KOGWIS 2022

15TH BIANNUAL CONFERENCE

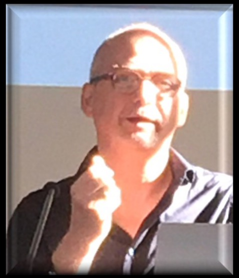
of the German Society for Cognitive Science

5th - 7th September 2022 Freiburg im Breisgau

Memory slices by Anna Strasser

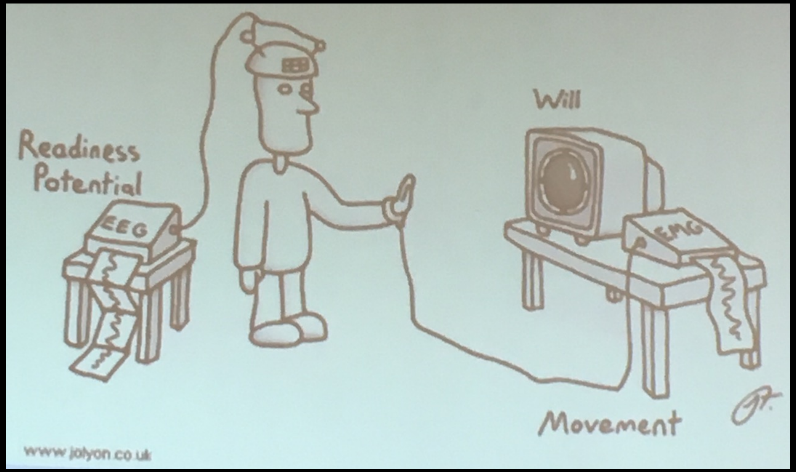
DISCLAIMER: JUST MEMORIES – AIMING FOR CORRESPONDENCE WITH REALITY BUT CANNOT GUARANTEE IT.

MARCEL BRASS
Free will: an empirical perspective



LIBET-STYLE EXPERIMENTS DO NOT DISPROVE FREE WILL

- conscious intentions preceded by brain activation (readiness potential)
- ❖ ONLY evidence of an accumulation process → **reflecting the decision process not its outcome**



CONSEQUENCES OF BELIEVING IN FREE WILL

a) intuition can overwrite beliefs (*Hume*)
b) catastrophic → fewer moral intuitions (*Smilansky*)
c) chance for giving up revenge (*Pereboom*)

Brass, M., Furstenberg, A., & Mele, A. R. (2019). Why neuroscience does not disprove free will. https://doi.org/10.1016/j.neubiorev.2019.04.024

EMPIRICAL EVIDENCE
- belief in free will
→ praise & punish more
→ more responsibility for humans than for the environment

however, experts might not be influenced by this …
→ study with judges

Keynote

NELE RUSSWINKEL & STEFAN KOPP
Computational cognitive modeling of the predictive active self in situated action

COMPAS project:

→ cognitive status & role of sense of control (SoC) in complex task situations

- computational cognitive architecture tested against human behavioral data as well as measures of SoC
- not only prediction-based (bottom up)

LEVELS OF CONTROL

1. sensorimotor control layer (SCL)
   - a predictive processing hierarchy (free energy)
2. cognitive control layer (CCL)
   - cognitive architecture ACT-R

computationally model of SoC

- *arises from*
  - conforming, deviating or conflicting prediction errors
  - precision in visual, acoustic & tactile information input modalities

VERENA VANESSA HAFNER
Tool-use and agency in artificial agents

COMPUTATIONAL PREDICTIVE MODEL OF A MINIMAL SELF: SENSE OF AGENCY & SENSE OF BODY OWNERSHIP

PREREQUISITES FOR THE DEVELOPMENT OF AN ARTIFICIAL SELF

MINIMAL SELF
- self-other distinction / social self / co-representation
- self-exploration simulation theory

TOOL USE & INVENTING TOOLS

ROBOT TRUST

OBJECT PERMANENCE IN ROBOTS
(Lang, C., Schillaci, G. & Hafner, V.V. (2018), A Deep Convolutional Neural Network Model for Sense of Agency and Object Permanence in Robots, DOI 10.1109/DEVLRN.2018.8761015)

