

# Foundations & Applications of Experience Sampling Methodology (ESM) & Ecological Momentary Assessment (EMA)

By [Dr. Louis Tay](#)

Special Acknowledgements: Andy Jiang for conducting additional literature searches for recent papers

## *Graduate Seminar Syllabus*

### Key Resources:

- **Platform:** The teaching version of the ExpiWell Platform will be used throughout the class to implement your ESM, EMA, and Ambulatory Assessment Project. Go to [www.expiwell.com](http://www.expiwell.com) to create your account for the class. Download the ExpiWell iOS or Android apps.
  - App Store: <https://apps.apple.com/us/app/expiwell/id1070733440>
  - Play Store: <https://play.google.com/store/apps/details?id=com.expimetrics&hl=en&gl=US>
- **Quick Overview of ESM and EMA**
  - Check out a webinar on ESM and EMA here: <https://youtu.be/Y80JwwMX3ts?feature=shared>
- **Texts:** There are no textbooks used for the class, but there are excellent resources that I recommend.
  - Myin-Germeys & Kuppens (2021). *The Open Handbook of Experience Sampling Methodology: A Step-by-Step Guide to Designing, Conducting, and Analyzing ESM studies* (2<sup>nd</sup> Edition).
  - Csikszentmihalyi, M. (2011). *Handbook of research methods for studying daily life*. Guilford Press.
  - Bolger, N., & Laurenceau, J. P. (2013). *Intensive longitudinal methods: An introduction to diary and experience sampling research*. Guilford press.

## Grading

| # | Component                                                                                                                                                                                          | Percentage |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1 | <b>Class Participation:</b> Summarizing papers, leading discussions each week                                                                                                                      | 15%        |
| 2 | <b>Initial Research Proposal:</b> Write a 2-page research proposal that provides key research questions and rationale for why ESM, EMA, and Ambulatory Assessment is the right tool in APA format. | 15%        |
| 3 | <b>Research Presentation:</b> Collect test data and showcase proposed steps for implementing your research study                                                                                   | 30%        |
| 4 | <b>Research Report:</b> Write a 15-page research paper introducing your study and proposed methods and analysis                                                                                    | 40%        |

## Class Schedule

| Week | Topic                                                                                              | Student Leader |
|------|----------------------------------------------------------------------------------------------------|----------------|
| 1    | What is ESM, EMA, DRM, and Ambulatory Assessment?                                                  |                |
| 2    | Overview of Implementing a Study                                                                   |                |
| 3    | Applications to Different Research Domains                                                         |                |
| 4    | Issues in Scheduling: Participant Burden and Compliance                                            |                |
| 5    | Self-Reports & Short Scales in ESM                                                                 |                |
| 6    | Ecological Momentary Interventions and Just-in-time Adaptive Interventions (JITAI)                 |                |
| 7    | Issues in Participant Recruitment, Management, and Compensation<br><br>***Research Proposal Due*** |                |
| 8    | Data Management, Basic Descriptives, and Visualization                                             |                |
| 9    | Psychometric Assessment of ESM scales: Reliability and Validity                                    |                |
| 10   | Basics of Multilevel Modeling                                                                      |                |
| 11   | Modeling Within-Person changes                                                                     |                |
| 12   | Advanced Modeling Techniques                                                                       |                |
| 13   | Future of ESM, EMA, and Ambulatory Assessment                                                      |                |
| 14   | ***Research Presentations***                                                                       | -              |

## **Week 1: What is ESM, EMA, DRM, and Ambulatory Assessment**

### **Key Issues:**

- Background and history
- Definitions
- Societies and research groups
- Technology platforms

### **Readings:**

Scollon, C. N., Kim-Prieto, C., & Diener, E. (2003). Experience sampling: Promises and pitfalls, strengths and weaknesses. *Journal of Happiness studies*, 4(1), 5-34.

Conner, T. S., Tennen, H., Fleeson, W., & Barrett, L. F. (2009). Experience sampling methods: A modern idiographic approach to personality research. *Social and personality psychology compass*, 3(3), 292-313.

Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological momentary assessment. *Annual Review of Clinical Psychology*, 4, 1-32.

Trull, T. J., & Ebner-Priemer, U. (2013). Ambulatory assessment. *Annual review of clinical psychology*, 9, 151-176.

Trull, T. J., & Ebner-Priemer, U. (2014). The role of ambulatory assessment in psychological science. *Current directions in psychological science*, 23(6), 466-470.

### **DRM**

Kahneman, D., Krueger, A. B., Schkade, D. A., Schwarz, N., & Stone, A. A. (2004). A survey method for characterizing daily life experience: The day reconstruction method. *Science*, 306(5702), 1776-1780.

Dockray, S., Grant, N., Stone, A. A., Kahneman, D., Wardle, J., & Steptoe, A. (2010). A comparison of affect ratings obtained with ecological momentary assessment and the day reconstruction method. *Social Indicators Research*, 99, 269-283.

Diener, E., & Tay, L. (2014). Review of the day reconstruction method (DRM). *Social Indicators Research*, 116, 255-267.

Lucas, R. E., Wallsworth, C., Anusic, I., & Donnellan, M. B. (2021). A direct comparison of the day reconstruction method (DRM) and the experience sampling method (ESM). *Journal of personality and social psychology*, 120(3), 816.

Societies and Groups:

- Society for Ambulatory Assessment: <https://ambulatory-assessment.org/>
- Daily Life at Work Listserv

## Week 2: Overview of implementing an ESM and EMA study

### Key Issues:

- A broad overview of practical issues and issues for consideration
  - Scheduling
  - Compensation
  - Participant management
  - Analysis
- Assessment vs intervention

### Readings:

Watch Video providing an Overview: <https://youtu.be/Y80JwwMX3ts?feature=shared>

Gabriel, A. S., Podsakoff, N. P., Beal, D. J., Scott, B. A., Sonnentag, S., Trougakos, J. P., & Butts, M. M. (2019). Experience sampling methods: A discussion of critical trends and considerations for scholarly advancement. *Organizational Research Methods*, 22(4), 969-1006.

Christensen, T. C., Barrett, L. F., Bliss-Moreau, E., Lebo, K., & Kaschub, C. (2003). A practical guide to experience-sampling procedures. *Journal of Happiness Studies*, 4(1), 53-78.

Reifsteck, E. J., Anderson, S. N., Newton, J. D., & Maher, J. P. (2021). A practical guide and empirical example for implementing ecological momentary assessment in sport psychology research with athletes. *Sport, Exercise, and Performance Psychology*, 10(3), 408.

Smith, K. E., & Juarascio, A. (2019). From ecological momentary assessment (EMA) to ecological momentary intervention (EMI): past and future directions for ambulatory assessment and interventions in eating disorders. *Current Psychiatry Reports*, 21, 1-8.

## **Week 3: Applications of ESM and EMA to different Domains**

### **Key Issues:**

- Applications to different domains of study
- What types of processes can we learn using ESM/EMA/Ambulatory methods
- What are the specific issues to consider for specific phenomena or populations

### **Readings / Resources (*Pick 4 readings*):**

#### **Clinical**

Myin-Germeys, I., Oorschot, M., Collip, D., Lataster, J., Delespaul, P., & Van Os, J. (2009). Experience sampling research in psychopathology: opening the black box of daily life. *Psychological medicine*, 39(9), 1533-1547.

Trull, T. J., & Ebner-Priemer, U. W. (2020). Ambulatory assessment in psychopathology research: A review of recommended reporting guidelines and current practices. *Journal of Abnormal Psychology*, 129(1), 56.

Walz, L. C., Nauta, M. H., & aan het Rot, M. (2014). Experience sampling and ecological momentary assessment for studying the daily lives of patients with anxiety disorders: A systematic review. *Journal of anxiety disorders*, 28(8), 925-937.

Wenze, S. J., & Miller, I. W. (2010). Use of ecological momentary assessment in mood disorders research. *Clinical psychology review*, 30(6), 794-804.

