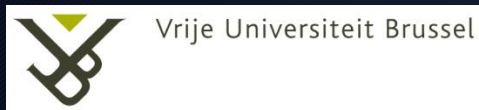


# The weakest link? An update on linkage analysis of serious sexual assaults

Jan Winter, M.Sc.

Dr. Gina Rossi

Vrije Universiteit Brussels



Dr. Jessica Woodhams

University of Birmingham



# Case linkage analysis

aka comparative case analysis

aka signature analysis

etc.

- Why is effective 'case linking' important?
  - Counteracting 'linkage blindness'
  - Increasing evidence
  - Developing efficient investigative strategies
  - Similar fact evidence
- What is the most effective method?
  - A number of 'independent' offence characteristics *or*
  - Or grouping offence characteristics according to underlying behavioural themes?

# Overview

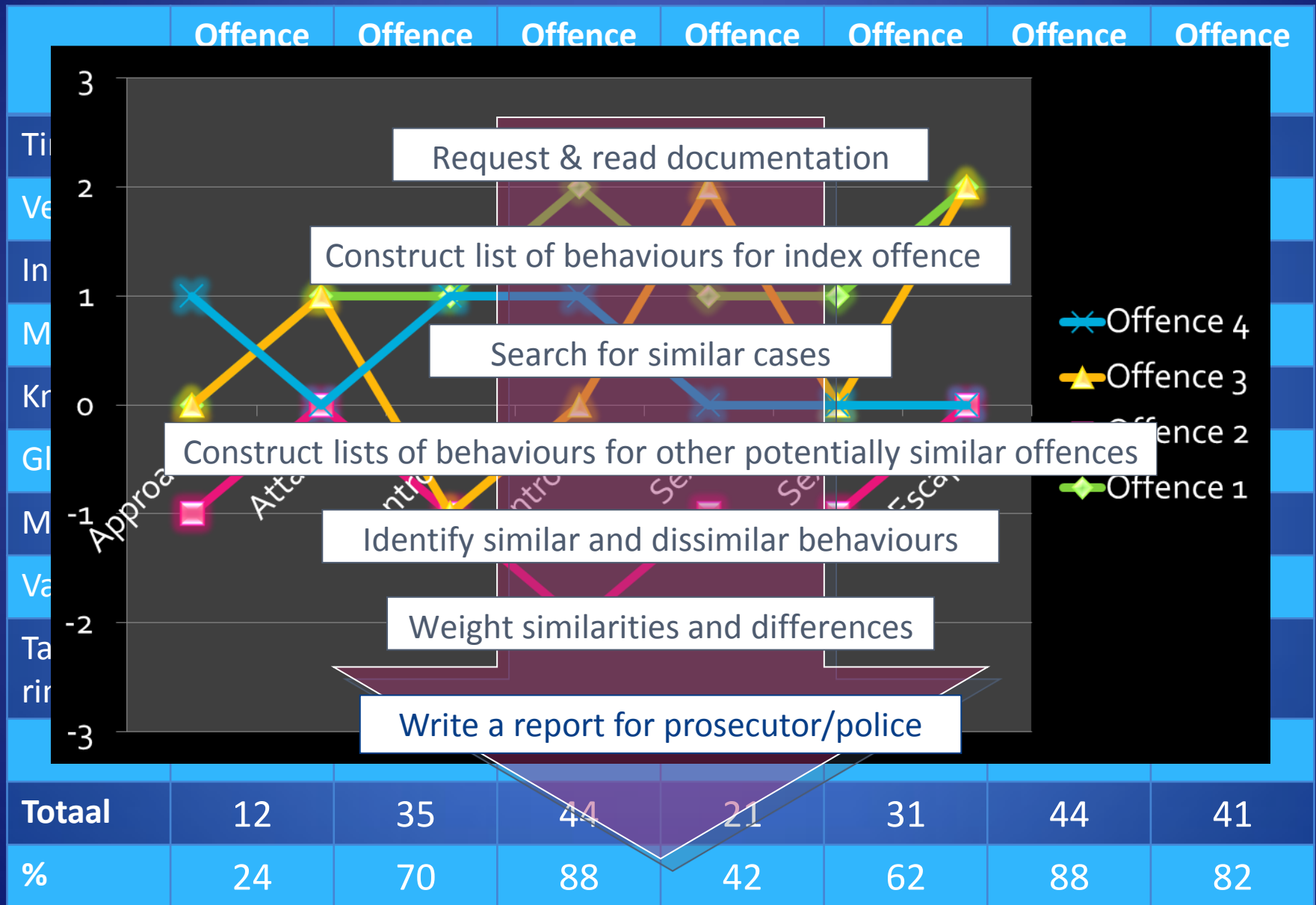
1. Linking process & practice
2. Underlying assumptions
3. Problems
4. Empirical evidence
  1. Dimensional behavioural linking approach
  2. Multivariate behavioural linking approach
5. Linkage accuracy comparison study
6. Outlook