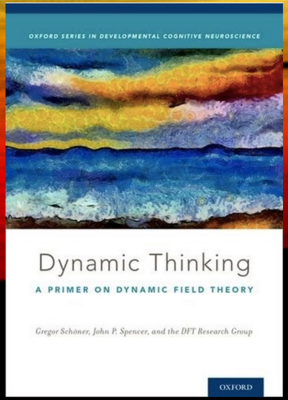
computational predictive model implemented it in different experimental setups of robot interaction

Re-enacting sensorimotor experience for cognition
https://www.frontiersin.org/research-topics/3747/re-enacting-sensorimotor-experience-for-cognition

Ciria, A., Schillaci, G., Pezzulo, G., Hafner, V.V. & Lara, B. (2021). Predictive Processing in Cognitive Robotics: a Review. Neural Computation (2021) 33 (5): 1402–1432.

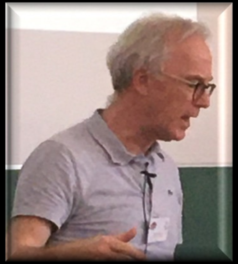
MEASURES OF THE SELF:
based on
1. properties of the computational models & instantiation in artificial agents
2. behavioural observations inspired by variations of a sensorimotor Turing Test

→ investigate measures can account for testing disturbances of the self
  → e.g., imbalance between predicted & perceived information



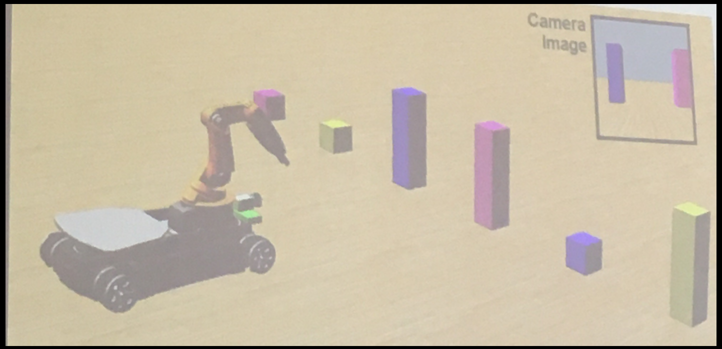
GREGOR SCHÖNER, JAN TEKÜLVE

A neural dynamic account of intentionality as the basis of an active self



DYNAMIC FIELD THEORY

intention
- 2 direction of fit
  1. world to mind
  2. mind to world



scenario:
intentional agent in simple world
- *world* (colored objects (small) | paint buckets (tall) | vehicle with arm)
- *perception* (see color/ feature | sense position, arm | paint in gripper)
- *intention in action* (move / reach to take up paint | reach to apply a coat of paint)

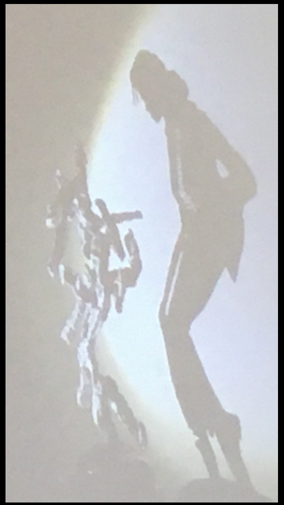
CONCLUSION
- intentional states = neural attractors
  - emerging & disappearing through instabilities controlled by conditions of satisfaction
  - neural dynamic architectures organize intentional processes across 2 directions of fit & 6 psychological modes
  - neural dynamics scales due to the stability → robustness properties of neural attractors

MARTIN BUTZ
Homeostasis drives the active self while generative models constitute it

