University of Strathclyde Glasgow

Morphed Passport Photo Detection by Human Observers

[redacted]

FRONTEX ICBB2019 Warsaw

[redacted]

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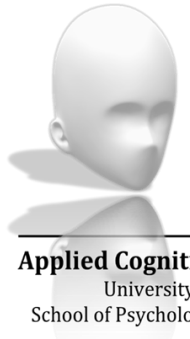

R^2

Applied Cognitive Psychology Lab
University of Strathclyde
School of Psychological Sciences & Health

Within-Person Variability

University of Strathclyde Glasgow

Within-Person Variability

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Provides A Route To ID Fraud

19%

Burton, White & McNeill (2010).

~Range of10%-30% UFM errors are the norm

The Morph Problem

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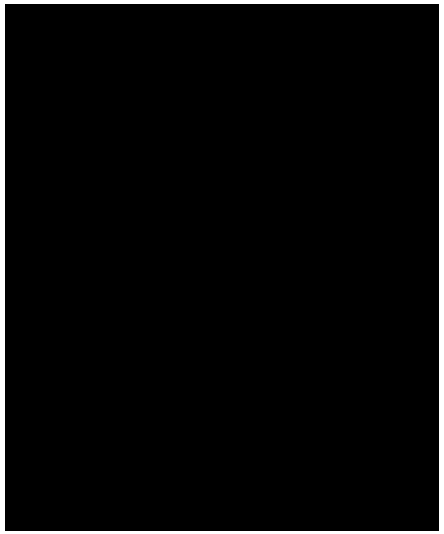
The Fraudster

F.O.G

Study 1
Detecting Morphed Photos

Robertson, D. J., Kramer, R. S., & Burton, A. M. (2017). Fraudulent ID using face morphs: Experiments on human and automatic recognition. *PloS one*, *12*(3), e0173319.

Study 1 Experiment 1



Match

Mismatch
Original Owner

Morphed Image
(Owner + Fraudster)

