

emotion and motivation

emotional design

What are we doing here?

plain vs from favorite restaurant



simple vs cute



soft, but also a cat



Don Norman strikes back

- Visceral
 - Immediate reaction; reflexive, instinctive
 - Look, feel: first impression
- Behavioral
 - Actually using
 - Usability, habits, learned responses
- Reflective
 - Planning and judging
 - The pleasure that comes from things
- <https://youtu.be/RIQEoJaLQRA> → Norman's Ted Talk about design that makes us happy



Why do we care about emotion? (1)

- Emotional aspects of product design → Norman talks about this in *Emotional Design*
 - Gives your work a personality, engages users, elicits attitudes towards your product, can be used to emphasize certain affordances (e.g., warning sounds)
- But also motivation for system usage
 - For example, computer games
 - Applications that rely on habit formation (e.g., medication or mood trackers)
 - Persuasion, attitude change, reward systems

Utilitarian vs. hedonic value

- Utilitarian value: when a product or service helps the user solve problems and accomplish tasks
- Hedonic value: the immediate gratification that comes from experiencing some activity

Think about this...

- What influences value? Internally? Externally?
- What is the optimal balance between utilitarian and hedonic value for a product?



Why do we care about emotion? (2)

- Measuring emotion
- Affective computing
 - Using monitoring and measurement of user's affective state as a continuous input into a computer system
- Impact of affect on user testing

definitions

two models of emotion

Emotion

APA Dictionary of Psychology, 2e, p. 362

- A complex reaction pattern involving experiential, behavioral, and physiological elements, by which an individual attempts to deal with a personally significant matter or event
 - Experiential: a subjective experience I went through, for example getting honked at by a car while I was crossing the street
 - Physiological: a bodily response, for example increased heartbeat and sudden sweating
 - Behavioral: an actual response, for example yelling at the driver

Appraisal

- Cognitive evaluation and interpretation of the nature and personal relevance of a stimulus—is the central component of emotion that distinguishes it from non-emotional reflexes/conditioned responses
- For example: I am having a conversation with someone, and they yell “fuck off!” in response to something I said. The exclamation in itself is not enough to elicit an emotion – I need to first consider the context in which the exclamation occurred.
 - Context A: I see someone throwing their trash on the ground and I ask them to pick it up and throw it in the bin. → “fuck off!” therefore elicits anger
 - Context B: I am telling my friend a story with an unexpected plot twist; friend exclaims in surprise. → “fuck off!” therefore elicits happiness, as my storytelling is clearly entertaining

Misattribution of arousal

Dutton, D. G., & Aron, A. P. (1974). Some evidence for heightened sexual attraction under conditions of high anxiety. *Journal of Personality and Social Psychology*, 30(4), 510-517.

- Misattribution of arousal: Physiological and behavioral signatures can be misattributed to unrelated stimuli, thus inducing an irrelevant emotion
 - The famous “bridge” study manipulated male sexual attraction to a female confederate by having participants walk across a suspension bridge or a firm bridge before talking to a woman. Lingering physiological arousal from walking on a suspension bridge was then attributed to physical attraction and intensified the emotional response.
- Cognitive appraisal is therefore *central* to the emotion process; it separates emotion from non-emotional reflexes, conditioned responses, priming, etc.

Regulation

- People's responses to their own emotions; sometimes people have the goal of maintaining, minimizing, or amplifying an emotion.
- Emotion regulation strategies (not an exclusive list):
 - Situation selection → avoiding talking to someone sexist about gender equality
 - Situation modification → change the topic of conversation when your grandpa starts complaining about kids these days
 - Attentional deployment → distracting yourself from the stimulus (playing guitar to focus on something other than your mother asking you when you'll give her grandkids)
 - Cognitive change → reframe the situation you are in ("I ripped my favorite sweater, but it was old, so now it's time to buy a newer, more fashionable one")
 - Response modulation → exhibit emotion inconsistent with your current state (smiling at grandma when you receive a very ugly sweater as a gift)

Mood

APA Dictionary of Psychology, 2e, p. 666



- Disposition to respond emotionally in a particular way that may last for hours, days, or even weeks, perhaps at a low level and without the person knowing what prompted the state.