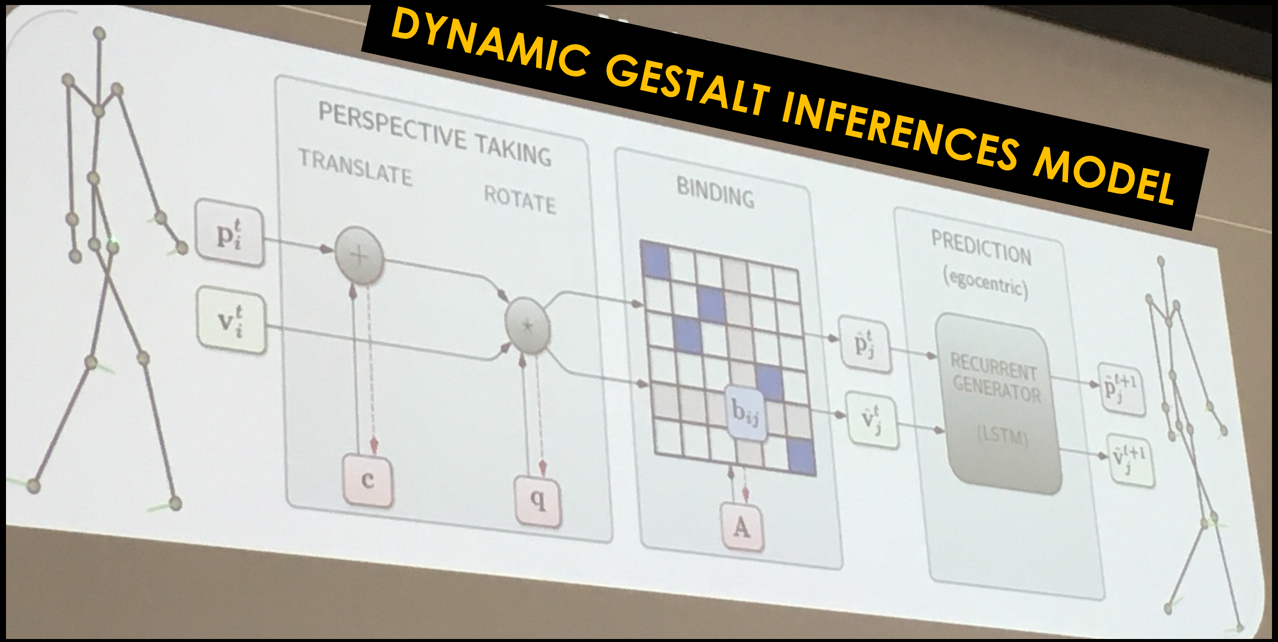
→ FREE ENERGY

minimization drives 3 types of inferences

1. retrospective in the here and how
2. retrospective & reflective
3. prospective

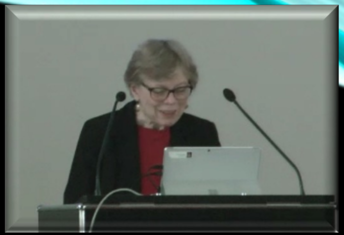


surprising causes of shadow



DEDRE GENTNER

Analogy, abstraction and relational knowledge



EMBODIMENT
- many human concepts are learned & stored as sensorimotor traces

\+

ABSTRACT ACCOUNT
- structural forms as hypothesis space

~~extreme embodiment~~
- ~~all concepts are embodied~~

~~extreme abstract account~~
- ~~learning = hypothesis testing~~

ABSTRACT RELATIONAL CONCEPTS
formed from embodied experience!
- via analogical comparison
- via structural alignment & mapping

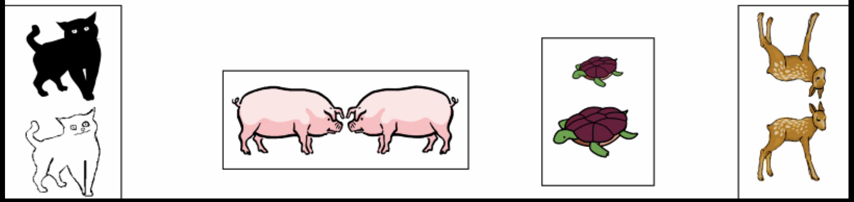
early in infancy
- structure-mapping abilities

acquiring language
- analogical abilities

individual learning & language evolution
- metaphoric language as a route to new abstractions both

3-YEARS-OLDS LEARNING A NEW SPATIAL RELATION VIA ONE OR TWO EXAMPLES

8 unfamiliar relations -- each given a novel label



(Christie & Gentner 2010)

There is a continuum of abstractness from strongly sensorimotor concepts to highly abstract concepts

