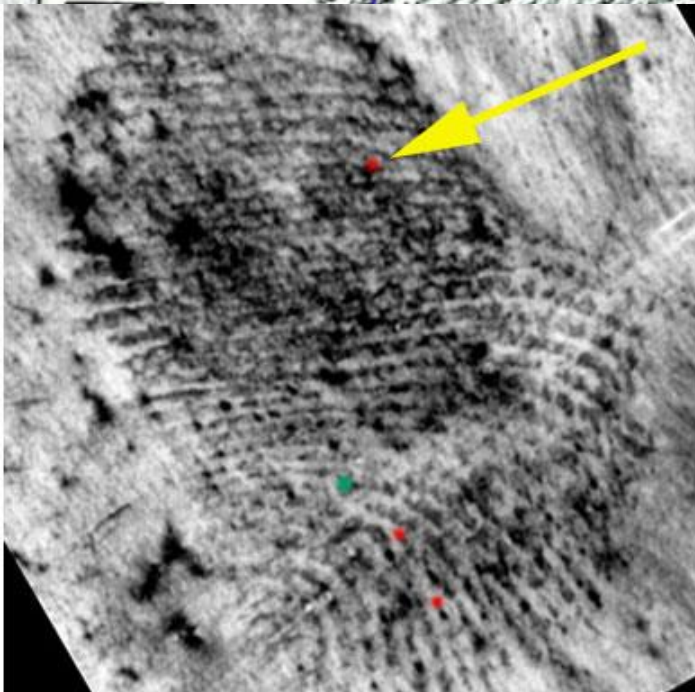
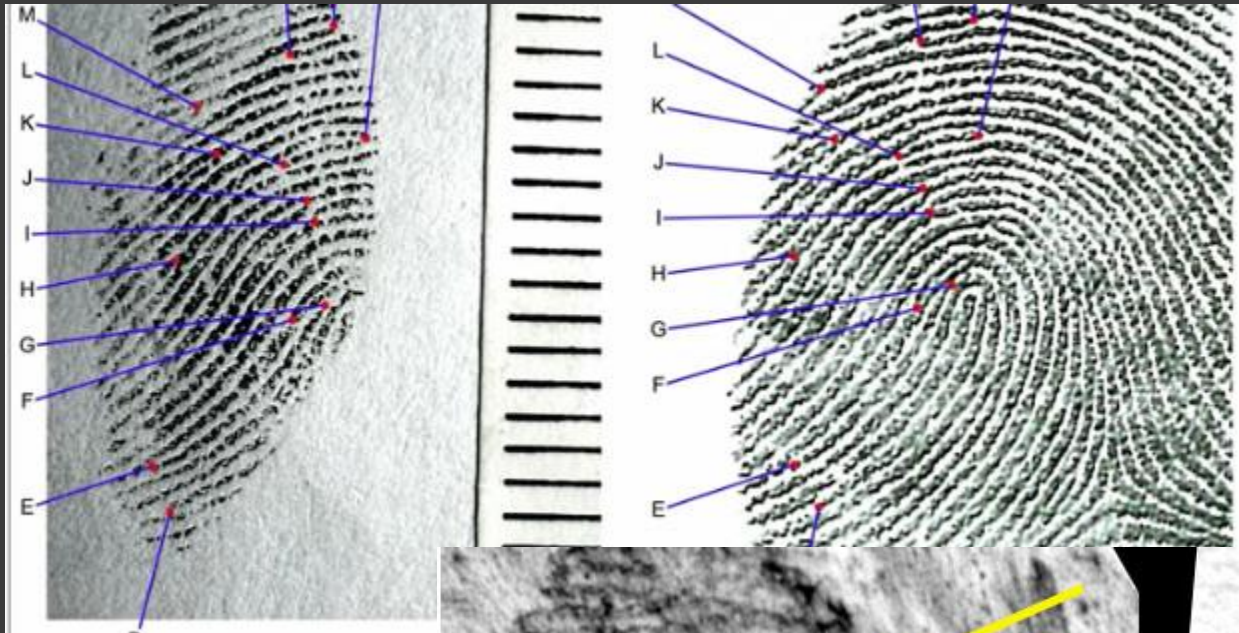


Michele Triplett, King County, WA

RATING THE COMPLEXITY OF FINGERPRINT COMPARISONS

Risk of Error



Background

- Historically: The FP discipline has given discrete subjective conclusions, based on the examiners training and experience (ID/no ID).

- 2013 - 2015

- 2015 - 2017

- 2018 - 2019

Journal of Cold Case Review

Volume 1, Issue 2, December 2015

Complexity, Level of Association and Strength of Fingerprint Conclusions

By Michele Triplett^[1]

Abstract

False convictions and false incarcerations have pushed the topic of forensic errors into the national spot light. Friction ridge comparisons (referred to as fingerprints for the remainder of this paper) are very accurate but errors have occurred. The strength of any conclusion needs to be indicated since criminal proceedings rely heavily on this type of information. The following paper discusses a possible explanation for errors and offers a more accurate and transparent approach for arriving at and reporting results. The proposed approach labels the complexity and demonstrable level of association found between two impressions which allow others to more accurately discern the strength of a conclusion.

Rate/Measure the Factors

- Shape/ridge flow, L1 detail
- Area of hand
- Orientation
- Focal points
- Feature type (ending ridge, bifurcation, dot, pore, edges, incipients) , L2 L3
- Feature quantity
- Feature quality
- Intervening ridges between features
- Intervening ridge quality
- Feature rarity, pattern force area
- Distortion: pressure, twisting, movement, tonal reversal, tonal shifts, artifacts, overlapping ridges
- Contrast
- Spatial Relationship between features
- Repeatability
- Reproducibility
- Discrepancies, background noise, artifacts
- Simultaneous
- Training
- Experience

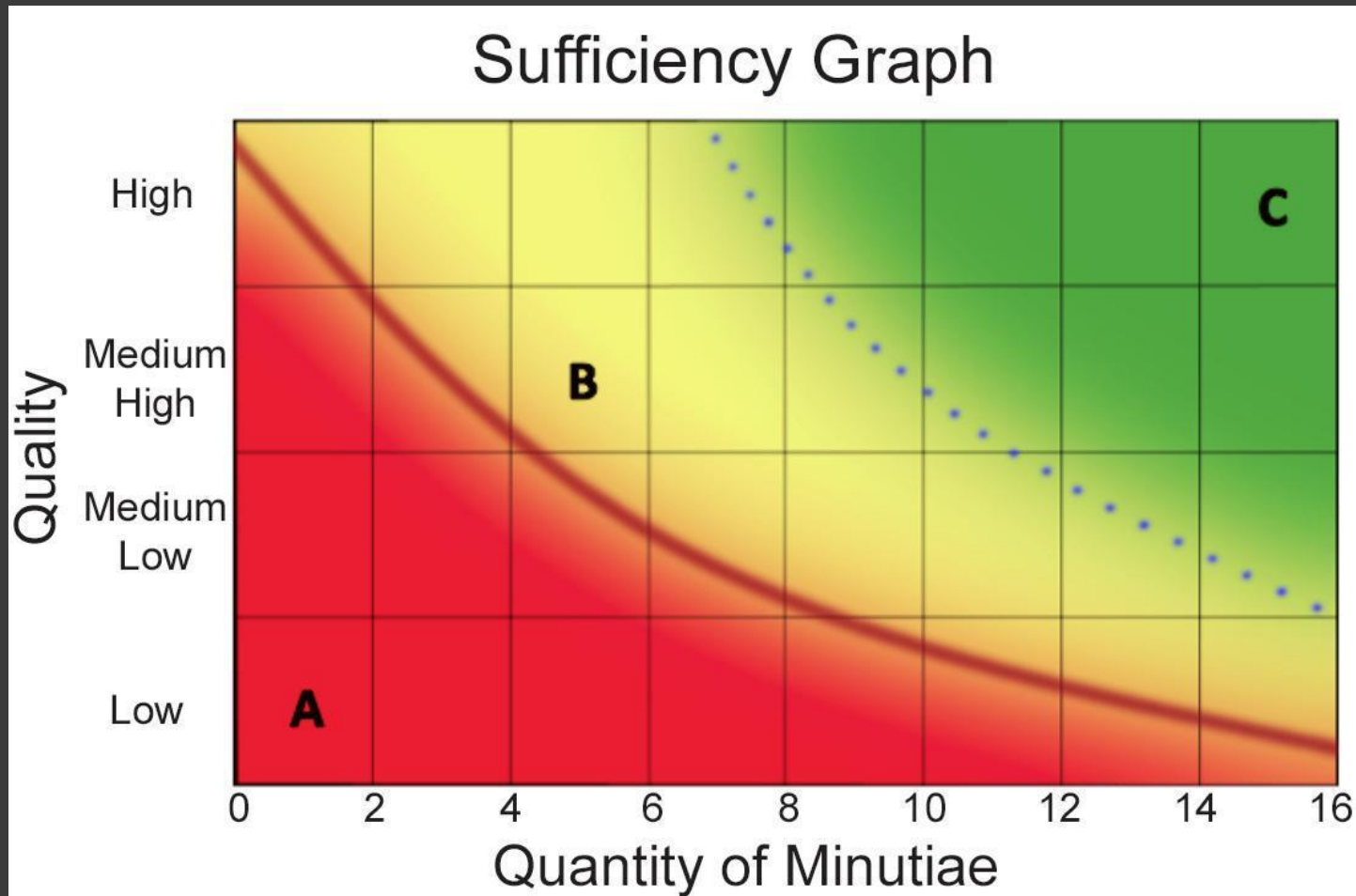
Measure the Factors

- Shape/ridge flow, L1 detail
- Area of hand
- Orientation
- Focal points
- Feature type (ending ridge, bifurcation, dot, pore, edges, incipients) , L2 L3
- Feature quantity
- Feature quality
- Intervening ridges between features
- Intervening ridge quality
- Feature rarity, pattern force area
- Distortion: pressure, twisting, movement, tonal reversal, tonal shifts, artifacts, overlapping ridges
- Contrast
- Spatial Relationship between features
- Repeatability
- Reproducibility
- Discrepancies, background noise, artifacts
- Simultaneous
- Training
- Experience

Simplifying 6 into 4 categories

- ⦿ Area of hand
 - ⦿ Orientation
 - ⦿ Feature type
 - ⦿ Feature quantity
 - ⦿ Feature quality
 - ⦿ Intervening ridge quality
-
- ⦿ Area/Orientation
 - ⦿ Feature type
 - ⦿ Feature quantity
 - ⦿ Overall quality

Previous Q/Q Graph



Method to Rate Complexity of a Comparison

- ① Measure the key factors of the comparison:
(need parameters, not opinion)
 - Area / Orientation (self evident?)
 - Features Used (bifurcations or creases/pores)
 - Clarity/Ambiguity (can others see it)
 - Amount of data (limited or abundant)
 - (Rarity of features is only needed when info is limited)

Factors for Complexity OF A COMPARISON (not the Conclusion)