Colombo, D., Fernández-Álvarez, J., Patané, A., Semonella, M., Kwiatkowska, M., García-Palacios, A., ... & Botella, C. (2019). Current state and future directions of technology-based ecological momentary assessment and intervention for major depressive disorder: a systematic review. *Journal of clinical medicine*, 8(4), 465.

#### **Emotions and Well-Being**

Schimmack, U. (2003). Affect measurement in experience sampling research. *Journal of Happiness Studies*, 4(1), 79-106.

De Vries, L. P., Baselmans, B. M., & Bartels, M. (2021). Smartphone-based ecological momentary assessment of well-being: A systematic review and recommendations for future studies. *Journal of Happiness Studies*, 22, 2361-2408.

#### **Family**

Laurenceau, J.-P., & Bolger, N. (2005). Using Diary Methods to Study Marital and Family Processes. *Journal of Family Psychology*, 19(1), 86-97.

## **Developmental**

Hoppmann, C. A., & Riediger, M. (2009). Ambulatory assessment in lifespan psychology: An overview of current status and new trends. *European Psychologist, 14*(2), 98-108.

van Roekel, E., Keijsers, L., & Chung, J. M. (2019). A review of current ambulatory assessment studies in adolescent samples and practical recommendations. *Journal of Research on Adolescence, 29*(3), 560-577.

## **Personality**

Hofmans, J., De Clercq, B., Kuppens, P., Verbeke, L., & Widiger, T. A. (2019). Testing the structure and process of personality using ambulatory assessment data: An overview of within-person and person-specific techniques. *Psychological Assessment, 31*(4), 432.

## **Physical Activity**

Reichert, M., Giurgiu, M., Koch, E. D., Wieland, L. M., Lautenbach, S., Neubauer, A. B., ... & Liao, Y. (2020). Ambulatory assessment for physical activity research: state of the science, best practices and future directions. *Psychology of sport and exercise, 50*, 101742.

## **Organizational**

Beal, D. J. (2015). ESM 2.0: State of the art and future potential of experience sampling methods in organizational research. *Annual Review of Organizational Psychology and Organizational Behavior, 2*(1), 383-407.

Uy, M. A., Foo, M. D., & Aguinis, H. (2010). Using experience sampling methodology to advance entrepreneurship theory and research. *Organizational Research Methods, 13*(1), 31-54.

## Week 4: Issues in Scheduling: Participant Burden and Compliance

### Key Issues:

- Types of Schedules & Effects
- Participant Burden and Compliance
- Event-based triggers & Reminders

### Readings (*Pick 4 readings*):

Hasselhorn, K., Ottenstein, C., & Lischetzke, T. (2022). The effects of assessment intensity on participant burden, compliance, within-person variance, and within-person relationships in ambulatory assessment. *Behavior Research Methods*, 54(4), 1541–1558. <https://doi.org/10.3758/s13428-021-01683-6>

Shiffman, S. (2007). Designing protocols for ecological momentary assessment. *The science of real-time data capture: Self-reports in health research*, 27-53.

Smyth, J. M., Jones, D. R., Wen, C. K., Matera, F. T., Schneider, S., & Stone, A. (2021). Influence of ecological momentary assessment study design features on reported willingness to participate and perceptions of potential research studies: an experimental study. *BMJ open*, 11(7), e049154.

van Berkel, N., Goncalves, J., Lovén, L., Ferreira, D., Hosio, S., & Kostakos, V. (2019). Effect of experience sampling schedules on response rate and recall accuracy of objective self-reports. *International Journal of Human-Computer Studies*, 125, 118-128.

Eisele, G., Vachon, H., Lafit, G., Kuppens, P., Houben, M., Myin-Germeys, I., & Viechtbauer, W. (2022). The effects of sampling frequency and questionnaire length on perceived burden, compliance, and careless responding in experience sampling data in a student population. *Assessment*, 29(2), 136-151.

