

Embodied health: a guiding perspective for research in health psychology

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Health psychology is based on a biopsychosocial model, which conceptualises health as a product of biological, psychological and environmental factors. However, many studies in health psychology reflect a more narrow focus on the psychosocial influences of health, leaving out physical influences, while the majority of medical studies neglect the influence of psychosocial variables. We suggest that shifting focus to the relationship between bodily experiences and health-related cognition can bridge the gap between psychological and medical research traditions. We review the literature on the theory of embodied cognition and discuss its potential to serve as a framework to guide health research. Finally, we make suggestions regarding the potential contribution of an embodied health perspective to research on preventive health behaviour, physician–patient communication and adherence to treatment recommendations.

Keywords: embodiment; Cartesian dualism; biopsychosocial model of health

What we feel and think and are is to a great extent determined by the state of our ductless glands and viscera. (Aldous Huxley)

The practice of medicine can be defined as a modern day social ritual (Verghese, 2010). The typical doctor's visit is comprised of a standard set of procedures including interview and history-taking, examination, diagnosis and discussion of treatment maintenance. Regardless of the specific procedures and dialogue these visits entail, depending on the nature of the illness, most medical encounters follow this same progression of basic actions that amounts to the distinct phenomenological experience of the doctor's visit. In addition to serving a pragmatic function of organising the interaction between patient and doctor, the ritual of medical interaction, like all rituals, also bears symbolic significance. Doctors have acknowledged the delicacy of this ritual and subsequently emphasised the importance of direct one-on-one physical and social exchange as the primary tool for improved patient care (Verghese, 2010).

Researchers studying health behaviours and outcomes will find a rich set of variables operating simultaneously in the context of a medical visit. However, health research has not yet arrived at a way to completely capture the richness of this experience (Suls & Rothman, 2004). One major challenge in this research is the fragmentation between the work of doctors (grounded in the biomedical model, which defines health as the absence of disease) and social scientists, particularly

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psychologists (grounded in the perspective of cognition, behaviour and subjective experience). Although the proliferation of social science-based approaches to studying medicine provides a more complete understanding of health contexts, the vestiges of fragmentation between medical and social scientific perspectives are evident in any attempt to synthesise findings from the medical and social science literatures on health behaviour. Indeed, compared to traditional medical researchers, psychologists examine different variables (emphasising psychosocial variables, such as emotions), use different approaches to research design (observation or laboratory experiments with random assignment vs. clinical trials) and different tools of measurement (self-report questionnaires, interviews, tests of cognitive performance, etc), and apply a unique vocabulary (e.g., ‘cognitive dissonance’, ‘self-regulation’).

The disconnection between studies of the mind and body reflects a foundation in the view of *dualism*, which assumes a distinction between body and mind such that the body is characterised by physical material and the mind is not (see Wilson, 2002). The biomedical model and most of modern ‘Western’ medicine was founded on Cartesian dualism, addressing problems with the body separately from mental processes. Health psychology, in concordance with a biopsychosocial model that emphasises the relationship between biological, psychological and social variables, originated as a means to resolve the fragmentation between medical and psychosocial research perspectives. The inception of health psychology and the biopsychosocial model as a discipline has undoubtedly led to a number of great advances, including the surge of multidisciplinary collaboration between researchers and the induction of several new venues (e.g., conferences, journals, societies, etc.) to disseminate findings from this field (Suls & Rothman, 2004).

Despite these advances, health psychology has yet to completely bridge the sizeable gap between research based in medicine and psychology. Although some instances of overlap have emerged, health psychology remains primarily concerned with psychosocial variables relating to health, while medical research remains primarily concerned with biology and anatomy. It is important to credit health psychology for its theoretical basis in the biopsychosocial model, which allows for the broad conceptualisation of health as a product of biological, psychological and social variables. However, too often the specific studies conducted in health psychology narrowly emphasise the role of psychosocial factors and neglect to examine the direct influence of the body on physical and psychosocial health outcomes. This stubborn discrepancy between medical and psychological perspectives suggests that the mind/body divide stems from discontinuity at the foundation of health theory and research.

The biopsychosocial model is by no means a novel construct for health psychologists. Indeed, nearly every textbook and overview of the field of health psychology references this model (Brannon & Feist, 2010; DiMatteo & Martin, 2002; Friedman, 2011; Marks, Murray, Evans, & Estacio, 2010; Taylor, 2011a). Despite most health researchers’ fluency with this model, it has not been fully translated into empirical investigations of health psychology. In fact, among studies published during one year in the journal *Health Psychology* (November 2001–October 2002), only half measured biological variables (physiological reactivity, disease markers and mortality; Suls & Rothman, 2004). Furthermore, the compartmentalisation of biological and psychosocial research into two separate disciplines stands as an obstacle to the advancement of health psychology. In a survey of medical schools in

the United States, 50% of schools dedicated <40 hours of instruction to health psychology and psychosomatic research (Waldstein, Neumann, Drossman, & Novack, 2001). Based on these findings, it seems that health research has yet to overcome the simplistic dualist perspective that separates mind and body.

Embodied cognition applied to health psychology

We propose the application of the theory of embodied cognition as a potentially wide-ranging advancement in health psychology research and theory. Embodied cognition is the study of the multi-directional relationship between cognition, affect, motivation and bodily states (Semin & Smith, 2008). A unique facet of this theory is the idea that bodily states can influence and even induce psychological states and, subsequently, behavioural outcomes.

An overview of embodied cognition

Traditional theories of cognition conceptualise the brain as a computer, taking input from the world and translating it into mental output (e.g., perception, memory, attitudes, beliefs, emotions) via complex algorithms (Wilson, 2002). According to this view, mental processes are internalised, abstract and generally disconnected from the body. To the contrary, the theory of embodied cognition states that cognition is not an obscure, abstract process isolated in the brain, but that all cognitive and affective processes are situated within a physical context, including variables such as posture and bodily movements (Wilson, 2002). Theories of embodied cognition also state that processing cognitive and affective information enacts a type of 'motoric reexperiencing'. As such, comprehension of emotional expressions is enhanced when a person's bodily (sensorimotor) and psychological feedback are congruent (e.g., smiling while listening to a cheerful tone; Niedenthal, 2007). Similarly, theories of embodiment purport that *simulation* underlies all cognitive representations, such that cognition requires similar sensorimotor and neural mechanisms to those that accompany bodily action (see Barsalou, 1999). Simulation implies that intrapsychic experiences involve mental performance (e.g., feelings of liking and approval activate the physiological response of reaching for something; see Cacioppo, Priester, & Berntson, 1993) and, accordingly, sensorimotor actions can facilitate intrapsychic experiences (e.g., frowning can induce feelings of sadness; Duclos et al., 1989).

