

<b>Institution:</b> University of Stirling		
<b>Unit of Assessment:</b> 4. Psychology, Psychiatry and Neuroscience		
<b>Title of case study:</b> EvoFIT Facial composites: Helping police identify serious criminal suspects		
<b>Period when the underpinning research was undertaken:</b> 2000 - 2020		
<b>Details of staff conducting the underpinning research from the submitting unit:</b>		
<b>Name:</b>	<b>Role:</b>	<b>Period employed by submitting HEI:</b>
Peter Hancock	Professor	1995 - present
<b>Period when the claimed impact occurred:</b> 1 August 2013 - present		
<b>Is this case study continued from a case study submitted in 2014? N</b>		
<b>1. Summary of the impact</b>		
<p>EvoFIT is a system of software and procedures that helps police to identify suspects of serious crimes, such as rape and assault. Our research has resulted in a system that is easy to use and highly effective, with identification rates around 60 to 70% compared to 5% for traditional systems like E-fit. During the REF period, EvoFIT has been used by 26 police forces in 11 countries for over 2,500 investigations, assisting in the identification and arrest of an estimated 1,500 serious offenders, including a murderer.</p>		
<b>2. Underpinning research</b>		
<p>If you are a victim or witness of crime, the police may ask you to create a 'composite' of the perpetrator's face. This is a difficult task, but we have applied our understanding of the psychology of human face recognition to create a system to make it easier and more accurate. EvoFIT is the culmination of 25 years of funded research, initiated at Stirling and more recently in close collaboration with the University of Central Lancashire (UCLan). It had its origins in Hancock's work at Stirling in the 1990s (see output <b>R1</b>), which resulted in a studentship for Charlie Frowd. After 2000, it was funded by a link grant (DTI/EPSC) and a further EPSC grant (2005-7). Since then, research has continued at Stirling and at UCLan, where Frowd moved in 2007, with the aid of small development grants, student project work and income from the system. The research has been collaborative, principally between Hancock and Frowd but involving numerous other researchers, including police practitioners.</p> <p>Beyond developing the software, we have investigated the whole process of composite production, from interviewing the witness to presenting the final image. We developed a novel 'holistic cognitive interview' that invited witnesses to consider the overall appearance of the face; we showed an advantage for asking witnesses to focus on internal features of the face, which are most important for familiar face recognition; and demonstrated that presenting the complete composites as animated caricatures promotes recognition. A key part of our methodology is to evaluate composite systems in a way that emulates, so far as possible, the usage by police, with a realistic delay before making the composites. We were thus able to determine that combining techniques produces an additive improvement in final recognition rates (<b>R2</b>). Our extensive research enabled us to perform our own meta-analysis, to identify what aspects are most important across studies. This confirmed the benefit of using internal features and the holistic-cognitive interview (<b>R3</b>).</p> <p>Our research has continued to refine our understanding of each stage of the process. During the initial interview, we now ask witnesses to concentrate on the eye region, which is known to be the critical area for familiar face recognition (<b>R4</b>). During composite construction, it is possible for witnesses to become confused and lose their memory of the target face. We have shown that focussed breathing exercises significantly improve the final composites (<b>R5</b>). Finally, we have developed methods for adding 'paraphernalia' such as beards, hats and sunglasses to the final composites, which shows what the suspect might look like when thus disguised (<b>R6</b>) (see example usage, below). We were able to show that this achieves more than simply recreating the appearance of the suspect: covering up areas that were not seen by the witness prevents someone who is attempting to identify the composite from being misled by inaccurate information.</p>		
<b>3. References to the research</b> (Stirling researchers in <b>bold</b> text)		
<p><b>R1. Hancock.</b> (2000) Evolving faces from principal components. Behavior Research Methods, Instruments &amp; Computers, 32, 327-333. DOI: <a href="https://doi.org/10.3758/BF03207802">10.3758/BF03207802</a></p>		

