Positive Affect as a Heterogenous Construct:
Implications for Healthy Aging

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- Daniel Mroczek, Ph.D.
- Bert Uchino, Ph.D.

► How do we understand happiness (i.e., positive affect)?

   ► Does happiness change over time?

   ► What distinguishing happy people form unhappy ones?

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► How do we understand happiness (i.e., positive affect)?

► What are the mechanisms connecting positive affect and health?

► Do health and well-being involve more than high levels of positive affect and low levels negative affect?
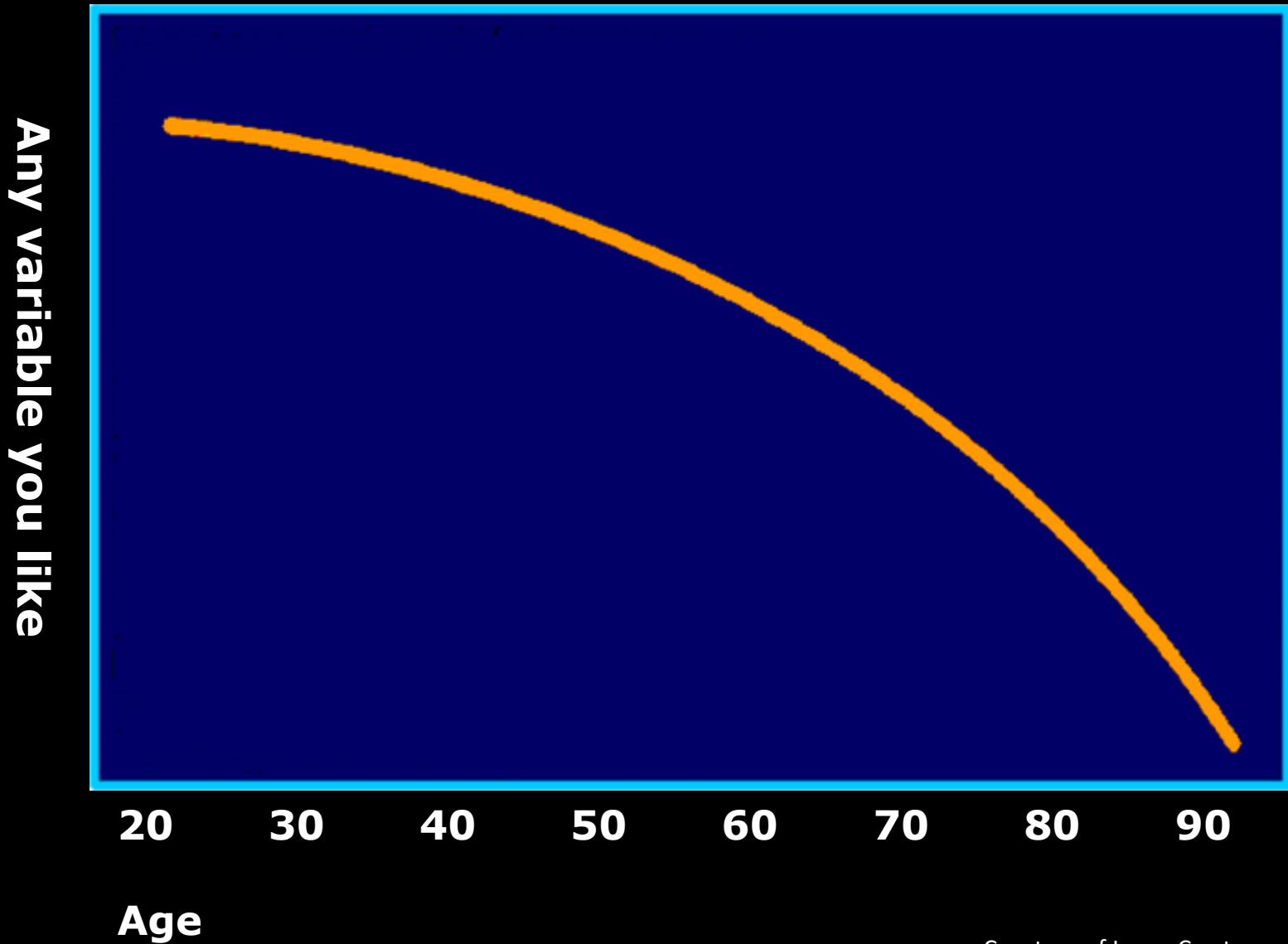
► Positive affect as a heterogeneous construct.

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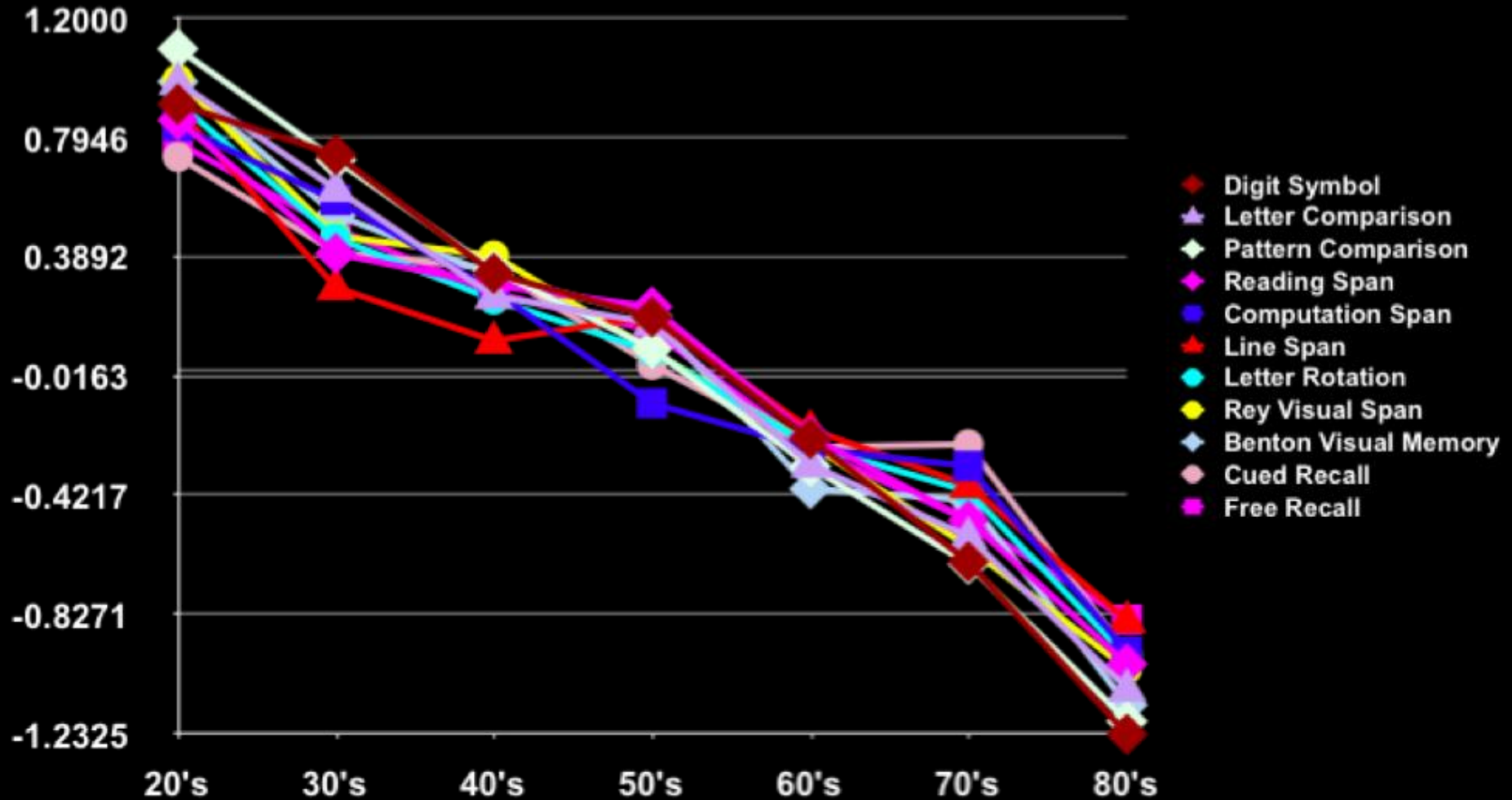
► Positive affect as a dynamic phenomena

PART N° 1

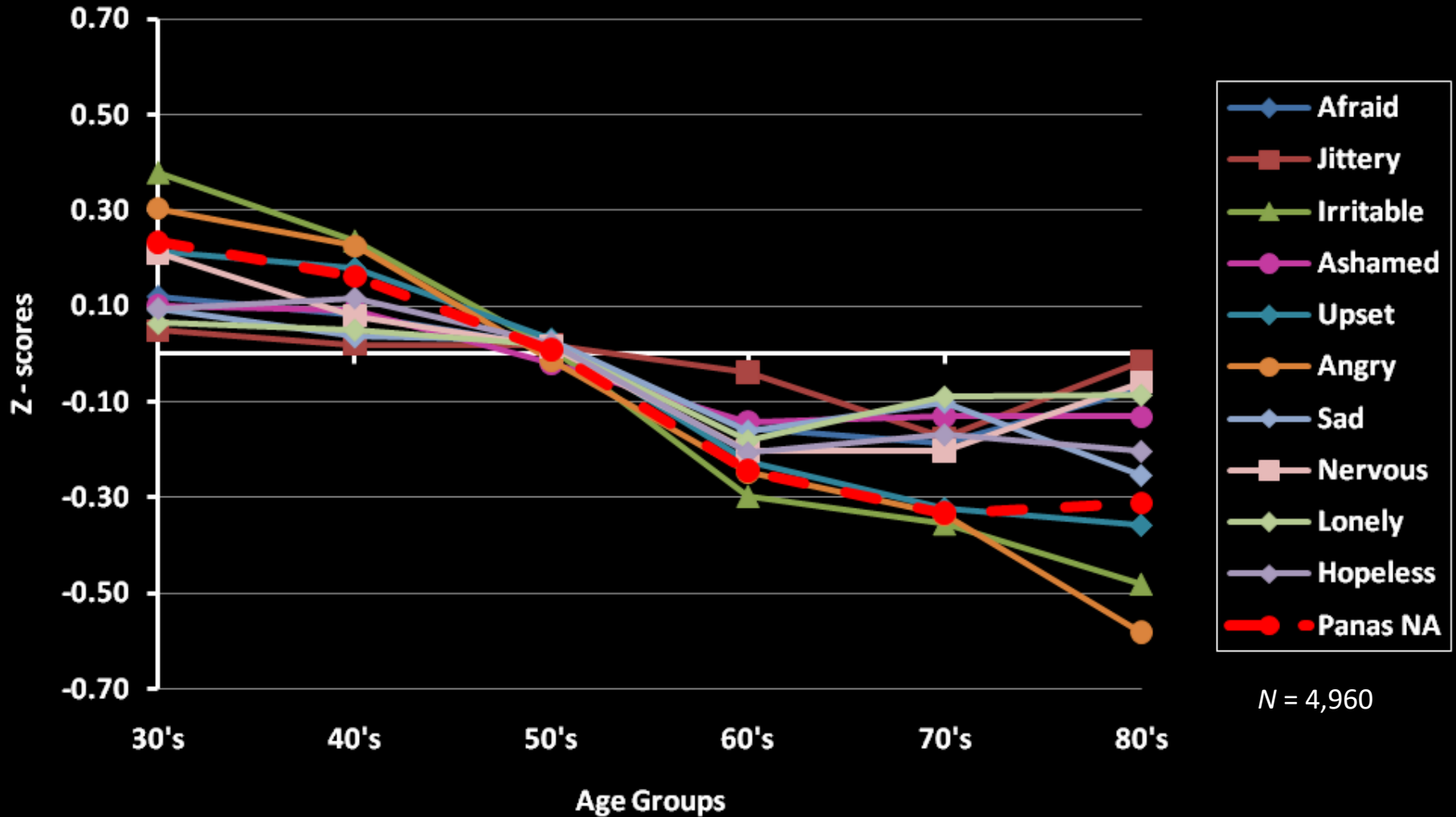► How do we understand positive affect? (a longitudinal puzzle)

Lay View: Age as Loss

Any variable you like

Age

20 30 40 50 60 70 80 90

Courtesy of Laura Carstensen

The Aging Mind

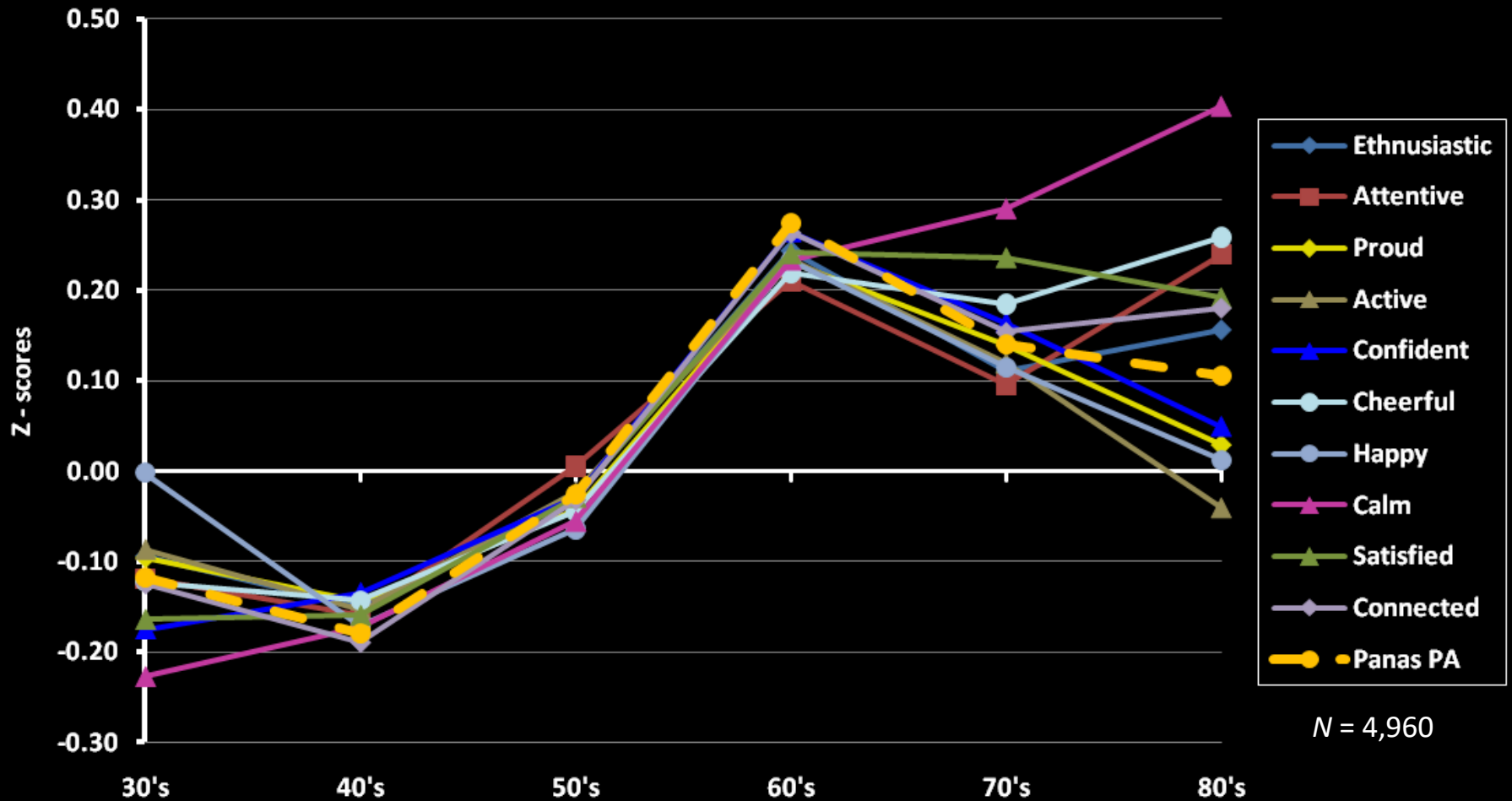Courtesy of Denise Park: *Psychology & Aging* (2002)

Lifespan View: Age as Emotional Stability

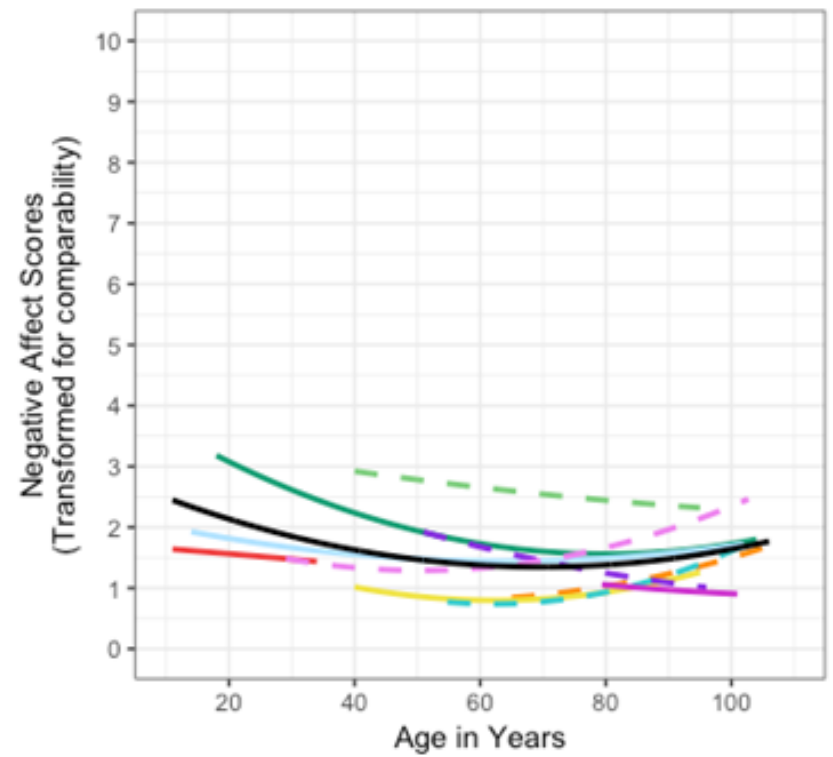*N* = 4,960

Lifespan View: Age as Emotional Stability

N = 4,960

Study

— ADDH	— — DEAS (P)	— LSOG	— — SATSA
— — ALSA	— HRS	— — NAS	— Meta-Analysis
— DEAS (C)	— — LASA	— Octo-Twin	

N = 84,778
Age (11 to 106 yrs)

region — Australia — Germany — Netherlands — Sweden — USA

PART N° 1

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► How do we understand positive affect? (a cross-sectional puzzle)

