NEW DIRECTIONS IN IMPLICIT MEASUREMENT OF SEXUAL INTEREST: APPLYING ORDINAL TEST THEORY

Sean Hammond
School of Applied Psychology
UCC

Implicit Measurement

"Implicit measurement involves the elicitation of non-volitional responses that serve to indicate the presence and/or degree of an underlying latency"

Hammond, Griffin & Devine 2011

- Primary purpose is to avoid response biases due to impression management

Challenges in Implicit Measurement

- The Challenge of Isomorphism
- The Challenge of Implicit Measurement
- The Challenge of Information

The Isomorphic Challenge

- Observed measurements are often simple and accurate. For example:
  - Reaction times (IAT)
  - Viewing Times (VT)
  - Changes in Penile Circumference (PPG)

- Fundamental assumption that measurements are isomorphic to the construct in question
  - At best the measures are indirect estimates of the construct in question
  - This is essentially an issue of validity – measures may be highly reliable but their interpretation may be fallacious.

The Ipsative Challenge

- Many implicit strategies involve inherent ipsative judgements (Glasgow 2012).
- This militates against arriving at normative conclusions (Hammond & Barrett, 1999).
- This is a particular challenge for viewing time and PPG
- Essentially such measurements are

The Information Challenge

- Typically there is a comparison of measures taken under a number conditions.
- Summarising this information will inevitably result in loss of information.
- Eg. The mean reaction time comparison in the standard IAT approach.

A Broad and Practical Definition of Measurement

"Measurement is an operation applied in order to make comparison between objects"

Hammond (2006)

- This definition departs from representational measurement theory
- It encompasses qualitative and quantitative distinctions
- Ordinal Measurement Theory focuses upon the ordinal relationship between objects

Dominance Relations

Raw Data

	v1	v2	v3	v4	v5
P1	2.3	3.4	4.1	1.7	7.6
p2	4.1	5.6	8.2	5.9	4.5
p3	0.5	0.1	0.8	0.2	0.3
p4	20.3	34.1	45.2	99.2	35.6

Rank Data

4	3	2	5	1
5	3	1	2	4
2	5	1	4	3
5	4	2	1	3

Dominance Matrix

.	3	4	2	3
1	.	4	3	3
0	0	.	1	1
2	1	3	.	2
1	1	3	2	.

Implicit Association Task

- Simplistic scoring
  - Mean RT difference between the two conditions
  - Sometimes a *t* or *d* statistic utilising variability

- Difficulties not often addressed
  - RT's notoriously non-normal, prone to outliers so that interval measurement is distorting
  - Might assume other distributions but this adds complexity to the summary statistics utilised

Simple use of Dominance Relations

- The score is the degree to which RTs in condition A are longer than in condition B? (A dominance score)
- No need for distributional assumptions or statistical jiggery pokery to salvage ill-fitting data
  - Generate a Bernoulli distributed vector d so that:-
    - If $a_i > b_i$ then $d_i=1$
    - If $a_i < b_i$ then $d_i=0$
      - Where i=1…n of stimuli
- Using vector d, direct individual scores may be derived using:-

$$p = \frac{n!}{r!(n-r)!} \times 0.5^{r} \times 0.5^{n-r}$$

Where $r = \Sigma d_i$

$$z = \Theta^{-1}(p)$$

Misogeny Results

	Rapists (19)	General (189)	Sig	Effect Size
t	0.09 (0.13)	0.07 (0.21)	ns	0.11
d	1.02 (1.52)	0.93 (1.41)	ns	0.06
Dom	9.44 (8.61)	14.58 (8.69)	$p<0.05$	0.59
Binomial	0.03 (0.04)	0.06 (0.05)	$p<0.05$	0.55

Dominance vector approach Alpha = 0.94

Differential stimulus analysis possible (IRT, Factor Analysis etc.)

Modelling Dominance Relations

- Thurstone

$$p_{ij} = \Theta\left(\frac{\delta_i - \delta_j}{\sigma_i^2 + \sigma_j^2 - 2\sigma_{ij}} \right)$$

- Bradley-Terry-Luce

$$p_{ij} = \frac{e^{(\delta_i - \delta_j)}}{1 + e^{(\delta_i - \delta_j)}}$$

Viewing Time Paradigm

- Introduced by Gene Abel (1996) as a means of identifying ‘deviant’ sexual interest.
- Simple to administer and does not require sexually explicit images
- But
  - Data are purely ipsative so comparison between cases is problematic
  - The scoring process is rather opaque, indices of reliability are suspect.

