employed with the following factors: *skill level* (a between-group factor) with two levels: beginner and expert; *AOI* (a within-group factor) with five levels: guard, foil (blade and tip), armed hand, lower torso, and upper torso; and *the opponent's handedness* (a within-group factor) with two levels: right-handed and left-handed. Since the study aimed to compare beginners and experts, particular attention was given to testing these effects. In the event of significant main effects or factor interaction effects, to compute the corresponding multiple comparisons we used Bonferroni post hoc tests. The Greenhouse-Geisser epsilon correction was applied when the assumption of sphericity was violated. For between-group comparisons (i.e. experts vs. beginners), Hedge's g effect size was calculated. To interpret effect size estimates, we relied on Cohen's guidelines, with the value of 0.2 indicating small, 0.5 medium, and 0.8 large effects (Cohen, 1988). The statistical analyses were conducted by the Institute of Sensory Analysis in Warsaw.

Results

Dwell time (%)

The main effects of skill level ($F(1, 17) = 1.15, p > 0.05$), the opponent's handedness ($F(1, 17) = 0.12, p > 0.05$) and AOI ($F(1.69, 28.78) = 1.82, p > 0.05, \epsilon = 0.42$) did not reach statistical significance.

The interaction effect between skill level and AOI was marginally significant ($F(1.69, 28.78) = 3.33, p = 0.057, \eta_p^2 = 0.16, \epsilon = 0.42$). Experts spent significantly less time looking at the foil than beginners (effect size: $g = 1.18$). Also, experts spent significantly less time looking at the foil than the

upper torso and the armed hand. Beginners, however, showed comparable dwell times in each of the five examined areas of interest. The corresponding multiple comparisons of the means are featured in Table 1.

The interaction effect between the opponent's handedness and AOI was found to be significant ($F(4, 68) = 2.98, p < 0.05, \eta_p^2 = 0.15$). Fencers spent more time watching the armed hand and less time looking at the lower torso when confronting left-handed than right-handed opponents. The detailed comparisons of the means are presented in Table 2.

The interaction effect between the opponent's handedness and skill level ($F(1, 17) = 0.04, p > 0.05$), as well as the interaction effect between skill level, AOI, and the opponent's handedness ($F(4, 68) = 0.77, p > 0.05$) did not reach statistical significance.

Average fixation

The main effects of skill level ($F(1, 17) = 1.67, p > 0.05$), the opponent's handedness ($F(1, 17) = 0.89, p > 0.05$), and AOI ($F(1.80, 30.55) = 2.70, p > 0.05, \epsilon = 0.45$) did not reach statistical significance. No interaction effects were observed to be significant: skill level by AOI ($F(1.80, 30.55) = 1.83, p > 0.05, \epsilon = 0.45$), the opponent's handedness by skill level ($F(1, 17) = 1.05, p > 0.05$), the opponent's handedness by AOI ($F(2.52, 42.77) = 0.44, p > 0.05, \epsilon = 0.63$), nor the three-way interaction between these factors turned out to be significant ($F(2.52, 42.77) = 0.13, p > 0.05, \epsilon = 0.63$).

Glance count

The main effects of skill level ($F(1, 17) = 0.93, p > 0.05$) and the opponent's handedness ($F(1, 17) = 0.40, p > 0.05$) were found to be non-significant. The main effect of AOI, however, reached statistical significance ($F(1.92, 32.64) = 5.25, p < 0.05, \eta_p^2 = 0.24, \epsilon = 0.48$). The corresponding comparisons of the means are presented in Table 3.

The interaction effect between skill level and AOI reached statistical significance ($F(1.92, 32.64) = 5.17, p < 0.05, \eta_p^2 = 0.23, \epsilon = 0.48$). Beginners produced a significantly higher number of glances at the foil than experts (effect size: $g = 1.20$). Experts glanced at the foil less often than at other examined AOIs, whereas beginners glanced at the upper torso less often than at the guard (for the corresponding detailed comparisons of the means see Table 1).

The interaction effect between the opponent's handedness and AOI was significant ($F(4, 68) = 3.62, p < 0.01, \eta_p^2 = 0.18$). When confronting left-handed opponents, fencers glanced more often at the armed hand and less often at the lower torso than when duelling right-handed opponents (see Table 2). The interaction effect between the opponent's handedness and skill level ($F(1, 17) = 1.60, p > 0.05$), as well as the interaction effect between skill level, AOI, and the opponent's handedness ($F(4, 68) = 0.04, p > 0.05$) did not reach statistical significance.