The Nun Study

Danner, Snowdon, and Friesen (2001), *JPSP*

Code	Sample size		Effect size (95% CI)	% Weight
1.a	4753		0.87 (0.73, 1.03)	0.68
1.b	4753		1.05 (0.93, 1.16)	1.32
2	719671		1.02 (0.99, 1.06)	3.12
3	2310		0.83 (0.69, 0.99)	0.63
4	1751		0.90 (0.78, 1.04)	0.91
5	9050		0.70 (0.58, 0.83)	0.64
6	11557		0.95 (0.91, 0.99)	2.86
7.a	6163		0.96 (0.86, 1.07)	1.34
7.b	6163		0.85 (0.78, 0.93)	1.73
8	1021		1.02 (0.93, 1.12)	1.62
10.a	448		0.91 (0.73, 1.13)	0.46
10.b	1214		0.85 (0.74, 0.97)	0.99
11.a	3680		0.99 (0.90, 1.08)	1.66
11.b	3933		1.05 (0.89, 1.23)	0.76
12	7920		1.10 (1.04, 1.17)	2.40
13.a	650		0.99 (0.99, 1.00)	3.71
13.b	1343		1.00 (1.00, 1.00)	3.73
14.a	2541		0.98 (0.96, 1.01)	3.40
14.b	2177		0.96 (0.95, 0.99)	3.51
15.a	10056		0.75 (0.47, 1.21)	0.11
15.b	11512		0.63 (0.35, 1.12)	0.07
17.a	1402		1.13 (0.94, 1.35)	0.63
17.b	1402		0.86 (0.73, 1.02)	0.72
19.a	821		0.70 (0.55, 0.90)	0.36
19.b	1118		0.66 (0.52, 0.85)	0.38
20	9420		0.97 (0.96, 0.99)	3.61
21	9025		0.72 (0.57, 0.89)	0.45
22	2490		0.78 (0.63, 0.98)	0.44
23.a	111		0.34 (0.12, 0.94)	0.02
23.b	111		0.72 (0.54, 0.98)	0.26
24	4411		0.92 (0.86, 0.98)	2.27
25.a	1357		0.68 (0.41, 1.13)	0.09
25.b	1229		1.24 (0.57, 2.71)	0.04
26.a	204		0.85 (0.73, 0.98)	0.88
26.b	213		0.94 (0.80, 1.11)	0.74
27.a	3714		0.87 (0.83, 0.91)	2.83
27.b	3714		0.80 (0.77, 0.83)	3.08
28	3853		0.65 (0.44, 0.96)	0.15
29.a	3124		0.97 (0.86, 1.09)	1.20
29.b	3124		0.88 (0.76, 1.02)	0.88
30	861		0.92 (0.75, 1.14)	0.49
31	190		1.00 (0.97, 1.02)	3.47
32	4888		0.94 (0.72, 1.23)	0.32
33	968		0.74 (0.58, 0.95)	0.37
34	6856		0.99 (0.98, 1.00)	3.64
35	1384		0.99 (0.97, 1.00)	3.62
36	1238		0.60 (0.42, 0.87)	0.18
37	5131		0.45 (0.20, 0.70)	0.07
38	450		0.94 (0.91, 0.96)	3.35
40.a	42089		0.62 (0.51, 0.76)	0.54
40.b	46086		0.89 (0.66, 1.21)	0.26
41.a	30155		0.85 (0.80, 0.90)	2.45
41.b	43117		0.93 (0.86, 1.00)	2.02
42	97253		0.86 (0.79, 0.93)	1.87
43.a	832		0.62 (0.45, 0.86)	0.22
43.b	786		0.74 (0.45, 1.22)	0.10
44	2673		0.83 (0.67, 1.01)	0.51
45	8918		1.04 (0.85, 1.29)	0.49
46	43391		0.71 (0.63, 0.83)	0.97
47.a	320		0.53 (0.35, 0.79)	0.14
48.a	20323		0.90 (0.84, 0.97)	2.10
48.b	8916		0.84 (0.76, 0.92)	1.57
48.c	11407		0.79 (0.69, 0.91)	0.96
49	689		0.11 (0.03, 0.47)	0.01
50	26401		0.96 (0.94, 0.99)	3.42
51	421		0.65 (0.49, 0.86)	0.30
53.a	2511		0.85 (0.55, 1.36)	0.12
53.b	443		0.59 (0.12, 2.94)	0.01
54	1002		0.66 (0.44, 0.97)	0.15
55.a	1576		1.16 (0.91, 1.43)	0.43
55.b	2201		1.09 (0.77, 1.43)	0.24
58.a	1502		0.96 (0.90, 1.02)	2.30
58.b	1577		0.92 (0.85, 0.99)	1.92
59	503		0.29 (0.11, 0.77)	0.03
63	4185		0.91 (0.70, 1.16)	0.35
64	5328		0.85 (0.68, 1.06)	0.44
65	310		0.57 (0.36, 0.89)	0.12
66	3673		0.90 (0.85, 0.96)	2.40
67.a	108		0.15 (0.04, 0.55)	0.01
67.b	104		0.40 (0.12, 1.34)	0.02
68	491		0.89 (0.83, 0.96)	2.08
69	90		0.23 (0.10, 0.59)	0.03
70	1306		0.70 (0.44, 1.22)	0.09
71	349		0.45 (0.27, 0.76)	0.09
72.a	3870		0.74 (0.55, 0.99)	0.27
72.b	4109		1.25 (0.83, 1.85)	0.15
73	1214		0.45 (0.26, 0.78)	0.08
74	1002		0.56 (0.39, 0.80)	0.18
75	2573		1.25 (0.95, 1.64)	0.31
76	248		0.47 (0.27, 0.84)	0.08
Overall (I–squared = 85.6%, p = 0.000)			0.92 (0.91, 0.93)	100.00

NOTE: Weights are from random effects analysis

.5   1   2

Well-being reduces risk of mortality   Well-being increases risk of mortality

62 studies (*N* = 1,259,949)

Source: Steptoe et al. (2017)

PART N° 2

► What are the mechanisms connecting positive affect and health?

Overview

- self

- mind

- body

The Role of Positive Emotions in Positive Psychology

The Broaden-and-Build Theory of Positive Emotions

Barbara L. Fredrickson
University of Michigan

Positive Affect and the Other Side of Coping

Susan Folkman and Judith Tedlie Moskowitz
University of California, San Francisco

Does Positive Affect Influence Health?

Sarah D. Pressman and Sheldon Cohen
Carnegie Mellon University

Stress Regulation

- Background

- Laboratory stress challenge

- Daily cardiovascular responses

- Spousal bereavement

- Summary

The Stress-Buffering Hypothesis
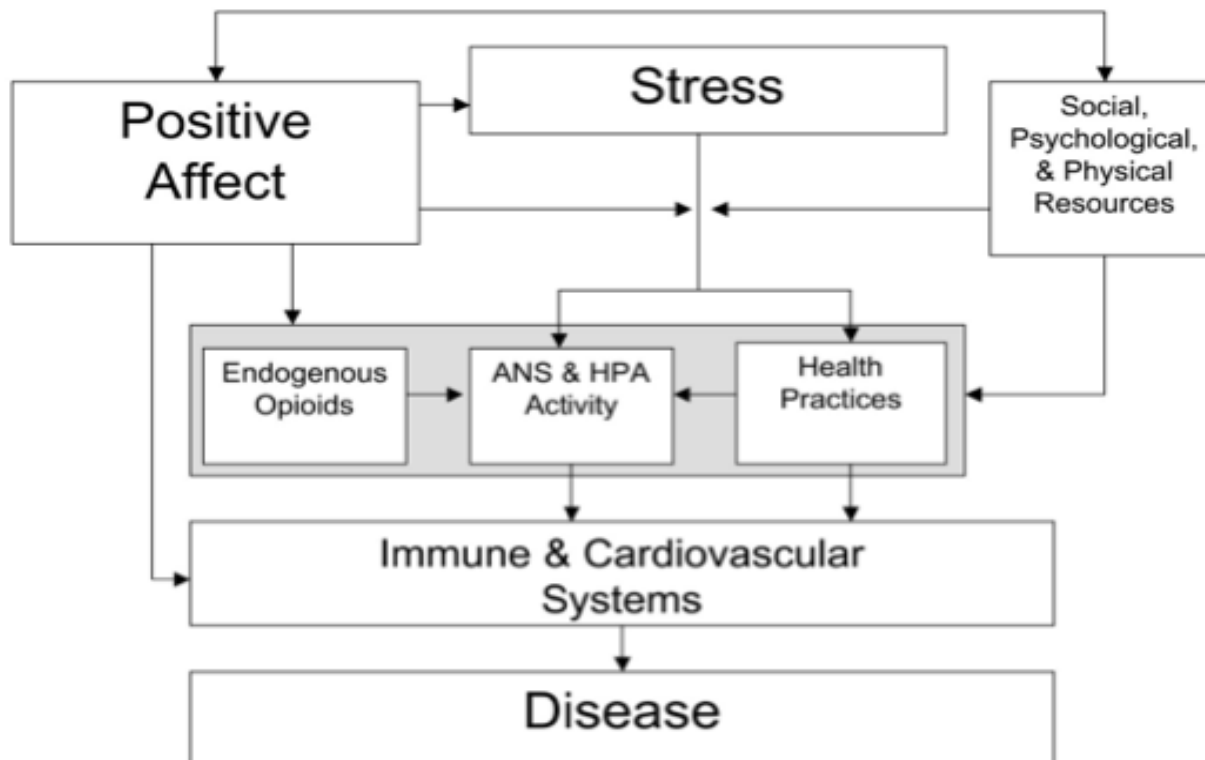
Pressman & Cohen (2005). *Psychological Bulletin*

The Stress-Buffering Hypothesis

Pressman & Cohen, 2005, *Psychological Bulletin*
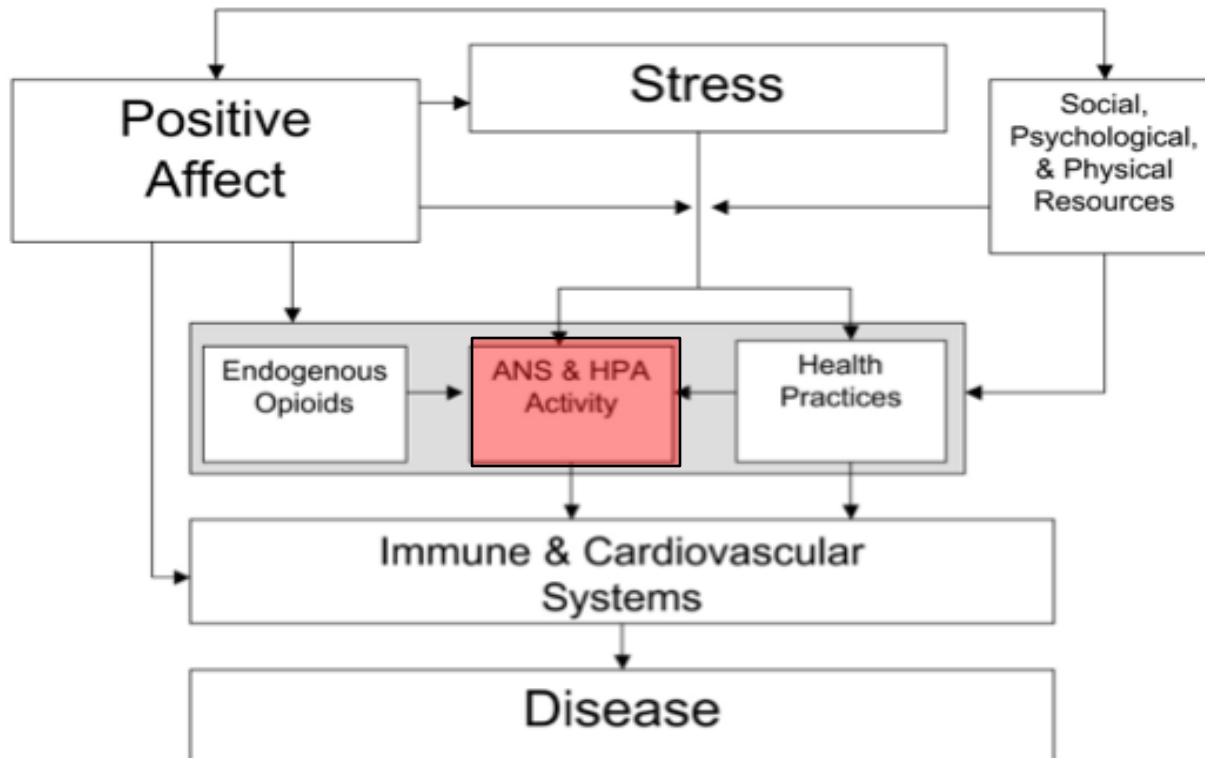
Stress Regulation

- Background

- Laboratory stress challenge

Lab Challenge Study

- Between-Ps Manipulation:
  - Positive emotion
  - Neutral

- Trier Social Stress Test
  - Speech anxiety
  - Mental arithmetic

- Dependent Measure:
  - Salivary cortisol

Trier Social Stress Test

Menacing Experimenter
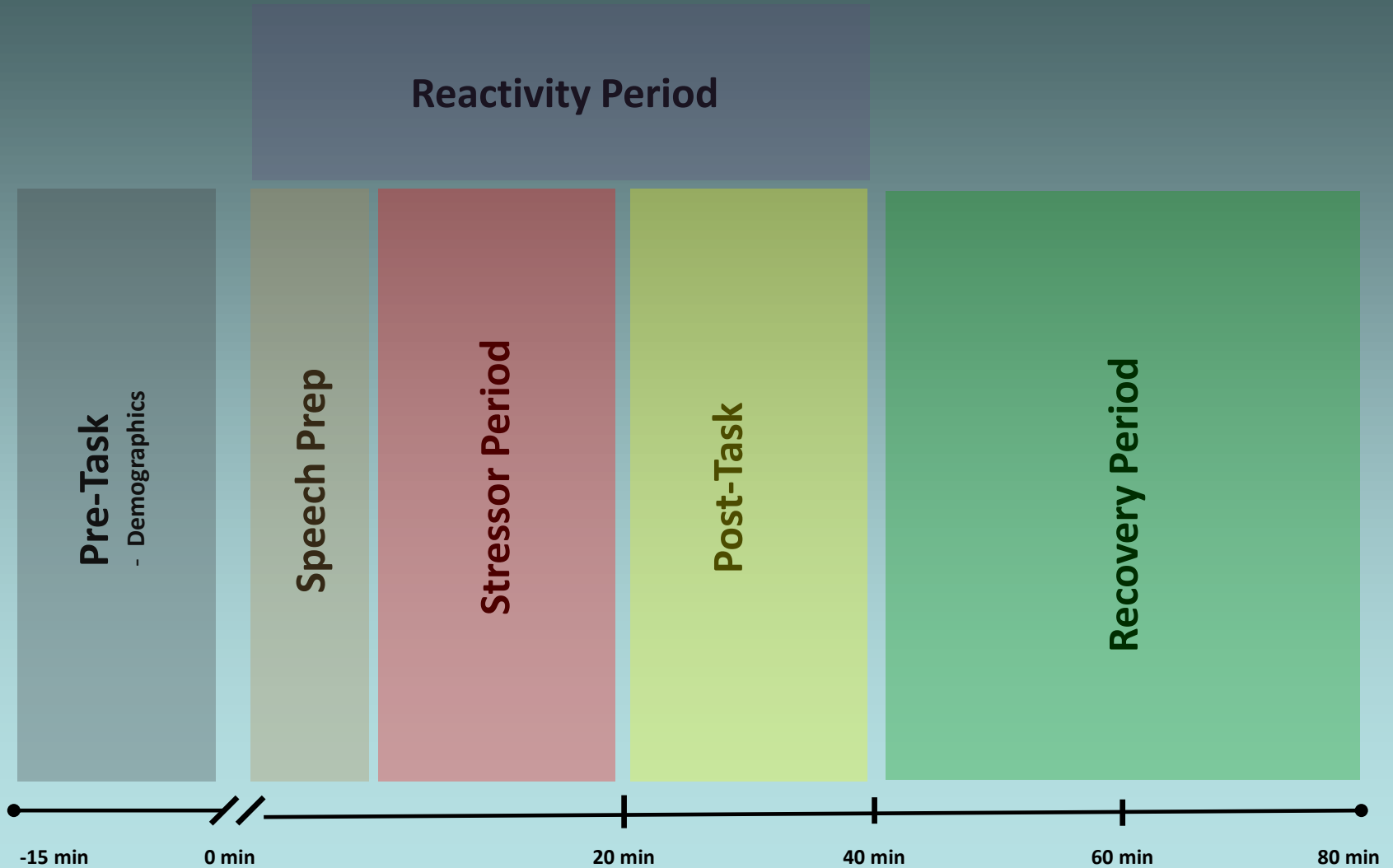
Analytic Strategy: Piecewise LGC

Cortisol $_{it}$ = π_0(baseline) + π_1(reactivity) + π_3(recovery) + r_{it}

BaselineCortisol Intercept (π_0)

Recovery Cortisol Slope (π_1)

Reactivity Cortisol Slope (π_2)

Analytic Strategy: Piecewise LGC

Person-level Model

$$\pi_{0j} = b_{00} + b_{01}(\text{Age}) + b_{02}(\text{Emotion}) + b_{03}(\text{Age x Emotion}) + u_{0j}$$

$$\pi_{1j} = b_{10} + b_{11}(\text{Age}) + b_{12}(\text{Emotion}) + b_{13}(\text{Age x Emotion}) + u_{1j}$$

$$\pi_{2j} = b_{20} + b_{21}(\text{Age}) + b_{22}(\text{Emotion}) + b_{23}(\text{Age x Emotion}) + u_{2j}$$

