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The biopsychosocial model is lost in translation: from misrepresentation to an enactive modernization

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ABSTRACT

Introduction: There are increasing recommendations to use the biopsychosocial model (BPSM) as a guide for musculoskeletal research and practice. However, there is a wide range of interpretations and applications of the model, many of which deviate from George Engel's original BPSM. These deviations have led to confusion and suboptimal patient care.
Objectives: 1) To review Engel's original work; 2) outline prominent BPSM interpretations and misapplications in research and practice; and 3) present an "enactive" modernization of the BPSM.
Methods: Critical narrative review in the context of musculoskeletal pain.
Results: The BPSM has been biomedicalized, fragmented, and used in reductionist ways. Two useful versions of the BPSM have been running mostly in parallel, rarely converging. The first version is a "humanistic" interpretation based on person- and relationship-centredness. The second version is a "causation" interpretation focused on multifactorial contributors to illness and health. Recently, authors have argued that a modern enactive approach to the BPSM can accommodate both interpretations.
Conclusion: The BPSM is often conceptualized in narrow ways and only partially implemented in clinical care. We outline how an "enactive-BPS approach" to musculoskeletal care aligns with Engel's vision yet addresses theoretical limitations and may mitigate misapplications.

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Introduction

George Engel formally proposed his biopsychosocial model (BPSM) in 1977 (Engel, 1977), and it is now widely endorsed as an important framework for musculoskeletal research and practice (Cohen, Vase, and Hooten, 2021; Foster et al., 2018; Hartvigsen et al., 2018). However, many interpretations and applications of the BPSM do not align with Engel's work (Mescouto, Olson, Hodges, and Setchell, 2020; Stilwell and Harman, 2019). Different perspectives and applications of the BPSM have led to confusion among educators, researchers, and clinicians resulting in suboptimal patient care (Ng et al., 2021; Sanders, Foster, Bishop, and Ong, 2013; Synnott et al., 2015).

Recently authors have critically examined Engel's work, presenting theoretical limitations, expressing concerns regarding the various ways the BPSM has been interpreted and applied, and offering BPSM enhancements (Aftab and Nielsen, 2021; Bolton and Gillett, 2019; Buetow, 2021; Davidsen, Guassora, and Reventlow, 2016; de Haan, 2020b, 2021; Ghaemi, 2009; Stilwell and Harman, 2019). As a result it has been shown that the BPSM in its application is often biomedicalized, fragmented, and used in reductionist ways, thereby deviating from the original model proposed by Engel. Two useful versions of the BPSM can be identified in the literature. The first version is a "humanistic" interpretation based on person- and relationship-centredness. The second version is a "causation" interpretation focused on multifactorial contributors to illness and health. Unfortunately, these versions have been running mostly in parallel. Convergence of these versions of the BPSM may be possible through recently proposed "enactive" frameworks that aim to clarify and extend (i.e. modernize) the BPSM (Aftab and Nielsen, 2021; Buetow, 2021; Coninx and Stilwell, 2021; de Haan, 2020a, 2020b, 2021; Maiese, 2021; Stilwell and Harman, 2019).

Both Engel's BPSM and enactive frameworks are rooted in systems theory, are anti-dualist and anti-reductionist, and call for a more comprehensive or "big picture" approach to health conditions and their management. However, enactive frameworks offer theoretical advancements beyond Engel's work. The enactive approach (Varela, Thompson, and Rosch, 1991), now

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commonly referred to as enactivism, has a foundation in: phenomenology (i.e. study of experience); pragmatism (i.e. practical and action-oriented approach); and the cognitive sciences (i.e. interdisciplinary study of cognition) (Gallagher, 2017). Therefore, enactivism offers a robust theoretical toolkit to address the complexities of lived experience, such as musculoskeletal pain, as well as the relation between the multiplicity of factors involved in the generation and maintenance of pain.

Considering growing concerns regarding the BPSM and its various interpretations, this narrative review aims to add to this ongoing discussion by asking: is Engel's BPSM lost in translation, and what modern iteration should we pursue? We have three objectives: 1) to present an overview of what Engel actually said about the BPSM by focusing on primary sources; 2) outline what other authors and we interpret as prominent versions (interpretations) and misapplications of the BPSM in research and practice; and 3) present an "enactive" modernization of the BPSM. We place a particular emphasis on recent developments in the enactive literature that target gaps and limitations in Engel's original model (Aftab and Nielsen, 2021; Bolton and Gillett, 2019; Buetow, 2021; Coninx and Stilwell, 2021; de Haan, 2020a, 2020b, 2021; Lehman, David, and Gruber, 2017; Low, 2017; Maiese, 2021; Stilwell and Harman, 2019). We argue that an enactive iteration of the BPSM (what we call an "enactive-BPS approach") strengthens and modernizes Engel's BPSM and may help mitigate misapplications. We conclude with some preliminary and pragmatic clinical applications of an enactive-BPS approach.

Methods and scope

To achieve our objectives, we conducted a critical narrative review with the scope of focusing on the BPSM in the context of healthcare and musculoskeletal pain. Narrative reviews involve the judicious and purposeful selection of relevant literature on a topic of interest and provide a summary as well as interpretation and critique (Greenhalgh, Thorne, and Malterud, 2018). We started by (re)reading Engel's key published works related to the BPSM and then reviewed relevant work related to Engel and the history of the BPSM. We extracted and synthesized content related to the underlying theory and characteristics of the BPSM. Then building on previous work (Mescouto, Olson, Hodges, and Setchell, 2020; Stilwell and Harman, 2019) we identified interpretations and criticisms of Engel's BPSM. Regarding identified BPSM criticisms, we integrated our critical perspectives and interpretations based on our recent review of Engel's work and other relevant literature. Subsequently, we aimed to identify prominent versions of the BPSM, as well as theoretical developments that aim to enhance or extend (i.e. modernize) the BPSM.

We included seminal articles that our team was already aware of, and additional literature was identified from a series of PubMed, CINAHL, Web of Science, and Google Scholar searches including combinations of core terms such as: biopsychosocial, enactiv*, Engel, George Engel, model, musculoskeletal, pain, review, theor*. Consistent with narrative review methodology (Greenhalgh, Thorne, and Malterud, 2018) this was an iterative process involving the identification of additional literature through reading, bibliography reviews, subsequent searches, and integrating content based on team discussion and consensus.

