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THE DETECTION OF PEOPLE CARRYING CONCEALED FIREARMS, VIA CCTV: DO THEIR EMOTIONS GIVE THEM AWAY?

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Abstract
 Illegal gun possession is an increasing problem in the UK; at the same time the UK has a massive CCTV deployment. Individuals can detect the emotional state of people shown in image sequences. Additionally, firearms are known to elicit certain emotional states in their bearers. Consequently, it may be possible for CCTV operators to determine if surveillance targets are carrying a concealed firearm on the basis of the target's emotional state. This study investigated whether observers are able to perceive differences in the emotional states of people who are and who are not carrying concealed firearms, as judged monitoring staged CCTV footage. Thirty-one participants viewed 24 mock CCTV clips of individuals walking. Half of the clips featured a concealed firearm; the other half featured a concealed, innocuous object.

The results showed that observers were able to differentiate between the two clip types by attributing different moods to those featured in each. However, their estimation of mood was dissimilar to the mood reported by those featured in the clips. Furthermore, observers' non-verbal sensitivity and their ability to recognize the mood of carriers showed little relationship. These issues are discussed with regard to the visual cues associated with this mood recognition task.

Introduction

A person's emotional state can be conveyed through their non-verbal behaviour, which in turn can be picked up and interpreted by an observer. The ability to interpret non-verbal behaviour and to recognize the emotional state of others through observation of non-verbal cues can vary from person to person. (Hall, 2001) and has been widely studied (e.g. Ekman and Friesen, 1969; Atkinson et al., 2004). Although the interpretation of the intentions of others through non-verbal behaviour might be a key element in the surveillance work of a CCTV operator, the issues surrounding the ability to decode emotional state through observation of non-verbal cues have not yet been investigated in the context of CCTV surveillance. It is possible that firearms might elicit specific, aggression-related emotional states in their bearers (Klinesmith 2006). Thus, the present study investigated the abilities of observers to read the emotional states of people viewed via CCTV; some of these people were bearing a concealed firearm and were known to have felt more aggressive whilst carrying the firearm. The following research questions were formulated:

- Is it possible to differentiate between surveillance targets when they are carrying a concealed firearm and when they are carrying a concealed innocuous object, in mock CCTV footage, based on their estimation of the surveillance target's mood state? (Mood Detection Task: MDT).
- To what degree does the estimation of gun carriers' mood by observers matches the ratings of mood made by surveillance targets themselves?
- Whether or not the decoding ability (i.e. sensitivity to bodily and facial expressions) of observers was related to their performance on MDT.

Method

Participants

Thirty-one undergraduates and postgraduates students from Loughborough University (20 male; age: range: 20 - 35 years; $M = 25.2$, $SD = 4.7$). None of the participants had previous experience with surveillance work or in spotting criminal behaviour in general.

Materials

- Mock CCTV footage. In total 144 video clips with 12 different surveillance targets in two conditions (concealed firearm present; concealed innocuous object present).
- Multiple Affect Adjective Check List - Revised (MAACL-R; Lubin & Zuckerman, 1999). Two scales: Dysphoria (subscales: Anxiety, Hostility and Depression); PASS (subscales: Positive Affect and Sensation Seeking).
- Profile of Nonverbal Sensitivity (PONS) test video clips (Rosenthal, et al., 1979).

Procedure

Two sessions:

1. PONS test (summary variables for decoding ability from the face, body, and total overall)
2. Mood Detection Task watching a surveillance target walk back and forth three times in mock CCTV footage. MAACL-R questionnaire afterwards to record how participants thought the person in those video clips was feeling.



Figure 1. Examples of still images of the mock footage (A - walking with a concealed firearm; B - walking with a concealed two-litre bottle)



Figure 2. Presented firearms: 32 Caliber Revolver; Glock; Sawn-off Shotgun, and matches - bottles of different sizes and weights

Results

1. Differentiation between carriers of a concealed firearm and carriers of a concealed innocuous object

Repeated measures ANOVA, with the Condition (firearm versus innocuous object) as the factor. Significant effect of Condition on the perceived level of anxiety ($F(1,30) = 9.016$, $p = .005$) and positive affect ($F(1,30) = 6.08$, $p = .020$) in the surveillance target. The differences in mean scores show that the observers rated the mood of surveillance target's in the firearm condition as more positive than the mood of surveillance target's in the innocuous object condition (see Figure 3).

