Reconceptualizing the therapeutic alliance in osteopathic practice: integrating insights from phenomenology, psychology and enactive inference.

Keywords: Active Inference, Enactivism, Embodiment, Therapeutic Alliance, Interoception, Touch, Narrative

Abstract (197 words)

This review presents key concepts from neurophysiology, phenomenology, psychology, and narrative medicine which underpin a developing enactive-ecological framework for osteopathic practice. This framework aims to provides a coherent theoretical basis for understanding healthcare processes and outcomes, based on the neuroscience principles of active inference and enactivism. It offers insights into factors that influence patients' pain perception and behaviour and foster or inhibit the development of effective therapeutic relationships. Although this approach offers promising opportunities to increase the scope of care by harnessing potential in the unique embodied ecological niches created between patients and osteopaths, it raises challenges to traditional treatment agendas. Healthcare which frames the patient-as-a person, and acknowledges the multidimensional nature of the self, requires practitioners to be collaborative and self-aware, and be able to elicit patients' lived experiences and body stories. Phenomenological and psychological studies into enactivism emphasise the complex, dynamic nature of therapeutic relationships and the need to understand each person's unique lifeworld context. The new framework represents an important step forward, but further research is now needed to explore ways of integrating active and enactive inference into practice, of developing psychological or mindful self- and body-awareness, and narrative communication skills for shared sense-making.

Introduction

This review presents some of the concepts from neurophysiology, phenomenology, psychology, and narrative medicine which underpin a new 'enactive-ecological' framework developed by Esteves et al (2022). Their framework aims to provide a sound theoretical basis for osteopathic interventions using the principles of Active Inference (AI) to illustrate how human behaviour is based on inferences about interoceptive, exteroceptive and proprioceptive inputs, cognitive beliefs and prior experiences of engagement with the lived world. AI is a key neuroscience concept in models of predictive coding and Bayesian brain processing, and also in the broader approaches of predictive engagement and embodied perspectives of the mind (Gallagher and Allen 2018; Kirchhoff 2017). These concepts are currently influencing philosophy, neuroscience, psychology, mental health (Nielsen and Ward 2018; De Haan, 2020) and osteopathy (Bohlen et al 2021), where advances in understanding the role of AI include collaborative communication and shared meaning-making (Kim et al 2022).

The new enactive-ecological framework enhances our understanding about patients' beliefs and pain-related behaviour, but it also has implications for clinical practice. This review does not aim to provide answers about the 'proper' scope of osteopathy but to outline aspects of AI that pose challenges to current approaches to practice. In the past, osteopathic education placed limited emphasis on the psychological, sociocultural and environmental factors considered central to person-centred healthcare. The new enactive-ecological framework suggests the benefits of collaborative therapeutic relationships which focus on the patient-as-a-person and awareness of the wide range of factors that affect pain perception and behaviour. For clarity, complex inter-related concepts describing the multidimensional nature of the 'self' are presented in separate sections exploring phenomenology, psychology, neuroscience, narrative medicine and clinical practice.

Active inference and Enactivism

Active inference provides a framework for understanding human behaviour in a wide range of contexts, but research is divided between studies that focus on brain processes or the brain-body-environment (Kirchhoff 2017). The philosophical assumptions of neurocomputational coding processes in the brain can be considered conflicting or complementary to enactive, embodied theories of mind, where engagement is key to conscious lived experience. Earlier neurophysiological research into AI is now complemented by theories of enactive inference, social cognition and phenomenological approaches to understanding lived experience. Gallagher and Allen (2018)

outlined three models of AI as a means of understanding sentient behaviour involving different philosophical assumptions and research methods: predictive coding, processing or engagement.

Humans navigate complex environments by making judgments about observations and interoceptive information, but our capacity to 'know' the outside world is limited by biological capacity. Parts of the world are hidden from our limited senses, so brains must make predictions. Predictive models are used to infer what is happening in and around us and assess what action to take: enactivism, which arose from embodied cognition (Varela et al., 1993; Damasio, 2000; Foglia and Wilson, 2013; De Haan, 2020). Stilwell and Harman (2019) proposed inseparable, interconnected states between the mind, body and environment (Stilwell and Harman, 2019:656), and paraphrased an enactive understanding of pain from Thompson (2014; 2020):

"Saying that pain is in the brain is like saying flight is in a bird's wings. A brain is needed to have pain and wings are needed to fly – but to understand pain or flight, one needs to consider the whole picture and the relational nature between things like a person (with a body/brain) and their social/environmental context; or the bird and the atmosphere. It follows that the experience of pain will not be found in the blood, brain, or other bodily tissues. The tissues in the body or the networks in the brain are not the key to pain – instead they are pieces of a larger system that is adapting and striving to sustain into the future. This always involves the environment that we shape and that shapes us."

Pain is an important factor in human survival mechanisms and has been conceptualised in the '5E' model as Embodied, Embedded, Enacted, Emotive and Extended (Stilwell and Harman 2019).

Embodied – phenomenologically "It is through my body that I understand other people" (Merleau-Ponty 1962:186). Our bodies simultaneously enable and limit our understanding and capacity to act.

Embedded – we make sense of our world using sensory information and past experiences, influenced by cultural, social and environmental factors and cognitive processes.

Enacted – we create understanding by interacting with people, the environment and cognitive sense-making, and then enact what is significant or meaningful in the world we perceive.

Emotive – cognition and emotion are intrinsically integrated at "biological, psychological and phenomenological levels" (Thompson & Stapleton, 2009:26). Emotions enable people to make meaning, so they are "constructions of the world, not reactions to it" (Barrett, 2017:16).

Extended – this challenges the notion of internal representations of the world. "A person does not "have" a model of the world, instead ... it *is* the model" (Gallagher, 2018; p.441).

Enactive approaches emphasise relationships between people and their environments, where pain is a "relational and emergent process of sense-making through a lived-body" (Stilwell and Harman, 2019:637). This contradicts theories that pain is located in body tissues and raises challenges to the artificial boundaries between the domains in the biopsychosocial model.

The free energy principle (FEP) and predictive coding theories explain how organisms use perception, action and learning to optimise their environment (Friston, 2010). FEP is a "unifying theory of brain and bio-behaviour" (Ramstead et al., 2018:1), which explains how organisms aim to minimise variations in free energy by reducing differences between predicted and actual state (e.g., Friston, 2013). Predictive coding is based on Bayesian Brain theory (Friston et al., 2017; Ongaro and Kaptchuk, 2018; Ramstead et al., 2020), which assumes that brains make predictions using interoceptive, exteroceptive and proprioceptive information and past experiences. Differences between expectations and lived experience create 'prediction errors', which require updates to avoid being surprised by unexpected situations where the need to initiate sudden action would use valuable resources (Kuperman et al 2020).

For example, if patients expect to feel pain when bending, they may misinterpret normal sensations to minimise the gap between prediction and feelings by aligning sensory inputs with prior expectations. Internal states can be altered to reduce prediction error (changing perception), or action can be taken to confirm 'top-down' predictions (changing the body). Combining perception and action typically provides better outcomes (Ramstead et al., 2018; Parr & Friston, 2019b) and enactive inference links embodiment, enactment and adaptive agency (Ramstead et al., 2020), which aligns with osteopathic concepts of function and person-centred care (Tyreman 2020). Prediction errors can be used to challenge and update prior predictions. In osteopathic practice, for example, being 'surprised' when a feared movement is pain-free helps patients become aware of automatic reactions and conscious reflection on prior predictions can change expectations about their physical capacities.

