FORENSIC PODIATRY: Footprint evidence examination workshop

ROYAL COLLEGE of PODIATRY

The Analysis and Comparison of Footprint evidence in Criminal Investigations

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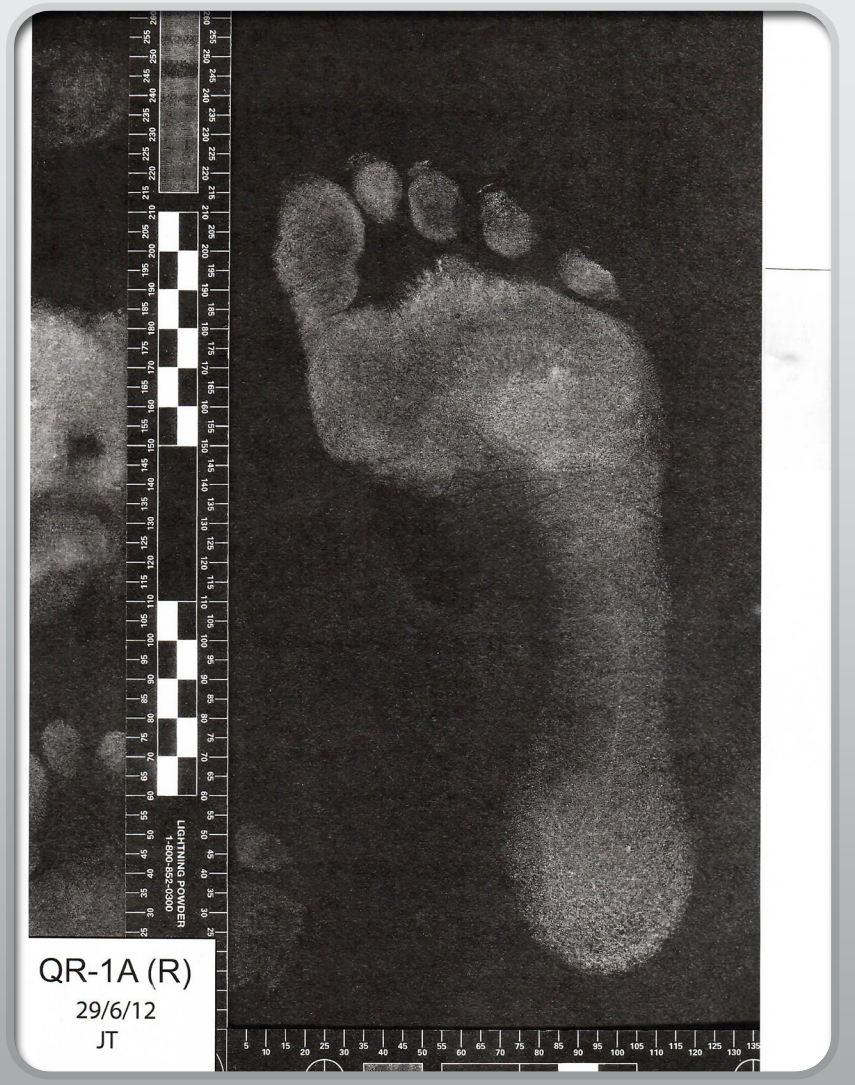


Aim:

To offer a fundamental practical overview of the processes involved in handling, analysing, and comparing crime scene footprint evidence to support investigations, aligning with the recently released Forensic Podology Code of Practice.

Learning objective

Hands-on experience will provide you with a basic understanding of how crime scene footprint evidence was used to assist in a double homicide investigation, in accordance with the legal requirements governing this discipline.

Long term learning

Since this true-crime murder case is accessible on Netflix, participants will have the opportunity to gain deeper insights into the circumstances of the case, ensuring that the workshop remains memorable beyond the conference.

Overview of the session…

- Definition
- The crime scene footprint
- Footprint comparison
- Footprint evidence analysis
- Weighing up the evidence
- The Netflix documentary ‘Till Murder do us Part - Soering versus Haysom’
- Working through the case evidence using the information gleaned from the presentation

Definition

- **Forensic footprint examination** involves the analysis, comparison and evaluation of the marks produced when the functioning foot interacts with a surface. This is a forensic technique usually employed to **assist** the investigation of a crime.

Code of Practice for Forensic Podology (2025) Royal College of Podiatry
https://rcpod.org.uk/api/documentlibrary/download?documentId=1114 .

Crime scene footprint evidence – the process

- Preliminary assessment
- Analysis (measurements – overlay and linear)
- Comparison
- Evaluation
- Verification

Usual exhibits provided by police

- Preliminary Assessor checks there are:

- life-size photographic images of crime scene (questioned) footprints –digital/hard copies

- inked (reference) footprints - digital/hard copies

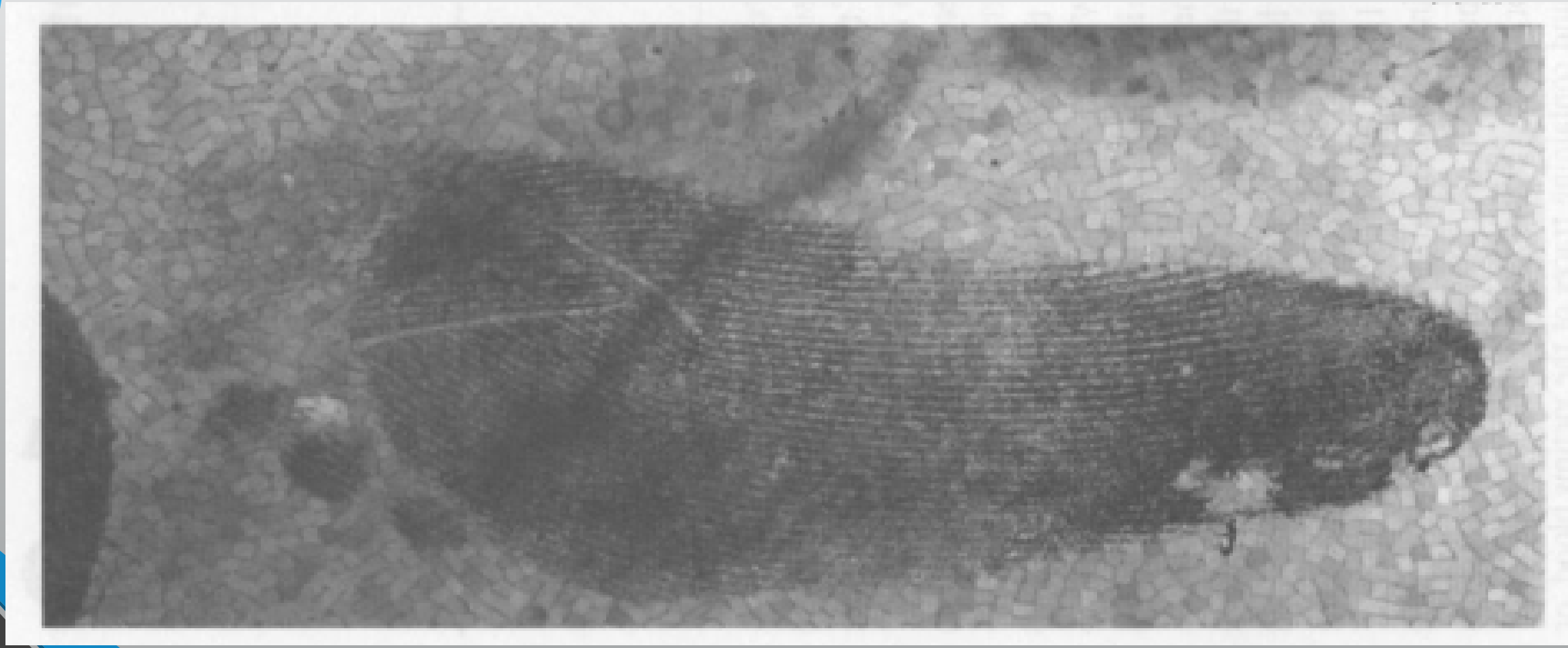
- scales next to each footprint exhibit – why?