Although there is no formal category of research or specific theory known as 'embodiment', we use this term as a simplified way to refer to the cluster of theories and related studies that are informed by the basic principles of embodied cognition. The principles of embodiment derive from the theory of affordances, which states that people perceive their environment in terms of how they can physically interact with and perform actions to manipulate objects that surround them (Gibson & Walker, 1984). As such, theories of embodiment imply that cognition, affect and behaviour are informed by the synthesis of mind, body and environment (Niedenthal, 2007).

Although many areas of research in the social sciences have linked physiological and psychological phenomena (e.g., the study of non-verbal behaviour; Manusov & Patterson, 2006), we suggest that embodied cognition is the first approach to examine the symbolic connotations of physical actions and to empirically

demonstrate the bidirectional causal relationship between bodily representations and psychological outcomes. Consequently, the majority of studies on embodiment draw from everyday linguistic examples (i.e., figurative language) to better understand how complex cognitive representations are ultimately rooted in a basic understanding of the physical world. Specifically, researchers have deconstructed conceptual metaphors (symbolic language used to help make sense of something that is otherwise obscure) to find rich examples of how associations drawn from the physical world that help make sense of abstract, psychological experiences (Lakoff, 1990; Lakoff & Johnson, 1999).

As demonstrated by the psycholinguistic approach, an examination of embodiment from a top-down perspective suggests that physical actions are inherently interrelated with their environments. For example, one classic study found that when participants were primed with words relating to the stereotype for elderly people (e.g., 'grey', 'retired', 'wrinkled'), they assumed the stereotype in their physical expressions by walking more slowly as they exited the laboratory compared to participants who were primed with neutral words (Bargh, Chen, & Burrows, 1996). This study was among the first to demonstrate the direct, causal connection between psychological representations and physical action (i.e., speed of walking).

Furthermore, physical simulation of psychological states via gestures, postures and facial expressions can induce the intrapsychic experience of these psychological states. For example, researchers have primed anxiety via embodied cues in facial expressions of anxiety (Duclos et al., 1989) and through bodily orientation, such as sitting literally 'on the edge of their seats' (Schnall & Laird, 2007). Similarly, the sense of moral impurity can be assuaged by the physical act of hand-washing after committing an unethical act (Zhong & Liljenquist, 2006), which demonstrates that even complex psychological states (moral purity) can be influenced by embodied primes (physical purity). Embodied cues also influence abstract attitudes. For example, physically enacting expressions of liking, such as head nodding (Briñol & Petty, 2008) or bending an arm as if to draw something closer (Cacioppo et al., 1993), can increase liking or preference.

Embodied cognition has been applied to the study of language (Gibbs, Costalima, & Francozo, 2004; Richardson, Spivey, Barsalou, & McRae, 2003), emotions (Niedenthal, 2007), attitudes (Cacioppo et al., 1993), infant motor development (Thelen, 2000), and persuasion (Briñol & Petty, 2008). However, this theory has yet to be fully integrated into health psychology research, which is especially surprising in light of the distinctly physical connotations that often underlie health-related cognitions. Some studies have indirectly applied this theory to the field of health psychology (e.g., research that examines the relationship between mental, social and physiological variables but is not formally identified as embodied cognition; Blascovich & Mendes, 2010; see also Dickerson & Kemeny, 2004), and an even smaller subset of research has deliberately applied the theory of embodied cognition to research on health psychology (Gangi, Sherman, & White, 2011; Sherman, Gangi, & White, 2010). Researchers have yet to systematically describe how the theory of embodied cognition can be applied to health psychology. It is the aim of this article to make a case for embodiment as a unique perspective to inform research on health outcomes and behaviours in everyday contexts.

Previous connections to health psychology

Embodiment and related ideas have been successfully incorporated in other disciplines, including literary studies (Sontag, 2001), anthropology (Csordas, 1990) and sociology (Freund, 1990). In addition, researchers in social psychology have approached quantitative studies through an embodied lens (Schubert & Semin, 2009). Given the ubiquity of embodied approaches in related fields, it may seem entirely intuitive and perhaps even unnecessary to suggest that this approach be applied in the field of health psychology. However, only a small fraction of the empirical work in health psychology has incorporated an embodied approach (Suls & Rothman, 2004), and as such the deceptively 'naïve and obvious' nature of our suggestion further affirms the need to address this gap in health psychology research (Funder, 2009).

Despite the general absence of embodied approaches in health psychology, several theorists have attempted to address the overlap between theories of embodiment and health psychology. Particularly of note are two recently published reviews connecting embodied cognition with health-related constructs. First, Blascovich and Mendes (2010) contributed a chapter in *The Handbook of Social Psychology* to the study of embodied variables, primarily focusing on the potential contribution of neurophysiological methods to social psychology. Their review enumerates specific neurophysiological systems, discusses the various interrelationships between these systems and gives recommendations for implementation of neuropsychological indexes to study social psychological processes (i.e., attitudes, consciousness, emotion, affect, self-regulation, interpersonal processes and intergroup interactions). Although this chapter provides detailed information regarding specific neurophysiological systems and their relationship to social psychological processes, it does not account for specific topics of interest to health psychology (e.g., adherence, patient–doctor communication, etc). Second, Santiago Delefosse (2011) presented a unique 'embodied socio-psychological' approach to health in a recent paper, which incorporates the perspectives of lifespan developmental theorists into a philosophical reframing of the study of illness.

Although these two papers are important in their distinct perspectives on the application of theories of embodied cognition, the scope of these papers is either too concrete (e.g., detailing specific neurophysiological systems) or too abstract (e.g., merging qualitative approaches from sociological, economical and philosophical literatures to deconstruct the concept of health and illness) to be of direct use for health psychology researchers. In contrast, we examine theories of embodiment broadly to illuminate the general utility of this perspective in the study of health psychology, while simultaneously giving special attention to specific areas of research that are well-suited for the implementation of embodied approaches: Furthermore, we identify supporting findings from health psychology that seem to echo the tenets of embodied cognition, thereby suggesting that the adaptation of an embodied perspective in health psychology is both amenable and intuitive.

We should note that although merely attending to embodied variables (e.g., measuring and manipulating bodily sensations) can deepen and broaden the impact of health research, the diversity of health-related issues requires that researchers adapt embodied approaches to reflect disease- or context-specific considerations. Healthcare manifests in a number of contexts (e.g., mailing in saliva samples for

genetic testing, delivering a child, end-of-life care planning), each of which introduces a unique set of physical and symbolic embodied variables. In the following sections, we provide some specific suggestions regarding the likely effectiveness of embodied interventions for improving healthcare and health behaviour. However, we recognise that our discussion does not provide an exhaustive account of all sensorimotor interventions, nor do our suggestions address the nuances of the full range of health contexts or health-related concerns. As such, we focus the majority of our discussion on a general embodied approach to health that allows adaptation by future researchers to address issues that are specific to their domains of interest (e.g., infectious disease, cancer, chronic illness, palliative care). Finally, to illustrate how embodiment might be articulated in a specific domain, we discuss the potential application of an embodied health approach in women's health.

