



# Effects of Meditation on the Neural System Underlying Social Cognition and Emotion

Prof. Dr. Tania Singer



# Objectives



Dissecting the Social Brain: Theory of Mind, Empathy, and Compassion



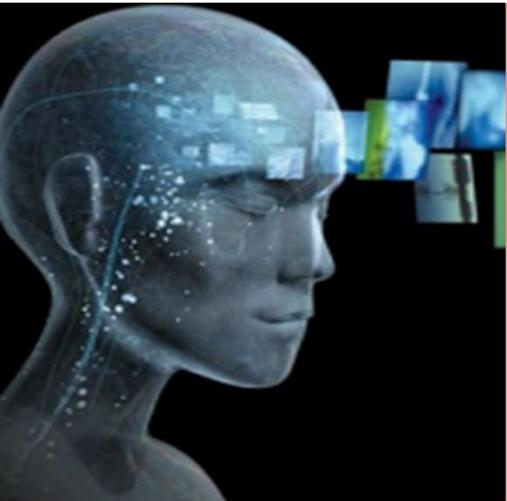
The *ReSource Project*: An Example for an Integrative and Multi-Method Longterm Mental Training Study



Differential Training Effects on: Social Cognition, Brain Plasticity, Stress, Body Awareness and Prosociality

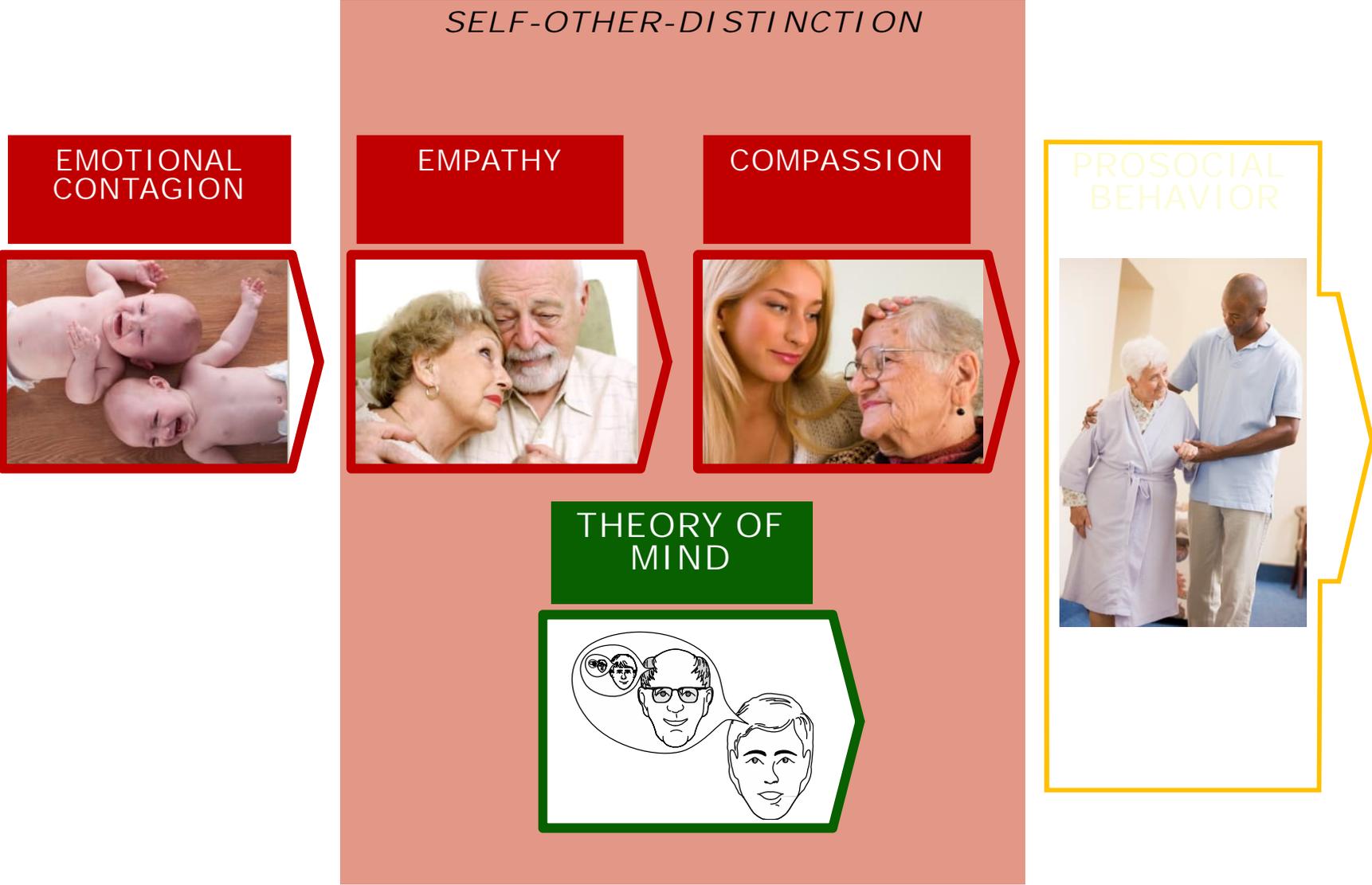


The CovSocial Project and Transfer into Society



# Dissecting the Social Brain, Empathy, Compassion and Theory of Mind

# Different Routes to the Understanding of Others

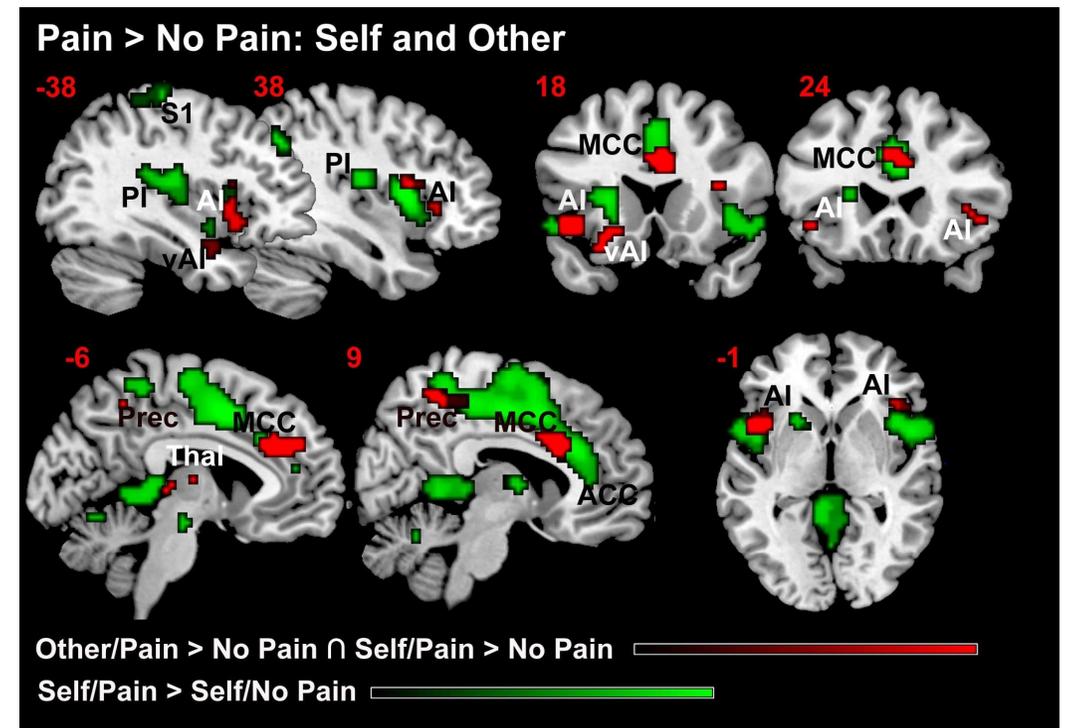
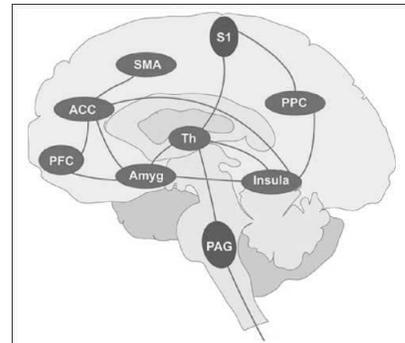


Singer (2012). *NeuroImage*; Bernhardt & Singer (2012). *Ann Rev Neurosci*; De Vignemont & Singer (2006). *TICS*

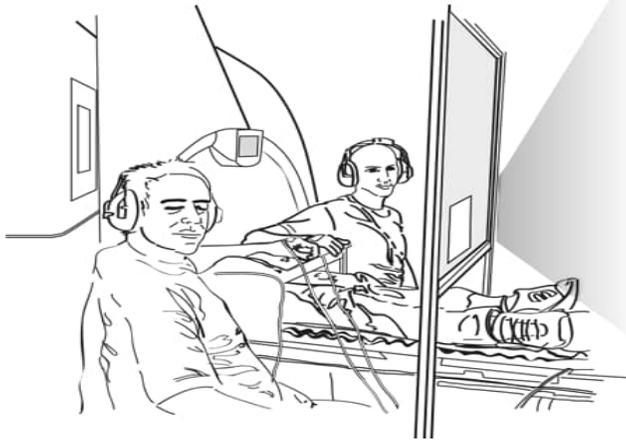
# Empathy: The Shared Network Hypothesis



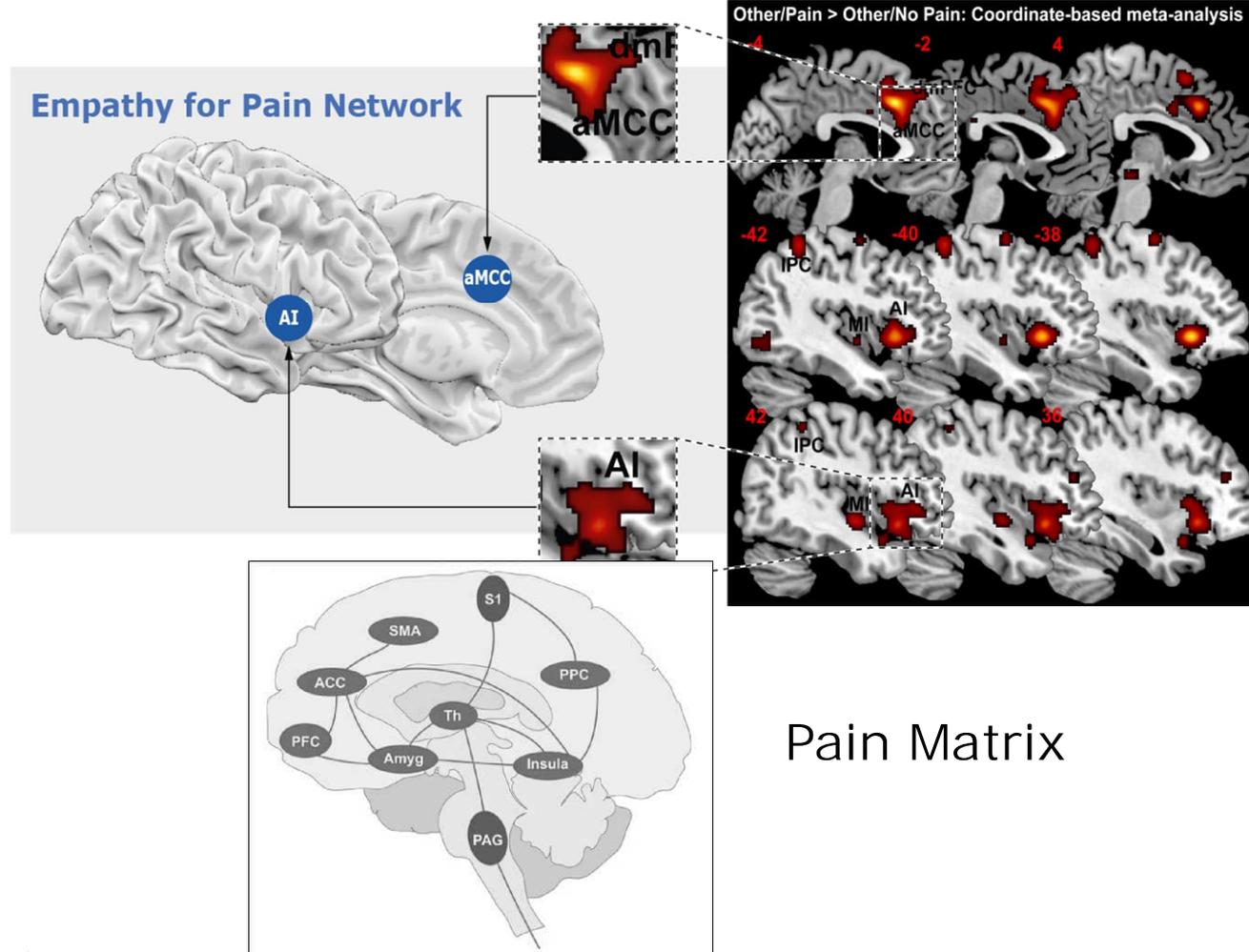
## The Pain Matrix



# Empathetic Brain Reactions on the Pain of Others



Empathy for Pain Network



Pain Matrix

Lamm, Decety, & Singer (2011). *NeuroImage*; Singer (2012). *Neuroimage*.

EMPATHY



COMPASSION



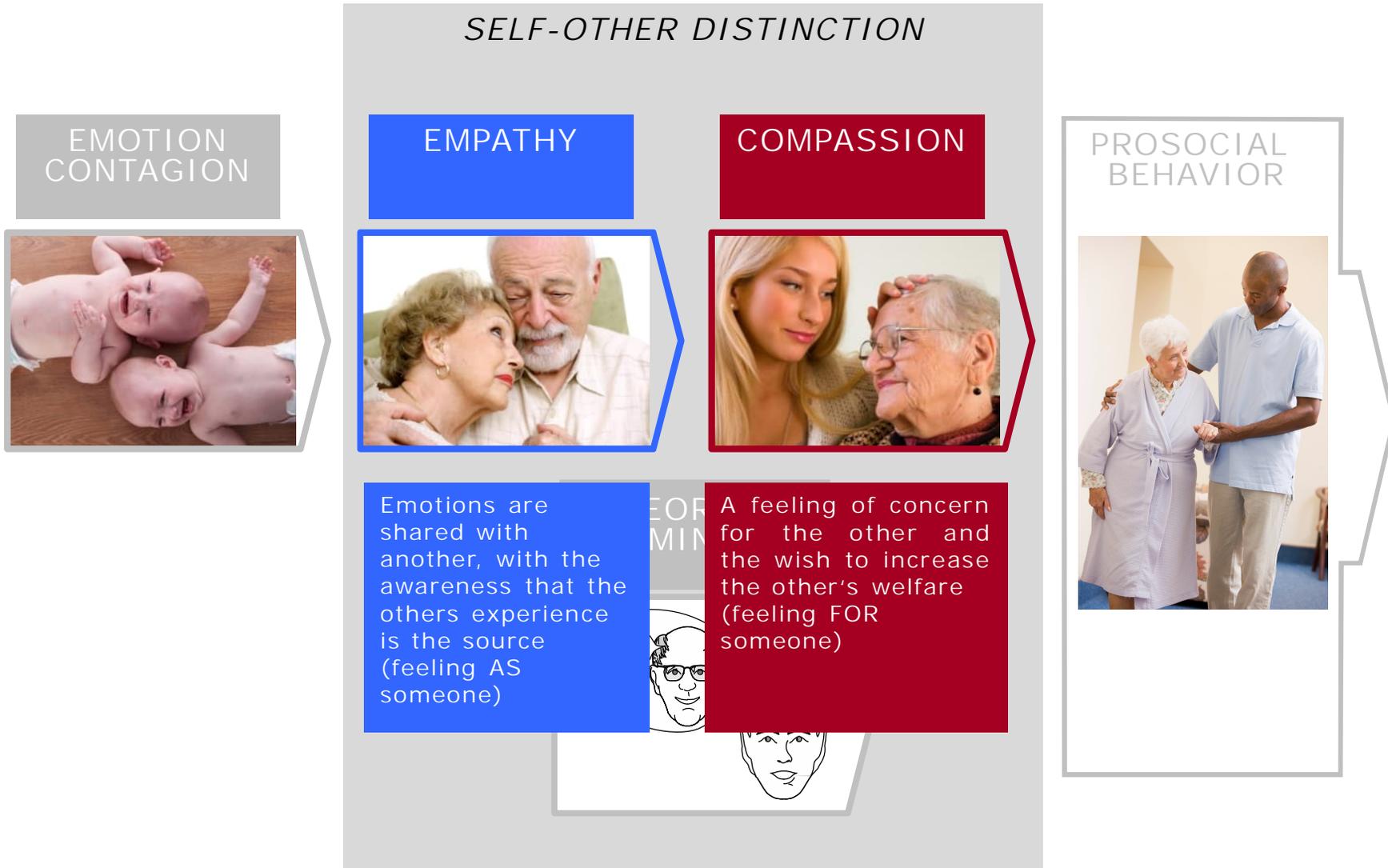
The Difference between Empathy vs.  
Compassion Training

# Different Routs to the Understanding of Others



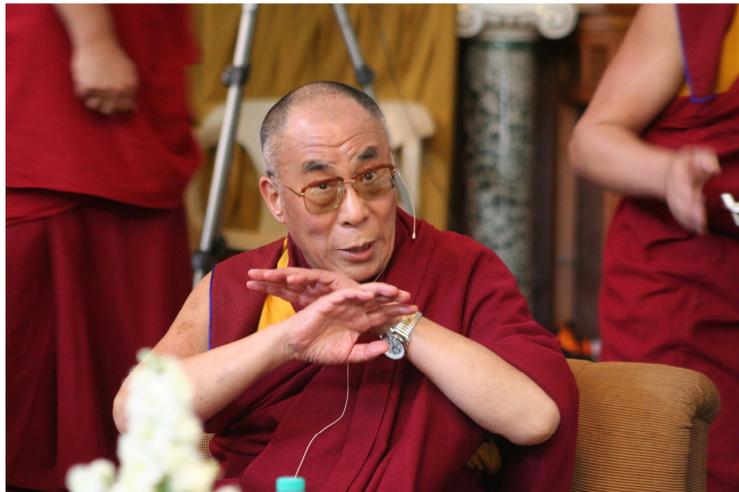
Singer (2012). *NeuroImage*; Bernhardt & Singer (2012). *AnnRevNeurosci*; De Vignemont & Singer (2006). *TICS*

# Different Routes to the Understanding of Others

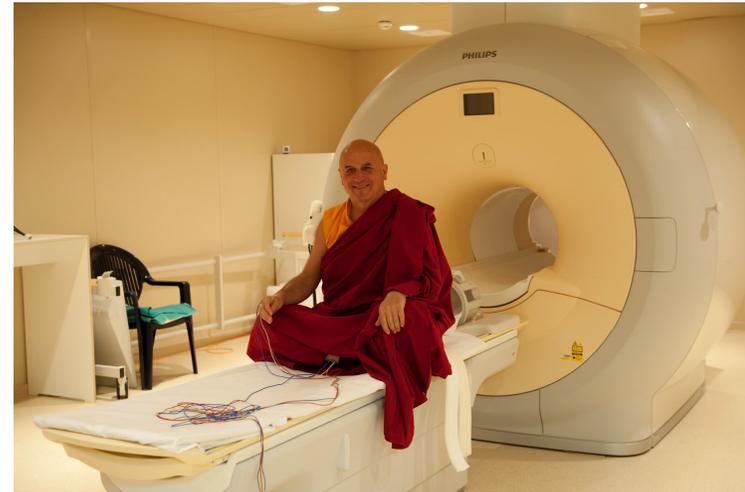
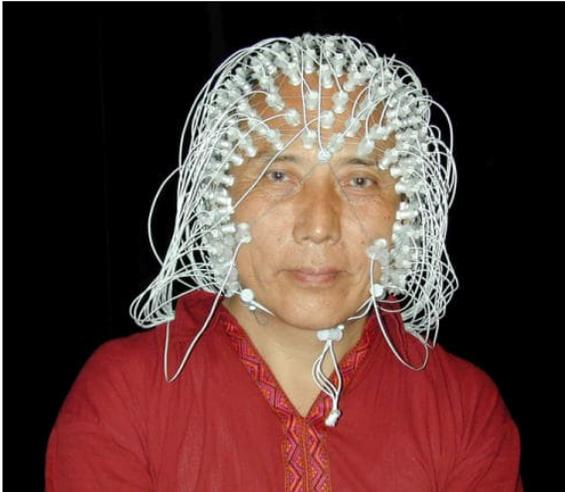
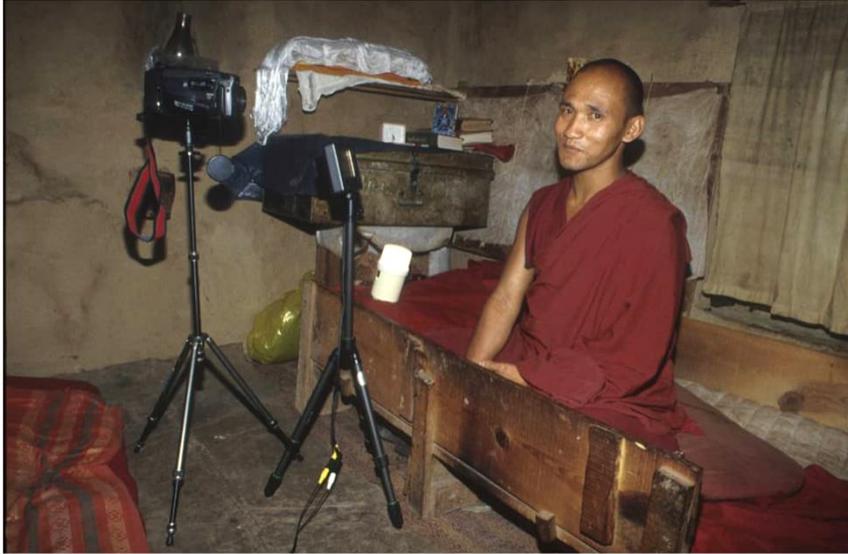