Concerning our scope, we would like to note that enactivism is a rapidly evolving movement with many facets. We do not aim to provide a detailed historical overview (Thompson, 2005, 2007; Varela, Thompson, and Rosch, 1991) or an analysis of the various strands of enactivism (Käufer and Chemero, 2021; Ward, Silverman, and Villalobos, 2017) and related concepts (De Jaegher and Di Paolo, 2007; Di Paolo and Thompson, 2014; Gallagher, 2017; Kiverstein and Clark, 2009; Ward and Stapleton, 2012). Rather, the scope of this paper is to introduce the core assumptions of enactivism and highlight central work being done in this area in relation to the advancement of the BPSM.

What did Engel actually say?

To answer if Engel's BPSM is lost in translation, we must first establish what Engel proposed. Unfortunately, much of the literature referring to the BPSM cite secondary and tertiary sources. These citation practices result in BPSM interpretations of interpretations. We strive to avoid this by focusing on Engel's original writings and related historical work.

Dissatisfaction with the biomedical model

Initially, Engel had an affinity to "reductionist biomedical science" (Engel and Engel, 2002) and physical explanations of disease processes (Gellman, 2016). However, influence from colleagues and time spent at the University of Cincinnati slowly "converted" him to the psychosomatic school of thought, and he subsequently served as the editor of the journal *Psychosomatic Medicine* (Gellman, 2016). Engel's development as both a researcher and physician led to his dissatisfaction with the biomedical model and his belief in the need for a new model. He believed that the biomedical model had

acquired the tradition and authority of dogma and was no longer adequate for the " . . . scientific tasks and social responsibilities" of medicine (Engel, 1977). More specifically, he argued that the biomedical model was: reductionist (i.e. complex health concerns inappropriately reduced to biochemical or pathoanatomical processes); dualist (i.e. separated body and mind); and that it " . . . leaves no room within its framework for the social, psychological, and behavioral dimensions of illness" (Engel, 1977). He recognized the need for a new approach, moving away from the dehumanizing biomedical model as it does not include the patient and their " . . . attributes as a person, a human being" (Engel, 1980).

A way forward: humanism and multifactorial causation

In contrast to the biomedical model, Engel argued that the BPSM addresses the need for a humanistic approach involving an appreciation of human experience, the causal complexities of illness and disease, and the caring interpersonal elements in healthcare (Engel, 1987). In his landmark paper, he argued:

> *To provide a basis for understanding the determinants of disease and arriving at rational treatments and patterns of health care, a medical model must also take into account the patient, the social context in which (they live), and the complementary system devised by society to deal with the disruptive effects of illness, that is, the physician role and the health care system* (Engel, 1977, p. 132).

Further, he stated:

> *By evaluating all the factors contributing to both illness and patienthood, rather than giving primacy to biological factors alone, a biopsychosocial model would make it possible to explain why some individuals experience as "illness" conditions which others regard merely as "problems of living," be they emotional reactions to life circumstances or somatic symptoms* (Engel, 1977, p. 133).

He emphasized that a move from the biomedical to BPSM "refers to a historical transition in scientific thinking that has been taking place over the past century and a half. Particularly pertinent for medicine is its explicit attention to humanness" (Engel, 1997). He placed a particular emphasis on a detailed and humanistic clinical interview and that "meaning is preeminent to measurement" (Engel, 1987). He contrasted this with the biomedical model that " . . . encourages bypassing the patient's verbal account by placing greater reliance on technical procedures and laboratory measurements" (Engel, 1977). He argued for increased rigor when taking patients' histories to uncover the multiplicity of factors that may be contributing to a person's illness. Further, he emphasized the importance of the clinician-patient relationship, stating that " . . . the behavior of the physician and the relationship between patient and physician powerfully influence therapeutic outcome for better or worse" (Engel, 1977). Finally, he highlighted the importance of fostering communication, collaboration, and complementarity within all those involved in an individual's care (Engel, 1978).

Theoretical foundation of the BPSM

Engel built the BPSM on general systems theory that conceptualized nature as a hierarchy of systems. Lower levels included molecules, cells, and organs; while higher levels included the person including experience and behavior, two-people, family, and community (Engel, 1977, 1980). In an attempt to avoid reductionism or dualism, Engel used general systems theory to emphasize that " . . . all levels of organization are linked to each other in a hierarchical relationship so that change in one affects change in the others . . . " (Engel, 1977). Engel viewed this as a "vertical stacking" where larger units are more complex and superordinate to less complex smaller units (Engel, 1982). Further, he briefly mentioned that "material and information flow" across the boundaries of each connected system (Engel, 1980).

Purpose and application of the BPSM

Engel concluded his landmark paper by suggesting that the BPSM provides a " . . . blueprint for research, a framework for teaching, and a design for action in the real world of health care" (Engel, 1977). His model was intended to represent the integrated and indivisible nature of the biological, psychological, and social domains that could not be separated and that " . . . all three levels, biological, psychological and social, must be taken into account in every health care task" (Engel, 1978). His model could not, nor was meant to, explain every aspect or dynamic in research, education, or healthcare. Instead, his model was intended to be a heuristic that users could implement across diverse contexts. As a heuristic framework for clinical medicine, Engel's BPSM deliberately avoided a rigid overt structure as he recognized the inherent individualism of patients' conditions and experiences and the varied roles of the healthcare practitioners involved in a patient's care.

After his landmark 1977 paper, he continued to refine and apply the BPSM, publishing work on the: clinical application of the BPSM (Engel, 1980); applications to education (Engel, 1978, 1982); and the importance of the

clinician-patient relationship and dialogue (Engel, 1987, 1992). Engel sought to broaden the scope of the clinician's perspective to include self-reflection on one's approach to patient assessment and treatment (Engel, 1987, 1997). He also aspired to transform the patient's role from a passive recipient of care to an active participant in the process of recovery (Borrell-Carrio, Suchman, and Epstein, 2004; Engel, 1977, 1980). Engel's BPSM is highly influential in research and practice and is interpreted and applied in many ways. In the next section, we outline two prominent versions of the BPSM that are found in the literature. These versions align with two core facets of Engel's work: humanism and multifactorial causation.

Two versions of the BPSM: humanistic and causation interpretations

Engel declared that, "the reductionist scientific culture of the day is largely responsible for the public view of science and humanism as antithetical" (Engel, 1980). We believe that this cultural influence has also perpetuated the split in the BPSM as either being focused on humanism or causation, with the former being largely neglected due to the perception that it is not scientific or a relevant research endeavor (Cassell, 2004; Engel, 1987). This division between humanism and scientific practices related to causation is apparent in the ways people talk about the BPSM. When there is an emphasis on lived experience or the relational and communication elements in Engel's BPSM, we call this focus the "humanistic" version of the BPSM. When there is an emphasis on factors or mechanisms contributing to a person's health concern, we call this the "causation" version of the BPSM. Historically these two versions of the BPSM with their particular focus (i.e. humanism or causation) have been running mostly in parallel in the literature and rarely integrated in meaningful ways. In the following subsections, we explore these two versions of the BPSM.

