Web-based Measurement: Effect of Completing Single or Multiple Items Per Web Page

Frances Thorndike, Lee Ritterband,
Per Carlbring, Linda Gonder-Frederick, Joshua
Magee, Fred Smyth

Web vs. paper-and-pencil

- Equivalence in measures of:
  1. General psychopathology[1]
  2. Panic/agoraphobia[2]
  3. Self-monitoring[3]
  4. Youth independence living[4]
  5. Emotional functioning[5]
  6. Parent attachment[6]

- 1 = Vallejo et al.; 2 = Carlbring et al., in press; 3 = Buchanan et al., 1999; 4 = Bressani et al., 2003; 5,6 = Fouladi et al., 2002

How to present online measures?

- Does progress indicator improve completion rates?
- Radio button vs. text boxes

Couper et al, 2001

Current Study

- Single-item-per page vs. multiple-items-per page
  - Do scores differ by method of presentation ($single\ vs.\ multiple$)?
  - Which method do subjects prefer?

METHOD

710 participants

Wait-List	Response Rate	Age	% Female
Social Phobia	268 / 300	35.1	56%
Panic	201 / 220	35.2	64%
Depression	241 / 280	34.9	61%

Procedure

- ~30% of Swedish Internet TX wait-list invited

- Asked to complete 4 web-questionnaires twice

- Asked to allow 1 – 4 hours between completing measures (mean = 3.2 hours)

Measures

◆ Beck Depression Inventory: BDI[1]

◆ Montgomery Åsberg Depression Rating Scale: MADRS[2]

◆ Beck Anxiety Inventory: BAI[3]

◆ Quality of Life Inventory: QOLI[4]

1 = Beck & Steer, 1996; 2 = Montgomery & Åsberg, 1979; Svanborg & Åsberg, 1994; 3 = Beck et al., 1988; 4 = Frisch et al., 1992

Measures cont'd

BDI	MADRS-S	BAI	QOLI
depression	depression	anxiety	life quality
21-item	9-item	21-item	16-item importance satisfaction
0 - 63	0 - 54	0 - 63	-6 - +6

Procedure cont'd

◆ Questionnaires: single-item per page or multiple-items-per-page

1. Jag blir nervös om jag behöver tala med auktoritetspersoner (lärare, chef etc.)

- Stämmer inte alls på mig

- Stämmer något på mig

- Stämmer ganska bra på mig

- Stämmer mycket bra på mig

- Stämmer precis på mig

Ångra tidigare svar

Instruktioner: Detta formulär består av grupper av fyra påståenden. Var snäll och läs igenom de olika påståendena noga, och *markera sedan det alternativ som bäst beskriver dina känslor under den senaste veckan, inklusive vad du känner idag*. Läs igenom alla påståenden inom gruppen innan du bestämmer dig.

Nr 1.
- ○ Jag känner mig inte ledsen.
- ○ Jag känner mig ledsen.
- ○ Jag är ledsen hela tiden och kan ej bryta mig ur det.
- ○ Jag är så ledsen och olycklig att jag inte står ut.

Nr 2.
- ○ Jag är inte speciellt pessimistisk inför framtiden.
- ○ Jag känner mig nedslagen inför framtiden.
- ○ Jag känner att jag inte har något att se fram emot.
- ○ Jag känner att framtiden är hopplös och att saker och ting inte kan förbättras

Nr 3.
- ○ Jag känner mig inte misslyckad.
- ○ Jag känner mig mer misslyckad än genomsnittsmänniskan.
- ○ När jag ser tillbaka på mitt liv kan jag bara se massor av misslyckanden.
- ○ Jag känner mig totalt misslyckad som människa.

Nr 4.
- ○ Jag uppskattar saker och ting på samma sätt som jag alltid har gjort.
- ○ Jag uppskattar inte saker och ting på samma sätt som jag alltid har gjort.
- ○ Jag har inget nöje av något nuförtiden.
- ○ Jag är missnöjd med/uttråkad av allt.

Nr 5.
- ○ Jag känner ingen speciell skuld.
- ○ Jag känner skuld en stor del av tiden.
- ○ Jag känner skuld mestadels.
- ○ Jag känner skuld jämt.

Order of questionnaires

Groups	T1	T2		T1	T2		T1	T2		T1	T2
4 Social Phobia	S	M		M	S		S	S		M	M
4 Depression	S	M		M	S		S	S		M	M
2 Panic	S	M		M	S						

S = single item per page
M = multiple item per page

RESULTS

Data Analysis Plan

1) Test for significant relationship between scores from single-item and multiple-item questionnaires (*test-retest reliability*)

Correlations

GROUP	BDI	MADRS	BAI	QOLI
Depressed				
SM	.99	.97	.97	.97
MS	.98	.98	.96	.97
MM	.96	.97	.96	.98
SS	.96	.97	.96	.97
Panic				
SM	.97	.95	.97	.98
MS	.98	.96	.96	.95

Correlations cont'd

GROUP	BDI	MADRS	BAI	QOLI
Social Phobia				
SM	.98	.95	.94	.97
MS	.97	.94	.97	.97
MM	.98	.98	.97	.98
SS	.97	.98	.98	.98

Data Analysis Plan cont'd

2) ## Check for factorial invariance

Is the web-questionnaire functioning to measure the same construct regardless of PRESENTATION or TIME?

Are the factor loading patterns the same…

Across different TIMES?

Across different PRESENTATIONS?

3) ## Used multiple-groups structural modeling approach[1]

4) ## Are factor means and variances affected by PRESENTATION method or TIME?

1 = McArdle & Hamagami, 1996

Findings

1) Significant relationship between single and multiple PRESENTATION methods (*r*)

2) Factorial invariance occurred for all measures *within* diagnostic group

   The web-questionnaire functioned to measure the same construct regardless of PRESENTATION or TIME.

   The factor loading patterns were the same...

   - Across different TIMES.
   - Across different PRESENTATIONS.

3) Factor means and variances were <u>not</u> affected by PRESENTATION method or TIME.

