

Increasing eyewitness identification accuracy in lineups using 3D interactive virtual reality

Developing an interactive 3D virtual reality lineup system to improve witness identification accuracy, combining computing and psychological expertise to enhance criminal justice practices.

Key details

Lead institution	University of Birmingham
Principal researcher(s)	Prof Heather Flowe h.flowe@bham.ac.uk
Police region	West Midlands
Collaboration and partnership	<ul style="list-style-type: none"> • Max Planck Institute for Human Cognitive and Brain Sciences (Germany) • University of Victoria (Canada) • University of Stirling (UK) • Humboldt University of Berlin (Germany)
Level of research	Professional/work based
Project start date	September 2023
Date due for completion	August 2026

Research context

Accurate witness identification is critical for criminal investigations, yet police lineups have relied on 2D photos for over a century. Analyses reveal witnesses frequently misidentify known innocent suspects, contributing to wrongful convictions. This project develops an interactive 3D virtual reality lineup system to improve accuracy.

Witnesses will view lifelike 3D faces rotatable into different angles, matching their memory. An international team with computing, psychological and policy expertise will create novel 3D facial representations with adaptable expressions and lighting.

Experiments will establish 3D virtual reality (VR) lineups significantly outperform 2D and active face exploration surpasses passive viewing. Varying retrieval cues (movement, lighting, expressions) will be tested for effects on accuracy.

Individual differences in face processing ability will be measured to model performance and identify characteristics associated with accurate identifications. Relationships between face memory, perception and lineup outcomes will be analysed using network modelling.

Unity software will enable dynamic 3D stimulus presentation, movement tracking and cross-national data collection using standardised procedures. Results across a diverse sample will inform policy recommendations for implementing interactive VR lineups.

In summary, this global collaboration unites world-leading academics and police to develop an innovative lineup technique grounded in psychological science and computing advances. By optimising witness memory retrieval, it aims to enhance justice and reduce misidentifications threatening the innocent.

Research methodology

This project will develop and test an interactive 3D virtual reality lineup system to improve witness identification accuracy. Existing 2D lineups will be rendered into 3D, enabling quick empirical validation using extensively tested materials. A novel 3D image library will also be created to examine additional retrieval cues like lighting changes and vertical head rotation.

360-degree 3D mock crime footage will capture diverse perpetrators from all angles. Fair lineups will be constructed following best practices. Validation will occur using 80 online participants.

Experiments will examine interactivity benefits, comparing 2D, 2.5D and 3D presentation. Additional retrieval cues will be tested including lighting, vertical rotation and expressions. Individual differences in face processing will be measured to identify characteristics associated with lineup

performance.

Data will be collected from 1,200 research participants in four experiments conducted at four international sites using standardised procedures and equipment. After a familiarisation phase, participants will complete the mock witness procedure – watching a crime and attempting a lineup ID. Performance across eight lineups per participant will be recorded.

A battery of face tests will assess perception and memory including the Cambridge Face Memory Test, Models Memory Test and Facial Identity Card Sorting Task. Network analysis will model face processing in 2D and 3D.

Unity software will enable naturalistic, dynamic 3D stimulus presentation and full recording of movements. Sample sizes will allow cross-national performance comparisons. Results will inform policy recommendations for implementing interactive 3D lineups.

Interim reports or publications

- For further information please see:

Meyer M, Colloff MF, Bennett TC, Hirata E, Kohl A, Stevens LM, Smith H, Saudigl T, and Flowe HD. (2023). [‘Enabling witnesses to actively explore faces increases discrimination accuracy’](#). Proceedings of the National Academy of Sciences.

- Colloff MF, Flowe HD, Smith HJ, Seale-Carlisle, TM, Meissner, CA, Rockey JC, Pande B, Kujur P, Parveen N, Chandel P, Singh MM, Pradhan S and Parganiha A. (2022). [‘Active exploration of faces in police lineups increases discrimination accuracy for own- and other- race faces’](#). American Psychologist, 7(2), pp 196–220.
- Windsor A, Flowe HD, Seale-Carlisle TM, Hett D, Jores T, Lee B, Stevens L, Condruz N and Colloff MF. (2022). [‘Children’s expressions of certainty are informative’](#). Journal of Experimental Psychology: General, 150(11), pp 2387–2407.
- Colloff M, Seale-Carlisle TM, Karo?lu N, Rockey JC, Smith HMJ, Smith L, Maltby J, Yaremenko S and Flowe HD. (2021). [‘Perpetrator pose reinstatement during a lineup test increases discrimination accuracy’](#). Nature Scientific Reports, 1(1) p 13830.

Research participation

21/04/2026

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To participate in this project, contact the Principal Investigator, [Professor Heather Flowe](#).

Tags

- [Operational policing](#)