Cortisol Reactivity and Recovery

Legend: Neutral, Positive Emotion

Y-axis: Salivary Cortisol (nmol/L), 0 to 12

X-axis: Post-Stress Task Onset — Baseline, 30 min, 60 min

N = 242
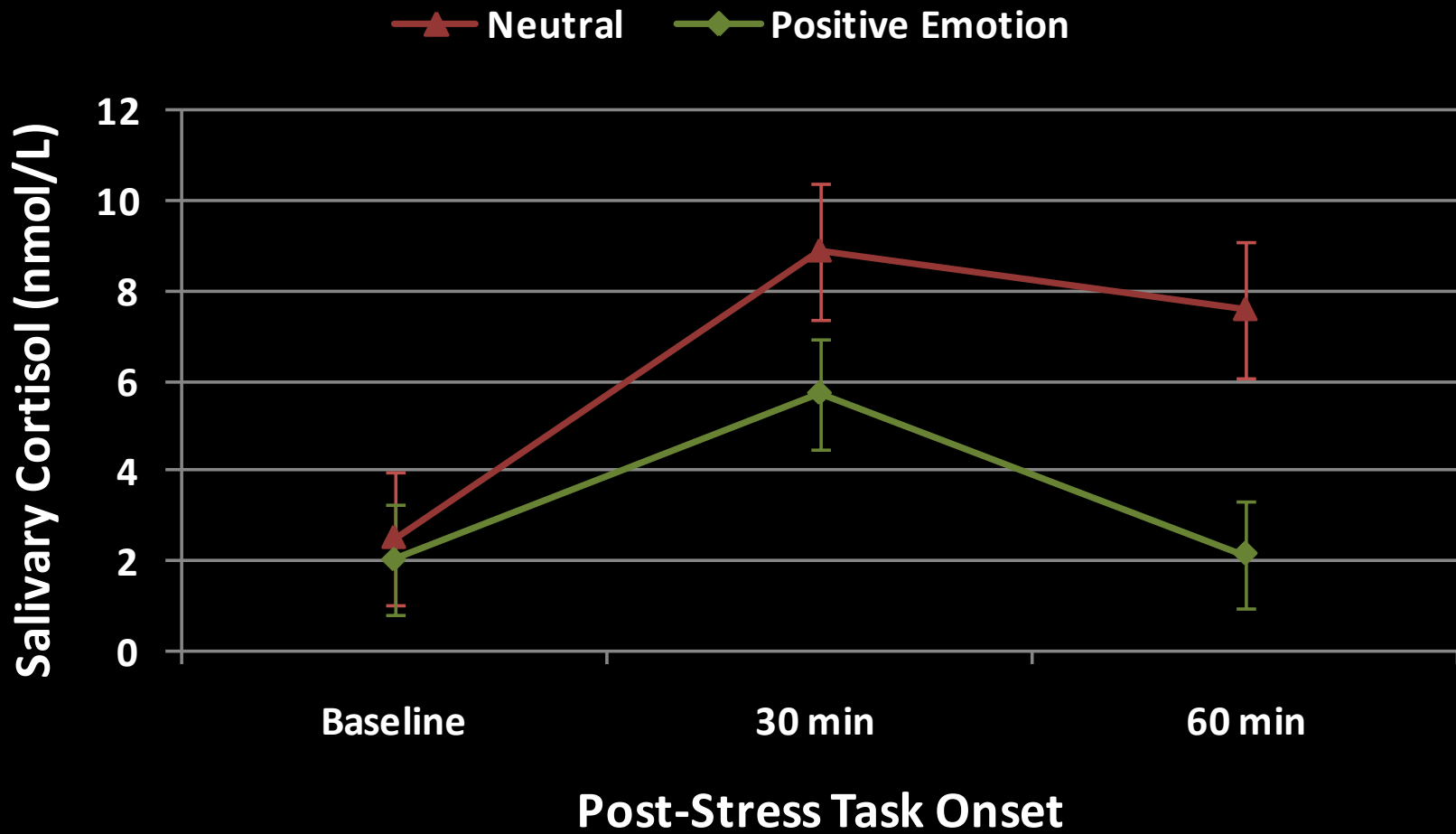
Cortisol Reactivity and Recovery
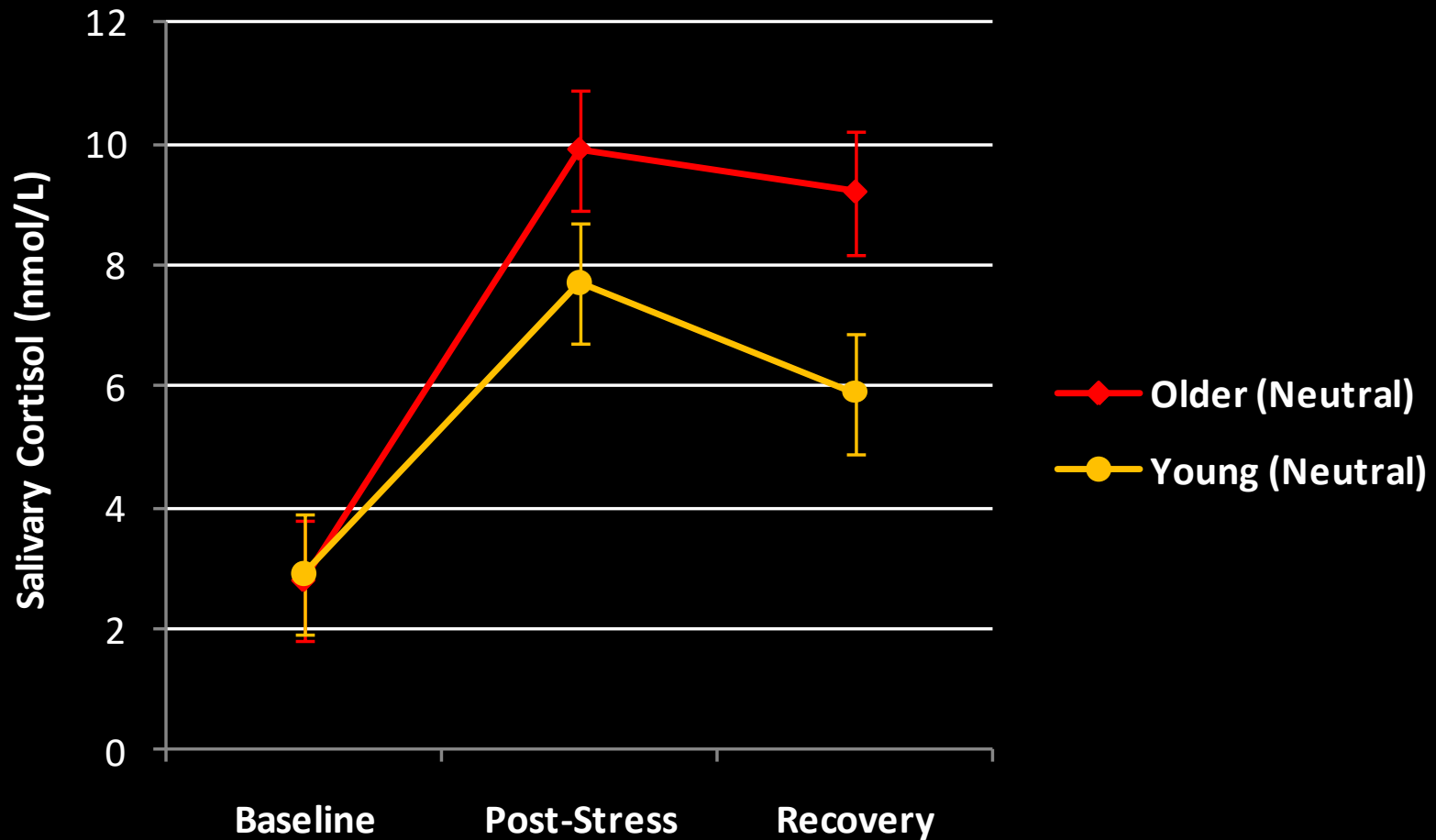
Positive Emotions Reduce Age Differences in Stress Responses
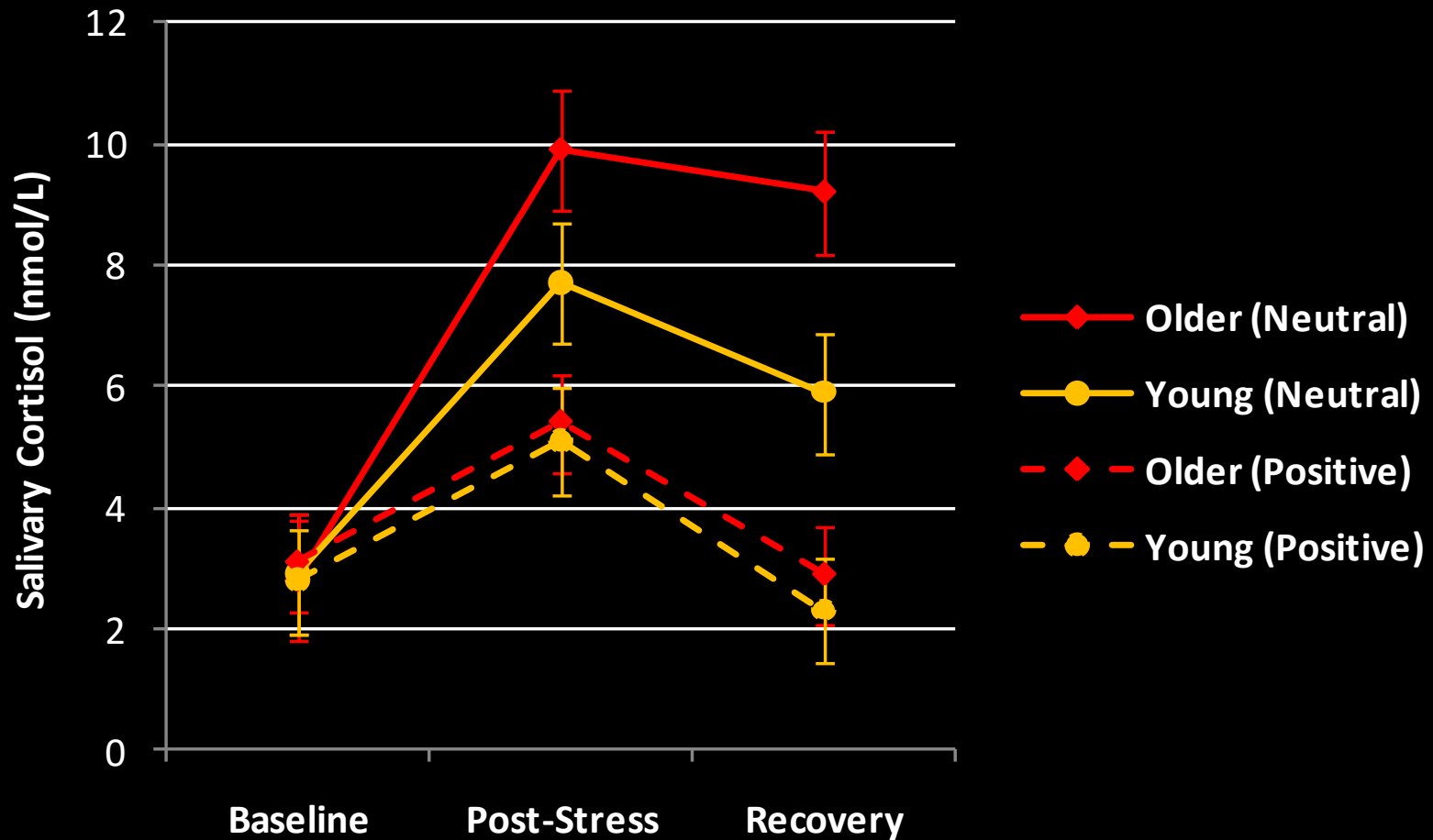
Stress Regulation

- Background

- Laboratory stress challenge

- Daily cardiovascular responses

Daily Cardiovascular Activity
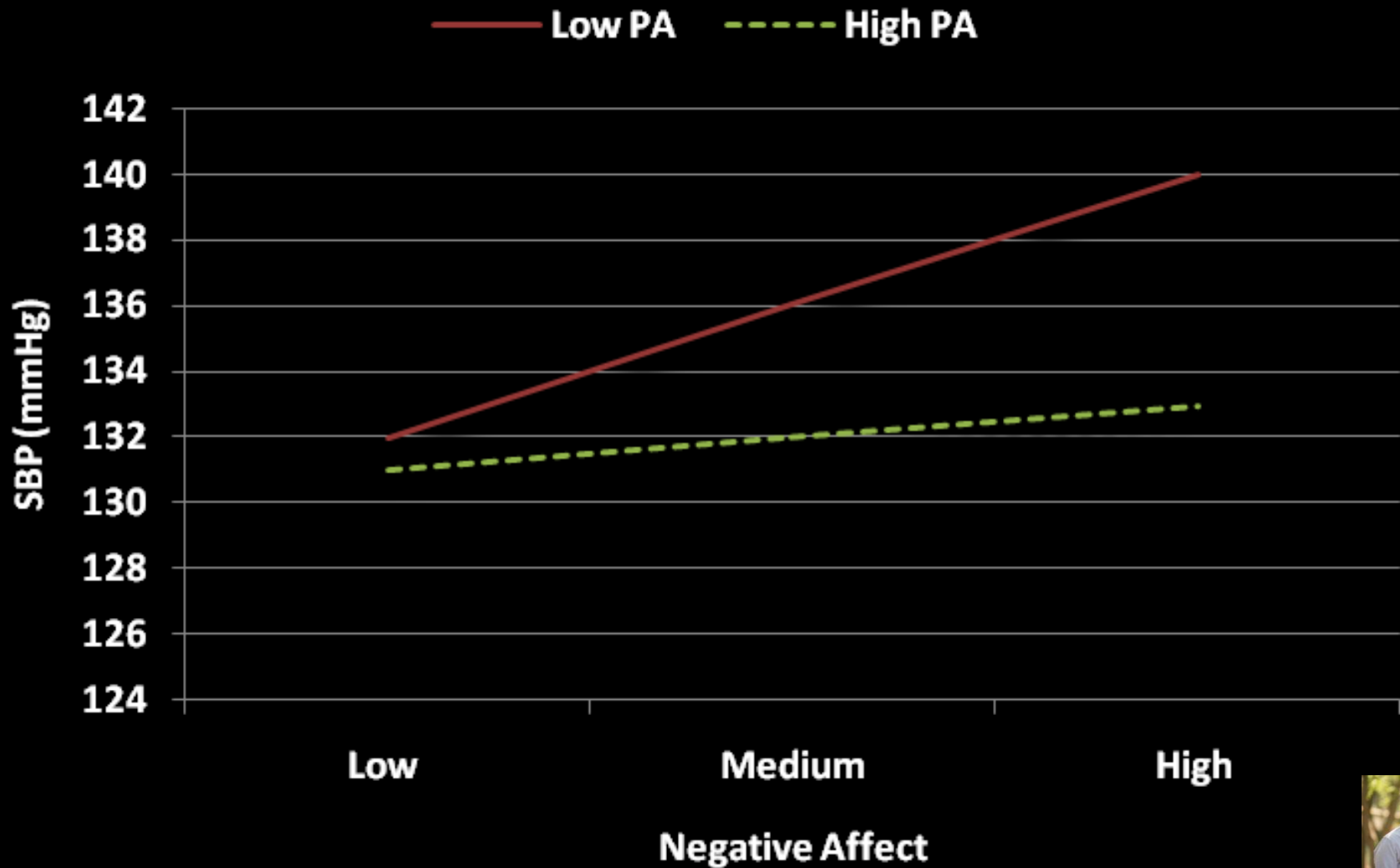
Ong & Allaire, 2006, *Psychology & Aging*

Stress Regulation

- Background

- Laboratory stress challenge

- Daily cardiovascular responses

- Spousal bereavement

Studies of Positive Emotions and Bereavement

- Wortman & Silver (1987)
- Moskowitz, Folkman, Collette, & Vittinghoff (1996)
- Folkman (1997)
- Stein, Folkman, Trabasso, & Richards (1997)
- Bonanno & Keltner (1997)
- Ong, Bergeman, & Bisconti (2004)
- Bonanno, Moskowitz, Papa, & Folkman (2005)
- Ong, Bergeman, Bisconti, & Wallace (2006)

Spousal Bereavement Study

- ## MIDUS Sample:
  - 48– 80 years old (M = 65.8, sd = 8.9 years)
  - 86% female

- ## Bereavement Status:
  - Widowhood Group
  - Control Group (matched on demographics)

- ## Measures:
  - Positive emotion (PANAS)
  - Salivary Cortisol

Ong, Fuller-Rowell, Bonanno, & Almeida, 2011, *Health Psychology*

Analytic Strategy: 3-Level MLM

Occasion-level Model

$$\text{Cortisol}_{0ij} = \pi_{0ij} + \pi_{1ij}(\text{Time since waking})_{tij} + \pi_{2ij}(\text{Time since waking}^2)_{tij} + \pi_{3ij}(\text{CAR})_{tij} + e_{tij}$$

Analytic Strategy: 3-Level MLM

Day-level Model

Intercept $(\pi_{0ij}) = \beta_{00j} + r_{0ij}$

Time since waking $(\pi_{1ij}) = \beta_{10j} + r_{1ij}$

Time since waking^2 $(\pi_{2ij}) = \beta_{20j} + r_{2ij}$

CAR $(\pi_{3ij}) = \beta_{30j} + \beta_{3ij}(\text{Wakeup time})_{ij} + r_{3ij}$

Analytic Strategy: 3-Level MLM

Person-level Model

Wakeup $(\beta_{00j}) = \gamma_{000} + \gamma_{001}(\text{Age})_j + \gamma_{002}(\text{Gender})_j + \gamma_{003}(\text{Education})_j + \gamma_{004}(\text{Smoking})_j +$

$\gamma_{005}(\text{Medication})_j + \gamma_{006}(\text{Extraversion})_j + \gamma_{007}(\text{Neuroticism})_j +$
$\gamma_{008}(\text{Negative Emotion})_j + \gamma_{009}(\text{Loss})_j + \gamma_{010}(\Delta \text{ Positive Emotion})_j +$
u_{00j}

Linear Slope $(\beta_{10j}) = \dots$

CAR $(\beta_{30j}) = \dots$

Average Cortisol Rhythms Across the Waking Day by Bereavement Status
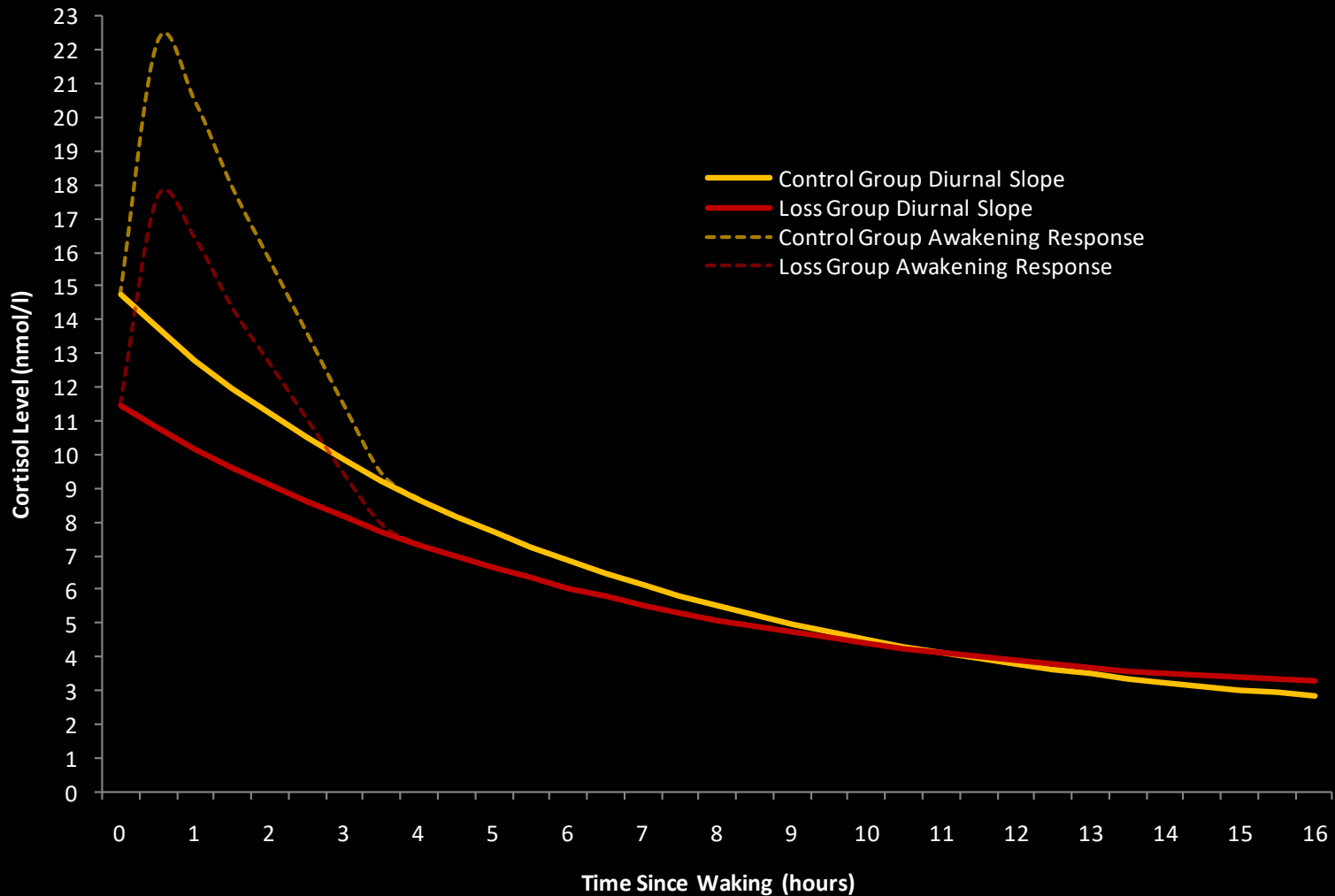
Positive Emotions Mediate

Change in Positive Emotion

-.34 [-.45, .26]**

-.21 [-.39, -.14]**

Bereavement Status

.12 [-.08, .14]

.18 [.11, .24]**

Cortisol Slope

Ong, Fuller-Rowell, Bonanno, & Almeida, 2011, *Health Psychology*
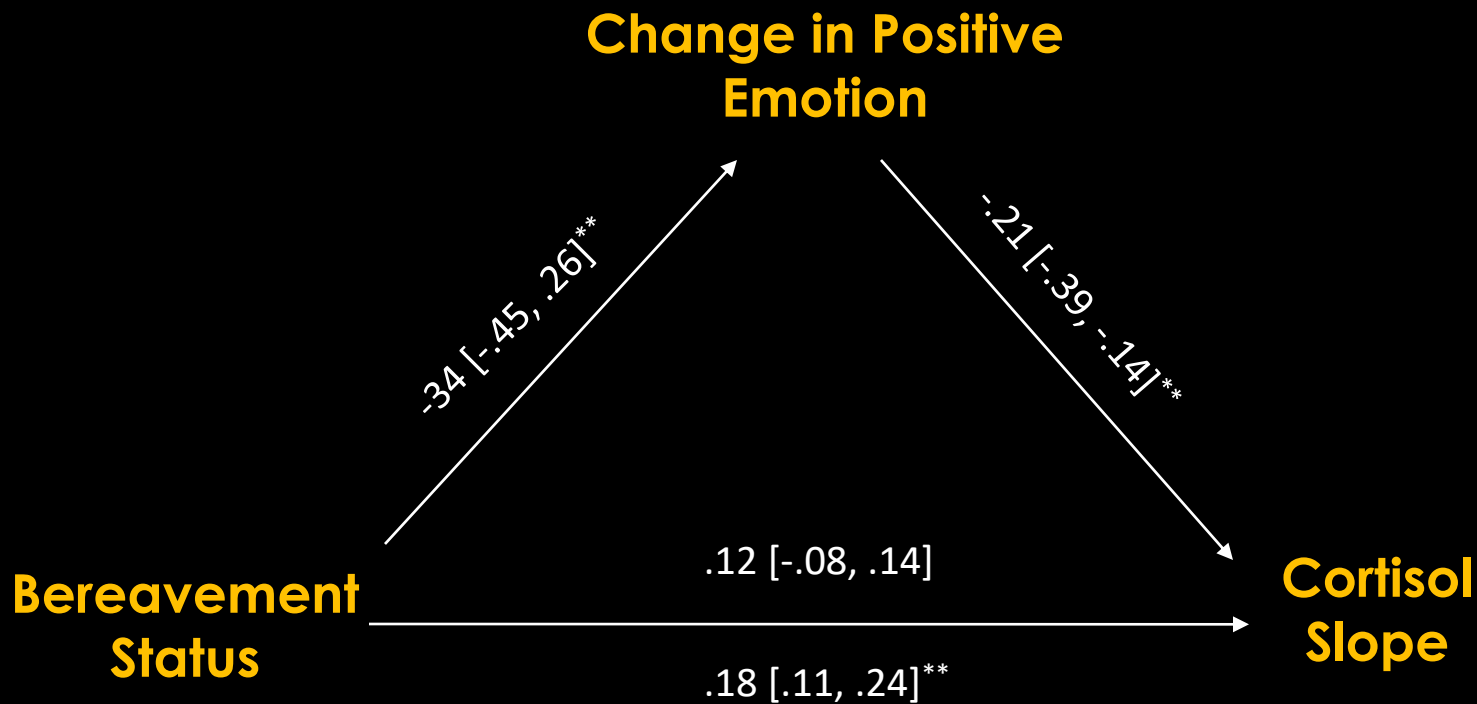
Individual Differences

- Background

- Bereavement

- Chronic pain

The Resilience Hypothesis

- Positive emotions are an active ingredient within trait resilience.