Humanistic Version of the BPSM

Humanism, broadly understood to include person- and relationship-centeredness, has been interpreted as a prominent aspect of Engel's BPSM (Borrell-Carrio, 2004; Daluiso-King and Hebron, 2022; Langendoen, 2004; Smith, 2002). Authors have proposed that person-centered care underpins the humanistic aspects of the BPSM, including the patient's perspective as part of the therapeutic process to encourage greater partnership between clinician and patient (Cowell et al., 2021). Indeed, person-centered care has been described as the practical application of the BPSM (Daluiso-King and Hebron, 2022; Langendoen, 2004; Smith, 2002). Since Engel's publications, there has been increased person-centered care advocacy and a re-thinking of the patient's role in their care. Person-centered care places the needs of the patient at the forefront (Stewart, 2001) and implies ethical consciousness about the patient as a capable person with agency (Melin, Nordin, Feldthusen, and Danielsson, 2021). Further, it includes seeking to understand the patient's perspective, goals, needs, concerns, and collaboration between clinician and patient, including shared decision-making (Borrell-Carrio, 2004; Mead and Bower, 2000; Stewart, 2001).

In addition to person-centered care within the BPSM, an overlapping and complementing construct is relationship-centered care (Borrell-Carrio, 2004; Smith, 2002) which can be interpreted as being situated within the "two-person" system in Engel's (1980) systems hierarchy. Smith (2002) suggested that relationship-centered care "extends the person-centered process to the remainder of the medical system, encouraging communication and relational principles at all levels among administrators, nurses, doctors, and unions." This facilitates further reflection on power and the systemic and socioeconomic influences on the delivery of care. Together, a person- and relationship-centered approach in the clinical encounter gives:

> *. . . the patient space to articulate his or her concerns, finding out about the patient's expectations, and exhorting the health professional to show the patient a human face. These approaches represent movement toward an egalitarian relationship in which the clinician is aware of and careful with his or her use of power* (Borrell-Carrio, 2004, p. 578).

After Engel's landmark paper in 1977, the concept of the clinician-patient relationship was further refined under the construct of the "therapeutic alliance." The therapeutic alliance sometimes called the working or therapeutic relationship is defined as "a trusting connection and rapport established between therapist and client through collaboration, communication, therapist empathy and mutual understanding and respect" (Cole and McLean, 2003). Additionally, the therapeutic alliance is based on: collaborative goal setting; agreeing upon interventions; assigning tasks linked to goals; and bonding as rapport and trust are established (Bordin, 1979). In the context of musculoskeletal care, the therapeutic alliance is now positioned as a key attribute of the BPSM (Daluiso-King and Hebron, 2022) and it has been put forward as a central component of person-centered behavior change within a BPS framework (Stilwell and

Harman, 2017a). Overall, the humanistic interpretation of the BPSM has focused on person- and relationship-centredness and the therapeutic alliance.

Causation Version of the BPSM

The BPSM is often used to understand so-called drivers or factors contributing to health concerns, including painful musculoskeletal conditions (Cohen, Vase, and Hooten, 2021; Fillingim, 2017; Gatchel et al., 2007; Pincus et al., 2013). In contrast to the humanistic version, this causation version has more of a focus on the etiology of a condition or personalizing treatment based on underlying mechanisms. The causation version of the BPSM has guided many important scientific and clinical advancements, including interest in more comprehensive, interdisciplinary pain care. However, on its own, implementing this version of the BPSM in clinical practice leaves much to be desired as there is a need to: further humanize the clinical encounter and the assessment of BPS factors; better integrate patients' experiences, concerns, and perspectives; and to avoid reductionist and dualist tendencies. This issue is explored further in the section on misapplications of the BPSM.

Engel used the general systems theory that was available to him and the BPSM reflects advanced thinking at the time. However, since his BPSM was introduced, complex systems theory, dynamical systems theory, and network theory developed allowing for a better understanding of complex, interacting, and non-linear processes (de Haan, 2020b). As described by Davidsen, Guassora, and Reventlow (2016) some theorists have interpreted Engel's thinking as what would now be considered a complexity view. However, Davidsen, Guassora, and Reventlow (2016) argued that a complexity view is more dynamic than Engel's work and that he lacked theoretical linkages between body and mind.

In recent years authors have addressed gaps in Engel's work by integrating contemporary theory into the BPSM to make it more dynamic and mitigate mind-body separation. For instance, Borrell-Carrio, Suchman, and Epstein (2004) put forward BPSM "clarifications" including that subjective experience depends on but is not reducible to physiology, and that we need to consider "circular causality" in the development of health issues. Yet pragmatically we have to make linear approximations in clinical practice. In contrast to a linear and unidirectional cause-effect perspective, circular causality suggests that a multitude of complex feedback loops generate and sustain specific phenomena over time.

Subsequent to the work of Borrell-Carrio (2004) and many others (Aftab and Nielsen, 2021; Bolton and Gillett, 2019; Buetow, 2021; Coninx and Stilwell, 2021; de Haan, 2020a, 2020b, 2021; Lehman, David, and Gruber, 2017; Low, 2017; Maiese, 2021; Stilwell and Harman, 2019) further emphasized the importance of lived experiences and patients' narratives within the complex, dynamical, interactive, and bi-directional connections across the three BPS domains. A commonality across all of this recent work is the incorporation of enactive theory (Newen, Gallagher, and De Bruin, 2018; Øberg, Normann, and Gallagher, 2015; Thompson, 2004; Varela, Thompson, and Rosch, 1991). We unpack the potential value of enactive theory later in this paper. First, we outline interpretations and applications of the BPSM that stray from the outlined versions.

Misapplications of the BPSM

Building on previous work (Mescouto, Olson, Hodges, and Setchell, 2020; Stilwell and Harman, 2019) our review of the literature resulted in the identification and labeling of three ways that the BPSM is framed and applied in manners that we interpret as deviating from Engel's original work. As these deviations may result in suboptimal musculoskeletal care, we label them as "misapplications." The three misapplications are: 1) the biomedicalization of the BPSM; 2) fragmentation of the BPSM; and 3) neuromania. Each of these misapplications conflict with the humanistic and causal considerations found in Engel's work and the two versions of the BPSM outlined above.

