Trajectories

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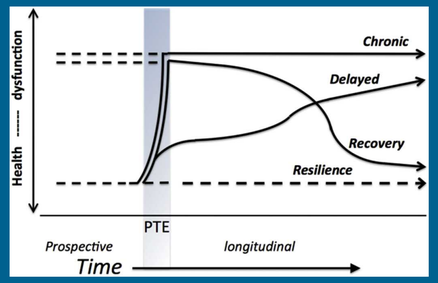
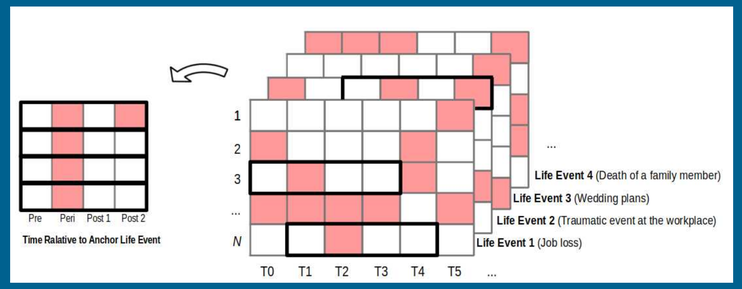
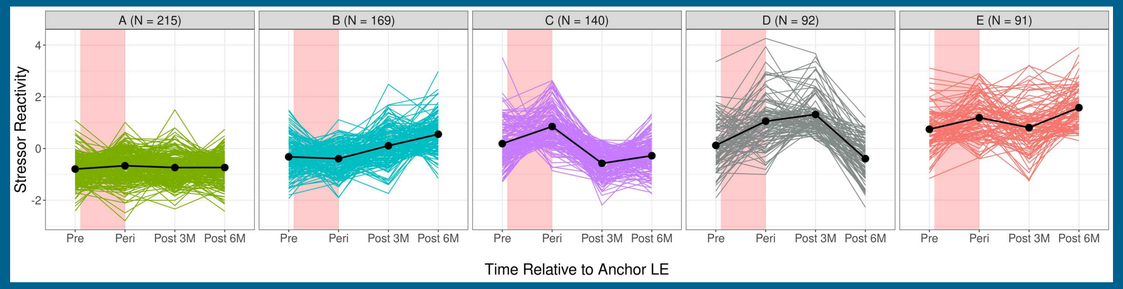


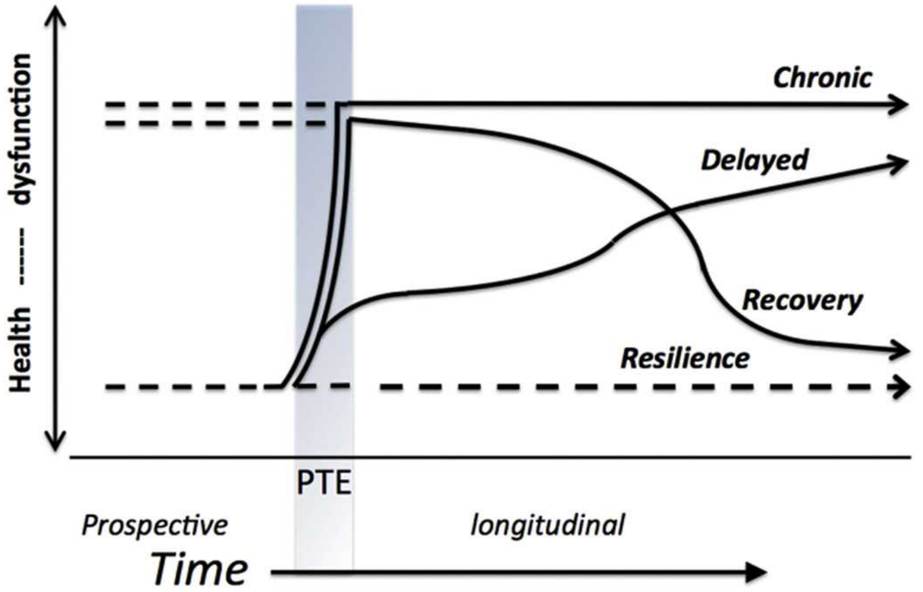




Resilience

Resilience: Maintenance or quick recovery of mental health during or after stressor exposure.[1, 2, 3]

Figure 1
Commonly observed longitudinal trajectories of response to potential trauma.



Note. Sourced from Galatzer-Levy et al. (2018).[4, 5]

[1] Kalisch, R., Müller, M. B., & Tüscher, O. (2015). A conceptual framework for the neurobiological study of resilience. *Behavioral and brain sciences,* 38, e92.

[2] Luthar, S. S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: A critical evaluation and guidelines for future work. *Child development*, 71(3), 543-562.

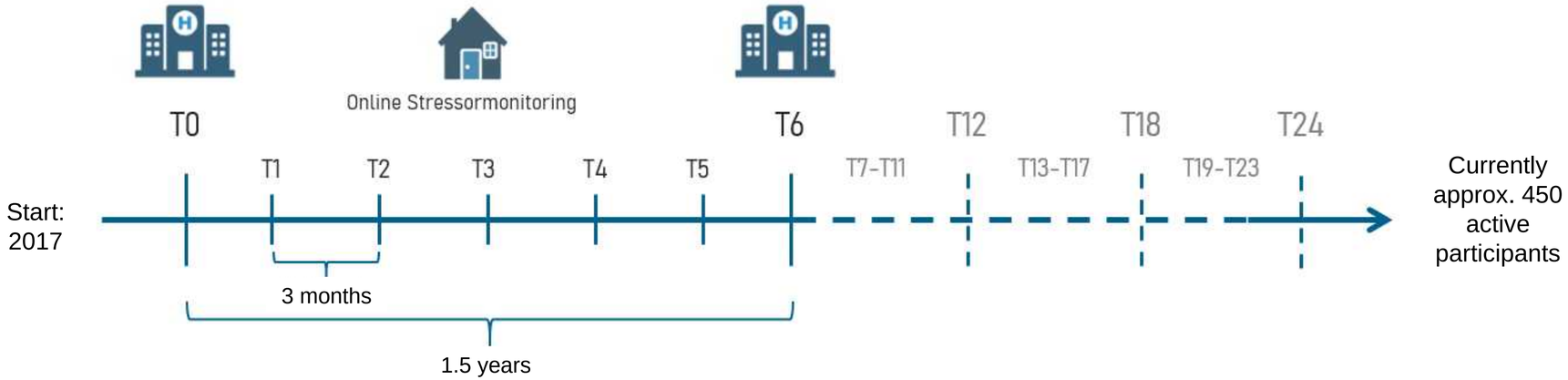
[3] Masten, A. S. (2001). Ordinary magic: Resilience processes in development. American psychologist, 56(3), 227.

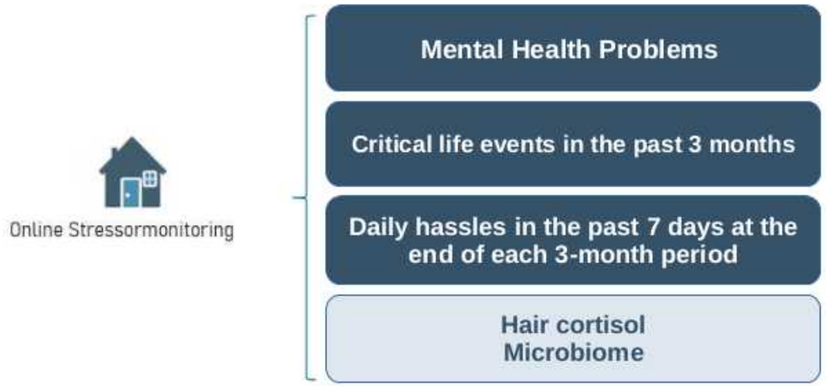
[4] Bonanno, G. A., Westphal, M., & Mancini, A. D. (2011). Resilience to loss and potential trauma. *Annual review of clinical psychology,* 7(1), 511-535.

[5] Galatzer-Levy, I. R., Huang, S. H., & Bonanno, G. A. (2018). Trajectories of resilience and dysfunction following potential trauma: A review and statistical evaluation. *Clinical psychology review*, 63, 41-55.

LORA - LOngitudinal Resilience Assessment[1]

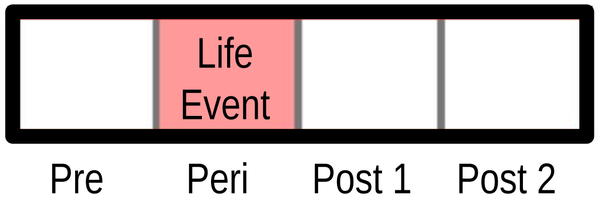
N = 1.191,
Initially healthy participants,
Sex: 35% male, 65% female,
Age: *M* = 28.59, *SD* = 7.96





[1] Chmitorz, A., Neumann, R. J., Kollmann, B., Ahrens, K. F., Öhlschläger, S., Goldbach, N., ... & Reif, A. (2021). Longitudinal determination of resilience in humans to identify mechanisms of resilience to modern-life stressors: the longitudinal resilience assessment (LORA) study. *European archives of psychiatry and clinical neuroscience*, 271, 1035-1051.

