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Descriptions of pain, metaphor and embodied simulation[1]

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ABSTRACT
The variety of sensations conveyed by the English word *pain* tend to be described via expressions that refer to potential causes of bodily damage (e.g. *stabbing*, *burning*). Such expressions are used metaphorically when they convey pain experiences that do not directly result from physical damage (e.g. migraine pain). In this paper I discuss psycholinguistic and neuroscientific research that suggests that these uses of metaphor may facilitate some form of embodied simulation of pain experiences on the part of listeners/readers, which may in turn provide the basis for an empathic response. I suggest that different kinds of metaphorical descriptions of pain vary in terms of their potential for eliciting a response involving embodied simulation, and in terms of the nature and intensity of the simulation they may elicit. I argue that the most relevant characteristics of metaphorical descriptions of pain in this respect are their level of detail, degree of creativity and textual complexity.

INTRODUCTION

In this paper I consider the most dominant metaphorical tendency for the description of pain experiences in English in the light of converging evidence that some form of embodied simulation is involved in comprehension generally, and in the processing of metaphorical expressions in particular. I begin by showing how the sensations conveyed by the English word *pain* tend to be described via expressions that refer to potential causes of bodily damage. This is the case, for example, with the use of the adjective *sharp* and of the simile involving a small garden rake in the two extracts below:

> Just had a sharp pain go right down the bottom of my leg!
>
> (from the spoken demographic section of the British National Corpus, file KWC)

> The pain was like a small garden rake over my eyes and top of my head, digging in and scraping away.
>
> (Migraine patient quoted in factsheet produced by the City of London Migraine Clinic)

[1] I am grateful to David Ritchie for comments on an earlier version of this paper.

Expressions such as *"sharp pain"* function metonymically when they describe pain that directly results from physical damage, and metaphorically when no such damage is involved. The latter is the case for both extracts above, and, as I will show, in most of the cases where similar descriptions occur in close proximity to the word *pain*. In the course of the paper, I discuss psycholinguistic and neuroscientific research that suggests that these uses of metaphor may facilitate some form of internal embodied simulation of pain experiences on the part of listeners/readers, which may in turn provide the basis for an empathic response. I point out that different metaphorical descriptions of pain are likely to vary in terms of their potential for eliciting a response involving some form of simulation, and in terms of the nature and intensity of the simulation they may elicit. I argue that the most relevant characteristics of metaphorical descriptions of pain in this respect are their level of detail, creativity and textual complexity. For example, I suggest that, other things being equal, descriptions of pain such as the one in the second extract above are likely to facilitate a richer and more intense simulation of pain experiences than that provided in the first extract.

PAIN AND LANGUAGE

Pain is a basic and essential human experience. In its prototypical form, it occurs as a response to tissue damage, and constitutes a crucial warning mechanism whose function is to prevent harm to our bodies: the pain experienced when coming into contact with a flame, for example, is due to the damage that the flame causes to our skin, and triggers a reaction (instinctively moving away from the flame) that prevents further damage. This kind of pain (known as 'nociceptive' pain) contrasts with less prototypical kinds of pain that are not, or not simply, explainable as a response to tissue damage. 'Phantom limb' pain, for example, is felt in parts of the body that have been amputated, and is an example of 'non-nociceptive' or 'neuropathic' pain. This kind of pain is due to problems within the nervous system that are often difficult to diagnose and treat. More common pain experiences such as migraine and backache tend to have both nociceptive and neuropathic components. This frequently applies to pain that becomes chronic: typically, the pain starts as a result of an episode involving tissue damage, such as an accident, but then persists long after the injuries have healed, for weeks, months, or years.

Pain is also the kind of subjective and poorly delineated experience that is difficult to express satisfactorily in language, especially when the pain is both chronic and at least partly neuropathic (see Scarry 1985). In such cases, there is no visible sign of physical damage, and investigations via X-rays and CAT scans may also fail to detect an obvious cause. Sufferers therefore have to rely primarily on language to communicate their experiences, and to obtain both emotional support and professional help. These are the circumstances in which both patients and doctors report communicative problems, and in which patients tend to feel misunderstood and misbelieved (e.g. Kugelmann 1999, Lascaratou 2007: 174-7).

While all kinds of pain tend to be associated with affective responses, for chronic sufferers the experience of negative emotions is often inextricably linked with the experience of negative physical sensations.[2] This is recognized in the definition of pain provided by the International Association for the Study of Pain (IASP), which also underscores the importance of language:

[2] See Damasio (1999: 71-9) for a discussion of the distinction between 'pain sensation' and 'pain affect'.

> An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. (http://www.iasp-pain.org)

Within this definition, pain is linked to tissue damage, but it is acknowledged that such damage may be potential as well as actual, and may also occur only in the *description* of the unpleasant experience on the part of the sufferer. In the rest of this section, I show how different types of pain, including non-nociceptive pain, are often conveyed via expressions that evoke different kinds of (causes of) physical damage. This tendency in the description of pain involves both metonymy and metaphor, and may be explained as an attempt to enable others to experience something akin to the sufferer's own sensations.

Metonymy, metaphor and pain

It is well recognized both in the clinical and in the social scientific literature on pain that sufferers frequently employ figurative language in order to express their pain experiences. Schott, a consultant at the National Hospital for Neurology and Neurosurgery in London, puts it as follows:

> Attempts to truly describe pain indeed appear as difficult as they are frustrating, yet the need to communicate is overwhelming, and I suggest that the only option available is the resort to analogy … (w)hether by means of metaphor or simile … . (Schott 2004: 210)

Indeed, pain shares some of the characteristics of target domains that have received considerable attention in the cognitive linguistic literature. Like LOVE, for example, it is a private, subjective and poorly delineated experience, which cannot be directly observed. In its prototypical form, it is also a common and widely familiar sensation. However, pain is also an embodied experience, and, in this respect, it is therefore more similar to typical source domains such as MOTION or HUNGER than to typical target domains such as TIME. While a great deal of work has been conducted on the metaphorical construction of emotional experiences in general (e.g. Kövecses 2000), it is only recently that pain has begun to receive the attention of cognitive linguists (Lascaratou 2007, 2008; Kövecses 2008; see also Halliday 1998 and Author forthcoming).