Fixation count

The main effects of skill level ($F(1, 17) = 0.94, p > 0.05$), the opponent's handedness ($F(1, 17) = 0.04, p > 0.05$) and AOI ($F(1.81, 30.82) = 2.06, p > 0.05, \varepsilon = 0.45$) were not significant.

The interaction effect between skill level and AOI was found to be statistically significant ($F(1.81, 30.82) = 3.94, p < 0.05, \eta_p^2 = 0.19, \varepsilon = 0.45$). Beginners exhibited a significantly higher number

of fixations on the foil than experts (effect size: $g = 1.17$). Experts fixated on the foil less than on the upper torso and the armed hand. We did not observe any significant differences between AOIs in the mean number of fixations among beginners, which may imply that they did not show preference to any particular AOI (see Table 1 for the corresponding comparisons of the means).

The interaction effect between the opponent's handedness and AOI was statistically significant ($F(2.81, 47.73) = 3.50, p < 0.05, \eta_p^2 = 0.17, \varepsilon = 0.70$). Fencers exhibited a significantly higher number of fixations on the armed hand and a lower number of fixations on the lower torso when confronting left-handed compared to right-handed opponents (see Table 2). However, neither the interaction effect between the opponent's handedness and skill level ($F(1, 17) = 0.36, p > 0.05$), nor the three-way interaction effect ($F(2.81, 47.73) = 0.13, p > 0.05, \varepsilon = 0.70$) reached significance.

Table 1
Means, standard deviations, and post hoc comparisons for the interaction effects between skill level and AOI for the examined dependent variables.

AOI	Dwell time (%)		Average fixation	
	Expert	Beginner	Expert	Beginner
G	1.89 (1.30)	2.65 (1.07)	4.83 (2.25)	5.46 (1.40)
F	1.04 (0.99) a b c	2.24 (1.04) a	3.87 (2.84)	5.36 (1.33)
AH	2.38 (0.96) b	2.32 (1.01)	5.78 (0.39)	5.78 (0.38)
LT	2.00 (0.98)	1.92 (1.11)	5.41 (1.38)	5.67 (0.46)
UT	2.38 (1.32) c	1.67 (1.22)	5.48 (1.46)	5.05 (1.76)
AOI	Glance count		Fixation count	
	Expert	Beginner	Expert	Beginner
G	2.18 (0.91) b	2.71 (0.66) f	2.25 (1.43)	3.05 (1.15)
F	1.14 (1.01) a b c d e	2.19 (0.74) a	1.35 (1.23) a b c	2.67 (1.04) a
AH	2.31 (0.73) c	2.21 (0.89)	2.83 (0.88) b	2.78 (1.11)
LT	2.24 (0.71) d	2.00 (0.81)	2.51 (1.13)	2.42 (1.05)
UT	2.09 (0.85) e	1.70 (0.82) f	2.85 (1.27) c	2.07 (1.11)

Dwell time (%)

$p < 0.05$: b, c

$p < 0.01$: a

Glance count

$p < 0.01$: a, b, d, e, f

$p < 0.001$: c

Fixation count

$p < 0.01$: a, b, c

Key: AOI – area of interest, G – guard, F – opponent's foil (blade and tip), AH – armed hand, LT – lower torso, UT – upper torso.

Table 2

Means, standard deviations, and post hoc comparisons for the interaction effects between the opponent's handedness and AOI for the examined depended variables.

	Dwell time (%)		Average fixation	
	Left-handed	Right-handed	Left-handed	Right-handed
AOI				
G	2.45 (1.19)	2.13 (1.28)	5.40 (1.42)	4.92 (2.21)
F	1.63 (1.23) c	1.72 (1.13)	4.56 (2.46)	4.76 (2.15)
AH	2.67 (0.79) a c d	2.03 (1.05) a	5.78 (0.37)	5.78 (0.40)
LT	1.65 (0.86) b d	2.26 (1.13) b	5.72 (0.34)	5.38 (1.38)
UT	1.99 (1.28)	2.03 (1.36)	5.45 (1.40)	5.06 (1.82)
	Glance count		Fixation count	
AOI				
G	2.36 (0.95)d	2.55 (0.69) f	2.87 (1.23)	2.47 (1.44)
F	1.63 (1.07) c d	1.76 (0.98) f	1.95 (1.36) c	2.14 (1.28)
AH	2.54 (0.50) b c e	1.97 (0.96) b	3.14 (0.64) a c	2.47 (1.19) a
LT	1.81 (0.74) a e	2.42 (0.68) a	2.14 (0.94) b	2.78 (1.13) b
UT	1.92 (0.77)	1.85 (0.93)	2.39 (1.11)	2.49 (1.38)