Sense making and Affordance

Theories of enactivism propose that organisms have to make sense of their environment for short and long-term survival needs (Thompson & Stapleton, 2009; Arandia & Di Paolo, 2021). Sense-making involves interactive, relational processes dependent on the environment and the organism's capacity for understanding. In allostasis, the body predicts and regulates energy needs before they occur (Barrett et al., 2016; Hutchinson and Barrett, 2019) and FEP minimises energy expenditure by making accurate environmental predictions. Enactivism focuses on how agents act on their surroundings, in contrast to ecological approaches which "select the opposite starting point, describing how the structure of the world shapes the subject's possibility to act" (Coninx and Stilwell 2021:4). In ecological psychology, possibilities for action are described as 'affordances' (Gibson, 1977; Rietveld, 2014). People perceive different affordances, determined by the environment and their capacity to use objects in the environment (Coninx and Stilwell, 2021) Enactive healthcare involves engaging with the patient's story and clinical outcomes are dependent on participatory sense-making between two autonomous people (De Jaegher and Di Paolo, 2007; Fuchs and De Jaegher, 2009; De Jaegher, 2018). Patient-practitioner dyads create 'ecological niches' (Vasil et al 2020), where affordances can be increased by practitioners' influence on patients, and vice versa. These concepts provide a framework for understanding complexity and dynamic intersubjectivity in therapeutic alliances (Shaw, 2003, 2004; Connolly, 2022).

In osteopathy, sense-making processes link enactivism and agency (Tyreman, 2013, 2018b). People who view the world as dangerous generate predictions to minimise free energy, so the world does not change but they limit activities which reduces agency in their lifeworld. The Skilled Intentionality Framework (SIF) is an ecological-enactive position where clinicians are sensitive to patients' sense-making and aware of a wide range of affordances (Rietveld et al 2018). Skilled intentionality and participatory sense-making, including touch and non-verbal communication (McParlin et al 2022) can enable practitioners to expand patients' beliefs about physical activity (Coninx and Stilwell 2021) and re-engage with a wider field of affordances (Morrison et al, 2009; Morrison, et al 2011).

In participatory sense-making, synchronisation occurs through collaborative communication (McParlin et al., 2022), and in strong therapeutic alliances, attuning to patients' needs enables practitioners to challenge patients' beliefs. "The precision of one's prior beliefs relative to another agent with whom one is coupled, has important implications for the degree and the direction of attunement with and across couplings" (Vasil et al., 2020:12). Participatory sense-making requires active collaboration and engagement with patients' beliefs and values, which contrasts with therapeutic relationships involving 'expert' practitioners. It also challenges biomechanical theories

and reductionist biopsychosocial models (Stilwell and Harman, 2019), which are inadequate for understanding complexity (Mescouto et al. 2020). The next section explores the implications of participatory sense-making and affordances from a phenomenological perspective.

2 Phenomenology

Phenomenology focuses on lived experience and key concepts include embodiment and 'the lived-body'. Embodied experiences are important foundations for therapeutic relationships and, in osteopathy, generate co-constructed narratives which enable deeper understanding of treatment interactions and management strategies (Shaw, 2004).

Embodiment

Embodiment is a phenomenological concept which rejects mind-body dualism and suggests the sense of 'self' arises through perception and engagement with the world (Merleau-Ponty 1962, 1968; Varela and Shear,1999; Heinämaa, 2018). Bodies are imprinted with biographical and cultural meaning in learning processes that start before language *(*Teie, 2016). Embodiment aligns with enactivism as we learn how to 'be' in the world through bodies which help us navigate the unknown. Perceptions of the lifeworld are both constructed and limited by physical capacities and biographical factors construct the narratives that define relationships with people and the environment (Shaw, 2003, 2004). Healthcare practices are embedded in cultural stories about healing and metaphorical language (Lakoff and Johnson, 1999; Verghese, 2011; Benedetti, 2011) and individual bodily interpretations and inferences "bring forth our own world" (Bruineberg, 2017:15).

In osteopathy, opportunities to explore patients' embodied experiences occur in dyadic 'ecological niches' (Vasil et al 2020), supported by practitioners' embodied reactions which offer clues to the nature of the therapeutic relationship (Shaw,2004; Kleinbub et al., 2020). Active inference provides a framework for understanding how individual psychophysiological states become synchronous in shared environments (Gallagher and Allen 2018). Sociocultural dynamics influence individual beliefs and behaviour, but cooperative communication (i.e., talk, touch and body language) functions to create shared narratives which contain niche-specific knowledge and meanings (Vasil et al 2020; Tison and Poirier 2021). Practitioners' beliefs and behaviour can positively influence patients' psychophysiological states (McParlin et al 2022) and practitioner awareness can be developed through psychological training, mindfulness, mentoring and peer discussions.

The Lived-body

The concept of the lived-body (Luciani and Cadoz 2007; Merleau-Ponty 1968) describes how meaning is created through embodied interactions and exercising agency, which depends on physical capabilities (Leder, 1990; Engelsrud, 2005; Dahlberg, 2019). Perception and action are based on predictions that influence how patients present symptoms and how they are perceived by practitioners. Encouraging patients to engage with active intention can have powerful psychological benefits, for example, when people in chronic pain re-engage with activities previously thought impossible. Change is most successful when activities align with patients' values and goals but capacity for change should be carefully assessed (Tyreman, 2018a;2018b), an approach which requires time to explore lived body experiences and narratives (Norlyk et al., 2013).

In clinical practice, two body narratives meet. Osteopaths who are aware of their own body stories can gain rich information if they experience striking, repeated physical reactions to certain patients (e.g., headaches, back pain, nausea; Shaw, 2004). Active inference provides a framework for understanding attachment processes and attunement in therapeutic relationships (Gallagher and Allen 2018) and explains how osteopaths can utilise verbal and non-verbal cues to infer, explore and influence patients' internal states (Kim et al 2022). Understanding attachment processes may help create effective alliances, based on attunement to a patient's unique lifeworld.

3 Psychological Concepts

National Institute for Clinical Excellence guidelines recommend psychological input for chronic pain (NICE 2021), but osteopaths do not need to become psychotherapists. Developing awareness of concepts such as therapeutic alliances and attachment theory can also help to strengthen practice.

Therapeutic alliances

Patients may view clinical settings as unknown or alarming, so it helps to develop safe, trusting therapeutic alliances. Psychological 'alliances' relate to boundaries in therapeutic contracts and 'relationships' relate to practitioners' qualities (Castonguay, 1993; Weinberger, 1993; Russell,1995; Glass et al.,1998; Drisko, 2004; Schenck and Churchill, 2012). "Many elements of the therapeutic context can play a role in enhancing predictions of well-being, especially in chronic situations" (Ongaro and Kaptchuk 2018:3). Positive alliances predict beneficial patient outcomes (Ferreira et al., 2013) and strong contextual predictors for improvement include effective alliances and clear communication about expectations (Bishop et al., 2021). Communication builds alliances through the social 'ritual of the therapeutic act' (Benedetti, 2011). "Placebo and nocebo effects are embodied psycho-neurobiological responses capable of modulating pain and producing changes at

different neurobiological, body at perceptual and cognitive levels. These modifications are triggered by different contextual factors presented in the therapeutic encounter between patient and healthcare providers, such as healing rituals and signs" (Rossettini et al., 2018:1). Listening builds alliances (Drisko, 2004; Schenck and Churchill, 2012), but requires time and space for stories to unfold. Common factors in successful therapeutic relationships include helping patients create new narratives (Prochaska and Norcross,1994; Horvath, 2005; Wampold et al., 2010; Tschacher et al. (2012)). In physical therapy, training in active listening and narrative medicine is still developing (Bishop et al., 2021), as biomedical communication often predominates (Mescouto et al., 2020).

Attachment

Neuroscience demonstrates how early experiences affect adults (Schore and Shore, 2008; Simpson et al., 2014; Rass, 2018; Lahousen, Unterrainer and Kapfhammer, 2019). Attachment theory describes childhood attachment patterns to caregivers and positive or negative effects on subsequent relationships (Bowlby, 1988). Early attachment problems predict psychopathologies, dissociation and anxiety disorders affecting adult relationships (MLSRA Institute of Child Development, 2021). In contrast, secure attachment leads to better self-agency, emotional regulation, self-esteem and ability to sustain relationships.

Early development is shaped by emotional experiences and attachment involves synchronising with others (Rass, 2018). Predictions about the world include past relationship experiences and secure attachment forms the basis of emotional regulation. Porges (2017) observed that practitioners can modulate patients' emotional responses through calmness and voice modulation, emphasising the importance of attachment in therapeutic alliances. Trauma has profound effects on bodily systems (Doidge, 2007, Ogden et al., 2015), but relationships can restore positive attachment patterns in trauma psychotherapy (Van der Kolk, 2015; Dana, 2018). Secure attachment patterns help to modulate ANS activity (Murphy et al., 2018), and talking therapies are described as 'down regulating' and body work with sensorimotor inputs as 'up regulating' (Ogden et al 2015). Osteopaths who represent trusted attachment figures promote reassurance (Duquette & Ainley, 2019), creating alliances where patients feel safe to explore negative experiences and opportunities for change.