Biomedicalization of the BPSM

Stilwell and Harman (2019) and Mescouto, Olson, Hodges, and Setchell (2020) highlighted the biomedicalization of the BPSM where interpretations and applications of the BPSM do not align with the humanistic and multicausal approach that Engel advocated for. They outlined how the BPSM is often presented with a humanistic and holistic coating; yet, upon deeper inspection, the way it is framed and used is reminiscent of the biomedical model that largely neglects social factors. This includes falling back into a focus on primarily biological factors and the identification of "objective" elements such as tissue damage, physical function, or biomarkers. At times, it is almost as if these elements were independent of the human and their experience, which is clearly contrary to Engel's proposal. To be clear, we are not downplaying the many scientific advancements that have taken place or the importance of biomedical research; rather, we flag the contradictions and problems that arise when researchers and clinicians endorse the

BPSM yet overlook, minimize, or attempt to override the humanistic elements that are at the core of Engel's work.

The biomedicalization of the BPSM trivializes the core humanistic facet of Engel's BPSM. A prominent version of the BPSM has developed that has a strong focus on identifying and intervening upon BPS factors or underlying mechanisms contributing to the health condition or disease of interest. This version of the BPSM appears to be increasingly tethered to "precision medicine," predictive modeling, personalized treatment algorithms, and a quest for biomarkers as outlined by Cohen, Vase, and Hooten (2021) in the recent *Lancet Series on Chronic Pain*. Cohen, Vase, and Hooten (2021) presented the best practice recommendation that care should be based on the BPSM yet largely miss Engel's core humanistic elements, including a strong emphasis on dialogue and the clinician-patient relationship. Instead Cohen, Vase, and Hooten (2021) stated that a promising and priority area is " ... the identification of biomarkers that can objectively quantify pain ... " and "objectify" pain treatment responses. This focus seems to contradict the idea that pain is fundamentally a subjective experience and does not align with Engel's push for a humanistic turn in medicine where meaning is preeminent to measurement (Engel, 1987).

Since its inception, the BPSM has guided various research programs aiming to uncover the biological, psychological, and social drivers of a range of health conditions, including musculoskeletal pain. On a quest to personalize care, researchers and clinicians have attempted to profile patients through batteries of tests and structured quantitative questionnaires in order to provide targeted treatment. For instance, research developments have resulted in prognostic screening tools and outcome measures that are increasingly recommended for clinical use (Lin et al., 2020). These questionnaires and tools may help identify various drivers or factors contributing to a patient's health condition (e.g. pain) and help clinicians stratify their care based on the risk of chronicity. However, as recognized by Engel (1997), these types of questionnaires and tools can be used with little meaningful clinician-patient interaction or an appreciation of the patient's lived experience and unique concerns. In turn, as Engel warned, we may overlook patients' important and scientifically-relevant qualitative narratives (Engel, 1997). Without meaningful integration of humanistic elements, "personalized" medicine can easily become "depersonalized" medicine (Fava and Sonino, 2017; Horwitz, Cullen, Abell, and Christian, 2013).

Aligning with Engel's concerns, some researchers have recognized the biomedicalization of the BPSM and its implications. For example Stewart, Kempenaar, and Lauchlan (2011) noted that "yellow flag" screening is based on the BPSM, yet implementation reflects the reductionist biomedical paradigm. Therefore, the authors called for improved integration of patients' unique experiences and meanings of pain. Indeed, patients have stressed that it is important for them to be able to express their individual concerns "because ticking a box was not enough to describe how their everyday life was affected (by pain)" (Ibsen et al., 2019). Furthermore Robinson-Papp, George, Dorfman, and Simpson (2015) reported that patients object to the quantification of their personal and idiosyncratic experiences of pain. Once again, we are not minimizing the potential importance of valid scientific and clinical tools; rather, within a BPS clinical framework, these tools should not replace or minimize the need for clinician-patient interaction, including an exploration of patients' unique concerns and experiences that elude quantification.

Ultimately, using the BPSM as a guide to identify BPS factors and quantify a person's health concerns and outcomes through a barrage of testing closely resembles a reductionist philosophy of the biomedical model rather than Engel's humanistic approach. Engel described how influence from the biomedical model leads to a search for explanations for patients' health issues, and that other humanistic factors are viewed as "overlay" or irrelevant to the clinician's task (Engel, 1980). This is still a feature of research and clinical practice but under the guise of the BPSM (Mescouto, Olson, Hodges, and Setchell, 2020; Stilwell and Harman, 2019).

Fragmentation of the BPSM

Related to the previous misapplication, the BPSM is often fragmented despite Engel's insistence on the inseparable and interconnected nature of the biological, psychological, and social domains. For example, if the source of a patient's concern cannot be found in the body, it is often suggested that it must be psychogenic, mental, or all in the patient's mind (Stilwell and Harman, 2019). This perpetuates the mind-body split (i.e. dualism) that can lead to blaming, stigmatization, and patient frustration as reflected in the following quote from a patient after a healthcare professional told them that there was nothing wrong with them: "I felt stupid – the pain isn't in my head it's in my back" (Holloway, Sofaer-Bennett, and Walker, 2007). Indeed, the fragmentation of the BPSM in clinical practice was highlighted in a recent systematic review on barriers and enablers influencing healthcare professionals' adoption of a BPS approach to musculo-skeletal pain (Ng et al.,

2021). Specifically, clinicians were reported to have the inability to make connections between biological and psychosocial factors or apply the BPSM in the humanistic and holistic fashion that Engel intended (Ng et al., 2021).

Mescouto, Olson, Hodges, and Setchell (2020) identified that most research tends to take a "segmented" approach to the BPSM, and some aspects are considered more frequently than others. The authors identified the tendency to place a strong focus on the biological domain and that there is a trend toward reductionism and dualism. Further, Pincus et al. (2013) suggested that the fragmentation of the BPSM in back pain research may explain why evidence-based treatment grounded in the BPSM has not produced impressive patient outcomes. Overall, the fragmentation of the BPSM does not align with Engel's push for a truly humanistic and multicausal approach to illness and disease that moves beyond traditional approaches that placed a focus on biological processes.

Neuromania

Building on the previous two misapplications, a third issue is that many working within BPS frameworks have started to place a central focus on the brain, and this so-called neurocentrism or neuromania (Tallis, 2011) risks overlooking or trivializing non-neural and non-reducible factors beyond the body, such as social context and culture (Gallagher, Hutto, Slaby, and Cole, 2013). Contrary to Engel's humanistic and multicausal propositions, these practices perpetuate a push to reduce patients' subjective experiences, such as pain, to anatomical and functional changes to neural networks.