The analyses provided in the above studies, and in relevant work from other areas, suggest that there is some variety in the source domains that are conventionally exploited in order to convey pain experiences. However, the findings of research on several different languages are consistent with Kövecses's (2008) general observation that 'the most important metaphors that provide the phenomenological character of pain' involve source domains that correspond to the most salient causes of pain. Kövecses's (2008) list of relevant conceptual metaphors includes the following:

> PAIN IS A SHARP OBJECT A *sharp stab* of pain made her sit back down.
> PAIN IS A TORMENTING ANIMAL A massive killing pain came over my right eye [...] I clawed at my head trying to uproot the *fiendish talons from their iron grip*.
> PAIN IS FIRE Pain is *fire that can devour* the whole body.
>
> (Kövecses 2008: 28; emphasis in original)

Different scholars use different labels in order to refer to the semantic fields or source domains that account for the most dominant metaphorical patterns in their data, such as 'attack', 'torture', 'alien invasion', 'abuse', 'impalement' and so on (e.g. Aldrich and Eccleston 2000, de Souza and Frank 2000, Lascaratou 2007, Söderberg and Norberg 1995). These different formulations can be subsumed under a general source domain that I will label *CAUSES OF PHYSICAL DAMAGE*. This is consistent with the wording of the IASP definition quoted above (see also Scarry 2008). Clearly, the metaphorical patterns that can be related to this broad source domain have a strong basis in metonymy, as they rely on common cause-effect associations for the experience of nociceptive pain in particular (see Lascaratou 2007: 164-5). The uses of the adjective *sharp* in the following extracts from the British National Corpus (hereafter BNC) can help to clarify the interaction between metaphor and metonymy in the description of pain experiences in terms of potential causes of physical damage of (see also Author forthcoming):

1. Gardeners know the value of a really sharp knife for pruning as well as propagating. (BNC, file A0G)

2. I dropped a drawing pin in the kitchen so keep your eyes open for it cos you'll get a sharp pain in the foot if you stand on that (BNC, file KP8)

3. For the past few months my husband, who's 43 and a smoker, has been getting a sharp pain in the pit of his stomach, which he's been 'curing' with a glass of milk. I'm worried it might be an ulcer but he refuses to see a doctor. (BNC, file G53)

4. She swallowed again and tried to ignore the terrible sharp pain that was twisting viciously into the side of her head. (BNC, file HGT)

5. And suddenly a sharp pain as if stabbed in the gut. (BNC, file A0L)

On the basis of the metaphor identification procedure proposed in Pragglejaz Group (2007), extract (1) can be described as involving the most basic meaning of the adjective *sharp*: a physical property of solid objects that have a very thin edge or a pointed end. In extract (2), the adjective is used to describe the kind of nociceptive pain sensation that arises in response to being cut with an object that has a very thin point (a drawing pin, in this case). This use is best described as metonymic, since it involves a cause-effect association between the basic meaning of *sharp* and what the Pragglejaz Group call the 'contextual' meaning of the adjective, i.e. the particular kind of pain sensation evoked in the extract. In contrast, the pain experiences described as *sharp* in extracts (3) and (4) do not arise as responses to injuries inflicted by means of sharp objects. The pain described in (3) is suspected to be caused by damage to the lining of the stomach, while (4) describes a headache that is not associated with any physical damage at all. It can therefore be argued that, in both cases, the contextual meanings (i.e. those particular kinds of pain sensations) are understood via comparison with the basic meaning: pain that does not result from damage inflicted by external entities is described in terms of a property of objects that can cause injuries associated with a widely familiar kind of nociceptive pain. As a consequence, the use of the *sharp* in both (3) and (4) can be described as metaphorical. Example (5) differs from all previous examples in that the pain that is being described by *sharp* (as well as by the simile *as if stabbed in the gut*) is primarily emotional: the character in question has just discovered that her husband has been unfaithful to her. While it is difficult to claim that her experience does not involve negative physical sensations as well as emotional distress, the metaphoricity of *sharp* is particularly

clear, as the contextual meaning is primarily to do with feelings of abandonment and distress.[3]

CAUSES OF PHYSICAL DAMAGE metonymies and metaphors for pain in English

In this section I provide concrete evidence for the dominance and variety of expressions drawing from the *CAUSES OF PHYSICAL DAMAGE* domain in the figurative description of pain in English. I rely on two different sources of examples of linguistic descriptions of pain experiences: the 100-million-word BNC and a widely used diagnostic questionnaire for pain sufferers, the McGill Pain Questionnaire (Melzack 1975).

A search for the string *pain* in the BNC returned 7002 hits in 1387 different texts. Collocates of *pain* were computed on the basis of log-likelihood[4] and within a window span of one word to the left and one word to the right of the search string. The top 62 collocates of this string include eight expressions that can be subsumed under the *CAUSES OF PHYSICAL DAMAGE* domain (NB: the numbers in brackets indicate the rank order of each word in the list of collocates): *searing* (12), *sharp* (25), *stabbing* (33), *lanced* (46), *seared* (49), *stabbed* (50), *stinging* (59), *burning* (62). An examination of all individual examples of these collocates revealed that either metonymy or metaphor were involved in all occurrences. More specifically, metaphorical uses accounted for over 85 per cent of the instances of the above expressions in close proximity to *pain*. The rest of this paper will therefore be concerned primarily with metaphorical uses of *CAUSES OF PHYSICAL DAMAGE* expressions in the description of pain experiences.

The eight expressions listed above differ in terms of the kind of cause of physical damage evoked by their basic meanings. Three have basic meanings to do with burning: *burning*, *searing* and *seared* (clearly, only two lemmas are involved here). All the others are broadly to do with pointed or sharp objects that can penetrate the body. *Sharp* describes a property of objects that can cause cuts. *Stabbing*, *stabbed* and *lanced* refer to the process of penetrating something with a pointed or sharp object. *Stinging*, in its most basic meaning, involves both penetration via a pointed object and the insertion of a harmful substance, as, for example, in the case of a bee sting. The processes or qualities evoked by the basic meanings of these expressions occur fairly commonly in everyday experience, and the type of pain sensation they may cause is widely familiar. The case where this applies less clearly is *stabbing/stabbed*, as most people do not have direct experience of being stabbed in the sense of being assaulted with a knife or similar object (see also Pither 2002 and de Souza and Frank 2000: 217).

A wide range of similar expressions for the description of pain are included in the McGill Pain Questionnaire (hereafter the MPQ), which was devised at McGill University in the 1970s in order to be able to assess the pain experienced by different kinds of patients (Melzack 1975). The MPQ has been used for the assessment of a wide variety of types of

[3] The metonymic basis of metaphorical descriptions of non-nociceptive and emotional pain in terms of different causes of physical damage can be accounted for by Grady's (1997) theory of 'primary metaphors' (see also Lakoff and Johnson 1999, Lakoff 2008). In Grady's terms, the experiential correlation between simple causes of physical damage (e.g. a blade, a flame) and nociceptive pain gives rise to a primary metaphor that can be labelled *"PAIN IS CAUSE OF PHYSICAL DAMAGE"*. This primary metaphor may in turn provide the basis for more complex metaphors for pain involving source domains such as *TORTURE*.