Singer (2012). *NeuroImage*; Bernhardt & Singer (2012). *AnnRevNeurosci*; De Vignemont & Singer (2006). *TICS*

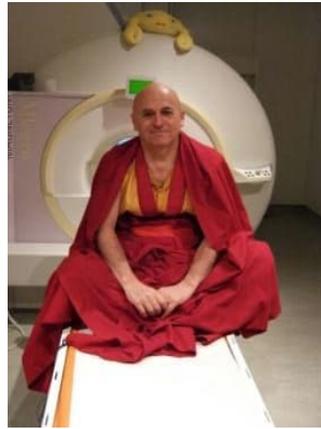
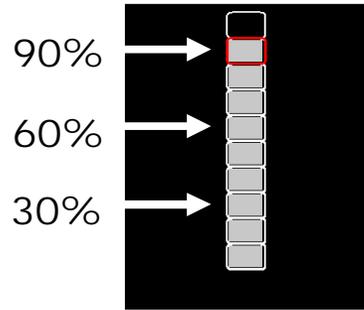
# Mind & Life Conference 2007, Dharamsala



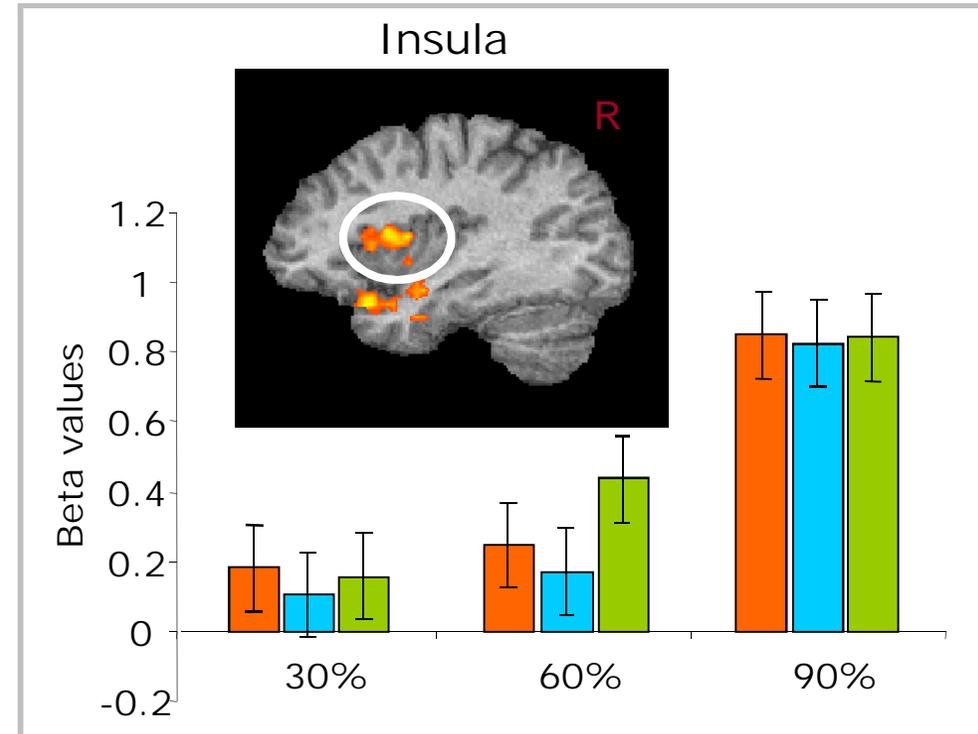
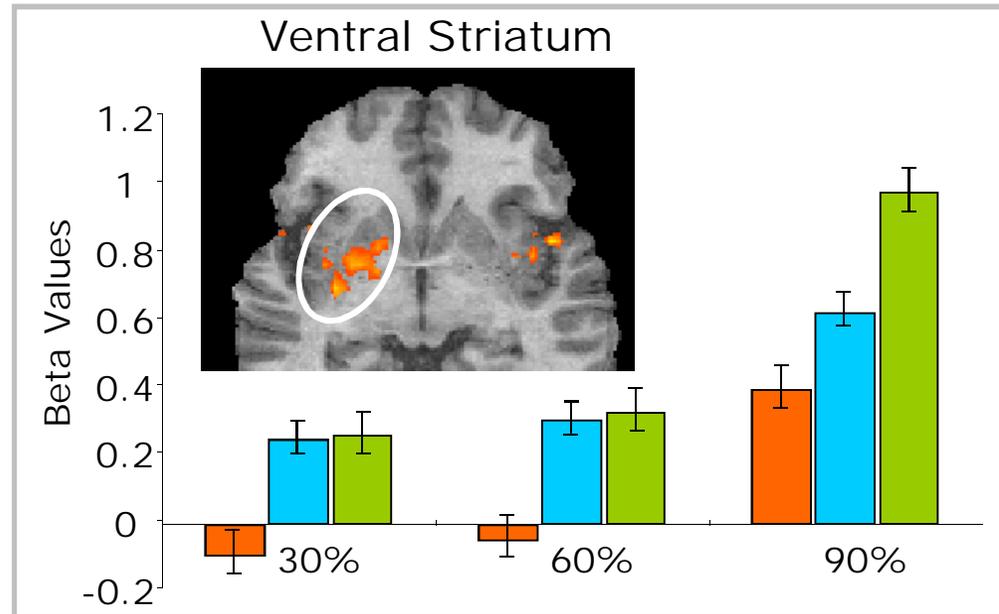
# Monks in the lab



# Studying Experts in Compassion Meditation



- Non-referential Compassion (4)
- Loving-kindness (*Metta*) (7)
- Compassion (4)

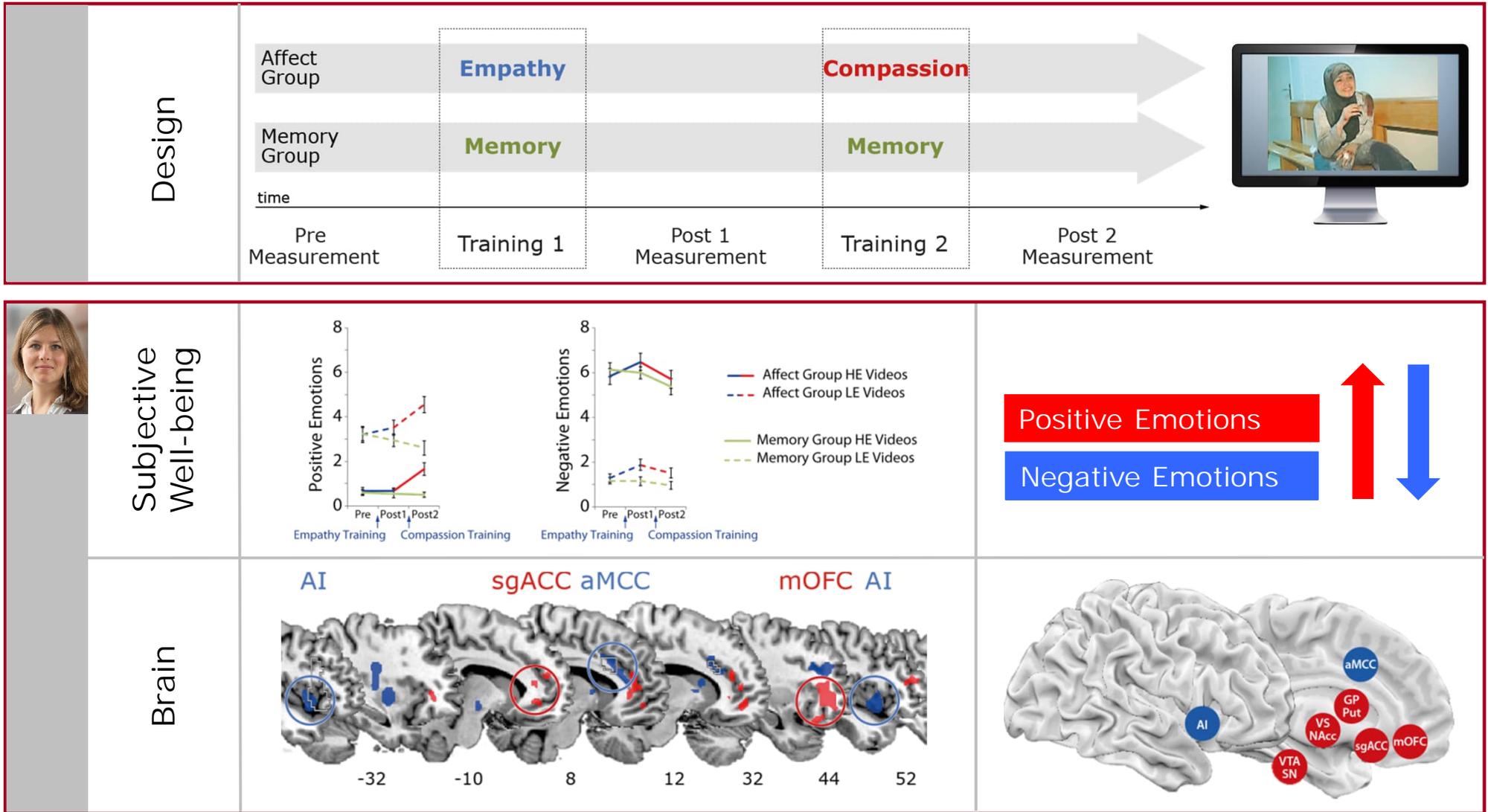


# Empathy, Empathic Distress, and Compassion



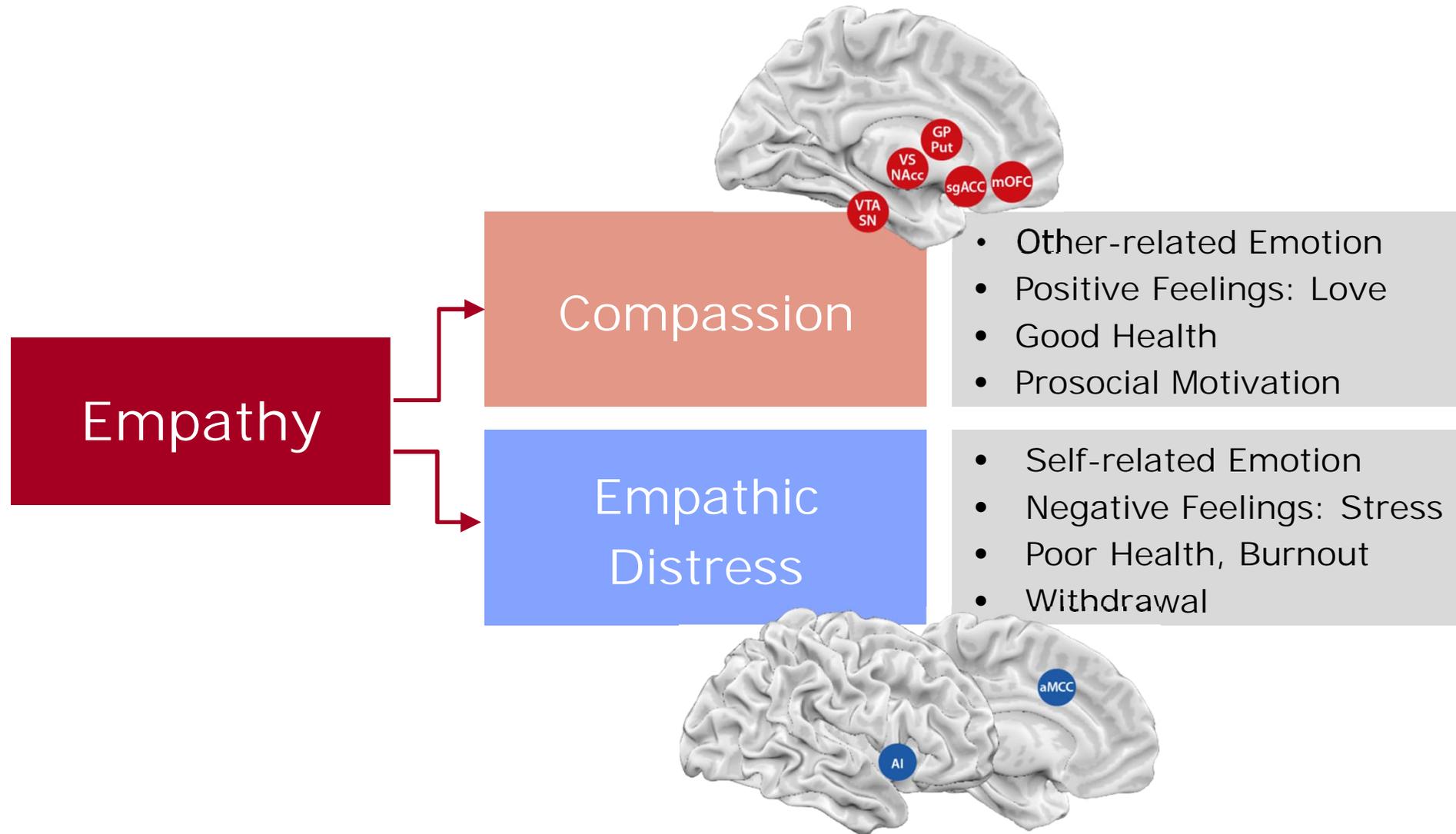
*Klimecki et al. (2013). Cereb Cortex; Leiberg et al. (2011). PLoS ONE; Klimecki et al. (2014). SCAN; Klimecki & Singer (2012). In: Pathological altruism. New York: Oxford University Press*

# Empathy vs. Compassion



Klimecki et al. (2014). SCAN

# Empathy, Empathic Distress, and Compassion



Klimecki et al. (2013). *Cereb Cortex*; Leiberger et al. (2011). *PLoS ONE*; Klimecki et al. (2014). *SCAN*; Klimecki & Singer (2012). In: *Pathological altruism*. New York: Oxford University Press

EMPATHY

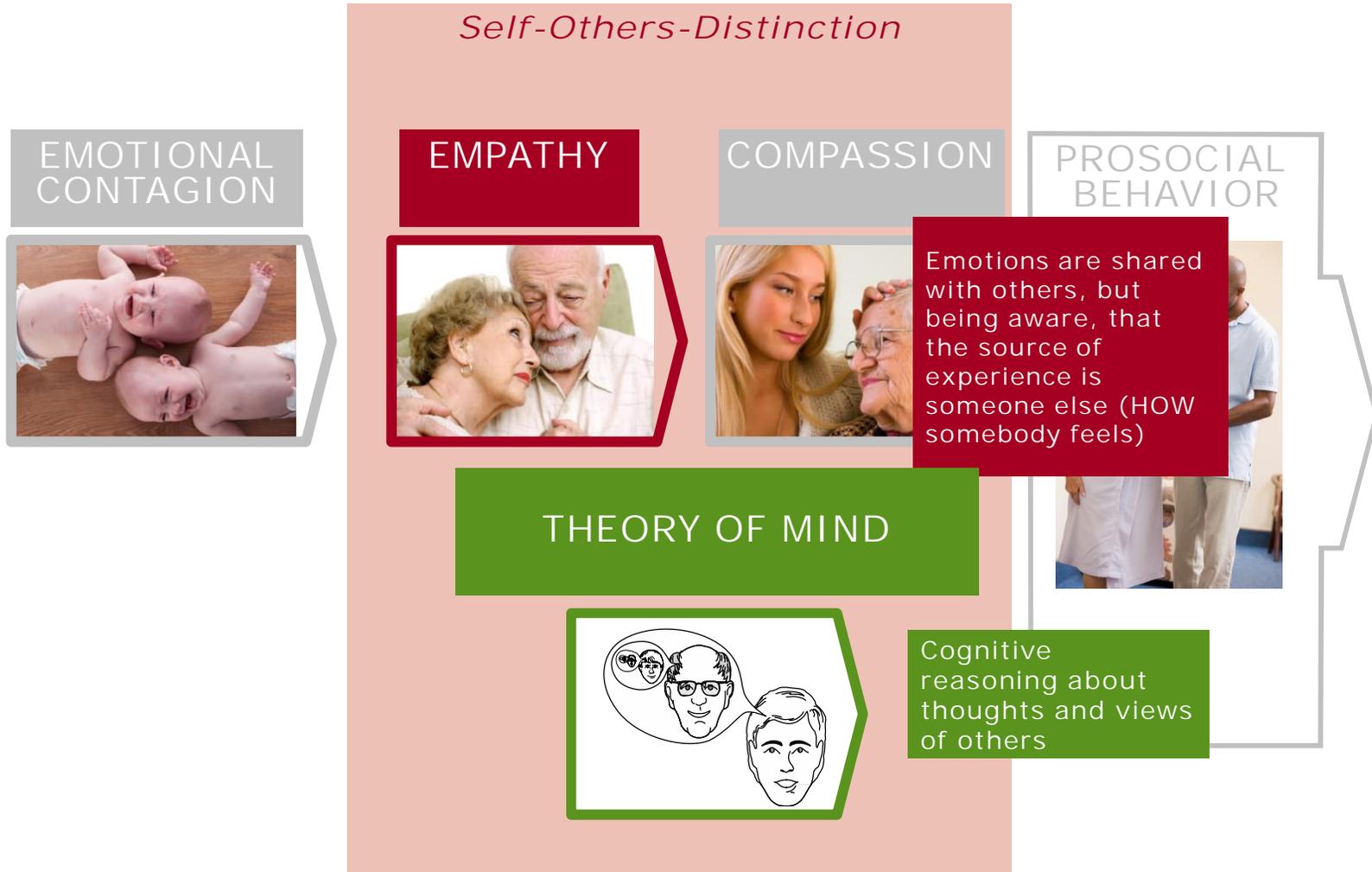


THEORY OF  
MIND



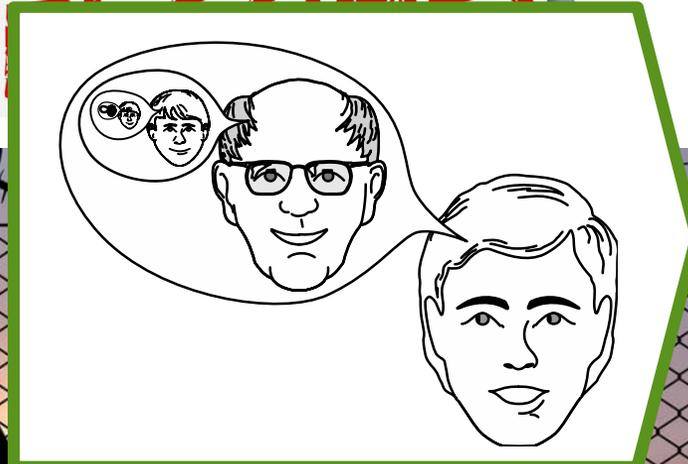
Theory of Mind, Perspective Taking  
or Mentalizing

