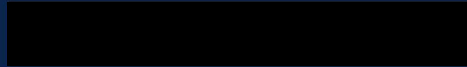




**Australian Government**  
**Department of Defence**  
Science and Technology

# Morph detection by humans: an Australian perspective



**International Conference on Biometrics for Borders 2019:**  
**Morphing and Morphing Attack Detection Methods**  
**Warsaw 9-10 October 2019**

# The morphing issue: a human perspective

- If a morph persona gets into a system, it is [REDACTED]  
[REDACTED] will be matched using automated facial recognition and verified facial comparison (Sellers, 2019)
- Most work on morphing is on technology [REDACTED]

# Detection by humans: what do we know?

- Previous studies have examined performance for (zero-effort) morphed images (2-3 images) as well as other forms of manipulation (e.g., face swaps, 2017; disguise)
- Detection of face morphs and artefacts a

## Our detection work: key questions

- What variables impact on human detection?

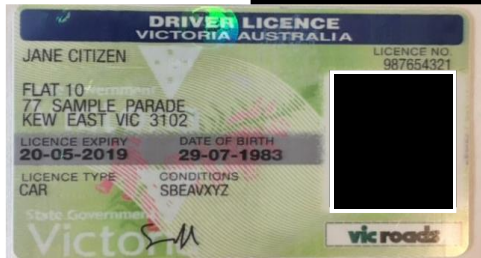
- [redacted] on
- image quality
- expertise

- What are the [redacted] of [redacted]?

- How can this [redacted]?

# Method of presentation

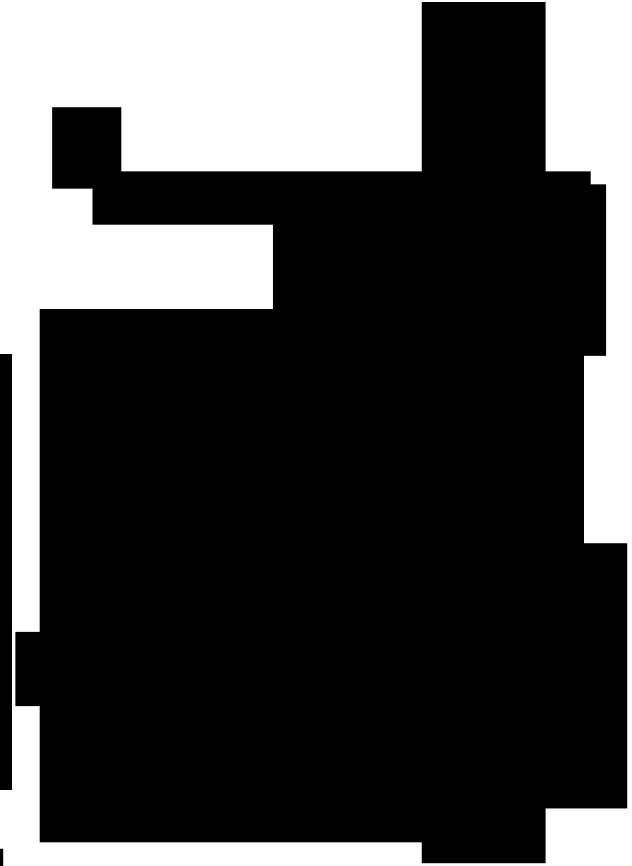
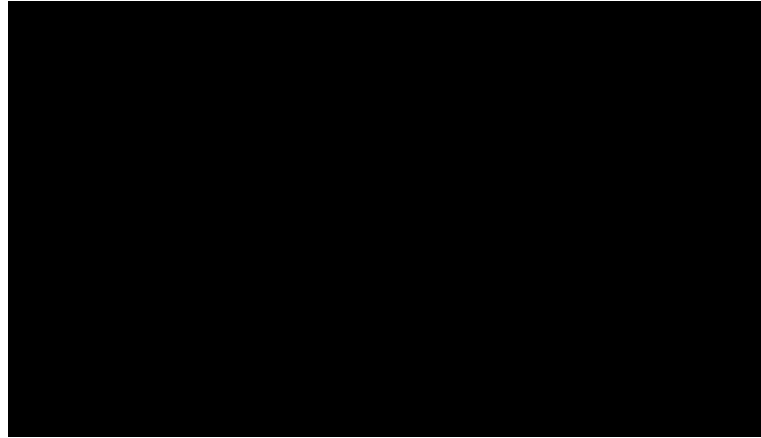
- Is detection a function of the method in which the face is presented?
  - on an identity document versus on a computer screen



# Face quality: original v print-scanned

- Is detection a function of face quality?

