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Externalizing the Private Experience of Pain: A Role for Co-Speech Gestures in Pain Communication?

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Despite the importance of effective pain communication, talking about pain represents a major challenge for patients and clinicians because pain is a private and subjective experience. Focusing primarily on acute pain, this article considers the limitations of current methods of obtaining information about the sensory characteristics of pain and suggests that spontaneously produced "co-speech hand gestures" may constitute an important source of information here. Although this is a relatively new area of research, we present recent empirical evidence that reveals that co-speech gestures contain important information about pain that can both add to and clarify speech. Following this, we discuss how these findings might eventually lead to a greater understanding of the sensory characteristics of pain, and to improvements in treatment and support for pain sufferers. We hope that this article will stimulate further research and discussion of this previously overlooked dimension of pain communication.

Pain is one of the most frequently reported symptoms in medical consultations (Gureje, Von Korff, Simon, & Gater, 1998), with discussions of pain taking up a substantial portion of the consultation time, particularly during the first consultation (Henry & Eggly, 2012). Despite this, pain presents a challenge to patients and clinicians because it is a subjective experience, directly accessible only to the sufferer and often with no visible signs (such as a wound) from which to infer the sensation. Even when there is a visible cause this may not reveal anything about the *sensation* of pain (e.g., whether it is throbbing or stinging), and amount of tissue damage does not correlate with self-reported pain intensity (Turk & Melzack, 2001). Problems also arise when trying to distinguish between similar pains (e.g., migraine and nonmigraine headache); here the patient's self-report is

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vital for making an accurate diagnosis and providing the correct treatment (Stafstrom, Rostasy, & Minster, 2002). Thus, patients need to articulate their pain effectively to get help and support, while doctors and concerned others need to understand the sufferer's experience in order to provide this; "Our ability to help . . . anybody in pain, depends upon the availability of reliable and valid information concerning the presence and specific nature of the individual's distress" (Hadjistavropoulos & Craig, 2002, p. 552).

The communication of sensory aspects of pain (e.g., sensation, intensity, location) is particularly important for acute pain, both at initial presentation and later when reviewing the effects of treatment (Briggs, 2010; Swann, 2010; Wood, 2008). In this article, we provide a brief review of current methods of assessing acute pain, focusing on the amount and usefulness of information obtained about the sensory characteristics of pain. Although other aspects of the total pain experience, such as impact on functioning, may be important in clinical settings, we do not focus on these as, compared to describing what pain feels like, it may be relatively easy to explain how pain has prevented engagement in work or exercise. We also do not review the research on the communication of chronic pain (e.g., Cinciripini & Floreen, 1983; Lin, Kupper, Gammaitoni, Galer, & Jensen, 2011; Rasmussen, Sindrup, Jensen, & Bach, 2004; Steihaug, 2005; Tai-Seale, Bolin, Bao, & Street, 2011; Upshur, Bacigalupe, & Luckmann, 2010), as this is typically geared toward managing the impact of pain, rather than on understanding the sensory aspects of the experience. However, chronic pain studies that have considered the communication of sensory dimensions of pain are included where relevant.

Following this, we introduce *co-speech hand gestures* (the movements of the hands and arms that spontaneously accompany speech), and their possible role in pain communication. Because this is a relatively new area of research, with a limited number of studies conducted so far, it would be premature to attempt to provide a comprehensive "review of the literature." Instead, we introduce the key findings to date and consider how these might inform pain communication. In particular, we discuss how co-speech gestures might overcome some of the limitations of other methods of pain communication, arguing that by attending to these gestures alongside speech, clinicians and other health professionals may obtain a better understanding of the characteristics of someone's pain. We discuss the potential implications of this for the treatment and support that patients receive and consider the limitations of research conducted to date and avenues for future research.

The co-speech gestures we discuss in this article are crucially different from the behaviors traditionally referred to as "nonverbal communication" (e.g., facial expression, eye gaze, posture; see fourth section for more detail). Nonverbal communication of patients and health care practitioners has been studied extensively, both in medical consultations and in psychiatric therapy sessions, with these behaviors serving as important signals of emotion, attention, and empathy, and their usage linked to outcomes such as increased patient satisfaction (e.g., Finset & Piccolo, 2011; Henry, Fuhrel-Forbis, Rogers, & Eggly, 2012; Lepper, Martin, & DiMatteo, 1995; Robinson, 2006; Sheeler, 2013; Stewart & Roter, 1989). Focusing on co-speech gestures in pain communication, this article takes a new approach, considering how this crucially different and comparatively understudied aspect of visual, bodily communication can contribute to pain communication by conveying semantic, propositional information about pain. We hope that by introducing research on co-speech gestures and pain communication, this article will stimulate further discussion and research leading to positive implications for pain communication in clinical settings.

