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# The negative frequency-dependent perceptual advantage of left-handers in sport

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## Introduction

Left-handers occur at higher frequencies in many interactive sports, such as tennis, fencing or boxing, but not in non-interactive sports, such as gymnastics or golf (Grouios, 2004). For example, the rates of left-handed competitors in tennis were significantly overrepresented among top ranking players (World Number One: male 34.4 %, female 30.3 % and Top Ten: male 24.06 %, female 11.8) from 1968 through 1999 compared to the general population (10-13 %). The fact that left-handers do not occur more frequently in non-interactive sports contradicts the assumption of a general innate or neuropsychological superiority of left-handers in sports (Grouios, Tsorbatzoudis, Alexandris & Barkoukis, 2000; Raymond, Pontier, Dufour & Moller, 1996).

Another interpretation of the imbalance of motoric-dominance distribution may lie in the strategic aspects of these sports. In sports involving dual confrontation the advantage of left-handers is their rare occurrence. A sporting competitor playing against a left-hander is confronted with an unusual strategic play and angles of attack. For example, the counter clockwise rotations of the ball delivery of left-handed spin bowlers in cricket, which turns the ball away from a right-handed batsman when it contacts the pitch (Edwards & Beaton, 1996). Left-handers seem to enjoy a negative frequency-dependent strategic advantage compared to right-handers (Brooks, Bussière, Jennions & Hunt, 2004; Faurie & Raymond, in press; Goldstein & Young, 1996). In cricket and baseball the frequency of left-handers is best explained by such a negative frequency-dependent selection mechanism (Brooks et al., 2004; Goldstein & Young, 1996). Similarly, Left-handers may have a frequency-dependent advantage in fights, where both right- and left-handers are less familiar with this category of competitors.

Beside the strategic argument (e.g. unusual angles of attack), it is suggested that left-handers enjoy a negative frequency dependent perceptual advantage. In interactive sports the ability to anticipate an opponent's intention based upon the contextual information available early in an action sequence (e.g. postural orientation) is crucial to successful performance. As a result of a perceptual frequency effect, player could extract more meaningful information from a right-handed opponent's postural orientation or movement kinematics. Therefore, we assume that the strategic or tactical advantage of left-handedness in interactive sports is partly due to a perceptual frequency effect of handedness. The perceptual frequency effect should result in better anticipatory skills of sporting competitors when facing right-handed opponents than left-handed opponents.

## Method

Right-handed ($n$=54) and left-handed male tennis players ($n$=54) (experts, intermediates and novices) participated in a tennis anticipatory test where they had to predict the directions of opponent's tennis strokes on a computer screen (point of impact in their own half).

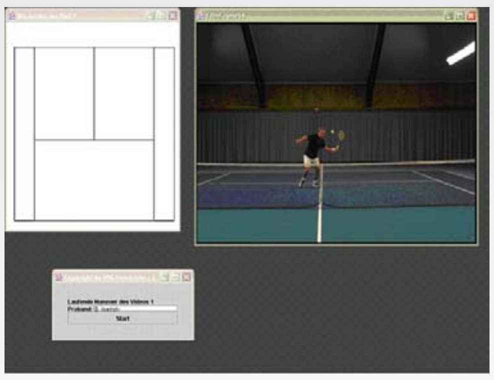

*Figure 1:* Screen interface of the testing program.

The 48 video clips of different strokes (serves, volleys and ground strokes) of two right- and two left-handed male intermediate tennis players where temporally occluded at the racquet-ball contact. These video clips were also mirrored along the vertical axis, so that the same clips were visible as a stroke of a left-hander and a right-hander.

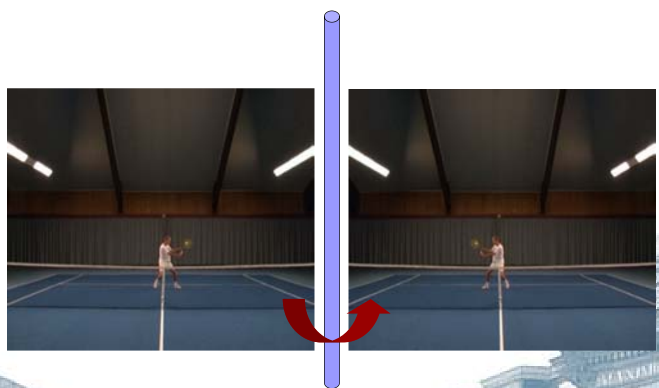

*Figure 2: Reflection* along the vertical axis

## Results

The 2 x 3 (Handedness Video x Group) repeated measure ANOVA revealed a highly significant main effect for handedness of the player in the clip (independent of actual handedness), $F(1, 102) = 83.74$, $p < .01$, $\eta^2 = .45$, indicating that the direction of right-handed tennis strokes could be anticipated more easily. This is evident in all three groups.

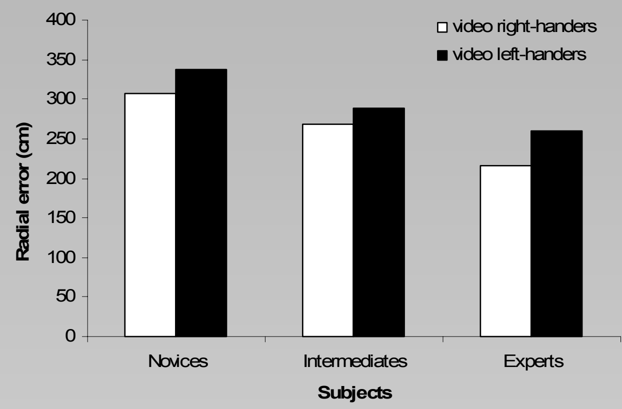


*Figure 3.* Mean radial error for left-handed and right-handed video clips.

The significant Handedness x Group interaction demonstrating that the experts have the most problems when facing left-handers, $F(2, 102) = 3.77$, $p < .05$, $\eta^2 = .07$. Additionally, the interaction of handedness of players in the video clips and handedness of subjects revealed that it seams easier predict the direction of the opposite hand side, $F(1, 102) = 4.01$, $p < .05$, $\eta^2 = .04$.


*Figure 4.* Mean radial error of left-handed and right-handed subjects.

## Discussion

The results of this study suggest that the advantage of left-handers in interactive sports is at least partially accounted for by perceptual frequency effects. Left-handed and right-handed tennis players could extract more meaningful information from a right-handed opponent's postural orientation or movement kinematics. Furthermore, the better anticipatory performance for the opposite hand side contradicts neuro-psychological theories and highlight the importance of perceptual frequency effects in sport.

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