4 Neurophysiological Concepts

Neurophysiological research into interoception, touch and mindfulness are described below to illustrate links between enactive inference and phenomenological lived body experience.

Interoception

Interoception is a key feature of lived-body experience in which neuroanatomical pathways and neurophysiological processes transmit information from organs and tissues to the brain, and vice versa, via the autonomic nervous system (ANS) (Oldroyd et al., 2019; Paulus et al., 2019; Cerritelli et al., 2021). The system includes peripheral and central pathways, nuclei and cortical regions which continuously sense neurochemical and anatomical changes (Carvalho and Damasio, 2021). Conscious cortical processing of ANS activity is vital for homeostasis (Craig 2002, 2003) and interoception is also the neurobiological ground of feelings, emotions, and cognitive processes. This source of 'how it feels being ourselves' influences self-perception, decision-making and agency (Varela et al., 1993; Damasio, 2000; Seth et al., 2012; Craig, 2015). Specific pathways and mechanisms create internal bodily experiences, but we are unaware of isolated organs, neural centres or a separate brain and body as the sense of self is a whole person phenomenon that pre-dates language (Fotopoulou and Tsakiris, 2017; Owens et al., 2018). Biomedical explanations offer limited understanding about the sense of self in complex, chronic conditions (Kirkengen and Ulvestad, 2007; Stillwell and Harman, 2019). Inferential models propose that interoception and predictive processing generate feelings, emotions, and selfhood (Paulus and Stein 2010; Seth and Critchley, 2013; Barrett and Simmons 2015; Pezzulo et al., 2015; Van den Bergh et al., 2017), where subjective feelings are shaped by predictions, interoceptive inferences and expectations (Seth et al., 2012).

The interoceptive cortex (IC) has neuroanatomically distinct arms called the anterior insular cortex (AIC) and anterior cingulate cortex (ACC). They issue predictions and encode prediction errors based on viscero-sensory information ascending to the posterior and mid-insula (Seth and Friston, 2016; Marshall et al., 2018). They co-actively form a "salience network" with the amygdala and inferior frontal gyrus that selects which stimuli deserve attention (Craig 2009; Medford and Critchley, 2010). The AIC is the primary neurofunctional hub between top-down cognitive processes and bottom-up sensory experiences (Marshall et al., 2018; Paulus et al., 2019). Predictive coding in the AIC assesses prediction errors and influences context-dependent behaviour by tracing links between the feelings, affordances and actions that affect agency (Seth and Critchley, 2013).

The ACC is a visceromotor centre with autonomic modulation functions for bodily arousal to meet behavioural demands (Holroyd and Yeung, 2012; Seth et al., 2012; Lavin et al., 2013). It connects to subcortical areas involved in internal regulation (Barrett and Bar, 2009; Harrison et al., 2010), and influences goal-oriented behaviour and decision-making about actions based on predicted effort and reward (Craig 2002, 2003; Holroyd and Yeung, 2012; Lavin et al., 2013; Watson et al., 2018).

Dynamic interplay between body sensations, environment, motivation and behaviour highlights the relevance of active inference and interoception for making sense of the world (Seth and Critchley, 2013; Bolis and Schilbach, 2020).

Perception is a process conducted by embodied agents with the capacity to make sense of interoceptive, exteroceptive and proprioceptive information from embodied experiences (Petersen et al., 2015; Zacharioudakis et al., 2020). Motivation to engage with the environment is guided by perceptions about what is relevant and meaningful (De Haan 2020). Perceptive engagement links active inference with enactivism as it is more than sensing and moving and includes sense-making and judgements about potentially useful or dangerous situations. In osteopathy, action-perception cycles may help to explain some treatment outcomes, as how links between sensing, perceiving, sense-making and physical engagement with the environment encourage people to explore reactions to pain and expand their field of affordances (Kim et al 2022).

Ecological healthcare emphasise how embodied interactions create unique interpretations of inner sensations, shaped by biographical experience. Enactivism adds a richer understanding of complex relationships between symptom perception and objective pathophysiological dysfunctions (Petersen et al., 2015; Pezzulo et al., 2015; Zacharioudakis et al., 2020). Together, they make sense of multi-faceted experiences which incorporate beliefs and body narratives co-created in ecological niches (Van den Bergh et al., 2017). Overlapping neurophysiological processing pathways for interoception, touch and mindfulness seen in fMRI studies highlight interactions between top-down cognition and bottom-up sensorimotor experiences (Casals-Gutiérrez and Abbey, 2020). Osteopathic care that combines touch and mindfulness appears to help patients with persistent pain (Abbey et al 2020), but research is needed to understand the complex sense-making processes this approach involves.

Mindfulness

Mindfulness is described as being non-judgmentally present to moment-to-moment experience, including thoughts, emotions, sensations and perceptions (Kabat-Zinn, 2012). People with persistent pain who struggle with bodily distress develop selective attention towards (hypervigilance) or away from discomfort (sensory attenuation) (Esteves et al 2022). Secular mindfulness (Harris 2009) and meditation enable people to focus at will on different sensorimotor experiences and improve interoceptive precision by focusing on top-down predictions of sensorimotor information (Laukkonen and Slagter, 2020). People can regulate their interoceptive states and predictions in changing environments (Fotopoulou and Tsakiris 2017; Fonagy and Campbell, 2017; Bolis and

Schilbach, 2020), through precise observations including wider sources of information (Lutz et al., 2019). Non-judgmental perception of inputs categorised as 'pain' reduces avoidant responses by improving precision-weighting in the posterior insula (Pagnoni, 2019; Laukkonen and Slagter, 2020) and down-regulation of pain affect suggests successful suppression of top-down narratives (Zorn et al., 2020). Uncoupling affective experiences from pain also decreases catastrophising, nociceptive threat-based predictions, and reduces emphasis on past predictions.

Mindfulness is typically an individual practice but combining mindfulness and touch in osteopathy may strengthen interoceptive skills. Guided practices can reframe sensations perceived as harmful as 'normal' and influence pain responses (Abbey et al 2020). Effects are enhanced by cooperative communication, combining touch and verbal guidance, and alignment in patients' and practitioners' active inference systems (McParlin et al 2020) and may be strengthened through shared processing pathways (Casals-Gutierrez and Abbey, 2020).

Touch

Touch is the earliest functional sense to develop (Duhn, 2010; Crucianelli and Filippetti, 2018), and the primary modality for communication and interaction. In early life, it enables sense-making in the environment by conveying a sense of the physical presence of the 'other' (Björnsdotter et al., 2014). Interoceptive touch refers to emotional and motivational aspects of tactile experiences, separated into discriminative and affective touch (McGlone et al., 2014; Pawling et al., 2017). Affective touch is linked to the specialised C-tactile (CT) system, which sends information to the interoceptive cortex via the posterior insula (PI). It contributes to embodiment via bottom-up regulatory ANS pathways (Björnsdotter et al., 2009; D'Alessandro et al., 2016). CT fibres are triggered by gentle stroking and are important in building secure attachment in infancy (Duhn, 2010; Denworth, 2015; Murphy et al., 2018; Croy et al., 2019). Touch is important in the enactive inference framework as physical contact helps people infer each other's mental states and influences prior beliefs and sensory arousal (Esteves et al 2022). Alliances are strengthened by repeated dynamic touching, similar to the neurophysiological effects of C-tactile afferents in social touch which promote synchrony and attunement (McParlin et al 2022).

