Ecological Momentary Assessment

tim.steenbergh@indwes.edu
• Define ecological momentary assessment (EMA) and explain its value in understanding human behavior
• Describe methodologies that belong to the EMA family
• Identify advantages and challenges of EMA research
• Discuss possible uses of EMA in research and the classroom
Humans as bundles of habits

The human being is a bundle of habits, stamped in to a tabula rasa; there is no limit to reform.

- Charles Taylor
They want to know if we would like to take part in a survey?
Survey Time!

• Take 5 minutes to complete the CES-D.

• NOTE: we will only talk about the experience of responding to survey questions like these.

• **How** did you answer the questions?
“Individuals’ self-reports provide the only window on their inner states. Unfortunately, this window is often foggy...”

Why are retrospective self reports “foggy?”

• Recall Bias: salience of unusual experiences over mundane; recency effects, effects of current mood
• Estimation problems
  • Frequency- frequent events and/or those that occur in irregular patterns are poorly estimated

Schwarz (2007)
Frequency estimation

During a typical day, I check my email _____ per day.

a. less than once  
b. 1 – 3 times  
c. 4 – 6 times  
d. 7 – 9 times  
e. 10 – 12 times  
f. more than 12 times
“Individuals’ self-reports provide the only window on their inner states. Unfortunately, this window is often foggy...”

Why are retrospective self reports “foggy?”

• Recall Bias: salience of unusual experiences over mundane; recency effects, effects of current mood

• Estimation problems
  • Frequency- frequent events and/or those that occur in irregular patterns are poorly estimated
  • Intensity- we have difficulty estimating intensity (peak and end effects)

• Inference strategies

Schwarz (2007)
C'MON PEOPLE WE NEED TO COME UP WITH SOMETHING NEW. WE CAN'T JUST KEEP ADDING BLADES.
EMA: Family of data gathering strategies designed to offer greater clarity by repeatedly assessing people in everyday contexts

- Daily diaries
- Self-monitoring (behavioral assessment)
- Experience Sampling Method (Csikszentmihalyi & Larson, 1987)
- Ambulatory Assessment
EMA can be...

• Event-based / user initiated (e.g., cigarette craving; after a social interaction)
• Interval-based (e.g., top of every hour)
• Randomly prompted (randomized notifications)
EMA: random assessment in a day

| Time     | 12:00 AM | 12:15 AM | 12:30 AM | 12:45 AM | 1:00 AM | 1:15 AM | 1:30 AM | 1:45 AM | 2:00 AM | 2:15 AM | 2:30 AM | 2:45 AM | 3:00 AM | 3:15 AM | 3:30 AM | 3:45 AM | 4:00 AM | 4:15 AM | 4:30 AM | 4:45 AM | 5:00 AM | 5:15 AM | 5:30 AM | 5:45 AM | 6:00 AM | 6:15 AM | 6:30 AM | 6:45 AM | 7:00 AM | 7:15 AM | 7:30 AM | 7:45 AM | 8:00 AM | 8:15 AM | 8:30 AM | 8:45 AM | 9:00 AM | 9:15 AM | 9:30 AM | 9:45 AM | 10:00 AM | 10:15 AM | 10:30 AM | 10:45 AM | 11:00 AM | 11:15 AM | 11:30 AM | 11:45 AM | 12:00 PM | 12:15 PM | 12:30 PM | 12:45 PM | 1:00 PM | 1:15 PM | 1:30 PM | 1:45 PM | 2:00 PM | 2:15 PM | 2:30 PM | 2:45 PM | 3:00 PM | 3:15 PM | 3:30 PM | 3:45 PM | 4:00 PM | 4:15 PM | 4:30 PM | 4:45 PM | 5:00 PM | 5:15 PM | 5:30 PM | 5:45 PM | 6:00 PM | 6:15 PM | 6:30 PM | 6:45 PM | 7:00 PM | 7:15 PM | 7:30 PM | 7:45 PM | 8:00 PM | 8:15 PM | 8:30 PM | 8:45 PM | 9:00 PM | 9:15 PM | 9:30 PM | 9:45 PM | 10:00 PM | 10:15 PM | 10:30 PM | 10:45 PM | 11:00 PM | 11:15 PM | 11:30 PM | 11:45 PM |
EMA: random assessment for a week

