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‘Co-evolving’ a new way to catch criminals

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For almost two decades, Charlie Frowd and his collaborators have worked with the police to develop the EvoFIT facial composite system, leading to an estimated 5000 suspect identifications and 1500 convictions.

One sunny Sunday afternoon in August 2007, I got a call from an investigating officer from Lancashire Police. The officer explained that, the week before, a teenage male had assaulted an 11-year-old girl in a park in Blackpool. Several potential suspects had been considered and then eliminated from the enquiry. DNA was available, but did not identify a suspect. Other evidence was potentially available – the appearance of the offender’s face – but this information was only available in the victim’s memory.

The force had previously used a traditional ‘feature’ facial-composite system to recover evidence of this type, but were reluctant to try this again: they had not found it helpful in around 20 criminal investigations. They had been talking with us about a system called EvoFIT that we (Vicki Bruce, Charlie Frowd and Peter Hancock) had been developing for 10 years. This request was a great opportunity to test what we had created.

EvoFIT differs from the traditional approach. Construction via previous systems required witnesses to provide a detailed, feature-by-feature description of the face, which necessitated that they had a strong and clear memory of it. EvoFIT is less reliant on these descriptions, emphasising recognition over recall. Eyewitnesses begin by selecting resemblances of the person they saw from a series of presented face images, with their choices combined, to ‘evolve’ a face.

This seemed like a very good idea, but performance was little better than traditional composite systems: images created by EvoFIT were only recognised by those familiar with the identity about 5% of the time. We had two breakthroughs. The first de-emphasised the external parts of the face (hair, ears, neck), to increase an eyewitness’s focus on the important internal features (the area including eyes, brows, nose and mouth; Fig. 1); the second developed tools that allowed an evolved face to be enhanced ‘holistically’, by adjusting global aspects such as weight, extraversion and health (Fig. 2). The resulting system allowed a composite to be created of an unfamiliar face seen two days previously that other people could correctly name at a forensically useful rate, about 25% of the time (Frowd et al., 2010).

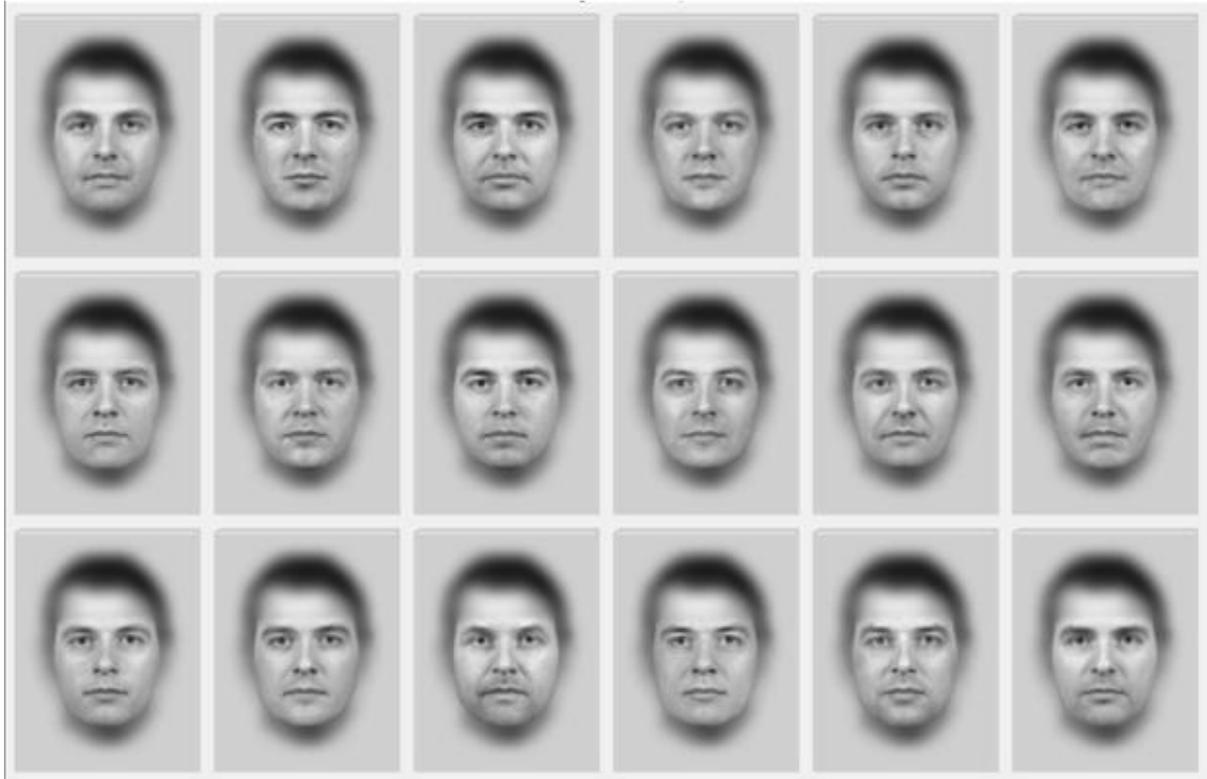


Fig. 1. Example EvoFIT face array. Presenting the external features blurred (as shown) helps constructors to more accurately select the internal features, the central area that is important for recognition of the composite (by the police and members of the public).