# 1. Linking process & practice

(Woodhams, Bull, & Hollin, 2007)

(Craigk & Patrick, 1994)

(Mokros & Schinke, 2006)



## 2. Underlying Assumptions

- *Consistency (Behavioural stability assumption)*
  - An offender behaves relatively consistent within a series of offences.
- *Uniqueness (Behavioural distinctiveness assumption)*
  - An offender will show a relatively unique combination of offence behaviour that differentiates him from others.
- Stranger sex offenders exhibit some consistency across offences (e.g., Bennell et al., 2009; Bootsma & van den Eshof, 2006; Grubin et al., 2001; Grubin et al., 1997; Lundrigan, et al. 2010; Mokros & Alison, 2002; Santtila et al., 2005; Woodhams & Labuschagne, 2011; Woodhams et al., 2007; Yokota et al., 2007).
- Linking serial sexual crimes enjoys therefore empirical support.

## 2. Underlying Assumptions -Bootsma & Eshof (2006)

	Unique	Not unique
Consistent	<ul style="list-style-type: none"><li>• Geographic behaviour</li><li>• Approach</li><li>• Age group victim</li></ul>	<ul style="list-style-type: none"><li>• Precautions</li><li>• Crime scene risk</li><li>• Specific sex behaviour (anal penetration)</li></ul>
Not consistent	<ul style="list-style-type: none"><li>• Compensating behaviour</li><li>• Weapon use</li><li>• Violence– anger</li></ul>	<ul style="list-style-type: none"><li>• Degree of sexual &amp; intimate behaviour</li></ul>

# 3. Problems...

- Despite some evidence for consistency, there's need for a clear theoretical framework in research & practice
- Changes in M.O. can be due to (Woodhams & Labuschagne, 2011):
  - Situational dynamics (victim resistance, location(s), time)
  - Learning processes
  - Evolving fantasy element...
- Research primarily based on solved samples (Bennell & Canter, 2002)
- Uncertainty on including high and low occurring characteristics...
- ...and which offences of a series should be included to (Woodhams & Labuschagne, 2011)
- Ignoring the value of non-occurring characteristics (Salo, 2008)
- Comparable statistical approaches (Bennell et al., 2009)?

# 3. Problems (cont.): To scale or not to scale?

## Multivariate behavioural linking

- Pragmatic approach
  - Using all available information
- + Comparison of a larger no. of characteristics
- “*one size fits all approach*”  
(see following presentation from Woodhams et al.)

## Dimensional behavioural linking

- Theory assumed approach
  - Using groups of characteristics that share a common/latent theme
- + Allows for more intra-series differentiation (e.g., binding and gagging belong to the same theme)
- + Bigger picture approach
- Susceptible to more interpretation errors

# 4. Empirical Evidence

## Dimensional behavioural linking

- Grubin et al. (2001): largest ViCLAS study ever
  - 4 behavioural domains & 4 types per domain
    - Control (victim choice, approach, etc.)
    - Escape (precautions)
    - Sex (sex. behaviour)
    - Style (verbal behaviour)
- } 256 ≠ types!
- 79 of 81 series were correctly linked
  - Control (68%) > Escape (52%) > Sex (50%) > Style (46%)
  - Only 14-26% consistency within 4 domains
  - Consistency dependent on situation & victim recollection abilities

# 4. Empirical Evidence (cont.)

## Multivariate behavioural linking

- 27 single behaviours yielding an AUC = .75 (Bennell et al., 2009)
- 111 offence characteristics: AUC = .77-.88  
Woodhams & Labuschagne (2011); see next presentation

# 5. Linkage accuracy comparison study

(Winter, Lemeire, Meganck, Geboers, Rossi, & Mokros, in prep.)

## Rationale

- Previous studies compared Mokken based scaling vs. Bayesian Analysis in Italian serial homicides ( $N = 116$ ) (Santtila et al., 2008 & Salo, 2008):
  - Mokken based scaling predict. accuracy: 63%
  - Bayesian based predict. accuracy: 83%
- To investigate which approach is more accurate in linking serious sexual offences.

# 5. Linkage accuracy comparison study

(Winter, Lemeire, Meganck, Geboers, Rossi, & Mokros, in prep.)

## Method

- Sample of solved cases provided by SCAS ( $N = 209$ ):
  - Serial sexual offences ( $n = 90$ ) committed by 30 offenders
  - One-off rapes ( $n = 79$ )
  - Attempted rapes ( $n = 50$ )
- 2 coders, good IRR ( $K = .78$ )
- Significant differences betw. serial & non-serial offences
- 7 derived Mokken Scales with acceptable-strong scale properties
- DFA (LOOCV) linkage prediction based on the Mokken scales sum scores
- Naive Bayesian linkage prediction (LOOCV) with 47 variables entered simultaneously

# 5. Linkage accuracy comparison study

(Winter, Lemeire, Meganck, Geboers, Rossi, & Mokros, in prep.)

