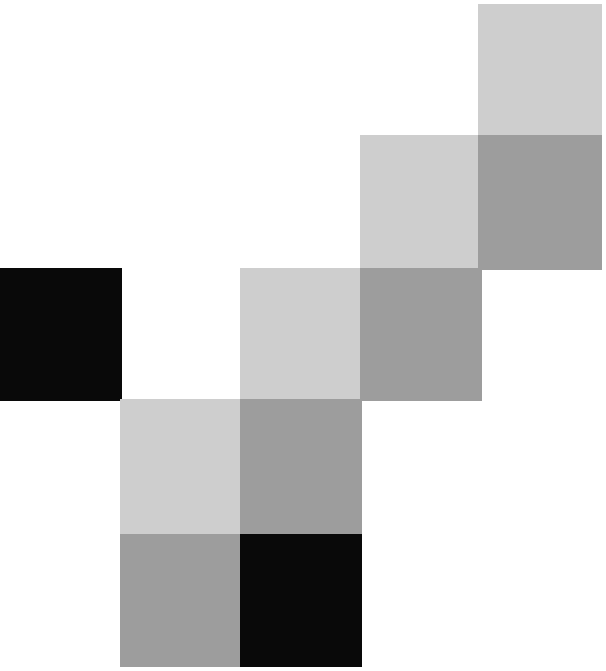


Categorical Data

Mx class 2004

Univariate Genetic Analysis

- Saturated Models
  - Free thresholds
- Univariate Models
  - Variances partitioned in a, c/d and e
  - Free thresholds (or not)

Practical Example

- Dataset: VTR
- FF1 interview
- MDD (DSM-IIIR)
- Adults: 18-60 years
- N individuals

MZF (zyg=1): 1180
DZF (zyg=2): 880

Contingency Tables

MZF			DZF		
T2 T1	-	+	T2 T1	-	+
-	329	83	-	201	94
+	95	83	+	82	63

-: unaffected +: affected

Raw Dataset usmdd.ord

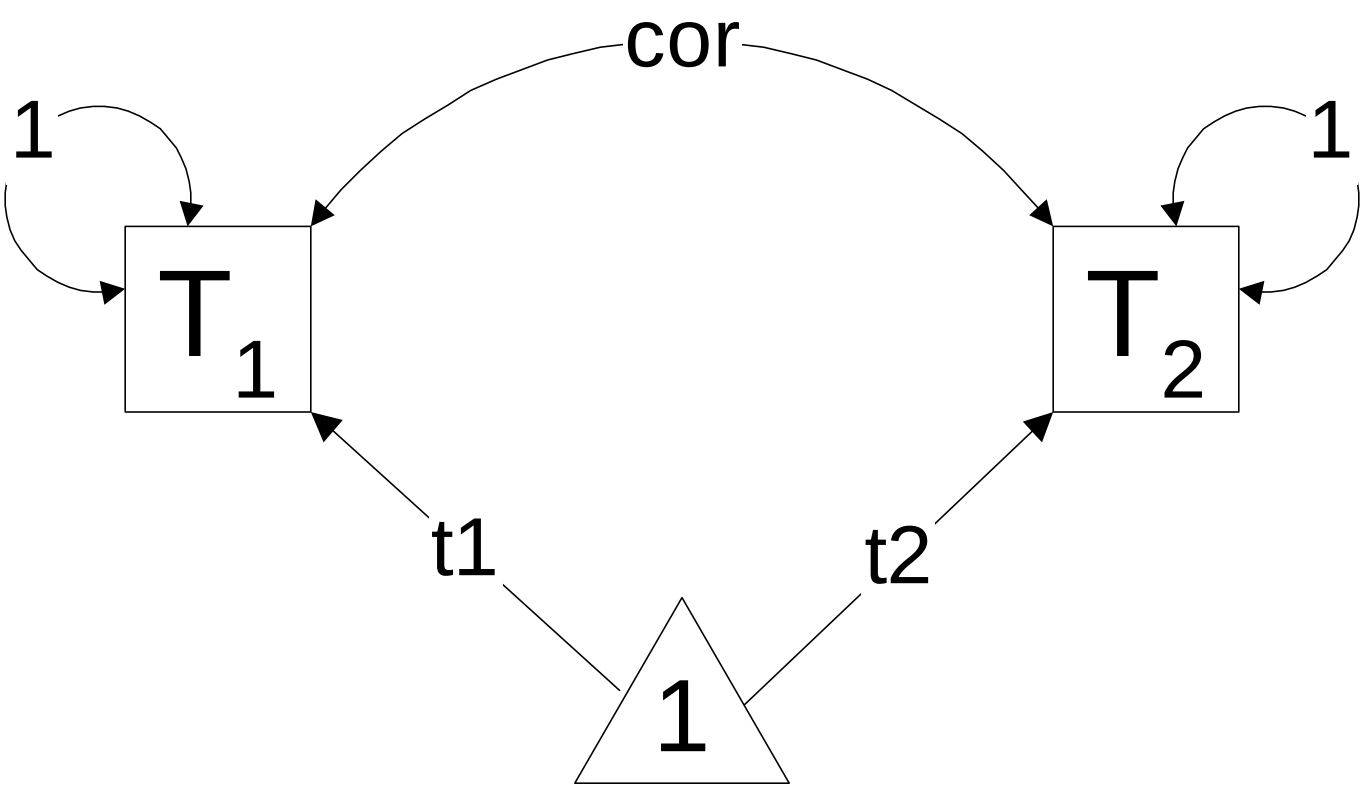
1 0 0	2 0 0
1 0 0	2 0 0
1 0 0	2 0 0
1 0 0	2 0 1
1 0 0	2 0 1
1 0 1	2 0 1
1 0 1	2 1 0
1 1 0	2 1 0
1 1 0	2 1 0
1 1 0	2 1 0
1 1 1	2 1 0
1 1 1	2 1 1
1 1 1	2 1 1