BDI Means by Group

	BDI – Time 1	BDI – Time 2
Depressed		
SM	26.8	25.8
MS	25.2	25.2
MM	24.0	23.6
SS	26.2	25.1
Panic		
SM	17.9	17.0
MS	16.8	16.5

Mean BDI of outpatients diagnosed with mild MDE = 18 / moderate MDE = 27 / severe MDE = 34.
Steer, Brown, et al. 2001

BDI Means by Group *cont'd*

	BDI – Time 1	BDI – Time 2
Social Phobia		
SM	15.1	14.3
MS	14.6	13.9
MM	16.0	15.9
SS	15.2	15.1

Mean BDI of outpatients diagnosed with mild MDE = 18 / moderate MDE = 27 / severe MDE = 34.
Steer, Brown, et al. 2001

MADRS-S Means by Group

	MADRS–Time 1	MADRS–Time 2
Depressed		
SM	25.0	25.3
MS	25.2	24.5
MM	24.5	24.4
SS	24.4	24.0
Panic		
SM	17.9	17.7
MS	19.3	17.9

Mean MADRS-S of depressed primary care patients before TX = 28.0. *McIntyre et al., 2006*

MADRS-S Means by Group cont'd

	MADRS–Time 1	MADRS–Time 2
Social Phobia		
SM	14.7	15.0
MS	17.2	15.7
MM	17.8	16.8
SS	15.8	14.8

Mean MADRS-S of depressed primary care patients before TX = 28.0. *McIntyre et al., 2006*

BAI Means by Group

	BAI – Time 1	BAI – Time 2
Depressed		
SM	20.4	20.6
MS	21.3	18.9
MM	19.2	18.4
SS	19.3	18.4
Panic		
SM	20.7	21.1
MS	23.5	21.4

Mean BAI for sample with panic disorder with agoraphobia = 27.27. *Beck et al., 1988*

BAI Means by Group cont'd

	BAI – Time 1	BAI – Time 2
Social Phobia		
SM	14.5	15.2
MS	17.8	15.3
MM	20.5	19.9
SS	16.4	15.5

Mean BAI for sample with panic disorder with agoraphobia = 27.27. *Beck et al., 1988*

Factor means by diagnostic group

BDI: Depressed > Panic > Social Phobia

MADRS: Factorial invariance did not hold
across diagnostic groups

BAI: Factorial invariance did not hold
across diagnostic groups

QOLI: Depressed < Panic & Social Phobia

Subject Preference
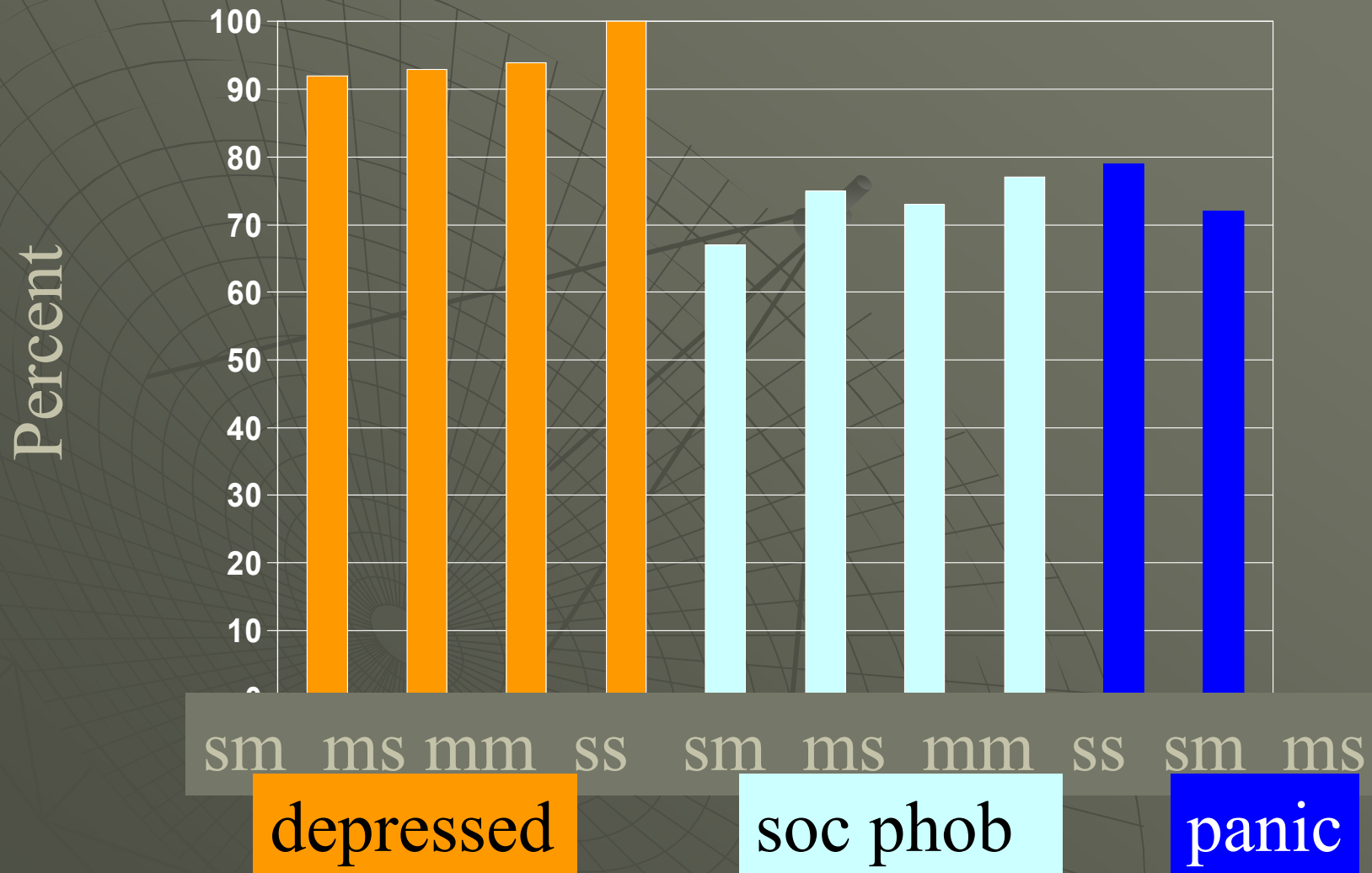
DISCUSSION

Discussion

- Validity for Internet administration of BDI, MADRS-S, BAI, QOLI
  - Whether single-item or multiple-item administration
- No differences between scores on single-item or multiple-item administrations
- Majority preferred single-item presentation
  - Especially for depressed group (>90%)