- they have filtered out superfluous information from Lead Assessor – e.g.? Why

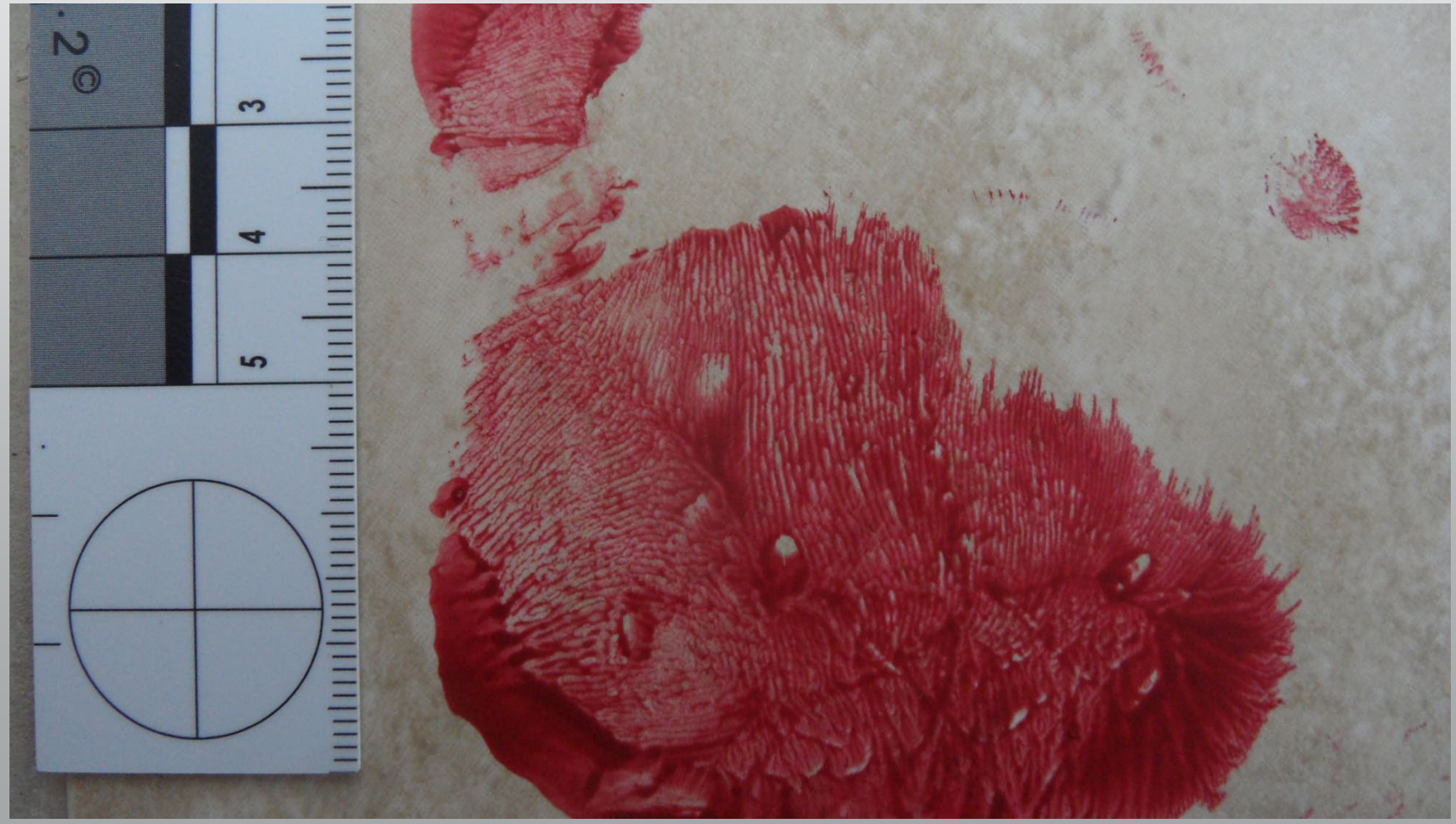
- Lead Assessor always analyses questioned footprints first – why?

Crime scene footprints

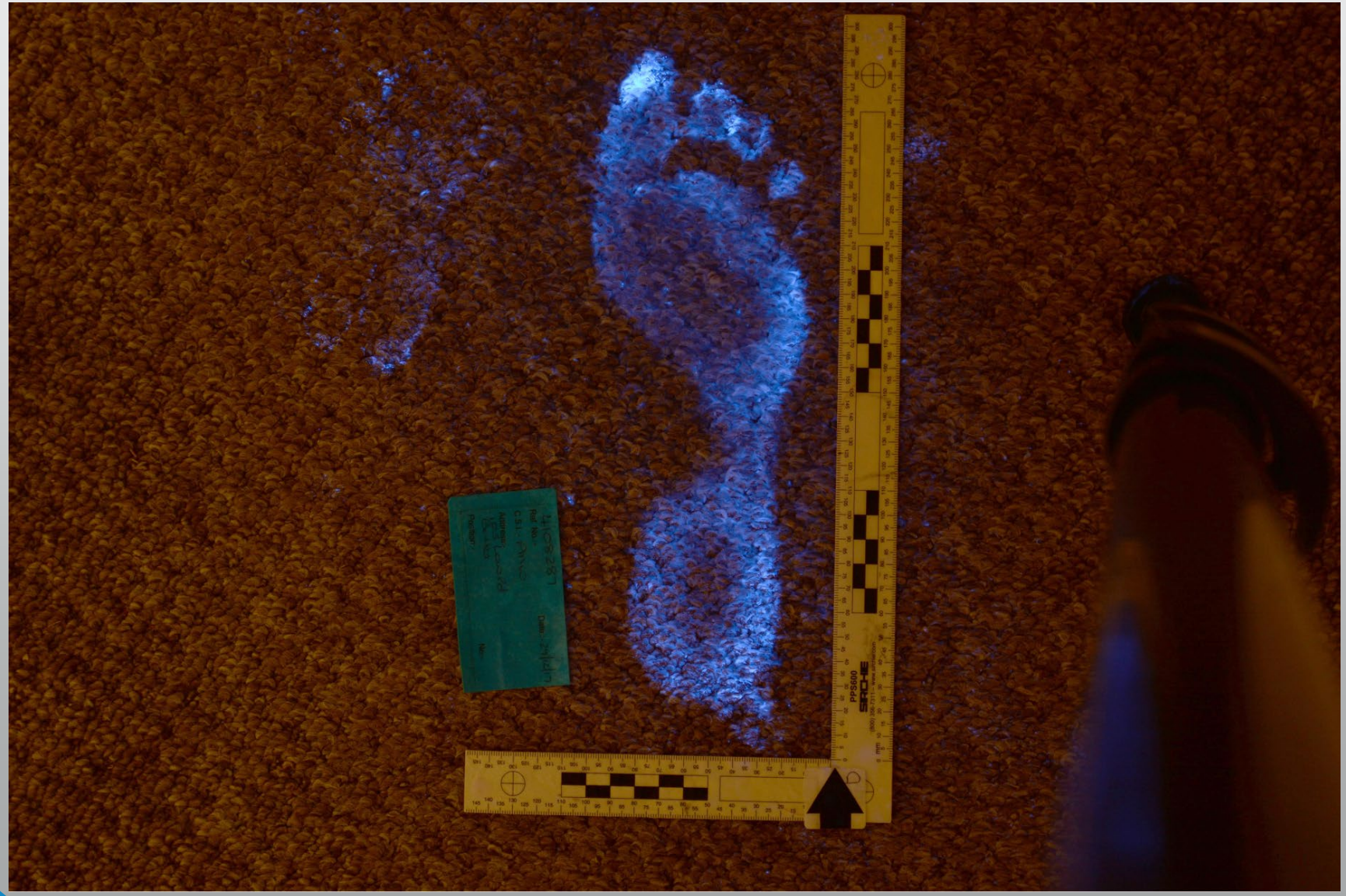
Socked footprint



Refer to ridge pattern analyst (dermatoglyphic evidence)