Modelling the VTP

$$p_{nij} = \frac{e^{\left(2\left(\delta_i - \delta_j\right)\left(\theta_n - \bar{\delta}_{ij}\right)\right)}}{1 + e^{\left(2\theta_n\left(\delta_i - \delta_j\right) - \left(\delta_i^2 - \delta_j^2\right)\right)}}$$

Where

p_{nij} = the probability of person n favouring stimulus i over stimulus j

δ_i = the scale parameter for stimulus i (derived from a standard BTL estimation.)

θ_n = the trait strength of person n

$$\bar{\delta}_{ij} = \frac{\delta_i + \delta_j}{2}$$

Estimation

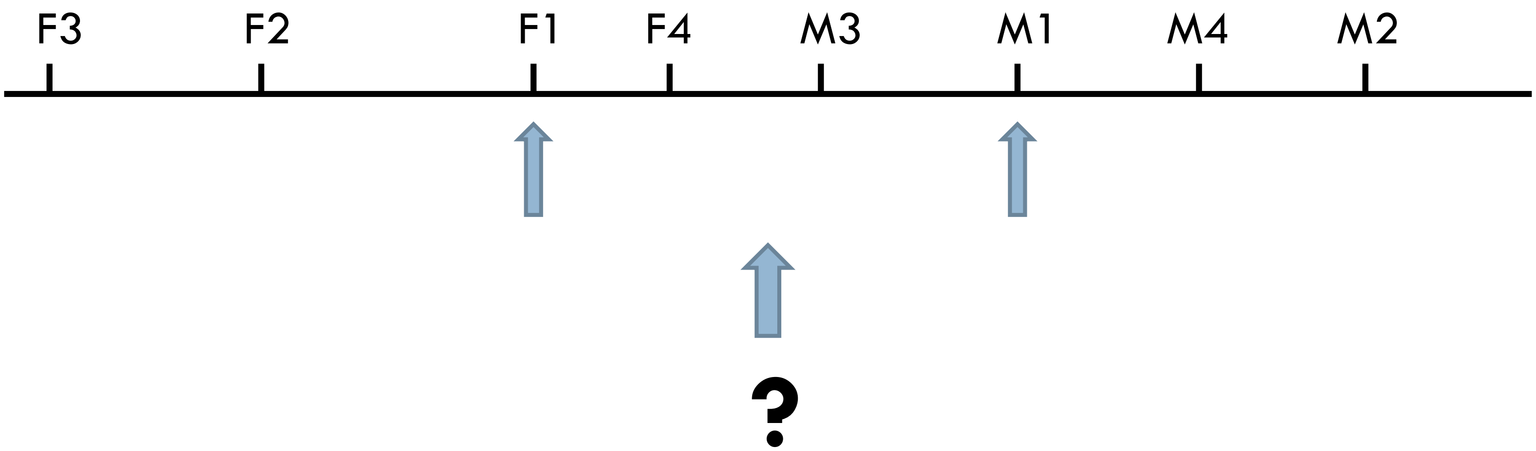
Likelihood for the model

$$L = \prod_n \prod_j \prod_i \frac{e^{\left(2\theta_n\left(\delta_i - \delta_j\right) - \left(\delta_i^2 - \delta_i^2\right)\right)}}{1 + e^{\left(2\theta_n\left(\delta_i - \delta_j\right) - \left(\delta_i^2 - \delta_i^2\right)\right)}}$$

Leading to an estimation algorithm for θ

$$\theta_n^{t+1} = \theta_n^t - \frac{2\left(\sum s_{ni}\delta_i - \sum \delta_i \sum_{j,j\neq i} p_{nij}\right)}{-4\sum_i \sum_{j,j\phi i} \left(\delta_i - \delta_j\right)^2 p_{nij}\left(1 - p_{nij}\right)}$$

Unidimensional Model



Estimate of fit $\chi^2 = 538.56$ awful

Multidimensional Unfolding

$$p_{nij} = \frac{\exp^{\left(-c\left(d_{in}^2 - d_{jn}^2\right)\right)}}{1 + \exp^{\left(-c\left(d_{in}^2 - d_{jn}^2\right)\right)}}$$