Feeling

- The subjective, experiential component of emotion and mood that is sometimes considered independent from them, in that it does not necessarily lead to observable responses and behaviors
 - Feelings are usually valenced (negative or positive) → in fact, we define emotional valence through feeling

Affect

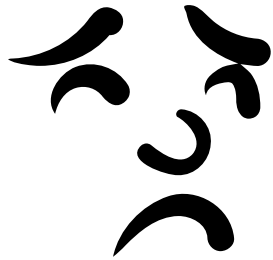
- Sometimes the term **affect** is used to designate emotions, moods and feelings together

Categorical vs. dimensional models (1)

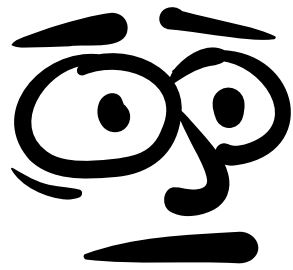
- Categorical models of emotion:
 - all humans have the same set of universal and cross-cultural emotions
 - those basic emotions can be distinguished from each other based on their behavioral or physiological signatures (for example, facial expressions)
 - Example in popular culture: Pixar's *Inside Out*



happy



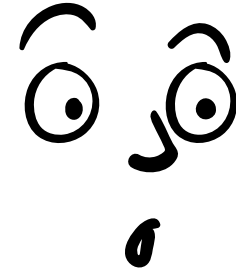
sad



fear



anger



surprise

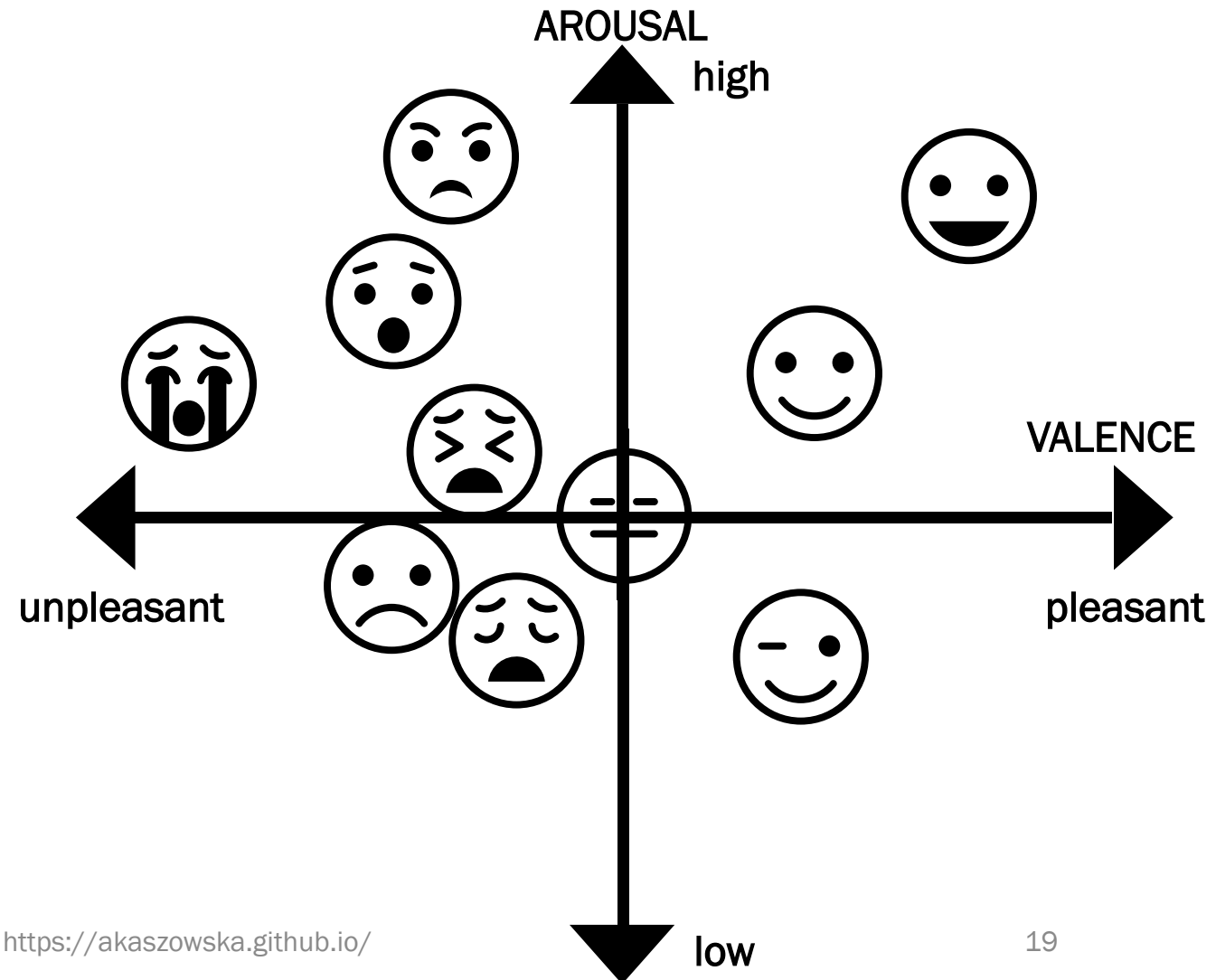


disgust

Categorical vs. dimensional models (2)

Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, 39(6), 1161–1178.

- Dimensional models of emotion:
 - all emotions are distributed on a two-dimensional space, containing arousal and valence dimensions
 - point (0,0) is medium arousal and neutral valence



Valence: Broaden-and-build

Fredrickson, B. L. (1998). What Good Are Positive Emotions? *Review of general psychology*, 2(3), 300–319.

- The overall balance of people's positive or negative emotions has been shown to contribute to their subjective well-being
- Do positive emotions only signal optimal functioning, or do they also produce optimal functioning?
- Fredrickson argues that positive emotions appear to broaden peoples' momentary thought–action repertoires and build their enduring personal resources:
 - For example, joy creates the urge to play, push the limits, or be creative
 - Interest creates the urge to explore, take in new information and experiences
 - Contentment creates the urge to sit back and savor current life circumstances

Emotions simplify thinking