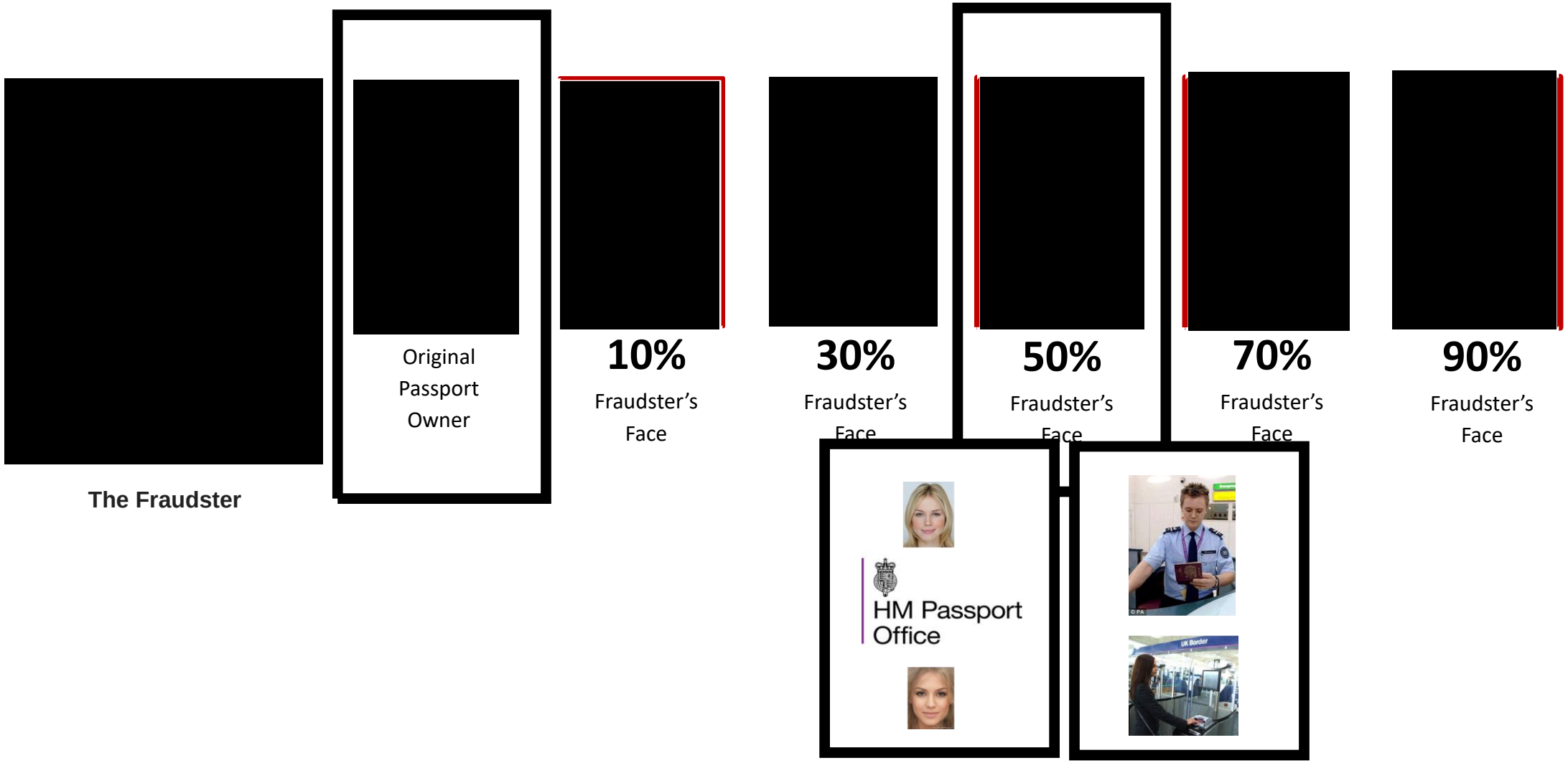
No Awareness of Morph Fraud

Press 1 For Match

Press 2 For Mismatch

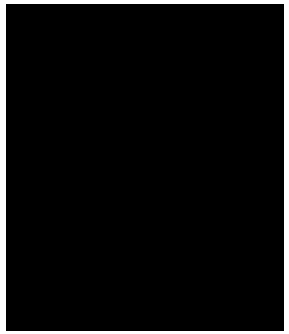
Study 1 Experiment 1

No Awareness of Morph Fraud

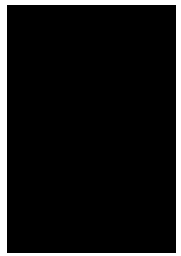


Study 1 Experiment 1

No Awareness of Morph Fraud



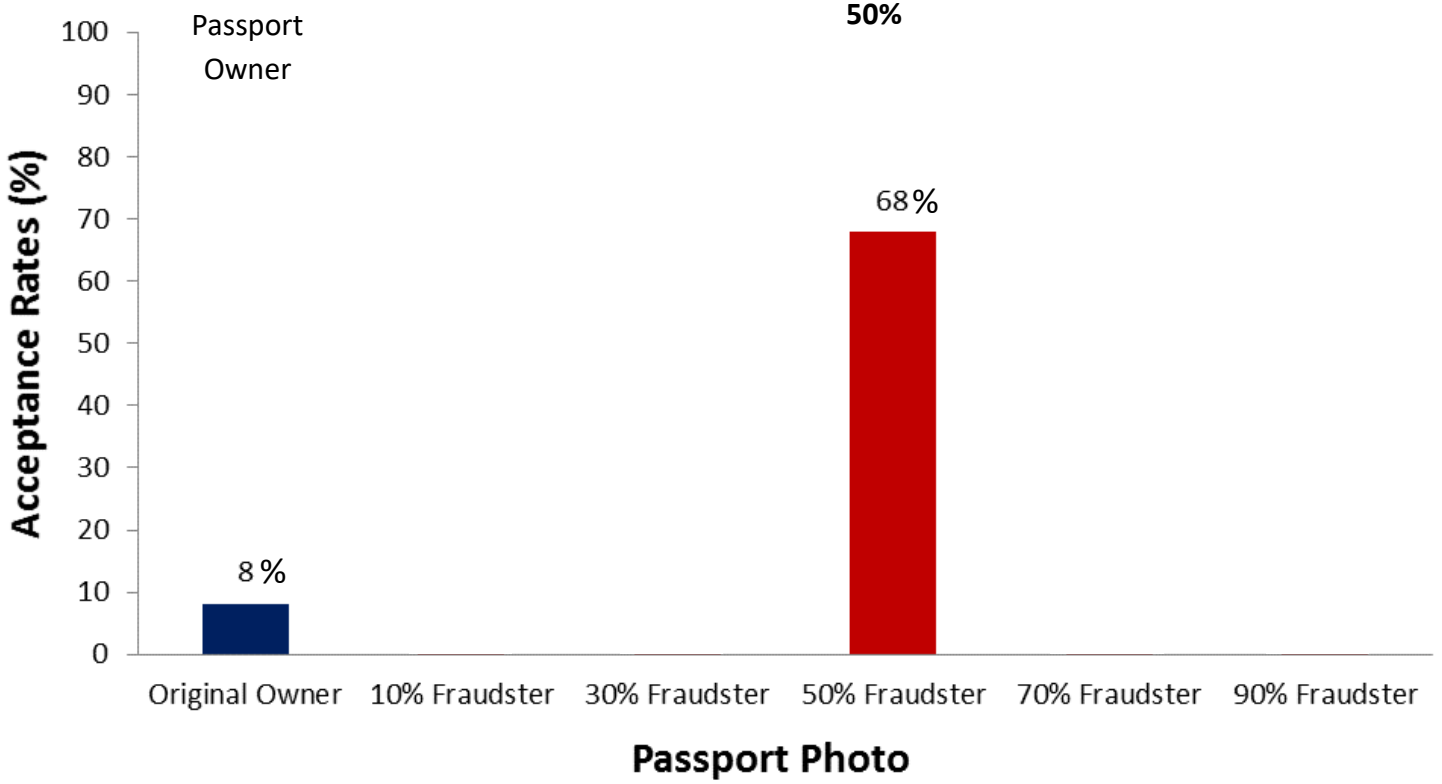
The Fraudster



Passport Owner

50%

60%



