How to analyze a dynamic system of physiological and self-reported data (n=1)?

- 22 september 2017 -

H.G. van Lier

Tactus verslavingszorg

UNIVERSITY OF TWENTE.

When developing an just in time intervention you try to predict the future for a person.


First we need to
evaluate if this is
possible in a context.

Is there dependence between physiological and self-reported craving **over time**?

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(Dis)prove dependence between self-reported and physiological craving?

Is there dependence between physiological and self-reported craving **over time**?

Predict self-reported craving with physiological craving?

2 physiological
2 self-reported

Data

Questionnaire every 3 hours.

Variables

2 physiological:

- (mean) skin conductance (SC) level
- (total) amplitude

Variables

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- (mean) SC level
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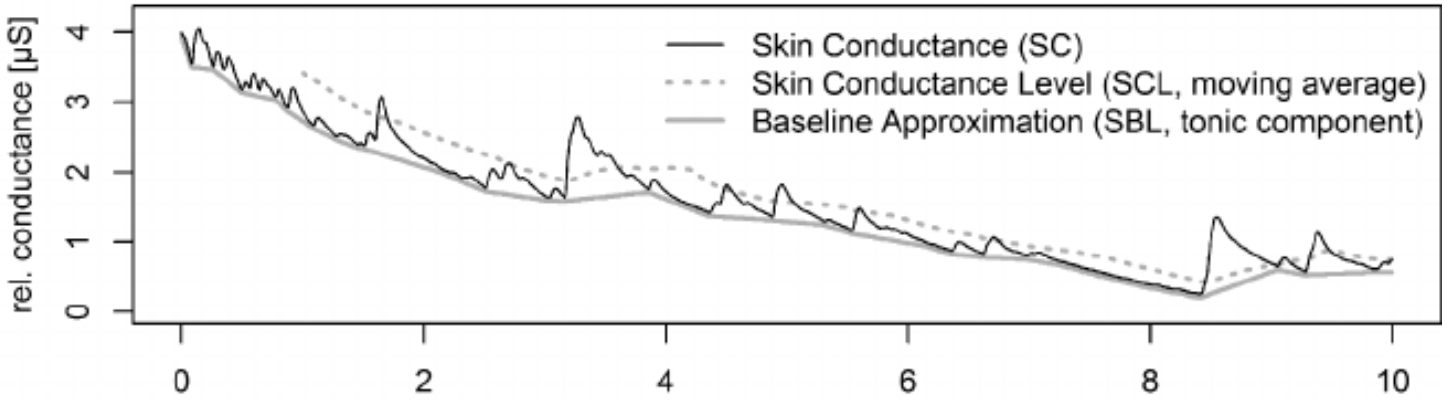
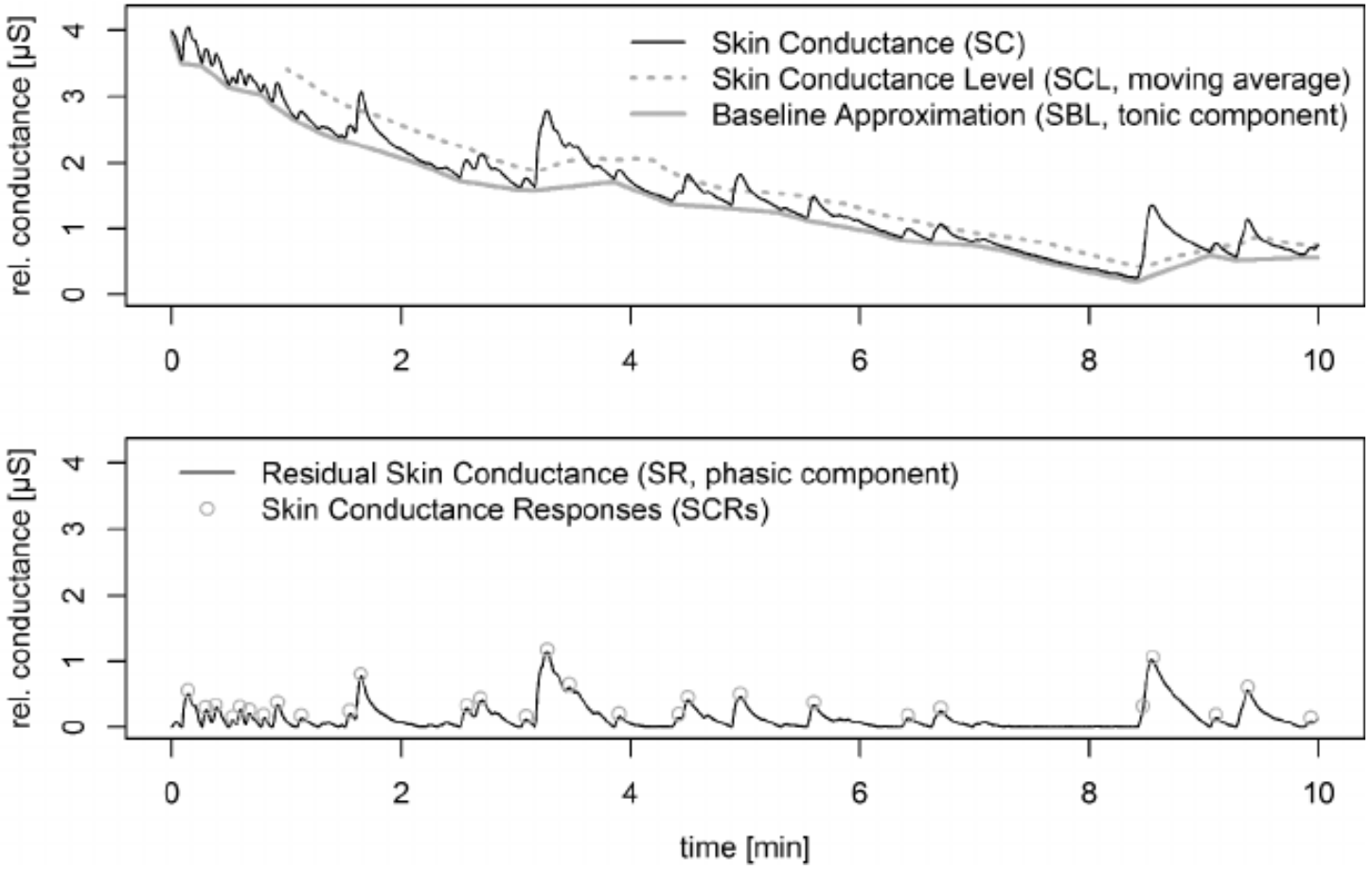


(Leiner, Fahr & Früh, 2012)

Variables

2 physiological:

- (mean) SC level
- (total) amplitude



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Variables

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- (mean) SC level
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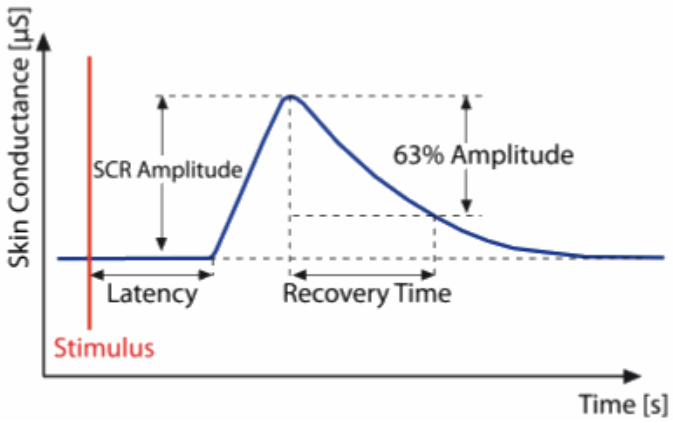