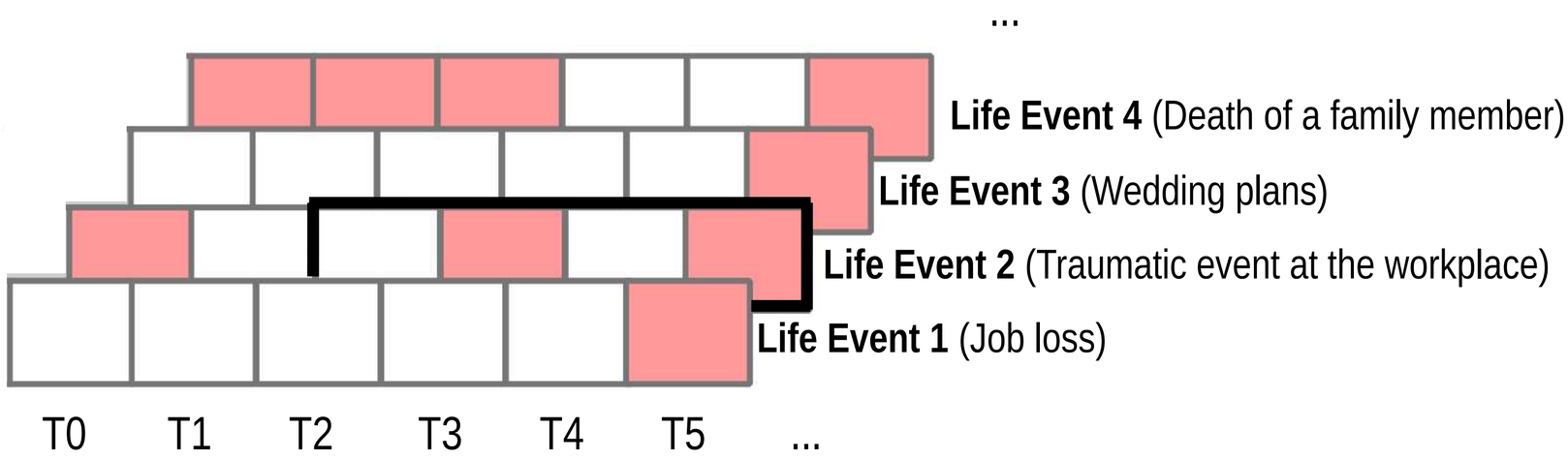
Stressor Lock



Time Ralative to Anchor Life Event

[1] Ahrens, K.F., Schenk, C., Kollmann, B.,… , Reif, A., Kalisch, R, & Plichta, M. M. (in press). Resilience to Major Life Events: Advancing Trajectory Modeling and Resilience Factor Identification by Controlling for Background Stressor Exposure. *American Psychologist.* https://doi.org/10.1037/amp0001315

Stressor Lock



[1] Ahrens, K.F., Schenk, C., Kollmann, B.,... , Reif, A., Kalisch, R, & Plichta, M. M. (in press). Resilience to Major Life Events: Advancing Trajectory Modeling and Resilience Factor Identification by Controlling for Background Stressor Exposure. *American Psychologist.* https://doi.org/10.1037/amp0001315

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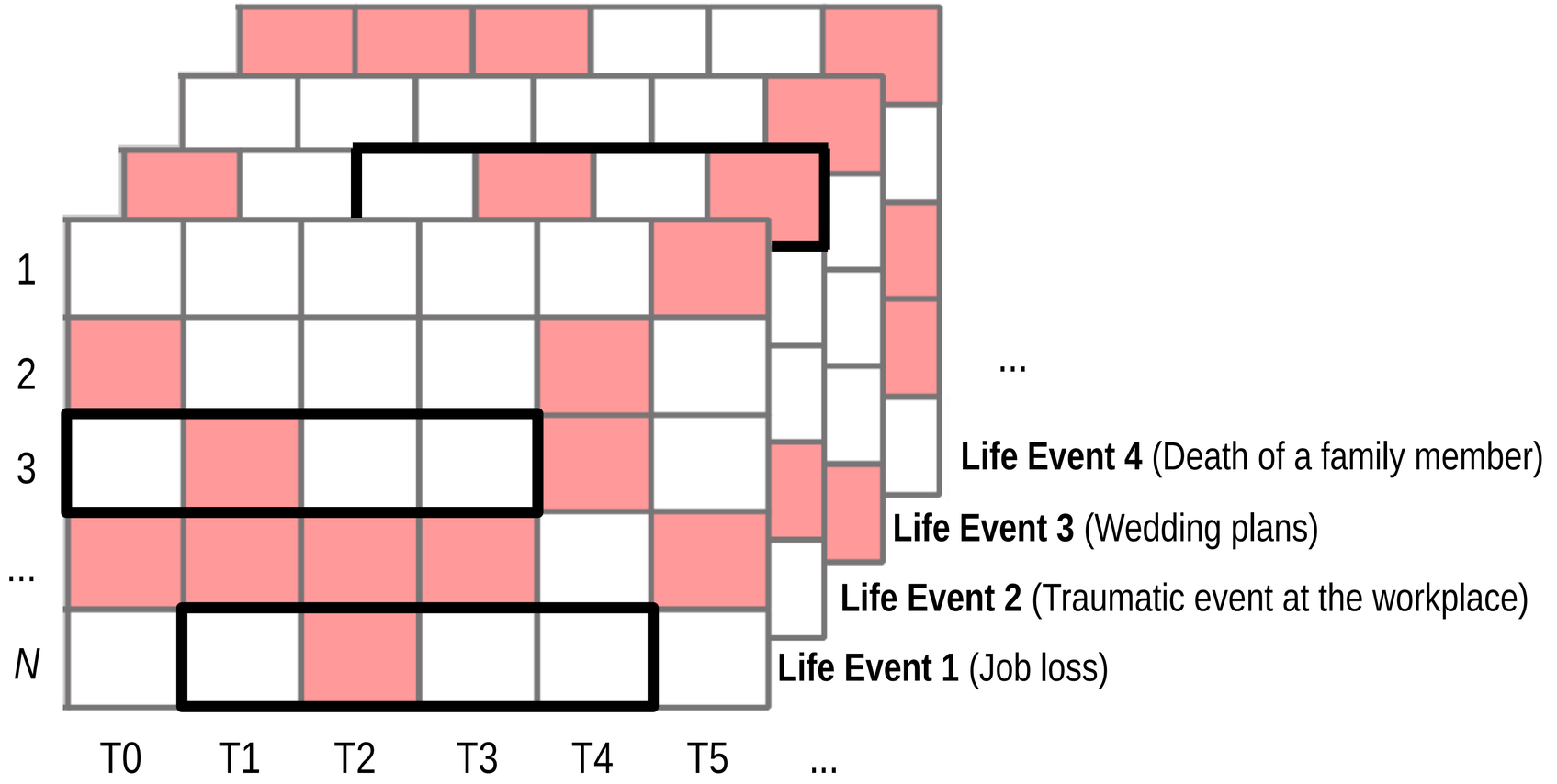

[1] Ahrens, K.F., Schenk, C., Kollmann, B.,... , Reif, A., Kalisch, R, & Plichta, M. M. (in press). Resilience to Major Life Events: Advancing Trajectory Modeling and Resilience Factor Identification by Controlling for Background Stressor Exposure. *American Psychologist.* https://doi.org/10.1037/amp0001315

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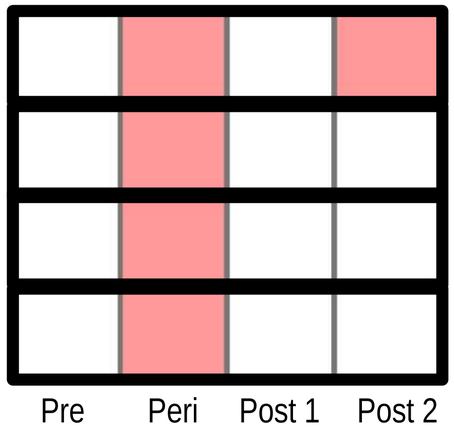
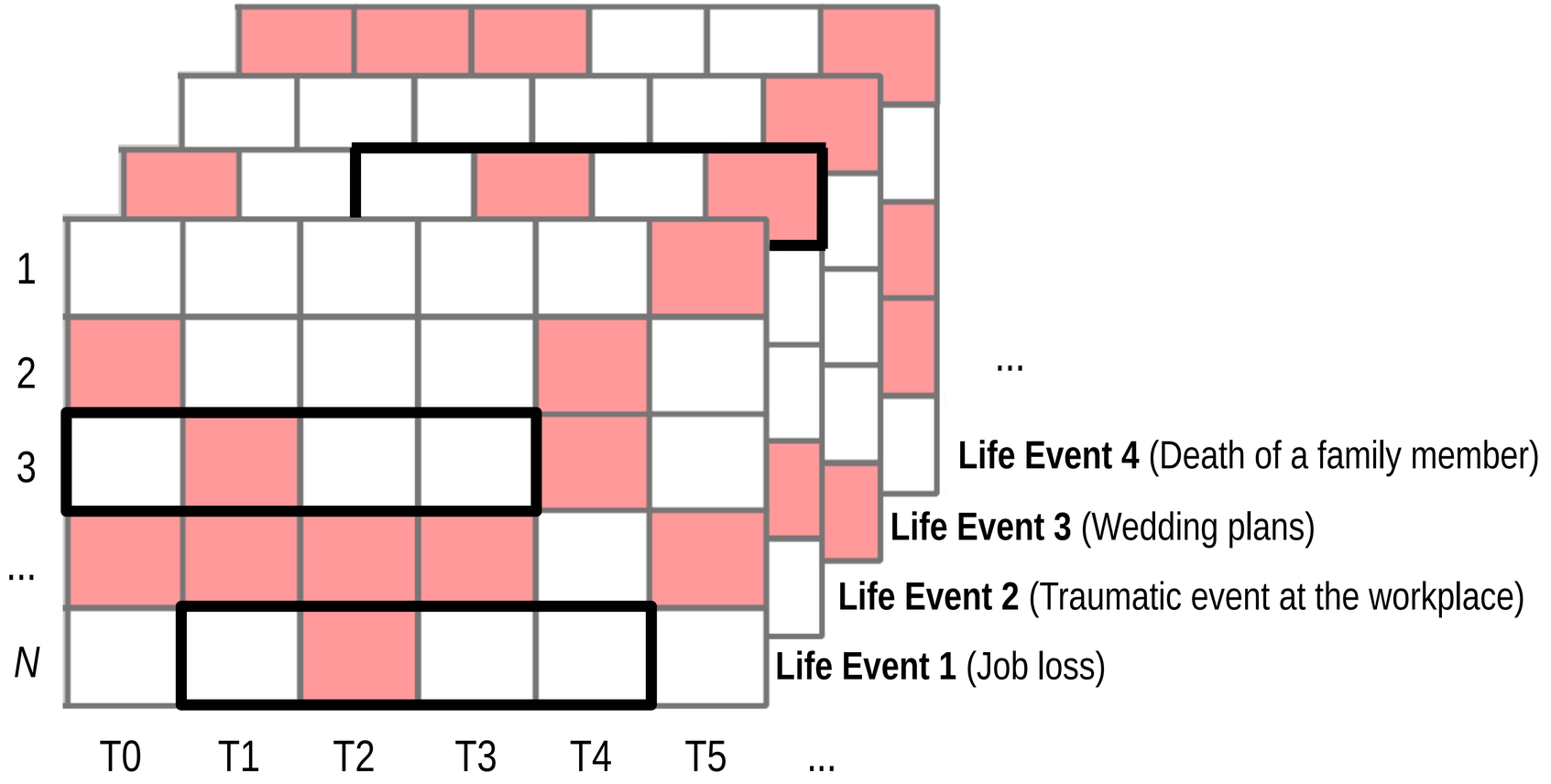


