Affective User Research & Human-AI Interaction

Seminar Summer 2024, Karlsruhe Institute of Technology

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Karlsruhe Institute of Technology

human-centered systems lab

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Affective User Research & Human-AI Interaction

Seminar #1&2 Part: Affective User Research

Dr. Ivo Benke, Dr. Lennard Schmidt

Detailed Agenda (45 mins)

1. Warm-up: What is affective user research
2. Importance of affective user research
3. Key Concepts
    a. Valence (positive/negative)
    b. Arousal (intensity)
    c. Motivation/Approach-Avoidance
    d. Relationship between emotions and cognition, behavior, and decision-making.
    e. Distinguishing affective states from emotions, moods, and personality traits.
4. Methods
    a. Self-report measures
    b. Behavioral measures
    c. Physiological measures
    d. Neuroimaging techniques
5. Q&A

Warm-up

1) Can you recall a personal experience where your emotions significantly influenced your perception or interaction with a system, application or service?

2) How might affective user research have improved that experience?

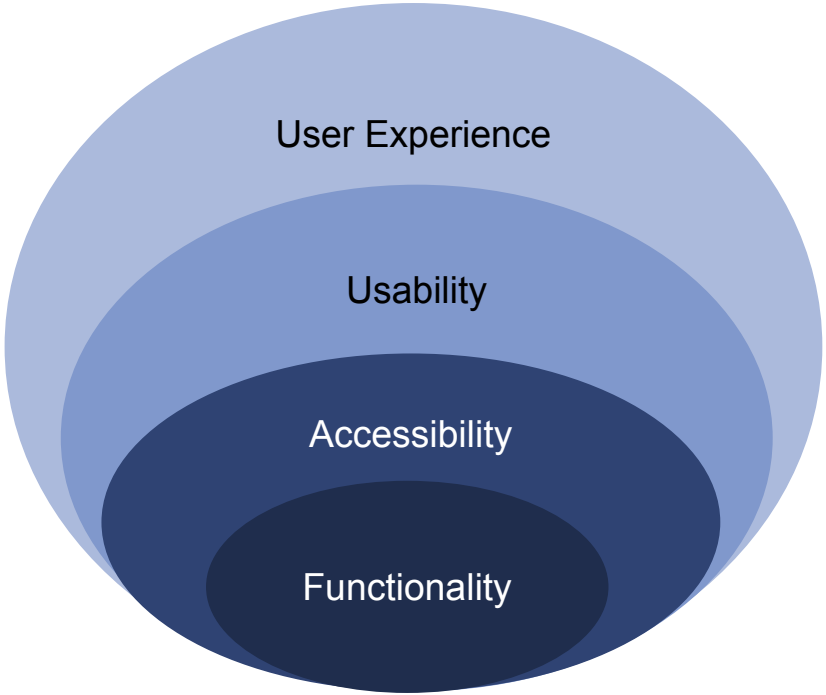

“Focus on the user and all else will follow.”
- Rule #1, Google’s “Ten Things” Philosophy

Foundation: Human-centered design process

Beyond Functionality

- Interactive systems should be designed with a human-centric focus

- Accessibility, usability, and user experience are important non-functional characteristics of interactive systems



ISO 9241

- A family of standards covering ergonomics of human-computer interaction, e.g.
  - The human-centred design process;
  - Displays and display related hardware;
  - Physical input devices;
  - Workplace ergonomics;
  - Environment ergonomics;
  - Control centers.
- Important standards are:
  - **ISO 9241-11**: Usability: Definitions and concepts
  - **ISO 9241-110:** Dialogue principles
  - **ISO 9241-210:** Human-centred design processes for interactive systems

Definition Accessibility

Accessibility is the extent to which an **interactive system** enables **users** to interact with it, regardless of their level of vision, hearing, dexterity, cognition, physical mobility, etc.

- Note:
  - Standards and guidelines for accessibility are available; standards may be legally enforced in some markets. Relevant guidelines include W3C's Web Content Accessibility Guidelines (WCAG) 2.0 and ISO 9241-171, Guidance on software accessibility.
  - Assistive technologies, such as screen readers, may be used by people with visual impairments to help them interact with an **interactive system**. Additional descriptions, for example alt tags, can be added to the code of non-textual elements, such as pictures and diagrams, to convey their meaning.

Usability

Definition Usability (ISO 9241-11): The extent to which a system, product, or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.

You can not tell whether something is usable without considering:

- the user
- the goals
- the task
- the context

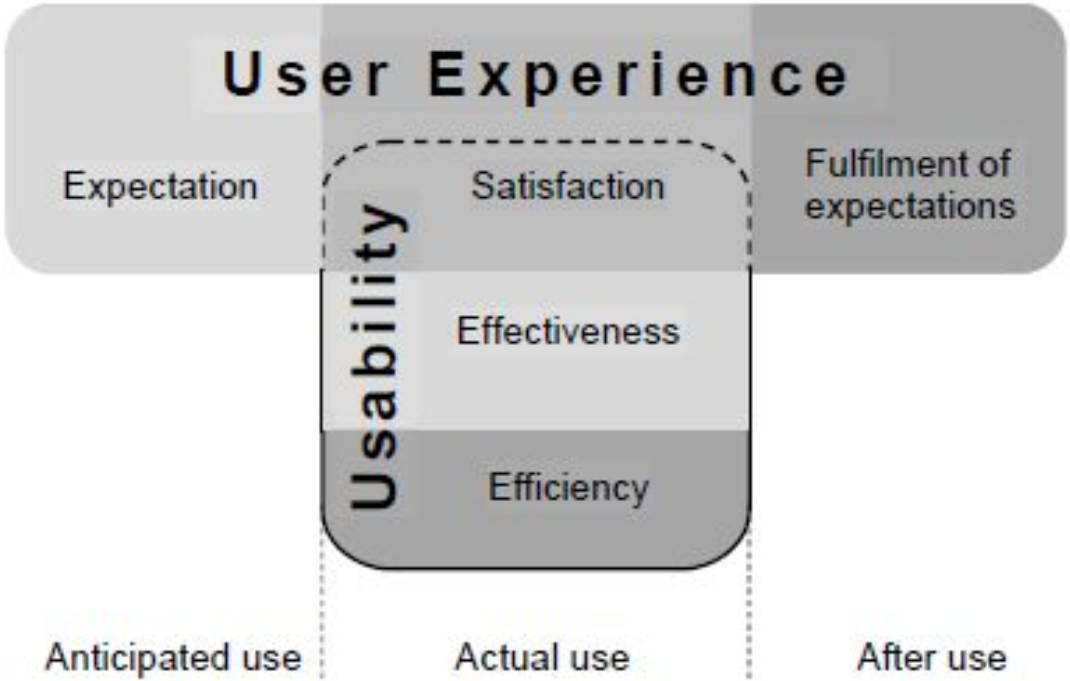
Appropriate for user, task and context!

User Experience (UX)

User Experience (ISO 9241-210)**:** A **user's** perceptions and responses that result from the use and/or anticipated use of an **interactive system**

- **Users'** perceptions and responses include the **users'** emotions, beliefs, preferences, comfort, behaviours, and accomplishments that occur before, during and after use.
- User experience is a consequence of brand image, presentation, functionality, system performance, interactive behaviour, and assistive capabilities of the **interactive system**.
- It also results from the **user's** internal and physical state resulting from prior experiences, attitudes, skills, abilities and personality; and from the **context of use**.

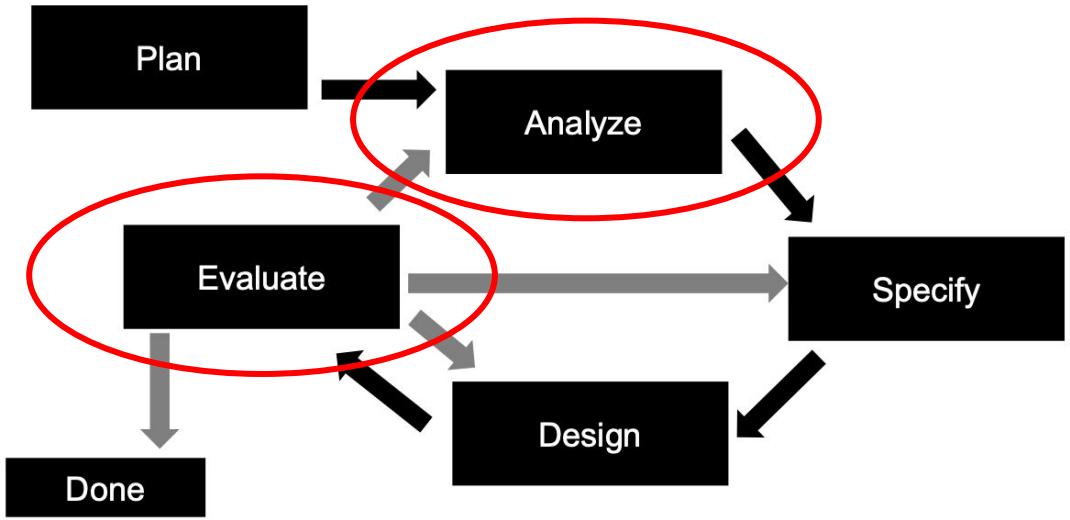
Relationship between Usability and UX



Usability is **effectiveness**, **efficiency** and **satisfaction** during actual use, while user experience is about general perceptions and responses during anticipated use, actual use and after use.

Human-Centered Design Process

Human-centered design (HCD) is an approach to design that places real people at the center of problem-solving. At every phase of the design process, consideration of your customers and their context comes first.