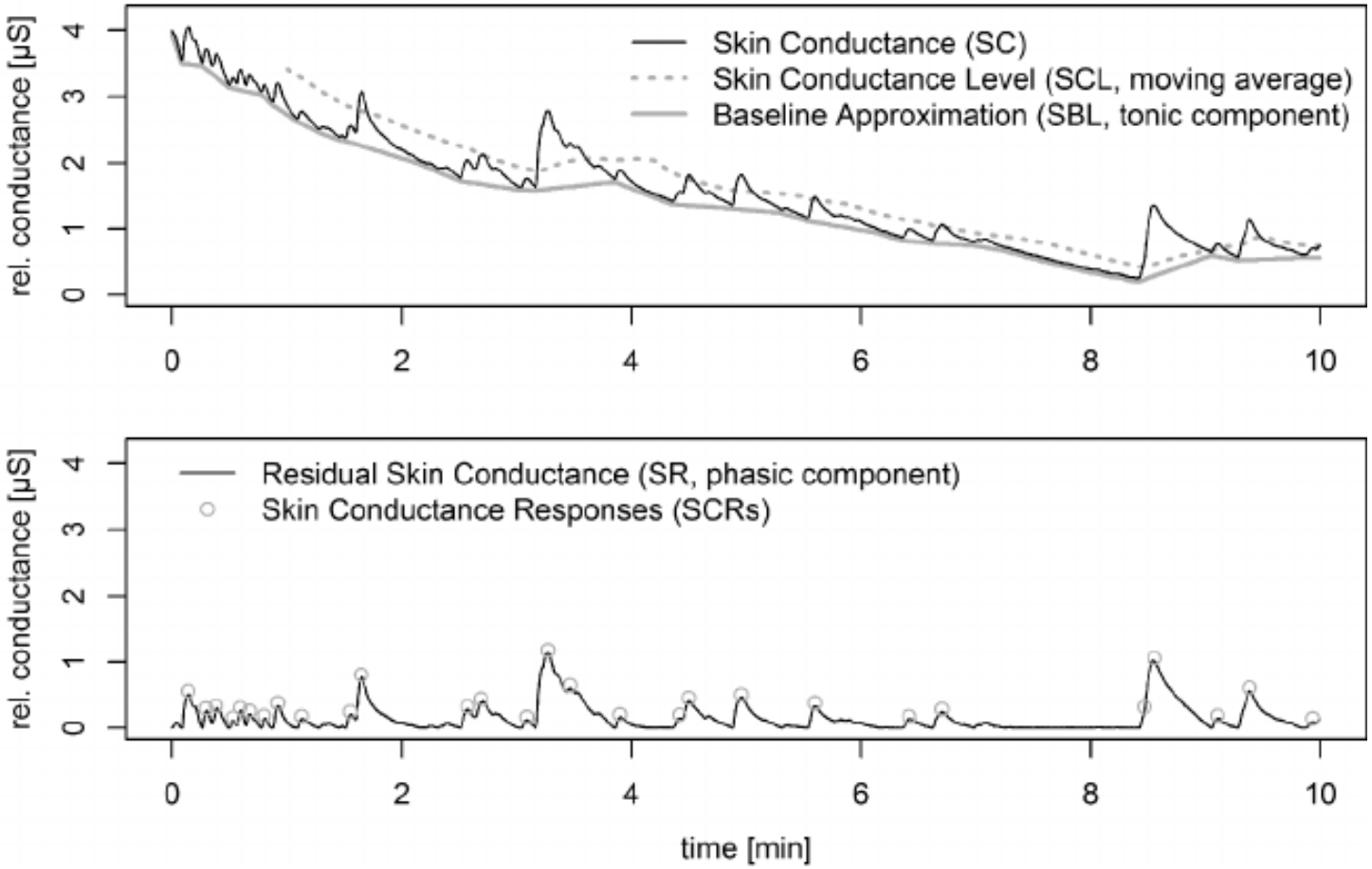

(Leiner, Fahr & Früh, 2012)

Variables

2 self-reported:

- craving
- coping

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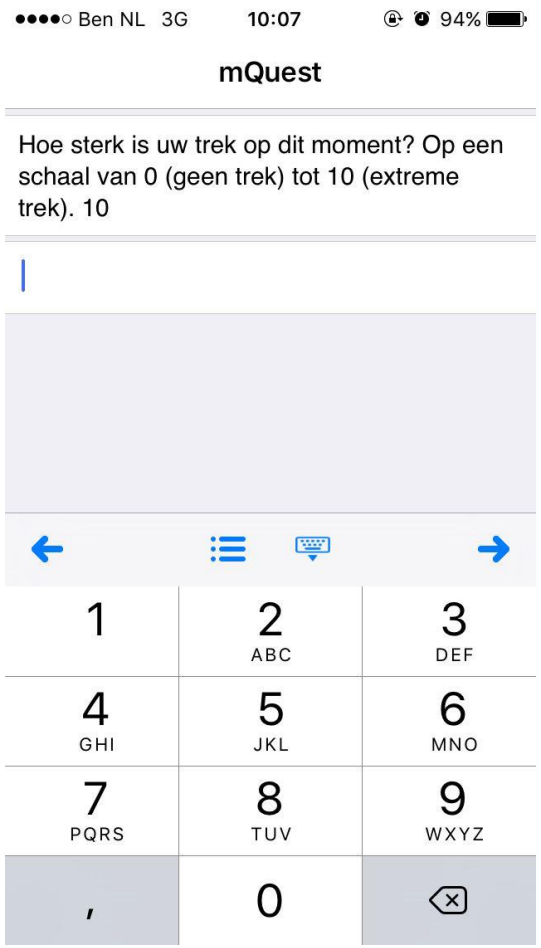


How strong is your craving currently? On a scale of 0 (no craving) to 10 (extreme craving).

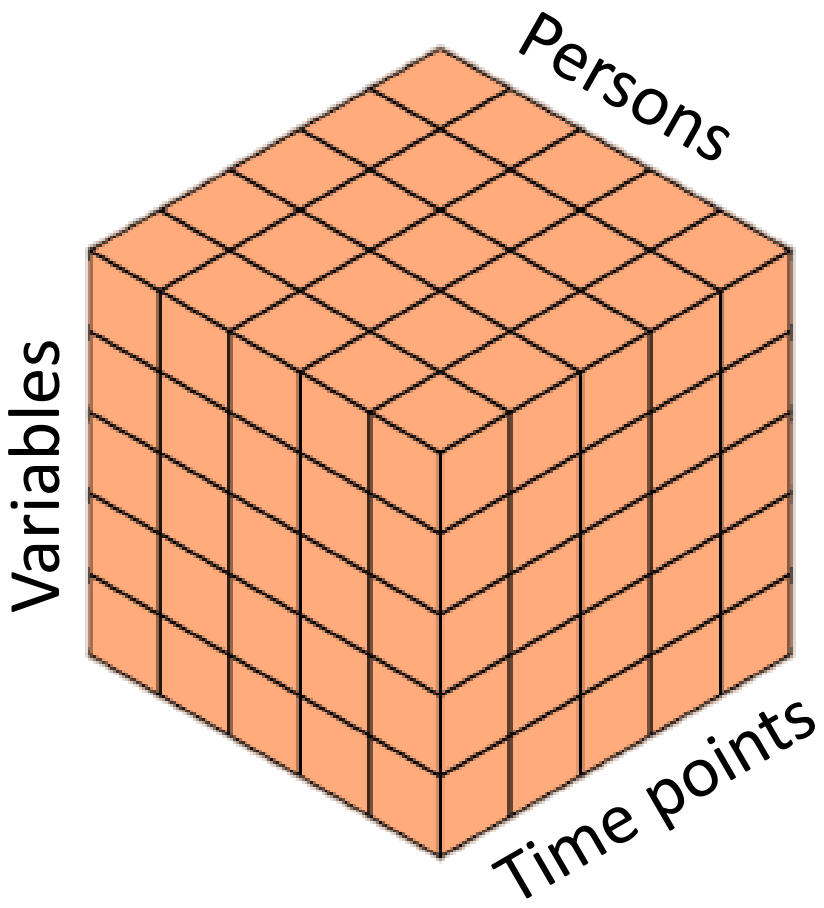
Variables

2 self-reported:

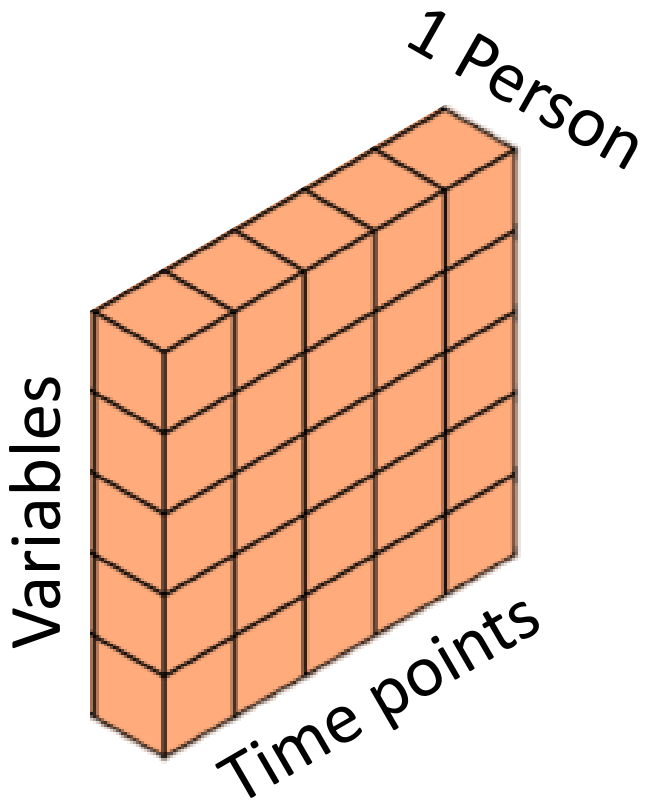
- craving
- coping

To what extent do you think you are able to resist your craving currently? On a scale of 0 (not resistible) to 10 (easy to resist).

