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Memory Reconsolidation, Emotional Arousal and the Neuroscience of Enduring Change: Implications for Psychoanalysis

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Lecture #6
Levels of Emotional Awareness: Theory, Measurement and Findings

- Evolution: Humans are unique in being capable of being aware of their own emotions
- Life History Strategy: Environmental determination of individual differences in this capability
- Theory of levels of emotional awareness
- Measurement: Levels of Emotional Awareness Scale
- Findings with the LEAS
    - Psychometric, psychophysiologic, imaging
    - Clinical: mental health, systemic medical d/o

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Review

The evolution and development of the uniquely human capacity for emotional awareness: A synthesis of comparative anatomical, cognitive, neurocomputational, and evolutionary psychological perspectives

Ryan Smith[a,*], Horst Dieter Steklis[b], Netzin G. Steklis[b], Karen L. Weihs[b], Richard D. Lane[b]

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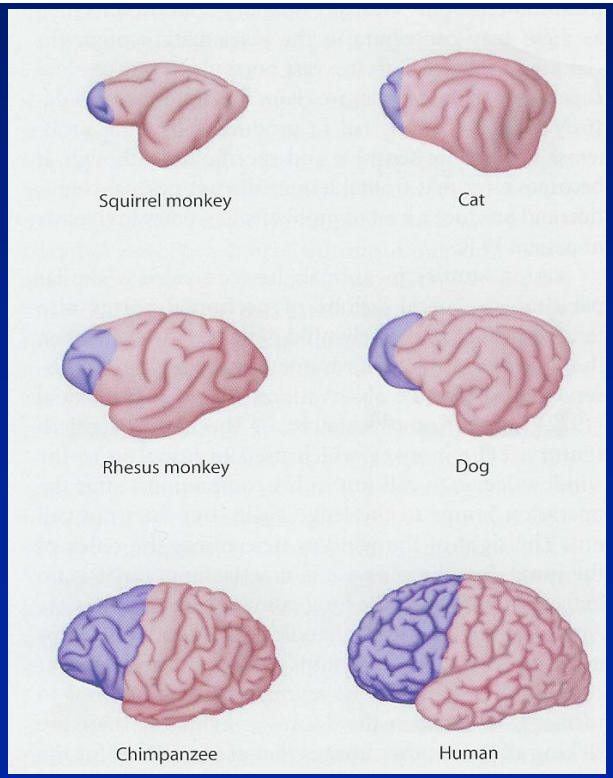
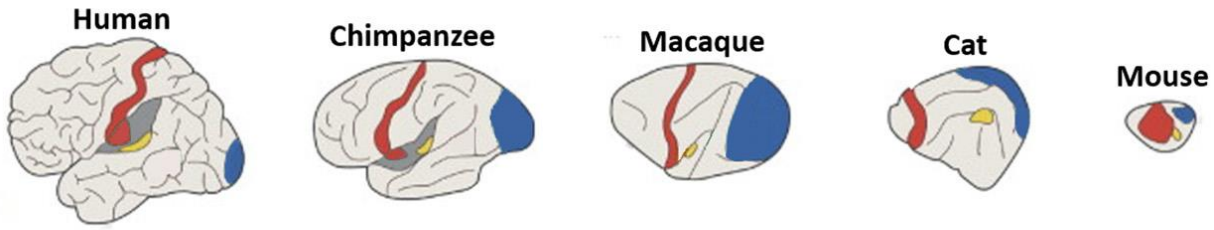
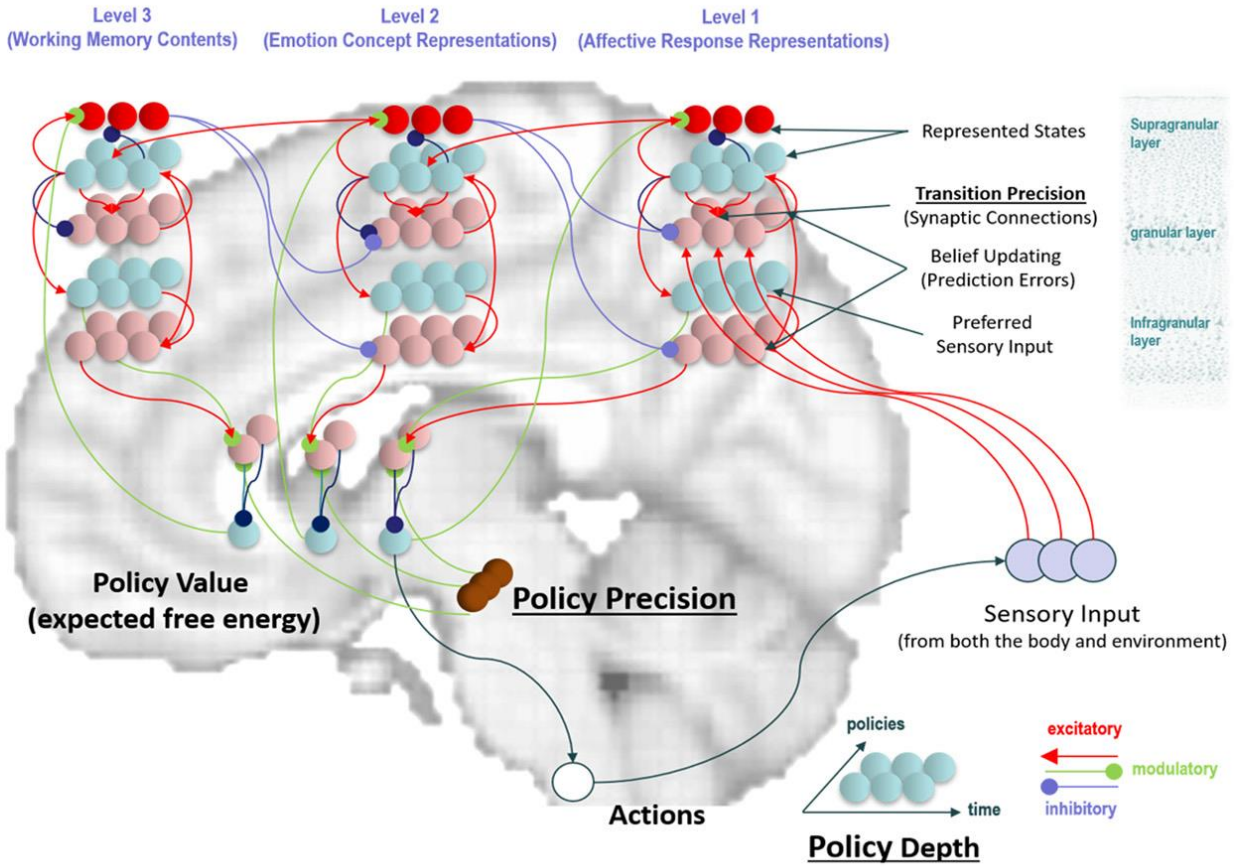
[b] University of Arizona, 1501 N. Campbell Ave, Tucson, AZ 85724-5002, United States