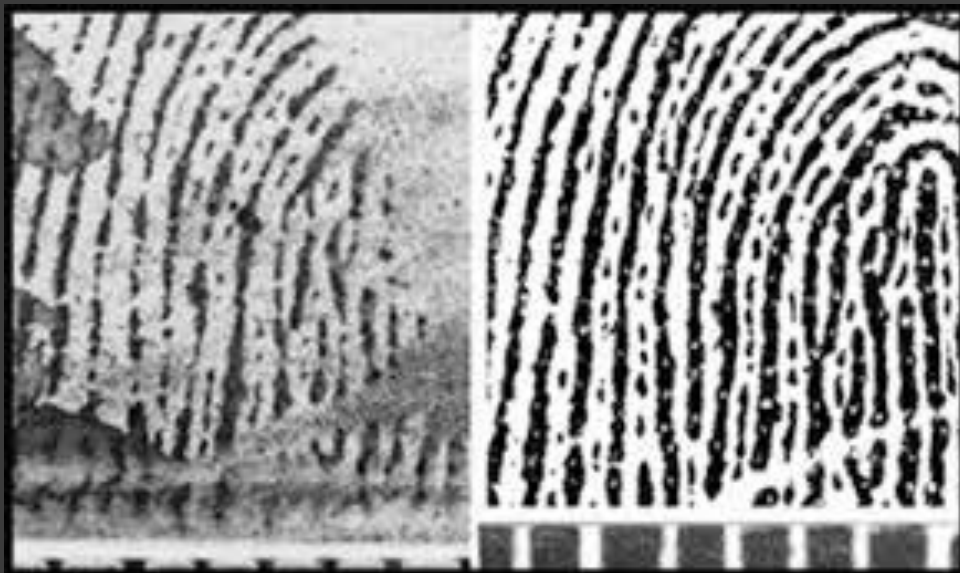
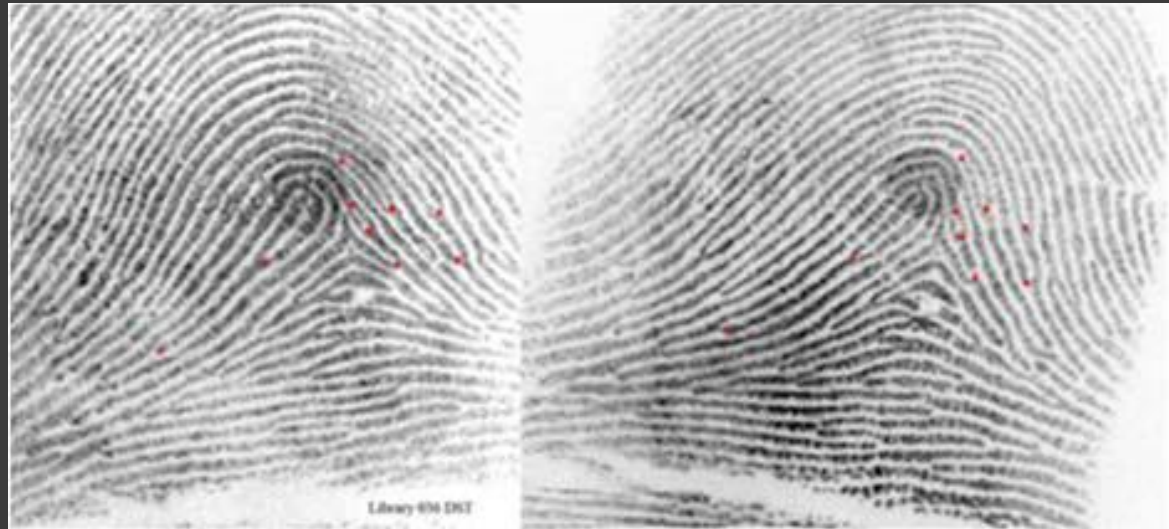
FACTORS TO ASSESS			
AREA / ORIENTATION:	Self-evident (to others)	Not Self-evident	
TYPE (of features used):	Primary (ending ridges, dots, bifurcations)	Secondary (creases, incipient)	Tertiary (pores, simultaneous)
QUALITY (ambiguity/clarity):	Predominantly Clear (would be assessed the same by others)		Predom. Ambig.
QUANTITY (of prim/sec features):	Abundant (more than needed; others may use different features)		Limited (others would have to use the same features)
COMPLEXITY RATING:	All in column indicates BASIC	At least one in column raises to ADVANCED	At least one in column raises to COMPLEX

If borderline, rate higher

Complexity Ratings Meanings

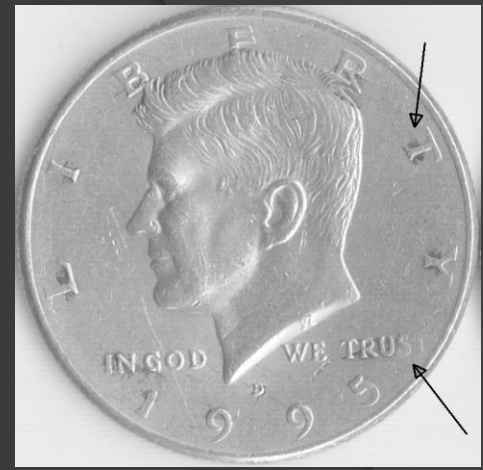
- ◎ **Basic (Standard TP Quality, lights-out)**
 - Only need initial training
 - **Self-evident** A/O, bifurcations/ridge endings, clear, **abundant**
 - Easily **reproducible** by others with minimal training
 - Virtually no risk of error
- ◎ **Advanced (Standard LP quality, palms)**
 - Need advanced training (orientation clues)
 - Not **self-evident** A/O, nonstandard features, slight **ambiguity**, abundant
 - Easily **demonstrable** to all others
 - Virtually no risk of error for ID (risk of error for false exclusion)
- ◎ **Complex (tonal shifts, past errors)**
 - **Predominant ambiguity** and/or **limited** data
 - Not easily demonstrable
 - Higher risk of error; need more QA

Basic / Advanced / Complex



Basic / Advanced / Complex

- ◎ Overwhelming amount of clear data, easily repeatable
 - Virtually no risk of error for ID
- ◎ Compelling amount of data, easily demonstrable
 - Virtually no risk of error for ID (risk of error for false exclusion)
- ◎ Low amount of quantity and quality, not easily demonstrable
 - Risk of error increases



QA (what is needed)

- ◎ **Complexity** determines the QA needed
 - Consultation
 - Documentation
 - Verification (as a review of correct application)
 - Extra QA (verification)
 - (Blind Verification is checking reproducibility, not if a conclusion is arrived at correctly or well supported)

Example regarding an injury:

Complexity

surface wound

internal bleeding

What Is Needed

needs a bandage

needing surgery

Not same QA for all (basic and complex)

Verification as Reproducibility

- Reproducibility is a scientific requirement for physical phenomenon, not for analytical conclusions.
- Blind is not better, blind checks reproducibility, does not check if method is applied correctly.
- Verification as a review of the basis, the conclusion, the complexity rating, and the QA (not independent assessment) –
- as with long division.

Verification

- Conclusion: Does it meet requirements for an ID? (need requirements)
- Complexity: Are the features demonstrable?
- QA: Does it meet requirements for QA (documentation)?

Complexity Determines QA

- ◎ Basic: easily reproducible
 - Documentation isn't necessary
 - QA to check complexity is accurate (and confirm no documentation is needed)
- ◎ Advanced: easily demonstrable
 - Document area/orientation
 - QA to check complexity is accurate
- ◎ Complex: may be difficult to demonstrate
 - Full Documentation of similarities, dissimilarities, distortion
 - QA to scrutinize if the conclusion is supportable (scrutiny found errors)
 - May want management review

QA - Not the same for each situation

- ⦿ Don't need to do a pre-analysis before a comparison for Basic to diminish bias, bias is an issue when information is ambiguous, it doesn't apply to BASIC comparisons (can do side by side).
- ⦿ Requiring pre-analysis and full documentation for basic, to diminish bias, shows a lack of understanding of when bias is possible.

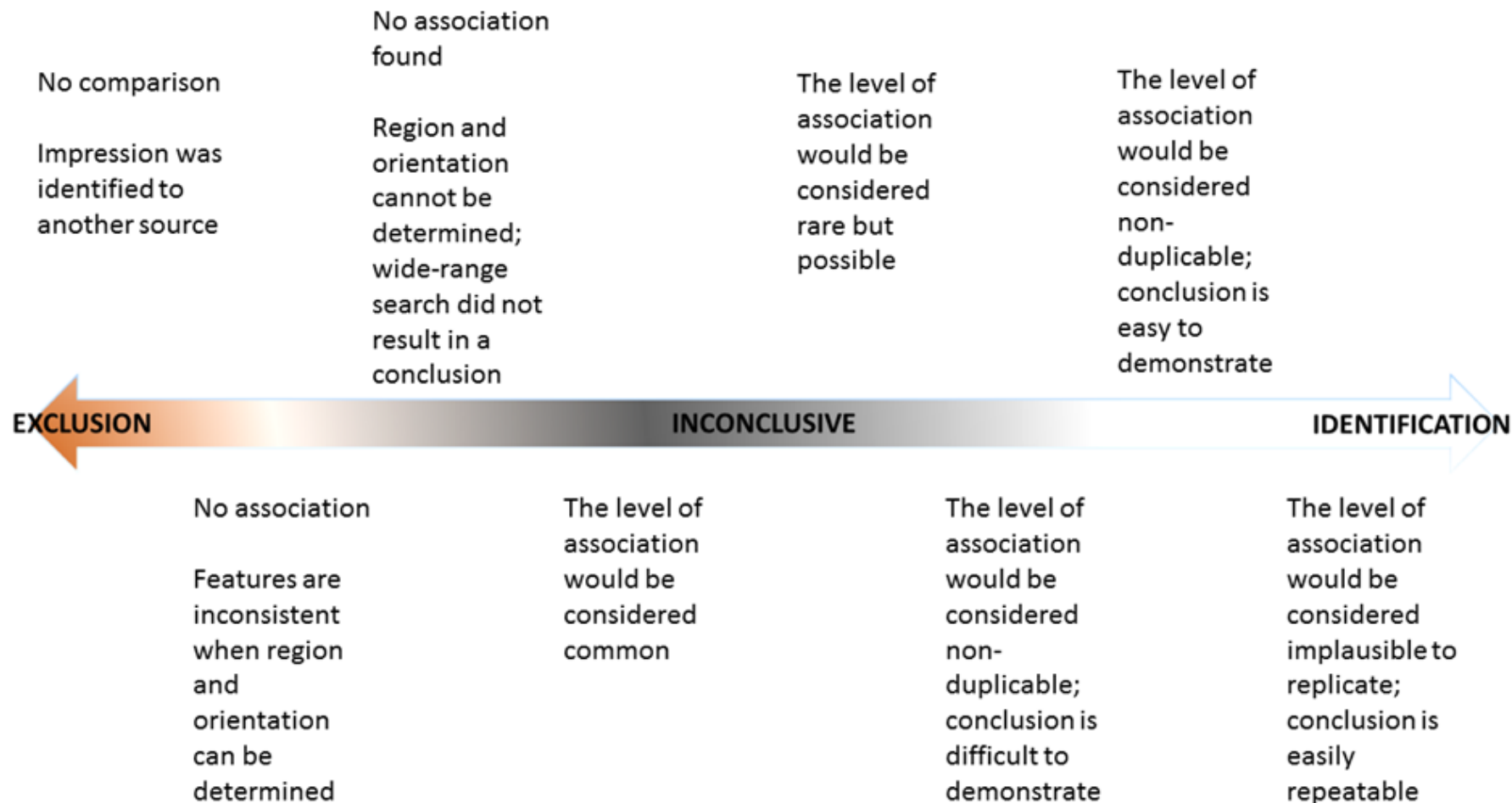
Complexity and QA Determines the Conclusion

- Conclusions are based on data, not artificial/subjective thresholds:
 - Fingerprints has been around for 100 years
 - I have 20 years of experience
 - Studies show low risk of error (overall, not specific)
 - I'm 100% confident (but could be wrong)
 - Consensus threshold (we all agreed, we voted)
 - Operational decision (not scientific)
- Works for all pattern recognition (bitemarks)
 - States the quantity and quality of the data, and a tested conclusion, not just someone's opinion.
- Rates the strength of ID's, not lumps all ID's together
- Turns a subjective opinion into a systematic method; turns pseudoscience into science