Cattel's Data box (Cattel, 1952)



N=1



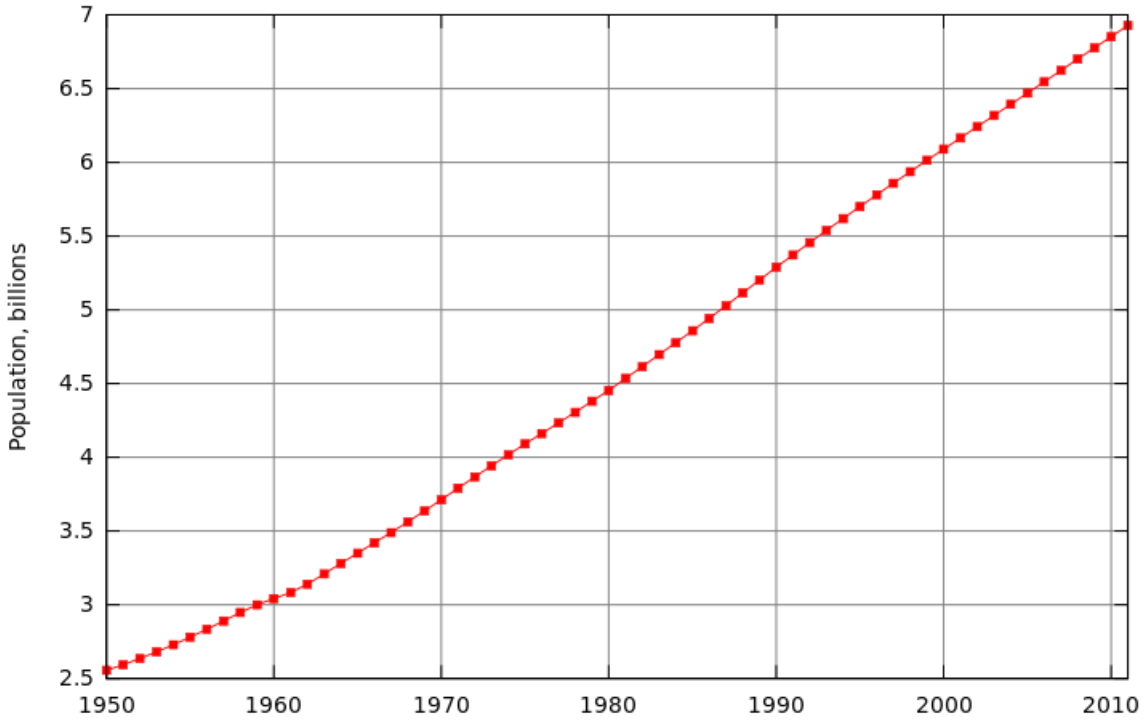
Dynamic system

Two or more variables measured over time.

Not one outcome and another explanatory variable, but a system of variables continuously influencing each other back and forth over time.

Longitudinal data:

- (Linear) trend



Longitudinal data:

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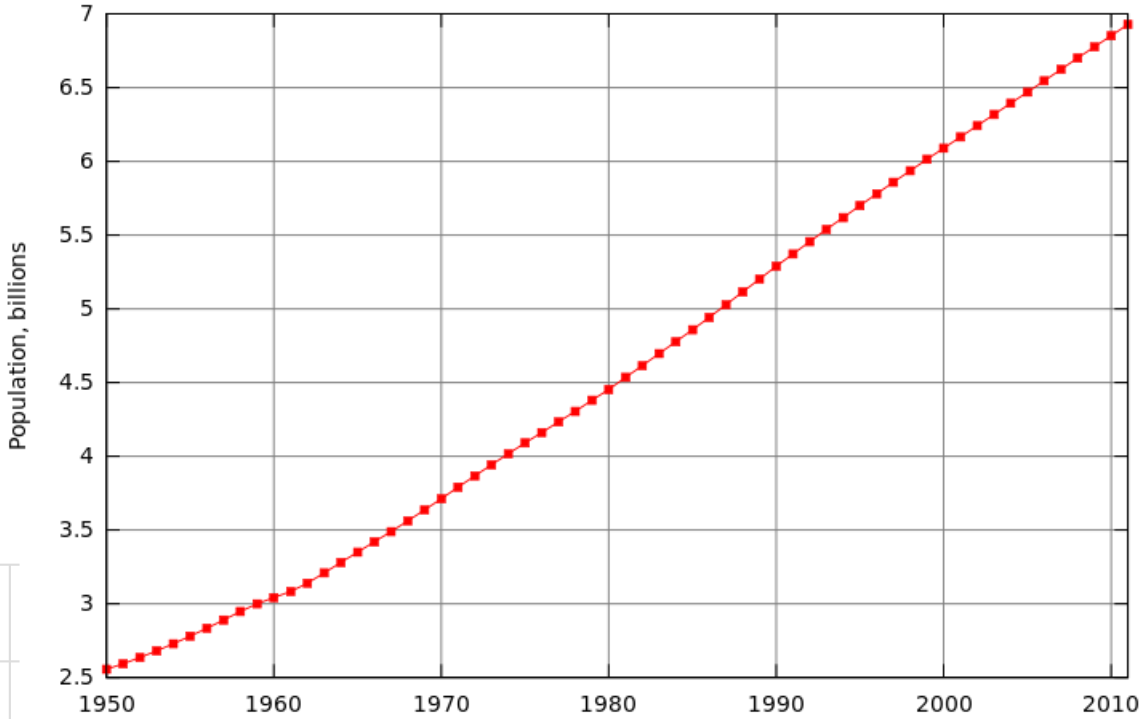

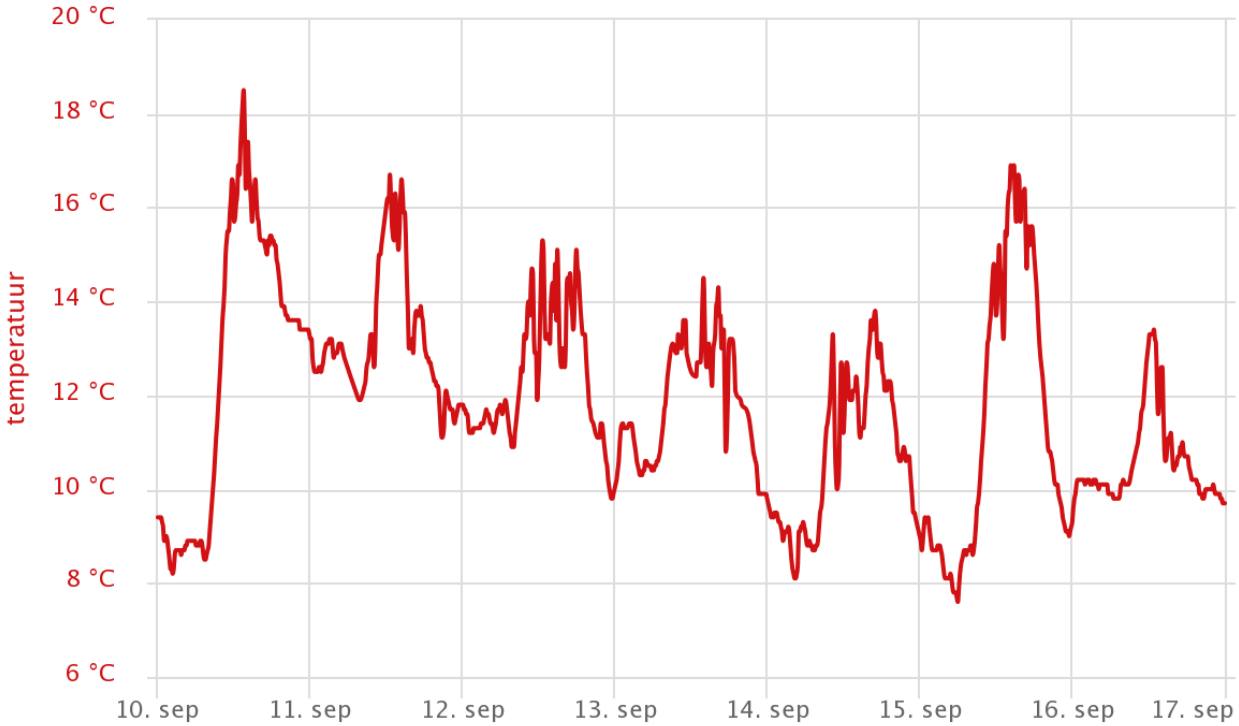

Time series data:

- Autocorrelation
- (Linear) Trend

Time series data

We want to study:

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- relationships between a variable and itself on prior time point: **autoregressive relations**

