

Dyadic Data Analysis

(Or, “what we really need to know if we’re going to study peer relations”)

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Plan for talk

- **Overview and Basic Definitions**
 - Interdependence (AKA nonindependence); Distinguishability; Types of designs
- **Analyzing Standard Dyadic Data**
 - Three analytic frameworks; Actor-Partner Interdependent Model (APIM)
- **One-with-many**
 - Overview; Data analysis; Conclusions
- **Basic Social Relations Modeling (SRM)**
 - Overview; Data analysis; Advanced SRM; Conclusions
- **Final thoughts**
 - Opportunities in peer relations research; State of the field; Further readings

Interdependence

- **Conceptual definition** = two or more people are somehow 'linked' (e.g., one influences the other, people have shared influences).
- **Statistical definition** = scores that people (cases) have are more similar / dissimilar than if randomly sampled from population.
- **Challenge** = traditional analytic techniques assume independence of sampling from population.

Distinguishable vs. indistinguishable (exchangeable)

- **Distinguishable** = people in dyads fit into separable roles, characteristics etc.
- **Indistinguishable (AKA exchangeable)** = people in dyad are not separable by role, etc.
- **Examples**
 - Sex: Same-sex versus mixed-sex couples
 - Age: Twins versus non-twin siblings (birth order)
 - Role: Mutual friends versus unrequited liking

Types of designs

- **Standard dyadic = Each child has one partner.**
 - Nonreciprocal = Assess one child's affect, perception, behavior, etc toward the partner
 - Reciprocal

	A	B	C	D	E	F	G	H
A		X						
B								
C				X				
D								
E						X		
F								
G								X
H								

Types of designs

- **Standard dyadic = Each child has one partner.**
 - Nonreciprocal
 - Reciprocal = Assess both children's affect, perception, behavior, etc toward the partner

	A	B	C	D	E	F	G	H
A		X						
B	X'							
C				X				
D			X'					
E						X		
F					X'			
G								X
H							X'	

Types of designs

- One with many = focal individual with multiple (nonoverlapping) partners
 - Nonreciprocal = assess focal child's affect etc with multiple partners, or multiple partners' affect etc toward focal child

	A	B	C	D	E	F	G	H
A		X	X	X				
B	X'							
C	X'	OR						
D	X'							
E						X	X	X
F					X'	OR		
G					X'			
H					X'			

Types of designs

- One with many = focal individual with multiple (nonoverlapping) partners
 - Nonreciprocal
 - Reciprocal = assess focal child's affect etc with multiple partners, and multiple partners' affect etc toward focal child

	A	B	C	D	E	F	G	H
A		X	X	X				
B	X'							
C	X'	AND						
D	X'							
E						X	X	X
F						X'		
G						X'	AND	
H						X'		

Types of designs

- **Social relations models = many with many**
 - Round robin = Assess all children's affect, perception, behavior, etc toward all peers

	A	B	C	D	E	F	G	H
A		X	X	X	X	X	X	X
B	X'		X	X	X	X	X	X
C	X'	X'		X	X	X	X	X
D	X'	X'	X'		X	X	X	X
E	X'	X'	X'	X'		X	X	X
F	X'	X'	X'	X'	X'		X	X
G	X'	X'	X'	X'	X'	X'		X
H	X'	X'	X'	X'	X'	X'	X'	

Types of designs

- **Social relations models = many with many**
 - Round robin
 - Half block = Assess one group of children's (e.g., boys') affect, etc toward a second set of children (e.g., girls)

	A	B	C	D	E	F	G	H
A					X	X	X	X
B					X	X	X	X
C					X	X	X	X
D					X	X	X	X
E								
F								
G								
H								

Types of designs

- **Social relations models = many with many**
 - Round robin
 - Half block
 - Full block = Assess one group of children's affect etc toward a second set of children, and the second group's affect etc toward the first.

	A	B	C	D	E	F	G	H
A					X	X	X	X
B					X	X	X	X
C					X	X	X	X
D					X	X	X	X
E	X'	X'	X'	X'				
F	X'	X'	X'	X'				
G	X'	X'	X'	X'				
H	X'	X'	X'	X'				

Types of designs

- **Social relations models = many with many**
 - Round robin
 - Half block
 - Full block
 - Block round robin = Assess all children's affect etc toward all peers, but divide matrix by groups.

	A	B	C	D	E	F	G	H
A		X	X	X	X	X	X	X
B	X'		X	X	X	X	X	X
C	X'	X'		X	X	X	X	X
D	X'	X'	X'		X	X	X	X
E	X'	X'	X'	X'		X	X	X
F	X'	X'	X'	X'	X'		X	X
G	X'	X'	X'	X'	X'	X'		X
H	X'	X'	X'	X'	X'	X'	X'	

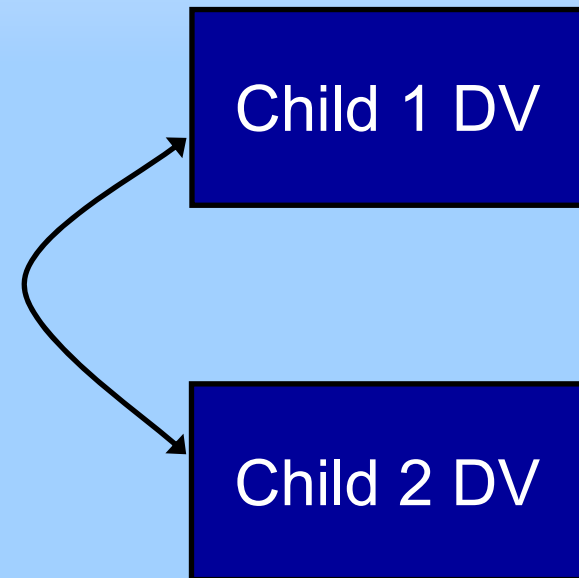
Standard dyadic - Analytic Frameworks

- **General Linear Model**
 - Simple for basic calculations (e.g., interdependence on one variable for distinguishable dyads)
 - Quickly becomes complex / nonintuitive (e.g., analysis of dyad mean and difference scores)
- **Multilevel modeling**
 - Individuals nested within dyads (2 person groups)
 - Straightforward for indistinguishable dyads, but less so for distinguishable dyads (special error structures, nonintuitive 2-intercept models)
- **Structural Equation Modeling (or path analysis)**
 - Most straightforward approach for either distinguishable or indistinguishable dyads
 - Advantages of latent variable framework

Actor-Partner Interdependence Model

Distinguishable dyads

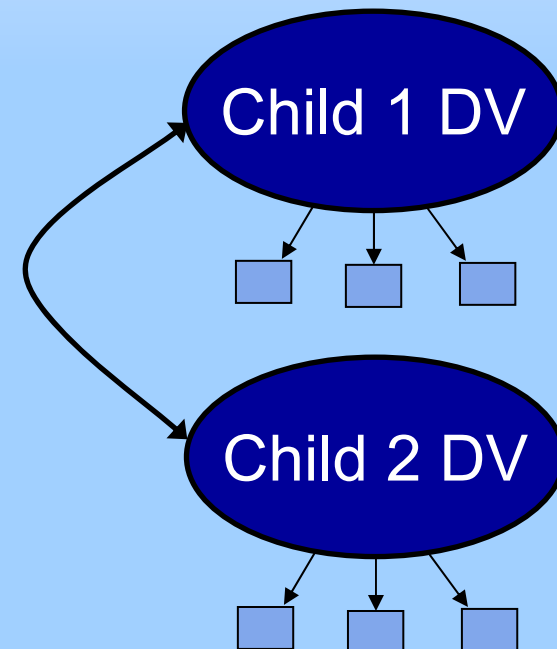
- DVs only – assessing similarity
 - Bivariate correlation between dyad members