Frequency Data: usmdd?.ctf

MZ
0 0 329
0 1 83
1 0 95
1 1 83

DZ
0 0 201
0 1 94
1 0 82
1 1 63

Saturated Model



! Estimate thresholds & correlations – Saturated
! US MDD data – females contingency tables

- #NGroups 2
- #define nvar2 2

- Title 1: MZ data
- Data NInput=2
- CTable 2 2
- 329 83 95 83
- Begin Matrices;
- T Full nvar2 1 Free
- X Stnd nvar2 nvar2 Free
- End Matrices;
- Start 1 T 1 1 - T nvar2 1
- Threshold T;
- Correlation X;
- Option RSiduals
- End

- Title 2: DZ data
- Data NInput=2
- CTable 2 2
- 201 94 82 63
- Begin Matrices;
- T Full nvar2 1 Free
- X Stnd nvar2 nvar2 Free
- End Matrices;
- Start 1 T 1 1 - T nvar2 1
- Threshold T;
- Correlation X;
- Option RSiduals
- Option Multiple Issat
- End

usmddsatct.mx

! Estimate thresholds & correlations – Saturated
! US MDD data – females raw ordinal data

- #NGroups 2
- #define nvar2 2
- Title 1: MZ data
- Data NInput=3
- Ordinal File=usmdd.ord
- Labels zyg mdd1 mdd2
- Select if zyg=1
- Select mdd1 mdd2 ;
- Begin Matrices;
- T Full 1 nvar2 Free
- X Stnd nvar2 nvar2 Free
- End Matrices;
- Start 1 T 1 1 - T 1 nvar2
- Threshold T;
- Correlation X;
- Options RSiduals
- End

- Title 2: DZ data
- Data NInput=3
- Ordinal File=usmddmz.ord
- Labels zyg mdd1 mdd2
- Select if zyg=2
- Select mdd1 mdd2 ;
- Begin Matrices;
- T Full 1 nvar2 Free
- X Stnd nvar2 nvar2 Free
- End Matrices;
- Start 1 T 1 1 - T 1 nvar2
- Threshold T;
- Correlation X;
- Options RSiduals
- End

usmddsatord.mx

! Estimate thresholds & correlations – Saturated
! US MDD data – females frequency data

