

# Picturing the impossible: Pictures, repetitions, and item-set card effects in measuring vocabulary

Eleanor Fang Yan & Lee Branum-Martin  
Georgia State University



# Agenda



- Introduction
- Assessment Design
- Statistical Approaches
- Results
- Conclusions
- Limitations & Future Directions



- Background
  - With reliable design and valid scoring, subtests of language assessment batteries are expected to show good global fit of a single factor confirmatory model.
  - TOLD-4: Test of Language Development, 4th edition
    - IPV: Intermediate level of Picture Vocabulary Subtest
  - IPV's complicated assessment design features make a single-scale model impossible.
- Purpose
  - To examine the psychometric properties and structural validity of a picture vocabulary test



- TOLD-4, IPV
  - 9 picture cards
  - Each with 6 pictures
  - 7 – 11 items per card
  - 80 items in total
  - Ceiling rule
    - Stop testing when participants miss 3 consecutive items.

# Picture Card 1

tail wagger ..... (D) 1.

hibernating mammal ..... (B) 2.

branch swinger ..... (A) 3.

bird chaser ..... (D) 4.

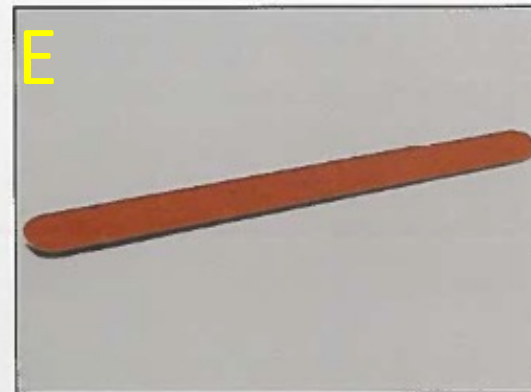
grizzled carnivore ..... (B) 5.

abrasive surface ..... (E) 6.

playful primate ..... (A) 7.

keen edged ..... (C) 8.

ursus posing ..... (B) 9.



# Assessment Design (cont.)



Card	Item Details	Items that share the same answer			
1	9 : 1-9	1,4	2,5,9	3,7	
2	11: 10-20	10,20	12,14	15,19	16,17,18
3	8 : 21-28	21,26	22,27,28		
4	10: 29-38	30,38	31,33	32,35	34,37
5	8 : 39-46	39,42	40,45		
6	7 : 47-53	48,50	49,53		
7	8 : 54-61	55,61	57,58		
8	10: 62-71	62,69,70	64,67	68,71	
9	9 : 72-80	72,78	73,80	74,79	



- Unique Features

- 6 choices per item



**nominal vs. binary**

- method effects of card splits



**single-factor vs. bi-factor**

- repeated item answers



**residual covariances**



- *Ideal Model*: representing both trait and method features
  - Bi-factor Multifactor Nominal CFA with residual covariances





- *Ideal Model*: representing both trait and method features
  - Bi-factor Multifactor **Nominal** CFA with residual covariances