Time Ralative to Anchor Life Event



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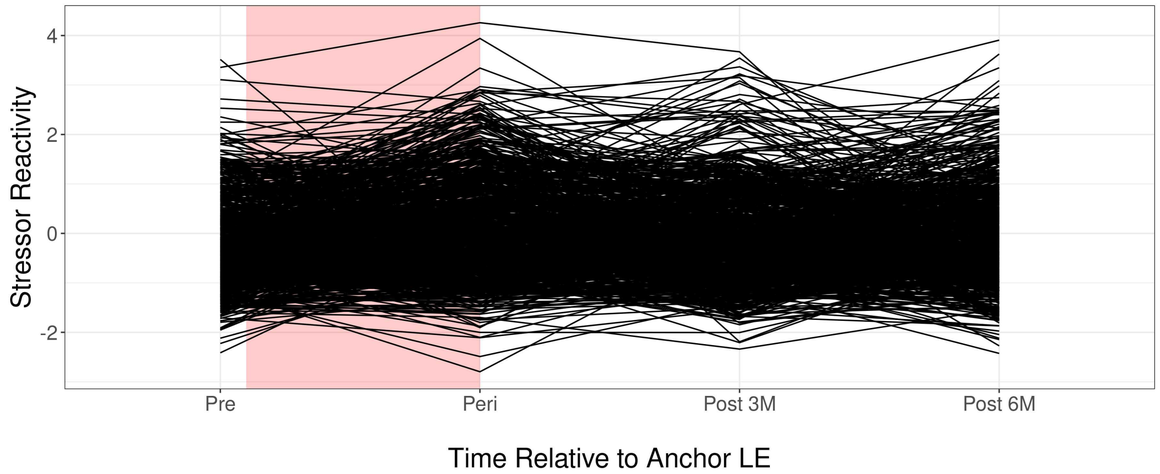
Trajectories - Clustering by k-means for longitudinal data



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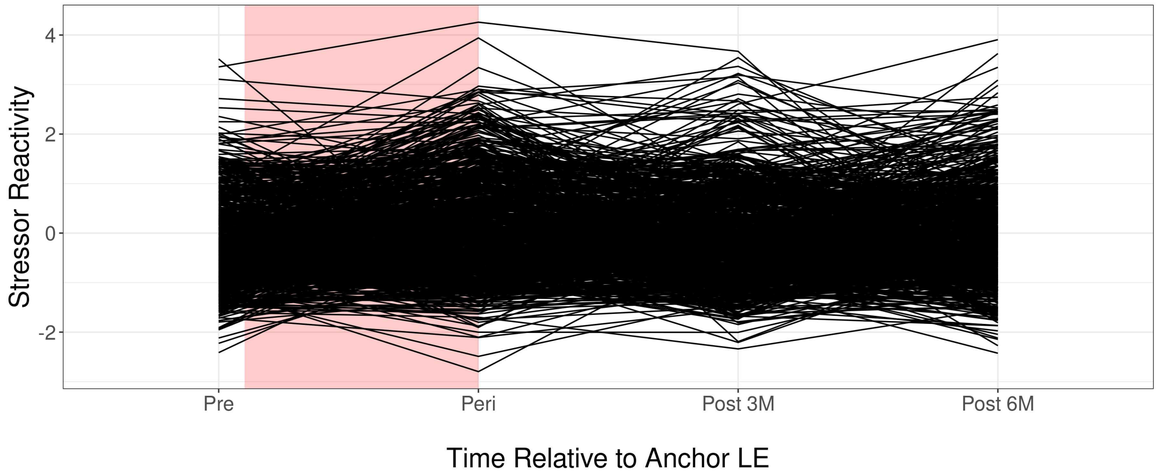
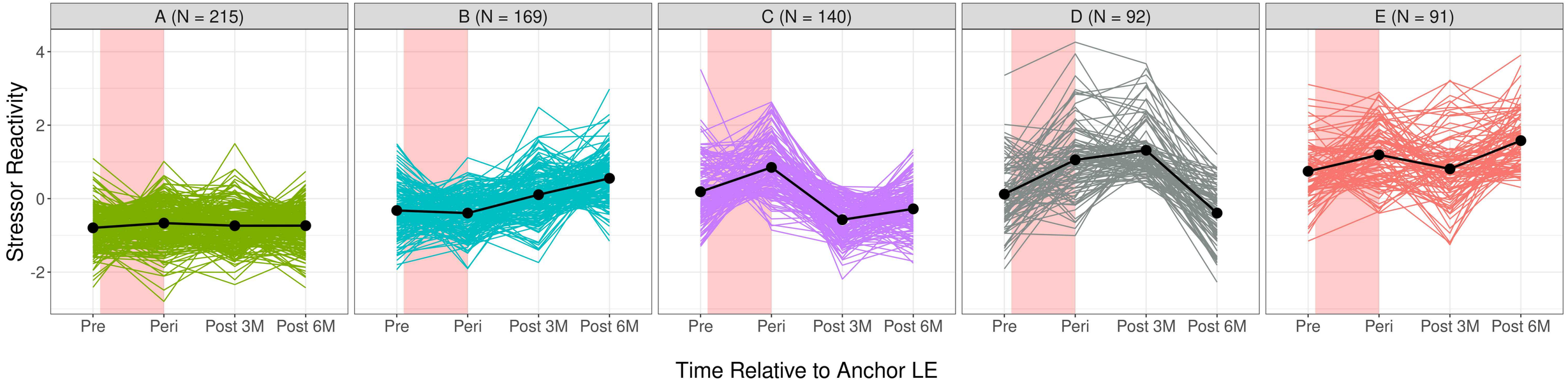
Trajectories - Clustering by k-means for longitudinal data

Dr. Kira Ahrens

Prof. Dr. Raffael Kalisch

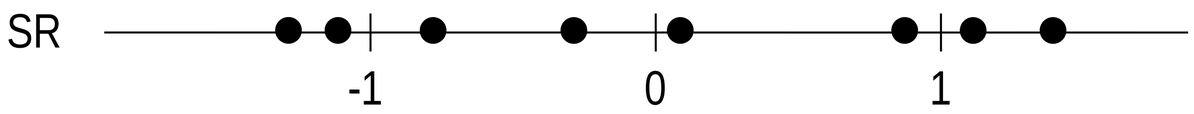
Prof. Dr. Michael Plichta





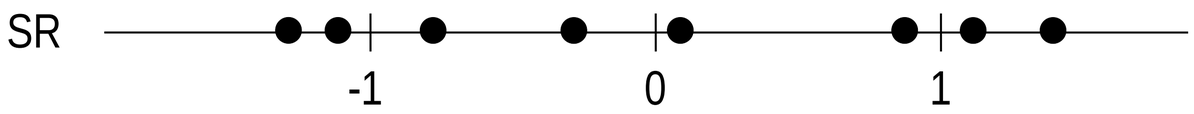
[1] Ahrens, K.F., Schenk, C., Kollmann, B.,… , Reif, A., Kalisch, R, & Plichta, M. M. (in press). Resilience to Major Life Events: Advancing Trajectory Modeling and Resilience Factor Identification by Controlling for Background Stressor Exposure. *American Psychologist.* https://doi.org/10.1037/amp0001315

k-means Clustering



k-means Clustering

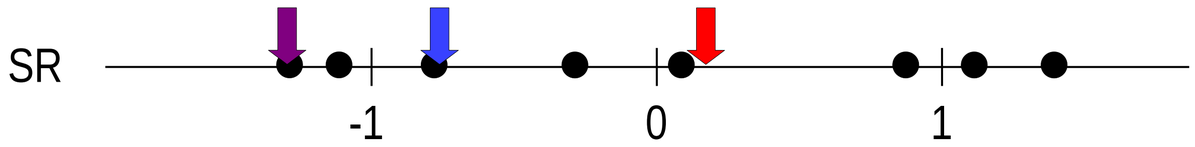
1. Choosing the number of clusters: $k = 3$



