

## University of Dundee

### Understanding Forensic Gait Analysis #1

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# **UNDERSTANDING FORENSIC GAIT ANALYSIS**



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University of Dundee

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# UNDERSTANDING FORENSIC GAIT ANALYSIS

Welcome to the first issue in our Understanding Forensic Analysis series of comics! These have been created by the Leverhulme Research Centre for Forensic Science and The Scottish Centre for Comics Studies at the University of Dundee and are based on the judicial primers produced in collaboration between members of the judiciary, the Royal Society, and the Royal Society of Edinburgh.

The Lord Chief Justice of England and Wales and the Lord President of Scotland have worked together with the Royal Society and the Royal Society of Edinburgh to create a series of judicial primers to assist the judiciary with better understanding of scientific evidence in the courtroom. They were written by leading scientists and members of the judiciary, and peer reviewed by practitioners, scientists and judges. The aim of the primers is to present clear, scientifically accurate information and to address the limitations and challenges associated with applying scientific evidence in a courtroom. The Understanding Forensic Analysis comic series led by the Leverhulme Research Centre for Forensic Science at the University of Dundee reinterprets the primers in order to visualise these issues and challenges for a wider audience.

Understanding Forensic Gait Analysis is an examination of the process of visual comparisons made in forensic gait analysis, and considers the new methods that are being developed but still need to be scientifically proven.

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The Scottish Centre for Comics Studies (SCCS) leads a research project on the use of comics for educational purposes. It has, in collaboration with various private, public and third sector partners, and working with other researchers, produced comics that communicate the findings of research, or engage the public with important issues related to healthcare, science communication, and social justice. We are proud to be working with the Leverhulme Research Centre for Forensic Science to produce these comics based on the judicial primers.

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# GAIT ANALYSIS

GAIT REFERS TO A PARTICULAR MANNER OF WALKING -

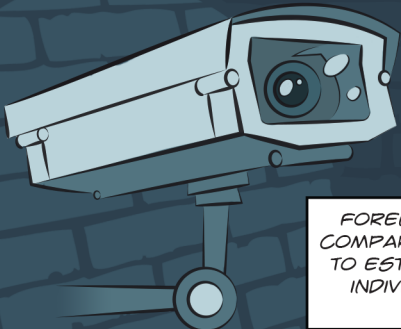
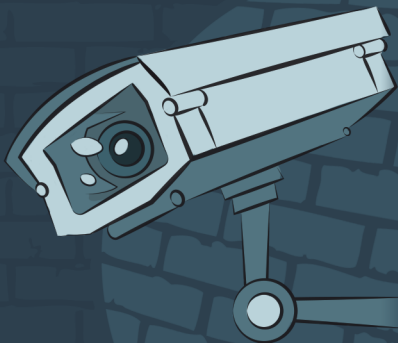
A PATTERN OF MOVEMENTS AND BEHAVIOURS.



