The success of recent terrorist attacks has disclosed to the public the dangers connected with failure in detecting threats and prohibited items at checkpoints.

Visual inspection with X-rays is currently one of the most cost-effective security measures at major transportation checkpoints for goods and vehicles. More often than not, performance of X-ray-aided screening systems ultimately depends on the human operator. The study of how inter-observer variability and human factors affect the use of X-ray imaging is thus crucial. The development of routine methods to measure the potential performance of human screeners is likely to aid the correct selection of security staff and to improve the efficacy of visual inspection in aviation and non-aviation security settings. Selection and training of security personnel for the London 2012 Games has also recently highlighted this requirement. To this objective, neuropsychology and visual cognitive neuroscience offer an invaluable source of research evidence and testing protocols that can either be directly employed or modified, and more finely attuned for security applications.

X-RAY IMAGE INTERPRETATION: X-ray image interpretation poses peculiar challenges to the human screener, with its cluster of superimposed shapes that are often seen from unusual viewpoints. In a professional environment, continued training with the screening task plays a fundamental role in building and maintaining a mental library of images of threats and prohibited items, and in optimising efficiency of the screening and decision-making process. However, specialised training is not as effective when it comes to the intrinsic visual complexity of the image, causing well-known shapes and objects to go unrecognised.

TRANSLATIONAL RESEARCH: Based on the type of visual challenge posed by transmission X-ray images and the similar challenge that is typical of a well-known experimental testing instrument, it is possible to draw a parallel between the security domain and the visual cognitive neuroscience domain. We can use the knowledge of this similarity to predict what type of individual differences may be relevant and what personnel selection instruments may help improve efficiency of the screening system.

In the Embedded Figures Test (EFT - from cognitive neuroscience) a target shape is to be found in a complex shape. When it is inserted in the complex shape, the target shape changes its visual meaning (for example, it appears as part of a different shape and loses its apparent individuality). In order to be identified, it has to be ‘disembedded’ from its confounding context. People with superior disembedding ability could therefore be expected to outperform more context-dependent people also in the security X-ray screening task. In the general population there is a quick way to know whether a person may good or not at disembedding, by means of a self-report testing instrument, the Autism Quotient questionnaire, which contains an ‘attention to detail’ subscale.

Our research suggests that the use of the ‘attention to detail’ subscale may help identify, within a

Several billion pieces of baggage pass through a single international airport every year, and legal borders of a typical Western country are crossed by thousands of people, vehicles, animals, plants

TRANSMISSION X-RAYS: In X-ray transmission, matter particles (X-ray photons) are projected with a suitable energy through the items to be inspected and picked up by a detector at the opposite side. The resulting X-ray image is the distribution of those particles that have passed through the item and are recorded by the detector. Depending on content density of the item being screened, X-rays are subjected to different levels of attenuation, which are visually translated into different levels of grey and/or different colours. The final image is a two-dimensional projectiosub31fhe dines tem 1( )-25(di)7

COMPARABLE CHALLENGES: A parallel can be drawn between a typical security screening task and a well-known neuropsychological test – the Embedded Figures Test (EFT). Like a screening task, the EFT requires object localisation and recognition within a cluster of confounding shapes (see Figure 1).

Figure 1 – the comparable challenges presented by the EFT and the X-ray screening test

Fact 1: Individuals with a diagnosis of autism spectrum disorder (ASD) outperform non-autistic individuals in the EFT. Their enhanced abilities are attributed to heightened attention to visual detail