- R2.** Frowd, Skelton, Hepton, Holden, Minahil, Pitchford, **McIntyre**, Brown & **Hancock**. (2013). Whole-face procedures for recovering facial images from memory. *Science & Justice*, 53(2), 89-97. DOI: [10.1016/j.scijus.2012.12.004](https://doi.org/10.1016/j.scijus.2012.12.004) McIntyre was Hancock's PhD student.
- R3.** Frowd, Erickson, Lampinen, Skelton, McIntyre & **Hancock** (2015). A decade of evolving composites: regression-and meta-analysis. *Journal of Forensic Practice*, 17(4), 319-334. DOI: [10.1108/JFP-08-2014-0025](https://doi.org/10.1108/JFP-08-2014-0025)
- R4.** Skelton, Frowd, **Hancock**, Jones, Jones, Fodarella, Battersby & Logan (2020). Constructing identifiable composite faces: The importance of cognitive alignment of interview and construction procedure. *Journal of Experimental Psychology: Applied*, 26(3), 507-521. DOI: [10.1037/xap0000257](https://doi.org/10.1037/xap0000257)
- R5.** **Martin**, **Hancock** & Frowd (2017). Breathe, relax and remember: An investigation into how focused breathing can improve identification of EvoFIT facial composites. 2017 Seventh International Conference on Emerging Security Technologies (EST), 79-84. DOI: [10.1109/EST.2017.8090403](https://doi.org/10.1109/EST.2017.8090403) Martin is Hancock's PhD student.
- R6.** Brown, Portch, Skelton, Fodarella, Kuivaniemi-Smith, Herold, **Hancock** & Frowd (2019). The impact of external facial features on the construction of facial composites. *Ergonomics*, 62(4), 575-592. DOI: [10.1080/00140139.2018.1556816](https://doi.org/10.1080/00140139.2018.1556816)

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Funding body - PIs	Year	Amount	Title/Rating
EPSRC/DTI Link Bruce & <b>Hancock</b>	2000-2003	GBP172,000	Crime-Vus (Rated: Outstanding)
EPSRC <b>Hancock</b> , Frowd & Bruce	2005-2007	GBP224,000	Evolving a better composite (Rated: Tending to Outstanding)
EPSRC Public Engagement <b>Hancock</b> & Frowd	2006-2007	GBP36,000	Sensational EvoFIT (Rated: Tending to Outstanding)

#### 4. Details of the impact

##### Summary

This case study details effective systems and procedures for the police to identify offenders of mainly serious crime. The primary impact is its use in over 2,500 investigations across the UK and 10 other countries. This has been achieved through:

- (i) the EvoFIT facial-composite system
- (ii) enhanced interview techniques developed specifically for facial-composite construction (detailed recall of environment, holistic-cognitive interview), and
- (iii) post-production techniques (stretched composite, hat-sunglasses presentation) for enhancing recognition of finished composites by police officers and members of the public.

##### Overview

EvoFIT was conceived from the outset as a system to be used by police. We consulted police composite operators early in the development; they told us our image quality was too good and might confuse people into thinking it was an actual photograph. Cycles of development resulted in a first operational use in 2009 for a case of indecent assault; the composite led directly to the identification and confession of the perpetrator. EvoFIT is now deployed in 26 police forces (**S1**), comprising 17 of the 43 (40%) constabularies in England and Wales, plus Police Scotland and the Police Service of Northern Ireland. This figure includes 14 new users gained since 2013. In the UK it is used by police forces in Essex, Cambridgeshire, Bedfordshire, South Wales, Staffordshire, Dyfed Powys, Cheshire and Wiltshire. Beyond the UK, it is now used across Ireland and has been used for case work in Boston Police Department, Austria, Czech Republic, France and an Israeli embassy. In 2020 it was trialled in Costa Rica. The Irish police were so pleased with their new system that they made a video about it (**S3**). Thirty-eight five-year software licenses, totalling 190 years, have been purchased, and 117 police officers / staff have completed (usually) five-day practitioner training. Total income to the project to December 2020 is GBP343,600.

A recent development has been the production of an online version of EvoFIT that will permit access from anywhere with web access. The system is being trialled by Boston Police Department; early results are positive with indications that it will save time and therefore money. It has been authorised for use in one UK police force, with another in progress.

To achieve the highest identification of offenders, training courses have incorporated best procedures and software emerging from underpinning research. Each development is novel (not used previously in policing) and involved a change of practice: stretched view (published 2013 but introduced in 2015), evolve with attention to eye region (2016), ignore facial width (2016), detailed recall of (environment) crime scene (2017), enhanced (eye-region) Holistic-Cognitive Interview (2018) and hat-sunglasses secondary exhibit (R6) (2019). These milestones in research were initially introduced for police to trial to elicit feedback, and then released as a procedural or software enhancement during annual workshops attended by trained police practitioners. Users report good uptake of techniques relating to underpinning research during this REF cycle: detailed recall of environment (80% of all composites constructed), Holistic-Cognitive Interview (89%) and attentional focus to eye region (50%). See the example usage (below) for a recent illustration of the ability to add hats, beards, and sunglasses.

