Impact case study (REF3b)

| **Institution:** |
| University of Central Lancashire |

| **Unit of Assessment:** |
| UoA 4 Psychology, Psychiatry and Neuroscience |

| **Title of case study:** |
| Providing software, training and support to the police to allow them to identify criminal suspects using facial-composite images. |

1. Summary of the impact (indicative maximum 100 words)

Frowd's research aims to understand the extent to which witnesses and victims of crime construct accurate facial composites (pictures of criminal's faces), and to develop techniques which maximize the effectiveness of composites, thus allowing the police to identify as many offenders as possible using this type of forensic evidence. The principal impact involves a software system (EvoFIT), a new interview (Holistic-Cognitive Interview, H-CI) and two formats (animated caricature and stretched composite) for the police to publish composites in the media. In the audit period, these advancements have been used by police forces in the UK, US, Romania and Israel.

2. Underpinning research (indicative maximum 500 words)

The contribution relates to the construction and recognition of facial composites, images which are used by police to detect suspects of crime. The collaborative research in this area was originally carried out between 1998 and 2006 at the University of Stirling: Charlie Frowd completed his PhD and continued as PDRA there. The research was supported by three EPSRC grants held by Peter Hancock (Stirling) and Vicki Bruce (Newcastle) at Stirling (PhD studentship; DTI, £220k, 2005-7; PPE, £40k, 2006-7). Dr Frowd relocated to UCLan in 2007 (then Winchester in 2013). In addition to an understanding of how people construct faces[4], there are three main contributions that have emerged from his collaborative research.

Research from Stirling. The first main contribution is a new interview (holistic-cognitive interview, H-CI) to be used by police with witnesses and victims of crime at the start of face construction using traditional 'feature' composite systems. The interview encourages eyewitnesses to focus on the character of the target face and results in a three-fold increase in the recognisability of a resulting composite[3]. Second, extensive research at Stirling led to the initial commercial version of a new method (computer program) for the police to construct a composite face[1,4]. This method (called EvoFIT) involves eyewitnesses repeatedly selecting from arrays of complete faces to 'evolve' a composite. Third is a new animated-image format for police to publish composites—especially for wanted-person's webpages and on TV. Watching a composite being caricatured, by progressively exaggerating and de-emphasising facial features, substantially improves a person's ability to correctly name the face[2]. This research also indicates that animated caricature is effective for the three main types of composite system.

Research from UCLan. After relocation to UCLan in 2007, Dr Frowd made further developments in these three areas. First, he developed another novel method to reliably improve recognition of composites (e.g. when published in the media). The method was based on a either physically stretching the image or looking at the face from the side, a 'perceptual' stretch[6]. Dr Frowd also explored the underpinnings of animated caricature in detail by a UCLan funded project (£10k) [2]. Second, for EvoFIT, is a novel method to construct the face (initial focus on central region of the face)[6] and a 30% reduction in the

number of screens required to evolve the face[4]. Research also established that the H-CI was effective for EvoFIT[5], and assessed performance when these techniques were combined. Correct identification of EvoFIT composites increased twenty-fold[6] (using H-CI, latest EvoFIT and the perceptual-stretch method to name the composite) compared to composites created from procedures in 2007. In addition, the combined effectiveness of the H-CI and perceptual stretch for a feature system was assessed and confirmed by an ESRC grant at Leeds University (£80k, 2011-13). An additional contribution, supported by two grants from HEFCE and the North-West Development Agency (NWDA) (£15k total, 2008, 2010), has been field trials of EvoFIT in five police forces in the UK and Romania.

3. References to the research (indicative maximum of six references)

1. Frowd, C.D., Hancock, P.J.B., & Carson, D. (2004). EvoFIT: A holistic, evolutionary facial imaging technique for creating composites. *ACM Transactions on Applied Psychology (TAP),* 1, 1-21.

2. Frowd, C.D., Bruce, V., Ross, D., McIntyre, A., & Hancock, P.J.B. (2007). An application of caricature: how to improve the recognition of facial composites. *Visual Cognition*, 15, 954-984. A follow-up project, leading to a four-experiment paper, was published in the same journal in 2012.