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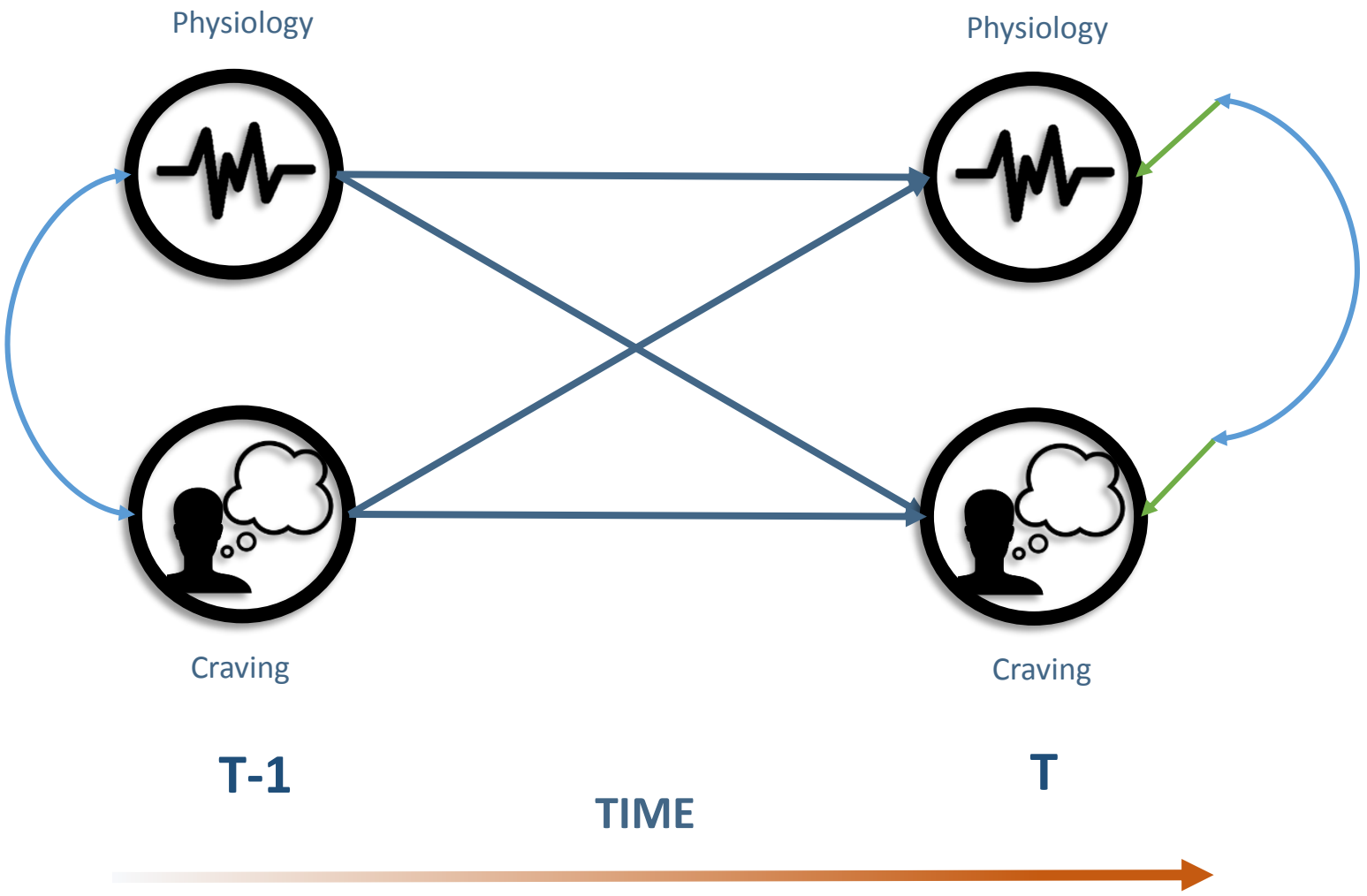
- relationships between a variable and itself on prior time point: **autoregressive relations**
- relationship between different variables on prior time point: **cross-lagged relations**

Vector Auto Regressive Model



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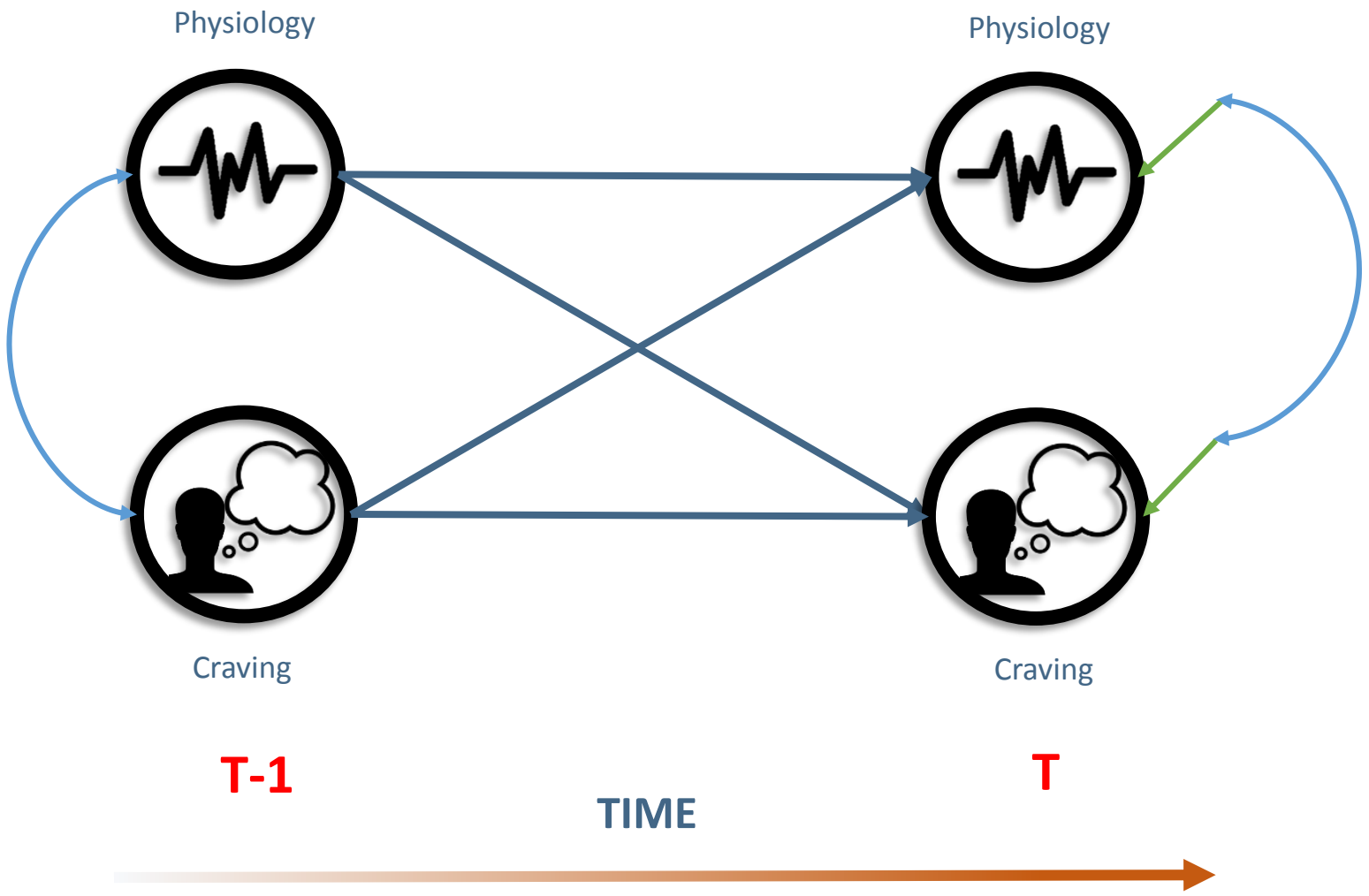

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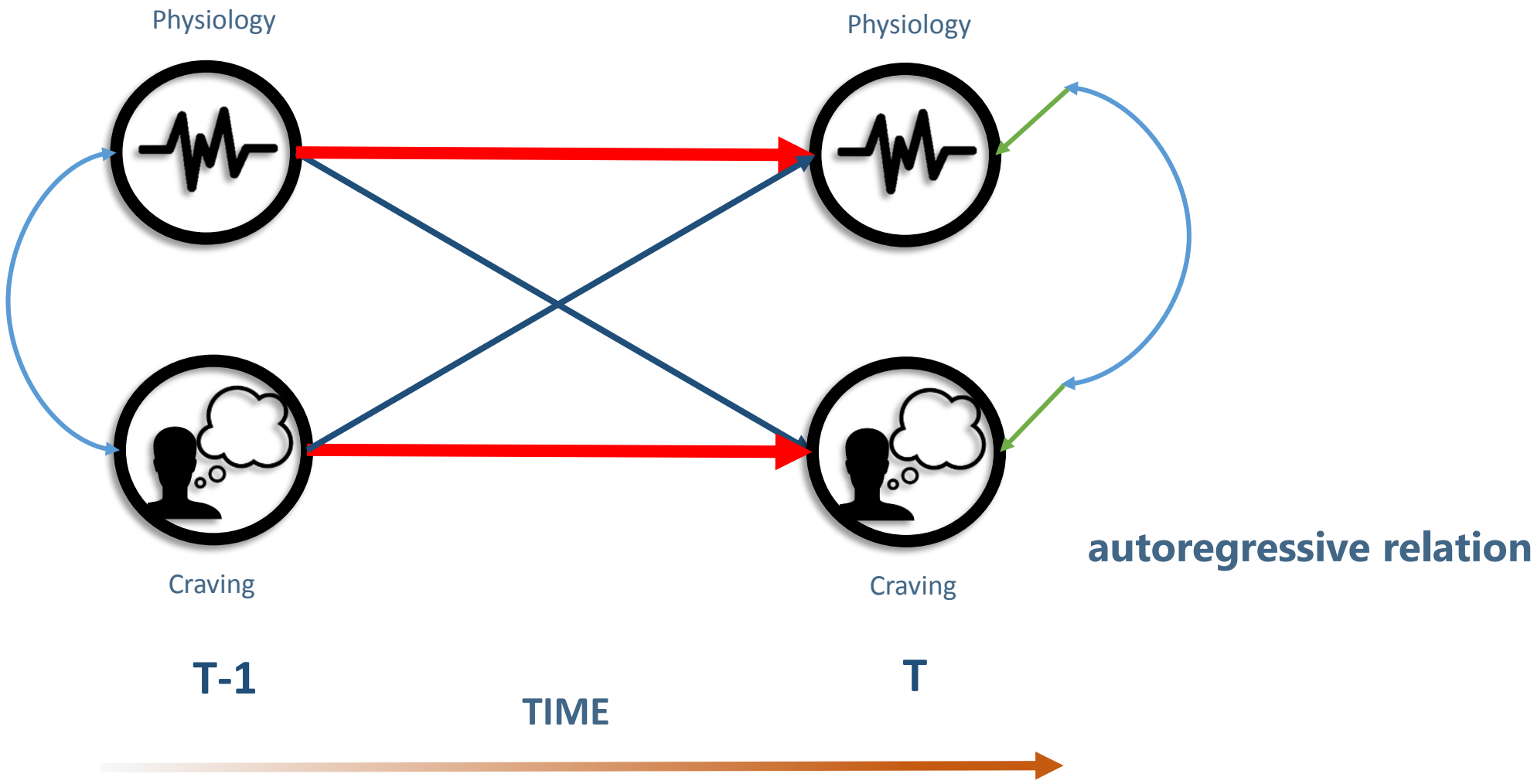