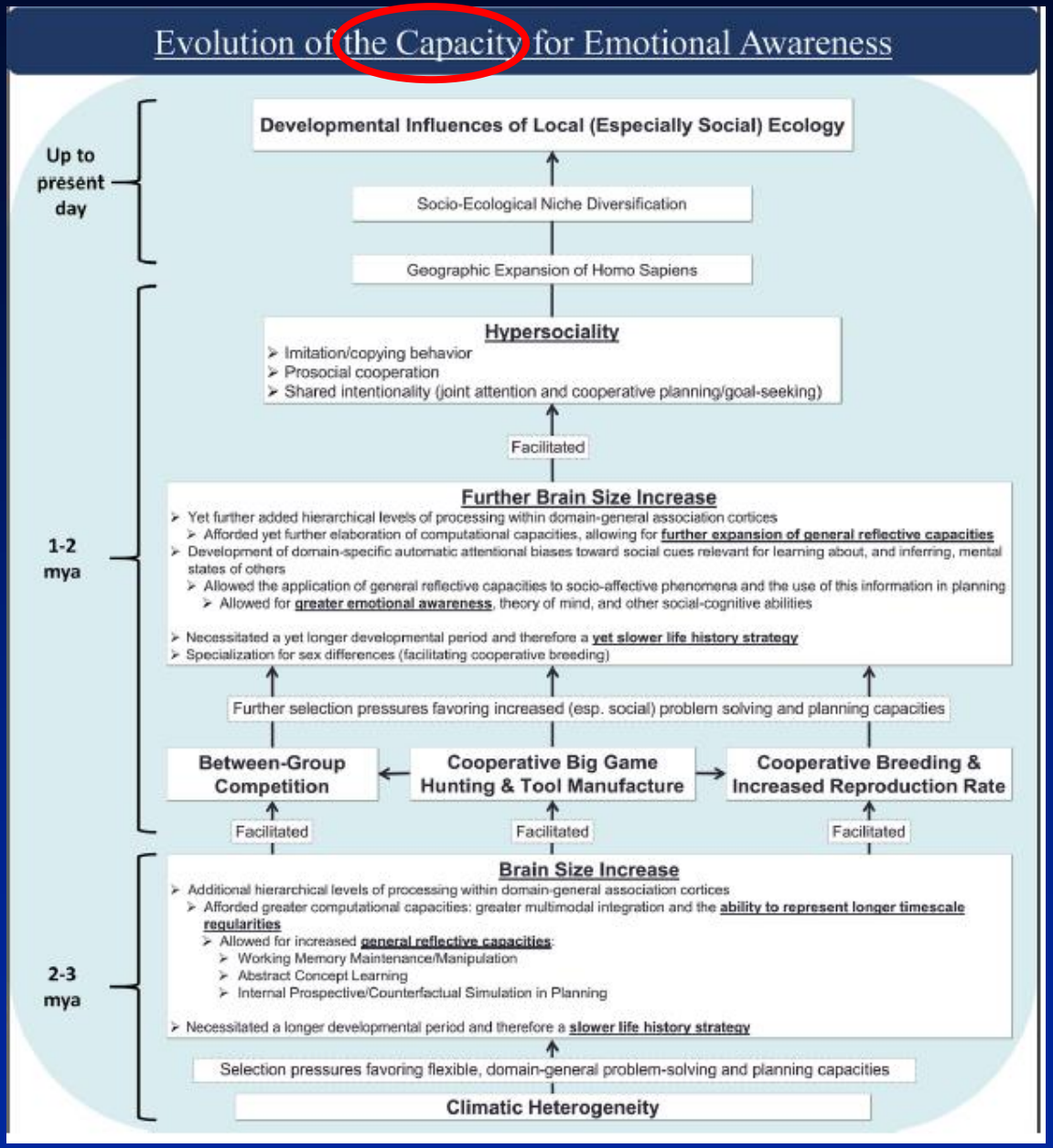
Expanded association cortex allows for deeper computational hierarchy





Neocortical Expansion in Humans Creates the *Capacity* to Reflect Upon or Be Aware of One's Own Emotional Experiences

- Disproportionate cortical expansion during human evolution reflects additional hierarchical levels of computational processing, allowing representation of multi-modal regularities over longer timescales
- These representations make possible abstract concept learning, internal simulation of distal future outcomes and expanded working memory capacity
- These allow for the ability to simulate emotions, learn emotion concepts and manipulate them in working memory when deciding how to act


Evolution of the Capacity for Emotional Awareness
Up to present day
1-2 mya
2-3 mya
Developmental Influences of Local (Especially Social) Ecology
Socio-Ecological Niche Diversification
Geographic Expansion of Homo Sapiens
Hypersociality
Imitation/copying behavior
Prosocial cooperation
Shared intentionality (joint attention and cooperative planning/goal-seeking)
Facilitated
Further Brain Size Increase
Yet further added hierarchical levels of processing within domain-general association cortices
Afforded yet further elaboration of computational capacities, allowing for further expansion of general reflective capacities
Development of domain-specific automatic attentional biases toward social cues relevant for learning about, and inferring, mental states of others
Allowed the application of general reflective capacities to socio-affective phenomena and the use of this information in planning
Allowed for greater emotional awareness, theory of mind, and other social-cognitive abilities
Necessitated a yet longer developmental period and therefore a yet slower life history strategy
Specialization for sex differences (facilitating cooperative breeding)
Further selection pressures favoring increased (esp. social) problem solving and planning capacities
Between-Group Competition
Cooperative Big Game Hunting & Tool Manufacture
Cooperative Breeding & Increased Reproduction Rate
Facilitated
Facilitated
Facilitated
Brain Size Increase
Additional hierarchical levels of processing within domain-general association cortices
Afforded greater computational capacities: greater multimodal integration and the ability to represent longer timescale regularities
Allowed for increased general reflective capacities:
Working Memory Maintenance/Manipulation
Abstract Concept Learning
Internal Prospective/Counterfactual Simulation in Planning
Necessitated a longer developmental period and therefore a slower life history strategy
Selection pressures favoring flexible, domain-general problem-solving and planning capacities
Climatic Heterogeneity

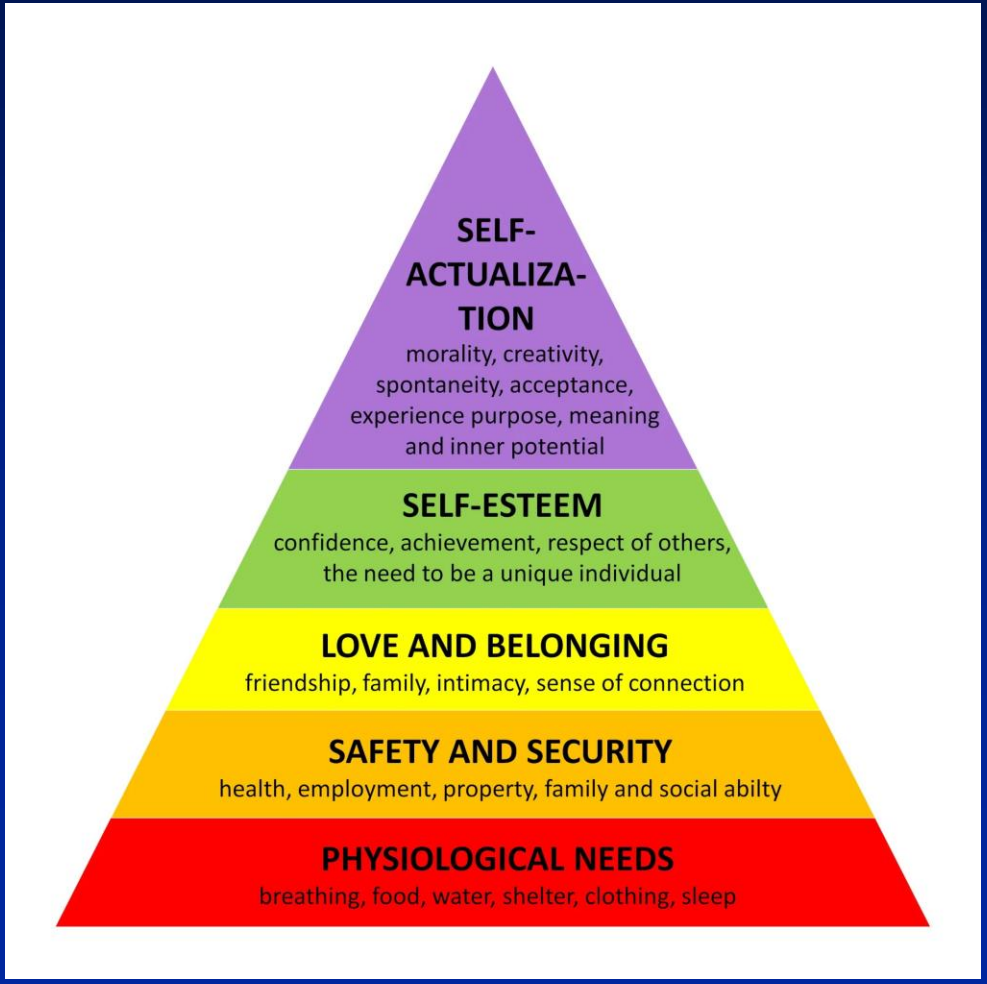
Life History Strategy: Environmental Determination of Whether Higher EA *Actually* Develops

- Within evolutional biology, there is a fundamental trade-off in the lifetime allocation of finite energy resources to either somatic growth and development or reproduction
- A primary goal or biological imperative is survival of the species
- Speed (fast or slow) includes time to maturation and longevity
- If environmental conditions are harsh and unpredictable, less investment in more offspring is an effective strategy (fast life history strategy).
- If environmental conditions are safe and secure, more investment in a fewer number of offspring is an effective strategy (slow life history strategy).