Alan Jasanoff a neuroscientist (2018a, 2018b) has recognized the cultural obsession with the brain and ensuing negative implications. As reflected in the following quote, the concern with neurocentrism is that we may minimize or overlook important humanistic and environmental processes:

> *The more we feel that our brains encapsulate our essence as individuals, and the more we believe that our thoughts and actions simply emanate from the bundle of flesh in our heads, the less sensitive we will be to the role of the society and environment around us, and the less we will do to nurture our shared culture and resources* (Jasanoff, 2018b).

In musculoskeletal care, there has been growing interest in explaining pain, which refers to a range of educational interventions that aim to change patients' understandings of the biological processes that are thought to underpin pain (Moseley and Butler, 2015). Authors have suggested that explaining pain is the "pragmatic application of the biopsychosocial model of pain . . . " (Moseley and Butler, 2015). However, the strong focus on biology and the brain seems to stray from Engel's vision and may have unwanted clinical implications. For instance, patients may believe that they are being told that their pain is all in their head.

Although there is limited research exploring neuromania in the context of musculoskeletal pain, looking to other fields provides a warning that the trend toward giving biologically focused explanations for patients' experiences may have unwanted, paradoxical outcomes. For example, in the context of mental health, there is some evidence that brain and biologically-focused explanations and beliefs may increase rather than decrease stigma and negative beliefs toward mental health (Berent and Platt, 2021; Larkings and Brown, 2018) and may negatively impact patient outcomes (Schroder et al., 2020). Research on this topic in the context of musculoskeletal pain is desperately needed.

What is the source of BPSM misapplications?

What we and others interpret as BPSM misapplications may, in part, be the result of the way Engel presented the BPSM. A growing number of authors have recognized that much of Engel's writings are vague and without strong underlying theory (Bolton and Gillett, 2019; Buetow, 2021; Davidsen, Guassora, and Reventlow, 2016; de Haan, 2020b; Ghaemi, 2009; Stilwell and Harman, 2019). This helps explain the wide range of interpretations and applications of his work. Some authors have argued that an issue is that Engel did not embrace the full potential of general systems theory (Benning, 2015). Engel positioned general systems theory as the theoretical foundation of the BPSM; however, he was very brief in describing this. For example, in his 1977 paper formally introducing his BPSM, he only dedicated a single paragraph to general systems theory. In this paragraph he outlined that everything is linked in a hierarchical relationship and that change in one level of the hierarchy will impact the other levels. Because of Engel's lack of detail and vagueness, authors have suggested that the dynamics and integration of the three domains (i.e. bio, psycho, and social) could be further developed to avoid BPSM misinterpretations and misapplications (Coninx and Stilwell, 2021; de Haan, 2020b; Stilwell and Harman, 2019).

It is also important to note that the tone of Engel's writings reflect the era his papers were written in, as well as what appears, at times, a lingering affinity to aspects of the biomedical paradigm. Some authors have clearly picked up on this, and some have even suggested that

Engel's work is "anti-humanistic" (Ghaemi, 2009). Others have stated that the BPSM is insensitive to patients' subjective experiences (Benning, 2015).

An issue is that Engel's proposed theoretical foundation (i.e. general systems theory) for the BPSM does not clearly or explicitly accommodate or embrace the humanistic, relational, and phenomenological elements that he touched on throughout his works. Therefore, it is little surprise that authors such as Benning (2015) discussed how the BPSM lacks philosophical coherence and that there are " ... no safeguards against either the dominance or the under-representation of any one of the three domains of bio, psycho, or social." Further, as noted by Buetow (2021) the BPSM "still wrestles with the dominant biomedical discourse, in which biological, psychological and social factors reduce to an objective physicality." In the next section, we discuss how an enactive-BPS approach is promising as it aligns with Engel's vision, brings the humanistic and causal versions of the BPSM together, helps fill important theoretical gaps, and may potentially mitigate BPSM misapplications that are receiving increasing attention.

Merging the two versions: an enactive-BPS approach

An enactive-BPS approach helps us to appreciate the complexity and totality of human experience that is intrinsically embodied and embedded in an environment. It also allows us to avoid the potentially reductionist and fragmented perspectives that have developed from the BPSM focused on causative factors. In general, enactivists argue for an integrative framework whereby experience is not located in an immaterial mind abstracted from the living body (i.e. dualism) or simply reduced to neural processes (reductionism). Instead there is an appreciation of the whole embodied person and how interactions in their environment, including other people, *enact* or *bring forth* experiences of ourselves and the world (Varela, Thompson, and Rosch, 1991). There are now many strands of enactivism being applied to health conditions and healthcare in general (Aftab and Nielsen, 2021; Coninx and Stilwell, 2021; de Haan, 2020b; Maiese, 2021; Stilwell and Harman, 2019; Toro, Kiverstein, and Rietveld, 2020). Enactivism offers new and interesting ways to think about both human experience and causation. Below we outline the humanistic and causal aspects of enactivism and the associated theoretical concepts (i.e. affordances, emergence, co-determination, and organizational causality) that may help unify, strengthen, and modernize Engel's BPSM.

Enactivism and humanism

Enactivism encapsulates and builds on the humanistic approach that Engel endorsed and facilitates the merging of the two interpretations of his work outlined above. Similar to Engel, enactivists emphasize lived experience but with an additional focus on opportunities for action (affordances) in the environment that a particular person perceives as available based on their concerns and abilities (Käufer and Chemero, 2021). In the context of healthcare, a patient's experience (e.g. pain) and their interactions in their physical and social environment can shape disability and actions afforded, for better or worse (Coninx and Stilwell, 2021; Gallagher, 2018; Stilwell and Harman, 2019; Toro, Kiverstein, and Rietveld, 2020).

The enactive focus on a person's engagement with their environment and their perceived action possibilities allows us to better explore and recognize how musculoskeletal pain can alter or permeate one's life and their attunement to the environment (Coninx and Stilwell, 2021). Often people experiencing chronic pain are no longer able to flexibly attune to the environment in the way they were before. They can become stuck perceiving a world of closed-off or threatening possibilities which may foster a vicious circle of excessive avoidance, negative emotions, isolation, and hopelessness. People can develop patterns where they stop believing in their bodily abilities and further refrain from (meaningful) activities. Unfortunately, messages from others may substantially contribute to this (e.g. blame, stigma, and treating the body like a broken machine) (de Oliveira et al., 2020; Setchell et al., 2017; Stilwell, Stilwell, Sabo, and Harman, 2021).