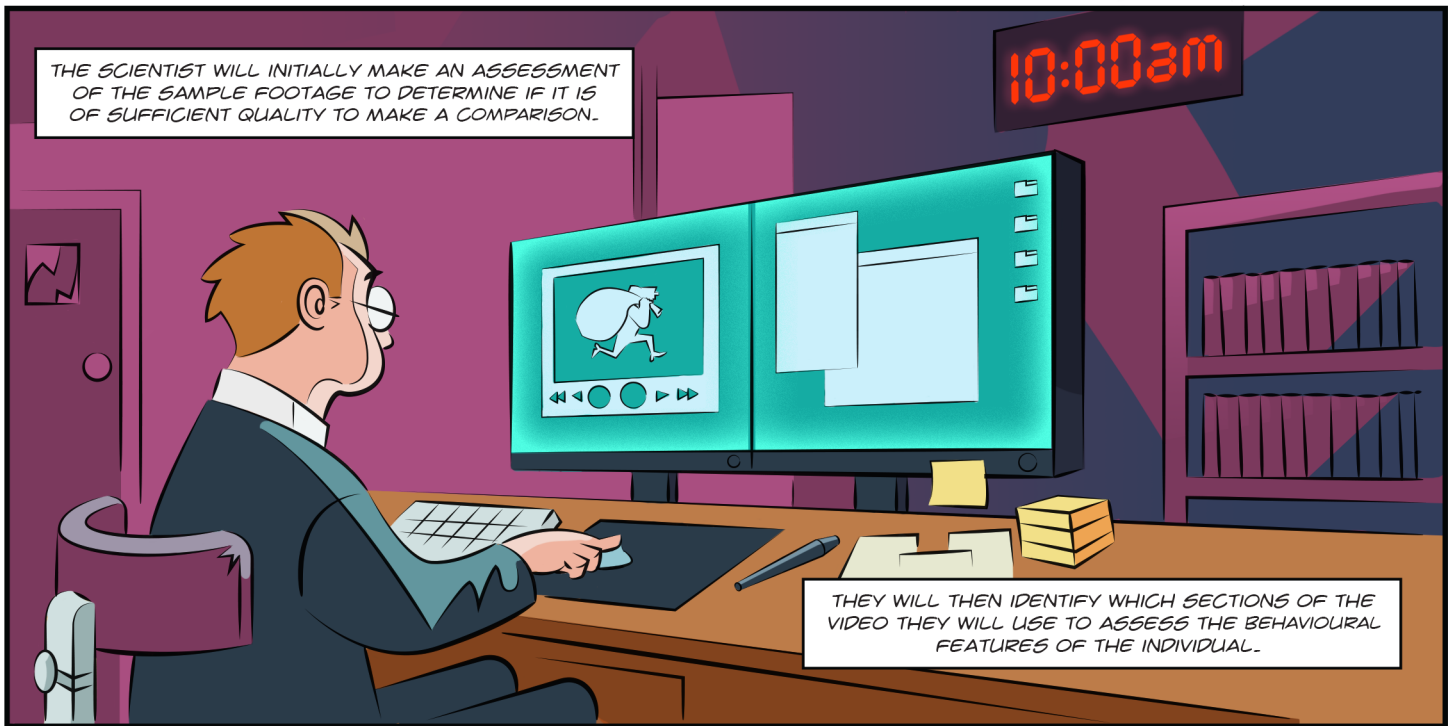
FORENSIC GAIT ANALYSIS IS A RELATIVELY NEW FORM OF EVIDENCE IN THE UK CRIMINAL COURTS.



FORENSIC GAIT ANALYSIS IS THE DIRECT VISUAL COMPARISON OF TWO OR MORE VIDEO RECORDINGS TO ESTABLISH WHETHER THEY ARE OF THE SAME INDIVIDUAL OR DIFFERENT INDIVIDUALS BASED ON GAIT PATTERN ALONE.