Three areas of application

The significant role of physical variables arises in nearly all commonly experienced health contexts, including patients' experiences in hospitals and other health facilities, communication of health-related messages in the media and more personal and direct forms of health-related communication (e.g., among family and friends). We will highlight the role of embodied cognition in three distinct areas of study: (1) preventive health behaviour (promotion and behaviour change), (2) physician-patient communication and (3) adherence to treatment recommendations. Furthermore, this article will demonstrate how embodied variables such as spatial orientation and sensorimotor input are greatly relevant to central topics in health research, such as patient satisfaction, motivation, persuasion and judgement and decision-making. Although this article does not comprehensively consider all of the relevant areas of research in health psychology, we examine certain areas of research that stand out as most likely to benefit from an embodied approach.

Preventive health behaviour

Most patients and physicians view healthcare as a means to ameliorate symptoms and illnesses *after* they occur (DiMatteo & Martin, 2002). For some health conditions, by the time a patient begins to recognise serious symptoms, it can be too late for the patient to fully recover. In fact, many of the leading causes of death in the United States can be avoided by participation in preventive health behaviours. One study found that in the year 2000, tobacco was responsible for the greatest number of deaths in the United States, followed by physical inactivity/poor diet, and alcohol consumption (Mokdad, Marks, Stroup, & Gerberding, 2004). It is apparent that one of the greatest potential contributions of embodied health psychology is to promote and facilitate preventive health behaviours.

Over the years, health psychologists have proposed a number of preventive health models and theories of behaviour change (Michie & Johnston, 2012). A common characteristic of preventive health models is that individual beliefs and subjective appraisals are a prominent component of the motivational and decision-making process (Leventhal, Diefenbach & Leventhal, 1992; Prentice-Dunn & Rogers, 1986; Prochaska, 2008). For example, the transtheoretical model of health behaviour change, protection-motivation theory and the health belief model take into account

subjective appraisals of risk, severity, cost, benefit and efficacy (Prentice-Dunn & Rogers, 1986; Prochaska, 2008; Rosenstock, Strecher, & Becker, 1988). Perhaps beyond other models of preventive health behaviour, the common-sense model of illness representation uniquely emphasises the influence of subjective beliefs, including intuitions and speculations about personal health risk as the primary motivation for health behaviour change (Leventhal et al., 1992; Leventhal, Weinman, Leventhal, & Phillips, 2008). According to the common-sense model, people's attention to and interpretation of somatic symptoms is essential to motivating and sustaining health behaviour change. Specifically, the subjective interpretation of somatic symptoms (e.g., heart palpitations) will lead people to make health-related attributions about the symptom (e.g., panic disorder, heart attack or natural fluctuation in heartbeat), which then guide the course of action taken in response to the symptom (Leventhal et al., 1992).

One of the central implications of the common-sense model of illness representation is that health-related inferences are not influenced by simple communication (e.g., telling someone that are or are not at risk for developing a disease). Instead, people sustain health-related beliefs through their ability to consciously experience, observe and draw coherent conclusions about their health (Leventhal et al., 1992). For example, a patient who has heart disease but does not experience any relevant symptoms must be trained to understand the connection (or lack thereof) between subjective experience and objective medical risk (Leventhal et al., 2008). In light of the common-sense model, an embodied approach provides a unique tool for health promotion. That is, embodiment offers a means by which to draw connections between tangible sensations and valid health information by pairing traditional health language with congruent physiological feedback.

Language and preventive health behaviour

Embodied cognition also demonstrates the utility of language as both an influence and indicator of beliefs about health and illness. A particularly valuable resource for enhancing researchers' understanding of the subjective experiences of preventive health is patients' and healthcare consumers' narrative accounts of their experiences (see Stephens, 2011). For example, researchers examining the narrative accounts of African-American women on the topic of breast cancer screening find that regardless of their actual, objective susceptibility for breast cancer, women commonly perceive their subjective experience as patients to be threatening on a sexual, moral and aesthetic level (e.g., shame about the body and being naked, shame about being a woman, fear of scarring as a potential consequence of breast cancer biopsy, respectively; Lende & Lachiondo, 2009).

Similarly, researchers who study the use of conceptual metaphors in language have identified this specific type of figurative language as a unique linguistic tool people enlist to describe and make sense of their experiences with health and illness (Gibbs & Franks, 2002). Researchers have found that such metaphors are often grounded in bodily experiences, borrowing from the logic and memory of physical events to represent an abstract idea. As Lakoff (1990) eloquently states:

Thought is *embodied*, that is, the structures used to put together our conceptual systems grow out of bodily experience and make sense in terms of it; moreover, the core of our

conceptual systems is directly grounded in perception, body movement, and experience of a physical and social character. (p. xiv)

For example, the metaphor of 'living a *balanced* life' draws on the experience of objects in space and physical balance (Gibbs et al., 2004). The theory of embodied cognition suggests that people's decisions are not based on systematic and rational decision-making heuristics, as previous health theories might imply, but that implicit attitudes, beliefs and emotions underlying health-related cognitions are often shaped by people's physical relationship to a given environment. Researchers have looked to language to understand how people make sense of their experience (Lende & Lachiondo, 2009). The language people use to describe their experiences, particularly metaphors, reveals that complex psychosocial events are situated within or adapted to a bodily experience of the physical world (Gibbs et al., 2004; Lakoff, 1990). The study of language in embodied cognition often serves as a qualitative counterpart to quantitative studies.

When applying embodiment in a novel terrain (e.g., health psychology), this type of open-ended investigation is crucial to guide theory and future research. We suggest that by exploring the metaphors that people use to describe conceptions of health and illness, we can identify embodied variables to target for interventions. For example, one study found that common metaphors used to discuss cancer include metaphors that characterise cancer as an obstacle on life's journey, a battle or a teacher (Gibbs & Franks, 2002). An embodied health approach might begin by identifying such metaphors as a foundation for future interventions to promote preventive health behaviour and improve health outcomes. Perhaps by capitalising on people's views of themselves as travellers, soldiers or students, interventions can successfully tap into underlying psychosocial constructs that shape people's perspectives on health and health behaviour.

Simulation and preventive health behaviour

Another insight of embodied cognition that is pertinent to researchers and practitioners interested in promoting preventive health behaviours is the cognitive process of simulation. The construct of simulation is based on the idea that people's perceptions are oriented towards the affordances of their environment, or the physical potential for interaction that is present in a given environment (Gibson & Walker, 1984). The idea that simulation is integral to perception is further supported by the research on the mirror neuron system, which demonstrates how neuronal processes that occur in the mental representation or perception of an action very closely resemble the neuronal processes that occur during an authentic performance of an action (Gallese & Goldman, 1998).