**Impossible!!!**



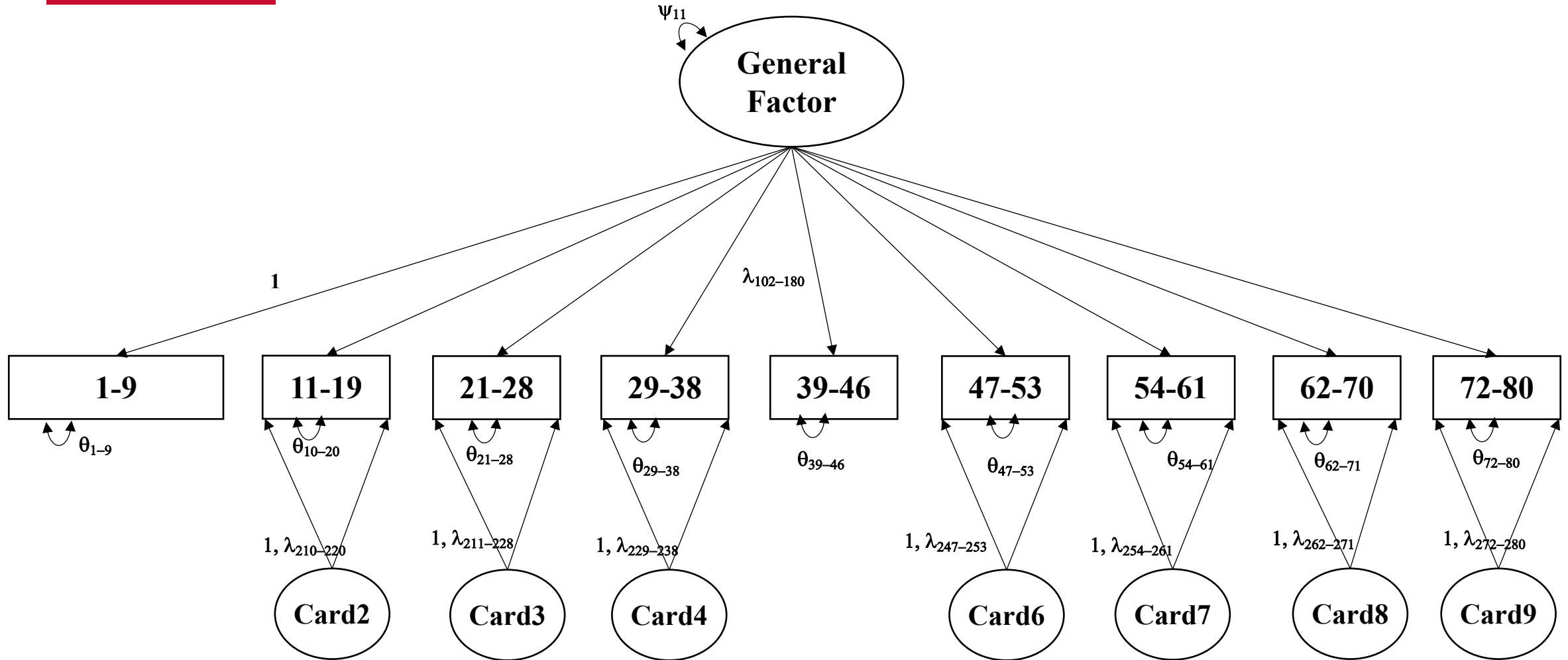
- Single-factor CFA
  - w/ | w/o Residual Covariances→ **Trait-only Model**
- Multifactor CFA
  - w/ | w/o Residual Covariances→ **Method-only Model**
- Bi-factor Multifactor CFA
  - w/ | w/o Residual Covariances→ **Trait-Method Model**

# Results



Trait/Method	Model	$\chi^2$	df	CFI	TLI	RMSEA	Note
Trait	Single	6185	3002	.68	.67	.05	High Correlations & Zero Variances
Trait	Single, residual	6139	2977	.68	.67	.05	Negative Thetas
Method	Nine cards	3433	2813	.92	.92	.02	Negative Thetas
Method	Nine cards, residual	2897	2499	.93	.93	.02	Negative Thetas
Trait-Method	Bifactor	2781	2476	.96	.96	.02	
Trait-Method	Bifactor, residual	2519	2358	.98	.98	.01	Negative Thetas