Discussion cont'd

- Preference data may not hold with different populations.
  - Samples without psychopathology?
- Preference does not necessarily equate with behavior.
  - Does it matter if subjects prefer single-item?
- Potential moderating variables:
  - Task type
    - single assessment vs. daily symptom diaries
  - Familiarity with measures

Limitations

- Sampling bias
  - Wait-list groups for Ψ TX
  - High in depression (BDI = 23.00 for depressed group)
  - Internet access
- No experimenter control
  - Nonserious responders?

Implications

- Extends our knowledge about how to present online measures
- Will aid in the construction of future online data capturing systems
- Suggests next step in web-survey research

Future Directions

- Additional experiments with:
  - Different populations
    - Depressed vs. normals
  - Different tasks
    - single assessment vs. daily diaries
    - 21-item vs. 200-items
- Does preference impact behavior?
  - Does it improve completion rates?

Conclusion

◆ The Web offers us more options with data collection, but we need to understand how these options impact subject responses.

Thank you
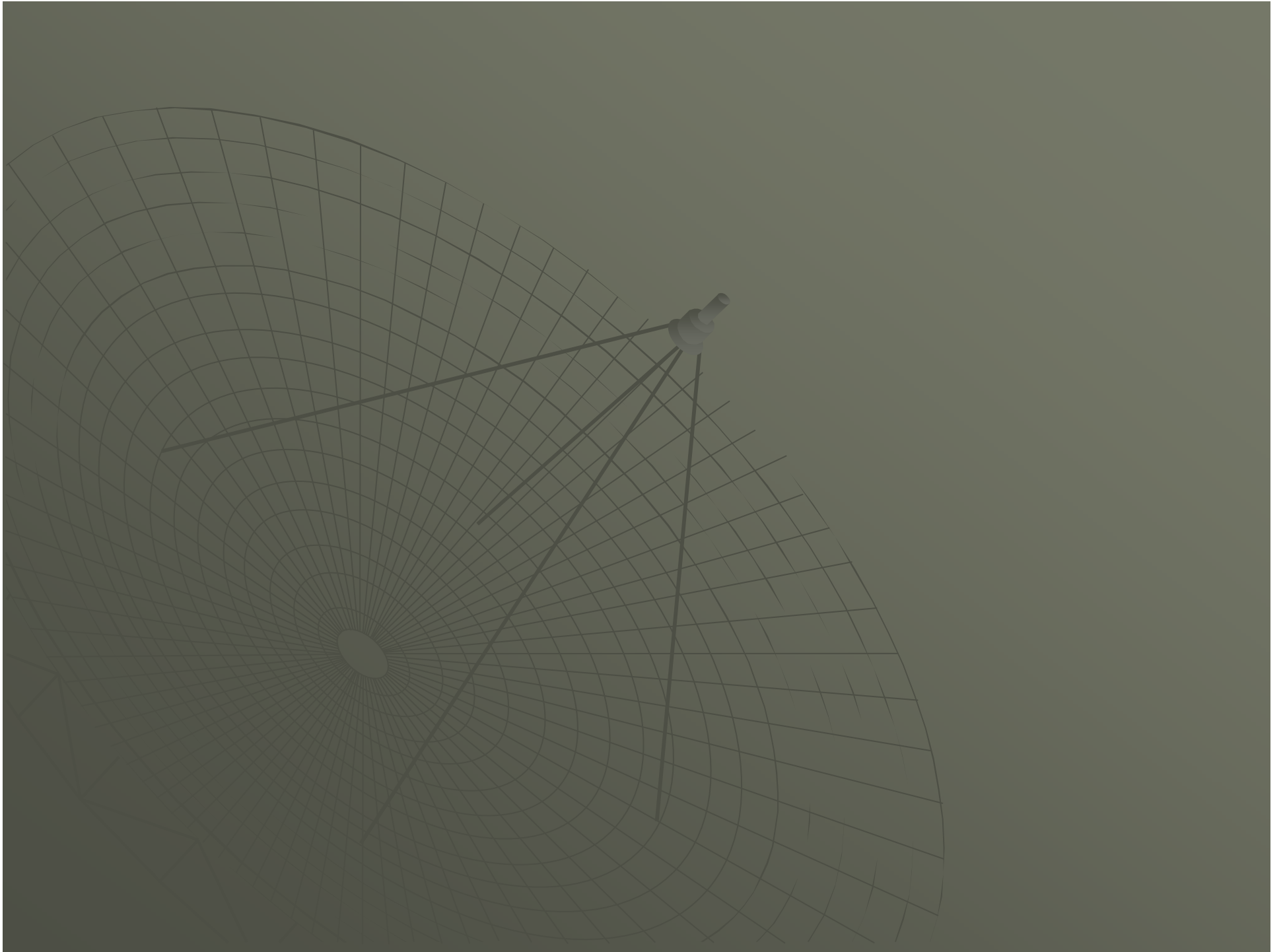
SEM steps

For each measure:

1) Baseline model (determined by testing alternatives found in the literature) was specified in which all parameters were freely estimated for each group.

2) We next tested a model in which factor loadings were constrained to be equal across the groups.

3) If the decrement in fit between this model and the baseline was not significant, we concluded that the assumption of factorial invariance was warranted.

   I.e., The web-questionnaire was measuring the same construct across Presentation Type and Time.

QOLI Means by Group

	QOLI–Time 1	QOLI–Time 2
Depressed		
SM		
MS		
MM		
SS		
Panic		
SM		
MS		

Mean QOLI for Swedish outpatients with anxiety = 0.84. Mean QOLI for controls = 2.76. *Őst et al., 1997*.

