Toward a Biopsychomotor Conceptualization of Pain

Implications for Research and Intervention

Michael J. L. Sullivan, PhD

Objectives: Nearly 400 years ago, René Descartes proposed a model of pain perception that characterized pain as a purely physical phenomenon, devoid of psychologic influence. The characterization of pain as an exclusively sensory (or experiential) phenomenon continues to dominate current conceptualizations of pain.

Methods: This paper advances the view that the exclusive focus on pain sensation or experience as the essential feature of the pain system has given rise to conceptual frameworks that are incomplete and flawed. It is argued that individuals with pain differ from individuals without pain not only in how they “feel” but they differ in how they “behave.”

Results: Arguments are put forward advocating for a biopsychomotor conceptualization of pain where pain behaviors are construed as integral components of the pain system. The biopsychomotor model proposes that at least 3 partially independent behavioral subsystems are integral components of pain. These include communicative pain behaviors, protective pain behaviors, and social response behaviors. Evidence is reviewed suggesting that different dimensions of pain behavior are functionally distinct, and questions are raised about the nature of motor programs responsible for the elicitation and maintenance of different forms of pain behavior.

Discussion: Clinical and theoretical implications of a biopsychomotor conceptualization of pain are discussed.

Key Words: pain, pain behavior, communication, protection, injury, biopsychomotor

For the purposes of this paper, the term "pain behavior" will be used to refer to specific body movement enacted during the experience of pain. Such movement might include facial or postural configuration, actions oriented toward protection or care of an injury, and actions oriented toward the pain-related stimulus or pain-relevant environment. Future research in this area might reveal this definition to be too general or too restrictive. However, it provides a reasonable starting point for a discussion on the place of behavior within a conceptual framework of pain.

A brief history of pain concepts will be presented to highlight how pain might have come to be conceptualized as a predominantly sensory/experiential phenomenon. Literature will be reviewed showing why a sensory/experiential conceptualization of pain is not only incomplete but flawed as well. Finally, a biopsychomotor conceptualization of pain will be presented. The potential advantages of a biopsychomotor conceptualization of the pain system will be discussed from both theoretical and clinical perspectives.

THE HISTORY OF PAIN AS A SENSORY PHENOMENON

The systematic study of pain can be dated back to the work of the French philosopher, René Descartes. Although Descartes was not the first to speculate on the mechanisms and functions of pain, he advanced a model of pain that has laid the foundation for many current theoretical models of pain (Fig. 1).

The adjacent graphic was used by Descartes to describe his conception of pain perception. In this example, Descartes explained that the flame would cause pores in the foot to open, that controlled tubes that drove the spirits to the brain. In other words, damage to the body was thought to stimulate neural pain pathways sending signals directly to the brain where they would give rise to the sensation of pain. According to this model, the degree of pain experienced would be directly proportional to the amount of tissue damage.

Descartes espoused a dualistic perspective of human nature where the forces governing the operation of the body were seen as distinct from the forces governing the operation of the mind. For Descartes, pain was part of the operation of the body and could be explained entirely in mechanistic terms. Although the language of pain transmission has changed over time from pores and spirits to lesions and neurotransmitters, current conceptualizations of pain are remarkably similar to that put forward by Descartes almost 400 years ago.

Descartes has often been criticized for imprinting our consciousness with a dualist template from which we have been unable to break free. However, it is not only a dualist world view that is reflected in Descartes' pain model, but the seeds of a conceptualization of pain that focuses almost exclusively on pain sensation. Even the graphic depiction of the young man with his foot in the fire has all psychologic influences removed; he experiences pain in a social void, shows no expression of distress, and takes no action to deal with the pain.

In 1965, Melzack and Wall proposed the Gate Control Theory (GCT) of pain (Fig. 2). They argued that pain experience was jointly determined by physiologic, motivational, cognitive, and emotional factors.