# Trait-Method Model: Bi-factor Multifactor CFA



Items dropped: 8

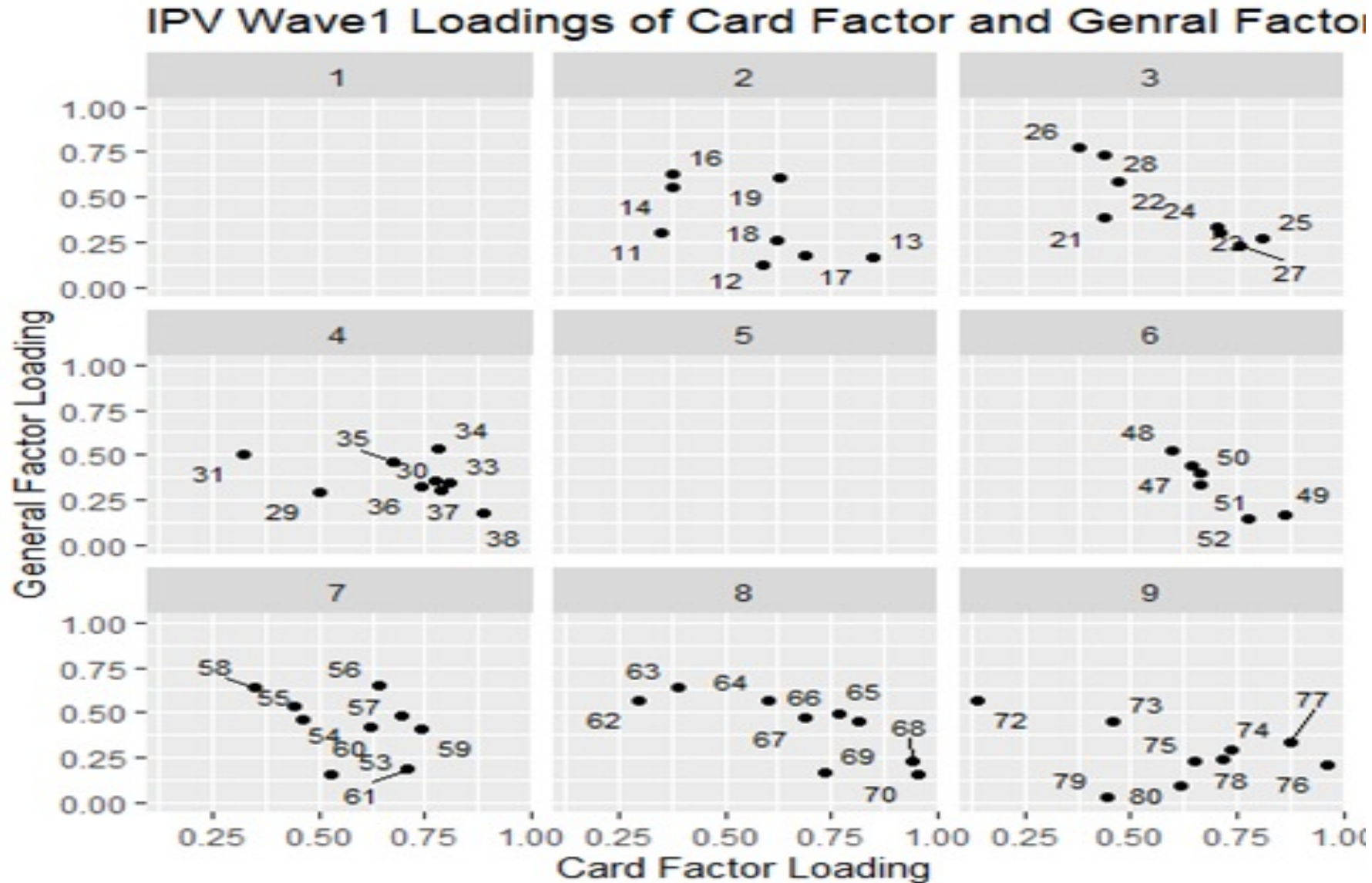
10,15,20

32

43

71

# Results (cont.) - Scatterplot of Parameters



# Conclusion



- Unique Features

- 6 choices per item

→ **nominal vs. binary**

→ **binary**

- method effects of card splits

→ **single-factor vs. bi-factor**

→ **Trait and Method are both essential.**

- repeated item answers

→ **residual covariances**

→ **Did not affect global fits**

TOLD-4 IPV shows a problematic structure.

# Limitation/Future Directions



- Non-parametric Item Response Theory (IRT)
- Dynamic Fit Indices (DFI)
- *Looking forward to suggestions!*

# Acknowledgement



- National Institutes of Health, National Institute on Deafness and Other Communication Disorders (NIDCD)
  - Secondary Data Analysis: R21DC019732 (PI: Branum-Martin & Washington)
- National Institute of Child Health and Human Development (NICHD)
  - Original Data Collection: R24HD075454 (PI: Julie A. Washington)
- We appreciate the great work of research assistants in the lab!
  - Stephanie Diaz & Roula Aldib