QOLI Means by Group cont'd

	QOLI-Time 1	QOLI-Time 2
Social Phobia		
SM		
MS		
MM		
SS		

Mean QOLI for Swedish outpatients with anxiety = 0.84. Mean QOLI for controls = 2.76.
Őst et al., 1997.

Pros & cons of Web-surveys

PROS

- More subject recruitment opportunities
- More rapid data collection
- Richer source of information[1]
- Can manipulate survey features
- Greater automation / experimental control
- Fewer data coding errors
- Increased efficiency
- More flexibility
- After initial fees, lower unit costs
  - $40 - $100 per phone interview[2]
  - $1.93 per mail survey
  - Minimal additional cost after system is designed

CONS

- Questionable data quality
- ↓ control over treatment of subjects
- Sampling biases
- High attrition rates
  - Low initial engagement
    - 526 out of 13,990 HMO responded to invite[1]
  - High drop out
    - Of 526, only 57% agreed to be randomized

1 = Kraut et al., 2004; 2 = Couper et al., 2001; 3 = Clarke et al., 2002

SEM Steps cont'd

4) Significant differences in model fits would indicate that equality constraints for the given parameter were untenable.

   I.e., One of these conditions (Presentation Type or Time) was having a significant effect.

5) Proceeded to compare factor means and variances across conditions.

Root-mean-square error of approximation ($rmsea$; ε_a)

Accounts for both sample size and model complexity in evaluating goodness-of-fit

Value of *rmsea*	Judged
< .05	Close
.05 - .08	Fair
.08 – 1.0	Mediocre
> 1.0	Poor

1 = MacCallum, Browne, & Sugawara,1996

BDI as example

- 3 factor model[1]

  CA = Cognitive-Affective & Performance Difficulties

  CD = Cognitive Distortions

  S = Somatic

  Enns, Cox, Parker, & Guertin (1998)

  1 = Enns, Cox, Parker, & Guertin (1998)
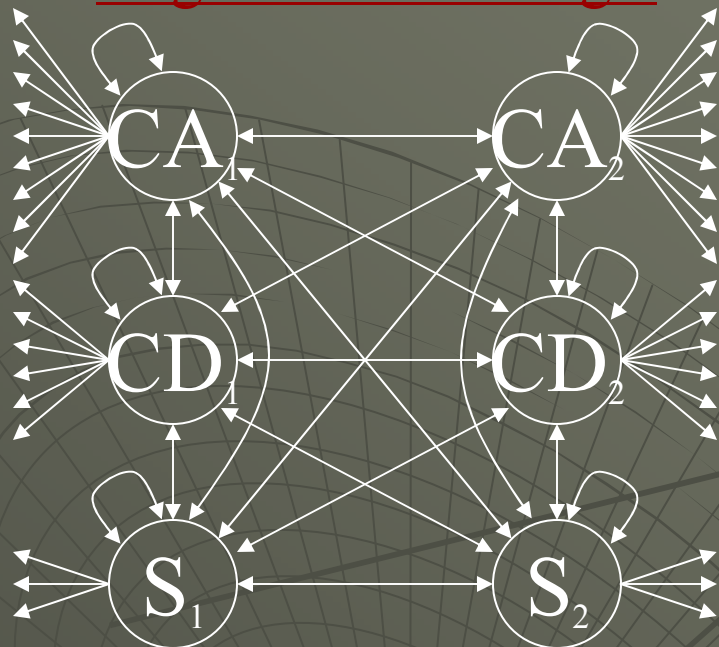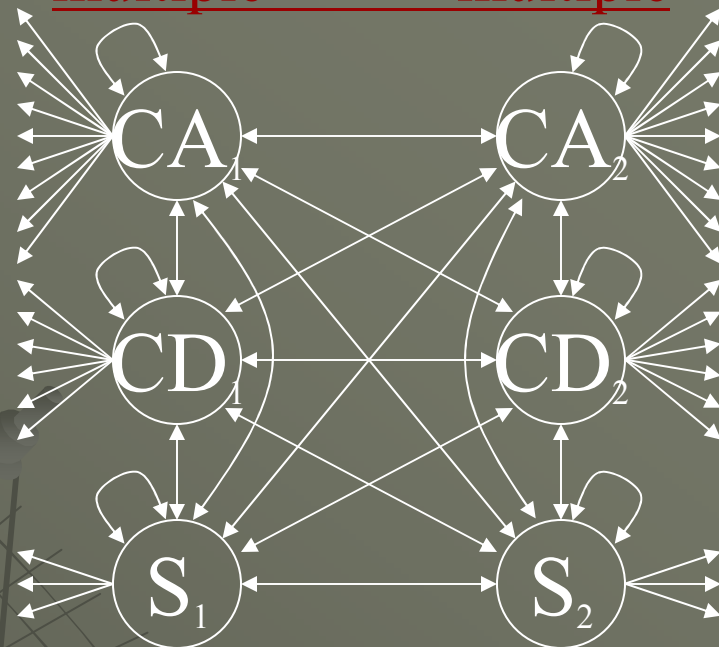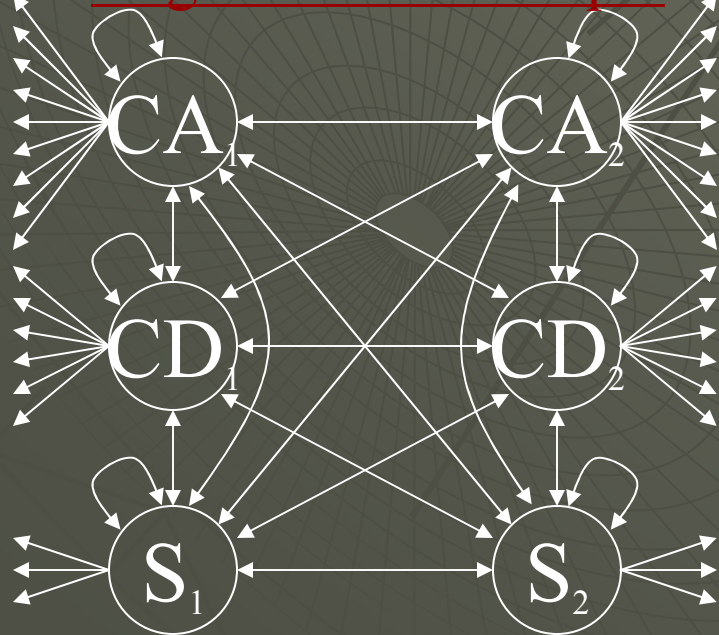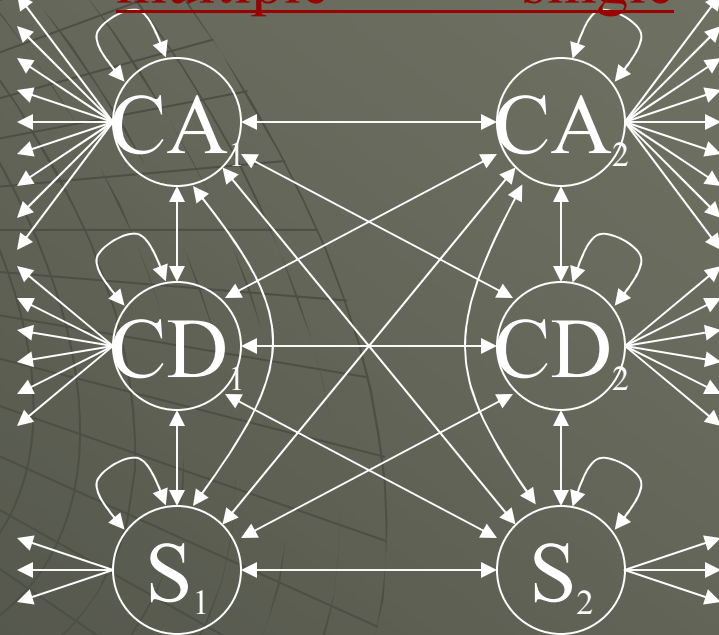
Measurement Invariance Tests of 3-Factor Model (Depressed Sample)