Fig. 2. Holistic Tools. After the face has been evolved, constructors continue to use face recognition to enhance the likeness using a set of scales that change the face globally. Shown here are scales that change weight (top row), extraversion / outgoingness (centre row) and health (bottom row); while the two right images in each row show an increase in the characteristic, the two left images show a decrease. In this example, the external features have been concealed, to allow changes to be more clearly seen (an effect on which we later capitalise).

A time was arranged to meet with the victim at Blackpool Police Station. Adhering to best practice, a Cognitive Interview was used to help the victim remember the face. This part of the process involved reinstating the context, by asking her to think back to the place of the crime, and then to freely recall the offender's face in as much detail as possible, followed by prompting for further details (cued recall). He was described as being 16- to 20-years-old with a slim build and dark, short, stubby hair, lighter at the tips. The victim then worked through the various screens in EvoFIT, selecting the best overall matches to evolve the face, and then enhancing it using holistic tools. She also remembered a scar on her attacker's forehead and an earring in his left ear, and so those were added to the image (see Fig. 3).



Fig. 3. The EvoFIT (left) was created by a victim of sexual assault in Lancashire. The facial composite was named by members of the public as the person photographed (right). These identifications led to his arrest and, in conjunction with further evidence,

conviction for the attempted rape of a child under 13 years. For further details, see https://www.lancashiretelegraph.co.uk/news/2338740.seven_year_sentence_for_teen_age_blackpool_rapist/ and Frowd et al. (2011).

Police Community Support Officers showed the composite to visitors at the park that evening, seven days after the offence took place there. Two people named the face, leading to identification of the suspect shown in Fig. 3. Property stolen from the victim was recovered from this person's home address, and the suspect was picked out of an identity parade by visitors who were at the park around the time of the crime. He was convicted at Preston Crown Court and given a seven-year prison sentence.

Field trials

The EvoFIT constructed in this case provided that all-important name, one that gave focus to the investigation: to assess whether the person named was likely or not to be responsible for the offence. While laboratory research is important to indicate system performance, it is success in real cases that matters. As such, Lancashire police conducted a field trial of EvoFIT. This six-month assessment revealed that EvoFIT was valuable: 20 per cent of composites constructed by witnesses and victims directly led to the identification of a suspect.

Derbyshire police evaluated EvoFIT over a longer (12-month) period. This additional exercise found a similar rate of arrest (19.3 per cent). It also revealed that, in 44 per cent of cases, a name was put forward for a composite. While not all of these suggestions were likely to have been correct, police investigators tell us that names given add value to an investigation by allowing the number of *potential* suspects to be reduced.

Further enhancements

We returned to the laboratory in search of more effective procedures. One project simplified the Cognitive Interview, asking eyewitness only to *freely* recall the offender's face (rather than to then prompt for further recall). This change to the interview protocol dramatically increased suspect identification, from 20 per cent to ~40 per cent (Frowd et al., 2011), highlighting the importance of this interview (see also later). A second project examined the impact of the external features presented in EvoFIT face arrays. It led to the surprising finding that best performance occurred when only the internal features (Fig. 4) were selected, evolved and enhanced, with external features added thereafter. When face constructors used both developments together, the resulting composites were named at a remarkable 45 per cent correct (e.g. Frowd et al., 2012).



Fig. 4. An example of a more recent EvoFIT face array. This improved interface to memory presents internal features for eyewitnesses to select the best overall matches, with selected images evolved and enhanced (e.g., using holistic and shape tools). External features are selected and added towards the end of face construction.

More success

We received another request for assistance in 2012, this time out of the blue, from Greater Manchester Police. The relevant investigation focused on a series of sexual assaults on young women in the south area of Manchester, several of which were particularly callous. The rapist was described as being male, around 30 years of age and was believed to have been offending for seven years. A composite (from another system) had been created in the case but as there were concerns about the quality of the image, it was not used to try to identify the offender.

An EvoFIT composite was arranged to be constructed seven days after the most recent offence using the best procedures (described above) suggested by research. The revised (shortened) version of the Cognitive Interview was used, after which the victim worked through the various face arrays, selecting the best matches from the presented screens of internal features, then adjusting the global characteristics of the face with holistic tools (for weight, age, health, etc.) before adding external features (and lightening them) to create the composite (Fig. 5). The image was released to the media and was consistently named as a well-known resident of the community in Chorlton. On arrest, the suspect admitted that he would have continued offending had he not been stopped. He received an indefinite prison sentence.