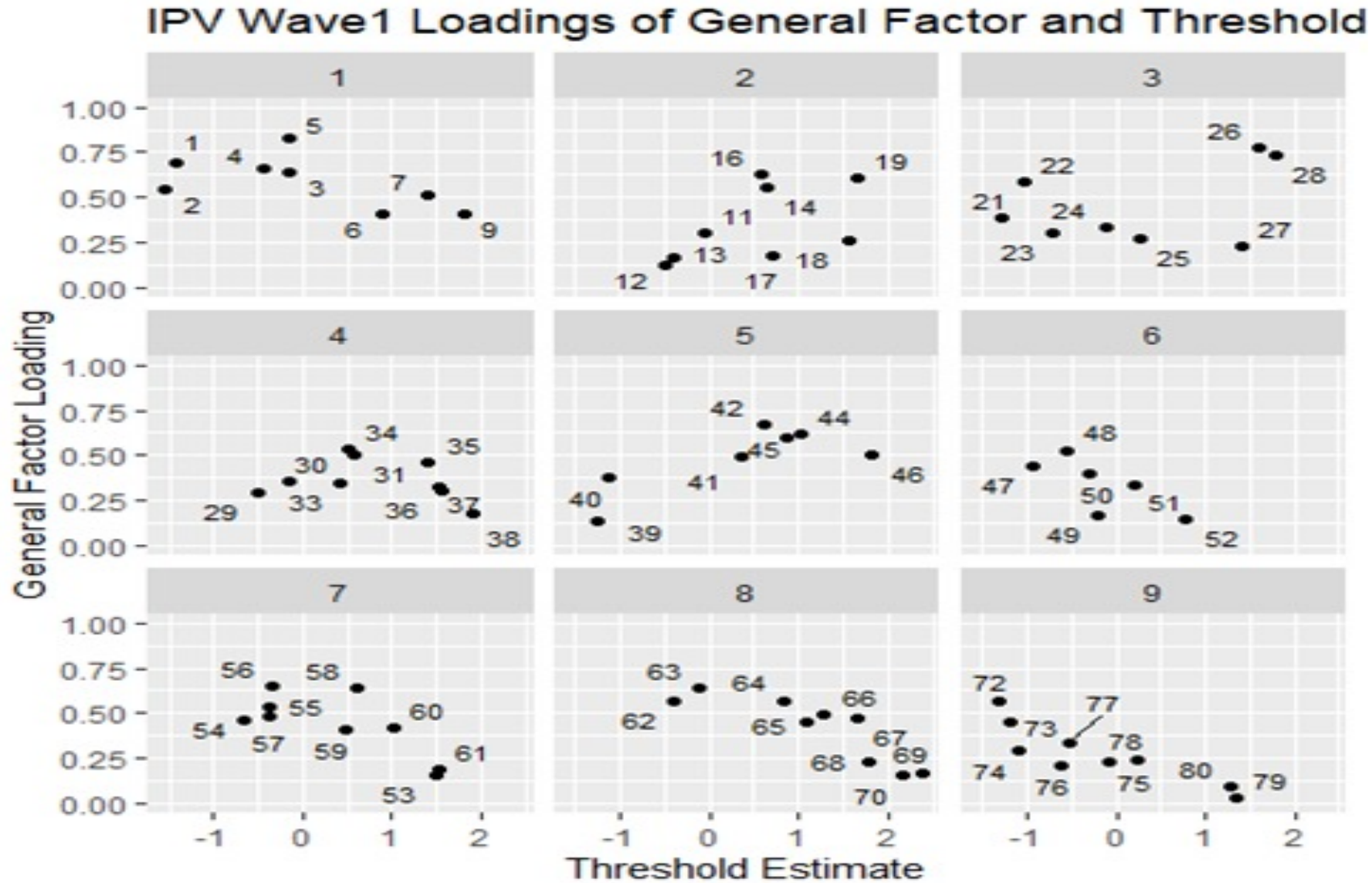


Picturing the impossible:  
Pictures, repetitions, and item-set  
card effects in measuring vocabulary

Thank you!

Eleanor Fang Yan: [fyan2@student.gsu.edu](mailto:fyan2@student.gsu.edu)