# Different Routes to the Understanding of Others

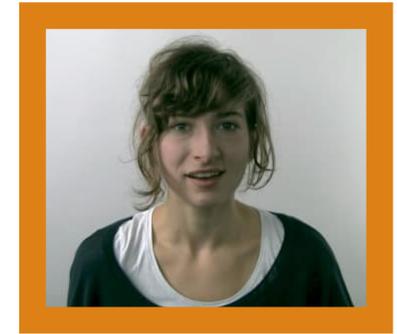
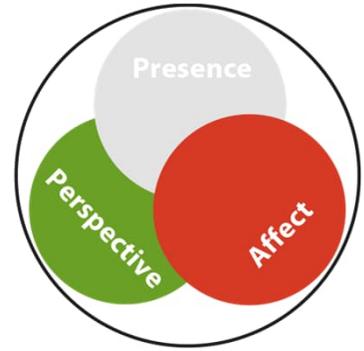


Singer (2012). *NeuroImage*; Bernhardt & Singer (2012). *Ann Rev Neurosci*; De Vignemont & Singer (2006). *TICS*

# Perspective Taking Needed to Move into Global Compassion



# How do We Measure Brain Responses of Empathy/Compassion and Perspective Taking?



Screen Inside



Neutral

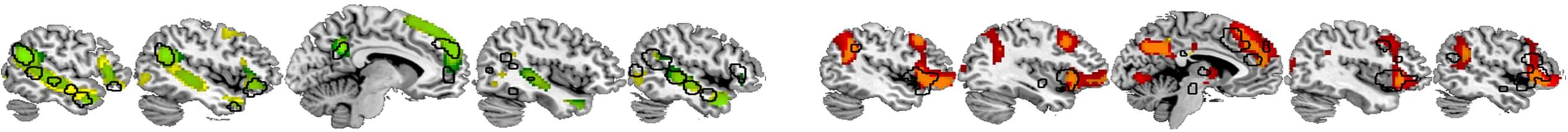
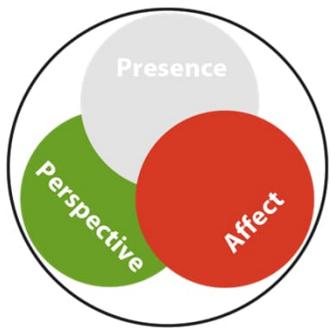
Cognitive Perspective Taking  
Theory of Mind Accuracy Score

Emotional

Compassion/Loving-kindness  
Ratings



# Empathy/Compassion and Perspective Taking Have Distinct Networks in the Brain



**Neutral**

nonCPT      CPT

Cognitive Perspective Taking  
Theory of Mind Accuracy Score

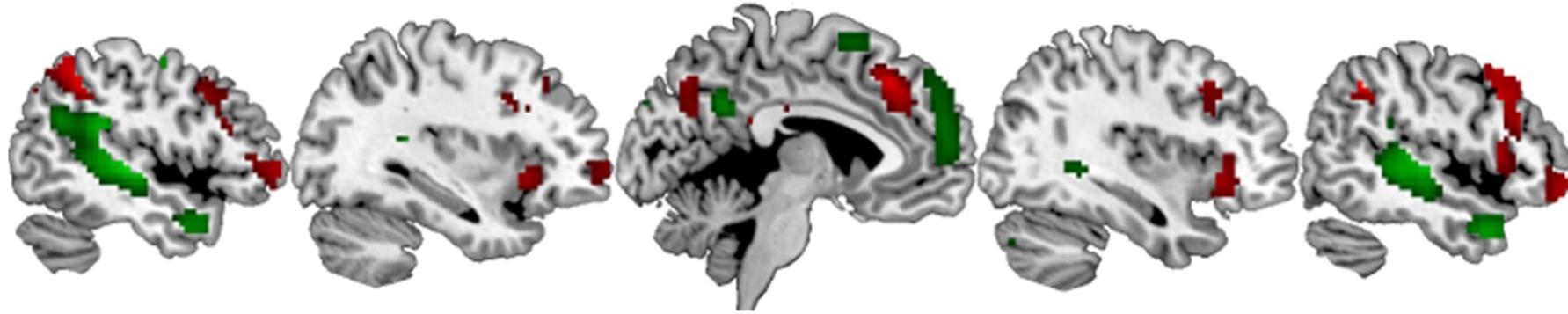
**Emotional**

nonCPT      CPT

Compassion/Loving-kindness  
Rating

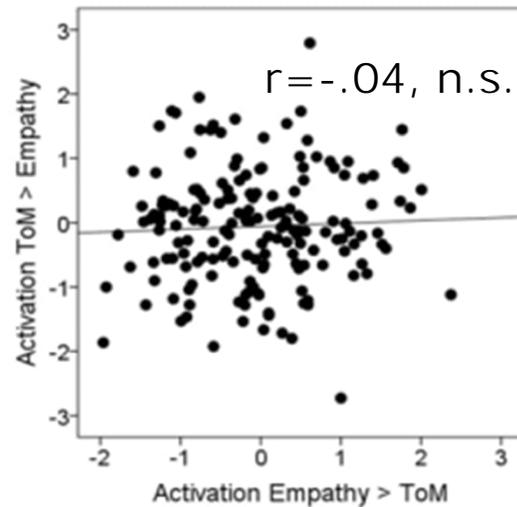


# Independency of Networks

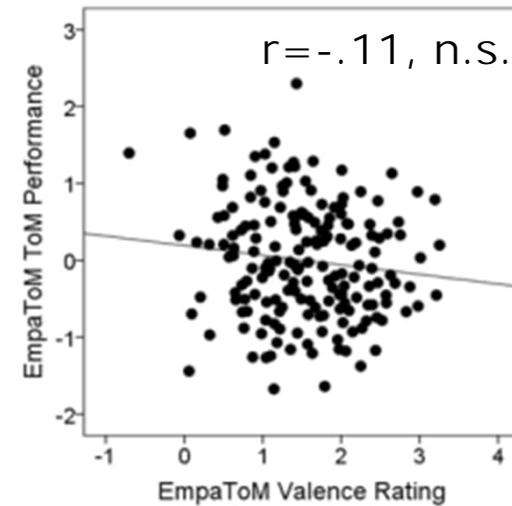


- ToM effect questions > Empathy effect videos
- Empathy effect videos > ToM effect questions

Specific contrasts

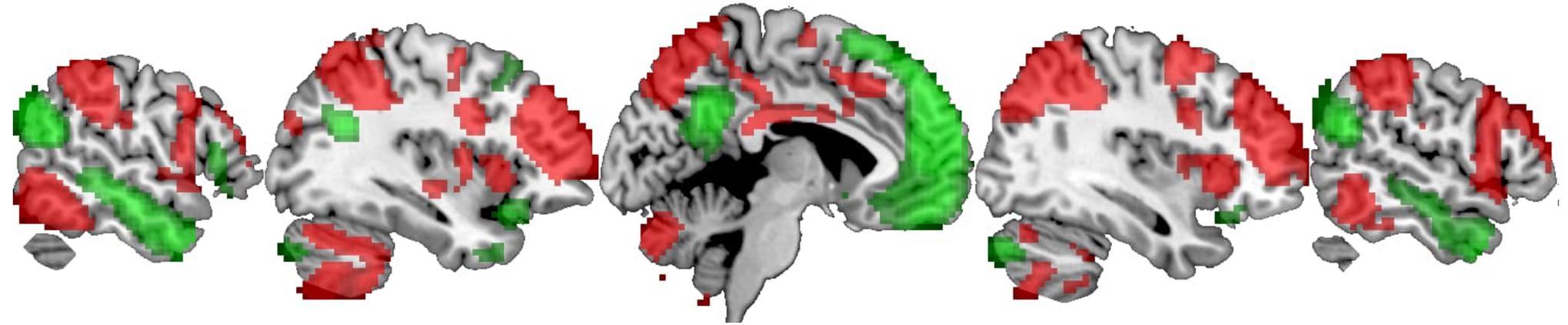
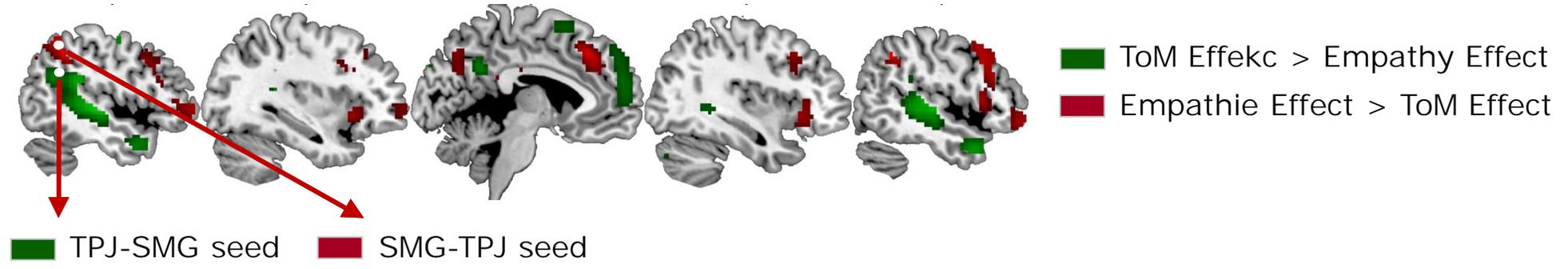


Behavioral measures



# The EmpaToM – *ReSource* Resting State Validation

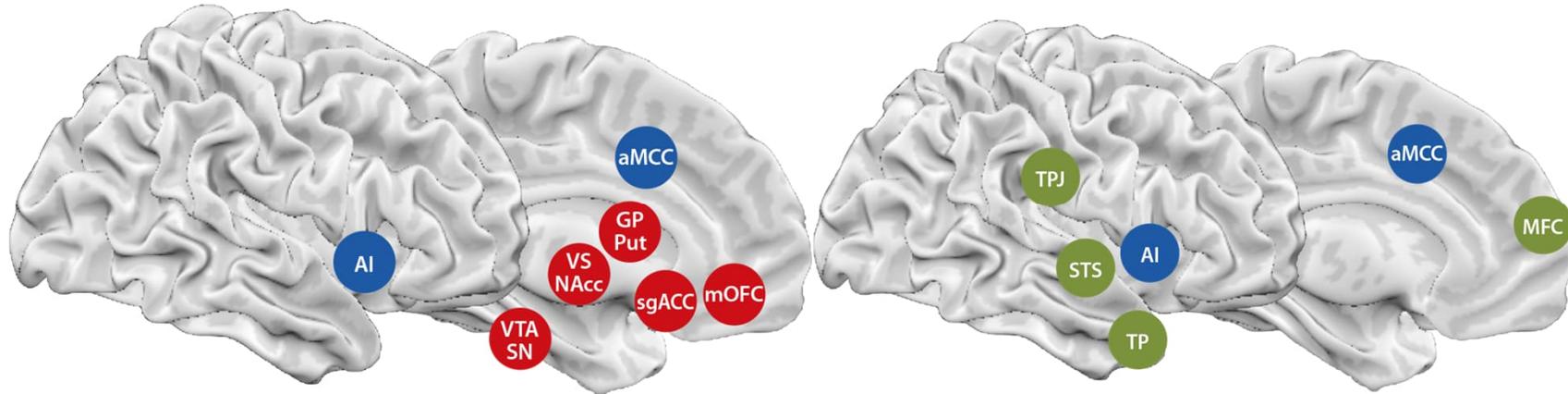
## Empathy and ToM



FWE  $p < 0.05$ ,  $k > 10$   
 $N = 178$  (107 female),  $40.9 \pm 9.5$  years

Kanske\*, Böckler\*, Trautwein\* & Singer (2015). *Neuroimage* \*contributed equally

# These socio-affective / socio-cognitive abilities are based on different networks



# Two Mental Training Studies



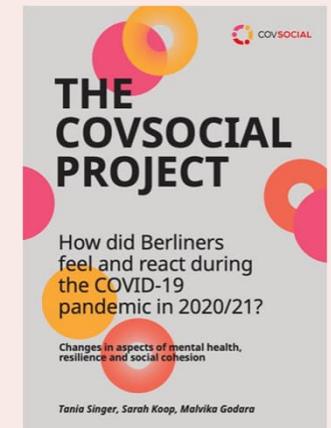
9-month intensive in-person  
mental training study



**European Research Council**  
Established by the European Commission



10-weeks online  
mental training study



## Partner

Gefördert durch die Max-Planck-Gesellschaft und im Rahmen der  
Exzellenzstrategie von Bund und Ländern durch die Berlin University Alliance



# Global Problems

Loneliness



Stress



Individualism/Narcisism



Climate Crisis



Depression



Poverty



# Aims

Social Connectedness



Social Skills



Global Cooperation



Shared Humanity



Mental Health



Stress Reduction





The ReSource Project

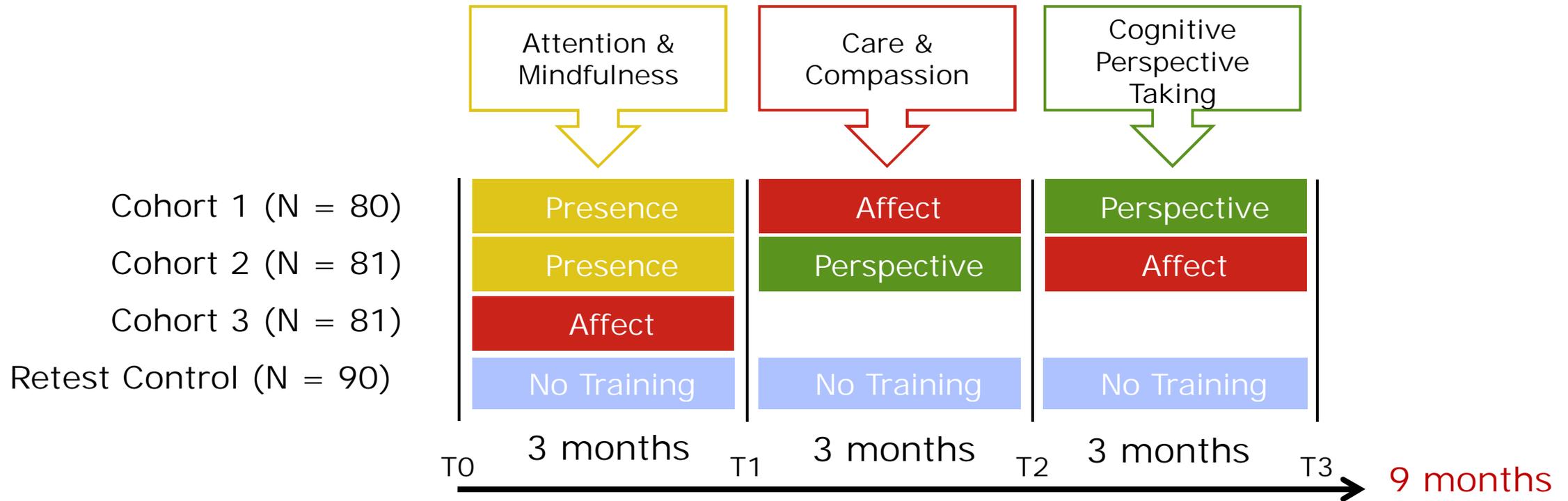
A One-Year longitudinal  
Training Study to induce  
Plasticity in the Social Brain



European Research Council  
Established by the European Commission



# The Design of the *ReSource* Project



# The *Resource* Model

- Attention
- Interoceptive Awareness

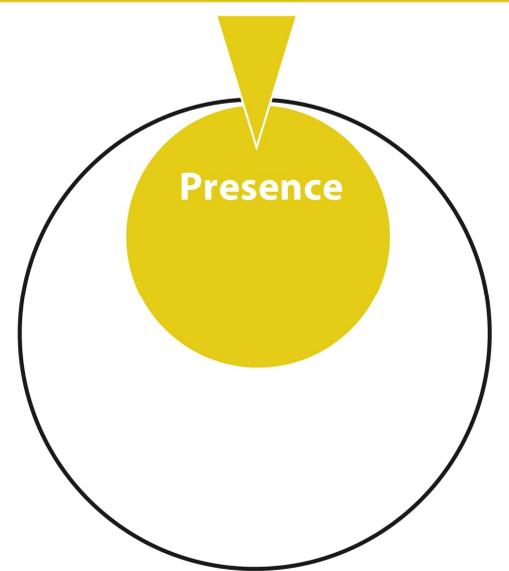
## The Core Exercises



Breathing Meditation



Body Scan



Presence

# The *ReSource* Model

- Attention
- Interoceptive Awareness

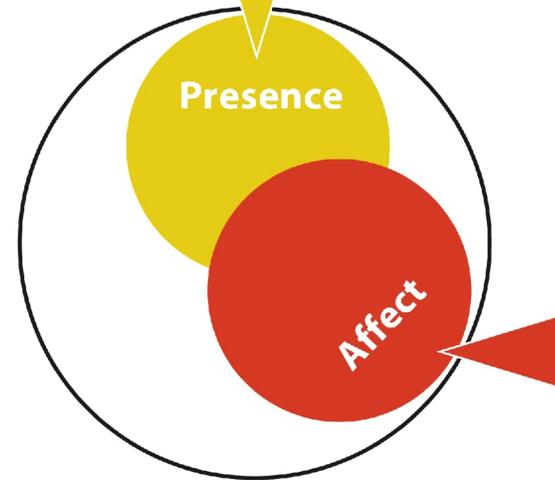
## The Core Exercises



Breathing Meditation



Body Scan



- Care / Compassion / Gratitude
- Prosocial Motivation
- Dealing with difficult Emotions

## The Core Exercises

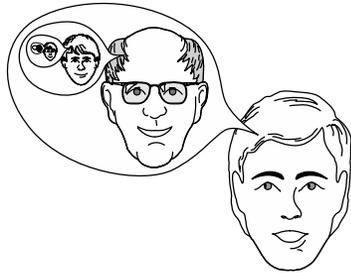


Loving-kindness  
Meditation



Affect Dyad

# The *ReSource* Model



- Attention
- Interoceptive Awareness

## The Core Exercises



Breathing Meditation



Body Scan



- Meta-Cognition
- Perspective taking on Self
- Perspective taking on Others

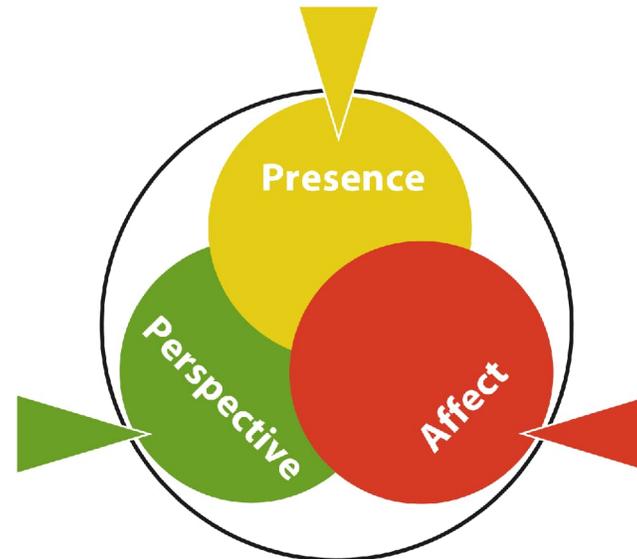
## The Core Exercises



Observing-thoughts  
Meditation



Perspective Dyad



- Care / Compassion / Gratitude
- Prosocial Motivation
- Dealing with difficult Emotions

