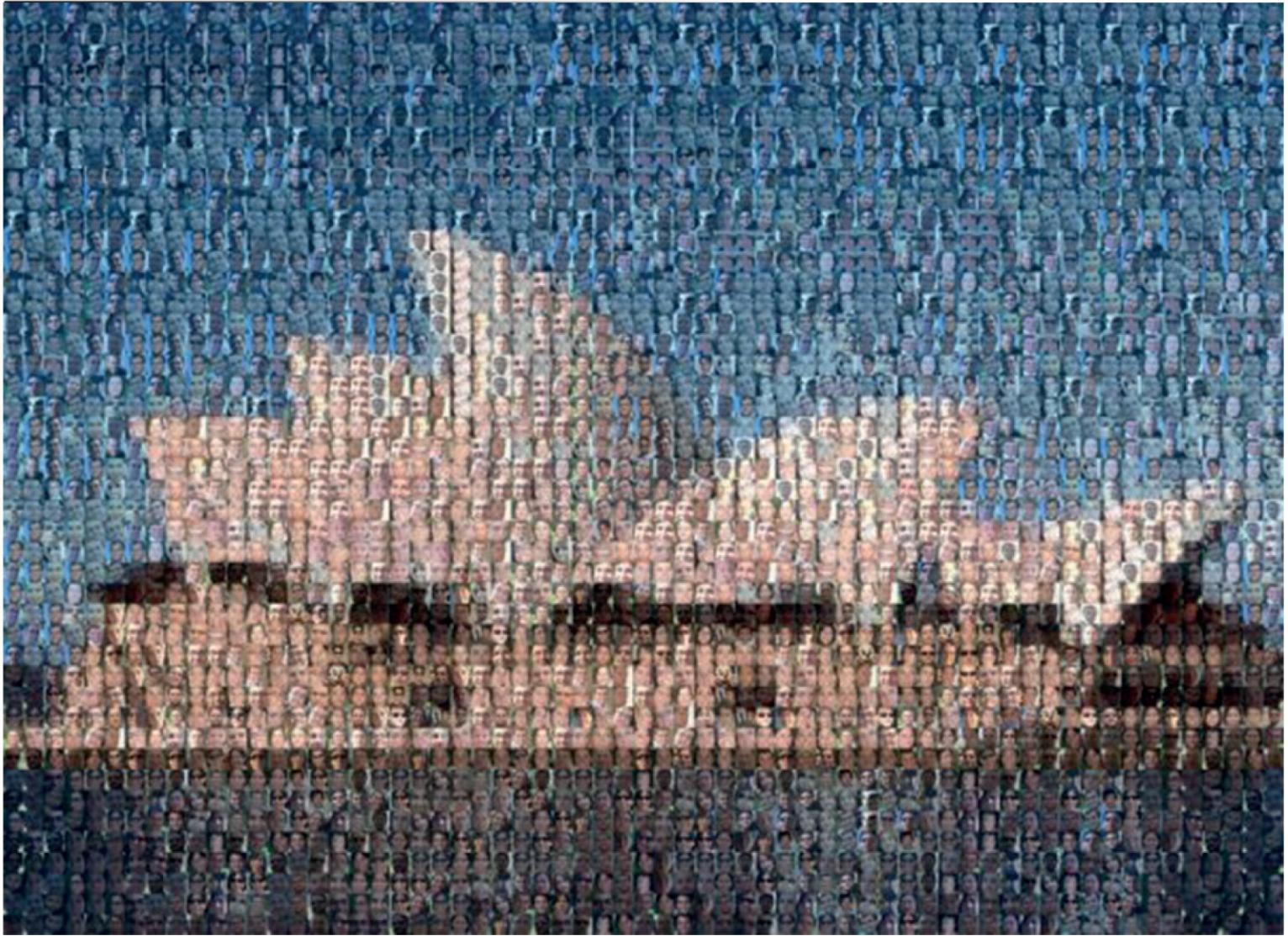


UNFAMILIAR FACE MATCHING RESEARCH MEETING



Theory and Practice
In Unfamiliar Face Identification

19-20 February 2014



UNSW
AUSTRALIA

Introduction

Welcome to the Unfamiliar Face Matching Research Meeting 2014. The Unfamiliar Face Matching Research Meeting is a forum focusing on the applied and theoretical aspects of unfamiliar face matching. It provides an opportunity for both researchers and end-users of face matching systems to present and discuss the objectives, directions and outcomes of research in the field.