Health psychologists have already begun to exploit this tenet of embodied cognition by using the predisposition for simulation to facilitate learning of preventive health behaviours (Gangi et al., 2011; Sherman et al., 2010). In one experiment, participants who were randomly assigned to hold a piece of floss in their hand (thereby activating their motor system via physical contact with the floss) while watching a video about flossing performed the action of flossing more skilfully and more often than participants who did not hold the floss in their hand while watching the health video (Sherman et al., 2010). As demonstrated by previous research,

embodied interventions serve to ground the communication of health information in basic physical actions. Moreover, supplementing health instructions with physical simulations of health-related actions is an application of motoric re-experiencing, such that patients' physical experiences are matched with the verbal instructions they receive. Although speculative, it is proposed here that physical simulation and participation during a health visit encourages patients to remain attentive and psychologically present, which may be particularly beneficial in health contexts in which patients are often overwhelmed with information, and thus susceptible to disengagement and mental distancing from the interaction.

Persuasion, embodiment and preventive health behaviour

The promotion of preventive health behaviour is not unlike the art of persuasion that is required for any type of marketing. In an era of patients as healthcare consumers, it is the role of researchers and medical professionals to understand how to craft health messages that successfully persuade the general public to engage in preventive health behaviour (Beisecker & Beisecker, 1993). Research on embodied cognition highlights the function of the body and activation of the sensorimotor system as a tool to facilitate persuasion and influence attitudes. Notably, one study of embodied cognition found that head nodding can prime liking and approval, such that participants who were asked to nod their heads, a gesture commonly used to express approval, while listening to a dialectical message (i.e., an editorial on the importance of carrying identification cards) found the message to be more persuasive than people who shook their heads horizontally, a gesture commonly used to express disapproval, while listening to the same message (Briñol & Petty, 2003).

Similarly, another study found that the action of extending an arm can prime a withdrawal or avoidance motivational orientation (motivating inhibition of action to avoid threat; see Sherman, Mann, & Updegraff, 2006) and negatively influence preference for a neutral stimulus, whereas arm flexion action can prime an approach motivational orientation (motivating action taken towards reward pursuing rewards) and positively influence preference for a neutral stimuli (Cacioppo et al., 1993). This finding is particularly pertinent to health promotion because patients with an approach motivation orientation are more receptive to gain-framed messages that emphasise the advantages of health behaviours (Sherman et al., 2006).

Taken together, these studies suggest that by addressing the bodily sensations experienced by subjects as they are exposed to persuasive health messages, researchers might be able to boost motivation to engage in health behaviours. Specifically, we suggest that pairing persuasive health messages alongside bodily movements commonly associated with approval or enjoyment (e.g., head nods or arm flexions) will increase the potency of preventative health messages.

Self-assessment of illness and health

Among the most successful applications of the common-sense model is study of symptom perception. According to the common-sense model, symptoms are a reflection of the psychological representations or schemas that guide appraisals of physiological events (Leventhal et al., 1992). Research suggests a complex interplay between authentic triggers (e.g., physical sensations), situational influences (e.g., low

stimulus environments, tense or anxious situations, past experiences with a given context, social prevalence or highly publicity of illness) and individual differences (e.g., gender, negative affect, history of trauma) that shapes symptom perception (Pennebaker, 1999). Thus, even seemingly straightforward assessments of personal health, such as identifying the presence of a migraine, involve more than just physiological events. As such, although people are largely accurate in reports of their general health status (Bailis, Segall, & Chipperfield, 2003), they often report inaccurate perceptions of specific symptoms, such that reported symptoms are not highly correlated with the presence of associated biological or autonomic markers (Pennebaker, 1982, 1999). Another indication of the subjective and psychologically driven nature of symptom perception is the finding that symptoms are often associated with, or perhaps primed by, situational cues. For example, one study found that chemotherapy patients who had experienced illness in the clinic setting reported anticipatory nausea and vomiting when attending the clinic weeks, months and sometimes years after the initial event (Challis & Stam, 1992). This finding suggests that patients' associations with a physical setting were enough to induce the same physical reaction to the environment even in the absence of the original source of threat.

Finally, research on the embodied schemata of disgust and contagion can illuminate how people evaluate their health. An embodied theory of disgust predicts that physiological reactions relating to 'core disgust', a reaction to potential contamination that can be transmitted by mouth or by food (e.g., bacteria, germs), resemble reactions to complex or 'elaborated disgust', more abstract forms of disgust in response to body modifications or surgery, deformity, death and incest (Haidt, Rozin, McCauley, & Imada, 1997). Disgust is an emotion that is particularly salient in health contexts, given the threat of contamination as well as the more abstract forms of disgust that are associated with medical interactions. Medical interactions often defy social rules associated with typical interpersonal encounters, particularly regarding the handling of bodily fluids and violation the exterior body.

Much like the process of symptom perception, assessments of certain contexts as disgusting are not based on logic but rather on laws of 'sympathetic magic' (Haidt et al., 1997). For example, people refuse drink apple juice from a new bedpan, even when they know it has never been used (Rozin & Nemeroff, 1990). The threat related to contexts of disgust often involves exposure to animal and human byproducts, as exemplified by the previously cited finding. An embodied approach to improving the often uncomfortable and potentially repulsive experiences that take place in a medical exchange would be to 'humanize' these procedures. In addition to the visceral sensation of disgust, embodiment has been used to manipulate more abstract sensations associated with cleanliness, such as moral impurity. The aforementioned finding that hand-washing mitigates a sense of moral impurity (Zhong & Liljenquist, 2006) demonstrates how bodily feedback can influence even complex affective components of self-evaluations. Physical cleanliness as moral cleanliness is an especially salient metaphor for illnesses that carry social stigmas, such as sexually transmitted diseases. We suggest that placing an emphasis on the sophistication of medical rituals through sanitation, organisation, professionalism (e.g., embodied power) and compassion (embodied empathy) will reduce the influence of specious sources of threat (e.g., sympathetic magic).

Physician–patient communication

Physician–patient communication is a widely researched area of health psychology (Williams, Weinman, & Dale, 1998). A review of the empirical research on physician–patient communication revealed that good communication is related to a number of important health outcomes, including emotional well-being, functional status, relief of symptoms and pain control (Stewart, 1995). Furthermore, the findings from a recent meta-analysis examining 127 studies demonstrated that physician–patient communication is highly positively correlated with rates of treatment adherence (Haskard Zolnierek & DiMatteo, 2009). Because of its clear and profound impact on patient outcomes, researchers have sought to improve communication in the hospital setting via interventions that train both patients and doctors on how to speak clearly, ask questions and listen to each other (Rao, Anderson, Inui, & Frankel, 2007). Furthermore, reviews of the literature have found that communication can be improved through training (Rao et al., 2007), especially if physicians have an opportunity to be an active participant during training and to rehearse what they learn in training during the course of the training intervention (Berkhof, Rijssen, Schellart, Anema, & van der Beek, 2011).