SCRIPT: CHRIS MURRAY & LAURA FINDLAY ART: MARK BROWN

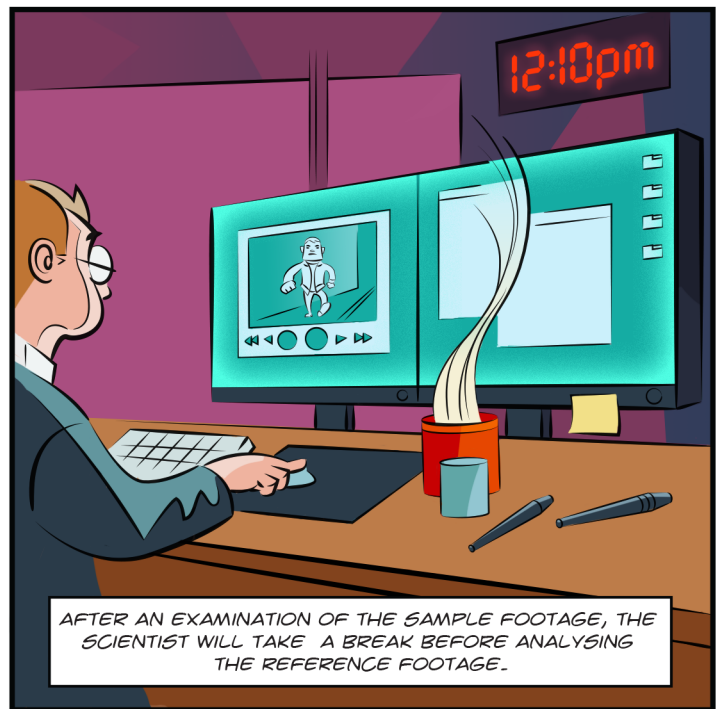


THE SCIENTIST WILL INITIALLY MAKE AN ASSESSMENT OF THE SAMPLE FOOTAGE TO DETERMINE IF IT IS OF SUFFICIENT QUALITY TO MAKE A COMPARISON.

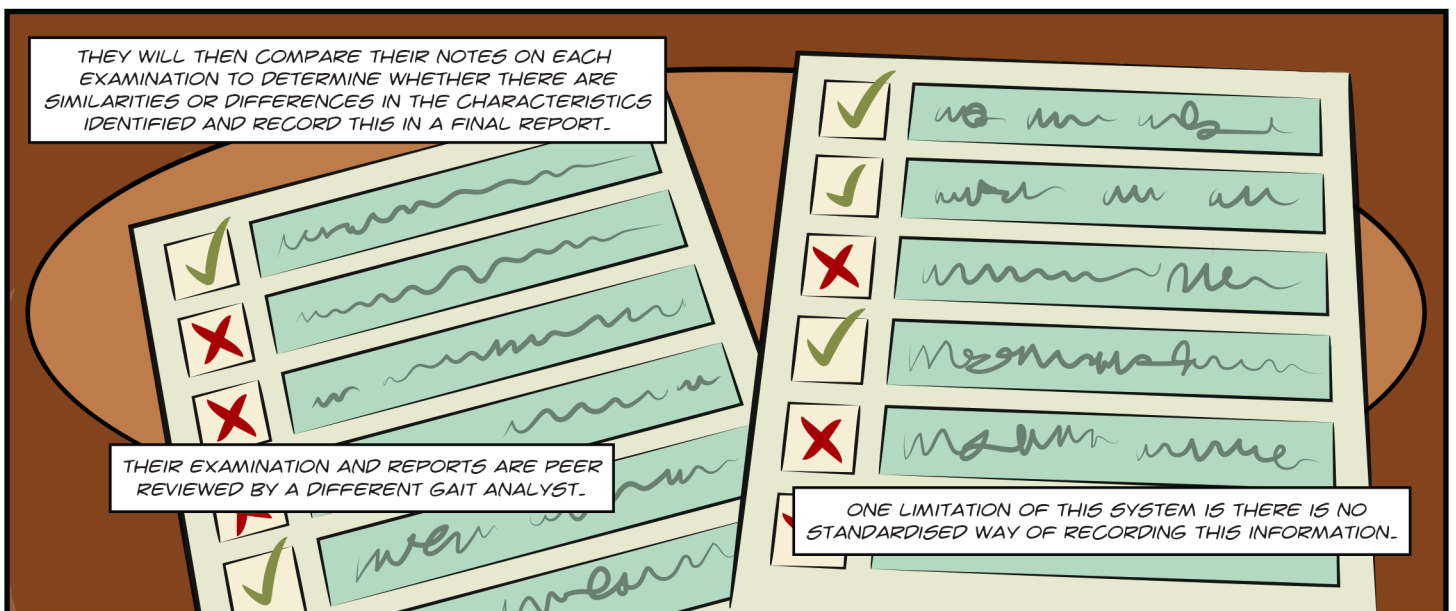
THEY WILL THEN IDENTIFY WHICH SECTIONS OF THE VIDEO THEY WILL USE TO ASSESS THE BEHAVIOURAL FEATURES OF THE INDIVIDUAL.



THEY WILL DESCRIBE THE BEHAVIOURAL FEATURES THEY IDENTIFY, SOMETIMES USING A CHECKLIST. THEY SHOULD ALSO NOTE ASPECTS THAT INFLUENCE THE RECORDING, SUCH AS LIGHTING, CAMERA ANGLE, AND UNEVEN GROUND.