Williams, M. T., Lewthwaite, H., Fraysse, F., Gajewska, A., Ignatavicius, J., & Ferrar, K. (2021). Compliance with mobile ecological momentary assessment of self-reported health-related behaviors and psychological constructs in adults: systematic review and meta-analysis. *Journal of medical Internet research*, 23(3), e17023.

van Genugten, C. R., Schuurmans, J., Lamers, F., Riese, H., Penninx, B. W., Schoevers, R. A., ... & Smit, J. H. (2020). Experienced burden of and adherence to smartphone-based ecological momentary assessment in persons with affective disorders. *Journal of Clinical Medicine*, 9(2), 322.

Jones, A., Remmerswaal, D., Verveer, I., Robinson, E., Franken, I. H., Wen, C. K. F., & Field, M. (2019). Compliance with ecological momentary assessment protocols in substance users: A meta-analysis. *Addiction*, 114(4), 609-619.

Wen, C. K. F., Schneider, S., Stone, A. A., & Spruijt-Metz, D. (2017). Compliance with mobile ecological momentary assessment protocols in children and adolescents: a systematic review and meta-analysis. *Journal of medical Internet research*, *19*(4), e132.

Wrzus, C., & Neubauer, A. B. (2023). Ecological momentary assessment: A meta-analysis on designs, samples, and compliance across research fields. *Assessment*, *30*(3), 825-846.

## Week 5: Self-Reports and Short Scales in ESM

### Key Issues:

- Short scales and Single item scales
- Ways to adapt scales for ESM
- Types of ESM scales and response options
  - Immediate
  - Past window
- Scale shortening procedures

### Readings:

Heggestad, E. D., Scheaf, D. J., Banks, G. C., Monroe Hausfeld, M., Tonidandel, S., & Williams, E. B. (2019). Scale adaptation in organizational science research: A review and best-practice recommendations. *Journal of Management*, 45(6), 2596-2627.

Matthews, R. A., Pineault, L., & Hong, Y. H. (2022). Normalizing the use of single-item measures: Validation of the single-item compendium for organizational psychology. *Journal of Business and Psychology*, 37(4), 639-673.

Murray, A. L., Xiao, Z., Zhu, X., Speyer, L. G., Yang, Y., Brown, R. H., ... & Ribeaud, D. (2023). Psychometric evaluation of an adapted version of the perceived stress scale for ecological momentary assessment research. *Stress and Health*.

Versluis, A., Verkuil, B., Lane, R. D., Hagemann, D., Thayer, J. F., & Brosschot, J. F. (2021). Ecological momentary assessment of emotional awareness: Preliminary evaluation of psychometric properties. *Current Psychology*, 40, 1402-1410.

Frumkin, M. R., Greenberg, J. K., Boyd, P., Javeed, S., Shayo, B., Shin, J., ... & Rodebaugh, T. L. (2023). Establishing the Reliability, Validity, and Prognostic Utility of the Momentary Pain Catastrophizing Scale for use in Ecological Momentary Assessment Research. *The Journal of Pain*.

## **Week 6: Ecological Momentary Interventions and Just-in-time Interventions (JITAI)**

### **Key Issues:**

- Understanding EMI and JITAIs
- Practical recommendations for EMI and JITAIs
- Ways to implement event triggers and personalization on ExpiWell for EMIs and JITAI

### **Readings:**

Balaskas, A., Schueller, S. M., Cox, A. L., & Doherty, G. (2021). Ecological momentary interventions for mental health: A scoping review. *PloS one*, 16(3), e0248152.

Shim, Y., Scotney, V. S., & Tay, L. "Conducting mobile-enabled ecological momentary intervention research in positive psychology: key considerations and recommended practices." *The Journal of Positive Psychology* 17.5 (2022): 708-717.

Schueller, S. M., Aguilera, A., & Mohr, D. C. (2017). Ecological momentary interventions for depression and anxiety. *Depression and anxiety*, 34(6), 540-545.

Schneider, S., Junghaenel, D. U., Smyth, J. M., Fred Wen, C. K., & Stone, A. A. (2023). Just-in-time adaptive ecological momentary assessment (JITA-EMA). *Behavior Research Methods*, 1-19.