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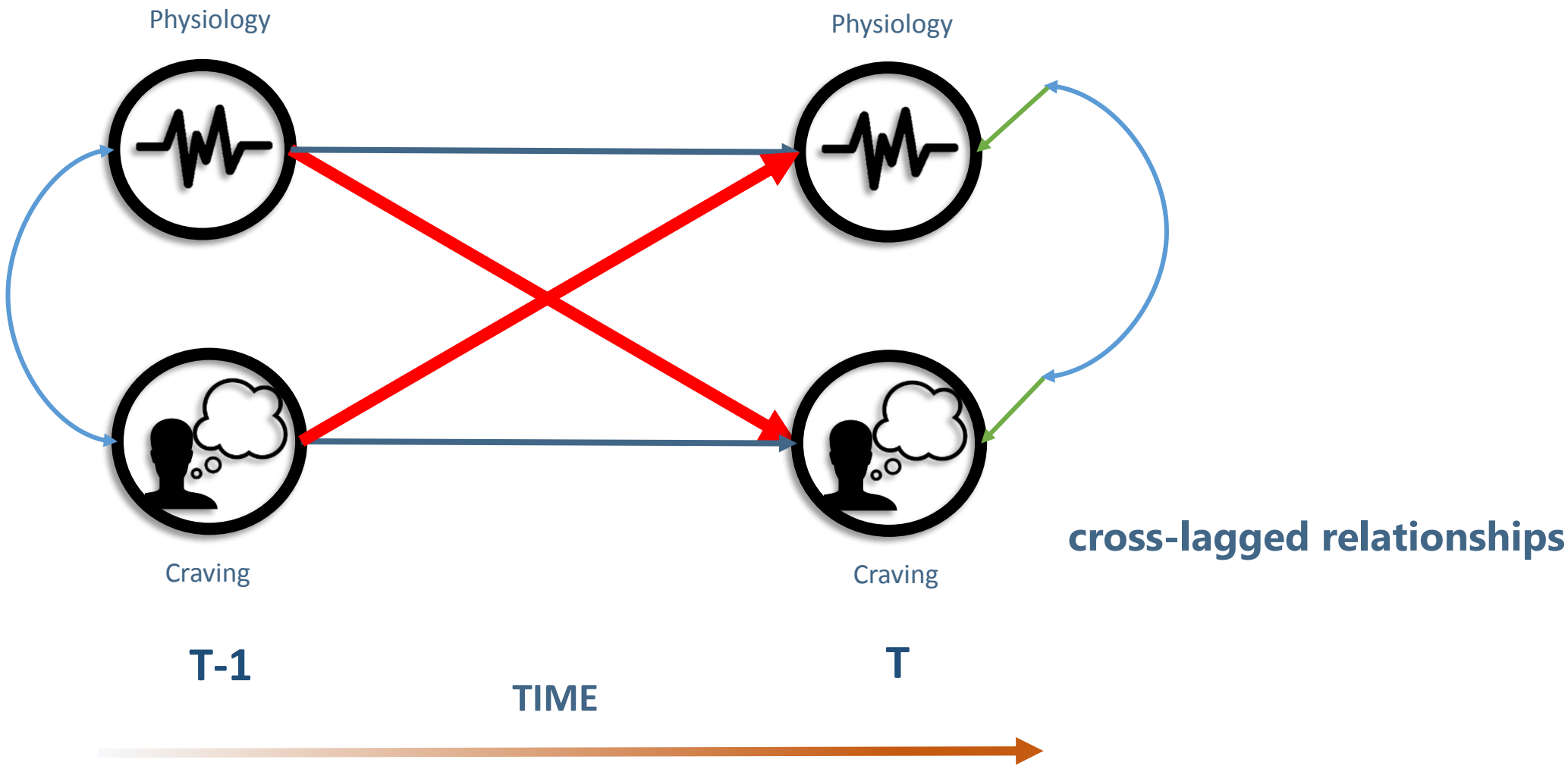

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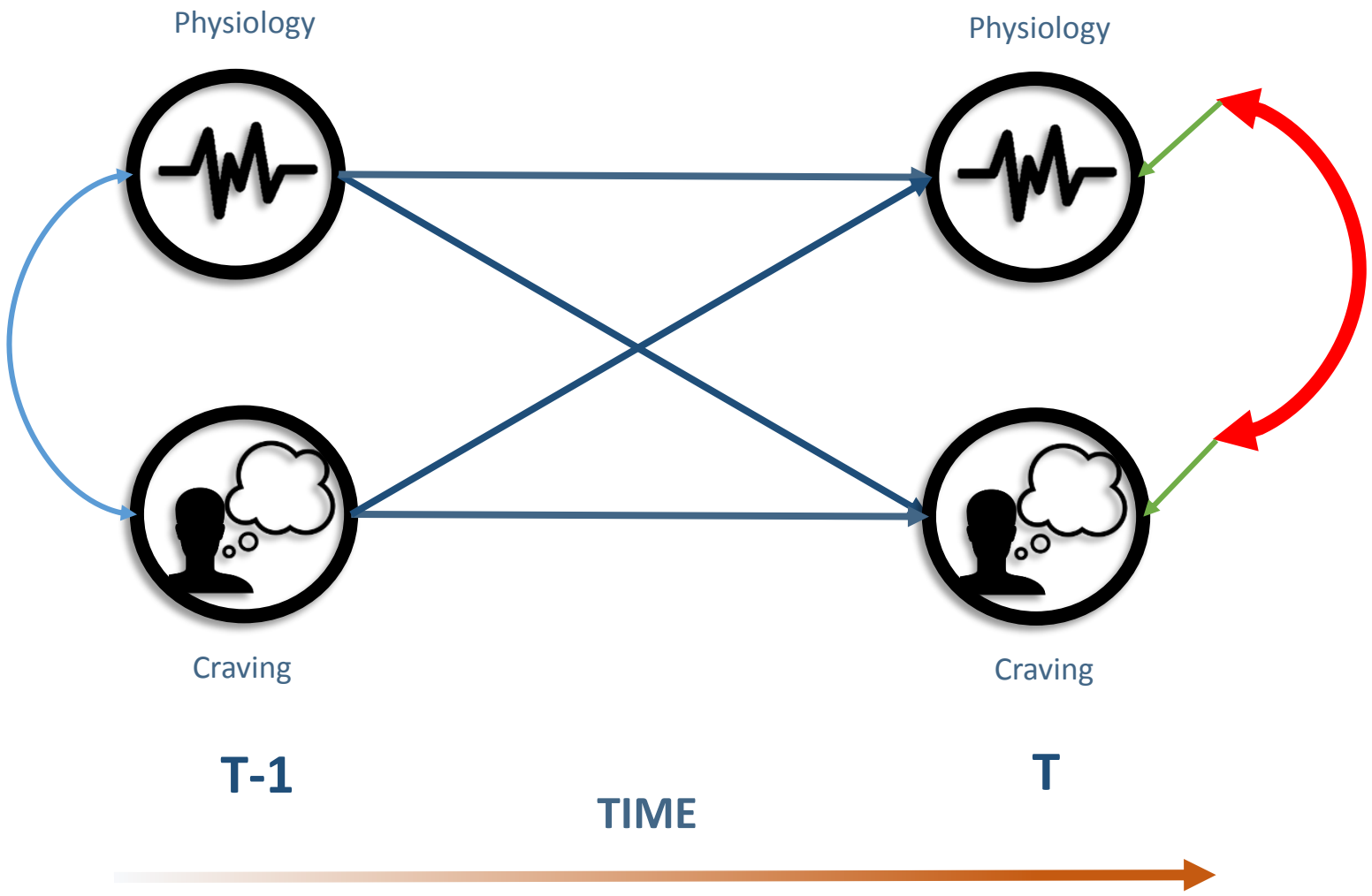