AFTER AN EXAMINATION OF THE SAMPLE FOOTAGE, THE SCIENTIST WILL TAKE A BREAK BEFORE ANALYSING THE REFERENCE FOOTAGE.



THEY WILL THEN COMPARE THEIR NOTES ON EACH EXAMINATION TO DETERMINE WHETHER THERE ARE SIMILARITIES OR DIFFERENCES IN THE CHARACTERISTICS IDENTIFIED AND RECORD THIS IN A FINAL REPORT.

THEIR EXAMINATION AND REPORTS ARE PEER REVIEWED BY A DIFFERENT GAIT ANALYST.

ONE LIMITATION OF THIS SYSTEM IS THERE IS NO STANDARDISED WAY OF RECORDING THIS INFORMATION.



**A WIDE RANGE OF PROFESSIONALS MAY PRESENT AS GAIT ANALYSTS**

*WHICH IS NOT A LEGALLY PROTECTED TITLE. THERE ARE NO ACADEMIC QUALIFICATIONS IN FORENSIC GAIT ANALYSIS PER SE, AND SO PROFESSIONALS INVOLVED IN THE FIELD MAY HOLD QUALIFICATIONS IN A WIDE RANGE OF RELATED AREAS.*

*THIS MEANS THAT QUALIFICATIONS ON THEIR OWN ARE UNLIKELY TO DEMONSTRATE THE COMPETENCE OF THE PERSON TO ACT AS AN EXPERT WITNESS IN RELATION TO FORENSIC GAIT ANALYSIS EVIDENCE.*

# HOW UNIQUE IS AN INDIVIDUAL'S GAIT?

THE UNDERLYING ASSUMPTION IS THAT EACH PERSON HAS A DISTINCTIVE GAIT PATTERN THAT CAN BE IDENTIFIED.



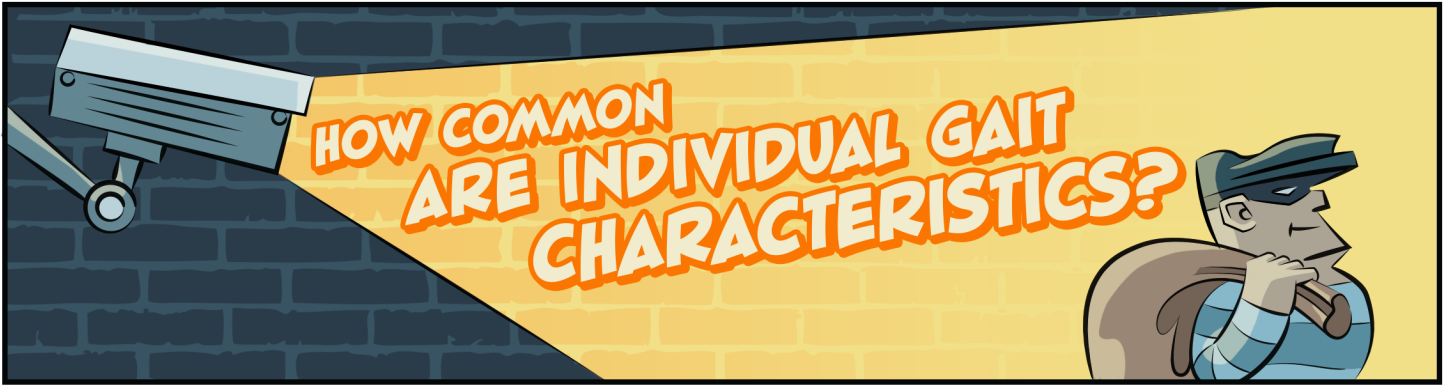
THE UNDERPINNING SCIENCE IS SPARSE AND LARGELY TRANSLATED FROM THE MORE DEVELOPED FIELDS OF CLINICAL GAIT ANALYSIS AND BIOMECHANICS, WITH MORE RECENT INSIGHTS FROM BIOMETRICS.

