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Using Latent State-Trait Theory to Analyze Intensive Longitudinal Data

By Sebastian Castro-Alvarez, dr. Jorge Tendeiro, prof. dr. Rob Meijer, dr. Laura F. Bringmann,

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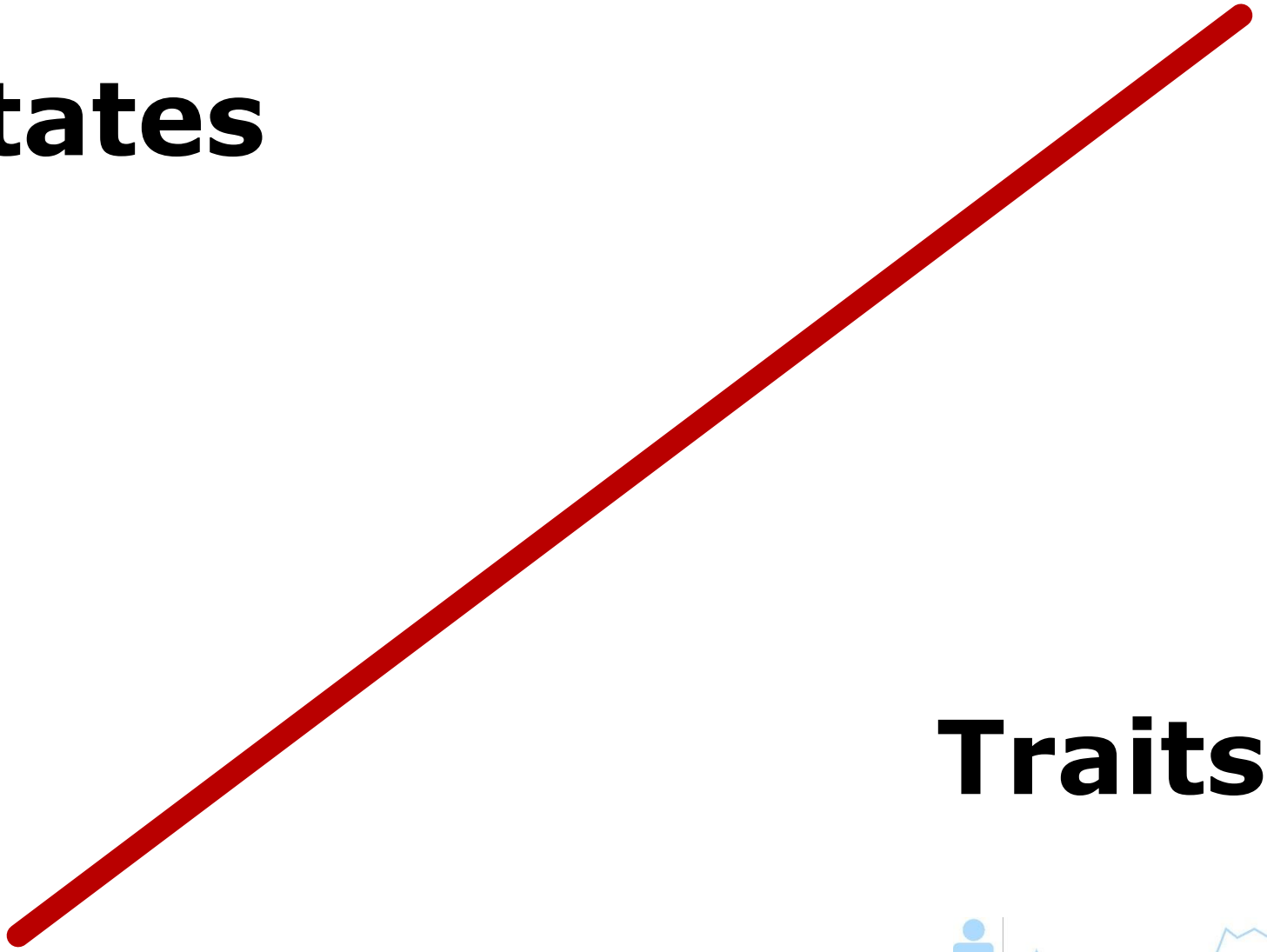
States and Traits

States



Traits

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States and Traits

States

Situational

Variability

Within

Traits

States and Traits

Situational

States

Anxiety

Variability

Mood

Within

Traits

States and Traits

States

Situational

Anxiety

Variability

Mood

Within

Between

Person's Disposition

Traits

Stability

States and Traits

States

Situational

Anxiety

Variability

Mood

Within

Between

Intelligence

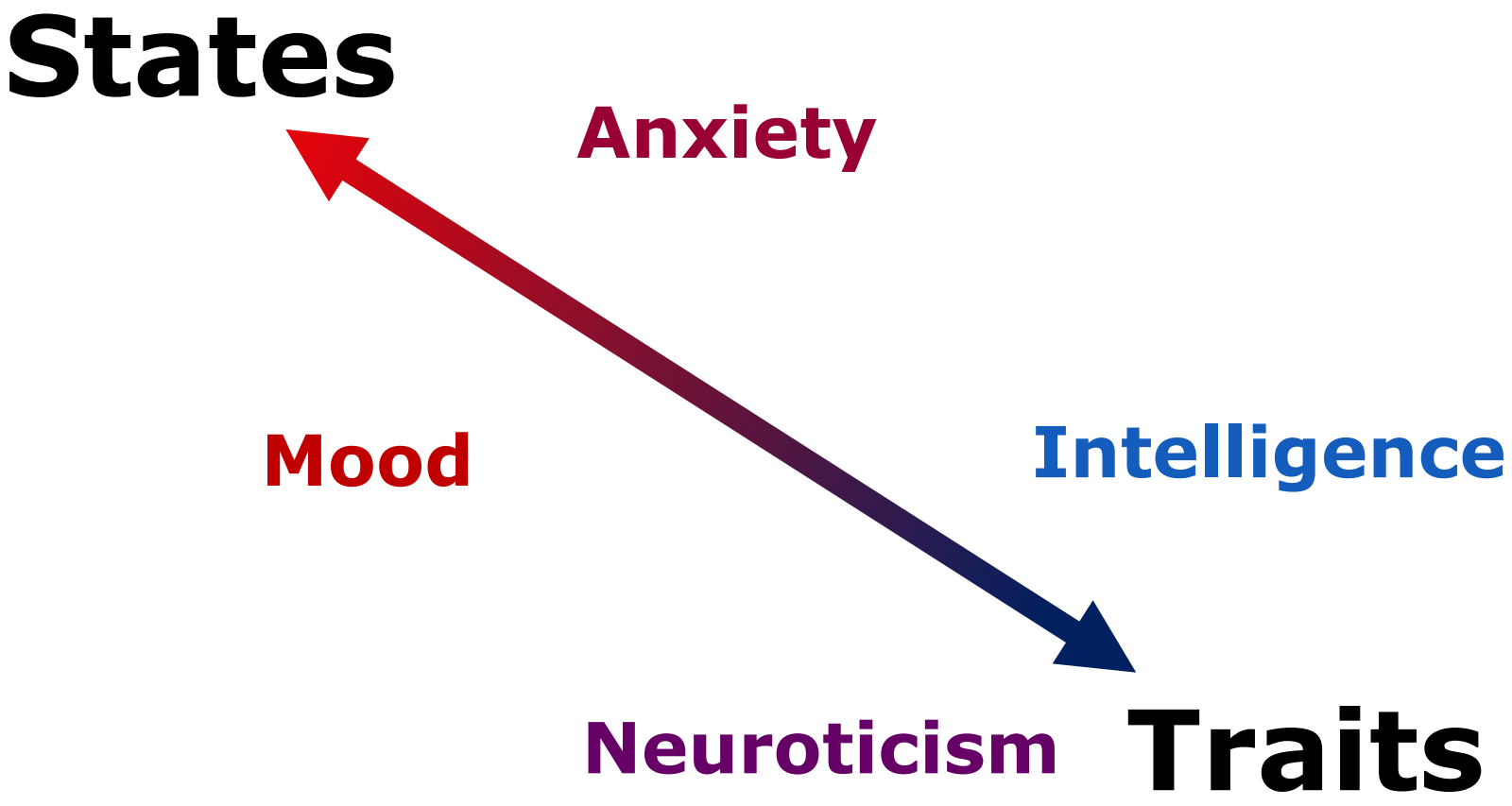
Person's Disposition

Traits

Neuroticism

Stability

States and Traits



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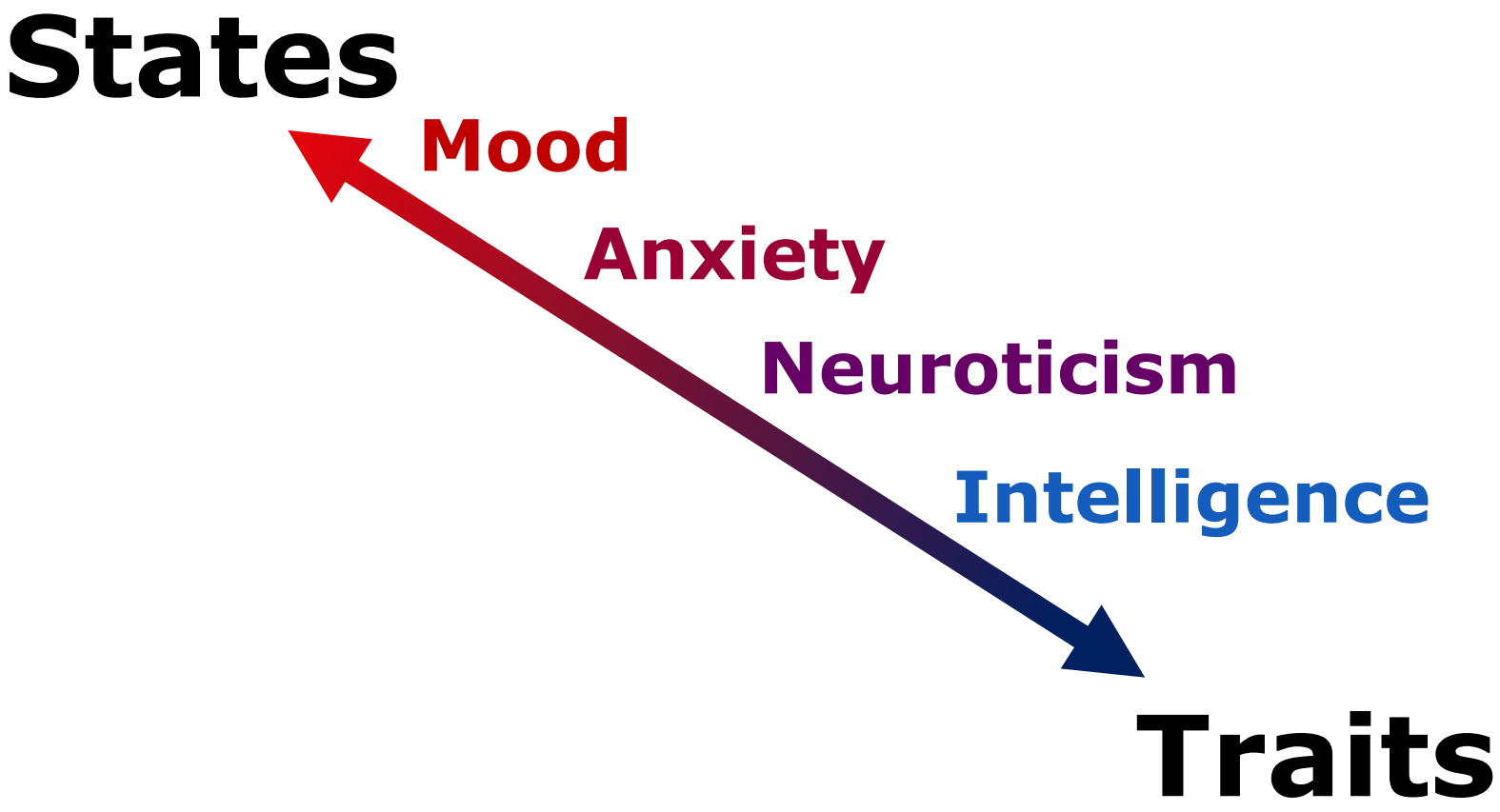
States and Traits



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Latent State-Trait Theory (LST)

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Longitudinal SEM

Latent State-Trait Theory (LST)