Three factors differentiate touch from other senses; it is mutually-dyadic, multi-sensory, and generates homeostatic information (Crucianelli and Filipetti, 2018). Mutually-dyadic refers to the bidirectional process of physical contact: we cannot touch someone without being touched (Merleau-Ponty, 1968). Therapeutic touch has been conceptualised as intrinsically shared and

synchronous (Ciaunica and Fotopoulou, 2017). The multi-modal integration of interoceptive, proprioceptive and exteroceptive information and spatial-contextual features shape the meaning and psychophysiological impact of touch. Homeostatic-informative aspects describe how touch contributes to neurophysiological regulation, including sensory cues from the body and outer environment. Homeostatic-physiological impacts are influenced by type of tactile stimulation (McParlin et al 2022) and cranial touch may modulate parasympathetic nervous system activity (Edwards et al., 2018). Touch location, speed, pressure, expectation, predictability, temperature, and cultural biases and beliefs all influence individual interpretations (Ellingsen et al., 2015). Osteopaths create varied opportunities to 'touch' patients, with outcomes influenced by synchrony between a practitioner's intentions and the patient's perception. Enactive inference is therefore important for understanding an individual's awareness, agency and body narrative.

5 Narrative Medicine

There are important links between active inference, therapeutic relationships and narrative medicine as lived experiences influence symptom perception and narratives about the body and self. Interdisciplinary narrative medicine incorporates phenomenology, language, aesthetics and bioethics and proposes that thoughts do not exist outside the person's lifeworld but are brought into being by speaking. It incorporates literature and art as creative representations of body-stories, as well as relational language and the social realities that underpin healthcare dialogues. Stories are central to lived experience and clinical encounters, as people make sense of themselves and their world through storytelling (Venema, 2000). Language conveys nuanced meanings, making it important to understand communication from individual's socio-cultural context to enable participatory sense-making. Speech is a cooperative embodied action through which individuals create shared meanings.

Friston et al (2020) analysed linguistic exchanges to explore how question and answer dialogues evolve. They demonstrated a communication hierarchy in which higher level beliefs, predictions and inferences sequentially influenced word selection to clarify meanings. Questions were answered quickly and precisely in linguistic exchanges where there were shared beliefs, but when beliefs were imprecise, exchanges demonstrated uncertainty until convergence emerged through a process of joint creative thinking. This indicates the value of narrative medicine for exploring patients' word choices and understanding how dialogues illuminate beliefs and misunderstandings. Training in narrative medicine can increase empathy, relationship-building, perspective-taking, reflection and resilience and decrease burnout by developing narrative competence (Remein et al, 2019).

Narrative competence

Narrative competence is defined as the "ability to absorb, acknowledge, interpret and act on the stories and plights of others" (Charon, 2001:1897). Clinicians access the meaning behind words, silences and body language through listening, representation and affiliation. Close attendance to spoken experience is supported by exploring poems and visual art as analogies for the lived-body. Reading poetry has been described as akin to entering a complex system and may help clinicians to negotiate clinical uncertainty and ambiguous language more effectively (Maretic and Abbey, 2021). Uncertainty is part of clinical decision-making and the centre of a person's illness experience when the familiar sense of agency changes. Tyreman (2015) argued that the role of practitioners is not finding solutions to problems but enabling people to regain trust in their own bodies but sharing patients' journeys through uncertainty requires specific therapeutic attitudes and skills. Phenomenology proposes that humans inhabit individual worlds that cannot be experienced by others but can be 'expressed'. Clinical encounters involve the 'voice of medicine' and the 'voice of the lifeworld' (Mishler, 1984). Narrative medicine suggests that patients and osteopaths engage through a shared focus on the body where meanings is created in the dyadic space. Co-constructed narratives, however, depend on practitioners' abilities to find points of entry into a patient's world and requires narrative competence in imaginative thinking and radical listening skills.

Narrative humility

Narrative medicine is underpinned by humility (DasGupta, 2008), where practitioners acknowledge they cannot fully understand someone-else's experience. Levinas' philosophy of the 'Other' recognises that other people always lie outside our self-understanding (Irvine, 2005). We recognise common experiences but also parts of their world experience that we do not, or cannot, share. Recognition is about knowing and the limits of knowing (Felski, 2008), which has ethical implications for balancing power in clinical relationships. Narrative humility enables practitioners to collaborate and interact with patients' stories without expecting to fully understand.

Sociology defines illness as a biographical disruption, with narratives that represent embodied chaos and breakdown in adaptive agency. These can be hard to hear because of lack of narrative sequence and painful loss of agency and require *narrative listening* (listening and thinking *with* and not *to* the person's story; Frank, 1995), which focuses on plot, voice, space, temporality and meaning. Practitioners who can hold a listening space enable people to explore new possibilities in familiar stories and construct alternative meanings and sense of agency. People in pain are vulnerable and

often feel invalidated by healthcare communication (Carel and Kidd, 2014). Narrative training helps practitioners become reflective, trust patients' stories, and bridge gaps between medical terms and the language of lived experience. It explores intersubjectivity in therapeutic alliances and puts patients' stories centre stage, enabling practitioners to work with complex pain experiences. Narrative skills can therefore deepen understanding in clinical settings, but the process requires humility, witnessing, and deep, dynamic recognition of self and other (Charon, 2001).

6 Clinical applications and challenges

Concepts presented above suggest that active and enactive inference are not simply theories or tools to employ within traditional models of osteopathic practice. The enactive-ecological framework proposed by Esteves et al. (2022) raises challenges to familiar therapeutic relationships and modes of communication. Patients' beliefs and goals may not fit with osteopaths' agendas, so strong, flexible therapeutic alliances are needed to work with prior predictions and shared sense-making. The Osteopathy, Mindfulness and Acceptance Programme (OsteoMAP: Abbey et al 2020) illustrates one example of integrated manual treatment and psychological self-management interventions, with dual aims that are aligned with an ecological-enactivist approach.

'Patients' can be conceptualised as complex bio-medical or neurophysiological systems *and* bio-psychosocially as 'people' within a unique lifeworld (Norlyk et al., 2013). 'Pain' can be interpreted as physical dysfunction *and* as part of an embodied narrative. Osteopaths can help patients to manage pain *and* encourage learning and dialogue to make sense of people's experiences. Dual agendas can be conflicting *or* complementary, where both are used for different purposes using different skills.

The OsteoMAP study analysed outcomes from six-week courses for people with persistent pain (Carnes et al 2017; Abbey et al 2020). Psychological interventions aimed to develop flexibility, the core concept of Acceptance and Commitment Therapy (ACT) and included mindfulness to increase body and self-awareness (Hayes et al 2012). Quantitative outcomes showed improvements in quality of life, active coping behaviour, acceptance and mindfulness. Qualitative data suggested challenges for osteopaths in managing dual treatment aims included maintaining mindful awareness throughout sessions and choosing when to focus on treatment or patient self-learning.

Behavioural interventions are effective when grounded in personal learning (Harris 2009) and motivated by an individual's goals (Michie and Johnston 2012). This raises challenges for expert practitioners, as facilitative communication is required for person-centred care (Thomson et al 2012; Thomson et al 2014; Tyreman 2020). Interventions to improve body awareness have physical

and psychological health benefits (Farb et al 2015; Mehling et al 2013) and self-awareness of habitual reactions strengthens self-care. Enactivism offers insights into *how* changes occur, and predictive processing explains the limits of pain education or cognitive reassurance for patients who do not feel heard (Kube et al 2020). OsteoMAP results suggested better outcomes when osteopaths created opportunities to notice differences between Patients' prior predictions and actual bodily sensations using mindfulness and graded exposure (George and Zeppieri 2009).

Barriers to using OsteoMAP effectively included challenges in learning when and how to shift between treatment and exploring present-moment experience (Carnes et al 2017). When osteopaths felt uncertain, they reverted to 'expert' treatment agendas and people who were less aware of their own experience or less able to create open communication struggled to create learning opportunities. Some practitioners were effective in generating interoceptive 'surprise' when experiences did not fit with expectations and exploring sensations in detail to increase interoceptive precision. Non-verbal clues about anxiety (i.e., facial cues, tensing muscles, posture) were used to explore habitual reactions to feared sensations and avoided movements. Osteopaths who remained open and curious created flexible interventions grounded in patients' experiences that sometimes led to transformational changes.

OsteoMAP was not, however, useful for all patients or osteopaths. Body awareness requires the ability to describe sensations and willingness to share thoughts and feelings. Sessions using enactivism or mindfulness differ from previous treatment and need careful communication and consent to embody an effective model of person-centred care. This approach requires self-awareness, developed through psychological skills training, mindfulness or narrative approaches. OsteoMAP aligns with the new ecological-enactive framework for osteopathic practice (Esteves et al., 2022), but both inevitably require the development of different attitudes, knowledge and skills.

