

PSYCHOMETRY AND EPIDEMIOLOGY: USE OF ITEM RESPONSE THEORY (IRT) MODELS IN LONGITUDINAL STUDIES OF CHILD DEVELOPMENT

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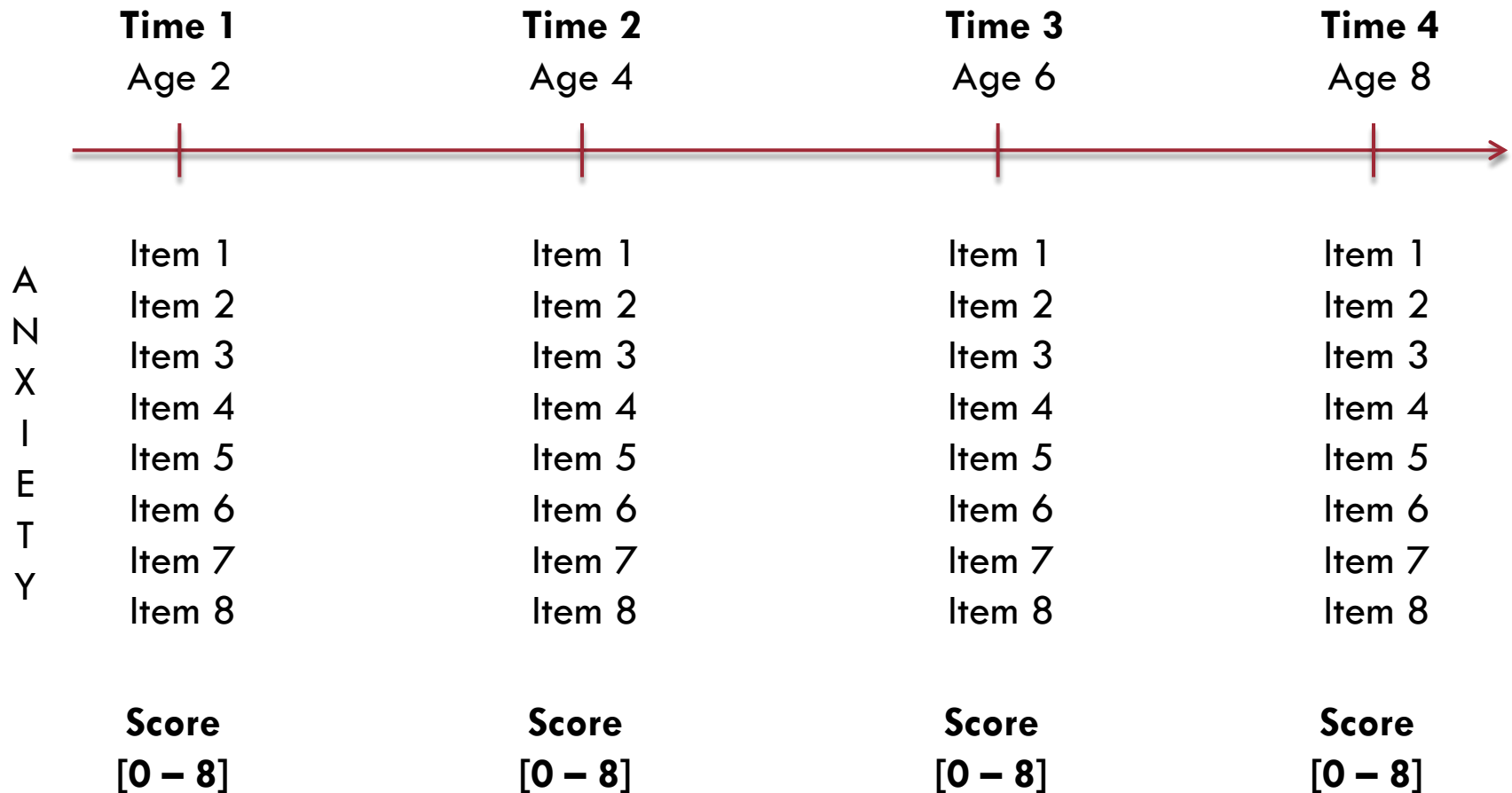
2nd meeting of Marie Curie International Exchange Program
June 3-4, 2012, Ste Justine Hospital, Montreal, Canada