Enactive theoretical advancements, with a focus on affordances related to clinician-patient interaction and the clinical environment, have helped researchers to better theorize historically challenging clinical phenomena such as placebo and nocebo effects (Arandia and Di Paolo, 2021; Ongaro and Ward, 2017) and to take a "thoroughly humanistic" approach that appreciates the " ... vulnerability that all living beings have in common in their relation with their environment" (Bruineberg, 2021). Thus, in accordance with an enactive approach, pain can only be understood in consideration of the person as a whole. This involves investigating the (re)organizations of involved physiological systems, but always in the context of the person including their experiences, concerns, and expectations – who constantly affects and is affected by the environment in which they are embedded. Dent and Ward (2022) summarized:

> *Enactivism is an agency-based perspective of human functioning which conceptualizes human beings as embodied organisms who exist in a needful, adaptive relationship with a dynamic physical, social, and cultural environment* . . . (Experiences) *are purposeful phenomena which are enacted by organisms to meet functional needs related to survival and self-maintenance in their environment . . . What it means to act adaptively in an enactive sense is not limited to simple biological survival; as social and culturally embedded beings, we also understand the world in terms of actions related to socially or culturally determined needs, and how best to meet these . . . From a person's subjective, first-person perspective, actions which are adaptive at the biological level are not understood to be any more or less "real" or fundamental to survival than those at a social, cultural, or individual level* (Dent and Ward, 2022, p. 2-4).

Buetow (2021) specifically highlights the humanistic implications of enactivism for pain care:

> *The non-reductive, naturalistic ability of enactivism to transcend mind-body dualism shares a relational ontology with and complements a person-centred approach to health care issues such as pain management . . . An opportunity thus arises for person-centred health care to mobilize an enactive approach to pain, which extends biopsychosocial care and patient-centred health care* (Buetow, 2021, p. 56).

In the following, we outline enactive perspectives on causality, which are intertwined with the humanistic focus of enactivism outlined above. Using an enactive-BPS approach to better understand the person in pain means considering the unified integration of interacting factors across the BPS domains, which always includes a sociocultural context that we shape and that shapes us, impacting experiences of pain and agency.

Pain and Causation in the Person-Environment System

By integrating enactive theory into a modernized BPSM, we can extend and in part replace Engel's vague idea of information "flow" and restructure his vertical hierarchy by introducing the closely related enactive concepts of emergence, co-determination, and organizational causality.

Emergence and Co-Determination

With an enactive-BPS approach, we can consider complex experiences, such as pain, as emergent. Emergence was a concept that Engel appeared to be heading toward when citing systems theorists and Borrell-Carrio (2004) briefly mentioned emergence when outlining their BPSM "clarifications." Their perspective on emergence related to how different levels of Engel's hierarchy could interact to produce emergent properties, similar to how "large weather patterns" are dependent on initial conditions and many (sometimes small) influences (Borrell-Carrio, 2004). Here, we add further details on emergence and unpack this challenging concept in relation to musculoskeletal pain and then expand on these ideas using analogy.

The concept of emergence has been used in different manners and it remains the subject of ongoing heated debates. For present purposes, we refer to the concept of emergence to emphasize that complex systems can show characteristics that their isolated parts do not. That is, more global systems, such as a person in their environment, can instantiate certain properties that the more local components of such systems, such as the neural and endocrine system, do not possess. At the same time, the properties of a complex system are determined by the dynamic interplay of the involved parts. More global processes (e.g. patients' experiences) are determined by the constellations and interconnections of more local processes (e.g. physiology) (Coninx and Stilwell, 2021; de Haan, 2020b). The other way around, the parts of a system behave differently than in isolation or in the organization of another system. As such, the properties and behaviors of more local processes are constraint by being part of more global processes. Therefore, there is an appreciation of the co-determination of more global processes and more local processes. This co-determination is asymmetric in that changes to more global processes necessarily involve changes to more local processes, while not all local changes necessarily bring about changes to more global processes (de Haan, 2020a, 2020b).

Now we can apply these ideas to pain. Pain is an emergent property of the person as a whole, including brain and body, in their environment. Thus, ascribing pain to a local part of the person, say their leg or brain, would be a misidentification. Pain always includes changes in some physiological processes; yet, physiological processes are more local and do not necessarily result in changes of more global processes, like pain (Stilwell and Harman, 2019). Changes in physiological processes do not neatly correspond to changed global processes (e.g. changes in imaging findings do not neatly correspond to changes in experience). More specifically, tissue injury and neural re-organization are local processes that, by themselves, do not always result in or taken together "add up" to more global processes, such as pain. For example, increased nociception does not automatically equate to increased pain intensity (Wall and McMahon, 1986). Therefore, the pain that a person experiences in a particular context cannot be reduced to a single factor (e.g. injured tissues) or the mere collection of heterogenous factors. Nor can we treat the body

like a mechanical clock where pain is the indicator of a broken gear that can be fixed. These ideas are still quite abstract, so we will now unpack them further using a cake analogy.

Cake analogy

We can think about the relation between global and local processes in analogy to the relation between a cake and its ingredients, such as salt, water, flour, sugar, and eggs (de Haan, 2020b). The cake represents a more global system, in our case, the person experiencing pain. The ingredients are the more local components of which the cake is made, standing in for physiological processes. We cannot reduce the generation and maintenance of pain to a single physiological process; like we cannot reduce a cake to just the flour. The way ingredients bring about emergent properties of a cake (e.g. softness) are best understood in their interplay and not all changes in ingredients add up to changes in the entire cake. For example, not every change in the amount of sugar will have a noticeable effect; we can only understand the respective contribution to the emergent properties of the cake in the context of the other ingredients (e.g. amount of salt, water, and flour).

Correspondingly, the generation of pain is best understood in the dynamic coupling of neural and non-neural processes (e.g. interconnection of changes in the neural, endocrine, and immunological system) (Chapman, Tuckett, and Song, 2008). At the same time more global processes such as a patient's expectations and experiences of unpleasant emotions associated with pain, necessarily imply and constrain changes of physiological aspects (e.g. neural reorganization) just like changes to the cake as a whole involves changes to the ingredients and their chemical organization.

Finally, we must also consider sociocultural context as it is not simply a passive background setting; rather, it is a part of the system, affecting psychological as well as physiological processes. Culture permeates or "colours" subjective experiences (Hutto, Gallagher, Ilundáin-Agurruza, and Hipólito, 2020; Wiech and Shriver, 2018) such as pain. Continuing with the cake analogy, the effects of culture are similar to how the temperature of an oven impacts the overall state of a cake, including its ingredients (de Haan, 2020a). With an enactive perspective, physiology, experiences, and culture are distinct but not separate processes; they are all parts of the same person-environment system.