## The Core Exercises



Loving-kindness  
Meditation

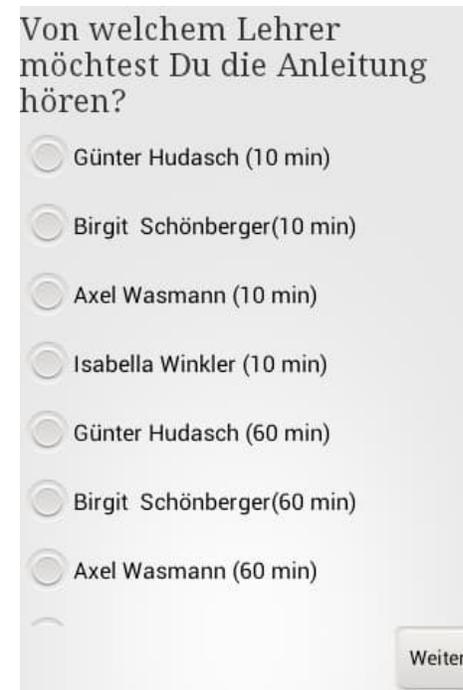
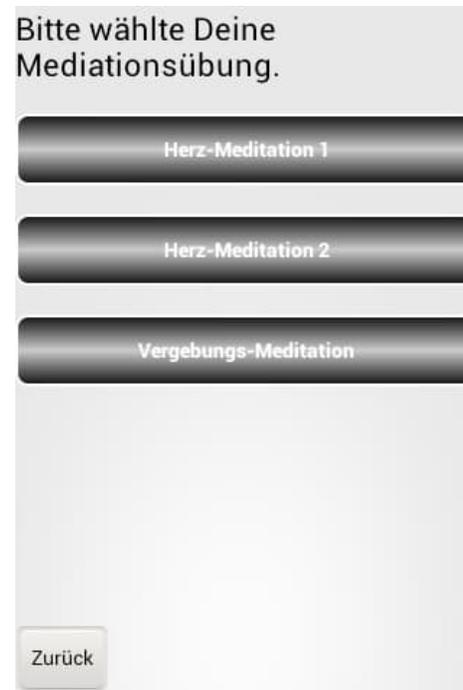
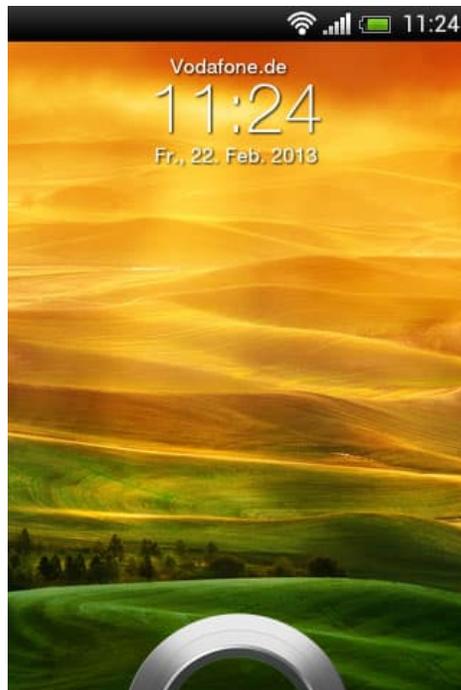


Affect Dyad

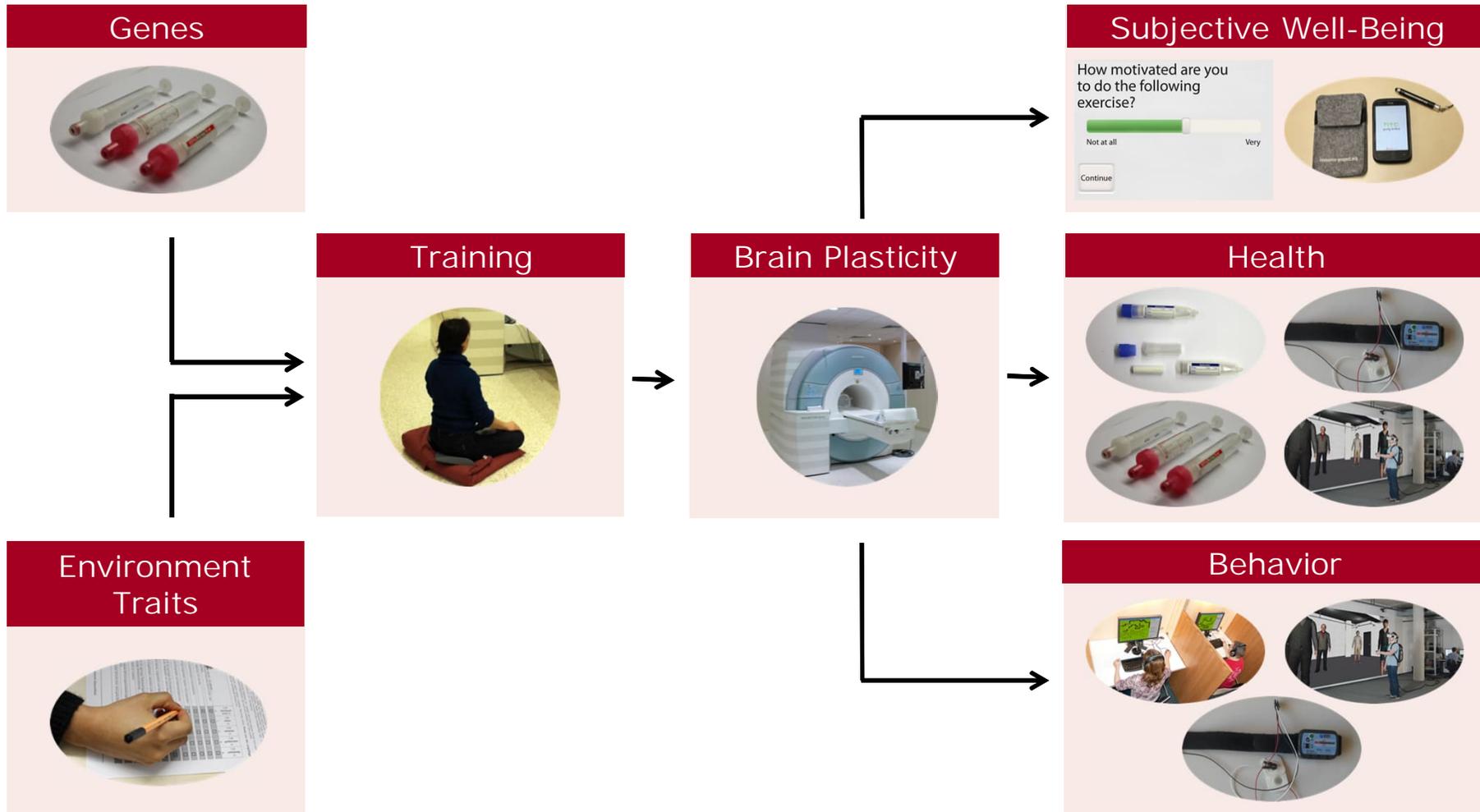
# Daily Practice via Internet-Platform and Smartphone App



# Daily Exercises via a Smartphone App



# The *ReSource* Design



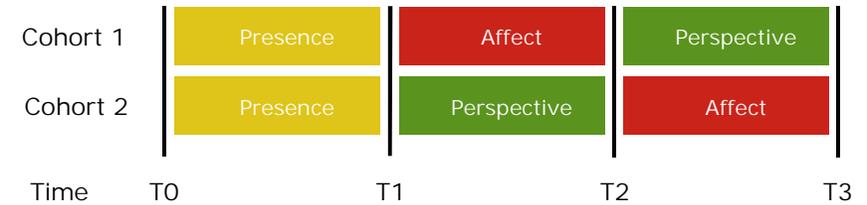
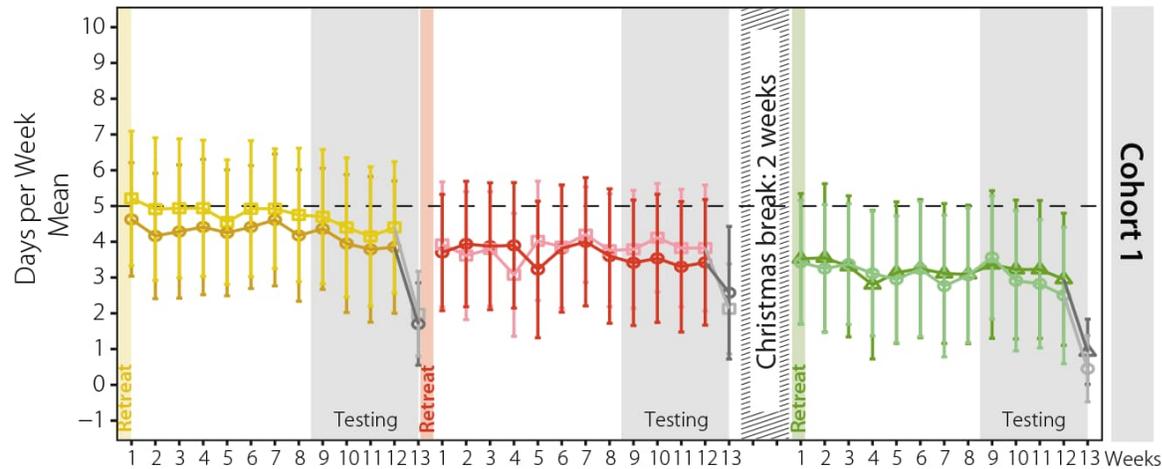
- 10 MRI Paradigms
- 4 Virtual Scenarios
- 10 Computer Paradigms

- 5 Economic Games
- 5 Paradigms for ANS
- 9+ Biological Measures

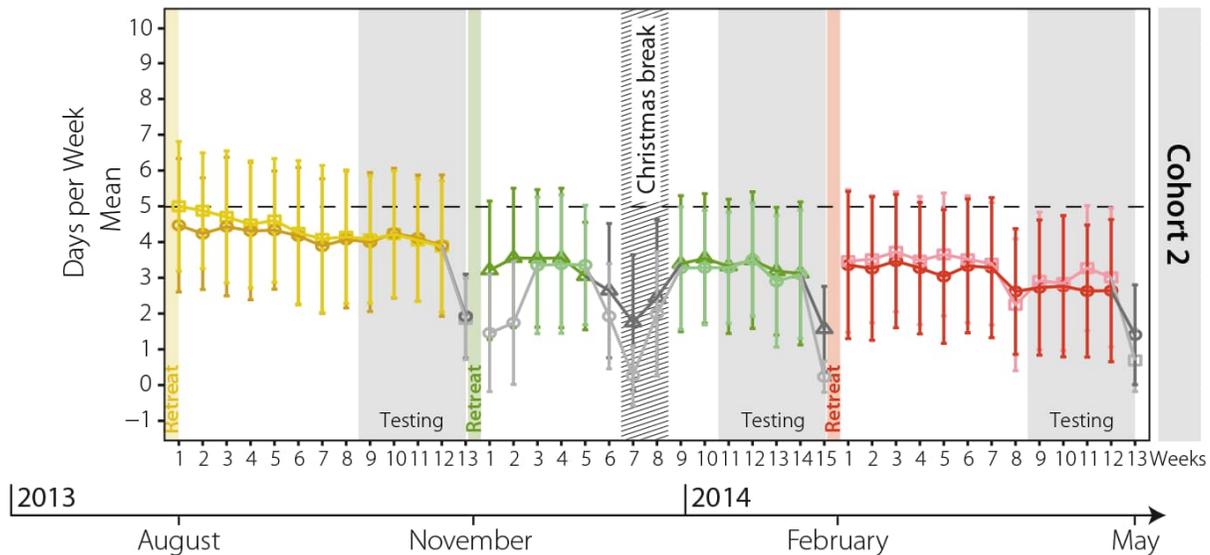
- 49 Trait Questionnaires
- Several other Questions
- Experience Sampling

$\Sigma > 90$   
Measures

# Practice of the Core Exercises of both Cohorts



Total dropout during the Training Phases (T0–T3)  
7.83 %

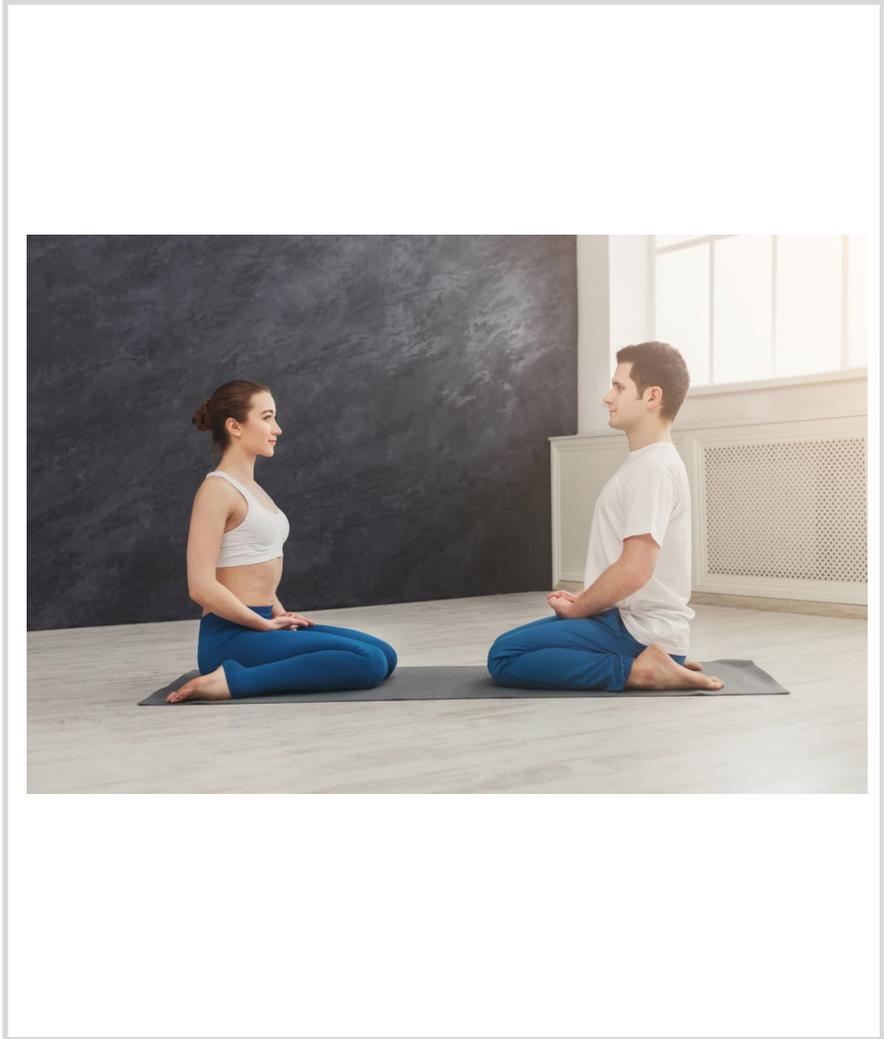


- ▣ Breathing Meditation
- Body Scan
- ⊖ Loving-kindness Meditation
- △ Observing-thoughts Meditation
- ⊞ Affect Dyad
- ⊕ Perspective Dyad

# Contemplative Dialogues Dyadic Exercises



# Contemplative Dyadic Practices: Life and Online via App

Two photographs: on the left, a man in a white t-shirt talking on a black mobile phone; on the right, a woman in a striped shirt sitting cross-legged and talking on a mobile phone.

Dyade

Anderer Selbst

Bitte begrüße kurz Deinen Dyadenpartner und beginne dann wie folgt mit der Übung:  
Dein Dyadenpartner stellt Dir nun Deine erste Frage. Bitte beantworte diese nach Erörtern des Gongs.

00:05

Two orange microphone icons and a green gong icon with a speech bubble.A photograph of a smartphone and a gong on a wooden surface. The smartphone screen displays the text "htc pure better" and "reverser-project.org".

# Contemplative Dyads



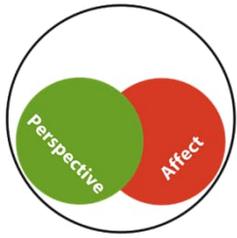
## Affect Dyad

- Empathic Listening
- Accepting difficult emotions
- Gratitude/Care/Self-compassion
- Interoceptive Body Awareness
- Social Closeness and Connectedness



## Perspective Dyad

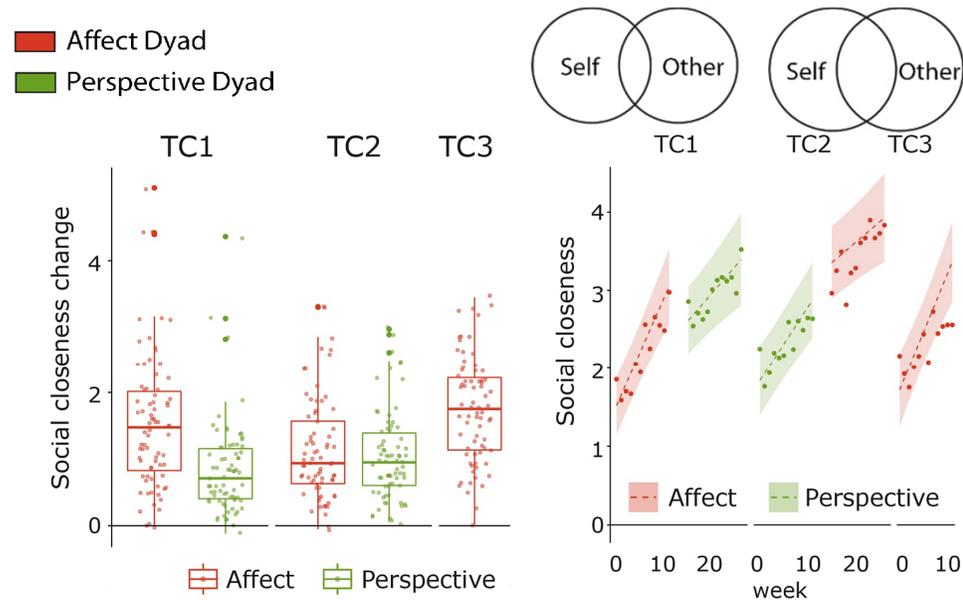
- Meta-Cognition on thoughts
- The inner Observer
- Inner Part Work (IFS)
- Perspective on Self and others (ToM)
- Social Closeness & Connectedness



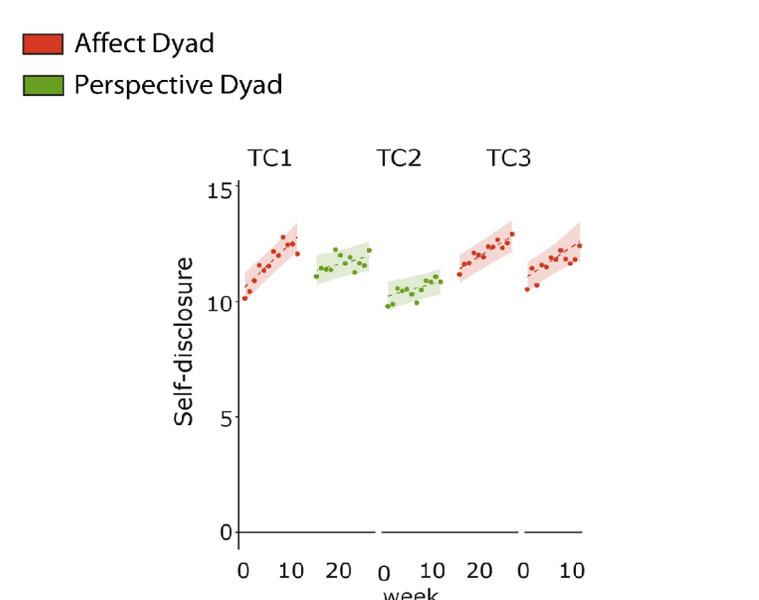
# Changes in Social Closeness & Personal Disclosure over Time

Cohort 1	Presence	Affect	Perspective
Cohort 2	Presence	Perspective	Affect
Cohort 3	Affect		

**Social Closeness:**  
Move 2 circles → to represent relationship with dyad partner



**Personal Disclosure:**  
„How personal was the difficult situation you talked about?“



# Dyads and Intersubjectivity

- Participants liked the Dyadic Exercises
- Participants practiced the Dyadic Exercises