Individual Differences

- Background

- Bereavement

- Chronic pain

Chronic Pain Study

- **14-day diary study**
  - 52 - 95years old (*M* = 76.3, *sd* = 8.8 years)
  - 76% female

- **Person-level measure**
  - Trait resilience

- **Day-level measures**
  - Positive emotion (PANAS)
  - Pain
  - Pain catastrophizing

Empirical Strategy

- The ego-resilience scale (Block & Kremen, 1996)
-

  - "The capacity of the individual to effectively modulate and monitor an ever-changing complex of desires and reality constraints."

  - I get over anger with someone reasonably quickly.

  - I enjoy dealing with new and unusual situations.

  - I quickly getting over and recover form being startled.

Measurement of Daily Pain
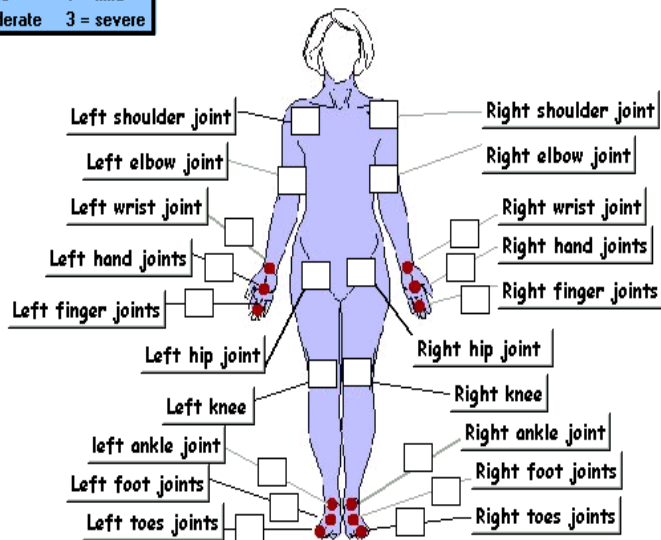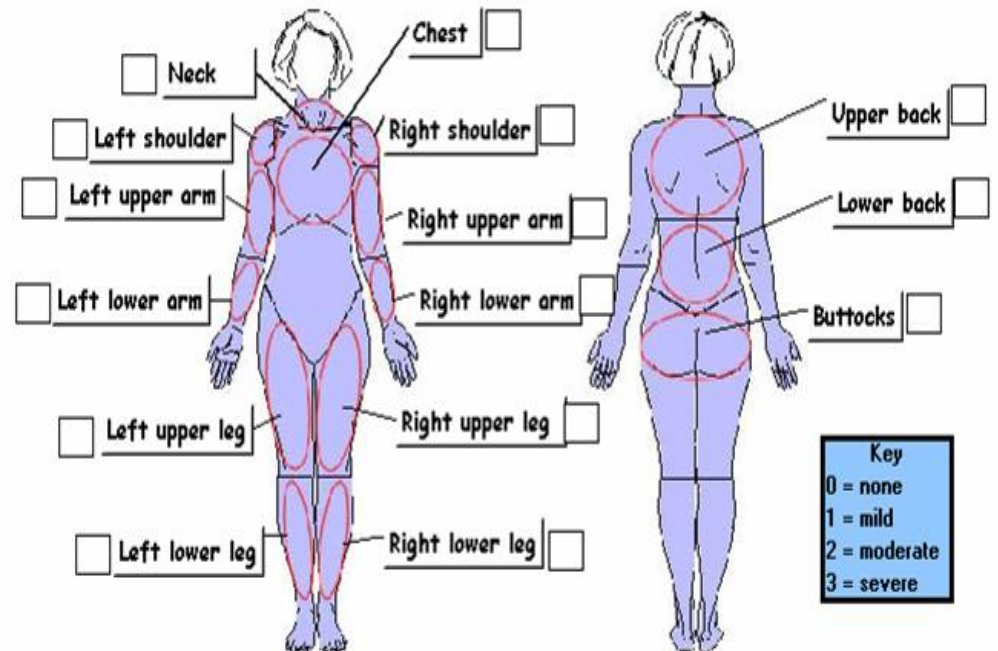
Measurement of Pain Catastrophizing

- ## Helplessness
  - "I felt can't stand it anymore"

- ## Rumination
  - "I kept thinking about how badly I want the pain to stop"

- ## Magnification
  - "I became afraid that the pain may get worse"

Scoring: 1 (not at all), 2 (to a slight degree), 3 (to a moderate), 4 (to great degree), 5 (all the time)

Positive Emotions Mediate

Ong, Zautra, & Reid, 2010, *Psychology & Aging*

Positive Emotions Mediate

Ong, Zautra, & Reid (2010). *Psychology & Aging*
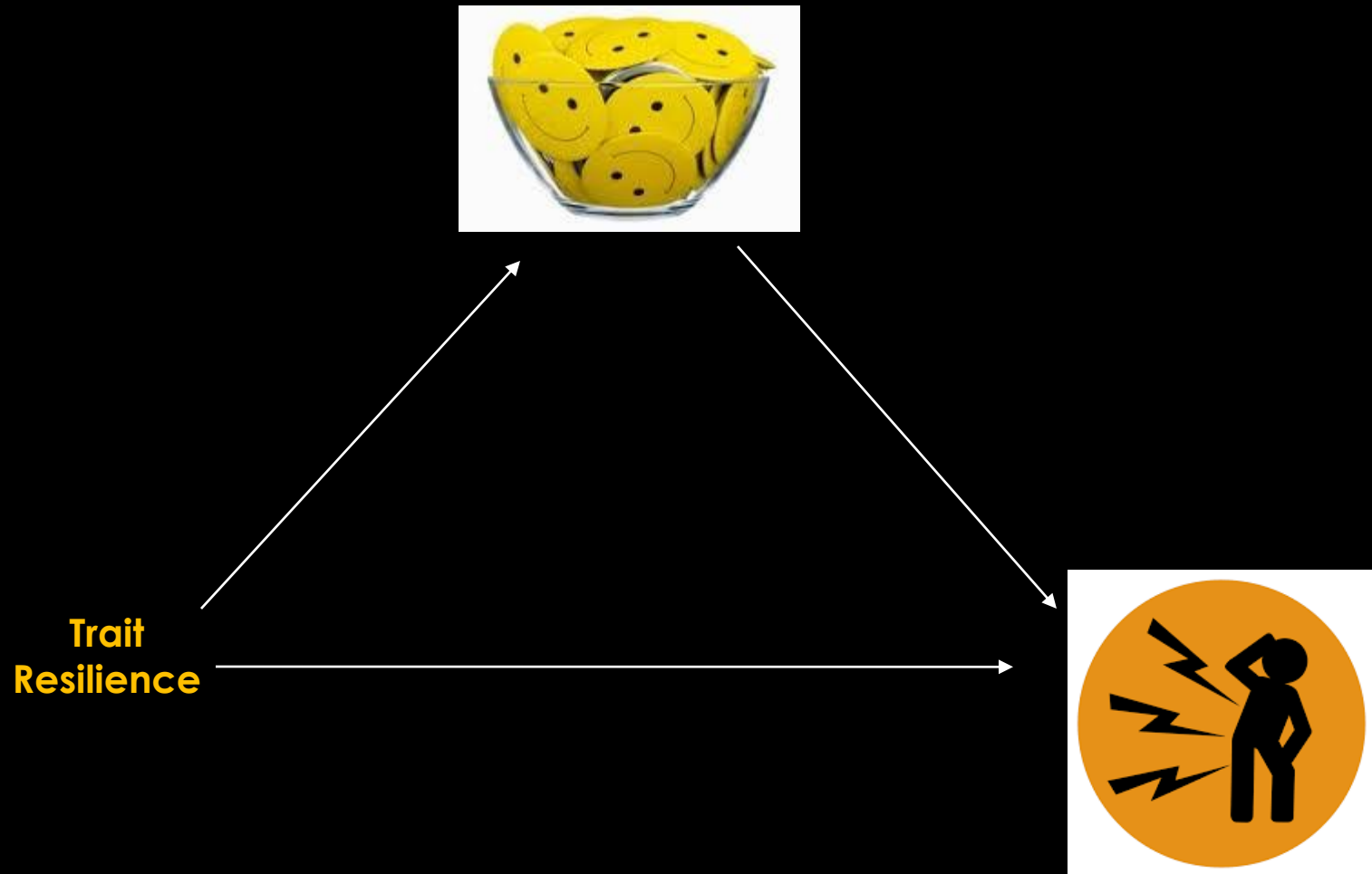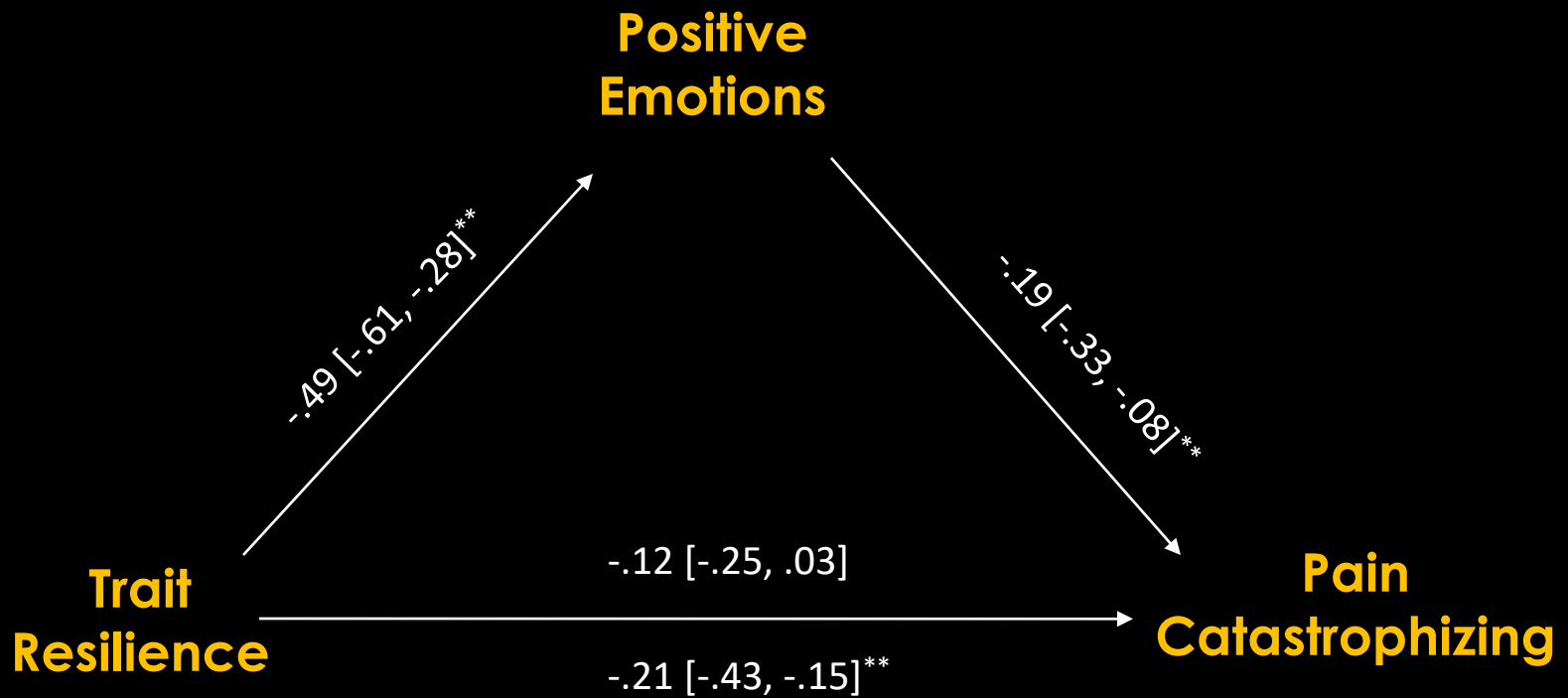
Forest Plot for Observational Studies

Study	Observed Outcome
Finan, Quartana, & Smith (2013a)	-0.12 [-0.27, 0.02]
Finan, Quartana, & Smith (2013b)	-0.07 [-0.10, -0.05]
Gruszczynska, & Knoll (2015a)	-0.29 [-0.48, -0.10]
Gruszczynska, & Knoll (2015b)	-0.25 [-0.45, -0.05]
Gruszczynska, & Knoll (2015c)	-0.05 [-0.25, 0.15]
Kruszewski (2010)	-0.24 [-0.30, -0.18]
Mun, et al. (2017a)	-0.29 [-0.42, -0.16]
Mun, et al. (2017b)	-0.06 [-0.19, 0.07]
Potter (1999)	-0.14 [-0.17, -0.12]
Seebach et al. (2012a)	0.00 [-0.04, 0.04]
Seebach et al. (2012b)	-0.02 [-0.09, 0.05]
Strand et al. (2007)	-0.05 [-0.09, -0.01]
Zautra et al. (2001a)	-0.21 [-0.36, -0.06]
Zautra et al. (2001b)	-0.18 [-0.39, 0.03]
RE Model	-0.13 [-0.18, -0.07]

Observed Outcome

Forest Plot for Intervention Studies

Study	Standardized Mean Difference
Basler, Jakle, & Kroner-Herwig (1997)	-0.06 [-0.51, 0.39]
Behrouz, et al. (2017)	-1.23 [-1.80, -0.65]
Carson et al. (2005)	0.28 [-0.33, 0.88]
Davis, & Zautra (2013)	0.01 [-0.43, 0.45]
Dowd et al. (2015a)	-0.49 [-1.03, 0.05]
Dowd et al. (2015b)	0.05 [-0.53, 0.63]
Fors, & Gotestam (2000)	-1.04 [-1.73, -0.34]
Garland et al. (2014)	-0.57 [-0.94, -0.20]
Garland et al. (2017)	-0.35 [-0.89, 0.18]
Guillory et al. (2015)	-0.38 [-0.86, 0.10]
Hausmann et al. (2017)	-1.08 [-1.80, -0.35]
Hausmann et al. (2018)	0.10 [-0.13, 0.32]
Muller et al. (2016)	-0.53 [-0.99, -0.08]
Peters et al. (2017)	-0.04 [-0.42, 0.34]
Shaygan, Boger, & Kroner-Herwing (2017a)	-0.35 [-0.65, -0.05]
Shaygan, Boger, & Kroner-Herwing (2017b)	-0.05 [-0.35, 0.25]
Tse et al. (2010)	-1.25 [-1.76, -0.74]
Zautra et al. (2008)	-0.22 [-0.69, 0.26]
RE Model	-0.36 [-0.57, -0.16]

Standardized Mean Difference

29 studies (N = 3,521)

So What Good Are Positive Emotions?

Upward Spiral of Well-Being

Positive Emotions

Longevity: Enhanced health, survival

Building: Resilience, social resources

Buffering: Stress, Negative Emotion

Flexibility: Cognitive, relationships

Broadening

Positive Emotions

Age

Adapted from Fredrickson (2013)

PART N° 3

_____

► Do health and well-being involve more than high levels of positive affect and low levels negative affect?

A Dark Side of Happiness? How, When, and Why Happiness Is Not Always Good

June Gruber[1], Iris B. Mauss[2], and Maya Tamir[3,4]

[1]Yale University, Department of Psychology, New Haven, CT; [2]Department of Psychology, University of Denver, CO; [3]Department of Psychology, The Hebrew University of Jerusalem, Israel; and [4]Department of Psychology, Boston College, MA

Valuing Happiness Is Associated With Bipolar Disorder

Brett Q. Ford and Iris B. Mauss
University of California, Berkeley

June Gruber
University of Colorado Boulder

Special Issue Article

A Review and Synthesis of Positive Emotion and Reward Disturbance in Bipolar Disorder

June Gruber*
Psychology Department, Yale University, New Haven, CT USA

Can Feeling Too Good Be Bad? Positive Emotion Persistence (PEP) in Bipolar Disorder

June Gruber
Yale University

The Psychic Costs of Intense Positive Affect

Ed Diener, C. Randall Colvin, William G. Pavot, and Amanda Allman
University of Illinois at Urbana-Champaign

PERSPECTIVES ON PSYCHOLOGICAL SCIENCE

The Optimum Level of Well-Being

Can People Be Too Happy?

Shigehiro Oishi,[1] Ed Diener,[2] and Richard E. Lucas[3]

[1]University of Virginia, [2]University of Illinois, and [3]Michigan State University

Does Childhood Personality Predict Longevity?