Measurement Error

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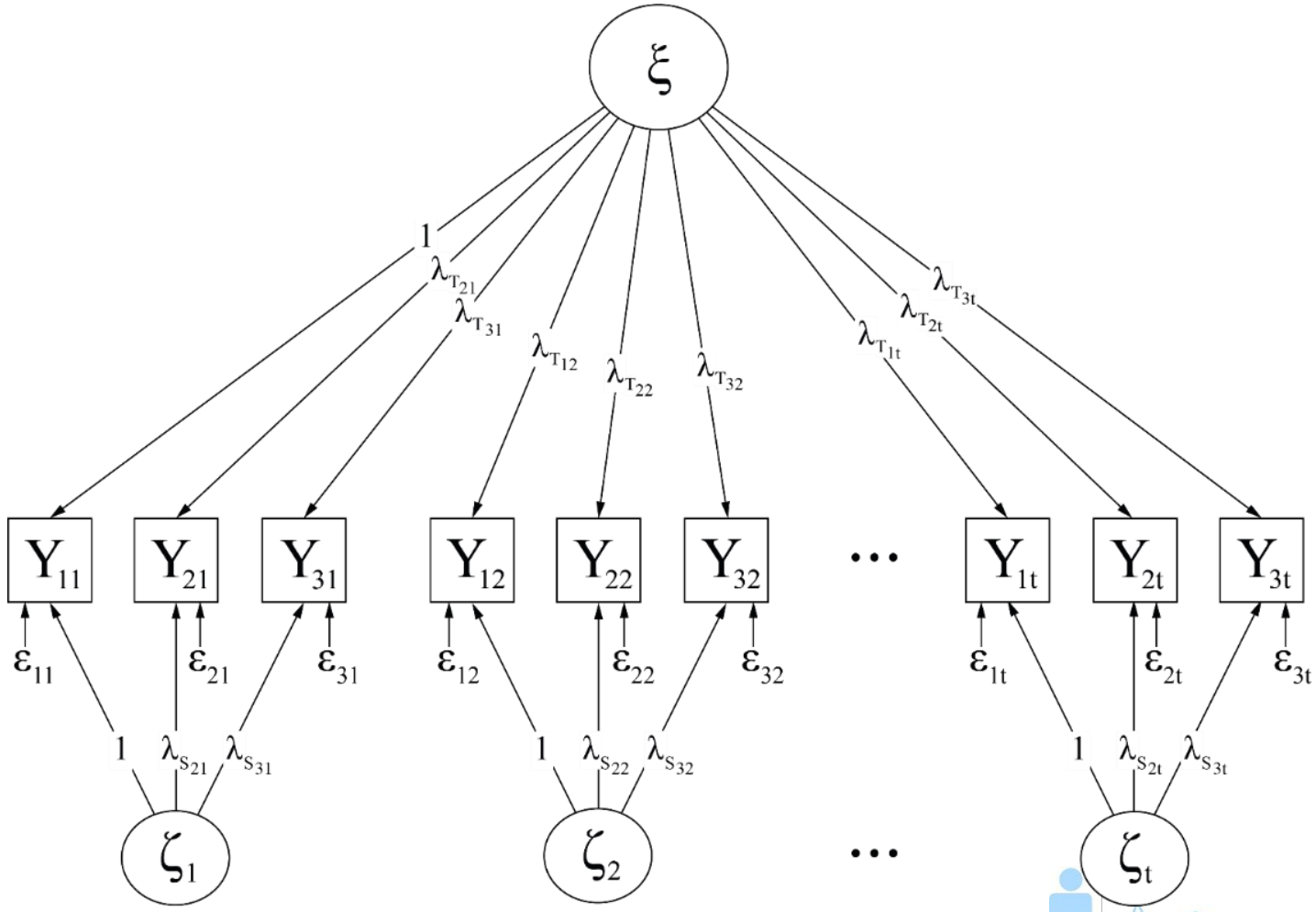
Latent State-Trait Theory



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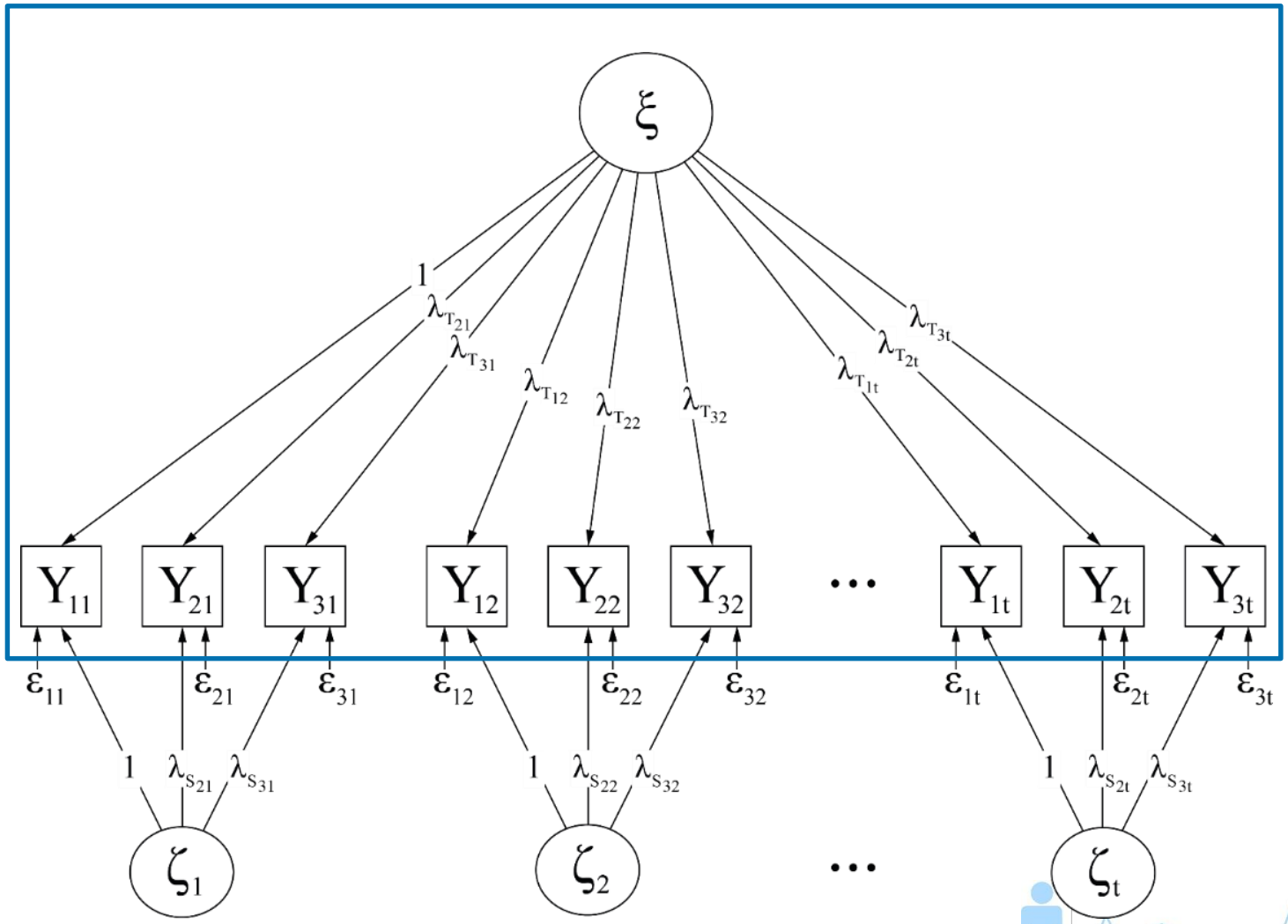
Latent State-Trait Theory



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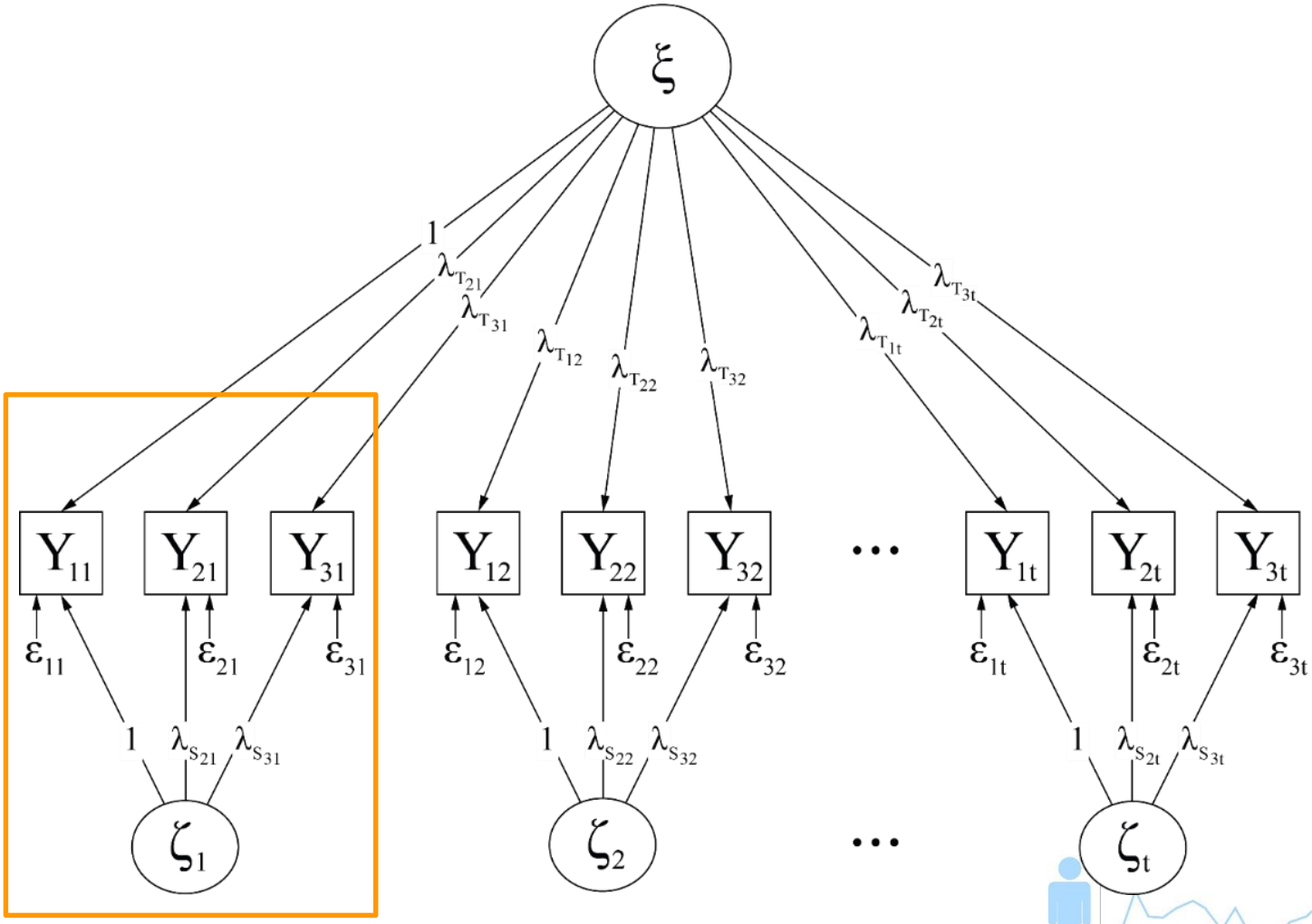
Latent State-Trait Theory



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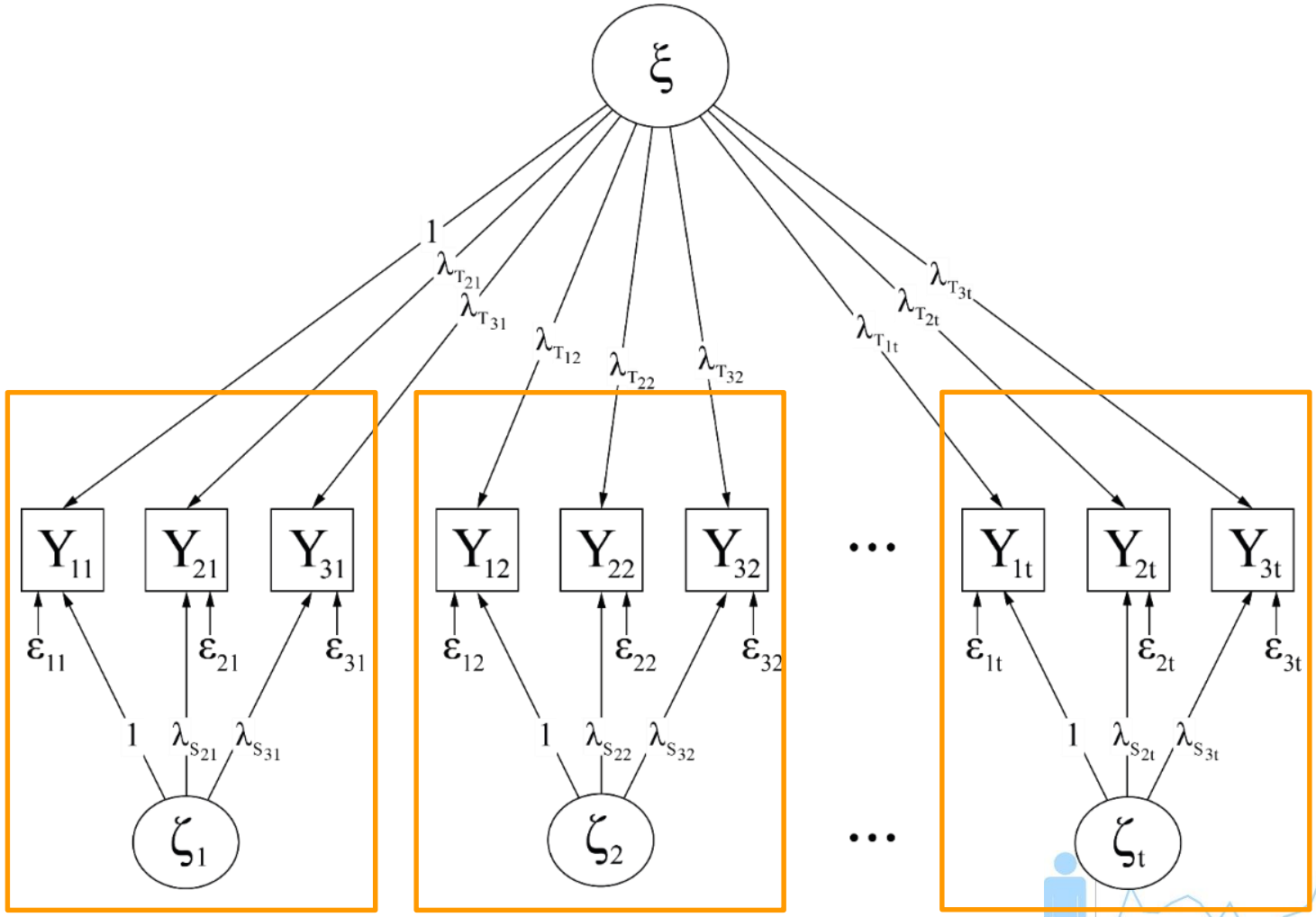
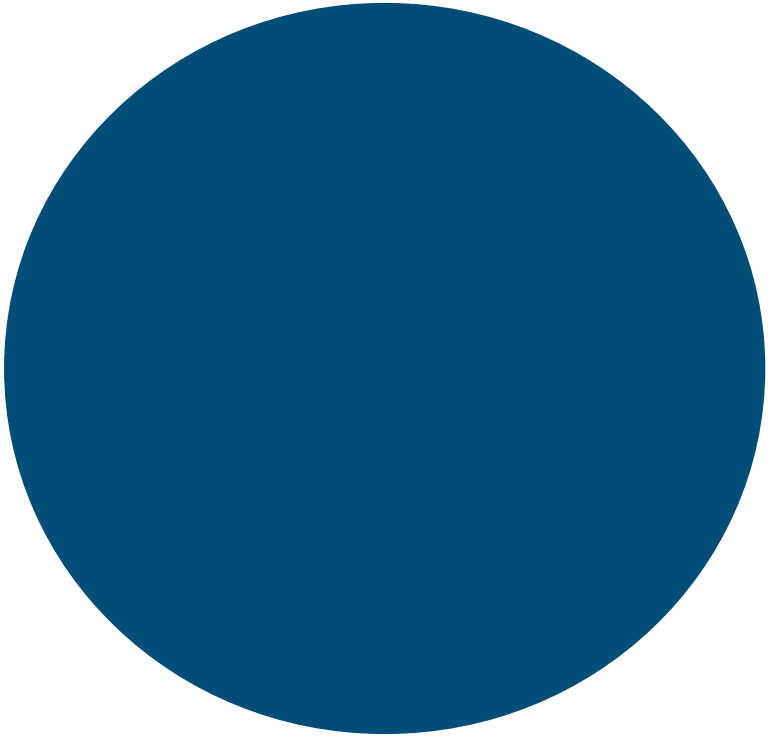
Latent State-Trait Theory