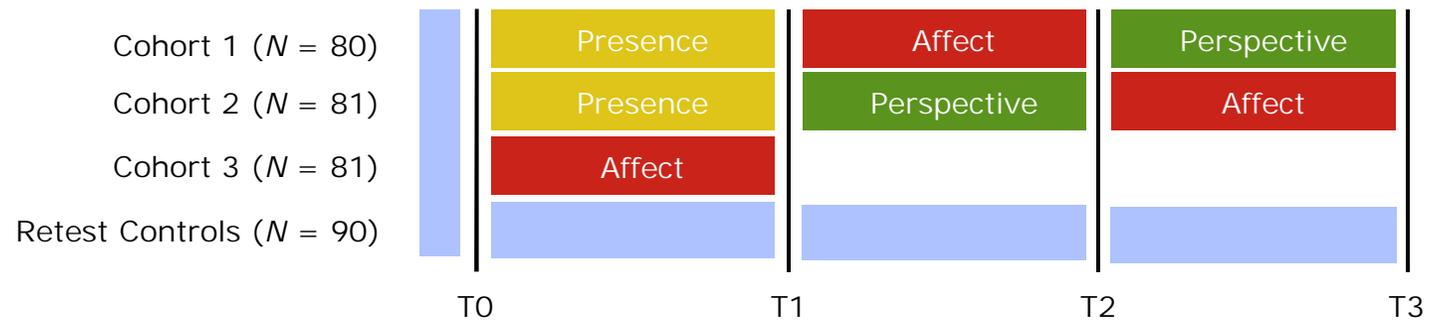
Interdependence  
Shared Humanity



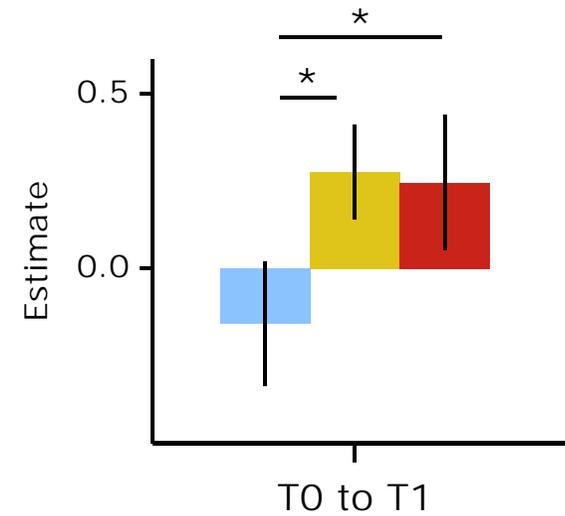
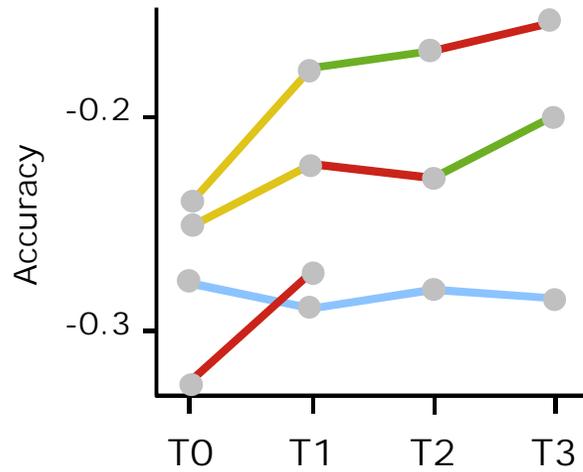
Social Closeness

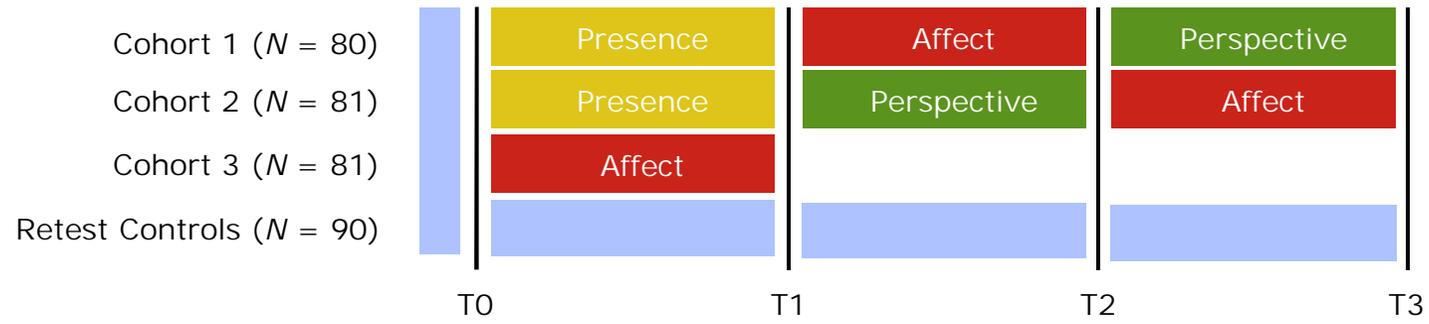


Changes in Attention, Compassion,  
Cognitive Perspective Taking and Cortical  
Thickness  
after Mental Training



## Attention Performance

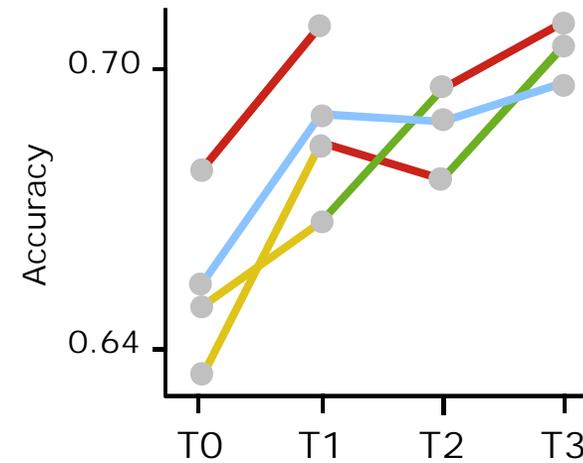
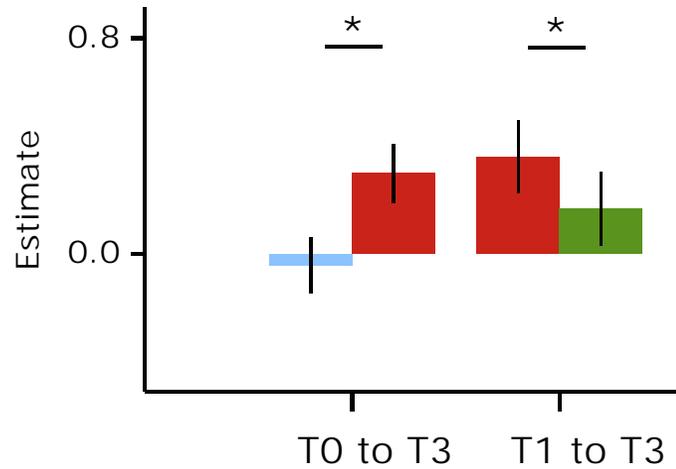
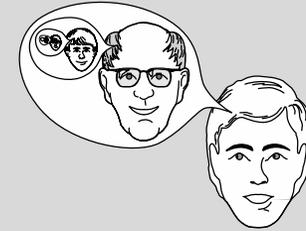


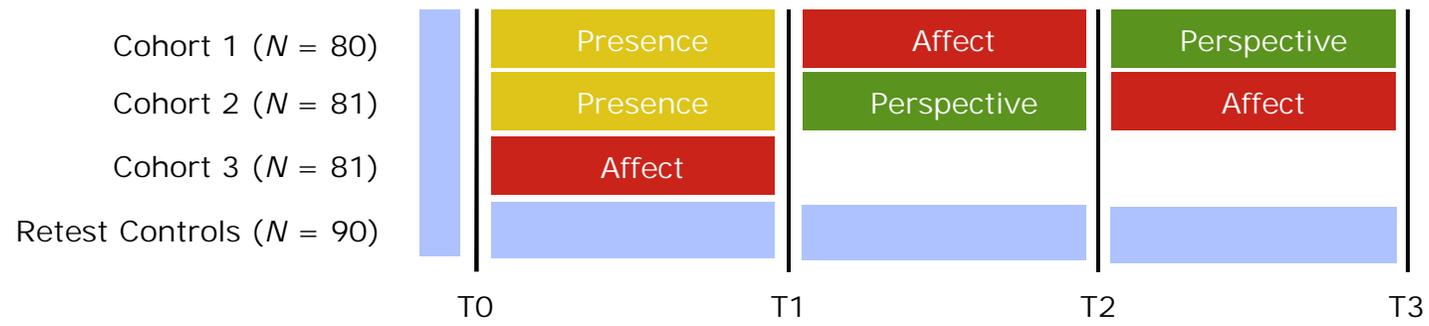


## Compassion



## Theory of Mind

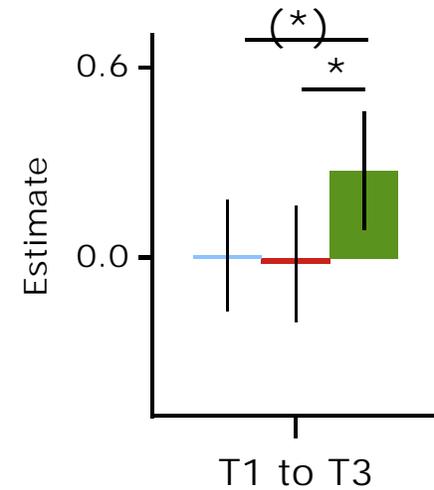
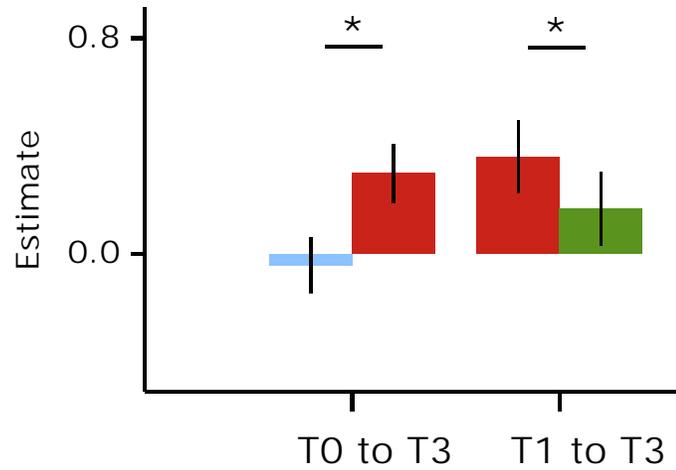
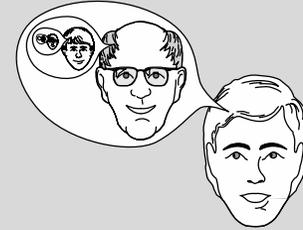




## Compassion



## Theory of Mind

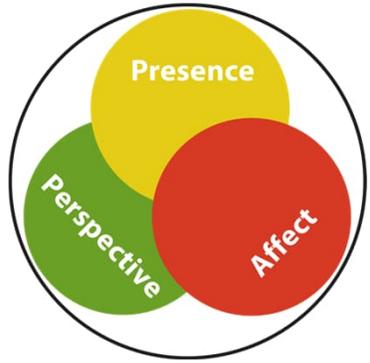




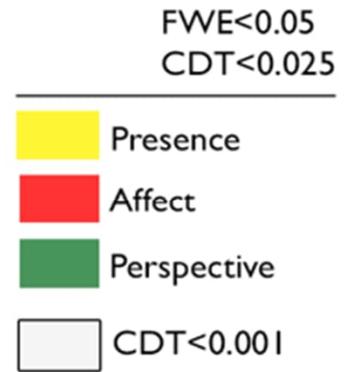
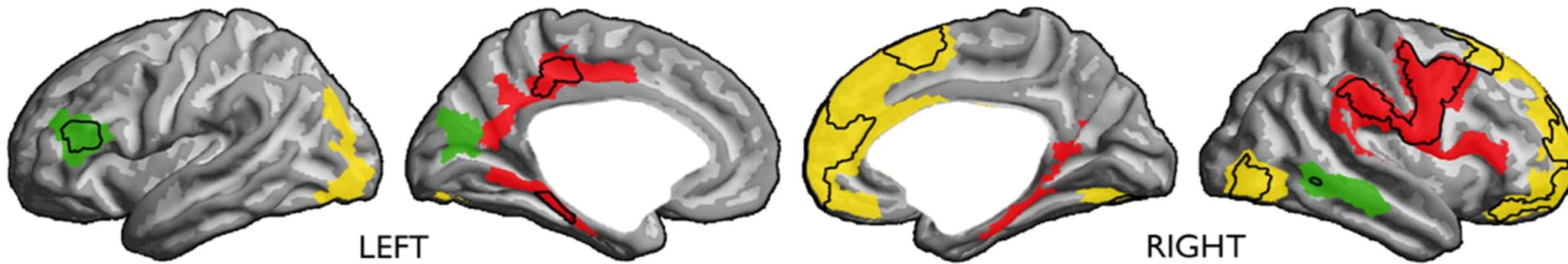
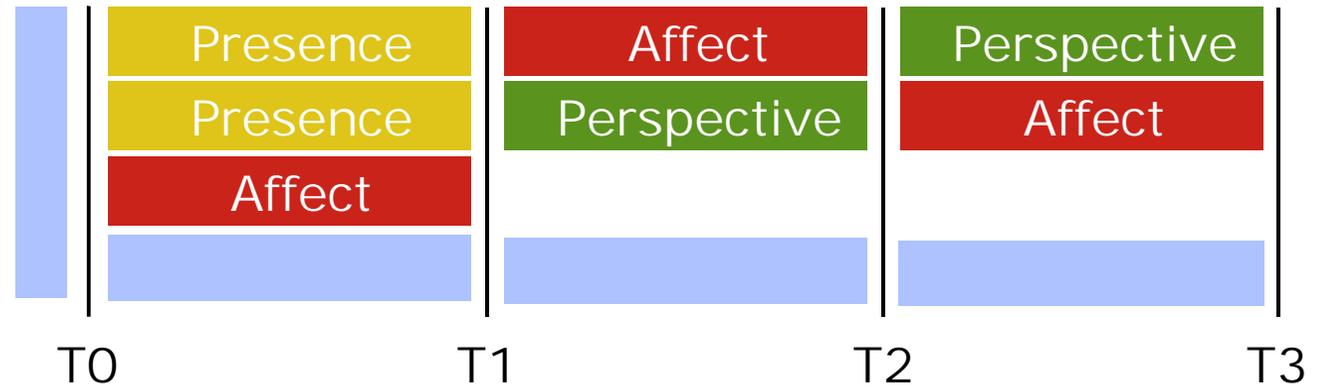
# Changes in Cortical Thickness after Mental Training



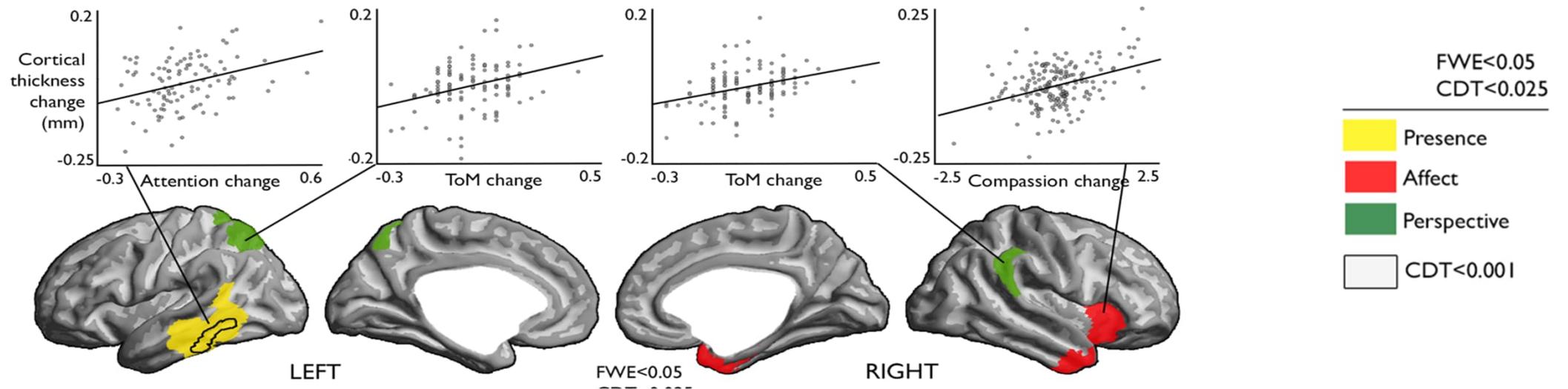
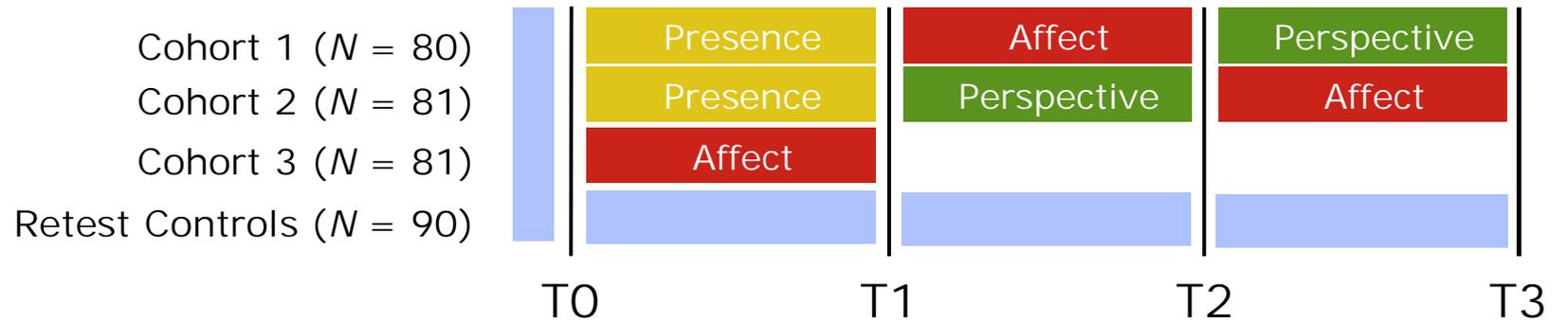
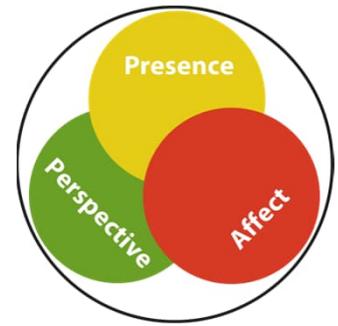
# Module-Specific Training-Related Cortical Thickness Increases



Cohort 1 ( $N = 80$ )  
 Cohort 2 ( $N = 81$ )  
 Cohort 3 ( $N = 81$ )  
 Retest Controls ( $N = 90$ )



# Behavioral Modulation of Training-Related Cortical Thickness Change

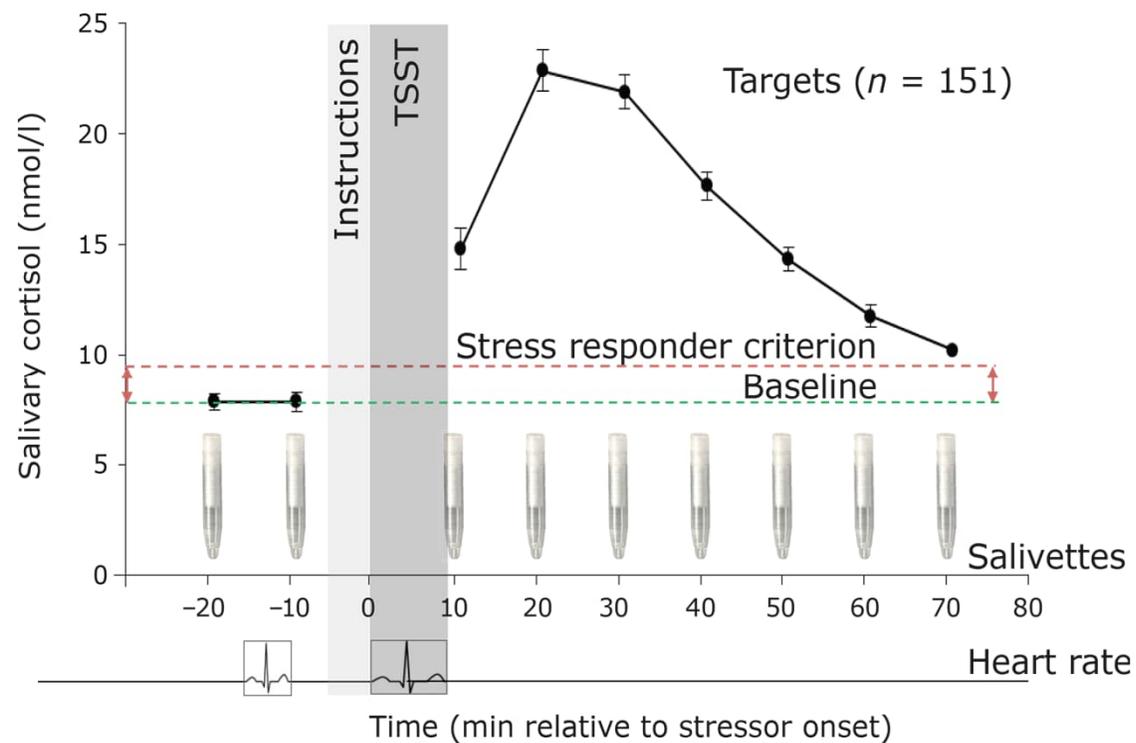
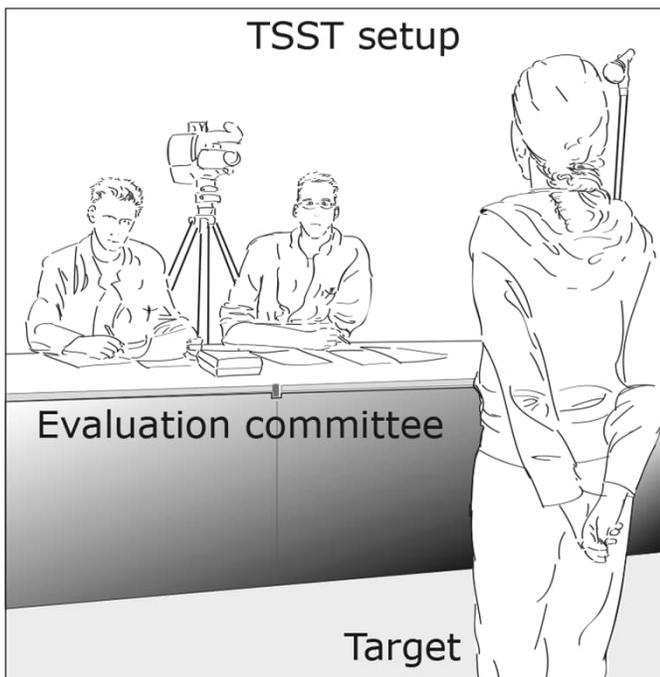