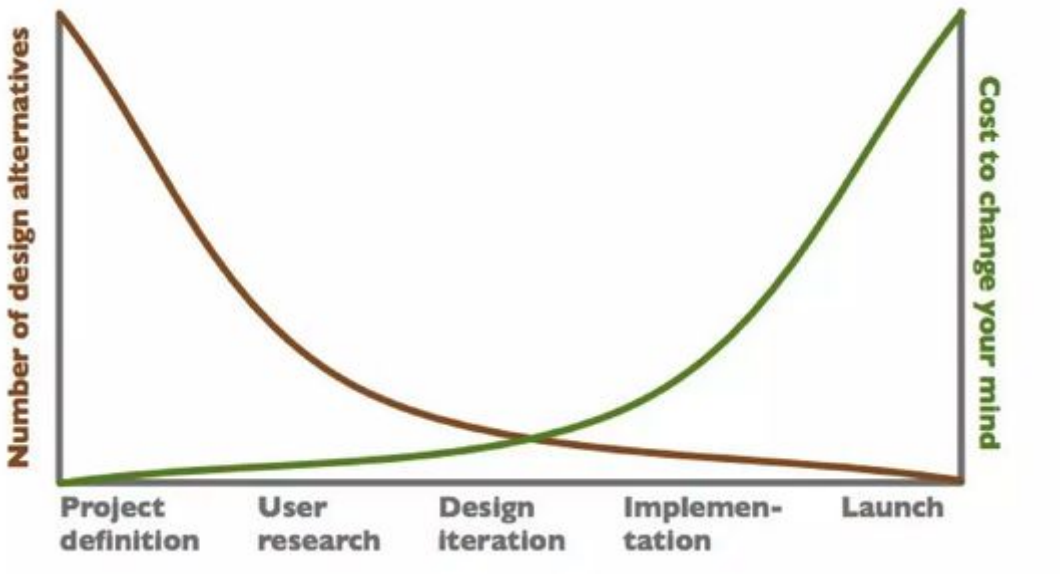


- 5 key activities
- Emphasize explicit understanding of humans, goals, tasks, resources and environments.
- Humans are involved throughout the entire process

Building on DIN EN ISO 9241-210

Why understanding the user matters...: Transforming digital Interactions

“Design is not just what it looks like and feels like. Design is how it works.”
Steve Jobs



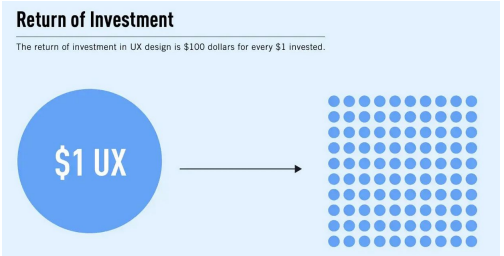
- 91% of unsatisfied customers don't complain but leave a website without giving feedback after a bad experience. userinterviews.com
- Every dollar invested in UX brings $100 in return. Forbes.com

Importance of affective user research in HCI

The role of affective user research: Beyond usability towards meaningful experiences

User experience (UX) design has evolved beyond its traditional focus on functionality and usability to incorporate emotional design as a critical component.

Emotional design aims to elicit specific emotional responses from users, recognizing that emotions significantly impact user behavior, decision-making processes, and overall satisfaction.



Importance of Emotions in UX

- **Guiding User Behavior**: Emotions heavily influence how users perceive and interact with products/services, guiding their decision-making process
- **Deepening Engagement**: Emotional engagement leads to stronger connections with users, fostering loyalty and satisfaction.
- **Memorability**: Emotional experiences are more memorable, enhancing brand recall and user affinity.

Importance of affective user research in HCI

Benefits of Affective User Research

- **Understanding Emotions:** Affective user research focuses on uncovering users' emotional responses throughout their interaction journey.
- **Enhancing UX:** By integrating emotional insights, UX can be optimized to meet not only functional but also emotional needs.

Applications in UX Design

- **Design Iteration**: Emotional insights inform iterative design processes, ensuring designs resonate emotionally.
- **Personalization**: Tailoring experiences based on emotional responses enhances personalization efforts.
- **Competitive Edge**: Emotional design can differentiate products in competitive markets, boosting user preference and loyalty.

https://design.google/library/evoking-emotions-pamela-pavliscak

Key Concepts

Affect & Emotions

Affect & Emotions

Affect is concerned with describing the whole range of emotions, feelings, moods, sentiment and other aspects of people that might be considered non-cognitive and non-conative. *(Benyon, 2014)*

Affective Phenomena

Affective traits	Broad and general longer-lasting Less contextualized Less tied to a cause	Irritability, Positivity
Mood states		Bad mood, Good mood
Emotion states		
Sensory states		

Affect & Emotions (2)

Moods are affective states that are diffuse and unfocused, that is, not directed toward a specific object.
They are continually present (tonic) and shape the background of our moment-moment experience, but fluctuate over time. *(Frijda, 1993; Larsen, 2000; Parkinson, Totterdell, Briner, & Reynolds, 1996)*

Affective Phenomena

- Affective traits
- Mood states
- Emotion states
- Sensory states

Broad and general
longer-lasting
Less contextualized
Less tied to a cause

Irritability, Positivity

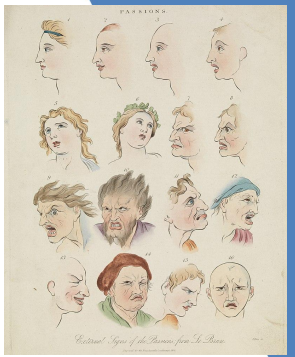
Bad mood, Good mood

Affect & Emotions (3)

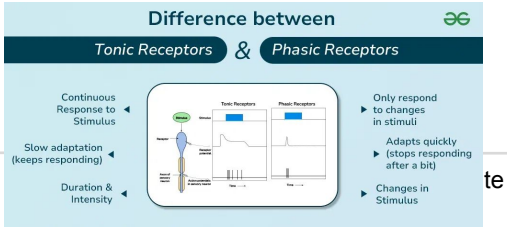
Episodic, relatively short-term, biologically-based patterns of perception, experience, physiology, action, and communication that occur in response to specific physical and social challenges and opportunities. *(Keltner and Gross 1999)*