Model	rmsea	$\Delta\chi^2/\Delta df$	95%rmseaΔ
<u>Loadings</u> FREE	.114	$\chi^2/df = 5283/2956$	
EQ in method Time-1	.114	32/34	.00-.05
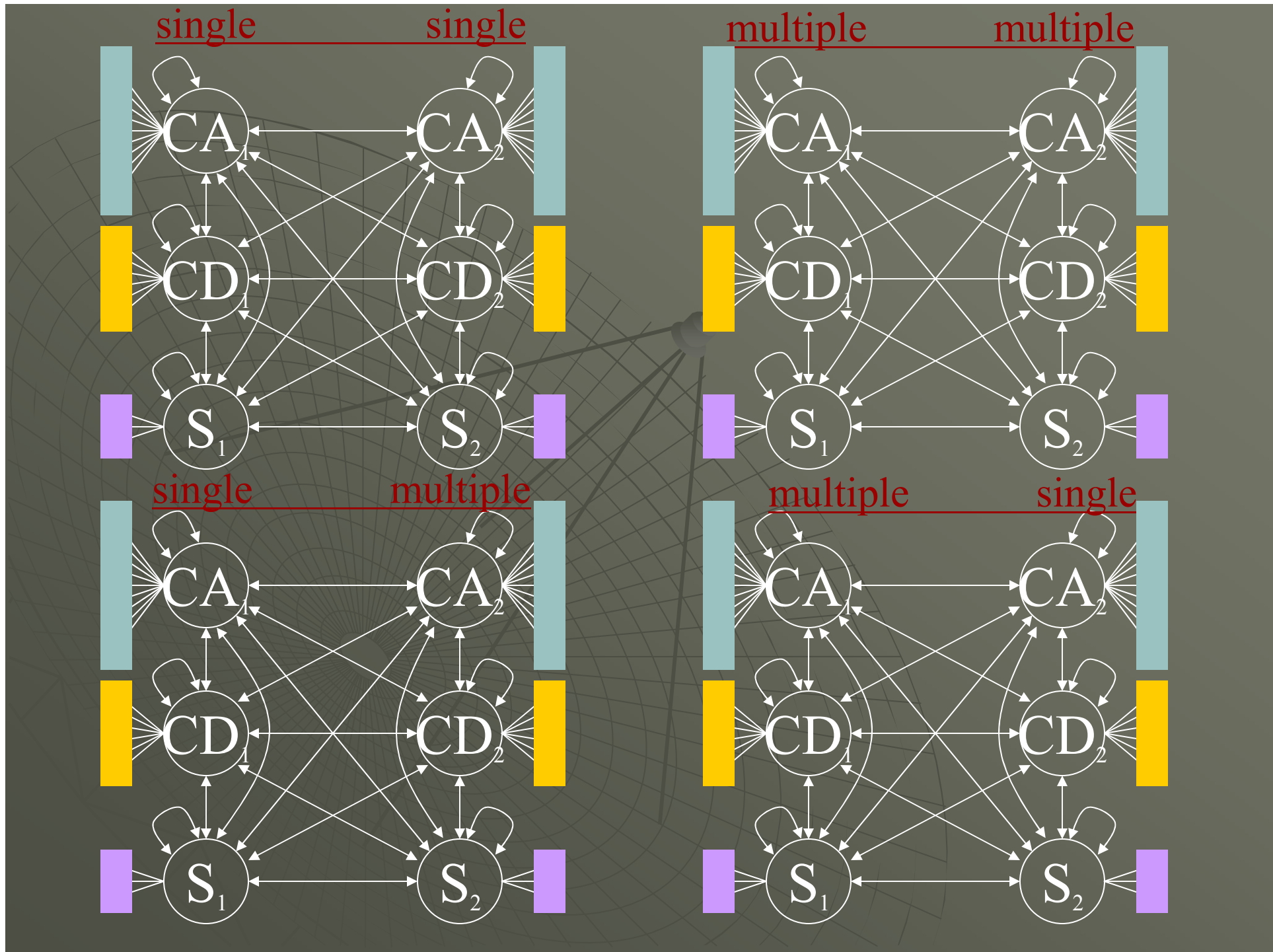
Measurement Invariance Tests of 3-Factor Model
(Depressed Sample)