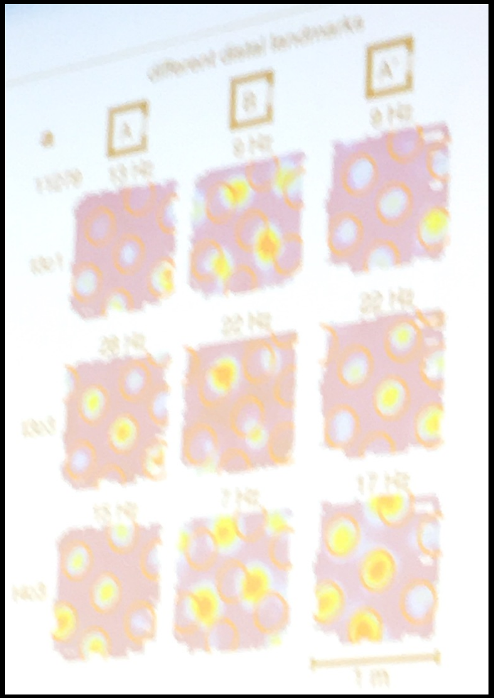
Abstract concepts—including many relational concepts—often evolve from sensorimotor concepts

This evolution is driven by analogical abstraction processes

Keynote

TRISTAN BAUMANN, HANSPETER A. MALLOT
Gateway identity & spatial remapping in a combined grid & place cell attractor

HUMANS CAN REASON ABOUT SPACE → THERE MUST BE SPATIAL REPRESENTATIONS



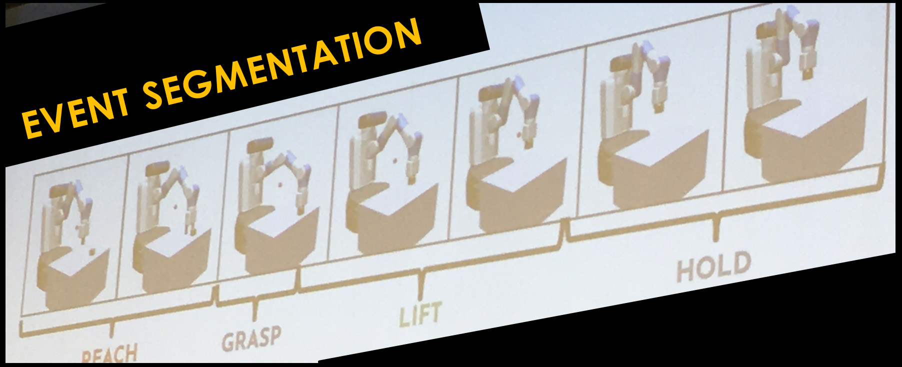
place & grid cells → context-specific firing fields

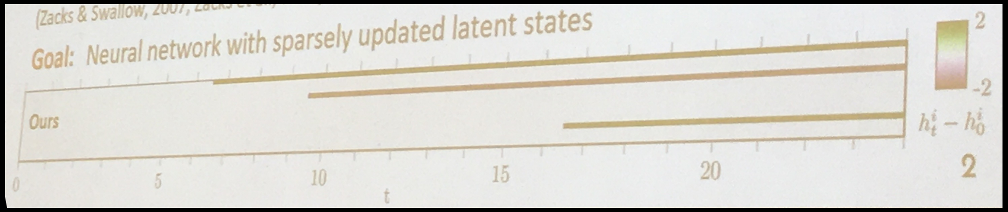
- context change is signaled by remapping
- remapping happens immediately when another room is entered
- patters depend on local position information (at the entrance)

➢ Gateways between rooms must play a special role

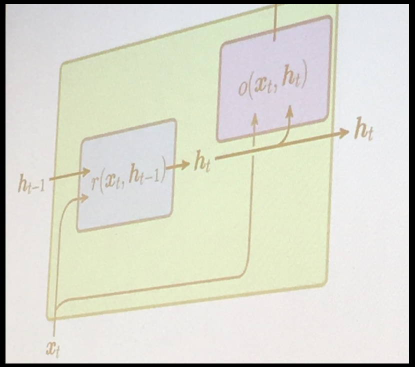
CHRISTIAN GUMBSCH, GEORG MARTIUS, MARTIN V. BUTZ

Learning latent event codes for hierarchical prediction & generalization

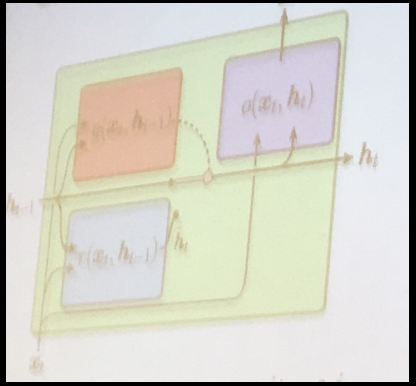




RECURRENT NEURAL NETWORK



GATED RECURRENT NEURAL NETWORK



GateLORD punishes the network for gate opening
→ Loss function
→ better in prediction & generalization