Shen, L., & Bigsby, E. (2010). Behavioral activation/inhibition systems and emotions: A test of valence vs. action tendency hypotheses. *Communication Monographs*, 77(1), 1-26.

- Major discrete emotions have specific functions and drive specific actions
- For example:
 - Surprise → response to a novel stimulus → can be positively or negatively valenced → serves an orienting function → drives attention allocation
 - Disgust → response to proximity to something indigestible → negatively valenced → serves a maintenance function → drives withdrawal from gustatory experience
 - Happiness → response to progress towards a goal → positively valenced → functions as a self-reward → drives basking and bonding

Micro-valences of everyday objects?

Lebrecht, S., Bar, M., Feldman Barrett, L., & Tarr, M.J. (2012). Micro-valences: perceiving affective valence in everyday objects. *Frontiers in Psychology*, 3, 107.



Mere exposure effect

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, 9(2, Pt.2), 1–27.

Bornstein, R. F. (1989). Exposure and affect: Overview and meta-analysis of research, 1968–1987. *Psychological Bulletin*, 106(2), 265.

- People develop a preference for things, or a more positive response to things, merely because they are familiar with them
 - How much exposure is needed for mere exposure effect to take place? Research shows that MEF is most robust when unfamiliar stimuli are presented briefly, and MEF reaches the peak effect with 10-20 presentations. Delay between exposure and measurement of liking tends to increase MEF's strength as well.
 - For example, people like a song more after they heard it a few times, but many repetitions can reduce the preference
- Zajonc argues that preferences can take place without conscious cognition because affect is faster than cognition, and affective responses are made with more confidence
- What's the mechanism? Availability heuristic? Default effects? Does this mean that nudges can lose their effect over time with frequent exposure?

Hedonic adaptation

Diener, E., Lucas, R. E., & Scollon, C. N. (2009). Beyond the hedonic treadmill: Revising the adaptation theory of well-being. In *The science of well-being* (pp. 103-118). Springer, Dordrecht.