Latent State-Trait Theory

Total Variance of Y_{ij}



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Latent State-Trait Theory

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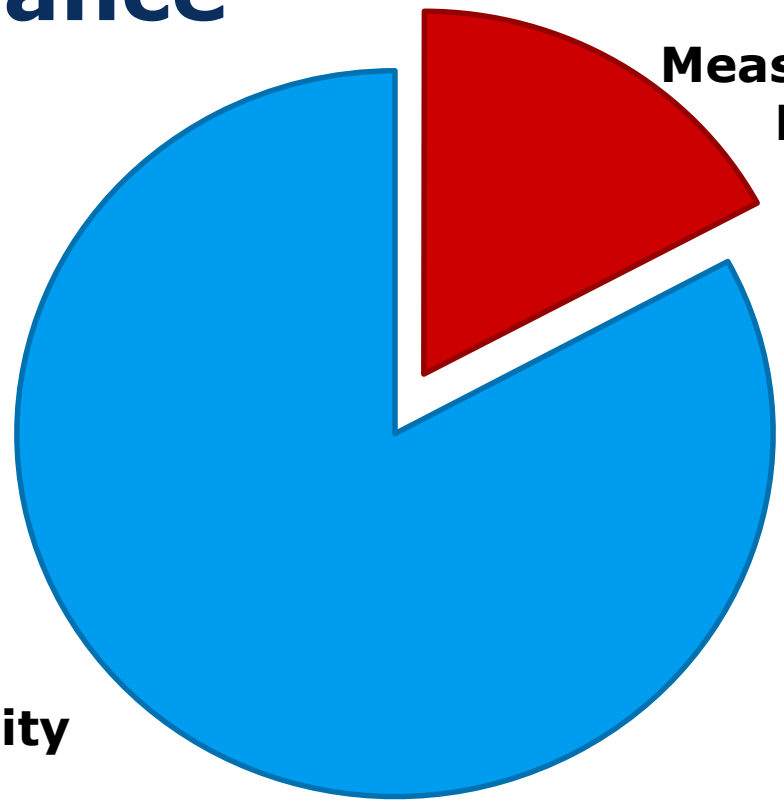

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Latent State-Trait Theory

Total Variance of Y_{ij}

Reliability

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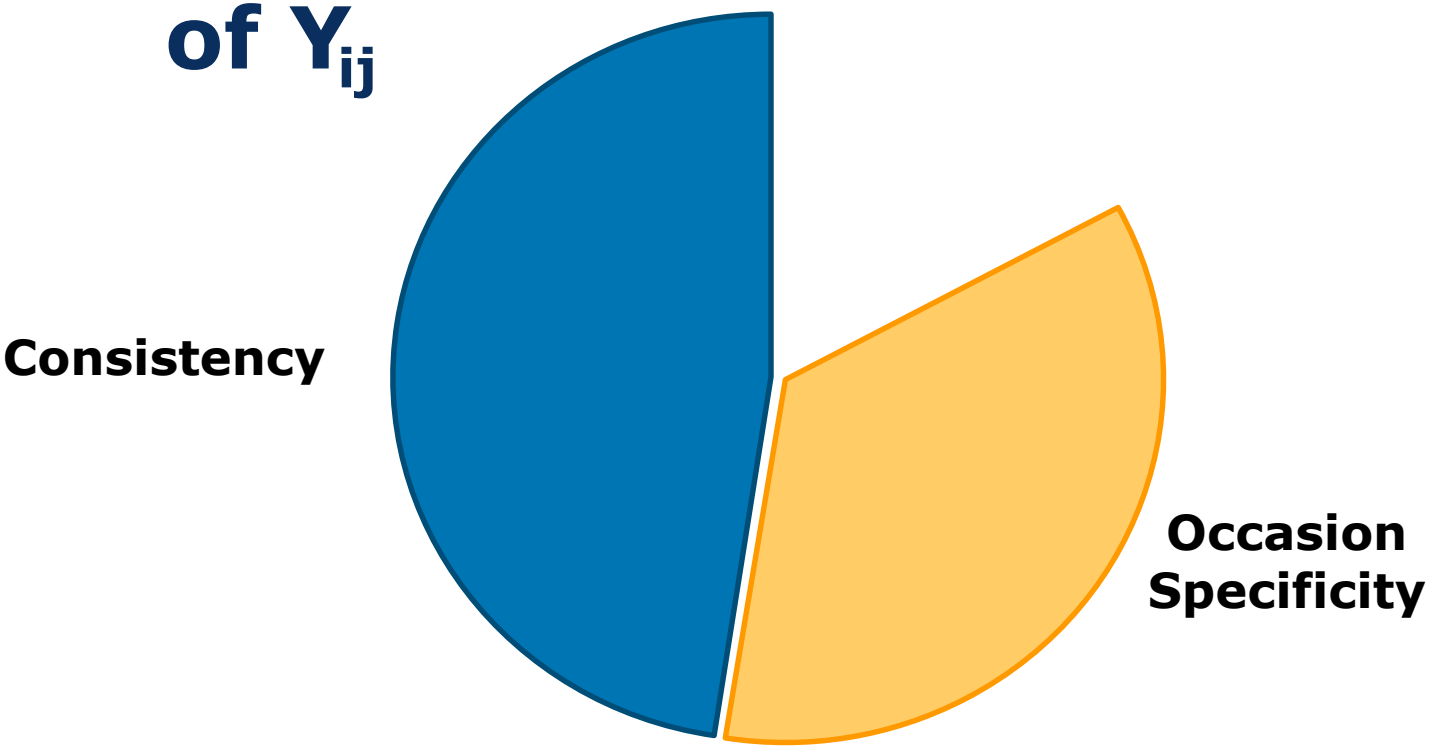
Latent State-Trait Theory

Total Variance of Y_{ij}



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Intensive Longitudinal Data

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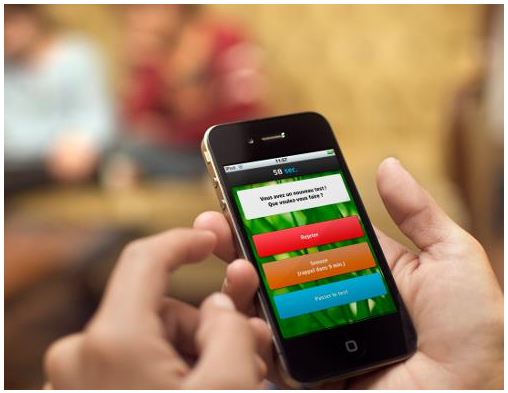
Intensive Longitudinal Data

Context Matters!



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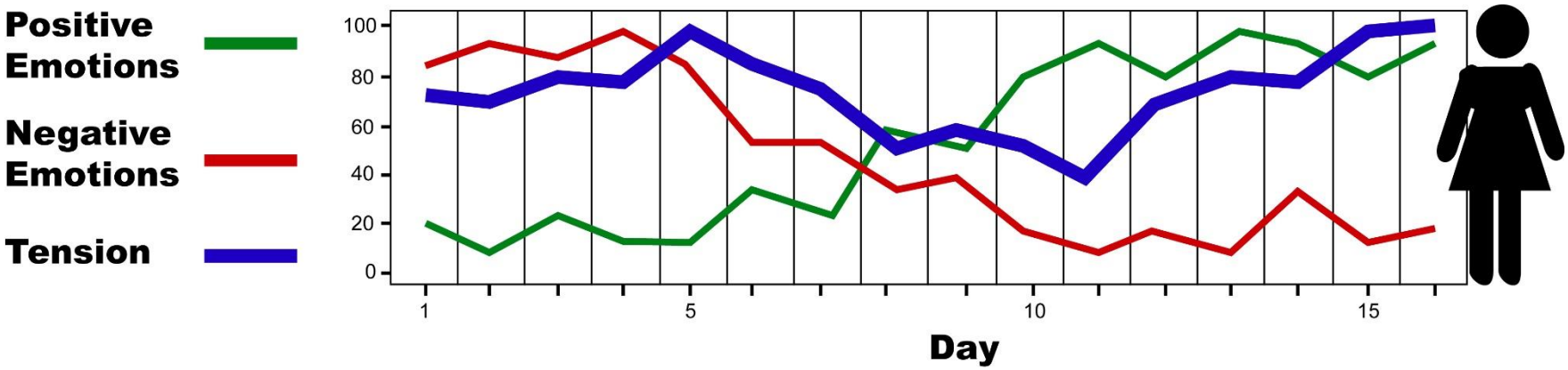
Intensive Longitudinal Data



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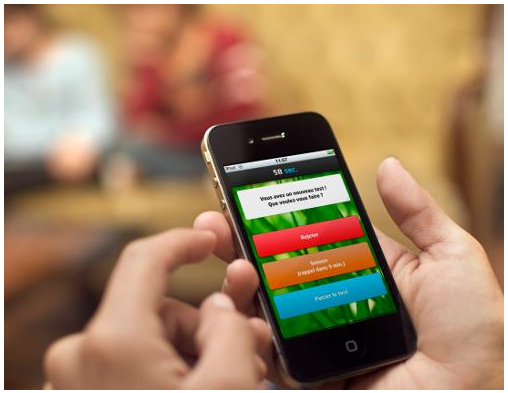

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Can We Study States and Traits with Intensive Longitudinal Data?

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Are We Studying States and Traits with Intensive Longitudinal Data?

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Multilevel Analysis

Dynamic SEM

Multilevel - (Vector) Autoregressive

Time Series Analyses

Are We Studying States and Traits with Intensive Longitudinal Data?

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Multilevel Analysis

Dynamic SEM

Multilevel - (Vector) Autoregressive

Time Series Analyses

Are We Studying States and Traits with Intensive Longitudinal Data?

States = Within Variation

Traits = Between Variation

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Multilevel Analysis

Dynamic SEM

Multilevel - (Vector) Autoregressive

Time Series Analyses

Are We Studying States and Traits with Intensive Longitudinal Data?

LST?

States = Within Variation

Traits = Between Variation

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LST and Intensive Longitudinal Data

Multistate-singletrait (MSST)

States and Traits

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LST and Intensive Longitudinal Data

States and Traits

Common-Unique Trait-State (CUTS)

Method Factors

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LST and Intensive Longitudinal Data

States and Traits

Autoregressive Effect

Trait-State-Occasion (TSO)

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LST and Intensive Longitudinal Data

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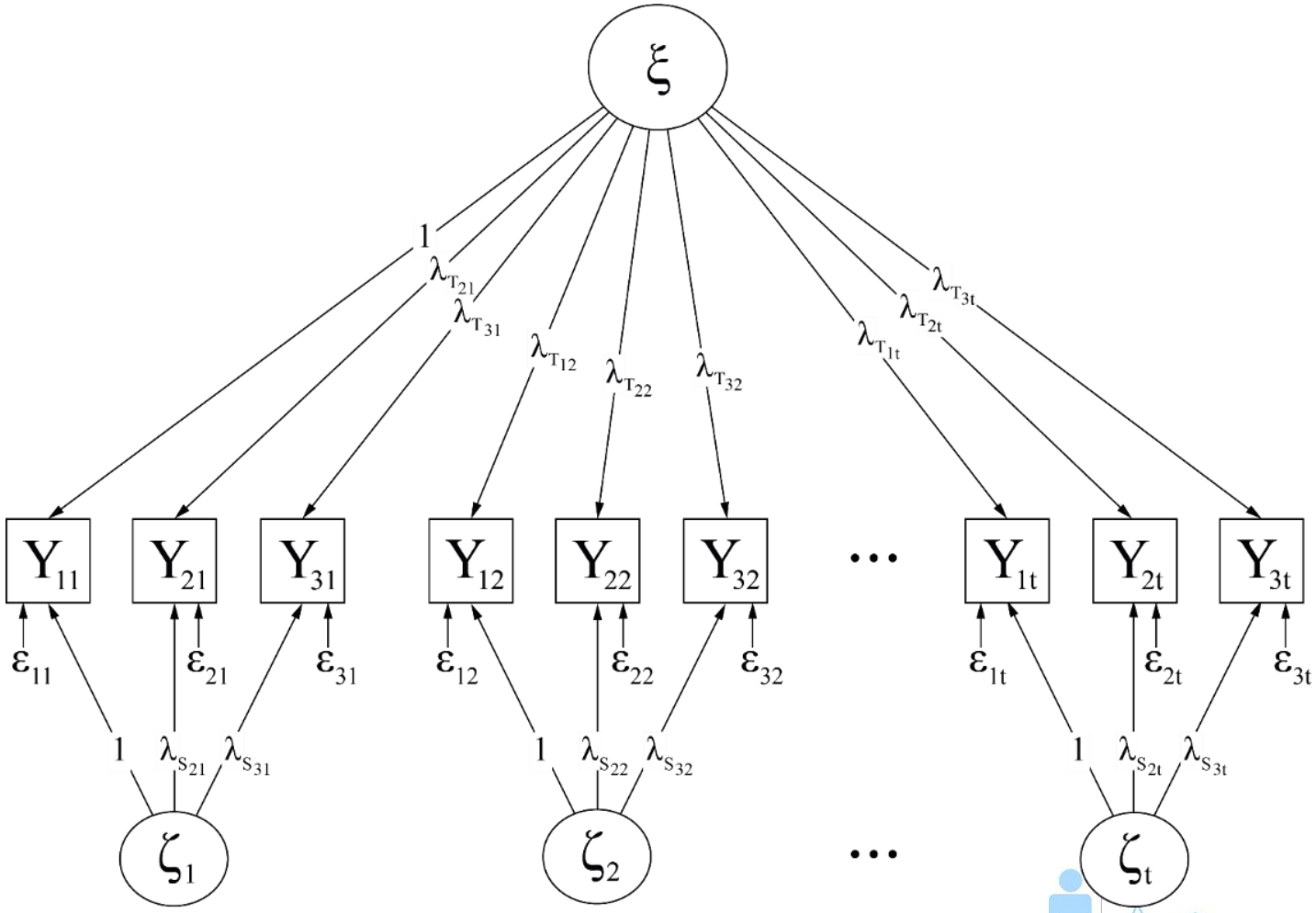