VERBAL SELF-REPORT OF PAIN

Speech is considered to be the most accurate and reliable means of assessing pain, particularly in the absence of physical indicators (Craig, 2009; National Cancer Institute, 2011; Tian, Panesar, Bhatt, & Carson-Stevens, 2011), and patients and physicians spend up to 23% of the consultation time talking about pain (Henry & Eggly, 2012). Despite the obvious importance of speech, there are problems with this mode of communication, both for the patients, in terms of finding the right words to describe their pain, and for the listeners, in terms of correctly inferring the nature of the pain from the words used.

It has long been recognized that pain is extremely difficult to translate into language; "English, which can express the thoughts of Hamlet and the tragedy of Lear, has no words for the shiver and the headache . . . let a sufferer try to describe a pain in his head to a doctor and language at once runs dry" (Woolf, 1993, p. 200). In some cases, this difficulty in describing pain leads to frustration and the subsequent abandonment of attempts to communicate pain, perpetuating a cycle of withdrawal and ineffective communication (Ehlich, 1985; Scarry, 1985); "Unable to express pain, we come to believe there is nothing to say . . . silenced we become isolated in pain and the isolation increases the pain" (Frank, 1991, p. 30).

Pain, like other subjective, phenomenal experiences such as taste and smell, can be said to be ineffable, that is, difficult or impossible to put into words in a way that truly represents the experience (Majid, 2013). In the same way that it would seem impossible to explain to congenitally blind individuals what *red* is when they cannot experience this for themselves (Levinson & Majid, in press), it can be argued that it is not possible to truly express the subjective experience of pain. Although "pain-words" (e.g., "throbbing," "stinging," "stabbing") can be learned through their application to experiences of injury (IASP Task Force on Taxonomy, 1986), the true establishment of names can only occur through the process of ostensive definition, that is, by pointing at and naming

things in the shared public world (for a philosophical discussion of this problem see Wittgenstein, 1953). However, for sensations such as pain, there is no referential content for ostensive definition; we cannot show our pain to others and say "*this* is a stinging pain," meaning that it is not possible to unequivocally identify and name pain within a public language. Thus, even when the same description is used by different speakers or by the same speaker at different times, we do not know whether it carries the same intended meaning. Salovey and colleagues (1992) found that when asked to indicate which types of pain were best described by a series of adjectives, participants provided an average of 10 different types for each adjective. This suggests that verbal pain language is ambiguous and people struggle to map lexical pain terms onto specific pains, highlighting the potential for misunderstanding of others' pain descriptions. In the following sections, we discuss the ways in which researchers and medical professionals have attempted to overcome some of the problems associated with the verbal communication of pain.

ALTERNATIVE METHODS OF OBTAINING INFORMATION ABOUT PAIN

Self-Report Pain Assessment Tools

Pain assessment tools, such as numerical and verbal rating scales, are simple to administer and attempt to make pain "measureable" by categorizing and quantifying aspects of the experience. These tools are used in research settings to measure changes in intraindividual pain across time (Defrin, Grunhaus, Zamir, & Zeilig, 2007; McCaffrey & Freeman, 2003), and distinguish between different types of pain (Crawford, 2009; Dubuisson & Melzack, 1976). However, these tools do not necessarily provide more detailed or useful information than would be obtained from verbal self-report. For certain tools, such as numerical rating scales, patients assign a numerical value to an aspect of their pain (e.g., "on a scale of 1 to 10, how intense is the pain?"). While this might be a useful method of recording pain scores over time, it does not necessarily add much to the verbal pain description. Other tools, such as the McGill Pain Questionnaire (MPQ; Melzack, 1975), are more comprehensive and contain a range of descriptors from which sufferers can select those that apply to their pain. While this is useful when patients struggle to verbalize pain, it nevertheless limits the choice of descriptors to a predefined list with no option to indicate alternatives, with patients being "forced" to select descriptors that may not accurately reflect their pain or capture all aspects of it (Ho, Spence, & Murphy, 1996).