The central tenet of the GCT was that the transmission of nerve impulses from afferent fibers to spinal cord transmission (T) cells were modulated by a spinal gating mechanism operating through the substantia gelatinosa.
Melzack and Wall proposed that the spinal gating mechanism could be influenced by the relative amount of activity in large-diameter (L) and small-diameter (S) fibers, and by descending impulses from the brain.

The GCT in many ways revolutionized pain research. Not only did the theory propose a multi-dimensional conceptualization of pain that included psychologic processes, it helped explain clinical pain phenomena such as injuries without pain, and pain that existed in the absence of discernible lesion. As shown in Figure 2, the GCT also considered a place for behavior. But the “action system” of the GCT operated at the spinal level; the role of behavior was relegated to the domain of reflexes. Research prompted by the GCT addressing the action system of pain has focused primarily on animals, and the actions studied have been reflexive withdrawal or escape responses.

Melzack later proposed a “neuromatrix” model of pain, which greatly expanded the dynamic role of networks within the brain to explain the experience of pain. According to the neuromatrix theory, the brain has a neural network that integrates information from multiple sources and levels to produce the sensation of pain. Melzack suggested that various brain regions produce cyclical processing and synthesis of nerve impulses through the neuromatrix and give rise to a “neurosignature” of pain. Albeit a fascinating extension of GCT, beyond reflexive withdrawal or escape, the neuromatrix model is silent on the role of behavior in the pain system.

Considerable research has accumulated over the past 2 decades indicating that physiologic or medical status variables cannot fully account for presenting symptoms of pain and disability associated with various health conditions. Although biopsychosocial models have been important in drawing attention to social and psychologic influences on pain, these models have not fully addressed the place of behavior within the pain system. Biopsychosocial models of pain have tended to emphasize the role of cognitive factors and social contingencies on pain and behavior. Within these models, pain behavior is viewed primarily as a consequence of various cognitive, emotional, or social influences, not as an integral component of the pain system.

**CAN PAIN BE ADAPTIVE WITHOUT BEHAVIOR?**

From an evolutionary perspective, pain signals have been discussed as an internal mechanism that increases the probability of survival. Pain experience alerts the individual to the possibility that the integrity of the body has been compromised. However, central to the survival value of the pain system is the mobilization of behaviors that will act on the source of the pain, or tend to the consequences of pain. Indeed, it could be argued that without a pain behavior system, there would be no adaptive value to the pain signal itself. A pain system without behavior might be as adaptive as a fire station without firemen.

Despite the apparent centrality of behavior to the survival value of the pain system, there has been surprisingly little advance in the development of conceptual models of pain that specifically address the functions and mechanisms of pain behavior. The amount of research has been conducted on the functions, correlates, determinants, and outcomes of pain behavior pales in comparison to the research conducted on the sensory aspects of pain.

Borrowing themes from Descartes’ original depiction of the pain system, Figure 3 shows how a sensory pain model can be extended to include behavioral

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**FIGURE 3.** A biopsychomotor model of pain.
dimensions of pain. The biopsychomotor model of pain suggests that in addition to the sensory component of the pain system, it will be important to consider 2 main intraindividual behavioral systems: the communicative behavior system and the protective behavior system. Communicative pain behaviors might include facial expressions such as grimacing or wincing, and verbal or paraverbal pain expressions such as pain words, grunts, sighs, and moans. The overt display of distress during pain experience conveys information to observers about the internal state, pain-related limitations, and needs for assistance of the individual who is experiencing pain.\textsuperscript{5,6,16,17} Self-reports of pain such as numerical values provided to quantify pain experience can also be considered as communicative pain behaviors. However, the translation of pain experience into a numerical value likely engages cognitive processes that might not be evoked when pain is expressed through facial display or paraverbal responses.