- #NGroups 2
- #define nvar2 2
- Title 1: MZ data
- Data NInput=3
- Ordinal File=usmddmz.ctf
- Labels mdd1 mdd2 frq
- Definition frq ;
- Begin Matrices;
- T Full 1 nvar2 Free
- X Stnd nvar2 nvar2 Free
- F Full 1 1
- End Matrices;
- Start 1 T 1 1 - T 1 nvar2
- Specify F frq
- Threshold T;
- Correlation X;
- Frequency F;
- End

- Title 2: DZ data
- Data NInput=3
- Ordinal File=usmdddz.ctf
- Labels mdd1 mdd2 frq
- Definition frq ;
- Begin Matrices;
- T Full 1 nvar2 Free
- X Stnd nvar2 nvar2 Free
- F Full 1 1
- End Matrices;
- Start 1 T 1 1 - T 1 nvar2
- Specify F frq
- Threshold T;
- Correlation X;
- Frequency F;
- End

usmddsatfrq.mx

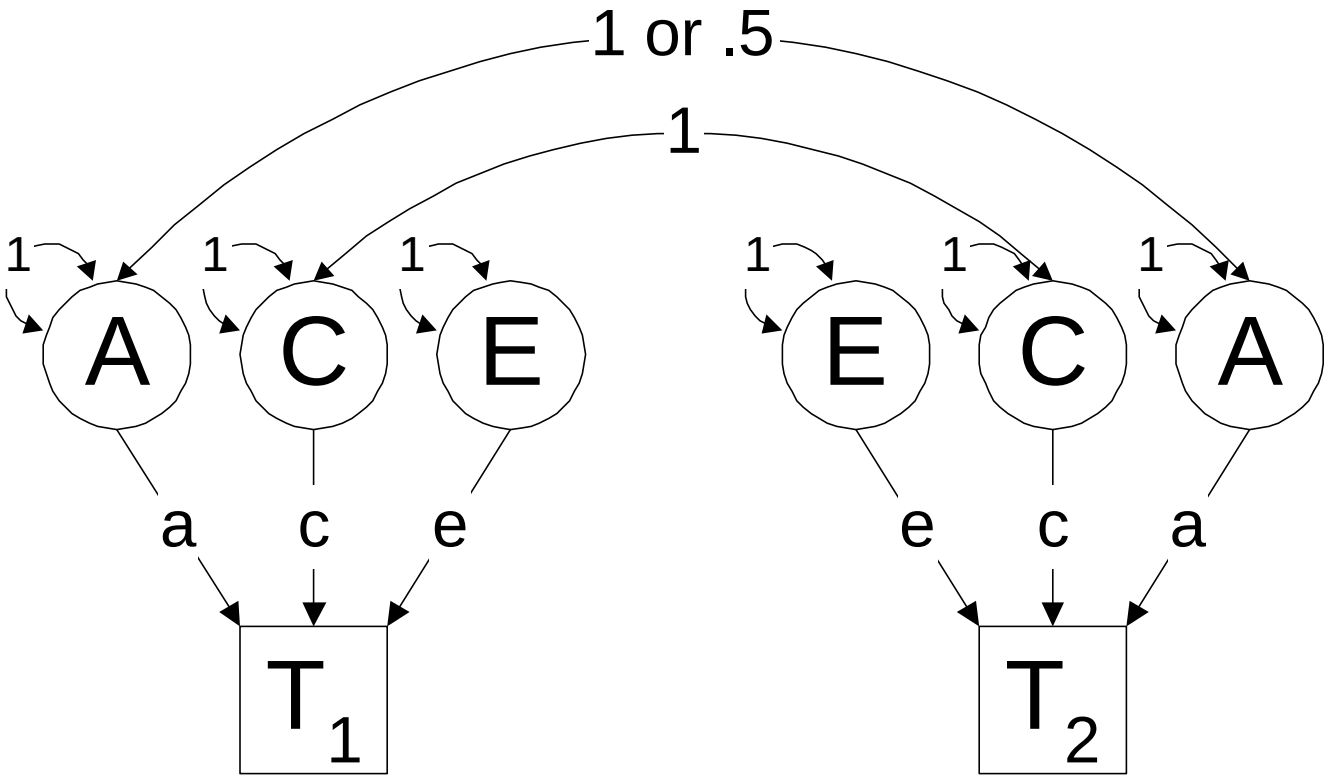
Dat File: usmdd.dat

- Data NInput=3
- Rectangular File=usmdd.ord
- Labels zyg mdd1 mdd2

Submodels: Equality of Thresholds

	MZ (group 1)					DZ (group 2)					par
	t1	t2	v1	cor	v2	t3	t4	v3	cor	v4	
Full	1	2	0	3	0	4	5	0	6	0	6
II	1	1	0	3	0	4	4	0	6	0	4
III	1	1	0	3	0	1	1	0	6	0	3

ACE Model



! Estimate variance components - ACED model
! US MDD data - females

```
#NGroups 4
#define nvar 1
#define nvar2 2

Title 1: Model Parameters
 Calculation
 Begin Matrices;
  X Lower nvar nvar Free!a
  Y Lower nvar nvar     !c
  Z Lower nvar nvar Free!e
  W Lower nvar nvar Free!d
  H Full 1 1         !0.5
  Q Full 1 1         !0.25
 End Matrices;
  Matrix H .5
  Matrix Q .25
  Label Row X add_gen
  Label Row Y com_env
  Label Row Z spec_env
  Label Row W dom_gen
Begin Algebra;
  A= X*X';           !a^2
  C= Y*Y';           !c^2