# Influence of Training on Stress Responsivity



*Engert et al. (2017). SciAdv*

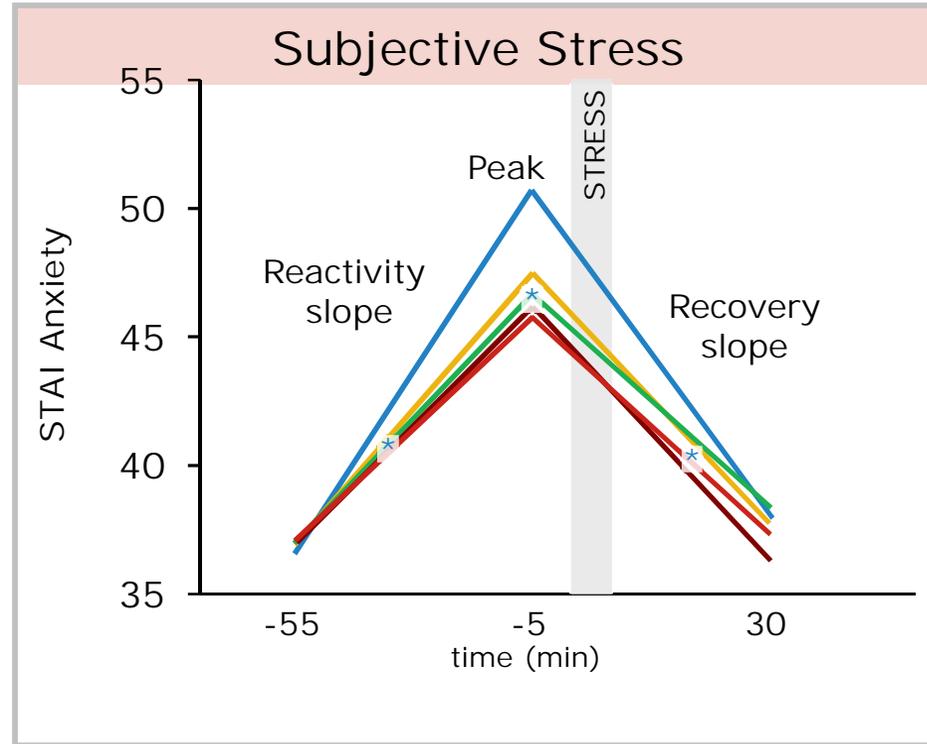
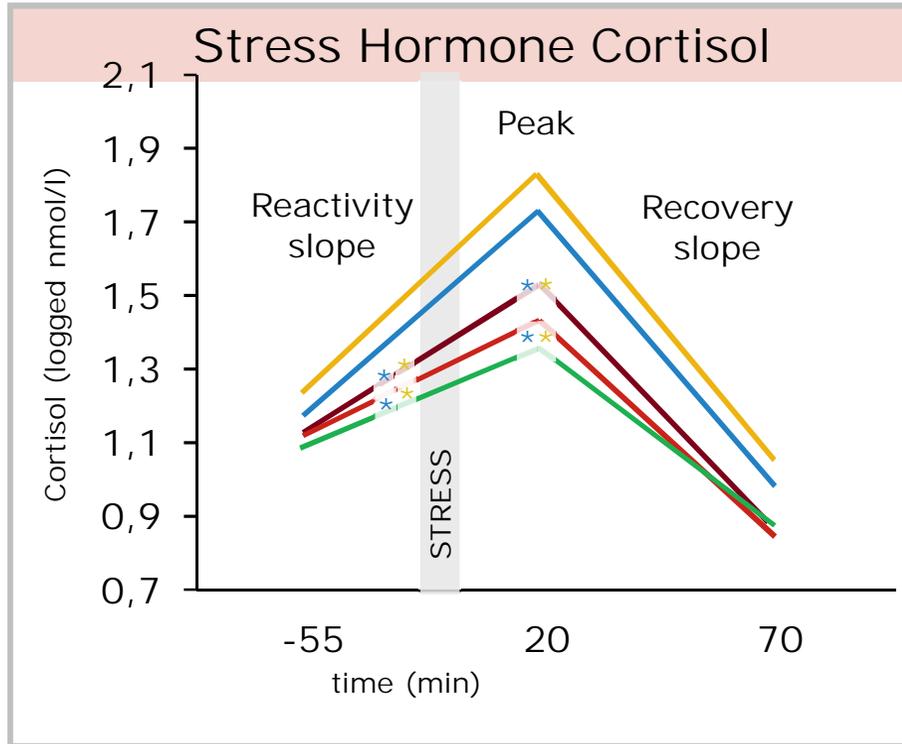
# Experimental Design of the Trier Social Stress Test



# Social Stress Reduction as a Function of Training Modules



- No Training
- T1 Presence
- T1 Affect
- T2 Perspective+
- T2 Affect+



PROSOCIAL  
BEHAVIOR



# Can Mental Training Improve Prosocial Behavior and Cooperation

# Film on Prosocial Behavior



# The Structure of Human Prosociality

- 1) Altruistically motivated Behavior  
(e.g. Trust, Donation, Helping)

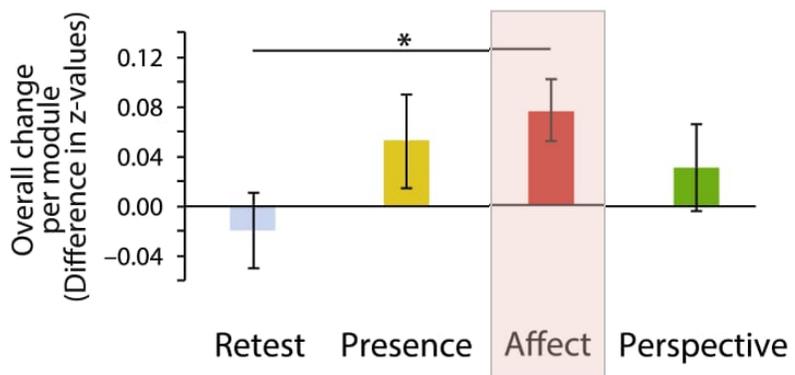


- 2) Self-report / Do I think that I am Altruistic?  
(e.g. Questionnaires)

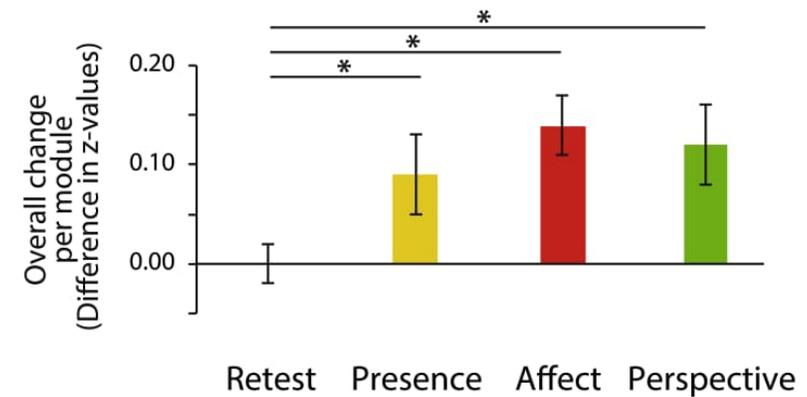
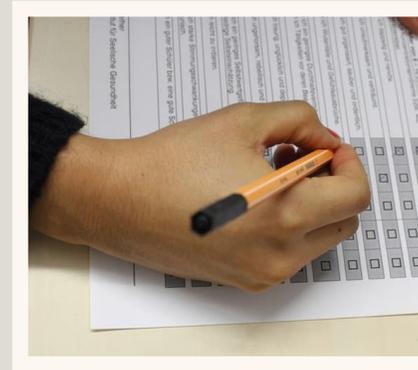


# The Structure of Human Prosociality

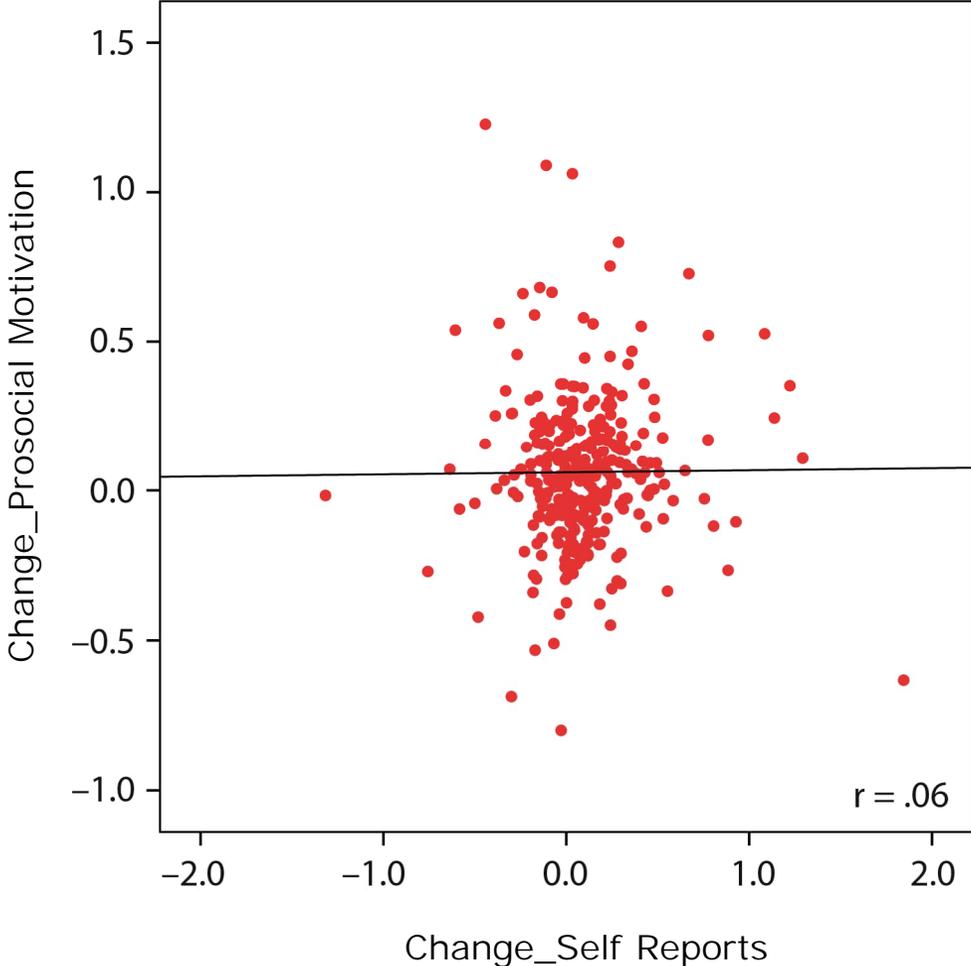
- 1) Altruistically Motivated Behavior (e.g. Trust, Donation, Helping)



- 2) Self-Report / Do I think that I am Altruistic? (e.g. Questionnaires)



# No Correlation Between Changes in objective and subjective measures of prosocial behaviors





# Body Awareness, Interoceptive Accuracy, and Vagal Regulation



# Interoceptive Accuracy

Interoceptive accuracy measured through:

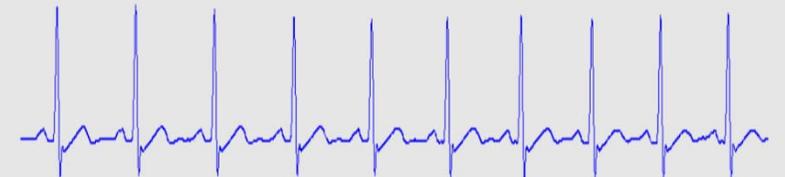
## Heart Beat Perception task

*(Brenner & Jones, 1974; Schandry, 1981; Whitehead et al., 1977)*

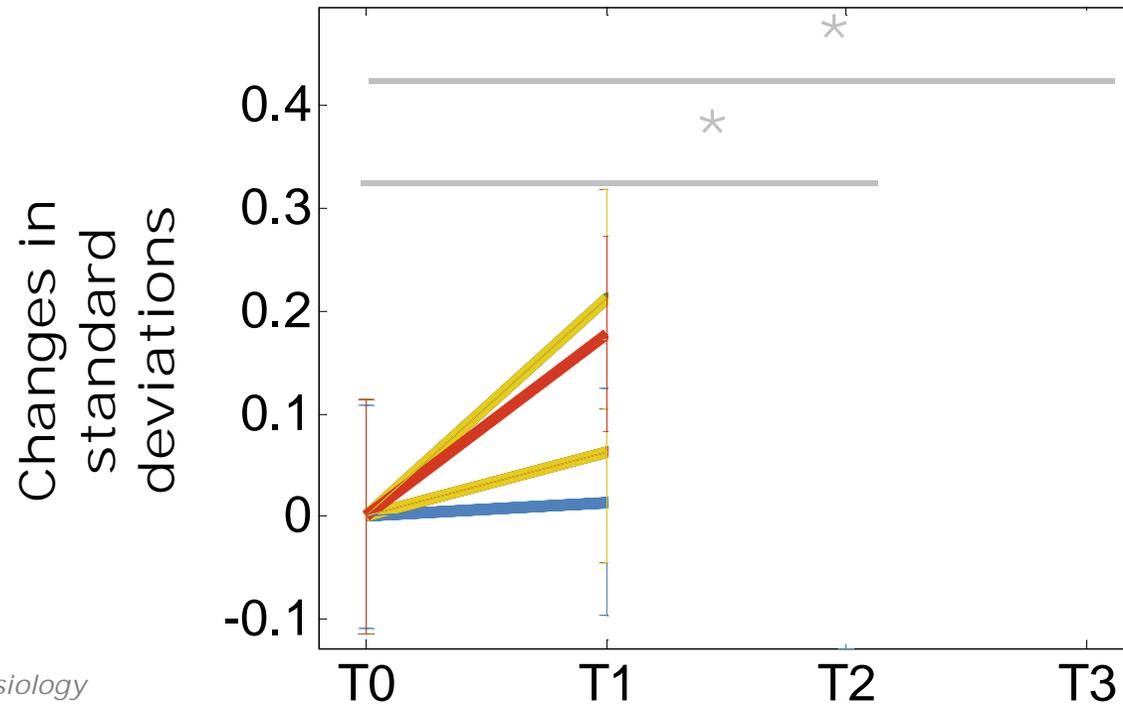
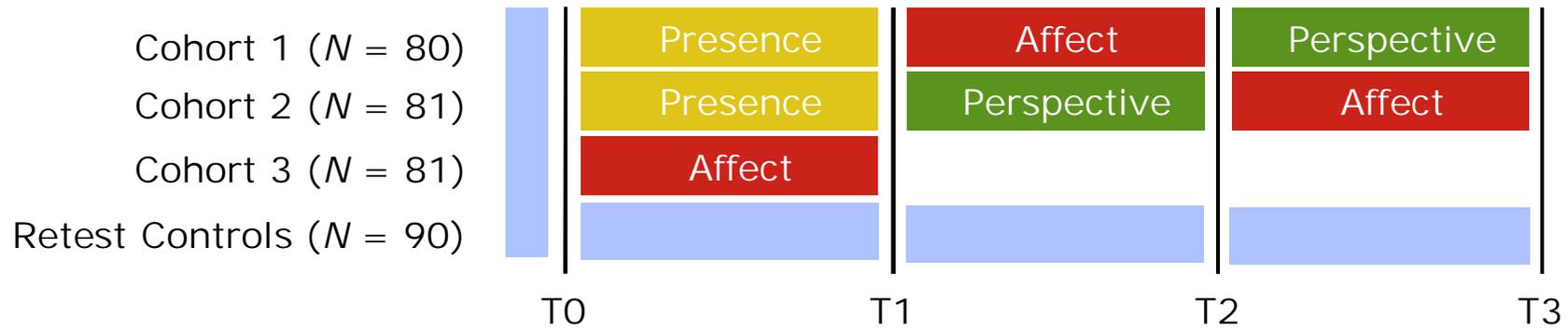
Subjectively counted heartbeats



Objectively counted heartbeats



# Changes in Interoceptive Accuracy



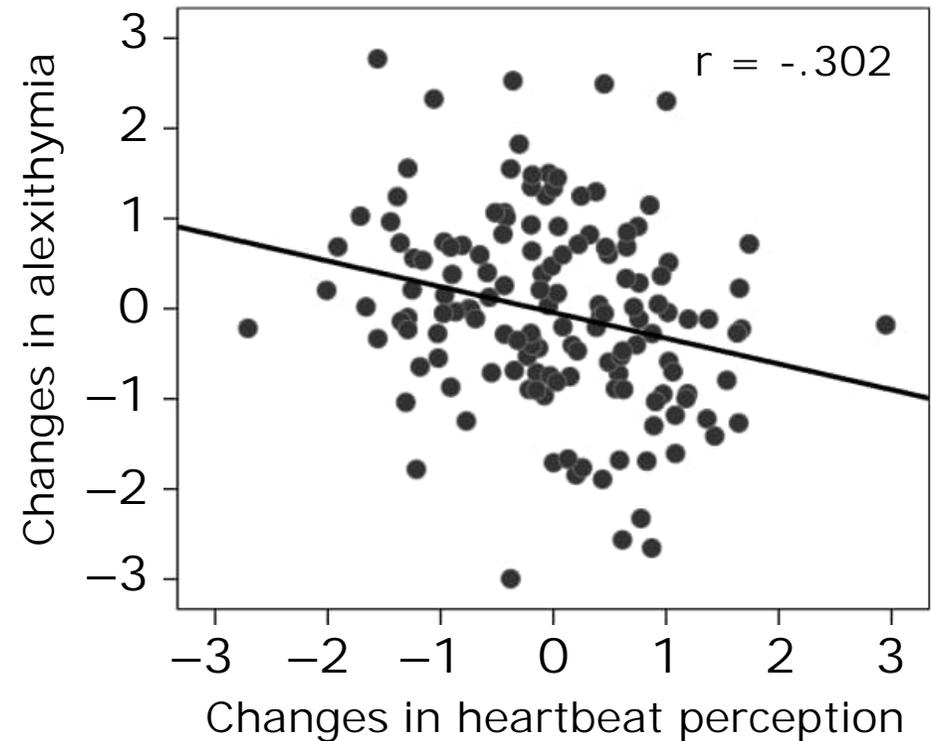
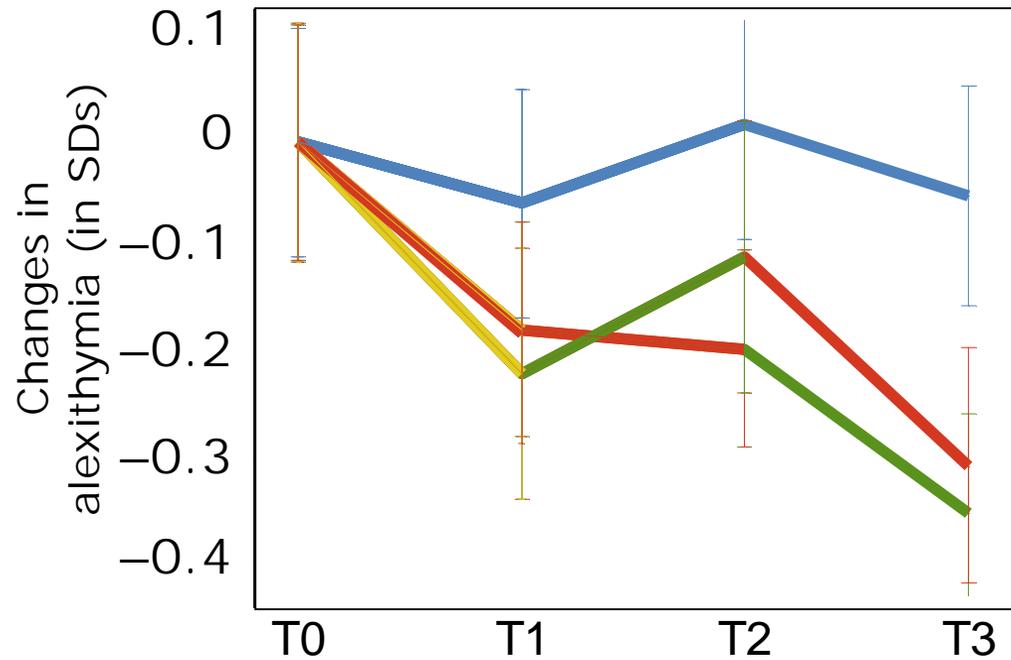
# Changes in Emotional Awareness