Longitudinal studies of child development



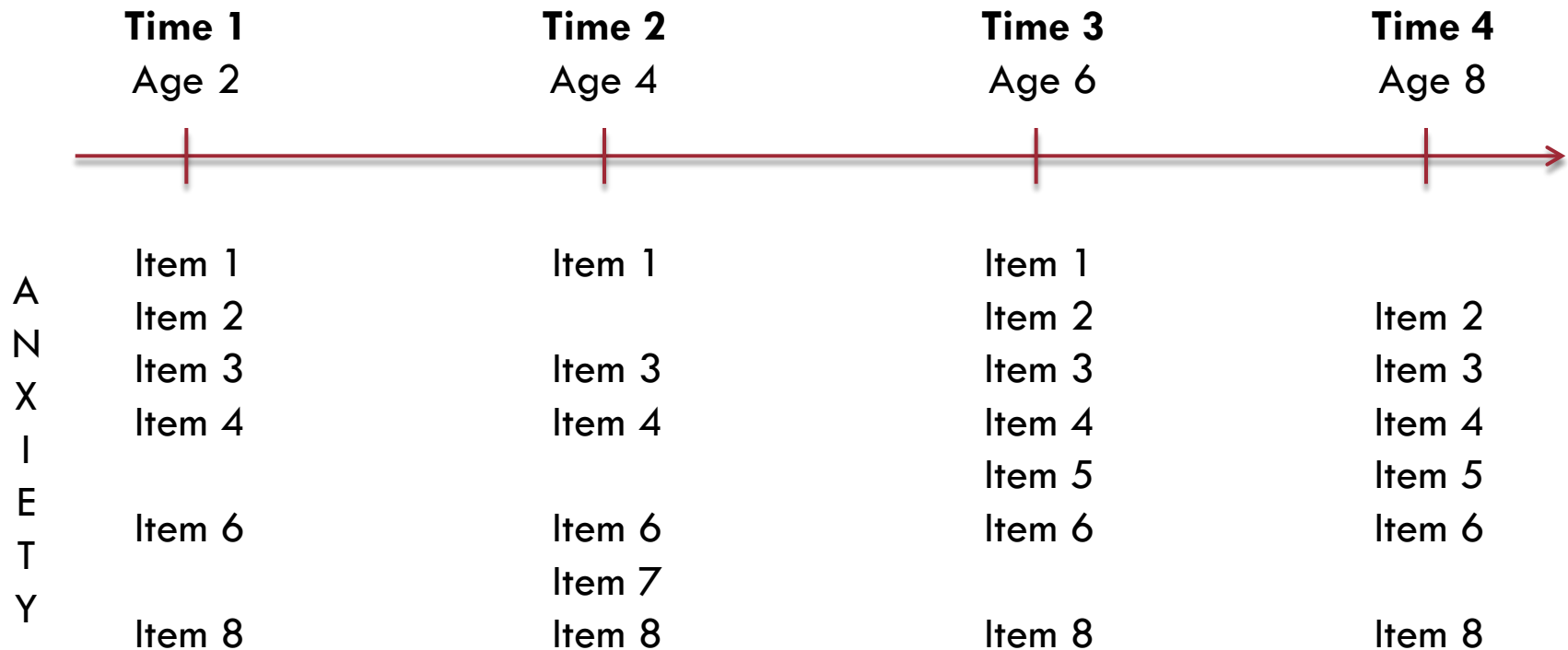
A
N
X
I
E
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Y

Longitudinal studies of child development



(binary items, yes =1, no=0)