How can physician–patient communication be improved by attention to embodied variables? The interpersonal exchange between patients and their healthcare providers is a natural setting for the research and application of embodied cognition. The current literature on physician–patient communication illustrates a growing trend towards patient-centred care (Smith & Hoppe, 1991). This effort towards maintaining patient integrity and increasing physician’s attentiveness to patients’ needs is evident in recently developed interventions targeted to increase empathy and caring in medical professionals (Bonvicini et al., 2009; Mast, Hall, & Roter, 2008; Morse, Bottorff, Anderson, O’Brien, & Solberg, 2006). While it has yet to be directly applied to the medical context, research on embodied cognition demonstrates how satisfaction with an interaction can be shaped by bodily cues. Specifically, research has found that mimicry or synchrony of gestures, posture and other embodied characteristics (which often occurs naturally and unconsciously in an interaction between two people) serves as a cue for good rapport, such that participants who interacted with a confederate that engaged in synchrony reported greater liking for their conversational partner (Chartrand & Bargh, 1999). Synchrony was also correlated with empathy (Chartrand & Bargh, 1999), which suggests that synchrony can be enlisted in interventions targeted to increase perceived physician attentiveness and empathy in physicians and providers.

Non-verbal behaviour and embodiment

Similarly, one dimension of physician–patient interactions, non-verbal communication, inherently contains implications for the role of embodiment. Research from the study of non-verbal communication indirectly supports the theory of embodied cognition at a basic conceptual level, linking bodily, environmental and psychological variables together (Goldin-Meadow & Beilock, 2010). Although it has not yet been formally and explicitly differentiated by researchers, it is proposed here that the fundamental difference between non-verbal communication and embodied cognition is that non-verbal communication refers to the body as a tool to express emotions,

attitudes and abstract ideas, whereas the theory of embodied cognition addresses the direct influence of a person's bodily feedback on their own cognition. In essence, non-verbal communication examines the unidirectional influence of mental states on physical expressions, while embodied cognition emphasises the multi-directionality of the relationship between mind, body and environment.

In one notably relevant study from the literature on non-verbal communication, participants were randomly assigned to interact with a doctor in a series of experimental conditions manipulating doctors' bodily position including their angle of lean, head movement and positioning of the arm and leg (Harrigan & Rosenthal, 1983). This study demonstrates how the abstract process of appraising others is grounded in basic physical action, such that patients reported greater satisfaction when they interacted with the doctors who were leaning forward, nodding their heads and holding their arms open during the interaction (Harrigan & Rosenthal, 1983).

These findings make apparent how abstract beliefs that have the power to influence peoples' appraisals of their doctor (e.g., that the doctor is empathetic, attentive and open to the patient) can be extracted from bodily actions. However, the literature on non-verbal communication has focused primarily on communication or the meaning that is expressed in the physical actions of *others*. As a first step towards mapping this finding from non-verbal communication onto the study of embodied cognition, researchers might examine how patients' own actions and the shared experience of the physical exchange between physicians and patients can influence patient satisfaction and other psychosocial health outcomes. An embodied approach to non-verbal health behaviour suggests that in addition to the physicians' non-verbal cues, patients might receive implicit cues about their experience via their own sensorimotor experiences. As previously discussed, embodied manipulations have successfully primed anxiety through facial expressions (Duclos et al., 1989) and postures (i.e., sitting 'on the edge of your seat'; Schnall & Laird, 2007). Therefore, we suggest that manipulation of patients' own non-verbal cues (e.g., tense or relaxed bodily postures) can influence patients' experiences during interactions with their healthcare providers.

Embodiment and patient satisfaction

Indeed, patient satisfaction with an interaction is influenced by a number of related variables in addition to perceived empathy (Kim, Kaplowitz, & Johnston, 2004) and perceived doctor attentiveness (Zachariae et al., 2003). Satisfaction is also related to patient sense of control (Trummer, Mueller, Nowak, Stidl, & Pelikan, 2006) and involvement during the physician–patient interaction (Beach et al., 2005; Carlsen & Aakvik, 2006). As previously described, we predict that patients' perceptions of the healthcare provider as attentive and empathetic can be enhanced by patients' internal embodied cues (Chartrand & Bargh, 1999). Similarly, patients' sense of control and involvement could be easily targeted by embodied interventions and enhanced by a greater focus on embodied variables. One study examined women's involvement in the physical exam procedure (by way of self-insertion of the speculum) and found that women who were randomly assigned to take part in the procedure reported a greater sense of control and involvement. This finding exemplifies one simple application of physical variables to activate the sensorimotor system and

simultaneously increase patient sense of control and involvement in the context of a medical visit (Wright, Fenwick, Stephenson, & Monterosso, 2005).

Finally, subtle physical sensations can implicitly convey information about the quality of an interpersonal interaction. Findings from embodied cognition demonstrate that haptic sensations significantly alter people's evaluations of social interactions. Specifically, participants exposed to the rough texture of sandpaper evaluate interpersonal scenarios as more adversarial and 'rough' than participants who encountered a smooth texture (Ackerman, Nocera, & Bargh, 2010). Similarly, contact with objects that are warm in temperature imparts a sense of interpersonal 'warmth' (Williams & Bargh, 2008) and increases interpersonal trust (Kang, Williams, Clark, Gray, & Bargh, 2010). These findings suggest that sensations that typically occur in the background of social interactions could contribute to patient satisfaction. We suggest that patient satisfaction with the physician–patient interaction can be improved by increasing non-verbal synchrony, increasing patients' physical involvement in exam procedures and refining the haptic sensations to which patients are exposed during an interaction (e.g., smooth textures and warm temperatures).

Adherence to treatment recommendations

Adherence is perhaps one of the most complex issues that health psychologists have sought to resolve in the domain of healthcare (DiMatteo, 2004). DiMatteo, Haskard Zolnierrek, and Martin (2011) proposed the Information-Motivation-Strategy (IMS) model to demonstrate the extent to which patients' adherence to treatment recommendations is based on patients' knowledge about and understanding of the details of the treatment, their beliefs about the efficacy of the treatment, their desire to follow through with treatment and their ability to complete the treatment (DiMatteo et al., 2011; Martin, Williams, Haskard, & DiMatteo, 2005). This model further suggests that interventions targeting adherence must address more than one factor challenging patients' compliance in order to be successful (DiMatteo et al., 2011). Inevitably, research on adherence must also address legitimate external (e.g., socio-economic) limitations, as these variables have a direct relationship with non-adherence (Mojtabai & Olfson, 2003). In conjunction with interventions that target concrete external barriers, embodied cognition can serve to address the physiological and psychosocial barriers to patient comprehension, dedication and capacity to follow through with treatment.

