Exploring the sense of touch from a neuropsychological approach; addressing the TWMS

Jude Nicholas



Overview

A) From the sense of touch to Tactile Cognitions

B) The importance of Tactile Information Processing for people with deafblindness

C) Is tactile cognition a robust function?

D) Addressing the TWMS

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Looking at the past…

- Just two decades ago the sense of touch was considered “more primitive” or inferior to vision and hearing… consequently, far less (scientific) attention had been directed to the topic of understanding tactile functions.

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A) From the Sense of Touch to Tactile Cognitions

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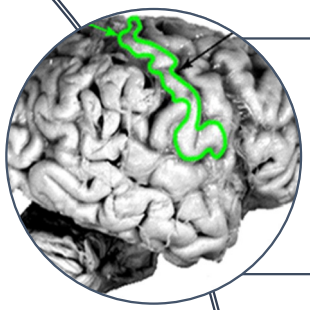
Philippe Mercier; The Sense of Touch; Circa 1744-1747

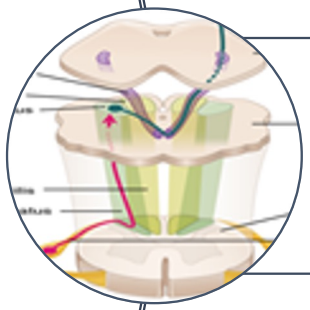
- The sense of touch is part of a purposive and information-seeking sensory system (i.e., somatosensory system)

The somatosensory system:
Processing of tactile/bodily-tactile information in a three-level system