Protective pain behaviors might include any action that is intended to reduce the probability of further injury, minimize the experience of pain, or promote recovery from injury. For example, the withdrawal of a limb from a hot surface serves to terminate the action of a noxious stimulus and in turn, protects the limb from further injury.\textsuperscript{3} Similarly, the use of limping to alter weight distribution during ambulation might minimize pain to an injured limb and reduce the probability of injury exacerbation.\textsuperscript{18,19} Protective pain behaviors might also include movements such as guarding, holding, touching, or rubbing of the injured or affected area of the body.\textsuperscript{20}

The social response system is an extraindividual behavior system, and comprises all elements of the social context within which pain is experienced. Feelings of empathy or sympathy triggered by the observation of others’ experience of pain can prompt caregiving or support behavior.\textsuperscript{5,6,21} Social behavioral responses might promote survival by providing critical care and can also act as potent reinforcers influencing the probability of the future occurrence of pain behavior.\textsuperscript{22,23} In the sections to follow, each behavioral dimension of the pain system is examined in more depth, summarizing research conducted to date and highlighting directions for future research.

**COMMUNICATIVE PAIN BEHAVIORS**

Craig and colleagues\textsuperscript{2,6,17} have proposed a model of pain communication that addresses how pain information is communicated to others in the social environment. According to this model, an infant’s ability to effectively communicate its distress is critical to its survival. As the child develops and becomes more autonomous, it needs to rely less on others for its survival and pain displays decrease in frequency and intensity.\textsuperscript{17} Still the effective communication of pain remains important for survival when injury has been severe and others’ assistance is required for protection or care. Others in the social environment might also learn from the individual’s experience, thus maximizing the probability of their own survival.\textsuperscript{5,6}

Facial displays and vocalizations are 2 of the primary channels through which pain information might be communicated to others.\textsuperscript{17} Facial displays can be an important channel of pain communication when others are in close proximity; vocalizations can be an important channel of pain communication when others are not in view.\textsuperscript{24,25} Considerable research has been conducted on the facial displays that accompany the experience of pain.\textsuperscript{2,5,25} The configuration of the face rapidly communicates to observers’ information about the internal state of the person experiencing pain.\textsuperscript{5,26}

There is likely an innate component to facial displays of pain.\textsuperscript{5,27} Newborn facial response to tissue damage is very similar to that of older children and adults.\textsuperscript{25,28} The lowering of the brow, wrinkling of the nose, raising of the upper lip, and closing of the eyes are frequently observed facial muscle actions associated with the experience of pain.\textsuperscript{28} Albeit innate, facial displays of pain, like any other form of human behavior, are likely to be influenced by a variety of factors such as individual differences in expressivity, communication goals, environmental contingencies, and cultural display rules. Given the variety of potential influences on pain behavior, it is not surprising that marked differences in expression are observed across individuals.\textsuperscript{5}

In a recent study,\textsuperscript{29} patients with low back pain were asked to lift a series of weights under 2 communication goal conditions. In one condition, patients were asked to estimate the weight of the object lifted, and in another condition, patients were asked to rate their pain when they lifted the object. Facial displays of pain were more pronounced during the pain rating task than the weight estimation task. Other pain behaviors (eg, holding, guarding) were not affected by the communication goal manipulation. Findings showing that facial displays, and not other forms of pain behavior, are influenced by the manipulation of communication goals support the functional distinctiveness of different forms of pain behavior.\textsuperscript{29}

Research has revealed that there are marked individual differences in the manner in which people will express pain. It has been shown that individuals who are depressed display more intense facial responses to painful stimulation than individuals who are not depressed.\textsuperscript{30,31} Numerous investigations have reported that women display more pronounced facial expressions of pain than men.\textsuperscript{32,33}

There is recent evidence suggesting that individuals who are high in pain catastrophizing are particularly likely to display marked facial expressions in response to painful stimulation.\textsuperscript{33,34} The term pain catastrophizing refers to a particular response to pain that includes elements of rumination, magnification, and helplessness.\textsuperscript{35} In one study, high pain catastrophizers displayed more intense facial responses to painful stimulation when they were in the company of a research
They might catastrophizing has also been associated with 14,38,39 47 50 40 29 285 45 clinical and experimental 20 47,51 37 22 reduced participation in activities of daily In other words, disability due to pain after injury, or as a result of compromise because of illness, there are obvious advantages to engaging in behavior that will promote recovery or minimize further injury.3

