The effects of stress levels on the construction of facial composites
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Introduction
When a person witnesses a crime, they are often asked to describe the features of the perpetrator and to make a composite of his or her face. The traditional method for creating faces from memory involves the selection of individual facial features – eyes, nose, mouth, etc. This procedure can be incredibly difficult for witnesses (or victims), as they may have only seen the face for a short amount of time and so find it difficult to recall the component features.

It is thought that people identify faces as a whole, or holistically, as opposed to identifying them by their individual features. This is illustrated by Kovera, Penrod and Pappas (1997), who asked people to create composites of former classmates, which were then given to other classmates to identify. There was almost a zero identification rate because the face constructors could not remember the facial features very well. Later work confirmed the general ineffectiveness of ‘feature’ methods for situations where the target person is unfamiliar and the memory of the face is several days old (e.g. Frowd et al. 2005 and 2007).

In contrast, Frowd, Bruce, Smith and Hancock (2008b) found that asking the constructors to focus on the more global aspects of a face, such as how old or masculine the face appears, can help some people to build a more identifiable face. There are alternative systems emerging as well that are based more on face recognition rather than face recall, as discussed below; these systems perform better for many more witnesses and therefore offer greater hope for catching criminals (e.g. Frowd et al. 2007, in press).

A potentially important factor when constructing faces in general is how stressed a witness is at the time of the incident. Stress refers both to the circumstances that place physical or psychological demands on an individual and to the emotional reactions experienced in these situations (Speilberger 1979). There is a process the body goes through in order to control feelings of stress. When a potentially dangerous situation arises the body involuntarily responds by increasing heart and breathing rates, releasing sugars into the blood stream and increasing blood pressure. This is due to the autonomic nervous system, which acts as the body’s control system, sending signals to produce adrenalin. This results in a stressed and
aroused state, and enables the body to better respond to the situation. The body’s reaction to stress is sometimes known as the ‘fight or flight’ response.

The recall of information about faces has been found to be lower when physical arousal is high (e.g. Brigham, Maass, Martinez and Whittenberger 1983) and, as arousal can occur during stress, this suggests that recall will be lower when stress levels are high. Eyewitness Testimony also involves face recall: it is an account of an event given by people who have witnessed a crime. Research has similarly found that high levels of stress can negatively affect Eyewitness Testimony (Deffenbacher, Bornstein, Penrod and McGarty 2005). For example, Valentine and Mesout (2009) found that high levels of anxiety (stress) were associated fewer correct descriptors given of a target person, more incorrect details and fewer correct identifications made from a lineup. It has been also been found that children with social phobia have significantly worse facial recognition skills than children without social phobia, and greater reported anxiety upon completion of a recognition task (Simonian, Beidel, Turner, Berkes and Long 2001). A similar result was found by Mueller, Bailis and Goldstein in 1979, who carried out a recognition test which revealed superior performance by participants with low anxiety.

There are several so-called ‘feature’ systems to build faces, as previously mentioned, but they do not work very well. One reason for this is that we recognise faces better when the focus of attention is directed towards the face as a whole, rather than towards its parts (e.g. Frowd et al. 2007). This is demonstrated by how difficult it can be to identify a famous face when given just the eyes. There are alternative approaches. One that has been revised and tested extensively is called EvoFIT. It was originally developed at the University of Stirling, by Drs Charlie Frowd and Peter Hancock, but at UCLan since 2007 (when Charlie relocated here). The system requires witnesses to repeatedly select and breed complete faces to produce a composite. While the faces contain random characteristics at the start, repeating the selection and breeding enable a specific face to be ‘evolved’ – hence the name Evolving Facial Identification Technique, or EvoFIT. A more detailed description of EvoFIT may be found in Frowd, Bruce and Hancock (2008a). EvoFIT is being marketed by UCLan and several police forces are using it, including Lancashire constabulary. The present study looked at the effects of stress on face construction uses this technology.
Two stages were required. In the first, participants looked at a target face under either a low or a high stress and then constructed a composite of the face using EvoFIT. In the second, the composites were shown to other people to name. It was hypothesised that higher levels of stress would negatively impact upon construction; specifically, participants under higher levels of stress at the time of seeing their target face would produce less recognisable composites than those under lower stress.

