Diagnostic Palpation in Osteopathic Medicine:

A Putative Neurocognitive Model of Expertise

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Outline

- Palpation: sensation, perception and decision making
- Investigating the development of expertise in diagnostic reasoning in osteopathy
- Diagnostic palpation: a putative neurocognitive model of expertise
- Implications for practice and future research

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Background

- Clinical decision making in osteopathic medicine is typically based on the findings from the clinical examination.
- Diagnostic palpation seeks to determine the texture, compliance, warmth, humidity, tenderness and movement of soft tissues and joints (Lewit, 1999).

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Palpation and reliability

- Despite its central role in osteopathic medicine, diagnostic palpation lacks clinically acceptable levels of reliability (Seffinger et al., 2004; Stochkendahl et al., 2006).
- Interestingly, findings from studies in other fields of medicine demonstrate similar trends to those reported in the field of manual medicine (e.g. Yen et al., 2005).
- The reliability problem might be explained by how individual perceptual judgments regarding the nature of the lesion or dysfunction are made.

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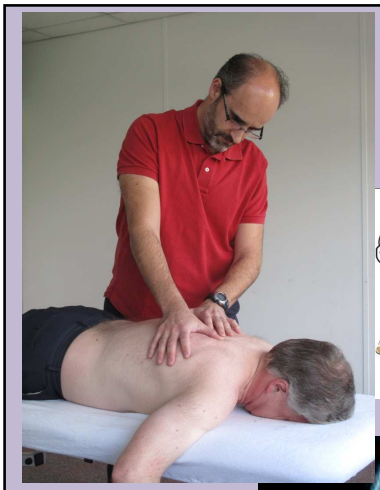
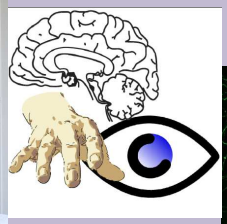
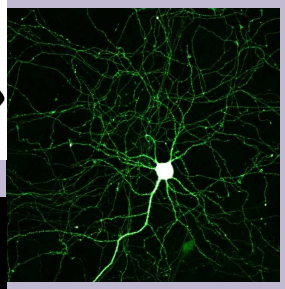
Sensation vs. perception in decision making







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Perception and decision making

- Osteopaths make perceptual judgments regarding the nature of the patient's clinical problem based on objective and subjective diagnostic data.
- Perception is, however, far from perfect (Dror, 2005). Human perception reflects a probabilistic process. Perceptual estimates will necessarily have some variance associated with it (e.g. Ernst, 2006).
- This variance may be attributed to the inherent noise of neural transmission in the CNS (Ernst and Bülthoff, 2004).

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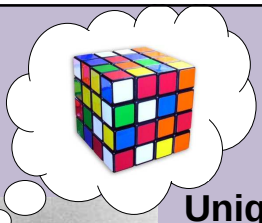
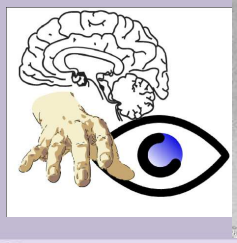
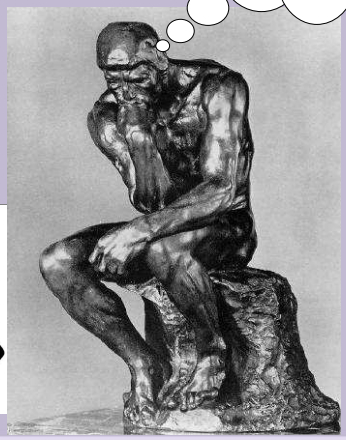
Diagnostic palpation…



Uniqueness?

Cognitive and perceptual processes…





Vision, haptics, multisensory perception…

Experience and neuroplasticity …

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Surveying the literature…

- Multisensory integration - combining and integrating the information from multiple different sensory modalities contributes to more robust perceptual estimates (Deneve and Pouget 2004; Ernst and Bulthoff 2004).
- Sensory Dominance: Vision for space, hearing for time, olfaction for appetitive, touch and olfaction for affective.
- Modality appropriateness and intersensory interactions in the judgment of specific perceptual attributes.
- Crossmodal attention (Spence and Driver, 2004)