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00</td>
<td>12:15</td>
<td>12:30</td>
<td>12:45</td>
<td>1:00</td>
<td>1:15</td>
<td>1:30</td>
<td>1:45</td>
<td>2:00</td>
<td>2:15</td>
<td>2:30</td>
<td>2:45</td>
<td>3:00</td>
<td>3:15</td>
<td>3:30</td>
<td>3:45</td>
<td>4:00</td>
<td>4:15</td>
<td>4:30</td>
<td>4:45</td>
<td>5:00</td>
<td>5:15</td>
<td>5:30</td>
<td>5:45</td>
<td>6:00</td>
<td>6:15</td>
<td>6:30</td>
<td>6:45</td>
<td>7:00</td>
</tr>
<tr>
<td>8:00</td>
<td>8:15</td>
<td>8:30</td>
<td>8:45</td>
<td>9:00</td>
<td>9:15</td>
<td>9:30</td>
<td>9:45</td>
<td>10:00</td>
<td>10:15</td>
<td>10:30</td>
<td>10:45</td>
<td>11:00</td>
<td>11:15</td>
<td>11:30</td>
<td>11:45</td>
<td>12:00</td>
<td>12:15</td>
<td>12:30</td>
<td>12:45</td>
<td>1:00</td>
<td>1:15</td>
<td>1:30</td>
<td>1:45</td>
<td>2:00</td>
<td>2:15</td>
<td>2:30</td>
<td>2:45</td>
<td>3:00</td>
</tr>
</tbody>
</table>

13
• Provides ecologically valid data
• Enables modeling of longitudinal change at both the individual and group level
Intra-subject Change

Atkins (2012)
Inter-subject Change

Atkins (2012)
• Provides ecologically valid data
• Enables modeling of longitudinal change at both the individual and group level
• Allows analysis of the relationship of variables in time and context (eg, mood and attention in classroom)
• Technology is making it easier/automated
• Can provide objective physical measurement concurrently with subjective reports
EMA Technology

- Old School: daily diaries, alarm watches, and Palm Pilots
- Today: Smartphone Apps
  - Powerful data collection possibilities
  - Mass-reach potential
  - Natural portability/ minimal intrusion
- Web-based question development and data collection
iHabit™ Platform Specs

- Runs on iPhone, iTouch or iPad (Android is next)
- Free download from iTunes
- Visual and/or audible alarms notify user of question
- *Check In questions* can be randomized to gather a representative sample of responses
- Branching allows researcher to drill down on relevant variables
- *End of Day* feature works as electronic daily diary
- *Free Response* allows dynamic data input
- Data is time-stamped, stored on device, then uploaded to server when WiFi signal is available
1. Create questions & prompts

2. Send questions & prompts

3. Provide experience data

4. Analyze App User Data

LifeData Manager

iHabit™ app user
What have you been doing in the last 10 minutes? (Pick all that apply.)

Select all that apply:
- Working
- Relaxing/Napping
- Sports/Exercise
- Entertainment (Media)
- Entertainment (Social)
How many of the last 20 minutes have you spent working on academics?

Minutes:

0
1
2

Blurred Vision

No
Minor
Severe

Symptoms

0 1 2 3 4 5 6

Back  Skip  Next
Do we really want to know?

In the last 5 minutes, what has been your level of interest in the presentation?

72%

None  Very High

Back  Next
Study 1: First Year Students
First Year Students
(N=81)

PRETEST (Week 2)
Self Efficacy | Social Support | Stress

RANDOM ASSIGNMENT

POSTTEST (Week 14)
Self Efficacy | Social Support | Stress
Life Satisfaction | App Ratings

No App Control (n=37)

Weeks 3, 8 & 14

Habit (n=44)
## Examples of iHabit™ Study Questions

<table>
<thead>
<tr>
<th>Check in Questions</th>
<th>End of Day Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many of the last 20 minutes have you...</td>
<td></td>
</tr>
<tr>
<td>spent working on academics?</td>
<td>What time did you go to bed last night?</td>
</tr>
<tr>
<td>spent socializing?</td>
<td>What time did you get up this morning?</td>
</tr>
<tr>
<td>spent playing sports/exercising?</td>
<td>How much time did you spend in direct interaction with faculty today?</td>
</tr>
<tr>
<td>spent praying or thinking of God?</td>
<td>How confident are you in your ability to succeed academically?</td>
</tr>
<tr>
<td>spent in recreational use of electronics (phone, computer, tv, etc)?</td>
<td>Overall, how confident are you in your academic ability?</td>
</tr>
<tr>
<td>wasted?</td>
<td>How much effort did you put into your academics today?</td>
</tr>
</tbody>
</table>
EMA of Time Spent on Activities

Results: In the Moment
EMA: Time Spent Over Course of Semester

Results: In the Moment

Week 3 (n=44)
Week 8 (n=33)
Week 14 (n=26)
Posttest: Perception of % of Time Wasted & Correlations with First Semester GPA

Results:
In the Moment Effects

- Control: $r = 0.15$, $p = 0.27$
- iHabit™: $r = -0.49$, $p = 0.001$
Time Spent on Rec Use of Electronics & Correlations with First-Semester GPA

Results:

In the Moment Effects

Control: $r = 0.06$, $p = 0.40$

iHabit™: $r = -0.35$, $p = 0.01$
End of Day Results
Academic Enjoyment & Effort Ratings

Results: End of Day
The iHabit app made me more aware of how I spend my time

Posttest Results

- Very Strongly Disagree
- Strongly Disagree
- Mildly Disagree
- Neutral
- Mildly Agree
- Strongly Agree
- Very Strongly Agree
I changed how I spend my time in response to the app.
Reactivity:
The tendency to change our behavior when it’s measured

Ecological Momentary Intervention
Study 2
Gratitude
Randomized EMA/I Study

Pretest

Full Day Gratitude
- Gratitude Prompts
- Evening Gratitude Practice

End of Day Gratitude
- Control Prompts
- Evening Gratitude Practice

Control
- Control Prompts
- Evening Control Practice

Posttest

1-Month Follow Up
EMA “Happiness” Ratings

[Graph showing EMA ratings for different days and conditions]
EMA Challenges & Limitations

• Data overload
• Statistical analyses can be complicated
• Problems with self-report, while reduced, remain
• Technology dependent
# Data Output

<table>
<thead>
<tr>
<th>dataID</th>
<th>packID</th>
<th>questionID</th>
<th>serial</th>
<th>timestamp</th>
<th>data</th>
<th>studentID</th>
</tr>
</thead>
<tbody>
<tr>
<td>86688</td>
<td>health12</td>
<td>affect_rel</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:47</td>
<td>4</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86689</td>
<td>health12</td>
<td>affect_hap</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:47</td>
<td>7</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86690</td>
<td>health12</td>
<td>affect_con</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:47</td>
<td>5</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86691</td>
<td>health12</td>
<td>affect_pea</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:47</td>
<td>3</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86692</td>
<td>health12</td>
<td>affect_ale</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:47</td>
<td>5</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86693</td>
<td>health12</td>
<td>stress_str</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:48</td>
<td>4</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86695</td>
<td>health12</td>
<td>stress_exc</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:48</td>
<td>1</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86696</td>
<td>health12</td>
<td>stress_goo</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:48</td>
<td>1</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86697</td>
<td>health12</td>
<td>eating_che</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:48</td>
<td>yes</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86718</td>
<td>health12</td>
<td>eating_hear</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:48</td>
<td>5</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86719</td>
<td>health12</td>
<td>eating_too</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:48</td>
<td>1</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86720</td>
<td>health12</td>
<td>eating_con</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:48</td>
<td>5</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86721</td>
<td>health12</td>
<td>eating_hun</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:48</td>
<td>3</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86722</td>
<td>health12</td>
<td>eating_gui</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:48</td>
<td>no</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86723</td>
<td>health12</td>
<td>napping_na</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:48</td>
<td>yes</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86724</td>
<td>health12</td>
<td>exercise_c</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:48</td>
<td>1</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86725</td>
<td>health12</td>
<td>exercise_l</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:49</td>
<td>1</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86726</td>
<td>health12</td>
<td>exercise_j</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:49</td>
<td>vigorous</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86727</td>
<td>health12</td>
<td>exercise_c</td>
<td>96D3EFB7-6C09-428E-824D-925495F3F233</td>
<td>9/25/2012 22:49</td>
<td>1</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86471</td>
<td>health12</td>
<td>affect_rel</td>
<td>60F3C3CB-EB48-43AE-881B-FF636B4C1A09</td>
<td>9/26/2012 22:44</td>
<td>5</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86472</td>
<td>health12</td>
<td>affect_hap</td>
<td>60F3C3CB-EB48-43AE-881B-FF636B4C1A09</td>
<td>9/26/2012 22:44</td>
<td>5</td>
<td>xxxxxxxx</td>
</tr>
<tr>
<td>86473</td>
<td>health12</td>
<td>affect_con</td>
<td>60F3C3CB-EB48-43AE-881B-FF636B4C1A09</td>
<td>9/26/2012 22:44</td>
<td>6</td>
<td>xxxxxxxx</td>
</tr>
</tbody>
</table>
EMA Applications for Teaching

• Well-suited for dispositional outcome assessment and change
• Potential for real-time assessment
• Examples
  • First Year Programming
  • Advanced Topics Personal Change Assignment
  • Minority Group Relations
Acknowledgements

Jason Runyan, DPhil
Doug Daugherty, PsyD
Don Sprowl, PhD
Brian Fry, PhD
Tiffany LeFever, BS
Chuck Bainbridge, BS
Emily Ragsdale, BS
Hannah Woodard
Sarah Ringenberg
Amy Sloan
Caleb King
For more info contact:
tim.steenbergh@indwes.edu
or visit:
www.emaresearch.org