Parameter for ID

- ⦿ An ID is when there is compelling justification (data) to satisfy others (hold up to scrutiny).
- ⦿ **Compelling justification** is objective data and an accepted method (valid principles and accepted).
- ⦿ **Satisfy others** is the scientific criteria for observational sciences (Einstein's Theory of Relativity)

Verbal Scale of Conclusions (3 strengths for ID's) vs. "extremely strong support"

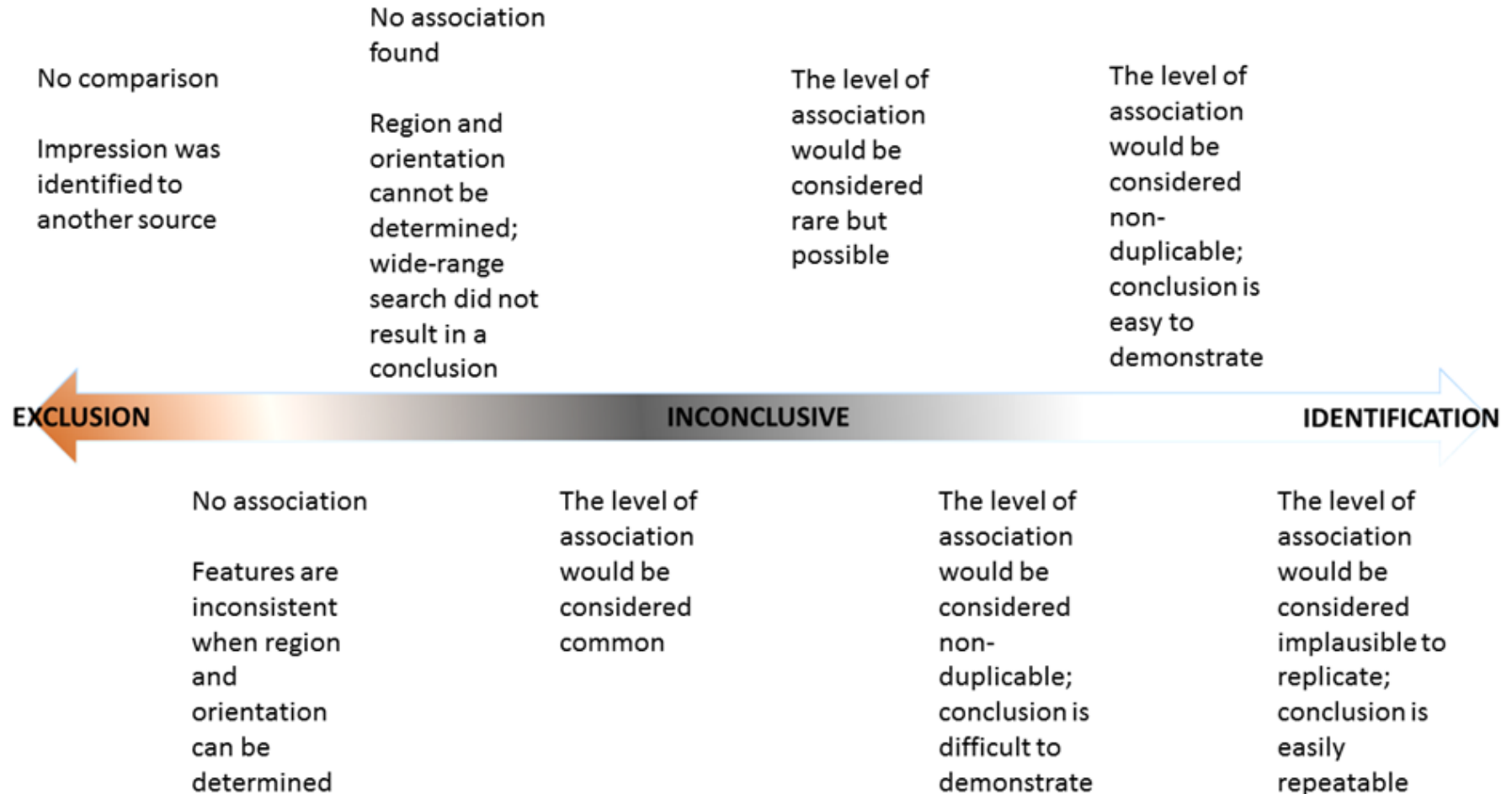


*Complexity levels range from light to dark

Verbal Scales for nonquantifiable conclusions

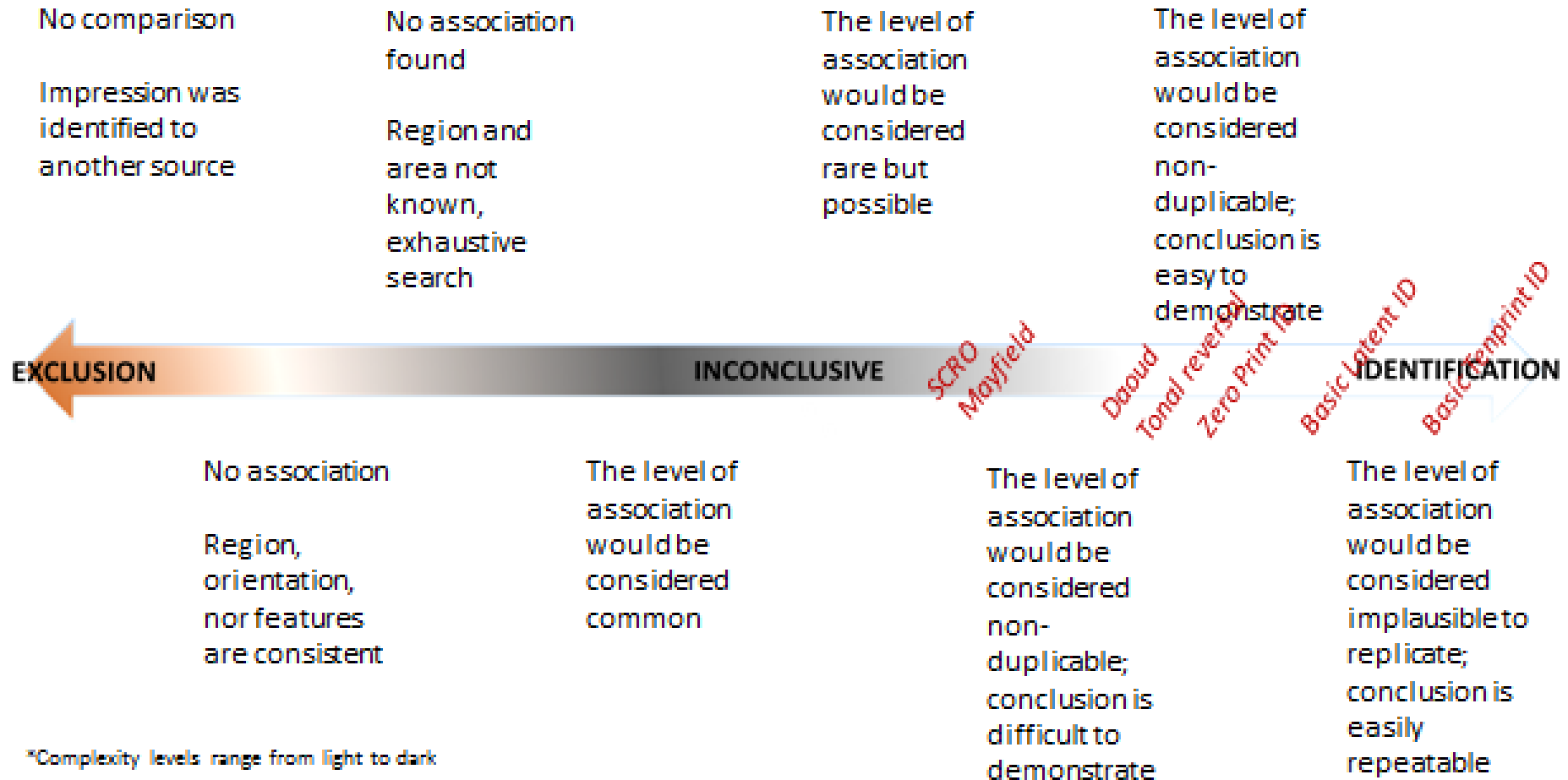
- Broken Bones: hairline, compound
- Hospital Scale: stable, serious, critical
- Cancer: Stage 1, 2, 3, 4
- Spiciness of food

Testing (QA) Determines the **Acceptable** Level of Association (the conclusion)



*Complexity levels range from light to dark

Conclusion Scale



*Complexity levels range from light to dark

Reporting 3 Strengths for Identifications:

- ① “The comparison is *Basic*. The level of association is overwhelming and easily repeatable by others.”
- ② “The comparison is *Advanced*. The level of association is *compelling*, easily demonstrable, and considered implausible to replicate.”
- ③ “The comparison is *Complex*. *Testing against strong scrutiny* determined the association to be persuasive and considered implausible to replicate.”

Advanced Comparisons

- If an examiner misses an ID (in casework or on a test), it is not due to incompetence, due to the data, lack of area/orientation clues.
- LPE may need additional training in the orientation clues.

Complexity and strength go hand in hand

As Complexity ↑

Strength ↓

Risk of Error ↑

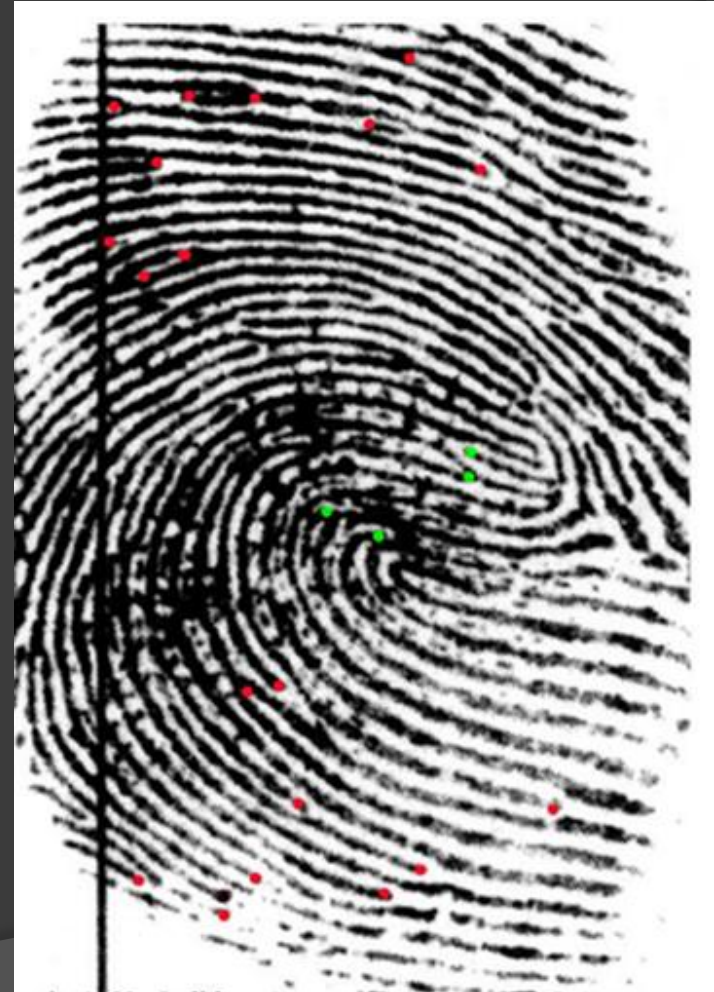
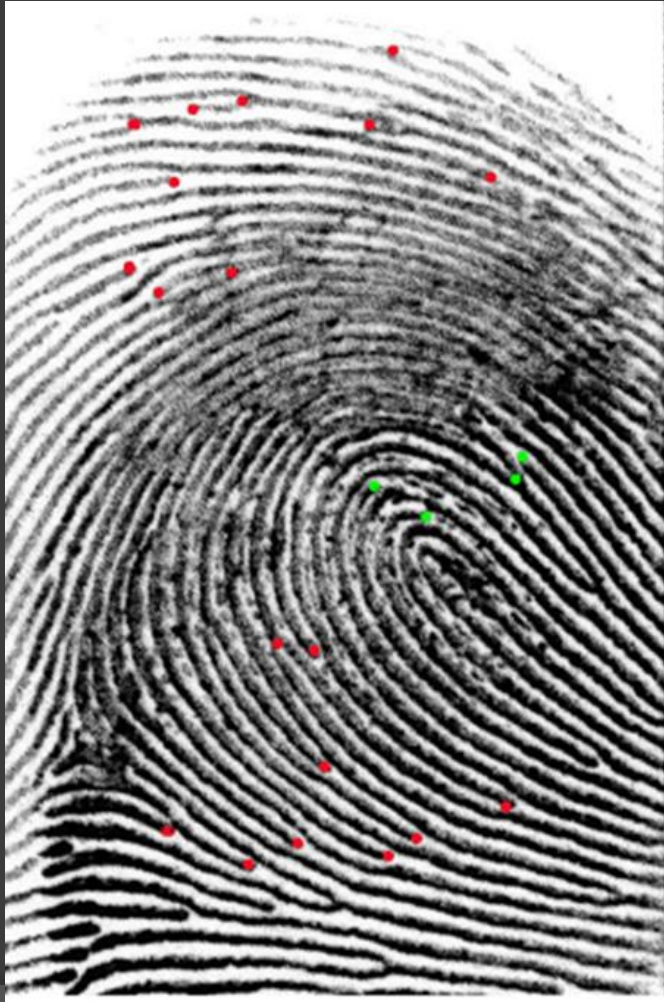
QA ↑ for the Strength ↑