In addition, problems may arise in the interpretation of these measures at two stages: (1) the initial interpretation of measures by patients and (2) health care professionals' interpretation of patients' responses. When asked to interpret the maximum value (i.e., the highest score) on a visual analogue scale, some patients interpreted it numerically, some emotionally, and others in functional terms, while individual pain scores were confounded by factors such as tiredness, distress, and presence of other distinct pains (Williams, Davies, & Chadury, 2000). Further, different people have been found to give different ratings to identical stimuli; for example, one patient's "8" might be another patient's "3" on a 1–10 scale, suggesting that the scores on these tools are relative only to the sufferer and are not comparable across people (Ho et al., 1996). In terms of interpretation by health care professionals, more than 50% of nurses were concerned that these tools were subjective, inaccurate, and subject to problems of under- and overtreatment (Simons & MacDonald, 2004), a concern that is supported by evidence that pain is often underestimated on the basis of these measures, especially at high levels (Sjöström, Haljamäe, Dahlgren, & Lindström, 1997). This has obvious implications, as underestimation of pain is likely to lead to inadequate treatment and pain relief. The fact that these tools are subject to interpretation issues at two distinct stages means that, to some extent, these measures are more problematic than simple verbal self-report.

Finally, although guidelines recommend the use of pain assessment tools within clinical settings (e.g., National Institute for Health and Clinical Excellence, 2011; Royal College of Physicians, British Geriatrics Society, & British Pain Society, 2007), these are not enforced and there is no single guideline for the United Kingdom (Simons & MacDonald, 2004; Wood, 2008). In a pediatric setting, fewer than 25% of nurses documented pain intensity scores and there was no evidence of other pain assessment tools being used (Jacob & Puntillo, 1999). Nurses perceive numerous barriers to the use of assessment tools, including inadequate training and lack of knowledge, concerns about the extra time and work involved, and the possibility of patients becoming frustrated at being given too much paperwork (Simons & MacDonald, 2004). The fact that these tools are not widely utilized within clinical practice and that they do not appear to provide a significant amount of detail over and above verbal self-report indicates there may be a need for alternative approaches to pain communication.

Observational Indicators of Pain

People often communicate pain through nonverbal behaviors such as preverbal utterances (e.g., "ow"), sighing, and facial expressions (e.g., McCahon, Strong, Sharry, & Cramond, 2005; Sullivan et al., 2006). These behaviors allow others to make inferences about the presence of pain and associated distress, and may be useful for recognizing pain needing immediate attention, as well as for the identification of pain in populations with cognitive difficulties or language impairments (Swann, 2010). However, although these behaviors can be important in determining the presence of pain, there are some limitations in terms of the information they provide and their interpretation.

First, observational indicators tend to be generic across types of pain, meaning that they cannot be used to distinguish between different types of pain or to glean specific information about pain characteristics. For example, research indicates that there is a "prototypical" facial expression of pain, which is produced in response to various types of pain (Prkachin & Craig, 1995), signaling the presence of pain but not providing information about what type of pain it is. Further, observational indicators are often an immediate and brief response to intense transitory pain, limiting their utility to the identification of acute pain and making them less useful when discussing pain retrospectively (Prkachin, 1992; Prkachin & Craig, 1995).

Second, caution is needed when interpreting these behaviors as their display is influenced by factors such as culture, personality, and motivations (Prkachin & Craig, 1995), and they are susceptible to reinforcement and conditioning (Fordyce, 1976; Keefe & Block, 1982). Research has also indicated that observers are unable to discriminate effectively between real and exaggerated pain using these behaviors (Hadjistavropoulos, Craig, Hadjistavropoulos, & Poole, 1996). Prkachin, Berzins, and Mercer (1994) found that on the basis of facial expressions, observers significantly underestimated the level of pain relative to levels reported by sufferers, and while self-reported pain consistently correlated with the production of painful facial expressions, observers' ratings did not. Further, even if observers' pain ratings were correlated with amount of pain behavior, there may still be a difference in the absolute pain scores provided by observers and sufferers (e.g., if observers systematically underestimate pain). Thus, while observational indicators allow for simple distinctions between whether or not a person is in pain, it may not be possible to estimate the level of pain based on these cues (Hadjistavropoulos, Craig, Hadjistavropoulos, & Poole, 1996). Given that underestimation may lead to undertreatment, a reliance on these methods may have detrimental consequences for pain sufferers. While clinicians and concerned others should not ignore these pain-related behaviors, they nevertheless do not appear to address the challenges of verbal pain communication as a means of obtaining meaningful information about the precise nature of the pain.