Foot impression on carpet



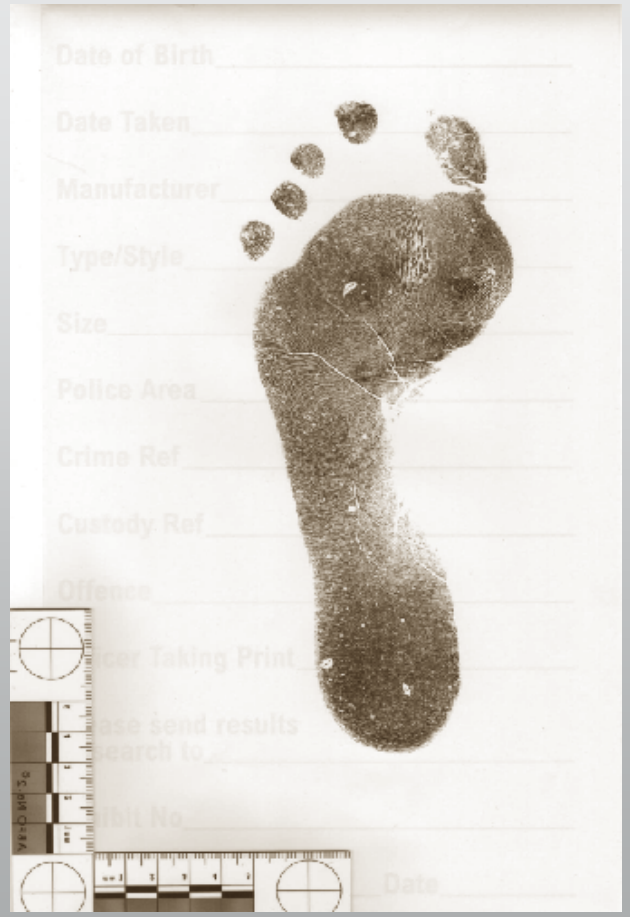
Footprint evidence comparison

‘Unknown’ or ‘Questioned’ footprints

Vs

‘Known’ or ‘Reference’ footprints

Footprint Comparison



Inked footprint from suspect

Crime scene footprint

Inked reference footprints

- From suspect
- From other household members
- From victim

Footprint collection method

How individual is the human footprint?

- Cassidy, 1987 – No matches in n=90
- Bodziak, 2000 – No matches in n=1000
- Freedman et al.,1946 – No matches in n=6700
- Rossi,1983 – No matches in n=6800
- Kennedy et al., 2003 – No matches in n=24000
- Kennedy et al., 2005 – Statistically suggested probability of 1:1.27 billion chance match

However, currently there's no forensic podiatry evidence that can be demonstrated at unique level.

Footprint evidence analysis

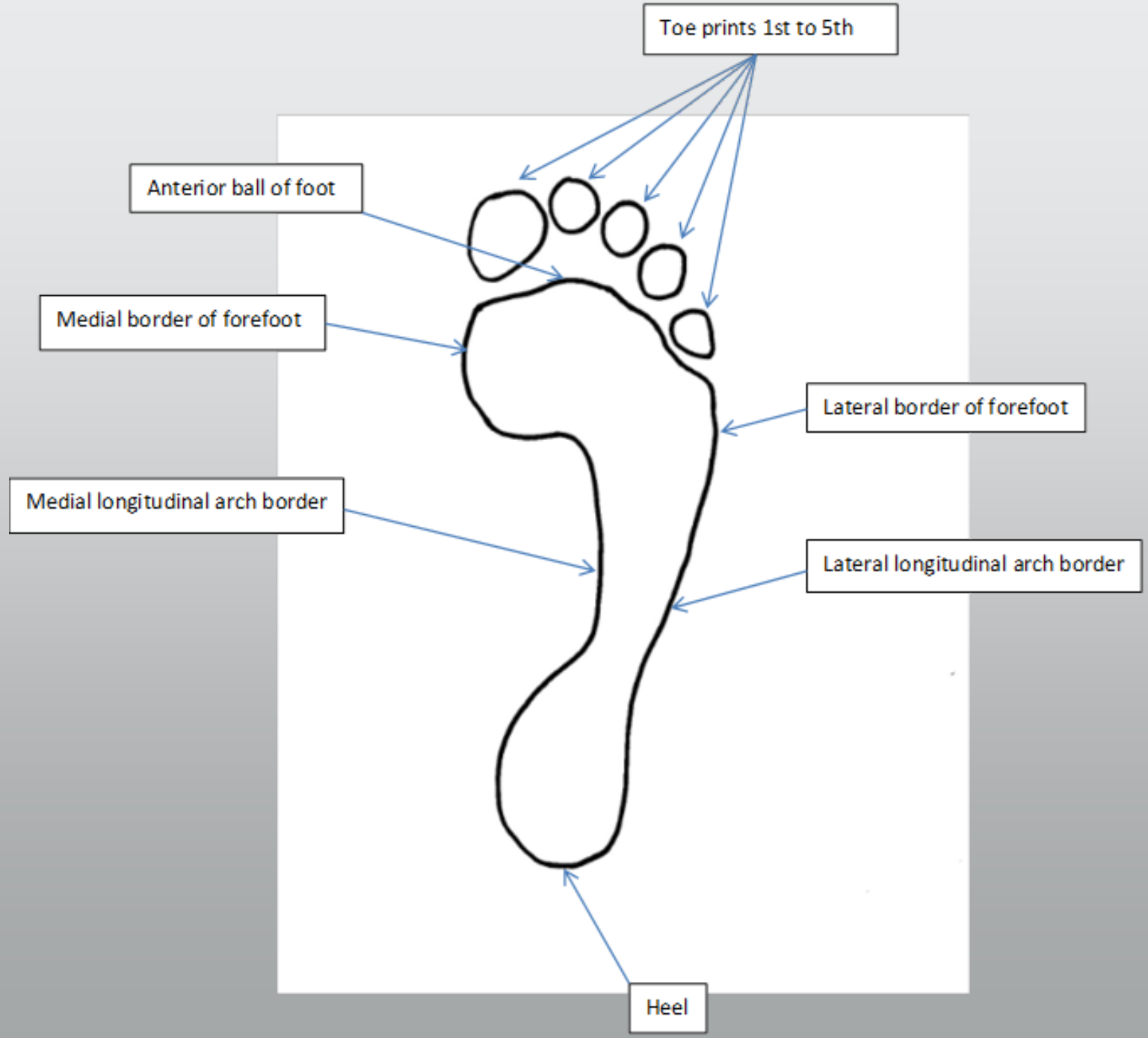
MEASUREMENT

INTERPRETATION

Measurement

Overlay Method

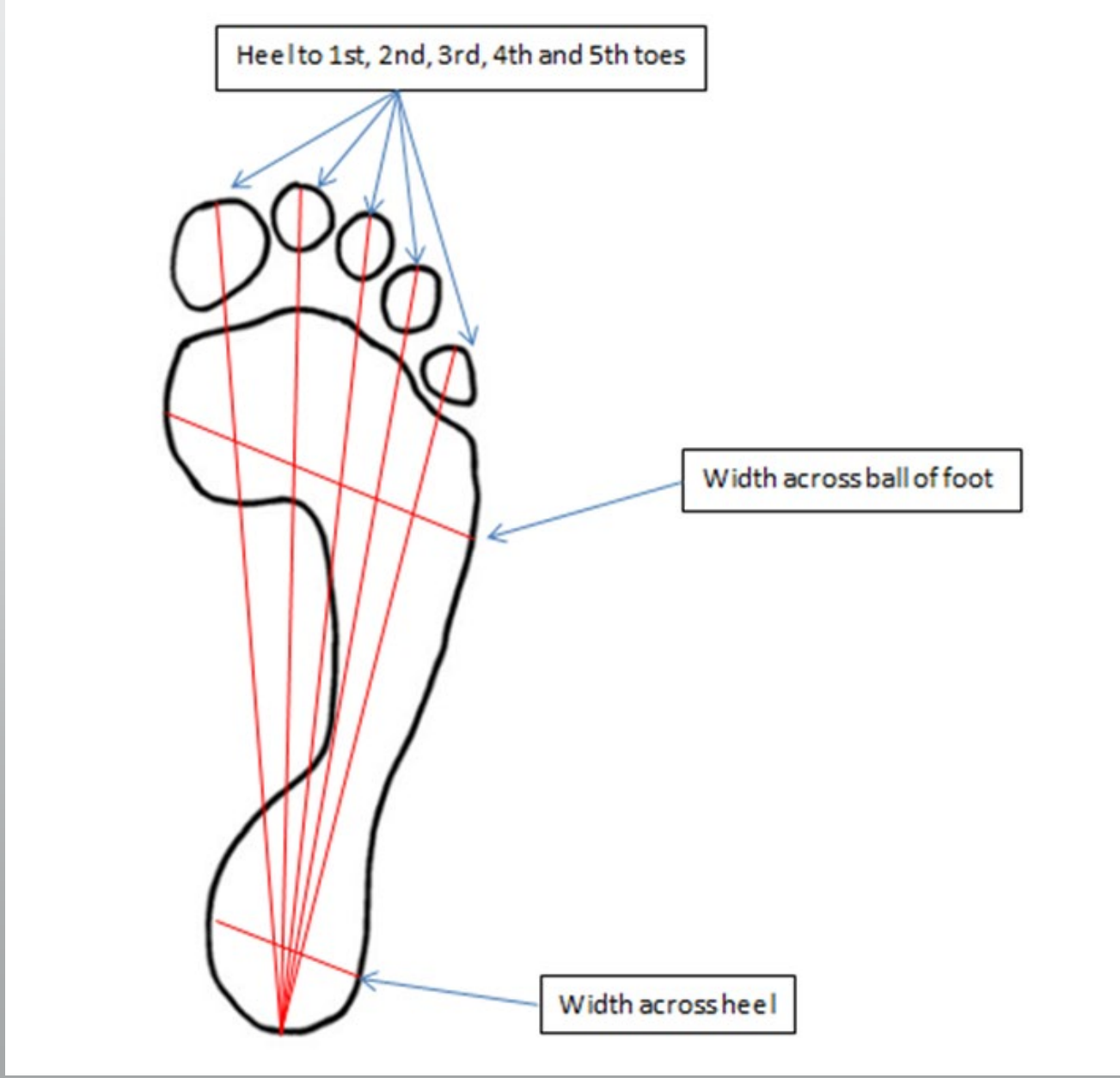
Qamra, Sharma, & Kaila,1980
Smerecki & Lovejoy,1985
Laskowski & Kyle 1988