Actor-Partner Interdependence Model

Distinguishable dyads

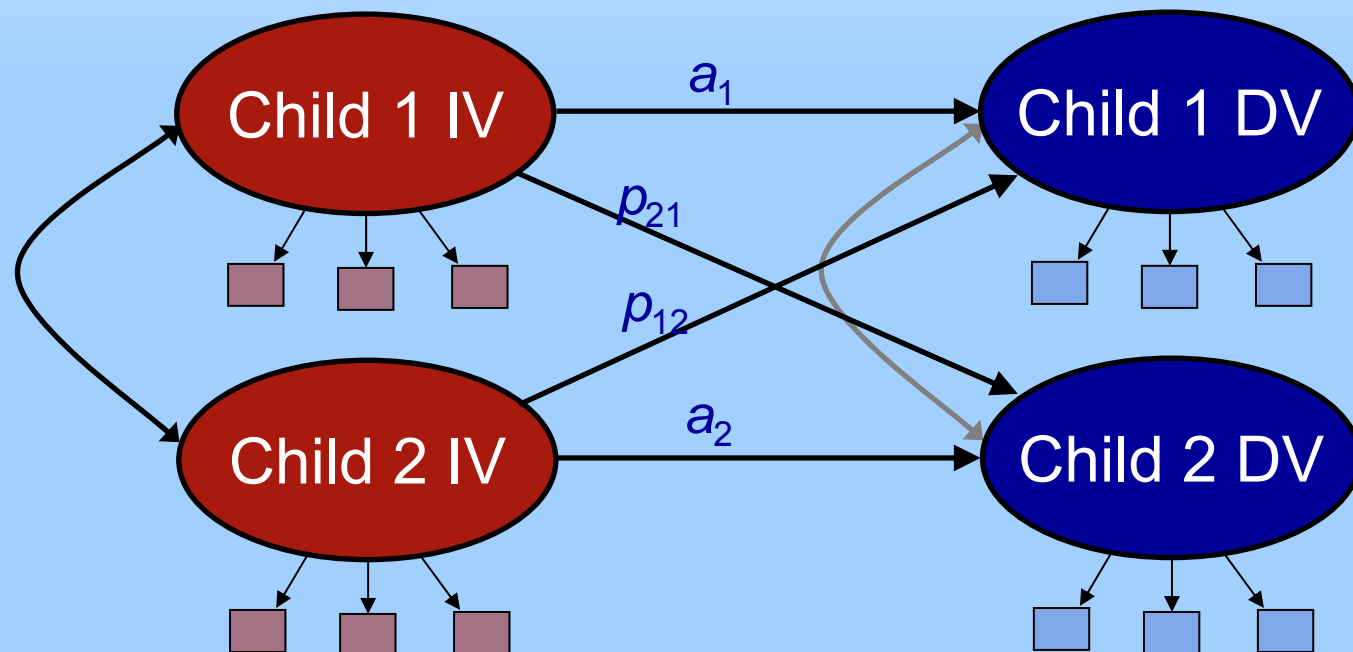
- Latent DVs only – assessing (true) similarity
 - Can evaluate measurement equivalence across dyad members
 - Latent correlation is disattenuated (unbiased) estimate of similarity



Actor-Partner Interdependence Model

Distinguishable dyads

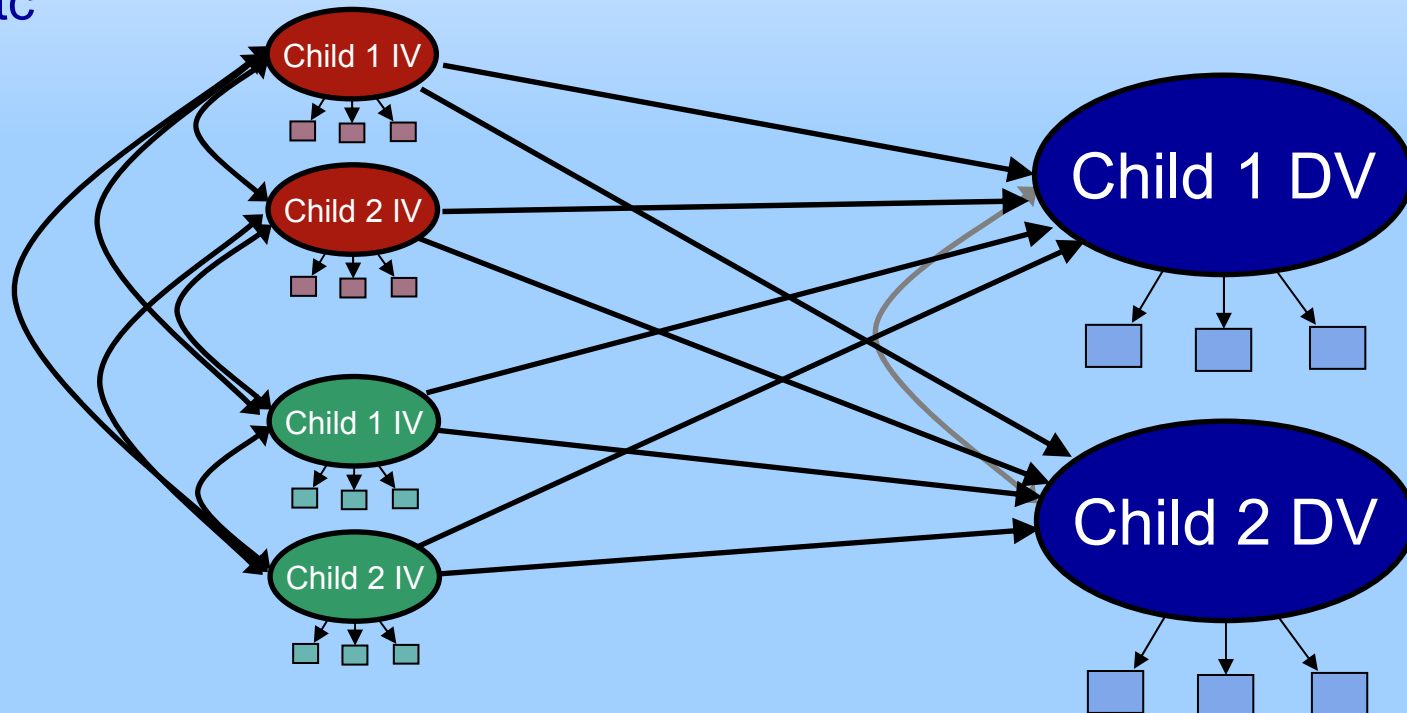
- Adding predictors
 - Actor effects = within-person IV \rightarrow DV predictions
 - Partner effects = across-person IV \rightarrow DV predictions
 - Can compare magnitudes of four effects



Actor-Partner Interdependence Model

Distinguishable dyads

- Adding multiple predictors
 - Multiple IVs
 - Interaction terms
 - Mediators
 - Etc