Visual Representations of Pain

Recently, researchers have begun to explore the use of visual representations as an aid to pain communication. Patients' drawings of their headaches have been found to contain detailed information about features of the pain such as location and quality (Broadbent, Niederhoffer, Hague, Corter, & Reynolds, 2009), and clinicians are able to differentiate with some success between migraine and nonmigraine headaches based on these images (Stafstrom et al., 2002; Wojaczynska-Stanek, Koprowski, Wróbel, & Gola, 2008). However, the utility of these methods may depend on patients' abilities to express themselves creatively; patients who lack skills or confidence may be less able to portray pain in this manner.

Other work has used photographs as a means of expressing pain and facilitating dialogue. Baker and Wang (2006) asked older adults with chronic pain to photograph objects that reflected their pain and compose narratives to accompany these. Participants reported that this process was beneficial and allowed them to share their experiences with others, although the utility of these photographs in medical consultations was not explored. Following a collaboration with chronic pain sufferers to produce photographs representing pain (Padfield, 2003), Padfield and colleagues gave patients 64 pain images (e.g., a tightly twisted steel wire being heated by a flame) from which they could select those that best reflected their pain to use within medical consultations (Padfield, Janmohamed, Zakrzewska, Pither, & Hurwitz, 2010). Postconsultation questionnaires revealed that doctors and patients found the photographs useful for facilitating discussion, improving communication, and creating a shared understanding of pain. However, this method increased consultation length, constrained patients to a limited choice of images, and was felt by some to deflect the focus of the consultation away from the actual pain.

Interim Summary

The evidence so far indicates that there are numerous limitations to current methods of pain communication. In particular, while using photographs and drawings within the pain consultation may allow more information to be shared, other methods, such as facial expressions and numerical rating scales, do not appear to contribute detailed information about the pain over and above that provided by speech. Further, many of these methods need to be utilized *in addition to* verbal self-report, requiring extra consultation time and making them impractical within real medical consultations. To reach a more workable solution to the problems of verbal pain communication it may be necessary to consider the benefits of improving or enhancing the spontaneous self-report of pain, rather than attempting to bypass this process. The next section discusses a possible means of achieving this, focusing on the "co-speech hand gestures" produced spontaneously alongside natural speech.

THE ROLE OF CO-SPEECH GESTURES IN COMMUNICATION

Co-speech gestures are the movements of the hands, arms, and other body parts that spontaneously accompany speech

(Kendon, 2004; McNeill, 1985, 1992). These gestures can be categorized as "representational" or "nonrepresentational" (Alibali, Heath, & Myers, 2001; Jacobs & Garnham, 2007). Representational co-speech gestures are related to the semantic content of speech and can convey a range of information about entities and events in the real or imagined environment of the speaker (McNeill, 1992). For example, a representational gesture may involve moving the hand in a circular motion when describing a "round" table. Conversely, nonrepresentational co-speech gestures primarily serve pragmatic functions such as adding emphasis, marking the delivery of information, or managing turn-taking (Bavelas, Chovil, Coates, & Roe, 1995; Bavelas, Chovil, Lawrie, & Wade, 1992; Kendon, 2004; McNeill, 1992). Although nonrepresentational gestures are an important aspect of communication, we focus on representational gestures due to their close relation to the propositional content expressed in speech and their ability to represent semantic information in a visible manner, both aspects that indicate that gestures may allow us to obtain more information about the precise nature of pain.

Co-speech gestures are crucially different from bodily behaviors traditionally categorized as "nonverbal communication" (e.g., eye gaze, posture, and facial expression). Rather than serving interpersonal functions (e.g., smiling while someone is speaking) or providing cues to an emotional state (e.g., grimacing when in pain), co-speech gestures serve functions analogous to those of speech in that they convey propositional information (e.g., using the hands to indicate the size or shape of an object). Thus, although "nonverbal communication" in the traditional sense is indeed an important aspect of pain communication, it is not the focus of the following sections, which instead are concerned with representational co-speech gestures. From this point onward, we use the term "gestures" to refer to representational co-speech gestures unless otherwise stated.

