

# The influence of spatial occlusion on visual search behavior of karate athletes

Simon Salb, Markus Splitt, Nicole Bandow, Kerstin Witte

## 1 Introduction/Related Work

In martial arts, the ability to anticipate and response appropriately has to be seen as a performance determinant. Common methods in anticipation research are temporal and spatial occlusion, as well as eye tracking (Panchuk & Vickers, 2009; Savelsbergh, Williams, van der Kamp & Ward, 2002). For studying anticipatory skills in karate the presentation of attack scenes on a life size video screen (Williams & Elliott, 1999) using spatio-temporal occlusion proved to be a valid method (Bandow, Emmermacher, Stucke, Masik & Witte, 2014; Zerbe, E., Kirbach, M., Bandow, N., Emmermacher, P., Witte, K., 2013; Mori, Ohtani & Imanaka, 2002). Since there is evidence that spatial occlusion can influence the visual behavior of athletes (Hagemann, Schorer, Cañal-Bruland, Lotz & Strauss, 2010) it is important to consider this method critically. Prior studies did not record eye movements while applying spatial occlusion for studying anticipation in karate (Bandow et al., 2014). The aim of the present study is to explore the influence of spatial occlusion on the visual search behavior of karate athletes.

## 2 Our Contribution

Seven karate athletes with experience in national and international competition responded physically to life size videos of a karate reverse punch shown on a back projection screen (2 m x 2.5 m). Spatial occlusion was conducted by covering relevant body regions (hip, punching arm, front leg) of the opponent in the video sequences with background images. The participants' visual behavior was recorded with a binocular head mounted eye tracker (SensoMotoric Instruments; model: SMI Eye Tracking Glasses). Each video sequence was presented three times in randomized order to prevent a learning effect. Eye tracking data was analyzed using the software BeGaze (SensoMotoric Instruments, Teltow, Germany). Therefore nine areas of interest (AOI) were defined representing nine regions of the opponents' body relevant for karate kumite. As dependent measures relative fixation time per AOI, mean fixation duration per trial and the number fixations per second in each trial were chosen (Dicks, Button & Davids, 2010). A reliability analysis revealed no significant differences between three repeated measurements. By means of one-way ANOVA/ Kruskal-Wallis test significant differences between

the occlusion conditions were tested. The results matched with the findings of Williams & Elliott (1999) and showed primary fixation of the head and upper torso under all conditions (e.g. 58% head and 22% upper torso under non occluded condition). There was no difference in visual search behavior between occluded and non occluded stimuli. Neither mean fixation duration [ $\chi^2(3)=4.543$ ,  $p=.208$ ] nor number of fixations per second [ $F(3,24)=1.747$ ,  $p=.184$ ] showed significant differences between the occluded and non occluded conditions. Analyzing relative fixation duration per AOI confirmed those findings. For example, the relative fixation duration of the head did not significantly differ between conditions [ $F(3,24)=.232$ ,  $p=.873$ ].

### 3 Discussion

Due to the small sample size ( $n=7$ ), variations between the subjects influence the results. Therefore it is required to gather more data in order to make general conclusions. It will be necessary to conduct further studies occluding regions of primary fixations (head, upper torso) to determine the influence of spatial occlusion on visual search of karate athletes. As long as spatial occlusion is conducted by making body regions invisible that are no main fixation locations, there seems to be no influence on visual search behavior.

### References

1. Bandow, N., Emmermacher, P., Stucke, C., Masik, S. & Witte, K. (2014). Comparison of a video and a virtual based environment using the temporal and spatial occlusion technique for studying anticipation in karate. *International Journal of Computer Science in Sport*, 13 (SPLISSUE.1), 44–56.
2. Dicks, M., Button, C. & Davids, K. (2010). Examination of gaze behaviors under in situ and video simulation task constraints reveals differences in information pickup for perception and action. *Attention, Perception, & Psychophysics*, 72 (3), 706–720.
3. Hagemann, N., Schorer, J., Cañal-Bruland, R., Lotz, S. & Strauss, B. (2010). Visual perception in fencing: do the eye movements of fencers represent their information pickup? *Attention, perception & psychophysics*, 72 (8), 2204–2214.
4. Mori, S., Ohtani, Y. & Imanaka, K. (2002). Reaction times and anticipatory skills of karate athletes. *Human Movement Science*, 21 (2), 213–230.
5. Panchuk, D. & Vickers, J.N. (2009). Using spatial occlusion to explore the control strategies used in rapid interceptive actions: Predictive or prospective control? *Journal of sports sciences*, 27 (12), 1249–1260
6. Savelsbergh, G. J., Williams, A. M., van der Kamp, J. & Ward, P. (2002). Visual search, anticipation and expertise in soccer goalkeepers. *Journal of sports sciences*, 20 (3), 279–287.
7. Williams, A.M. & Elliott, D. (1999). Anxiety, expertise, and visual search strategy in karate. *Journal of Sport & Exercise Psychology*, 21 (4), 362–375.
8. Zerbe, E., Kirbach, M., Bandow, N., Emmermacher, P., Witte, K. (2013). Comparison of temporal and spatial occluded video karate attacks with regard to predictability. In Fac. of Elec-

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