Contingent Mirroring and Responsiveness

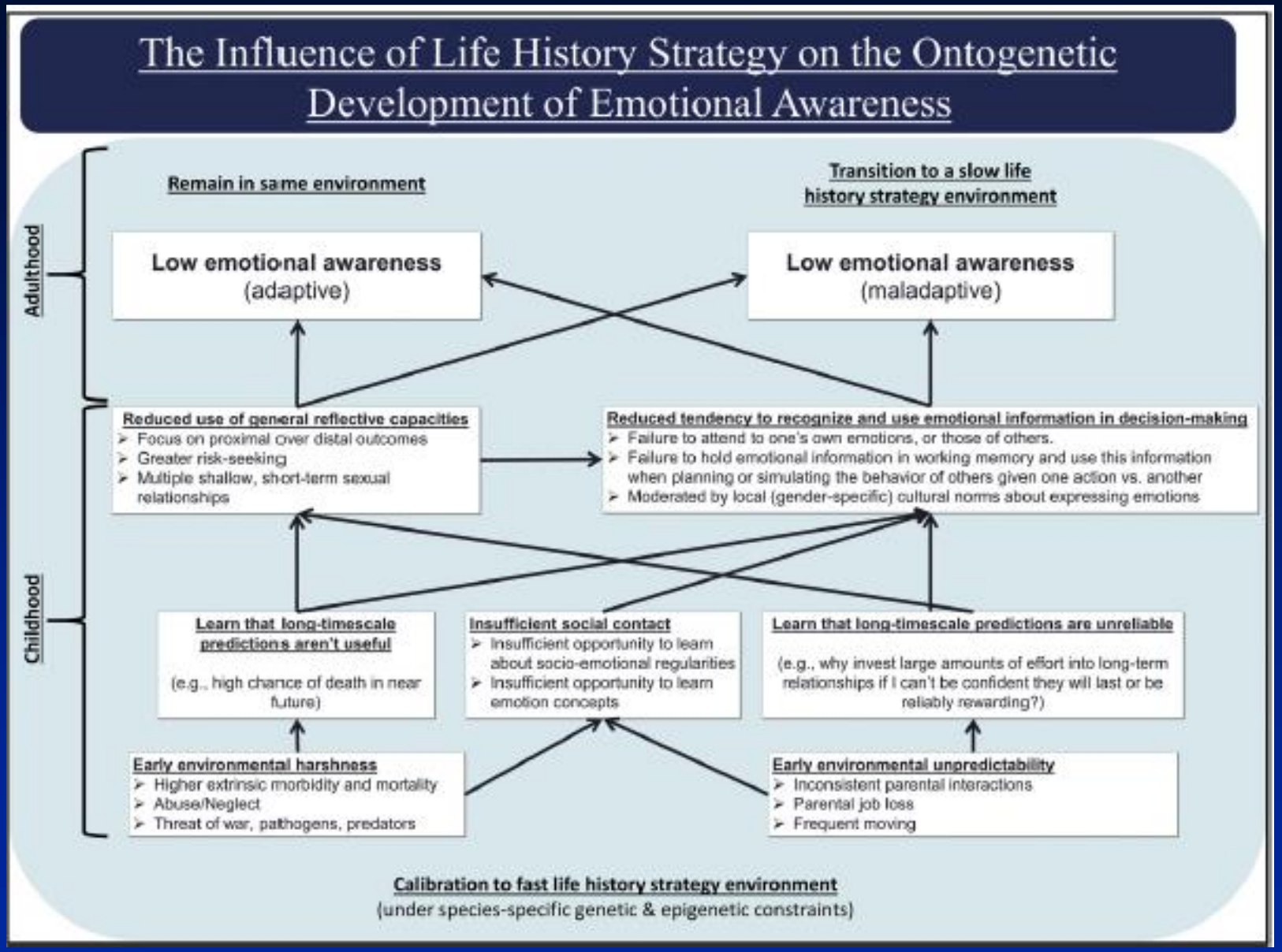
- The ability to know what is going on in our own minds initially requires reliable input from others about the meaning of our own bodily responses
- Slow LHS is associated with greater time and effort devoted to the emotional development of children
- Children learn that emotional signals have meaning and that it is useful to pay attention to them

Maslow's Hierarchy of Needs (1943)



- In the context of abuse or neglect, basic survival (biological and psychological) is the top priority
- If the environment is safe and secure, promoting attachment, self-esteem and self-actualization become possible
- Emotional awareness plays a key role in developing these capacities

The Influence of Life History Strategy on the Ontogenetic Development of Emotional Awareness



Early developmental emergence of human amygdala–prefrontal connectivity after maternal deprivation

Dylan G. Gee[a], Laurel J. Gabard-Durnam[a], Jessica Flannery[a], Bonnie Goff[a], Kathryn L. Humphreys[a], Eva H. Telzer[a,b], Todd A. Hare[c], Susan Y. Bookheimer[a,d], and Nim Tottenham[a,1]