Strength is based on complexity and QA,
not on the reproducibility

Difficulty vs COMPLEXITY

- ⦿ **Difficulty** is based on the person (training, experience and ability) not on data (the comparison)
- ⦿ **Complexity** is based on factors within the comparison
- ⦿ Difficulty is subjective while rating the complexity WITH PARAMETERS is not.
- ⦿ Rating the complexity in this manner reduces subjectivity.

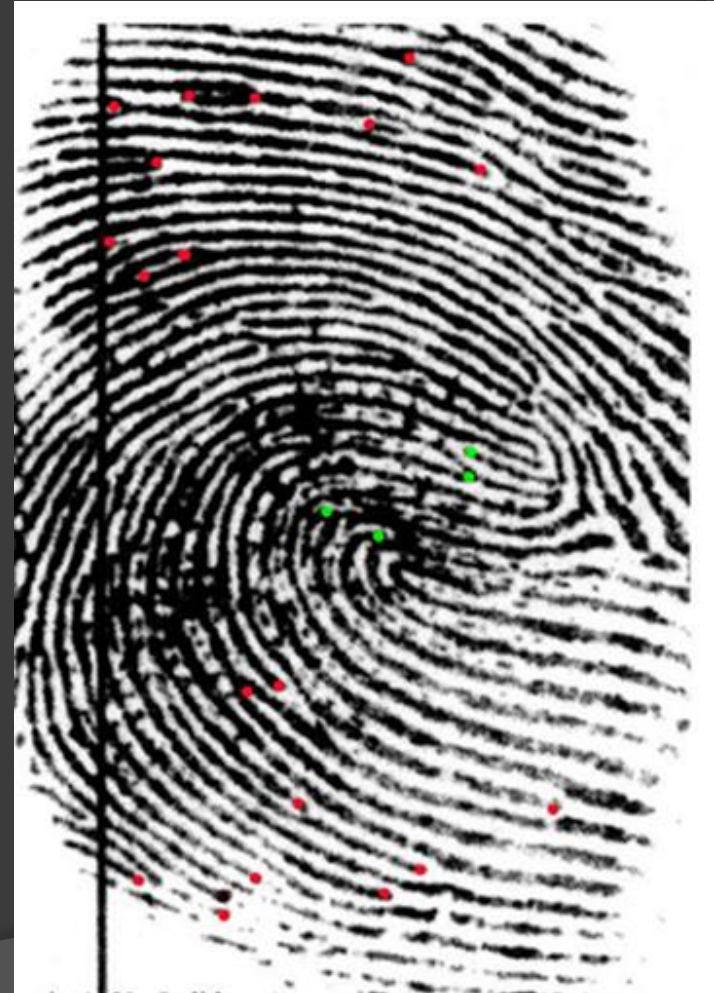
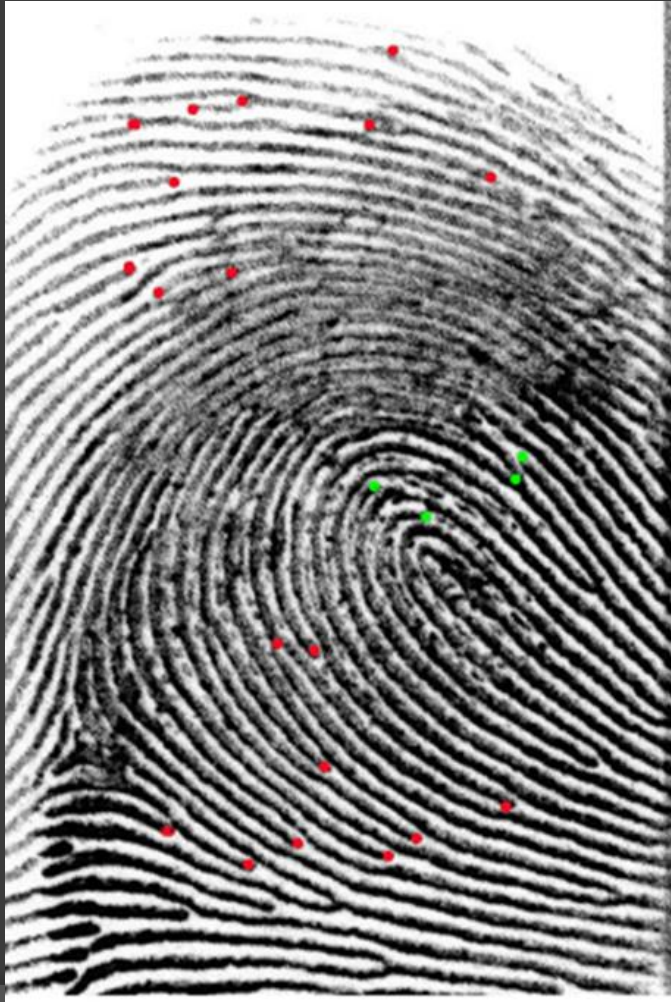
Assessing the complexity of the prints in isolation, both appear basic



Assessing **Print** Complexity (either)

FACTORS TO ASSESS			
AREA / ORIENTATION:	Self-evident (to others)	Not Self-evident	
TYPE (of features used):	Primary (ending ridges, dots, bifurcations)	Secondary (creases, incipient)	Tertiary (pores, simultaneous)
QUALITY (ambiguity/clarity):	Predominantly Clear (would be assessed the same by others)	Some ambiguity	Predom. Ambig.
QUANTITY (of prim/sec features):	Abundant (more than needed; others may use different features)		Limited (others would have to use the same features)
COMPLEXITY RATING:	BASIC	ADVANCED	COMPLEX

However, complexity changes during a comparison... making individual assessment irrelevant and unnecessary



Assessing Comparison Complexity

FACTORS TO ASSESS			
AREA / ORIENTATION:	Self-evident (to others)	Not Self-evident	
TYPE (of features used):	Primary (ending ridges, dots, bifurcations)	Secondary (creases, incipient)	Tertiary (pores, simultaneous)
QUALITY (ambiguity/clarity):	Predominantly Clear (would be assessed the same by others)	Some ambiguity	Predom. Ambig.
QUANTITY (of prim/sec features):	Abundant (more than needed; others may use different features)		Limited (others would have to use the same features)
COMPLEXITY RATING:	BASIC	ADVANCED	COMPLEX

Example: Assess the 4 factors



Factors for Complexity (not Conclusion)

FACTORS TO ASSESS			
AREA / ORIENTATION:	Self-evident (to others)	Not Self-evident	
TYPE (of features used):	Primary (ending ridges, dots, bifurcations)	Secondary (creases, incipient)	Tertiary (pores, simultaneous)
QUALITY (ambiguity/clarity):	Predominantly Clear (would be assessed the same by others)	Some ambiguity	Predom. Ambig.
QUANTITY (of prim/sec features):	Abundant (more than needed; others may use different features)		Limited (others would have to use the same features)
COMPLEXITY RATING:	BASIC	ADVANCED	COMPLEX

Verbally w/o chart

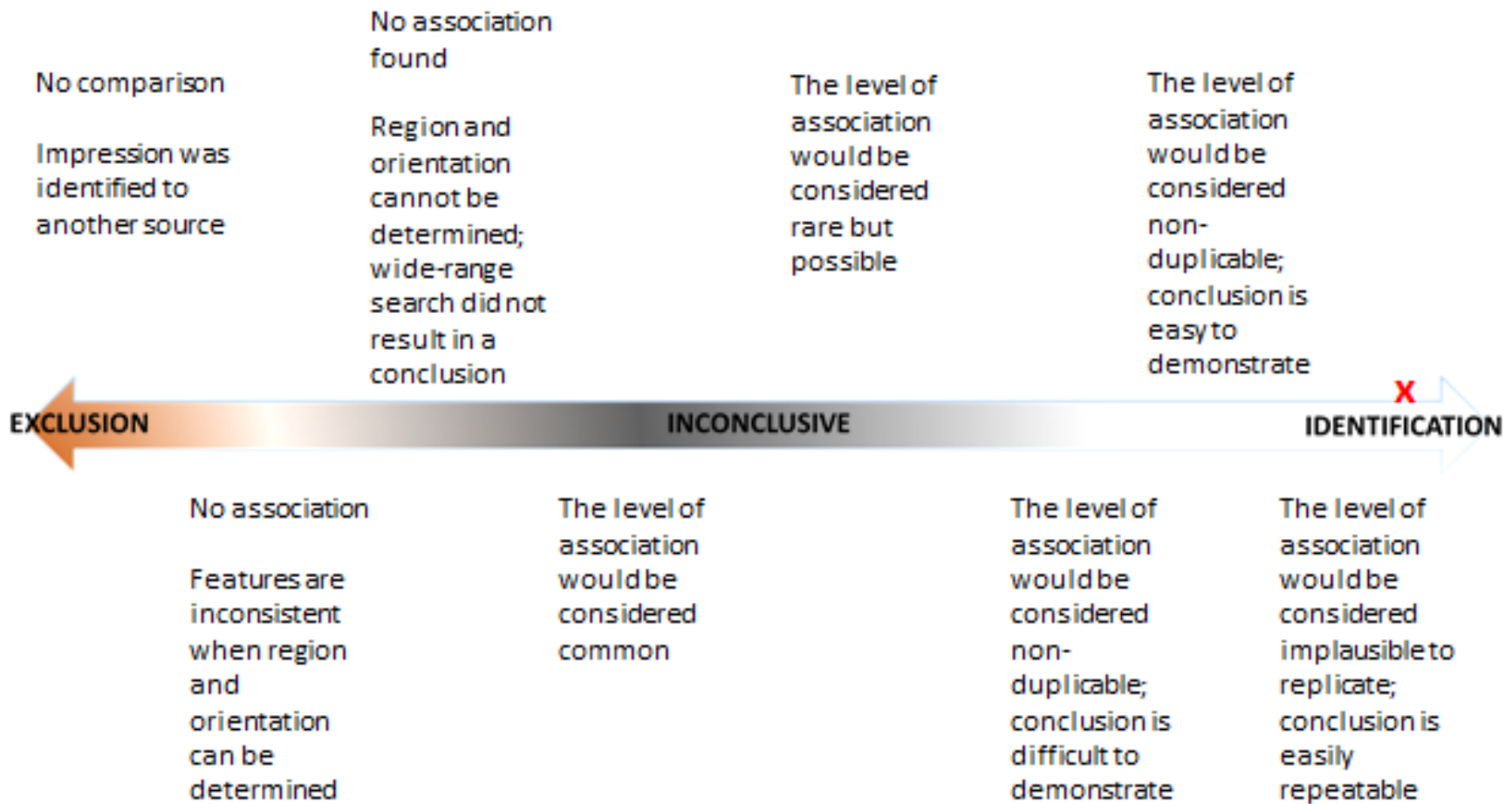
- ⦿ Self-evident direction and orientation
- ⦿ Galton points (primary features) and intervening ridges are utilized
- ⦿ Ambiguity: others interpret features the same
- ⦿ Amount: others may use different data