Emotion is the experience of a form of biological response to environmental stimulus, resulting in physical and psychological changes and subsequent readiness for action. *(Frijda 1986)*

Affective Phenomena



Affective traits	Broad and general longer-lasting Less contextualized Less tied to a cause	Irritability, Positivity
Mood states		Bad mood, Good mood
Emotion states	*Directed and phasic*	Anger, Happiness
Sensory states		Pain, Pleasure



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Emotion is the experience of a form of *biological response* to *environmental stimulus*, resulting in *physical and psychological changes* and *subsequent readiness for action*. *(Frijda 1986)*

Four components:

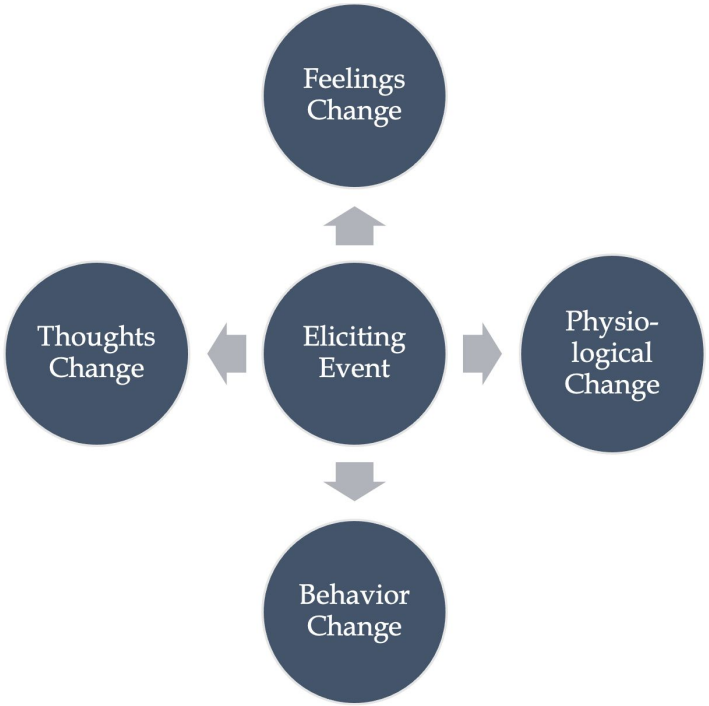
- behaviors (“action” and “communication”),
- subjective feelings (“experience”),
- thoughts (“perception”), and
- physiology (“physiology”).

These four components change after an eliciting event occurs.

An eliciting event is the situational cause that activates changes in these four components.

- An eliciting event could be external to the self, such as when the presence of a bear in our environment would cause fear.
- The eliciting event could be internal to the self, such as when we experience a drop in self-esteem because we lied to our friend, thus causing the emotion guilt.

Affect & Emotions (5)



https://psu.pb.unizin.org/psych425/chapter/is-it-an-emotion/

What‘s the Reason for Emotions?

- Emotions serve **individual** functions:
  - Help decision-making, avoid threats, assess challenges and opportunities within immediate environment

- Emotions serve **collective and social** functions:
  - **Dyads:** Signal mental states, reward/punish prior actions, evoke complementary or reciprocal behavior
  - **Groups:** Define group boundaries and members, define group roles and identitites, motivate collective action
  - **Cultures:** Define cultural identity, identify norms and values, affirm ideologies and power structures

Measuring Emotions

How to analyze or even measure emotions emotions?

- **Categorical approach**
  Categorical approaches emphasize differences between emotions and seek to identify discrete categories of emotion that are distinguishable

- **Dimensional approach**
  Dimensional approaches **emphasize similarities** between emotions and seek to identify underlying dimensions that account for this similarity

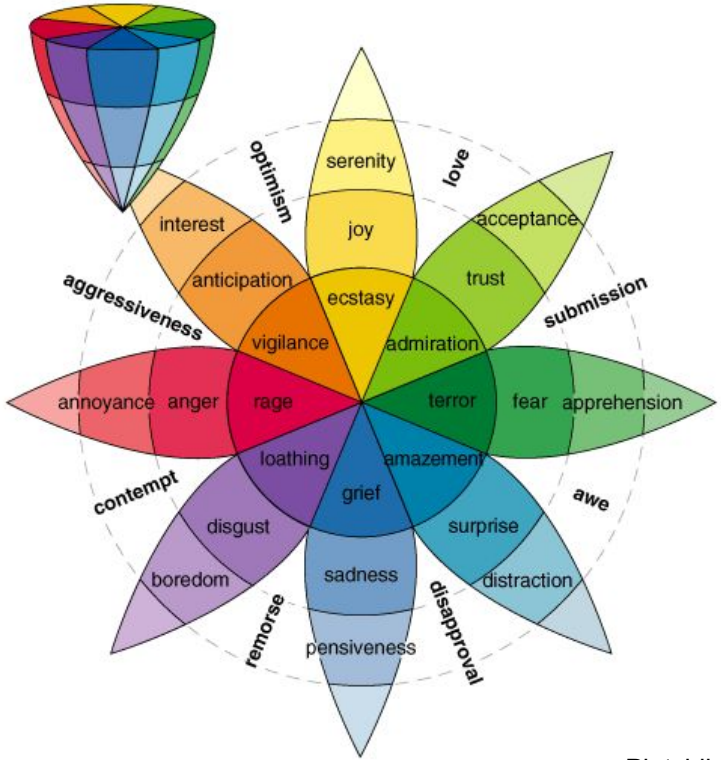
Measuring Emotions: Categorical Approaches

