

# SEM, interrupted

## A cautionary note on derived metrics as mediators

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@McCormickNeuro

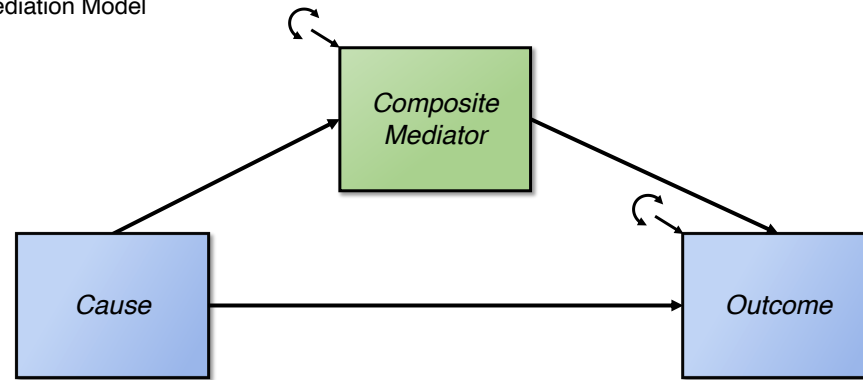


<https://mccormickneuro.github.io/>

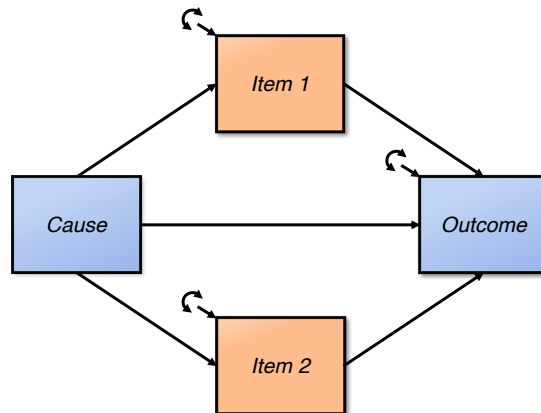
# Take Home Message

Mediation attempts to model the causal flow between some *Cause* and *Outcome* through an intervening (or mediating) variable. When the mediator is a composite, however, different items might support different parts of the mediation, leading to an “interrupted” causal structure. We can better diagnose these issues with a SEM framework.

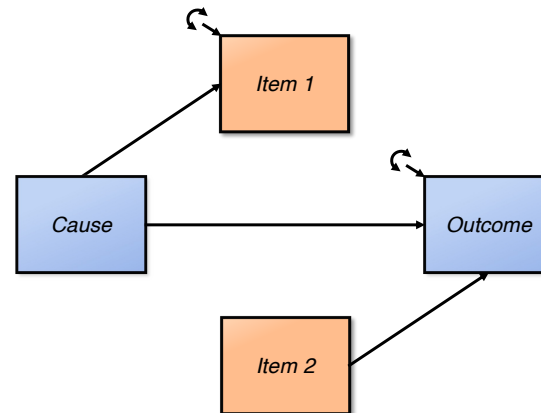
A. Classic Mediation Model



B. Implicit Mediation Assumption



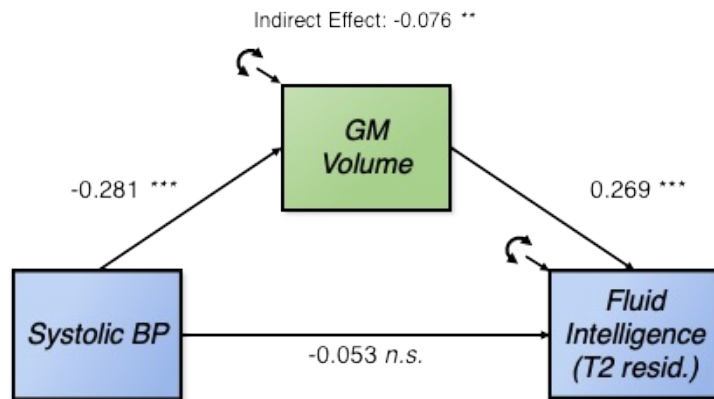
C. Potential “Interrupted Mediation” Alternative