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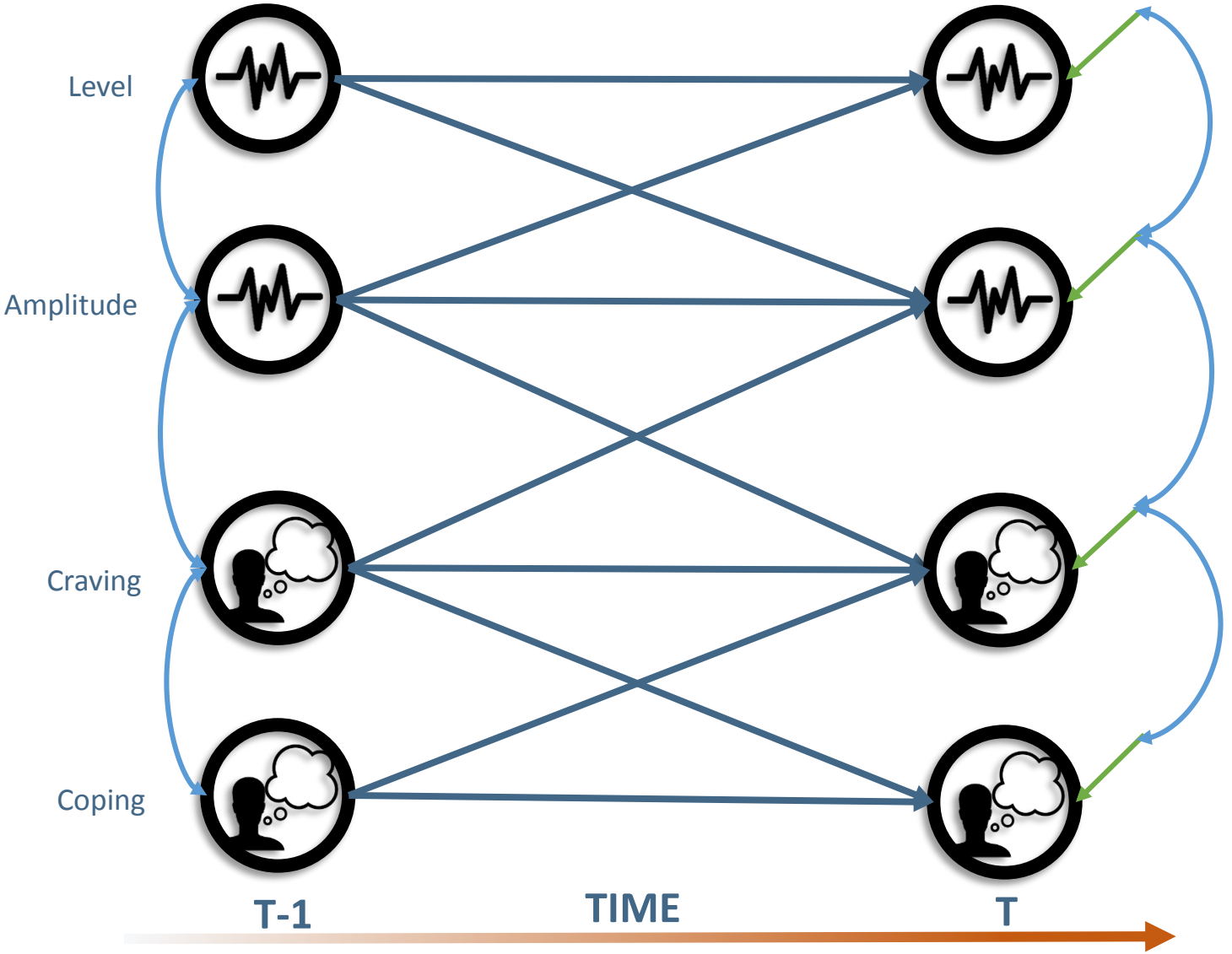

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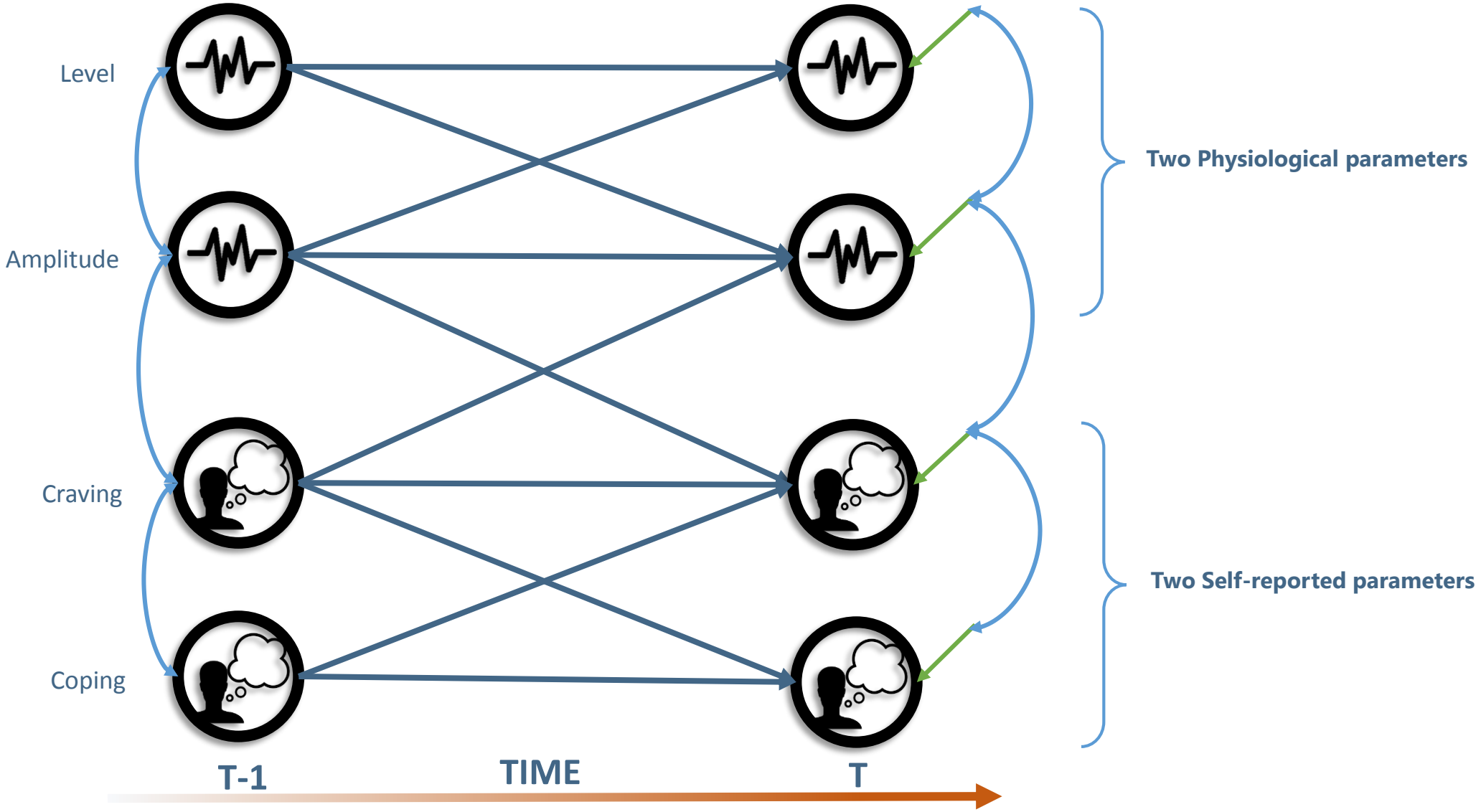