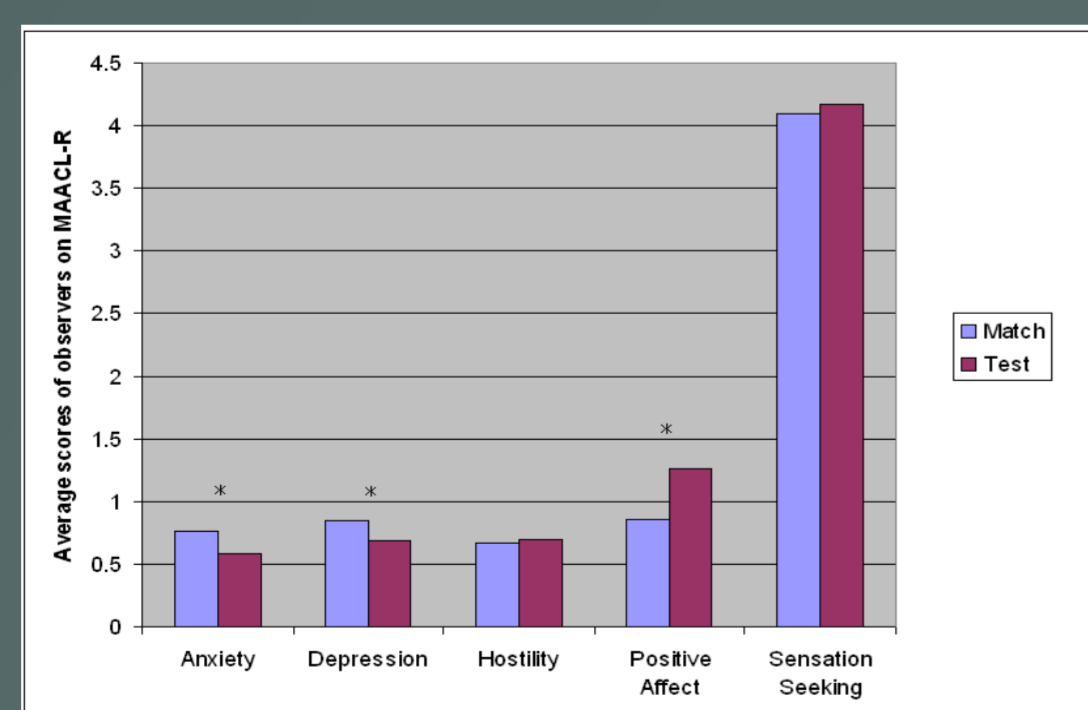


Figure 3. The surveillance targets' mood (mean scores on the scales of MAACL-R in Match (i.e. carrying a bottle) and Test (i.e. carrying a firearm) condition), estimated by observers.

2. Performance on MDT

Repeated measures ANOVA, with the Condition (firearm, innocuous object) as the factor showed a significant effect of Condition on performance of observers on MDT ($F(1,30) = 218.77$, $p = .000$, for Anxiety; $F(1,30) = 23.630$, $p = .000$, for Depression; $F(1,30) = 46.852$, $p = .000$, for Hostility; $F(1,30) = 109.718$, $p = .000$, for Dysphoria; $F(1,30) = 47.616$, $p = .000$, for Positive Affect; $F(1,30) = 32.972$, $p = .000$, for Sensation Seeking; $F(1,30) = 19.508$, $p = .000$, for PASS). In the Match condition the differences between observers' and targets' scores on all the scales, except Sensation Seeking scale, were significantly lower than these differences in the Test condition (see Figure 4). This means that the performance on MDT was more accurate when the surveillance targets were carrying an innocuous object.