[4] The log likelihood ratio is a widely used method for calculating statistical significance in corpus linguistics, as it does not assume normal distribution (see Dunning 1993). The log likelihood value of the collocations mentioned below is above 15.13, which corresponds to $p < 0.0001$.

pain (from backache through labour pain to oncological pain), and has been translated into several other languages. One of the sections of the questionnaire is concerned with the *quality* of the pain experience, and requires sufferers to indicate what their present pain 'feels like' by choosing among 78 one-word descriptors, divided into 20 groups. At least a third of the 78 descriptors of pain included in the MPQ can be described as instantiations of the source domain *CAUSES OF PHYSICAL DAMAGE*, and can be further classified in terms of different types of causes of physical damage:

PHYSICAL DAMAGE VIA INSERTION OF POINTED OBJECTS: *stinging, pricking, boring, drilling, penetrating*
PHYSICAL DAMAGE VIA THE APPLICATION OF SHARP OBJECTS: *sharp, cutting, lacerating, stabbing, lancinating, piercing*
PHYSICAL DAMAGE VIA PULLING/TEARING: *tugging, pulling, wrenching, drawing, squeezing, tearing*
PHYSICAL DAMAGE VIA THE APPLICATION OF PRESSURE/WEIGHT: *pinching, pressing, crushing, tight, heavy*

In addition, a further set of descriptors metaphorically evoke a malevolent animate agent whose actions may cause physical damage (*punishing, cruel, vicious, torturing, gnawing, killing*), and two groups of descriptors relate, respectively, to high and low temperatures, which, when extreme, can also result in tissue damage: *hot, burning, scalding, searing*; *cool, cold, freezing*. The MPQ also contains several expressions that have basic meanings to do with movement, which would cause tissue damage if it occurred inside the body: *beating, pounding, jumping, shooting*. The remaining descriptors primarily convey the emotional or affective dimensions of the pain, as in the case of, for example *wretched* and *annoying*.

Some of the metaphorical descriptors listed above are among the frequent collocates of *pain* I identified in the BNC, while at least some of the others cannot be regarded as equally frequent or conventional as descriptions of pain experiences. Nonetheless, the authors of the questionnaire state that their list of descriptors was derived from several different 'authentic' sources, including the medical literature and patients' language use in medical consultations. In addition, the MPQ itself is also likely to exert some kind of influence over the language used by both doctors and patients, due to its widespread use. As I have already noted with regard to *stabbing* as a collocate of *pain* in the BNC, some of the descriptors in the MPQ are to do with types of physical damage that most respondents may well not have experienced directly (e.g. *lacerating, torturing,* as well as *stabbing*). While discussing specifically the use of the expression *"stabbing pain"*, Miller (1978) suggests that 'the patient has abstracted from his *idea* of stabbing an image of violent penetration which he uses in a metaphorical way to refer to his own pain' (Miller 1978: 28; quoted in Schott 2004: 210). I will return to this issue below.

Overall, both the BNC and the MPQ provide evidence of the pervasiveness of metaphorical descriptions of pain in English that realize the source domain I have labelled *CAUSES OF PHYSICAL DAMAGE*. I will now turn to neuroscientific and psycholinguistic research that suggests that some form of embodied simulation may be involved in the processing of these expressions, and may indeed be part of the motivation for their frequent use.

SIMULATION, PAIN, AND METAPHOR

Over the last two decades, different lines of research in neuroscience, psychology and psycholinguistics have suggested that internal, embodied simulation is involved in a variety of cognitive activities, including imagination and the comprehension of action and language. More specifically, it has been suggested that some form of simulation may be involved in empathic responses to others' pain on the one hand, and in the processing of metaphorical expressions on the other.

Barsalou (2008, 2009) builds on evidence from psychology and cognitive science in order to propose that a variety of cognitive activities, such as memory and prediction, involve the internal simulation of previous experiences. He defines simulation as the (partial) 'reenactment of perceptual, motor, and introspective states acquired during experience with the world, body, and mind' (Barsalou 2008: 618; see also Gibbs 2006a). Among the sources of evidence cited by Barsalou is an increasing body of research on 'mirror neurons' (for an overview see Rizzolatti and Sinigaglia 2008). The term 'mirror neurons' was coined in the early 1990s in order to describe some groups of neurons in the ventral premotor cortex of macaque monkeys which fired both when the animal executed a goal-directed hand action (e.g. picking up a peanut), and when it observed an experimenter performing the same action (Rizzolatti et al. 1996). Subsequent research has suggested that a complex mirror neurons system may also exist in human beings. Some groups of neurons have been found to become active when we perform particular actions, when we observe others performing those actions, when we imagine those actions, and when we process linguistic descriptions of those actions (Aziz-Zadeh et al. 2006). This has been found to apply not only to goal-directed movements involving hands, feet and mouths, but also to movements that are not directed to particular objects, and to actions that are new for the subjects but within their potential repertoire, such as playing the guitar (Buccino et al. 2004). More importantly, some experimental findings suggest that mirror neurons may be involved in attributing goals and intentions to others (Iacoboni et al. 2005), while evidence of mirroring mechanisms has been found for some sensory and emotional experiences, such as disgust and pain (e.g. Wicker et al. 2003, Singer et al. 2004). These findings have been interpreted as evidence that simulation involving mirror neurons may provide the foundation for human beings' ability to empathize with others and to engage in 'mindreading' (see Gallese et al. 2004, Goldman 2006, 2009; see also Jacob 2008 for a critique). Here I will focus particularly on research involving the simulation of others' pain experiences.

Simulation, pain and empathy

A series of studies have shown that some parts of the neural network for the representation of painful experiences (the 'pain matrix') become active both when someone experiences a painful stimulus and when they observe someone else in a pain-inducing situation. More specifically, fMRI brain imagining has revealed activity in the areas of the pain matrix associated with the *affective* qualities of pain (the bilateral anterior insula and the rostral anterior cingulate cortex) when subjects observed their own partner experience a familiar pain stimulus (Singer et al. 2004) and when they watched photographs representing limbs in pain-inducing situations (Jackson et al. 2005). In contrast, Avenanti et al. (2005) found evidence of mirroring effects in the *sensori-motor* areas of the pain matrix, which is responsible for representing, for example, the localization and intensity of painful experiences. Using single-scope transcranial stimulation, Avenanti et al. noted that, during the observation of painful stimuli, the excitability of the subjects' hand muscles was

substantially reduced. This is consistent with what happens when pain is directly experienced in one's hands, as the inhibition of muscle activity contributes to self-preservation.

In a rare experiment involving linguistic stimuli, Osaka et al. (2004) investigated the reactions of Japanese participants to six pain-evoking words with an onomatopoeic element, as opposed to nonsense words involving similar repetitions of sounds. The relevant words were as follows:

> "zuki-zuki" for throbbing pain with a pulsing sensation, "ghan-ghan" for splitting headache as if being continuously struck, "kiri-kiri" for stabbing pain with a feeling of being drilled into with something sharp, "chiku-chiku" for an intermittent pain akin to being struck by thorns, "hiri-hiri" for a lingering feeling of pain, "zukin-zukin" for continuous throbbing pain. (Osaka et al. 2004: 124)

At least three of the words (*ghan-ghan*, *kiri-kiri* and *chiku-chiku*) are similar to the English expressions I discussed in the previous section: they evoke situations involving physical damage, and, from the glosses provided by Osaka et al., appear to be used metaphorically to describe pain experiences that do not result from that kind of tissue damage. Osaka et al.'s findings are similar to those of Singer et al. (2004) and Jackson et al. (2005): activity in the anterior cingulate cortex was observed in response to the pain-evoking words, but not in response to the nonsense syllables. In other words, an internal simulation involving the affective component of the neural system for pain seems to be possible in response to linguistic descriptions of pain, as well as in the response to the perception of pain in others. Due to Osaka et al.'s rather general use of the notion of 'onomatopoeia', it is difficult to draw strong conclusions concerning the precise aspects of the pain-evoking expressions that might have been particularly responsible for the effects that were observed.