NICOLAS KUSKE, FLORIAN RÖHRBEIN, JULIEN VITAY, MARCO RAGNI, FRED HAMKER

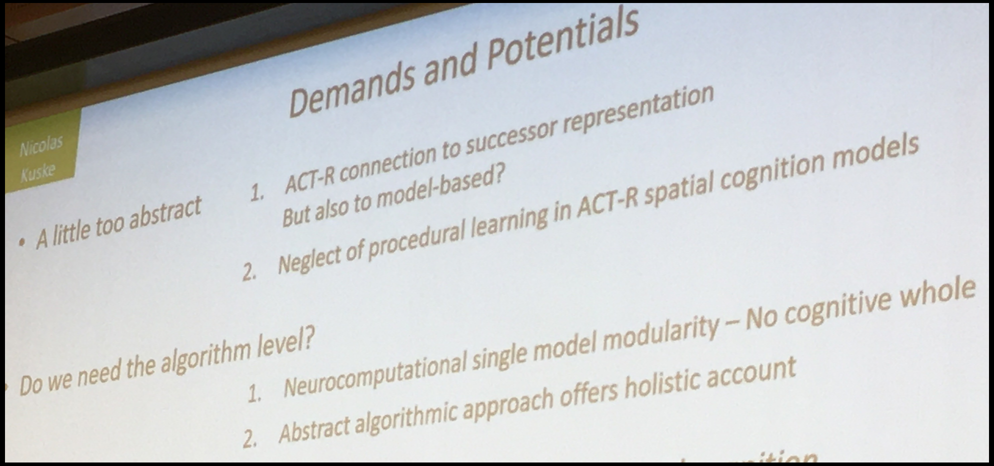
Demands & potentials of different levels of neuro-cognitive models for human spatial cognition

- 2 levels of model organization in order to *understand* cognition
  1. neurocomputional (too complex?)
  2. algorithmic (so simple Too abstract?)

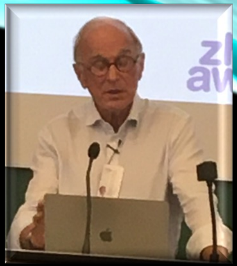
DUAL PROCESS

1. declarative planning DP
2. procedural habitual PH

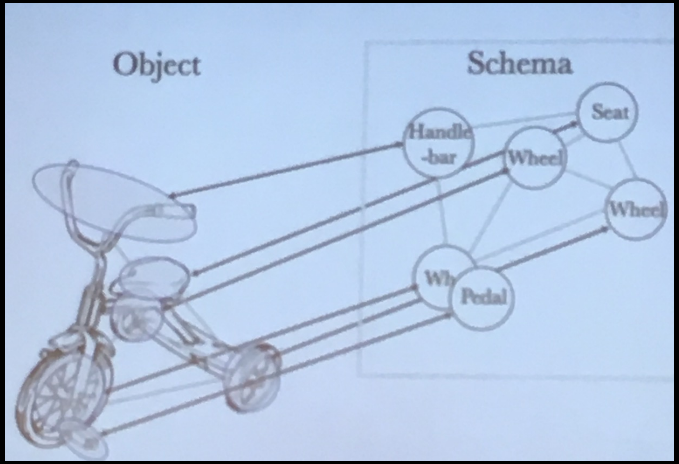
ACT- R adaptive control of thought rational cognitive architecture



CHRISTOPH VON DER MALSBURG, BENJAMIN GREWE, THILO STADELMANN
Making sense of the natural environment



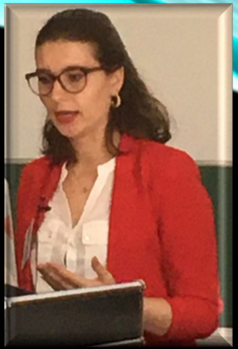
- structured network patterns as symbol
- object / schema
- texture representation
  - by feature neurons??
  - NO by net fragments
    - constitute Gestalt laws