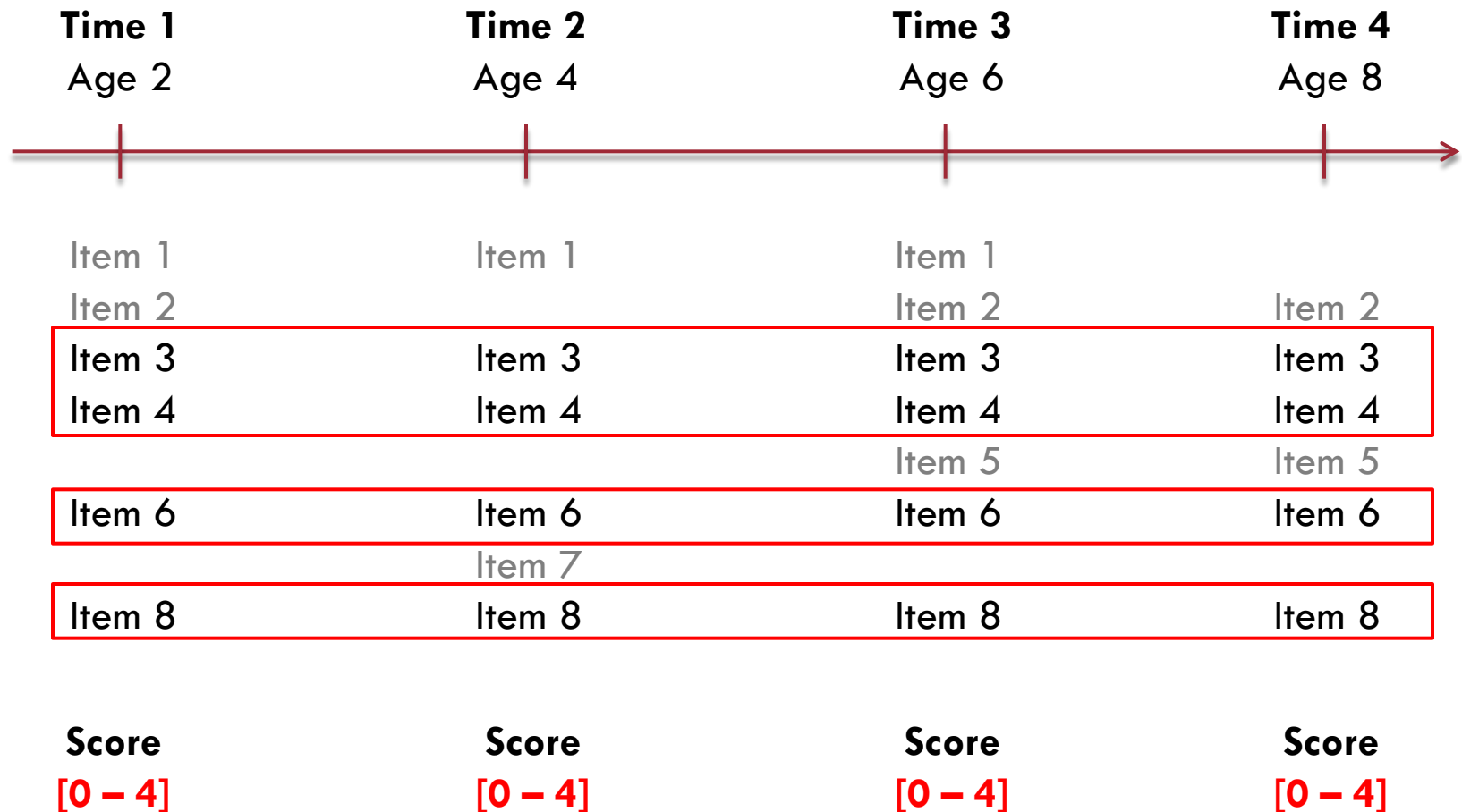
Longitudinal studies of child development



- Organizational problems (omission of an item, questionnaire changed, etc.)
- Lack of relevance of the item at some development stages (~Differential Item Functioning over time)

Classical models and longitudinal studies

A
N
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Y



→ Loose precision

Item Response Theory (IRT)