The first Unfamiliar Face Matching Research Meeting was held at UNSW in February 2013. The meeting was a great success, bringing together users, developers and designers of security systems that deploy Automatic Face Recognition software, with researchers studying human user performance in these systems. The meeting provided an informal setting where the latest research findings were presented and the practical implications of the work was discussed. From this meeting, it became apparent to us that while the 'human factor' in FR systems remains a neglected area of study in general, Australia is emerging as a world leader in this type of research.

Research in this field has important practical applications, potentially leading to an improvement in our ability to detect identity fraud and other crime. But this research has also led to significant advances in theory and particularly a better understanding of the differences between familiar and unfamiliar face processing.

The study and application of unfamiliar face matching is an area in which Australia has particular expertise, with several active research groups and excellent collaboration with users from various sectors of government. We hope that this forum will enable delegates to identify common problems and encourage collaborative projects in the future.

Richard Kemp, David White & James Dunn

February 2014



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Title	Topic	Presenter
9.30am Introductions		
Session 1	UNSW Australian School of Business (ASB) Building, Level 1, Room 119	
10.00 - 10.05am	Introduction	Richard Kemp
10.05 - 10.15am	An Update on DSTO's Unfamiliar Face Research 2013+	Rebecca Heyer
10.15 - 10.25am	Discussion	
10.25 - 10.45am	APO Facial Case Reports	Patrica Moss & Trevor Alt
10.45 - 10.55am	Discussion	
10.55 - 11.05am	Blind Justice: Recent responses to unfamiliar face matching evidence	Gary Edmond & Mehera San Roque
11.05 - 11.15am	Discussion	
11.15 - 11.40am Morning tea		
Session 2	UNSW Australian School of Business (ASB) Building, Level 1, Room 119	
11.40 - 11.50am	Developing expertise in identification of fingerprints and faces	Rachel Searston
11.50 - 12.00pm	Discussion	
12.00 - 12.10pm	Error rate of Department of Immigration and Border Protection (DIBP) Face Image Comparison Specialists	Catherine Carey
12.10 - 12.20pm	Discussion	
12.20 - 12.30pm	Motivation improves unfamiliar face matching but does not account for individual differences	James Dunn
12.30 - 12.40pm	Discussion	
12.40 - 12.50pm	Implementing an Unfamiliar Face Aptitude Testing System	Andrew Burr
12.50 - 1.00pm	Discussion	
1.00 - 1.10pm	Can rating feature similarity improve face matching accuracy?	Alice Towler
1.10 - 1.20pm	Discussion	
1.20 - 2.00pm Lunch		
Session 3	UNSW Australian School of Business (ASB) Building, Level 1, Room 119	
2.00 - 2.10pm	How is shape based matching affected by surface pigmentation?	Harold Hill
2.10 - 2.20pm	Discussion	
2.20 - 2.30pm	Face-matching and "within-face" variability	Nadia Manon
2.30 - 2.40pm	Discussion	
2.40 - 2.50pm	Predicting false recognition from position in face-space	Harold Mathews
2.50 - 3.00pm	Discussion	
3.00 - 3.10pm	Biometric Variations from Passport Photographs from Retail Outlets	Vanessa Spiteri
3.10 - 3.20pm	Discussion	
3.20 - 3.30pm	Developing a test of unfamiliar voice matching: Preliminary findings	Tanya Wayne
3.30 - 3.40pm	Discussion	
3.40 - 3.50pm	Face angle estimates and matching across different viewpoints	Kevin Brooks
3.50 - 4.00pm	Discussion	
4.00 - 4.10pm	Towards optimal user input for face recognition software	David White
4.10 - 4.45pm General discussion		
4.45pm Wine and cheese		

Abstracts: Session 1

AN UPDATE ON DSTO'S UNFAMILIAR FACE RESEARCH 2013+

Rebecca Heyer

Defence Science Technology Organisation (DSTO)

This paper aims to provide an update on DSTO's research activities in the unfamiliar face space since the 2013 Unfamiliar Face Meeting and foreshadows the research activities scheduled for 2014. An update will be provided on PhD studies in one-to-many unfamiliar face matching and the impact of ageing on face matching; DSTO client-sponsored projects investigating algorithm performance; vulnerabilities in unfamiliar face matching (human)/face recognition (algorithm); and unconstrained face matching (human) and recognition (algorithm).