Toe prints 1st to 5th
Anterior ball of foot
Medial border of forefoot
Lateral border of forefoot
Medial longitudinal arch border
Lateral longitudinal arch border
Heel

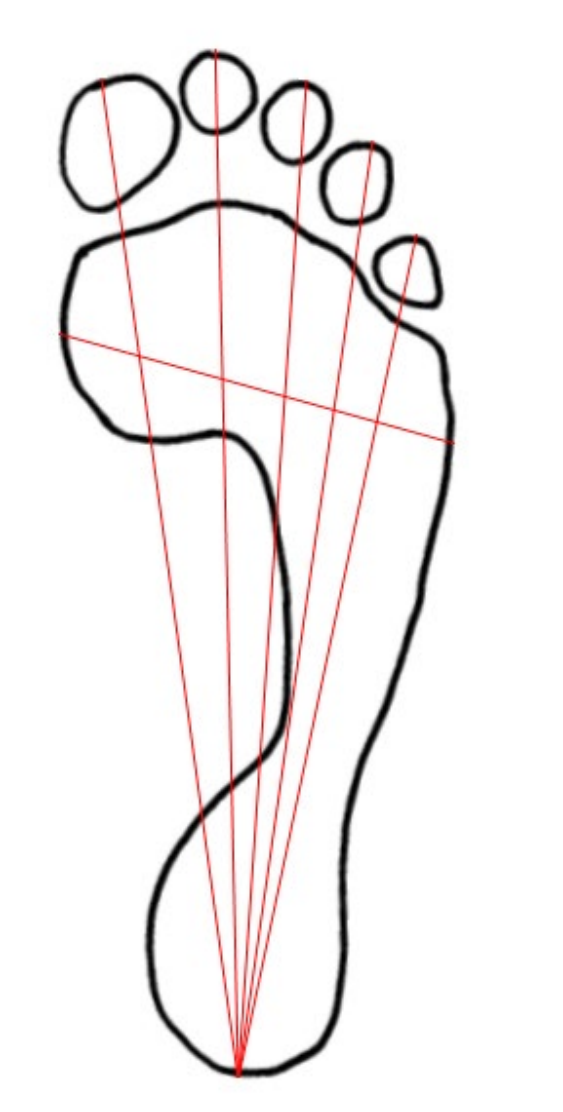
Overlay comparison table

Morphological feature	Shape	Position	Overall fit
1st toe print	+	-	-
2nd toe print	-	+	-
3rd toe print	++	++	-
4th toe print	+	+	--
5th toe print	-	-	--
Anterior ball of foot	-	-	--
Lateral border	+	+	--
Medial border	+	+	-
Heel	-	-	-