It has been shown that back pain influences the anticipatory postural compensation during movement that involves the spine.38 It has been suggested that the increased activation of deep muscle structures during movement might reflect a protective mechanism aimed at minimizing movement that might be associated with an increase in pain.41 It has been shown that the anticipation of movement can bring about the same changes in deep muscle activation as actual movement.42 Anticipatory postural adjustments do not seem to be affected by manipulations aimed at taxing attentional resources.38

There are indications that emotional factors related to fear of pain play a significant role in the degree of protective behavior individuals will display when experiencing pain. Fear of pain has been defined as a “highly specific negative emotional reaction to pain eliciting stimuli involving a high degree of mobilization for escape/avoidance behavior.”43 Clinical and experimental research continues to accumulate showing that individuals who score high on measures of fear of pain are less active,44 have reduced range of motion,14 are prone to discontinuing activities that are associated with pain,45 and avoid activities that they expect will be associated with pain.46 In some studies, fear of pain has been shown to be a better predictor of activity avoidance than medical status variables or pain itself.37,46

Other psychologic factors have also been shown to correlate with protective pain behavior. Self-reported functional disability has been shown to correlate significantly with protective pain behaviors, such as guarding or holding.29 Self-reported functional disability has also been shown to correlate with activity reduction during an experimental lifting task.57 Reduced confidence in one’s ability to perform physical activities (ie, self-efficacy) has been associated with exercise performance decrements,48 reduced participation in activities of daily living,49 and a higher frequency of avoidance behaviors.50 Self-efficacy has been shown to predict protective pain behaviors beyond the variance contributed by fear of pain.50 Catastrophizing has also been associated with indices of protective behavior such as activity intolerance, work disability, or self-reported functional limitations; however, these associations have not been as robust as those between fear of pain and protective behavior.47,51

The domain of protective pain behavior is vast and likely comprises functionally separate subgroups of behaviors. The reflexive withdrawal of a limb from a hot surface and the alterations in activity patterns associated with anticipated pain likely implicate different neurophysiologic mechanisms and are likely differentially influenced by environmental contingencies and learning history.42,52 It is also possible that behaviors initiated to minimize injury (eg, escape) may have different determinants than behaviors initiated to reduce pain after injury (eg, rubbing, holding).41,42

The research that has been conducted to date suggests that protective pain behaviors may underlie the disability that is often associated with pain conditions.42,53 Research showing that protective pain behaviors are only modestly

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It is possible that protective pain behaviors are not simply a proxy for pain experience. It is likely, however, that the functional distinctiveness of communicative and protective pain behaviors is restricted to their primary function, not their sole function. Although behaviors such as guarding and holding are classified as protective pain behaviors, they also have a communicative influence insofar as they are perceived by others. Similarly, communicative pain behaviors can also serve a protective function by soliciting assistance or caregiving from others.

More research is needed on the determinants and correlates of protective behaviors. Research is also needed to determine the nature of the functionally separate subgroups of protective pain behaviors. Advances in this area might play an important role in the development of interventions that might help minimize the severity of disability that is associated with pain.

**SOCIAL RESPONSE**

Recent research suggests that human beings are not only “equipped” to express pain, but are also equipped to respond to others pain. Research on the neuroanatomic correlates of pain suggests that mechanisms involved in the experience of pain are also implicated in the perception of pain in others. In the case of empathy, survival advantage has been discussed in relation to the sustained viability of the “group” as opposed to the “self.”

It has been suggested that individuals’ capacity for empathy might play a role in how they react to others expression of pain and suffering. Goubert et al broadly defined empathy as the “sense of knowing anothers’ pain experience.” Phenomenologic and neurophysiologic conceptualizations of empathy (as it relates to pain) suggest that the perception of another’s pain behavior automatically activates representations of personal experiences associated with pain. It is likely that this “sharing” of pain experience underlies the observers’ motivation to assist or care for the individual who is displaying pain behavior.