(measured by Toronto Alexithymia Scale, Bagby et al., 1994)

„I am often unsure, what I actually feel.“

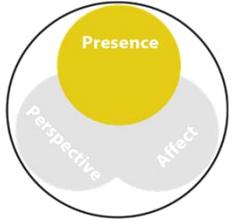
„It is difficult for me, to express my feeling with the right words.“

„I rather talk to people about every day things than my feelings.“



# Summary

## Presence Training



## Subjective Experiences



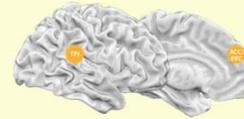
Body Awareness



## Attention



## Brain Plasticity



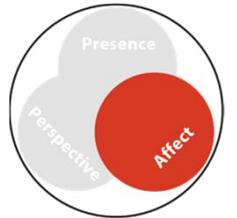
## Subjective Stress



## Body/Autonomic Awareness/Reg.



## Affect Training



## Subjective Experiences



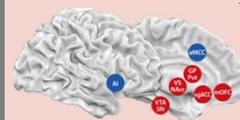
- Positive  
- Other



## Compassion Altruism



## Brain Plasticity



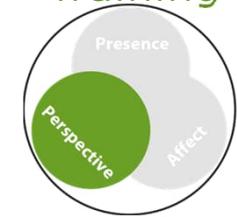
## Social Stress (Cortisol)



## Body/Autonomic Awareness/Reg.



## Perspective Training



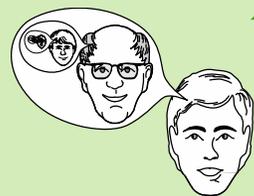
## Subjective Experiences



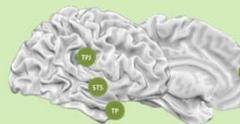
Meta-Cognition



## Social Cognition



## Brain Plasticity

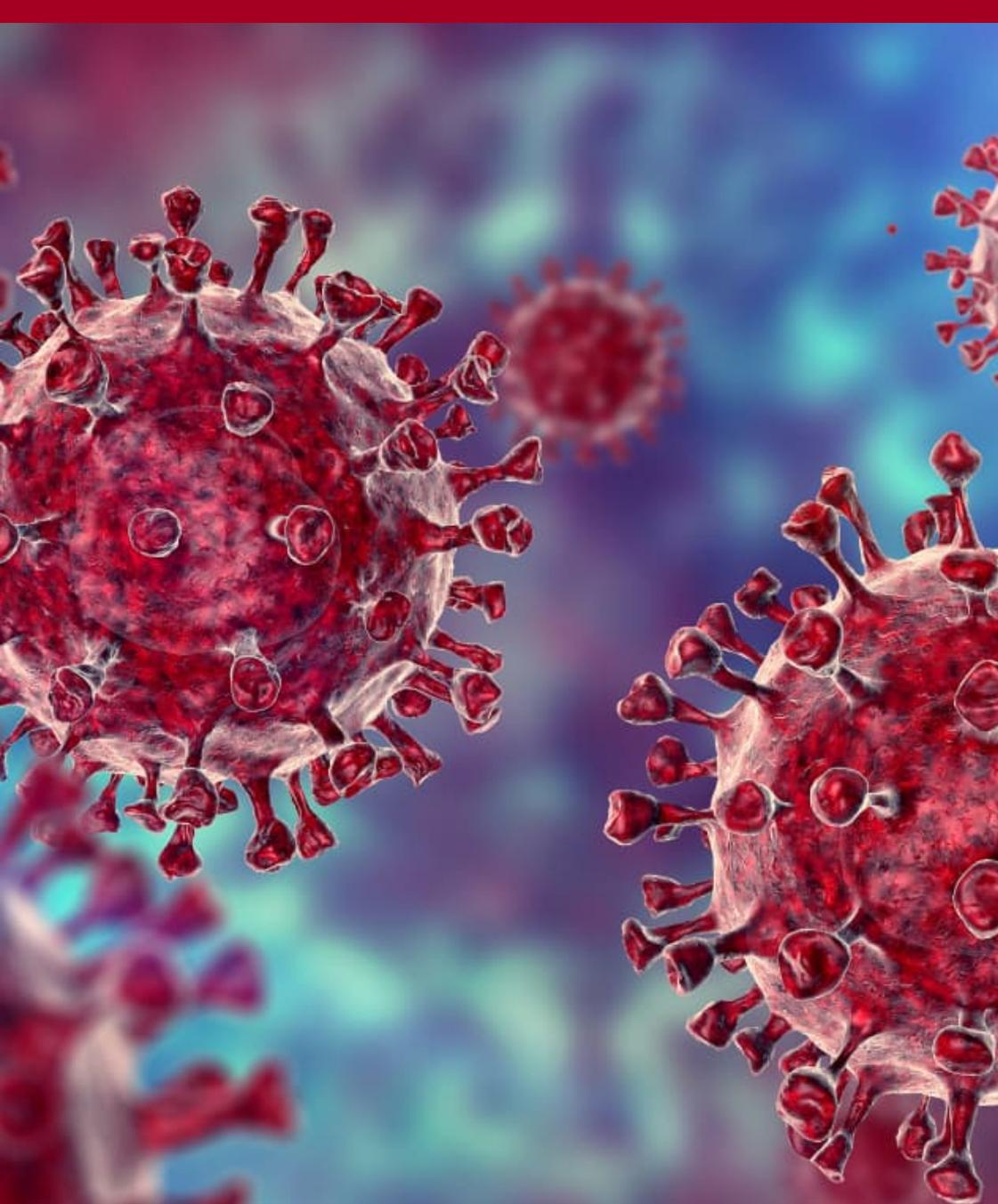


## Social Stress (Cortisol)



## Body/Autonomic Awareness/Reg.





COVSOCIAL

How Did Berliners feel and react during the Covid-19 pandemic in 2020/21/22

Changes in mental health, resilience and social cohesion

Partner

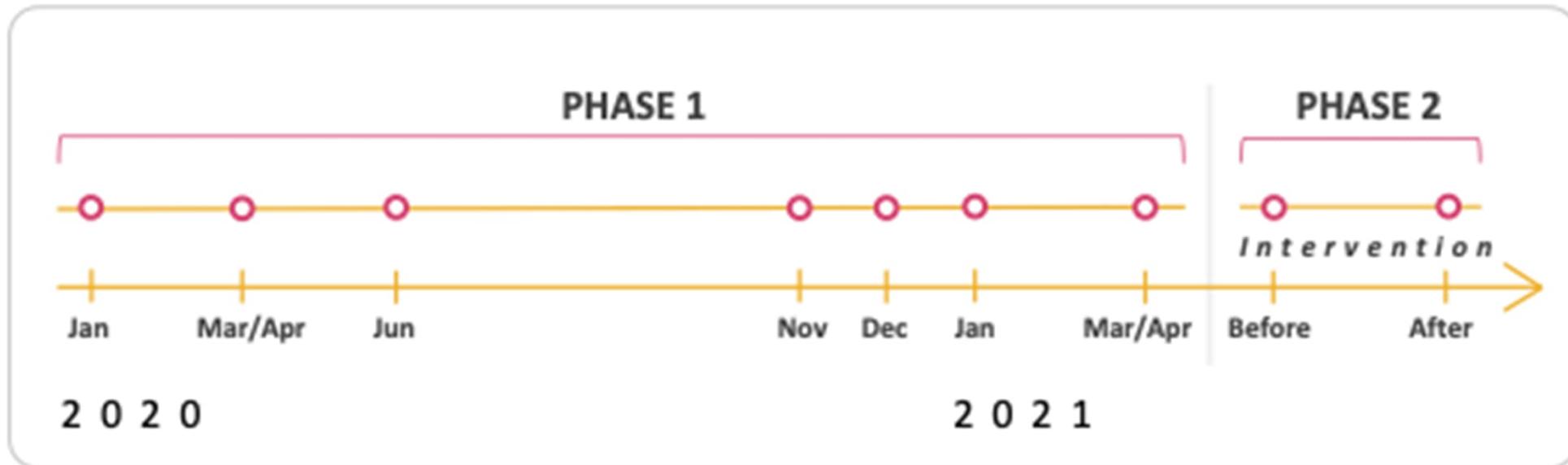
Gefordert durch die Max-Planck-Gesellschaft und im Rahmen der Exzellenzstrategie von Bund und Ländern durch die Berlin University Alliance



SOCIAL  
NEUROSCIENCE  
LAB



# Design of the CovSocial Project

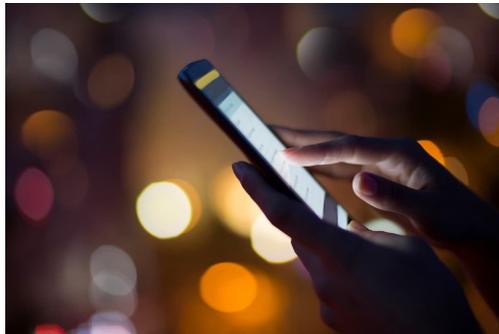


# Berlin Population Sample: Inclusion Criteria

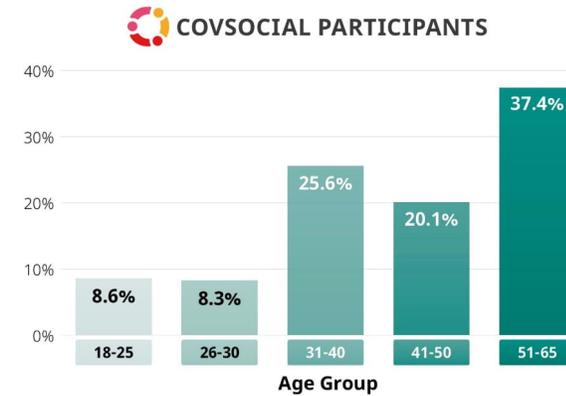
Based in Berlin



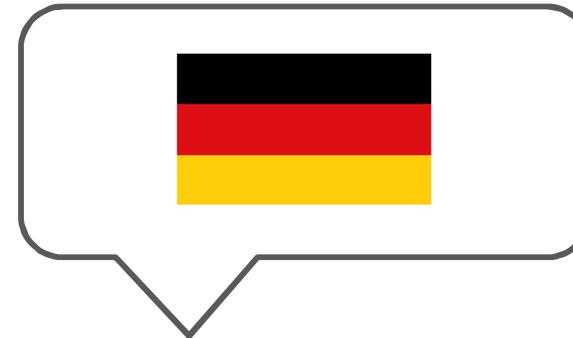
Access to smartphone



Age: 18 – 65 years old



German Language





# First descriptive results of Phase1

from January 2020 until March 2021  
(T1 - T7)



# MEASURES



## Questionnaires

- Demographics
- Trait Questionnaires
- 7 Time-Specific Surveys

### Phase 1



## Genetic markers

- Genetics sample from saliva sample



## Computerized Behavioral Tasks

- EmpaToM
- Zurich Prosocial Game
- Scrambled Sentences Task

### Phase 2



## Ecological Momentary Assessment (EMA)

- 5 x/day on 8 days pre and post intervention
- 66 days EMA during the intervention
- 56 x Daily EMA pre and post practice



## Questionnaires

- Phase 1 questionnaires
  - Pre and post intervention questionnaires
  - Weekly questionnaires
- On anxiety, emotion regulation, depression, Alexitymia, stress, (self)compassion, resilience, loneliness, health, covid, interoceptive awareness



## Epigenetic markers

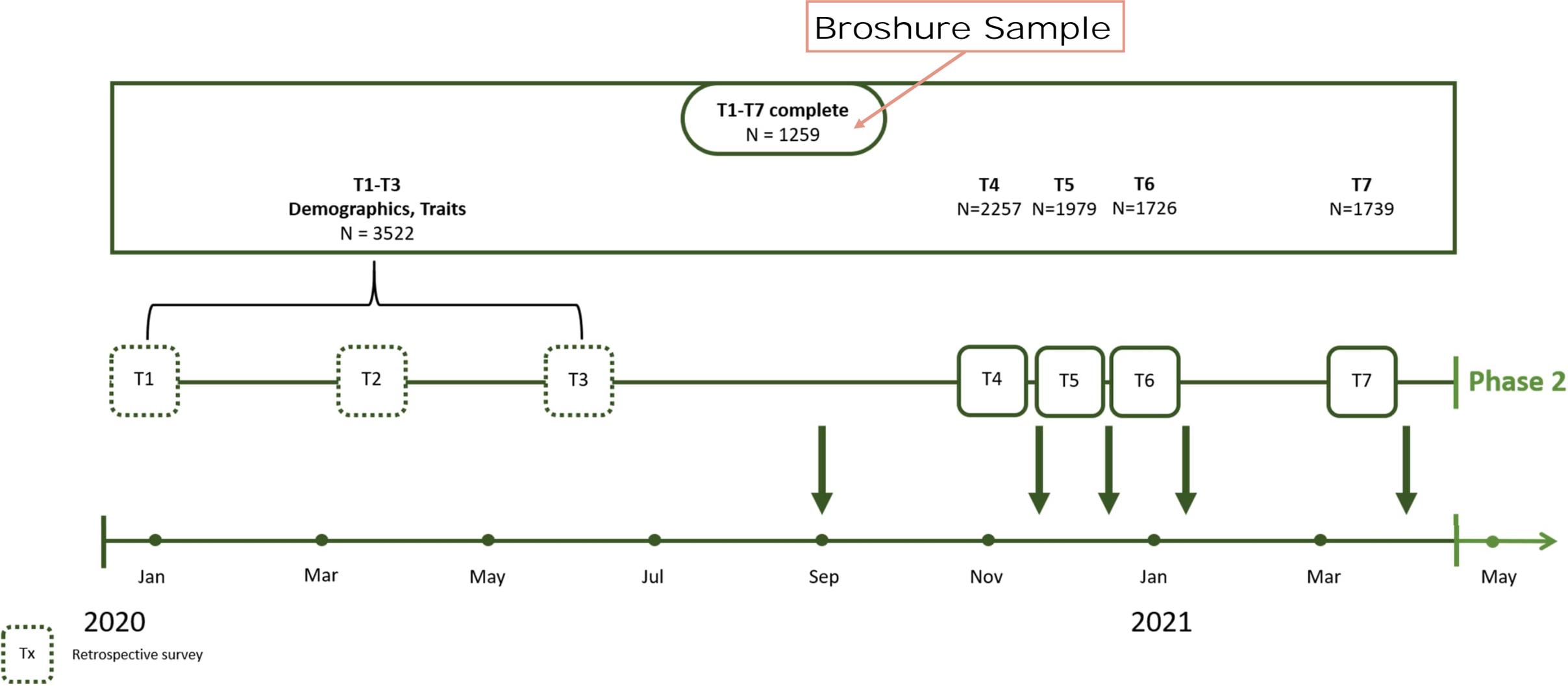
- Genetics sample from saliva sample

## Biological markers

- Pre and Post Assessment of CAR (8 saliva samples over 2 days)
- Cross-sectional Assessment of cortisol as stress marker (7 saliva samples during a stress test)



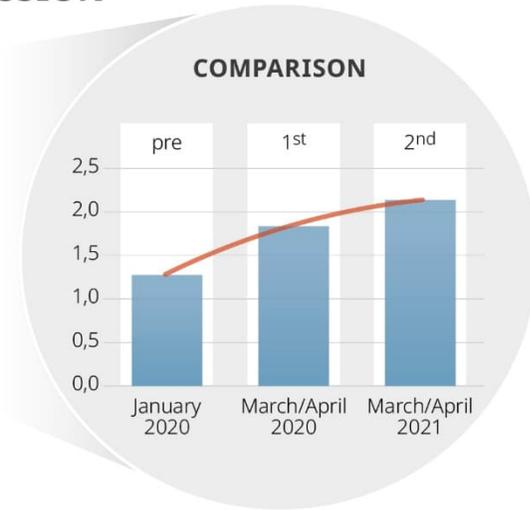
# Timeline Phase 1



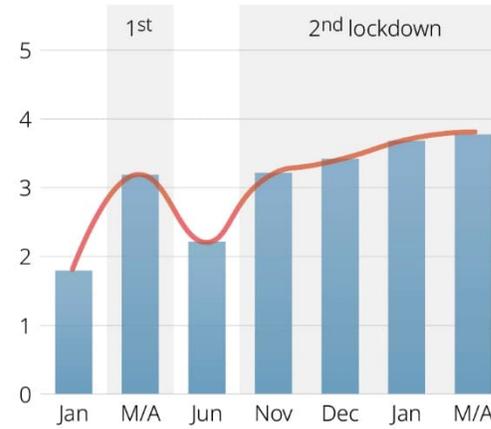


# Longitudinal Timelines for Mental Health

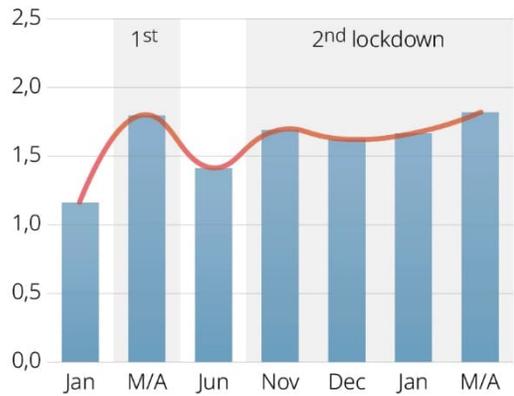
## DEPRESSION



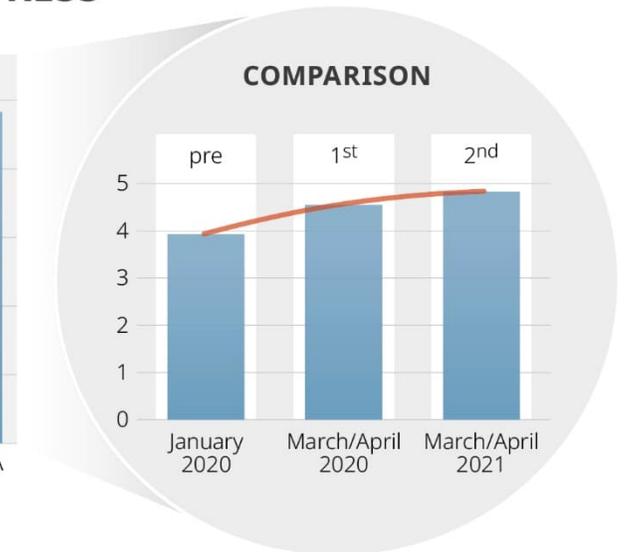
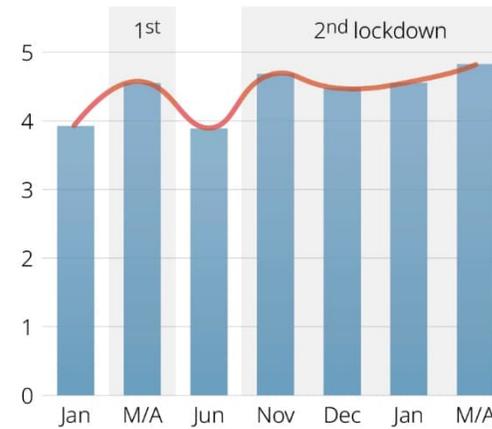
## LONELINESS