Study 1 Experiment 2

Awareness Morphs Contained Within Set

Here is an example of the morphing process, and some tips on what to look out for.

This is the person who's passport has been stolen

This is an image of the fraudster (the person who has stolen the passport)

The fraudster can use commonly available technology (e.g. photoshop) to make a new morphed image which can contain different 'amount's of the owner's face and their own. Here are some examples.

Tip 1: Ghost like outline of another face

Tip 2: Does the image look altered in any way

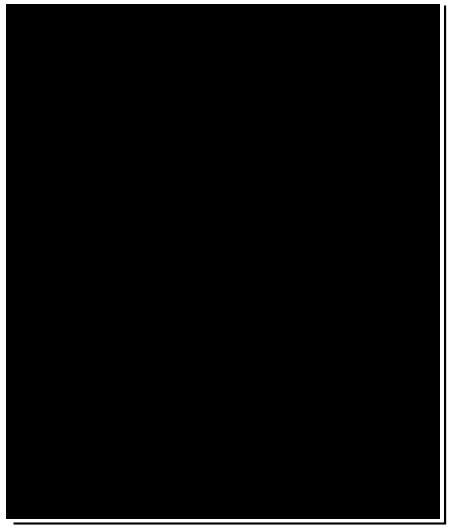
100% Image of Owner	20% of Fraudster's face added	40% of Fraudster's face added	60% of Fraudster's face added	80% of Fraudster's face added	100% Image of Fraudster