Howard S. Friedman, Joan S. Tucker, Carol Tomlinson-Keasey, Joseph E. Schwartz, Deborah L. Wingard, and Michael H. Criqui

POSITIVE EMOTION

Integrating the *Light* Sides and *Dark* Sides

edited by JUNE GRUBER, PhD
and JUDITH TEDLIE MOSKOWITZ, PhD, MPH

OXFORD

A. Net Intraindividual Variability

B. Time-structured Intraindividual Variability

Magnitude of **Dynamic Characteristic** (iSD) or **Dynamic Process** (frequency)

Intraindividual Change – Aging

Macrotime (e.g., age)

Adapted from Ram & Gerstorf (2009). *Psychology & Aging*

Adapted from Ram & Gerstorf, 2009, *Psychology & Aging*
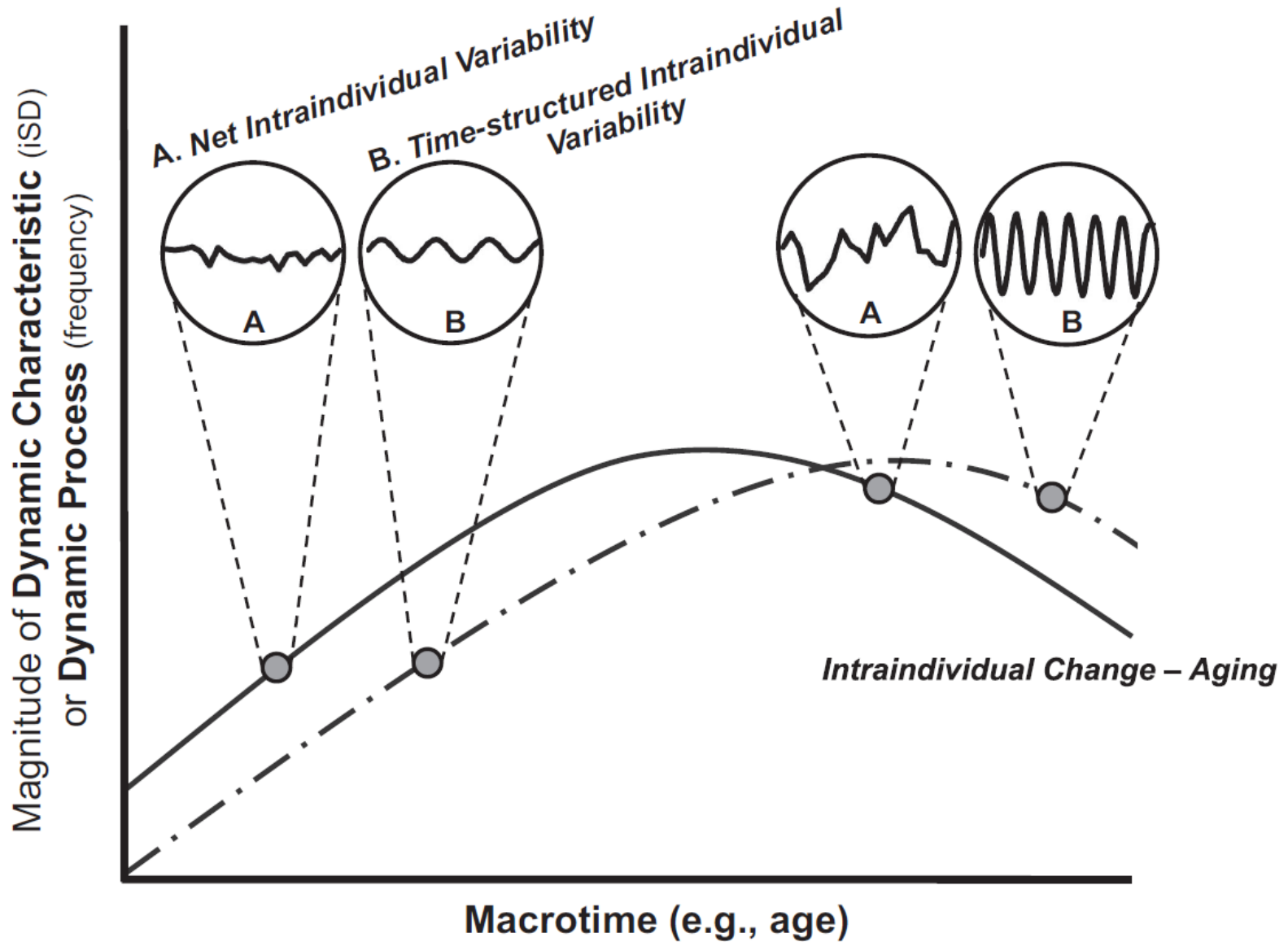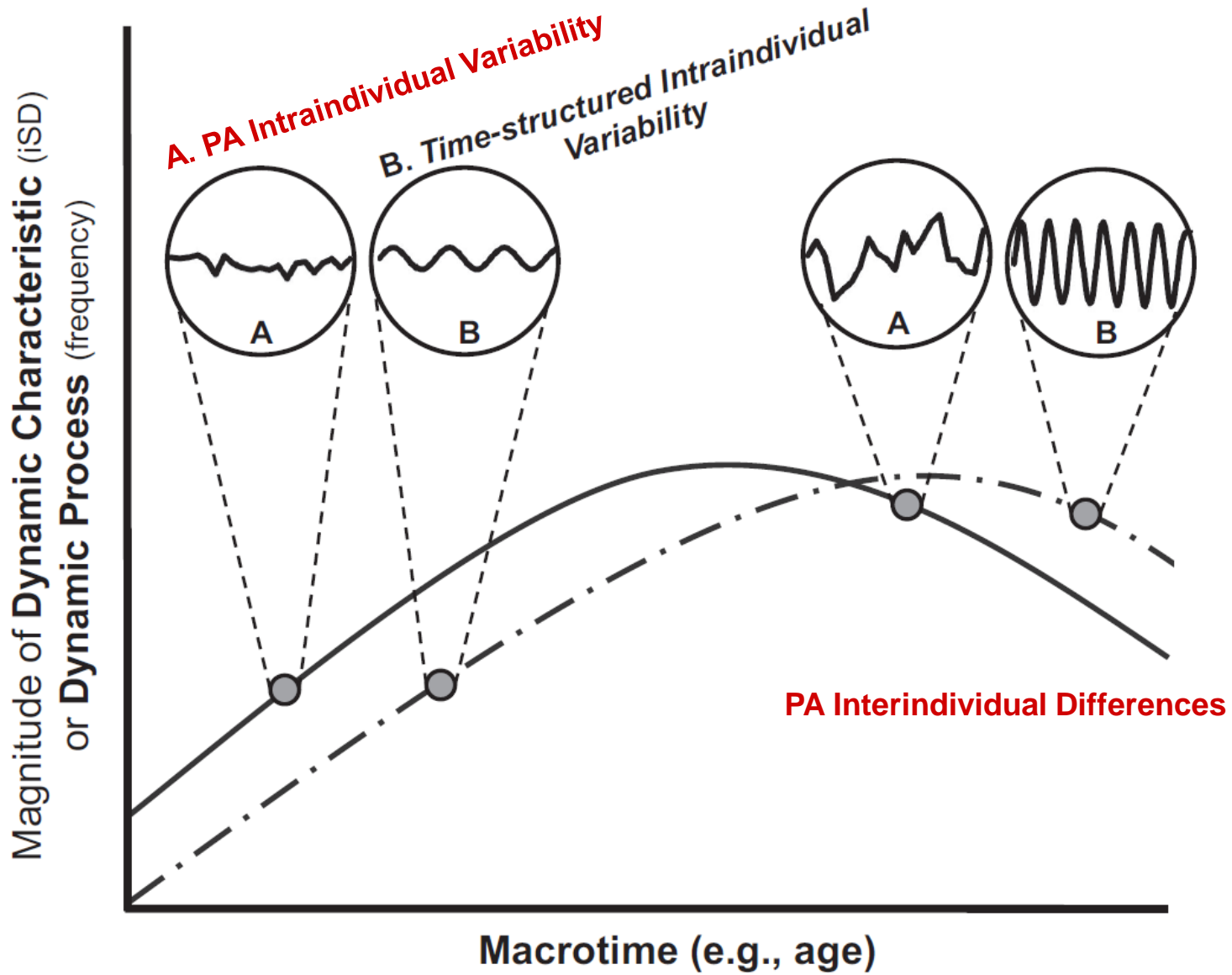
Enduring vs Fragile Positive Affect

Enduring PA (slow changing) reflects global levels of PA that are relatively stable across time.
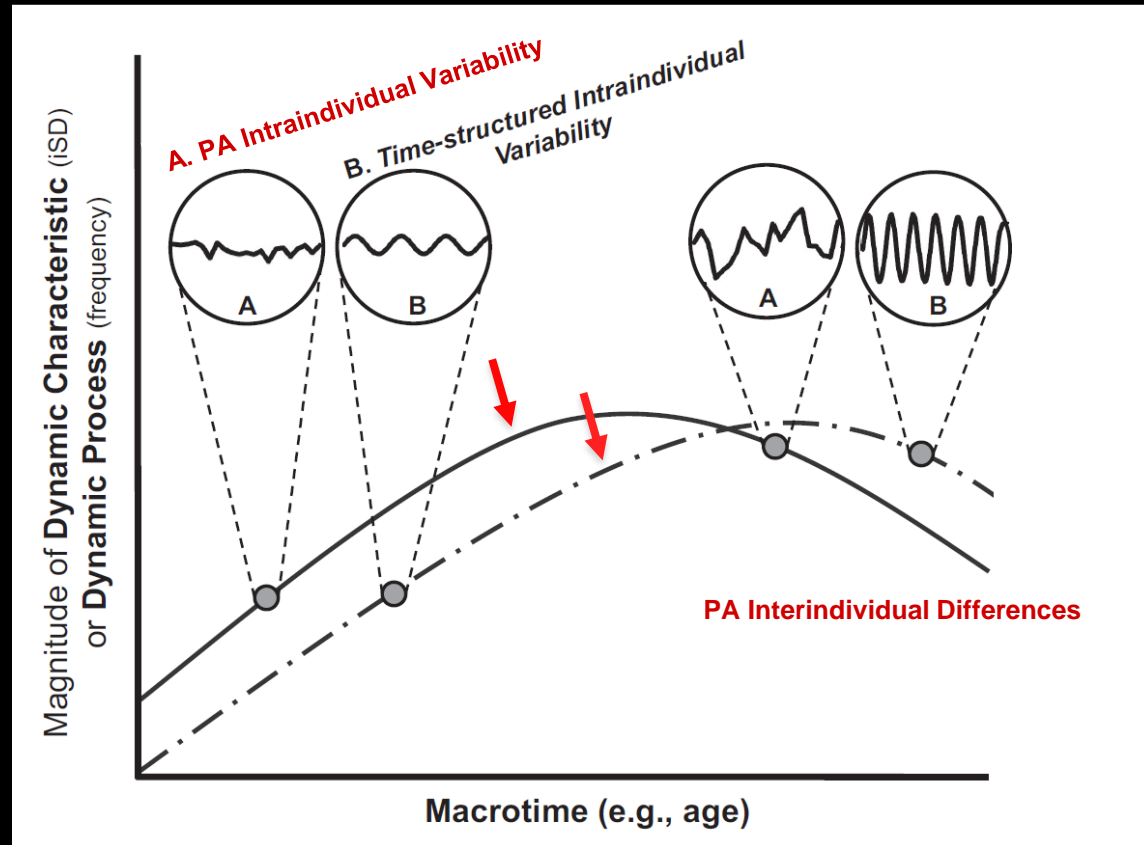
Enduring vs Fragile Positive Affect

Fragile PA (fast changing) reflects short-term fluctuations in PA that are variable and subject to external influence.

The Syllogism of Emotions

1. There are individual differences in well-being

2a. Emotions are important markers of well-being

2b. Emotions are inherently dynamic

3. A-2a and A-2b help to explain A-1

4. (A-2a) · (A-2b) also matter
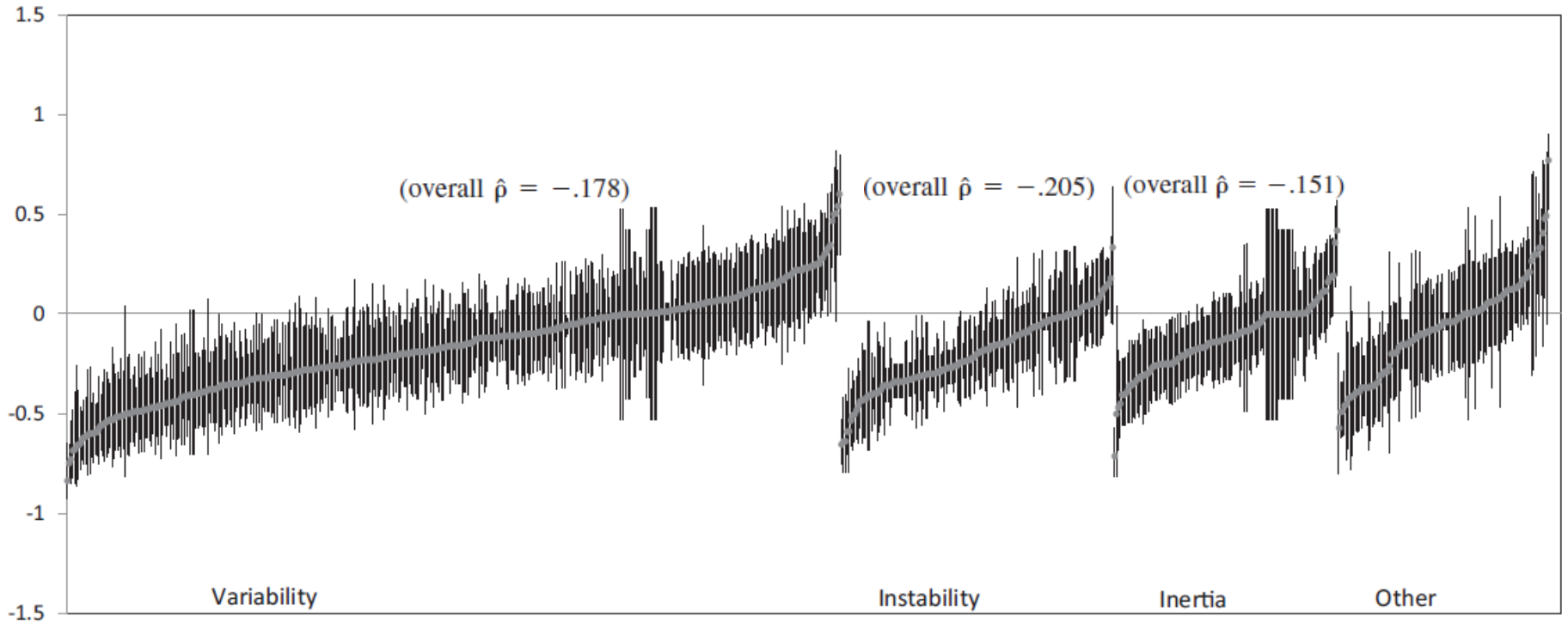
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© Nilam Ram

Positive Affect Dynamics
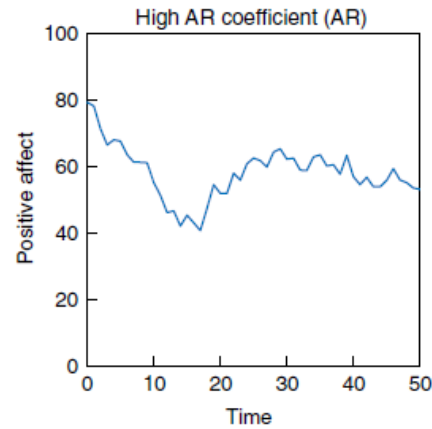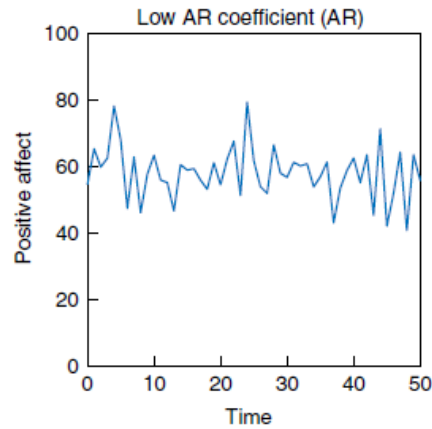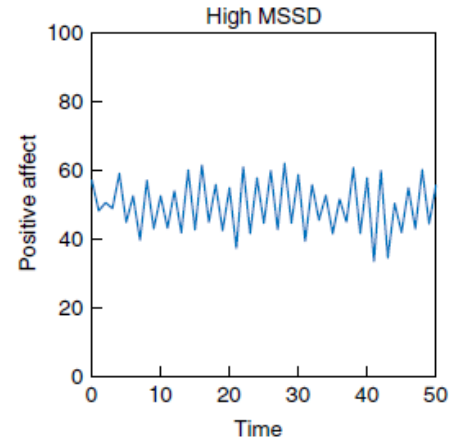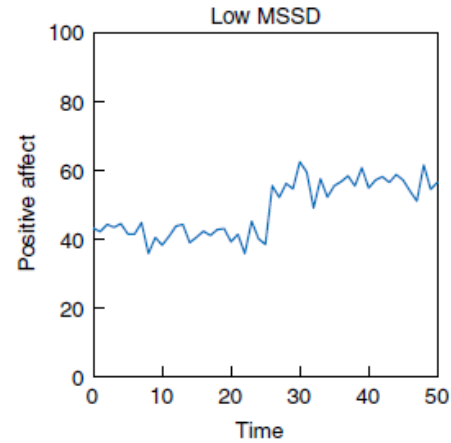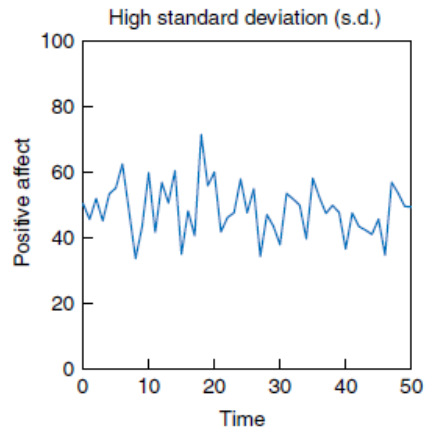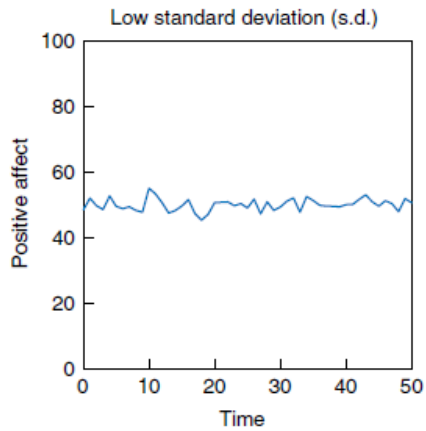
Affect Dynamics and Psychological Well-Being

(overall $\hat{\rho} = -.178$)   (overall $\hat{\rho} = -.205$)   (overall $\hat{\rho} = -.151$)

Variability   Instability   Inertia   Other

79 studies ($N = 11{,}381$)

Complex affect dynamics add limited information to the prediction of psychological well-being

Egon Dejonckheere [1,2]*, Merijn Mestdagh [1,2]*, Marlies Houben[1], Isa Rutten[1], Laura Sels[1], Peter Kuppens[1] and Francis Tuerlinckx[1]

What is their incremental value of affect dynamic measures above and beyond mean levels?

Effect sizes psychological well-being
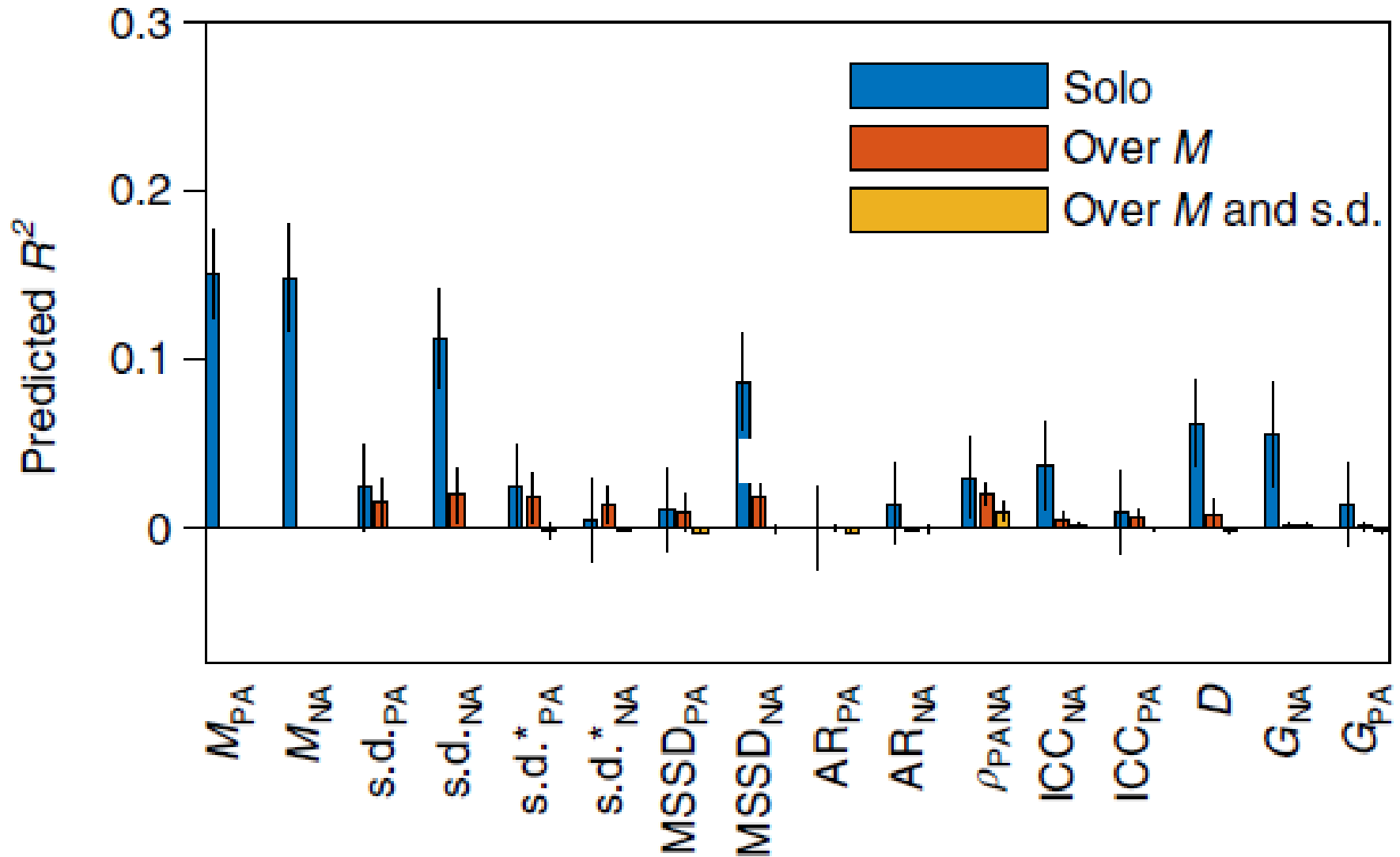
15 studies (N = 1,777)

Source: Dejonckheere et al. (2019)

Beat the Mean

© Merijn Mestdagh

Mortality Study

- ## Sample
  - *N*=3,834
  - English Longitudinal Study of Ageing
  - Adults aged 50 years or older

- ## Question
  - Are temporal fluctuations in positive affect associated with mortality in older adults?