Embodiment, information and adherence

Physician–patient communication has a profound influence on adherence, such that patients dealing with physicians who communicate poorly have a 19% greater risk of non-adherence than do patients working with physicians who communicate well (Haskard Zolnierrek & DiMatteo, 2009). Interventions targeted at improving the information facet of the IMS model can be informed by findings from research on embodied cognition. Many of the factors influencing preventive health behaviours and communication are also relevant to the topic of patient adherence (DiMatteo, 1994; Rothman, 2000). For example, perceived physician empathy (a variable that is related to patient satisfaction) predicts greater rates of adherence (Kim et al., 2004).

In addition, researchers have found that factors relating to medical information exchange (e.g., diagnosis, prognosis, treatment name and purpose) and perceived aptitude of the doctor mediated the role of empathy on adherence to treatment, such that provision of more information was negatively associated with compliance, and perceived expertise of the doctor was positively associated with patient compliance and satisfaction (Kim et al., 2004).

The role of embodied variables in increasing perceived physician empathy and patient education has been discussed in previous sections of this article (see sections on synchrony and liking in physician–patient communication and simulation in preventive health behaviours, respectively). In line with our previous predictions, we expect that non-verbal synchrony will improve patients' adherence to recommendations by increasing their perceptions of physicians' empathy. Similarly, we suggest that simulation can improve patients' learning of treatment procedures by way of motoric re-experiencing, which provides a physical component that is compatible with the informational aspects of learning.

Embodiment, power and adherence

The ability to monitor power and dominance in a social setting likely evolved as an adaptive skill (Oosterhof & Todorov, 2008). Therefore, is not surprising that dominance can be conveyed in simple physical cues. For example, physical elevation has received extensive empirical support as a cue for power and dominance, such that people at a higher elevation are perceived as more dominant (Schwartz, Tesser, & Powell, 1982). Researchers have yet to examine how the relationship between embodiment and dominance cues might improve adherence to treatment recommendations.

Elevation comes into play at the doctor's office in two particular moments: (1) when the physician enters a room as the patient remains seated, and (2) when the physician is seated during the exam, typically at a lower level than the patient who may be seated on a raised exam table. Although relative patient–physician elevation during the initial introduction of the physician is important as a first impression, the majority of the interaction consists of the patient and the physician seated at different levels. Though speculative, it seems that this tangible incongruence in elevation during the patient's interaction with the practitioner has the potential to implicitly convey information about patient self-efficacy, their relationship to the doctor and the role that is expected of both patient and physician. Researchers have noted that the difference in elevation and the relative spatial orientation of the patient and doctor in the exam room during the typical medical interaction (i.e., the patient seated on an exam table at a higher elevation than the doctor) represents an unfamiliar and sometimes awkward spatial arrangement, implying that the patient is there for 'inspection' (Beach & Le Baron, 2002). Although the patient is seated at a higher elevation, which in another context might signify dominance, the interaction centres around an examination table designed to facilitate assessment of the patient that is traditionally initiated and directed by the doctor.

These latent messages imparted by the patient's physical experience of an exam can influence later adherence. For example, patients may feel less inclined to ask clarifying questions about their diagnosis or treatment plan if they receive bodily

cues to be passive subjects of the interaction with their doctor. Alternatively, patients may feel equally threatened if the doctor stands or sits in a position that conveys dominance (e.g., looming over the patient), given that perceived physician dominance is associated with lower patient involvement (Mast et al., 2008). Therefore, it is the role of researchers studying embodied cognition to determine exactly how the elevation and spatial orientation of physicians and patients influence patients' perceptions of the physician's authority and to determine how these variables can be adjusted to improve adherence. Research has identified elevation and size as particularly important cues for power and dominance, such that elevated heights, tall stature and large objects (even abstract symbols, such as font size) tend to impart a greater magnitude of authority (Schwartz et al., 1982). Based on previous findings regarding embodied power, we suggest that patients' self-perceptions and sense of empowerment can be primed and thus strengthened via embodied cues (e.g., elevating posture, seated position or eye level).

Embodiment and adherence motivation

Patients' motivation to adhere to treatment recommendations can also be prompted by bodily cues. Similar to the challenge of 'selling' the preventive health behaviours, the art of persuasion is also applicable to adherence. However, researchers have found that the process of promoting health motivation differs between initial health changes and changes that must be sustained over time (Rothman, 2000). When physicians provide critical information regarding treatment recommendations, patients must perceive this information as relevant and useful in order to ultimately adhere to the recommendations. In fact, a study of patient adherence to cancer treatment regimens found that perceived utility of adherence recommendations was the strongest correlate of adherence intention, above and beyond the influence of social norms, patients' beliefs about the severity of the medical condition and perceived susceptibility (DiMatteo et al., 1993). As previously discussed, researchers have found a strong connection between embodiment and persuasion (Briñol & Petty, 2008; Cacioppo et al., 1993), and these findings have clear applications in the domain of health for persuading patients of the usefulness of treatment. As previously stated, we expect that embodied cues associated with approval and liking will increase the persuasiveness of health messages, although the nature of adherence messages is different in some ways from preventive health messages.

Furthermore, we venture to speculate that embodied cues might motivate not only abstract attitudes towards treatment but also concrete behaviours, as is required to for adherence. Following this logic, perhaps it is possible for embodied cues to instill in-patients a sense of accountability for their own treatment, for example by signing a contract or release of liability, carrying a weight, or having to hold or pick themselves up 'by their bootstraps,' which in turn may prompt adherent behaviour. Given the diverse range of patient experiences, the specific nature of effective symbolic manipulations likely depends on particularly disease and treatment types. To optimise interventions, researchers must first extract salient symbols from patients' narrative accounts of their illness and treatment procedures. We suggest that embodied interventions can motivate patients to adhere to treatment recommendations by activating concepts of physical actions (e.g., drawing boundaries,

planting/tending a garden) that are symbolic of more abstract concepts, such as patient vigilance, self-nourishment and accountability.

Embodiment and adherence strategies

The final dimension of the IMS model, *strategy*, is one that is driven in large part by concrete external factors, such as access to treatment, complexity of the treatment plan and patients' support systems (DiMatteo et al., 2011). However, even the relatively straightforward task of identifying strategies to improve patient education about their illness can be facilitated by embodied variables. For example, engaging the sensorimotor system while educating a patient on how to perform a health-related procedure, such as monitoring heart rate or blood glucose levels, can serve to ground the otherwise vague or potentially confusing verbal instructions given by the doctor in terms of tangible physical actions. As previously discussed, research has already demonstrated the utility of embodied primes as a means to enhance patient education in the areas of dental health and oral hygiene (Gangi et al., 2011; Sherman et al., 2010). Therefore, in addition to providing a concrete foundation on which to ground abstract health information, we expect that both physical simulation and supplementation of treatment instruction with compatible sensorimotor signals (i.e., motoric re-experiencing) will improve patients' ability to form coherent strategies to sustain treatment adherence.