3. Frowd, C.D., Bruce, V., Smith, A., & Hancock, P.J.B. (2008). Improving the quality of facial composites using a holistic cognitive interview. *Journal of Experimental Psychology: Applied*, 14, 276-287.

4. Frowd, C.D. (2012). Facial Recall and Computer Composites. In C. Wilkinson and C. Rynn (Eds). *Facial Identification* (pp. 42-56). Cambridge University Press: New York.

5. Frowd, C.D., Nelson, L., Skelton F.C., Noyce, R., Atkins, R., Heard, P., Morgan, D., Fields, S., Henry, J., McIntyre, A., & Hancock, P.J.B. (2012). Interviewing techniques for Darwinian facial composite systems. *Applied Cognitive Psychology*, 26, 576-584.

6. Frowd, C.D., Skelton F., Hepton, G., Holden, L., Minahil, S., Pitchford, M., McIntyre, A., Brown, C., & Hancock, P.J.B. (2013). Whole-face procedures for recovering facial images from memory. *Science & Justice*, 53, 89-97.

4. Details of the impact (indicative maximum 750 words)

Dr Frowd's research has provided police with (i) a new facial-composite system (EvoFIT), (ii) a new interview (H-CI) and (iii) two methods to enhance recognition of finished composites (animated caricature and stretched composite). The research underlying this impact is collaborative, in particular with Peter Hancock at Stirling (also submitting an Impact Case Study to this UOA). The contribution of research underpinning the impact is roughly equal between UCLan and Stirling.

Commercial applications of EvoFIT
EvoFIT has been in regular police use since August 2007, first via police field trials and then from 2009 as a commercial product managed by UCLan Business Services Ltd. EvoFIT has been deployed for a range of crimes, mostly serious (e.g., rape, burglary, murder), and there are many documented cases of success[c-g,j] with two described below. During the REF audit period, EvoFIT training has been delivered to 59 personnel in 13 police forces in the UK, Europe (Romania), the US (Boston Police Department) and the Middle East (Israel)[f]. Biannual workshops are run to provide police users with on-going training and software updates. Since the business started at UCLan in 2009, total income from EvoFIT is £106k[f].

Frowd has orchestrated field trials of EvoFIT involving five police forces and 29 police personnel[j]. This involved Lancashire (2007-2008) and Derbyshire (2008-2009) forces, and indicated that EvoFIT directly led to the arrest of an offender in 26 out of 111 cases (23%)[d]. In 2009-2010, using a research-improved version of EvoFIT for Devon-and-Cornwall and Romania forces, the arrest rate was 36%[d]. In 2010, the arrest rate was 60% in Humberside police using a further-improved version of EvoFIT; in this audit, also involving involved H-CI and caricature animation, the conviction rate was 29% of arrests, or 17% of all composites constructed[j,k]. Since 2008, EvoFIT has been used in 14 police forces and over 3,000 times in total with witnesses and victims of crime[f].

The first commercial version of EvoFIT was used in August 2007 (we acknowledge that this case study straddles the assessment period, but essentially relates to the current one). EvoFIT was used to locate an offender who attempted to indecently assault an 11 year old girl in Blackpool. In spite of an extensive search, seven days after the offence, Lancashire police could not locate the offender and so an EvoFIT was constructed by the victim. The police took the composite to the park where the crime occurred and two members of the public identified the face as a local person, Ross Gleave. In June 2008, Gleave received a seven-year custodial sentence for the offence[d].

In 2010, Greater Manchester Police were unable to locate a rapist who had attacked at least two women in the south of the city. An EvoFIT was constructed with the most recent victim seven days after the attack. The composite was published in the media, and online using animated caricature, and the face was identified by members of the public as local shop-worker, Asim Javed. He confessed to the crimes and was sentenced to seven years in prison[g].

Public appeals and Police training
Composites are shown to police officers and members of the public to identify[g,h]. The research has shown that naming is substantially improved when composites are seen with animated caricature or as stretched images. The former technique has been incorporated into three commercial composite systems: PRO-fit, EFIT-V and EvoFIT[b,c,i]. Frowd has trained 40 composite-officers in nine police forces in the UK and US on how to use caricaturing for PRO-fit, and 59 officers (14 forces) for EvoFIT. Instruction in the composite-stretch techniques have been given to EvoFIT police users, plus officers from 13 forces attending a forensic workshop in January 2013 at Leeds University.