Linear measurement

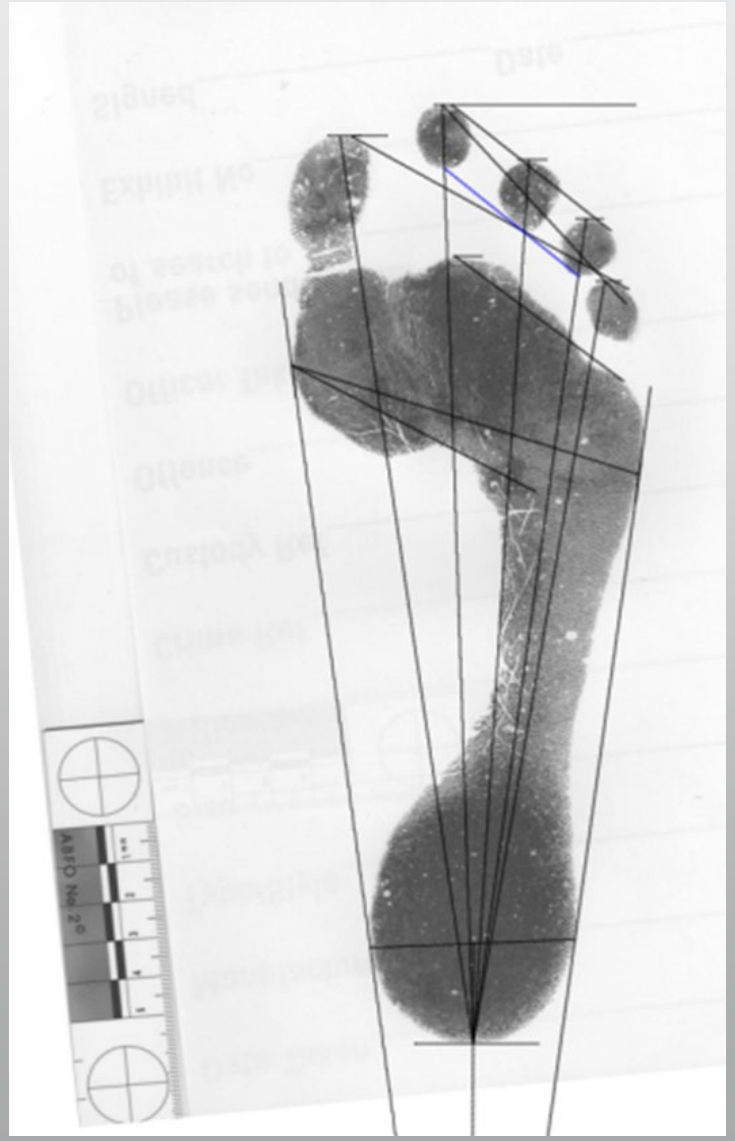


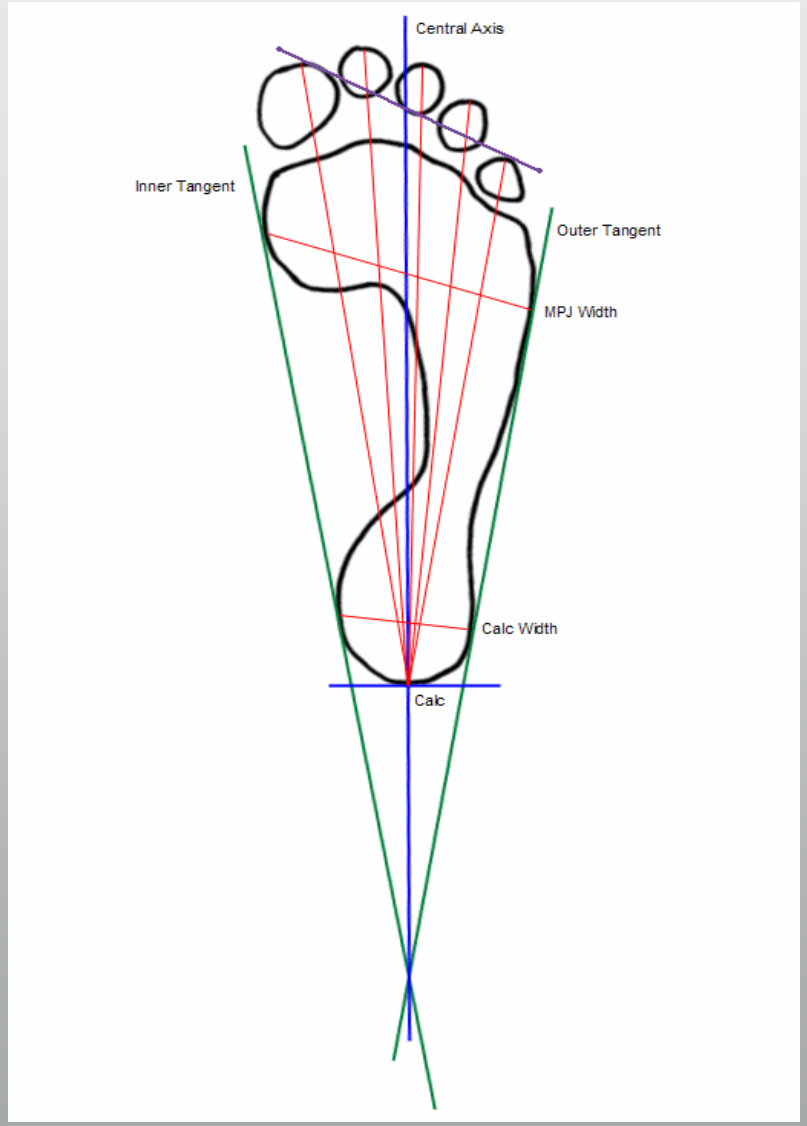
Gunn Method



Gunn,1991

Reel Method





Reel et al., 2010; Reel, 2013

Linear measurement comparison table

Measurement	KNOWN FOOTPRINT	QUESTIONED FOOTPRINT	+/- mm
Heel to 1st Toe	250mm	250mm	**0mm**
Heel to 2nd toe	255mm	253mm	**2mm**
Heel to 3rd toe	244mm	240mm	**4mm**
Heel to 4th toe	233mm	232mm	**1mm**
Heel to 5th toe	216mm	215mm	**1mm**
Cross ball measurement	97mm	95mm	**2mm**

Are these methods valid? Do they give reliable results?

‘Whilst the courts can consider all possible sources of evidence, they may rule scientific results inadmissible where the validity of a method cannot be demonstrated.’

Forensic Podology Code of Practice (2025) P. 29

Reliability & Validity

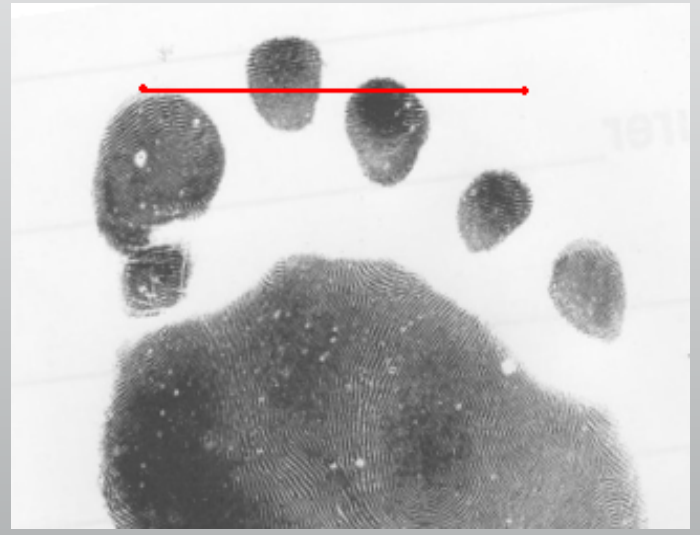
- Intra-rater reliability
- Inter-rater reliability
- Content validity
- Discriminant validity
- Convergent validity
- Concurrent validity
- Predictive validity
- External validity

Gunn, 1991; Reel, 2013; Reel et al., 2010; Burrow, 2016; Hu et al., 2018 Nirenberg et al., 2019a; Nirenberg et al., 2019b;

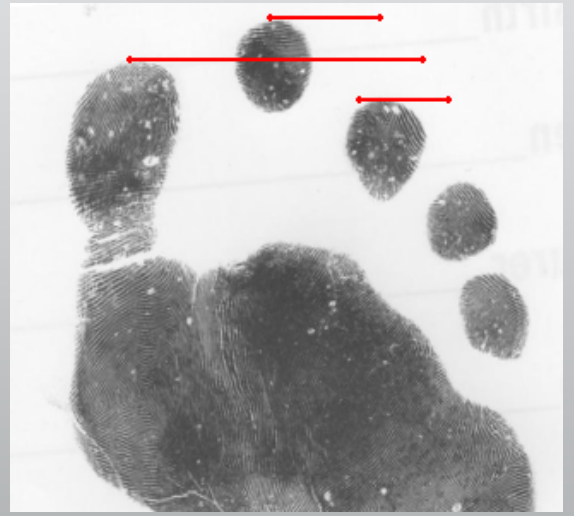
Interpretation

Toe formula

1,2,3,4,5.



2,3,1,4,5.

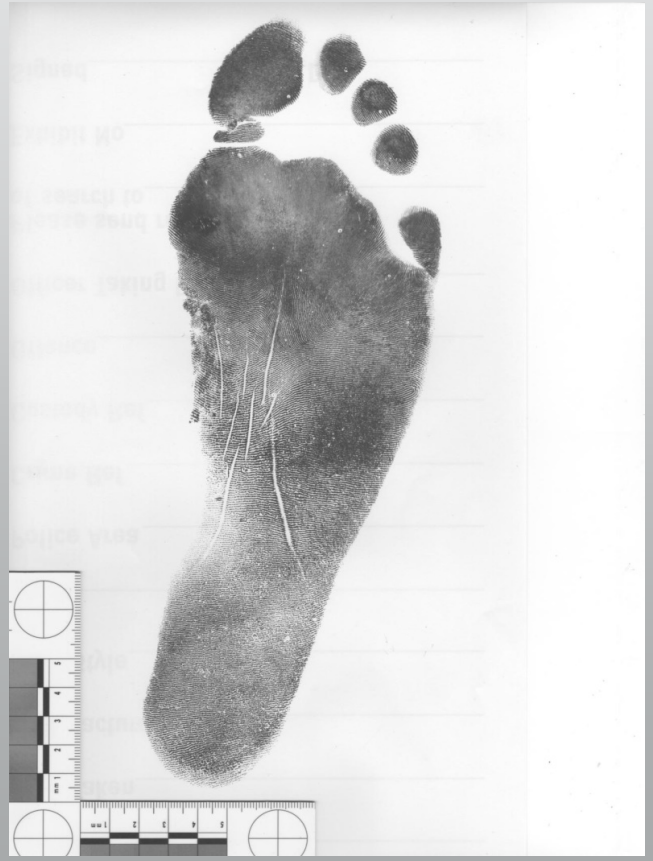


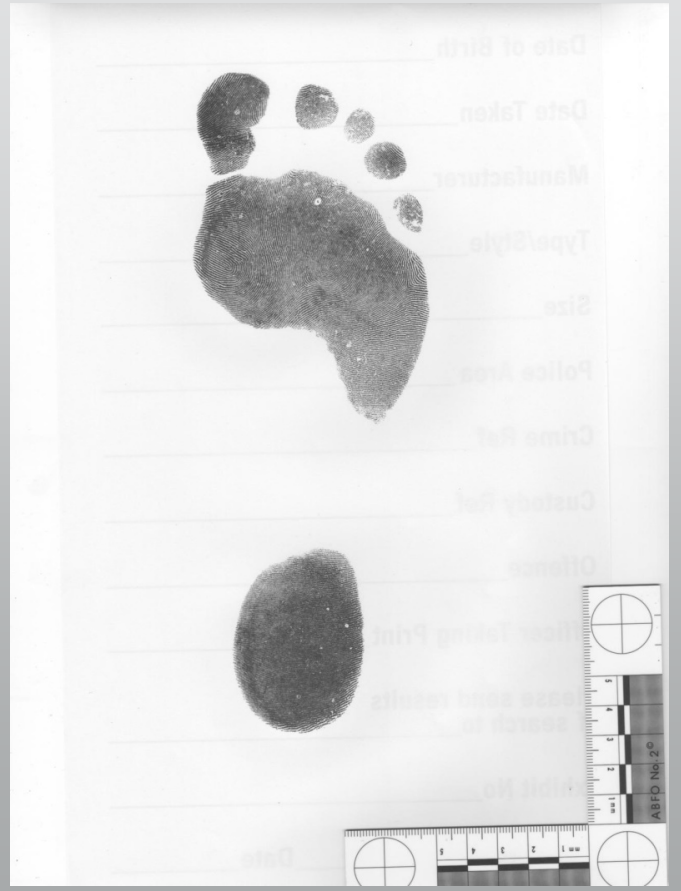
2,1,3,4,5.