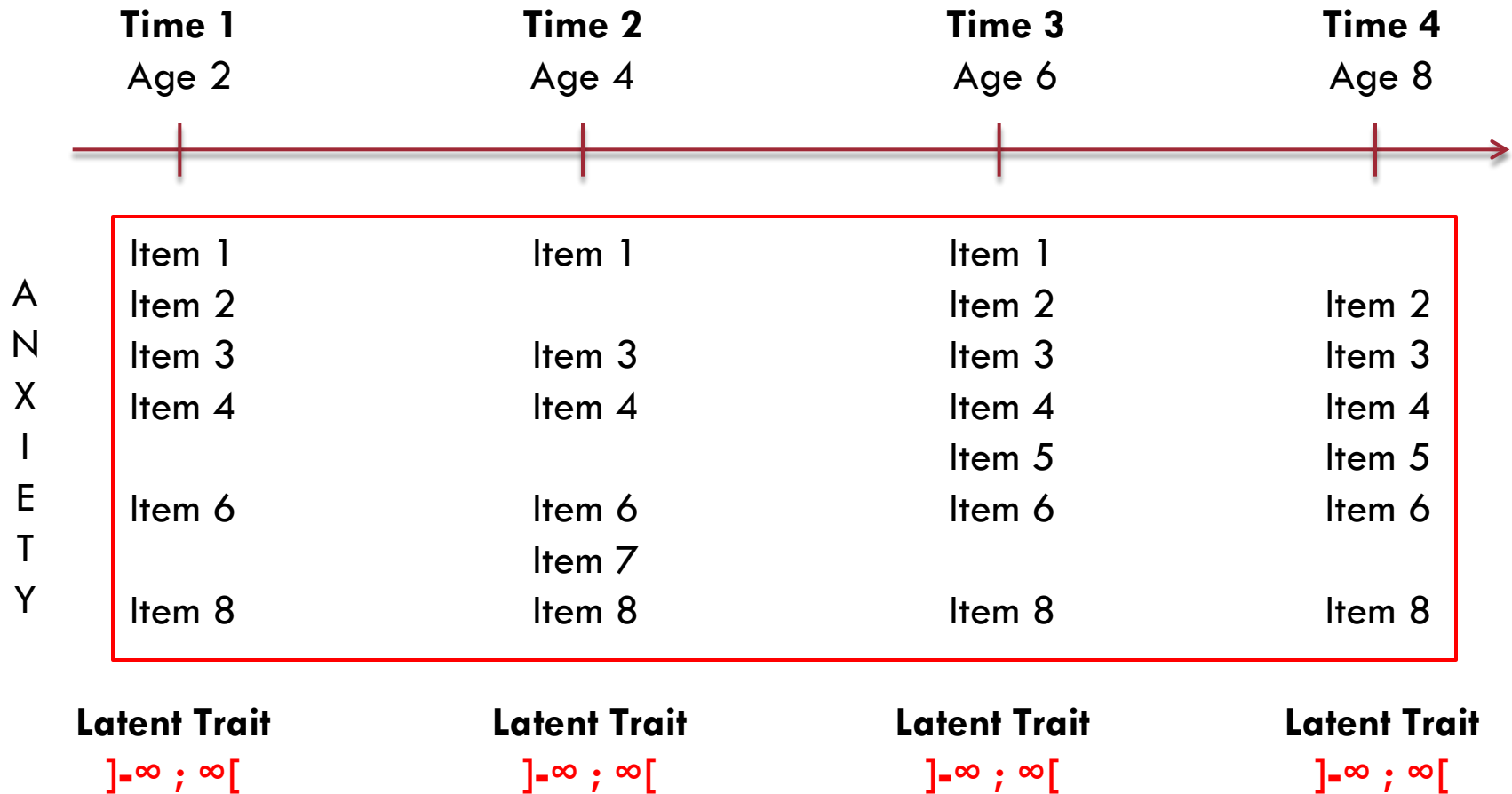
Latent Trait (LT)

- concept we want to measure (ex: anxiety)
- quantitative variable
- no limits ($\in]-\infty ; \infty[$)
- zero is arbitrarily fixed
- interval scale