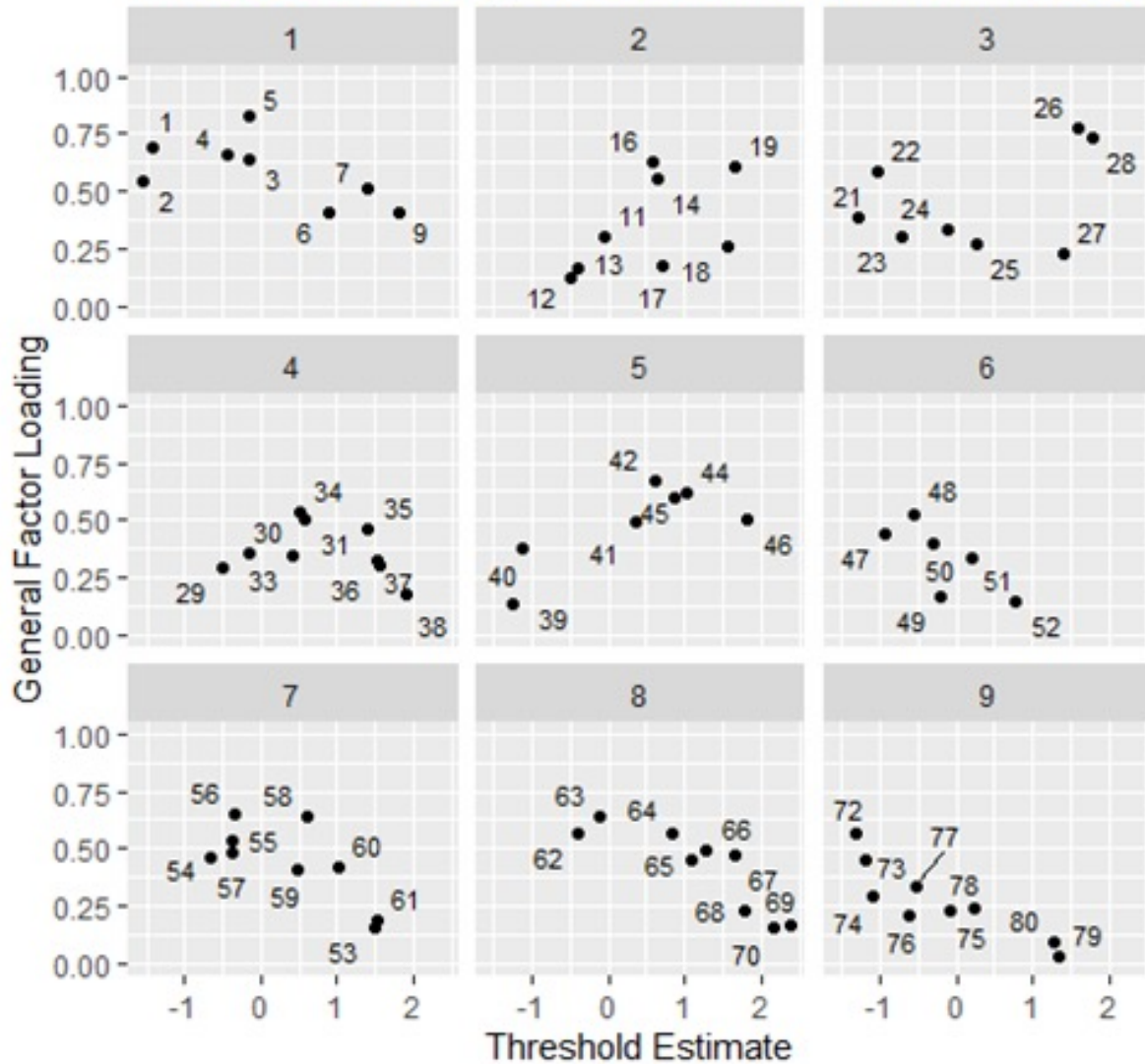
# Results (cont.) - Scatterplots of Parameters