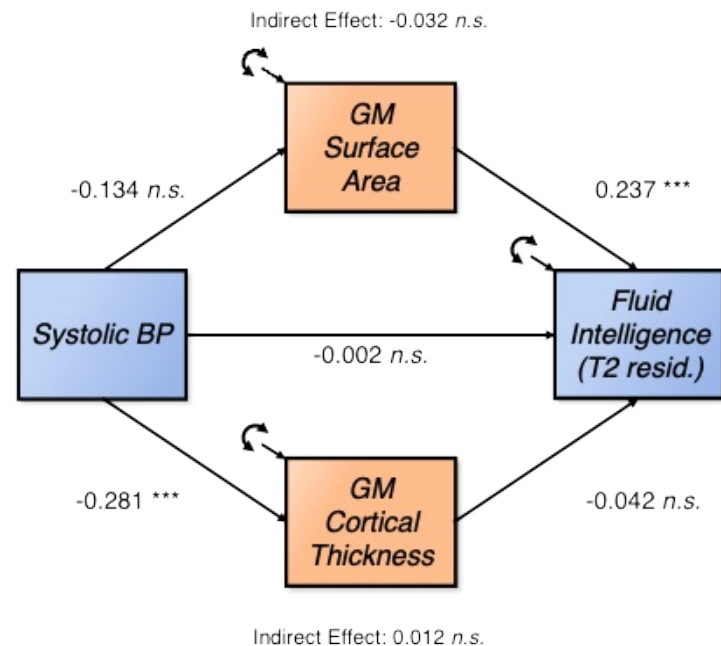
# A New(-er) Challenge for Mediation

- Prior work has focused on causal inferences issues for mediation models in cross-sectional data<sup>1</sup>
  - We show that when individual items in composites have different causal mechanisms, spurious mediation can occur

A. Grey Matter Volume (Composite) Model



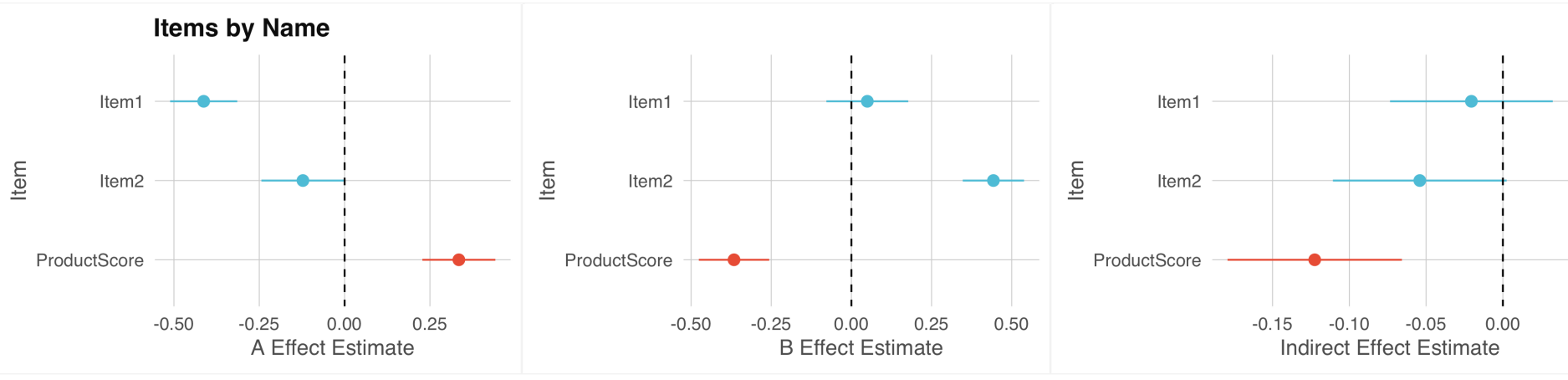
B. Simultaneous Model for Surface Area and Thickness



# Diagnosing Item-Level Behavior

- One simple solution is to assess the mediating effects of the items in a composite