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…more literature…

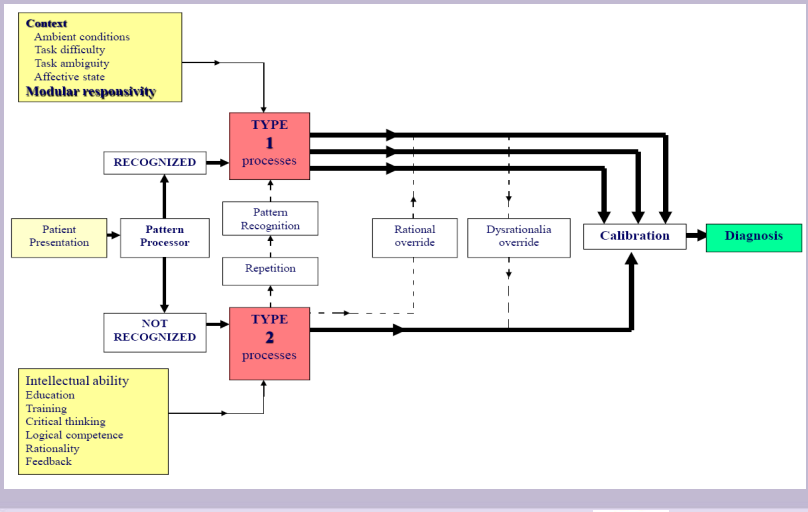
- Vision and haptics are likely to play a synergistic role, and occur within the context of crossmodal visuo-haptic networks (bimodal neurons in somatosensory and visual areas, Tal and Amedi, 2009).
- Perceptual judgments of somatic dysfunction likely to involve both top-down and bottom-up processing. Top-down processing associated with mental imagery is likely to play an important role.
- Experience-based neuroplasticity – changes at a structural and functional level.

Reasoning and decision making

- Dual-process theory (e.g.,Kahneman, 2003)
- System 1 is a rapid, automatic, and intuitive mode of processing which shares commonalities with perception. System 1 is highly contextualised.
- System 2 is a slow, deliberative, and analytical mode of processing.

Universal model of diagnostic reasoning

(Croskerry, 2009)



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Important research questions

- How do osteopaths coordinate different types of knowledge, reasoning strategies and memories from previous patient encounters in their clinical decision-making?
- How do expert osteopaths process and bind together diagnostic data across different senses?
- How does diagnostic data conveyed by different senses converge in the brain to form a perception of soft tissue dysfunction?

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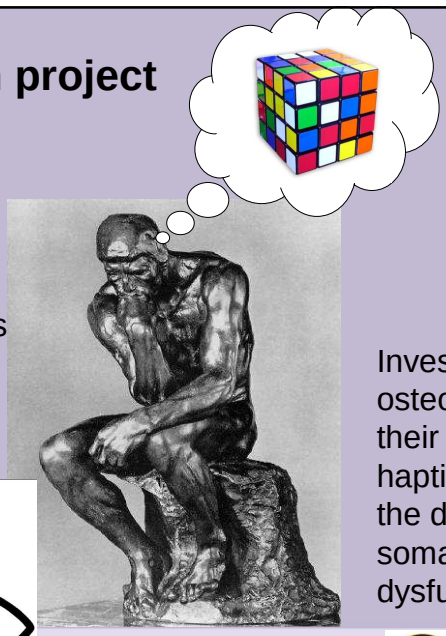
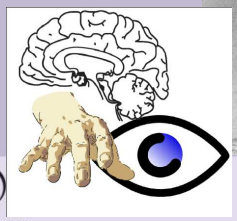
The research project

Examining the mental representation of knowledge and reasoning strategies in osteopathic clinical decision making





Investigating how osteopaths use their visual and haptic systems in the diagnosis of somatic dysfunction.

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Knowledge and reasoning: findings

- The development of expertise in osteopathic medicine is associated with the processes of knowledge encapsulation and script formation.
- Biomedical knowledge, however, remains strongly represented in the clinician's LTM.
- Analogical reasoning likely to promote the transfer between new and previous analogous clinical encounters encoded in the clinician's LTM.
- Experienced osteopaths made use of both Type 1 (non-analytical) and Type 2 (analytical) processing.

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Vision, haptics…the findings

- Ongoing clinical practice enables osteopaths to combine visual and haptic sensory signals in a more effective fashion.
- Visuo-haptic sensory integration is likely to be facilitated by top-down processing associated with mental imagery.
- Visual, tactile, and kinaesthetic imagery are likely to play a central role in enabling experts to access mental representations of normal and altered structure and function from their LTM.