Dwell time (%)

$p < 0.05$: a, b, c, d

Glance count

$p < 0.05$: b, d, e, f

$p < 0.01$: a, c

Fixation count

$p < 0.05$: a, b

$p < 0.01$: c

Key: AOI – area of interest, G – guard, F – opponent's foil (blade and tip),

AH – armed hand, LT – lower torso, UT – upper torso.

Table 3

Means, standard deviations, and post hoc comparisons for the main effects for the examined depended variables.

Main effects	Dwell time (%)		Average fixation		Glance count		Fixation count	
Skill level								
Expert	2.18	(1.27)	5.21	(1.81)	2.09	(0.91)	2.60	(1.33)
Beginner	2.24	(1.14)	5.51	(1.11)	2.21	(0.80)	2.68	(1.13)
AOI								
G	2.29	(1.22)	1.16	(1.85)	2.46	(0.83) a c	2.67	(1.33)
F	1.67	(1.12)	4.66	(2.28)	1.69	(1.02) a b	2.04	(1.31)
AH	2.34	(0.97)	5.78	(0.38)	2.26	(0.81) b	2.80	(1.00)
LT	1.96	(1.04)	5.55	(1.00)	2.12	(0.76)	2.46	(1.07)
UT	2.01	(1.30)	5.25	(1.62)	1.89	(0.84) c	2.44	(1.24)
Opponent's handedness								
Left-handed	2.19	(1.16)	5.46	(1.36)	2.15	(0.84)	2.61	(1.15)
Right-handed	2.23	(1.24)	5.28	(1.60)	2.16	(0.87)	2.67	(1.30)

Glance count

$p < 0.05$: b, c

$p < 0.001$: a

Key: AOI – area of interest, G – guard, F – opponent's foil (blade and tip),

AH – armed hand, LT – lower torso, UT – upper torso.

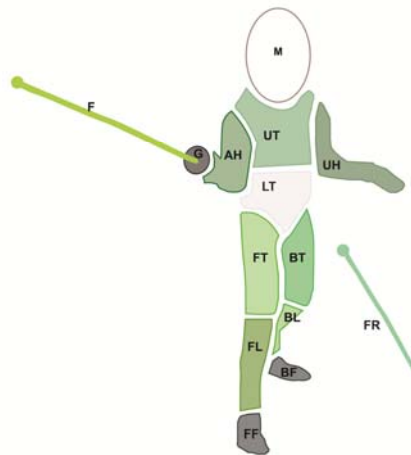


Figure 1

Schematic reference image of a right-handed opponent showing the areas of interest (AOIs).

Discussion

Effective and efficient information pick-up plays a crucial role in fencing as such a fast-moving combat sport requires an athlete to react quickly in response to their opponent's actions. Here, experts surpass novices for a number of reasons. First, compared to beginners, their information pick-up is quicker (Mann et al., 2007). Second, they detect information from a selected number of areas of interest (Williams et al., 1999). Third, elite athletes focus on particular areas of interest for a shorter time, compared to novices (Bard et al., 1981).

We showed that expert fencers paid less attention to the opponent's foil than novices: they looked at it less often, for a shorter time, and gave it a fewer number of fixations. Instead, experts paid more attention to other areas, mainly the armed hand and the upper torso. Novices engaged other perception strategies, paying comparable attention to all five examined areas. In fact, with the ability to efficiently pick up information from other areas, experts did not

need to pay much attention to the foil. The foil blade, moving the fastest out of all examined regions, is not an area where movement is initiated. During a duel, the opponent's weapon, especially the blade and the tip, is very close to the target area. Therefore, fencers who pay attention to the foil (here, beginners) have a more limited chance of a quick and adequate reaction to their opponent's movement. The chances of more appropriate reactions increase when the fencer's attention is directed towards the armed hand, which is more typical of expert fencers. Focusing on that area raises the odds of appropriate anticipation of the onset of movement initiation. Not paying much attention to the foil may thus be one of the important elements of strategies exhibited by expert fencers: one that contributes to their speed of reaction. Additionally, in duels with left-handed opponents, fencers watched significantly more the armed hand (dwell time, glance count, and fixation count) and significantly less the lower torso than in bouts with right-handed opponents. These findings remain quite consistent with the results of the studies

conducted by Witkowski et al. (2018, 2020) and highlight the importance of handedness in one-on-one interactive sports (Harris, 2016; Loffing and Hagemann, 2016; Richardson and Gilman, 2019).