## Results

- Predictive accuracy of the Bayesian analysis:
  - Top 1: 36%
  - Top 5: 57%
  - But including one-off's and attempts: **13%**
- Predictive accuracy of the Mokken derived scales:
  - Top 1: 29% (59%)
  - But including one-off's and attempts: **9%**

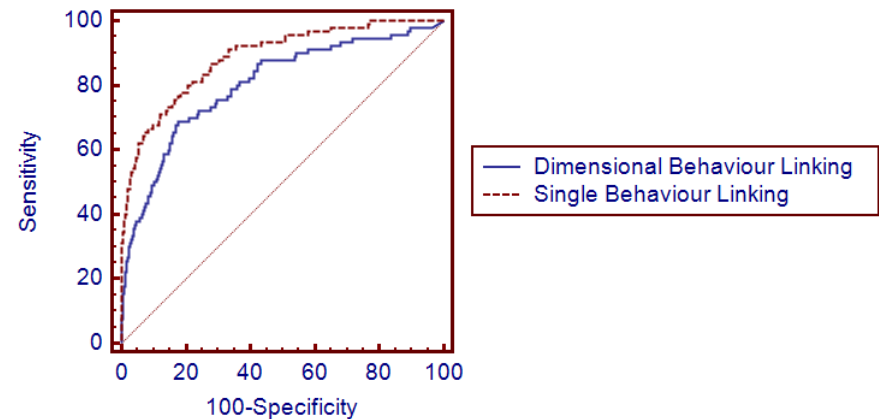
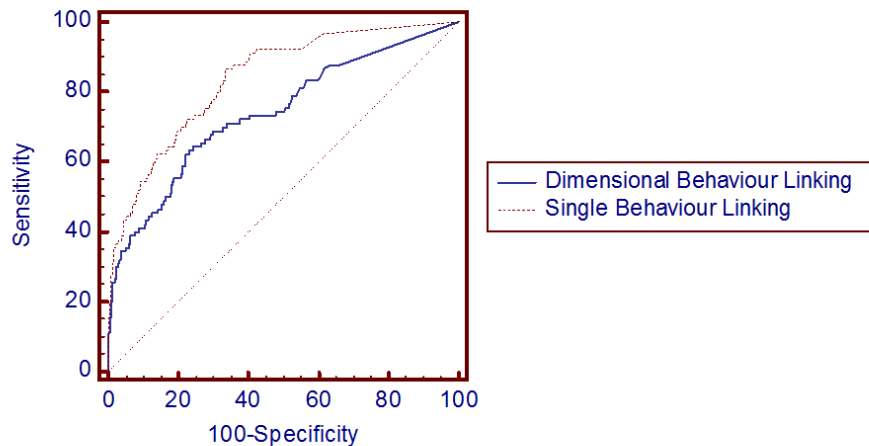
# 5. Linkage accuracy comparison study

(Winter, Lemeire, Meganck, Geboers, Rossi, & Mokros, in prep.)

Behavioural scale	Percentage correct links LOCV
Location: Indoor	12.2%
+ Location: Outdoor	15.6%
+ Controlling behaviour	27.8%
+ Expressive violence	30.1%
+ Forced sexual acts	30%
+ Compensating behaviour	26.7%
+ Degrading behaviour	28.9%

# 5. Linkage accuracy comparison study

(Winter, Lemeire, Meganck, Geboers, Rossi, & Mokros, in prep.)



**Figure 1.** ROC-curve comparison of dimensional behaviour linking ( $AUC = .74$ ) and single behaviour linking ( $AUC = .84$ ) when looking at serial cases only ( $n = 90$ ).

**Figure 2.** ROC-curve comparison of dimensional behaviour linking ( $AUC = .80$ ) and single behaviour linking ( $AUC = .89$ ) when looking at serial cases and one-off offences ( $n = 219$ ).

# 6. Discussion & outlook

- Relative consistent offender behaviour
  - Geographical & controlling characteristics remain most valid predictors
- Different approaches offer similar, very accurate results
- Direct hit (error free) accuracy is limited in 'real'-life circumstances
  - But cannot be expected (Woodhams & Labuschagne, 2011)
  - See following presentation for unsolved-solved linkage comparisons
- Final linking decision are made by qualified analysts, but statistical approaches can offer support
- Larger replication samples needed & sample overlap with Grubin et al. studies (1997; 2001)

# Thank you for your attention!

## Questions?



## Slides?

[jwinter@vub.ac.be](mailto:jwinter@vub.ac.be)