### Detailed assessment

In an assessment of impact completed by trained police practitioners (S2a, S2b), covering the period from September 2013 to December 2019, 2,802 witnesses and victims of crime constructed an EvoFIT composite. Based on the mean number of composites constructed by police forces per month, an additional estimated 709 composites were likely to have been created by July 2020, for a total of 3,149 constructed from September 2013 to July 2020. Police field trials (S4) indicate an arrest rate of 60%, which translates to identification of 1,889 suspects, with 29% (548) leading to conviction. For comparison, identification rates from the traditional 'E-fit' system are about 5% (S6). EvoFIT composites were requested by 1,657 different police investigators and were circulated internally to an estimated minimum cumulative total of 18,700,000 police staff (based on the mean circulation rate per force, see S2a). The assessment also revealed that, in addition to police-managed websites, investigators have published EvoFITs in 33 different media outlets. We further analysed a sample of the first 150 police appeals for information returned on the Internet using search terms such as "evofit appeal" and found EvoFIT composites were constructed in a wide range of serious crimes. A total of 250 offenders were sought by 17 police forces for serious offences including murder, rape, (sexual) assault, (attempted) child abduction, stabbing, robbery, and burglary. Asked for feedback from victims, one officer replied, "Even though it was initially explained that the composite is more like a drawing, at the end the victim exclaimed 'It's him!' (she thought that the composite is the real photo of the offender)" (S2b).

### Public engagement

In addition to the formally assessed impact described above, we have undertaken various forms of public engagement to inform a wider audience of the technology. With funding from EPSRC (rated 'Tending to outstanding') we installed an interactive exhibit at the Dundee Science Centre; further funding from the British Psychological Society (BPS) enabled exhibits for Glasgow Science Centre and 'We the Curious' in Bristol. A portable version of this popular exhibit has been used at over 15 science festivals and public events in the UK, including BPS events designed to attract school students to Psychology (S6). Hancock has talked about the development of EvoFIT, for example at an invited workshop at the University of Reading in 2018 and at a Science Cabaret at Stirling in 2016. The system has featured in TV dramas, such as 'Spooks' and 'The Fall' (S7) and featured in a BBC Ideas video about facial composites that has been viewed over 17,000 times since release in May 2020 (S9).

### Example usage

There are numerous examples where EvoFIT led to identification of offenders (e.g., S4, S5, S8). One notable case, which we cannot illustrate for legal reasons, identified a child sex offender from the 20-year-old memory of the victim. The system also produced an image of a man sought for rape in Dublin that was described by the Irish police as 'almost perfect'; the man was subsequently found, arrested and charged (S5). Because of the problems of disguise (R6), EvoFIT was deployed in a widely advertised investigation by Dyfed Powys in 2018 to locate murder suspect

Wayne Tidy. An EvoFIT of Tidy was created from the police photograph (Fig. 1, far left) with a range of disguises (Fig. 1, middle four images); Dyfed Powys reported these were very helpful (S8) when briefing officers on his likely appearance: on arrest (Fig. 1, far right), he had grown a beard similar to the centre depiction.



**Figure 1.** Example use of EvoFITs created based on police photograph of suspect (far left)

### Conclusion

Our research has revolutionised the production and presentation of facial composites, resulting in many solved cases, reduced effort for the police and a less stressful experience for the witness/victim. While we can assess usage, it is much harder to quantify the effect on public perceptions of safety or the mental state of victims. However, the likely effect on the recovery of a rape victim whose composite directly leads to the identification and capture of her attacker feels like the most important impact of all.

### 5. Sources to corroborate the impact

**S1.** List of EvoFIT police users, with dates when used.

**S2.** EvoFIT usage surveys:

**S2a.** EvoFIT facial composite images: a detailed assessment of impact on forensic practitioners, police investigators, victims, witnesses, offenders and the media. In Proceedings of IEEE International Conference on Emerging Security Technologies 2019 DOI: [10.1109/EST.2019.8806211](https://doi.org/10.1109/EST.2019.8806211)

**S2b.** Update on survey (S2a) to cover period to December 2019.

**S3.** Irish police video about their new facial composite system, EvoFIT: <http://stir.ac.uk/5a3>

**S4.** Frowd et al. (2012). Catching Even More Offenders with EvoFIT Facial Composites. In Stoica et al. (Eds.) IEEE Proceedings of 2012 Third International Conference on Emerging Security Technologies (pp. 20 - 26).

**S5.** Examples of media appeals using EvoFIT (Gardaí (Dublin), Heddlu Gogledd Cymru, Rossendale Police, Cumbria Police).

**S6.** Frowd, Hancock, Russell, & Heard (2014). Taking research to members of the public. *The Psychologist*, 27(11), 857-859. (An article in the Psychologist magazine describing development of face evolver exhibits.)

**S7.** Images from 'The Fall' on BBC1. Police Service of Northern Ireland generated the composite for the programme:



**S8.** Testimonial: Dyfed Powys Police, about use of EvoFIT images for identification of murder suspect Wayne Tidy.

**S9.** BBC Ideas video on facial composites <https://www.bbc.co.uk/ideas/videos/do-police-sketches-actually-help-catch-criminals/p08dllt4>