ENVIRONMENT

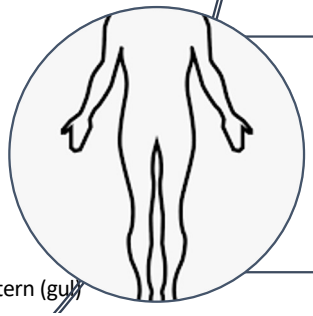


3. Tactile Cognition



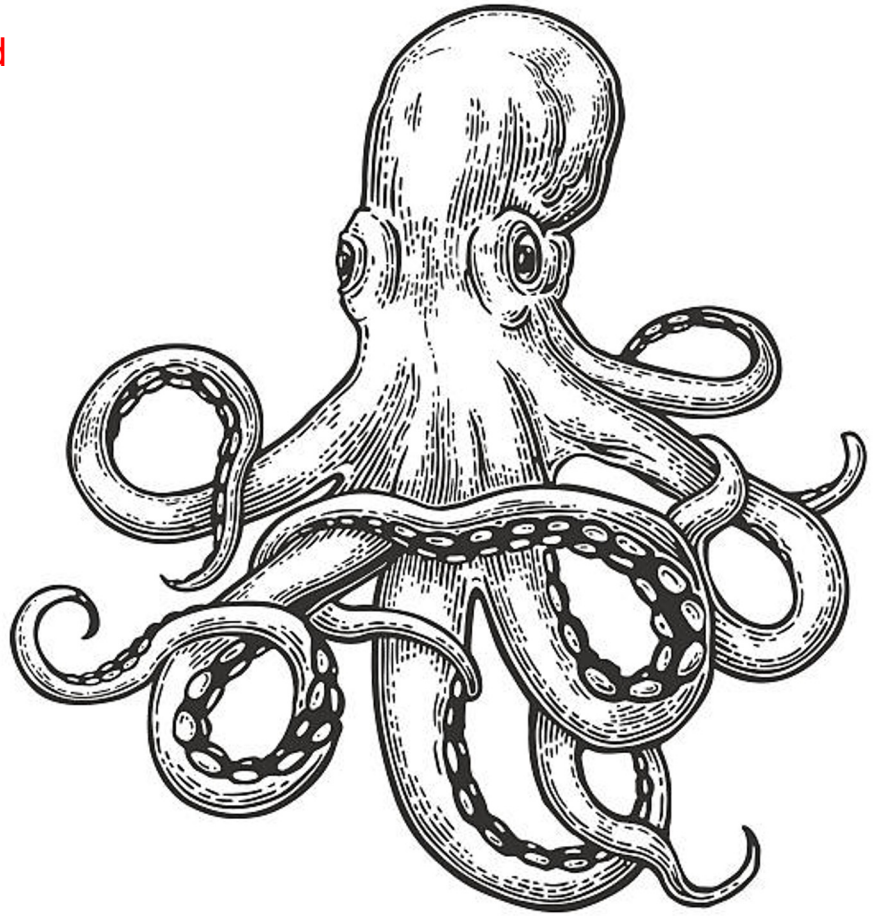
2. Tactile perception

Haptic perception/bodily-tactile perception



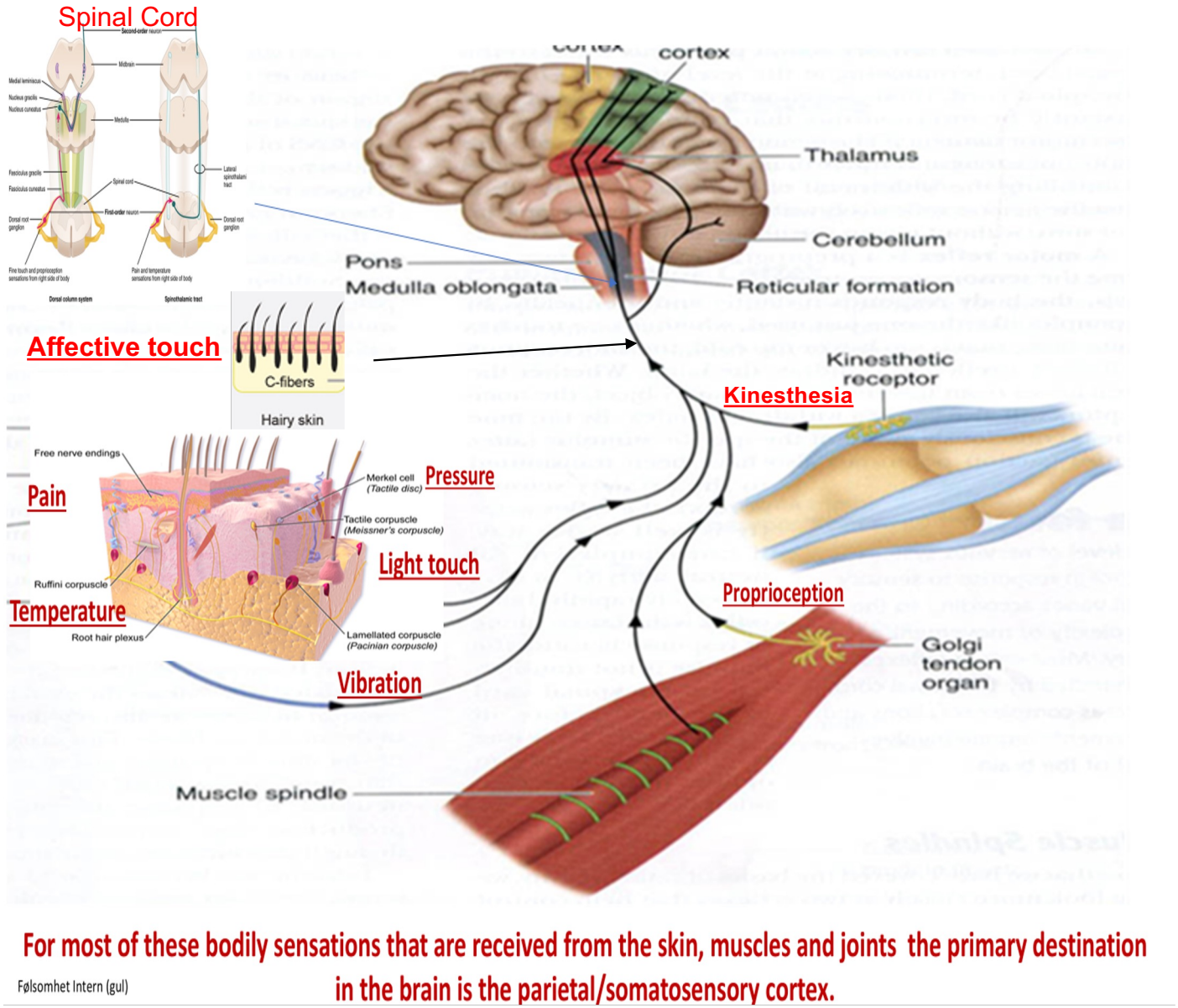
1. Somatosensations (bodily sensations)

The somatosensory system is a complex and multisensory system with sensory receptors spread across our bodies like the tentacles of an octopus



s
(body sensations)

- Somatosensation is the process by *which* ***physical energy*** is transduced by specialized receptors in the skin, muscle, joints or internal body into ***neural activity***, enabling the detection of **bodily sensations**.



For most of these bodily sensations that are received from the skin, muscles and joints the primary destination in the brain is the parietal/somatosensory cortex.

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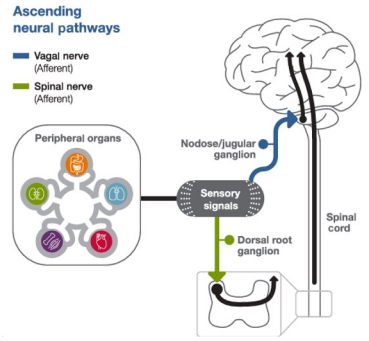
Somatosensations

- **Mechnoreception**
  - Light touch
  - Pressure
  - Vibration
  - Affective touch: *(pleasant social touch)*
- **Thermoception**
  - Temperature
- **Nociception**
  - Pain
- **Proprioception/ Kinesthesia**
  - Body`s own ability to sense its own position and location in space
  - Body`s own ability to sense the movement of body parts
- **Interoception**
  - Internal bodily signals (awareness of the internal body state)

Exteroception



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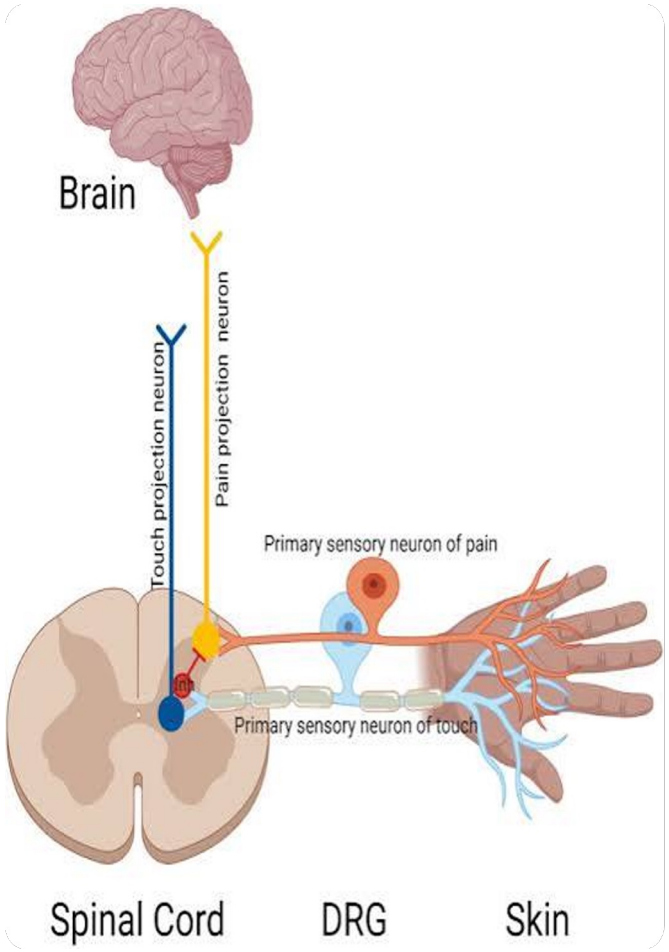

2. Tactile or haptic perception is the central nervous system`s ability to *interpret somatosensations* when physically exploring tactual properties of objects

The spinal cord acts as an active gatekeeper and integrator rather than a simple relay cable.