Several of the above studies also investigated the potential relationship between 'mirroring' neural patterns on the one hand, and, on the other hand, the subjects' empathic tendencies and their conscious attribution of pain sensation to others under experimental conditions. Singer et al. (2004) found a correlation between amount of activation in the affective areas of the subjects' pain matrix while observing their loved ones in a pain-inducing situation and their scores on a questionnaire that measured their empathic tendencies. Jackson et al. (2005) and Avenanti et al. (2005) reported a correlation between degree of activity in the relevant areas of the pain matrix during exposure to others' pain and the subjects' ratings of the intensity of the pain experienced by the people who received the painful stimulation (see also Avenanti et al. 2006). A more recent study using the same method as Avenanti et al. (2005) interestingly found no mirroring effects in subjects with Asperger syndrome watching videos involving the painful stimulation of hands (Minio-Paluello et al. 2009), while Xu et al. (2009) provide evidence that the amount of activation in the affective areas of the pain matrix during exposure to others' pain may be lower when the stimuli involve members of a different racial group from that of the subjects.

Cumulatively, these studies suggest that some form of simulation observable at the neural level occurs in response to others' sensory and emotional experiences, including particularly pain experiences, and that this simulation may provide the basis for empathic responses to others' experiences. While the observation of neural processes in the research on empathy for pain may suggest a brain-body opposition, Gallese (2009) emphasizes that the activation of shared neural circuits provides evidence for 'embodied' simulation, which he defines as 'a

crucial functional mechanism of intersubjectivity by means of which the actions, emotions, and sensations of others are mapped by the same neural mechanisms that are normally activated when we act or experience similar emotions and sensations' (Gallese 2009: 520). He adds that:

> Following this perspective, empathy is to be conceived as the outcome of our natural tendency to experience our interpersonal relations first and foremost at the implicit level of intercorporeity, that is, the mutual resonance of intentionally meaningful sensory-motor behaviors. (Gallese 2009: 523)

Damasio (2003) captures a range of similar phenomena via the notion of 'as if body loops', which occur when emotional body states, such as pain, are simulated internally as a result of activity in 'body-sensing' brain regions, but in the absence of actual stimulation of the body (e.g. physical damage) (Damasio 2003: 115-18).

The kind of empathy that is mediated by embodied simulation in Gallese's sense is a relatively automatic, unconscious process: it involves a similarity between the sensory and/or emotional states we experience when involved in particular activities, and those we experience when watching others involved in those activities.[5] Avenanti et al. (2005) make sense of the differences between their findings and those of studies such as Singer et al. (2004) and Jackson et al. (2005) by further distinguishing between sensory and affective reactions to others' experiences:

> It may thus be possible to think of at least two forms of empathy linked to one another in an evolutionary and developmental perspective. A comparatively simple form of empathy, based on somatic resonance, may be primarily concerned with mapping external stimuli onto one's body. A more complex form of empathy, based on affective resonance, may deal with emotional sharing and with the evaluation of social bonds and interpersonal relations. (Avenanti et al. 2005: 958)

Both of the empathic phenomena mentioned by Avenanti et al. need to be distinguished, however, from the conscious attribution of mental states (e.g. beliefs) to others (Goldman 1996), and from the more complex phenomenon known as 'perspective-taking'—the ability to consider the world from someone else's viewpoint (Galinsky et al. 2008). In addition, the 'mirroring' phenomena observed in the above studies do not exhaust the complexity of the reactions we can have to others' pain. The experience of feelings of compassion for others in pain depends in large part on a range of further factors, such as our relationship with the person in question, our openness to sharing their experiences, our sense of responsibility for their well-being, and so on (see Rizzolatti and Sinigaglia 2008: 190-2; Cameron 2010).

Nonetheless, the relatively basic form of empathy that is mediated by embodied simulation is an important phenomenon in responses to others' pain. In Gallese et al.'s (2004) terms, embodied simulation allows an *experiential* as opposed to a *conceptual* understanding of another person's experiences. A conceptual understanding of another's experience is achieved when, for example, visual stimuli are interpreted as evidence that someone is

[5] The use of the term 'simulation' should not therefore be taken to suggest an exact match between the internal states of self and other, whether in terms of the nature or of the intensity of these internal states. Indeed, Gallese (2009: 231) acknowledges that the 'mirror' metaphor in 'mirror neuron' research 'is perhaps misleading'.

performing particular actions or experiencing particular sensations or emotions. In the case of pain, this involves *knowing that* someone is in pain. An experiential understanding of another's experience, in contrast, is achieved when, for example, visual stimuli activate visceromotor structures that provide an albeit partial first-person simulation of the actions, sensations or emotions that someone else is going through. In the case of pain, this involves *experiencing* sensory and emotional states that are similar to those one would directly experience in the other person's situation. I suggest that the metaphorical patterns for the description of pain experiences I discussed in the previous section are motivated, at least in part, by the urge to convey one's pain sensations in a way that allows others to experience something that approximates as closely as possible what those sensations feel like. As pain sensations are difficult to put into words, we tend to describe them in terms of situations involving something that causes the most basic kind of physical, nociceptive pain.

I therefore propose that the variety of metaphorical descriptions of pain experiences that draw from the *CAUSES OF PHYSICAL DAMAGE* source domain can be seen as potential triggers of embodied simulations of similar experiences. This raises the question of how different metaphorical descriptions of pain differ in terms of the nature of the simulation they may facilitate, or, indeed, in their potential for triggering a simulation at all. This issue is particularly important if we consider that, by and large, we are not exposed to the causes of other people's pain, but only to their verbal descriptions of their pain experiences. The findings of Osaka et al. (2004) provide some tentative evidence for the potential of metaphorical descriptions of pain to cause a partial simulation of others' pain experiences. As other existing experimental evidence involves visual stimuli, my discussion is inevitably speculative. It will, however, build on relevant work on metaphor processing, which is briefly discussed next.[6]

Metaphor and simulation

According to Gibbs and Matlock (2008), simulation plays a central role in the comprehension of metaphor:

> People understand metaphors by creating an imaginative simulation of their bodies in action that mimics the events alluded to by the metaphor. (Gibbs and Matlock 2008: 162)

The view of embodied simulation that is relevant to this claim is broader than the approach that is adopted in mirror neuron research (see Gibbs 2006b), and relies on the findings of a variety of psycholinguistic experiments. For example, Gibbs et al. (2006) investigated whether people's descriptions of the mental images they formed when reacting to metaphorical expressions such as *"stretch for understanding"* were affected by watching, imitating or imagining the relevant physical action (e.g. physically stretching). They found that, under all three conditions, the majority of informants (78 per cent) talked about performing the relevant action when verbalizing their reactions to the metaphorical expressions. Further evidence in support of the hypothesis that embodied simulation is involved in the processing of metaphorical expressions comes from studies that investigated

[6] Following Steen 1994: 44, I use the terms 'metaphor processing', 'metaphor comprehension' or 'processing of metaphorical expressions' to refer to 'any psychological process relating to linguistic metaphors'.

priming effects. Wilson and Gibbs (2007) found that informants recognized expressions such as *"grasp the concept"* faster if they had just performed or imagined the relevant physical movement (e.g. grasping an object). Similar priming effects were found by Matlock (2004) for sentences involving fictive motion, namely metaphorical expressions drawing from the source domain of MOVEMENT, such as *"The road goes through the desert"*. Matlock found that informants read and recognized this kind of sentence faster when they had previously read about fast, long-distance travel over an easy terrain, as opposed to slow, short-distance travel over a difficult terrain (see also Matlock, Ramscar and Boroditsky 2005).