BASIC

Conclusion is easily reproducible by others

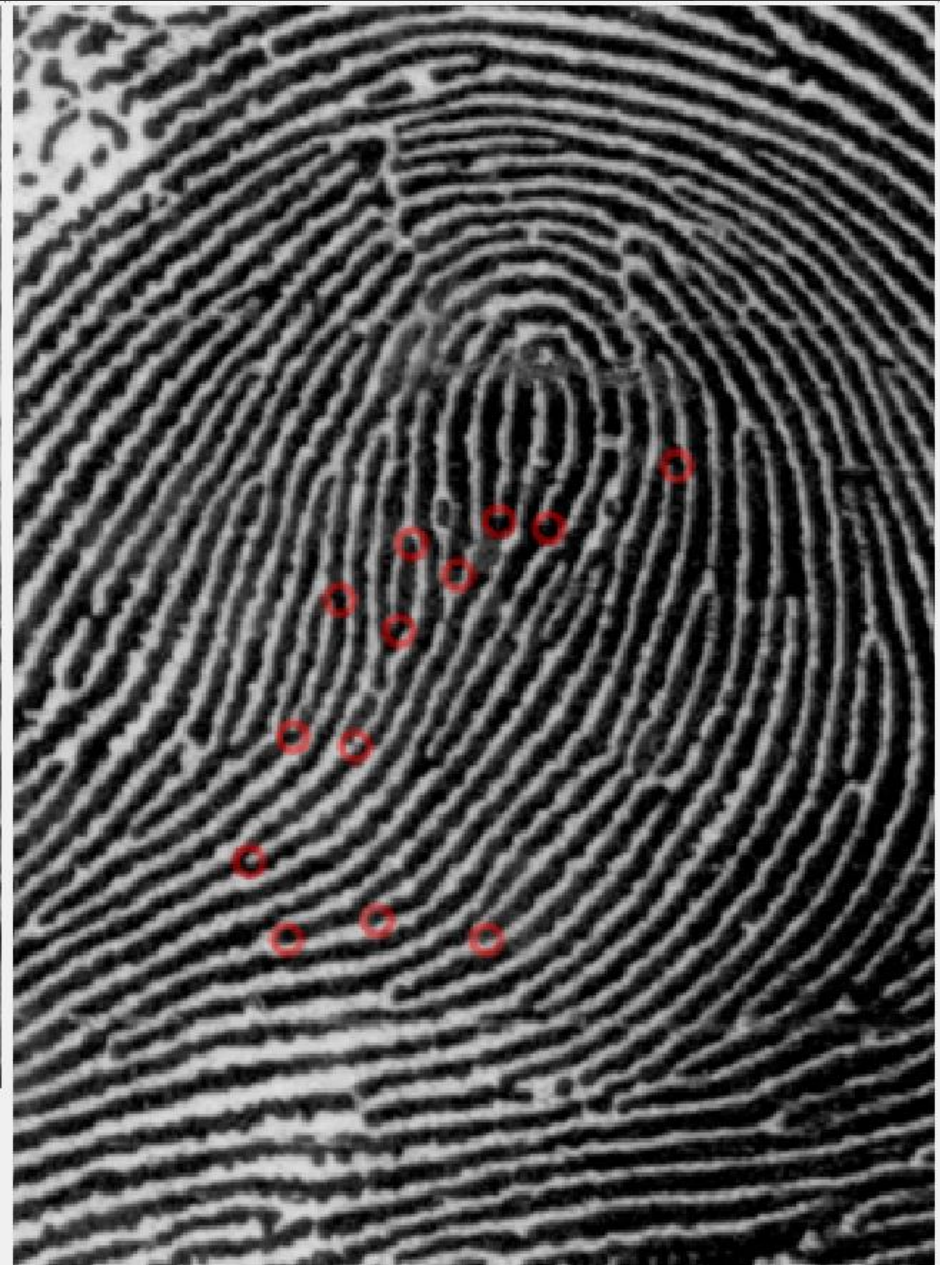
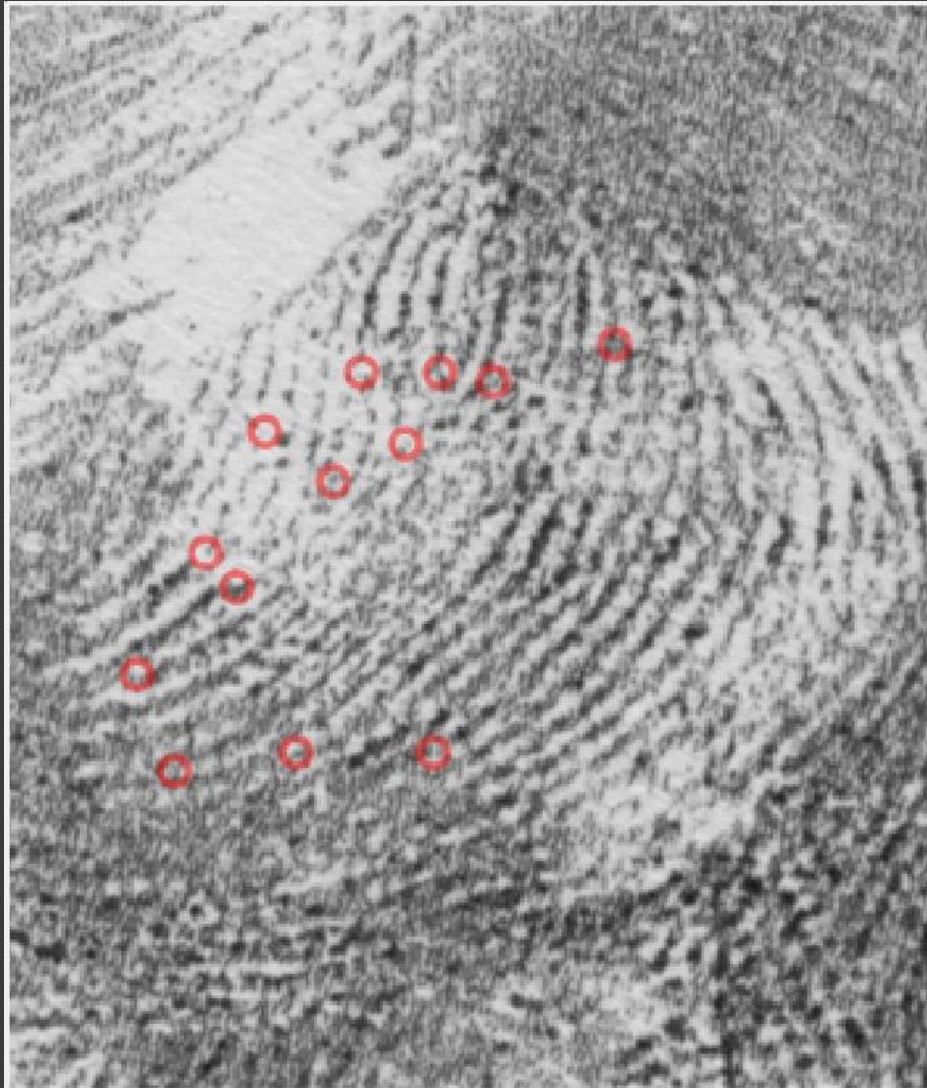
Little (virtually no) risk of error

Strength of Conclusion: Overwhelming Association, Low Risk of Error



*Complexity levels range from light to dark

Example:



FACTORS TO ASSESS			
AREA / ORIENTATION:	Self-evident (to others)	Not Self-evident	
TYPE (of features used):	Primary (ending ridges, dots, bifurcations)	Secondary (creases, incipient)	Tertiary (pores, simultaneous)
QUALITY (ambiguity/clarity):	Predominantly Clear (would be assessed the same by others)	Some ambiguity	Predom. Ambig.
QUANTITY (of prim/sec features):	Abundant (more than needed; others may use different features)		Limited (others would have to use the same features)
COMPLEXITY RATING:	BASIC	ADVANCED	COMPLEX

Verbal assessment (in lieu of chart)

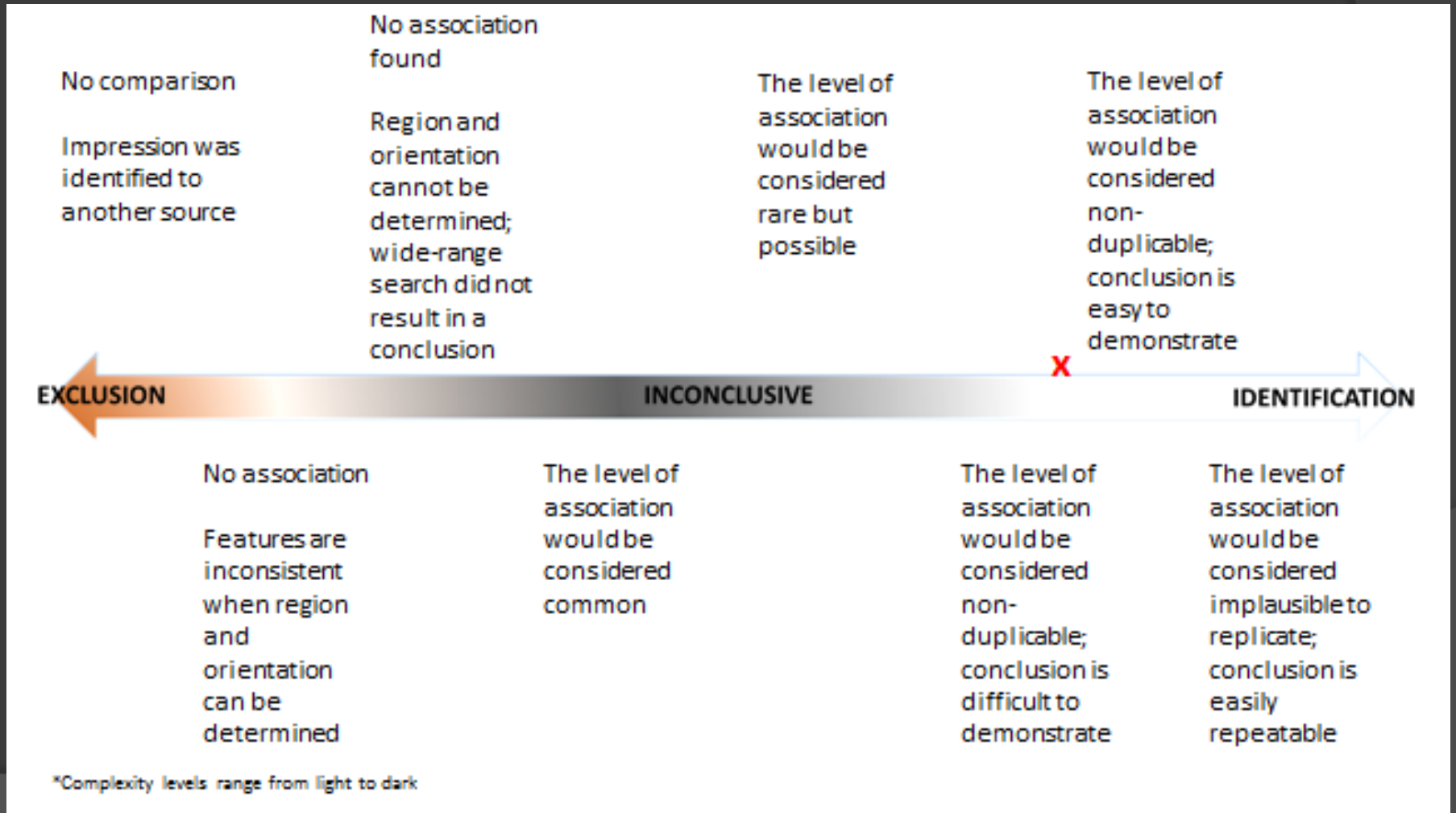
- A/O self-evident
- Features: Ending ridges and bifurcations
- Features are ambiguous (not easily demonstrable as a result of tonal shifting)
- Amount: Others would use the same features since that's all that exists.