The close semantic integration of gestures and speech has led to suggestions that *together* they constitute language, with gestures allowing the speaker to visibly express ideas in a way that is not permitted by speech (Kendon, 1980, 2000, 2004; McNeill, 1992, 2005). Research into the communicative functions of gestures has demonstrated that the differences between speech and gesture allow not only for the same information to be expressed differently within the two modalities, but also for gestures to represent unique information that is not contained in speech at all (e.g., Holler & Beattie, 2002, 2003a; Kelly & Church, 1998; McNeill, 1992). For example, a speaker may say, "and she chases him out again," while performing a gesture in which the hand appears to swing an object through the air (McNeill, 1992, p. 106). Here, the gesture adds information about the way the act of chasing is performed (while swinging an object) that is not contained in the speech. Quantitative analyses of the amount and type of information in speech and gestures during cartoon narration tasks (one of the traditional paradigms in the field of gesture research) indicate that around a quarter of the overall information is represented uniquely in gesture (Holler & Beattie, 2003a). This important semantic contribution of gestures is further highlighted when speech is ambiguous (Holler & Beattie, 2003b) or when information is difficult to express verbally (Bavelas, Kenwood, Johnson, & Phillips, 2002; Bergmann & Kopp, 2006; Emmorey & Casey, 2001).

Research into the comprehension of gestures by untrained recipients (as opposed to trained analysts) has revealed that gestures communicate a significant amount of information to addressees both on their own and in conjunction with speech (for a meta-analysis of studies of gesture comprehension see Hostetter, 2011). For example, naive observers were able to recount 11% more information when they could see gestures as well as hear speech (Beattie & Shovelton, 1999). Further evidence that untrained recipients are able to use the information in gestures comes from studies using techniques such as electroencephalograph (EEG) and functional magnetic resonance imaging (fMRI), which reveal that the brain processes and semantically integrates gestural information with the accompanying speech (e.g., Dick, Goldin-Meadow, Hasson, Skipper, & Small, 2009; Green et al., 2009; Holle, Gunter, Rüschemeyer, Hennenlotter, & Iacoboni, 2008; Kelly, Creigh, & Bartolotti, 2010; Wu & Coulson, 2007).

While these studies suggest that gestures play a considerable role in communication about external objects and events, there have been few studies focusing on the communication of internal experiences such as pain. We propose that because gestures are imagistic, idiosyncratic representations, they are likely to present an alternative means by which patients can visually represent their pain. Of particular relevance is the possibility that gestures may add information that is not contained in speech at all or which further clarifies the verbal pain description. Thus, gestures may ease the communicative burden for pain sufferers, overcoming the problems of finding appropriate verbal labels for their pain, while aiding the recipient by allowing them to obtain more information about the pain. If attending to gestures does give rise to greater understanding of the pain then this is likely to have a positive impact on doctors' understanding of patients' pain and thus their ability to provide appropriate treatment and support.

CO-SPEECH GESTURES AND PAIN COMMUNICATION

In recent years, researchers have initiated investigations into the role of gestures in pain communication, particularly from the perspective of what these gestures may add to our

understanding of the characteristics of pain.[1] For example, Vyasse (1992, cited in Albarran, Durham, Chappel, Dwight, & Gowers, 2000) found that when describing chest pain, patients used gestures to show the location and quality of their pain (e.g., by tapping on the chest to represent the sensation of cardiac dysrhythmia). More recently, qualitative research into the spontaneous hand gestures produced by patients during medical consultations and interviews reveals that patients use gestures in three key ways: (1) to specify the location of pain, (2) to demonstrate painful actions, and (3) to depict pain sensation (Heath, 2002; Hyden & Peolsson, 2002). For example, Heath (2002) discusses an instance in which a gesture is used to depict the sensation of a band tightening around the head (leading to a diagnosis of tension headache), while Hyden and Peolsson (2002) describe a patient tapping rapidly on the back of the hand to indicate the sensation of pins and needles. These findings suggest that gestures can indeed contribute information about pain and are used by pain sufferers within the clinical contexts. However, although these studies illustrate potential functions of gestures within pain communication, they focus on detailed descriptions of a limited number of individual gestures. As such, they do not provide information on the frequency of these gestures in pain communication, and, crucially, their relationship with the verbal pain message (in terms of whether they are able to add to or clarify the spoken information).