Although the findings of these psycholinguistic studies cannot be straightforwardly extended to the processing of metaphors for pain, they do suggest that some form of embodied simulation may potentially be triggered by metaphorical descriptions such as those involving the *CAUSES OF PHYSICAL DAMAGE* source domain. However this claim relies on the problematic assumption that the basic, nonmetaphorical meanings of expressions such as *stabbing* or *burning* are involved in the processing of descriptions such as *"a stabbing/burning pain"*.[7] Although Gibbs and Matlock (2008: 168) point out that this claim does not necessarily imply a two-stage model of metaphor comprehension, it does raise the issue as to whether all metaphorical expressions are processed in the same way. Gibbs (2006b) recognizes that his account of metaphor understanding in terms of embodied simulation is not intended to explain all instances of metaphor use, due to the complexity and variety of the ways in which metaphor can manifest itself in communication.

There is evidence from both psycholinguistic and neuroscientific research that the linguistic realization and degree of conventionality of metaphorical expressions affect the way in which they are processed. A series of studies by Gentner and Bowdle suggest that similes and novel metaphors are processed via comparison involving 'structure mapping' across domains, while conventional metaphors are processed via categorization, i.e. by placing the target concept within an abstract category evoked by the conventionalized metaphorical meaning of the expressions that is used metaphorically (Gentner and Bowdle 2001, 2008; Bowdle and Gentner 2005). These claims are broadly consistent with Giora's (2003) Graded Salience Hypothesis, according to which the most salient meanings of linguistic expressions are always activated first, regardless of context. As salient meanings may be literal or non-literal, highly conventionalized metaphorical expressions will be processed by accessing the metaphorical meanings directly, while novel metaphorical expressions may require a two-stage process. Indeed, recent brain-imaging research does not suggest a clear-cut distinction between metaphorical and non-metaphorical language, but points to differences between the processing of metaphorical expressions that have lexicalized and 'salient' metaphorical meanings, as opposed to the processing of novel metaphorical expressions, where the metaphorical meaning is not salient. Several studies have shown that the brain's right hemisphere is involved in the processing of expressions that realize novel conceptual metaphors, but not in the processing of expressions that have conventional metaphorical meanings (Ahrens et al. 2007, Giora 2007).

Steen (2008) builds on the work by Gentner and Bowdle in particular in order to distinguish between 'deliberate' metaphors, that are processed via some form of comparison involving a cross-domain mapping, and 'nondeliberate' metaphors, that are not. Deliberate uses of metaphors are characterized by explicit linguistic devices that aim to shift the recipient's

[7] For example, it has been suggested that mirroring mechanisms involving the motor areas of the brain are involved in the processing of metaphorical expressions such as *'grasping a concept'* (e.g. Lakoff 2008, Gallese and Lakoff 2005), but the experimental evidence is inconclusive (see Aziz-Zadeh et al. 2006).

attention towards the source domain, as in the case of 'A is B' metaphors, similes, and novel metaphors. Nondeliberate metaphors, in contrast, tend to be conventional, and involve no textual indication of the need to activate knowledge from the source domain. Both Steen and Gentner and Bowdle recognize, however, that the processing of metaphorical expressions is likely to be affected by the textual context (e.g. Gentner and Bowdle 2001: 233). Steen (2008: 222-3), in particular, points out that the use of conventional metaphorical expressions may be described as deliberate when several words from the source domain are used in close proximity to one another and acknowledges that 'the full formal range of linguistic and rhetorical construction types for deliberate metaphor is an urgent issue for further research' (Steen 2008: 225).

Ritchie (2008, 2009) usefully attempts to distinguish between different degrees and modes of involvement of 'simulation' in the processing of different metaphorical (and non-metaphorical) expressions. His Context-Limited Simulation theory (Ritchie 2006) combines Barsalou's perceptual simulation model of cognition with Sperber and Wilson's (1995) Relevance Theory. Within Ritchie's theory, all linguistic expressions may activate links to other linguistic expressions as well as a variety of 'perceptual simulators'. These include simulations of sensori-motor experiences (e.g. visual characteristics such as shape), proprioceptive experiences (i.e. internal body states such as warmth), and introspective experiences (i.e. cognitive and emotional experiences such as fear). Ritchie's approach to metaphor relies on a (fuzzy) distinction between 'primary' and 'secondary' simulators associated with words. 'Primary' simulators correspond to the defining characteristics of the relevant concept, while 'secondary' simulators correspond to further, looser associations. For example, the word *shark* may activate links to other words and phrases (e.g. *predator*) and to primary simulators for size, shape, colour, and so on. In addition, the word may activate links to a wider set of linguistic expressions (e.g. *surfer*) and secondary simulators for bloodied water, scenes from horror films, emotions such as fear, and so on. (Ritchie 2006: 110-13). In Ritchie's definition, words are used metaphorically when, in context, most - if not all - primary simulators are suppressed as irrelevant, and only some of the secondary simulators remain active. For example, Ritchie argues, the metaphorical use of *shark* in "*My lawyer is a shark*" is processed primarily in terms of secondary simulators for introspective emotional states such as fear and distrust. In addition, however, some primary perceptual simulators may nonetheless be weakly activated, such as images of sharp teeth (Ritchie 2006: 130). Ritchie (2006: 215) also recognizes that context-irrelevant simulators may not be completely suppressed if they are 'salient' in Giora's (2003) sense.