## Distribution of Mediation Effects

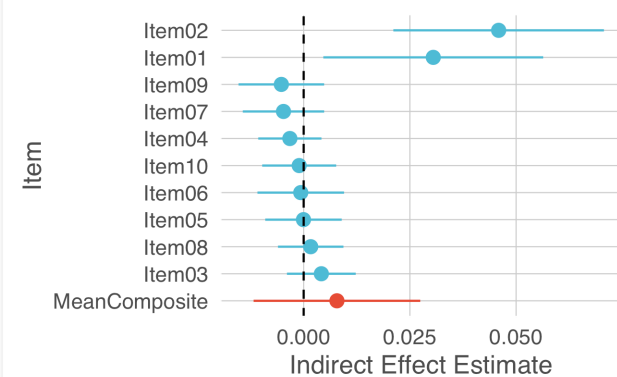
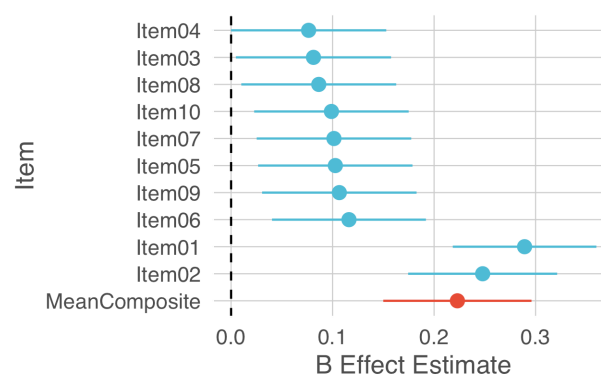
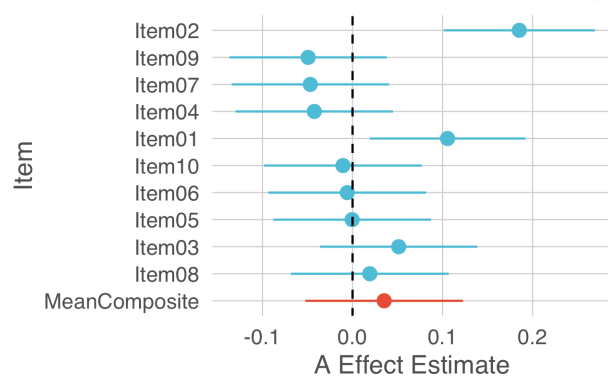


# Diagnosing Item-Level Behavior

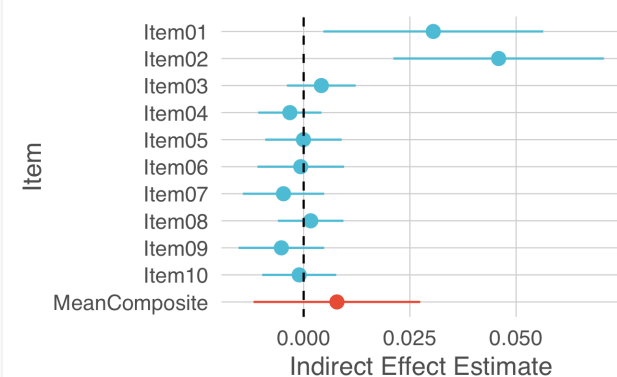
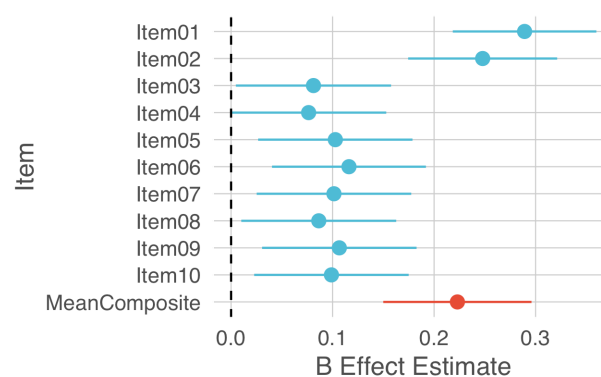
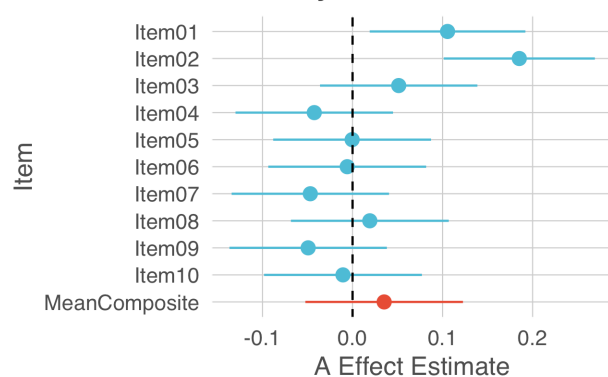
- We also show that composites might suppress item-level mediation effects when only a few items (Item01 and 02) mediate the effect