[1]

k-means Clustering

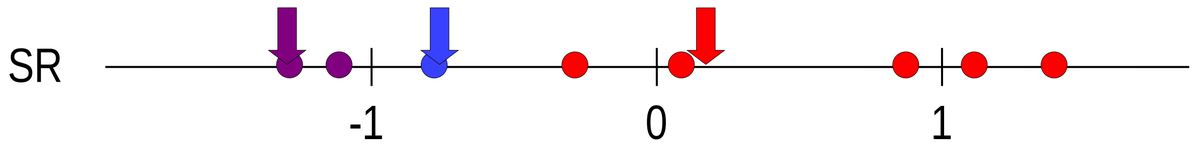
1. Choosing the number of clusters: *k* = 3
2. **Select cluster centers**



[1]

k-means Clustering

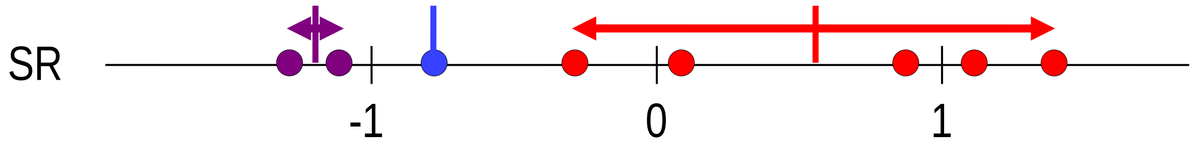
1. Choosing the number of clusters: *k* = 3
2. Select cluster centers
3. **Assign data points to the nearest cluster**



[1]

k-means Clustering

1. Choosing the number of clusters: $k = 3$
2. Select cluster centers
3. Assign data points to the nearest cluster
4. **Re-initialize centroids**



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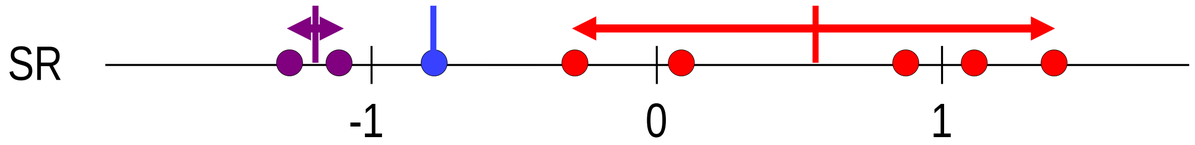


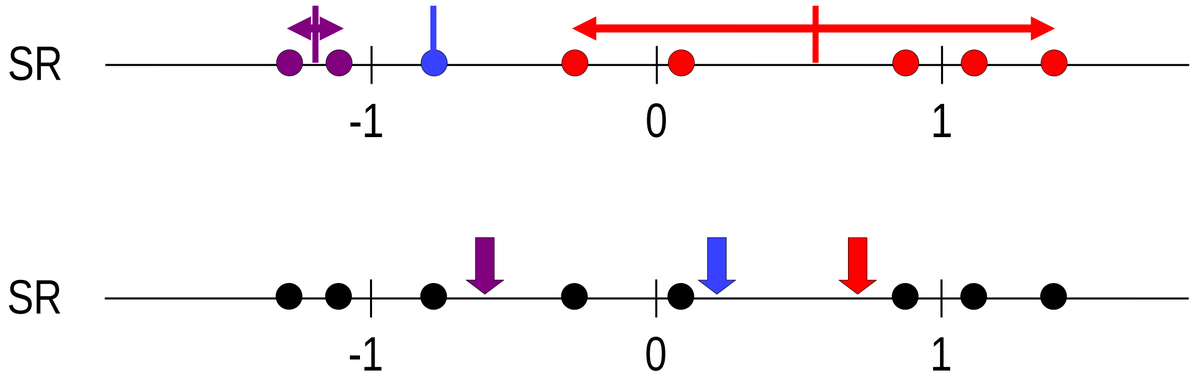
Total within-cluster variance:

1st run:

[1]

k-means Clustering

1. Choosing the number of clusters: $k = 3$
2. Select cluster centers
3. **Assign data points to the nearest cluster**
4. **Re-initialize centroids**



Total within-cluster variance:

1st run:

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k-means Clustering

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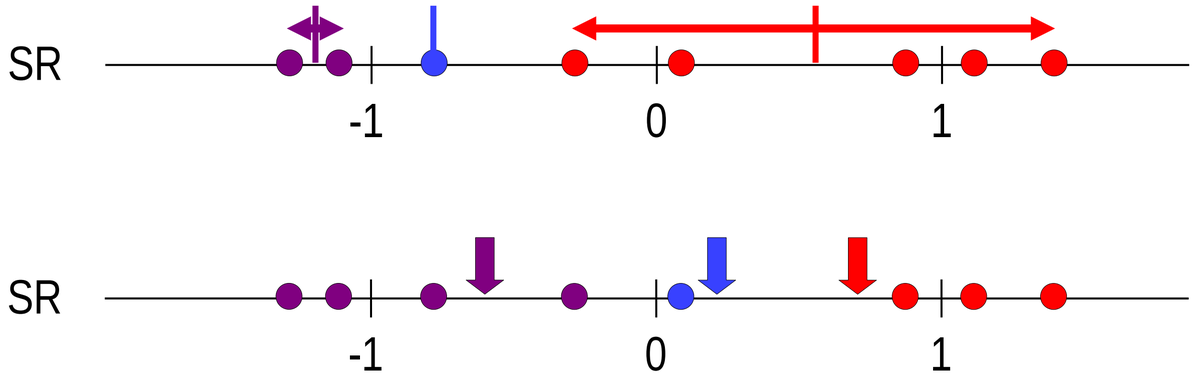

Total within-cluster variance:

1st run:

[1]

k-means Clustering

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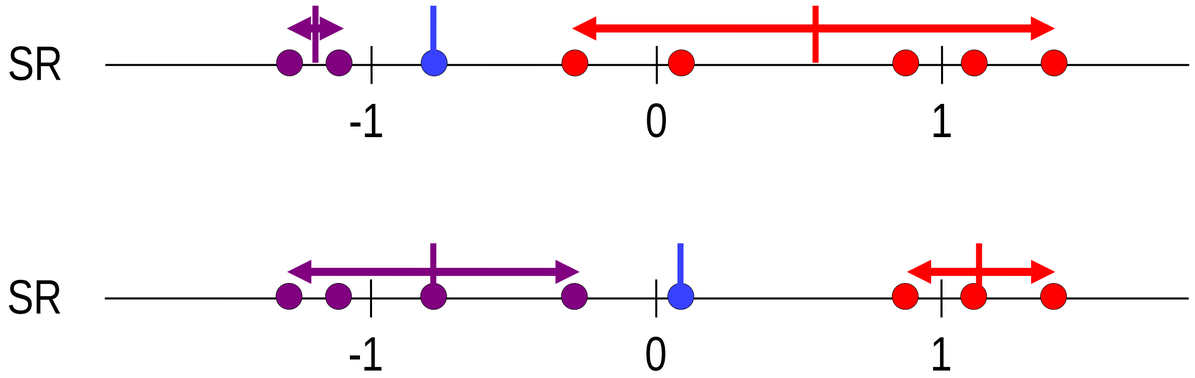


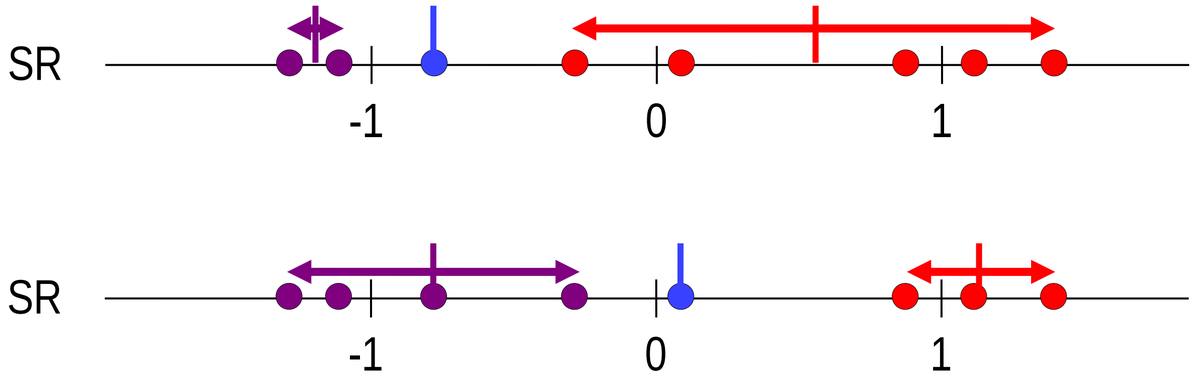
Total within-cluster variance:

1st run:

[1]

k-means Clustering

1. Choosing the number of clusters: $k = 3$
2. Select cluster centers
3. **Assign data points to the nearest cluster**
4. **Re-initialize centroids**



Total within-cluster variance:

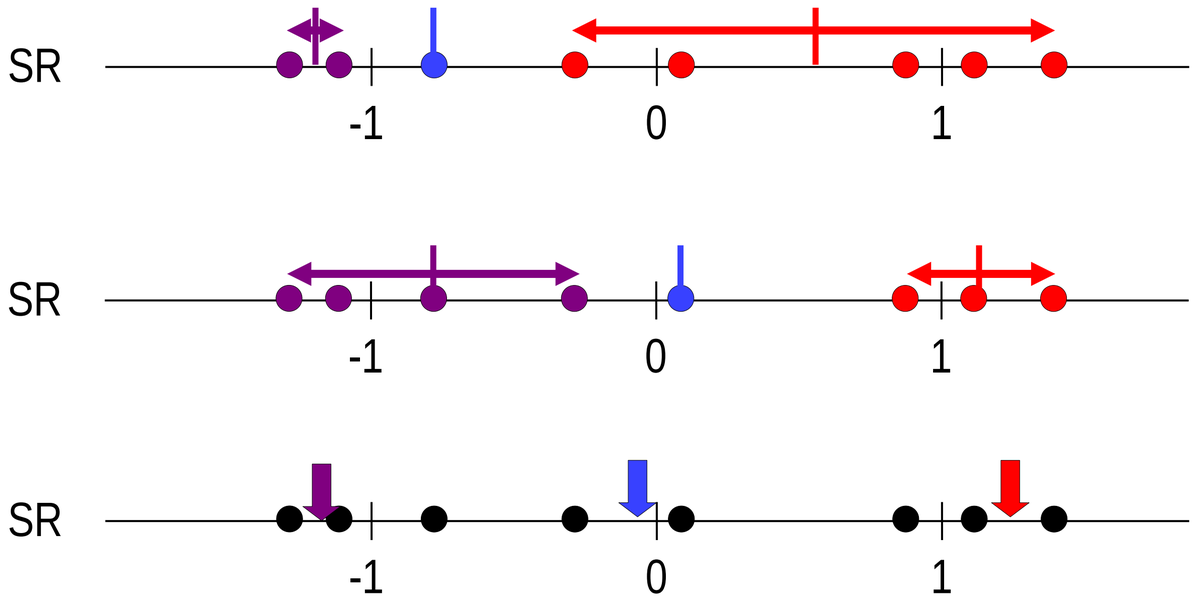
1st run:

2nd run:

[1]

k-means Clustering

1. Choosing the number of clusters: $k = 3$
2. Select cluster centers
3. **Assign data points to the nearest cluster**
4. **Re-initialize centroids**



Total within-cluster variance:

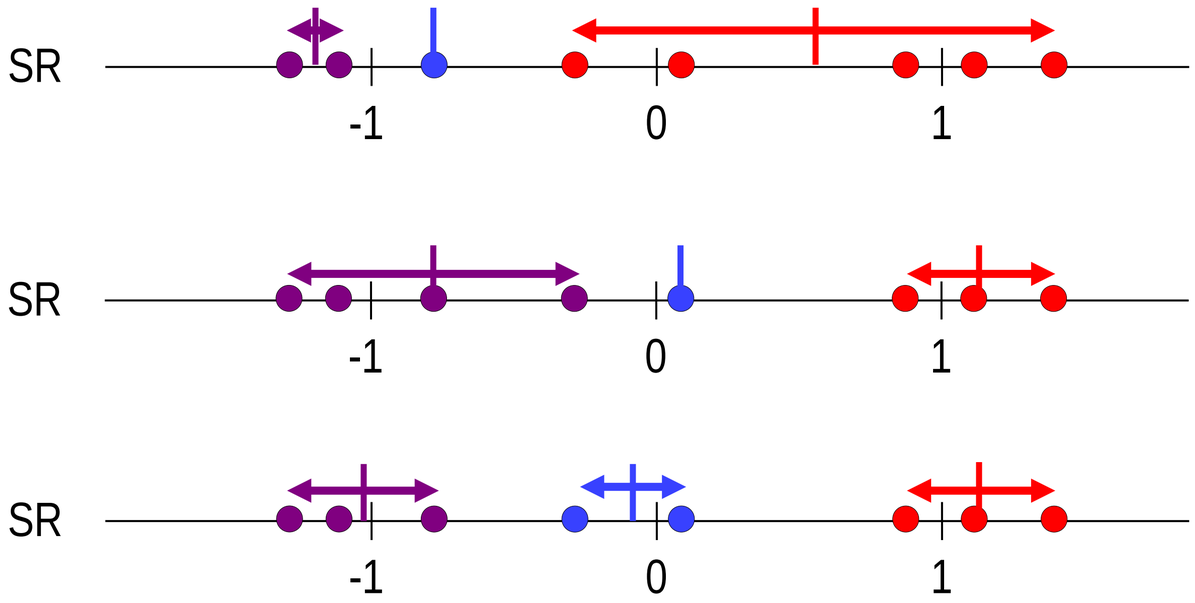
1st run:

2nd run:

[1]

k-means Clustering

1. Choosing the number of clusters: $k = 3$
2. Select cluster centers
3. **Assign data points to the nearest cluster**
4. **Re-initialize centroids**



Total within-cluster variance:

1st run:

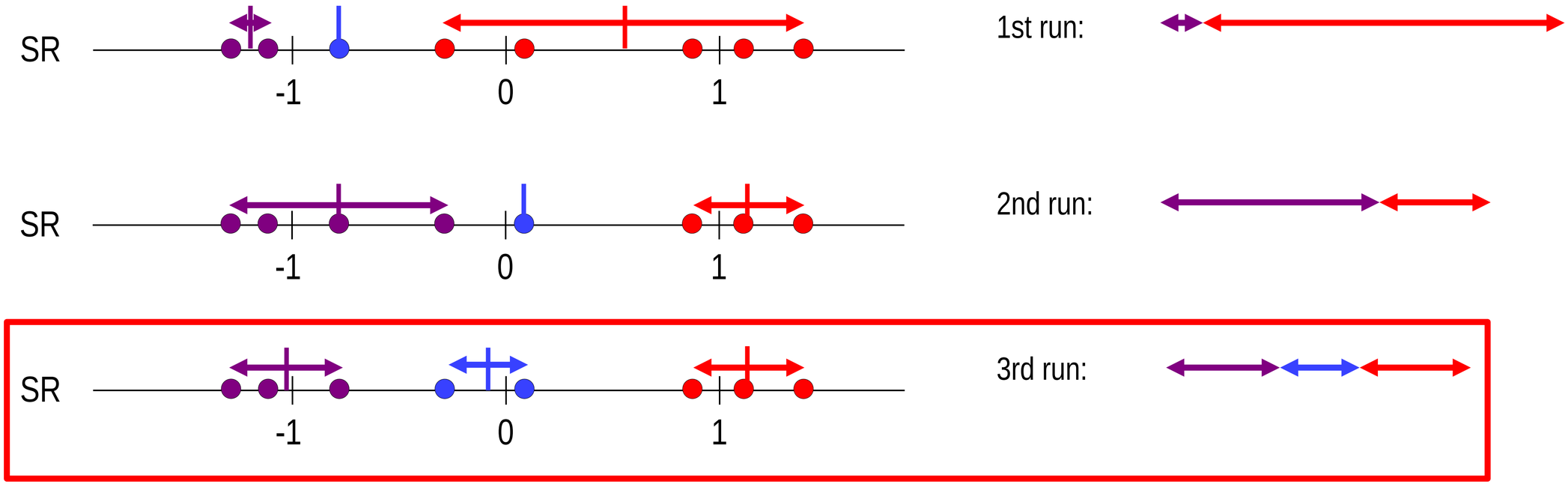
2nd run:

3rd run:

[1]

k-means Clustering

1. Choosing the number of clusters: $k = 3$
2. Select cluster centers
3. **Assign data points to the nearest cluster**
4. **Re-initialize centroids**

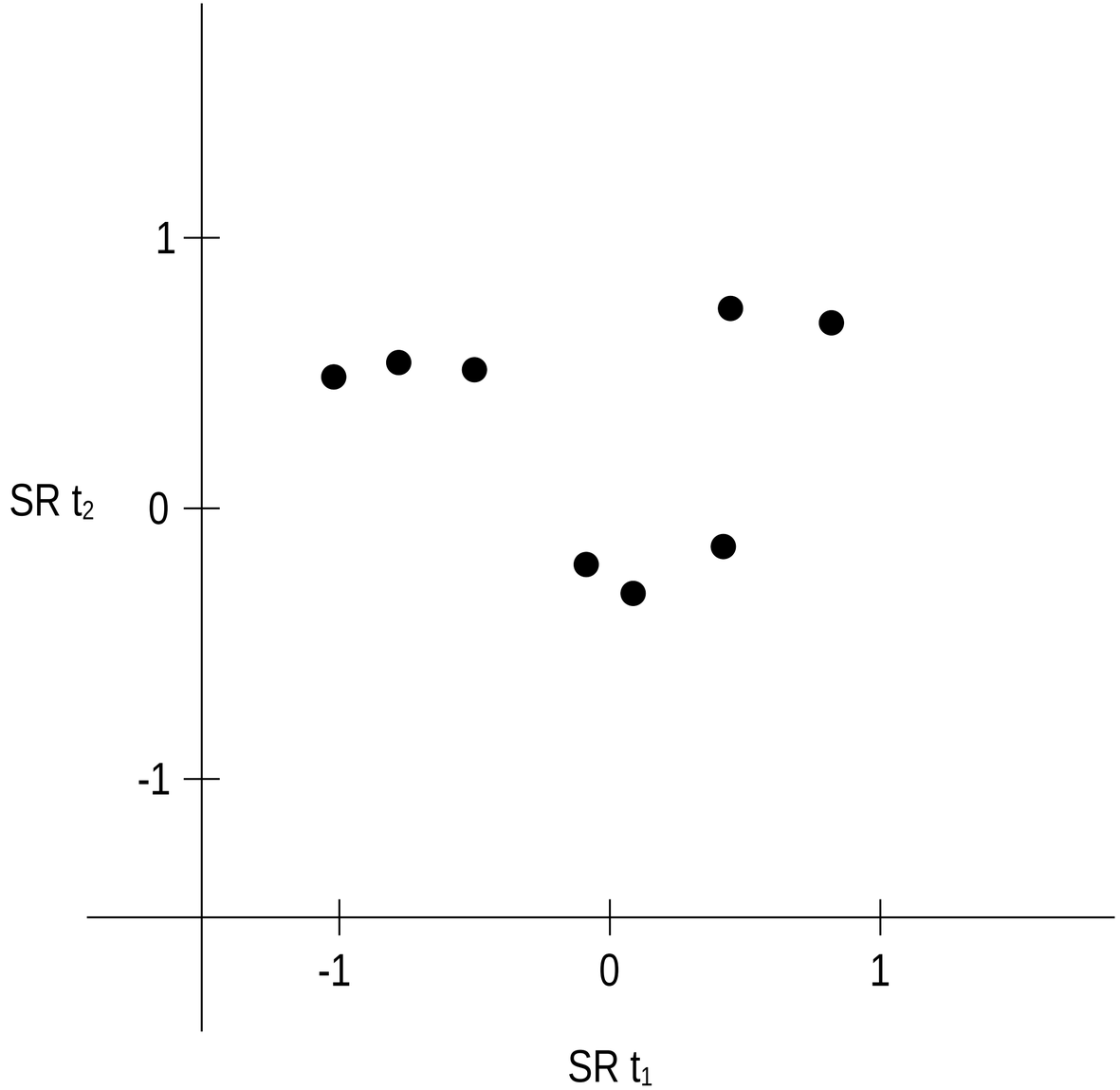


Total within-cluster variance:

[1]

k-means Clustering for longitudinal Data

1. Choosing the number of clusters: $k = 3$
2. Initializing centroids
3. **Assign data points to the nearest cluster**
4. **Re-initialize centroids**



k-means Clustering for longitudinal Data

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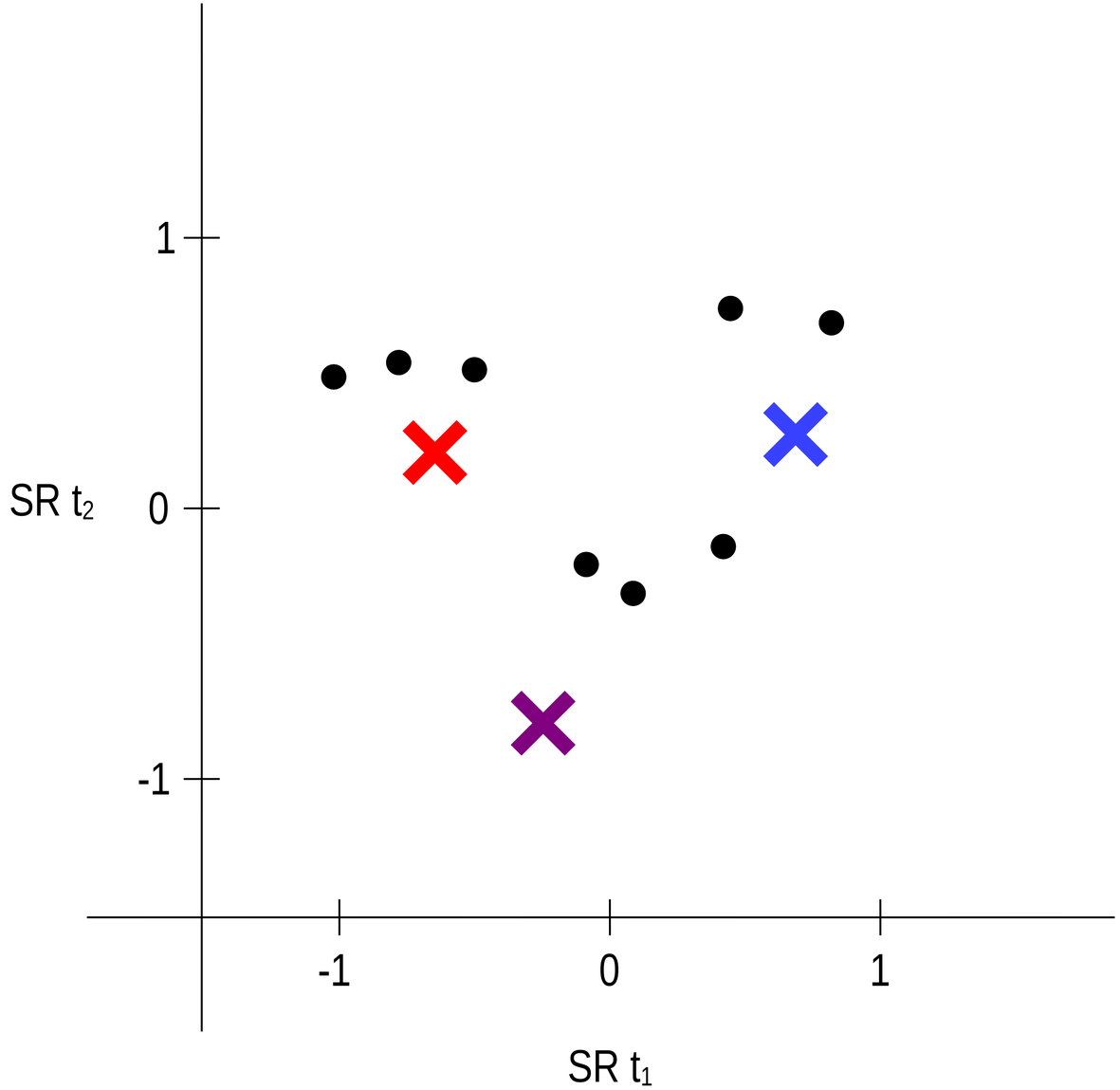
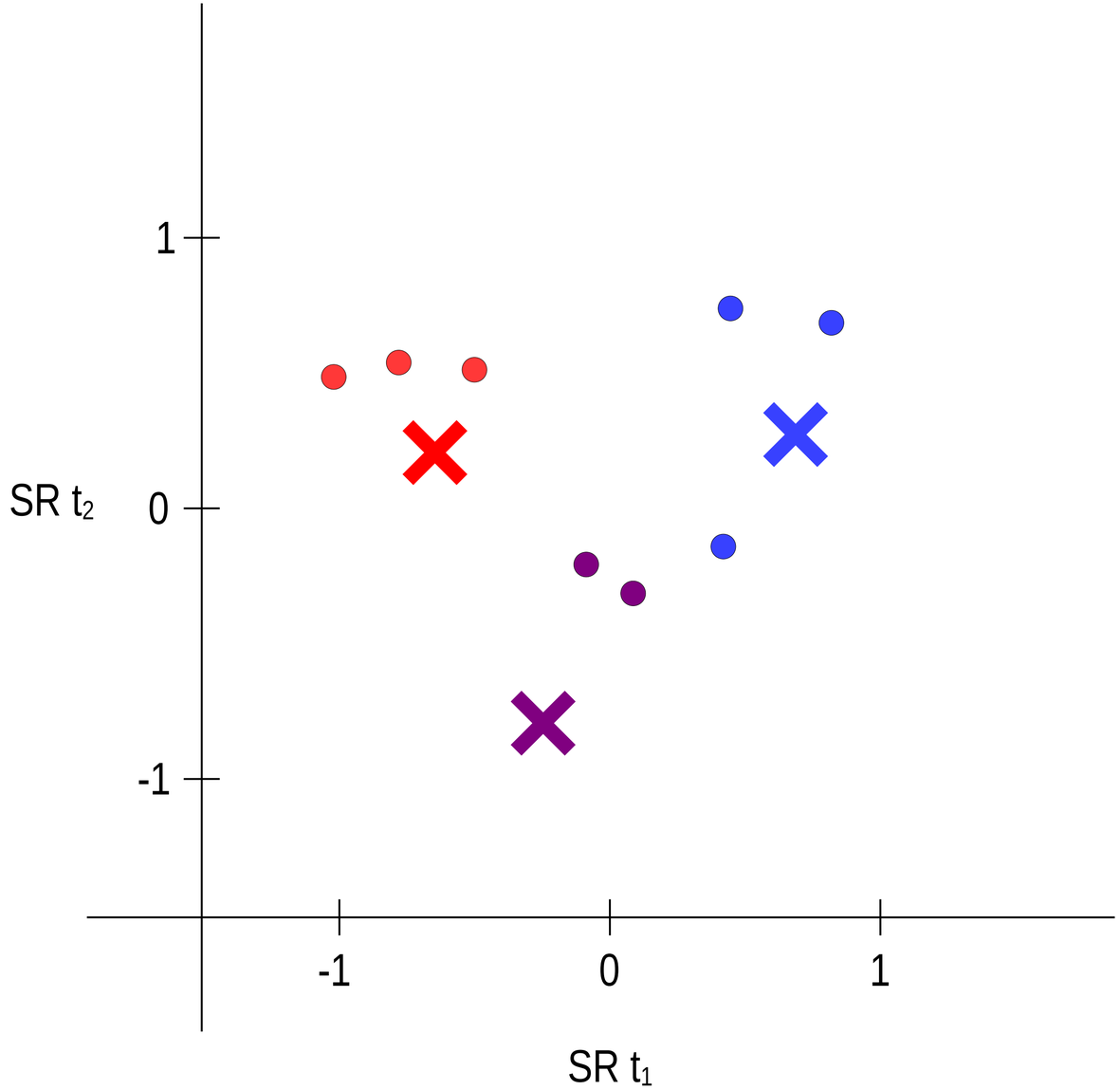
2. Initializing centroids
3. **Assign data points to the nearest cluster**
4. **Re-initialize centroids**



k-means Clustering for longitudinal Data

1. Choosing the number of clusters: $k = 3$
2. Initializing centroids
3. **Assign data points to the nearest cluster**
4. **Re-initialize centroids**