Tip 3: Changes at the neck area (ghost outline of another person's shirt collar for example)

Tip 4: A dark patch over forehead could indicate a morph (one person wears hair up, the other down)

Study 1 Experiment 2

Awareness Morphs Contained Within Set



Match

Mismatch
Original Owner

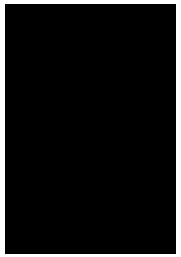
Morphed Image
(Owner + Fraudster)

Press 1 For Match
Press 2 For Mismatch
Press 3 For Morph

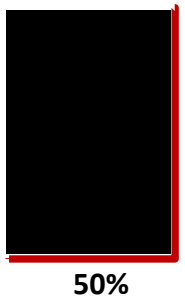
Study 1 Experiment 2

Awareness Morphs Contained Within Set

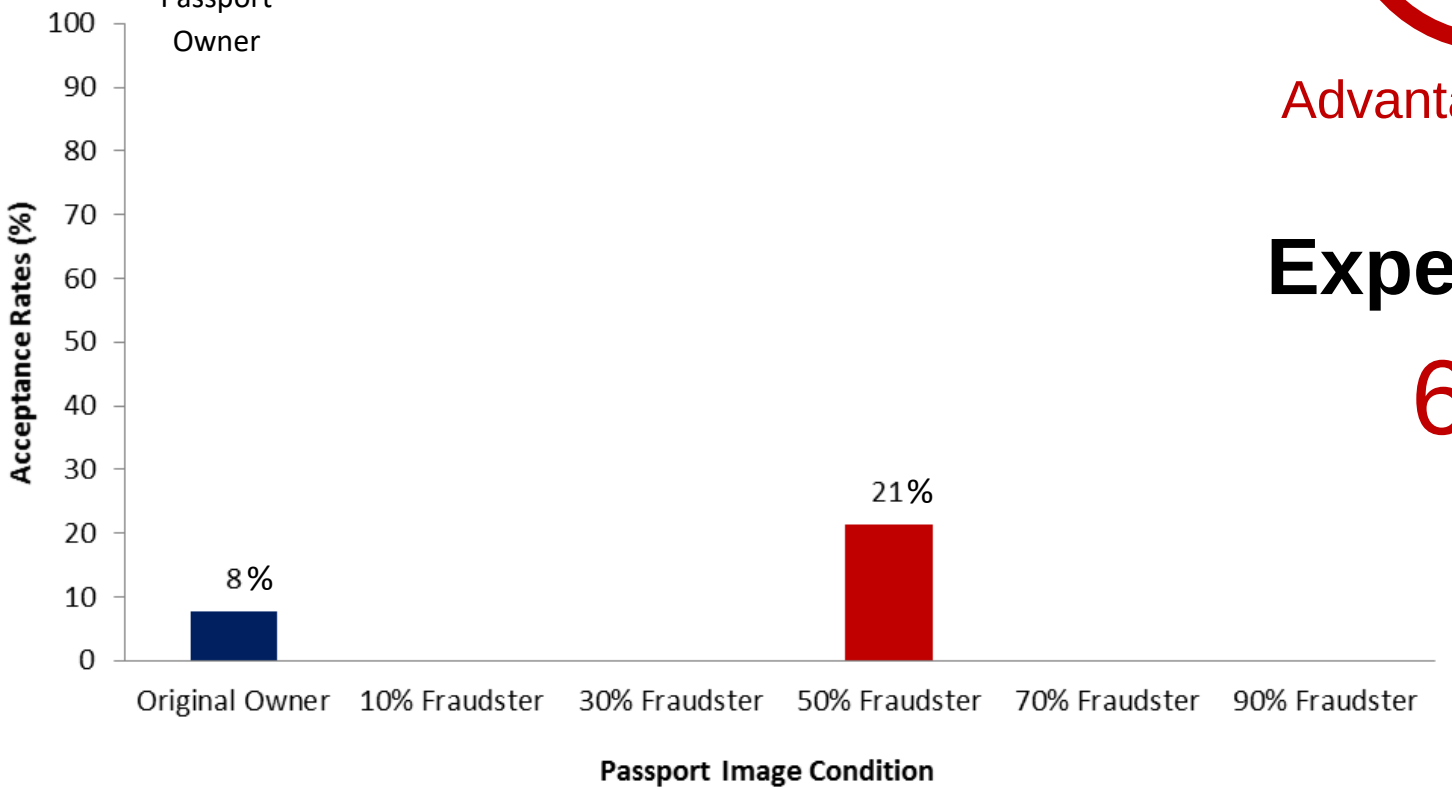
The Fraudster



Passport Owner



50%



Experiment 2

13%

Advantage Reduced

Experiment 1

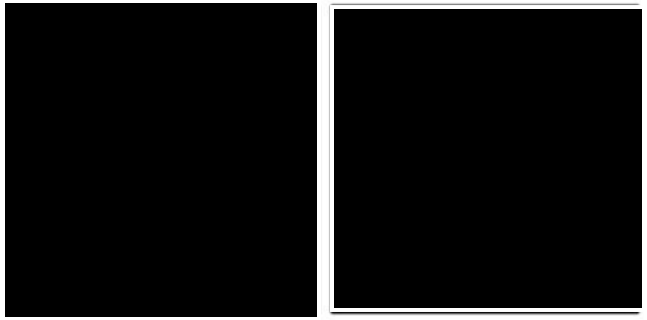
60%

Study 2
Improve Morph Detection?

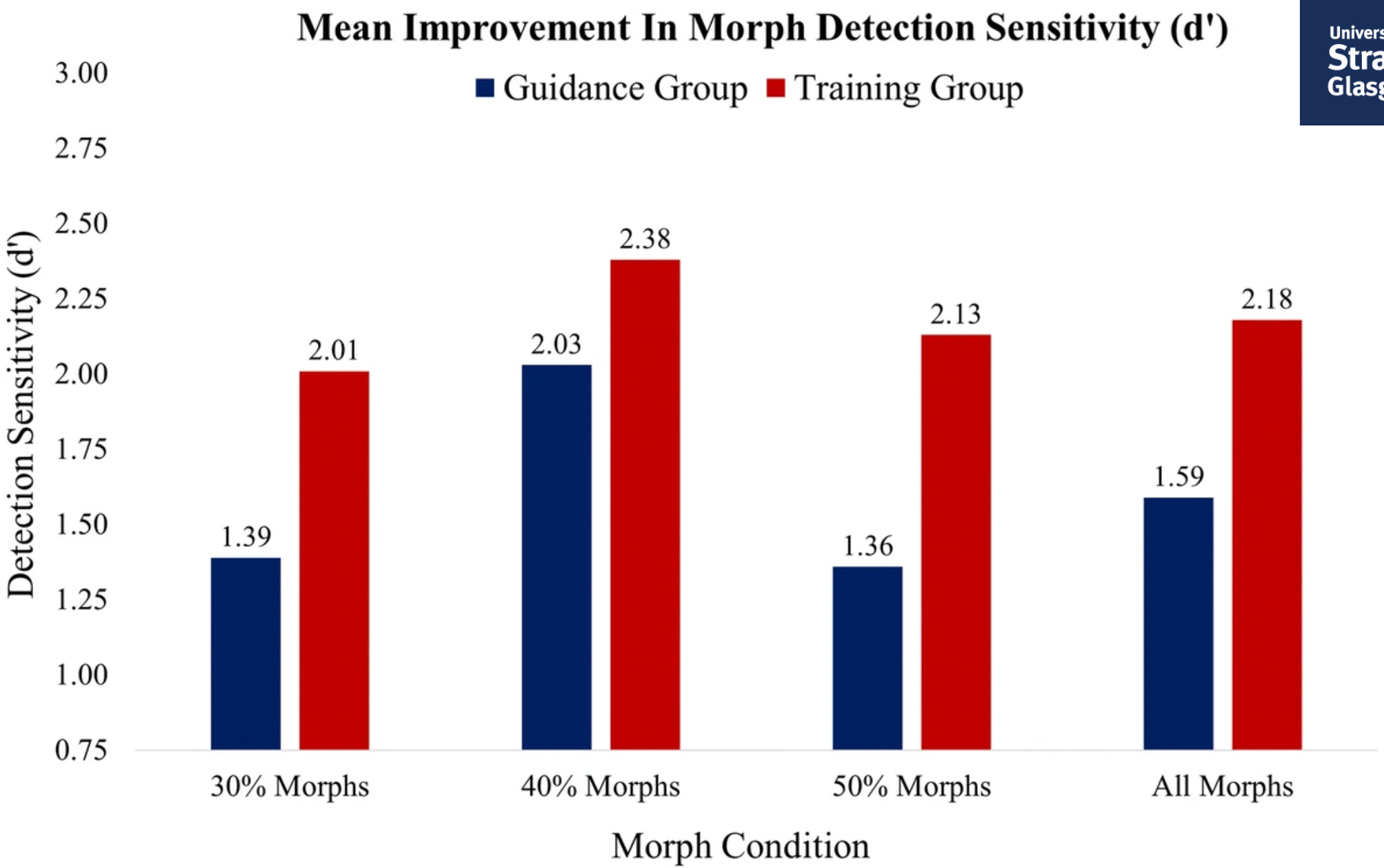
Robertson, D. J., Mungall, A., Watson, D. G., Wade, K. A., Nightingale, S. J., & Butler, S. (2018). Detecting morphed passport photos: a training and individual differences approach. *Cognitive research: principles and implications*, *3*(1), 27.