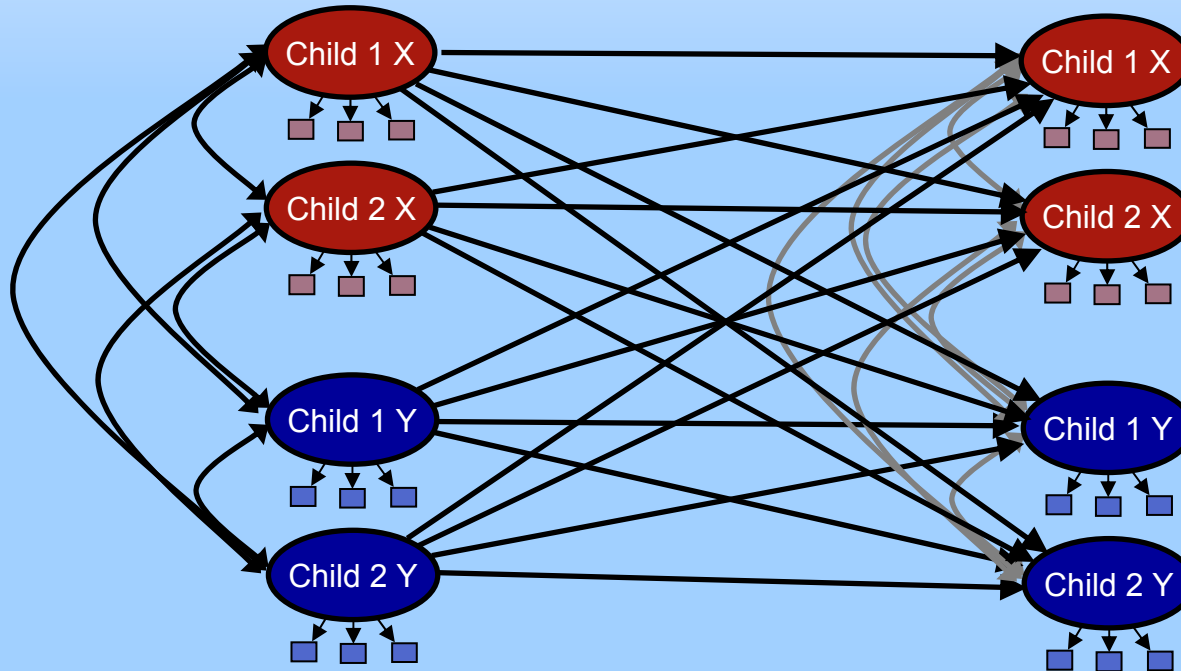


Actor-Partner Interdependence Model

Distinguishable dyads

- Longitudinal analyses

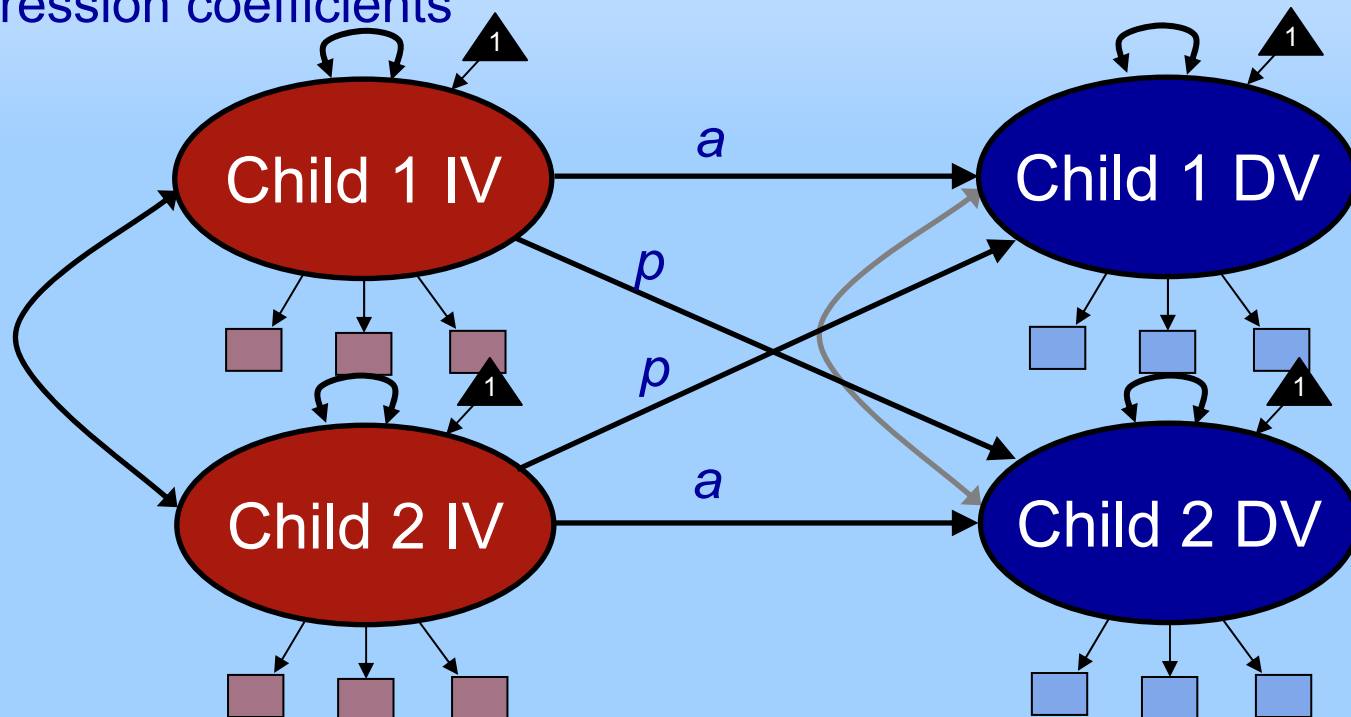
- Extension of basic panel model analysis
- One variable: actor effects = stability; partner effects = influence
- Two variables: Antecedent / consequence associations between X and Y, which may differ for actor and partner effects



Actor-Partner Interdependence Model

Indistinguishable (exchangeable) dyads

- Key modification: Constrain equivalent parameters equal
 - Factor loadings
 - Variances & means
 - Regression coefficients



Actor-Partner Interdependence Model

- Flexible framework of analyzing standard dyadic data
 - Single or multiple variables
 - Concurrent or longitudinal data
 - Distinguishable or indistinguishable (exchangeable) dyads

One with many - Overview

- Each 'focal child' has relationships with multiple 'partners'
 - Assumes that partners are separate for each focal child
- Two considerations
 - Nonreciprocal vs reciprocal
 - Indistinguishable vs distinguishable
- Analytic approaches
 - Multilevel modeling
 - Structural equation modeling

	A	B	C	D	E	F	G	H
A		X	X	X				
B	X'							
C	X'							
D	X'							
E						X	X	X
F					X'			
G					X'			
H					X'			

One with many – Data analysis

- **Nonreciprocal, indistinguishable partners**
 - Straightforward nesting of partners within focal children
 - Multilevel analysis (similarity of partners w/in focal child → empty model):

Level 1: $Y_{ij} = \pi_{0j} + \varepsilon_{ij}$
 where Y_{ij} = score of child i with partner j
 π_{0j} = Mean of child i across partners
 ε_{ij} = deviation of partner j from mean of child i

Level 2: $\pi_{0j} = \gamma_{00} + \zeta_{0i}$
 where γ_{00} = average across individuals and partners
 ζ_{0i} = deviation of child i

Variance estimates: σ_0^2 = variance across focal children
 σ_ε^2 = variance within focal children (across partners)

ICC represents similarity of partners within focal children $ICC = \frac{\sigma_0^2}{\sigma_0^2 + \sigma_\varepsilon^2}$

One with many – Data analysis

- Nonreciprocal, indistinguishable partners
 - Straightforward nesting of partners within focal children
 - Multilevel analysis (adding partner predictor):

Level 1: $Y_{ij} = \pi_{0j} + \pi_{1j}X_{ij} + \varepsilon_{ij}$

where Y_{ij} = score of child i with partner j

π_{0j} = Intercept of child i across partners (Mean if X centered)

π_{1j} = **Prediction for child i**

Level 2: $\pi_{0j} = \gamma_{00} + \zeta_{0i}$

$\pi_{1j} = \gamma_{10} + \zeta_{1i}$

where γ_{00} = average across individuals and partners

ζ_{0i} = deviation of child i

γ_{10} = **average prediction across individuals and partners**

ζ_{1i} = **deviation of prediction for child i**

One with many – Data analysis

- Nonreciprocal, indistinguishable partners
 - Straightforward nesting of partners within focal children
 - Multilevel analysis (adding focal child predictor):