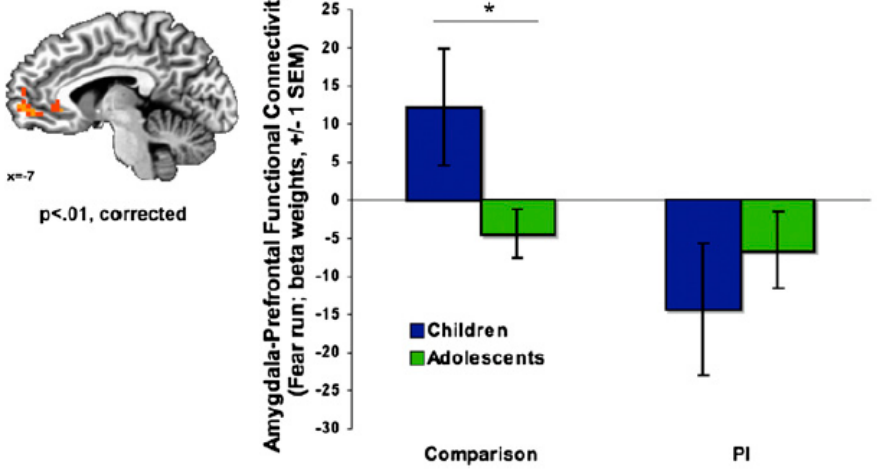
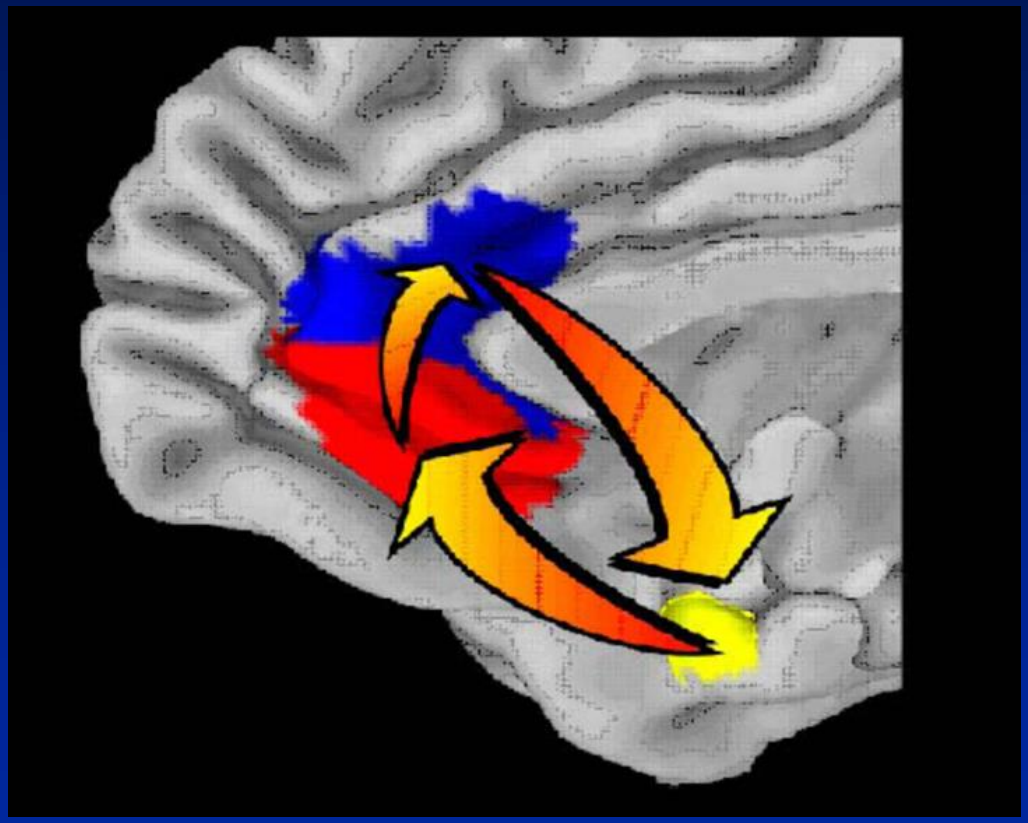


Fig. 1. Mature amygdala–mPFC connectivity following maternal deprivation. (*Left*) A group × emotional run interaction was observed in the mPFC ($P < 0.01$, corrected), such that group differences emerged for the fear run. (*Right*) Unlike comparison children who showed immature (positive) amygdala–mPFC connectivity, PI children exhibited the mature pattern of negative amygdala–mPFC coupling, such that PI children resembled adolescents. *Post hoc analysis of age, independent of the whole-brain analysis. SEM = standard error of the mean.



Proceedings of the National Academy of Sciences, 2013, *110*(39), 15638-15643.

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In this issue:

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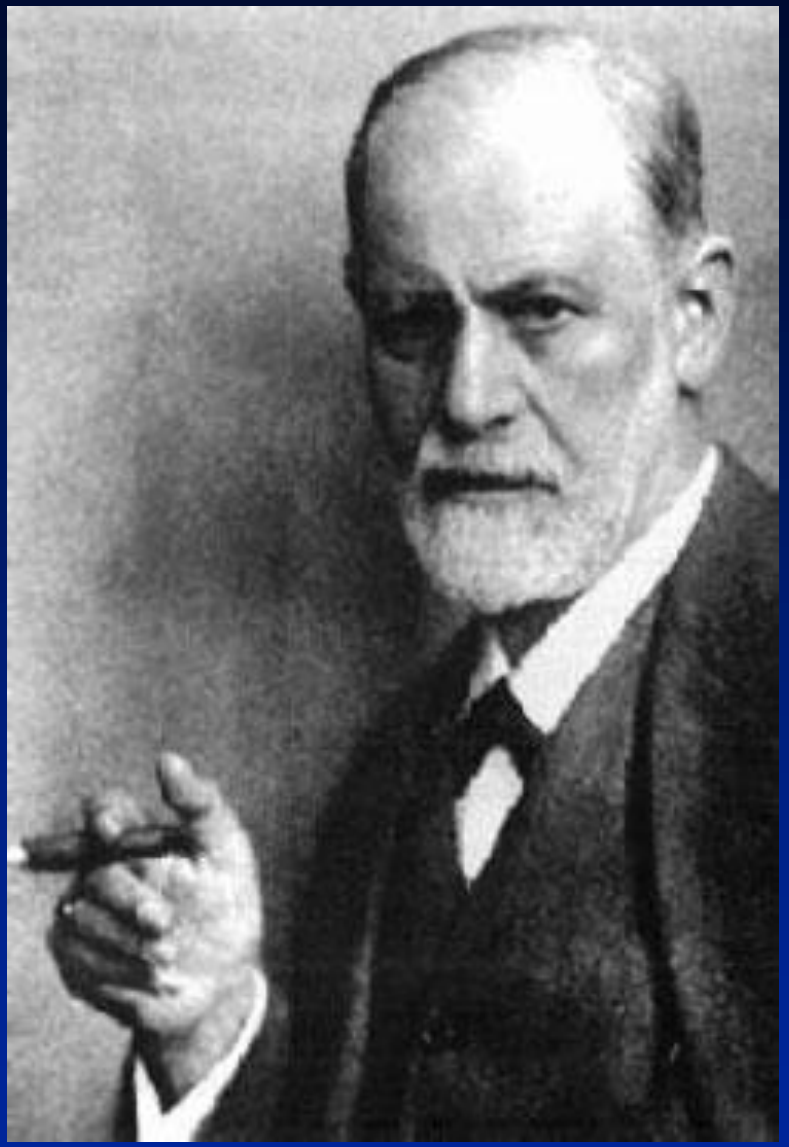
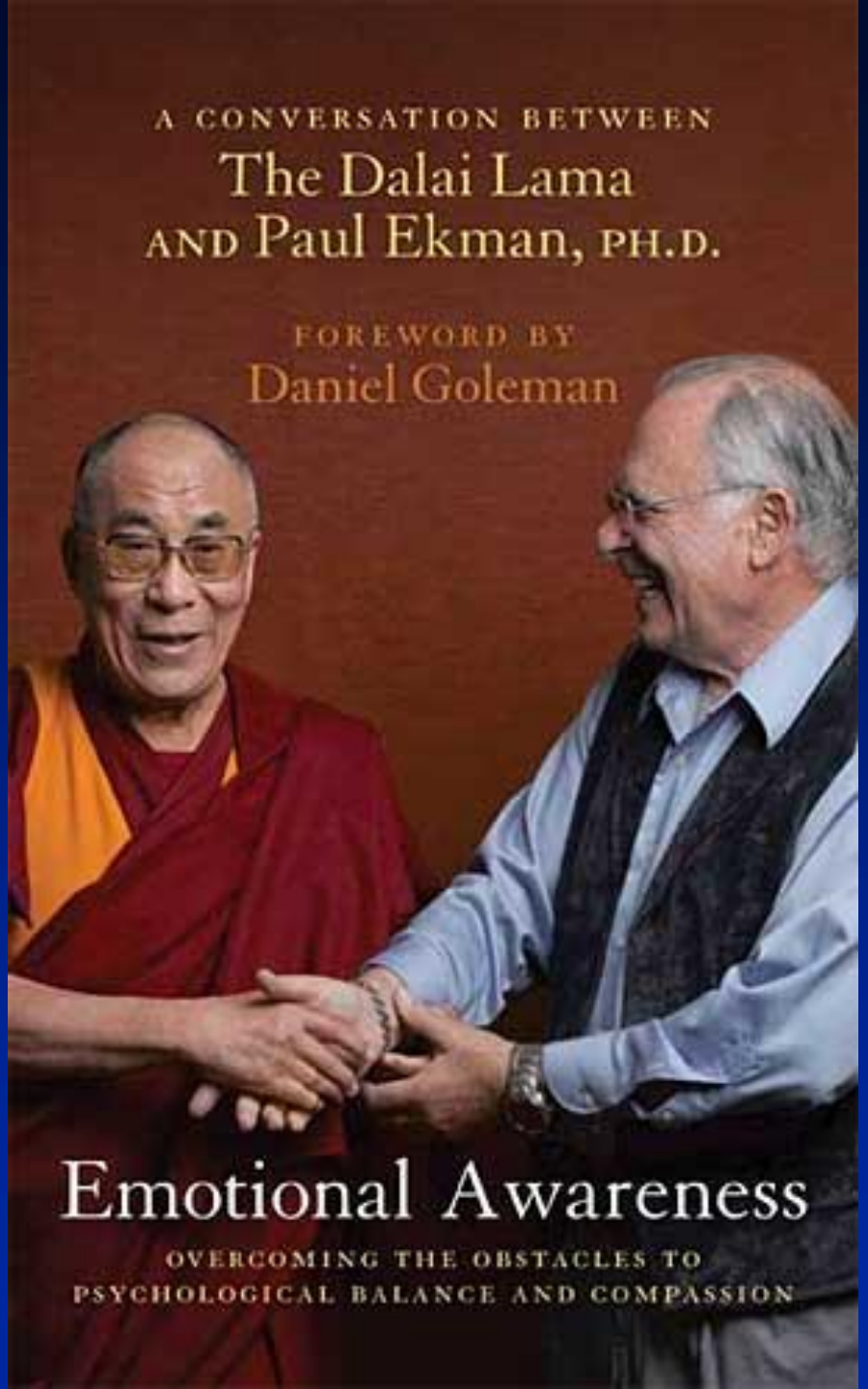
Jean Piaget