«Many a little thing has many names»

Tactile perception the specific involvement of the sense of touch through skin contact with an object or surface

Haptic perception/Bodily tactile perception is a broader term encompassing the sense of touch, proprioception/ kinesthesia, and includes low or high intimacy body contact (involved in Social Haptics, Tactile communication, Bodily-tactile interactions, Protactile sign language)

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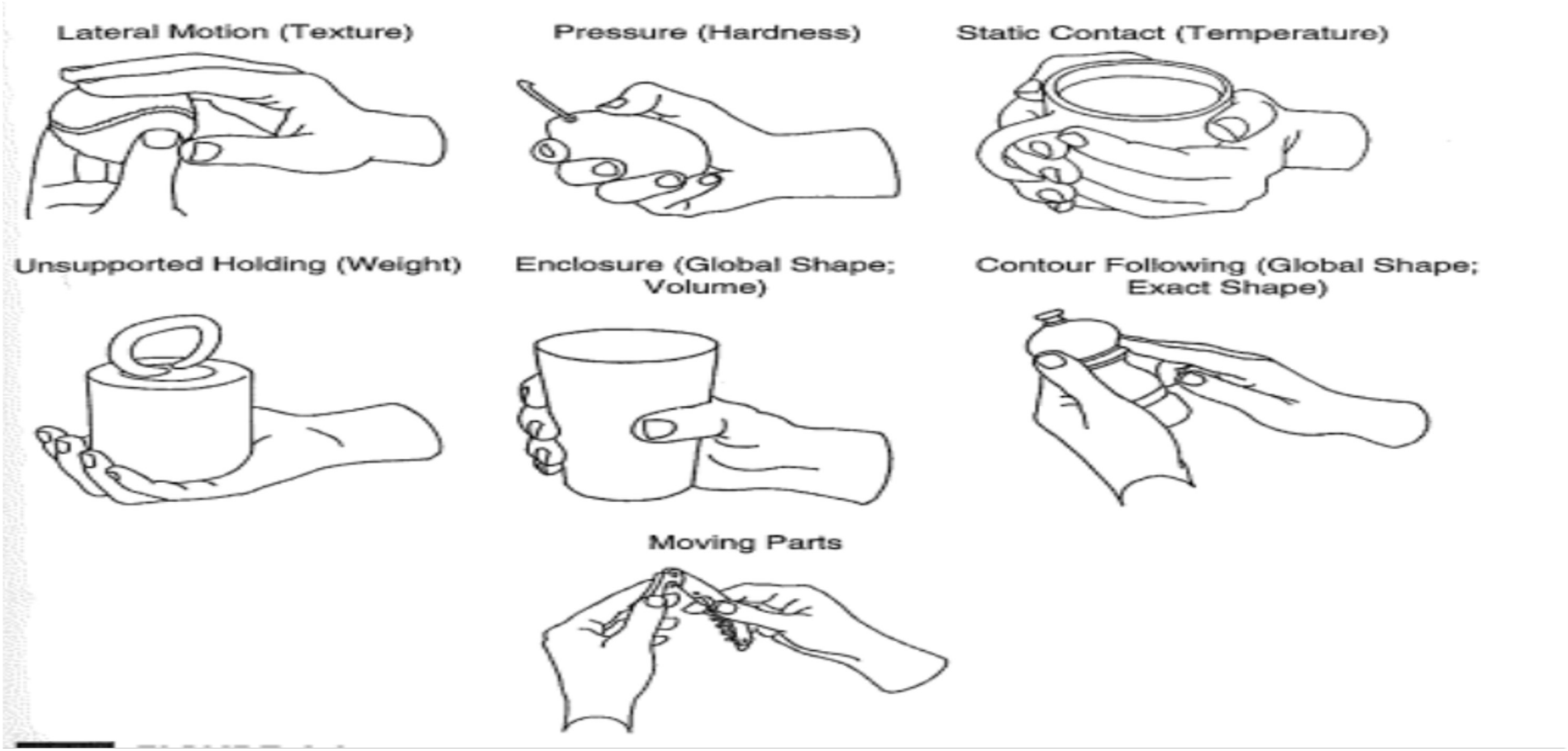
Low or high intimacy body contact are key aspects of social interactions and interpersonal relationships



Using specific exploratory procedures for the perception of specific tactual surface properties (i.e., hardness) or physical dimensions (i.e., weight)



(Lederman and Klatzky, 1987; Nicholas, Johannessen & van Nunen, 2019)

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Exploratory procedures follow a developmental progression

- Grabbing and grasping in infants are considered precursors for exploratory procedures (Klatzky, et. al., 2005)
- These exploratory procedures or tactual scanning stratagies have to be learned or acquired (Davidson, 1985).

3. Tactile cognition is the process by which the brain interprets and makes sense of the information received from the tactual world, enabling recognition, memory, and interaction.

It involves complex neural mechanisms that allow for perception, attention, working memory and memory.

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B) The importance of Tactile Information Processing for people with deafblindness

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- Tactile Information Processing refers to how we make use of available tactile information