7 Discussion and Conclusion

– INSERT Figure 1 HERE –

Figure 1 illustrates biomedical and psychosocial healthcare concepts with an 'enactive-ecological' core that illustrates a multidimensional perspective of the patient-as-a-person. Concepts based on different philosophical assumptions may conflict but are all relevant to varied models of practice. The conclusions of this review are:

- Active inference and predictive engagement are important concepts that are best understood within a person-centred perspective
- Therapeutic alliances and attachment theory are central to healthcare process and outcomes
- Patients' illness experiences of illness can be understood in a multi-dimensional context using neurophysiological and phenomenological concepts
- It is necessary to prioritise lived experiences over treatment agendas to enable patients' narratives to unfold
- Using enactive inference in practice requires shifts in therapeutic relationships and the development of skills to facilitate patient learning

The enactive-ecological framework proposed by Esteves et al., (2022) is a promising means for understanding mechanisms of effect and outcomes in osteopathic healthcare. New approaches, however, require re-evaluation of traditional aims, working practices and education. Active inference and predictive processing were initially analysed in biomedical and neurophysiological research, but there are challenges in assuming that this identified tools that can be applied to patients in the traditional practitioner-led modes of practice. More recent phenomenological and psychological studies into enactivism emphasise the complex, dynamic nature of therapeutic relationships and the need to understand patients in their unique sociocultural lifeworld context.

The new framework represents an important step towards evidence-based osteopathic practice but would benefit from further research to assess:

- How to introduce concepts of active inference and enactivism in osteopathic education
- Effective methods of teaching psychological or mindful self- and body-awareness
- Narrative and communication skills training for participatory sense-making

Osteopaths have the potential to positively influence patients' health beliefs, body awareness, and the prior predictions that influence avoidant behaviour. There is currently limited knowledge about *how* positive changes occur or the barriers that limit changes for patients and practitioners. Further research is recommended to explore how to create effectively integrated mind-body interventions in the conceptual framework of enactive inference to increase the scope of osteopathic healthcare.

Word count: 5,555

8 Conflicts of Interest

9 Author Contributions

10 Funding

11 Acknowledgements

12 References

Abbey H., Nanke, L. and Brownhill, K., 2020. Developing a psychologically informed pain management course for use in osteopathic practice: The OsteoMAP cohort study. *International Journal of Osteopathic Medicine,* 39, pp. 32-40.

Arandia, I., & Di Paolo, E. 2021. Placebo From an Enactive Perspective. *Frontiers In Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.660118

Barrett, L., 2017. The theory of constructed emotion: an active inference account of interoception and categorization. *Social Cognitive and Affective Neuroscience*, 12(11), pp.1-23.

Barrett, L. and Bar, M., 2009. See it with feeling: affective predictions during object perception. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1521), pp.1325-1334.

Barrett, L., Quigley, K., & Hamilton, P. 2016. An active inference theory of allostasis and interoception in depression. *Philosophical Transactions Of The Royal Society B: Biological Sciences*, *371*(1708), 20160011. https://doi.org/10.1098/rstb.2016.0011

Barrett, L. and Simmons, W., 2015. Interoceptive predictions in the brain. *Nature Reviews Neuroscience*, 16(7), pp. 419-429.

Benedetti, F., 2011. *The patient's brain*. Oxford University Press, New York.

Bishop, F., Al-Abbadey, M., Roberts, L., MacPherson, H., Stuart, B., Carnes, D., Fawkes, C., Yardley, L. and Bradbury, K., 2021. Direct and mediated effects of treatment context on low back pain outcome: a prospective cohort study. *BMJ Open*, 11(5), p. e044831.

Björnsdotter, M., Gordon, I., Pelphrey, K., Olausson, H. and Kaiser, M., 2014. Development of brain mechanisms for processing affective touch. *Frontiers in Behavioral Neuroscience*, 8.

Björnsdotter, M., Loken, L., Olausson, H., Vallbo, A. and Wessberg, J., 2009. Somatotopic Organization of Gentle Touch Processing in the Posterior Insular Cortex. J*ournal of Neuroscience*, 29(29), pp. 9314-9320.

Bohlen L, Shaw R, Cerritelli F and Esteves JE (2021) Osteopathy and Mental Health: An Embodied, Predictive, and Interoceptive Framework. Front. Psychol. 12:767005. doi: 10.3389/fpsyg.2021.767005

Bolis, D. and Schilbach, L., 2020. "Through others we become ourselves": The dialectics of predictive coding and active inference. *Behavioral and Brain Sciences*, 43.

Bowlby, J., 1988. *A secure base*. Routledge, London.

Bruineberg, J., 2017. Active Inference and the Primacy of 'I Can', in Metzinger, T. and Wiese, W. (eds). *Philosophy and Predictive Processing*. MIND Group, Frankfurt, pp. 1-18.

Carel, H. and Kidd, I., 2014. Epistemic injustice in healthcare: a philosophical analysis. *Medicine, Health Care and Philosophy,* 17(4), pp. 529-540.

Carnes, D., Mars, T., Plunkett, A., Nanke, L. and Abbey, H., 2017. A mixed methods evaluation of a third wave cognitive behavioural therapy and osteopathic treatment programme for chronic pain in primary care (OsteoMAP). *International Journal of Osteopathic Medicine*, 24, pp. 12-17.

Carvalho, G. and Damasio, A., 2021. Interoception and the origin of feelings: A new synthesis. *BioEssays*, 43(6), p. 2000261.

Casals-Gutiérrez, S. and Abbey, H., 2020. Interoception, mindfulness and touch: A meta-review of functional MRI studies. *International Journal of Osteopathic Medicine*, 35, pp. 22-33.

Cerritelli, F., Chiacchiaretta, P., Gambi, F., Saggini, R., Perrucci, M. and Ferretti, A., 2021. Osteopathy modulates brain–heart interaction in chronic pain patients: an ASL study. *Scientific Reports*, 11(1).

Charon R., 2001. The patient-physician relationship. Narrative medicine A model for empathy, reflection, profession, and trust. *J Am Med Assoc*, 286(15), pp. 1897-902.

Ciaunica, A., and Fotopoulou, A., 2017. The touched self: Psychological and philosophical perspectives on proximal intersubjectivity and the self in C. Durt, T. Fuchs, and C. Tewes (eds*), Embodiment, enaction, and culture: Investigating the constitution of the shared world.* MIT Press, London, pp. 173-192.

Connolly, P. 2022. Instability and Uncertainty Are Critical for Psychotherapy: How the Therapeutic Alliance Opens Us Up. *Frontiers In Psychology*, *12*. doi: 10.3389/fpsyg.2021.784295

Coninx, S. and Stilwell, P., 2021. Pain and the field of affordances: an enactive approach to acute and chronic pain. *Synthese*, pp. 1-29.

Craig, A., 2002. How do you feel? Interoception: the sense of the physiological condition of the body. *Nature Reviews Neuroscience*, 3(8), pp. 655-666.

Craig, A., 2003. Interoception: the sense of the physiological condition of the body. *Current Opinion in Neurobiology*, 13(4), pp. 500-505.

Craig, A., 2009. How do you feel - now? The anterior insula and human awareness. *Nature Reviews Neuroscience*, 10(1), pp. 59-70.

Craig, A., 2015. *How Do You Feel?: An Interoceptive Moment with Your Neurobiological Self.* Princeton University Press, Princeton.

Croy, I., Sehlstedt, I., Wasling, H., Ackerley, R. and Olausson, H., 2019. Gentle touch perception: From early childhood to adolescence. *Developmental Cognitive Neuroscience*, 35, pp. 81-86.

Crucianelli, L. and Filippetti, M., 2018. Developmental Perspectives on Interpersonal Affective Touch. *Topoi*, 39(3), pp. 575-586.

D'Alessandro, G., Cerritelli, F. and Cortelli, P., 2016. Sensitization and Interoception as Key Neurological Concepts in Osteopathy and Other Manual Medicines. *Frontiers in Neuroscience*, 10, 100.