Sigmund Freud


A CONVERSATION BETWEEN
The Dalai Lama
AND Paul Ekman, PH.D.
FOREWORD BY
Daniel Goleman
Emotional Awareness
OVERCOMING THE OBSTACLES TO
PSYCHOLOGICAL BALANCE AND COMPASSION

Importance of Emotional Awareness in Psychotherapy

"Accurately recognizing emotions is critical to psychological health, and most major therapeutic approaches aim to address deficits in emotional awareness."

Burum, B. A., & Goldfried, M. R. (2007). The centrality of emotion to psychological change. *Clinical Psychology: Science and Practice, 14,* 407– 413.

Levels of Emotional Awareness: A Cognitive-Developmental Model

- The ability to be aware of one's own emotions is a cognitive skill like any other
- This ability develops over time
- Similar to Piaget's stages of cognitive development, developmental transformations occur in the capacity to be aware of one's own feelings.

Lane R, Schwartz GE: Levels of emotional awareness: a cognitive-developmental theory and its application to psychopathology. American Journal of Psychiatry 144:133-143, 1987.

The Levels of Emotional Awareness Construct

- According to Piaget, cognition becomes more differentiated and integrated with development.
- The higher the level of emotional awareness, the greater the differentiation, integration and desomatization of emotional experience and expression.

Lane R, Schwartz GE: Levels of emotional awareness: a cognitive-developmental theory and its application to psychopathology. American Journal of Psychiatry 144:133-143, 1987.

Levels of Emotional Awareness

1: bodily sensations

2: action tendencies

3: unidimensional emotional experience

4: multidimensional emotional experience (blends)

5: multidimensional experience of self and other

Prototypical Clinical Expressions of Levels of Emotional Awareness

- Level 1 -- somatization
- Level 2 -- acting out
- Level 3 – one emotion at a time / splitting
  e.g. happy or sad
- Level 4 – accepting conflicting emotions
  e.g. happy and sad
- Level 5 – accurate empathy

The Three Process Model of Emotional Awareness

Emotion

© 2017 American Psychological Association
1528-3542/17/$12.00 http://dx.doi.org/10.1037/emo0000376

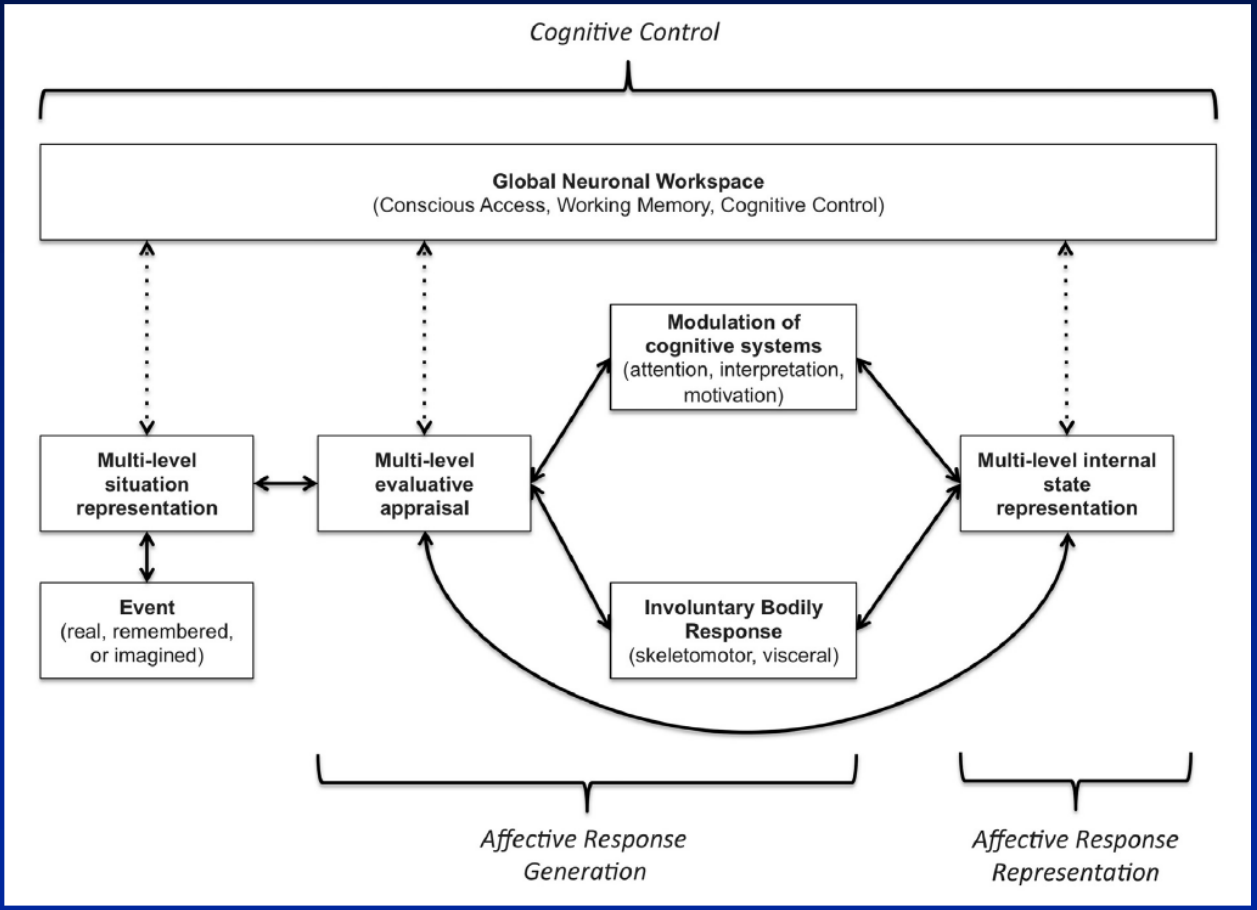
The Structure of Emotional Experience and Its Relation to Trait Emotional Awareness: A Theoretical Review

Ryan Smith, William D. S. Killgore, and Richard D. Lane
University of Arizona

- Affective response generation
- Affective response representation
- Cognitive control of conscious access

Smith R, Killgore WD, Lane RD. The structure of emotional experience and its relation to trait emotional awareness: a theoretical review. Emotion 2018; 18(5), 670.