Overall, this complexity view in enactivism adds detail to Engel's vague concept of information "flow" across systems. The enactive-BPS approach positions pain as an emergent property of the person in their context that cannot be fully understood in the consideration of isolated factors, but only in their co-determination and unfolding over time. Enactive thinkers commonly discuss this co-determination (i.e. local-to-global and global-to-local) under the labels of reciprocal or circular causality (Fuchs, 2018, 2020; Thompson, 2007; Thompson and Varela, 2001) and more recently the promising concept of organizational causality (de Haan, 2020a, 2020b, 2021). Complementing the concept of emergence outlined above, we find the concept of organizational causality to be particularly promising.

Organizational Causality

Engel's vertical hierarchy may benefit from the enactive concept of organizational causality to allow a more integrated perspective on the complex interaction between biological, psychological and social processes. The assumption of a vertical hierarchy is misguided as it implies an understanding of the biological, psychological, and social domains as opposing ontological structures that exist independently and causally interact in a sequential two-way manner, for example by sending "information" up and down always creating change in the system above or below (Engel, 1977). This understanding still facilitates a dichotomous or trichotomous reading and does not readily get at the concepts of emergence and co-determination outlined above.

Instead, the view of an organizational hierarchy emphasizes that more global and local processes relate in terms of part-whole relations: the properties of a more global system are determined by the properties and organizations of the more local systems that it is composed of. Further, global properties constrain local characteristics and interactions. Global and local systems determine each other, however, changes in more global systems necessarily imply changes in more local systems while this relation does not hold the other way around. Local processes may only in their interplay with other aspects bring about changes in more global processes. Furthermore, the concept of organizational hierarchy emphasizes that local and global processes do not relate as neatly mapping vertical levels. More global and more local processes are potentially overlapping and cross-cutting, dynamically interacting along multiple feedback loops.

An organizational hierarchy accommodates the idea of anti-dualism in that processes of all three BPS domains are located in the same ontological realm, and the related concept of emergence (see above) emphasizes that none of the domains are reducible to or considered more fundamental than any of the others. The three BPS domains are all part of *one* complex and dynamical

system: local and global processes characterize excerpts of the same person-environment system with varying spatio-temporal complexity that are interwoven along more or less extended feedback loops (de Haan, 2020a, 2020b, 2021). Aftab and Nielsen (2021) summarized this view:

> *. . . there is no tripartite structure to the ontology. Instead, the brain, body, and environment are considered to all be constituted from material substance, and to form a complex dynamical system existing across different scales of time and space (i.e. the so-called 'brain-body-environment system')* (Aftab and Nielsen, 2021, p. 16).

With our enactive-BPS theoretical foundation in place, we can now apply these ideas to everyday musculoskeletal practice in the next section.

Clinical relevance of an enactive-BPS approach

Start by building a relationship

We feel that embracing the humanistic aspects of the enactive-BPS approach is a vital starting point for clinicians to start to integrate this approach into their practices. Thus, at the core of the clinical encounter is a focus on fostering a strong therapeutic alliance (i.e. relationship). An enactive approach motivates that we should listen and validate a person's experiences as real regardless of objective observations from a third-person or outsider perspective (Stilwell and Harman, 2019). This simple change may foster trust and mitigate stigmatization. In addition, a clinician's openness, empathy, and compassion can build trust and open dialogue that is conducive to the exploration of the patient's questions and concerns. The aim is not simply the transfer of information from one party to another, but instead a dynamic process that culminates in mutual understanding. Without an appropriate level of care and support it may be difficult to work toward mutually agreed upon goals and tasks (Lejuez et al., 2005) hence the relationship forms the core of an enactive-BPS approach.

Further, clinician-patient interaction itself can shape patients experiences as illustrated in recent literature on contextual factors and effects in relation to musculoskeletal pain (Rossettini, Carlino, and Testa, 2018). Therefore, interactions with patients, including history taking and assessment, can be considered interventions in their own right. This aligns with the perspectives that "listening is therapy" (Diener, Kargela, and Louw, 2016) and "evaluation is treatment" (Louw et al., 2021).

With a humanistic foundation and appreciation of social context, below we provide some preliminary and pragmatic clinical applications of the following four important elements in an enactive-BPS approach to musculoskeletal pain care: 1) complexity and uncertainty; 2) causal reasoning; 3) behavior change; and 4) self-management.

Complexity and uncertainty

An enactive-BPS approach appreciates that pain experiences are the result of a complex and dynamic web of causal factors in the person-environment system. This entails that the initiating factors of pain may not be the same as maintaining factors, and the effectiveness of a specific treatment cannot simply be reverse engineered to conclude what caused the pain. Further, there is non-linearity; the size of an expected treatment effect can be quite disproportionate (positive or negative) to the applied intervention as many factors interplay and treatment effects are context-sensitive (Coninx and Stilwell, 2021; de Haan, 2020b; Low, 2017). This helps explain the wide variation in treatment responses observed in musculoskeletal pain management, and the importance of individualized care not only across patients, but within patients over time.

As a consequence, influences on musculoskeletal pain are not fixed; they interact in complex ways across the person-environment system and change over time (Coninx and Stilwell, 2021). Therefore, treatments that worked in the past may no longer work as expected when applied in the future. Inspired by enactive theory (Thompson, 2007), this emphasis on time is a central feature of the "expanded" BPSM put forward by Lehman, David, and Gruber (2017). With an enactive-BPS approach, clinicians need to be flexible, comfortable with uncertainty, and for care to be tailored to each individual (Coninx and Stilwell, 2021; de Haan, 2020b). Such complexity and uncertainty could thereby be shared and explored in the interaction with patients, which does not need to be considered an obstacle but an opportunity for shared causal reasoning.

Causal reasoning

Patients often report a strong desire for a diagnosis and information regarding the cause of their pain and any underlying pathology (Lim et al., 2019). However, persistent pain often eludes clear and specific causative factors and this may lead to uncertainty, worry, and the avoidance of valued activities. A patient may not engage in behavior change because the therapeutic relationship is poorly established and they feel uncertain regarding the cause of their pain and management plan (Stilwell and Harman, 2017b). Therefore, clinician-patient communication is an important feature of the enactive-BPS approach in which the patient integrates new knowledge and personal meanings that are

hopefully validating, empowering, and consistent with best available evidence. A good therapeutic relationship and enabling context can facilitate dialogue that allows information of potential causal relevance to be explored by the patient and clinician together, and then treatment options discussed through a process of shared decision-making.

While it is clearly important to identify pathology and other more local factors that may be contributing to a person's illness, we also need to fully embrace the more global factors such as the patient's narrative, experiences, and perspectives. With this approach, there is an appreciation that the humanistic elements (e.g. patient's narrative) can have both causal information and influence. This aligns with Engel's (1980) statement that: " . . . the prime object of study is a person, and many of the data for necessary hypothesis development and testing are gathered within the framework of an ongoing human relationship . . . ." Without a humanistic approach involving person and relationship centredness, it may be difficult to uncover important factors that may be contributing to a person's health concern.