Discrete emotion theory or **Robert Plutchik's theory: Basic/primary emotions**

- Are common/innate to everyone
- Are irrespective of culture and individual differences
- Different emotions triggered by different brain regions
- Appear and start quickly

Emotions have three components:

- Subjective experience or feelings
- Associated physiological changes (aware of some of these; little or no conscious control of them)
- Behavior evoked

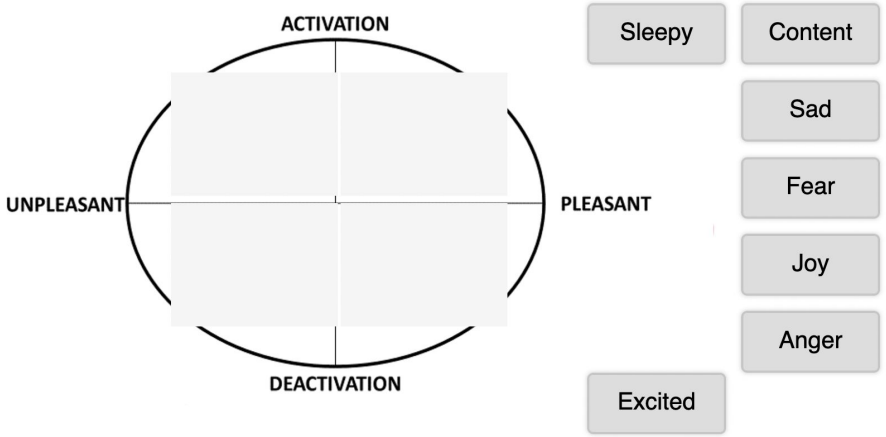


Plutchik (1981)

Measuring Emotions: Dimensional Approach

Circumplex Model of Affect

- Two-dimensional models focus on **Valence** - positive vs. negative **Arousal** - active vs. inactive
- These two dimensions for a circle or "circumplex model" which forms blends of the two dimensions



Yik, Russell, & Steiger (2011). A 12-point circumplex structure of core affect. Emotion, 11(4), 705–731.

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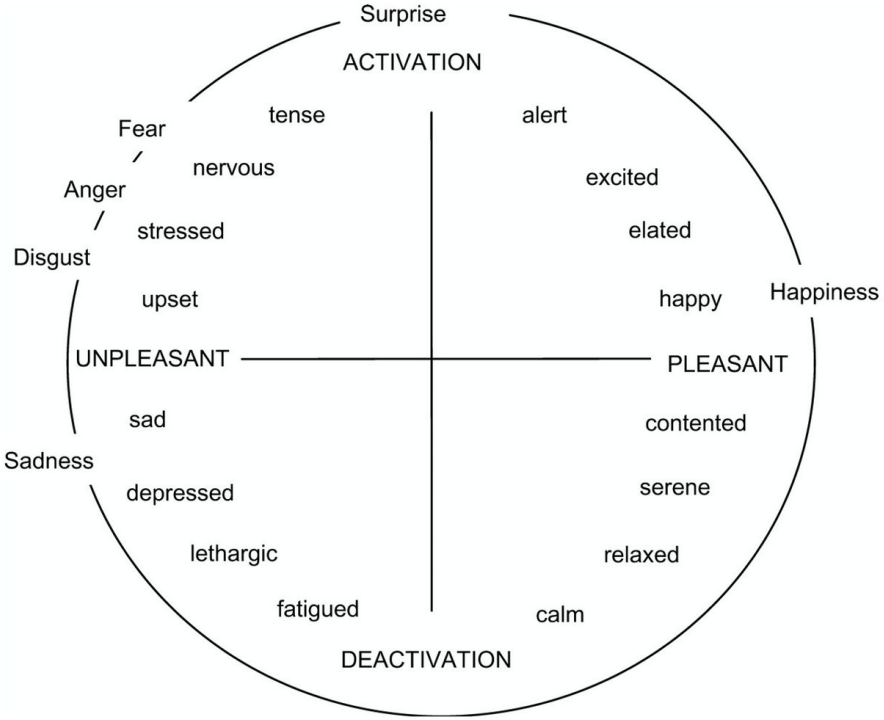