The Three Process Model of Emotional Awareness



Smith R, et al. Consciousness and Cognition 68, 33-46, 2019.

Repertoires of Emotion Concepts Vary Across Individuals

8 pack	+8 = 16 pack	+8 = 24 pack
Red	Carnation Pink	Violet Red
Orange	Red Orange	Scarlet
Yellow	Yellow Orange	Dandelion
Green	Yellow Green	Green Yellow
Blue	Blue Green	Cerulean
Violet (purple)	Blue Violet	Indigo
Brown	Red Violet	Apricot
Black	White	Gray

Levels of Emotional Awareness Scale

- A performance measure
- 10 emotion-evoking scenes, each described in 2-4 sentences, each involving two people
- How would you feel? How would the other person feel?
- Subjects can write as much or as little as needed to answer the two questions
- Each of the 10 scenes is scored separately on a 0-5 scale

Lane R, Quinlan D, Schwartz G, Walker P, Zeitlin S: The levels of emotional awareness scale: A cognitive-developmental measure of emotion. Journal of Personality Assessment 55:124-134, 1990.

Scene from the LEAS

"You and your best friend are in the same line of work. There is a prize given annually to the best performance of the year. One night the winner is announced: your friend. How would you feel? How would your friend feel?"

Scoring of the Levels of Emotional Awareness Scale

0: Non-emotion terms
1: Bodily sensations
2: Action tendencies or non-specific terms
3: One specific emotion term
4: Two or more specific emotion terms (self or other)
5: Both self and other are at level 4 and non-identical

LEAS Reliability

- Internal consistency (Cronbach's α)
  - 20-item version (n=371): .84(S), .83(O), .88(T)
  - 10-item version (n=375): .78(A), .79 (B)
- Inter-rater
  - ICC r=.96 (1996); Pearson r=0.98 (2009)
  - 18 student raters r=.92 (range per pair = 0.79-0.99) (2009)
- Intra-rater reliability r=.993 (16 protocols 2 yrs apart) (2009)
- Test-retest
  - 2-3 weeks (n=13): .67 (S), .60(O), .66(T) (SB)
  - 4 weeks (n=25): 0.80 (T) (SB)
  - 10 months (n=33): r=.39, p<.03

NIH RDOC Matrix

Domain: Social Processes

Construct: Perception and Understanding of Self

Subconstruct: Self-Knowledge

The LEAS is one of 5 measures listed in this category.
To date there are 230 data and theory papers published
A Children's LEAS (ages 8-18) is available (34 references)
State-related LEAS successfully assessed in an EMA study*

Versluis et al. Ecological momentary assessment of emotional awareness. Current Psychology 2021

eLEAS
Levels of Emotional Awareness Scale
Electronic Version

LEAS has been translated into 20 languages

<u>eLEAS</u>
English (2010)
German (2023)*
Hebrew (soon)
Arabic (soon)

*Herpertz J. et al. Frontiers in Psychiatry (published March 2023)

Text Analysis

- Emotional range – identify every scorable word in a text sample, assign the level scores, eliminate duplicates, generate the sum
- Multi-level responses – identify whether both implicit (level 1 and level 2) responses and explicit (level 3) are included in a given text sample
- Word count – potentially an index of verbal ability and/or effort
- “Smart” eLEAS currently being developed with NLP: context, spelling, appropriateness

Development and validation of a computer program for measuring emotional awareness in German—The geLEAS (German electronic Levels of Emotional Awareness Scale)

Julian Herpertz[1*†], Jacob Taylor[2†], John J. B. Allen[3], Stephan Herpertz[4], Nils Opel[1,5,6,7], Maike Richter[1,7], Claudia Subic-Wrana[8], Jan Dieris-Hirche[4*‡] and Richard D. Lane[9‡]

- Sex differences
- Emotion recognition accuracy in faces
- Mental State Stories (ToM)
- Verbal ability
- Age / SES / Education level
- Discriminant validity:
  - Negative affect (BDI-2, DASS-21)
  - 20-item Toronto Alexithymia Scale (TAS-20)

Frontiers in Psychiatry 2023; 14: 443.

Selected Psychometric and Behavioral Findings with the LEAS

- Sex differences
- Openness to feelings
- Emotion recognition accuracy in faces (PAT, MSCEIT)
- Emotional blends and progression in stories (MSCEIT)
- Range and differentiation of emotional experiences (EES)
- Actual amount of social support
- Stable sense of well-being despite negative mood
- Differentiation in somatic symptom ratings
- Impulse control
- Heart rate variability
- Empathy – self-report and behavioral

Levels of Emotional Awareness Scale: Psychiatric Disorders

- Borderline Personality Disorder (Levine et al. 1997)
- PTSD sx and dissociation in PTSD (Lanius 2008)
- Depression (Berthoz 2000; Donges, 2005)
- Anxiety (Novick-Klein, 2005)
- Asperger's Disorder (Pratt)
- Schizophrenia (Baslet, 2009; Beals, submitted)
- Eating Disorders (Bydlowski, 2005)
- Substance abuse (Carton 2010); Smoking (Jouanne 2008)
- Cocaine Abuse with impaired insight (Moeller 2012)
- Somatoform disorders (Subic-Wrana, 2005, 2010)
- Psychopathy (Smith, 2023)
- Panic Disorder: Predictor of psychotherapy outcome (2013)