— d?



Images: for illustration purposes only, generated following Karras, T., Laine, S. and Aila, T. (2018) A Style-Based Generator Architecture for Generative Adversarial Networks. arXiv:1812.04948, <https://arxiv.org/abs/1812.04948>

# Expertise: novices v experts, but what kind of experts?

- Are experts better than novices at detection?

- Who are the experts? There is currently no group dedicated to this area. There are two groups of experts:
  - facial comparison
  - imagery

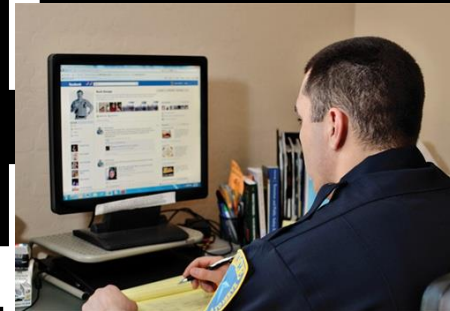


Image: <http://www.policemag.com/magazine/2011/10.aspx>

# Overview

## ■ 300 detection trials

- 100 on an ID card (5 face types, 50% raw/digital, 50% print-scanned)
- 100 on screen 8x10cm (5 face types, 50% raw/digital, 50% print-scanned)
- 100 on screen 8x10cm (5 face types, 50% raw/digital, 50% print-scanned)

## ■ N = 108 participants

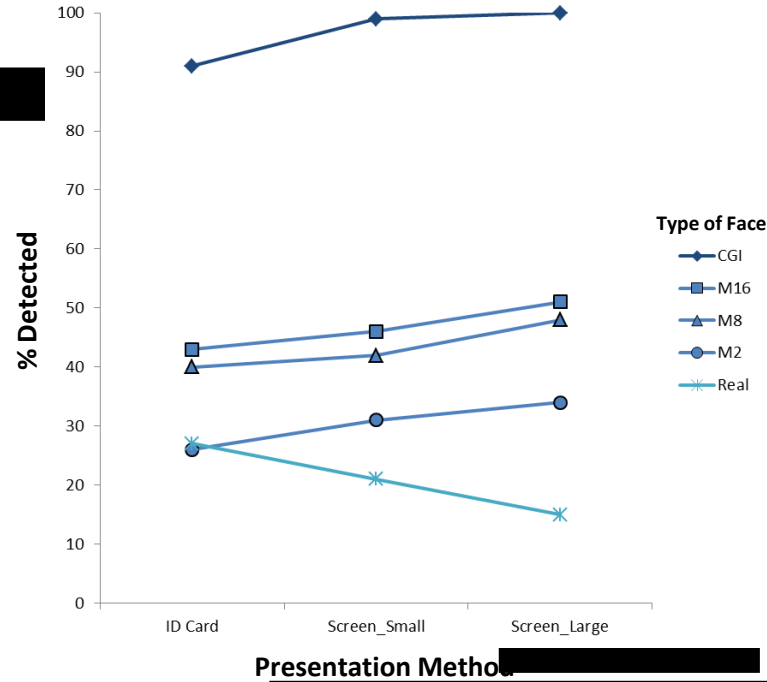
- 66 novices (DSTI)
- 42 experts (24 from law enforcement, 18 from security agencies)