- Valence becomes more neutral as exposure repeats over time
 - Repeated exposure → less motivation, less enjoyment
- Adaptation is normal for rewards: adaptation to heroin, insulin in anticipation of food
 - Sometimes anticipation of reward produces the same hedonic effect as the reward itself
- Hedonic Treadmill Theory
 - The pursuit of happiness is like a person on a treadmill: you have to keep working just to stay in the same place
 - Everyone returns to the same neutral set point after a significantly emotional life event
 - That set point falls within a certain individual range

Arousal: Easterbrook hypothesis

Easterbrook, J. A. (1959). The effect of emotion on cue utilization and the organization of behavior. *Psychological review*, 66(3), 183.

Teigen, K. H. (1994). Yerkes-Dodson: A law for all seasons. *Theory & Psychology*, 4(4), 525-547.

- Proposed explanation of Yerkes-Dodson law
- The range of cues attended to is inversely related to the degree of arousal: in a state of increased arousal, attention narrows and fewer environmental stimuli are focused on. So, the peripheral details are weaker, but the central details are more focused on.
- But what about:
 - What drives the peripheral/central detail distinction?
 - Expertise? It modulates attention after all
 - Individual characteristics such as stress perception or resilience?
 - Is it narrowing of attention, or reallocation of resources to other cognitively demanding processes under pressure?

Think about this...

Emotional and motivational influences on cognitive control

Chiew, K.S., & Braver, T.S. (2011). Positive affect versus reward: emotional and motivational influences on cognitive control. *Frontiers in Psychology*, 2, 279.

Cognitive control

- A collection of mechanisms, including perceptual selection, response biasing, and online maintenance of contextual or goal information, by which the human cognitive system adaptively configures itself to optimally perform specific tasks
- Most of the goals we pursue in daily life are emotionally or motivationally meaningful:
 - Obtaining pleasurable outcomes
 - Obtaining outcomes that are important for survival
 - Avoiding outcomes that are neither

Experimental research

- Examining how affect modulates cognitive control
 - Emotional manipulations: direct induction of affectively valenced subjective experience
 - IAPS (International Affective Picture System); IADS (International Affective Digitalized Sounds); ANEW (Affective Norms for English Words); ANET (Affective Norms for English Text)
 - Faces, NimStim (Set of Facial Expression); RaFD (Radboud Faces Database); NIMH-ChEFS (NIMH Child Emotional Faces Picture Set)
 - Also arousal induction: task-induced stress
 - Motivational manipulations: introduction of reward or punishment incentives
- Both manipulations carry affective significance, and both were hypothesized to impact goal-pursuit and/or cognitive control

Chiew and Braver (2011): definitions

- An emotion may be presently considered a construct of multiple processes that together serve to provide an index of value associated with an internal or externally experienced state.
- While a motivation may be similarly comprised of multiple components, a motivation should be considered a state that produces behavior specifically oriented to carry out a goal that has hedonic value.
- Thus, whereas an emotion may emerge from one's status relative to motivational goals, it may not necessarily be directly relevant to a particular goal.

Positive affect and cognitive control (1)

- Broaden-and-build theory of positive emotions
- Coasting hypothesis: positive affect is a result of feeling confident about progress towards goals, for example because that progress is faster than anticipated. So, a person is free to “coast” and consider new ideas or pursuit other goals. → I am ahead on the work schedule so I can do something else and still meet the deadline.

Positive affect and cognitive control (2)

- Cognitive stability vs. cognitive flexibility: positive affect facilitates performance under conditions that depend on flexibility, but impairs under conditions stressing maintenance

Think about this...

- Can you think of situations where it might be *more beneficial* to be in a slightly bad mood? Maybe it makes more sense to be slightly grumpy when working on data analysis or a project report?

- Are there specific tasks that are selectively facilitated by positive affect?
 - For example, verbal working memory

Reward motivation and cognitive control

- Information processing accounts: motivational signals may play a more focused role in prioritization, updating, and termination of goal representations
 - Motivation influences how we think about goals
- Positive motivational signs: encouragement, praise, reward, goal achievement

Emotion vs. motivation?

Aarts, H., Custers, R., and Veltkamp, M. (2008b). Goal priming and the affective-motivational route to nonconscious goal pursuit. *Social Cognition* 26, 555–577.