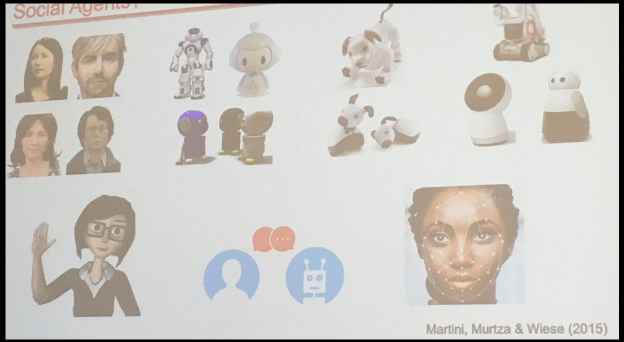
	feature neurons	net fragments
relationship	association	structural relationship
	bags of features / Hebbian assemblies	building blocks
		symbolic & sub symbolic representation
structured by		learning& self-organization

NET FRAGMENTS
= brain spanning nets
constitutes mental life

EVA WIESE, YASMINA GIEBELER
Robots as social agents: challenges and insights from social neuroscience



SOCIAL AGENTS - PHYSICAL APPEARANCE



SOCIAL AGENTS – CHALLENGES

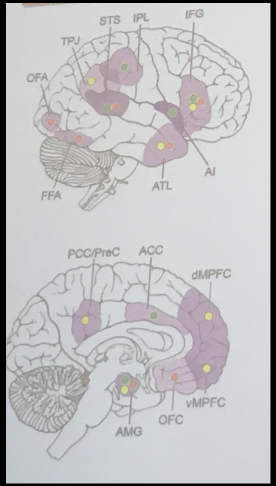
- prior experiences
- mental models
- social AI
- content & environment
- measurement
- development

SOCIAL AGENTS – FUNCTIONAL ROLE

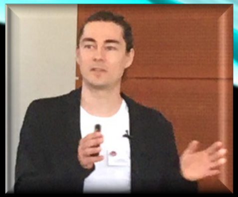
- intuitive dialogue
- reduced workload
- social learning
- transparency & trust
- positive affect
- integration

SOCIAL AGENTS – SOCIAL NETWORKS IN THE BRAIN

- Mirroring Networks
- underactivated mentalizing networks
- underactivated face-recognition networks



two studies	
social attention	Wiese et al 2012
drainage of cognitive resources	Wiese et al. 2018

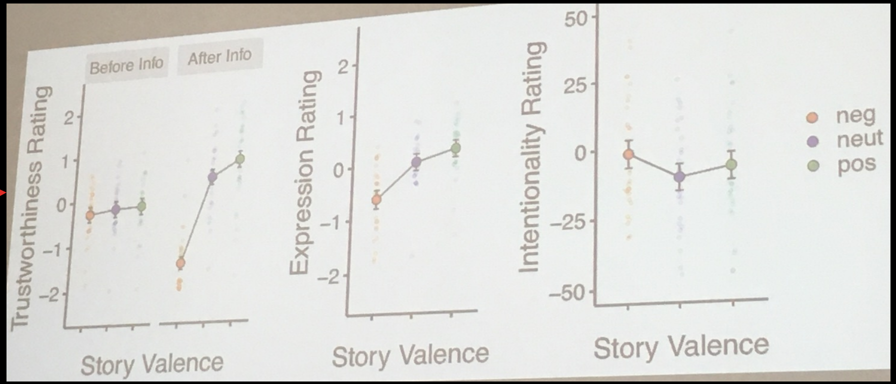


MARTIN MAIER, ALEXANDER LEONHARDT, RASHA ABDEL RAHMAN

Bad robots? Humans rapidly attribute mental states during the perception of robot faces

INTERACTING WITH ROBOTS WE SWITCH BETWEEN THE DESIGN & INTENTIONAL STANCE

		Results
questionnaire	60 participants 36 robot images	• Ratings of trustworthiness & facial expression align with the valence of learned knowledge.
EEG *pre-registration* https://osf.io/cBva7	30 participants 18 robot images	• Ratings of trustworthiness & facial expression align with the valence of learned knowledge. • Intentionality: robots aren't rated as totally unintentionally • BAD robots are rated acting more intentionally than GOOD or NEUTRAL robots



N170 component:
- early visual face perception

early posterior negativity (EPN):
- reflexive response to emotional visual stimuli

late positive potential (LPP):
- more elaborated evaluation of emotional stimuli