Level 1: $Y_{ij} = \pi_{0j} + \varepsilon_{ij}$

where Y_{ij} = score of child i with partner j
 π_{0j} = Mean of child i across partners

Level 2: $\pi_{0j} = \gamma_{00} + \gamma_{01}Z_i + \zeta_{0i}$

where γ_{00} = average across individuals and partners
 ζ_{0i} = deviation of child i

γ_{01} = Prediction of average for children (across partners)

One with many – Data analysis

- Nonreciprocal, indistinguishable partners
 - Straightforward nesting of partners within focal children
 - Multilevel analysis (focal child and partner predictors):

Level 1: $Y_{ij} = \pi_{0j} + \pi_{1j}X_{ij} + \varepsilon_{ij}$

where Y_{ij} = score of child i with partner j

π_{0j} = Intercept of child i across partners (Mean if X centered)

π_{0j} = Prediction for child i

Level 2: $\pi_{0j} = \gamma_{00} + \gamma_{01}Z_i + \zeta_{0i}$

$\pi_{1j} = \gamma_{10} + \gamma_{11}Z_i + \zeta_{1i}$

where γ_{00} = average across individuals and partners

ζ_{0i} = deviation of child i

γ_{10} = average prediction across individuals and partners

ζ_{1i} = deviation of prediction for child i

γ_{01} = Prediction of intercept for children

γ_{11} = **interaction of child X partner predictors**

One with many – Data analysis

- Nonreciprocal, distinguishable partners

- Include dummy codes for distinguishable partners

- # dummy codes = # relationship types - 1

- Multilevel analysis:

Level 1: $Y_{ij} = \pi_{0j} + \pi_{1j}\text{DC1} + \pi_{2j}\text{DC2}\dots + \varepsilon_{ij}$

where Y_{ij} = score of child i with partner j

π_{0j} = Intercept of child i (value for comparison relationship)

π_{1j} = Difference of relationship 1 (vs. comparison) for child i

π_{2j} = Difference of relationship 2 (vs. comparison) for child i

Level 2: $\pi_{0j} = \gamma_{00} + \zeta_{0i}$

$\pi_{1j} = \gamma_{10} + \zeta_{1i}$

$\pi_{1j} = \gamma_{10} + \zeta_{1i}$

...

where γ_{10} = average difference of Relationship 1 w/ comparison

ζ_{1i} = deviation of difference of Relationship 1 for child i

γ_{20} = average difference of Relationship 2 w/ comparison

ζ_{2i} = deviation of difference of Relationship 2 for child i

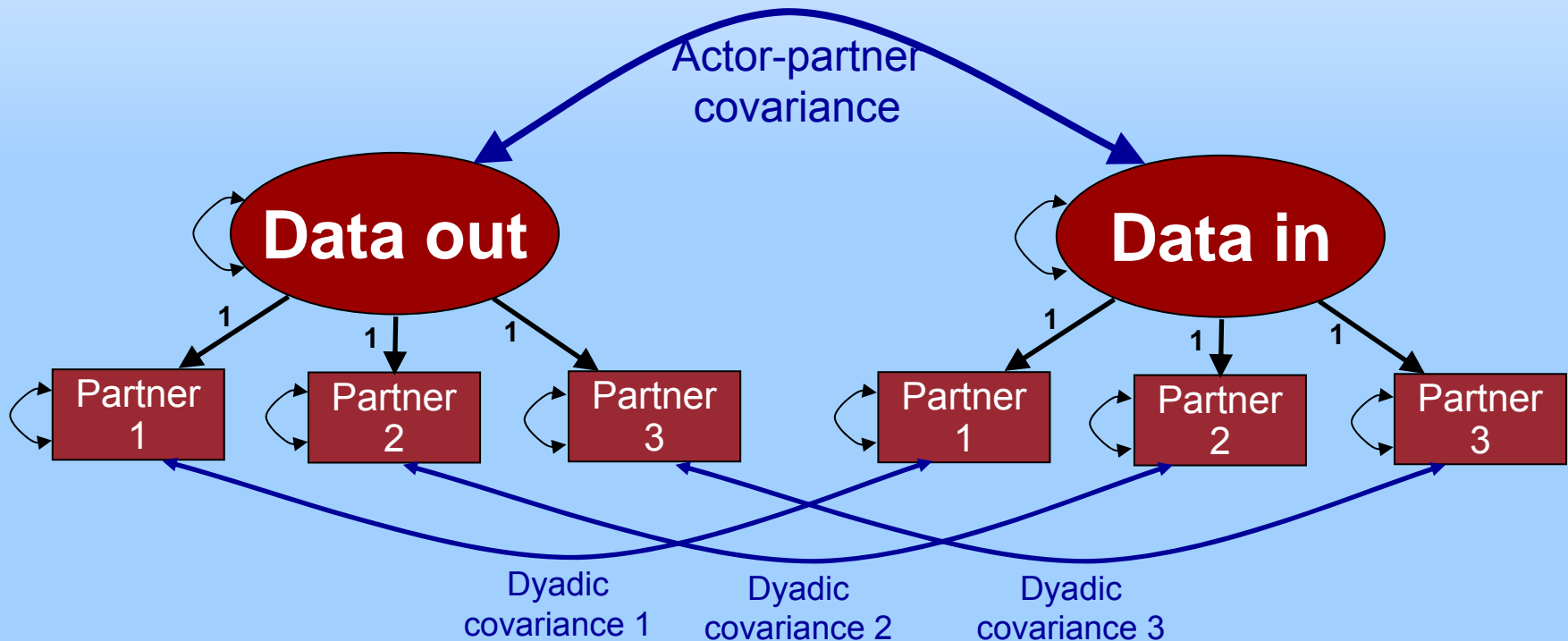
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One with many – Data analysis

- **Reciprocal data**
 - Methods are more complex than for nonreciprocal data
 - Can use multilevel analysis, but need to include multiple DVs and specify error structures