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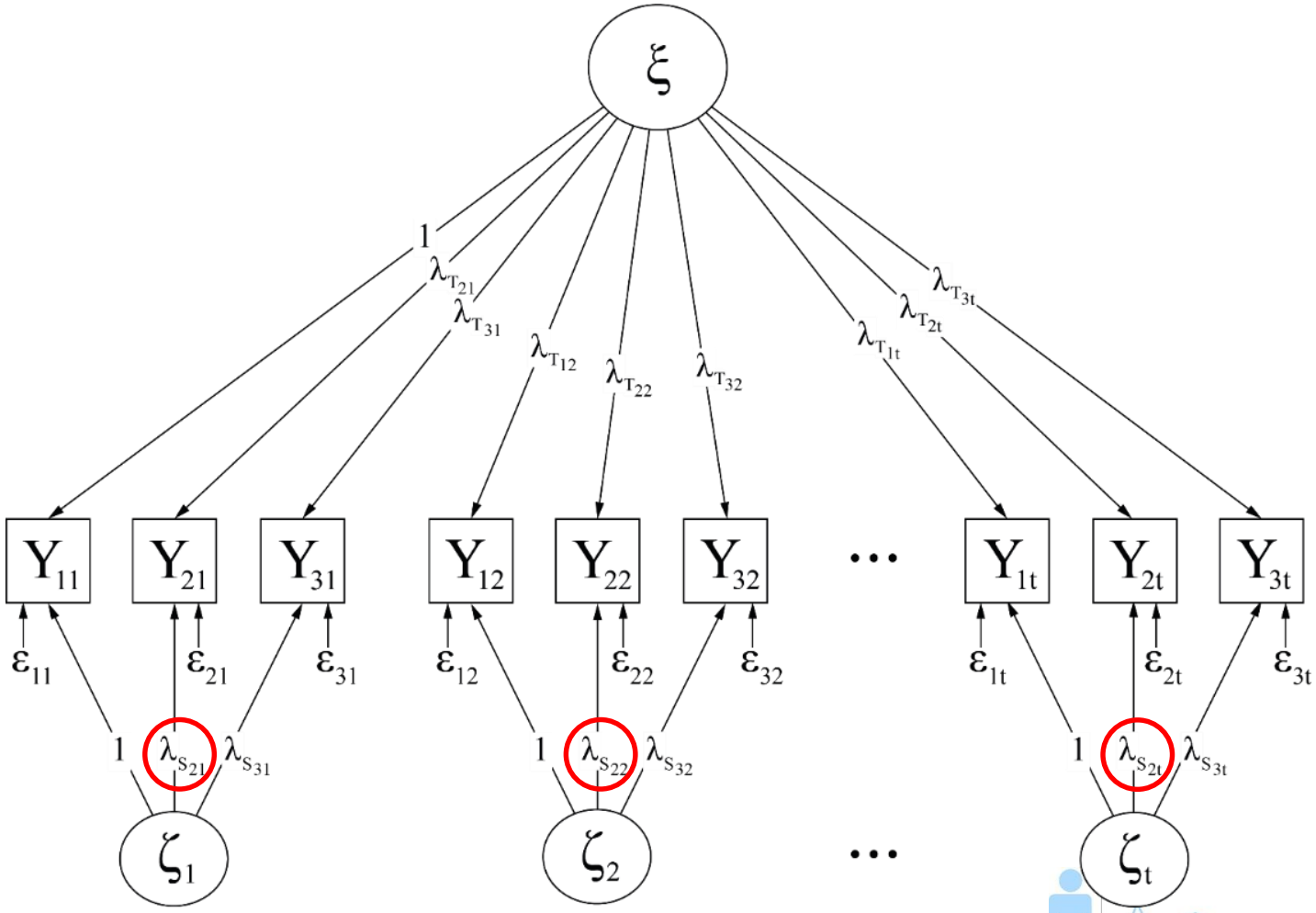
Multistate-Singletrait (MSST)



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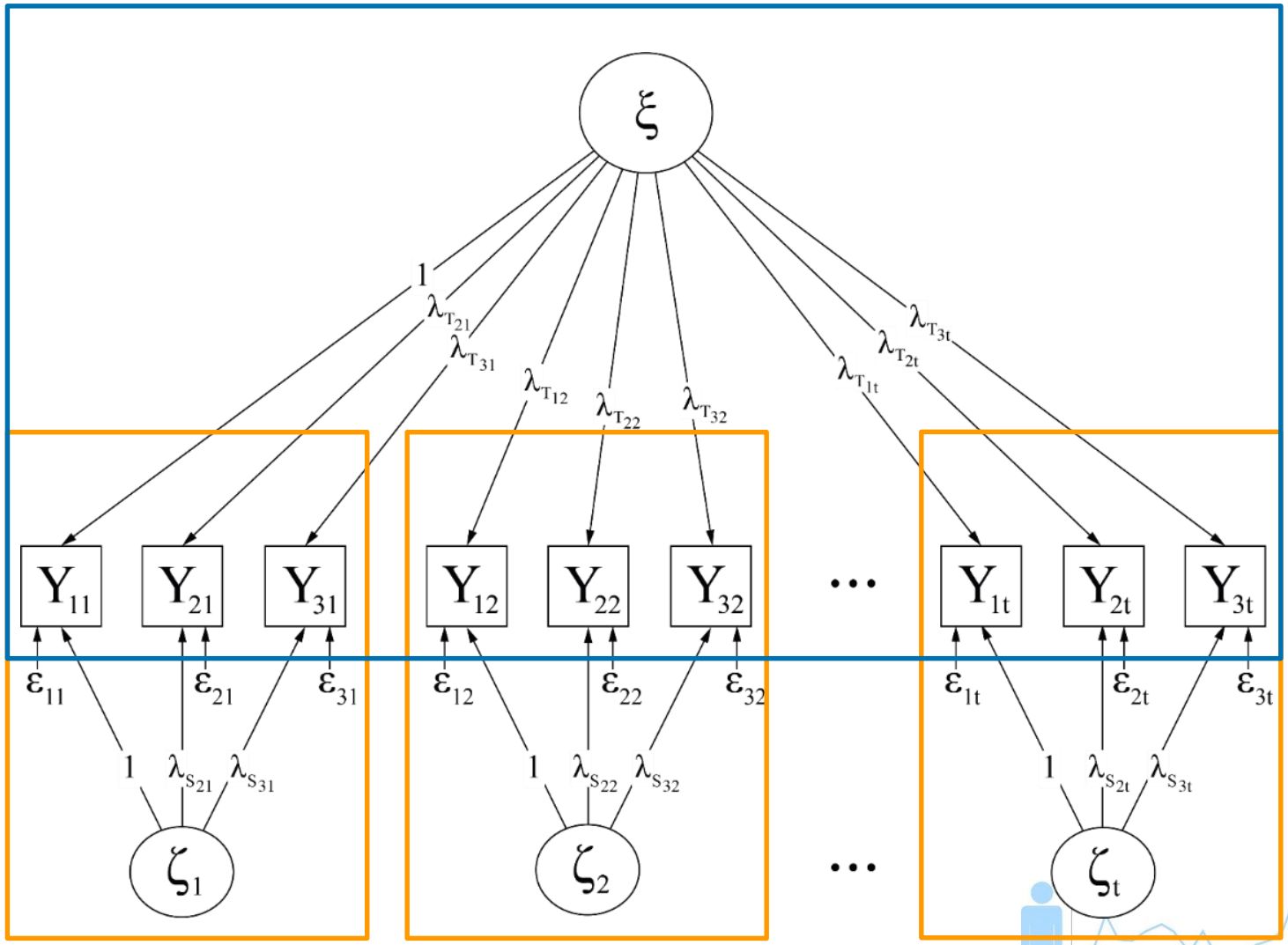
Multistate-Singletrait (MSST)



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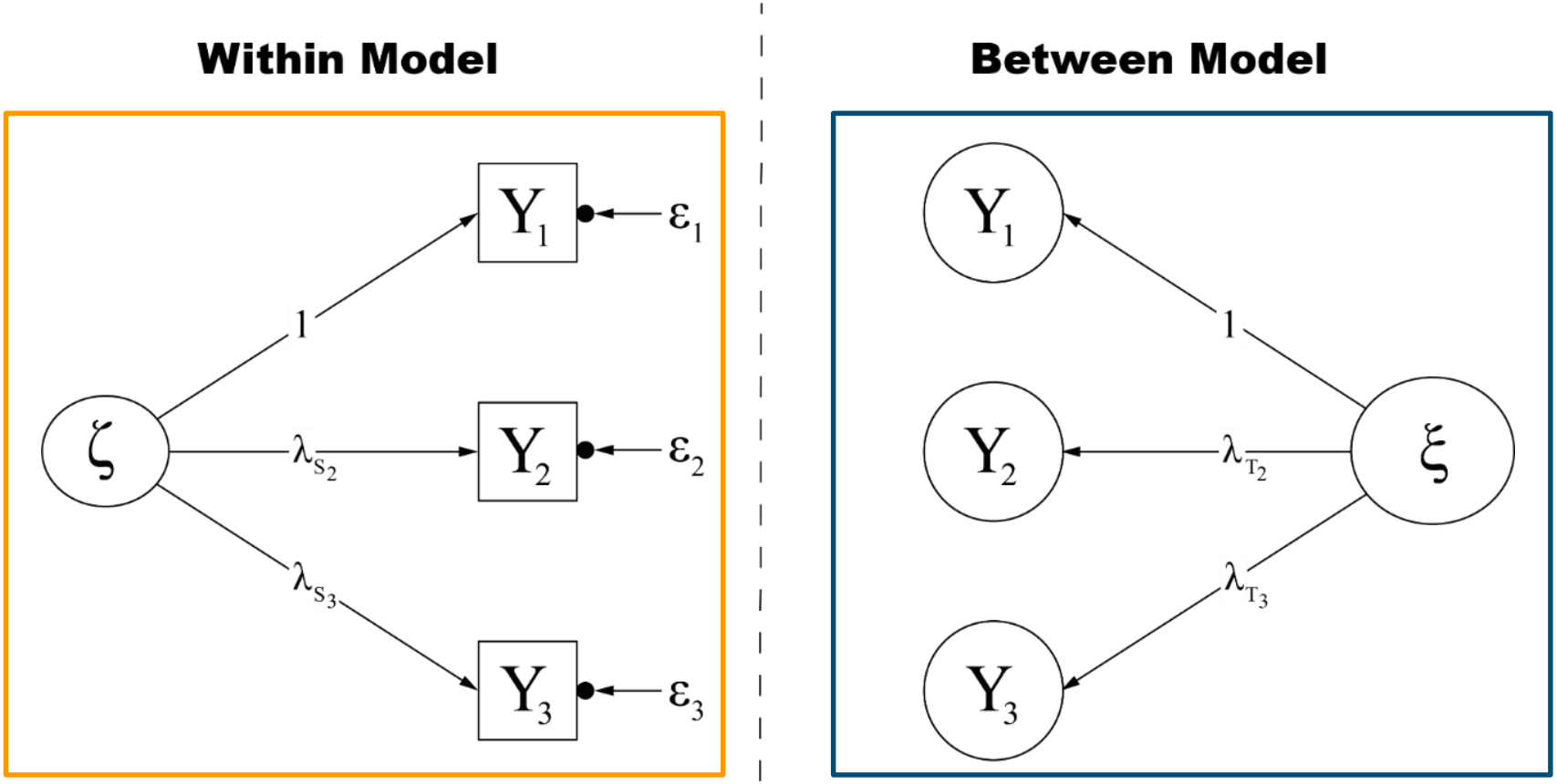