Initial interview
Eyewitnesses are interviewed by police composite-officers, initially to obtain a description of an offender's face, and then as part of face construction. The research indicates that the H-CI substantially improves recognisability of a constructor's composite. Dr Frowd has trained the same police personnel as for animated caricature (above) to use the H-CI[f].

Expertise
During the assessment period, and previously, Dr Frowd has been invited to disseminate composite research findings at meetings of the expert network group on facial identification (formerly, a working party of the Association of Chief Police Officers). He regularly appears in the media to disseminate composite research and results of case studies (newspapers, TV, local and national radio) - most recently on the One Show, Quest TV, BBC Crimewatch and BBC Radio 4.

5. Sources to corroborate the impact (indicative maximum of 10 references)

a. Frowd, C.D., Skelton, F., Atherton, C., & Hancock, P.J.B. (2012). Evolving an identifiable face of a criminal. *The Psychologist*, 25, 116-119. (Article summarizing key developments.

This work also contains a review of an article in the same publication four years previously.)

b. http://www.abmsoftware.com/Products_PRO-fit.html -- PRO-fit 'feature' composite system incorporating holistic-cognitive interview and animated caricature.

c. http://www.EvoFIT.co.uk -- commercial website for EvoFIT. Also contains details of holistic-cognitive interview, animated composite, customer testimonials and details of media coverage.

d. Frowd, C.D., Hancock, P.J.B., Bruce, V., Skelton, F.C., Atherton, C., Nelson, L., McIntyre, A., Pitchford, M., Atkins, R. Webster, A., Pollard, J., Hunt, B., Price, E., Morgan, S., Greening, R., Stoika, A., Dughulia, R., Maftei, S., & Sendrea, G. (2011). Catching more offenders with EvoFIT facial composites: lab research and police field trials. Global Journal of Human Social Science, 11, 46-58. (Details of first two police field-trials of EvoFIT. There is also an article in previous year in *IEEE International Conference on Emerging Security Technologies*. Refer to [10] below for latest police field trial.)

e. http://www.the-investigator.co.uk/files/The_Investigator_Free_Online_Magazine_-_Feb_-_April_2011.pdf -- see pages 27-29 for an article on EvoFIT in the Investigator magazine given to senior police officers in the UK; see also page 2 for example crimes that EvoFIT has helped to solve.

f. EvoFIT police usage and income. Documents stored at the HEI and is available for audit. (Indicates usage in more than 3,000 individual composites in criminal investigations; also included are police forces in which EvoFIT has been used.) Further, this source contains evidence that the H-CI has been used by three police forces and an independent forensic practitioner who use the EFIT-V composite system (from feedback from a forensic workshop in Leeds, January 2013).

g. http://menmedia.co.uk/manchestereveningnews/news/crime/s/1345540_face_of_man_wanted_over_south_manchester_rapes -- another investigation where EvoFIT helped to solve the investigation – in this case, to catch a serial rapist in the south part of Manchester.

h. An example of an animated composite used in a police investigation. Archived webpage from Cumbria Police 'first ever evofit in bid to trace robber' (incident 8th April 2010). (Uclan can suppy).

i. http://www.visionmetric.com/index.php?option=com_content&task=view&id=66&Itemid=0 – a third commercial facial composite system (EFIT-V) incorporating animated caricature.

j. Frowd, C.D., Pitchford, M., Skelton, F., Petkovic, A., Prosser, C., & Coates, B. (2012). Catching Even More Offenders with EvoFIT Facial Composites. In A. Stoica, D. Zarzhitsky, G. Howells, C. Frowd, K. McDonald-Maier, A. Erdogan, and T. Arslan (Eds.) *IEEE Proceedings of 2012 Third International Conference on Emerging Security Technologies*, DOI 10.1109/EST.2012.26 (pp. 20 - 26). (Details of recent EvoFIT field trials with Humberside police.)

k. Contact 1. Brian Coates, Detective Constable, Major Incident Team, Humberside Police.