  E= Z*Z';           !e^2
  D= W*W';           !d^2
 End Algebra;
End
```

usmddaces.mx

! Estimate variance components - ACED model
! US MDD data - females II

```
Title 2: MZ data
 #include usmdd.dat
 Select if zyg =1
 Select mdd1 mdd2 ;
 Begin Matrices =Group 1;
  T Full 1 nvar2 Free
 End Matrices;
 Thresholds T;
 Covariance
    A+C+E+D | A+C+D   _
    A+C+D   | A+C+E+D;
 Option RSiduals;
End
```

```
Title 3: DZ data
 #include usmdd.dat
 Select if zyg =2
 Select mdd1 mdd2 ;
 Begin Matrices =Group 1;
  T Full 1 nvar2 Free
 End Matrices;
 Thresholds T;
 Covariance
    A+C+E+D  |H@A+C+Q@D _
    H@A+C+Q@D|A+C+E+D;
 Option RSiduals
End
```

! Estimate variance components - ACED model
! US MDD data - females III

```
Title 4: Constrain var=1
 Constraint
 Begin Matrices =Group 1;
  I Iden 1 1
 End Matrices;
  Start .5 all
 St 1 T 2 1 1-T 2 1 nvar2
 St 1 T 3 1 1-T 3 1 nvar2
 Begin Algebra;
  P=A|C|E|D;
 End Algebra;
 Constraint A+C+E+D=I;
!ADE model
 Option NDecimals=4
 Option Sat=2508.004,2054
 Option Multiple
End
```

```
!AE model
 Drop W 1 1 1
End

!ACE model
 Free Y 1 1 1
End

!CE model
 Drop X 1 1 1
End

!E model
 Drop Y 1 1 1
End
```

usmddaces.mx

Submodels

*1 constraint: A+C+D+E=1

Matrix / Model	X (a)	Y (c)	Z (e)	W (d)	Cor NP	Mean NP	NP	DF
Sat					2	4	6+1*	
ADE	Free		Free	Free		4	7	0
AE	Free		Free	Drop		4	6	1
ACE	Free	Free	Free			4	7	0
CE	Drop	Free	Free			4	6	1
E		Drop	Free			4	5	2

Goodness-of-Fit

	-2LL	df	χ^2	df	p	AIC
Sat						
ADE				0		
AE				1		
ACE				0		
CE				1		
E				2		