A recent study made a first attempt to systematically investigate how semantic information is represented in speech and gestures during pain communication (Rowbotham, Holler, Lloyd, & Wearden, 2012). This involved detailed analysis of video-recorded interviews with individuals who had recently experienced physical pain, using a "semantic feature approach" that attempts to quantify the information in gestures and speech. Gestures and speech were coded according to whether they contained information about various aspects of pain (including location, sensation, size, and intensity), allowing the researchers to establish whether gestures contributed any information that was not contained in the accompanying speech. Gestures frequently accompanied pain descriptions, with 41% of the information about pain represented in *gesture alone*, with gestures primarily contributing unique information about location, size, and quality of pain. For example, a speaker might say "It's a really bad headache" while producing a gesture in which a hammering motion is made, thus conveying gestural information about the pain sensation (hammering) that was not contained in speech.[2] Further, 36% of information was represented simultaneously in speech and gestures, particularly pain sensation, suggesting that gestures and speech can interact to convey information about the same aspect of pain. A qualitative investigation of the role of gestures when similar information (in this case, pain sensation) is represented simultaneously in speech and gesture together indicates that gestures perform two key functions, to (1) add completely new information about aspects of pain sensation that are not represented in speech at all (e.g., with speech indicating that the sensation is "sharp" while the accompanying gesture shows it to have a "throbbing" element), and (2) clarify the verbal description by containing more specific information about the same aspect of pain sensation that is described in speech (Rowbotham, Wearden, Lloyd, & Holler, 2013). A follow-up quantitative study confirmed that gestures did indeed contribute additional detail about pain sensation that was not contained in speech, and did so in nearly half of instances, while gestures also provided more specific representations than the accompanying speech in a small proportion of instances (Rowbotham, Holler, Wearden, & Lloyd, 2014). A recent study also revealed that participants use more gestures when describing high compared to low-intensity pain, suggesting that as well as adding information about the characteristics of pain, gesture frequency may also serve as an indicator of pain severity (Rowbotham, Wardy, Lloyd, Wearden, & Holler, 2013).

These initial investigations highlight the potential value of gestures in the communication of information about pain characteristics that may be difficult to express in speech. In particular, attending to gestural communication alongside speech may allow us to obtain a fuller and more specific representation of the pain than we would from speech alone. This is likely to have important implications for the diagnosis and treatment of pain and for the provision of empathy and understanding. The National Cancer Institute (2011) recommends that medical professionals "listen to the patient's words about the quality of the pain; these provide valuable cues to its etiology." Based on the evidence discussed so far, we would recommend that we should also attend to the gestures produced during pain descriptions.

[1]Other studies have considered whether the form of the gesture (e.g., a point to the chest versus a palm laid flat on the chest) can be used to distinguish between myocardial infarction (MI) and non-MI chest pain within an emergency setting (Albarran et al., 2000; Marcus et al., 2007). Although patients did use their hands to indicate the location of the pain, the form of the gesture was not a reliable indicator of outcome, suggesting that these gestures are not useful for diagnosis in this context. However, the researchers did not consider whether gestures can tell us anything about the sensory experience of pain, and as patients were asked to "show" their pain, the focus was not on the spontaneous co-speech gestures that we consider in this article.

[2]Of course, in this example the speech also contains information that is not depicted in gestures, e.g., about the type of pain ("headache") and to some degree the intensity ("really bad"), but the current argument is concerned with what gestures can add to speech. It is accepted that speech will also contain information that is not in gesture, hence our suggestion that both modalities should be attended to as they interact in the representation of meaning.

DISCUSSION AND CONCLUSION

Discussion

Although initial research appears promising, it is still in its early stages and there are a number of potential limitations still to address. First, the studies by Rowbotham and colleagues focus on pain communication within a university setting, usually with student participants being interviewed about their pain by a researcher. Despite attempts to make the interview situation as similar to a medical consultation as possible, there are inherent differences that may affect the communication process. For example, participants were asked to "describe the pain in as much detail as possible," meaning they may have focused more on depicting sensory characteristics than would a patient in a medical consultation, potentially leading to inflations in gesture use. Further, the motivation behind pain descriptions in experimental and clinical contexts is necessarily different, with patients in clinical settings more likely to seek and support for their pain. Thus, more research is needed to establish whether the results of studies conducted to date can be corroborated in clinical settings.