Nahum-Shani, I., Smith, S. N., Spring, B. J., Collins, L. M., Witkiewitz, K., Tewari, A., & Murphy, S. A. (2018). Just-in-time adaptive interventions (JITAIs) in mobile health: key components and design principles for ongoing health behavior support. *Annals of Behavioral Medicine*, 52(6), 446-462.

Perski, O., Hébert, E. T., Naughton, F., Hekler, E. B., Brown, J., & Businelle, M. S. (2022). Technology-mediated just-in-time adaptive interventions (JITAIs) to reduce harmful substance use: a systematic review. *Addiction*, 117(5), 1220-1241.

### **ExpiWell Event-Triggers and Personalization:**

<https://support.expiwell.com/portal/en/kb/articles/event-triggering-30-1-2022>

<https://support.expiwell.com/portal/en/kb/articles/personalize-timings-for-ema-and-esm>

## **Week 7: Issues in Participant Recruitment, Management, and Compensation**

### **Key Issues:**

- Screening participants and creating screeners
- Attention checks during baseline surveys
- Viewing participant engagement
- Factors affecting participant engagement
- Compensating participants via Amazon Gift Cards

### **Readings:**

Burke, L. E., Shiffman, S., Music, E., Styn, M. A., Kriska, A., Smailagic, A., ... & Rathbun, S. L. (2017). Ecological momentary assessment in behavioral research: addressing technological and human participant challenges. *Journal of medical Internet research*, 19(3), e77.

Stone, A. A., Schneider, S., Smyth, J. M., Junghaenel, D. U., Wen, C., Couper, M. P., & Goldstein, S. (2023). Shedding light on participant selection bias in Ecological Momentary Assessment (EMA) studies: Findings from an internet panel study. *Plos one*, 18(3), e0282591.

Stone, A. A., Schneider, S., Smyth, J. M., Junghaenel, D. U., Couper, M. P., Wen, C., ... & Goldstein, S. (2023). A population-based investigation of participation rate and self-selection bias in momentary data capture and survey studies. *Current Psychology*, 1-17.

Martinez, G. J., Mattingly, S. M., Robles-Granda, P., Saha, K., Sirigiri, A., Young, J., Chawla, N., Choudhury, M. D., D'Mello, S., Mark, G., & Striegel, A. (2021). Predicting Participant Compliance With Fitness Tracker Wearing and Ecological Momentary Assessment Protocols in Information Workers: Observational Study. *JMIR mHealth and uHealth*, 9(11), e22218. <https://doi.org/10.2196/22218>

Srinivas, P., Bodke, K., Ofner, S., Keith, N. R., Tu, W., & Clark, D. O. (2019). Context-Sensitive Ecological Momentary Assessment: Application of User-Centered Design for Improving User Satisfaction and Engagement During Self-Report. *JMIR mHealth and uHealth*, 7(4), e10894. <https://doi.org/10.2196/10894>

### **ExpiWell Screening, Attention Checks, and Participant Logs:**

<https://support.expiwell.com/portal/en/kb/webhelp/screening-participants>

<https://support.expiwell.com/portal/en/kb/articles/paying-participants>

<https://support.expiwell.com/portal/en/kb/articles/logs>

## **Week 8: Data Management, Basic Descriptives, and Visualizations**

### **\*\*\*\* Lecture Format \*\*\*\***

#### **Key issues:**

- Managing collected data
- Learning how to use R
- Creating R script for basic descriptives and visualisations

#### **Resources:**

Online book (Chapter 5): <https://bookdown.org/wadetroberts/r-you-ready-for-r/descriptive-statistics-and-data-visualization.html>

For a basic introduction:

<https://www.youtube.com/watch?v=XhDdhTQQoCs&list=PLbkhiRA2P3qLPRhbHfwJ82RyIsL5PL3HL&index=3>

More advanced visualizations:

[https://www.youtube.com/watch?v=HPJn1CMvtmI&list=PLtL57Fdbwb\\_C6RS0JtBojTNOMVlgpeJkS](https://www.youtube.com/watch?v=HPJn1CMvtmI&list=PLtL57Fdbwb_C6RS0JtBojTNOMVlgpeJkS)

#### **R Resources:**

<https://education.rstudio.com/learn/beginner/>

## Week 9: Reliability and Validity of Self-Reported Data

### Key Issues:

- Reliability with g-theory
- Psychometric isomorphism
- Isomorphism of predictive validity evidence across levels
- Analyzing response times

### Papers:

Calamia, M. (2019). Practical considerations for evaluating reliability in ambulatory assessment studies. *Psychological Assessment*, 31(3), 285–291.