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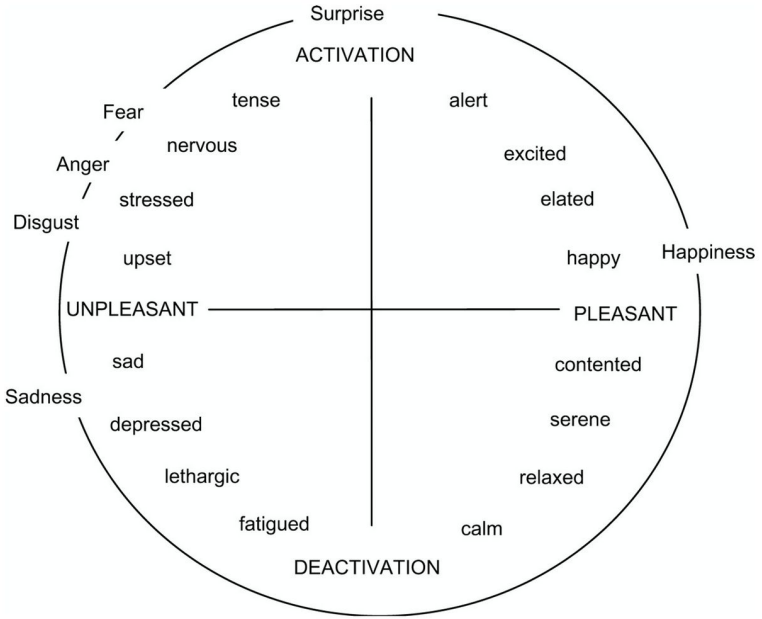
Valence

Valence is the subjective spectrum of positive-to-negative evaluation of an experience an individual may have had.

- The valence of an emotion refers to its positive or negative ‘charge’ or force. It is, as some have famously called it, the “heat of emotion” (Charland, 2005).
- Emotional valence refers to the emotion's consequences, emotion-eliciting circumstances, or subjective feelings or attitudes.
- It describes the extent to which an emotion is positive or negative



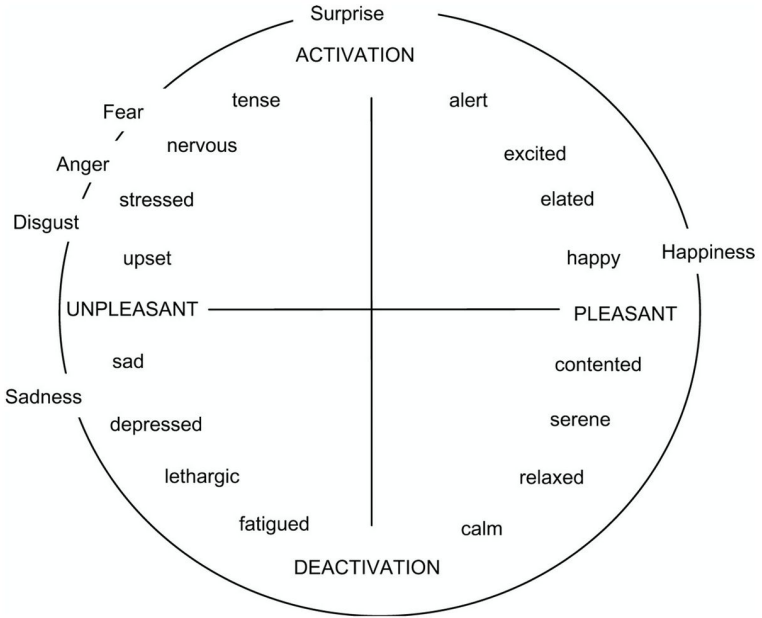
Vazard, J. Feeling the Unknown: Emotions of Uncertainty and Their Valence. *Erkenn* **89**, 1275–1294 (2024). https://doi.org/10.1007/s10670-022-00583-1

Arousal

- Arousal refers to a state of physiological activation or cortical responsiveness, associated with sensory stimulation and activation of fibers from the reticular activating system.
- Arousal refers to a state of excitement or energy expenditure linked to an emotion. Usually, arousal is closely related to a person's appraisal of the significance of an event or to the physical intensity of a stimulus. Arousal can either facilitate or debilitate performance. See also catastrophe theory.

Arousal is objectively measurable as activation of the sympathetic nervous system, but can also be assessed subjectively via self-report.

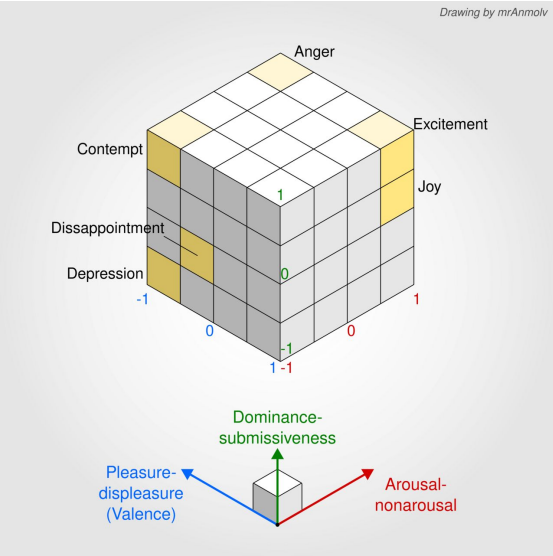
Arousal refers to an emotion‘s intensity level, i.e., the strength of the associated emotional state (Feldman Barrett & Russell, 1999; Lang, Bradley, & Cuthbert, 1997; Russell, 2003).



Measuring Emotions: Dimensional Approach

PAD Emotional State Model

- Three-dimensional models focus on
  Pleasure- positive vs. negative
  Arousal - active vs. inactive
  Dominance – dominant vs. submissive
- Pleasure and arousal represent the “core affect“.
- Dominance represents the appraisal process in an emotional episode. Representation of the cognitive assessment of the situation that elicits the emotion.