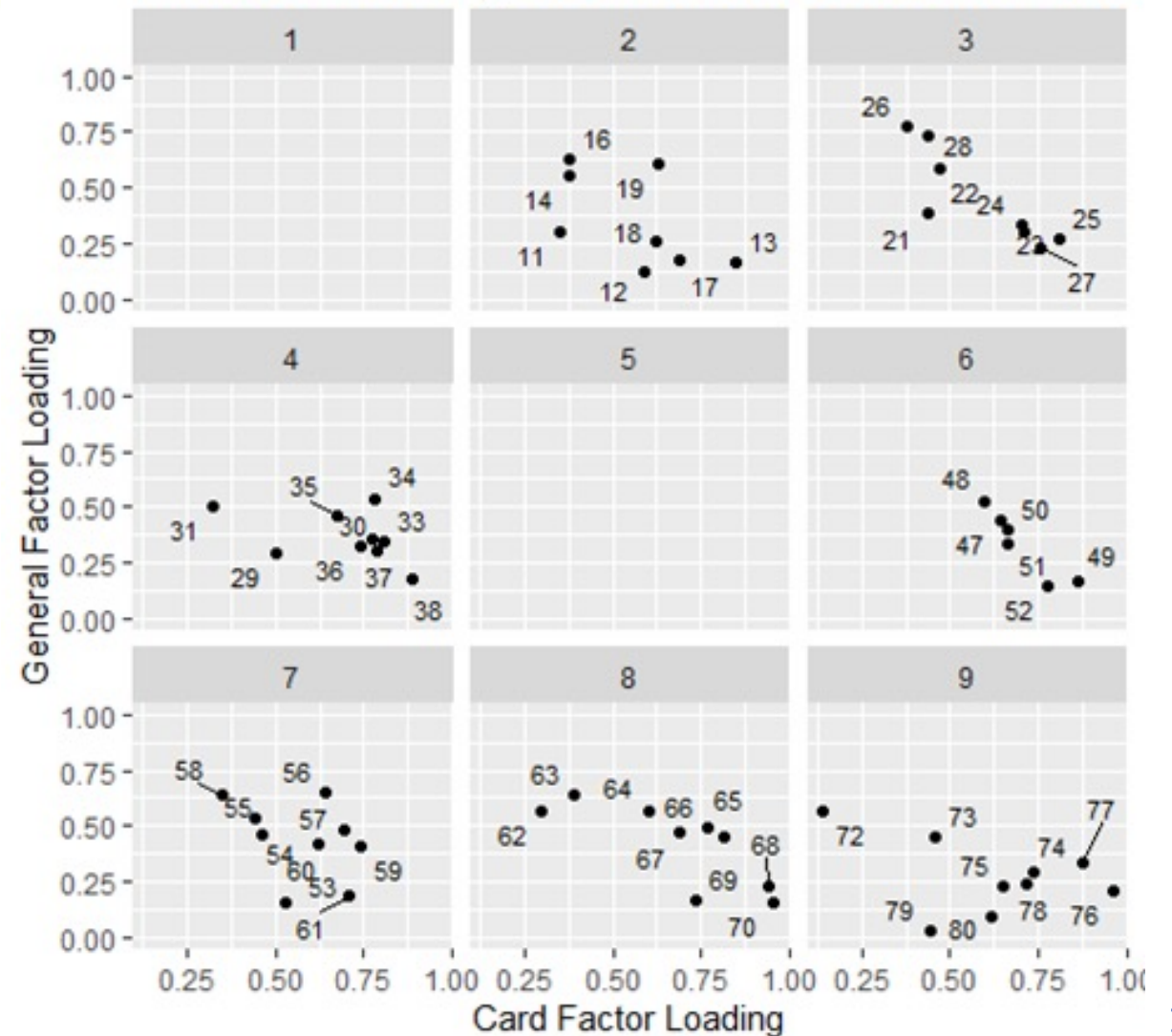
# Results (cont.) - Scatterplots of Parameters