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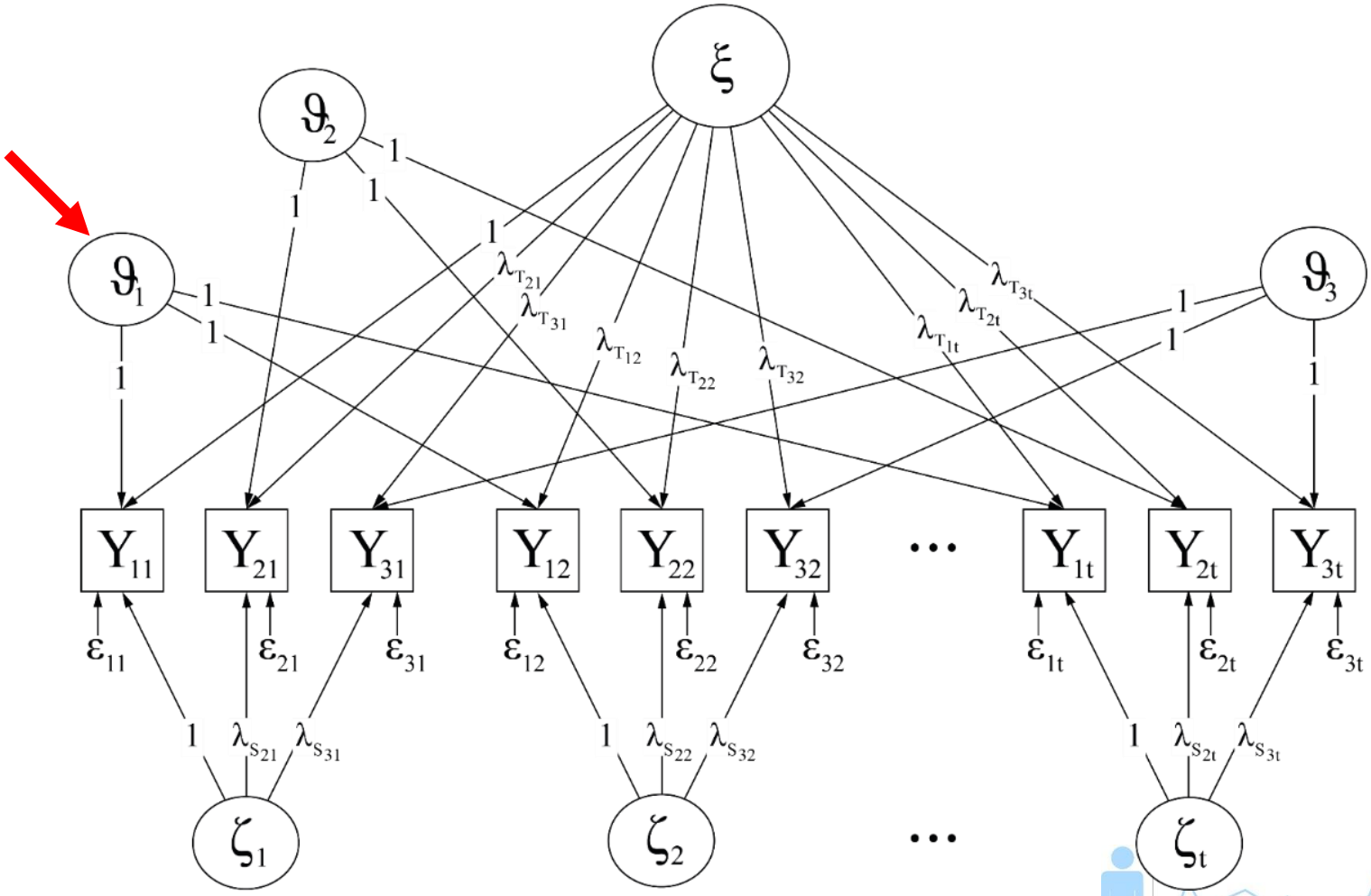
Common-Unique Trait-State (CUTS)



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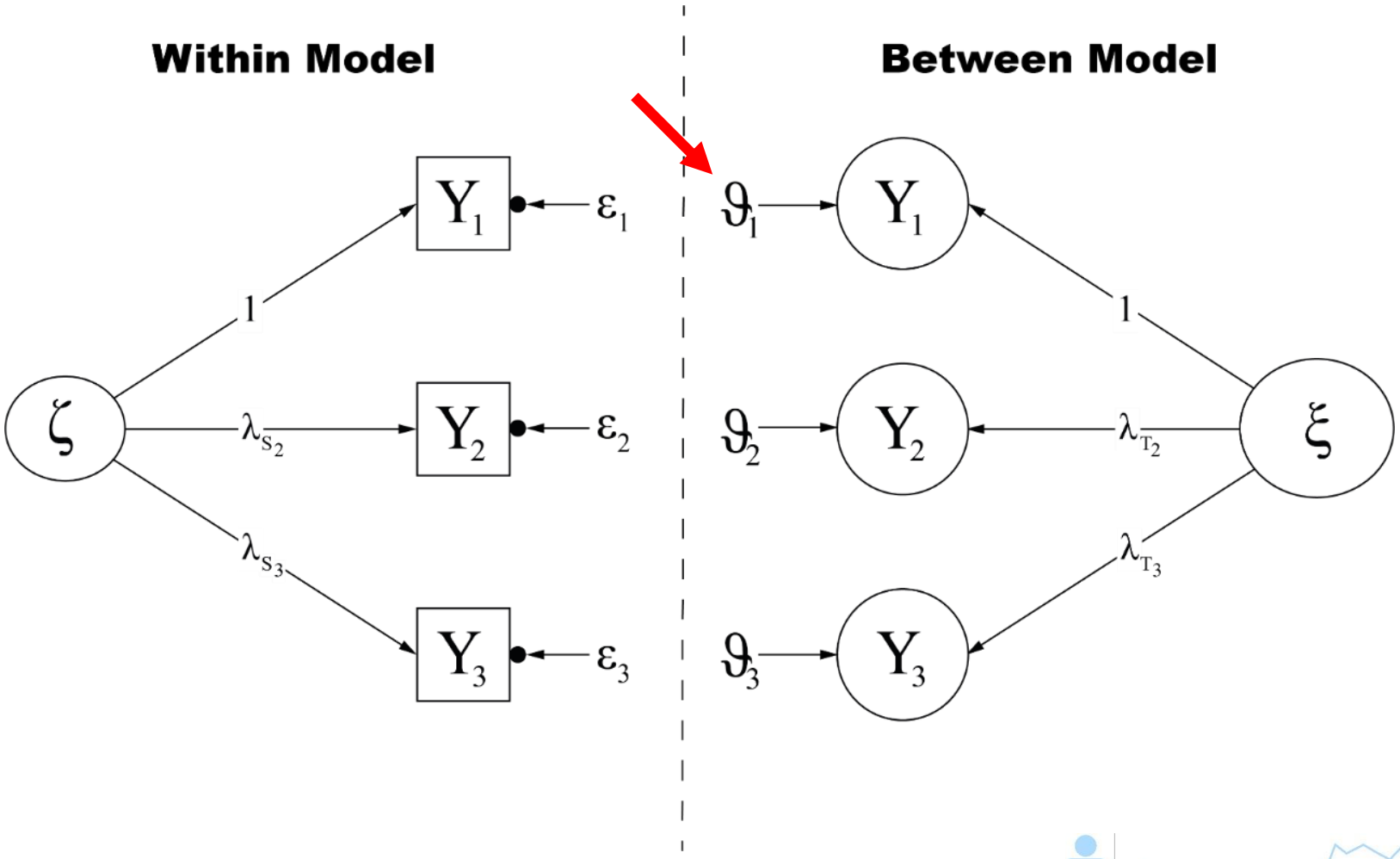
Common-Unique Trait-State (CUTS)



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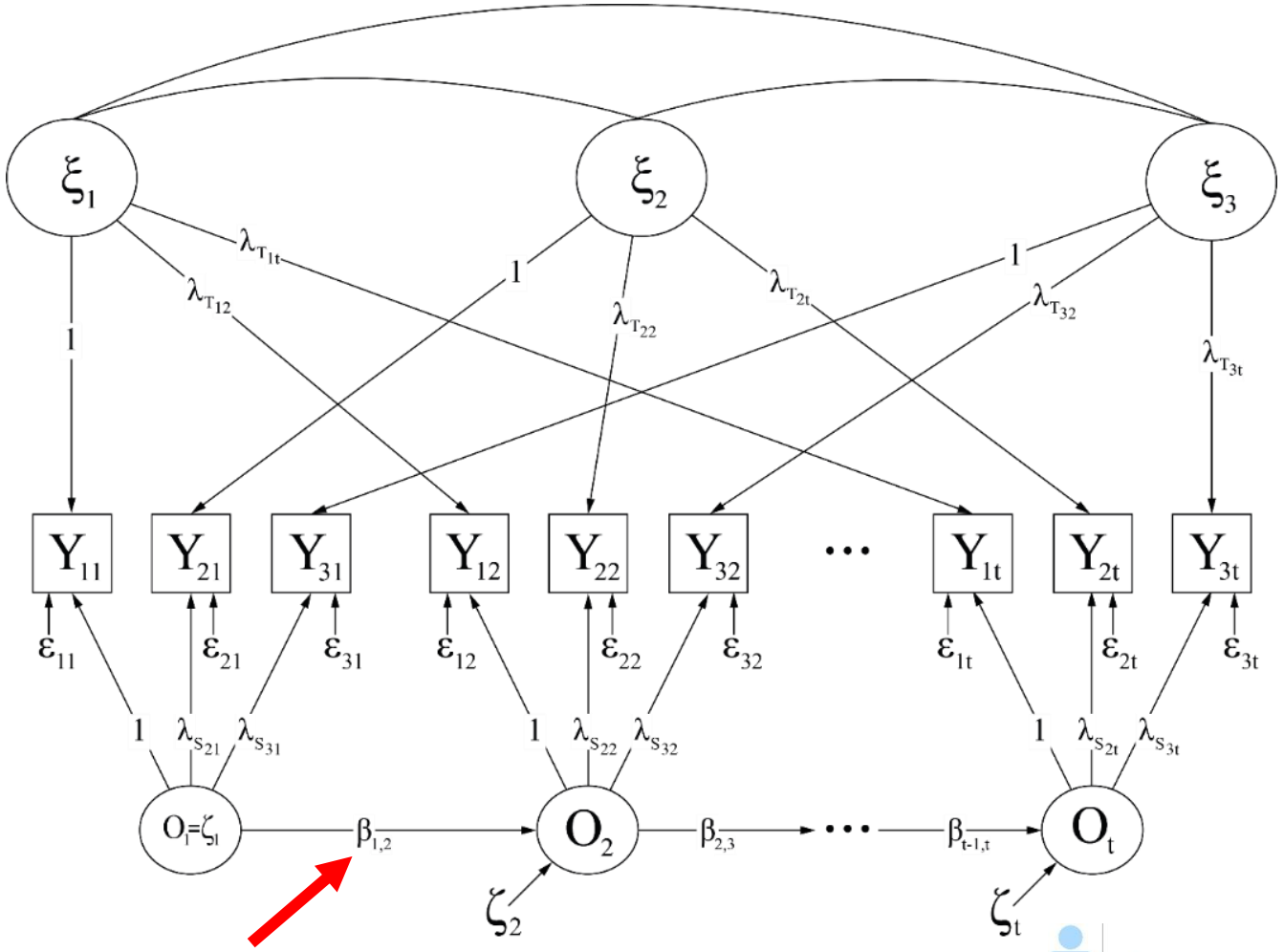
Trait-State-Occasion (TSO)



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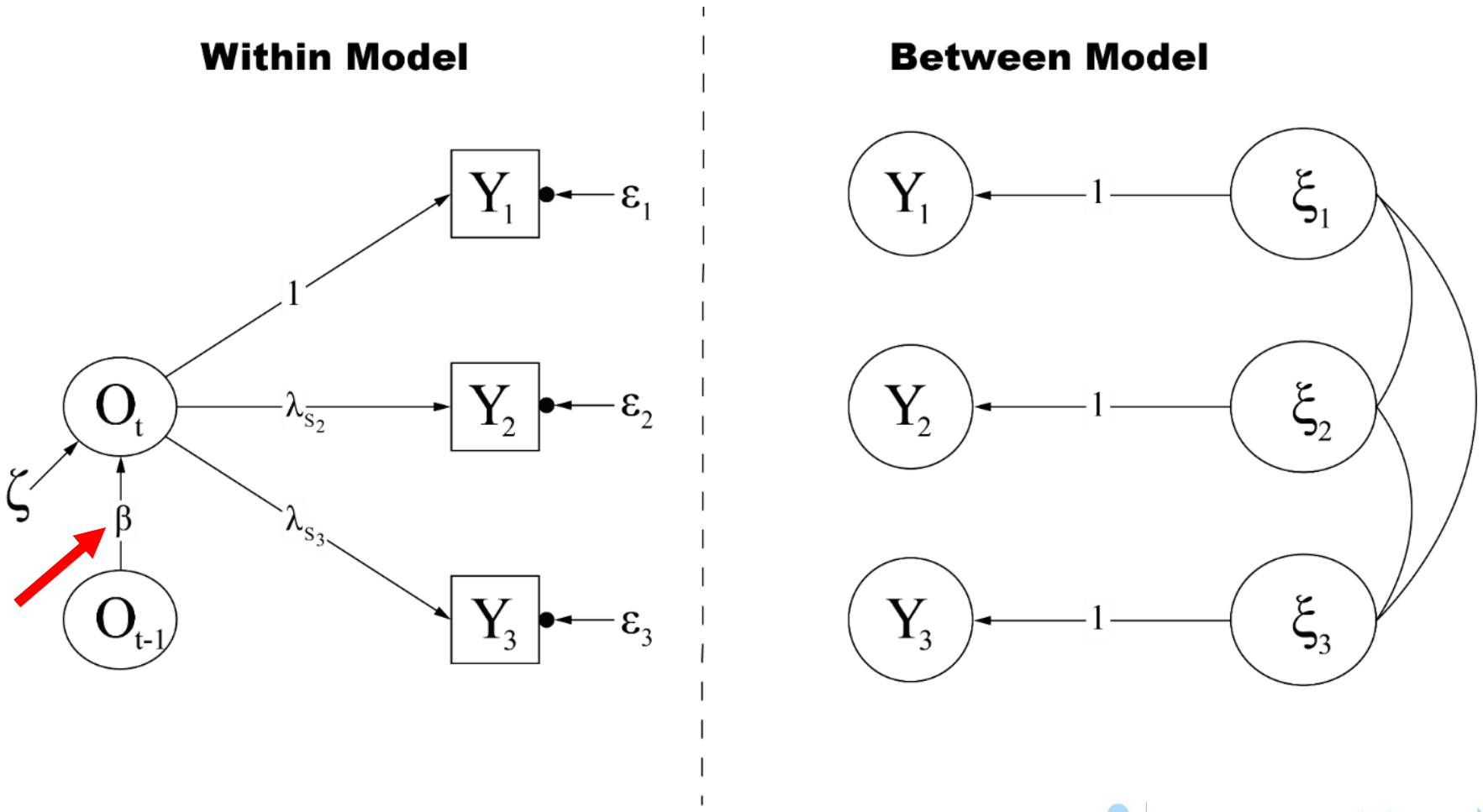

Simulation Study

When is the multilevel version preferable over the single level version?