Fig. 5. The composite shown on the left was constructed by a victim of sexual assault. This image was released in the media, leading to identification and later conviction of the person shown on the right (<https://www.manchestereveningnews.co.uk/news/local-news/jailed-rapist-who-prowled-streets-871487>).

The EvoFIT constructed in this case is striking, particularly for the likeness of the upper half of the face. The composite initiated several research projects that highlighted the importance of the eye area – the eyes, brows and area of the face in between (e.g., Fodarella et al., 2017; Skelton et al., 2020). These projects indicate that more effective composites are created when constructors focus on the eye area, both during the Cognitive Interview and when selecting from the presented face arrays. These modified procedures are now best practice, helping subsequent eyewitnesses to create more identifiable faces.

The ‘internal features’ version of EvoFIT (Fig. 4) was subject to further assessment. This exercise was carried out by Humberside Police and indicated that EvoFIT and its associated procedures were now more effective: 60 per cent of faces created during the trial period led to identification, with 29 per cent of those cases resulting in conviction.

Taking EvoFIT online

During the Covid pandemic, we received another request for assistance, this time from Cumbria Police. Measures taken to prevent viral transmission at this time usually meant that composites were not created, or practitioners were required to wear protective suits, and so there was a need to formulate a different approach.

We had been working on procedures for use in less serious crime – where EvoFIT also appears to be effective (as Fig. 6 illustrates). In these cases, we anticipated that police practitioners would not have time to interview witnesses due to resources being needed for more serious offences, and thus we had developed a self-administered version of EvoFIT where witnesses themselves could create the face either as an application installed on a personal computer or via a web browser (<https://research.evofit.cloud/>). We had demonstrated that this system had good utility in an experimental setting, with composite naming at ~50% correct (Ford et al., 2025). In the Cumbria Police case, the witness was able to construct a face online that benefitted the investigation. Since

then, several forces have adopted 'self administered' EvoFIT, even using it (e.g., due to financial constraints) for serious crime (e.g. murder).



Fig. 6. The composites shown to the left and centre were created by two witnesses to bicycle theft perpetrated by a young male. A photograph of the person identified in the investigation is shown on the right (see Frowd et al., 2011 for further details).

Concealed identity

As is usually the case, including the investigations illustrated above in Fig. 3, 5 and 6, the person believed to be responsible is identified soon after a composite has been constructed. At other times, the offender may be at large for longer, and so his or her appearance can be markedly different – for example, the person’s hair may grow or otherwise be changed, naturally, or deliberately in an attempt to conceal identity. We were approached by Dyfed-Powys Police with such a dilemma. Their request arrived at a time when we had obtained laboratory findings to suggest that composite recognition could be improved when parts of an image were concealed with a hat and / or opaque sunglasses (Brown et al., 2019). The police case involved a middle-aged male suspected of murder who had gone on the run. We created a composite of the suspect that was shown in different ways, with this array of images used to brief officers who were in search of him. One of these images proved to be particularly useful (Fig. 7).



Fig. 7. Locating a murder suspect. A composite was created of a murder suspect being sought by police in Wales (far left), a likeness from which we created alternatives. These images were used to brief officers as to his likely appearance. A month later, on

arrest (far right), he had grown a beard similar to the depiction shown on the centre-right (<https://www.westerntelegraph.co.uk/news/17560858.murderer-went-run-sentenced-life-prison/>). The depictions demonstrate how a person's appearance can differ drastically if facial hair has changed or accessories have been added.

An active search

We are currently helping officers from Police Scotland's Fugitive Active Search Unit to locate another murder suspect, Derek Ferguson, who has been at large for 18 years. Here, based on evidence collected in the case, we considered alternative depictions showing the face not just with different hair and accessories but also with likely changes to age and lifestyle (e.g., Fig 2). The case is ongoing, and readers might like to play the animated sequence created as part of the appeal for information on Sky News (<https://news.sky.com/story/police-release-animated-image-of-man-wanted-for-2007-murder-of-thomas-cameron-12926675>).

Where next?

We want to make facial composites as identifiable as possible: more effective evidence means that a composite needs to be circulated among fewer people for identification, saving police time. Also, previously, we relied on methods for facilitating recognition of finished composites, such as by presenting the face as a dynamic caricature or by viewing the face side on. However, such methods are impractical to use in all cases, and so we have been developing the Cognitive Interview and EvoFIT so that enhancement techniques are not needed in the first place – although they still have value when a further police appeal for information is necessary, such as in the case of Derek Ferguson.