In order to reconcile his own theory of perceptual simulation in metaphor processing with Gibbs's (2006) approach to metaphor and embodied simulation, Ritchie (2009: 254) suggests that a metaphorical expression may activate:
1) 'a few connected words', and hence no internal simulation;
2) 'a limited set of partial simulations', such as a small number of relevant perceptions;
3) 'a complete (conceptual metaphor-based) schema, as proposed by Gibbs' (2006b), resulting in a rich internal simulation of somebody else's experience.
In other words, according to this classification, the kind of rich simulation discussed by Gibbs (2006b) in relation to metaphorical expressions (i.e. option 3 above) results from the activation of complex source domains as discussed in Conceptual Metaphor theory (Lakoff and Johnson 1999). In contrast, the more limited perceptual simulation that involves 'only a few related perceptions' (i.e. option 2 above) does not require the activation of the relevant source domain. It may, however, be more appropriate to think of Ritchie's (2009) three types

of expressions and responses as representing different points on a continuum[8], as the distinction between 2 and 3 in particular is overly clear-cut. The rich embodied simulations described by Gibbs do rely on the basic, non-metaphorical meanings of metaphorical expressions, but the activation of these meanings does not necessarily involve the complete activation of complex source domains or whole conceptual metaphors. On the other hand, in several cases the perceptual simulators discussed by Ritchie in relation to conventional metaphorical expressions correspond rather closely to the source domain meanings of those expressions (or, in his own terms to primary perceptual simulators), as when he suggests, for example that interpreting *"a chilly reception"* may involve 'the sensation of cold' as well as 'the emotion of rejection' (see also the discussion of *"My lawyer is a shark*" above).

In sum, a discussion of metaphorical descriptions of pain as possible triggers of embodied simulations needs to take into account their linguistic characteristics, their degree of conventionality or novelty, and the relevant co-text and context. In the next section, I return to the linguistic expression of pain experiences and I propose an approach to their analysis as potential triggers of embodied simulations that attempts to take into account the variety and complexity of actual metaphor use.

VARIATION IN METAPHORICAL DESCRIPTIONS OF PAIN AND EMBODIED SIMULATION

In this section I build on the work discussed in the previous sections in order to suggest that different kinds of metaphorical descriptions of pain drawing from the *CAUSES OF PHYSICAL DAMAGE* source domain may facilitate different kinds of simulation processes. I propose that the nature and intensity of the simulation that may be involved in the processing of different metaphorical descriptions will depend primarily on (a) the property, entity or process that corresponds to the most basic, nonmetaphorical meaning of the metaphorically used word(s); (b) the degree of conventionality or novelty of the metaphorical uses of the relevant expressions, both in relation to pain experiences and in relation to other target domains; and (c) the presence of local metaphorical patterns, which may contribute to the evocation of detailed metaphorical scenarios.

I begin by returning to the adjective *sharp*, which is used to describe a pain sensation in the first extract from the BNC I quoted at the beginning of the paper. The extract, which is reproduced again below, occurs during an informal conversation among a group of students:

6. Just had a sharp pain go right down the bottom of my leg! (From the spoken demographic section of the BNC, file KWC)

This utterance elicits a response from another speaker (*Oh, don't worry about it!*), but no other references to pain occur within the part of the interaction that is included in the relevant file in the BNC. As I mentioned earlier, there is ample evidence of the conventionality of the metaphorical use of *sharp* to describe non-nociceptive pain sensations. *Sharp* is one of the descriptors for pain that are included in the MPQ. In the BNC, *sharp* is the 25th most frequent collocate of *pain*: it occurs 26 times immediately before the word *pain*. 21 of these

[8] This is consistent with Ritchie's latest thinking (personal communication).

occurrences are metaphorical as in example (6) above, amounting to approximately 4.5 occurrences out of 1,000 citations of *sharp*. This far exceeds the threshold suggested by Deignan (2005) for establishing the distinction between conventional or novel metaphorical uses of words on the basis of corpus evidence: Deignan suggests that 'any sense of a word that is found less than once in every thousand citations can be considered either innovative or rare' (Deignan 2005: 40). In addition, the entry for *sharp* in the Macmillan English Dictionary for Advanced Learners (which is based on a different corpus of contemporary English) includes, amongst others, a meaning of the adjective that is explained as follows: 'a sharp pain is sudden and severe'. The adjective also has a range of other similarly frequent metaphorical uses, some of which can be broadly related to the use I am discussing here, as they are to do with sudden, intense and unpleasant experiences (e.g. *"a sharp taste"*, *"a sharp noise"*, *"a sharp look"*). In Giora's (2003) terms, it can be argued that the salient meanings of *sharp* are likely to include the sudden and severe quality of some sensations and experiences, including pain sensations. In Steen's (2008) terms, the metaphorical use of *sharp* in examples such as (6) can be described as a nondeliberate use of metaphor.

It is possible, in principle, that the use of *sharp* in descriptions such as (6) may be processed via a simulation that involves the most basic meaning of the adjective. In Ritchie's (2006) terms, this would involve (primary) sensory perceptual simulators for the visual and tactile characteristics of sharp objects, as well as proprioceptive simulators for the sensation of being cut by a sharp object, and introspective simulators for the resulting emotions of distress and anxiety. However, such a rich simulation is rather unlikely, due to the conventionality of *sharp* as a metaphorical description of pain and of other negative experiences, and to the fact that no other metaphorical expressions are used by the speaker to evoke a scenario involving physical damage (the other metaphorical expression in the same utterance, *"go right down"* involves the source domain of *MOVEMENT* and is also rather conventional). Hence, it is more likely that *sharp* will be processed by accessing directly an appropriate conventional metaphorical meaning. In Ritchie's terms, this may involve the activation of secondary proprioceptive simulators for nociceptive pain and/or introspective simulators for pain-related distress and anxiety. Due to the semantic bleaching caused by the adjective's frequent and varied metaphorical uses, it is even more likely that the use of *sharp* in the extract above may only activate simulators for generically unpleasant proprioceptive and introspective experiences, or that it may not facilitate a perceptual simulation at all, but simply give access to other relevant words that are associated with it, such as *severe* or *terrible*.

Let me now compare the above use of *sharp* with the use of *drilling* to describe the pain caused by a headache in the example below, from a novel by K. A. Mitchell. The extract occurs after a short stretch of dialogue that takes place in the playing fields of the school where Sean, one of the novel's main characters, is a teacher:

7. The drilling pain started up on the left side of Sean's head again. He couldn't remember ever getting headaches like this before. (Mitchell, K. A., 2009, *Regularly Scheduled Life*, Samhain Publishing, p. 95)

The metaphorical use of *drilling* as a description of non-nociceptive pain is similar to that of *sharp* in so far as it is part of the same broad linguistic pattern that I have captured in terms of the conventional conceptual metaphor *"PAIN IS CAUSE OF PHYSICAL DAMAGE"*. Like *sharp*, *drilling* is also one of the descriptors for pain that are included in the MPQ. Indeed, the description of the character's pain as *drilling* in the extract above is unlikely to be perceived as particularly creative, let alone as a one-off. On the other hand, however, this use of *drilling*