Communicative pain behavior (eg, facial displays) might be particularly likely to give rise to empathy-driven responses from the social environment. Prkachin et al reported that observers ranked facial actions as more important indicators of pain experience than other bodily movements. Research indicates that 36% to 70% of the variance in observers’ pain inferences can be accounted for by the facial display of the person experiencing pain. In one study, only 1% of the variance in observers’ pain inferences was accounted for by pain behaviors other than facial displays. It is possible that facial pain behaviors may be more specific indicators of pain experience and, as such, considered by observers to be more reliable indicators of pain than other forms of pain behavior.

Social response to others’ communication of pain might play a role in the development and maintenance of pain-related disability. Fordyce applied principles of learning theory to explain how social responses might contribute to pain-related disability. According to the principles of operant conditioning, behaviors are influenced by their consequences. A particular behavior (eg, moaning) that is followed by a positive consequence (eg, empathic attention) will have a higher probability of being emitted in the future, regardless of the level of pain. In this case, “moaning” becomes instrumental in achieving empathic attention. Fordyce argued that although pain behaviors might be reactive to pain experience in the short term, in the long term these behaviors increasingly come under the control of social environmental reinforcement contingencies. Thus, according to Fordyce, the social environment could give rise and maintain pain-related disability through selective reinforcement of pain behavior.

The term “solicitous communication” has been used to describe a particular style of responding to an individual’s pain behavior that contributes to heightened pain-related disability. Solicitous communication has been defined as utterances reflecting concern about a pain patient’s physical condition (eg, “Are you sure you aren’t going to hurt your back?”) or discouraging continued activity (eg, “Maybe you should slow down or stop now”). Solicitousness communication by a pain patient’s spouse has been shown to be associated with increased pain behavior. Pain patients with solicitous spouses report more intense pain when they believe their spouse is watching through a 1-way mirror. In a study of spousal interaction, solicitous spouse communications preceded the display of pain behavior in pain patients.

Findings such as these have been explained in terms of operant learning, where the solicitous spouse selectively reinforces displays of pain behavior. Research suggests that there are important individual differences in the manner in which observers perceive and respond to individuals in pain. In a recent study, Sullivan et al reported that individuals with high levels of pain catastrophizing not only experienced more intense pain, but perceived more intense pain in others as well. Gracely et al found that catastrophizing was associated with greater activation of the anterior cingulate cortex when patients with fibromyalgia were exposed to painful stimulation. Similar regions show activation when pain catastrophizers observe others experiencing pain.

The relation between catastrophizing and heightened perception of others’ pain could also have implications for how catastrophizing might influence caregiving behavior of others in their social environment. One possibility is that the caregiver with high levels of...
catastrophizing might be better able to detect pain behaviors and in turn respond with appropriate intervention. Alternately, the catastrophizing spouse of a chronic pain patient might be motivated to engage in excessive palliative or solicitous behavior to reduce the patient’s expression of distress, and inadvertently contribute to increased disability in the pain patient.66–68

LINKS BETWEEN THE BEHAVIOR OF PAIN AND THE BEHAVIOR OF EMOTION

Darwin69 argued that discrete emotions were patterns of movement that served adaptive functions in evolution. More recently, emotion theorists have elaborated this position to explain how perceptual, cognitive, physiologic, and behavioral dimensions of emotion represent coordinated systems of response to environmental stimuli, driven by survival goals.70–72 The requirements of survival are frequently discussed in relation to fight or flight responses where behavioral responses are initiated to escape from a threatening situation or to overcome the threat of the situation.73,74 A template or feature matching process is assumed where “emotionally competent” stimuli possess features that will elicit specific emotional reactions and associated behavioral responses.4,75