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Overall findings

- The results of the six studies indicate that the development of expertise in diagnostic palpation in osteopathic medicine is associated with changes in cognitive processing.
- Whereas the experts' diagnostic judgments are heavily influenced by top-down, non-analytical processing; students rely, primarily, on bottom-up sensory processing from vision and haptics.
- Ongoing training and clinical practice are likely to lead to changes in the clinician's neurocognitive architecture.

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Putting it all together

Putative neurocognitive model of expertise in diagnostic palpation

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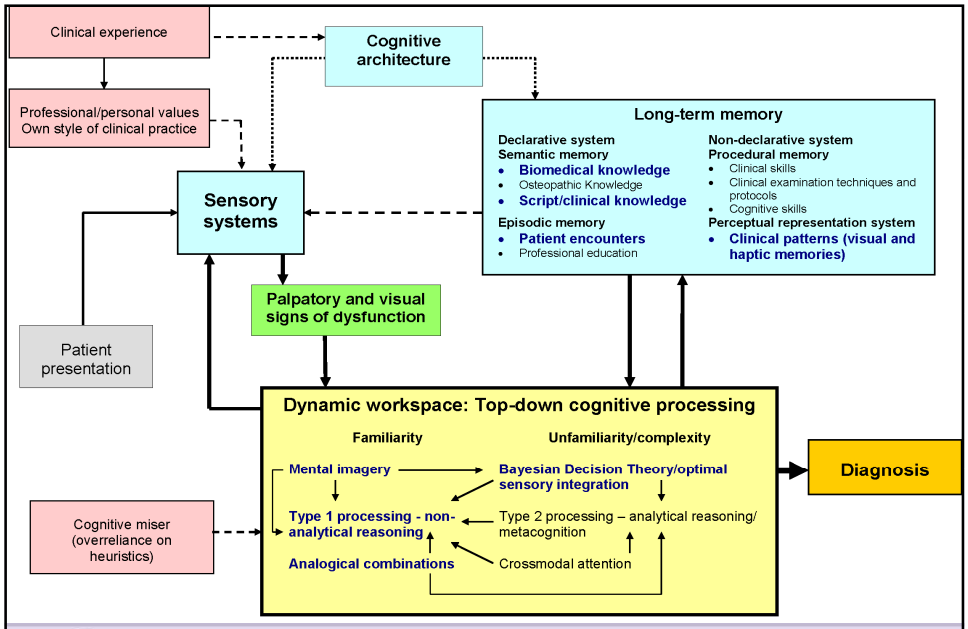

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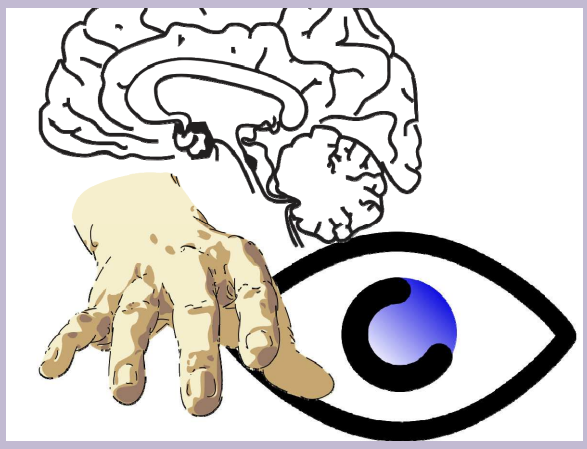

Vision and haptics or… mind's eye and mind's hand?

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Implications for education

- Students and clinicians should:
  - be encouraged to appraise the reliability of different sensory cues in the context of clinical examination;
  - combine sensory data from different channels;
  - and consider using both analytical and non-analytical reasoning in their decision making.
- As students progress through their programme of study, they should:
  - be encouraged to use available opportunities to experience normal and altered patterns of structure and function;
  - and reflect on the validity and reliability of their diagnostic judgments.

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Further research

- To investigate the neuroanatomical and neurophysiological changes that are likely to occur in the nervous systems of osteopaths, as a result of their extensive use of vision and haptics in patient diagnosis and management.
- To continue investigating the role of mental imagery and multisensory integration in the development of diagnostic expertise.
- To examine the role of verbal descriptions and analogies to the physical world commonly used by osteopaths to describe patterns of altered tissue texture and joint mobility.

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Acknowledgements

- Professor Charles Spence, Oxford University
- Professor Stephen Rayner, OBU
- Georgina Glenny, OBU
- All students and colleagues who keep asking WHY and HOW.
- In memory of Professor John Geake, University of Western Australia

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Thank you

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