**Composite Construction**

**Design**
The present study was carried out under forensically relevant, or realistic, conditions as far as possible in the laboratory. This involved a participant undertaking a cognitive interview prior to composite construction, a procedure designed for use in police interviews in order to recall as many details of the face as possible. There was also a 24-hour delay between observing the target and constructing the composite, to be similar that found in real life.

There are a number of tasks that can be used in the laboratory to make a person feel anxious. One of them is backward counting, a standard method. For this simple procedure, a person tends to feel quite agitated when counting backwards from three hundred in intervals of seven, once per second, but finds it fairly easy when counting backwards from three-hundred in intervals of three. The former method was used for those appearing in the ‘high’ stress condition, the latter for those in the ‘low’ stress condition. After the stress manipulation had been administered, participants were shown their target face.

The study used photographs of footballers as targets. The set was chosen to allow the identities to be familiar to the intended participant-witnesses (the people who would build the faces) and unfamiliar to participant-judges (who would later name the composites). Ten target photographs were used to provide sufficient experimental power, and these images are described in the Materials section below. The targets were constructed once in each stress condition (low and high) of the experiment, and so 20 participant-witnesses were recruited in total.
Participants
Composite construction was carried out by 20 volunteer students from the University of Central Lancashire. They were non-football supporters, had an age range of 18 to 24 years and an average age of 20.9 years (standard deviation of 7.3 years). There were 17 females and 3 males. Each person was recruited via opportunity sampling.

Materials
The chosen targets were 10 Caucasian footballers: Peter Crouch, Robbie Fowler, Steven Gerrard, Ryan Giggs, Frank Lampard, Gary Neville, Paul Scholes, Alan Smith, Ole Gunnar Solskjaer and John Terry. All of the pictures were in a frontal view, in colour and approximately 3 x 3 inches in size. A metronome was used to encourage participants to count backwards at the desired rate.

Procedure
Participants made two visits to the laboratory, firstly to look at a target photograph, and secondly to construct a facial composite. They were randomly assigned to one of two conditions, high or low stress, and were tested by the Experimenter individually throughout. Those in the high stress condition were asked to count backwards from three-hundred in sevens, once per second using a metronome, and those in the low stress condition were asked to similarly count backwards except in threes. Afterwards, each person was shown a photograph of a footballer for one minute.

Between 22 and 26 hours later, participants returned to the laboratory. They first underwent a Cognitive Interview. The Experimenter asked participants to form a clear mental image of the target and then to describe the face in a free recall format. They were told that the interviewer would be making notes during the recall, but would not interrupt. After the interview, they were asked to construct a facial composite of the target using the EvoFIT composite system. The system was started and participant-witnesses chose appropriate hair, ears and neck, followed by the ‘facial aspect’, the width and length of the face. Participants were informed that screens of faces would be presented and that they were generally required to select those which resembled the target face. They were presented first with screens of face shapes and asked to choose six from a selection of 60 alternatives that best matched the target; the presented faces changed in terms of feature shapes and the placement on the face. They were then asked to pick the six face textures closest to the target’s, this time from a selection of
alternatives that changed by (greyscale) colourings of the facial features. The best shape and texture was next identified and all selections bred together, to combine characteristics. The selection and breeding procedure was normally repeated twice more to ‘evolve’ a likeness of the target. Finally, ‘holistic’ transforms were applied to the face with the best likeness. These allowed the participant-witness to improve facial quality by changing the age, face width, masculinity, health, weight, and other such global operations. The resulting image was saved to disk as the composite.