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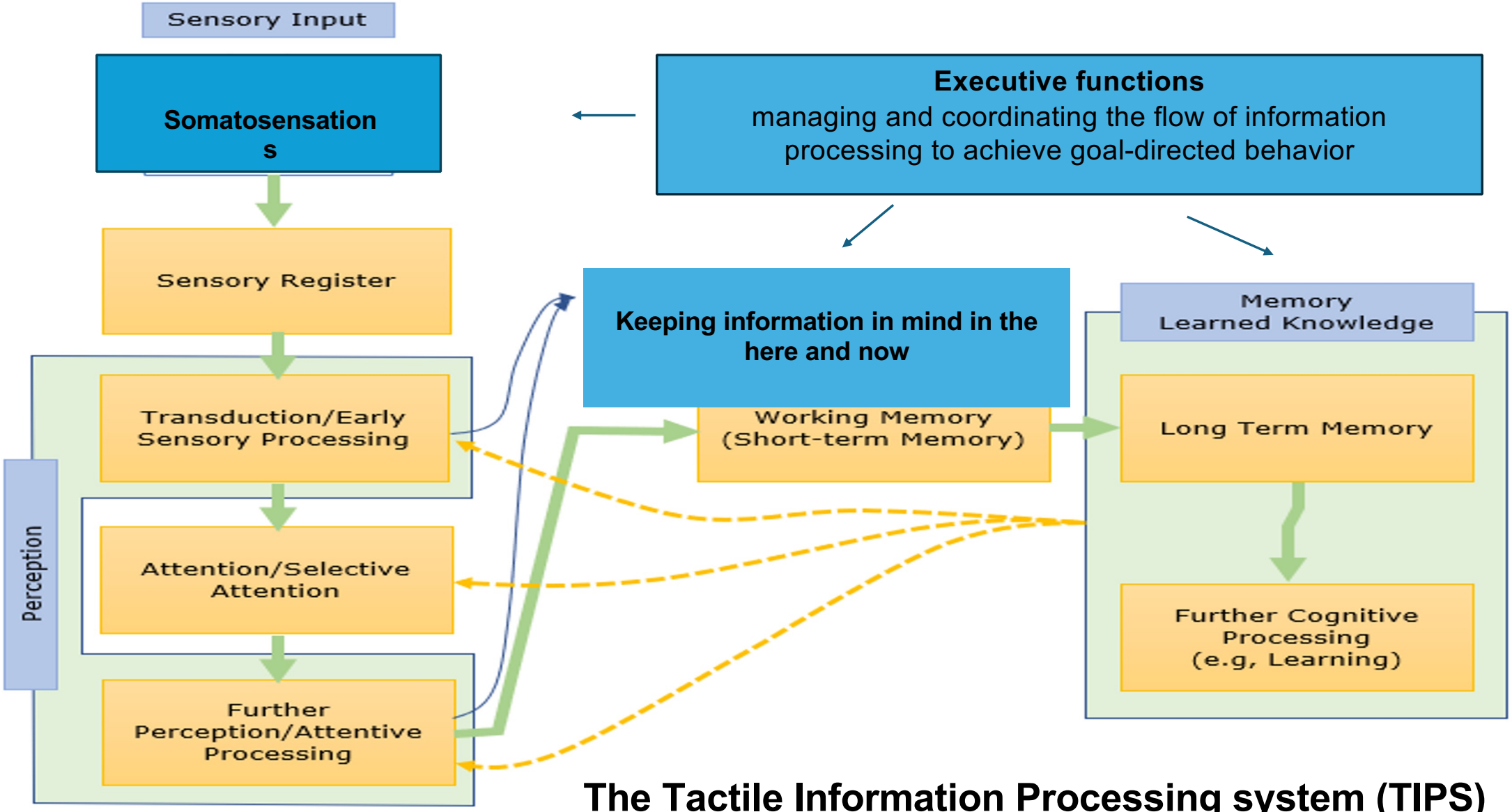

The Tactile Information Processing system (TIPS)

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Taking into account the TIPS, we should view deafblindness…

not as a negative state in which sight and hearing are fragmented or absent, but as a **positive state of being** in which the sense of touch, proprioception/ kinesthesia, and low or high intimacy body contact are the **main source for information processing**

- **C) Is tactile cognition a robust function?**

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The sense of touch generates powerful and long-lasting memories (Hutmacher & Kuhbandner, 2018; Hutmacher, 2019)

- In a study when 25 blindfolded participants **"tactually explored"** 168 household objects for one hour, the participants could remember the **correct objects 94%** just after the study period and **85% a week later.**
- **The sense of touch generates memories** that are far more complex and l**ong-lasting** than previously thought.



168 Objects (10 s per Object)

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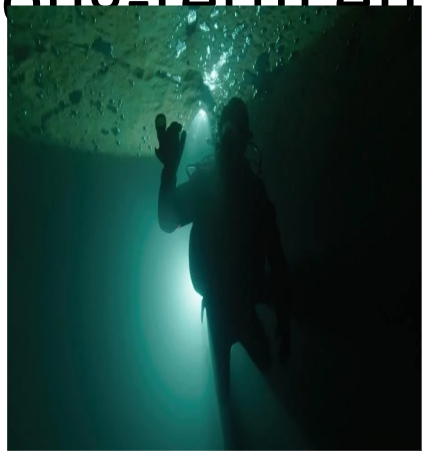
Ability of the tactile brain system to reorganize; (Bast-Pettersen , et. al., 2015)

- In a prospective longitudinal study, **superior ability of problem-solving and remembering in the tactile modality** was found in students at a school for professional divers, with long-term effects.



Practice makes perfect:
Experiencing blurry vision and muffled hearing during diving may increase the functional ability of the tactile system Due to tactile feedback, divers often compensate by relying heavily on touch cues for tasks in low-visibility and high-depth environments.

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Playing Mahjong is associated with better cognitive functional abilities in Older Individuals (Tse et at., 2024)

- The complex nature of **Mahjong,** which requires strategy, pattern recognition, working memory, and rapid decision-making **using the sense of touch,** supports cognitive enhancement and is linked to improved attention, and processing speed, while potentially reducing the risk of **Mild Cognitive Impairment.**



Tactile tiles with patterns are physical gaming tiles. These tiles are designed to be tactile, offering a tangible, textured feel for identification during play.