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Simulation Study

When is the multilevel version preferable over the single level version?

Are these models suitable to analyze intensive longitudinal data?

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Simulation Study

Base Model

MSST

CUTS

TSO

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Simulation Study

Base Model	Number of Measurements
MSST	30
CUTS	60
TSO	90

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Simulation Study

Base Model	Number of Measurements	Proportion of Missing Values
MSST	30	0%
CUTS	60	10%
TSO	90	

Simulation Study

Base Model

X

Number of Measurements

X

Proportion of Missing Values

	MLE	BAYES
MSST	✓	✓
ML-MSST	✓	✓
CUTS	✓	✓
ML-CUTS	✓	✓
TSO	✓	✓
ML-TSO	✗	✓

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Simulation Study

Base Model

X

Number of Measurements

X

Proportion of Missing Values

18

	MLE	BAYES
MSST	✓	✓
ML-MSST	✓	✓
CUTS	✓	✓
ML-CUTS	✓	✓
TSO	✓	✓
ML-TSO	✗	✓

X 100

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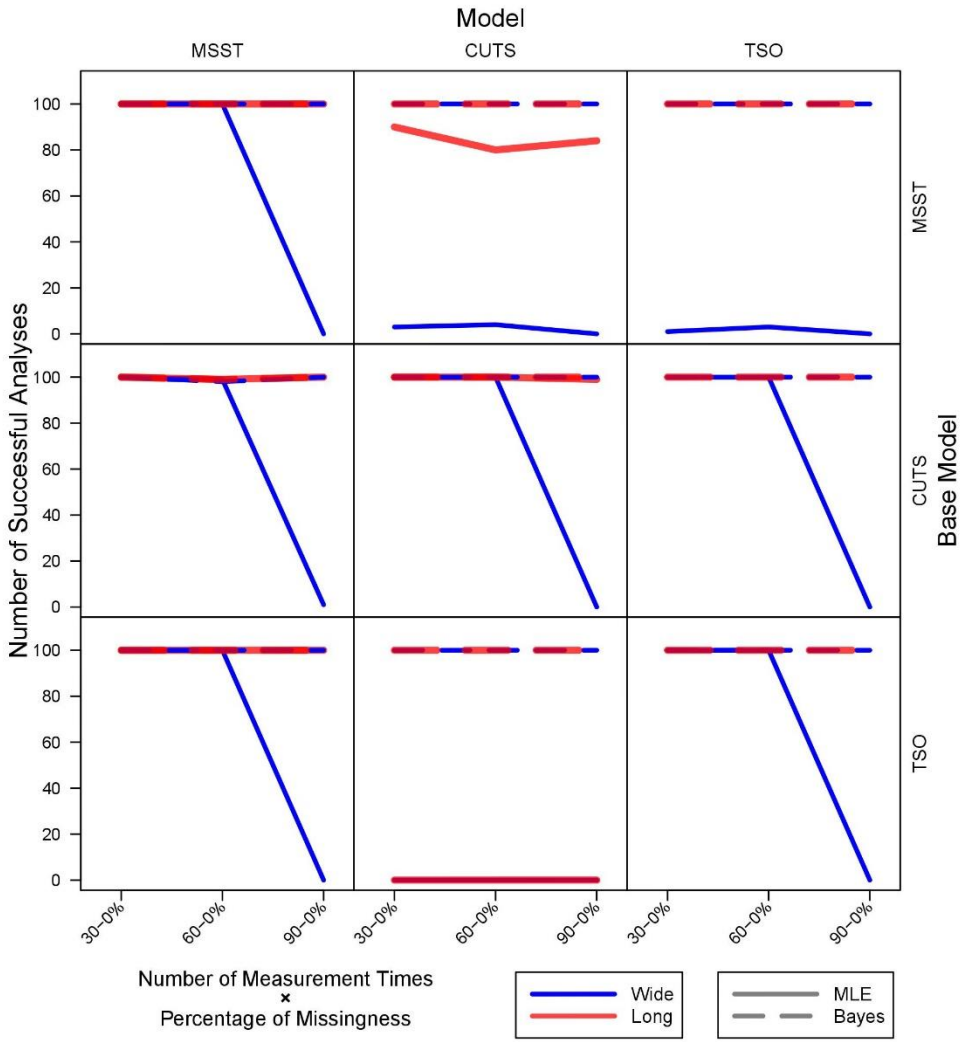
Number Succesful Analyses



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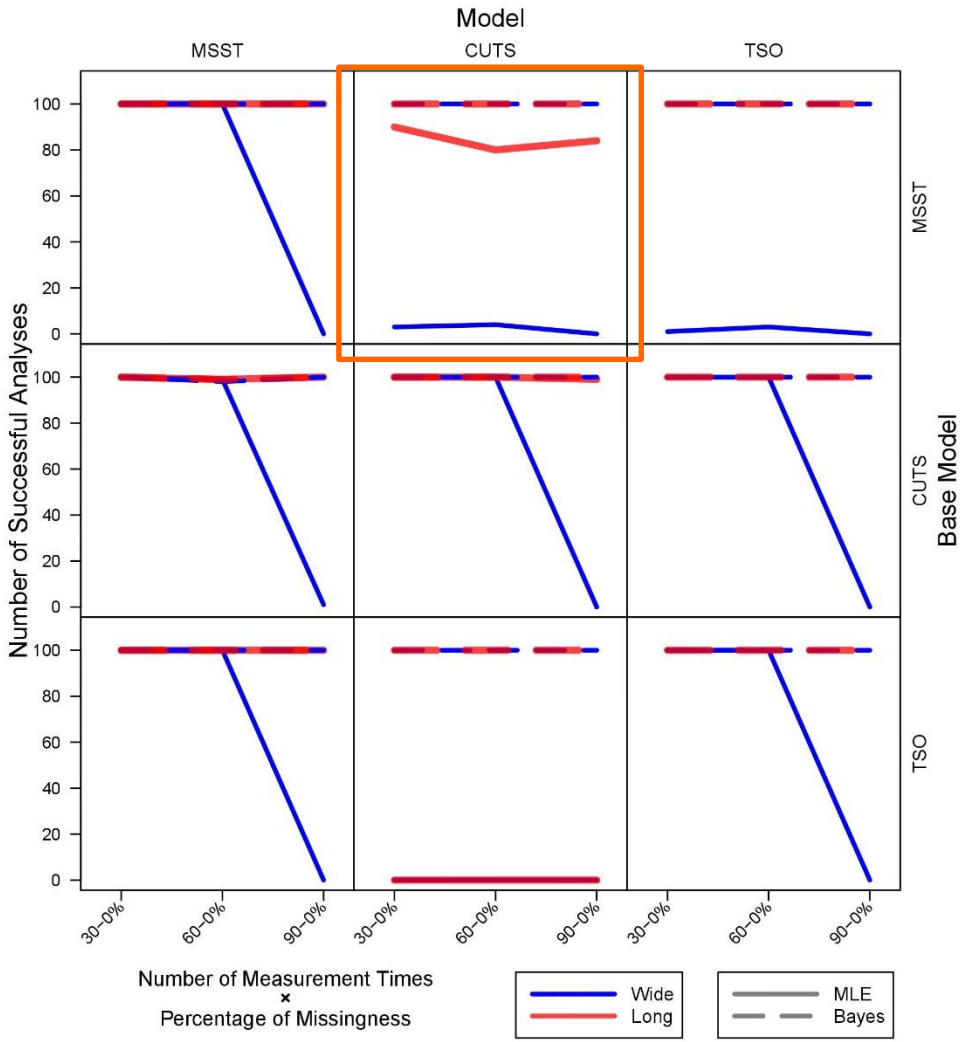

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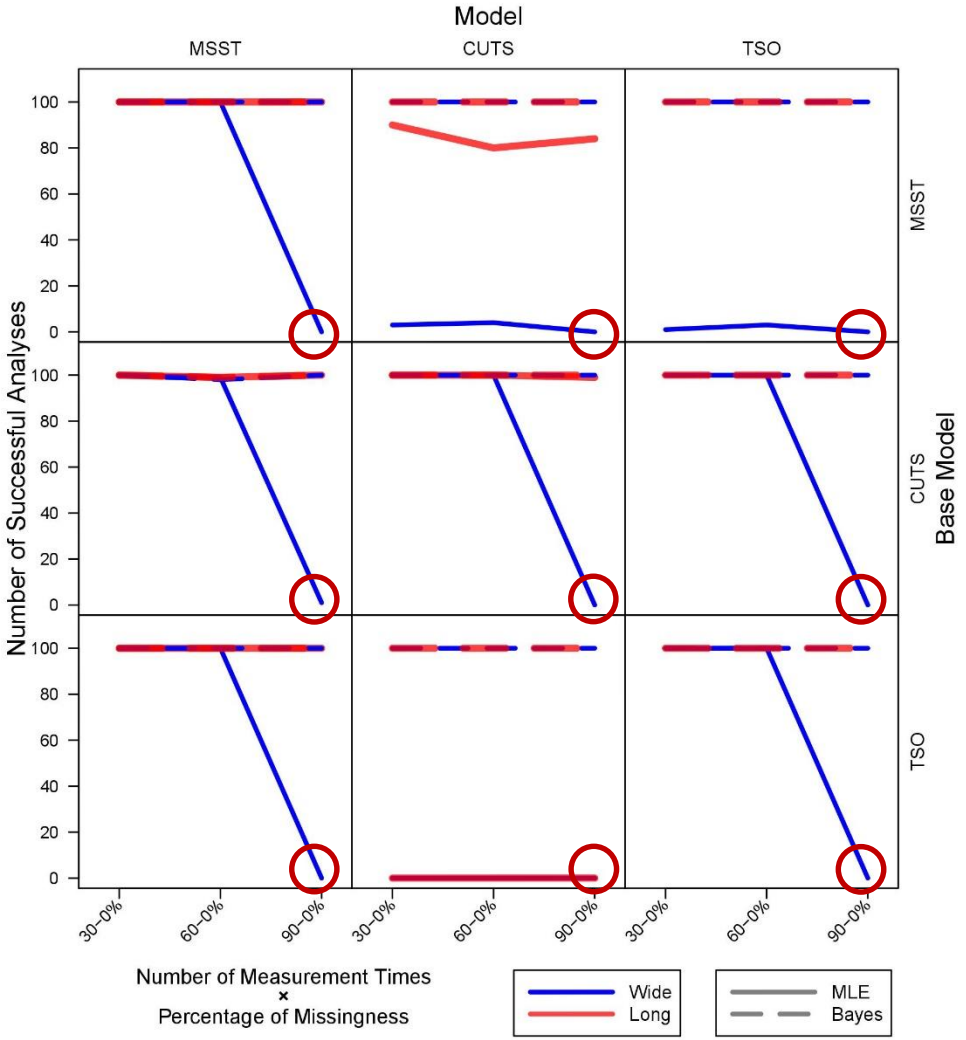

Timeout

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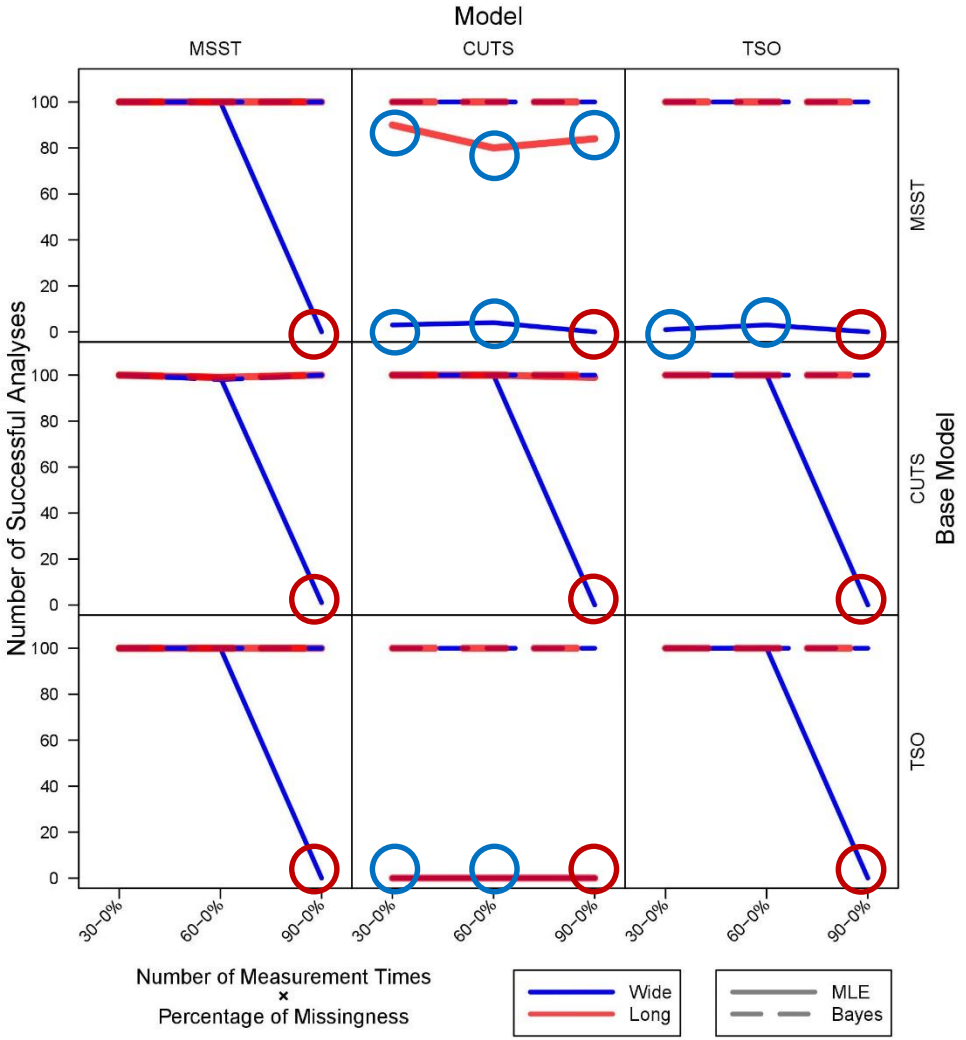
Number Succesful Analyses