is much less conventional than the use of *sharp* I discussed earlier. In the BNC, *drilling* never occurs within five words of *pain*, and I also found no metaphorical collocations with *pains*, *ache*, *hurt* and *head*. The Macmillan English Dictionary reports no sense of the word that relates to pain. In Giora's (2003) terms, the description of a particular type of pain sensation is unlikely to be one of the salient meanings of *drilling*, so that, in context, the use of this expression to describe pain is more likely to be intended and perceived as deliberate (Steen 2008). In addition, while the basic meaning of *sharp* is a property of objects, the basic meaning of *drilling* is the process of making a hole using a very specific kind of tool, which involves both penetration and rotation. Most people are also likely to be familiar with the sensation of having a tooth drilled, which, even under local anaesthetic, can produce a powerful and unpleasant physical sensation. Hence, other things being equal, there is greater potential that the processing of *"drilling pain"* in example (7) may involve the basic meaning of the adjective, and the activation of some elements of a scenario in which a tool capable of drilling is applied to someone's body. In Ritchie's terms, this would result in a simulation that could involve (primary) sensory simulators for the shape and feel of a drill, proprioceptive simulators for the sensation of being penetrated by a drill, and introspective simulators for the anxiety and distress that would accompany such a situation. While such a rich simulation is, in my view, more plausible than in the case of *sharp*, it needs to be taken into account that the use of *drilling* in relation to pain is not entirely novel, and that no other linguistic expression in the co-text contributes to the evocation of a scenario involving physical damage. It is therefore possible that the processing of *drilling* in the extract above may activate a more limited simulation, involving only secondary proprioceptive simulators for unplesant physical pressure and/or introspective simulators for emotional distress. In both extracts (6) and (7) any simulation triggered by *"sharp pain"* or *"drilling pain"* is also likely to be relatively fleeting, as neither description of pain is elaborated in the relevant local (spoken or written) co-text.

Let me now quote again the extract from the BNC I introduced in section 2 as example 4, which is extracted from a novel.

8. She swallowed again and tried to ignore the terrible sharp pain that was twisting viciously into the side of her head. (From the Imaginative Writing section of the BNC, file HGT)

The pain described here is experienced by a character called Robyn while she is having an awkward conversation with a man with whom she unexpectedly had sex the night before. Robyn's headache has first been mentioned eight paragraphs before the extract above, where it was described as *"hanging excruciatingly over one side of her face"*. In extract (8) the pain that is first described as *terrible* and *sharp* is subsequently presented as *"twisting viciously into"* the side of the head of the character. In other words, *sharp* is the first element in a local textual pattern that involves two further metaphorically used words, namely: the verb *twist*, which suggests a particularly painful way of penetrating the body with a sharp object, and the adverb *viciously*, which personifies the pain by attributing a particular attitude to it. There is no evidence in the BNC or in corpus-based dictionaries that *twisting* or *viciously* are conventionally used metaphorically in relation to pain, although they are consistent with the conventional description of pain in terms of physical damage and malevolent aggression (in fact, *vicious* is one of the descriptors included in the MPQ). In other words, within the co-text, *sharp* contributes to a textual pattern that involves some degree of metaphorical creativity, and that, in Steen's (2008) terms, may be described as a case of deliberate metaphor. In addition, the local metaphorical pattern provides enough detail to imagine a

specific scenario of physical aggression, or even torture. This arguably creates the conditions for a rich simulation of the kind described by Gibbs (2006b), for example, whereby a reader may imagine going through the experience of being subjected to a protracted physical attack. This may involve sensory simulators for the shape and feel of an object capable of being twisted into one's head, and possibly of the body of an attacker brandishing this object. In addition, further proprioceptive simulators may be activated for the sensations of internal pressure and pain resulting from that kind of physical attack, as well as introspective simulators for the fear, distress and helplessness associated with being assaulted by a malevolent agent. Any such simulation would be more sustained than in the case of the previous two examples, as the description of the character's headache occupies more textual space and involves several words contributing to evoke a single pain-inducing scenario.

I will finish by considering two examples where both the creativity and the deliberateness of the metaphorical descriptions are more obvious. Example (9) is a part of a quotation attributed to a migraine sufferer in a factsheet produced by the City of London Migraine Clinic, and was briefly introduced at the beginning of the paper:

9. The pain was like a small garden rake over my eyes and top of my head, digging in and scraping away.

(Migraine patient quoted in factsheet produced by the City of London Migraine Clinic)

Here the description of the sufferer's migraine pain involves a simile of the form 'A is like B'. Similes have been found to favour processing via comparison involving mappings from source to target domain (see Gentner and Bowdle 2008): in other words, the basic, physical meanings of the expressions that make up the simile are activated in processing.[9] The description provided via the simile is consistent with the conventional pattern that I have related to the source domain *CAUSES OF PHYSICAL DAMAGE*, but is both more creative and richer in detail than the examples above, and evokes a very specific and vivid metaphorical scenario. This scenario includes both a very precise kind of object that can cause physical damage (*"a small garden rake"*), and two actions that involve both movement and penetration *("digging in and scraping away"*) and that are performed on two very precise parts of the sufferer's head (*"over my eyes and top of my head").* None of the expressions that form the local textual pattern in this extract have conventional metaphorical uses to do with the sensation of pain: in fact, *garden rake*, and any scenario normally associated with it, would normally be unrelated to physical harm but rather have positive emotional associations. For all these reasons, I would argue, this example is likely to facilitate a rich and intense simulation of what it would be like to be in that very specific pain-inducing situation. The words that make up the simile can activate sensory simulators for the size of the rake and its normal setting and function, as well as further sensory associations to do with colour, weight, and so on (depending, in part, on the reader's familiarity with gardening and garden rakes). The level of detail and creativity of the description can further activate proprioceptive simulators for very specific sensations of physical pressure and pain, and introspective

[9] In terms of the metaphor identification procedure proposed in Pragglejaz Group (2007), the expressions that are part of similes are used in their basic meanings, and are therefore not used metaphorically (see also Semino 2008: 16-17). The metaphoricity of some simile lies in the comparison between the basic meanings of these expressions and the aspects of the topic or target domain that the simile is used to describe.

simulators for the acute distress and helplessness that would arise experiencing that kind of pain. Indeed, the quotation from which extract (9) is taken was included in the London Migraine clinic factsheet in order to help convey how a migraine attack is different from the milder headaches that most people are familiar with. Arguably, this is best achieved by putting readers in a position to feel what it is like to experience a kind of pain that they are unlikely to have ever experienced directly.

My final example is taken from a book that resulted from a project involving chronic pain sufferers attending a residential course held at the INPUT Pain Management Unit at St. Thomas's hospital in London (Padfield 2003). Eleven sufferers agreed to work with an artist, Deborah Padfield, to produce photographs that conveyed their experience of pain. The photographs were accompanied by verbal descriptions of what the images represented, which are written in strongly personal and autobiographical terms. Example (10) below is part of the verbal description produced by Frances Tenbeth, who, at the time of the project, had been suffering from chronic pain for 42 years:

10. I am constantly battling with the physical pain. You could possibly describe it as swords on fire. It is as if they are ripping out my leg all the time. Red hot swords. They move. They start in my back and move down relentlessly, like an escalator. […] I think it is probably one rod and a million swords. (Frances Tenbeth in Padfield 2003: 60)

This extract opens with a metaphorical use of the verb *battle* to describe the sufferer's relationship with her pain. Frances then explicitly introduces a figurative comparison between her pain and *"swords on fire"*, and goes on to use metaphorical expressions that are to do with at least two kinds of causes of physical damage: sharp metal objects cutting the flesh (*"ripping out"*, *"rod"*, *"a million swords"*), and heat (*"hot"*, "*on fire"*). The hotness of the metaphorical swords is also conveyed metonymically by references to colour (*"red"*), while the description of the swords includes movement up and down Frances's back and legs (*"move down relentlessly"*, *"like an escalator"*). In other words, while all the various figurative expressions can be subsumed under the *CAUSES OF PHYSICAL DAMAGE* source domain, there is creativity in the choice of at least some of the specific expressions that are used (e.g. *"swords"*, *"ripping out"*), and in the establishment of a tight textual pattern that involves the combination of different kinds of causes of physical damage (application of sharp objects, movement of sharp objects, and heat), resulting in a rich metaphorical scenario. Frances's description is also very detailed in terms of references to very specific objects, their characteristics and their (hyperbolic) number (a million swords).