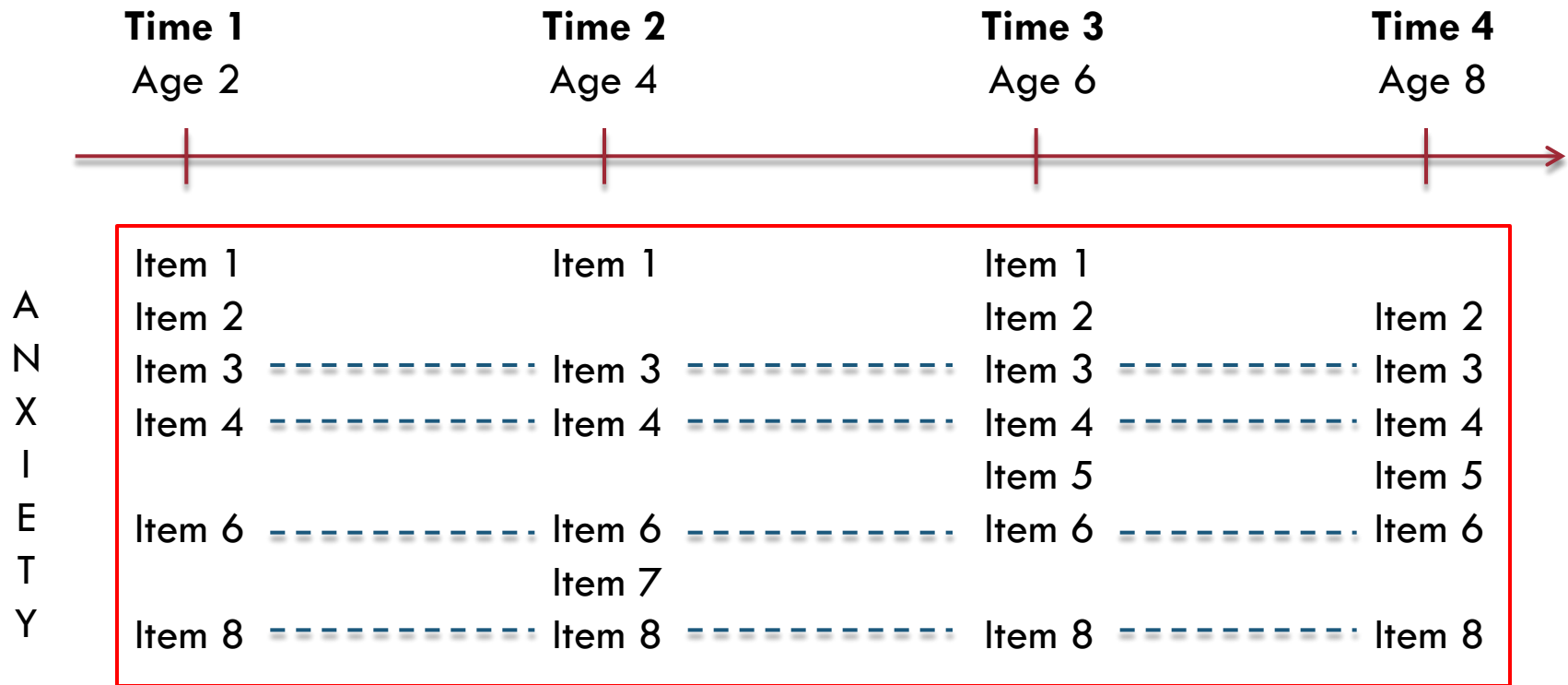
Latent Trait
(Anxiety)



IRT and longitudinal studies



IRT and longitudinal studies



Latent Trait

$]-\infty ; \infty[$

Latent Trait

$]-\infty ; \infty[$

Latent Trait

$]-\infty ; \infty[$

Latent Trait

$]-\infty ; \infty[$

- Zero at the same level
 - Same scale
- } for the latent trait at each time

Objective

To compare the results obtained by the analysis of longitudinal data having missing items

- ▣ using the score
- ▣ using the latent trait estimations by IRT models

Analysis : group-based trajectory modeling (ex: SAS Proc TRAJ)

Methods

I. Simulation study

Artificial data sets

simulated using

theoretical trajectories

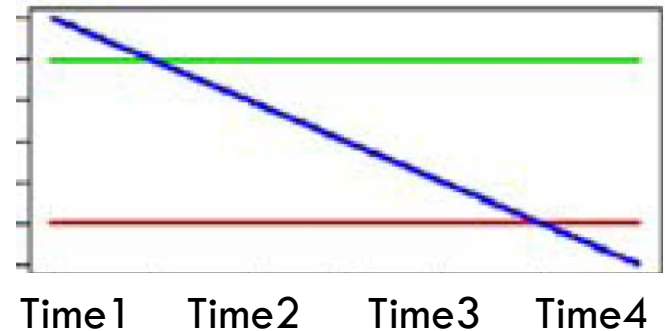
Time 1 Time 2 Time 3 Time 4



Item 1	Item 1	Item 1	Item 1
Item 2	Item 2	Item 2	Item 2
Item 3	Item 3	Item 3	Item 3
Item 4	Item 4	Item 4	Item 4
Item 5	Item 5	Item 5	Item 5
Item 6	Item 6	Item 6	Item 6
Item 7	Item 7	Item 7	Item 7
Item 8	Item 8	Item 8	Item 8

ex:

Ex:
Level of
anxiety



Methods

I. Simulation study

Artificial data sets

simulated using

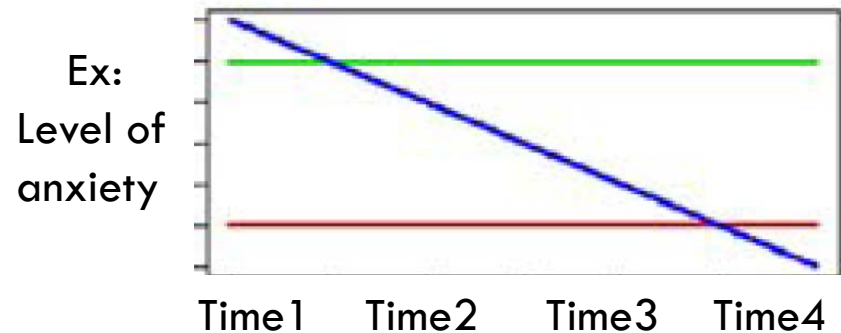
theoretical trajectories

Time 1 Time 2 Time 3 Time 4



Item 1	Item 1	Item 1	Item 1
Item 2	Item 2	Item 2	Item 2
Item 3	Item 3	Item 3	Item 3
Item 4	Item 4	Item 4	Item 4
Item 5	Item 5	Item 5	Item 5
Item 6	Item 6	Item 6	Item 6
Item 7	Item 7	Item 7	Item 7
Item 8	Item 8	Item 8	Item 8

ex:



- Proc TRAJ
 - Trajectories using **score**
 - Trajectories using **LT estimations**

Methods

I. Simulation study

Artificial data sets

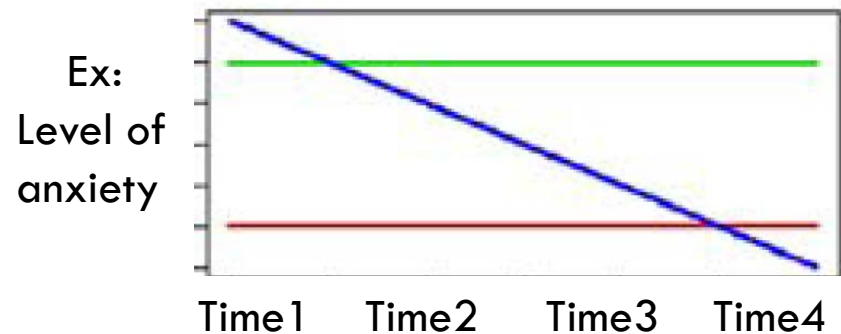
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theoretical trajectories

Time 1 Time 2 Time 3 Time 4

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Item 4	Item 4	Item 4	Item 4
Item 5	Item 5	Item 5	Item 5
Item 6	Item 6	Item 6	Item 6
Item 7	Item 7	Item 7	Item 7
Item 8	Item 8	Item 8	Item 8

ex:



Comparison
(criteria)

- Proc TRAJ
 - Trajectories using **score**
 - Trajectories using **LT estimations**

Methods

I. Simulation study

Artificial data sets

simulated using

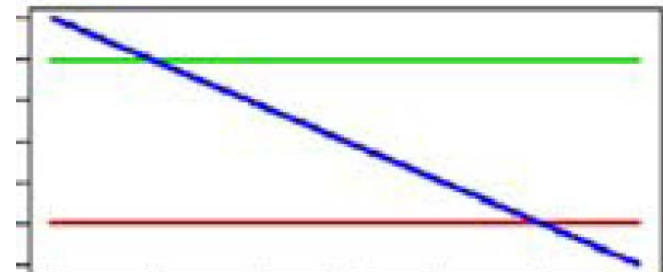
theoretical trajectories

Time 1 Time 2 Time 3 Time 4



Item 1	Item 1	Item 1	Item 1
Item 2		Item 2	Item 2
Item 3	Item 3	Item 3	Item 3
Item 4	Item 4	Item 4	Item 4
Item 5	Item 5	Item 5	Item 5
Item 6	Item 6		
Item 7	Item 7	Item 7	Item 7
Item 8	Item 8	Item 8	Item 8