Dahlberg, H., 2019. Beyond the absent body - A phenomenological contribution to the understanding of body awareness in health and illness. *Nursing Philosophy*, 20(2), p. e12235.

Damasio, A., 2000. *The feeling of what happens*. Heinemann, London.

Dana, D., 2018. *The polyvagal theory in therapy*. W Norton, New York.

DasGupta, S., 2008. Narrative humility.*The Lancet*, 371(9617), pp. 980-981.

De Haan, S. (2020). An enactive approach to psychiatry. *Philosophy, Psychiatry and Psychology*, *27*(1). https://doi.org/10.1353/ppp.2020.0001

De Jaegher, H. 2018. "The intersubjective turn," in *The Oxford Handbook of Cognition: Embodied, Embedded, Enactive and Extended*, eds A. Newen, S. Gallagher, L. de Bruin (Oxford University Press), 453–468. doi: 10.1093/oxfordhb/9780198735410.013.24

De Jaegher, H., & Di Paolo, E. 2007. Participatory sense-making. *Phenomenology And The Cognitive Sciences*, *6*(4), 485-507. https://doi.org/10.1007/s11097-007-9076-9

Denworth, L., 2015. The Social Power of Touch. *Scientific American Mind*, 26(4), pp. 30-39.

Doidge, N., 2007. *The Brain that Changes Itself*. Penguin, London.

Duhn, L., 2010. The Importance of Touch in the Development of Attachment. *Advances in Neonatal Care*, 10(6), pp. 294-300.

Drisko, J. W. 2004. Common factors in psychotherapy outcome: Meta-analytic findings and their implications for practice and Research. *Families in Society: The Journal of Contemporary Social Services, 85*(1), 81-90. doi:10.1606/1044-3894.239

Duquette, P., & Ainley, V. 2019. Working With the Predictable Life of Patients: The Importance of "Mentalizing Interoception" to Meaningful Change in Psychotherapy. *Frontiers In Psychology*, *10*. doi: 10.3389/fpsyg.2019.02173

Edwards, D., Young, H., Curtis, A. and Johnston, R., 2018. The Immediate Effect of Therapeutic Touch and Deep Touch Pressure on Range of Motion, Interoceptive Accuracy and Heart Rate Variability: A Randomized Controlled Trial with Moderation Analysis. *Frontiers in Integrative Neuroscience*, 12.

Ellingsen, D., Leknes, S., Løseth, G., Wessberg, J. and Olausson, H., 2016. The Neurobiology Shaping Affective Touch: Expectation, Motivation, and Meaning in the Multisensory Context. *Frontiers in Psychology*, 6.

Engelsrud, G., 2005. The lived body as experience and perspective: methodological challenges. *Qualitative Research*, 5(3), pp. 267-284.

Esteves, J. E., Cerritelli, F., Joonhan, K., & Friston, K., 2022. Osteopathic care as (En)active inference: a theoretical framework for developing an integrative hypothesis in osteopathy, Frontiers in Psychology DOI: 10.3389/fpsyg.2022.812926

Farb, N., Daubenmier, J., Price, C., Gard, T., Kerr, C., Dunn, B., Klein, A., Paulus, M. and Mehling, W., 2015. Interoception, contemplative practice, and health. *Frontiers in Psychology*, 6.

Felski, R., 2008. *Uses of Literature*. New York: Wiley-Blackwell, New York.

Ferreira, P., Ferreira, M., Maher, C., Refshauge, K., Latimer, J. and Adams, R., 2013. The Therapeutic Alliance Between Clinicians and Patients Predicts Outcome in Chronic Low Back Pain. *Physical Therapy*, 93(4), pp. 470-478.

Foglia, L., & Wilson, R. A., 2013. Embodied cognition. *Wiley Interdisciplinary Reviews: Cognitive Science*, *4*(3), 319–325. https://doi.org/10.1002/wcs.1226

Fonagy, P. and Campbell, C., 2017. Mentalizing, attachment and epistemic trust: how psychotherapy can promote resilience. *Psychiatr Hung*, 32(3), pp. 283-287.

Fotopoulou, A. and Tsakiris, M., 2017. Mentalizing homeostasis: The social origins of interoceptive inference. *Neuropsychoanalysis*, 19(1), pp. 3-28.

Frank, A., 1995. *The wounded storyteller: Body, illness, and ethics*. University of Chicago Press, Chicago.

Friston, K., 2010. The free-energy principle: a unified brain theory? *Nature Reviews Neuroscience*, 11(2), pp.127-138.

Friston, K., FitzGerald, T., Rigoli, F., Schwartenbeck, P., O Doherty, J., and Pezzulo, G., 2016. Active inference and learning. *Neuroscience and biobehavioral reviews*, 68, pp. 862-879.

Friston, K., FitzGerald, T., Rigoli, F., Schwartenbeck, P., and Pezzulo, G., 2017. Active Inference: A Process Theory. *Neural computation*, 29(1), pp. 1-49.

Friston, K., Parr, T., Yufik, Y., Sajid, N., Price, C. J., and Holmes, E. 2020. Generative models, linguistic communication, and active inference. *Neuroscience and Biobehavioral Reviews*, 118, pp. 42-64.

Fuchs, T., & De Jaegher, H. 2009. Enactive intersubjectivity: Participatory sense-making and mutual incorporation. *Phenomenology And The Cognitive Sciences*, *8*(4), 465-486. https://doi.org/10.1007/s11097-009-9136-4

Gallagher, S., 2018. The Extended Mind: State of the Question. *The Southern Journal of Philosophy*, *56*(4), 421–447. https://doi.org/10.1111/sjp.12308

Gallagher S and Allen M. 2018. Active inference, enactivism and the hermeneutics of social cognition. Synthese,195:2627–2648. https://doi.org/10.1007/s11229-016-1269-8

George, S. and Zeppieri, G., 2009. Physical Therapy Utilization of Graded Exposure for Patients with Low Back Pain. *Journal of Orthopaedic and Sports Physical Therapy,* 39(7), pp. 496-505.

Gibson, J. J. 1977. Theory of affordances. In I. R. Shaw & J. Bransford (Eds.), Perceiving, acting, and knowing (pp. 67–82). Hillsdale: Erlbaum.

Harris, R. 2009. *ACT Made Simple*. Oakland New Harbinger Publications, California.

Harrison, N., Gray, M., Gianaros, P. and Critchley, H., 2010. The Embodiment of Emotional Feelings in the Brain. Journal of Neuroscience, 30(38), pp.12878-12884.

Hayes, S., Strosahl, K. and Wilson K., 2012. *Acceptance and Commitment Therapy. The process and practice of mindful change* (2nd ed). Guildford Press, New York.

Heinämaa, S., 2018. Embodiment and Bodily Becoming in D. Zahavi, (ed 2018). *The Oxford handbook of the history of phenomenology*. Oxford University Press: Oxford.

Holroyd, C. and Yeung, N., 2012. Motivation of extended behaviors by anterior cingulate cortex. *Trends in Cognitive Sciences*, 16(2), pp. 122-128.

Horvath, A O., 2005. The Therapeutic Relationship: Research and Theory. *Psychotherapy Research*,15(1-2), pp. 3-7.

Hutchinson, J., & Barrett, L.. 2019. The Power of Predictions: An Emerging Paradigm for Psychological Research. *Current Directions In Psychological Science*, *28*(3), 280-291. https://doi.org/10.1177/0963721419831992

Irvine C., 2005. On the other side of silence: Levinas, medicine, and literature. *Lit Med*, 24, pp. 8-18.

Kabat-Zinn, J., 2012. *Mindfulness for Beginners: Reclaiming the Present Moment - and Your Life.* Sounds True, Louisville.

Kim J, Esteves JE, Cerritelli F and Friston K. 2022. An Active Inference Account of Touch and Verbal Communication in Therapy. Frontiers in Psychology 13:828952. doi: 10.3389/fpsyg.2022.828952

Kirchhoff M. 2017. Predictive brains and embodied, enactive cognition: an introduction to the special issue. Synthese. DOI 10.1007/s11229-017-1534-5

Kirkengen, A. and Ulvestad. E. 2007. [Heavy burdens and complex disease--an integrated perspective]. *Tidsskr Nor Laegeforen,* 127(24), pp. 3228-31.