COMPLEX

Ambig. and limited data-not easily demonstrable

Higher risk of error

Testing Determined Acceptable/Persuasive Level of Association, Higher Risk of Error



Example:



Assessing Complexity w/Chart

FACTORS TO ASSESS			
AREA / ORIENTATION:	Self-evident (to others)	Not Self-evident	
TYPE (of features used):	Primary (ending ridges, dots, bifurcations)	Secondary (creases, incipient)	Tertiary (pores, simultaneous)
QUALITY (ambiguity/clarity):	Predominantly Clear (would be assessed the same by others)	Some ambiguity	Predom. Ambig.
QUANTITY (of prim/sec features):	Abundant (more than needed; others may use different features)		Limited (others would have to use the same features)
COMPLEXITY RATING:	BASIC	ADVANCED	COMPLEX

Assessing Complexity w/o Chart

- Don't need chart but the chart reminds people WHY
- Without chart: Not TP (big dissimilarity)
- Not Complex: Lots of data
- Must be Advanced

Assessing Complexity w/o Chart

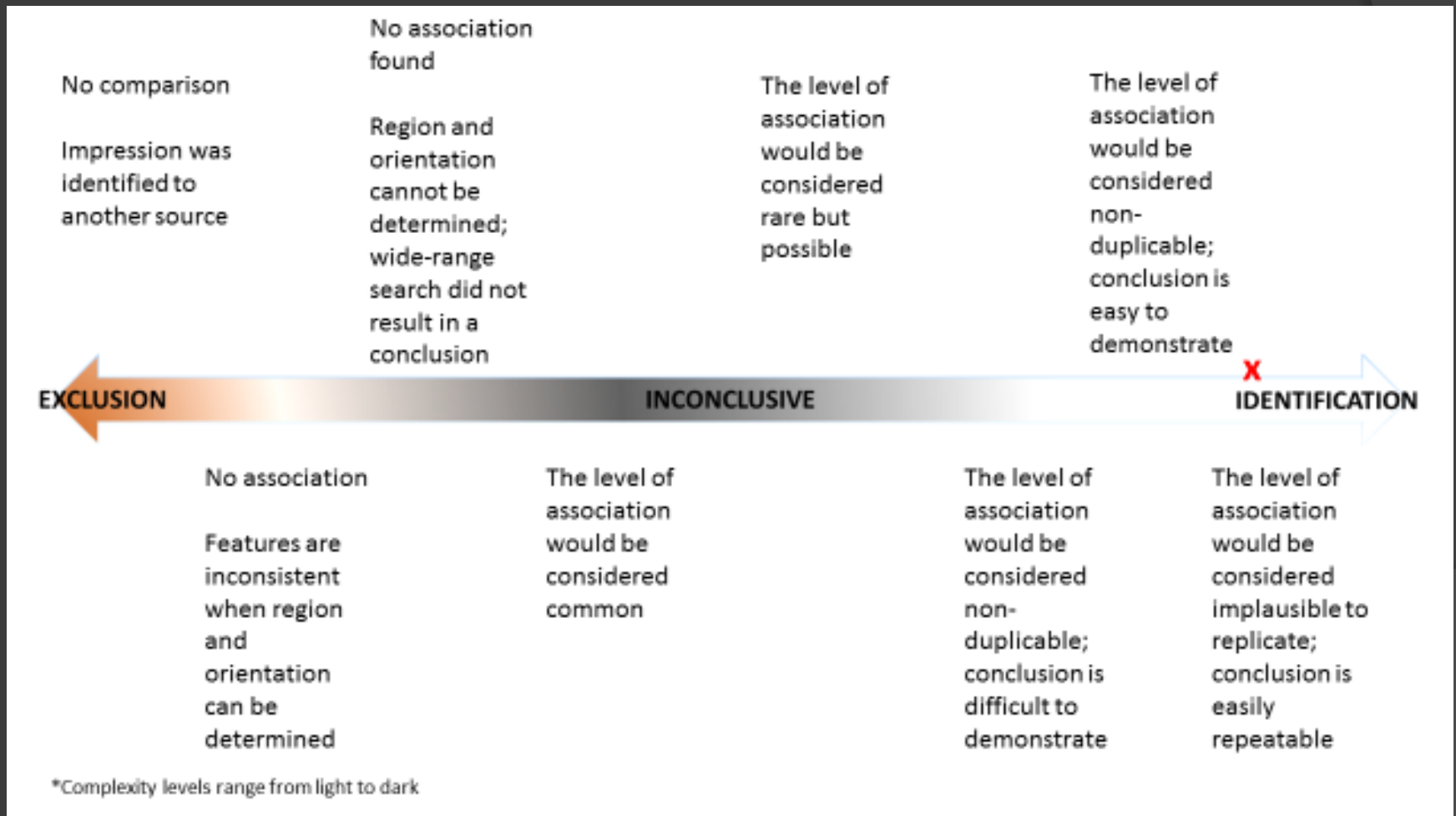
- Self-evident area and direction
- Use of L2 features and intervening ridges
- May not be easily repeatable (some may exclude on pattern type) due to ambiguity
- Abundance of data

Advanced

Easily demonstrable

Little (virtually no) risk of error for ID

Compelling Association, Low Risk of Error



Example: Mayfield Left Index Complex, but why?



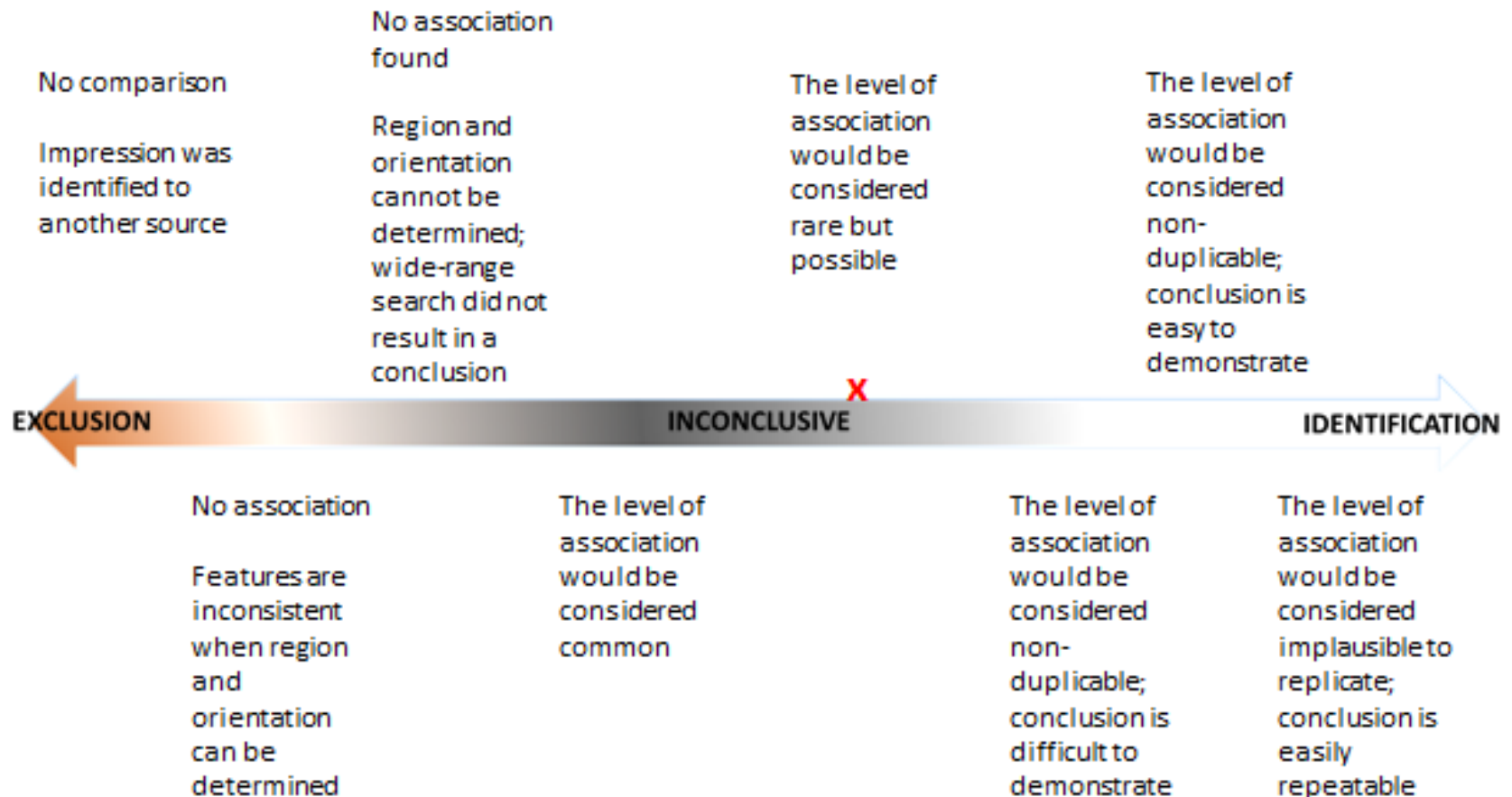
- ⦿ A/O: not self-evident
- ⦿ Features: ending ridges and bifurcations
- ⦿ High ambiguity (practitioner or others may assess features differently)
- ⦿ Amount: debatable

COMPLEX

Not demonstrable to the satisfaction of others (would not be an ID under this method)

