INTRODUCTION

The ability to detect potential threats to society has become ever more prominent in recent years given changes in the global socio-political climate. Such threats take many forms ranging from direct acts of terrorism to illegal trafficking of drugs or other materials. A common route for such activities is the direct concealment of materials and human carriers. It is therefore of vital importance to develop systems and techniques for the early detection of such concealment and deception. The behavioural sciences have a long history of exploring verbal and non-verbal cues to deception with the goal of trying to detect when people are lying about their previous behaviour or motives. Here we are attempting to find non-verbal behavioural signatures that indicate that a person is concealing an object which carries with it a large cost associated with its detection (analogous to carrying an illicit substance or weapon).

Given the frequent and often successful attempts at trafficking illegal items of high value across borders, many systems have been put in place (e.g. airport baggage screening) to detect such attempts. However given the limitations of these current systems, this study investigated the prevalence of visual and other behavioural signatures to concealment that could be seen by a multiple camera set-up. Ten participants were asked to conceal a high value item of which they could keep if they could successfully lie to our ‘lie detector machine’. 13 cameras observing every visible area of each participant were used to collect over 500 videos for analysis of bodily movement. Each participant underwent a conceal condition and a separate baseline condition where they did not conceal any items. 1500+ quantitative measures of bodily movement, including response time, were performed. It was found that, in the conceal condition, response time to the critical question increased. Hand movements decreased, blink rate increased and the left foot was nearly always in front of the right. In conclusion it appears that, within our experiment, there do exist behavioural signatures for the concealment of items that could be used in automated screening applications. Further work to address the limitations of this study including ecological validity will follow.

METHODOLOGY

Ten participants underwent two experimental conditions in a counterbalanced fashion. In the conceal condition, each participant was given £75 and told that if they could successfully lie when questioned “Are you concealing anything of high value” they could keep it. No items of high value were concealed in the baseline condition. Participants were instructed to walk into and stand in front of the cameras in which they would be presented with the critical question. 13 cameras covered all angles of the participants during the experiment. 520 videos, approximately 30 seconds long, were recorded for analysis. Over 1500 different measures were conducted with key

RESULTS

CONCLUSIONS

When participants were concealing items of high value:
- **Response time increased** for the critical question
- **Blink Rate increased** following the critical question
- Hand movements decreased following the critical question
- Left feet were positioned in front of right feet during the experiment. Measures that showed no significant differences between conditions were:
  - Distance between feet
  - Body Sway (side sway, frontal sway and head sway considered)
  - Hand Movements (number of hand actions performed after the critical question)
  - Time to settle to a stationary stance after entering the room
  - Time for 1st movement following the critical question

W(p=0.227)

Further work will investigate whether:
- **Response time will still be shorter:**
  1. If participants haven’t prepared their answer beforehand
  2. Compared to a baseline condition where no concealment condition
- **Foot position was due to the location of the door or some other factor**
- **Facial movements and/or expressions are related to concealment behaviour**
- **Foot position was due to the location of the door or some other factor**
- **A more ecologically valid study (possibly a field study) could be set up to test these findings again. More participants could be used with higher stakes**

REFERENCES