Key Points

Question Are temporal fluctuations in positive affect associated with mortality risk in older adults?

Findings In this survey study of 3834 adults aged 50 years or older, greater instability of momentary positive affect was associated with increased risk of mortality.

Meaning This finding suggests that instability of positive affective states in everyday life is relevant to health in old age.

$$MSSD_i = \frac{1}{T-1}\sum_{t=1}^{T-1}(affect_{i(t+1)} - affect_{i(t)})^2$$

Table 2. Associations of Positive Affect Measures With Mortality

Model (covariates)	Adjusted HR (95% CI)	P value
1 (Age, sex)		
Mean positive affect	0.83 (0.70-0.99)	.04
Positive affect instability	1.24 (1.07-1.44)	.004
2 (Age, sex, demographic factors)		
Mean positive affect	0.84 (0.71-0.99)	.04
Positive affect instability	1.24 (1.07-1.44)	.005
3 (Age, sex, demographic factors, baseline illness)		
Mean positive affect	0.90 (0.76-1.07)	.22
Positive affect instability	1.24 (1.04-1.46)	.01
4 (Age, sex, demographic factors, baseline illness, smoking, alcohol intake, physical activity)		
Mean positive affect	0.93 (0.79-1.11)	.43
Positive affect instability	1.24 (1.04-1.47)	.02
5 (Age, sex, demographic factors, baseline illness, smoking, alcohol intake, physical activity, mean negative affect, negative affect instability)		
Mean positive affect	0.92 (0.77-1.10)	.36
Positive affect instability	1.25 (1.04-1.49)	.02

Affective Reactivity
operationalizing idiographic processes
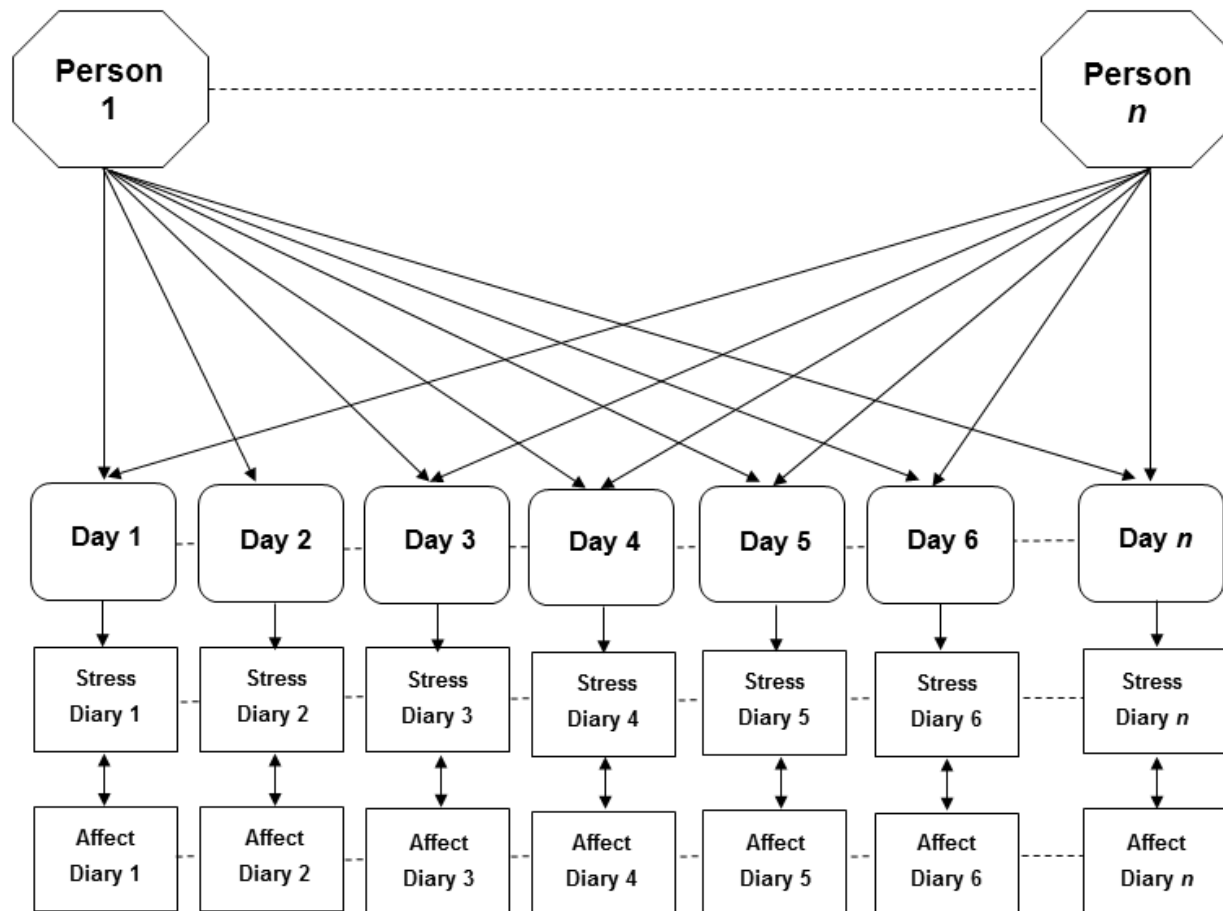

The degree of change in affect in response to daily stressors

Daily Affective Reactivity
conceptual representation of two-level data structure

Affective Reactivity: Underlying Health Vulnerability?
evidence from prior studies

Eudaimonic Well-Being

[1]Selcuk et al. (2016)

Depressive Symptoms

[2]O"Neill et al. (2004); [3]Gunthert et al. (2005); [4]Wichers et al. (2009); [5]Parrish et al. (2011); [6]Charles et al. (2013); [7]Ong et al. (2018)

Chronic Health / Health Behaviors

[8]Finan et al. (2009); [9]Ong et al. (2013); [10]Piazza et al. (2013); [11]Sin et al. (2015); [12]Puterman et al. (2017)

Mortality

[13]Mroczek et al. (2013); [14]Chiang et al. (2018)
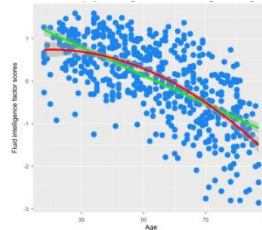
Fluid Cognitive Ability

[15]Stawski et al. (2010)

Physiology

[16]Jacobs et al. (2007); [17-18]Sin et al., (2015; 2016)

Potential problems with high levels of PA
Not *if* you have it, but *how* you get it

ORIGINAL ARTICLE

Linking Stable and Dynamic Features of Positive Affect to Sleep

Anthony D. Ong, PhD · Deinera Exner-Cortens, MPH ·
Catherine Riffin, MA · Andrew Steptoe, DPhil ·
Alex Zautra, PhD · David M. Almeida, PhD

Abstract

Background Poor sleep contributes to adult morbidity and mortality.

Purpose The study examined the extent to which trait positive affect (PA) and PA reactivity, defined as the magnitude of change in daily PA in response to daily events, were linked to sleep outcomes.

Methods Analyses are based on data from 100 respondents selected from the National Survey of Midlife in the United States.

Results Multilevel analyses indicated that higher levels of trait PA were associated with greater morning rest and better

progressive loss of sleep adversely affects health and well-being, recent empirical evidence demonstrates that positive affect (PA) may be conducive to adaptive sleep patterns. In an illustrative study, Steptoe, O'Donnell, Marmot, and Wardle [4] reported an inverse association between trait PA and sleep problems among a sample of healthy adults. Other studies conducted with clinical samples and healthy controls show similar associations between PA and sleep quality indicators, including increases in sleep duration and decreases in fragmented rapid eye-movement sleep [5, 6]. The available evidence, thus, suggests that the restorative benefits of sleep may be enhanced by high trait PA. More-

Affective Reactivity to Daily Stressors Is Associated With Elevated Inflammation

Nancy L. Sin and Jennifer E. Graham-Engeland
The Pennsylvania State University

Anthony D. Ong
Cornell University

David M. Almeida
The Pennsylvania State University

Objective: Inflammation increases the risk of chronic diseases, but the links between emotional responses to daily events and inflammation are unknown. We examined individual differences in affective reactivity to daily stressors (i.e., changes in positive and negative affect in response to stressors) as predictors of inflammatory markers interleukin-6 (IL-6) and C-reactive protein (CRP). *Methods:* A cross-sectional sample of 872 adults from the National Study of Daily Experiences (substudy of Midlife in the United States II) reported daily stressors and affect during telephone interviews for 8 days. Blood samples were obtained at a separate clinic visit and assayed for inflammatory markers. Multilevel models estimated trait affective reactivity slopes for each participant, which were inputted into regression models to predict inflammation. *Results:* People who experienced greater decreases in positive affect on days when stressors occurred (i.e., positive affect reactivity) had elevated log IL-6, independent of demographic, physical, psychological, and behavioral factors ($B = 1.12$, $SE = 0.45$, $p = .01$). Heightened negative affect reactivity was associated with higher log CRP among women ($p = .03$) but not men ($p = .57$); health behaviors accounted for this association in women. *Conclusions:* Adults who fail to maintain positive affect when faced with minor stressors in everyday life appear to have elevated levels of IL-6, a marker of inflammation. Women who experience increased negative affect when faced with minor stressors may be at particular risk of elevated inflammation. These findings add to growing evidence regarding the health implications of affective reactivity to daily stressors.

Keywords: daily stress, stress reactivity, inflammation, positive affect, negative affect

Affective reactivity to daily racial discrimination as a prospective predictor of depressive symptoms in African American graduate and postgraduate students

ANTHONY D. ONG AND ANTHONY L. BURROW
Cornell University

Abstract

This study examined whether individual differences in affective reactivity, defined as changes in positive or negative affect in response to daily racial discrimination, predicted subsequent depressive symptoms. Participants were African American graduate and postgraduate students ($N = 174$; M age = 30 years) recruited for a measurement-burst study. Data on depressive symptoms were gathered at two assessment points 1 year apart. Affective reactivity data was obtained from participants via a 14-day diary study of daily racial discrimination and affect. Participants who experienced pronounced increases in negative affect on days when racial discrimination occurred had elevated depressive symptoms 1 year later. Heightened positive affect reactivity was also associated with more depressive symptoms at follow-up. The results suggest that affective reactivity (either greater increases in negative affect or greater decreases in positive affect in the context of racial discrimination) may be an underlying psychological mechanism that confers vulnerability to future depressive symptoms.

Resilience as Sustainability

- **"Maintenance of functioning"**
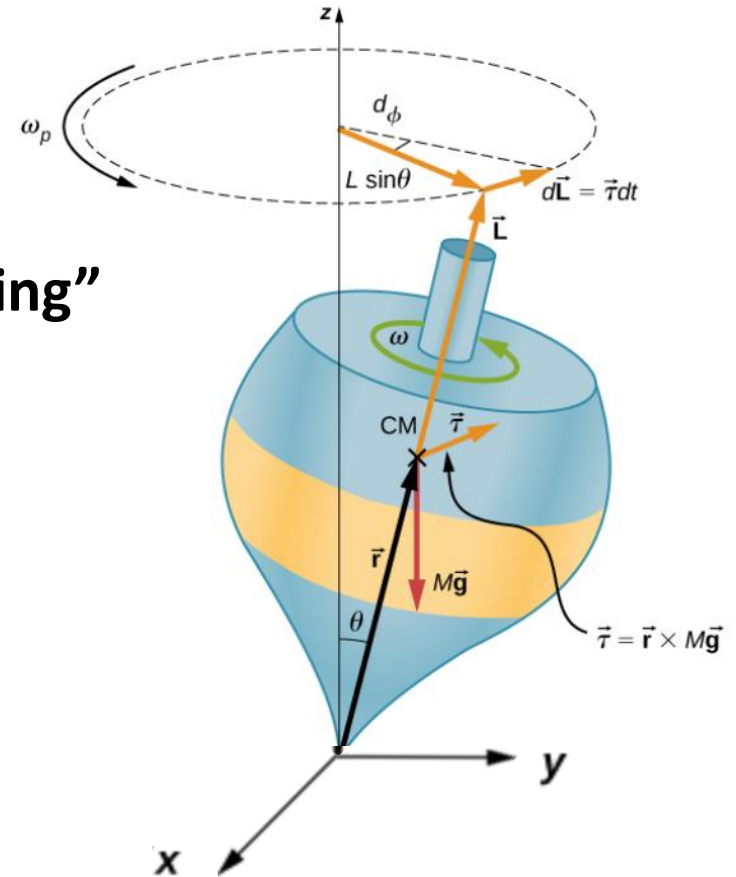
The Guardian

The Observer personality quiz

Feeling positive? It could help you stay healthy. Personality quiz

A positive outlook is beneficial when it comes to mental and physical wellbeing, but the diversity of your emotions is also important

---

Experiencing emotional diversity is more important than happiness

So don't worry if you're not happy, happy, happy

21/08/2017

For a while, happiness has been seen as the route to good health – stay happy, we've been told, and you will live longer and feel better.

What Is Emodiversity?

By Sidney Stevens   Updated February 09, 2018

Studies show that emotional variety spices up your physical and mental health. Icerko Lýdia/Wikimedia Commons

Most of us aim for emotional stability. That usually means opting for a few manageable emotions —

Biodiversity Theory

- **Ecosystem:** species interact with each other and the environment – each species serves specific functional roles
- **Biodiversity**: Variety (types) and relative abundance (quantity) of species
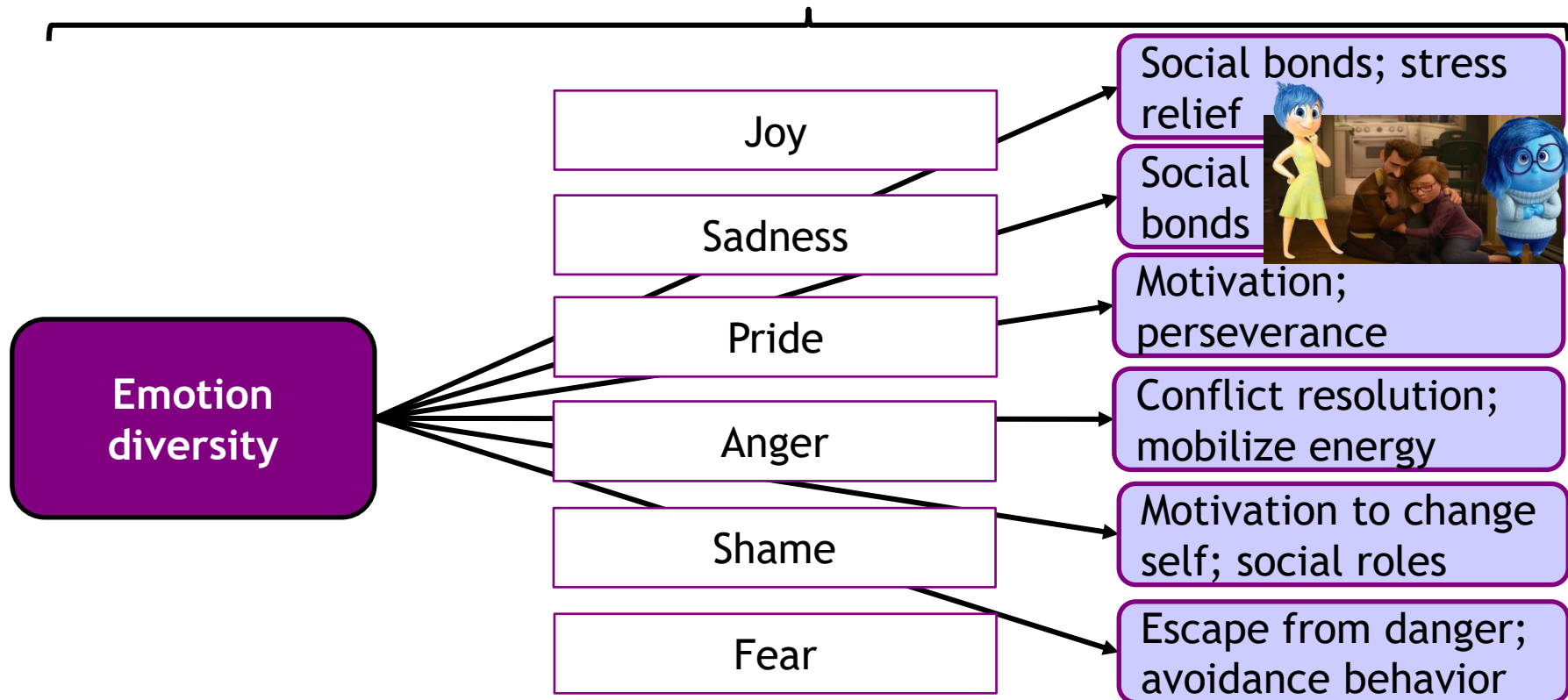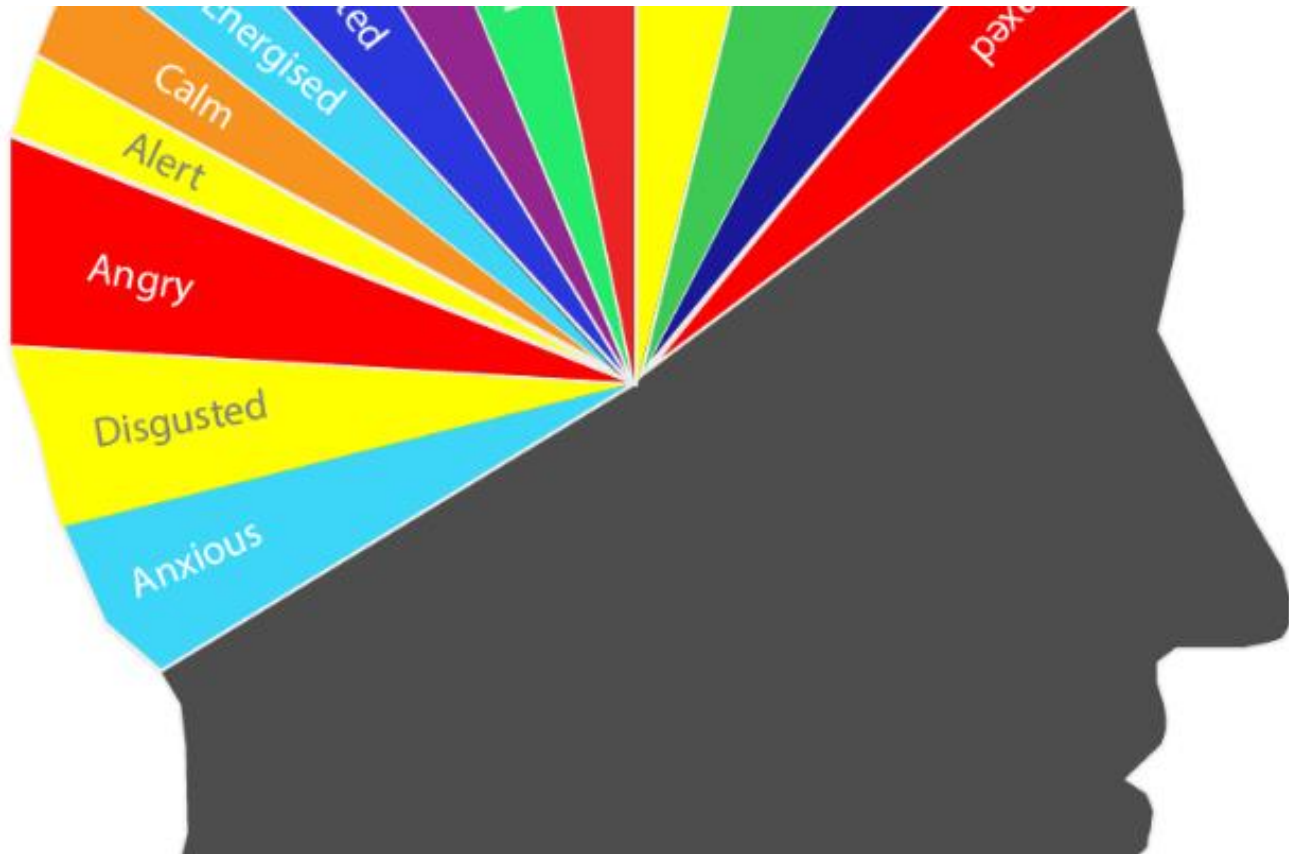
Markers of ecosystem health