**Composite Evaluation**

**Design**
Football fans were recruited for this part, to enable them to identify the composites. They were shown all 20 composites, 10 from the low stress condition and 10 from the high stress condition, as part of a within-subjects experimental design.

**Participants**
Composite naming was carried out by 20 volunteer participants. They were football supporters, male, had an age range of 19-25 years and an average age of 21.4 years (standard deviation of 6.8 years). They were recruited via an opportunity sample and were all undergraduate students from UCLan.

**Procedure**
Participant-judges were told that they would be evaluating composites of footballers constructed in a recent study. They were given a written list of the footballers’ names and asked to match them to the composites. They were shown 20 images, 10 composites from the high stress condition and 10 composites from the low stress condition, and provided a name for each where possible. The order of presentation of the composites was randomised for each person. Finally, participants were debriefed as to the nature of the study.

**Results**
For the two construction conditions, 137 composites out of a possible 400 were correctly identified (34.0%). Sixty were correctly identified in the high stress condition (30.0%), but more were identified in the low stress condition, 77 (38.0%). A two-tailed paired samples t-
test carried out on the items (target identification) scores revealed that composites in the high stress condition were named significantly worse than those in the low stress condition, t(9) = 2.95, p < .05, $\eta^2 = .49$.

**Discussion**

Some witnesses and victims are stressed at the time of seeing a person commit a crime. The present study aimed to find out whether such a physiological response would have an effect on face construction ability. In the project, one set of participants inspected a target photograph and a day later constructed a facial composite using the EvoFIT face breeding system; they were manipulated to experience either high or low stress immediately before seeing the photograph. The composites were shown to the second set of participants who attempted to identify them. It was hypothesised that stress would negatively affect the quality of the facial composites. The hypothesis was supported: more composites were identified in the low stress condition than in the high stress condition.

The study’s findings are in line with previous research: most have found that stress, arousal and anxiety exert a negative effect on face perception. As mentioned earlier, Brigham et al. (1983) found that face recall was poorer when a person was highly aroused; Deffenbacher et al. (2005) that high levels of stress negatively affected eyewitness testimony.

The idea was that if people were stressed when they witnessed a crime, they would be less likely to remember the facial features of the perpetrator. The study induced stress by asking the participants to count backwards from three hundred in either threes or sevens. However, this type of manipulation may not cause the same amount stress that a witness may experience, and it may not really be a ‘fight or flight’ response. Nevertheless, while the extent of the manipulation is likely to be less than in real life, the task would still release the same stress hormones and the natural reaction may reduce the ability to cope. The overall consequence was a reduction in the ability to accurately select from the presented face arrays in EvoFIT, and ultimately the production of a worse quality composite. Note, though, that even in the higher stress condition, identification was still fairly good, at 30% correct in the identification task, and this suggests value in still constructing the face.
The present study involved a student sample, but follow-up work could look at other populations to verify the more general nature of the results. Perhaps, in future, it would also be a good idea to use a control group, one that would not be stressed at all, in order to compare performance against the high and low stress conditions here. In this case, it is hypothesized that composites constructed in the control group would be identified the most (those participants are likely to experience the least stress and have the best face recall ability).

A future study might investigate the effect of stress in-between showing the target and constructing the composite. A person may not be anxious at the time of witnessing an event, but it may be the crime itself which causes the anxiety or trauma. This kind of reaction to an event is sometimes referred to as post-traumatic stress disorder (PTSD). Research has found a negative correlation between PTSD and reported levels of facial recognition (Islam-Zwart, Heath and Vik 2005), suggesting that face construction may similarly be affected were witnesses to experience stress in the intervening period prior to face construction.

In summary, the study looked at the effect of stress on composite construction ability using the EvoFIT face breeding system. It was found that stress had a significant and negative effect. Based on the findings, it would appear sensible to suggest that the police should continue to construct composites using EvoFIT with witnesses or victims that have experienced somewhat high levels of stress: while their composite may not be quite as good as for others with lower stress levels, the face would still appear to be useful for identification purposes.

References