Ex:
Level of anxiety



Time1 Time2 Time3 Time4

Missing Items
10%

Comparison
(criteria)

- Proc TRAJ
- Trajectories using **score**
 - Trajectories using **LT estimations**

Methods

I. Simulation study

Artificial data sets

simulated using

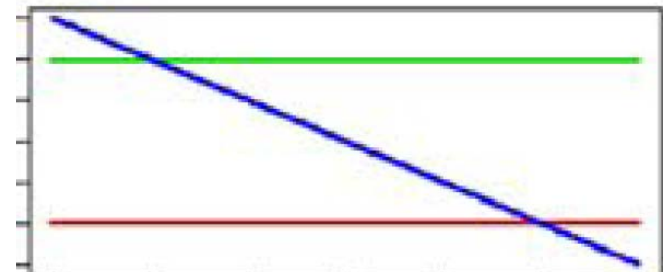
theoretical trajectories

Time 1 Time 2 Time 3 Time 4



Item 1	Item 1	Item 1	
Item 2		Item 2	Item 2
		Item 3	Item 3
Item 4	Item 4	Item 4	Item 4
Item 5	Item 5	Item 5	Item 5
Item 6	Item 6		
Item 7	Item 7	Item 7	Item 7
Item 8	Item 8	Item 8	Item 8

Ex:
Level of anxiety



Time1 Time2 Time3 Time4

Missing Items
20%

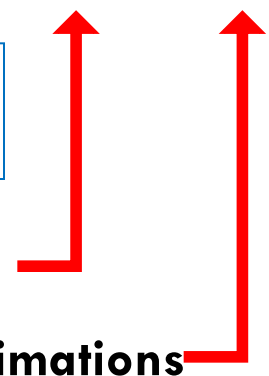
Comparison
(criteria)



Proc TRAJ

Trajectories using **score**

Trajectories using **LT estimations**

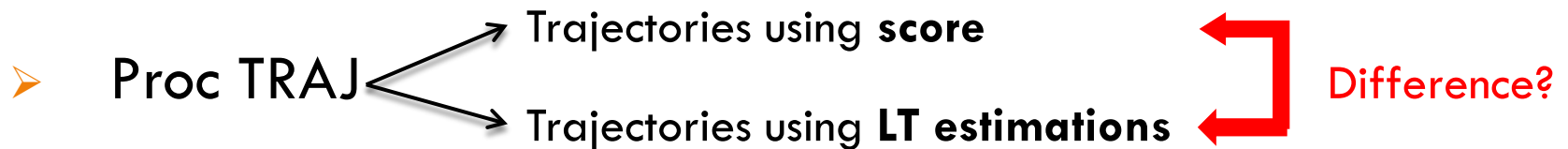


Methods

II. Application on real data

QLSCD : Quebec Longitudinal Study of Child Development

Échelle	Item	Time				
		E2	E3	E4/E5	E6	E7
Anxiété séparation (E)	- s'accroche aux adultes	8dd1	8dd1	6DD1	6DD1	6DD1
	- veut pas dormir seul	8pp1	8pp1	6PP1	6PP1	6PP1
	- réagit mal lorsqu'il s'est éloigné des parents	8tt1	8tt1	6TT1	6TT1	6TT1
	Demande tout le temps de l'aide	8ll1				
Ajout depuis E6	-préoccupé qu'il puisse arriver qq choses au parent				6J3	6J3
	- malaises, séparation d'avec les parents				6O2	6O2





- **Expected results**

- Better clustering of individual trajectories using LT estimations when the number of missing items increases

- **Parameters to consider**

- Sample size

- Number of items

- Number of occasions of data collection

- Shapes of trajectories



Thank you.