Biodiversity

Soil micro-organisms & plant roots	Fertile soil
Bees, birds, bats, & other insects	Pollination
Plant roots, burrowing critters	Water cycling and purification
Native vegetation, beneficial insects	Pest control

Magurran, 2004; example from http://www.agbiodiversity.com
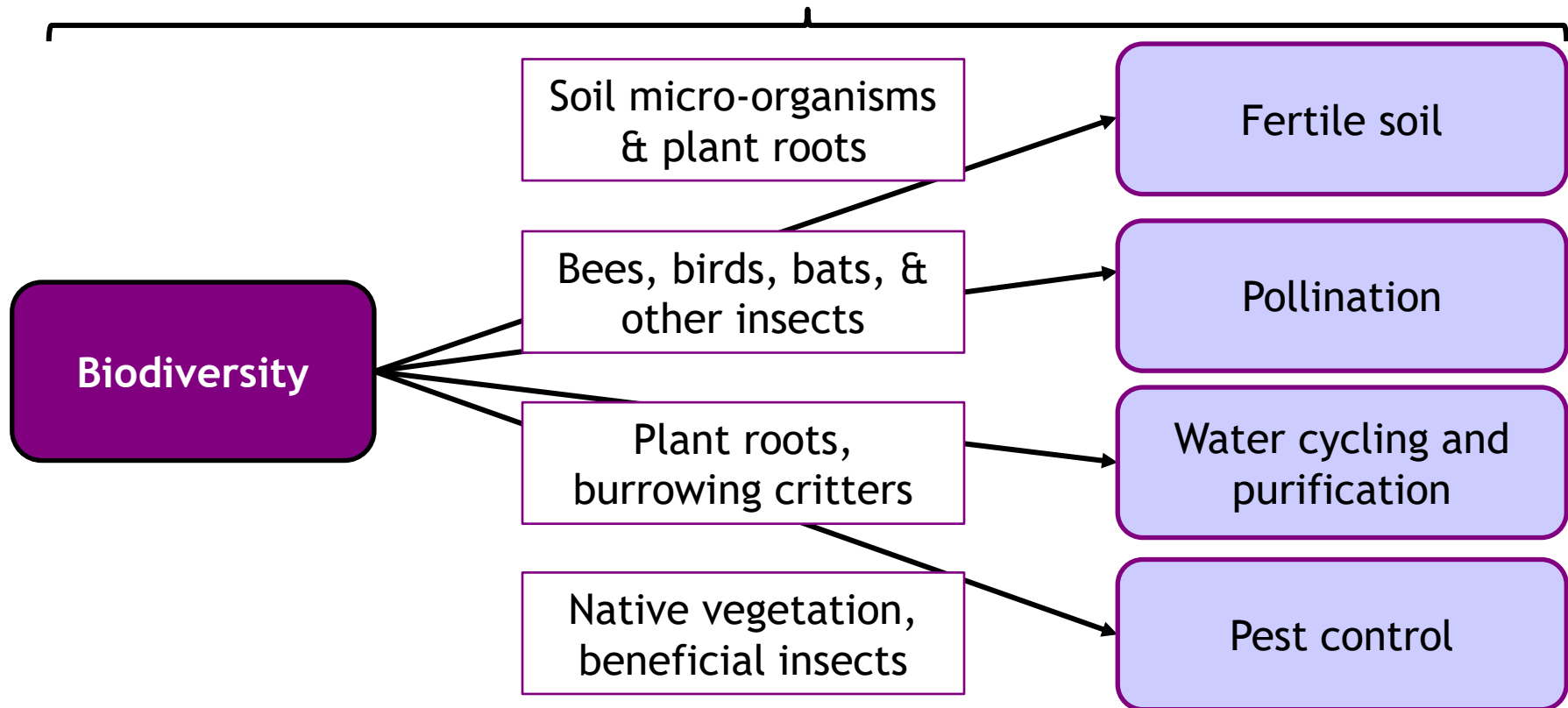
Emodiversity Theory

- **Emodiversity:** variety (types) and relative abundance (quantity) of emotions
- **Hypothesis:** depletion and/or overabundance of any one emotion will have consequences for the whole system
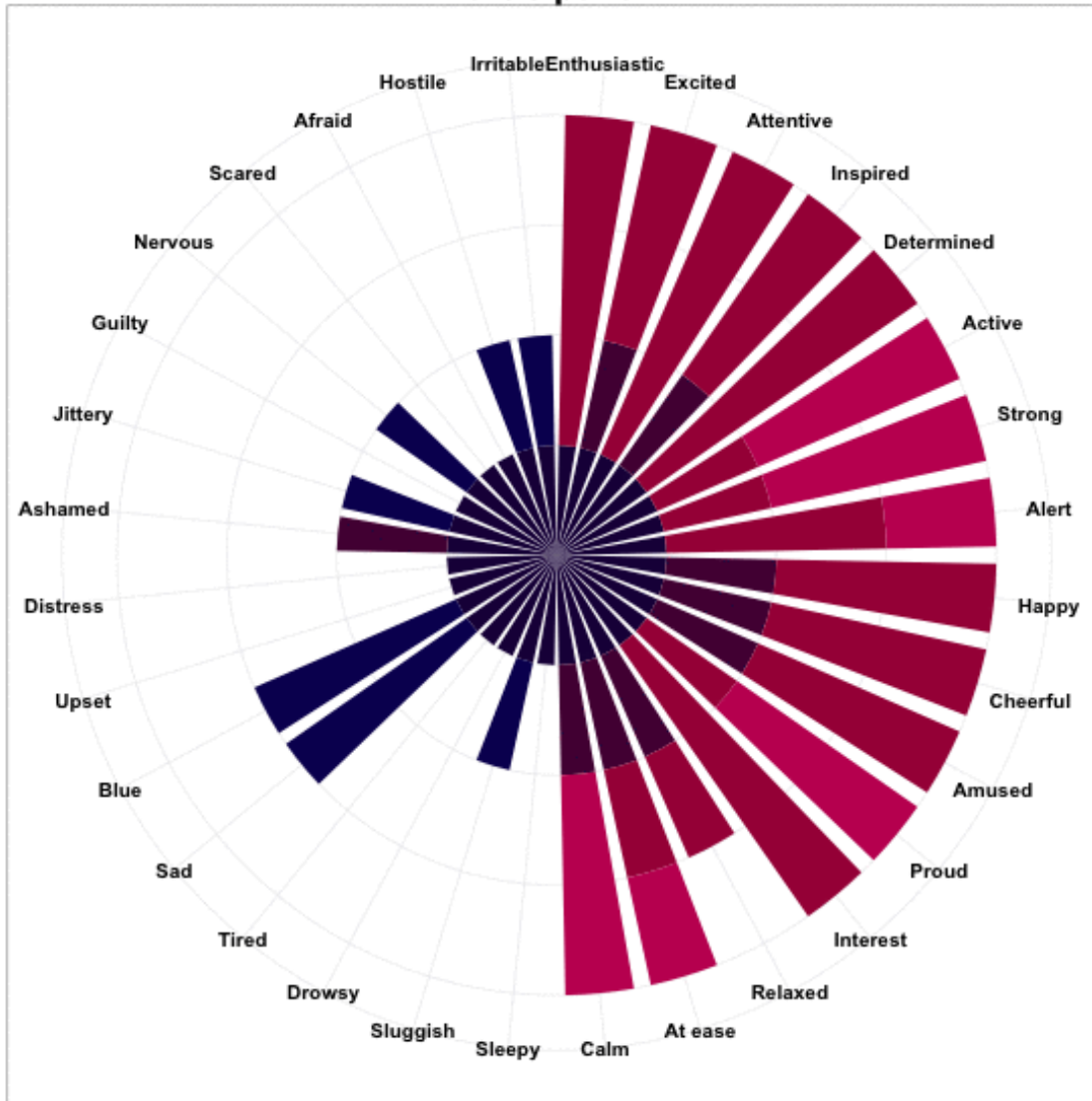
Markers of psychological and physical health

Emotion diversity →	
Joy	Social bonds; stress relief
Sadness	Social bonds
Pride	Motivation; perseverance
Anger	Conflict resolution; mobilize energy
Shame	Motivation to change self; social roles
Fear	Escape from danger; avoidance behavior

Ram & Pedersen, 2008; Ram et al., 2013; Quoidbach et al., 2014; 2015 Disney/Pixar film *Inside Out*

Emodiversity

Emodiversity Study

Participant 1

Daily Diary Design
- **30 days (*M*=27, *SD*=9.89)**
- **32 Discrete emotion items**

Participants
- **191 adults**
- **Age 40-65** (*M*=53.43, *SD*=7.43)
- 54% Female

Biomarkers of Inflammation
- C-Reactive Protein
- Interleukin-6
- Fibrinogen

Psychological Functioning
- SF36 mental component
- Who-Five Well-being Index
- ❏ Major Depression Inventory

Physical Functioning
- SF36 physical component

Ong, Benson, Zautra, & Ram, 2018, *Emotion*

Calculate iDiversity

Net intraindividual variability (time unstructured)

Shannon's Entropy

$$H' = -\sum_{j=1}^{M} p_j ln p_j$$

Simpson's Index

$$D = \frac{1}{\sum_{j=1}^{M} p_j^2}$$

p_j = proportion of all experiences belonging to the ith emotion
M = number of emotion categories
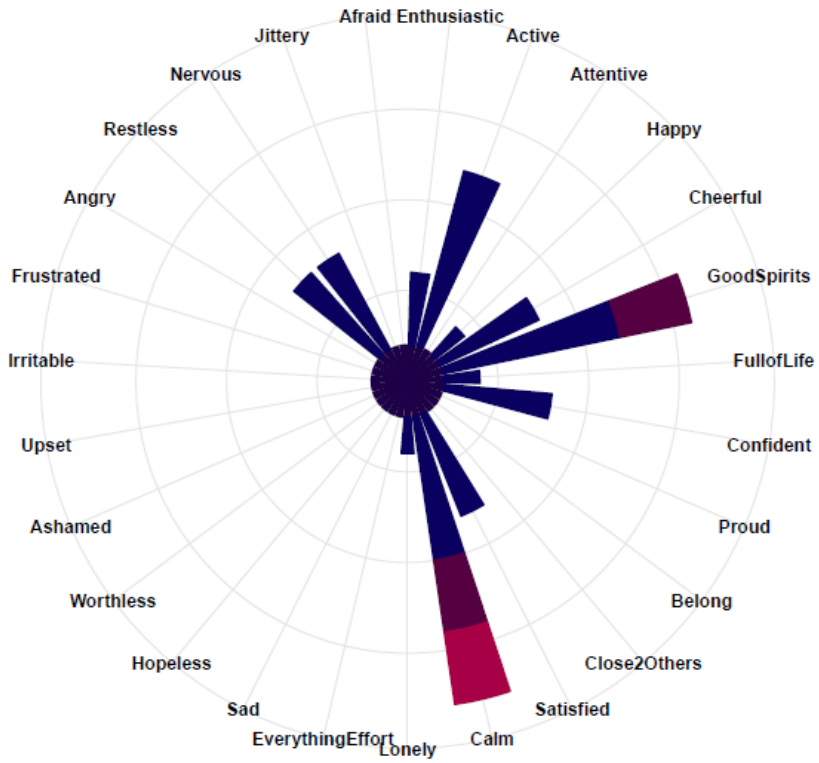
Low values (zero): homogenous emotion system
High values: highly diverse, heterogeneous emotion system
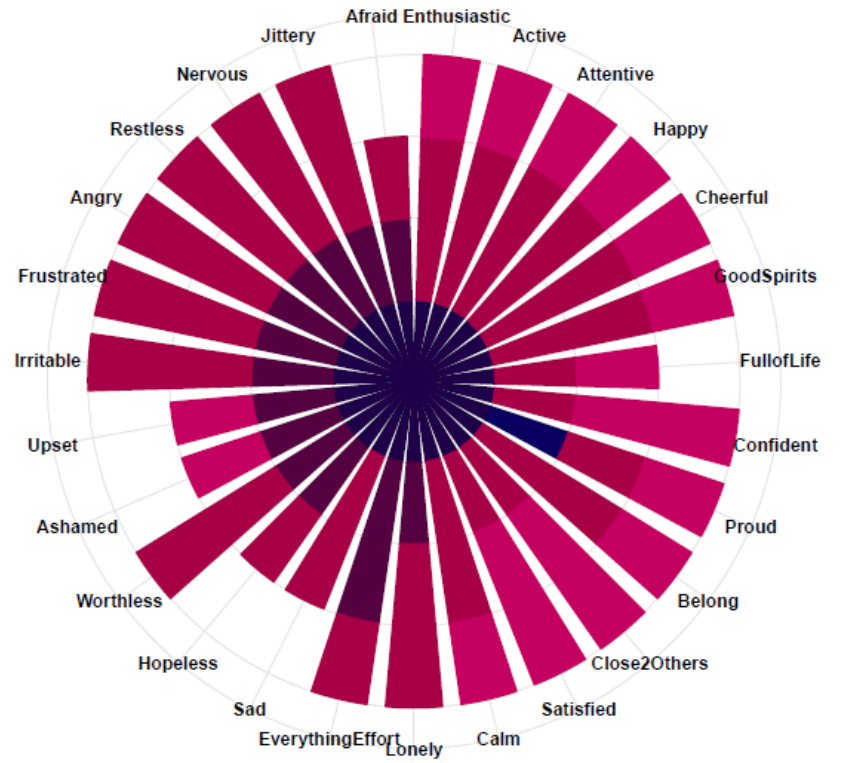
Low diversity person
- iDiversity = 2.55
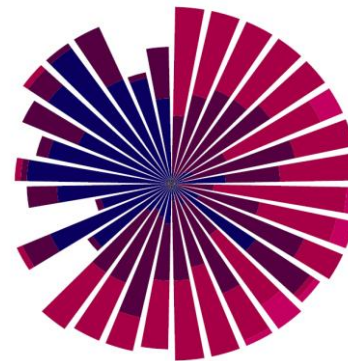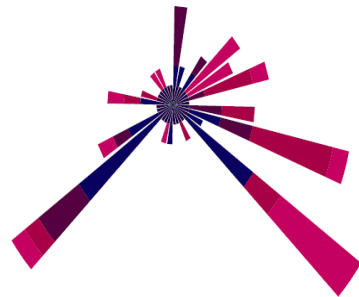
High diversity person
- iDiversity = 3.37

Magurran, 2004; Simpson, 1949; Shannon, 1949; Ram & Gerstorf, 2009

Person A

Person B

Afraid Enthusiastic
Jittery · Active
Nervous · Attentive
Restless · Happy
Angry · Cheerful
Frustrated · GoodSpirits
Irritable · FullofLife
Upset · Confident
Ashamed · Proud
Worthless · Belong
Hopeless · Close2Others
Sad · Satisfied
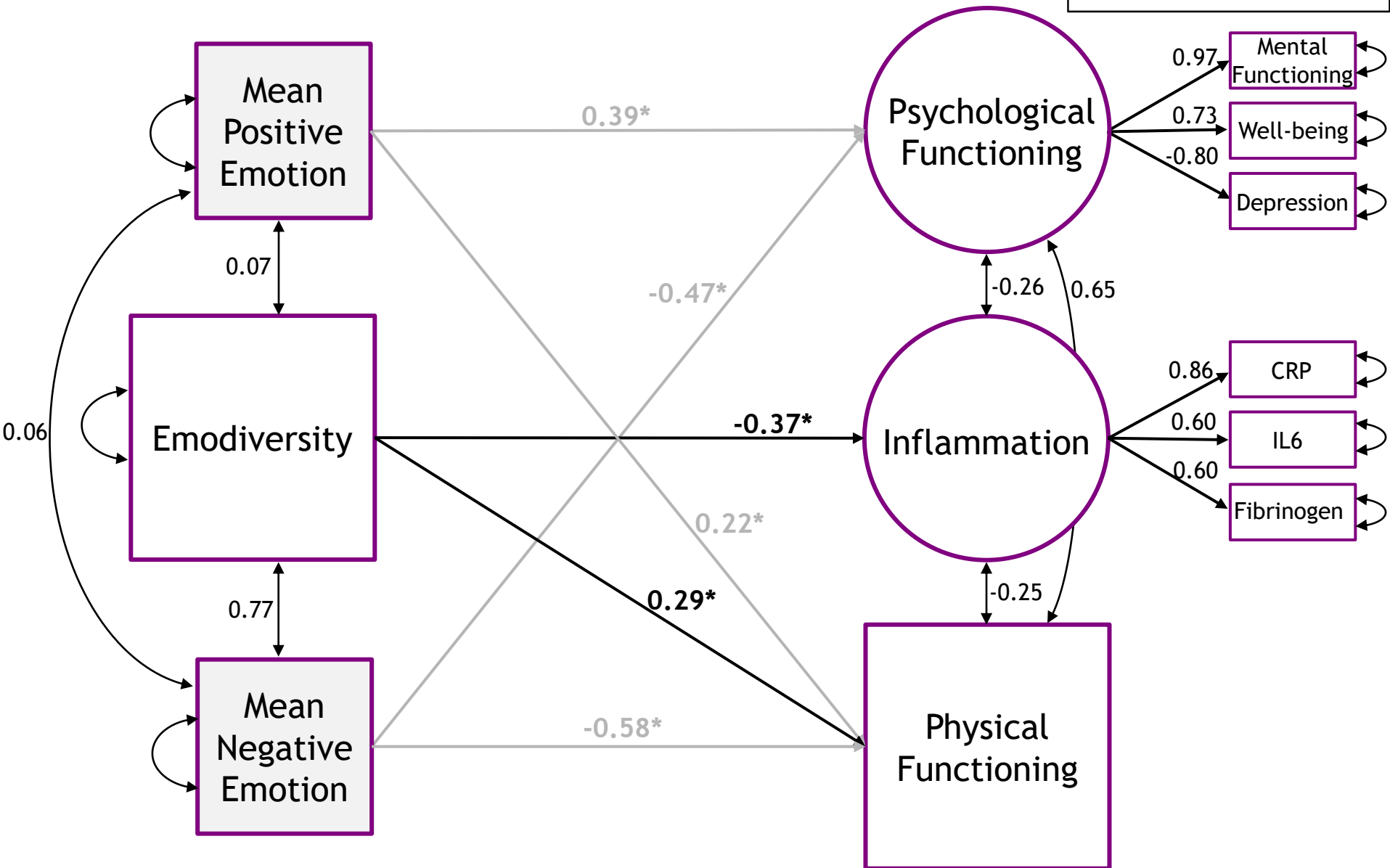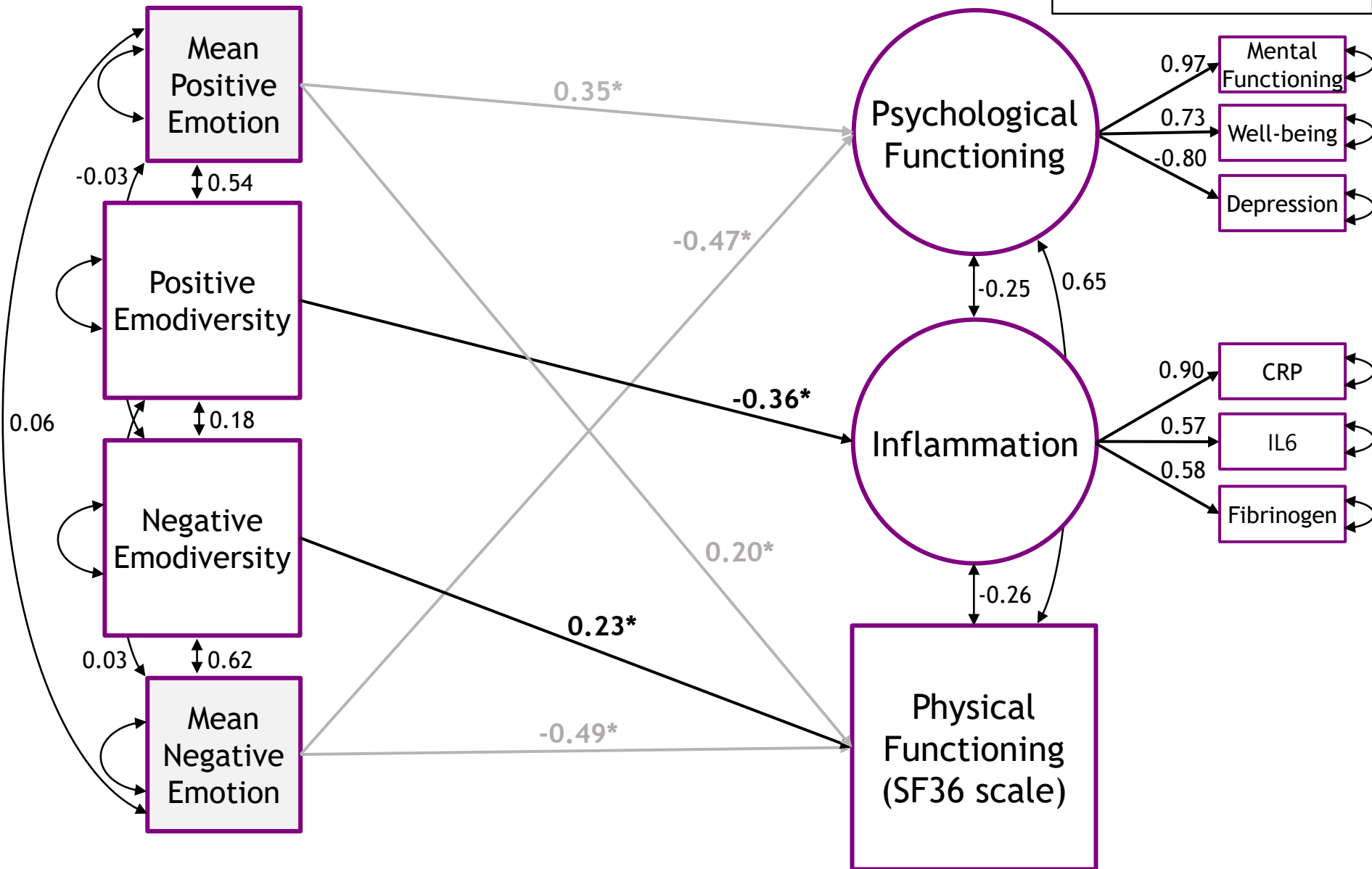EverythingEffort · Calm
Lonely