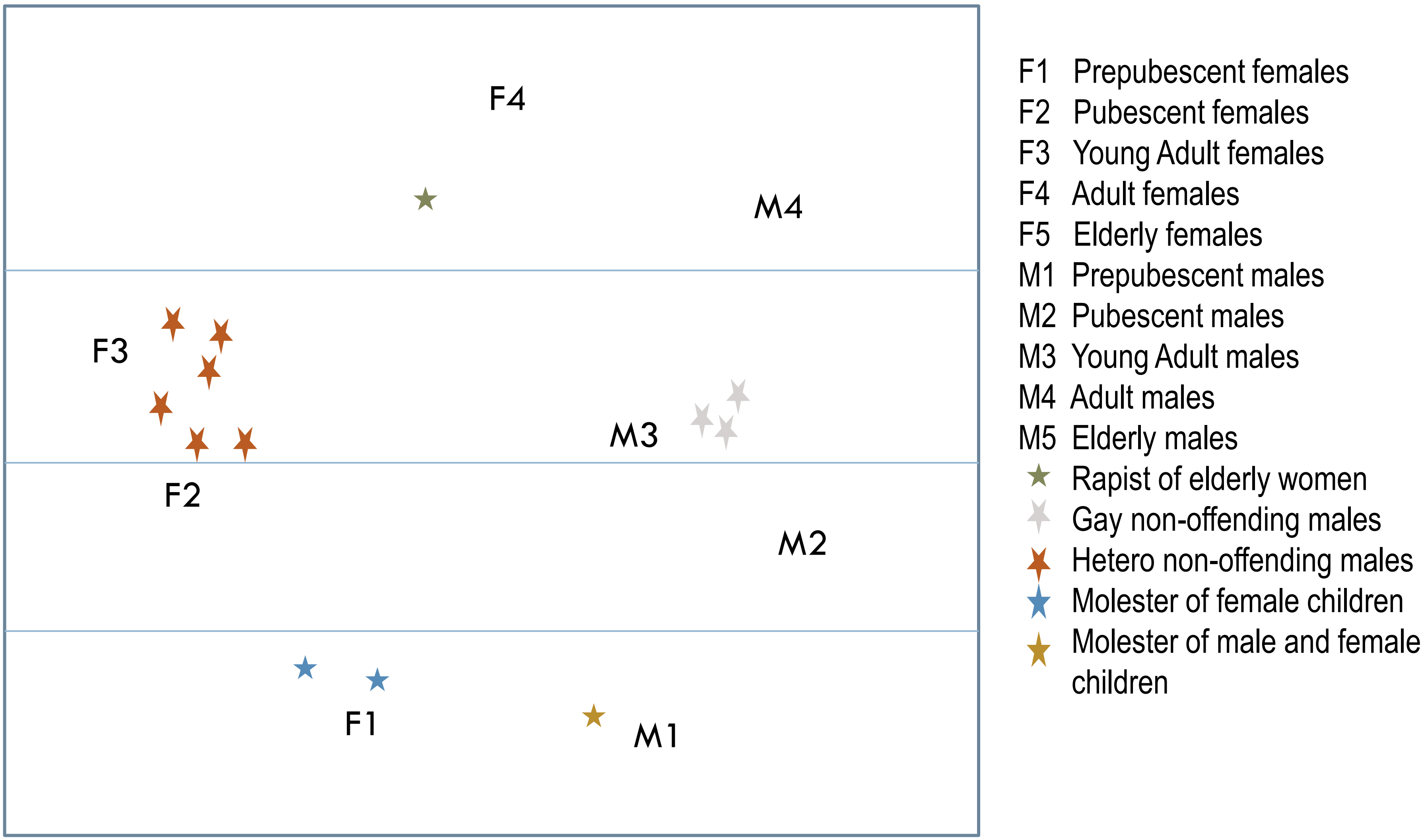
d_{in} = distance function linking person n with stimuli i
c = scaling constant

Likelihood not feasible but a loss function is possible :-

$$f = \left(d_{in}^2 - t_i\right) - \sum_{k=1}^{m}\left(x_{ik} - y_{nk}\right)^2$$

t_i = scaling constant per stimulus
x_{ik} = coordinate location of stimulus i on dimension k
y_{jk} = coordinate location of person j on dimension k

Placing Individuals with the Measured Space



Conclusions

- Forensic Assessment (FA) has typically borrowed from standard psychometric practice.
- One challenge in FA is dealing with non-compliant cases.
- As a result creative new strategies have been identified, particularly with sex offenders.
- However, received psychometric practice is wanting in this context.
- This paper suggests that Ordinal Test offers a future direction in Forensic Assessment.