## Distribution of Mediation Effects

Items by Effect Discrepancy

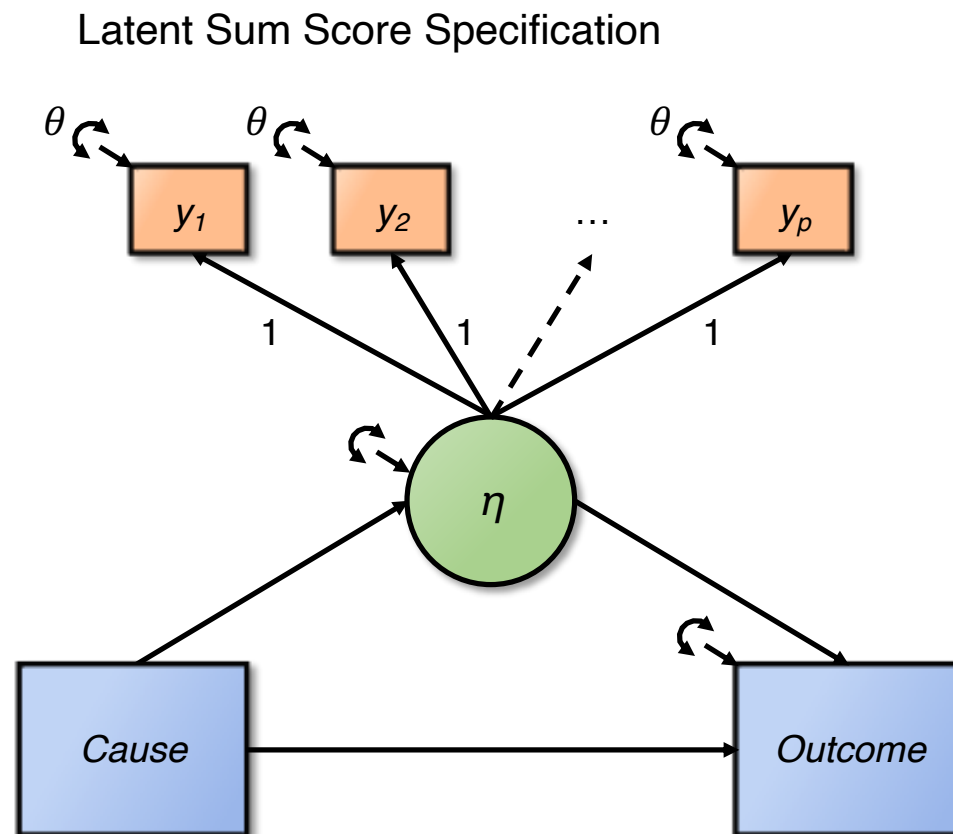


Items by Name



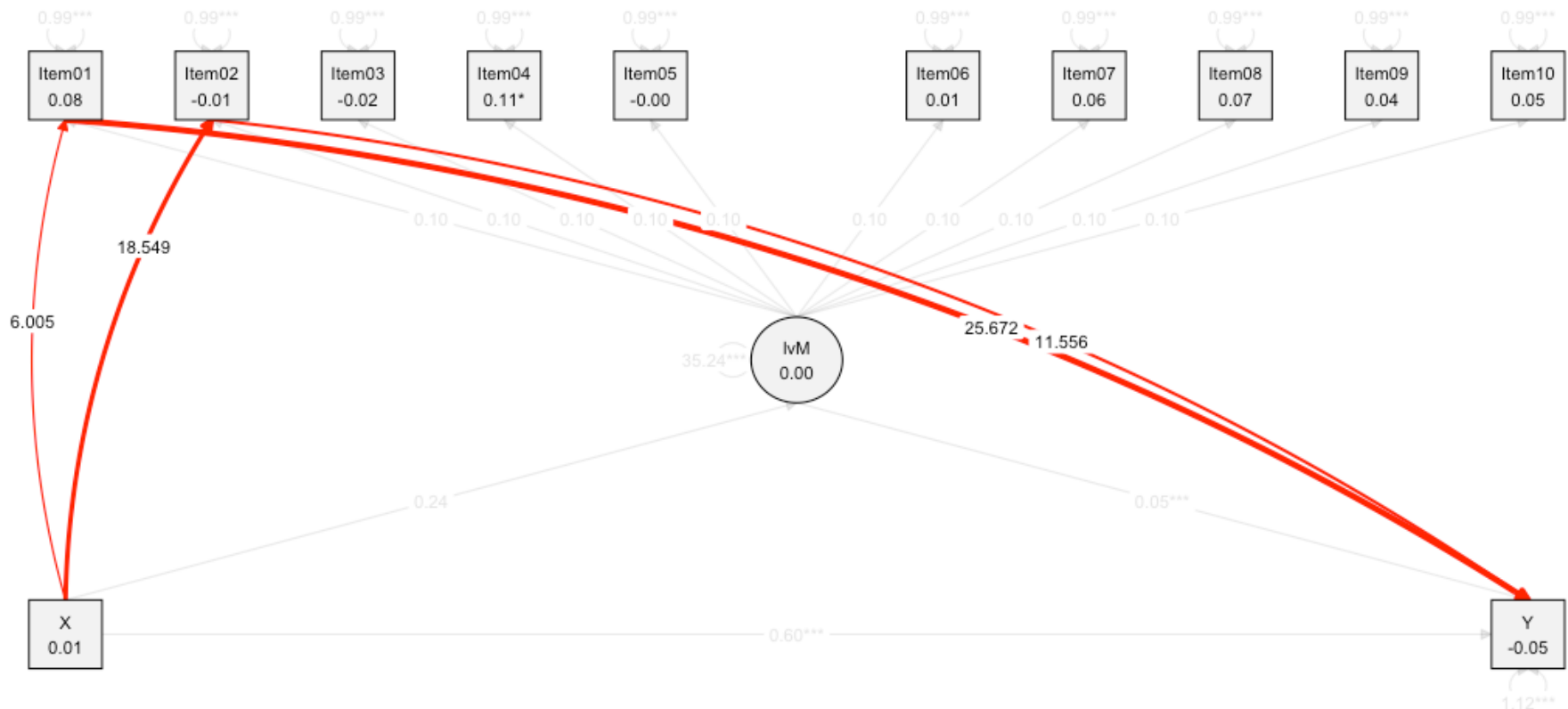
# Advanced Mediation Models

- We can include both the items and the composite in the same model using a latent variable SEM model.



## Advanced Mediation Models

- We can include both the items and the composite in the same model using a latent variable SEM model.
  - Model fit indices can identify a poorly specified mediation, modification indices can identify omitted mediation paths (below in red)



# New Tools for Mediation Analysis & Diagnostics

## SEM, interrupted



Upload Data

Analysis Options

Individual Item Mediation

Latent Variable Mediation

Latent Variable Diagnostics

Download Outputs

### Choose CSV File

Browse...

example02-10items.csv

Upload complete

### Analysis Nickname (Optional)

### User Data

ID	X	Y	Item01	Item02	Item03	Item04	Item05	Item06	Item07	Item08	Item09	Item10
1	0.31	-1.23	-1.77	2.21	-0.91	-0.35	-1.13	-1.49	-1.16	0.56	-1.29	0.23
2	-0.61	-0.09	1.05	-0.22	1.10	-0.58	0.25	0.24	0.87	0.66	-0.01	-1.11
3	1.02	1.13	1.54	-1.54	0.27	-0.06	-1.01	0.40	-1.53	-0.45	-1.06	0.63
4	0.01	-1.00	-0.17	0.73	-0.32	0.59	0.55	-1.45	0.02	0.50	0.67	0.49
5	0.54	-0.25	-2.61	-0.31	-0.21	0.17	0.02	-1.29	-0.51	-2.05	-0.10	-0.01
6	1.18	0.77	-0.87	1.38	1.09	0.49	1.63	0.12	-0.53	1.64	0.79	2.69