- Positive affective signals occurring in temporal proximity to activation of a cognitive goal should strengthen the maintenance, accessibility, and pursuit of the goal, regardless of whether those affective signals relate to goal attainment
 - As long as we experience a positive reinforcement around the time we are working towards a goal, that positive reinforcement *will* encourage us to pursue that goal – even if the reinforcement is completely unrelated to the goal itself. → getting a cookie while studying for an exam should motivate us to study, even though the actual motivation to study should be a good exam grade
- Do positive reward and emotion have similar effects on all cognitive processes?

Think about this...

Motivation

- The impetus that gives purpose or direction to behavior and operates in humans at a conscious or unconscious level
 - Extrinsic motivation: an external incentive to engage in a specific activity, especially motivation arising from the expectation of punishment or reward (e.g., completing a disliked chore in exchange for payment)
 - Intrinsic motivation: an incentive to engage in a specific activity that derives from pleasure in the activity itself (e.g., a genuine interest in a subject studied)
- Motives are frequently divided into:
 - physiological, primary, or organic motives, such as hunger, thirst, and need for sleep
 - personal, social, or secondary motives, such as affiliation, competition, and individual interests and goals.
- **Motivated cognition:** tendency to fit information processing to conclusions that suit some end or goal.

Domains of Motivated Cognition

- Perception: motives influence what and how people see
 - Biased visual search
 - Biased person perception (elevated facial attractiveness for faces similar to oneself)
- Attention: people direct attention towards information that supports desired conclusions
 - We accept “confirming” evidence at face value, but we subject “disconfirming” evidence to critical evaluation
- Reasoning, judgment, decision-making: use of convenient heuristics to reach desired conclusions
 - Biased engagement of accessible information to uphold positive self-evaluations
 - Use of heuristics in broad self-judgments (nonspecific domains: “talent”), but not narrow (specific evidence available: “cleanliness”) self-judgments
 - Cognitive dissonance reduction

Motivations for play in online games

Yee, N. (2006). Motivations for play in online games. *Cyberpsychology & Behavior*, 9(6), 772-775.

Yee (2006)

- Why do people play MMORPGs?
 - Massively-Multiplayer Online Role-Playing Games
 - MMORPGs may appeal to many players because they are able to cater to many different kinds of play styles
 - Are different sections of the player demographic motivated differently? Are certain motivations more highly correlated with usage patterns or other in-game behaviors?
 - Model value:
 - for researchers: for example, are certain kinds of players more susceptible to problematic usage?
 - for game developers: for example, how do certain game mechanics attract or alienate certain kinds of players?

Yee (2006)

- Results showed three subcomponents of motivation:
 - Achievement: for example, progress, optimization, collecting items, competing with others
 - Social: for example, socializing and teamwork
 - Immersion: for example, role-playing, customization, and overall escapism from real life

Where does motivation come from?

Think about this...

- Is nudging a form of motivation? Or does it just influence motivation?
- What role does motivation play in habit formation?
- What if we receive a reward for a behavior, but the reward is different from what we expected? How does that influence our motivation?
- Subjective experience is a core ingredient to emotion; should it also be considered core to the concept of motivation?
 - Is subjective awareness of motivational value required for motivation?

Affect detection

Calvo, R.A., & D'Mello, S. (2010). Affect detection: an interdisciplinary review of models, methods, and their applications. *IEEE Transactions on Affective Computing*, 1(1), 18-37.

Affective computing

Picard, R. W. (1997). Affective computing. The MIT Press

- Computational systems that recognize and respond to affective states of the user
 - automatically recognizing and responding to a user's affective states during interactions with a computer can enhance the quality of the interaction, thereby making a computer interface more usable, enjoyable, and effective
- Picard (1997): three types of affective computing applications
 - 1) systems that detect emotions of the user (and respond appropriately)
 - 2) systems that express what a human would perceive as an emotion
 - 3) systems that “feel” an emotion

Modeling affect (section 2)

- Emotions as expressions
- Emotions as embodiments
 - James-Lange theory: emotions are a result of psychophysiological reactions to events; people have a psychophysiological response to environmental stimuli, and then the interpretation of that response results in an emotional experience
 - Facial feedback hypothesis: if I force myself to smile (for example, by biting on a pencil) for a certain period of time, I will start feeling happier