Clinicians can help patients make sense of their pain in a variety of ways. For example, clinicians can help people seeking care for benign back pain to learn that there is no single explanation or "fix" for their pain. Rather, there are always many interacting factors, the body is adaptable, and pain is often malleable. This contrasts with the commonly learned perspective that chronic pain means one's body is broken and that their situation is unchangeable and permanent (Setchell et al., 2017). Further, an enactive-BPS approach places a focus on action and a pragmatic approach to education where it " . . . is not an affair of 'telling' and being told, but an active and constructive process" (Dewey, 1916/2001). Therefore, there is alignment with guided experiential therapies such as graded exposure to feared movements that help a person learn through experience that hurt (pain) does not always mean harm.

Additionally, enactive theory prompts us to consider how pain education involving metaphor may be more active and effective. Often metaphors are used in passive and didactic ways; for example, pain-related metaphors are verbally explained by a clinician or provided in written educational materials that the patient is to read and "think through." In contrast, enactive metaphors use bodily action to "act out" metaphorical understandings, and there is evidence that using this active element with intention can enhance learning compared to more traditional, passive encounters with metaphor (Gallagher and Lindgren, 2015). Enactive metaphors may help "show" patients the multidimensional and malleable nature of pain, and open up new opportunities for action inside and outside the clinic (Stilwell, Stilwell, Sabo, and Harman, 2021). For example, the metaphor "motion is lotion" can be used with lumbar flexion and a clinician's guiding touch to promote more relaxed and fluid motion, as well as a sense of safety and positive experience with the movement. Helping patients create new experiences and make sense of their pain may facilitate new patterns of behavior, breaking habits that are no longer helpful (e.g. long-term avoidance of lumbar flexion).

Behavior change

The overarching aim of an enactive-BPS approach is to help a patient to better attune to their environment by helping them view and experience their body and world in positive ways (Coninx and Stilwell, 2021). In relation to chronic pain, this may mean helping a person to become "unstuck." Over time, the goal is to help the patient regularly perceive opportunities for meaningful action based on self-identified goals. (Re)engagement in activities may result in reduced pain and disability, or at the very least guide the person toward engagement in personally valued activities. There are many ways to achieve this, including helping patients make sense of their pain and to see new opportunities for action (see above), intervening at the level of the body to reduce pain and improve movement, or changing the environment so that the patient is afforded new opportunities for action (Gallagher, 2018).

Changing the environmental context is often overlooked as behavior change is all too often viewed as simply the responsibility of the individual seeking care. However, an enactive-BPS approach challenges this individualistic perspective, instead arguing that behavior change is heavily influenced by the social and physical environment including the socio-political climate, socioeconomic status, inclusion and accessibility, and availability of health services. Indeed, authors have suggested that greater recognition of the social influences on pain outcomes is needed, along with broader public health strategies that " . . . extend beyond not only the traditional biomedical approach, but also the biopsychosocial approach as it is currently applied in the field of pain" (Karran, Grant, and Moseley, 2020).

We need to better identify and mitigate problematic and historically underrecognized sociocultural influences such as interpersonal and systemic power dynamics (Mescouto, Olson, Hodges, and Setchell, 2020). This is important given the stigma, shame, avoidance behaviors, social isolation, powerlessness, and dependency experienced by people living with musculoskeletal pain (Snelgrove and Liossi, 2013). An

enactive-BPS approach places greater responsibility with the clinician for helping create an optimal environment for enabling patients to regain their autonomy and to take an active role in their care. Patients can be set up to flourish by offering an environment where they feel they can express their concerns, be a partner in their care, and to restore their self-confidence through movements that they feel are safe yet challenging.

Self-management

The promotion of self-management can be seen as an empowering culmination of an enactive-BPS approach to musculoskeletal care. The importance of supported self-management strategies, such as exercise, for musculoskeletal conditions is now recognized and endorsed in guidelines worldwide (Foster et al., 2018; Lin et al., 2020). Yet, social barriers to exercise are commonly overlooked. Addressing these barriers, many of which are systemic, may be vital for many patients to engage in regular exercise. At the very least, clinicians can consider no or low-cost exercises whenever possible and ask patients what they prefer as there are many equally effective exercise options for persistent musculoskeletal pain, such as low back pain, with some options having no direct costs (e.g. walking). Of importance, self-management does not mean that people do not receive support or healthcare, rather it empowers people to help themselves when possible and to know when to seek assessment or treatment, including education or advice (Kongsted, Ris, Kjaer, and Hartvigsen, 2021). In enactive terms, self-management helps a person optimally adapt to their situation and maintain their autonomy.

Conclusion

Engel's BPSM has been lost in translation as it is used in many different ways and is often misrepresented and misapplied. The BPSM has been biomedicalized, fragmented, and used in reductionist ways. We presented humanistic and causation versions of the BPSM, and argued that merging the two in the form of a modernized enactive-BPS approach may be a useful way forward.

The presented enactive-BPS approach places a strong focus on the patient's lived experience, action and interaction, and perceived action possibilities (i.e. concept of affordances). Further, it extends and in part replaces Engel's vague idea of information "flow" as well as his "vertical" hierarchy by introducing the enactive concepts of emergence, co-determination of local and global processes, and organizational causality. This preliminary framework can guide personalized treatment; clinicians are prompted to equally consider the person, their physical and socio-cultural environment, and the interaction between the two mediated by the brain and body. This approach may help avoid the fragmentation and reduction of clinical phenomena such as the experience of pain and to better appreciate that treatment effects are context-sensitive and may vary within and across individuals over time due to changes in the complex person-environment system.

While the complexity of an enactive-BPS approach might appear overwhelming at first, it entails that there are many routes to change: there are many potentially effective interventions depending on the person's needs and goals. Further, we can think of musculoskeletal care as a team effort with many possible interventions across the person-environment system at different points in time and potential for mutually reinforcing effects. As suggested by Gallagher (2020) an enactive perspective entails that "one would treat the person, not as a patient who presents as a solitary clinical visitor, but as someone who is part of a situation that extends into the world." We presented some preliminary ideas as to what an enactive-BPS approach might look like in practice; however, future research is needed to operationalize such a framework. Further, as suggested by de Haan (2021) an enactive-BPS approach can inform empirical research, shaping " . . . the kinds of questions we ask, the kinds of places we look for answers, and the kinds of methodologies that we prefer." An enactive-BPS approach is a "big picture" framework that can help us resist an oversimplified and individualistic approach to musculoskeletal care and better appreciate patients' complex and changing experiences.

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