APO FACIAL CASE REPORTS

Patricia Moss & Trevor Alt

Australian Passport Office, Department of Foreign Affairs and Trade

The presentation will provide an example of a case report of a facial comparison examination conducted by the Identity Resolution Unit (IRU). The presentation will also summarise the importance of separating the roles between the examiner, the quality control officer, and the forensic examiner.

BLIND JUSTICE: RECENT RESPONSES TO UNFAMILIAR FACE MATCHING

EVIDENCE

Gary Edmond & Mehera San Roque

School of Law, University of New South Wales

This paper provides a short review of recent appeals (e.g. *R v Morgan*, *R v Honeysett* and *R v Dastagir*) concerned with the unfamiliar face matching evidence. It will also introduce some of the implications of *Dupas v The Queen* and increasing judicial interest in the probative value of incriminating expert evidence (in Victoria).

Abstracts: Session 2

DEVELOPING EXPERTISE IN IDENTIFICATION OF FINGERPRINTS AND FACES

Rachel Searston

School of Psychology, University of Queensland

There are many parallels between fingerprint identification and the identification of unfamiliar faces. The most evident being that both ultimately rely on humans—whether it be to decide if two fingerprints are from the same person or if two faces are the same person, both rely on human expertise in identification. Given this resemblance, there may also be parallels in how people learn and acquire expertise in these two domains. Cognitive scientists have been systematically studying how people learn and how to enhance learning for over a century. I will present a line of research aimed at applying established principles of learning to understanding the most effective and efficient ways of acquiring expertise in the identification of fingerprints. Preliminary research findings will be discussed, as well as broader applications to training and recruitment, and avenues for future research in the field of unfamiliar face identification.

ERROR RATE OF DEPARTMENT OF IMMIGRATION AND BORDER PROTECTION (DIBP) FACE IMAGE COMPARISON SPECIALISTS

Catherine Carey

Department of Immigration and Border Protection (DIBP), Canberra

There are several ‘influential’¹ studies that focus on human operator error rates when performing facial image comparison tasks. These studies have been conducted under a range of conditions and report large error rates. Our opinion is that these studies do not reflect work place errors of trained staff in performing Facial Image Comparison tasks of biometric matching outcomes. DIBP’s independent fingerprint data supports the consistency of DIBP facial image comparison specialists. This presentation will give an overview of the error rates of DIBP specialists in casework over a 12 month period.

MOTIVATION IMPROVES UNFAMILIAR FACE MATCHING BUT DOES NOT ACCOUNT FOR INDIVIDUAL DIFFERENCES

James Dunn

School of Psychology, University of New South Wales

Previous studies have reported large individual differences in performance on unfamiliar face matching tasks. These differences are stable across repeated tests and are robust to changes in task format, suggesting that face matching accuracy is predicted by factors relating to the individual. However, few studies have attempted to identify the nature of these internal factors. In this study we explored the possibility that motivation might be driving these individual differences, by examining the effect of awarding a prize for high performance in a one-to-many unfamiliar face matching task. We found that introducing motivation improved overall accuracy relative to a control group. However, this improvement was driven specifically by a reduction in misidentification errors. Importantly, individual differences in accuracy observed in the motivation block were predicted by accuracy in blocks where no incentive was provided - suggesting that these differences cannot be explained by motivation alone.

IMPLEMENTING AN UNFAMILIAR FACE APTITUDE TESTING SYSTEM

Andrew Burr

The Westbourne Group

How does one determine who is consistently 'good' at recognising faces, particularly in an operational context? While the accuracy of biometric systems have enjoyed massive improvements in recent years, the ability to determine which individuals have the greatest aptitude to use the output of these systems, in a consistent and reliable manner, remains an area of growing understanding. A collaboration between UNSW and The Westbourne Group primarily aims to develop a system to assess an individual's aptitude for recognising faces, based on the GFMT and recent studies at UNSW. The outcome of assessment via this system is expected to provide managers and employers with evidence of an individual's capability to recognise faces and ultimately indicate which individuals have the greatest aptitude in using the output from a biometric system. A secondary aim is to create a common platform to enable academic institutions to conduct further trials in the field of unfamiliar face matching.

CAN RATING FEATURE SIMILARITY IMPROVE FACE MATCHING ACCURACY?