Second, although people use gestures to depict information about the sensory characteristics of pain, we do not yet know how recipients understand this information. Although for concrete concepts (such as objects or actions), recipients are able to glean information from speakers' gestures (with this information aiding their understanding of the overall message; for a review see Hostetter, 2011), it is not yet apparent whether this is also the case for more abstract, sensory information, such as pain. Preliminary data suggest that when gestures contain additional information about pain (i.e., that is not contained in speech), recipients are able to pick this up and integrate it with the information contained in speech (Rowbotham, Holler, Wearden, & Lloyd, 2013). However, research needs to explore what impact this additional information has on clinically relevant outcomes, such as the speed and accuracy with which a diagnosis is made. Further, given that empathy can be defined as the "ability to understand another person's inner experiences and feelings" (Hojat et al., 2002), if seeing gestures leads to a more complete understanding of what the pain feels like to the sufferer, this may also have an impact upon physician empathy, and in turn on patient outcomes such as satisfaction.

Another question is whether it would be beneficial to provide formal training to clinicians to help them to glean information from gestures. There is evidence that people are able to obtain significantly more information from gestures following a short training session (with no detriment to their ability to pick up spoken information; Kelly, Singer, Hicks, & Goldin-Meadow, 2002). Thus, encouraging doctors to visually attend to patients should lead to improvements in the amount and clarity of pain information obtained. There is evidence that clinicians spend a considerable amount of time looking at patients' notes and tend to orient their posture and gaze toward medical records on the computer screen, rather than toward the patient (Hartzband & Groopman, 2008; Makoul, Curry, & Tang, 2001; Margalit, Roter, Dunevant, Larson, & Reis, 2006; McGrath, Arar, & Pugh, 2007; Ruusuvuori, 2001), further highlighting the potential need for training to prevent the information in gestures being missed. Initial investigations on the impact of instructing people to attend to gestures are currently underway in our lab, but further research is needed within the clinical setting to investigate how clinicians attend to the information contained in gestures and whether directing attention to this modality leads to better treatment and support.

Finally, future work should also consider how both parties use gestures within the context of a developing interaction. Speakers use various devices to orient listeners' attention to gestures, including looking at their own gestures (e.g., Enfield, 2009; Gullberg & Holmqvist, 1999, 2006; Gullberg & Kita, 2009), placing gestures in prominent places within the gesture space (e.g., directly in front of the recipient; Heath, 2002), and using multimodal utterances in which lexical items are replaced with a gesture (e.g., "it's like *this* kind of pain," while performing a gesture in which the hands are clenched and unclenched to indicate a cramping sensation). Further research needs to establish whether clinicians attend to gestures in these instances, and if not, how this affects the subsequent interaction. For example, if the gesture goes unnoticed, patients may attempt to convey the information through another modality or attempt to direct the clinicians' attention to their gestures. Gestures may also be used to build a shared understanding of the pain, with the patient performing a gesture that the clinician then repeats back, followed by clarification or acceptance on the part of the patient. Laboratory studies have provided some evidence of the use of gesture in the process of creating shared understandings of meaning as well as gesture mimicry for grounding, but these have focused on the communication of concrete conceptual information (Holler, Tutton, & Wilkin, 2011; Holler & Wilkin, 2011; Kimbara, 2006). The use of gestures by both patients and clinicians in the context of pain communication may also reflect the extent to which a shared understanding of the pain has been achieved. Heath (2002) provides some evidence for this when describing an interaction in which the doctor mimics the patients' earlier gestures (which depicted the sensation of a band tightening around the head) while explaining his assessment of the pain. Thus, there is some evidence to suggest that these gestures are used by doctors and patients to build up a shared understanding, but more work is needed, particularly in terms of whether this is something that occurs regularly within pain-focused interactions and how this impacts upon outcomes such as treatment and patient satisfaction.