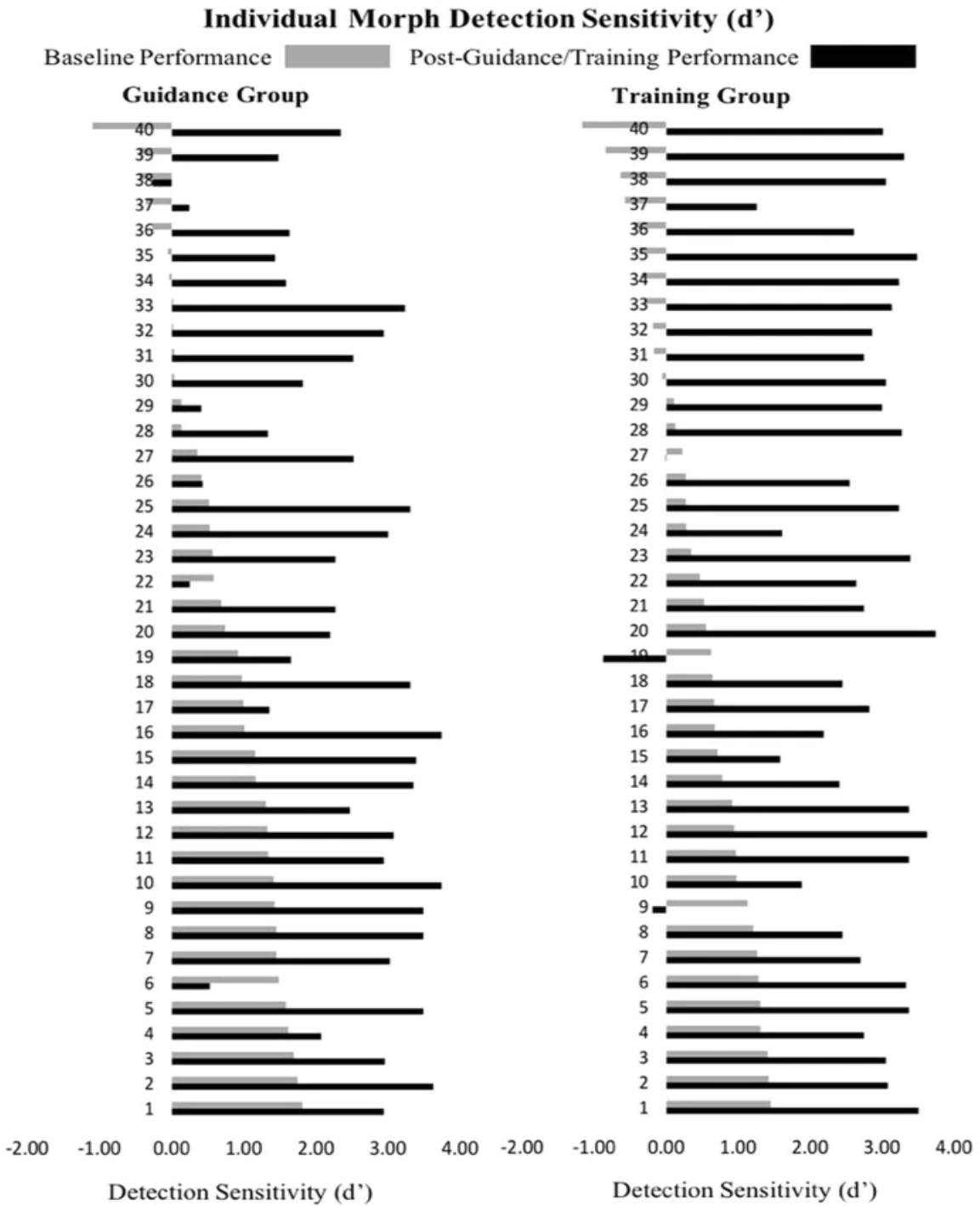
Pre-Training
Face Photo Arrays

Rudimentary Morph
Detection Guidance



Chance Level


Mean Improvement In Morph Detection Sensitivity (d')
Guidance Group
Training Group
Detection Sensitivity (d')
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
1.39
2.01
2.03
2.38
1.36
2.13
1.59
2.18
30% Morphs
40% Morphs
50% Morphs
All Morphs
Morph Condition



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Basic 2AF Training only benefitted initially poor performers

Study 1 & 2

Are super-recognisers also super-morph-detectors?

Robertson, D. J., Noyes, E., Dowsett, A. J., Jenkins, R., & Burton, A. M. (2016). Face recognition by metropolitan police super-recognisers. *PloS one*, *11*(2), e0150036.