Pathologies

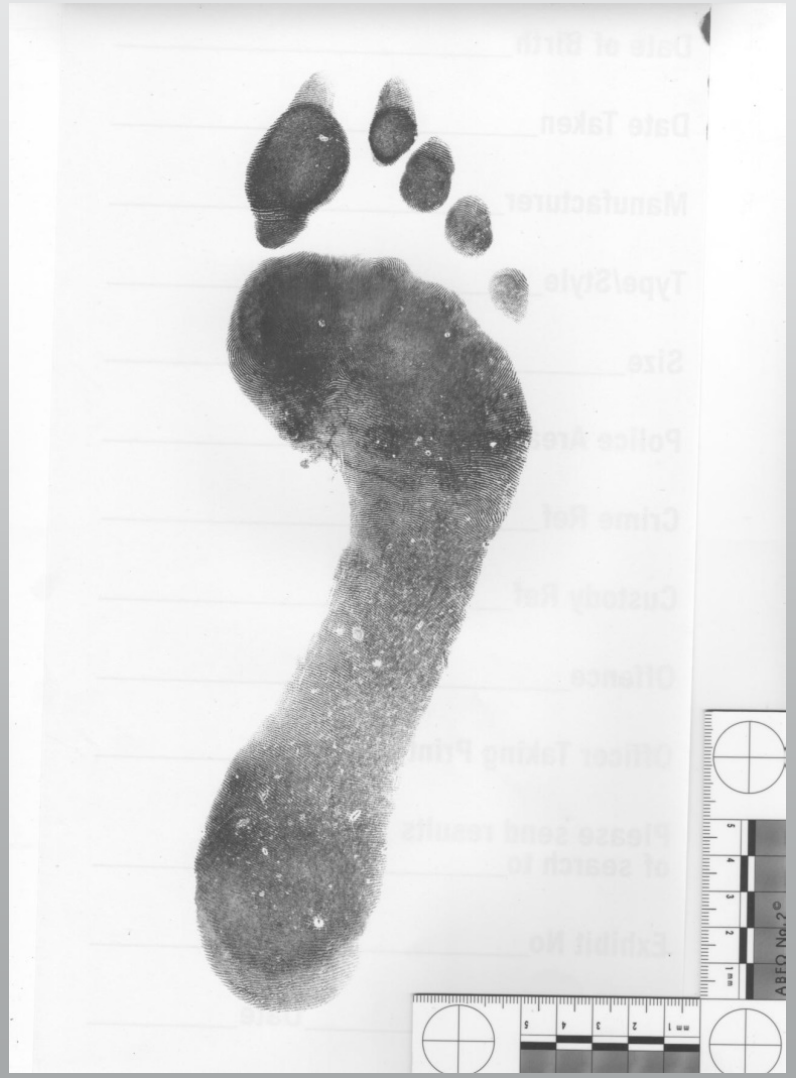
- HAV
- Tailor's bunion
- Surgically/congenitally shortened toes
- Pes planus/cavus
- Scarring/skin lesion e.g. verruca

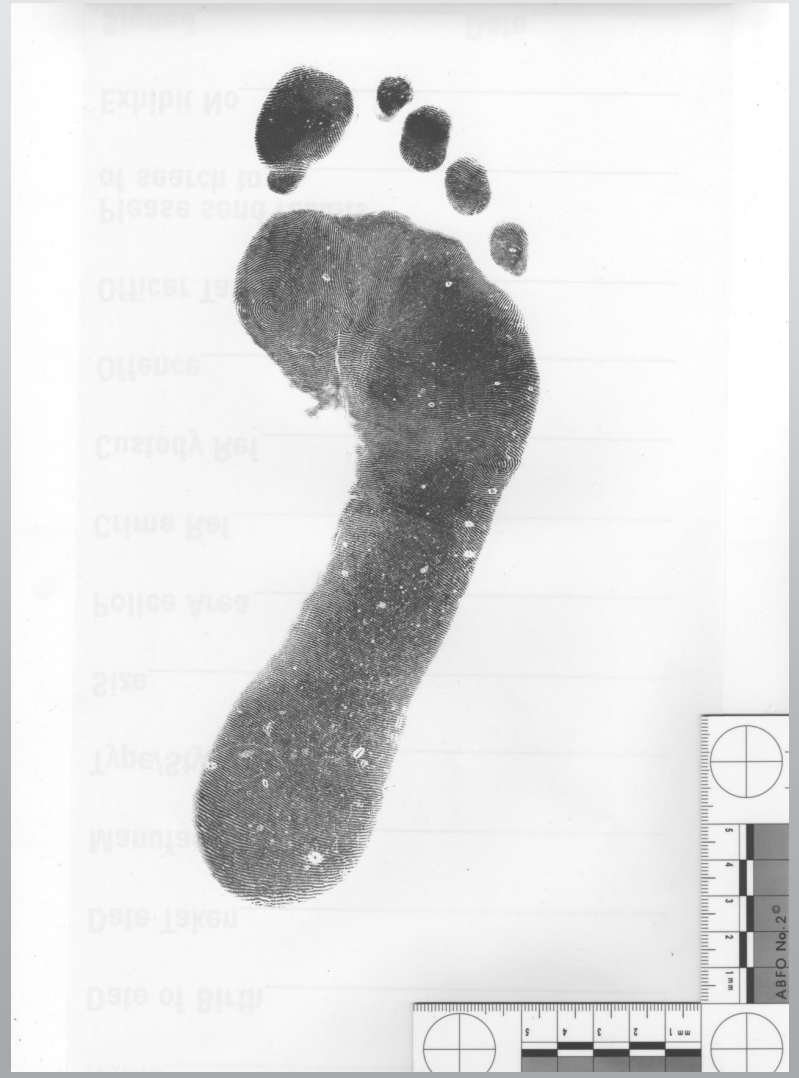
Pes planus vs pes cavus





Static vs dynamic footprints





Evidential weight

How to show evidential value?

- Remember – there's currently **no** forensic podiatry evidence demonstrated at 'unique' level.
- Consider results of the comparisons, podiatric explanations of features that differ yet are not incompatible and consider limitations before deciding on a value
- Evett's and Jackson's work on (logical) Bayesian approaches & likelihood ratios gave rise to use of verbal expression table

Verbal Expression Table

Extremely strong evidence to support
Very strong evidence to support
Strong evidence to support
Moderately strong evidence to support
Moderate evidence to support
Limited evidence to support
No evidence
Limited evidence to reject
Moderate evidence to reject
Moderately strong evidence to reject
Strong evidence to reject
Very strong evidence to reject
Extremely strong evidence to reject

Argument for the Prosecution

Argument for the Defence

Association of Forensic Science Providers. (2009)

Verification

Footprint evidence workshop:

The practical

Your turn!