<https://doi.org/10.1037/pas0000599>

Csikszentmihalyi, M., & Larson, R. (1987). Validity and reliability of the experience-sampling method. *The Journal of nervous and mental disease*, 175(9), 526-536.

Schneider, S., Hernandez, R., Junghaenel, D. U., Orriens, B., Lee, P. J., & Stone, A. A. (2023). Response times in Ecological Momentary Assessment (EMA): shedding light on the response process with a drift diffusion model. *Current Psychology*, 1-19.

Tay, L., Woo, S. E., & Vermunt, J. K. (2014). A conceptual and methodological framework for psychometric isomorphism: Validation of multilevel construct measures. *Organizational Research Methods*, 17(1), 77-106.

Stinson, L., Liu, Y., & Dallery, J. (2022). Ecological Momentary Assessment: A Systematic Review of Validity Research. *Perspectives on Behavior Science*, 45(2), 469–493.

<https://doi.org/10.1007/s40614-022-00339-w>

### Resources:

Hufford, M. R. (2007). Special methodological challenges and opportunities in ecological momentary assessment. *The science of real-time data capture: Self-reports in health research*, 54-75.

Toledo, M. J. L., Schneider, S., & Stone, A. A. (2024). Daily sampling frequency and sampling duration affect reliability of person-level estimates of physical activity outcomes: Optimizing Ecological Momentary Assessment studies of physical activities. *Psychology of Sport and Exercise*, 72, 102593.

<https://doi.org/10.1016/j.psychsport.2024.102593>

Degroote, L., DeSmet, A., De Bourdeaudhuij, I., Van Dyck, D., & Crombez, G. (2020). Content validity and methodological considerations in ecological momentary assessment

studies on physical activity and sedentary behaviour: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 17(1), 35.  
<https://doi.org/10.1186/s12966-020-00932-9>

Weatherson, K., Yun, L., Wunderlich, K., Puterman, E., & Faulkner, G. (2019). Application of an Ecological Momentary Assessment Protocol in a Workplace Intervention: Assessing Compliance, Criterion Validity, and Reactivity. *Journal of Physical Activity and Health*, 16(11), 985–992. <https://doi.org/10.1123/jpah.2019-0152>

Khor, A. S., Gray, K. M., Reid, S. C., & Melvin, G. A. (2014). Feasibility and validity of ecological momentary assessment in adolescents with high-functioning autism and Asperger's disorder. *Journal of Adolescence*, 37(1), 37–46.  
<https://doi.org/10.1016/j.adolescence.2013.10.005>

## Week 10: Basic Analysis with Multilevel Modeling

### Key Issues:

- Within Person Nested Data
- Rationale for multilevel modeling
- Understanding random effects: intercepts & slopes
- Growth Curve Models

### Readings:

Mitchell, T. R., & James, L. R. (2001). Building better theory: Time and specification of when things happen. *Academy of Management Review*, 26, 530-547.

Kahn, J. H. (2011). Multilevel modeling: Overview and applications to research in counseling psychology. *Journal of Counseling Psychology*, 58, 257-271.