- **D) Addressing the TWMS**

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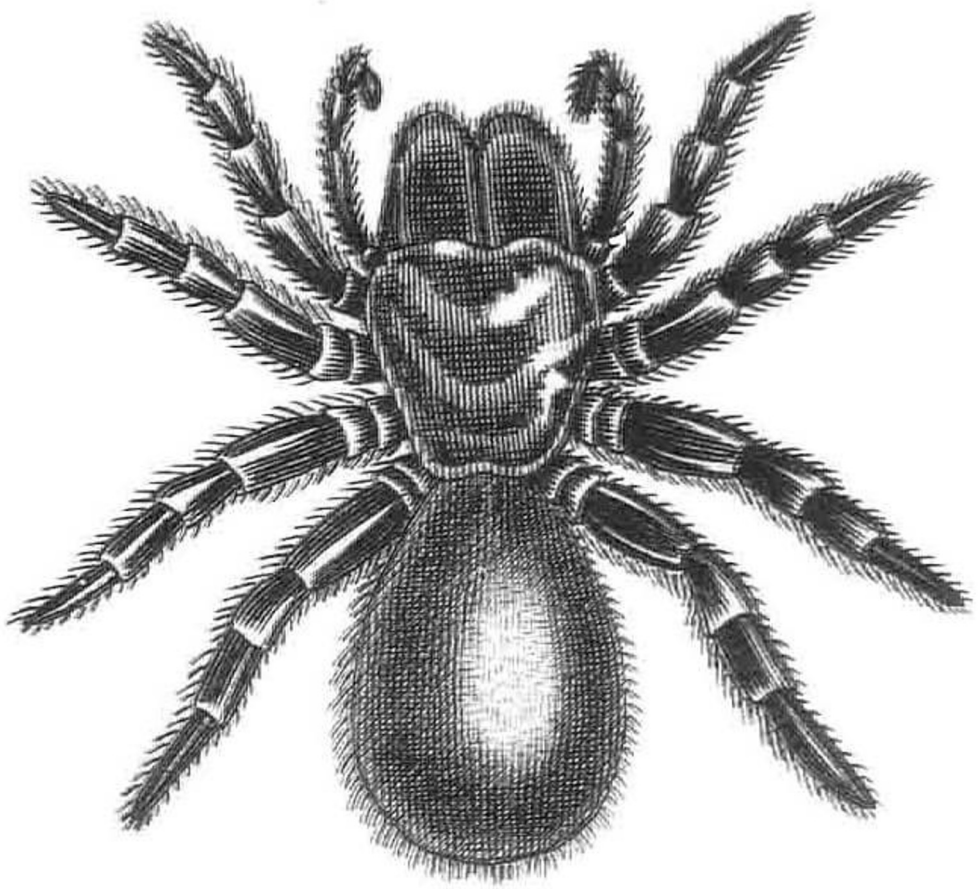
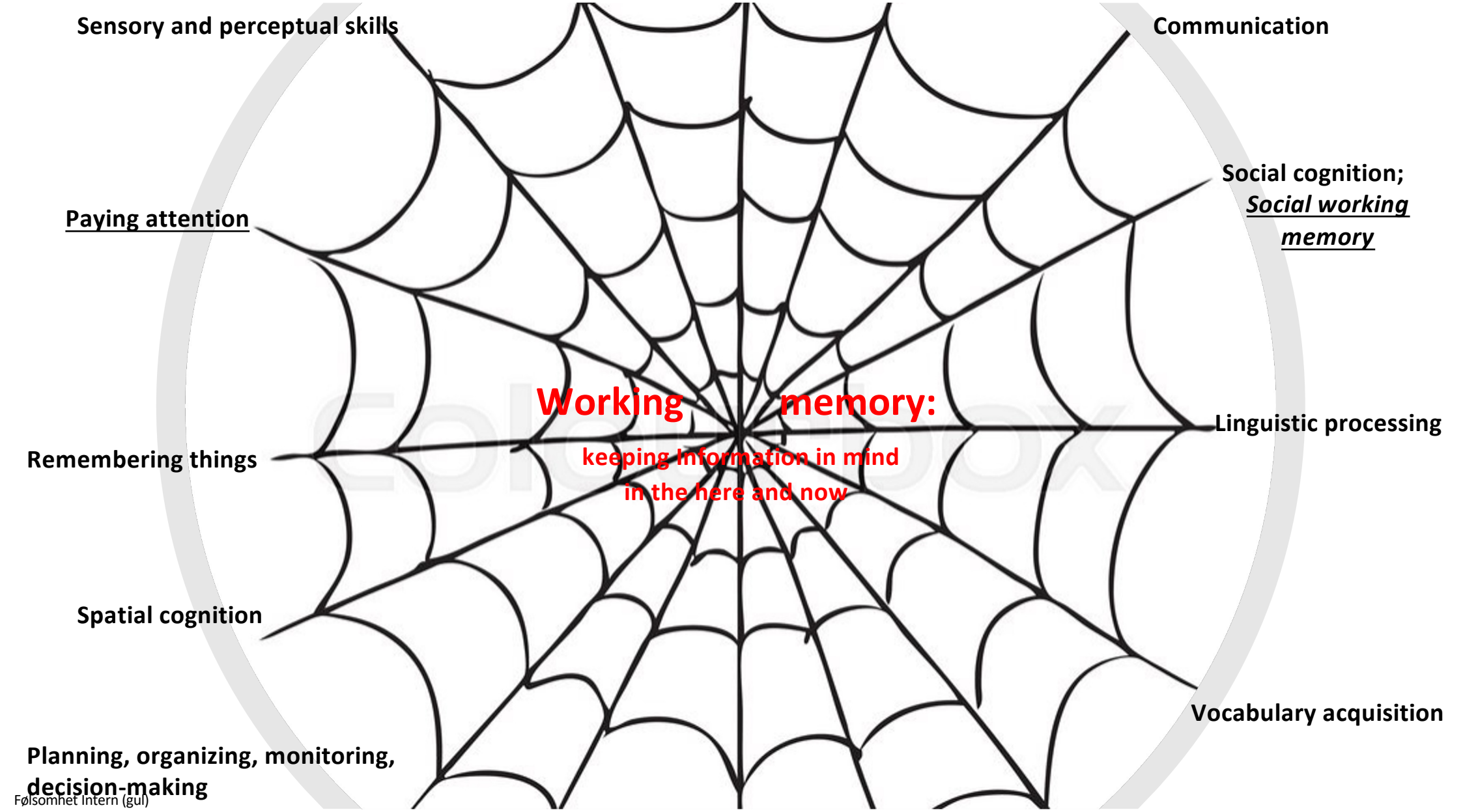
What is Working Memory (WM)?