Mehrabian, A. (1996). Pleasure-arousal-dominance: A general framework for describing and measuring individual differences in temperament. Current Psychology, 14, 261-292.

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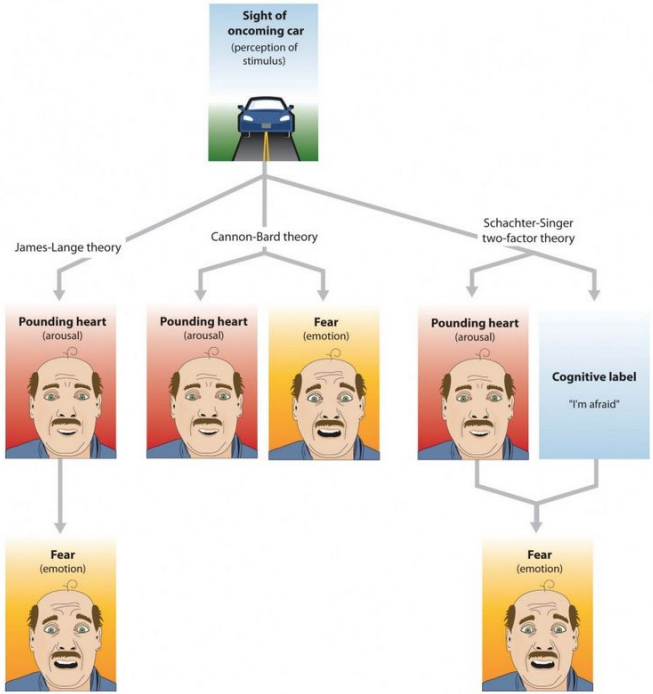
Theories of Emotions

There are multiple theories how emotions are created within the human body and mind.

Three Theories of Emotion:

- The James-Lange theory proposes the emotion is the result of arousal.
- The Cannon-Bard theory proposes that emotions and arousal occur at the same time.
- Schachter and Singer's two-factor model proposes that arousal and cognition combine to create emotion.



https://opentextbc.ca/introductiontopsychology/chapter/10-1-the-experience-of-emotion/

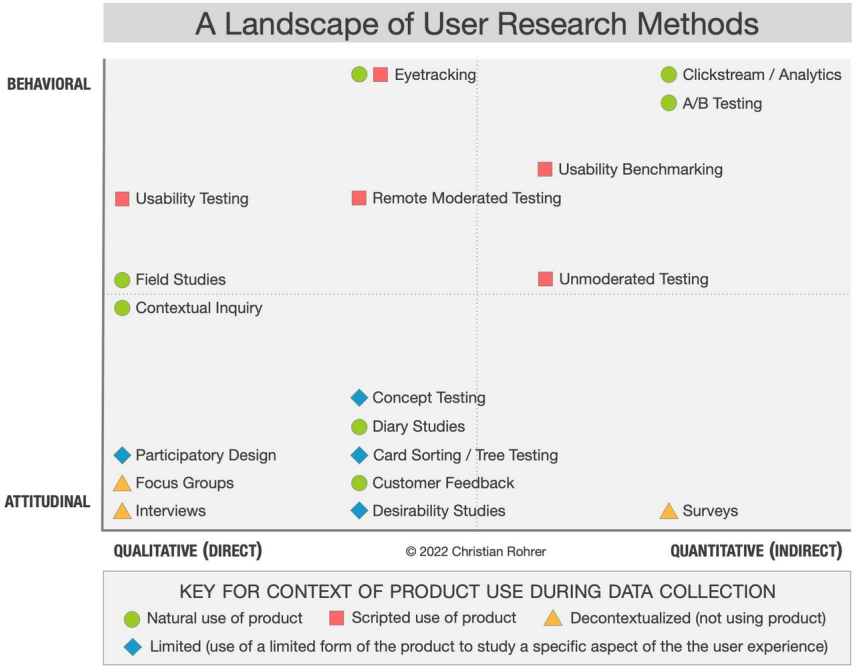
Methods

Methods for user research

The objective of user research is to understand the user, its motivation, and the expected behavior to inform a user-centered design.

To conduct user research there are multiple categories of data collection:

- Self-reported / Attitudinal data
- Behavioral data
- Physiological data & Neuroimaging data