Model	$rmsea$	$\Delta\chi^2/\Delta df$	$95\% rmsea\Delta$
<u>Loadings</u> FREE	.114	$\chi^2/df = 5283/2956$	
EQ in method Time-1	.114	32/34	.00-.05
EQ all	.113	*140/119	.00-.05

*relative to Model 1
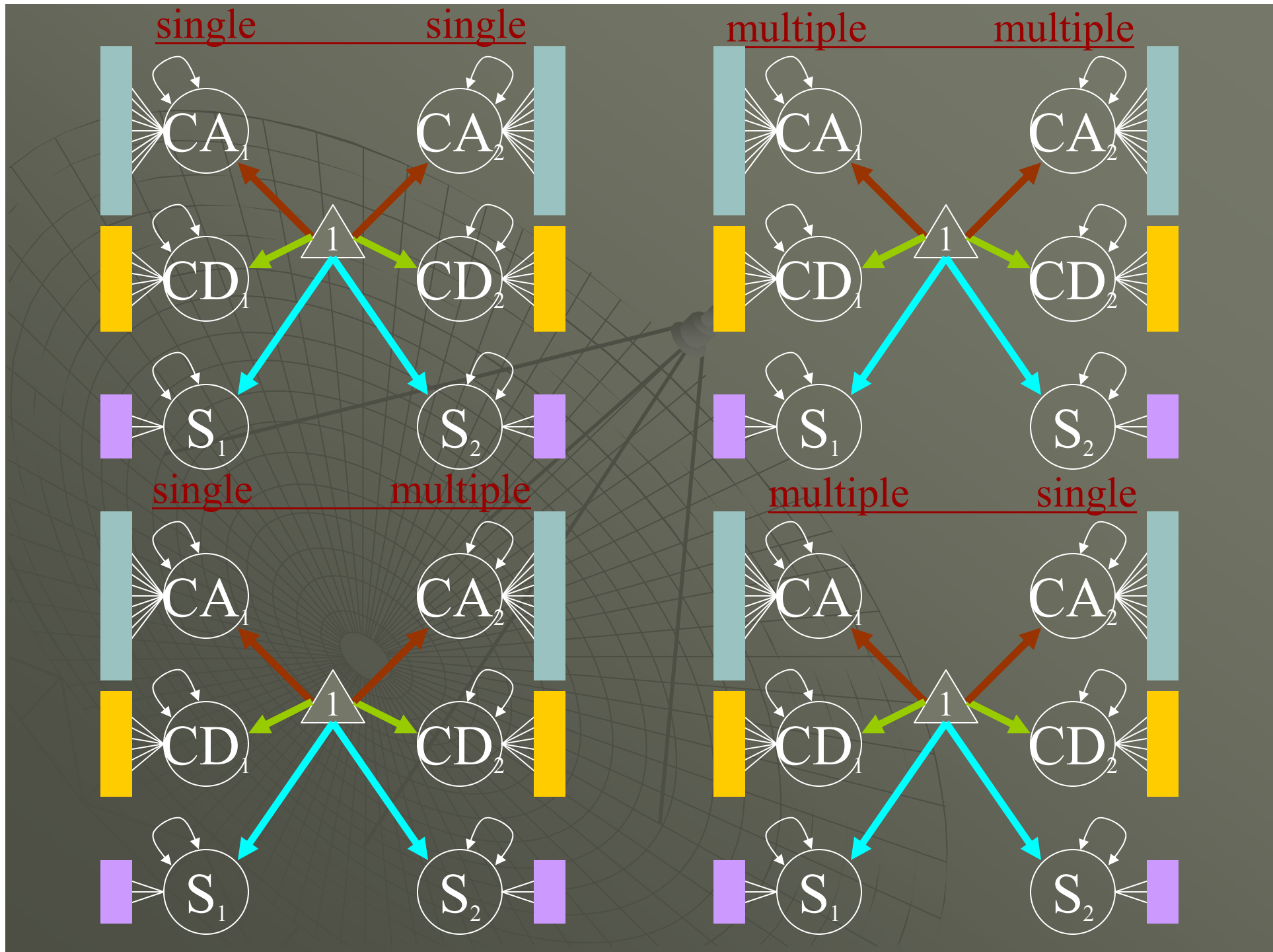
Measurement Invariance Tests of 3-Factor Model
(Depressed Sample)

Model	$rmsea$	$\Delta\chi^2/\Delta df$	$95\%rmsea\Delta$
<u>Loadings</u> FREE	.114	$\chi^2/df = 5283/2956$	
EQ in method Time-1	.114	32/34	.00-.05
EQ all	.113	*140/119	.00-.05
<u>Means</u> EQ all	.112	29/21	.00-.08