Working memory allows us to keep Information in mind
in the here and now





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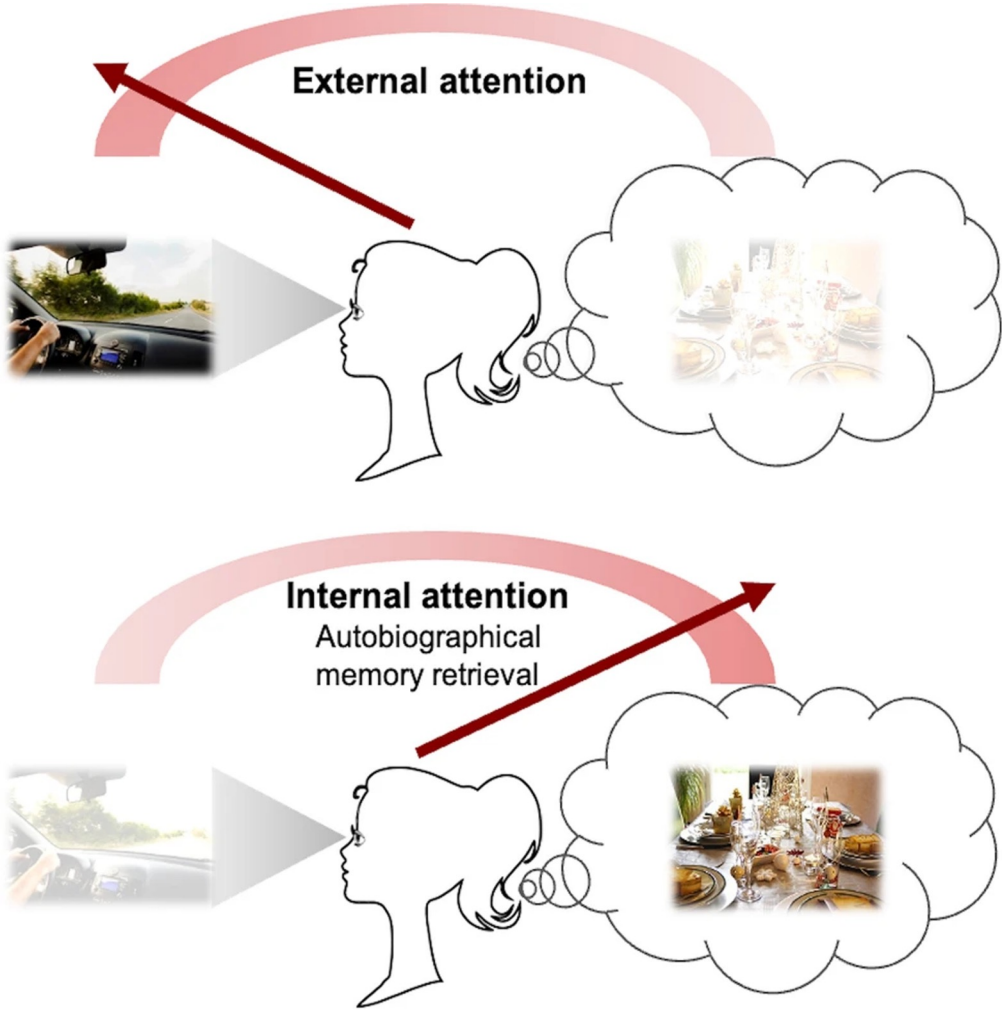
Working memory acts as a "mental workspace" for external and internal attention



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Social working memory is the brain's ability to hold, update, and use social information during active interactions



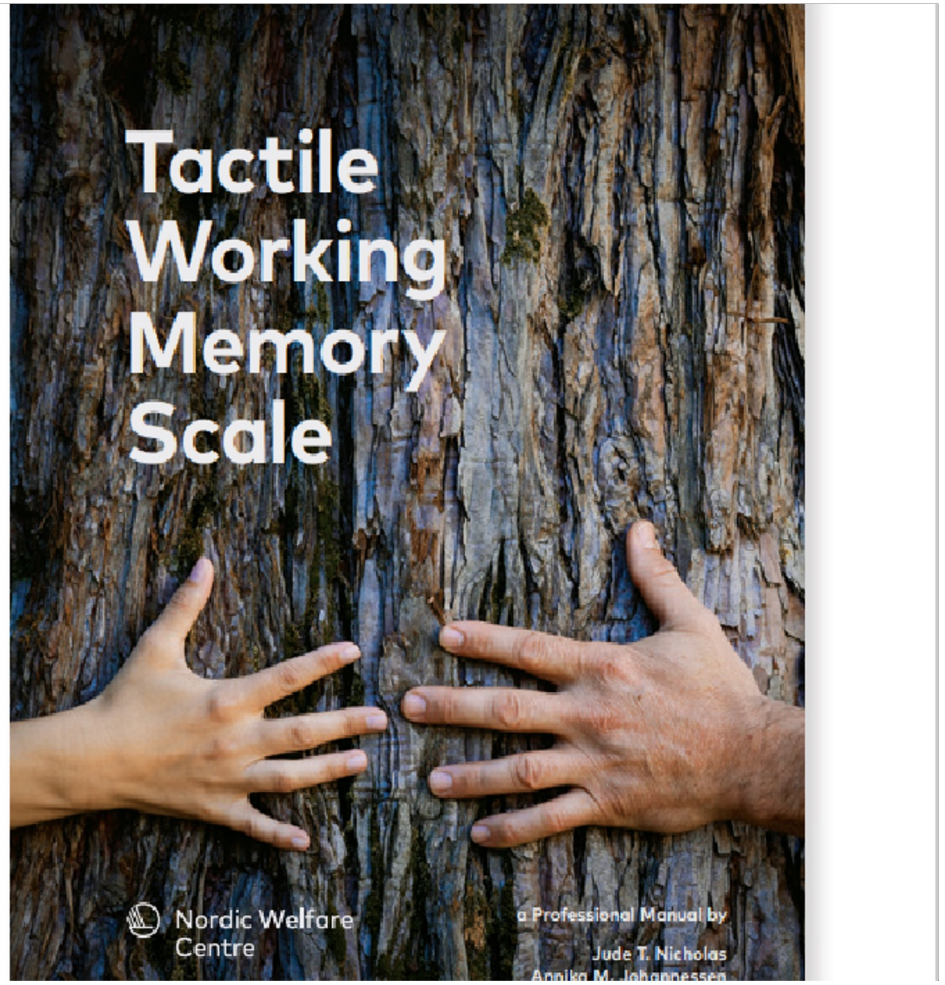


Tactile Working Memory Scale (TWMS)

A behavioral observation scale for identifying bodily-tactile working memory in everyday occurrences and during social interaction.