0   4

None of the time   All of the time

Results

N = 176 (Robust ML)
$\chi^2(24) = 40.12$, $p < .05$;
CFI = .97; RMSEA = .07
SRMR = 0.03

Results

N = 176 (Robust ML)
$\chi^2(28) = 55.93$, $p < .05$;
CFI = .95; RMSEA = .08;
SRMR = .04
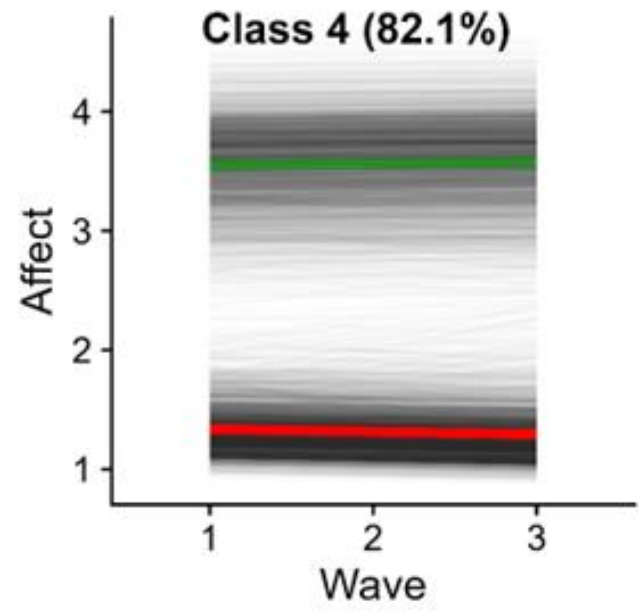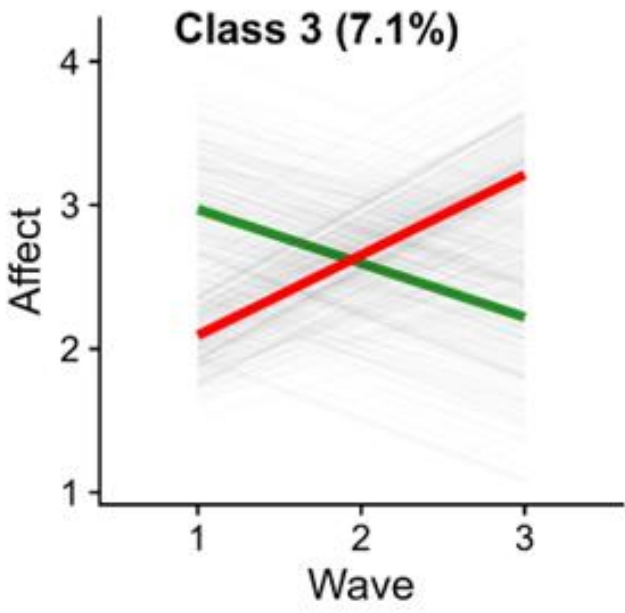
PART N° 4
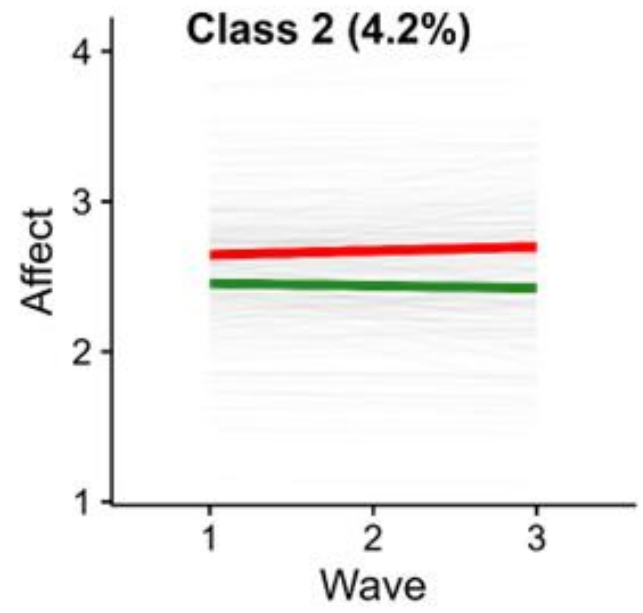
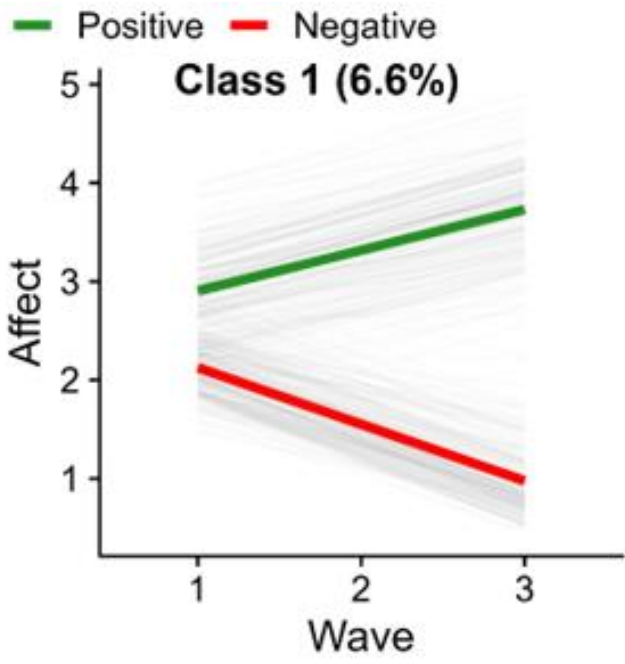▶ Positive affect as a dynamic phenomena

Positive Affect:
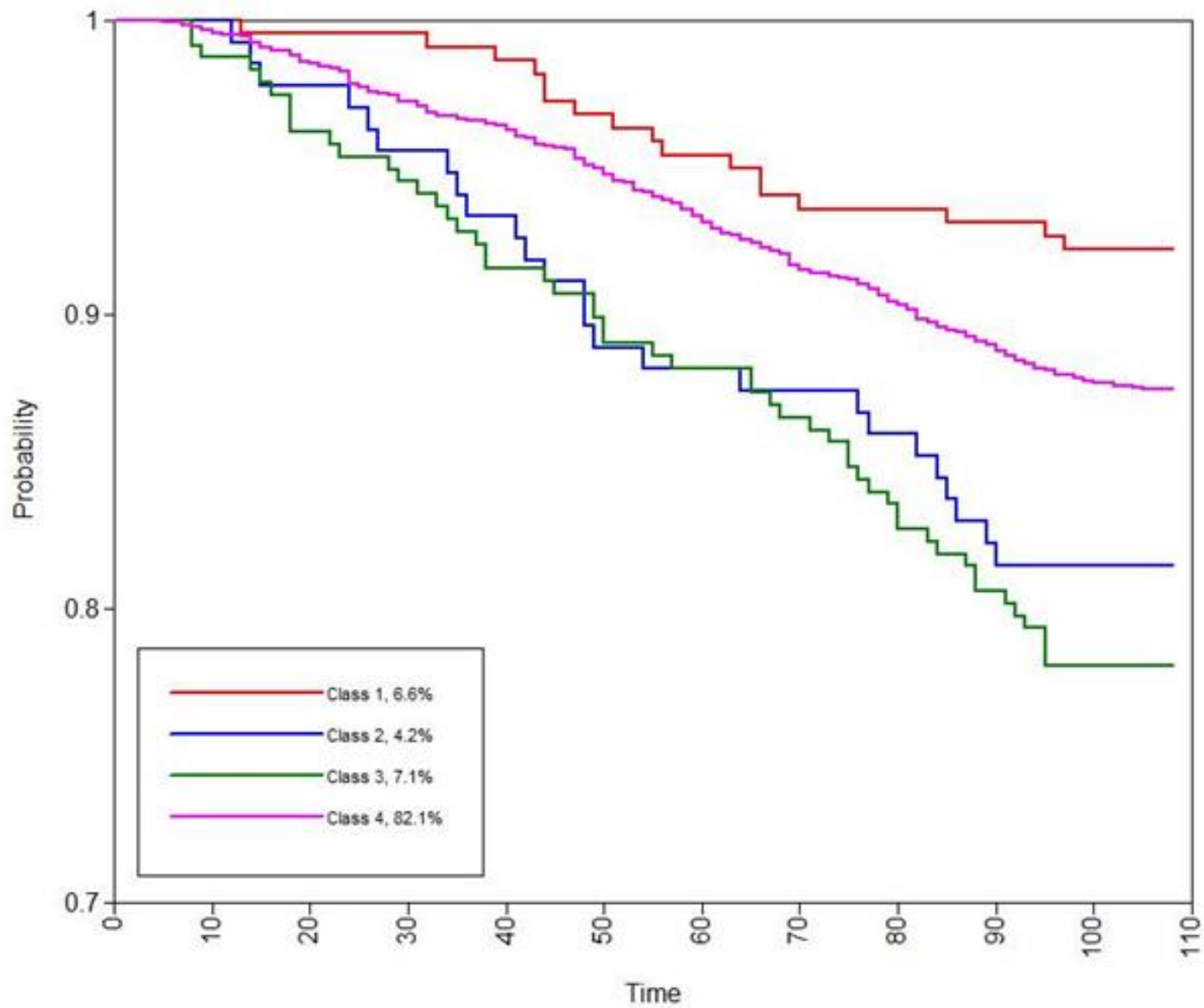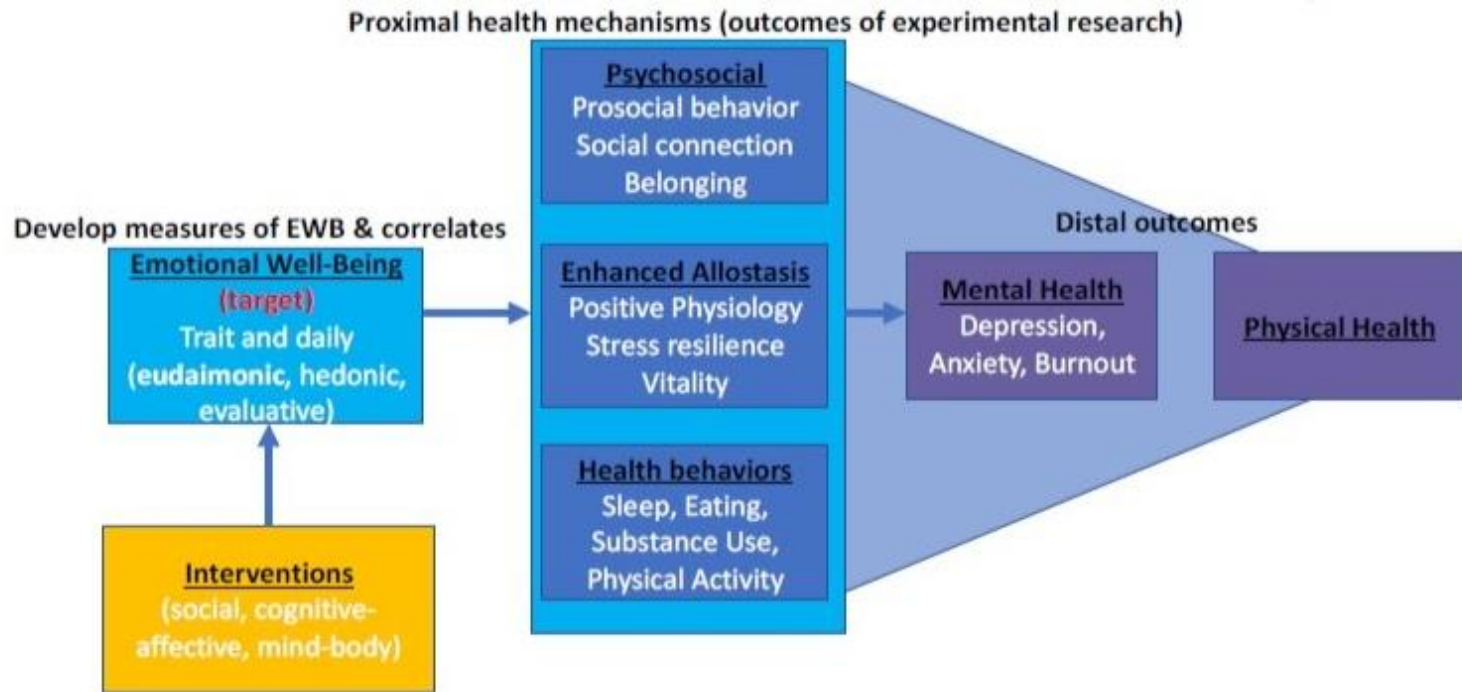# A Heterogeneous Construct

Photography by Glenn Affleck © 2002

Multiple Forms of Fragile High PA

- **Contingent High PA** (combination of high PA level and high PA reactivity to events)

- **Variable High PA** (combination of high PA level and large temporal fluctuation in PA over time)

- **Unstable High PA** (combination of high PA level and rapid oscillations of PA over time)

- **Inert High PA** (combination of high PA level and high temporal dependence in PA over time)
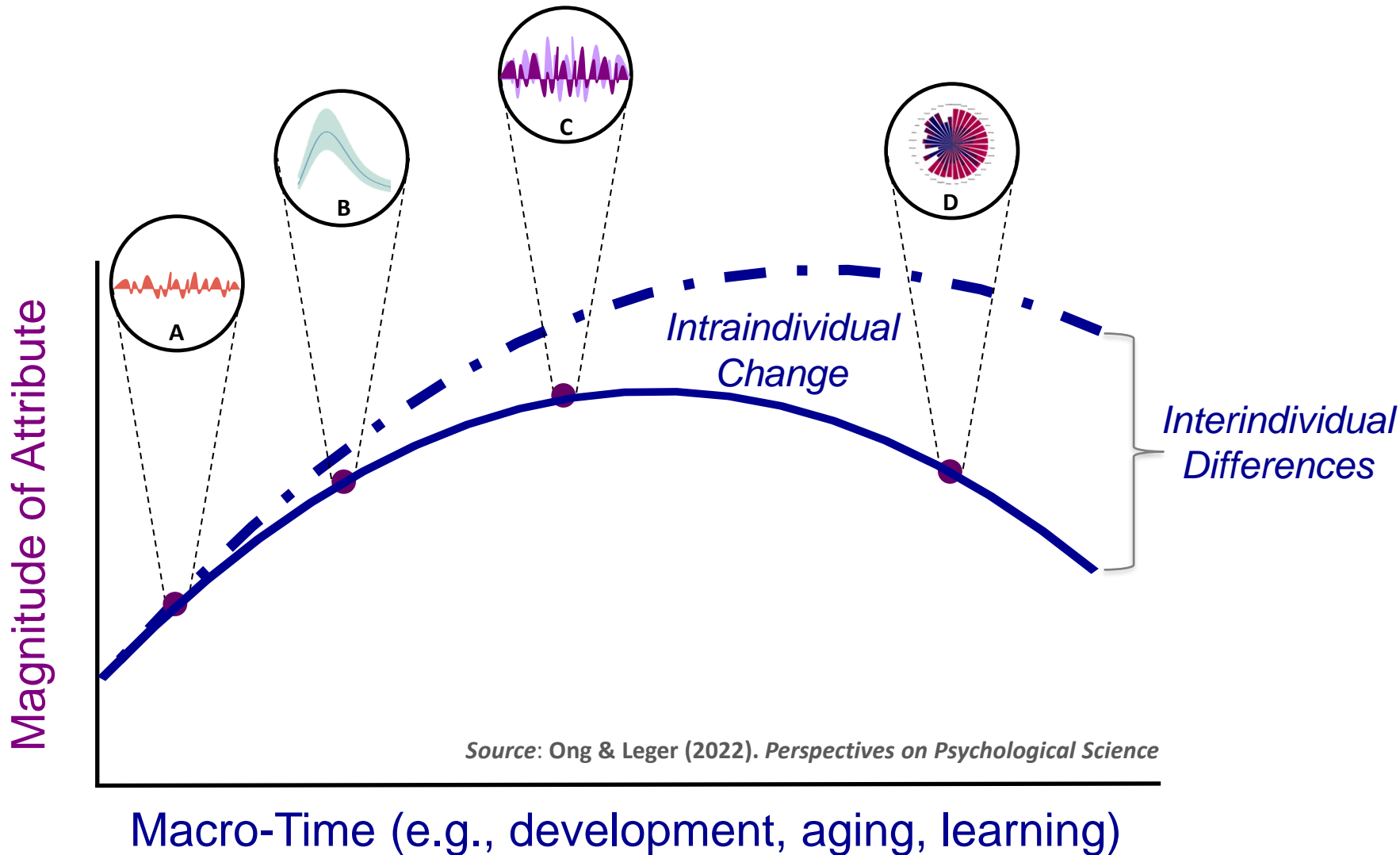
Proximal health mechanisms (outcomes of experimental research)

Psychosocial
Prosocial behavior
Social connection
Belonging

Develop measures of EWB & correlates

Emotional Well-Being
(target)
Trait and daily
(**eudaimonic, hedonic,**
evaluative)

Enhanced Allostasis
Positive Physiology
Stress resilience
Vitality

Interventions
(social, cognitive-
affective, mind-body)

Health behaviors
Sleep, Eating,
Substance Use,
Physical Activity

Distal outcomes

Mental Health
Depression,
Anxiety, Burnout

Physical Health

Courtesy of Elissa Epel

Intraindividual Variability and Change
Descriptive Framework

Source: Ong & Leger (2022). Perspectives on Psychological Science

Gerontology

Fragile and Enduring Positive Affect: Implications for Adaptive Aging

Anthony D. Ong[a, b]   Nilam Ram[c, d]

[a]Department of Human Development, Cornell University, Ithaca, NY, [b]Division of Geriatrics and Palliative Medicine, Weill Cornell Medical College, New York, NY, and [c]Department of Human Development and Family Studies, Pennsylvania State University, State College, PA, USA; [d]German Institute for Economic Research (DIW), Berlin, Germany

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CHAPTER

25

Distinguishing Between Enduring and Fragile Positive Affect: Implications for Health and Well-Being in Midlife

Anthony D. Ong, Nancy L. Sin, *and* Nilam Ram

Ryff & Krueger (Eds). (2018). *The Oxford Handbook of Integrative Health Science*

Thank You