*relative to Model 1

Depressives
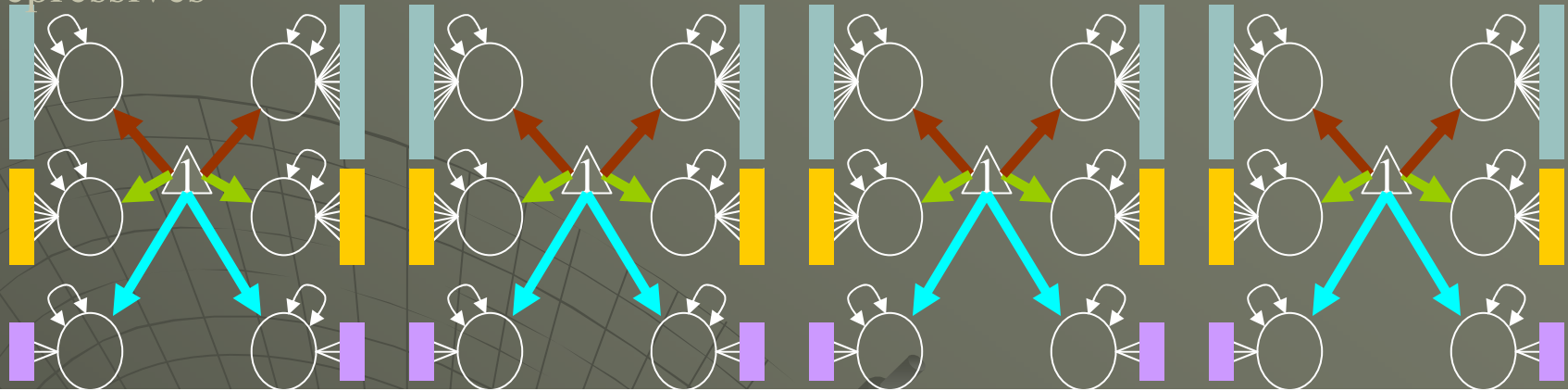
Social Phobics
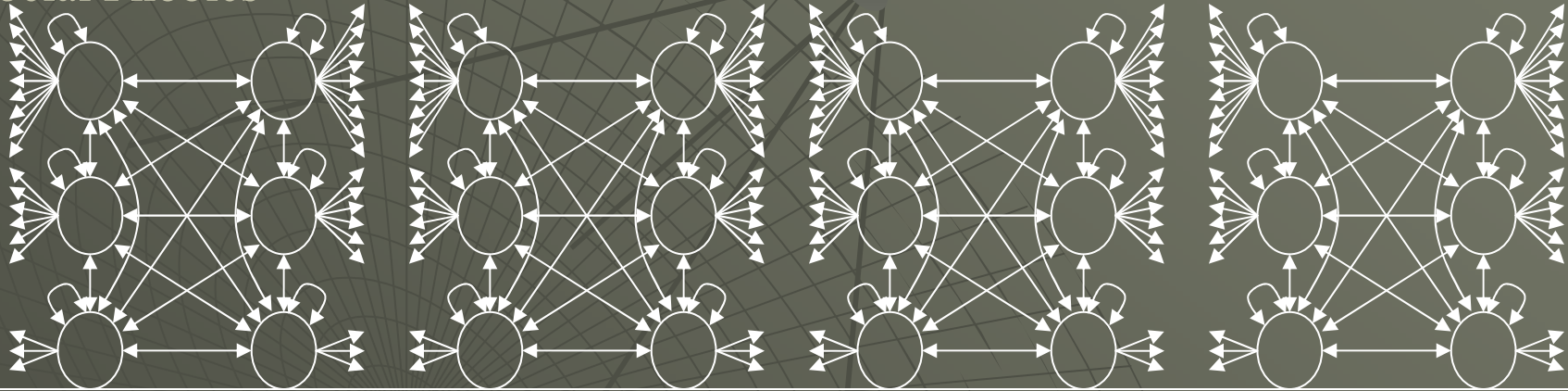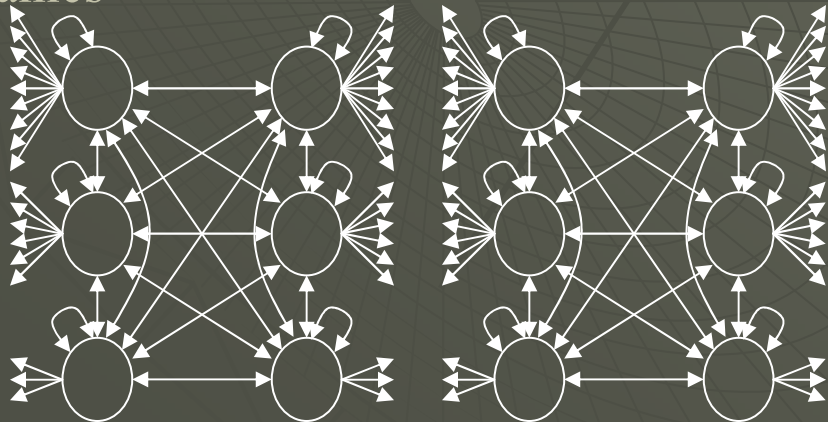
Panics

Measurement Invariance Tests of 3-Factor Model (Full sample, i.e., Social Phobics & Panics added)

Model	$rmsea$	$\Delta\chi^2/\Delta df$	95%$rmsea\Delta$
Add SP & P groups	.097	$\chi^2/df = 11353/6832$	
Loadings EQ all	.097	370/192	.03-.04
Means EQ in group	.097	48/30	.01-.05