## ■ Participants were asked to identify faces as real or fake

- if a face was declared fake, participants were asked to please tell us why

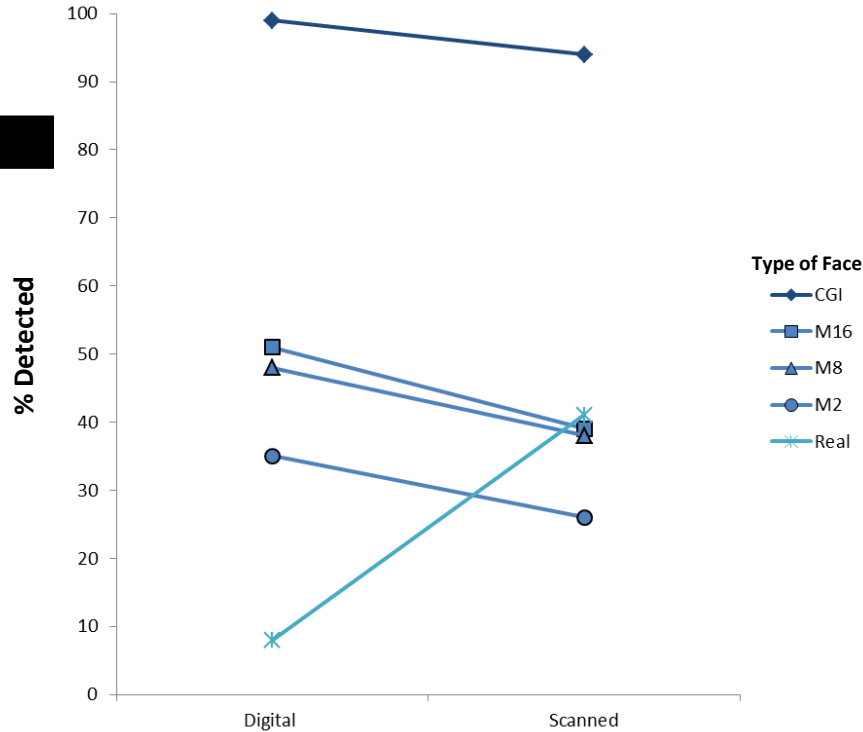


# Detection as a function of presentation method

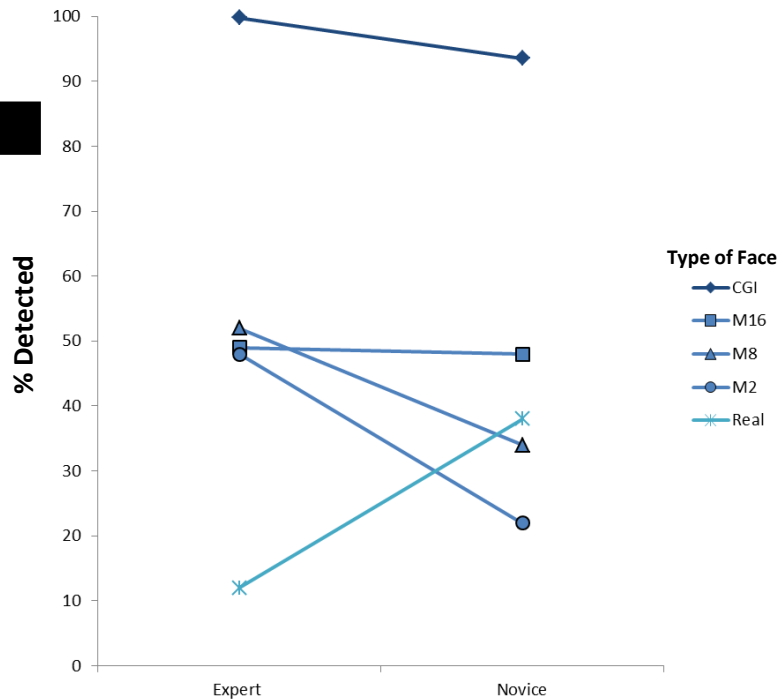


CGI faces most  
(although once  
almost 10% pas

# Detection as a function of face quality



# Detection as a function of expertise



No significant difference  
between experts and no

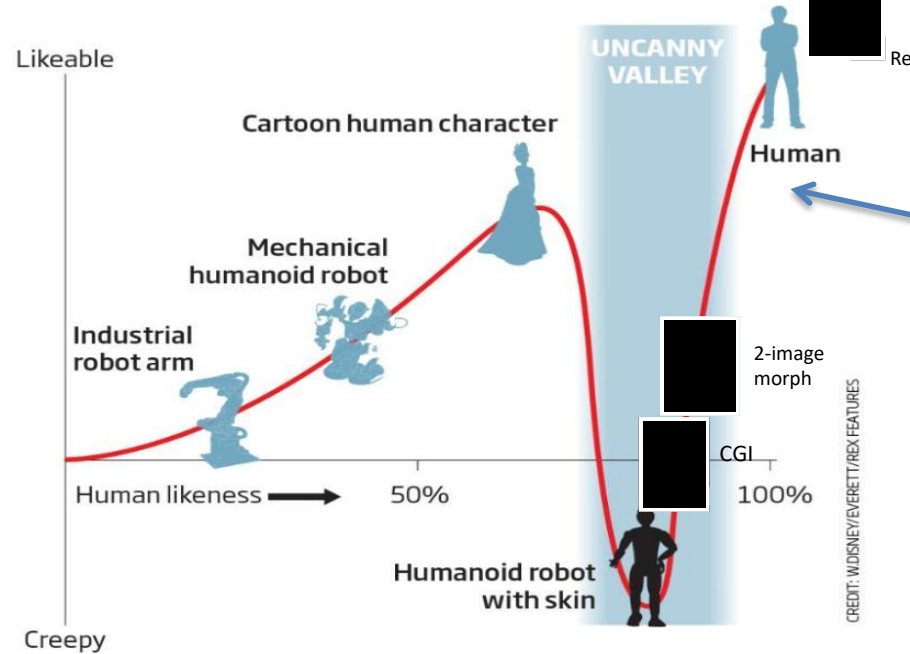
CGI, 16-imag

# What are the detection cues?



Theme	Detection Cues
Eyes	Creepy, lifeless, too large, colour not right, shadowing or extra detail that shouldn't be there particularly around the medial canthus and iris
Skin appearance	Weird, smooth texture, appears 'Photoshopped'
Lighting	Lighting not right, strange shadows appear where they shouldn't
Facial features (not eyes)	Misaligned, blurring or ghosting of features (particularly around the nostrils), features can appear out of proportion or lack definition
Face-head mismatch	Misplaced lines across the forehead, strange hairline, weird transition from the face to the neck
Image appearance	Appears airbrushed or 'Photoshopped', something not right
Face shape	Too symmetrical, seems too perfect, proportions slightly off
Face colouring	Colour of the face appears off, strange hues, uneven contrast
Expression	Unnatural, uneasy or emotionless
Overall impression	A feeling of something not being right, lack of detail, a feeling of not being natural or lifeless