Alice Towler

School of Psychology, University of New South Wales

Professionals in facial image comparison use a variety of strategies to assist with face matching decisions. One of these strategies involves comparing the similarity of facial features (e.g., ears, nose, eyes etc.) before making a same/different identity decision. In experiment one we investigated whether making these similarity ratings would improve face matching performance. This approach significantly improved matching accuracy, suggesting that featural comparison is beneficial to face matching performance. In experiment two, we found that experts were more accurate than novices when using this strategy, possibly as a result of current training practices which encourage feature-by-feature rather than holistic comparison of faces. Our findings confirm that feature-based comparison can improve face matching accuracy, and show that experts have a heightened ability to make identity judgments on the basis of individual features.

Abstracts: Session 3

HOW IS SHAPE BASED MATCHING AFFECTED BY SURFACE PIGMENTATION?

Harold Hill

School of Psychology, University of Wollongong

There are many situations involving craniofacial reconstruction where accurate surface “texture” information is not available. Using a same different matching and sex judgment tasks, we asked what, if any, generic texture information was best to add to the shape in these situations and how this compared to performance with the person’s original texture. The results showed that actual texture was best, as expected. However there was no overall advantage of adding a generic global or sex specific average texture over zero texture. Performance was dependent on the sex of the head with wrong texture more detrimental for female than male faces. For both actual and generic texture there was no difference as to whether images were colour or greyscale. Photographic negation disrupted pigment information, although even negative texture was better than no texture for matching, especially if at least the eye region was positive.

FACE-MATCHING AND “WITHIN-FACE” VARIABILITY

Nadia Menon

School of Psychology, University of New South Wales

In face matching tasks, people must decide if two photographs are of the same person or of different people. Although this task appears quite straightforward, people make many errors when the faces are unfamiliar. However, performance improves when multiple images of one of the identities being matched are provided (the ‘target’ face). Here, we test the effect of varying the degree of image variation in target-image arrays on face matching performance, by presenting either high-variability or low-variability pairs of images of the target identity. Our results show that participant’s response bias was most liberal (i.e. more likely to respond ‘same person’) when presented with high-variability target pairs. Performance was also more accurate when highly variable pairs were presented, compared to low-variability and single-image conditions. These results demonstrate that the amount of variability across pairs of target images has predictable and important effects on face matching performance. They also show that the influence of multiple target images on face matching amounts to more than just the influence of single “best” target image. Thus, people can extrapolate variance information from multiple images of the same face, to inform matching decisions.

PREDICTING FALSE RECOGNITION FROM POSITION IN FACE-SPACE

Harold Mathews

School of Psychology, University of Wollongong

Not all faces are equally likely to be falsely recognized. Being able to predict false-recognitions clearly has applications for security and in a court-room context including predicting the accuracy of matching that face. We will briefly describe work aimed at predicting false-recognition (in effect delayed sequential matching) from a face’s position in face-space. Face-space is a model of face-encoding and recognition in which faces are considered discrete points and/or vectors in a multidimensional space. Participants completed an old/new recognition task with stimuli where facial pigmentation was an average and when it was varied across stimuli. Face-spaces were defined by PCA analysis of both the 3D structure and pigmentation of the faces. False alarm rates were strongly predicted by distance from the origin of the structure-space when pigmentation was uniform ($R^2 = .59$) and by a combination of distance from the origin of the pigmentation and structure spaces when pigmentation varied ($R^2 = .38$).

BIOMETRIC VARIATIONS FROM PASSPORT PHOTOGRAPHS FROM RETAIL OUTLETS

Vanessa Spiteri

School of Science & Health, University of Western Sydney

Passport photographs are a visual representation or likeness of an individual that are used on official documentation to certify the identity and nationality of the passport holder. The main purpose of passport photographs as a means of establishing identity is a consistent requirement for government authorities to verify the entry and exit of foreign travellers. At present, passport photographs are required to adhere to a set of guidelines that have been developed by the Australian Passport Office. The purpose of these guidelines is to ensure uniformity for a biometric system and uniformity within passport photographs that may be produced from varied retail outlets such as specialist camera stores, photo-booths, chemists and post offices. Although these guidelines aim to ensure consistency amongst passport photographs sourced from retail outlets, its abilities to do so have not been empirically tested, even though there are considerable variables within how the photographic recording process affects variability of individuals, and how this variation may influence consistency within authority guidelines.