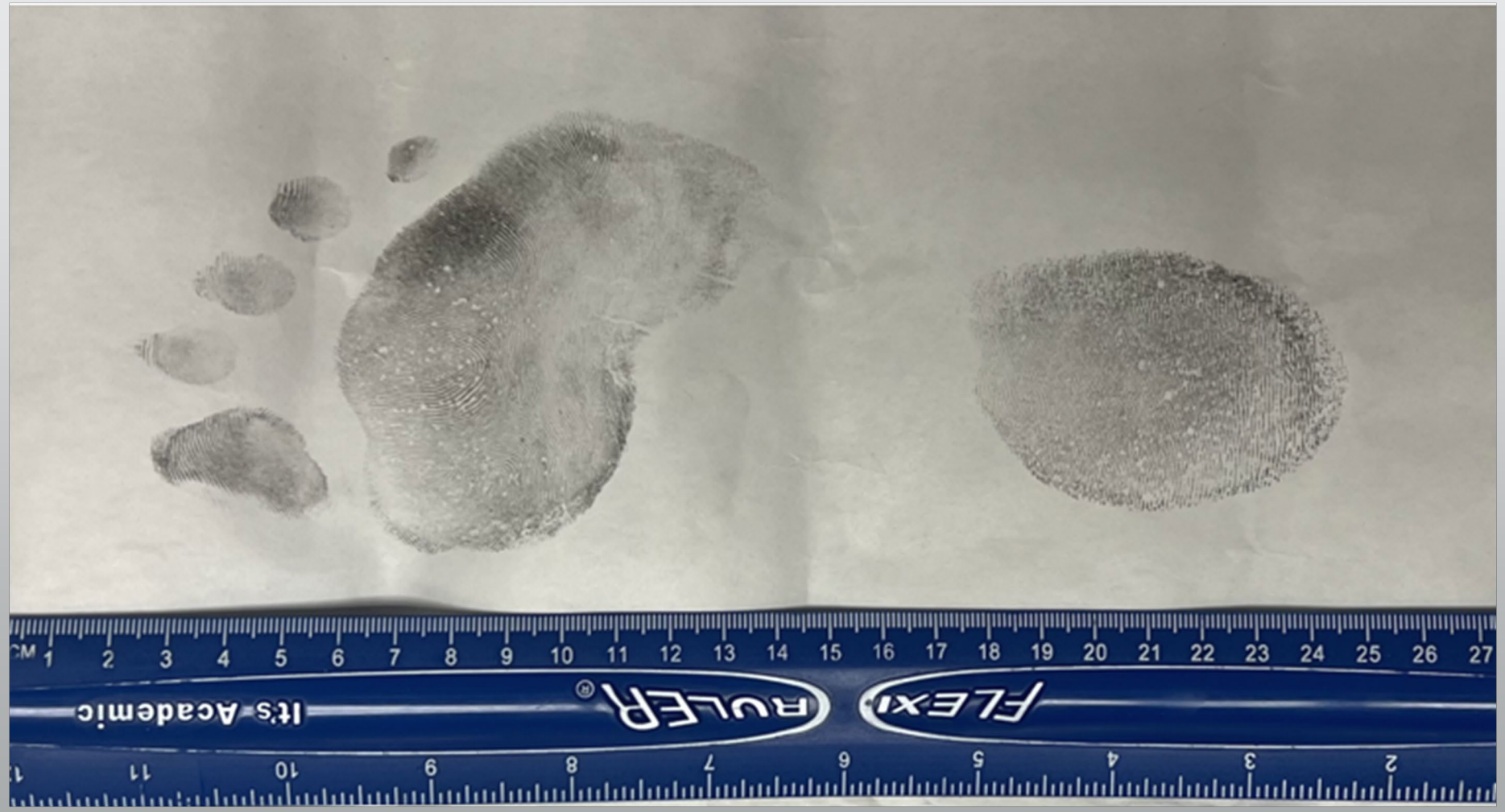
Soering vs Haysom

Printed and digital exhibits provided

- A single smudged footprint recovered from the crime scene labelled L/-3-85 HAYSUM
- L and R bare and socked static inked footprints labelled J. Soering
- R socked walking inked footprint labelled J. Soering
- R bare static inked footprint labelled Elizabeth Haysom
- R bare walking footprint labelled E. Haysom

Crime Scene Footprint

Elizabeth Haysom inked walking bare footprint (R)



Jens Soering inked walking socked footprint (R)

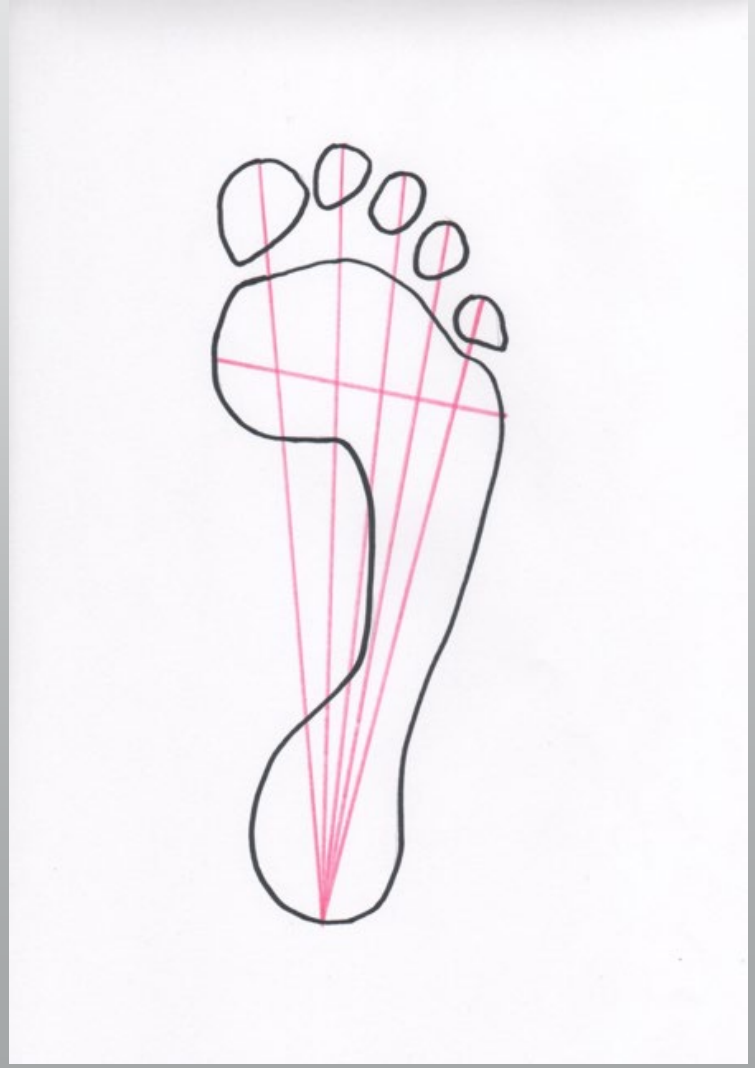
Questioned footprint analysis


4-3-85 HAYSUM


4-3-8

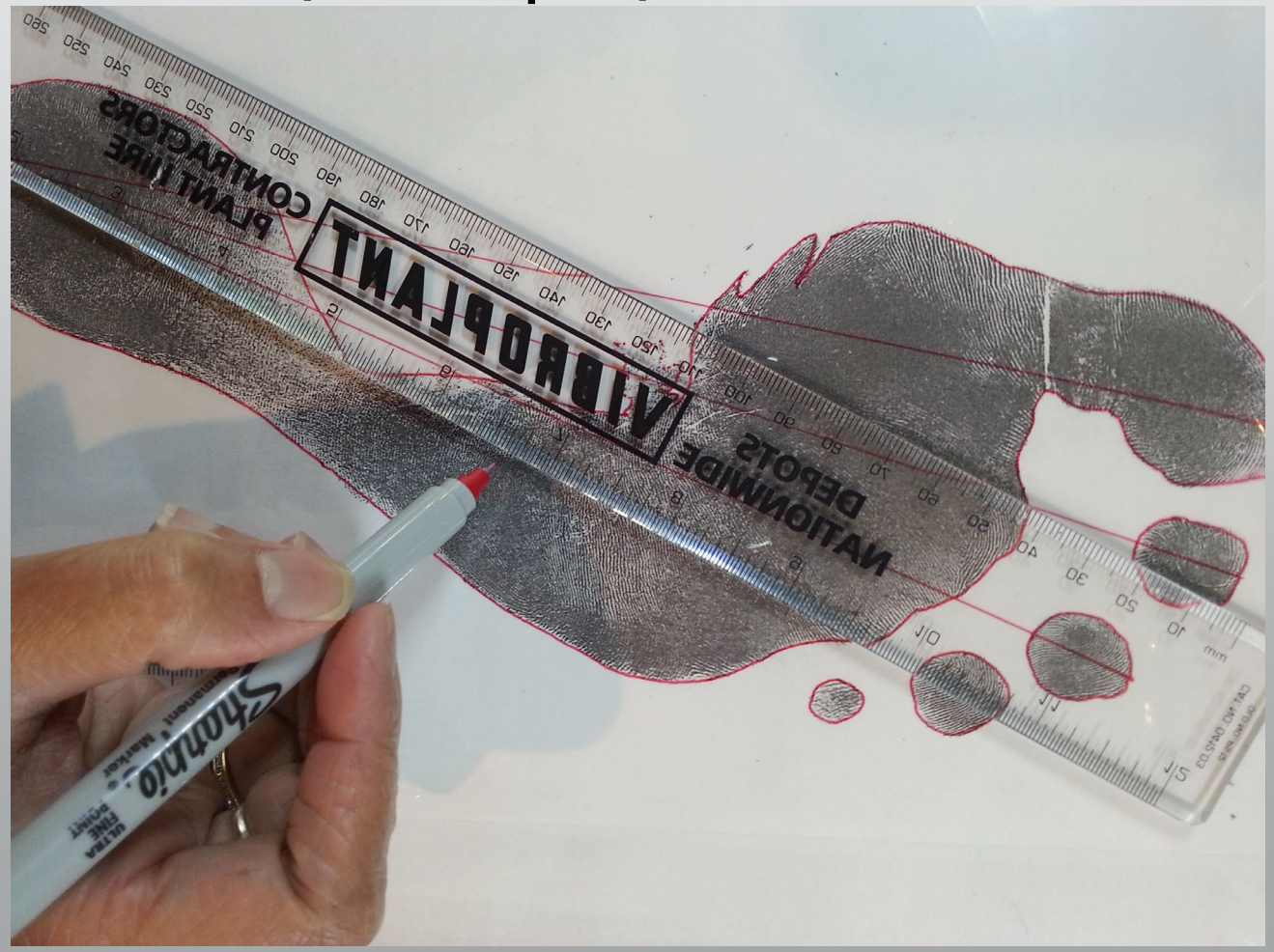
Task 1: Trace an overlay of the questioned footprint (acetate, paper clip, Sharpie)