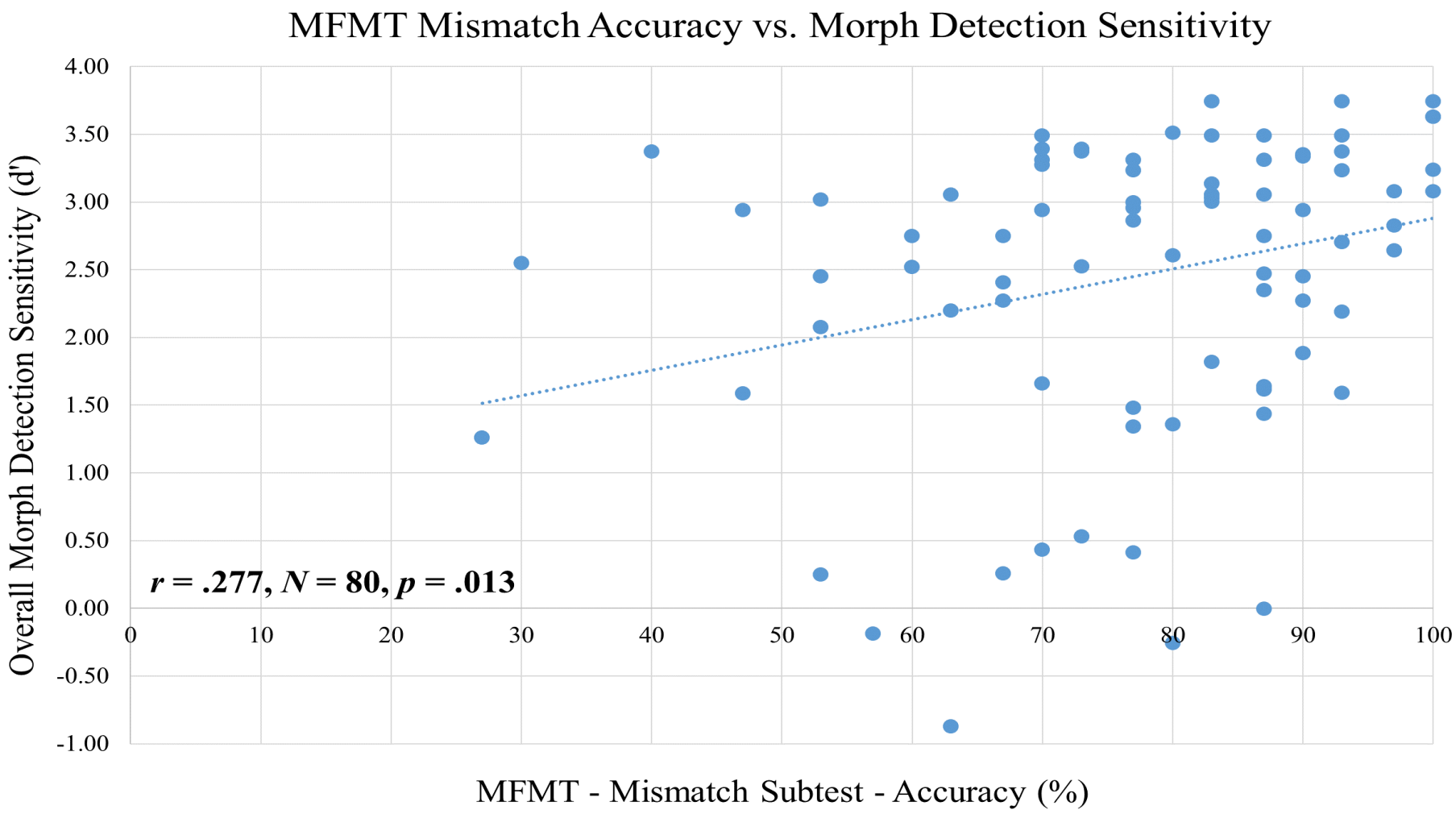
Individual Differences

Occupational Experience

Super-recognisers?

Towler, A., Kemp, R. I., Burton, A. M., Dunn, J. D., Wayne, T., Moreton, R., & White, D. (2019). Do professional facial image comparison training courses work?. *PloS one*, *14*(2), e0211037.

Data From Study 2



Support for selection

Summary

- Morphed passport photos are difficult to detect
- Awareness/Detection guidance improves performance
- Basic 2AFC training can provide a further benefit
- Identity recognition/morph detection may be linked
- Present data supports a selection and training approach

Caveats & Considerations

- We assume our set includes poor/moderate quality morphs
- Only use Caucasian observers/Caucasian Morphs
- Science/Practitioner partnerships (accessing real F. Attempts)
- May therefore be overestimating human detection rates
- See recent paper by Kramer et al. (2019)
- High quality morph detection may be beyond human perceptual capabilities
- Machine detection may be the best approach

References

Robertson, D. J. (2018). Face recognition: security contexts, super-recognizers, and sophisticated fraud. *The Journal of The United States Homeland Defence and Security Information Analysis Center (HDIAC)*, *5*(1), 6-10.

Kramer, R. S., Mireku, M. O., Flack, T. R., & Ritchie, K. L. (2019). Face morphing attacks: Investigating detection with humans and computers. *Cognitive research: principles and implications*, *4*(1), 28.

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