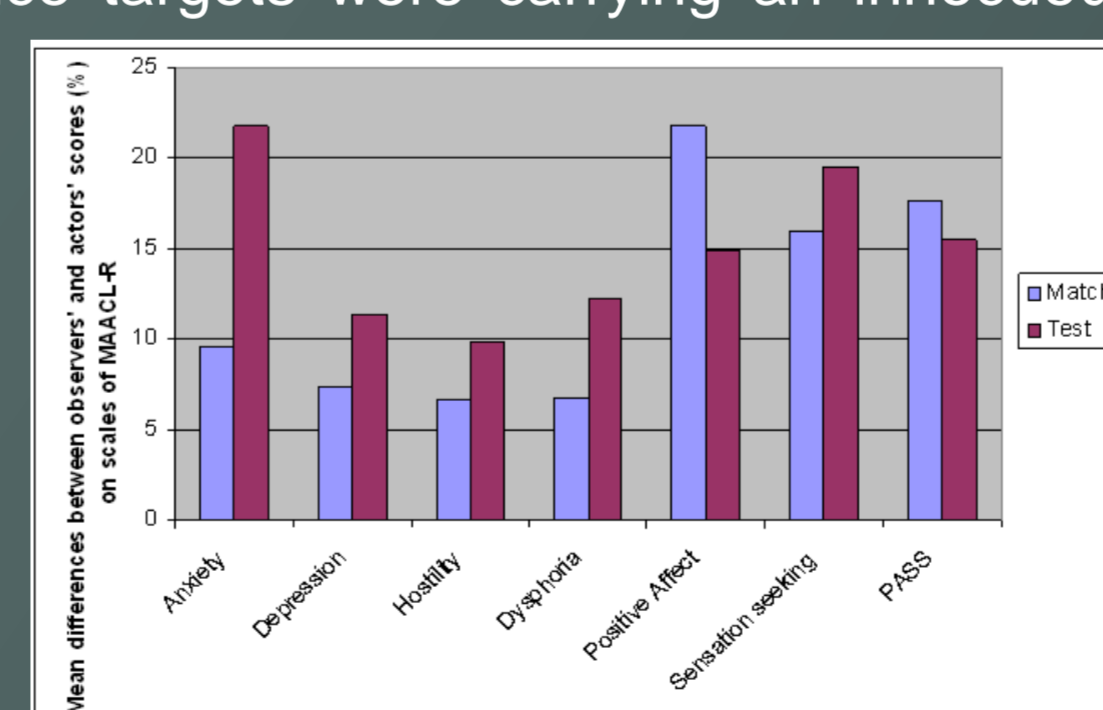


Figure 4. Mean differences in scores of observers and surveillance targets (presented in percentage of maximum possible score) on the scales of MAACL-R in Match condition (i.e. carrying a bottle) and Test condition (i.e. carrying a firearm).

3. Relationship between the measures of decoding ability (i.e. sensitivity to bodily and facial expressions) and the performance on MDT

The partial correlation analysis was used, in order to control for trait scores of observers.

- Significant positive correlation between PONS total test and the observers peer-ratings on Sensation Seeking scale in both, Match and Test conditions ($r = .651$, $n = 31$, $p = 0.005$ and $r = .697$, $n = 31$, $p = 0.002$, respectively).
- Significant positive correlation between PONS Body test and the observers peer-ratings on Sensation Seeking scale in both, Match and Test conditions ($r = .568$, $n = 31$, $p = 0.017$ and $r = .520$, $n = 31$, $p = 0.032$, respectively).
- Significant positive correlation between the scores of observers on PONS Face test and the performance on MDT related to Anxiety scale in Match condition ($r = .487$, $n = 31$, $p = 0.047$). No other correlations between the scores of these two tests were found.

Conclusion 1 & 2: The observers were able to discriminate between the emotional states of surveillance targets when they were carrying a firearm and when they were carrying an innocuous object. In general the observers detected the mood of surveillance targets better when the targets were carrying an innocuous object. When surveillance targets were carrying a firearm, their mood, associated with positive affective state was more accurately detected by observers than their mood, associated with other (negative) scales of the MAACL-R.

General Conclusion

The present study showed that untrained observers are able to differentiate between the images of people walking with or without a concealed firearm, based on the emotional state that they attribute to them. Although the observers could not infer correctly the self-estimated moods of the surveillance targets, they were more accurate in detection of surveillance targets' mood when the targets were carrying a concealed innocuous object. Questions arise regarding the cues being used by observers and the cues displayed by surveillance targets; for instance, which produced the misinterpretations? Such questions will be investigated in future studies. Future experiments will also explore the relationship between sensitivity to non-verbal cues and ability to detect a gun carrier. The visual cues used in attempting to decode the non-verbal cues displayed by carriers of concealed guns might be inferred by means of a questionnaire and determined empirically by eye-tracking.

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