A prototypical context: women's preventive health

The power of bodily feedback is evident in a number of specific health contexts. To make a case for the potential application of embodied cognition, we will now discuss one such paradigmatic context in detail: women's preventive health behaviour. We specifically examine cervical cancer screening and annual physical exam procedures. Women commonly describe this exam as mentally, emotionally and physically uncomfortable (Larsen, Oldeide, & Malterud, 1997; Millstein, Adler, & Irwin, 1984; Rajaram & Rashidi, 1998; Reddy & Wasserman, 1997; Seymore et al., 1986). The sources of this discomfort and anxiety include perceived indecency due to being nude (Borrayo & Jenkins, 2001), anticipated and perceived pain (in a sample of middle-aged African-American women, particularly those who are no longer sexually active; Hoyo et al., 2005) and perceived defenceless or a lack of a sense of control (Larsen et al., 1997). Although these procedures inevitably entail extreme physical intimacy, psychosocial health interventions rarely target embodied and situated (environmental) variables directly. Interestingly, health researchers have found that women report less distress when small changes are made in the physical variables related to the procedure, including patients' sitting position during the exam (Larsen et al., 1997; Seymore et al., 1986) and the ability to actively participate in the exam by self-insertion of the speculum (Wright et al., 2005). The studies on cervical cancer screening procedures are typically conducted by medical and public health researchers and not formally associated with the theory of embodied cognition. However, research on the spatial and sensorimotor characteristics of women's physical exams thus far suggests that embodiment might be a gateway to improving patients' experiences.

Unfortunately, women's preventive healthcare requires certain procedures that can be uncomfortable and even painful. For example, patients must undress and expose themselves for inspection and are then poked and prodded in areas that are both physically and psychologically sensitive. In lieu of complete modification of the procedures themselves, we suggest that embodied interventions can improve the subjective experience of patients in this context. As the findings from embodied cognition demonstrate, such interventions can successfully access complex (and often unconscious) intrapsychic processes via symbolic action. For example, an embodied approach might ameliorate issues such as patients' perceived indecency by emphasising physical cleanliness, or patients' sense of powerlessness via physical elevation.

Summary

The goal of this article was to articulate the potential applications of embodiment to three major domains of health psychology: preventive health behaviours, physician–patient communication and adherence to treatment. Sociologists, philosophers and scholars of the humanities have addressed the abstract issues of embodiment theories via descriptive and qualitative methodologies (e.g., Csordas, 1990; Freund, 1990; Sontag, 2001), which supplement the experimental findings from psychology and the cognitive sciences. It is beyond the scope of this article to comprehensively review these discursive literatures, so we narrowed our review to experimental findings from embodiment research and discussed their potential implications for experimental health research.

Research supports the use of simulation, one of the primary tenets of embodied cognition, as a tool to improve patient education and performance of preventive health behaviours (Gangi et al., 2011; Sherman et al., 2010). Subjective perceptions of health and illness also influence the likelihood that people will engage in preventive health behaviours, and these perceptions derive in part from symbolic representations of physical symptoms and disgust. Embodied variables are also related to empathy, liking and affiliation in everyday interactions with strangers (Chartrand & Bargh, 1999), which suggests that physician–patient communication can also benefit from research on embodiment. Finally, embodiment has implications for adherence to treatment recommendations, as demonstrated by previous research highlighting the effect of embodied variables on persuasion (Briñol & Petty, 2008; Cacioppo et al., 1993), and power (Schwartz et al., 1982).

Additional considerations

Researchers have yet to fully explore the theory of embodied cognition as a means to effect meaningful change in health-related contexts. Given the innovative approach of embodied interventions, it is likely that psychologists embarking on this new direction of research will encounter some obstacles in the adaptation, integration and practice of health and embodiment as two related, but previously distinct, perspectives in psychology. Researchers certainly will continue to identify new challenges as the movement towards an embodied health psychology grows. However, it is possible to anticipate some of these challenges even in the earliest stages of this movement.

First, it is proposed here that embodied primes have the potential to assume multiple meanings, thereby complicating study designs. For example, elevation has been used to represent power and dominance (Schwartz et al., 1982). However, taking into account alternative metaphors that are also based on elevation, such as 'rising to the occasion,' it seems that researchers might also use manipulations of elevation to symbolize an entirely different attitude, such as motivation or moral virtue. The dual meanings and subsequent implications of elevation, as well as similarly dual meanings of other embodied primes, poses a challenge for researchers designing studies on embodiment who might, for example, prime a perception of power when they intended to prime a sense of high moral virtue. However, this article suggests that this problem can be ameliorated by careful attention to the specific context in which the prime is introduced. For example, if the physical prime of elevated position is followed by a prompt for a behaviour that relates to morality, the elevation is likely to be associated with prosocial behaviour; in contrast, if elevation occurs in an exchange between two people in which dominance is being negotiated, elevation will likely be represented as a simulation of moving up within a social hierarchy. Furthermore, it is suggested that the overlap of bodily cues in these two seemingly disparate psychosocial states may be significant to understanding how these constructs are represented. In other words, perhaps the knowledge that social dominance and moral virtue are grounded in a common embodied form and can be primed by similar embodied actions suggests that the constructs are somehow associated with each other on a deeper level of representation.

Another potential obstacle for researchers who study embodiment and health psychology is the variation in effectiveness of embodied primes relating to individual differences and other unforeseen moderators. Again, due to the novelty of this topic of research and its application in the field of health research, it is possible that many of the individual and situational variables that interact with embodiment primes to influence psychosocial health outcomes will not be identified until studies can be replicated in diverse sociocultural contexts. These unidentified moderating variables might make it more difficult to detect the effect of embodied primes. Relatedly, individual differences in needs and expectations for health contexts might negate the effectiveness of embodied primes. For example, reducing anxiety during the medical interaction might not benefit patients for whom anxiety functions as a motivation to take action (Norem & Cantor, 1986).

Yet another key consideration is the degree to which embodied primes require that the subject of a prime is naïve to its purpose. Does the effect of an embodied prime diminish if patients consciously engage in an action to achieve some health-related gain? Embodied primes access unconscious cognitive processes that direct attention, motivation, emotions and beliefs (Niedenthal, 2007). However, it is unclear whether the underlying mechanisms of embodied manipulations are so deeply embedded that they can override conscious processes that might otherwise thwart interventions. The unfamiliar or awkward postures involved in some embodied manipulations (e.g., being 'forced' to hold one's palms out and opened may be interpreted as a stressful task when it is meant to be relaxing) might make it difficult to implement these interventions without patients' conscious awareness. Therefore, researchers interested in studying embodiment and health should determine when it is necessary for the prime to remain implicit and, second, how to subtly implement primes without compromising the natural flow of a medical interaction.