Most of the behaviors associated with pain would likely fall within the category of “flight” responses. Reflexive withdrawal, communicative and protective behaviors can be characterized as efforts to disengage from the pain stimulus. If pain is a signal of injury, actions aimed at terminating engagement with the cause of injury or preventing further injury would seem most adaptive. However, pain has also been associated with behaviors that can be characterized as “fight” responses. Numerous animal studies have demonstrated that pain can be a stimulus for aggressive behavior.76 The links between pain and aggressive behavior have been studied less extensively in humans, and it is likely that ethical and practical constraints limit the degree to which the conditions necessary for pain-induced aggressive behavior can be reproduced in the laboratory. Nevertheless, research in humans shows that pain experience is frequently associated with the self-reports of increased anger and hostility.77,78

The environmental context within which pain is experienced will likely contain an array of “emotionally competent” stimuli. As such, behavior of pain is likely to cooccur with the behavior of emotion such that pure expressions of pain behavior might be the exception than the rule. However, the survival advantage of a pain behavior system would depend on the degree to which pain behaviors could be distinguished from other forms of behavior associated with emotion. Indeed, there is research to suggest that facial displays of pain are distinct from the facial muscle actions used to display other types of emotion.28 Similarly, protective pain behaviors such as guarding, or limping do not seem to be elicited in the context of emotional experience without pain.

Pain behaviors and emotion behaviors have been discussed as automatic processes.17,52,71 In other words, the initiation of these behaviors does not require conscious deliberation, planning, or intention. Although (at least some) pain behaviors might be characterized by a high degree of automaticity, they are not immutable. Like all forms of motor output, these “automatic” behaviors can be influenced by display rules, and intentional exaggeration or intentional suppression.5 Still, there are indications that a certain degree of “leakage” might betray the intentional exaggeration or suppression of pain behaviors.79,80

THEORETICAL AND CLINICAL IMPLICATIONS OF A BIOPSYCHOMOTOR MODEL OF PAIN

Emerging research suggests that the different dimensions of the pain system serve different functions; they may be influenced by different internal and external contingencies, they likely have different correlates, and may well respond differentially to treatment interventions.22,37,54,81 Research to date suggests that subjective pain intensity, and objectives indices of communicative, protective, and social response behaviors are only partially overlapping dimensions of pain experience.17

The biopsychomotor model of pain has clear implications for the breadth of processes that will be considered as integral dimensions of the pain system. A number of investigators2–5,17 have discussed the operation of central motor programs responsible to the organization of action in response to painful stimulation. Motor programs for different forms of pain behavior might be organized at different levels of the central nervous system, and might be differentially influenced by social and psychologic factors. Reflexive withdrawal from a painful stimulus is likely modulated primarily at the spinal level, although accompanying facial or verbal pain expressions probably involve the implication of cortical centers.52 Anticipatory postural compensation and weight redistribution might require limited cortical resources but may nevertheless be influenced by higher level psychologic processes such as expectancies and fear.82 Behaviors enacted to alleviate pain such as holding or rubbing likely implicate significant higher level processes.83,84

It has been suggested that motor programs involved in the expression of pain might be activated when pain intensity rises beyond a certain threshold.5 It is possible that certain psychologic factors such as pain catastrophizing, fear, or depression might influence pain behavior by lowering the threshold for the activation of motor programs for the expression of pain. The latter explanation would suggest that individual differences in pain behavior might reflect the operation of automatic processes and not the intentional display of distress. Questions concerning the relative automaticity or intentionality of the pain behavior displays will need to be addressed in future research.

Traditional medical approaches to pain have given some recognition to the behavioral dimensions of pain,
but these have been regarded as secondary or reactive to pain. The implicit assumption has been that effective treatment of pain (sensation) will lead to the disappearance of pain behavior. Research, however, suggests that the behavioral dimensions of pain (eg, disability) may persist despite reductions in pain, and that disability can be reduced in the absence of reduction in pain.85

In recent years, a number of targeted interventions for pain patients have been described. Intervention strategies have been developed that specifically target various determinants of pain-related outcomes such as catastrophic thinking, depression, fear of pain, and spousal communication.86–91 It will be of interest to examine the degree to which changes in these cognitive, affective, and interpersonal determinants of pain and disability map onto changes in pain behavior profiles. It will also be of interest to examine the differential predictive power of behavioral and self-report indices for risk of chronicity and response to treatment. Research of this nature might afford insights into the relation between self-report indices of pain-related cognitive, affective and interpersonal dimensions of pain and disability, and pain behavior profiles.