Timeout

Errors

Improper Solutions

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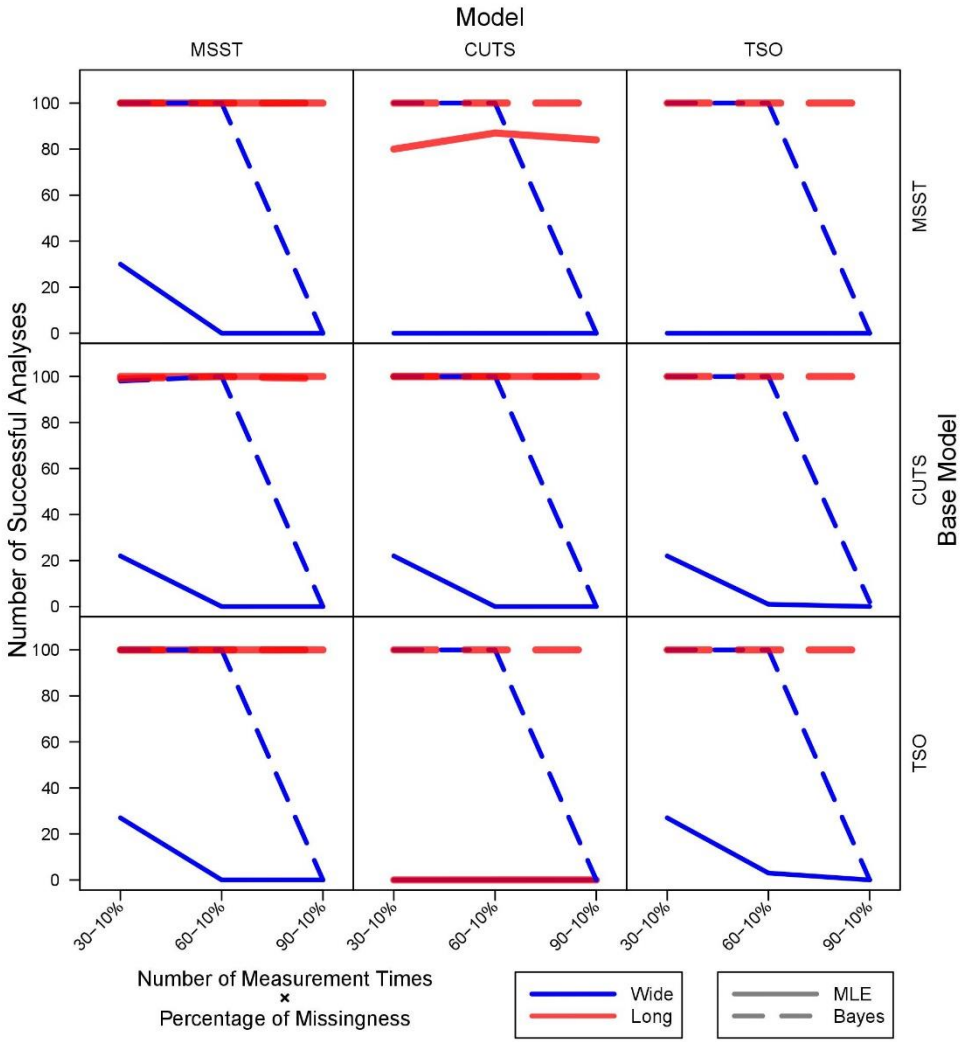
Number Succesful Analyses



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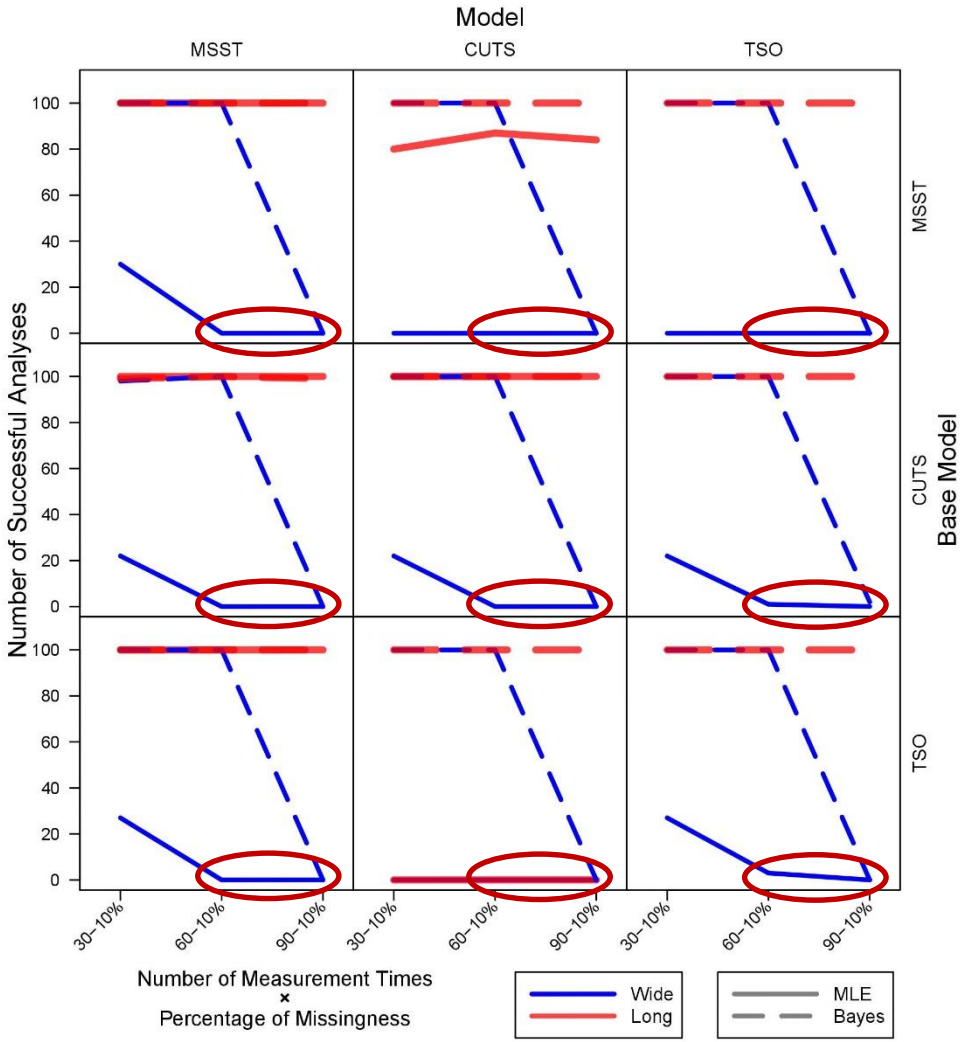

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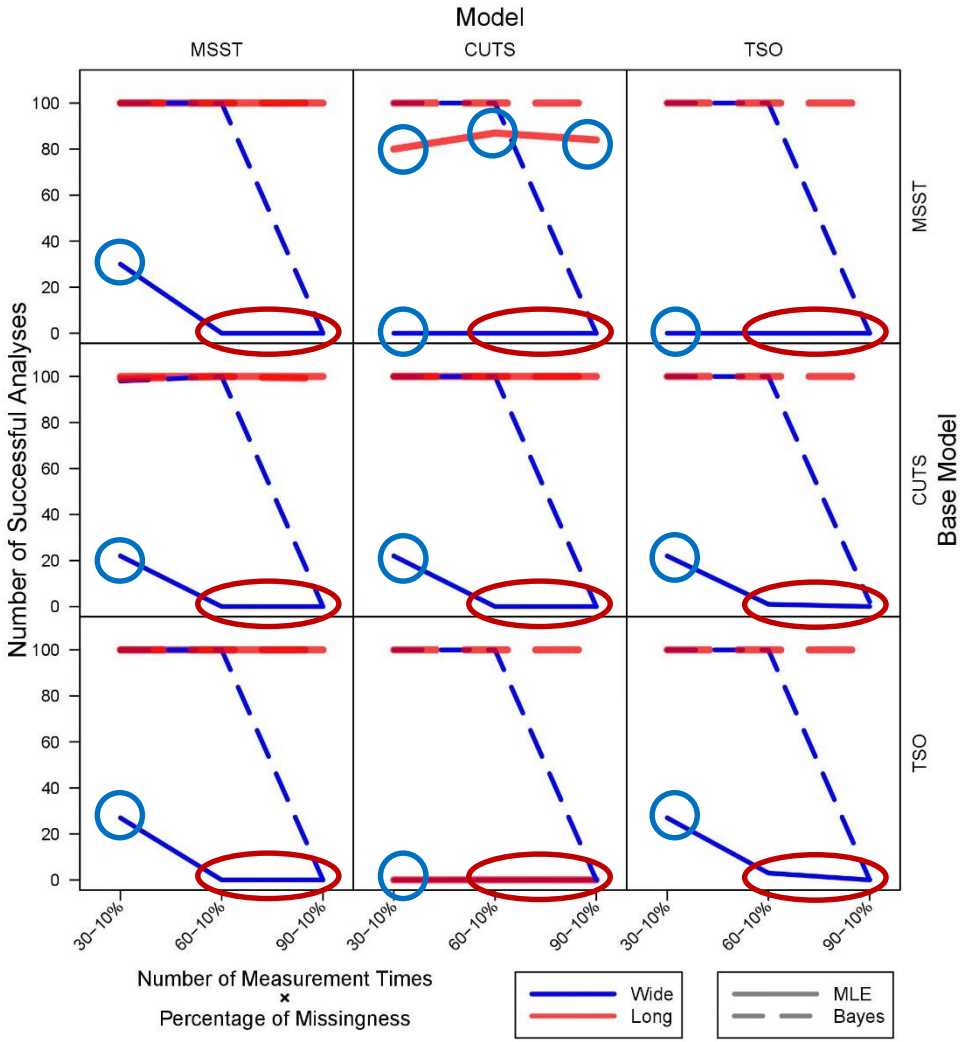

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Accuracy

BIAS

AbBIAS

RMSE

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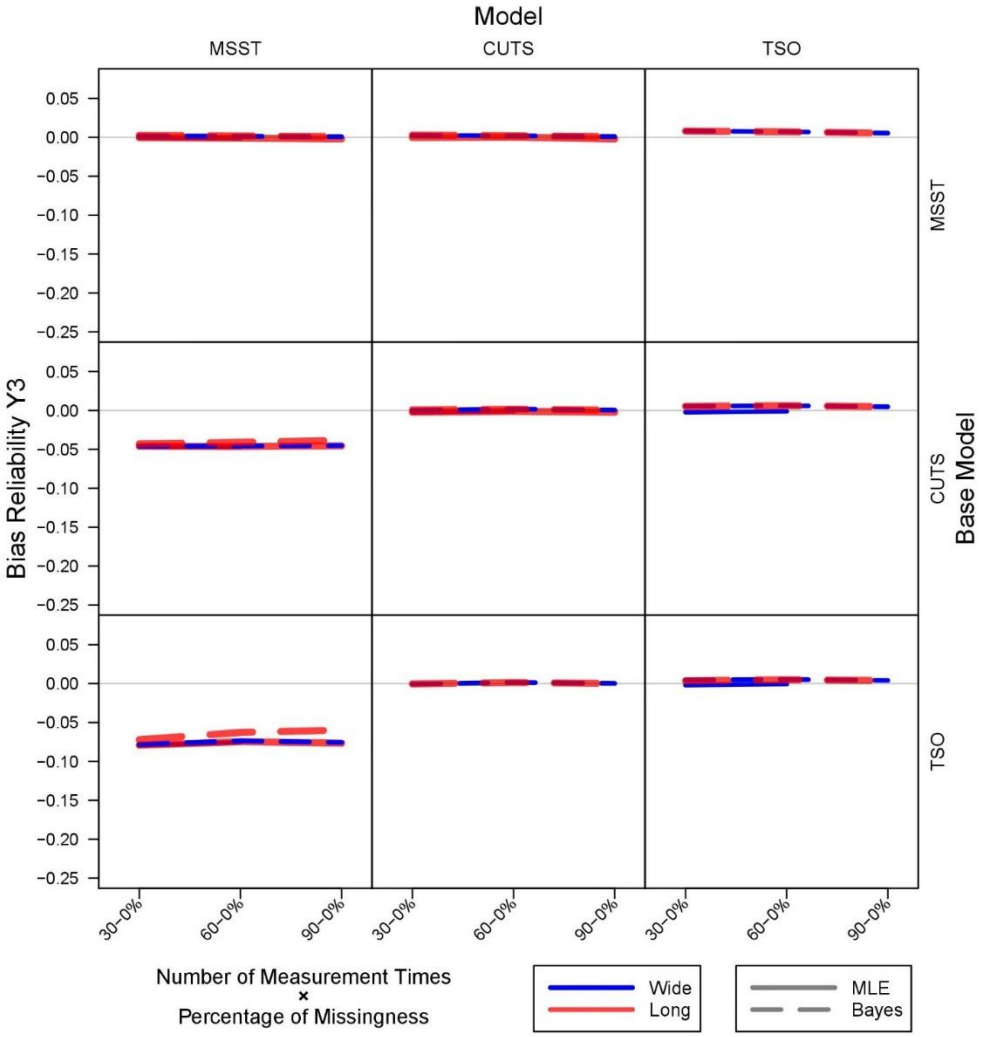
Accuracy