Clearly, health-related interactions do not take place in a vacuum. Embodied interventions cannot completely address health issues without the accompaniment of efforts to address socio-economic barriers to care (e.g., access, ethnic disparities, etc). Therefore, distinct efforts must address this issue by improving access to care. However, the theory of embodied cognition does offer a simple, inexpensive way to improve healthcare interactions. Research on human factors suggests that consideration of how people are situated within the physical space of a hospital can inform future hospital design and serve to reduce patient arousal and distress while increasing patient satisfaction with the hospital visit (Handyside & Suresh, 2010; Leather, Beale, Santos, Watts, & Lee, 2003; Swan, Richardson, & Hutton, 2003). While this type of large scale renovation to the overall hospital setting is useful, costly reconstruction of the hospital space and special technology or equipment is not absolutely necessary for the application of embodied interventions. In fact, the only cost required for embodied interventions is the relatively minimal cost required to train healthcare providers on how to implement these interventions in their practice.

Finally, embodied cognition has the potential to bridge cultural disparities by using the more universal language of physical (both spatial and bodily) expression to bypass language barriers. These interventions are ideal for diverse populations of patients as they do not require English language proficiency. However, non-verbal expressions are not immune to cultural differences. As such, the first step in examining the role of embodiment in health contexts is to observe differences in language and cultural representations of health-related experiences. For example, perhaps cultural differences arise in the extent to which certain health exchanges and procedures (e.g., having blood drawn, getting a mammogram, being interviewed about personal sexual history, etc.) are perceived as threatening. Upon detecting these cultural differences in the representation of health-related events, researchers can tailor embodied interventions towards populations who have a particular need for support.

Implications of an embodied perspective for health psychology

Traditionally, research in health psychology has relied on first-person self-reports as an indication of salient psychosocial predictors of peoples' emotions, beliefs and behaviours (Suls & Rothman, 2004). This dependence on self-report measures is a trend that researchers speculate will soon be surpassed by measures of variables that operate beyond conscious awareness (Taylor, 2011b). In fact, the influence of unconscious processes is already well-supported. Specifically, fMRI research monitoring brain activity while people are exposed to persuasive health messages (i.e., sunscreen promotion) has found that unconscious neural signals predict behavioural outcomes beyond self-reported attitudes and behavioural intentions (Falk, Berkman, Mann, Harrison, & Lieberman, 2010). Similarly, embodied approaches allow researchers to examine psychosocial variables as they are unconsciously manifested, and thereby manipulated, via the physical articulation of bodily senses (e.g., posture). Embodied cognition affords researchers a glimpse into peoples' innermost mental processes by a literal examination of 'where [and how] they stand'.

Although it is a core tenet of the biopsychosocial model, most health psychology research fails to take into account the multi-directional relationship between the mind, body and environment (Suls & Rothman, 2004). Instead, much of the research in health psychology disproportionately emphasises the influence of psychosocial variables on health-related outcomes, neglecting to consider the influence of bodily variables on health. Embodied approaches frame medical and other health-related experiences in terms of actions, sensations and physical exchanges between the patient, the doctor and the broader medical environment. Revisiting the analogy proposed in the beginning of this article, by viewing medical practice as a ritual, embodied cognition allows us to scrutinise the physical events that comprise this ritual in terms of how they situate the patient and doctor within a physical environment. The theory of embodied cognition maintains that peoples' qualitative appraisals of life events are informed and directed by their physical orientation within an environment. In the context of healthcare, embodied variables (e.g., bodily orientation, sensorimotor feedback) can influence the interaction between patients and doctors as well as their cognitions, affect and behaviour (Niedenthal, 2007). This article is the first to systematically chart the potential applications of an embodied cognition approach as it pertains to three major areas of research in health psychology (preventive health behaviour, physician–patient communication and adherence to treatment recommendations).

Directions for future research

One benefit of conducting research on a topic in its nascent stages is that the multitude of unanswered questions can pave the way for future research. Based on initial findings and theories of embodied cognition and health psychology, some key targets for future research are variables related to a persons' physical or somatic orientation (e.g., somatic/spatial sensitivity, athletic history, hypochondria, confidence/body image, subjective norms regarding proxemics), individual differences in how people experience potentially stressful medical encounters (e.g., neuroticism), and demographic variables that predict differences in how people interpret physical cues in health contexts (e.g., culture, gender, language and sexual orientation). As discussed in the previous section, future research can also address the role of conscious awareness in the efficacy of embodied primes and the importance of distinguishing multiple meanings arising from single embodied primes.

In light of the advanced technological tools and research methods now available, health research and practice faces many opportunities for renovation. Like many other industries, there has been a movement to incorporate electronic advancements intended to enhance accessibility and convenience in the communication and delivery of health services, commonly referred to as 'eHealth' (Oh, Rizo, Enkin, & Jadad, 2005). Many of these technologies (e.g., online resources providing information to patients, inter-hospital electronic health records, mobile device applications) diminish the necessity for patients and doctors to inhabit the same space at the same time. Although most of the literature on the eHealth movement makes optimistic predictions about its implications (Oh et al., 2005), it is possible (perhaps inevitable) that this new direction in healthcare will also have some negative consequences for both patients and doctors. The perspective of embodiment in health psychology allows researchers to examine the potential influence of physical

presence during a health-related interaction and extent to which the success of these interactions depend on the embodied and situated variables of which they are traditionally composed. In fact, without careful examination of how embodied and situated variables can influence health outcomes, it is impossible for health researchers and clinicians to predict the potential negative consequences of the eHealth movement.

Perhaps the greatest contribution of embodied cognition is the introduction of a broad perspective that can inform future health research and practice. Even without enumerating the advantages of specific manipulations, health providers and patients might benefit from guidance regarding interpretation and manipulation of feedback that is communicated via bodily senses. Do doctors who learn about the implications of embodiment make better use of and decisions about their interactions with patients? Are patients better able to manage their experiences if they know how to manipulate their own bodily orientation in order to respond to health-related problems appropriately? This latter proposition is supported by the success of biofeedback in treating chronic conditions such as headaches (Nestoriuc, Rief, & Martin, 2008) and even epilepsy (Tan et al., 2009). Biofeedback is similar to the application of embodied cognition in that it trains people to monitor and direct their own physiological responses to avoid undesired health outcomes. However, it is suggested here that there is a distinction in that embodied cognition examines the implications of bodily orientation beyond rudimentary physiological responses such as heart rate or muscle tone in an attempt to examine the abstract connotations of how people interact within a complex social, spatial and psychological network.

Coda

An oversimplified perspective of Cartesian dualism has hindered the advancement of health research. Physicians traditionally follow a reductionist biomedical model, which classifies the body into individual biological systems that are separate from mental processes. Conversely, psychologists examine behavioural and mental processes in terms of their psychological functions without sufficient consideration of organic, biological influences. Health psychology is a field in which monism, a perspective that emphasises the mind/body connection, is suited to thrive. The movement towards embodied health psychology enables scholars to circumvent the limitations of Cartesian dualism and begin to approach the study of health as an integrated system of physical, mental and environmental variables that are inextricably linked.

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