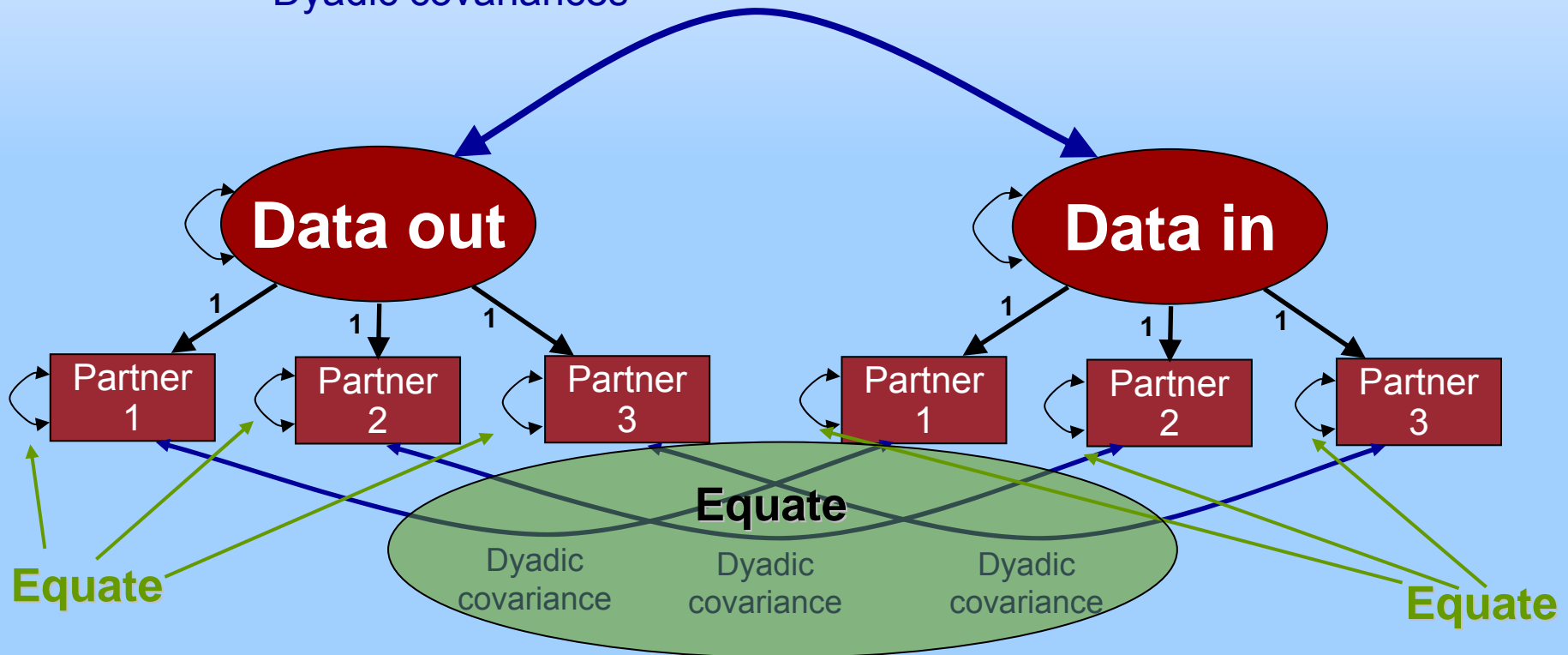
One with many – Data analysis

- Reciprocal data – distinguishable partners
 - Easier to use SEM
 - Data out = focal child's perceptions, behaviors, etc to partners
 - Data in = partners' perceptions, behavior, etc to focal child



One with many – Data analysis

- Reciprocal data – indistinguishable partners
 - Equate parameters across partners
 - Residual variances – out
 - Residual variances – in
 - Dyadic covariances



One with many - Conclusions

- **Newer approach to data analysis**
 - Few applications in child development research
 - Potentially valuable approach
- **Much work to be done**
 - Longitudinal analysis
 - Methods not yet considered
 - Opportunities in peer relations research not considered
 - Need to view nesting as opportunity rather than nuisance

Overview of Social Relations Models

- What is the SRM?
 - A *conceptual approach* to operationalize the individual and dyadic contributions to interpersonal perception, behavior, etc
 - A *data analytic approach* to partitioning interdependent group data into individual and dyadic sources

Social Relations Model (SRM)

- What is the SRM?
 - A conceptual approach
 - A data analytic approach
- My coverage of SRM
 - Focus on round-robin designs
 - Includes all basic effects
- A little terminology
 - Actor
 - Person enacting behavior, etc
 - Rows of sociomatrix
 - Partner
 - Person receiving behavior, etc
 - Columns of sociomatrix

	A	B	C	D	E	F	G	H
A		X	X	X	X	X	X	X
B	X'		X	X	X	X	X	X
C	X'	X'		X	X	X	X	X
D	X'	X'	X'		X	X	X	X
E	X'	X'	X'	X'		X	X	X
F	X'	X'	X'	X'	X'		X	X
G	X'	X'	X'	X'	X'	X'		X
H	X'	X'	X'	X'	X'	X'	X'	

SRM parameter estimates

- **Yields 3 (or 4) variance estimates**
 - Actor variance = Individual differences in *enacting* behaviors, etc
 - Partner variance = Individual differences in *receiving* behaviors, etc
 - Unique / Relationship variance = That due to specific dyadic combinations
 - Error variance = With multiple indicators, can separate unique variance into reliable relational versus error
- **Yields 2 covariance estimates**
 - Actor-partner covariance = Association between individual differences in actor and partner effects
 - Dyadic covariance = Association of parallel relationship variances (e.g., Child A to B with Child B to A)

SRM parameter estimates

- Actor effect
 - Actor variance (described later) based on individual actor effects
 - Actor effect for Child i (a_i):

	Partner					
Actor	1	2	3	4	5	
1	-	X_{12}	X_{13}	X_{14}	X_{15}	$M_{i\cdot}$
2	X_{21}	-	X_{23}	X_{24}	X_{25}	$M_{i\cdot}$
3	X_{31}	X_{32}	-	X_{34}	X_{35}	$M_{i\cdot}$
4	X_{41}	X_{42}	X_{43}	-	X_{45}	$M_{i\cdot}$
5	X_{51}	X_{52}	X_{53}	X_{54}	-	$M_{i\cdot}$
	$M_{\cdot i}$	$M_{\cdot i}$	$M_{\cdot i}$	$M_{\cdot i}$	$M_{\cdot i}$	$M_{\cdot\cdot}$

$$a_i = \frac{(n-1)^2}{n(n-2)} M_{i\cdot} + \frac{n-1}{n(n-2)} M_{\cdot i} - \frac{n-1}{n-2} M_{\cdot\cdot}$$

SRM parameter estimates

- Partner effect
 - Partner variance (later) based on individual partner effects
 - Partner effect for Child i (b_i):

	Partner					
Actor	1	2	3	4	5	
1	-	x_{12}	x_{13}	x_{14}	x_{15}	$M_{i\cdot}$
2	x_{21}	-	x_{23}	x_{24}	x_{25}	$M_{i\cdot}$
3	x_{31}	x_{32}	-	x_{34}	x_{35}	$M_{i\cdot}$
4	x_{41}	x_{42}	x_{43}	-	x_{45}	$M_{i\cdot}$
5	x_{51}	x_{52}	x_{53}	x_{54}	-	$M_{i\cdot}$
	$M_{\cdot i}$	$M_{\cdot i}$	$M_{\cdot i}$	$M_{\cdot i}$	$M_{\cdot i}$	$M_{\cdot\cdot}$

$$b_i = \frac{(n-1)^2}{n(n-2)} M_{i\cdot} + \frac{n-1}{n(n-2)} M_{\cdot i} - \frac{n-1}{n-2} M_{\cdot\cdot}$$

SRM parameter estimates

- Relationship effect
 - Relationship variance (later) based on relationship effects
 - Relationship effect for Child i to Child j (g_{ij}):

	Partner					
Actor	1	2	3	4	5	
1	-	x_{12}	x_{13}	x_{14}	x_{15}	$M_{i\cdot}$
2	x_{21}	-	x_{23}	x_{24}	x_{25}	$M_{i\cdot}$
3	x_{31}	x_{32}	-	x_{34}	x_{35}	$M_{i\cdot}$
4	x_{41}	x_{42}	x_{43}	-	x_{45}	$M_{i\cdot}$
5	x_{51}	x_{52}	x_{53}	x_{54}	-	$M_{i\cdot}$
	$M_{\cdot i}$	$M_{\cdot i}$	$M_{\cdot i}$	$M_{\cdot i}$	$M_{\cdot i}$	$M_{\cdot\cdot}$

$$g_{ij} = x_{ij} - a_i - b_j - M_{\cdot\cdot}$$

SRM parameter estimates

- Some computational magic...

- Appendix B of Kenny (1994)
- Lengthy, but not hard

$$1) A = \frac{\sum a_i^2}{n-1} \quad 2) B = \frac{\sum b_i^2}{n-1} \quad 3) C = \frac{\sum a_i b_i}{n-1}$$

$$4) e_{ij} = \frac{g_{ij} g_{ji}}{2} \quad 5) d_{ij} = g_{ij} - g_{ji}$$

$$6) D = \frac{2 \sum e_{ij}^2}{[.5(n-1)(n-2)]-1} \quad 7) E = \frac{\sum d_{ij}^2}{(n-1)(n-2)}$$

- Results in...