**GAIT ANALYSIS**  
NEW INTRODUCTION

**CLINICAL GAIT ANALYSIS**




**GAIT ANALYSIS**  
5TH EDITION

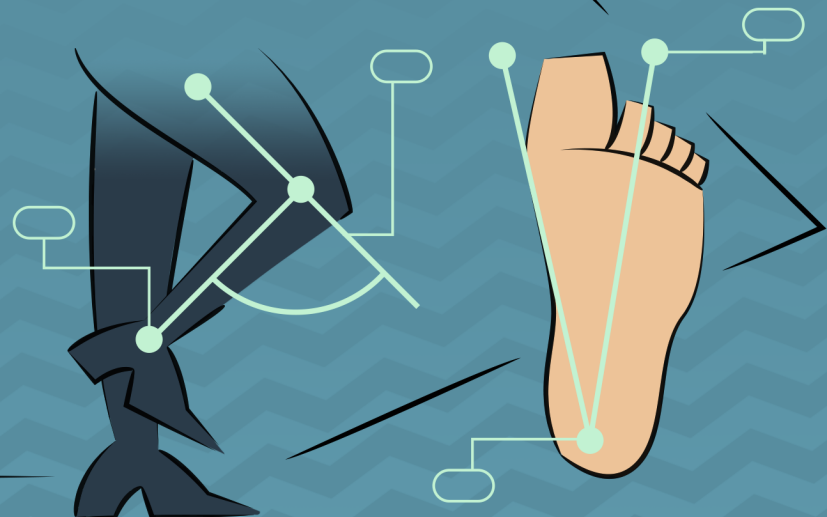


# HOW COMMON ARE INDIVIDUAL GAIT CHARACTERISTICS?


MANY OF THE FEATURES OF INTEREST ARE ANGLES, FOR EXAMPLE, OF JOINTS.



IN CLINICAL ANALYSIS THESE ARE MEASURED USING SOPHISTICATED EQUIPMENT CAPABLE OF MAKING 3D MEASUREMENTS UNDER IDEAL CONDITIONS...



IN FORENSIC PRACTICE ANGLES ARE ESTIMATED FROM VIDEO OFTEN UNDER LESS IDEAL CONDITIONS.



FOR A FEATURE TO BE USEFUL IT SHOULD BE CONSISTENT WITHIN AN INDIVIDUAL, DIFFERENT BETWEEN INDIVIDUALS, AND THOSE DIFFERENCES SHOULD BE MEASURABLE.

THERE'S NO ACCESSIBLE DATABASE THAT CURRENTLY EXISTS THAT PERMITS THE ASSESSMENT OF THE FREQUENCY OF GAIT CHARACTERISTICS IN THE POPULATION.