630 Kleinbub, J., Mannarini, S. and Palmieri, A., 2020. Interpersonal Biofeedback in Psychodynamic Psychotherapy.
631 *Frontiers in Psychology*, 11.

632 Kube, T., Rozenkrantz, L., Rief, W. and Barsky, A., 2020. Understanding persistent physical symptoms: Conceptual
633 integration of psychological expectation models and predictive processing accounts. *Clinical Psychology Review*, 76,
634 pp. 1018-29.

635 Kuperman, P., Talmi, D., Katz, N., & Treister, R. 2020. Certainty in ascending sensory signals – The unexplored
636 driver of analgesic placebo response. *Medical Hypotheses*, *143*, 110113. https://doi.org/10.1016/j.mehy.2020.110113

637 Lahousen, T., Unterrainer, H. and Kapfhammer, H., 2019. Psychobiology of Attachment and Trauma - Some
638 General Remarks from a Clinical Perspective. *Frontiers in Psychiatry*, 10.

639 Lakoff, G. and Johnson, M., 1999. *Philosophy in the flesh*. Basic Books: New York.

640 Laukkonen, R. and Slagter, H., 2021. From many to (n)one: Meditation and the plasticity of the predictive mind.
641 *Neuroscience and Biobehavioral Reviews*, 128, pp.199-217.

642 Lavin, C., Melis, C., Mikulan, E., Gelormini, C., Huepe, D. and Ibañez, A., 2013. The anterior cingulate cortex: an
643 integrative hub for human socially-driven interactions. *Frontiers in Neuroscience*, 7.

644 Leder, D., 1990. *The Absent Body*. The University of Chicago Press, Chicago.

645 Luciani, A. and Cadoz, C., 2007. *Enaction and enactive interfaces*. ACROE, Grenoble.

646 Lutz, A., Mattout, J. and Pagnoni, G., 2019. The epistemic and pragmatic value of non-action: a predictive coding
647 perspective on meditation. *Current Opinion in Psychology*, 28, pp.166-171.

648 Marshall, A., Gentsch, A. and Schütz-Bosbach, S., 2018. The Interaction between Interoceptive and Action States
649 within a Framework of Predictive Coding. *Frontiers in Psychology*, 9.

650 McGlone, F., Wessberg, J. and Olausson, H., 2014. Discriminative and Affective Touch: Sensing and Feeling.
651 *Neuron*, 82(4), pp. 737-755.

652 McParlin, Z., Cerritelli, F., & Friston, K., Esteves, J. E., 2022. Therapeutic alliance as active inference: the role of
653 therapeutic touch and synchrony, Frontiers in Psychology, DOI:10.3389/fpsyg.2022.783694

654 Medford, N. and Critchley, H., 2010. Conjoint activity of anterior insular and anterior cingulate cortex: awareness
655 and response. *Brain Structure and Function*, 214(5-6), pp. 535-549.

656 Mehling, W, Wrubel, J., Daubenmier, J., Price, C., Kerr C., Silow, T., Gopisetty, V. and Stewart, A., 2013. Body
657 Awareness: a phenomenological inquiry into the common ground of mind-body therapies. *Philosophy, Ethics, and*
658 *Humanities in Medicine*, 6(6).

659 Mescouto, K., Olson, R., Hodges, P. and Setchell, J., 2020. A critical review of the biopsychosocial model of low
660 back pain care: time for a new approach? *Disability and Rehabilitation*, pp. 1-15.

661 Merleau-Ponty, M., 1962. *The Phenomenology of Perception*. Routledge and Kegan Paul, London.

662 Merleau-Ponty, M., 1968. *The Visible and the Invisible*. Northwestern University Press, Evanston.

663 Michie, S. and Johnston, M., 2012. Theories and techniques of behaviour change: Developing a cumulative science
664 of behaviour change. *Health Psychology Review*, 6(1), pp. 1-6.

Minnesota Longitudinal Study of Risk and Adaptation, 2021. Minnesota Longitudinal Study of Risk and Adaptation – Institute of Child Development. [online] Available at: <https://innovation.umn.edu/parent-child/> [Accessed 15 July 2021].

Mishler, E.,1984. *Discourses of medicine: The dialectics of medical interviews*. Ablex Publications, New Jersey.

Morrison, I., Björnsdotter, M. and Olausson, H., 2011. Vicarious Responses to Social Touch in Posterior Insular Cortex Are Tuned to Pleasant Caressing Speeds. J*ournal of Neuroscience*, 31(26), pp. 9554-9562.

Morrison, I., Löken, L. and Olausson, H., 2009. The skin as a social organ. *Experimental Brain Research*, 204(3), pp. 305-314.

Murphy, M., Janicki-Deverts, D. and Cohen, S., 2018. Receiving a hug is associated with the attenuation of negative mood that occurs on days with interpersonal conflict. *PLOS ONE*, 13(10), p. e0203522.

Nielsen, K., and Ward, T. (2018). Towards a new conceptual framework for psychopathology: Embodiment, enactivism, and embedment. *Theory and Psychology*, *28*(6), 800–822. https://doi.org/10.1177/0959354318808394

NICE, Chronic pain (primary and secondary) in over 16s: assessment of all chronic pain and management of chronic primary pain. NICE guideline (NG193). [online] Available at: <https://www.nice.org.uk/guidance/ng193> [Accessed 24 May 2021].

Norlyk, A., Martinsen, B., & Dahlberg, K. 2013. Getting to Know Patients' Lived Space. *Indo-Pacific Journal Of Phenomenology*, *13*(2), 1-12. https://doi.org/10.2989/ipjp.2013.13.2.5.1179a

Oldroyd, K., Pasupathi, M. and Wainryb, C., 2019. Social Antecedents to the Development of Interoception: Attachment Related Processes Are Associated With Interoception. *Frontiers in Psychology*, 10.

Ogden, P., Fisher, J., Del Hierro, D. and Del Hierro, A., 2015. *Sensorimotor psychotherapy*. W Norton: New York.

Ongaro, G. and Kaptchuk, T., 2018. Symptom perception, placebo effects, and the Bayesian brain. *Pain*, 160(1), pp. 1-4.

Owens, A., Allen, M., Ondobaka, S. and Friston, K., 2018. Interoceptive inference: From computational neuroscience to clinic. *Neuroscience and Biobehavioral Reviews*, 90, pp.174-183.

Pagnoni G., 2019. The contemplative exercise through the lenses of predictive processing: A promising approach. *Prog Brain Res*, 244, pp. 299-322.

Parr, T., & Friston, K.,2019a. Active Inference, Novelty and Neglect. *Current Topics in Behavioral Neurosciences*, 41, pp. 115–128.

Parr, T., & Friston, K. 2019b. Generalised free energy and active inference. *Biological Cybernetics*, *113*(5-6), 495-513. doi: 10.1007/s00422-019-00805-w

Paulus, M., Feinstein, J. and Khalsa, S., 2019. An Active Inference Approach to Interoceptive Psychopathology. *Annual Review of Clinical Psychology*, 15(1), pp. 97-122.

Paulus, M. and Stein, M., 2010. Interoception in anxiety and depression. *Brain Structure and Function*, 214(5-6), pp. 451-463.

Pawling, R., Cannon, P., McGlone, F. and Walker, S., 2017. C-tactile afferent stimulating touch carries a positive affective value. *PLOS ONE*, 12(3), p. e0173457.

Petersen, S., Van Staeyen, K., Vögele, C., von Leupoldt, A. and Van den Bergh, O., 2015. Interoception and symptom reporting: disentangling accuracy and bias. *Frontiers in Psychology*, 6, p. 732.

Pezzulo, G., Rigoli, F. and Friston, K., 2015. Active Inference, homeostatic regulation and adaptive behavioural control. *Progress in Neurobiology*, 134, pp. 17-35.

Porges, S., 2017. The pocket guide to the polyvagal theory. W Norton, New York.

Prochaska, J. and Norcross, J., 1994. *Systems of Psychotherapy: A Transtheoretical Analysis* (3rd edition). Brooks/Cole, California.