# Uncanny valley (Mori, 1970)



Images: for illustration purposes only, generated following Karras, T., Laine, S. and Aila, T. (2018) A Style-Based Generator Architecture for Generative Adversarial Networks. arXiv:1812.04948, <https://arxiv.org/abs/1812.04948> and Matheson, H. E., & McMullen, P. A. (2011). A computer-generated face database with ratings on realism, masculinity, race, and stereotypy. Behavior Research Methods, 43(1), 224-228; <https://www.newsscientist.com/article/dn28432-into-the-uncanny-valley-80-robot-faces-ranked-by-creepiness/> and author's own

## How can we improve detection?

- Train those in roles where there is a high risk of coming into contact with such images to spot the tell-tale signs
  - focus on specific features (recurring cues)
  - understand those produced by those techniques
  - don't disclose to a technician
- Robertson et al. (2018) particularly for improving the performance

Ref: Robertson, D. J., Mungall, A., Watson, D. G., Wade, K. A., Nightingale, S. J., & Butler, S. (2018). Detecting morphed passport photos: a training and individual differences approach. *Cognitive research: principles and implications*, 3(1), 27.

# How can we improve detection?

- Focus must be on developing technology that can be applied to large datasets and detects across both digital and physical formats
- Don't forget to
  - if technology
  - what are the
  - who are the b



for detectability

for detectability

Images: for illustration purposes only, generated following Karras, T., Laine, S. and Aila, T. (2018) A Style-Based Generator Architecture for Generative Adversarial Networks. arXiv:1812.04948, <https://arxiv.org/abs/1812.04948>.

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This research  
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Defence Science & [REDACTED] up, Aust