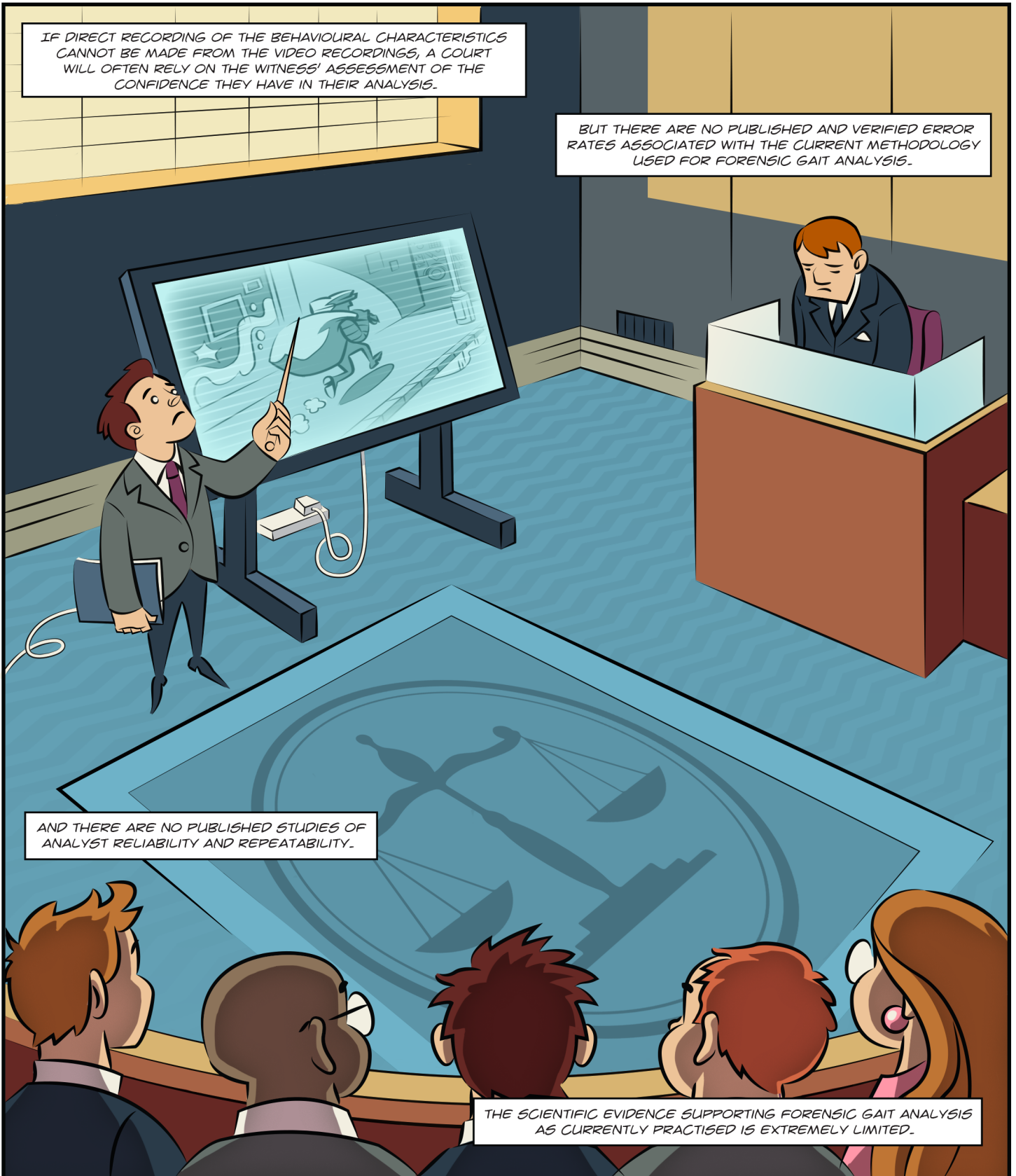


# HOW ACCURATELY CAN PEOPLE BE IDENTIFIED USING GAIT DATA?



IF DIRECT RECORDING OF THE BEHAVIOURAL CHARACTERISTICS CANNOT BE MADE FROM THE VIDEO RECORDINGS, A COURT WILL OFTEN RELY ON THE WITNESS' ASSESSMENT OF THE CONFIDENCE THEY HAVE IN THEIR ANALYSIS.

BUT THERE ARE NO PUBLISHED AND VERIFIED ERROR RATES ASSOCIATED WITH THE CURRENT METHODOLOGY USED FOR FORENSIC GAIT ANALYSIS.



AND THERE ARE NO PUBLISHED STUDIES OF ANALYST RELIABILITY AND REPEATABILITY.

THE SCIENTIFIC EVIDENCE SUPPORTING FORENSIC GAIT ANALYSIS AS CURRENTLY PRACTISED IS EXTREMELY LIMITED.

# WHAT DOES THE FUTURE HOLD FOR FORENSIC GAIT ANALYSIS?

KNOWING THE GAPS THAT NEED TO BE FILLED IN ORDER TO DEMONSTRATE SCIENTIFIC ROBUSTNESS OF FORENSIC GAIT ANALYSIS PROVIDES AN OPPORTUNITY FOR RESEARCH IN THIS AREA. THIS WOULD INCLUDE ADDRESSING THE FOLLOWING CHALLENGES...

