Perceptual Anticipation in a Shoot/Don't Shoot Task

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Introduction

Use of lethal force in law enforcement is scrutinized more than ever in the media. Just last year, Andrew Finch of Wichita KS was fatally shot by law enforcement when officers reported Andrew was "reaching in his waistband." Perceptual cues, such as reaching into a waistband, are an indicator of potential danger for law enforcement. Cognitive mechanisms that cause a police officer to pull a trigger contribute to the unnecessary lethal force of weapons.

Perceptual–cognitive research shows promise in application to law enforcement in shoot/don't shoot scenarios. The ability to utilize environmental cues with integrated knowledge and respond to environmental cues has been studied in Sport Psychology. Such research focuses on studying perceptual–cognitive expertise across different sports (i.e., tennis and soccer). This research has indicated that experts contain a perceptual–cognitive advantage over novices (Mann, Williams, Ward, & Janelle, 2007). Deceptive actions have been found to reduce performance for both experts and novices (Güldenpenning, Kunde, & Weigelt, 2017). Indeed, there seems to be some practical application of perceptual–cognitive expertise and deception to law enforcement in shoot/don't shoot scenarios. There has been no previous application of using both perceptual–cognitive expertise and deception methods in law enforcement shoot/don't shoot scenarios. This study intends on taking the first steps to identifying perceptual–cognitive expertise in a shoot/don't shoot task.

Research Questions

1. Does perceptual–cognitive expertise exist in shoot/don't shoot scenarios?
2. What factors are involved in shoot/don't shoot scenarios?

Method

The current study aimed to replicate how anticipation ability has been studied in sport (i.e., tennis and soccer). Three males and one female were filmed drawing both weapons (e.g., gun) and non-weapons (e.g., cell phone) from concealed locations on their body. The film clips were edited and temporally occluded (i.e., replaced with a black screen) at five occlusion points. The first temporal occlusion point occurred before a weapon or non-weapon can be identified and the fifth occlusion point occurred when the object is fully drawn and aimed at the camera.

Experiment 1:

Participants (N = 39; 6 Male and 33 Female) watched videos where an actor/actress pulled out either a gun or a cell phone and identified the object as either a "weapon" or "non-weapon." Each stimulus was presented five times.

Experiment 2:

Participants (N = 36; 10 Male and 26 Female) watched videos in which an actor/actress pulled out either a gun or a cell phone and then identified the object as a "weapon" or "non-weapon". Each stimulus was presented only once.

Results

A one-way repeated-measures ANOVA was conducted in both experiments to determine whether there were statistically significant differences in SDT measures response bias (β) and sensitivity (d') over the five occlusion points. There were multiple outliers in experiment 1 (n = 8) and experiment 2 (n = 11) that were found and not removed from the dataset since a one-way repeated measures ANOVA was conducted without the outliers and found similar confidence intervals along with statistically significant findings.

Experiment 1

The temporal occlusion point statistically significant changes in SDT measures, $F(2.40, 91.19) = 44.49$, $p < .001$, partial $\eta 2 = .54$ with d' measures increasing from occlusion point 1 to occlusion point 5 (Figure 1). There was a statistically significant mean increase in d' measure from OP1 (M = 0.68, SD = 0.72) to OP 3 (M = 1.68, SD = 0.86) to OP 5 (M = 1.86, SD = 1.01). In other words, participants were more successful in discriminating a gun from a cell phone at earlier occlusion points. Response bias (β) was more conservative at early occlusion points and more liberal at later occlusion points.

	Sensitivity (d')		Response Bias (β)	
OP	*M*	*SD*	*M*	*SD*
1	.68	.72	1.46	1.20
2	.91	.83	.99	.60
3	1.68	.86	.62	.32
4	1.90	.95	.71	.58
5	1.86	1.01	.71	.77

Experiment 2

The temporal occlusion point statistically significantly changed d' measures across occlusion points, $F(3.62, 126.68) = 6.62$, $p < .001$, partial $\eta 2 = .16$. There was a statistically significant mean increase in d' measure from OP1 (M = 0.46, SD = 0.91) to OP 3 (M = 1.19, SD = 0.89) to OP 5 (M = 1.16, SD = .85). In other words, participants were more successful in discriminating a gun from a cell phone at earlier occlusion points. Response bias (β) was more conservative at early occlusion points and more liberal at later occlusion points.

	Sensitivity (d')		Response Bias (β)	
OP	*M*	*SD*	*M*	*SD*
1	.46	.91	1.18	.39
2	.70	.80	1.01	.37
3	1.19	.89	.91	.38
4	1.04	.91	.85	.30
5	1.16	.85	.94	.37

Conclusions

Experiment 1 found that participants were more likely to identify the actor/actress as pulling out a weapon in earlier occlusion points. Once more visual stimuli is available, participants may decide to respond with "non-weapon".

Like Experiment 1, Experiment 2 found that participants were more likely to respond with "non-weapon" when more visual stimuli is available. With repeated exposure to visual stimuli, participants become more conservative at early occlusion points and more liberal at later occlusion points.

References

Güldenpenning, I., Kunde, W., & Weigelt, M. (2017). How to trick your opponent: A review article on deceptive actions in interactive sports. *Frontiers in Psychology*, *8*.

Mann, D. T. Y., Williams, A. M., Ward, P., & Janelle, C. M. (2007). Perceptual-cognitive expertise in sport: A meta-analysis. *Journal of Sport and Exercise Psychology*, *29*, 457–478.