Relationship variance: $s_g^2 = \frac{D + E}{2}$

Dyadic covariance: $s_{gg'} = \frac{D - E}{2}$

Actor-Partner covariance: $s_{ab} = C - \frac{s_{gg'}(n-1)}{n(n-2)} - \frac{s_g^2}{n(n-2)}$

Actor variance: $s_a^2 = A - \frac{s_g^2(n-1)}{n(n-2)} - \frac{s_{gg'}}{n(n-2)}$

Partner variance: $s_b^2 = B - \frac{s_g^2(n-1)}{n(n-2)} - \frac{s_{gg'}}{n(n-2)}$

Advanced SRM

- **SRM with roles**
 - Each member of group is *distinguishable* in filling specific roles
 - Used in family research (e.g., mother, father, older child, younger child)
 - Attention to comparisons of parameters across roles
 - Individuals: e.g., actor means and variances of mother vs. father
 - Dyads: e.g., relationship means and variance of mother-father vs sibling dyads

Advanced SRM

- **Multivariate SRM**
 - Simultaneous analysis of multiple sociomatrices
 - Many parameters estimated
 - Estimates 3 (or 4) variances and 2 covariances within each variable
 - Estimates 6 across-variable covariances (per 2 variables)

Advanced SRM

Multivariate SRM

- Simultaneous analysis of multiple sociomatrices
- Many parameters estimated
 - Estimates 3 (or 4) variances and 2 covariances within each variable
 - Estimates 6 across-variable covariances (per 2 variables)

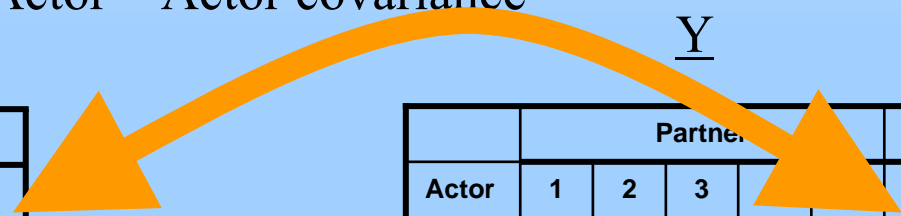
1) Actor – Actor covariance

X

	Partner					
Actor	1	2	3	4	5	
1	-	X ₁₂	X ₁₃	X ₁₄	X ₁₅	M _{1.}
2	X ₂₁	-	X ₂₃	X ₂₄	X ₂₅	M _{2.}
3	X ₃₁	X ₃₂	-	X ₃₄	X ₃₅	M _{3.}
4	X ₄₁	X ₄₂	X ₄₃	-	X ₄₅	M _{4.}
5	X ₅₁	X ₅₂	X ₅₃	X ₅₄	-	M _{5.}
	M _{.1}	M _{.2}	M _{.3}	M _{.4}	M _{.5}	M _{..}

Y

	Partner					
Actor	1	2	3			
1	-	X ₁₂	X ₁₃	X ₁₄	X ₁₅	M _{1.}
2	X ₂₁	-	X ₂₃	X ₂₄	X ₂₅	M _{2.}
3	X ₃₁	X ₃₂	-	X ₃₄	X ₃₅	M _{3.}
4	X ₄₁	X ₄₂	X ₄₃	-	X ₄₅	M _{4.}
5	X ₅₁	X ₅₂	X ₅₃	X ₅₄	-	M _{5.}
	M _{.1}	M _{.2}	M _{.3}	M _{.4}	M _{.5}	M _{..}



Advanced SRM

Multivariate SRM

- Simultaneous analysis of multiple sociomatrices
- Many parameters estimated
 - Estimates 3 (or 4) variances and 2 covariances within each variable
 - Estimates 6 across-variable covariances (per 2 variables)

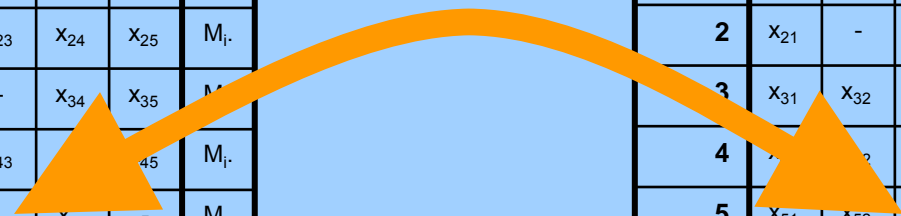
2) Partner – Partner covariance

X

Y

	Partner					
Actor	1	2	3	4	5	
1	-	X ₁₂	X ₁₃	X ₁₄	X ₁₅	M _{i.}
2	X ₂₁	-	X ₂₃	X ₂₄	X ₂₅	M _{i.}
3	X ₃₁	X ₃₂	-	X ₃₄	X ₃₅	M _{i.}
4	X ₄₁	X ₄₂	X ₄₃	-	X ₄₅	M _{i.}
5	X ₅₁	X ₅₂	X ₅₃	X ₅₄	-	M _{i.}
	M _{.j}	M _{.j}	M _{.j}	M _{.j}	M _{.j}	M _{..}

	Partner					
Actor	1	2	3	4	5	
1	-	X ₁₂	X ₁₃	X ₁₄	X ₁₅	M _{i.}
2	X ₂₁	-	X ₂₃	X ₂₄	X ₂₅	M _{i.}
3	X ₃₁	X ₃₂	-	X ₃₄	X ₃₅	M _{i.}
4	X ₄₁	X ₄₂	X ₄₃	-	X ₄₅	M _{i.}
5	X ₅₁	X ₅₂	X ₅₃	X ₅₄	-	M _{i.}
	M _{.j}	M _{.j}	M _{.j}	M _{.j}	M _{.j}	M _{..}



Advanced SRM

Multivariate SRM

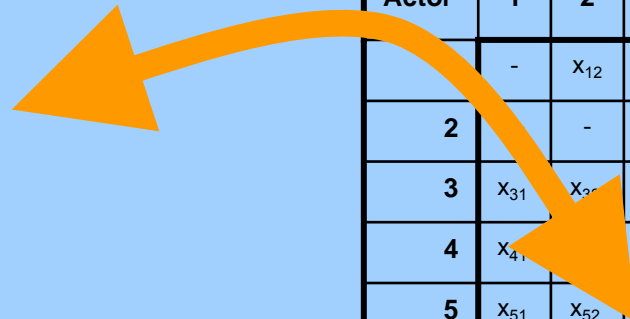
- Simultaneous analysis of multiple sociomatrices
- Many parameters estimated
 - Estimates 3 (or 4) variances and 2 covariances within each variable
 - Estimates 6 across-variable covariances (per 2 variables)

3) Actor – Partner covariance

X

Y

	Partner					
Actor	1	2	3	4	5	
1	-	X ₁₂	X ₁₃	X ₁₄	X ₁₅	M _{1.}
2	X ₂₁	-	X ₂₃	X ₂₄	X ₂₅	M _{2.}
3	X ₃₁	X ₃₂	-	X ₃₄	X ₃₅	M _{3.}
4	X ₄₁	X ₄₂	X ₄₃	-	X ₄₅	M _{4.}
5	X ₅₁	X ₅₂	X ₅₃	X ₅₄	-	M _{5.}
	M _{.1}	M _{.2}	M _{.3}	M _{.4}	M _{.5}	M _{..}



	Partner					
Actor	1	2	3	4	5	
1	-	X ₁₂	X ₁₃	X ₁₄	X ₁₅	M _{1.}
2		-	X ₂₃	X ₂₄	X ₂₅	M _{2.}
3	X ₃₁	X ₃₂	-	X ₃₄	X ₃₅	M _{3.}
4	X ₄₁		X ₄₃	-	X ₄₅	M _{4.}
5	X ₅₁	X ₅₂	X ₅₃	X ₅₄	-	M _{5.}
	M _{.1}	M _{.2}	M _{.3}	M _{.4}	M _{.5}	M _{..}

