Summary for Quiz 2 **Human Centered Design** 2021 v1.0

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Creative Technology – M3: Living and working tomorrow.

According to course guide 2021.

Information taken from lectures and books.

Memory & Attention *Key qualities of human performance*

Memory

Prerequisite (voorwaarde) to learn, develop skills and raise performance.

Without memory there is no language, art, science or culture.

Human memory is not just simple data storage. It is related to *motivation*, *affect*, *awareness* and *attention*.

Types of memory

- Short-term — Working memory, useful at the moment of performing a task.
  - Size — Limited to three or four items we can remember at once.
  - Design rules — Limit simultaneous available items to 6.
    Chunk information. +31534894853 → +31 53 489 4853
    Design for recognition rather than recall.
- Long-term — Stores (fairly reliable) characteristics ("knowings") of aspects.
  - Size — Infinite, although this is yet to be proven.

Accuracy can be trained through repetition of storing and retrieving.

Affected by contents; prone to confusion and interference.

Dominancy by similarities, thinking you remember because something looks like something you know.

Memory retrieval is supported by context.

Forgetting

Memories that are non-available (it was not stored) or not accessible (due to fatigue, demand or a lack of attention) are forgotten.

Possible theories on why we forget:

- Decay theory — Memories fade away after some time, not much evidence.
- Displacement theory — Considered true for working memory, overwrites existing memories if the capacity of the working memory is reached.
- Disuse — Memories that are not used often may be forgotten after a time of not accessing or using them.
- Interference theory — Remembering similar items or skills are selected and excluded based on dominant usage. Switching between automatic and manual cars.

- Retrieval failure — Feels like you know that you know. Tip of the tongue phenomenon.

To prevent forgetting, apply the following design rules:

Be consistent, use standards. Follow conventions.

Speak the user's language. There should be no need to wonder what words and actions mean.

Attention

Concentration of mental effort on sensory (physical) or mental events.

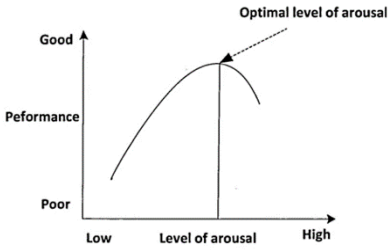
Attention is selective, there is competition between signals which can cause distraction.

Possible theories on how attention works:

- "Bottleneck" theory (Broadbent, Triesman, Norman) — Filter out attention while one single (and limited) channel of attention is available. Does not explain our capability of multi-tasking.
- Capacity allocation (Kahneman) — Capacity is applied to a task. Dependent on the task: balance between demand and allocated resources (homeostasis). This balance is influenced by arousal and non-voluntary control ("obliged" allocation of attention).
- Automatic & Controlled (Schneider, Shiffrin) — Information can be processed:
  - *Automatic* — For easy tasks. Resistant to change.
  - *Controlled* — When you consciously direct attention to the task.

Factors effects attention

- Positive stress (happiness, concentration) → Appropriate arousal.
- Negative stress (fatigue, anger or fear) → Inappropriate arousal.
- Physical condition (lack of sleep or rest).



Best performance is at optimal arousal, not too high, not too low.

Vigilance — Being alert to alarming situations. Such as being on watch.

Design rules
Make interactions interruptible, avoid rigidly required attention.
Allow user to define themselves pace and speed of interaction.
Optimize workload: not too high, not too low.

Arousal

State of being awoken, alert and ready to respond.

Needed to regulate consciousness, attention and information processing.

Too little or too much arousal can adversely affect task performance.

Preferred Task Demand (Workload)

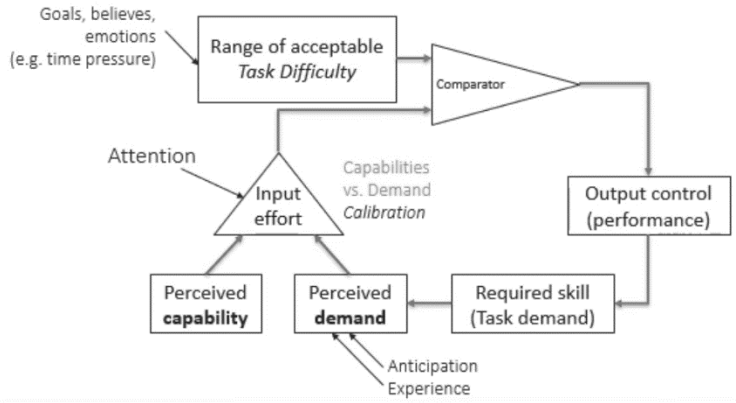
Lower boundaries (underload)

- Avoid boredom
- Prevent drowsiness

Higher boundaries (overload)

- Perceived capabilities, motivation.
- Task complexity, feasibility.

Task Capability Interface (TCI) model



To gain task difficulty homeostasis:

- Awareness of task demand
- Self-awareness

Range of acceptable task difficulty may rise due to priorities or emotions.

Attention has an influence on the effort we put in doing tasks but is also affected by the task itself.

Example:

When you are driving, and the circumstances change (for instance snow falls) there are two ways of reaching a balance you had when driving before. You put more effort into driving, or you reduce the speed to make driving easier (reduce the effort). The demand of the task became higher and we reached a balance by or changing the required capability (the speed) or increased our attention (effort) for the task. The change of speed also changed the required skill needed for the task.

Behavioural adaptation

If the difficulty of a task reduces there is a tendency to take more risks.

Often, we underestimate the risks due to supportive technologies → *Overreliance*

Grandpa on ebike goes zoef zoef, while he might not be capable of handling a bike with such power.

The netto safety effect of supportive technologies is often lower then theoretically possible.

Modalities for information transfer

Visual	+ High information density + Information transfer individually adaptable (and interruptible) - May be easily overlooked - Potential distraction (danger of too much and too many) + Positive relation to urgency vs irritation
Audible	- Low information density - Information not individually adaptable

 Audible	+ High urgency, advantages to attract attention. + Interruptive to other signals (advantageous for high urgency) o Moderate relation to urgency vs irritation
 Voice	- High cognitive workload when conveying detailed information - Information transfer not individually adaptable - Required attention competes with other signals (Relation urgency vs irritation not measured)
 Haptic Tactile	- Low information density + Fast transfer of signal via neuromuscular system o Information transfer not individually adaptable + Moderate to high urgency, advantages to attract attention. - Risk for startle (too high urgency)

Modality

Signals and modality influence selection of attention.

Signals convey urgency. Combinations of modality raise urgency.

Multi-sensorial information (e.g. visual or audible) are often intended to raise the effectiveness of signal.

Multi-sensorial information generally increases the perceived urgency.

If information from signals is identical, the reaction time improves.

Redundancy of signals does not necessarily increase signal reception. It reduces surplus in available attention.

If signals are improperly aligned → *confusion*.

For example, at train stations, if audio information does not match with what is on a screen we are confused. In conflict scenarios visual information is dominant (we tend to accept that instead of the other sources).