## ANXIETY



## STRESS

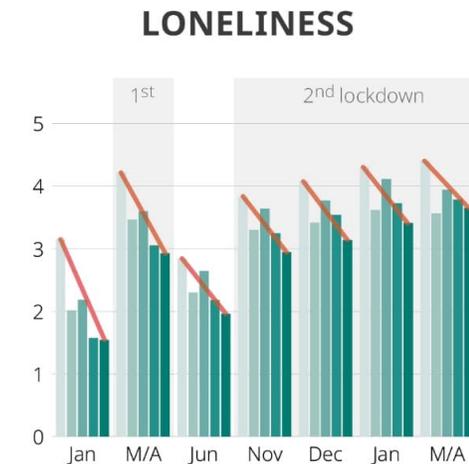
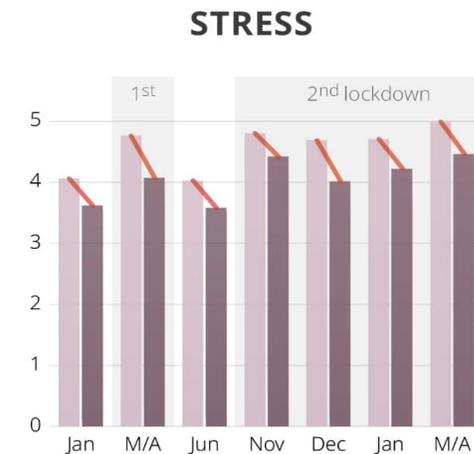
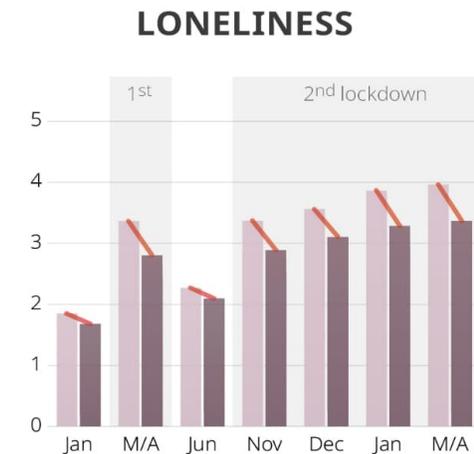
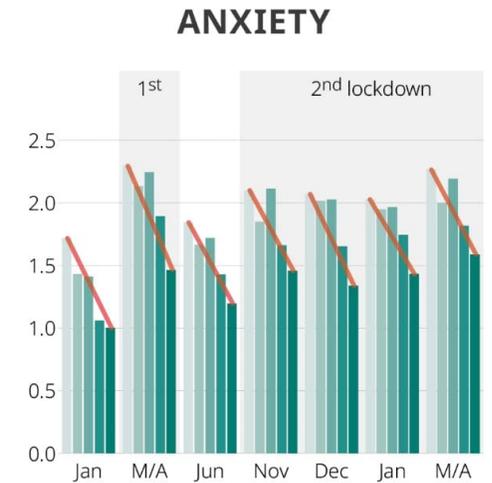
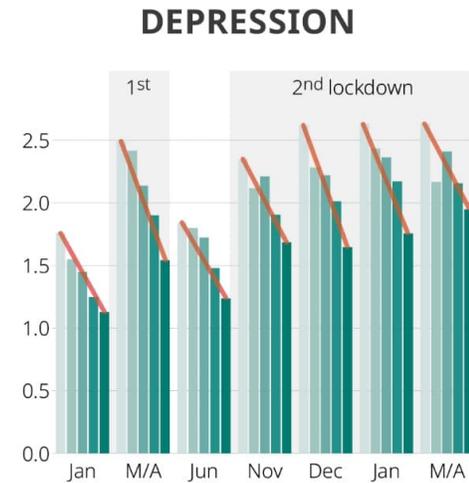
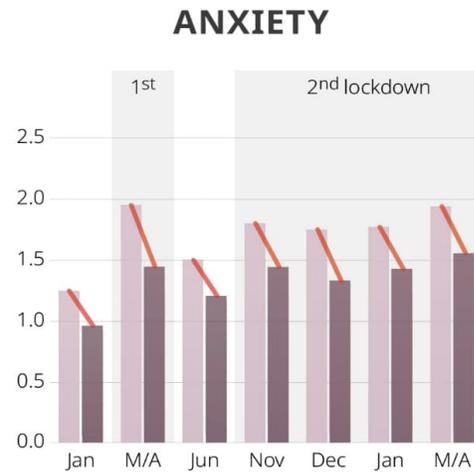
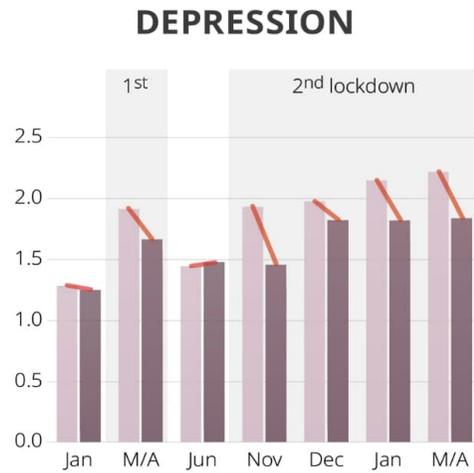




# Gender and Age Differences in Mental Health

♀ WOMEN    ♂ MEN

AGE GROUP    18-25    26-30    31-40    41-50    51-65

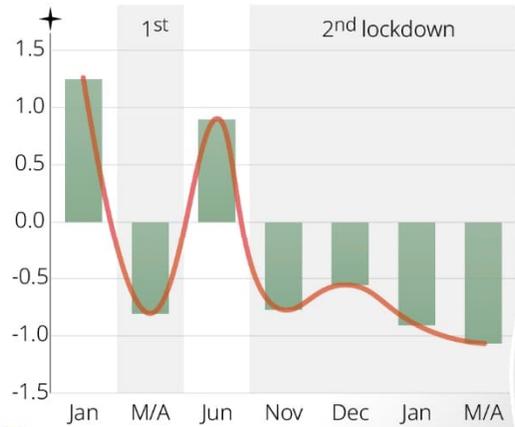




# Emotional Well-being During the Pandemic: Gender and Age Effects

## EMOTIONAL STATE

😊 PLEASANT FEELINGS

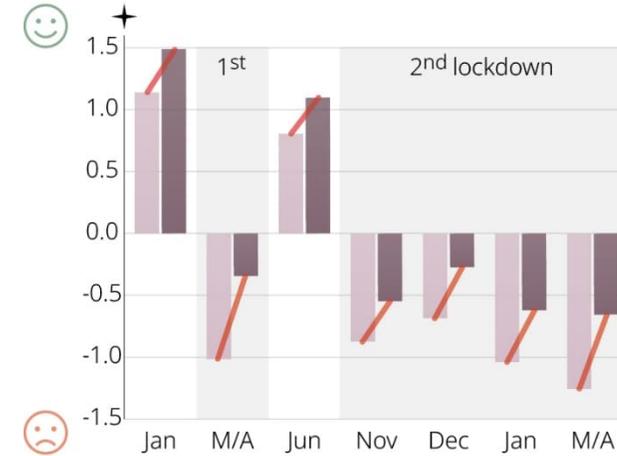


☹️ UNPLEASANT FEELINGS

### COMPARISON



♀️ WOMEN      ♂️ MEN

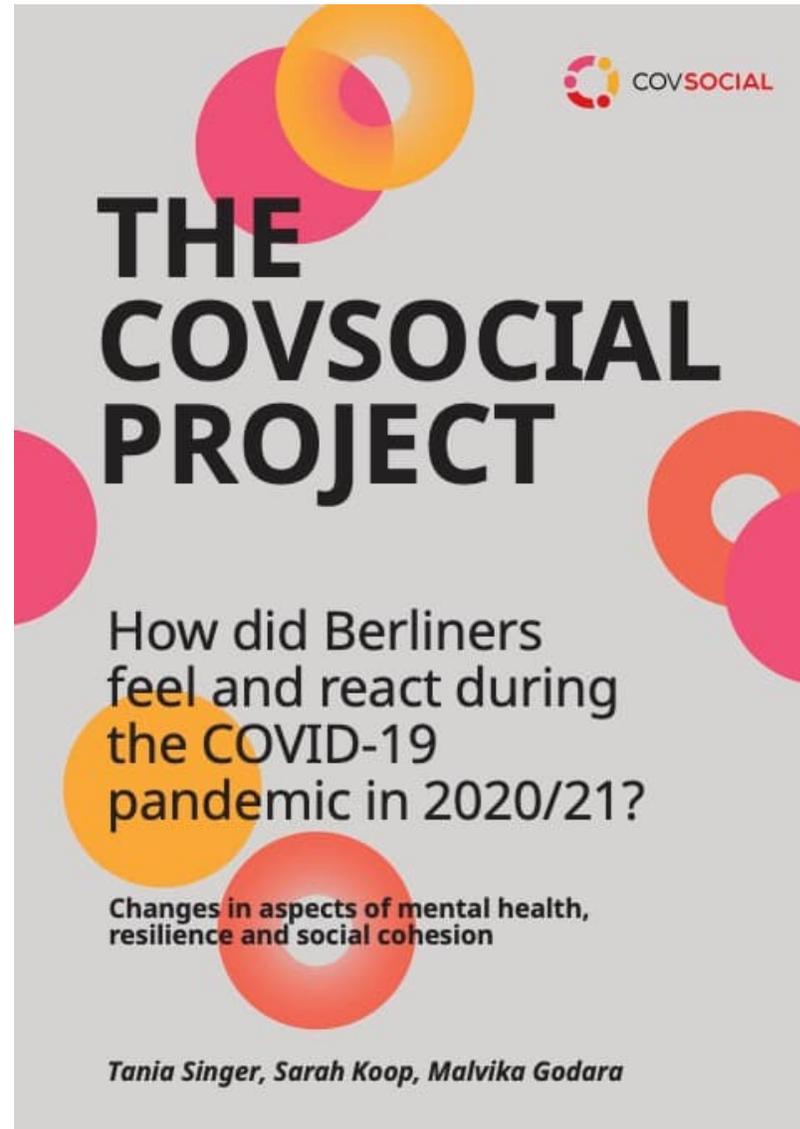


AGE GROUP    18-25    26-30    31-40    41-50    51-65





# CovSocial Project



Webpage:

[www.covsocial.de](http://www.covsocial.de)

Free downloadable  
report



Phase2: 10-weeks Mental Online Training for the Reduction of Stress, Loneliness and the increases in Mental Health and Social Skills

# Mental Health Crises

## Professional Public health Loneliness: a silent epidemic

Loneliness could harm physical health and should be viewed as a public health issue, says a new report from the World Health Organization.

Loneliness is a global public health issue, says a new report from the World Health Organization (WHO). The report, published in February 2020, states that loneliness is a global public health issue that can harm physical health and should be viewed as a public health issue.

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FEBRUARY 26, 2019 | TUESDAY  
ESTABLISHED 1845  
**NEW STRAITS TIMES**  
EXCLUSIVE | EXAMINE | EDUCATE | ENTERTAIN | KUALA LUMPUR WINNER OF 2016 & 2019  
TUESDAY, FEBRUARY 26, 2019 | New Straits Times  
OPINION | 17

**CONNECTION**  
**LONELINESS IS A MODERN EPIDEMIC**

Social pain can be just as real as physical pain, because physical pain and loneliness activate the same parts of the brain

Loneliness is a global public health issue that can harm physical health and should be viewed as a public health issue.

Loneliness is a global public health issue that can harm physical health and should be viewed as a public health issue.

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Loneliness is a global public health issue that can harm physical health and should be viewed as a public health issue.

Featuring original research from **Barna**

Why So Many of Us Feel Alone and How Leaders Can Respond

# THE LONELINESS EPIDEMIC

Susan Mettes  
Foreword by DAVID KINNAMAN

LIVING IN THE AGE OF ENTITLEMENT

"Overlooks the obsession that many Americans have with, well, themselves... thinking themselves entitled to things they haven't earned. It puts them at a terrible disadvantage in a global marketplace that is, of the time, getting more competitive." — San Francisco Chronicle

# The Narcissism Epidemic

JEAN M. TWENGE, PH.D.  
AUTHOR OF GENERATION ME  
— W. KEITH CAMPBELL, PH.D.

WITH A NEW FOREWORD BY THE AUTHORS

Loneliness in the EU  
Insights from surveys and online media data

European Commission



# Can we help reverse the negative Pandemie effects?

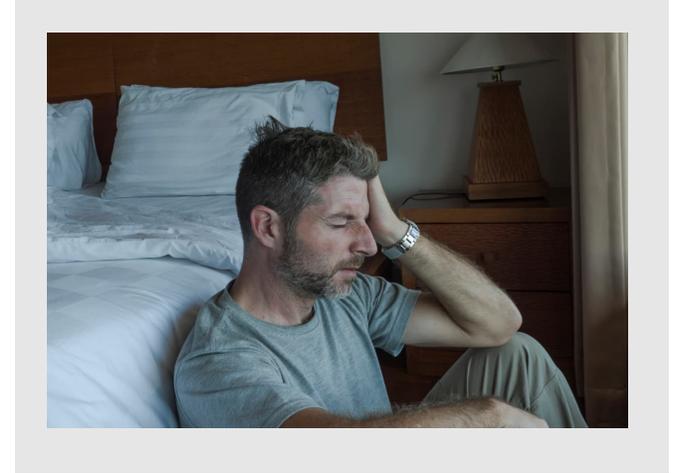
Loneliness



Stress



Depression



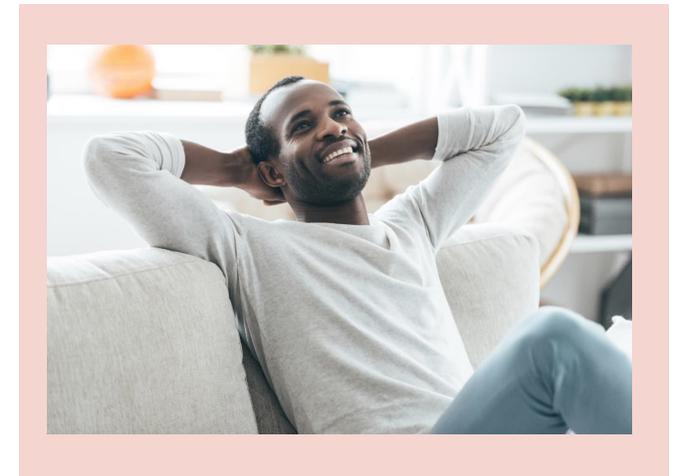
Social Skills & Connectedness



Stress Reduction

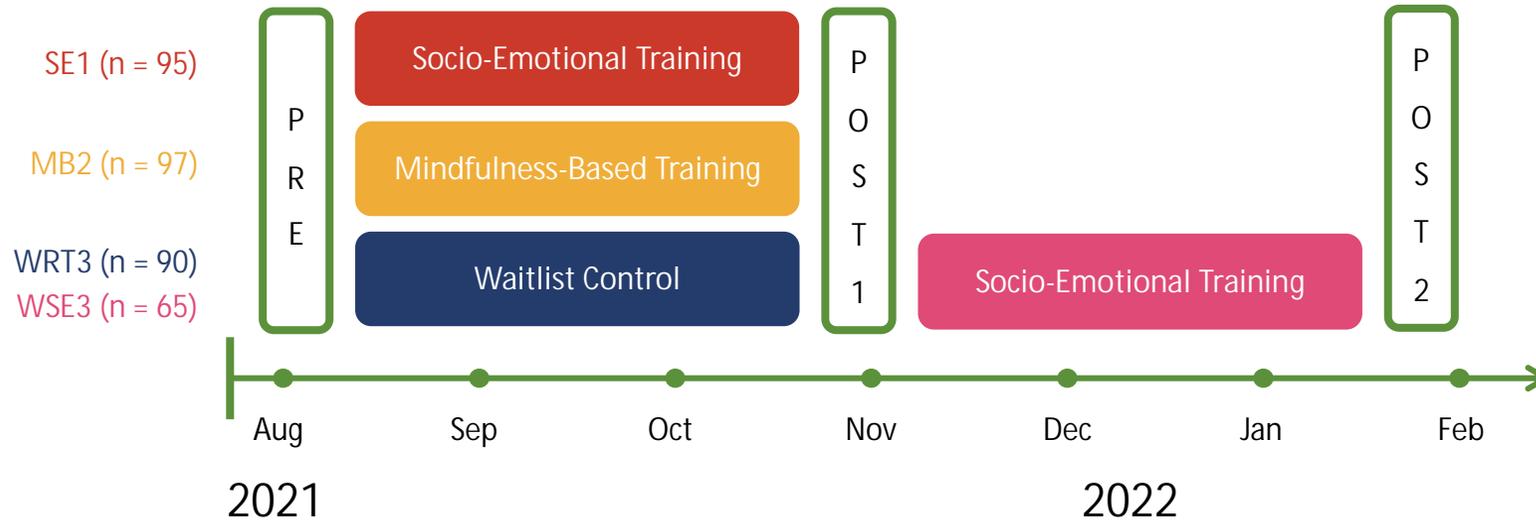


Mental Health & Resilience





# Design of Phase2 of the CovSocial Project

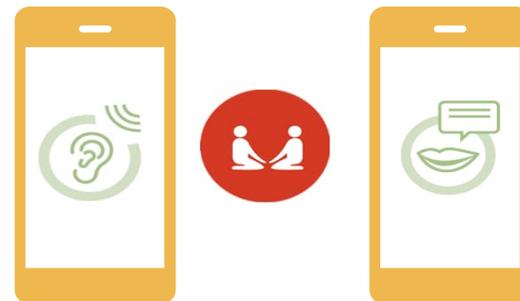


Total Dropout from Start		
	n	%
SE1 (n = 95)	25	26 %
MB2 (n = 97)	19	19,5 %
WRT3 (n = 90)	17	18,8 %
WSE3 (n = 65)	5	7 %
<b>Total (N = 282)</b>	<b>67</b>	<b>23 %</b>

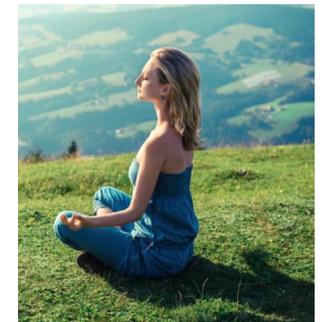
Teachers



Daily Dyads Practice



Daily Mindfulness Practice





# Translation into Society

# ReConnect – Masterclasses for HealthCare and Society

Prof. Dr. Tania Singer, Prof. Jean Gérard Bloch, Erick Rinner

Du jeudi 29 octobre à 17h au plus tard au dimanche 1 novembre (14h)

MASTERCLASS

**ReConnect**  
in healthcare

## Burnout ou Résilience ? De la Détresse Empathique à la Compassion

Trois jours de formation intensive pratique et théorique suivis de 8 semaines de pratique quotidienne en binôme

En coopération avec

Université de Strasbourg

TS Tania Singer



MASTERCLASS

**ReConnect**  
in business

Meditation - Social Neuroscience - Everyday Dyadic Practice

## Light-Up instead of Burn-Out! From Empathic Distress to Compassion

Prof. Dr. Tania Singer und Erick Rinner

3 Day Retreat & 8 Week daily Dyad Practice & Zoom Coaching

TS Tania Singer

In Cooperation with

Mit Prof. Dr. Tania Singer und Günter Hudusch

11.03.2021 - 14.03.2021 auf Deutsch

MASTERCLASS

**ReConnect**  
in society

3 Tage Retreat  
8 Wochen tägliche Praxis  
Plus Zoom Coaching

## From Inner Work to Societal Change How to train your Social Brain?

Stiftung Schloss Neuhardenberg  
Schinkelplatz  
15320 Neuhardenberg

HR-CONSULTING & COACHING

TS Tania Singer





# Humanize

Reconnecting people to  
self, other, and humanity

[www.humanize.com](http://www.humanize.com)



# Thank You!

[www.social.mpg.de](http://www.social.mpg.de)

[www.taniasinger.de](http://www.taniasinger.de)

[www.covsocial.de](http://www.covsocial.de)





THANK YOU!