### ID Variable:

ID

Number of Subjects: 500

### X Variable:

X

### Y Variable:

### Type of Mediator Composite

Mean Score

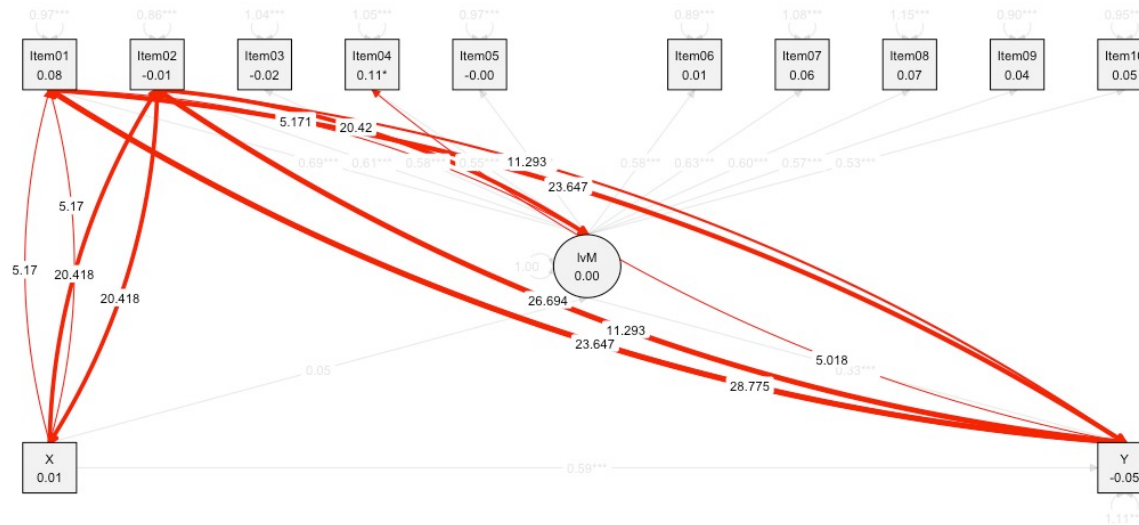
### Custom Mediator Name (Optional)



# New Tools for Mediation Analysis & Diagnostics

## Full Latent Variable Model Modification Indices

Note: Modification indices indicate the predicted improvement in model fit if a path was included in the model. When selecting "All", the displayed paths may violate the reasonable causal structure of the model. When selecting "Potential Item-Level Mediators", only paths which point in the "proper" (i.e.,  $X \rightarrow M \rightarrow Y$ ) direction are shown. While the table includes all potential MIs, the paths displayed here are restricted to those with values  $> 5.00$ .



### Filter MIs

☐ Potential Item-level Mediations ☒ All

Show 10 entries

Search:

	Parameter	MI	EPC
	All	All	All
1	Item01 ~ Y	28.775	0.215
2	Item02 ~ Y	26.694	0.192
3	Item01 ~~ Y	23.647	0.247
4	Y ~ Item01	23.647	0.254
5	lvM ~ Item02	20.42	-4.736
6	Item02 ~ X	20.418	0.202
7	X ~ Item02	20.418	0.231
8	Item02 ~~ Y	11.293	0.159
9	Y ~ Item02	11.293	0.185
10	lvM ~ Item01	5.171	-2.258

Showing 1 to 10 of 195 entries

Previous 1 2 3 4 5 ... 20 Next

# Acknowledgements

## Co-Authors

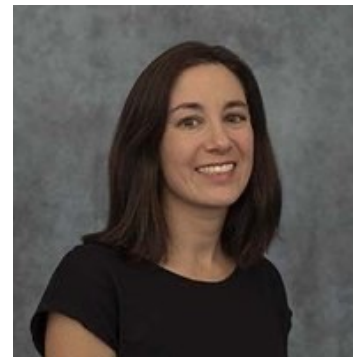
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- Mijka Rhemtulla
- Rogier Kiviet



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