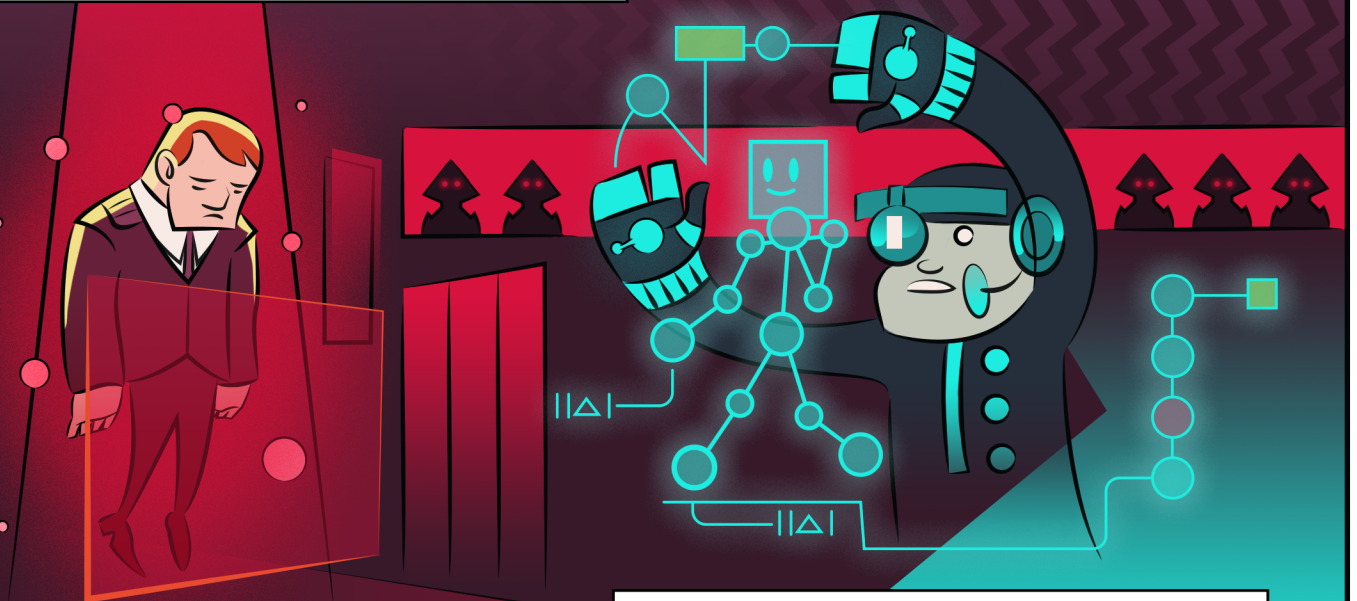
THERE IS NO EVIDENCE TO SUPPORT THE ASSERTION THAT GAIT IS UNIQUE.

THERE IS NO CREDIBLE DATABASE THAT PERMITS ASSESSMENT OF THE FREQUENCY OF EITHER NORMAL OR ABNORMAL GAIT CHARACTERISTICS.



THERE IS NO STANDARDISED METHODOLOGY FOR ANALYSIS, COMPARISON AND REPORTING OF GAIT CHARACTERISTICS.

NEW AUTOMATED METHODS OF EXTRACTING DATA FROM VIDEO AND MAKING COMPARISONS ARE BEING DEVELOPED FOR BIOMETRIC PURPOSES AND THE POTENTIAL FOR ADAPTING THESE FOR FORENSIC PURPOSES IS BEING EXPLORED.



WHILE THESE NEW METHODS MAY HOLD CONSIDERABLE PROMISE FOR THE FUTURE, RIGOROUS TESTING WILL STILL BE REQUIRED TO VALIDATE THEIR USE IN COURTS.



# DESIGNS & THUMBNAILS

CHARACTER DESIGN  
& THUMBNAILS:  
MARK BROWN



Gait refers to a particular manner of walking – a pattern of movements and behaviours...

Forensic gait analysis is a relatively new form of evidence in the UK criminal courts

Forensic gait analysis is the direct visual comparison of two or more video recordings to establish whether they are of the same individual or different individuals based on gait pattern alone

The scientist will initially make an assessment of the sample footage to determine if it is of sufficient quality to make an analysis.

10:00pm

They will then identify which sections of the video they will use to assess the anatomical features of the individual.