Modeling affect (section 2)

- Emotions as expressions
- Emotions as embodiments
- Cognitive approaches to emotions
- Emotions as social constructs
- Neuroscience
- Core affect and psychological construction of emotion

Affect detection: core issues

- Validity of the signal as a natural way to identify an affective state
 - Does this thing even measure what I want to measure?
 - Crucial aspect: validated relationship between the experience of emotion/affect and the signal; preferably a 1-to-1 mapping (but not possible when talking about emotion)
- Reliability of the signals in real-world environments
 - Are there other environmental factors that can introduce noise to the signal?
 - For example, temperature and physical exertion influencing perspiration
- Temporal resolution of the signal as it relates to the specific needs of the application
 - What if I am designing a system which must respond to the change in affect instantly, compared to offline affect monitoring?
- Cost and intrusiveness for the user

Detection (1)

- Facial expressions
 - <https://paulekman.com/facial-action-coding-system/>
- There's a cool video of Paul Ekman explaining
 - https://www.youtube.com/playlist?list=PLR1jY5KoFIIP6I_nlxWJ7v6tyngasvbC



disgust

- ① nose wrinkling
- ② upper lip raised



contempt

- ① lip corner tightened and raised on only one side of face



anger

- ① eyebrows down and together
- ② eyes glare
- ③ narrowing of the lips



fear

- ① eyebrows raised and pulled together
- ② raised upper eyelids
- ③ tensed lower eyelids
- ④ lips slightly stretched horizontally back to ears



surprise

- Lasts for only one second!
- ① eyebrows raised
- ② eyes widened
- ③ mouth open



sadness

- ① drooping upper eyelids
- ② losing focus in eyes
- ③ slight pulling down of lip corners

Detection (2)

- Paralinguistic features: *how* something is said
 - Prosody, nonlinguistic vocalization (such as laughing)
 - Amber says what: the 2017 Oscars <https://www.youtube.com/watch?v=NSHTthUoSxU>
- Body language
 - Movement, gesture, posture
- Physiology
 - Heart rate (EKG), muscle tension (electromyogram/EMG), skin conductance (electrodermal activity), eye tracking and pupillometry
- Brain imaging (functional magnetic resonance imaging, fNIRS) and EEG
- Written language and transcriptions of oral communication: *what* is said
- Multimodal approaches: data fusion, feature fusion, and decision fusion
- Not mentioned in article: self-reports

Challenges to affective interfaces (1)

Think about this...

- Affective interfaces rely on affect recognition (and subsequently adjust their functionality): but we are trained to control our emotions, especially in public places like work or school.
 - Is it possible to “trick” an interface? What does that say about system accuracy?
- Emotions are subjective: how do we deal with individual differences? Or cultural constraints for what is considered acceptable?
 - If frustration at the workplace is frowned upon, and the system recognizes a frustrated user and adjusts functionality accordingly: is the system implicitly ostracizing the user for a “shameful” emotion? How would that affect trust in the system?
- What about the context of emotion?
 - Stress in the office, stress in an airplane cockpit, stress at home on the couch

Challenges to affective interfaces (2)

Think about this...

- What about the *cause* of emotion? How does it play a role into adjusting system response?
 - I am frustrated → the system automatically shows me additional help options
 - I'm frustrated because I have no idea what I am doing → help options are very useful
 - I'm frustrated because I know what I am doing, but I'm in a hurry → help options frustrate me more
- Even if we can accurately identify emotions, will all users expect/benefit from the same system reaction to the same emotion?
 - I'm angry → do I need this emotion to be not recognized by the system, and therefore ignored? Or do I need a system to respond and address the cause of anger, if it can be identified?

In summary

- Emotions bias cognition, and therefore have many similar effects to nudging
- More specifically, emotions simplify decision making, and therefore could be seen as a kind of a reduced mental model
- Emotion-specific long-term memory?
- Arousal and valence follow some rules, which can be utilized in design:
 - Arousal expands or narrows perception across modalities
 - Positive valence generally facilitates creativity, while negative valences generally do not
- Arousal affects almost every aspect of performance: Yerkes-Dodson