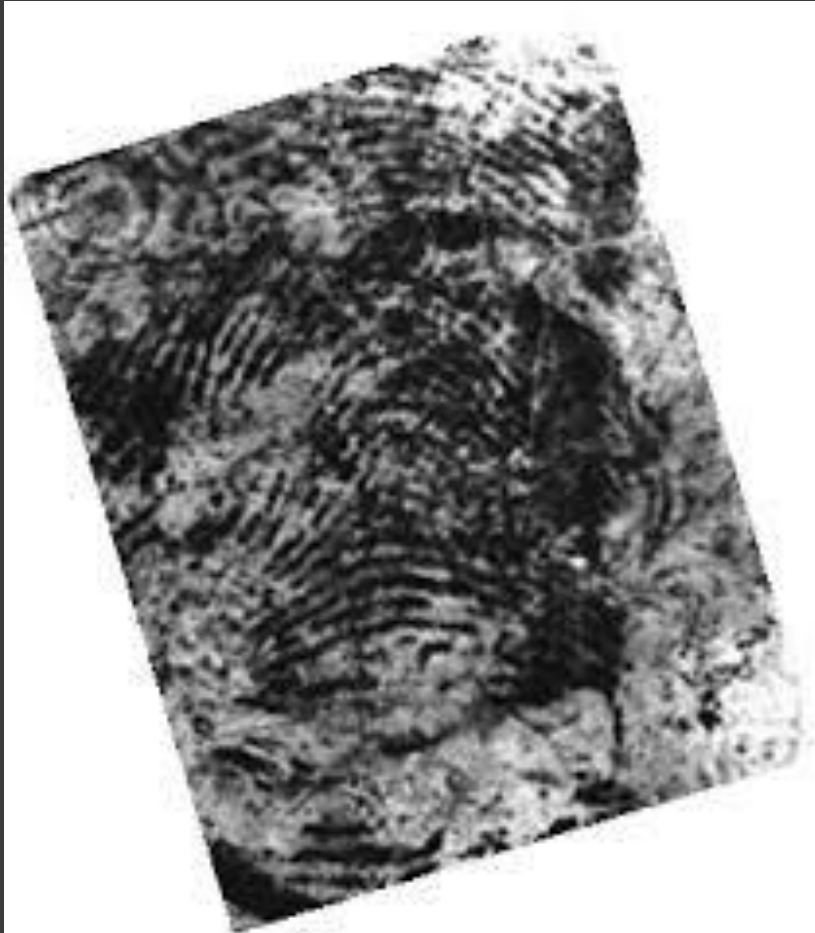
High risk of error

Testing Determined Considerable (or Non-Acceptable) Level of Association, High Risk of Error as an ID



*Complexity levels range from light to dark

Example: Daoud



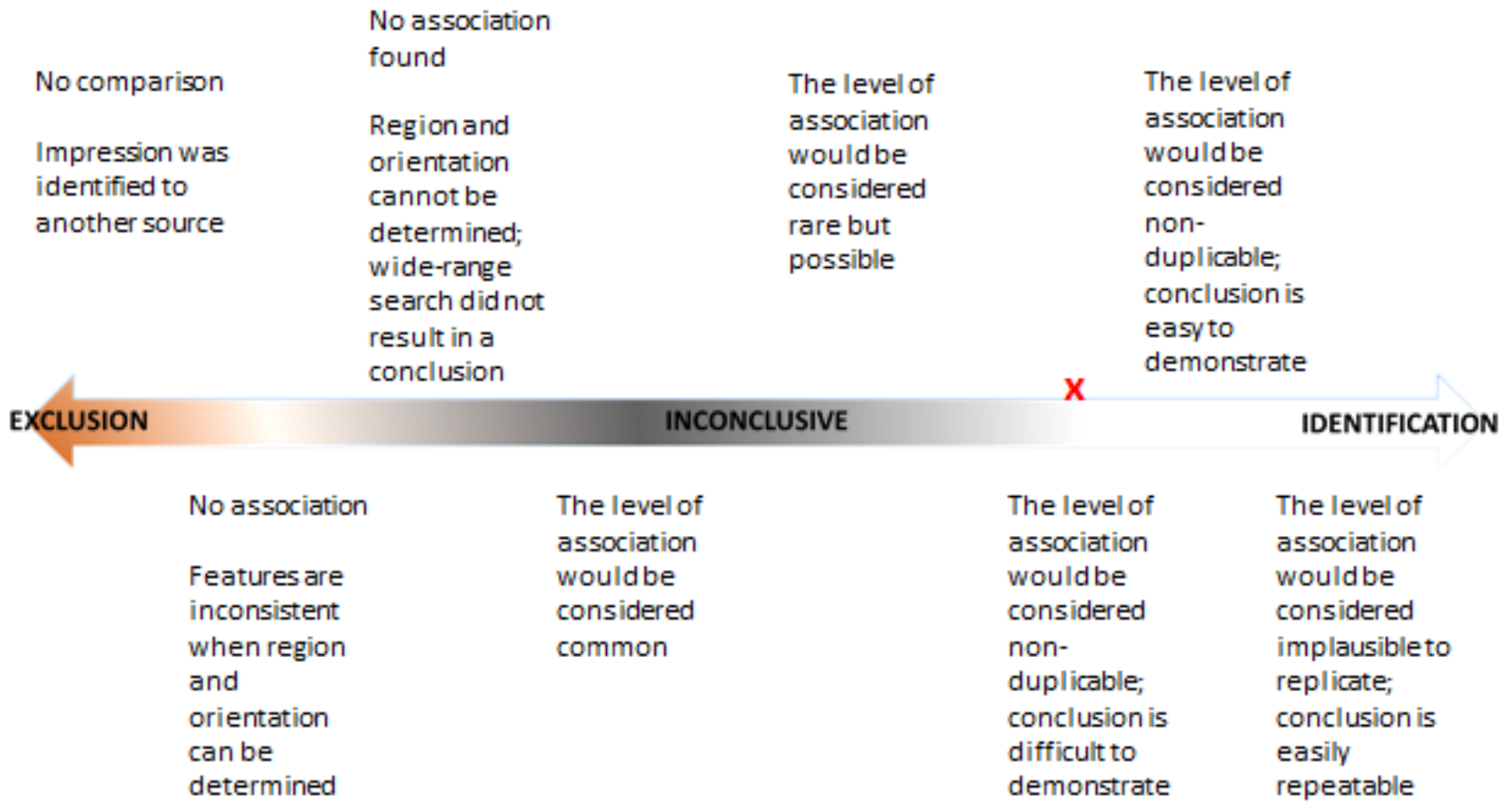
- ⦿ A/O: not self-evident
- ⦿ Features: ending ridges and bifurcations
- ⦿ High ambiguity (practitioner or others may assess features differently)
- ⦿ Amount: debatable

COMPLEX

Demonstrable to the satisfaction of other ...
low but acceptable level of association
(would be an ID under this method)

Risk of error

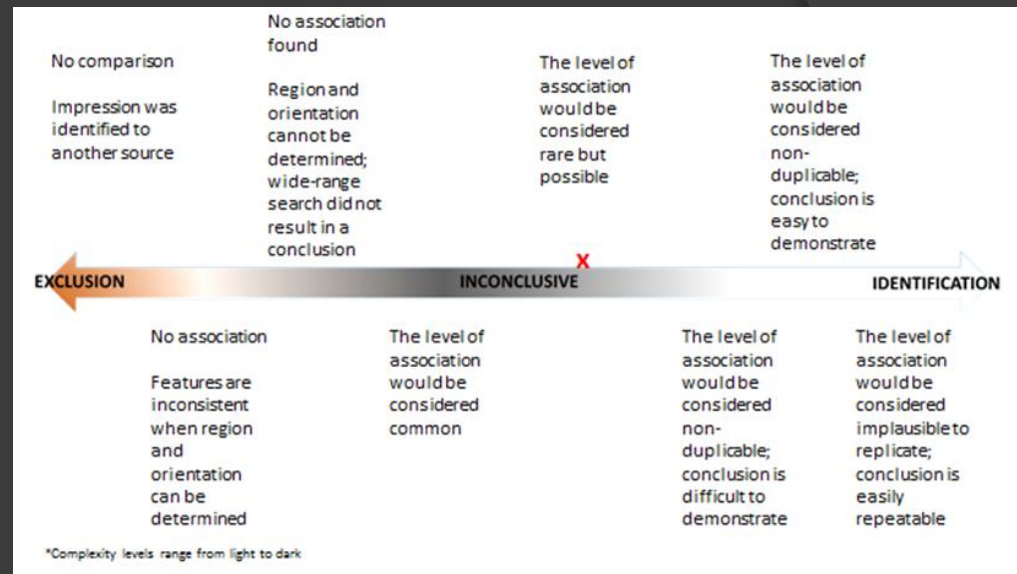
Testing Determined Acceptable (Persuasive) Level of Association, Higher Risk of Error



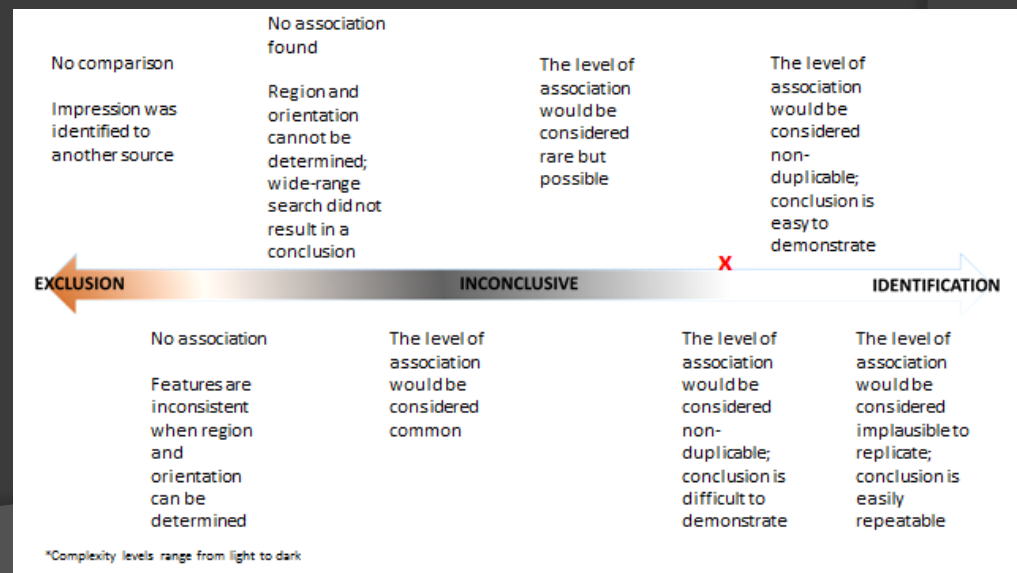
*Complexity levels range from light to dark

Mayfield vs Daoud

Non-Acceptable Level of Association (Inconclusive)