Advanced SRM

Multivariate SRM

- Simultaneous analysis of multiple sociomatrices
- Many parameters estimated
 - Estimates 3 (or 4) variances and 2 covariances within each variable
 - Estimates 6 across-variable covariances (per 2 variables)

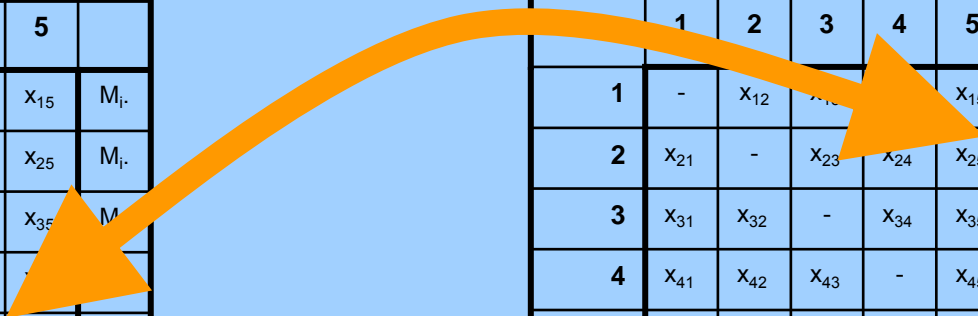
4) Partner – Actor covariance

X

Y

	Partner					
Actor	1	2	3	4	5	
1	-	X ₁₂	X ₁₃	X ₁₄	X ₁₅	M _{i.}
2	X ₂₁	-	X ₂₃	X ₂₄	X ₂₅	M _{i.}
3	X ₃₁	X ₃₂	-	X ₃₄	X ₃₅	M _{i.}
4	X ₄₁	X ₄₂	X ₄₃	-	X ₄₅	M _{i.}
5	X ₅₁	X ₅₂	X ₅₃	X ₅₄	-	M _{i.}
	M _{.j}	M _{.j}	M _{.j}	M _{.j}	M _{.j}	M _{..}

	Partner					
	1	2	3	4	5	
1	-	X ₁₂	X ₁₃	X ₁₄	X ₁₅	M _{i.}
2	X ₂₁	-	X ₂₃	X ₂₄	X ₂₅	M _{i.}
3	X ₃₁	X ₃₂	-	X ₃₄	X ₃₅	M _{i.}
4	X ₄₁	X ₄₂	X ₄₃	-	X ₄₅	M _{i.}
5	X ₅₁	X ₅₂	X ₅₃	X ₅₄	-	M _{i.}
	M _{.j}	M _{.j}	M _{.j}	M _{.j}	M _{.j}	M _{..}

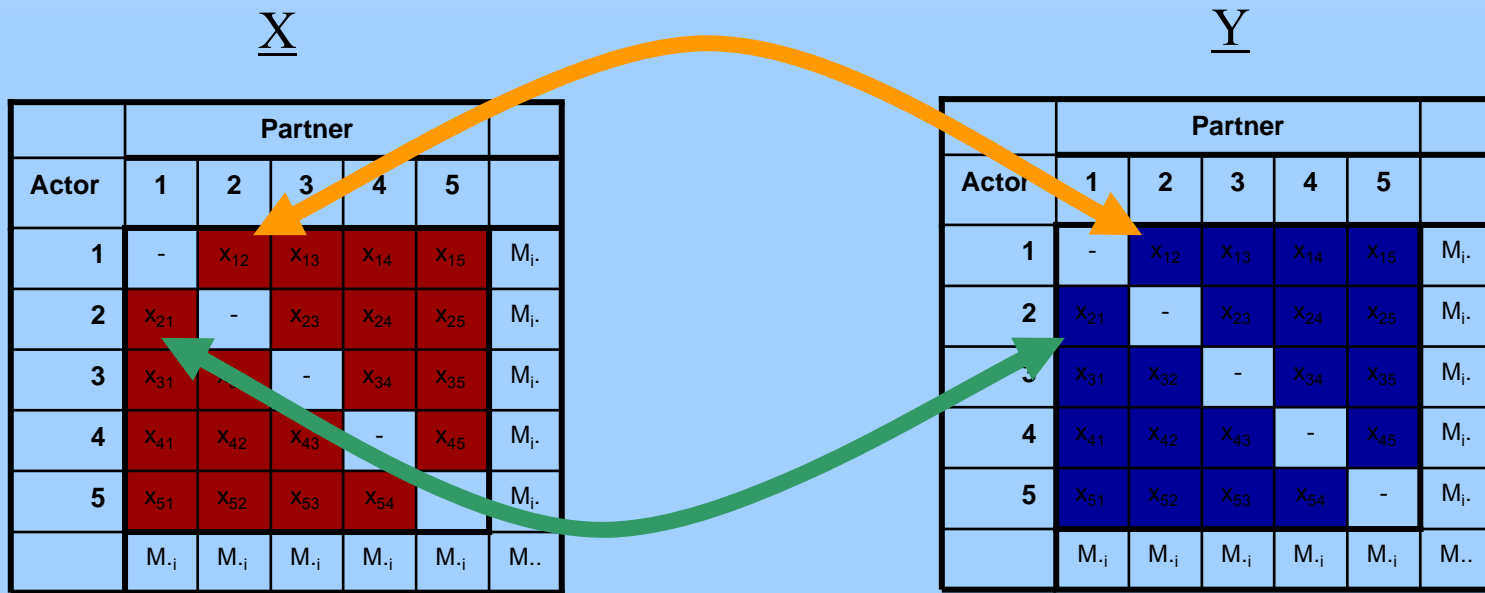


Advanced SRM

- Multivariate SRM**

- Simultaneous analysis of multiple sociomatrices
- Many parameters estimated
 - Estimates 3 (or 4) variances and 2 covariances within each variable
 - Estimates 6 across-variable covariances (per 2 variables)