### Resources:

Multilevel Models Workshop (Tutorial in R)

Part 1: <https://www.youtube.com/watch?v=n9gYDxR8bjI>

Part 2: <https://www.youtube.com/watch?v=ezb5znKdDeo>

Applied Multilevel Models (Tutorial in R)

Part 1: <https://www.youtube.com/watch?v=e5cvYhDgNeo>

Part 2: [https://www.youtube.com/watch?v=RncVw2\\_V9mM](https://www.youtube.com/watch?v=RncVw2_V9mM)

Part 3: <https://www.youtube.com/watch?v=s6V--jlAUmI>

Part 4: <https://www.youtube.com/watch?v=V2LUZBEUF9o&t=1s>

Online Book (Chapter 8): <https://bookdown.org/roback/bookdown-BeyondMLR/ch-multilevelintro.html>

## **Week 11: Modeling within-person changes**

### **Key Issues:**

- Issues of Centering
- Time-dependent error structures
- Autoregressive effects
- Predicting random effects

### **Readings:**

Enders, C. K., & Tofighi, D. (2007). Centering predictor variables in cross-sectional multilevel models: A new look at an old issue. *Psychological Methods, 12*, 121-138.

Hofmann, D. A., & Gavin, M. B. (1998). Centering decisions in hierarchical linear models: Implications for research in organizations. *Journal of Management, 24*, 623-641.

### **Resources:**

Multilevel Modeling for Intensive Longitudinal Data with Michael Russell  
<https://www.youtube.com/watch?v=8IxxU5H5iHA>

## Week 12: Advanced modeling techniques

### Key Issues:

- Introduction to
  - General Cross-Lagged Models
  - Mixed Models
  - Time Series Models

### Readings:

Zyphur, M. J., Allison, P. D., Tay, L., Voelkle, M. C., Preacher, K. J., Zhang, Z., ... & Diener, E. (2020). From data to causes I: Building a general cross-lagged panel model (GCLM). *Organizational Research Methods*, 23(4), 651-687.

Zyphur, M. J., Voelkle, M. C., Tay, L., Allison, P. D., Preacher, K. J., Zhang, Z., ... & Diener, E. (2020). From data to causes II: Comparing approaches to panel data analysis. *Organizational Research Methods*, 23(4), 688-716.

Zyphur, M. J., Hamaker, E. L., Tay, L., Voelkle, M., Preacher, K. J., Zhang, Z., ... & Diener, E. F. (2021). From data to causes III: Bayesian priors for general cross-lagged panel models (GCLM). *Frontiers in Psychology*, 12, 612251.

Crayen, C., Eid, M., Lischetzke, T., & Vermunt, J. K. (2017). A continuous-time mixture latent-state-trait Markov model for experience sampling data. *European Journal of Psychological Assessment*.

Jebb, A. T., Tay, L., Wang, W., & Huang, Q. (2015). Time series analysis for psychological research: examining and forecasting change. *Frontiers in psychology*, 6, 727.

Jebb, A. T., & Tay, L. (2017). Introduction to time series analysis for organizational research: Methods for longitudinal analyses. *Organizational Research Methods*, 20(1), 61-94.

## Week 13: Future of ESM techniques

### Key Issues:

- Mobile sensing
- AI/ML
- Wearable sensors
- Privacy/Ethical issues

### Readings:

Harari, G. M., & Gosling, S. D. (2023). Understanding behaviours in context using mobile sensing. *Nature Reviews Psychology*, 2(12), 767-779.

Harari, G. M., Müller, S. R., Aung, M. S., & Rentfrow, P. J. (2017). Smartphone sensing methods for studying behavior in everyday life. *Current opinion in behavioral sciences*, 18, 83-90.

Cipresso, P., Serino, S., Borghesi, F., Tartarisco, G., Riva, G., Pioggia, G., & Gaggioli, A. (2021). Continuous measurement of stress levels in naturalistic settings using heart rate variability: An experience-sampling study driving a machine learning approach. *ACTA IMEKO*, 10(4), 239-248.

Weidman, A. C., Sun, J., Vazire, S., Quoidbach, J., Ungar, L. H., & Dunn, E. W. (2020). (Not) hearing happiness: Predicting fluctuations in happy mood from acoustic cues using machine learning. *Emotion*, 20(4), 642.

Thapa, S., Hou, X., & Tay, L. (2021). Experience Sampling Methodology: Conceptual and Technological Advances for Understanding and Assessing Variability in Well-Being Research. *Research in Occupational Stress and Well-Being Volume 19: Examining and Exploring the Shifting Nature of Occupational Stress and Well-Being*