Levels of Emotional Awareness Scale: Systemic Medical Disorders

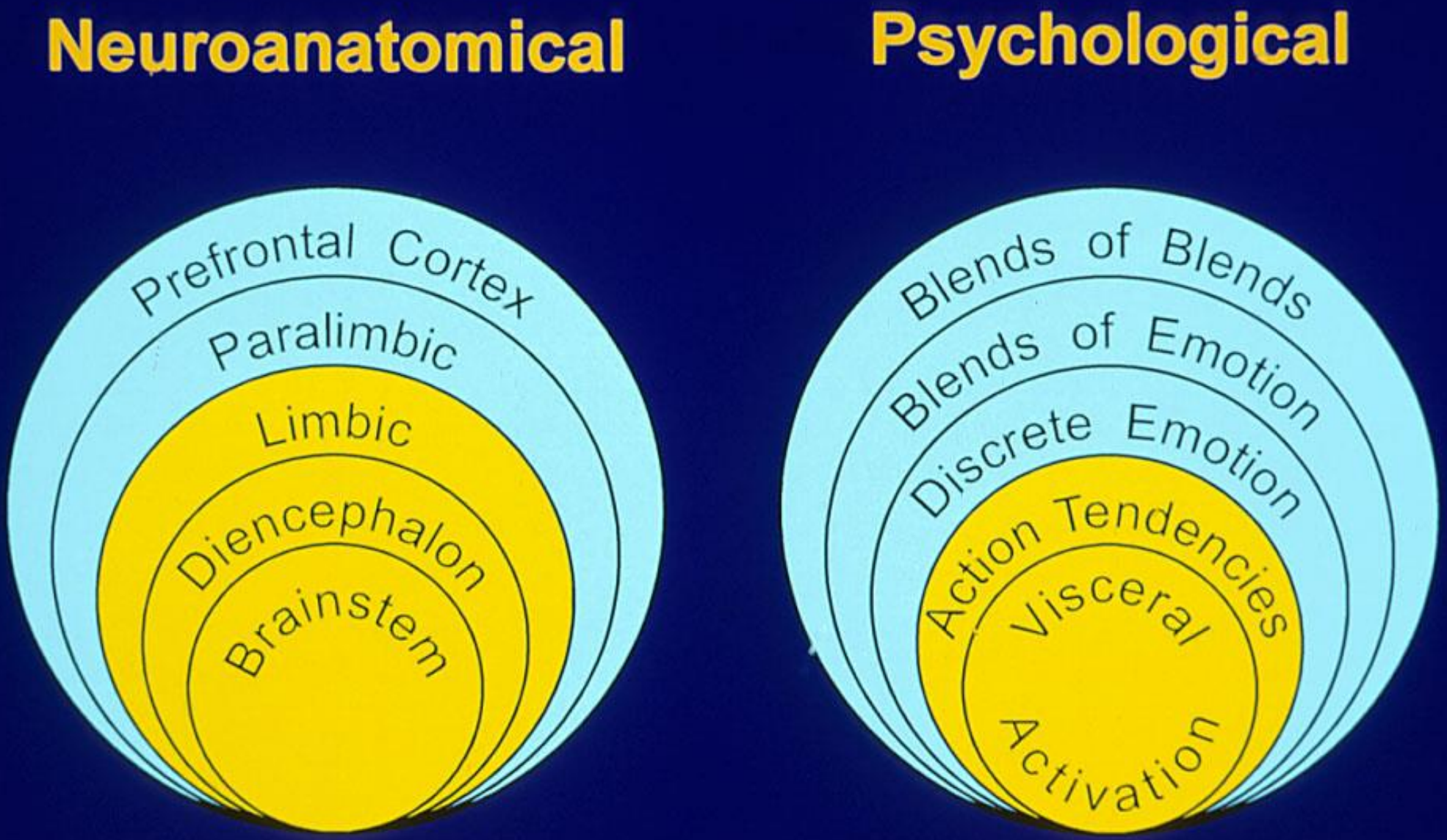
Disorders

- Hypertension: Essential vs. Secondary
- Skin-restricted lupus erythematosus
- Pain in Irritable Bowel Syndrome / Fibromyalgia
- Psoriasis
- Head trauma

Risk Factors

- Early life adversity
  - In early adversity, lower LEAS associated with greater number of γH2AX foci in peripheral blood leukocytes (marker of DNA double-strand breaks – "genotoxic stress")

Bergholz LM, et al. (2017). DNA damage in lymphocytes of patients suffering from complex traumatization. *DNA repair*, *52*, 103-109.

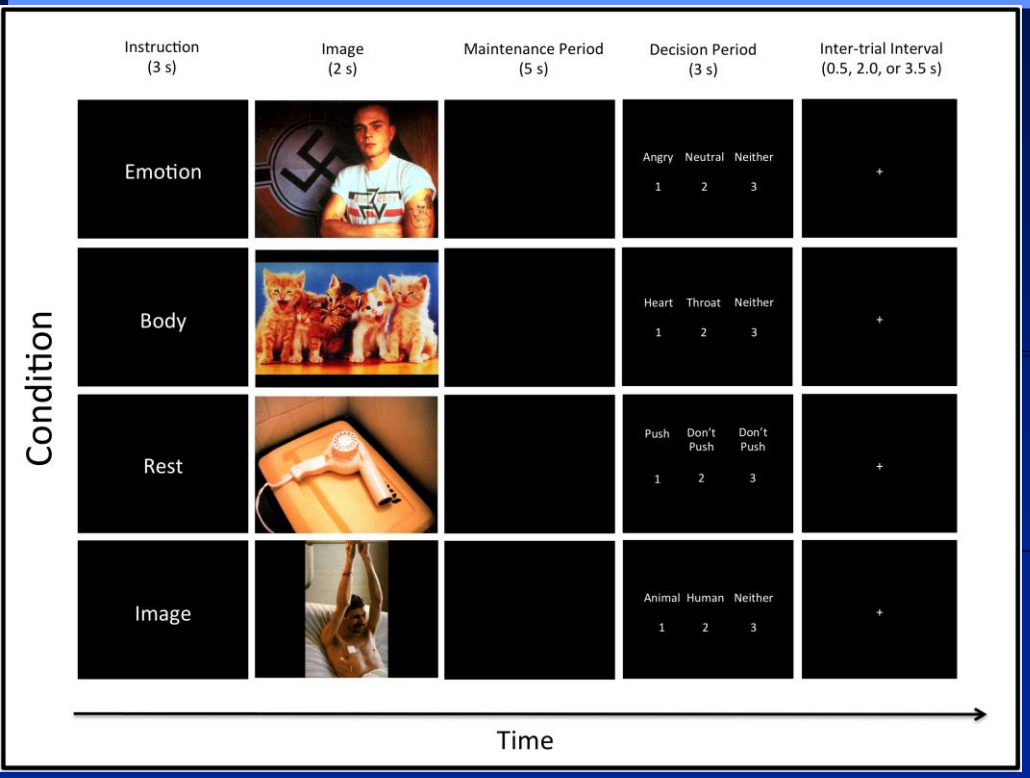


Lane RD. Neural correlates of conscious emotional experience. In *Cognitive Neuroscience of Emotion*. Edited by Lane R, Nadel L. New York, Oxford University Press, 2000, pp. 345-370.

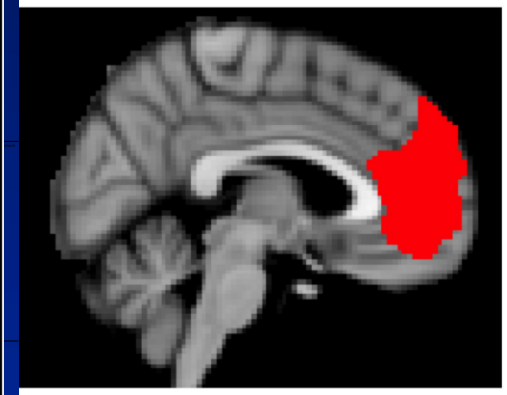
Functional, Structural and Resting State Imaging

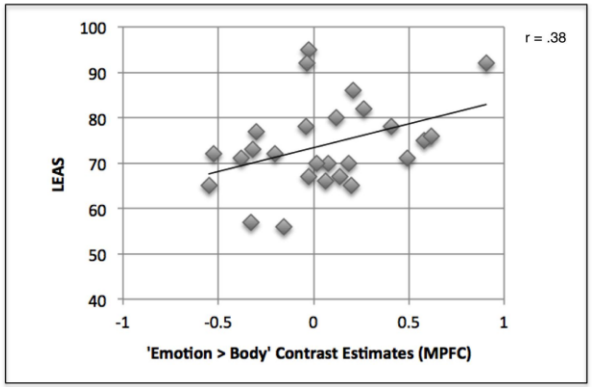
- 9 studies (6 functional, 2 resting state, 1 structural)
- LEAS correlates with areas involved in interoception, attention, emotional working memory and metacognition
- Increased cortical thickness in limbic, not default, network
- Increased connectivity in default and salience networks
- More efficient global integration (graph theoretic analysis)
- Increased neural response to subliminal happy faces
- Greater engagement in semantic processing; less premotor
- Greater MPFC engagement during emotion vs. body focus

Greater MPFC Activation During Emotion vs. Body Focus in Individuals With Higher Emotional Awareness



Contrasting Working Memory Maintenance of Emotions and Bodily Sensations:
The positive relationship between MPFC activation and trait emotional awareness





Smith R, Lane RD, et al. Common and unique neural systems underlying the maintenance of emotional vs. bodily reactions to affective stimuli: the moderating role of trait emotional awareness. Frontiers in Human Neuroscience 2018; 12:370.

LEAS Correlates Positively with HRV Results From 3 Studies

- n=32 Dutch students (75% women)*
  HRV = RMSSD at rest (3 minutes)
  LEAS Total Score (10-item version) $r = 0.423$ ($p<.05$)
- n=170 women newly diagnosed with breast cancer (UA, UCLA)
  HRV = lnHF at rest (5 minutes)
  LEAS (20-item version) $r = 0.19$, $p < .05$
- n=158 (74% women) with congenital Long QT Syndrome
  Average of 24.5 (SD=5.2) HRV samples per subject over 3 days
  Index of HRV: lnHF (5 minute samples, ambulatory)
  LEAS (20-item version): PCC $r = 0.165$, $p < .04$

*Verkuil B, Brosschot JF, Tollenaar MS, Lane RD, Thayer JF. Prolonged non-metabolic heart rate variability reduction as a physiological marker of psychological stress in daily life. Annals of Behavioral Medicine 2016; 5:1-11.