Time series data

Y
Y_1
Y_2
Y_3
Y_4
…
Y_T

Time series data

Y	**Y at lag 1**
Y_1	
Y_2	Y_1
Y_3	Y_2
Y_4	Y_3
…	…
Y_T	Y_{T-1}
	Y_T

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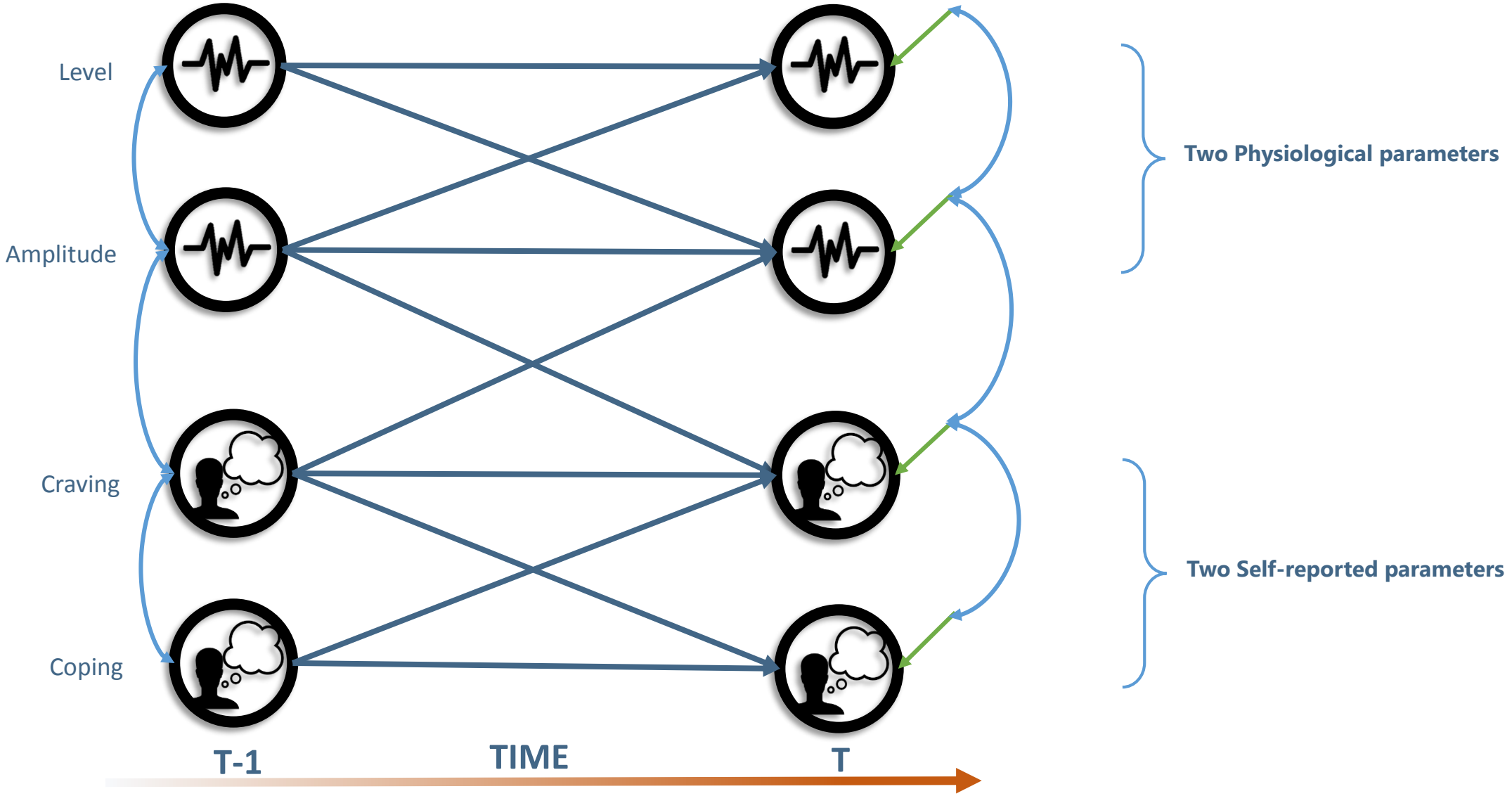
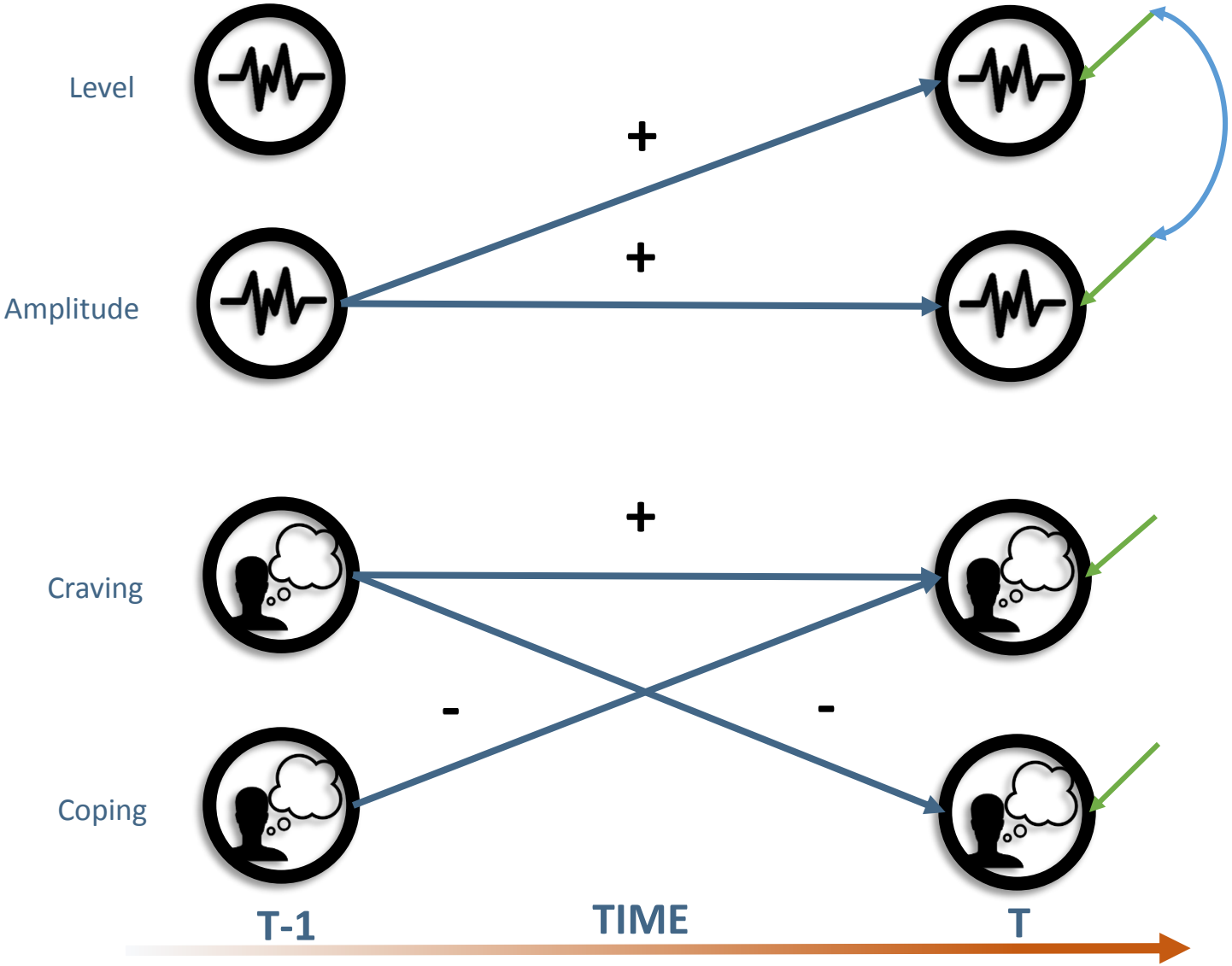
…	…
Y_T	Y_{T-1}
	Y_T

Vector Auto Regressive Model



Results



Conclusion

No dependence between physiology and self-reported craving over time for this person.

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Craving **predicts** coping 3 hours later

and

Coping **predicts** craving 3 hours later

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Total amplitude **predicts** mean SC level 3 hours later

Wrap Up..

If you want to **predict the future for a person**, it is advisable to use a VAR model (instead of linear regression) to evaluate the dependence between physiological and self-reported measures.

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If you want to **predict the future for a person**, it is advisable to use a VAR model (instead of linear regression) to evaluate the dependence between physiological and self-reported measures.

Added benefit: You don’t need to identify an outcome and an explanatory variable, but can analyze a system of variables continuously influencing each other back and forth over time.

Future research

- Amount of measurements needed to determine an individualized just in time intervention strategy?

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- Does a similar non-dependence between the physiological and self-reported parameters exist in other persons as well?