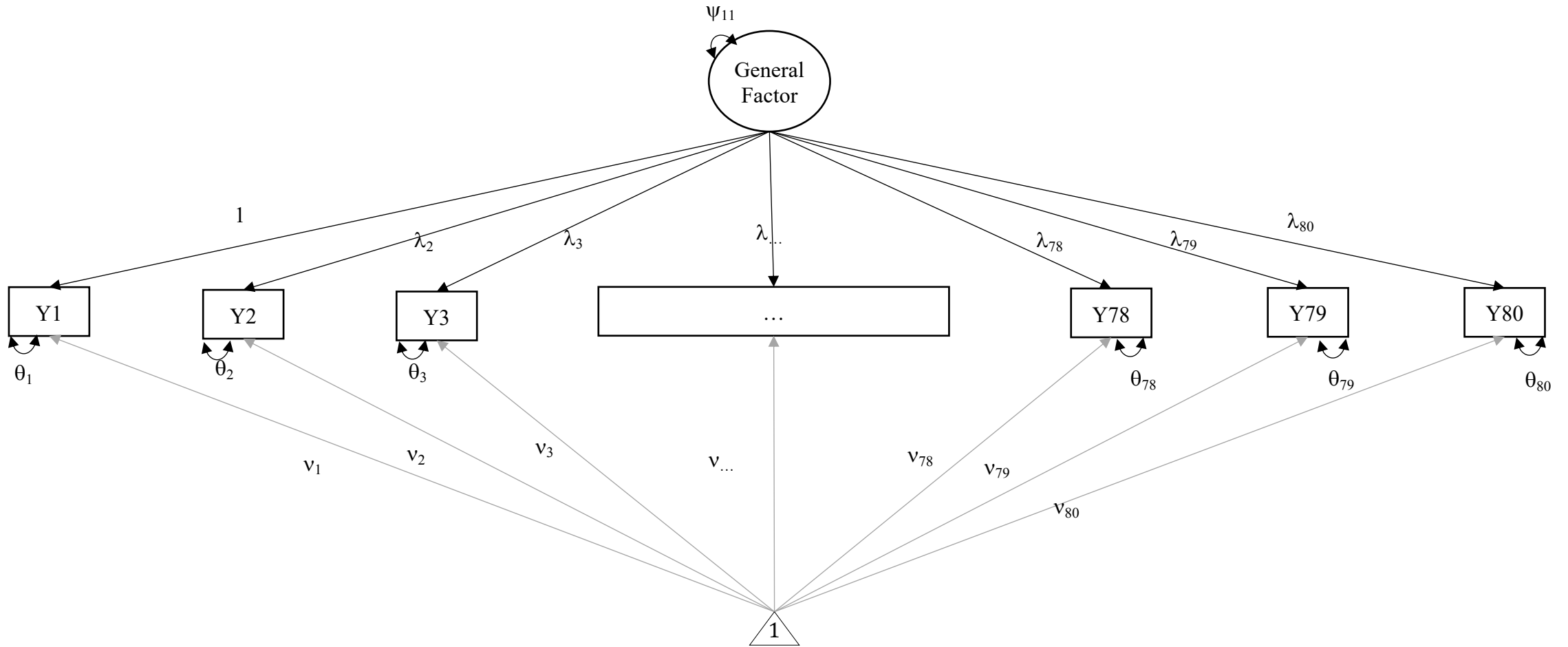
### IPV Wave1 Loadings of General Factor and Threshold



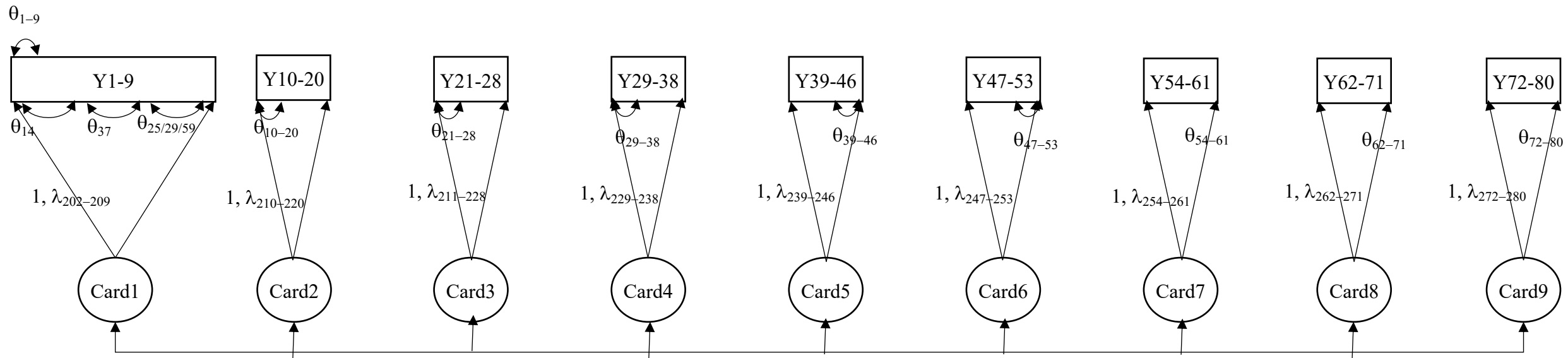
### IPV Wave1 Loadings of Card Factor and General Factor



# Single-Factor Model



# Multi-method Model



# Multi-trait Multi-method Model