Jude T. Nicholas, Annika M. Johannessen and Trees van Nunen

Download at: https://nordicwelfare.org/wp-content/uploads/2019/12/NWC-TWMS-Handbok-webb.pdf



Main assessment goal

- The TWMS is designed to determine ability rather than to detect deficit, and may consequently impact how effectively interventions can be applied

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Assessment principles

TWMS assessment required a sophisticated view of understanding tactile working memory and the environmental influences, in which both internal and external factors play an equal role .

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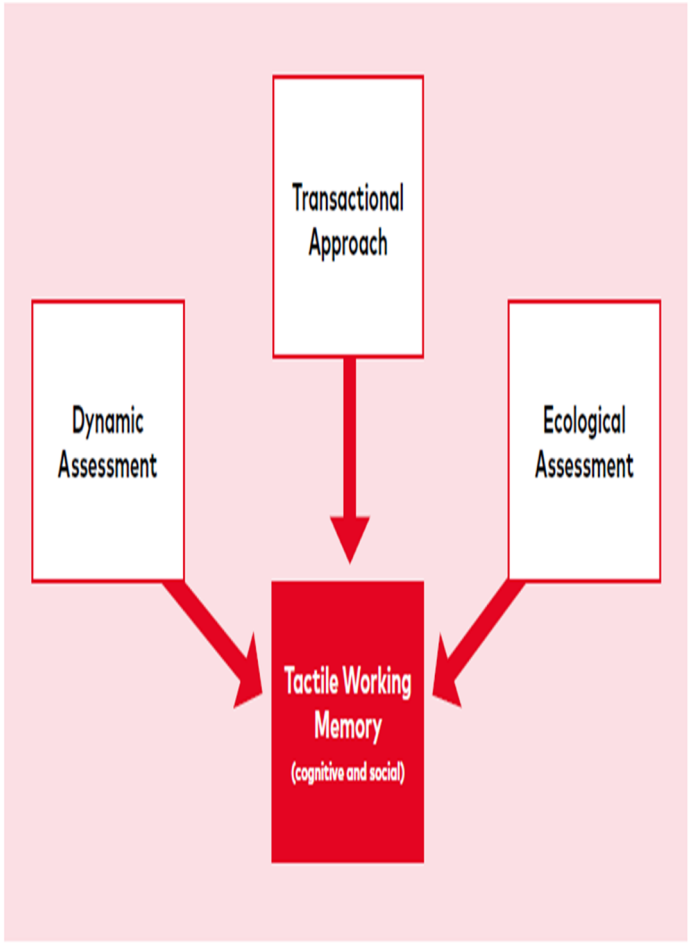
- Recognizing environments or settings in which the individual will function on an optimal level **(ecological):** *the person's competencies and potentials, as well as the systems within which he/she interacts*
- Focusing on the bidirectional and reciprocal exchanges between the person and social partner over time **(transactional):** the *potentials of the interaction partners*
- Integrating intervention into assessment and to support the individual to successfully perform **(dynamic):** *strength (not deficit, assets-based cognitive assessment; revealing learning potentials*



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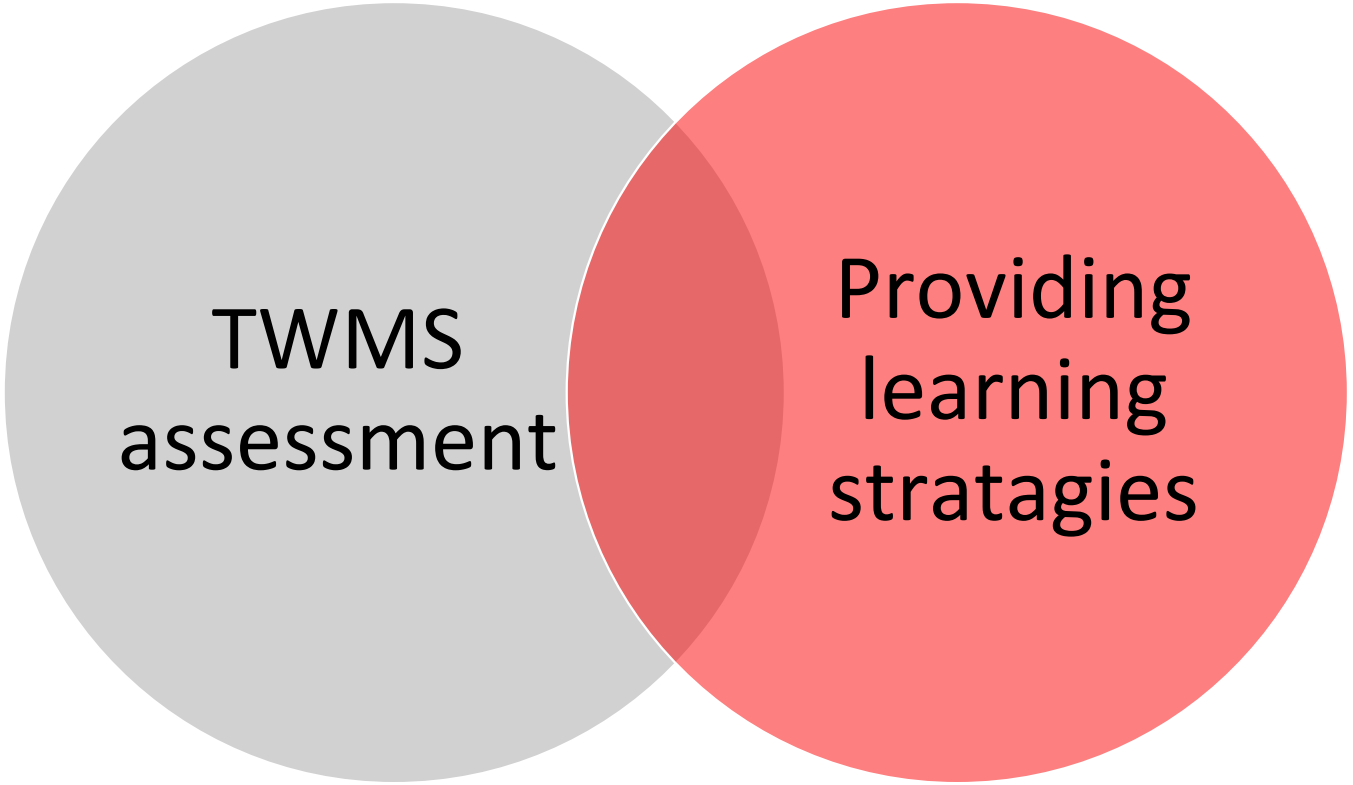