Because the focus of the present article has been on the communication of sensory characteristics of pain, we have

focused primarily on acute pain. For chronic pain conditions, communication may be geared more toward reducing the impact of pain on daily functioning. However, for chronic pain patients, having their pain understood and validated by clinicians is highly valued, even when it is not possible to treat the pain (Hurwitz, 2003; Kenny, 2004; Peters, Stanley, Rose, & Salmon, 1998; Turk, 2002; Werner & Malterud, 2003). As with acute pain, gestures may provide an outlet through which chronic pain sufferers can depict their pain sensation, making the pain "visible" within the shared interaction. Chronic pain patients may externalize their pain in this way not only to overcome the difficulties of explaining their pain verbally, but also to provide evidence that the pain is "real," thus providing reasonable grounds for seeking medical attention (Heath, 2002). As discussed earlier, by attending to the information in gestures, clinicians may obtain a clearer idea of the nature of the patients' pain, and thus may be more able to empathize with the experience. Future research should explore how clinicians attend to the gestures of chronic pain patients and assess what impact this has on clinician empathy and the degree to which the patient feels satisfied with the consultation.

The finding that gestures contain information about pain has important implications for children and nonnative speakers. Within these populations, the problems inherent in verbal pain communication are exacerbated due to limited vocabulary, particularly concerning the specific words applied to pain. Gestures are produced by speakers from all cultural and linguistic backgrounds (Feyereisen & de Lannoy, 1991) and are relied on by both speakers and listeners during communication in the speakers' second language (Gullberg, 2011). In children, gesture precedes language acquisition and children often use gestures to depict things they cannot yet express verbally (Acredolo & Goodwyn, 1985; Capone, 2007; Iverson & Goldin-Meadow, 2005; Özçalışkan & Goldin-Meadow, 2005). Thus, nonnative speakers and children may produce gestures that convey pain sensation in a more detailed way than they are able to convey verbally. However, to date no research has attempted to systematically investigate the use of pain-related gestures within these populations.

Although the present article has focused on the role of gestures in conveying information about pain, successful pain communication is likely to involve a combination of modalities, including speech, co-speech gestures, and nonverbal behaviors such as vocal tone and facial expression, with each modality contributing to the message in its own way. According to Hojat et al. (2001, p. 349), "The royal road to patient care is paved by understanding the patient through verbal and nonverbal cues in physician–patient interpersonal exchanges." Thus, we are not suggesting that clinicians should focus on gestures to the detriment of other channels of communication. Instead, we recommend that clinicians ensure that they visually attend to patients in such a way that they are able to pick up the information in both gestures and other nonverbal cues, in order to ensure they obtain as detailed an understanding of the pain as possible. Pain communication is a complex process, the success of which depends on a number of factors, including characteristics of both the patient (such as motivation, affective and cognitive response to pain, and communicational competence) and clinician (such as empathy, attention, and time), characteristics of the pain, and previous consultations. We are not proposing that gesture provides the "answer" to these diverse communicational challenges, but that by attending to gestures alongside other communicative channels, clinicians may be able to glean more information about the sensory characteristics of the pain, helping them to build a better understanding of the patients' pain.

Conclusions

We suggest that co-speech gestures represent an important source of information about characteristics of pain, contributing information that is not contained in speech and clarifying the often ambiguous verbal description. As this is a relatively new area of research, more work is required to establish the role of these gestures in clinical settings, particularly in terms of how they influence understanding of pain, and their implications for patient outcomes. We anticipate that the properties of the gestural modality will be particularly beneficial for communication about nonspecific pain (such as visceral pain) that is difficult to convey verbally, and for nonnative speakers and children, who may rely more heavily on this modality to substitute a limited pain vocabulary. To appreciate the role of gestures within a broader interactional context, it is necessary to establish how gestures interact with other modalities and how they are used across multiple consultations to build up an understanding of pain. Finally, research is needed to investigate the role of gestures in consultations about more complex pain experiences such as chronic or cancer pain. Pain is a complex and multifaceted experience, and pain communication is subject to myriad challenges, only one of which is the communication of information about the sensory pain experience. Nevertheless, the communication of this aspect of pain is important, not only in terms of determining appropriate treatment programs, but also in allowing the clinician to develop an appreciation of what the patients' pain is like so that they can empathize with their experience. We are not suggesting that co-speech gestures are the answer to the many problems associated with communicating pain, but we would argue that they are a valuable resource in obtaining information about the characteristics of pain, and thus have the potential to lead to improvements in this particular facet of pain communication.

To conclude, if the "purpose of communication is to arouse, within the mind of a recipient, a representation that is the same as the representation in the mind of the sender" (Salovey et al., 1992, p.7), then we should look to co-speech

gestures as well as speech if we want to understand the sensory characteristics of another person's pain. We hope that this article will spark further discussion and research in this exciting new area of pain communication.

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