In terms of ongoing work, as described in the accompanying online article and Frowd (2021), one of the newer techniques invites witnesses to write down a detailed description of the face prior to the initial Cognitive Interview, allowing consolidation of face memory and valuable practice with face recall. In another project, we have optimised the 'population size', the number of faces shown for the witness to select when evolving the face. In a third project, the "self-administered" system (mentioned earlier) is the focus of development, as this technique is likely to be increasingly important for reducing the amount of police time and resources required for face construction. In other work, we are developing procedures that adapt to young and elderly victims, help the police and public to better recognise composites, are sensitive to the crime scene (e.g., for different viewing distances) and reduce cognitive load. More generally, our research continues to seek ways to increase identification of facial composites from all software systems, not just EvoFIT.

A lovely challenge

Being involved in applied psychology is fascinating. In the early days, our time involved demonstrating the capabilities of the system, carrying out field trials and running

training courses. The demand has been such that training for police staff has become a regular event, one that requires five days to cover the Cognitive Interview, EvoFIT, forensic guidelines and exhibiting of evidence. This initial training is supported by annual workshops, necessary to maintain skills for face construction as well as a vehicle for discussing enhancement with police practitioners.

Indeed, police practitioners have good insight into potential ways to improve the process – ideas that form research projects. For example, a practitioner recently mentioned that elderly witnesses might benefit from blurring the lower half of the face, to help focus on the eye area—a suggestion that research has shown to be beneficial for face construction (manuscript in prep.). In general, promising techniques emerging from research are discussed and considered for cautious use on a trial basis, with some later becoming best practice (e.g., following research on the ‘internal features’ EvoFIT or on the benefit of initial witness focus on the eye area).

Our long-standing collaboration with police forces has been extremely productive, resulting in many staff being trained, and the EvoFIT system deployed on a regular basis. EvoFIT has been used in criminal cases in over 30 police forces in the UK, Europe and further afield, assisting in over 8,500 investigations. The impact is measurable: based on results of the field trials, EvoFIT composites of suspects have been recognised 5,000 times, with 1,500 convictions arising from these identifications. It is extraordinary that EvoFIT has been so successful despite the presence of severe cuts to police budgets; in fact, EvoFIT may help to mitigate the effect of constraints on funding.

The story of EvoFIT is shining example of collaborative research, one that involves the leadership and enthusiasm of many cognitive researchers including Charity Brown, Vicki Bruce, Cristina Fodarella, Peter Hancock, Emma Portch and Faye Skelton. Over time, we have observed that research problems and questions ‘co-evolve’: as we have gained understanding about one aspect of the process (e.g., how witnesses interact with EvoFIT), we have been able to evolve other aspects (e.g., the initial interview and the way in which composites are presented for recognition). Taking this approach will no doubt help to further optimise each stage of face construction and recognition. We continue with the lovely challenge of making the process as effective as possible, to maximise the chances that offenders will be identified correctly using this source of forensic evidence.

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References

Brown, C., Portch, E., Skelton, F. C., et al. (2019). The impact of external facial features on the construction of facial composites. *Ergonomics*, 62, 575-592.

Fodarella, C., Frowd, C. D., Warwick, K., et al. (2017). Adjusting the focus of attention: Helping witnesses to evolve a more identifiable composite. *Forensic Research & Criminology International*, 5, DOI: 10.15406/frcij.2017.05.00143.

Ford, C. J., Portch, E., Bate, S., & Mestry, N. (2025). Going it alone: Combining self-administered interview techniques with EvoFIT's self-administered facial composite construction. Poster presented at the meeting of the *Experimental Psychology Society*, 8-10 January 2025, London.

Frowd, C. D. (2021). Forensic Facial Composites. In M. Togli, A. Smith, A., & J. M. Lampinen (Eds.) *Methods, Measures, and Theories in Forensic Facial Recognition*. Taylor and Francis (pp. 34-64). Taylor and Francis.

Frowd, C. D., Hancock, P. J. B., Bruce, V., et al. (2011). Catching more offenders with EvoFIT facial composites: lab research and police field trials. *Global Journal of Human Social Science*, 11, 46-58.

Frowd, C. D., Pitchford, M., Bruce, V., et al. (2010). The psychology of face construction: Giving evolution a helping hand. *Applied Cognitive Psychology*, 25, 195–203.

Frowd, C. D., Skelton F. C., Atherton, C., et al. (2012). Recovering faces from memory: the distracting influence of external facial features. *Journal of Experimental Psychology: Applied*, 18, 224-238.

Skelton, F. C., Frowd, C. D., Hancock, P. J. B., et al. (2020). Constructing identifiable composite faces: the importance of cognitive alignment of interview and construction procedure. *Journal of Experimental Psychology: Applied*, 26, 507–521.