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20 items within **3 theoretically derived domains** that measure the perceptual, social cognitive and cognitive processes of tactile working memory, during tasks/activities & social interactions:

ENCODING (6 items)
(detection and initial interpretation)
MAINTAINING (7 items)
(temporarily retaining)
MANIPULATING (7 items)
(actively controlling /retrieval of stored information)



Categorized into 9 overlapping and non-overlapping item clusters

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Checklist of tactile learning strategies that supports Tactile Working Memory. (Nummedal, Johannessen & Nicholas, 2024)



https://www.dovblindhet.no/hvor-kan-jeg-lare/brosjyrer-og-boker/

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Why Tactile Working Memory?

- To gain a deeper understanding of the potentials of the tactile sense for people with deafblindness.
- Tactile-based instructions or interventions focusing on working memory could assist individuals with deafblindness for **enhancing their conscious awareness** of touch (i.e., acquired DB) or to acquire tactile skills for **enhancing their learning and communication** (i.e., congenital DB), when vision and hearing are not sufficient

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- Working memory which exists in the visual, auditory and tactile modalities, is a pivotal cognitive ability in humans, and we as humans tend to solve problems and make choices based on this **“here and now” unit of thought.**
- Particularly, this aspect has been highlighted in the 1922 novel “In Search of Lost Time” by the French author Marcel Proust, (French: À la recherche du temps perdu)...

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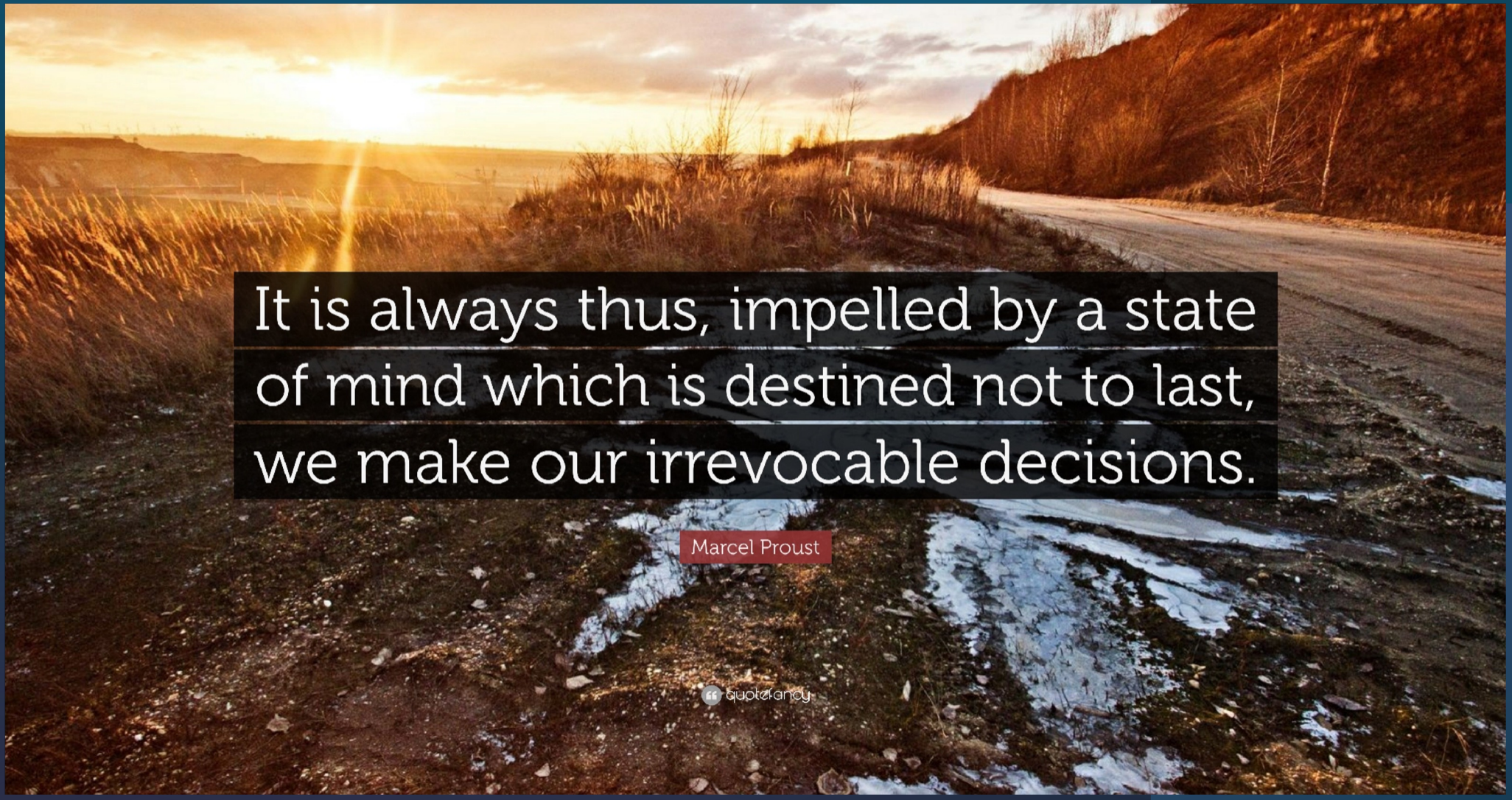
It is always thus, impelled by a state of mind which is destined not to last, we make our irrevocable decisions.
Marcel Proust
quotefancy


Thank You
For Your Attention