Ramstead, M., Badcock, P., & Friston, K. 2018. Answering Schrödinger's question: A free-energy formulation. *Physics Of Life Reviews*, *24*, 1-16. https://doi.org/10.1016/j.plrev.2017.09.001

Ramstead, M., Kirchhoff, M. and Friston, K., 2020. A tale of two densities: active inference is enactive inference. *Adaptive behavior*, 28(4), pp. 225–239.

Rass, E., 2018. *The Allan Schore reader*. Routledge, Oxford.

Rietveld, E. 2014. Affordances and unreflective freedom, in Jensen, R., & Moran, D. 2014. *The Phenomenology of Embodied Subjectivity*. Springer.

Rietveld, E., Denys, D., and Van Westen, M. (2018). Ecological-Enactive Cognition as engaging with a field of relevant affordances: The Skilled Intentionality Framework (SIF). In A. Newen, L. De Bruin and S. Gallagher, The Oxford handbook of 4E cognition. Oxford: Oxford University Press.

Remein, C., Childs, E., Pasco, J., Trinquart, L., Flynn, D., Wingerter, S., Bhasin, R., Demers, L. and Benjamin, E., 2020. Content and outcomes of narrative medicine programmes: a systematic review of the literature through 2019. *BMJ Open*, 10(1), p. e031568.

Rossettini, G., Carlino, E., & Testa, M., 2018. Clinical relevance of contextual factors as triggers of placebo and nocebo effects in musculoskeletal pain. *BMC Musculoskeletal Disorders*, *19*(1). doi: 10.1186/s12891-018-1943-8

Schenck, D. and Churchill, L., 2012. *Healers*. Oxford University Press, New York.

Schore, J. and Schore, A., 2008. Modern Attachment Theory: The Central Role of Affect Regulation in Development and Treatment. *Clinical Social Work Journal*, 36(1), pp. 9-20.

Seth, A. and Critchley, H., 2013. Extending predictive processing to the body: Emotion as interoceptive inference. *Behavioral and Brain Sciences*, 36(3), pp. 227-228.

Seth, A. and Friston, K., 2016. Active interoceptive inference and the emotional brain. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 371(1708), p. 20160007.

Seth, A., Suzuki, K. and Critchley, H., 2012. An Interoceptive Predictive Coding Model of Conscious Presence. *Frontiers in Psychology*, 2, p. 395.

Shaw, R., 2003. *The embodied therapist*. Brunner-Routledge, Hove.

Shaw, R., 2004. The Embodied Psychotherapist: An Exploration of the Therapists' Somatic Phenomena Within the Therapeutic Encounter. *Psychotherapy Research*, 14(3), pp. 271-288.

Simpson, J. A., Collins, W. A., Salvatore, J. E., and Sung, S., 2014. The impact of early interpersonal experience on adult romantic relationship functioning in M. Mikulincer and P. Shaver (eds), *The Herzliya series on personality and social psychology. Mechanisms of social connection: From brain to group.* American Psychological Association, Washington, pp. 221-234.

Stilwell, P. and Harman, K., 2019. An enactive approach to pain: beyond the biopsychosocial model. *Phenomenology and the Cognitive Sciences*, 18(4), pp. 637-665.

741 Teie, D., 2016. A Comparative Analysis of the Universal Elements of Music and the Fetal Environment. *Frontiers in*
742 *Psychology*, 07.

743 Thomson, O., Petty, N. and Moore, A., 2012. Reconsidering the patient-centeredness of osteopathy. *International*
744 *Journal of Osteopathy*, 16(1), pp. 25-32.

745 Thomson, O., Petty, N. and Moore, A., 2014. Clinical decision-making and therapeutic approaches in osteopathy:
746 A qualitative grounded theory study. *Manual Therapy*, 19, pp. 44-51.

747 Thompson, E., & Stapleton, M. 2009. Making Sense of Sense-Making: Reflections on Enactive and Extended Mind
748 Theories. *Topoi*, *28*(1), 23-30. https://doi.org/10.1007/s11245-008-9043-2

749 Thompson, E. 2014. The embodied mind: An interview with Evan Thompson. Fall 2014.
750 https://tricycle.org/magazine/embodied-mind/. Accessed 15 Dec 2021.

751 Thompson, E., 2020. *Expanding Our View of the Mind*. [podcast] Mind and Life. Available at:
752 <https://podcast.mindandlife.org/evan-thompson/> [Accessed 03 January 2022]

753 Tison, R. and Poirier, P., 2021. Communication as Socially Extended Active Inference: An Ecological Approach to
754 Communicative Behavior, Ecological Psychology, 33:3-4, 197-235, DOI: 10.1080/10407413.2021.1965480

755 Tschacher, W., Junghan, U. and Pfammatter, M., 2012. Towards a Taxonomy of Common Factors in
756 Psychotherapy-Results of an Expert Survey. *Clinical Psychology and Psychotherapy*, 21(1), pp. 82-96.

757 Tyreman, S., 2013. Re-evaluating osteopathic principles. *International Journal of Osteopathic Medicine*, 16(1), pp. 38-
758 45.

759 Tyreman, S., 2015. Trust and truth: uncertainty in health care practice. *Journal of Evaluation in Clinical Practice*, 21(3),
760 pp. 470-478.

761 Tyreman, S., 2018a Chapter 15, An Anthropo-Ecological narrative in Mayer, J. and Standen, C., (eds 2018),
762 *Textbook of osteopathic medicine*. Urban and Fischer, Elsevier.

763 Tyreman, S., 2018b Chapter 26, How to work with the Anthropo-Ecological narrative in clinical use in Mayer, J.
764 and Standen, C. (eds 2018), *Textbook of osteopathic medicine*. Urban and Fischer, Elsevier.

765 Tyreman, S., 2020. Person-Centred Care: Putting the Organic Horse back in front of the Mechanical Cart in M.
766 Loughlin and A. Miles (eds), *Person Centered Care: Advanced Philosophical Perspectives*, Aesculapius Medical Press,
767 London, pp. 95-105.

768 Van den Bergh, O., Witthöft, M., Petersen, S. and Brown, R., 2017. Symptoms and the body: Taking the inferential
769 leap. *Neuroscience and Biobehavioral Reviews*, 74, pp. 185-203.

770 Van der Kolk, B., 2015. *The Body Keeps the Score: Brain, Mind and Body in the Healing of Trauma.* Penguin Books,
771 New York.

772 Varela, F. and Shear, J., 1999. First person methodologies: why, what and how? *Journal of Consciousness Studies*, 6(2-
773 3), pp. 1-14.

774 Varela, F. J., Thompson, E., and Rosch, E. 1993. *The embodied mind: Cognitive science and human experience*. MIT
775 Press, Cambridge.

776 Vasil, J., Badcock, P., Constant, A., Friston, K., & Ramstead, M. 2020. A World Unto Itself: Human Communication
777 as Active Inference. *Frontiers In Psychology*, *11*. https://doi.org/10.3389/fpsyg.2020.00417

778 Venema, H., 2000. Paul Ricoeur of Refigurative Reading and Narrative Identity. *Symposium*, 4(2), pp. 237-248.

779 Verghese, A., Brady, E., Kapur, C. and Horwitz, R., 2011. The Bedside Evaluation: Ritual and Reason. Annals of
780 Internal Medicine, 155(8), p. 550.

781 Wampold, B., Duncan, B., Miller, S. and Hubble, M., 2010. *The heart and soul of change: Delivering what works in*
782 *therap*y (2nd ed). American Psychological Association, Washington.

783 Watson, P., van Wingen, G. and de Wit, S., 2018. Conflicted between Goal-Directed and Habitual Control, an
784 fMRI Investigation. *eNeuro*, 5(4), pp. ENEURO.0240-18.2018.

785 Zacharioudakis, N., Vlemincx, E. and Van den Bergh, O., 2020. Categorical interoception and the role of threat.
786 *International Journal of Psychophysiology*, 148, pp. 25-34.

787 Zorn, J., Abdoun, O., Bouet, R. and Lutz, A., 2020. Mindfulness meditation is related to sensory-affective
788 uncoupling of pain in trained novice and expert practitioners. *European Journal of Pain*, 24(7), pp. 1301-1313.