Depressives
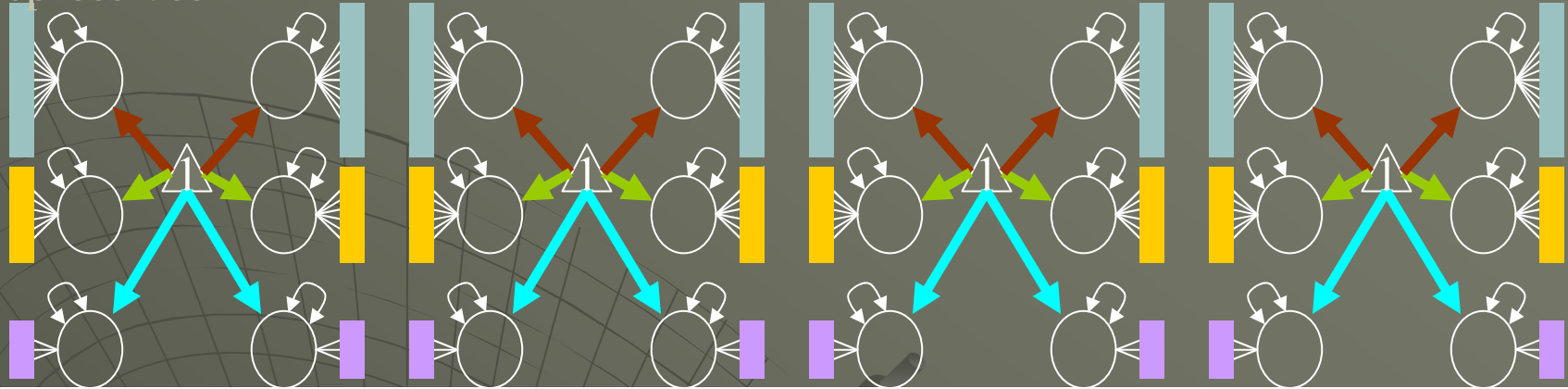
Social Phobics
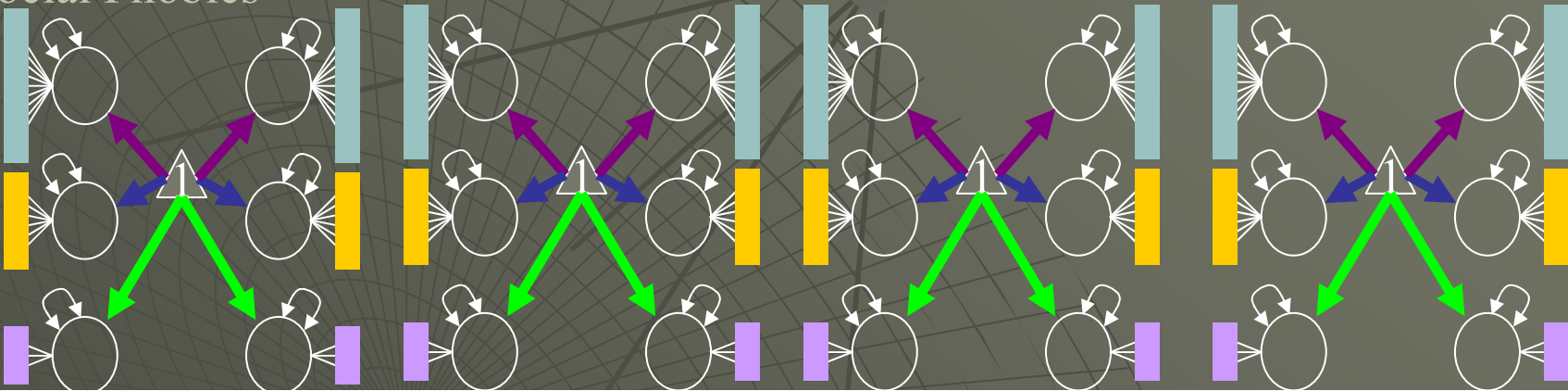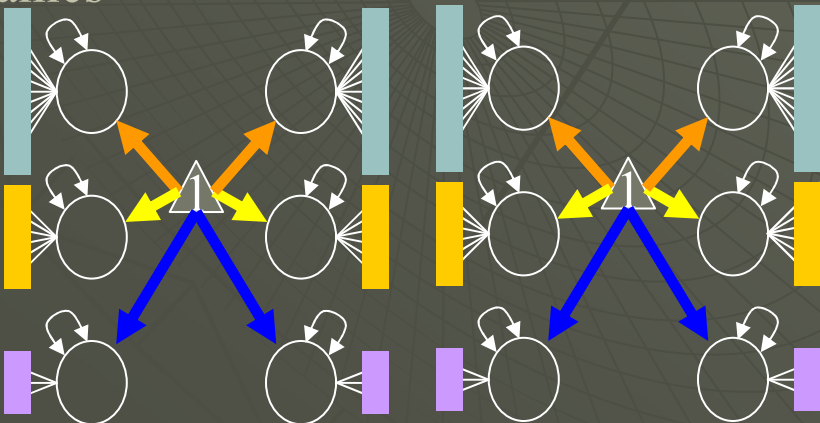
Panics

Depressives
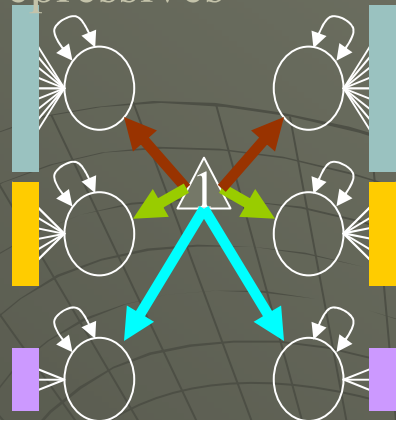
Cog-Aff 1.18 (.04)
Cog-Dis 1.24 (.05)
Somatic 1.09 (.05)

Deps=So-pho: 142/3   .22-.31

Deps=Panics: 87/3   .15-.24

Social Phobics
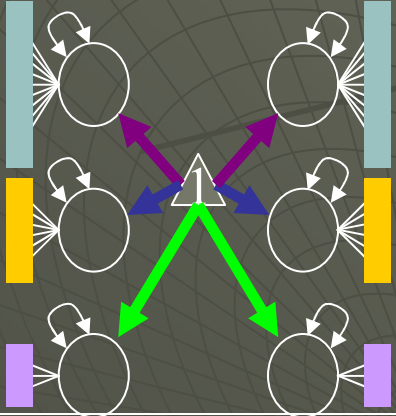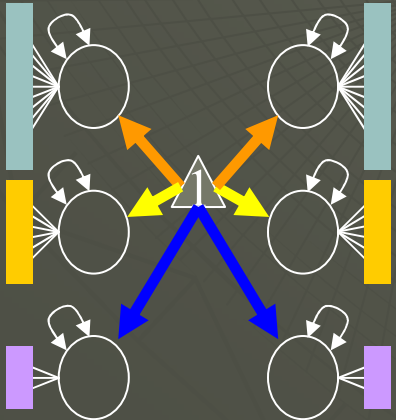
Cog-Aff 0.68 (.03)
Cog-Dis 0.81 (.03)
Somatic 0.63 (.04)

So-Pho=Panics: 87/3   .10-.19

Panics

Cog-Aff 0.82 (.03)
Cog-Dis 0.75 (.04)
Somatic 0.93 (.05)