DEVELOPING A TEST OF UNFAMILIAR VOICE MATCHING: PRELIMINARY FINDINGS

Tanya Wayne

School of Psychology, University of New South Wales

Although facial image comparison plays an important role in person identification, it is often necessary to identify people on the basis of other types of data. In legal contexts for example, experts often compare surveillance recordings to the voice of a criminal suspect, to decide whether or not these two samples originate from the same identity. In this talk I will present some preliminary work developing an individual difference test of ability on this task. Already, we have encountered some interesting challenges in this project, which I summarise in this presentation. Further, I will draw comparisons between face and voice matching tasks. There are many interesting similarities and differences between these tasks, and so this comparison might help improve understanding of person identification in both domains.

FACE ANGLE ESTIMATES AND MATCHING ACROSS DIFFERENT VIEWPOINTS

Kevin Brooks

Department of Psychology, Macquarie University

Matching two sequentially presented unfamiliar faces is relatively easy when images are taken from the same viewpoint angle, but performance drops as the difference in angle increases. This study aims to investigate a possible link between this “viewpoint cost” and the ability of human observers to estimate the angle of a human face/head in both pitch (nodding head) and yaw (shaking head) rotations. Furthermore, we sought to establish whether this deficit could be ameliorated using stereoscopic (3D) face stimuli. While only preliminary results are currently available, initial data suggest a stereoscopic advantage, and a correlation between angle estimation performance and face matching ability.

TOWARDS OPTIMAL USER INPUT FOR FACE RECOGNITION SOFTWARE

David White

School of Psychology, University of New South Wales

Recent research in our lab aims to improve unfamiliar face matching performance in occupational settings. Specifically, our focus has been to optimise reliability of user input to Automatic Face Recognition (AFR) systems, configured to perform a one-to-many database search. In this talk, I integrate our findings in a ‘blue-sky’ framework for ergonomic design of these systems. This framework contains four key recommendations: i) Face matching aptitude tests determine role assignment of staff; ii) Response feedback is presented to users - to improve accuracy and enable monitoring of staff performance; iii) Candidate list sizes are set to optimally balance probabilities of computer and human match detection; iv) Decisions of multiple users are aggregated for decisions flagged as high-risk. Although some aspects of this framework are specific to one-to-many database search in passport issuance, these general recommendations can be applied to a broad range of occupations where face matching is routinely performed.

Roundtable Meeting Agenda

Session 1 (9am - 10:30am)

UNSW, Australian School of Business (ASB) Building, Level 1, Room 118

SESSION CHAIR: DAVID WHITE

THE POTENTIAL VALUE OF MULTIMEGAPIXEL FACIAL IMAGES FOR REVIEWER AND FORENSIC COMPARER ACCURACY [*Jason Prince*]

STEREOSCOPIC (3D) FACE MATCHING IN HUMANS AND MACHINES [*Kevin Brooks*]

COMPARING IDENTITY MATCHING BASED ON DIFFERENT SOURCES OF VISUAL INFORMATION (I.E. SHAPE & REFLECTANCE) [*Harold Hill*]

HOW CLOSE DOES A MATCH HAVE TO BE TO CONCLUDE THAT IT IS THE SAME PERSON? [*Harold Hill*]

CAN WE PREDICT WHICH FACES ARE LIKELY TO GENERATE FALSE-MATCHES? [*Harold Hill*]

PRACTICAL IMPLICATIONS OF PREDICTING FALSE-MATCHES [*Harold Mathews*]

Session 2 (11am - 12:30pm)

UNSW, Australian School of Business (ASB) Building, Level 1, Room 118

SESSION CHAIR: RICHARD KEMP

JOINT GOVERNMENT AGENCY-UNIVERSITY PHD PROGRAMS [*Rebecca Heyer*]

VALIDATION AND TESTING OF FACIAL IMAGE COMPARISON SPECIALISTS [*Catherine Carey*]

APPLICATIONS OF LEARNING SCIENCE RESEARCH TO TRAINING AND THE DEVELOPMENT OF EXPERTISE IN UNFAMILIAR FACE IDENTIFICATION [*Rachel Searston*]

Meeting Organisers

Richard Kemp

School of Psychology, University of New South Wales, Sydney 2052

Ph: (02) 9385 1401

richard.kemp@unsw.edu.au

David White

School of Psychology, University of New South Wales, Sydney 2052

Ph: (02) 9385 3254

david.white@unsw.edu.au

James Dunn

School of Psychology, University of New South Wales, Sydney 2052

Mob: 0422 742 598

j.d.dunn@unsw.edu.au

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