k-means Clustering for longitudinal Data

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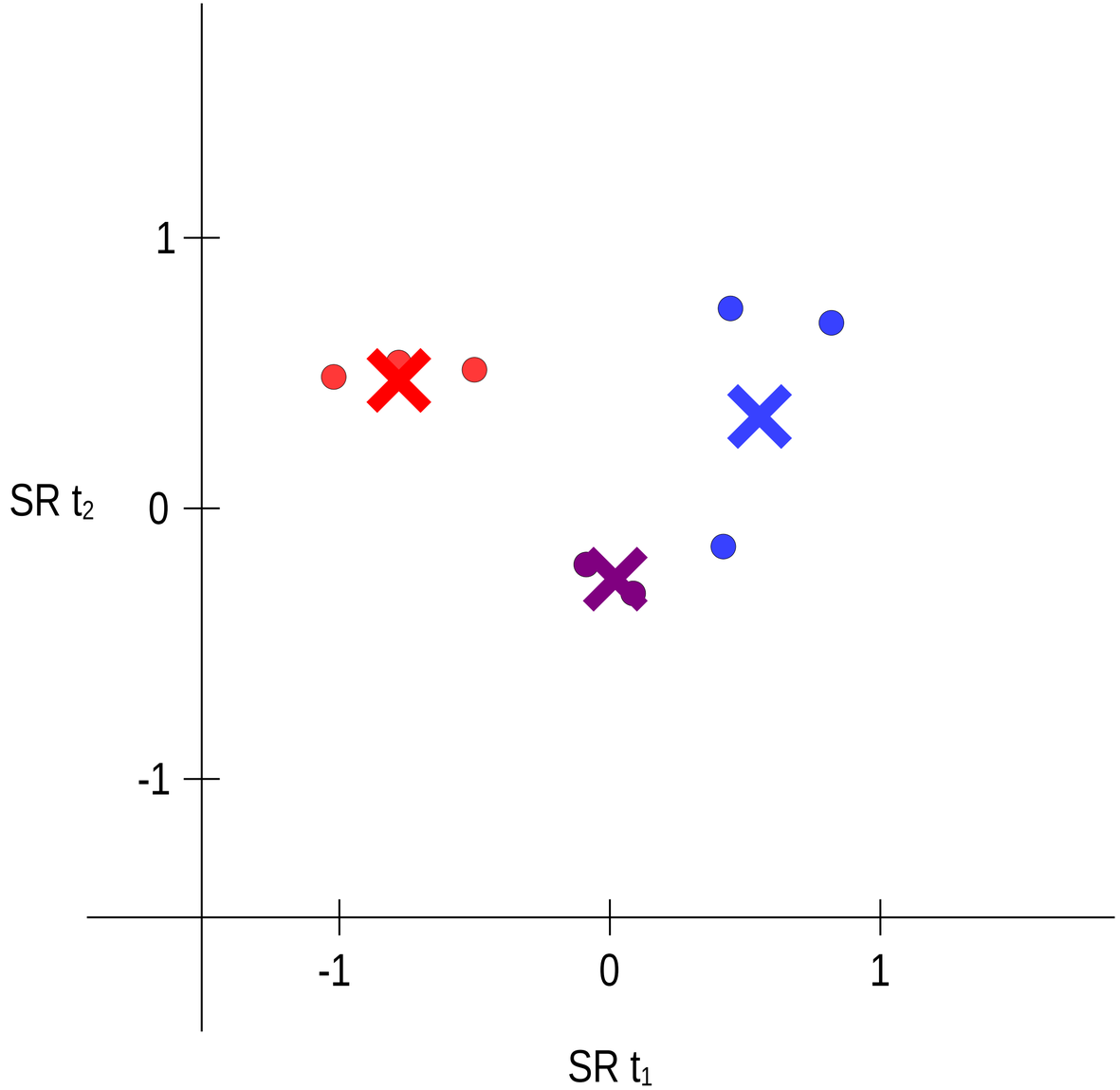

k-means Clustering for longitudinal Data

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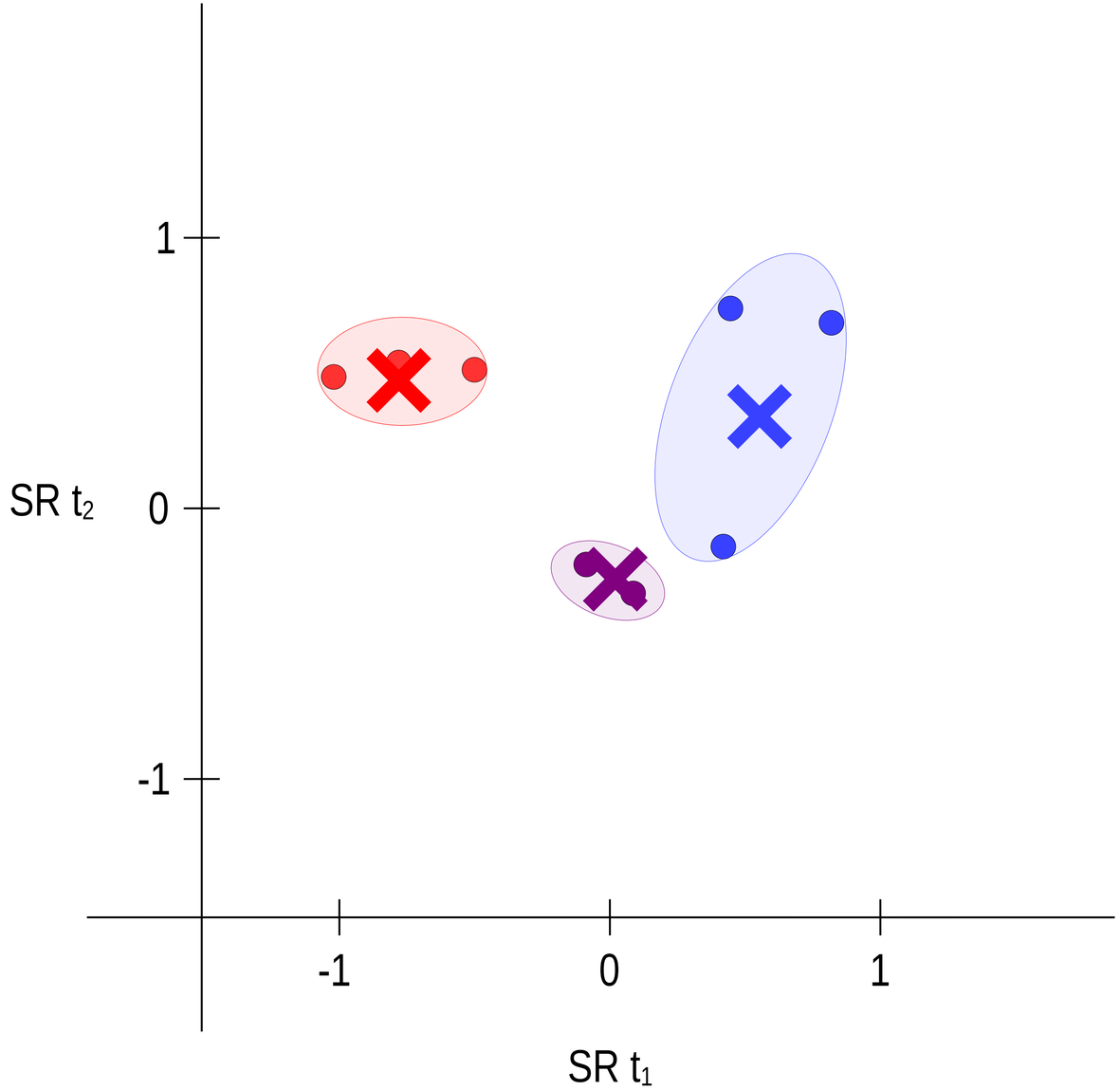


k-means Clustering for longitudinal Data

Data Preparation

`clusterLongData` (or `cld` in short) is the constructor for a object of class ClusterLongData.

Arguments:

- `traj [matrix(numeric)] or [data.frame]`: structure containning the trajectories. Each line is the trajectory of an individual. The columns refer to the time during which measures were made.
- `idAll [vector(character)]`: single identifier for each trajectory (ie each 'individual).
- `timeInData [vector(numeric)]`: precise the column containing the trajectories.

```
cldSDQ <- cld(traj       = data_wide_SR[, c("SR_pre", "SR_peri",
                                            "SR_post1", "SR_post2")],
              idAll      = data_wide_SR$subject.ID,
              timeInData = 1:4)
```


[1] https://cran.r-project.org/web/packages/kml/kml.pdf
[2] https://cran.r-project.org/web/packages/longitudinalData/longitudinalData.pdf
[3] https://www.jstatsoft.org/article/view/v065i04

k-means Clustering for longitudinal Data

Building partition with kml

`kml` is a implementation of k-means for longitudinal data (or trajectories).

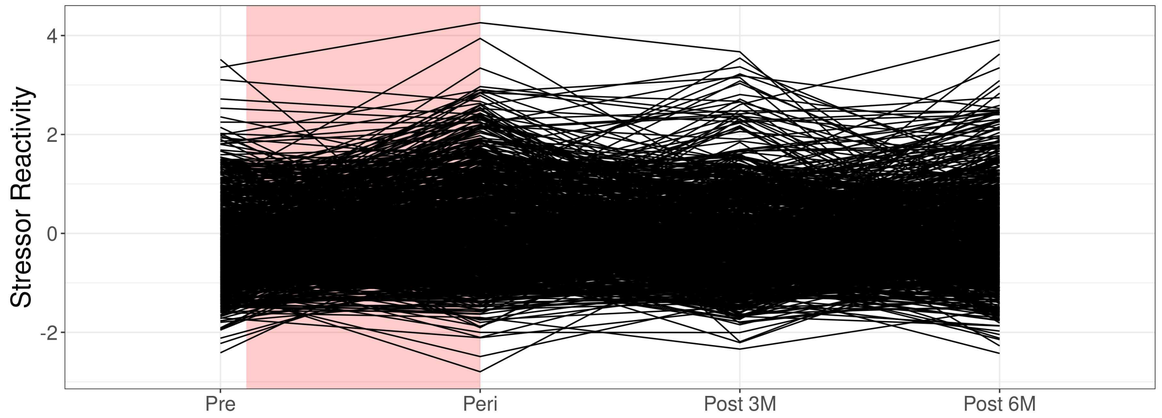
Arguments:

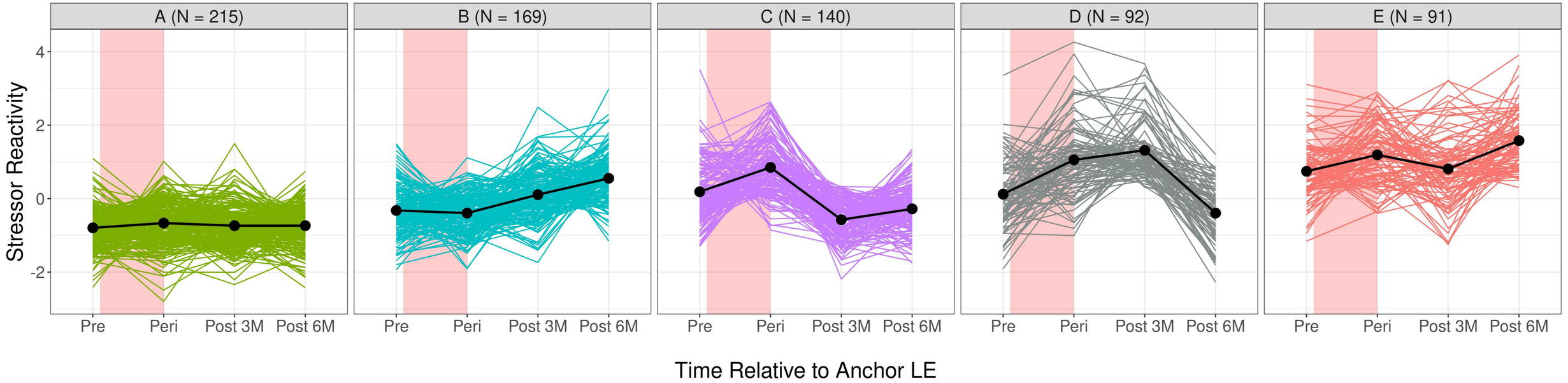
- `object [ClusterLongData]` (see above)
- `nbClusters [vector(numeric)]`: Vector containing the number of clusters with which kml must work. (Default is 2:6 and maximum number of cluster is 26)
- `nbRedrawing [numeric]` Sets the number of time that k-means must be re-run (with different starting conditions) for each number of clusters.
- `toPlot [character]`: either 'traj' for plotting trajectories alone, 'criterion' for plotting criterion alone, 'both' for plotting both or 'none' for not display anything

```
kml(object      = cldSDQ,
    nbClusters  = 2:5,
    nbRedrawing = 100,
    toPlot      = "none")
```


[1] https://cran.r-project.org/web/packages/kml/kml.pdf
[2] https://cran.r-project.org/web/packages/longitudinalData/longitudinalData.pdf
[3] https://www.jstatsoft.org/article/view/v065i04

Trajectories - Clustering by k-means for longitudinal data

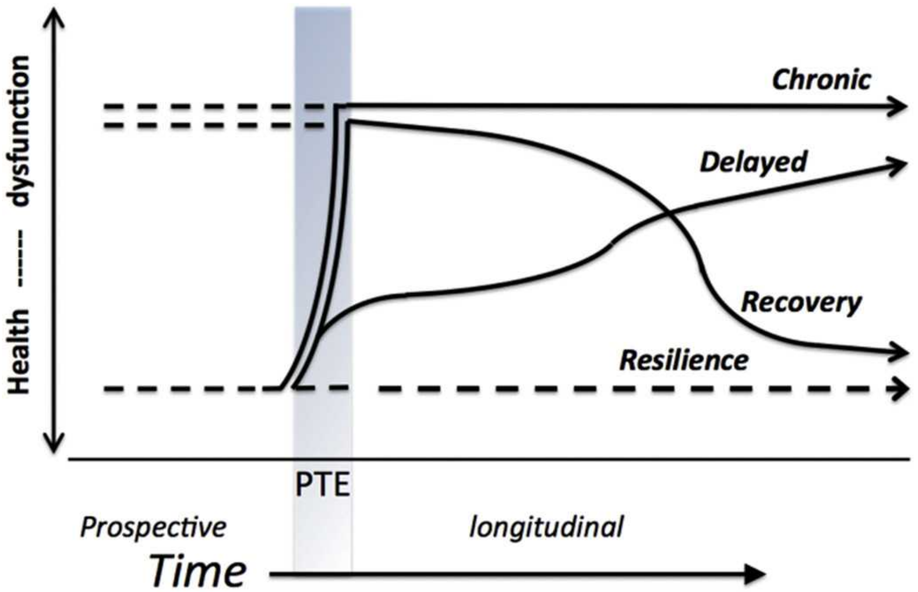




[1] Ahrens, K.F., Schenk, C., Kollmann, B.,… , Reif, A., Kalisch, R, & Plichta, M. M. (in press). Resilience to Major Life Events: Advancing Trajectory Modeling and Resilience Factor Identification by Controlling for Background Stressor Exposure. *American Psychologist.* https://doi.org/10.1037/amp0001315

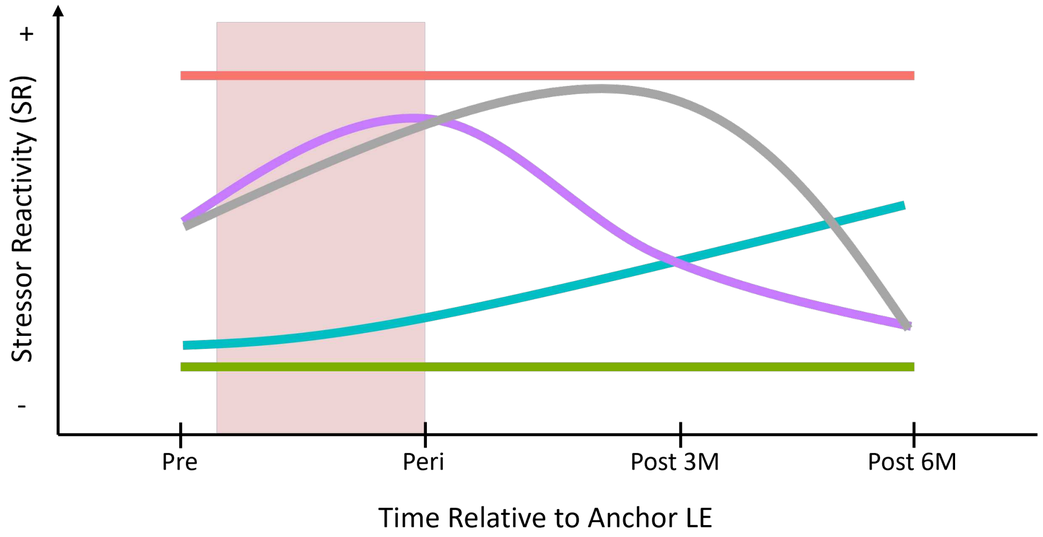
Trajectories - Clustering by k-means for longitudinal data

Figure 4.
Commonly observed longitudinal trajectories of response to potential trauma.



Note. Sourced from Galatzer-Levy et al. (2018).[1]

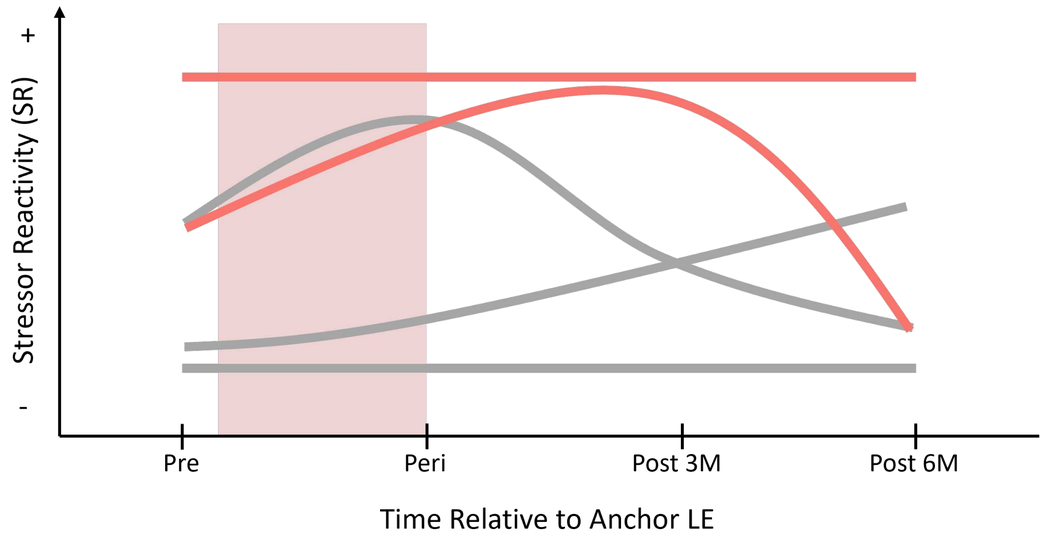
Figure 5.
Schematically illustrated trajectories of the presented study.



Note. In order to cluster the trajectories, not the raw mental health scores but the stressor reactivity was used to consider the background stressors.

[1] Galatzer-Levy, I. R., Huang, S. H., & Bonanno, G. A. (2018). Trajectories of resilience and dysfunction following potential trauma: A review and statistical evaluation. *Clinical psychology review*, 63, 41-55.

Validity of the Trajectories



Predictive validity:
Cluster membership significantly predicts mental disorders.

[1] Ahrens, K.F., Schenk, C., Kollmann, B.,… , Reif, A., Kalisch, R, & Plichta, M. M. (in press). Resilience to Major Life Events: Advancing Trajectory Modeling and Resilience Factor Identification by Controlling for Background Stressor Exposure. *American Psychologist.* https://doi.org/10.1037/amp0001315

Thank you for your attention! Are there any questions?