Future research

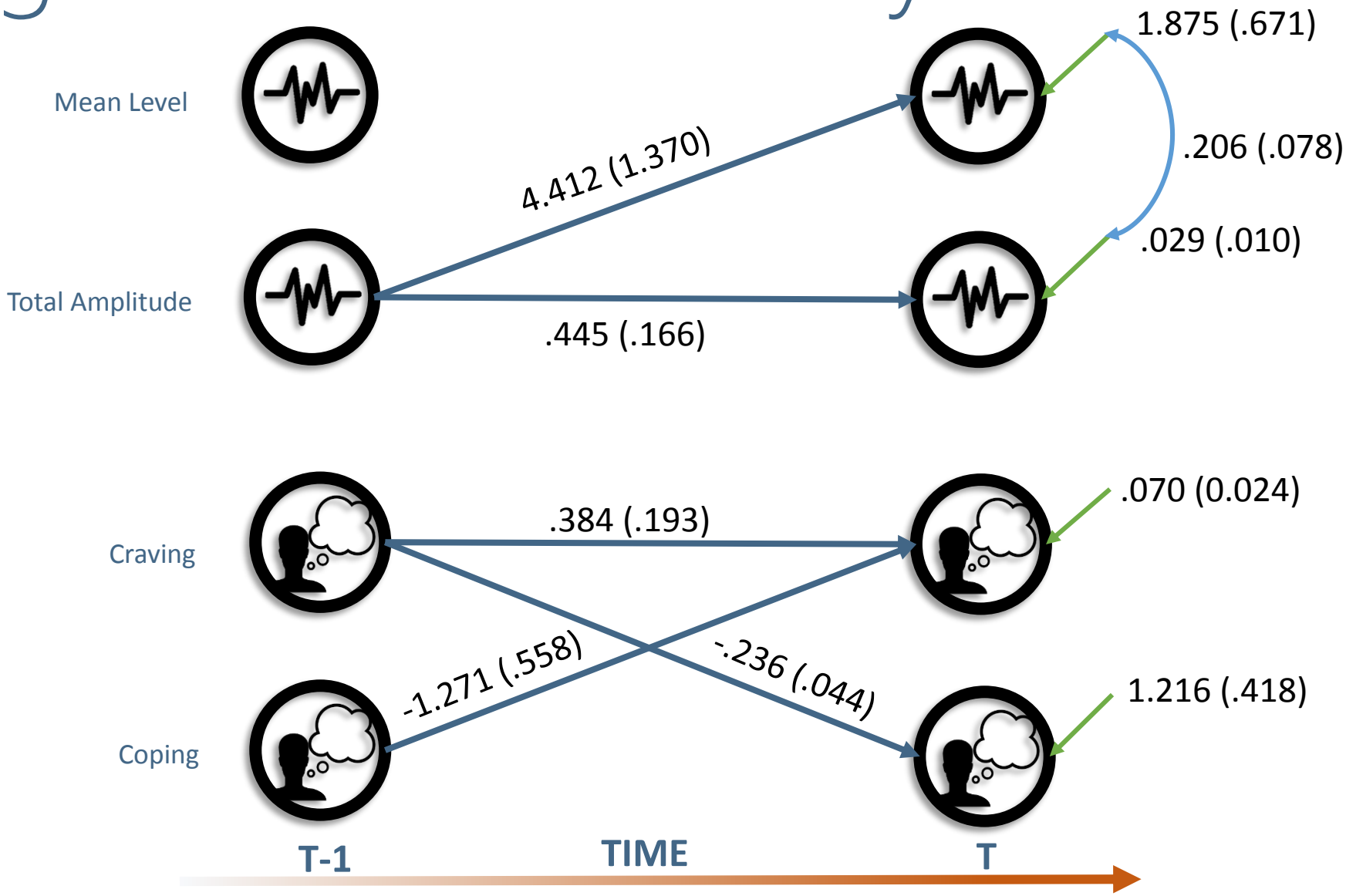
- Amount of measurements needed to determine an individualized just in time intervention strategy?
- Other physiological parameters might predict craving?
- Does a similar non-dependence between the physiological and self-reported parameters exist in other persons as well?
- Physiology might predict relapse?

Questions?

H.G. van Lier

h.g.vanlier@utwente.nl

Significant results only



MPLUS CODE

TITLE:
Physiology vs self-reported data;

DATA:
FILE IS y.dat;

VARIABLE:
NAMES ARE Crave Crave1 Coping Coping1 Amp Amp1 Level Level1;

USEVARIABLE ARE Crave Crave1 Coping Coping1 Amp Amp1 Level Level1;

MISSING ARE ALL (999);

OUTPUT:
TECH1 MODINDICES;

MODEL:
Crave ON Crave1;
Crave ON Coping1;
Crave ON Amp1;

Coping ON Coping1;
Coping ON Crave1;

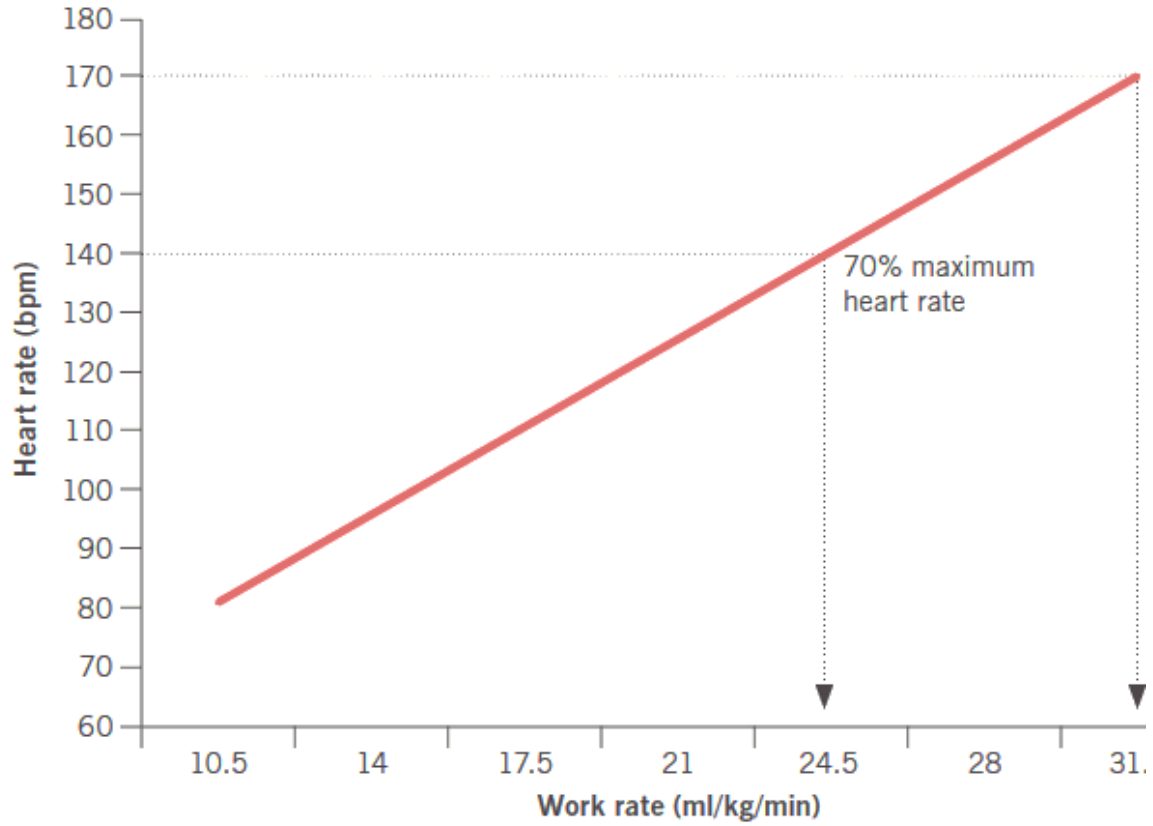
Amp ON Amp1;
Amp ON Crave1;
Amp ON Level1;

Level ON Level1;
Level ON Amp1;

Amp WITH Crave;
Crave WITH Coping;
Level WITH Amp ;

Normal regression

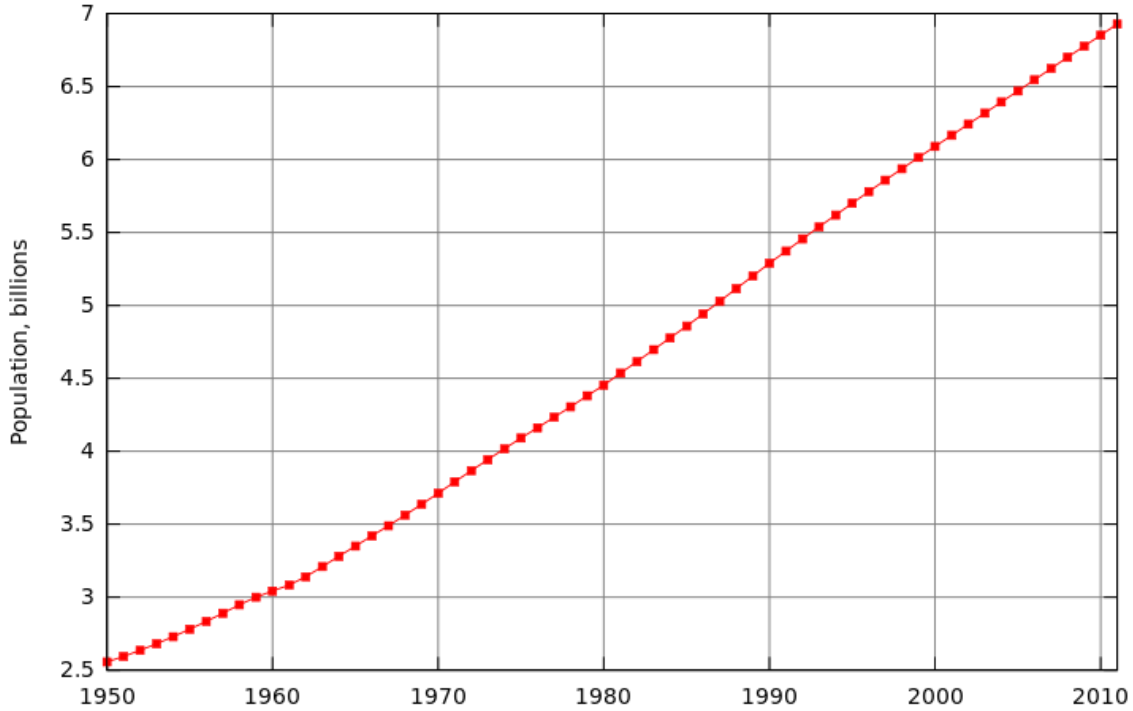
$$y = \beta_1 x_1 + \epsilon$$



Linear trend

$$y = \beta_1 x_1 + \epsilon$$

$$y_t = \beta_t t + \epsilon$$



Auto correlation

$$y = \beta_1 x_1 + \epsilon$$

$$y_t = \beta_t t + \epsilon$$

$$y_t = \beta_{t-1} y_{t-1} + \epsilon$$