The description from which this extract is taken is followed by three photographs: a close-up of a red, apparently incandescent spear-like object against a black background, and two images involving human legs covered in several groups of small daggers forming what Frances describes as a *"herring bone"* pattern. The blades of the daggers have a red shading that suggests heat, and the background is black in both cases. In other words, the interaction between the text and the photographs results in what Forceville (2008) calls a 'multimodal metaphor':

> As a first approximation, I will define multimodal metaphors as metaphors in which target, source, and/or mappable features are represented or suggested by at least two

> different sign systems (one of which may be language) or modes of perception. (Forceville 2008: 463)

Frances's verbal description makes fully explicit the figurative function of the daggers in the visual images, as well as the fact that their redness is meant to represent the perception of (metaphorical) heat. The multimodal interaction of the verbal text with the visual image adds to the overall deliberateness of Frances's description of her pain.

Overall, Frances's multimodal metaphorical description of her pain has the potential to facilitate a rich and intense simulation including multiple sensory, proprioceptive and introspective simulators. The extract contains a variety of lexical choices that can activate sensory simulators for the colour, size, shape and feel of specific physical objects (*"red hot swords", "one rod"*), as well as proprioceptive simulators for the intense physical sensations that would result from repeated penetration and burning via a large number of incandescent sharp objects. The associated introspective simulators for negative emotions are potentially much more powerful and overwhelming than in the case of the more conventional and less detailed descriptions I have discussed.

More specifically, in the case of brief and conventional metaphorical descriptions of pain such as *"sharp pain"* or *"drilling pain"* a particularly high degree of involvement is required on the part of the listener/reader in order for processing to involve a rich and intense simulation, or even any simulation at all (see also Cameron's 2010 notion of 'being prepared' for empathy). With examples such as (9) and (10), the opposite is the case. The level of detail, complexity and creativity of these metaphorical descriptions of pain is such that only a deliberately low degree of involvement (or positive resistance to empathy) would prevent a reader/listener from gaining what Gallese et al. (2004) call an *experiential* understanding of the other person's pain, i.e. going through at least part of the sensory, proprioceptive and introspective sensations that one would experience in the situation that is being described. Indeed, examples (9) and (10) were selected for inclusion in different types of publications as particularly powerful descriptions of the experiences of chronic pain sufferers. Example (10), was part of an exhibition which many visitors described as extremely moving and effective. I can also add anecdotally that some members of the audience for a talk including several examples such as (10) (and the accompanying photographs), reported feelings of emotional and physical discomfort. The multimodal nature of the project which gave rise to example (10) is likely to be particularly crucial, as it combines the kinds of effects that are usually treated as separate experimental conditions in neuroscientific research (e.g. Osaka et al. 2004, Jackson et al. 2005).

The form of simulation that is likely to be involved in processing the more creative and deliberate metaphorical descriptions would, in Ritchie's (2009) tripartite classification, fall under the rich, complex and intense embodied simulations of the kind suggested by Gibbs (2006b). In my discussion, however, I have not adopted strict distinctions between different types of simulations, but I have described potential simulations in terms of their degrees of intensity and richness, and of the range of simulators they may involve. Even the most complex simulations, would not, in my view, involve the activation of complete source domains, but rather the imaginative construction of detailed and specific scenarios, which draw from generic conceptual domains, but do not necessarily correspond to frequent or familiar pain-inducing situations. Indeed, the last two examples show even more clearly than expressions such as *"stabbing pain"* that we often hyperbolically describe pain sensations in

terms of scenarios that we have not experienced directly: the 'garden rake' scenario in (9) is implausible but possible, while the 'million swords' scenario in (10) is downright impossible. Even the most unrealistic scenarios, however, involve combinations of familiar sensations (e.g. being burned or being cut), or, in some cases, of extreme versions of familiar sensations (e.g. being stabbed or being cut with a million swords). Arguably, therefore, these scenarios can be simulated by integrating different (and relatively familiar) component elements into a single imaginable whole.[10]

CONCLUSIONS

The sensation of pain resulting from tissue damage is often described metonymically in terms of what causes the physical damage. Even when pain does not directly result from tissue damage, it tends to be described metaphorically in terms of a variety of causes of physical damage. I have provided evidence for the pervasiveness of this metaphorical tendency in particular by drawing from the British National Corpus and a widely used questionnaire for the clinical assessment of pain. I have explained this tendency by suggesting that the figurative description of all kinds of pain sensations in terms of causes of physical damage has the potential to facilitate in the addressee some form of embodied simulation, and that this may provide the basis for an empathic response. My claims are based on neuroscientific and psycholinguistic evidence that different kinds of simulation may be involved in comprehension generally, and more particularly in the perception of other people's pain experiences and in the processing of metaphorical expressions. I have suggested that different metaphorical descriptions of pain vary in terms of the extent to which they are likely, other things being equal, to trigger a simulation, and in the intensity, richness and complexity of the simulation they may facilitate. I have argued that this is likely to depend on the nature of the basic meanings of the relevant metaphorical expressions, the degree of conventionality or novelty of their metaphorical use in relation to pain experiences, and the presence and complexity of local metaphorical patterns, which may evoke more or less detailed pain-inducing scenarios.

My discussion of a range of descriptions of pain experiences from different genres has inevitably been rather speculative. In part, this is due to the fact that experimental work on simulation in response to others' pain tends to involve the use of visual rather than verbal stimuli. While there are good reasons for why this is the case, I would argue that it is even more important to understand how we respond to the verbal description of others' pain, as it is through verbal description that we primarily attempt to share with others the kinds of pain experiences for which empathy is needed most, namely those that are not straightforwardly caused by a clearcut and short-lived occurrence of physical damage. I hope that my account of the potential for simulation of the variety of ways in which pain experiences are actually described can make a contribution to the future development of experimental studies involving verbal stimuli.

[10] The imaginative production and interpretation of scenarios such as that evoked by Frances Tenbeth is also likely to rely on previous responses to descriptions and images of torture and injury in fiction and the media, which make such experiences familiar even to people who have no first-hand knowledge of them (I am grateful to David Ritchie for this observation).

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