Task 2: Measure your questioned footprint overlay using the Gunn Method & note measurements (ruler, Sharpie, measurement table)



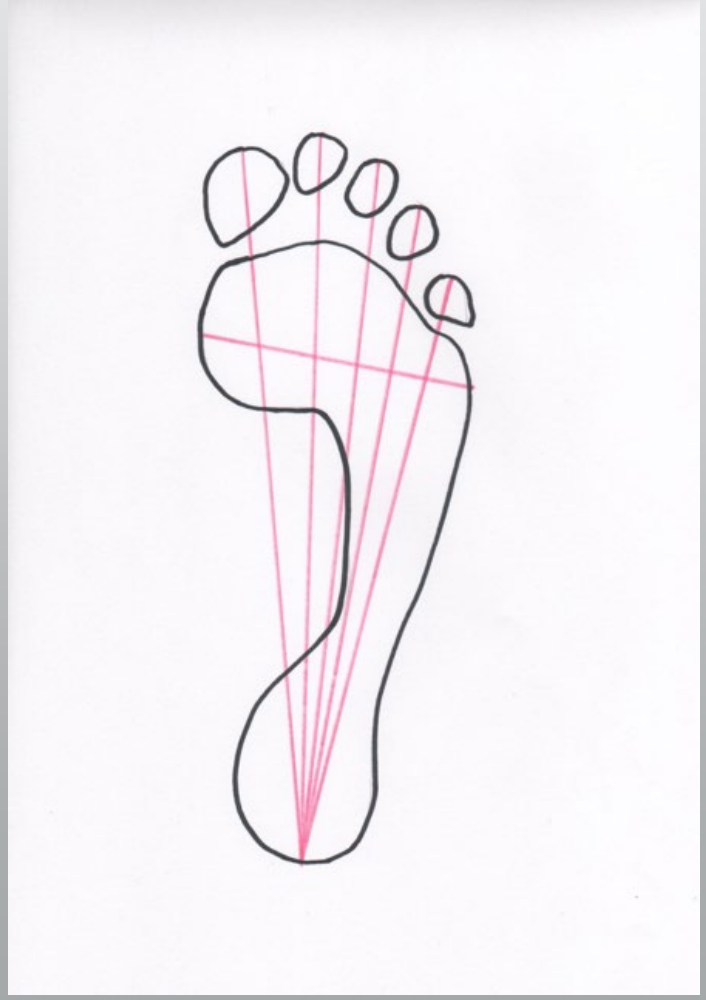
Task 3: Trace an overlay of the inked footprint of E. Haysom (acetate, paper clip, Sharpie)

Task 4: Measure your Haysom reference footprint overlay using the Gunn Method & note measurements (ruler, Sharpie, measurement table)



Task 5: Trace an overlay of the inked footprint of J. Soering (acetate, paper clip, Sharpie)

Task 6: Measure your J. Soering reference footprint overlay using the Gunn Method & note measurements (ruler, Sharpie, measurement table)



Task 7: Write down your measurement results in the table provided and work out differences

COMPARISON OF REFERENCE FOOTPRINTS WITH CRIME SCENE FOOTPRINT

Measurement (mm)	CRIME SCENE FOOTPRINT (A)	**HAYSOM** REFERENCE FOOTPRINT (B)	**Differences (mm)** (A-B)	CRIME SCENE FOOTPRINT (A)	**SOERING** REFERENCE FOOTPRINT (C)	**Differences (mm)** (A-C)
Heel to 1st toe print						
Heel to 2nd toe print						
Heel to 3rd toe print						
Heel to 4th toe print						
Heel to 5th toe print						
Across ball of footprint measurement						

Overlay comparisons

Morphological feature	**Shape**	**Position**	**Overall fit**
1st toe print			
2nd toe print			
3rd toe print			
4th toe print			
5th toe print			
Anterior ball of foot			
Lateral border forefoot			
Medial border forefoot			
Heel			

Weighing up the evidence…

- Who do you think made the crime scene footprint?
  - Jens Soering?
  - Elizabeth Haysom?
  - Neither (someone else)?

Findings

- All footprints displayed toe prints that have the same toe formula 1,2,3,4,5. This particular toe formula is not unusual.
- The questioned footprint and the reference footprint belonging to J. Soering showed that there is a gap between the 1st and the 2nd toe prints. From my database of 3,274 footprints, I observed 524 with the same toe formula (above) and gap between the 1st and 2nd toe prints (16%).
- Current research suggests when compared linear measurements fall within 5mm of each other, it supports the proposition that the footprints belong to the same person. For the comparison between the reference footprint labelled as belonging to J. Soering and the questioned footprint, most measurements using the Reel Method fell within this expected variation.


4-3-85 HAYSOM E

Limitations of the evidence provided?

- An L-shaped ruler was not used in the photography of the crime scene footprint and the dynamic footprint of E. Haysom, therefore it is unclear if the images had been photographed without distortion which could potentially affect all measurements.
- Only one footprint has been provided from the crime scene.
- Although there appears to be movement associated with the questioned footprint, it is unclear whether the foot had come to a standing position when it was formed or if the foot was in a dynamic state.
- The reference footprints were collected by someone other than the author of this report, therefore there is a lack of certainty whether some were collected in a dynamic or a static state.

Weighing up the footprint evidence – what do you think?

Extremely strong evidence to support
Very strong evidence to support
Strong evidence to support
Moderately strong evidence to support
Moderate evidence to support
Limited evidence to support
No evidence
Limited evidence to reject
Moderate evidence to reject
Moderately strong evidence to reject
Strong evidence to reject
Very strong evidence to reject
Extremely strong evidence to reject

Weighing up the footprint evidence

- "Based on my experience of footprint comparisons and taking into account the limitations listed, I would suggest that the comparison of the inked reference static and dynamic footprint images from J. Soering and the questioned footprint image from the crime scene **provides moderately strong support for the proposition that the reference and questioned footprints belong to the same person**."

Verbal Expression Table

Extremely strong evidence to support
Very strong evidence to support
Strong evidence to support
Moderately strong evidence to support
Moderate evidence to support
Limited evidence to support
No evidence
Limited evidence to reject
Moderate evidence to reject
Moderately strong evidence to reject
Strong evidence to reject
Very strong evidence to reject
Extremely strong evidence to reject

Argument for the Prosecution

Argument for the Defence

Association of Forensic Science Providers. (2009)

The case

The 1985 double murder of Derek and Nancy Haysom in Virginia involved their daughter Elizabeth Haysom and her boyfriend Jens Soering. Both were young university students at the time and fled to England shortly after the crime.

Derek and Nancy Haysom (Photo: Netflix)

Details of the murders and suspects

- Derek and Nancy Haysom, wealthy socialites, were found brutally stabbed in their home. Jens Soering, son of a German diplomat, and Elizabeth Haysom were initially not suspects but later arrested in England for fraud under false identities.

Legal proceedings and convictions

- Soering was extradited to the U.S. in 1990, tried, and sentenced to two consecutive life sentences for first-degree murder. Haysom pleaded guilty to accessory to murder before the fact and received a 90-year sentence. Evidence included a bloody sock print linked to Soering’s foot, though some questioned the conviction's strength.

Confessions and appeals

- Soering confessed multiple times but later retracted, claiming he initially confessed to protect Haysom, expecting diplomatic immunity. He alleged investigation irregularities and filed appeals, but his claims of wrongful conviction were found without merit.

Parole and post-incarceration status

- After serving decades in prison, both were granted parole in 2019; Haysom was deported to Canada in 2020, and Soering returned to Germany, barred from the U.S. and contact with the victims' family.

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Evidential weight

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Workshop

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Any Questions?

Thank you for your participation in this workshop

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