10 Studies Report Interventions That Increased Level of Emotional Awareness

- Less targeted interventions
  - multi-modal rx of somatic symptoms (Subic Wrana, et al., 2005)
  - art therapy in psychotic clients (Montag et al., 2014)
  - art therapy in young mothers (2022)
  - art therapy in breast cancer patients (Israel, in preparation)
- Interventions designed to improve emotional awareness
  - head injury (Radice-Neumann, et al. 2009)
  - fibromyalgia (Burger et al., 2016)
  - head injury (Neumann et al, 2017)
- Emotional intelligence training - healthy volunteers (Killgore, 2022)
- Emotion-focused training in nursing students (2022)
- Emotion training in 5-10 yr old children on autistic spectrum (2022)

Emotional Intelligence Training (EIT) Increases Level of Emotional Awareness

($p < .01$)

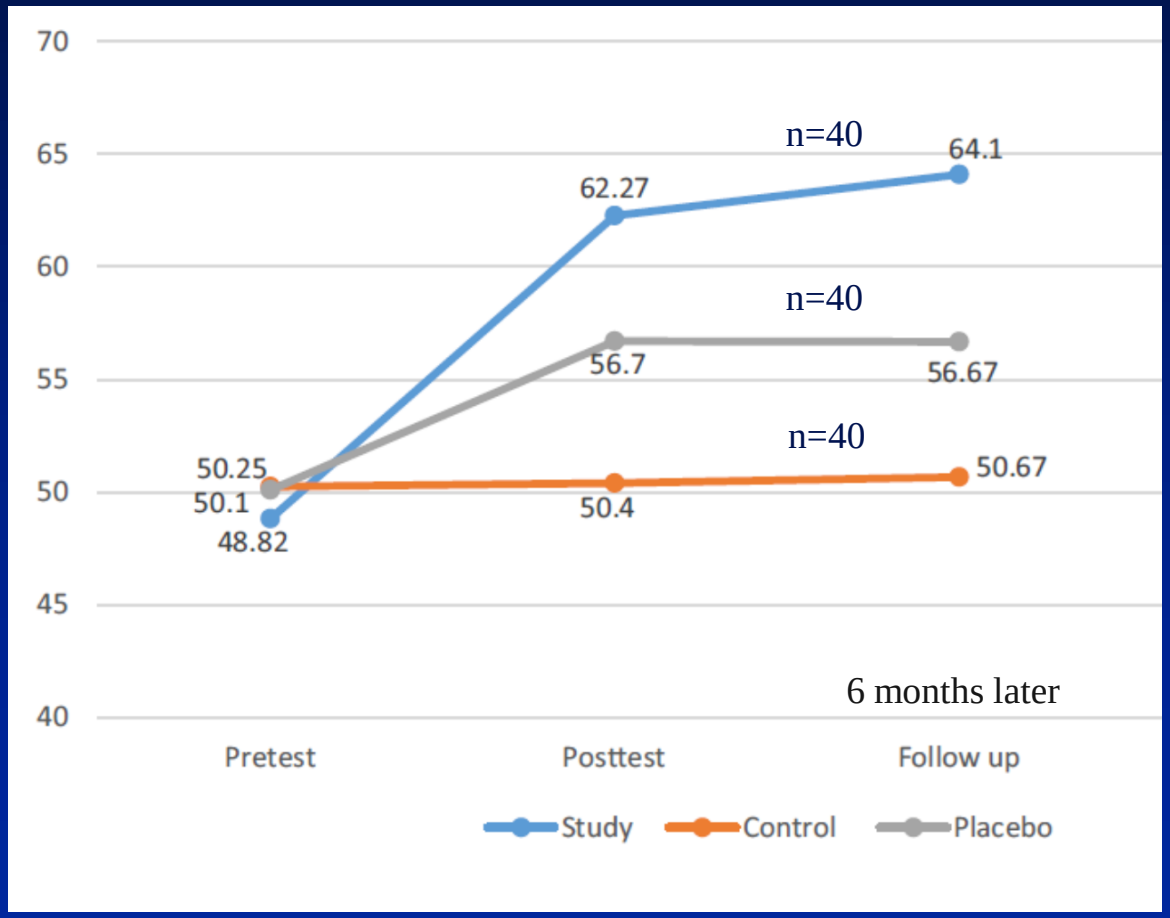
n = 211 EIT

n = 194 Placebo

Smith R, Persich MR, Cloonan S, Woods-Lubert R, Skalamera J, Berryhill SM, Weihs KL, Lane RD, Allen JJB, Dailey NS, Alkozei A, Vanuk JR, Killgore WDS. Improvements in Mindfulness, Interoceptive and Emotional Awareness, Emotion Regulation, and Inter-Personal Emotion Management Following Completion of an Online Emotional Skills Training Program. Emotion (in press, 2023).

Emotion-Focused Training in 2nd Year Nursing Students

LEAS



Study: 10 1.5-2 hr sessions of focused instruction in emotional awareness

Placebo: 10 1.5-2 hr sessions of open discussion about nursing

Control: Only 1 hr of instruction on emotional awareness skills

Sisman, F. N., & Buzlu, S. (2022). The impact of an emotion-focused training program on nursing students' emotional awareness and expression: A randomized placebo-controlled study. *Perspectives in Psychiatric Care*, *58*(1), 197-205.

Emotional Intelligence Training Increases Level of Emotional Awareness

Emotion-Focused Training Program session content		Techniques used[a]
Session 1	Getting acquainted, defining expectations from the program, learning about emotions and the place of emotions in an individual's life	Psychodrama Discussions Role playing Sociometry Doubling Mirroring Feedback Sharing Written material
Session 2	Developing a vocabulary for expressing emotions	
Session 3	Learning about the relationship between emotions, thoughts and behavior	
Session 4	Expressing emotions with body language	
Session 5	Expressing emotions with "me" language	
Session 6	Becoming aware of primary and secondary emotions	
Session 7	Developing emotional self-expression skills	
Session 8	Developing the skills of listening with empathy, reacting empathically	
Session 9	Learning to accept emotions that are hard to accept	
Session 10	Gains to be acquired from the emotional awareness training program	

[a]References Özbek & Leutz[16]; Dökmen[17]; Altınay.[23]

TABLE 1 Emotion-Focused Training Program session content

Sisman, F. N., & Buzlu, S. (2022). The impact of an emotion-focused training program on nursing students' emotional awareness and expression: A randomized placebo-controlled study. *Perspectives in Psychiatric Care*, *58*(1), 197-205.

Conclusions

- As a measure of awareness, LEA captures the structure of emotional experience in both state and trait contexts
- The body of empirical evidence supporting the theory of LEA is now both broad and coherent
- Behaviorally, LEA captures a learned socio-emotional skill
- Abundant evidence indicates that higher LEA is associated with better mental and physical health
- A plausible model links individual differences in level of emotional awareness, brain structure and function, and peripheral "information transfer systems" (autonomic, neuroendocrine, immune)

Conclusions

- The internal working model of the social world maps the relation between internal emotional responses and experiences and what is expected to transpire in the external world
- Variations in the level of emotional awareness organize the structure (differentiation and integration) of the internal working model
- LEA therefore defines a plausible line of emotional development
- Successful emotional development requires contingent mirroring and responsiveness from caregivers early in life and beyond
- The LEA model helps to explain limitations in emotional development and provides guidance on how to further advance this capacity or skill

Acknowledgement

Levels of Emotional Awareness
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