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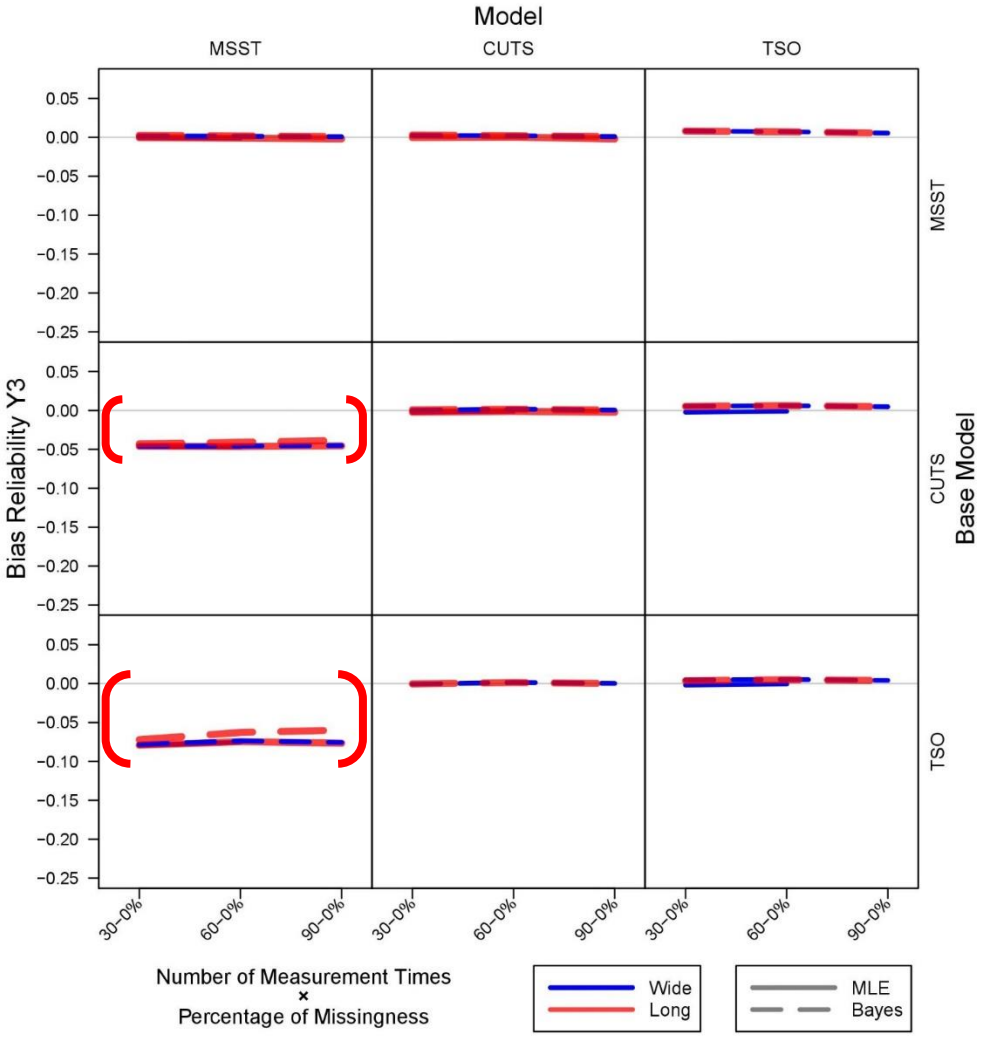

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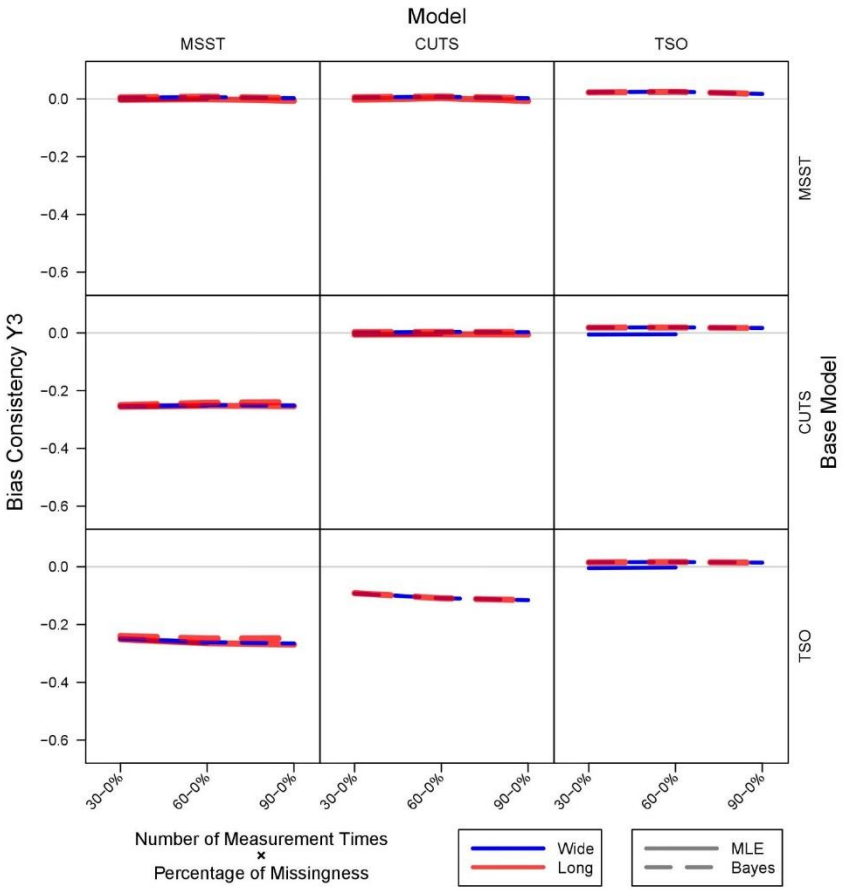

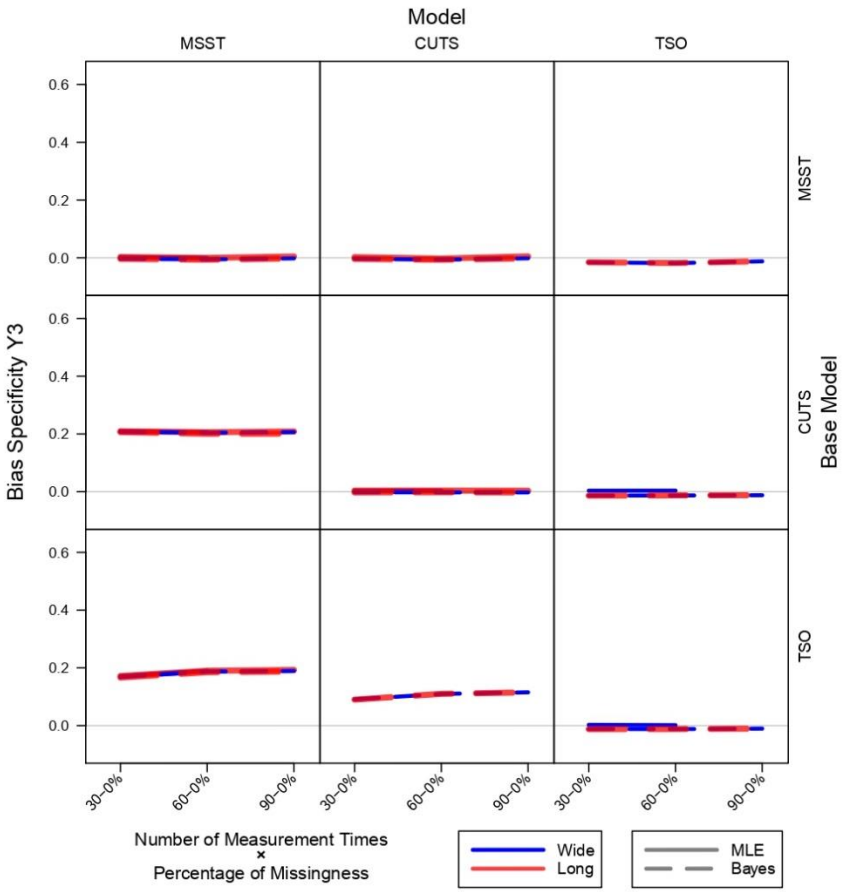

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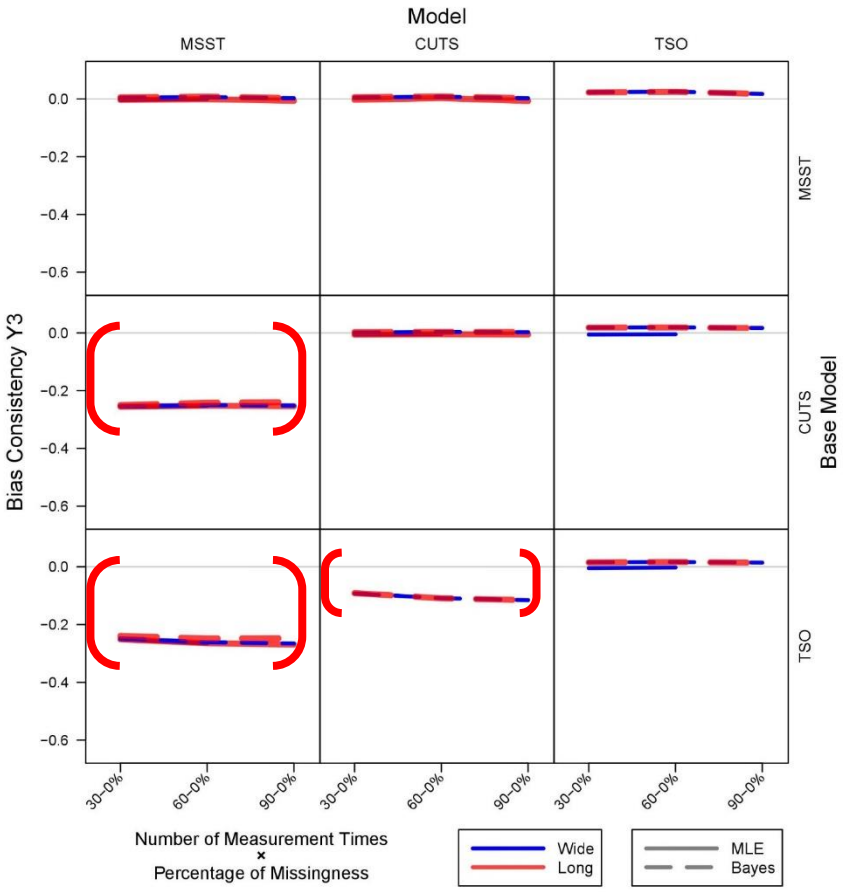

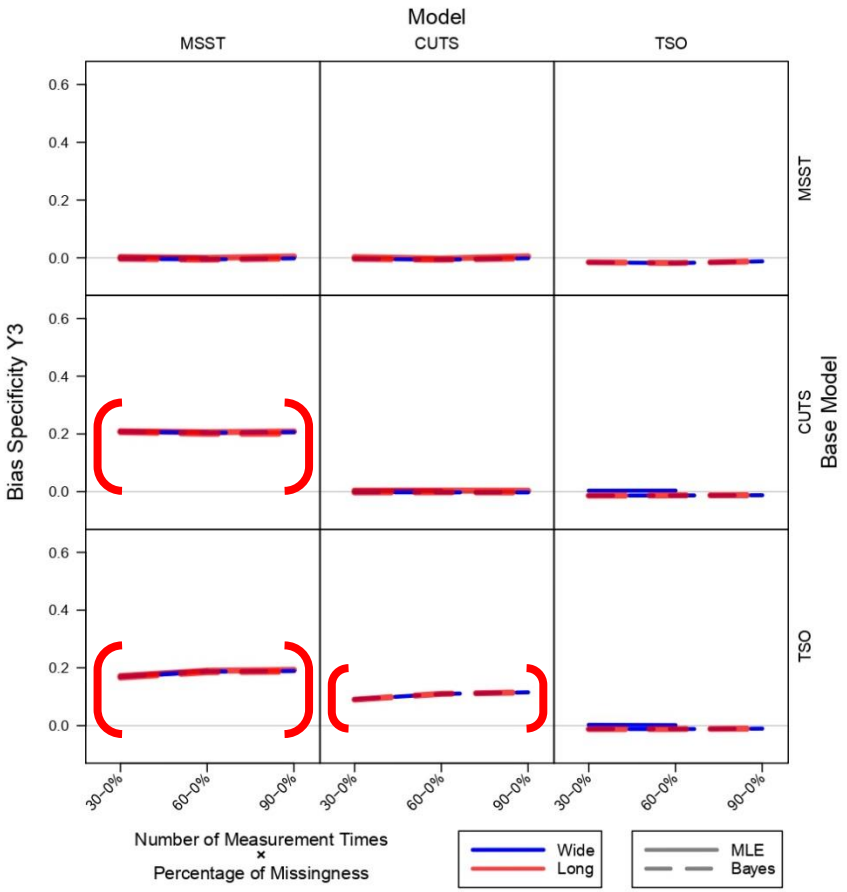

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Conclusions

If model converges, Multilevel LST = Single-level LST.

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Single-level LST is time consuming and can fail when the number of measurements increases.

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Conclusions

If model converges, Multilevel LST = Single-level LST.

Single-level LST is time consuming and can fail when the number of measurements increases.

The TSO seems robust and should be used to study states and traits in intensive longitudinal data.

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Conceptual Conclusions

ML-(V)AR with measurement error (Schuurman & Hamaker, 2018) ≈ TSO model with one indicator.

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ML-(V)AR with measurement error (Schuurman & Hamaker, 2018) ≈ TSO model with one indicator.

These models can be easily extended within the DSEM framework.

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Thank you