https://www.nngroup.com/articles/which-ux-research-methods/

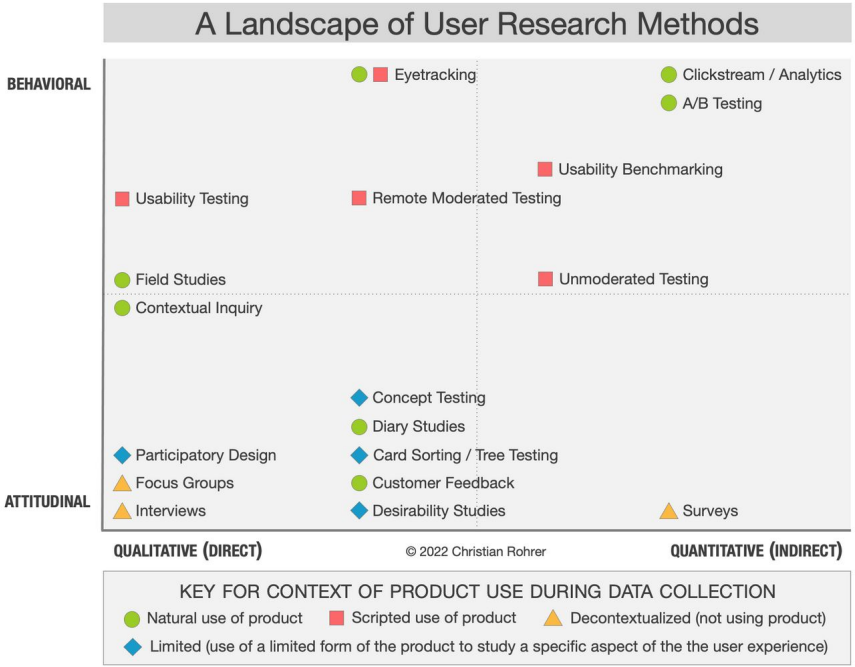
Self-reported data

This distinction can be summed up by **contrasting "what people say" versus "what people do"** (very often the two are quite different).

The purpose of attitudinal research is usually to understand or measure people's stated beliefs, but it is limited by what people are aware of and willing to report.

Examplary methods:

- Surveys
- Focus groups
- Interviews



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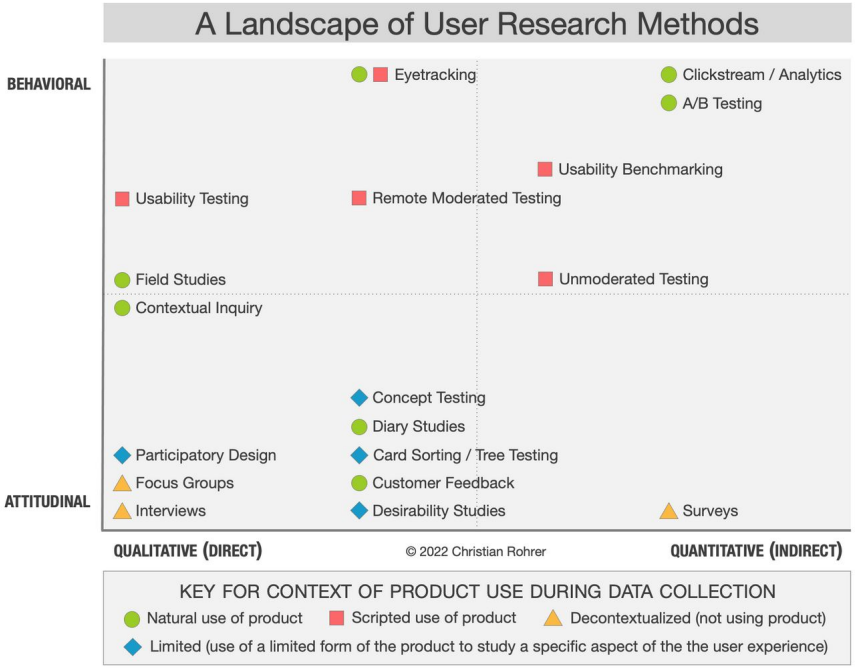
Behavioral data

On the other end of this dimension, methods that focus mostly on behavior seek to understand "what people do" with the product or service in question.

For example A/B testing presents changes to a site's design to random samples of site visitors but attempts to hold all else constant, in order to see the effect of different site-design choices on behavior.

Examplary methods:

- Usability testing
- A/B testing data
- Clickstream analysis



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Physiological data

Eye-tracking

- Heat Maps: Heat maps show where visitors looked and for how long. They use colors to indicate the duration of the gaze. Typically, colors shift from blue to red. Red areas on a page suggest that a participant or a group focused there for a longer time.
- Saccade Pathways: Saccade pathways map the eye's movements across different focus points. These pathways are displayed as lines on the screen. A red circle marks an area of focus, and a red line shows the eye's path moving from one focus point to another.

ECG: Analysis of heart rate data for arousal measurement.

Tobii launches UX Explore cloud platform, making eye-tracking-based mobile UX research more scalable APAC - English

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Tobii
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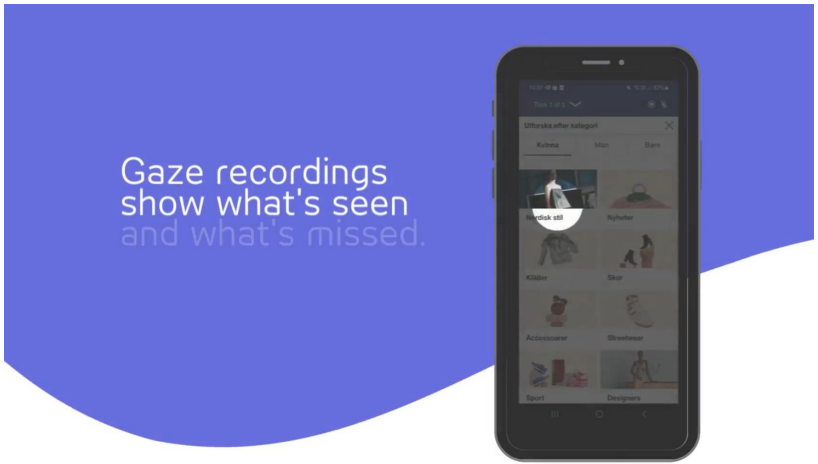

Questions, Comments, Observations