5) Intrapersonal Dyadic covariance

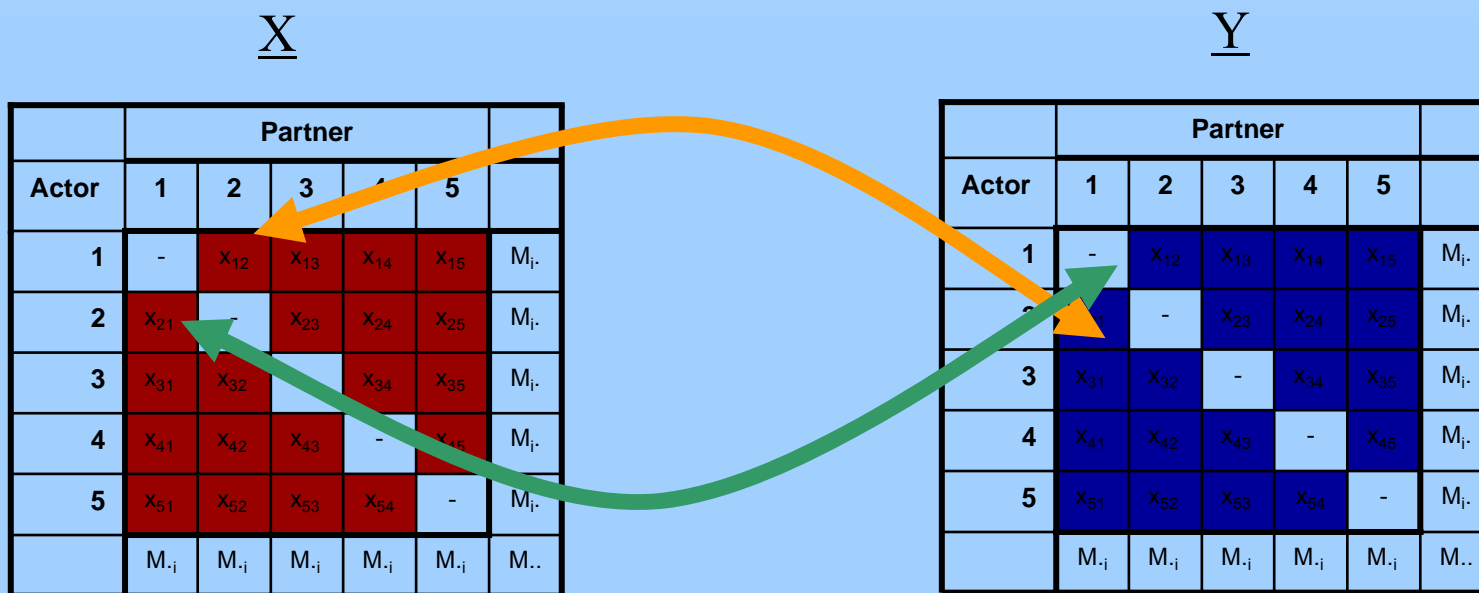


Advanced SRM

Multivariate SRM

- Simultaneous analysis of multiple sociomatrices
- Many parameters estimated
 - Estimates 3 (or 4) variances and 2 covariances within each variable
 - Estimates 6 across-variable covariances (per 2 variables)

6) Interpersonal Dyadic covariance



Advanced SRM

• Multivariate SRM

- Special application to accommodate multiple membership dyads (see Card et al., 2008)
 - Sociomatrix 1 contains information about dyadic relationships (e.g., friendships)
 - Sociomatrix 2 contains information about DV (e.g., perceptions or behavior toward partner)

Dyads (e.g., friends)

Actor	Partner					
	1	2	3	4	5	
1	-	x_{12}	x_{13}	x_{14}	x_{15}	$M_{i.}$
2	x_{21}	-	x_{23}	x_{24}	x_{25}	$M_{i.}$
3	x_{31}	x_{32}	-	x_{34}	x_{35}	$M_{i.}$
4	x_{41}	x_{42}	x_{43}	-	x_{45}	$M_{i.}$
5	x_{51}	x_{52}	x_{53}	x_{54}	-	$M_{i.}$
	$M_{.i}$	$M_{.i}$	$M_{.i}$	$M_{.i}$	$M_{.i}$	$M_{..}$

DV (e.g., perceptions)

Actor	Partner					
	1	2	3	4	5	
1	-	x_{12}	x_{13}	x_{14}	x_{15}	$M_{i.}$
2	x_{21}	-	x_{23}	x_{24}	x_{25}	$M_{i.}$
3	x_{31}	x_{32}	-	x_{34}	x_{35}	$M_{i.}$
4	x_{41}	x_{42}	x_{43}	-	x_{45}	$M_{i.}$
5	x_{51}	x_{52}	x_{53}	x_{54}	-	$M_{i.}$
	$M_{.i}$	$M_{.i}$	$M_{.i}$	$M_{.i}$	$M_{.i}$	$M_{..}$

Social Relations Models

- Flexible, powerful approach
- Challenging to use
 - SoReMo software is difficult to use
 - Can perform analyses in Excel, SPSS, etc
 - Tedious, but straightforward to follow equations
- Several unanswered questions
 - Inferential testing
 - Adequate methods for univariate SRM, but crude for multivariate SRM (though crude methods perform reasonably well)
 - Missing data in problematic
 - Not yet adapted for longitudinal analysis

Opportunities of dyadic analysis for peer relations research

- **What not to do:**
 - Ignore interdependence
 - Discard / only collect data from one person
- **Peer relations are necessarily dyadic**
 - Examples
 - Friendships and antipathetic relationships are dyadic by definition
 - Groups status is not a characteristic of the individual child, but rather the summation of dyadic perceptions peers hold toward the child
 - Most behaviors (e.g., aggression, prosocial) are necessarily dyadic, involving an enactor and target
 - We need to be interested in this interdependence, and not treat it as a statistical nuisance

State of the field

- Recent advances in quantitative methods
 - There now exist methods of analyzing many types of interdependent data
 - These advances are recent, and not thoroughly applied in developmental science

State of the field

- Recent advances in quantitative methods
- **Changes in peer relations research**
 - We can not continue to rely only on techniques that assume independence
 - There are many opportunities to use these techniques in peer relations research

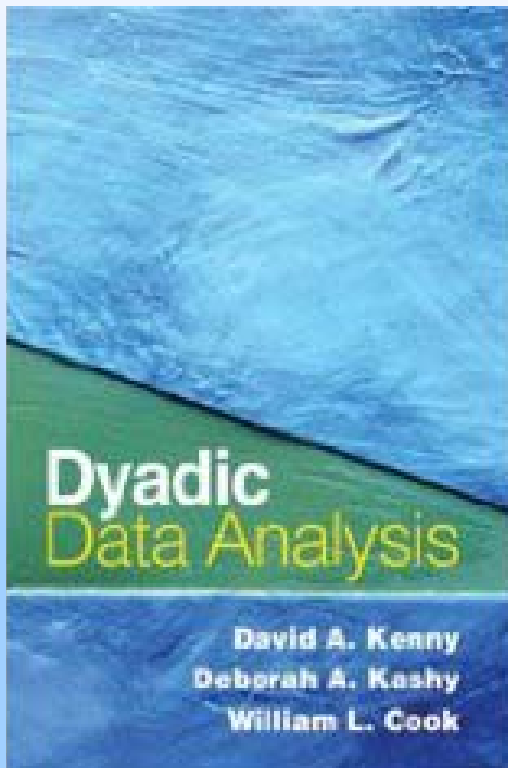
State of the field

- Recent advances in quantitative methods
- Changes in peer relations research
- **Challenges**
 - Many are unfamiliar with dyadic data analysis is (e.g., reviewers)
 - Requires us to use techniques that are sometimes statistically complex and typically not 'built in' to existing software packages
 - The quantitative innovators have not usually considered special needs of developmental science
 - E.g., longitudinal analyses

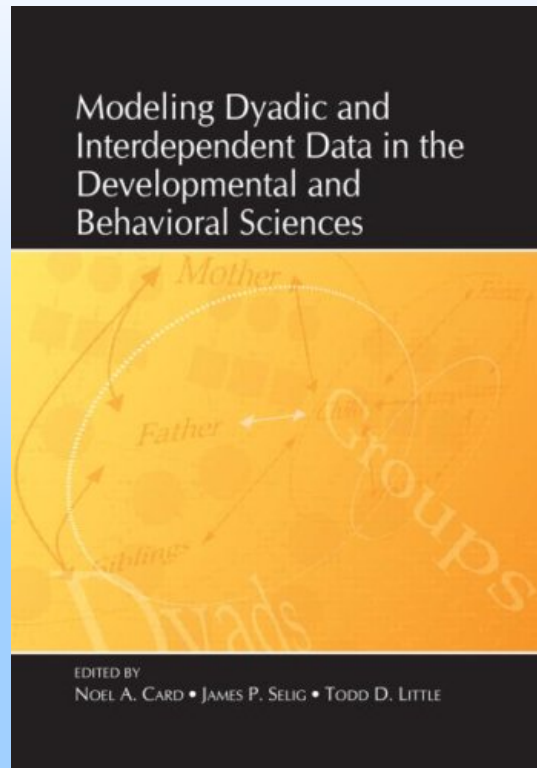
State of the field

- Recent advances in quantitative methods
- Changes in peer relations research
- Challenges
- **Conclusions**
 - Despite these challenges, we should try
 - Probably best approach to advance understanding of childhood peer relations

Further reading



Kenny, Kashy, &
Cook (2006).
Guilford



Card, Selig, & Little
(Eds.) (2008).
Routledge



Laursen (2005). Special
issue of IJBD, 29(2)

*Note: No picture of special
issue. Sorry Brett.*

Thank you

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