Clinicians involved in the treatment of pain have long been aware of the behavioral displays that accompany pain experience. Behaviors associated with distress displays, activity interruption or activity avoidance, are the most prominent components of pain-related disability.37 In the absence of empirical evidence concerning the meaning or significance of different behaviors associated with pain, clinicians have relied on their own intuitive inferences. In the domain of pain interventions, intuition-based practice has led to the frequent utilization of terms such as “functional overlay,” “chronic pain behavior,” “symptom magnification,” or “secondary gain.” These terms are often pejorative in nature and more often than not, impede, as oppose to facilitate the implementation of appropriate interventions. Research aiming to elucidate the meaning or significance of different pain behaviors might lead to the development of assessment or intervention tools that will improve the treatment experiences and treatment outcomes of individuals experiencing persistent pain conditions.

New avenues for intervention might become apparent if the different behavioral dimensions of the pain system are considered to be at least partially independent. Some patients might present with an overrepresentation of the communicative dimension of the pain system, others may present with an overrepresentation of the protective behavior dimension. Because these components are determined by different cognitive and affective factors, intervention techniques specifically designed to target the determinants of different behavioral components might yield better outcomes than interventions aimed simply at reducing pain intensity. In the same way that thought monitoring exercises have been used to increase individuals’ awareness of maladaptive cognitions, video feedback of pain behaviors could be used to increase individuals’ awareness of maladaptive pain behaviors. Behavioral interventions, such as structured activity planning, graded activity interventions, or exposure, might be particularly useful for targeting protective behaviors.

Several pain behavior coding systems have been developed to date. Keefe and Block developed the first systematic approach to the coding of pain behaviors. In this coding system, patients performed a variety of physical maneuvers as part of a standardized physical examination. More recently, Prkachin et al92 elaborated on the Keefe and Block system by incorporating greater focus on facial displays of pain. Prkachin et al92 also developed a means of coding pain behavior “on line” to reduce the resource demands associated with pain behavior coding. Sullivan et al59 used a lifting simulation task to elicit communicative and protective pain behaviors. Romano and colleagues60 have developed a system of coding partner-spouse interactions during simulated domestic activities. An important step in this domain of research will be the elaboration of a pain behavior protocol that will permit analysis of different dimensions of pain behavior. Such a system might be used to generate different pain behavior profiles. These pain behavior profiles might then provide the basis for tailoring interventions to the factors that are currently maintaining a patient’s high level of distress and disability.

At present, the task of coding pain behavior is resource intensive and limits the degree to which pain behavior assessment protocols can be incorporated into clinical assessment procedures. However, recently developed real-time coding procedures for the assessment of pain behavior and the development of brief performance tasks designed to elicit pain behavior represent important steps toward the inclusion of pain behavior assessment into standard clinical practice.92

SUMMARY

Arguments were put forward in support of a new conceptualization of pain where pain behavior is viewed as an integral component of the pain system. Central to the biopsychomotor model of pain is that a pain system can only be adaptive if the sensory component of the system is accompanied by a behavioral system designed to act on the source or consequences of injury or illness. The wide variability observed in pain behavior across people, despite seemingly comparable levels of pain intensity, supports the view that dysfunction may arise in behavioral systems functionally separate from pain sensation, and that treatments targeting pain sensation might not always yield the best outcomes. Evidence was reviewed suggesting that different dimensions of pain behavior were functionally distinct, and questions were raised about the nature of motor programs responsible for the elicitation and maintenance of different forms of pain behavior. Challenges for the future include a more in-depth examination of the determinants of different forms of pain behavior, and the development of assessment protocols that can be feasibly incorporated into routine clinical practice.
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