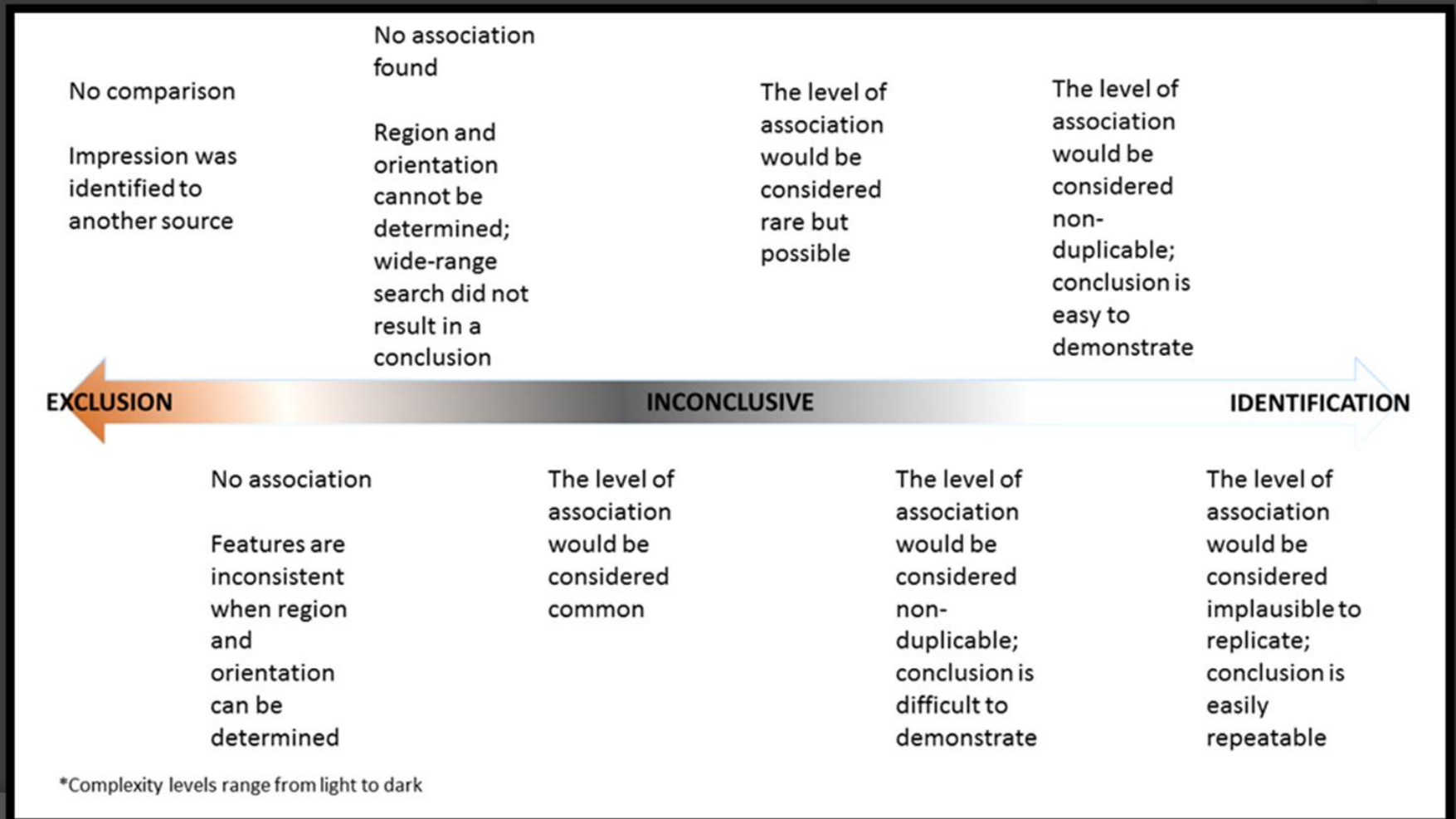
Low but Acceptable Level of Association



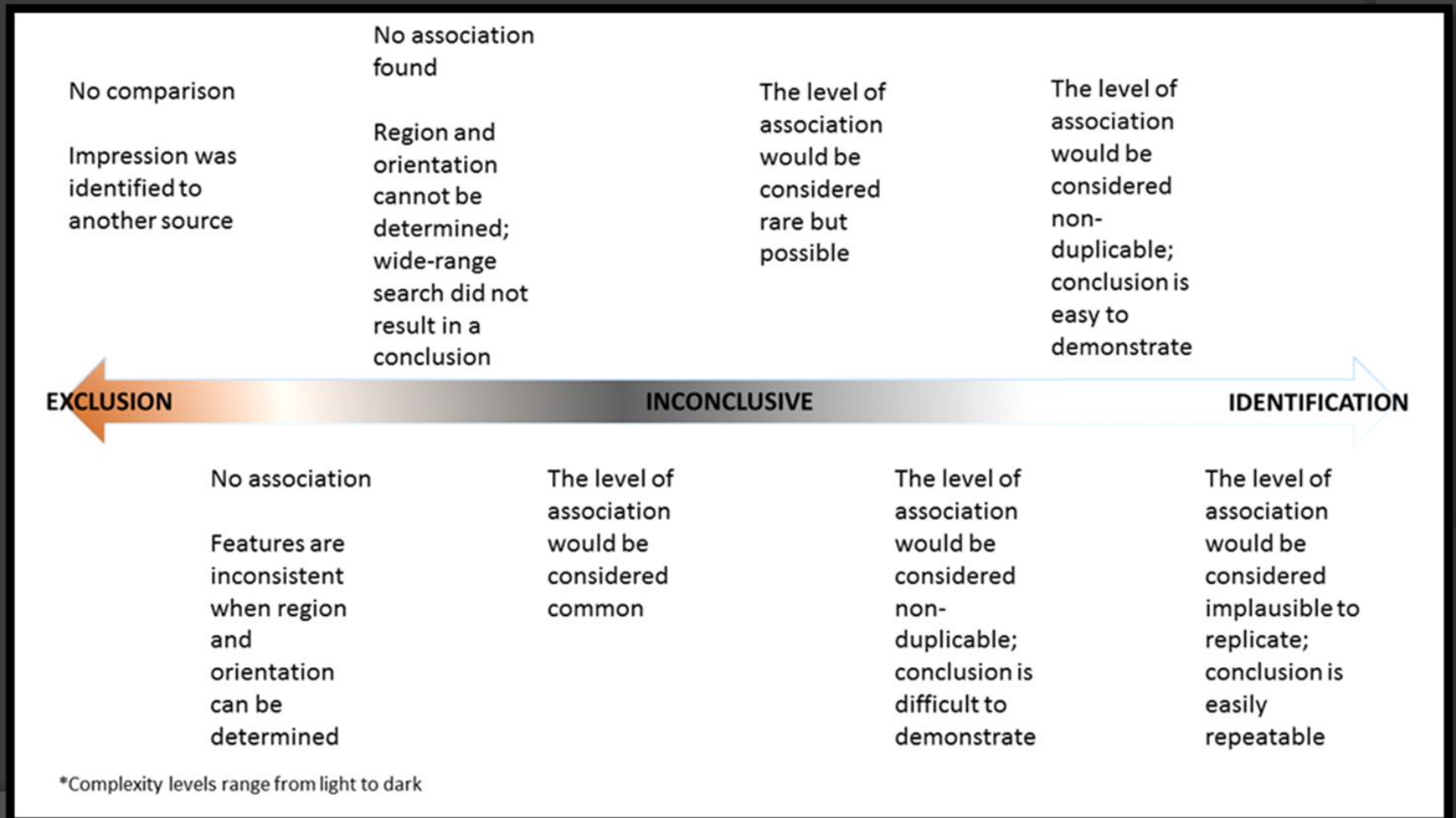
3 Levels for Identifications

3 Levels for Inconclusive

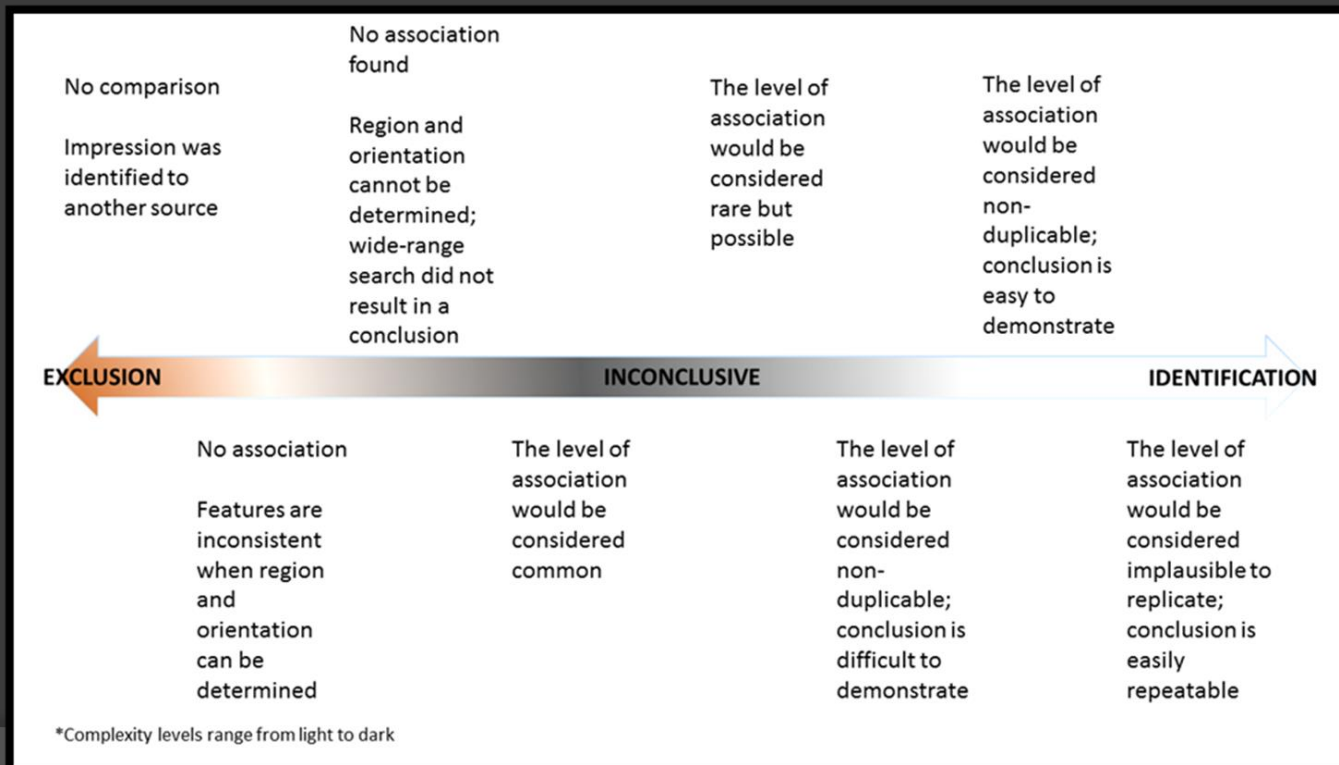
2 Levels for Exclusions



Same conclusions but gives additional pertinent information.



Based on defined parameters, not a database that exists in the mind of the examiner, based on their experience.



Identifications

- A) Overwhelming Association, easily repeatable
- B) Compelling Association, easily demonstrable
- C) Persuasive Association, difficult to demonstrate but acceptable

Inconclusive

A) Considerable Association but not sufficient
(to satisfy others)

B) Marginal or Common Amount of
Association

C) No Association Found

Exclusions

A) No comparison, ID'd to another subject
(logical deduction is a scientific method)

B) No Association Exists

Scale (**Exclusion**, Inconclusive, Identified)

- **No Comparison, ID'd to another subject**
- **No Association**

- No Association Found
- Marginal Association
- Considerable Association, not sufficient (investigative lead)

- Persuasive Association, difficult to demonstrate
- Compelling Association, easy to demonstrate
- Overwhelming Association, easily repeatable

Benefits:

- ⦿ Not new, defined way to measure and articulate **the basis** for conclusions (FRE 702)
- ⦿ QA Measures are dependent on complexity (when needed), not random (all verified, 10% technically reviewed)
- ⦿ Limits personal interpretation, which limits subjectivity and bias (puts the onus on the method, reducing practitioner liability)
- ⦿ More consistent conclusions because they are based on measurable criteria, not personal beliefs (follows science)
- ⦿ Significantly reduces the need for conflict resolution
- ⦿ Allows others to assess the relevance and risk of error
- ⦿ Recognizes differences in strength of identifications

Additional Benefits

- ⦿ Allows for RULES for **when to exclude** (when Basic)
- ⦿ Allows us to critique the complexity of competency tests, proficiency tests, and certification tests (and ability to compare different tests)
- ⦿ Allows for improved error rate studies
- ⦿ Allows us to hypothesize without having to say, 'I'd have to see the print'.
- ⦿ Allows us to judge the ability level of practitioners.
- ⦿ Transparent and Professional
- ⦿ Can start to use it informally without SOP changes
- ⦿ Labels comparisons by complexity, not TP vs Latents
- ⦿ Could perform lights-out latent prints for basic complexity 😊

~~Reactive~~

Proactive



Persistent Forensics Lab Problems Undermine Faith in Our Criminal Justice System, John Malcolm, 2016

“... the day when judges and jurors no longer trust the government’s experts. That would be a dark day indeed, and if it happens, the government will have only itself to blame.”

I'm sure this gives you a lot to think about... feel free to contact me anytime.

Michele Triplett

michele.triplett@kingcounty.gov

Cell: 206-819-3385