They will describe the anatomical features they identify, sometimes using a checklist. They should also note aspects that influence the recording, such as lighting, camera angle, and uneven ground.

12:00pm

After an examination of the sample footage, the scientist will take a break before analysing the reference footage..

They will then compare their notes on each examination to determine whether there are similarities or differences in the characteristics identified and record this in a final report.

Their examination and reports are peer reviewed by a different gait analyst.

One limitation of this system is there is no standardised way of recording this information.

# BIOGRAPHIES

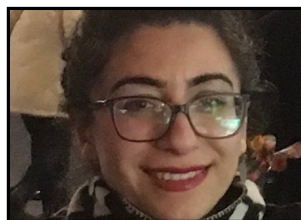
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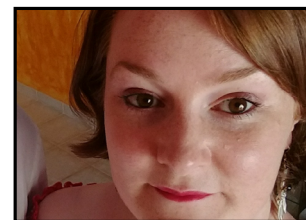
**CHRIS MURRAY** is Chair of Comics Studies and the Associate Dean for Knowledge Exchange and Partnerships at the *University of Dundee*. He is Director of the *Scottish Centre for Comics Studies* and *Dundee Comics Creative Space*. Murray co-edits *Studies in Comics*. He researches British comics, superhero comics and public information comics. [c.murray@dundee.ac.uk](mailto:c.murray@dundee.ac.uk)



**PHILLIP VAUGHAN** is a Senior Lecturer and Programme Director at the *University of Dundee*. He has worked with the *BBC*, *Sony*, *DC Comics*, *Warner Bros* and *EIDOS*. He has credits on work such as *Braveheart*, *Farscape*, *Star Trek*, *Wallace and Gromit*, *Tom & Jerry*, *Commando* and *Superman*. He currently hosts a podcast for *Comic Scene Magazine*. [@philipbvaughan](https://twitter.com/philipbvaughan)



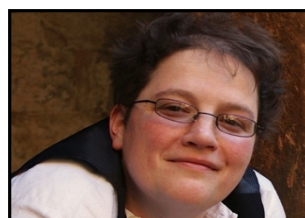
**GOLNAR NABIZADEH** is Lecturer in Comics Studies at the *University of Dundee* where she teaches on the *Comics & Graphic Novels MLitt*. Her research interests are graphic justice, critical theory, trauma and memory studies. Her monograph, entitled *Representation and Memory in Graphic Novels* (2019) is available from Routledge. [g.nabizadeh@dundee.ac.uk](mailto:g.nabizadeh@dundee.ac.uk)



**LAURA FINDLAY** is a project coordinator at *Screen Education Edinburgh*. She has worked on a number of public information comics, such as *The Gift: Transforming Lives Through Organ Donation*; her most recent comic is about the *Golden State Killer*. Her research interests include non-verbal communication through sound and image and representation in true crime narratives.



**MARK BROWN** graduated from *Duncan of Jordanstone College of Art and Design*, before moving to London where he cut his teeth creating content across various platforms. He has worked for *The BBC*, *Channel 4*, *The Daily Telegraph*, *Digit4*, *University of York*, *University of Dundee*, *HighScore TV*, *Original Gravity*, *The McManus Gallery* and *Firewords Quarterly*. [www.markbrown.online](http://www.markbrown.online)



**NIAMH NIC DAEID** is Director of the award winning *Leverhulme Research Centre for Forensic Science (LRCFS)*. The 10 year mission is to provide a robust underpinning for the scientific evidence presented in our Courts. She is a Chartered Chemist and an authorised Forensic Chemist with specialisms including fire investigation, clandestine drug chemistry and explosives. [n.nicdaeid@dundee.ac.uk](mailto:n.nicdaeid@dundee.ac.uk)



**HEATHER DORAN** is the Public Engagement Manager at the *Leverhulme Research Centre for Forensic Science, University of Dundee*. She is a member of the Public Communication of Science and Technology (PCST) committee and the Local Organising Committee for the PCST Conference 2020. She was Editor and co-founder of *Au Science Magazine*. [h.doran@dundee.ac.uk](mailto:h.doran@dundee.ac.uk)

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