Hagemann et al. (2010) examined whether eye movements of fencers watching fencing attacks reflected their actual information pick-up. The authors compared the results with those obtained using temporary and spatial occlusion techniques. In their study, 15 top-ranked expert fencers, 15 advanced fencers, and 32 sport students watched (on a computer screen) 405 fencing attacks and predicted target areas. Fencers from both groups showed a stronger foveal fixation to the opponent's torso and weapon, but top-ranking fencers fixated primarily on the upper torso. Likely for this reason, their performance worsened under spatial occlusion: they shifted their eye movements to neighbouring body areas (Hagemann et al., 2010).

Visual information underlies the ability to make decisions in complex situations and the relationship between view control and task performance. Mann et al. (2007) conducted a meta-analysis of perceptual-cognitive skills and compared them between expert and non-expert athletes. The investigated variables included response accuracy, reaction time, the number of visual fixations, the duration of visual fixation, and the quiet eye period. The authors concluded that experts picked up perceptual cues more efficiently than non-experts. In addition, they observed systematic differences in visual search behaviours of athletes: experts exhibited fewer fixations of longer duration. Discussing other sports, Causer et al. (2012) noted that experts and beginners indeed used eye movements differently, with this finding being also reported for racket sports and shooting (Abernethy, 1990; Causer et al., 2012; Hagemann and Strauss, 2006; Jarodzka et al., 2010).

Hijazi (2013) compared attention and visual perception levels between male and female fencers, and analysed the relationship between sport performance in fencing and the dimensions of attention and visual perception. Among women, positive correlations between the achievement level and visual discrimination, visual-spatial relationships, visual sequential memory, narrow attentional focus, and

information processing were found. Among men, the achievement level correlated with visual discrimination and visual sequential memory, broad external attentional focus, and information processing. For the combined group of men and women, the achievement level correlated with visual discrimination, visual sequential memory, broad external attentional focus, narrow attentional focus, and information processing. Men and women did not differ significantly regarding visual discrimination and visual-form constancy.

Comparisons that would include participants' sex as the variable were not included in our study, and could be undertaken in future research. We conducted a study where convenience sampling was used. Hence, we are not able to generalise our research results to the entire population of foil fencers. This can be viewed as a limitation of our study, and so can small sample sizes used. The relatively large effect sizes, however, let us infer some practical conclusions from our study.

A better understanding of visual perception strategies exhibited by high-performance fencers may serve as a firm foundation for developing modern training programmes relying on perceptual training, all the more so as visual inspection seems to be vital in the movement process (Vickers, 2007) and eye movements can provide an important indication of how fencers pick up information during duels.

Fencing coaches have often pondered over the question of where fencers should direct their gaze during duels. By analysing whether and how fencing experts and beginners differ in visual perception strategies employed during duels, our research aimed to shed some light on this issue. Indeed, experts did use different strategies as they paid less attention to their opponents' foil and more attention to other areas, the torso and the armed hand in particular. This finding can imply that expert fencers can pick up information about their opponents' actions earlier than beginners, as in order to move the weapon, their opponents first move their body.

Does this imply that beginner fencers should be encouraged to use the same strategy as experts? Not necessarily: it is possible that a beginner – lacking deeper understanding of how the human body reacts during fencing – would be

unable to pick up necessary information about their opponent's intended actions from the opponent's guard or torso. At some stage of developing their skills, however, fencers are likely to smoothly change their fencing habits, including their visual perception strategies. Coaches should be aware of that and teach beginning fencers how to pick up information about an opponent's intended action from other regions than the foil: the torso and armed hand in particular.

Will it speed up their progress? We are unable to answer this question without further detailed longitudinal studies. At the moment, however, we can state that high-performance fencers (experts) do engage different visual perception strategies than beginners. Coaches should therefore consider teaching young fencers how to predict an opponent's intended actions from various areas, beyond merely the foil and the armed hand.

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