

What is Pain? II: Pain Expression and Behaviour, Evolutionary Concepts, Models and Philosophies

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PAIN EXPRESSION: HOW DO WE 'KNOW' ANOTHER PERSON (OR ORGANISM) IS 'IN PAIN'?

As pain is an entirely subjective experience of the (internal) world of the 'self', the sufferer can only communicate their pain to external observers, such as health care providers or family members, in two ways. The first is verbally, by the use of language ('the narrative') and secondly by expressing pain behaviours such as vocalizations (groaning), facial expressions (grimacing), rubbing, limping, curling up in a ball (with a kidney stone or migraine) or even calling an ambulance.

'Pain expression' by means of language and behaviours may be seen as an *efferent* response to the *afferent* (internal) experience of pain.

Pain behaviours

Pain behaviours are a specific form of illness behaviour, which are in large part 'learned' or 'conditioned' (reinforced or modified) by past pain experiences (especially early in life) or by secondary gain (such as the attention of a solicitous spouse or doctor). However some (presumed) pain behaviours seem to be 'inborn' and are expressed in pre-term neonates (vocalizations, facial expressions) without prior experience of pain. Pain behaviours are highly subjective and outside observers (such as health care professionals) learn their (presumed) 'meaning' by experience.

Although verbal reports are the 'gold standard' for establishing the presence of pain in humans, observed pain behaviours are important in non-verbal humans such as neonates or in dementia and also in animals. Studies have demonstrated that pain behaviours correlate well with a patient's verbal pain reports, however external observers tend to 'underestimate' pain intensity.

Pain behaviours are an important part of clinical pain assessment (especially in infants and in the cognitively impaired) and are often used to assess or 'judge' the severity, nature and in some cases the legitimacy of the sufferer's pain.

Pain behaviours often form the basis of medico-legal assessments (including video-surveillance) as presumed objective markers of 'genuine', 'feigned' or 'inconsistent pain'. Waddell's signs for low back pain (eg diffuse tenderness over the lower back on light palpation, non-dermatomal sensory changes, pain on rotation of the hips or axial compression of the spine at the vertex) are pain behaviours 'evoked' during clinical examination which are said to correlate with 'significant psychological distress' but have been misinterpreted as signs of malingering.

In somatoform pain disorder, pain expression (especially behaviours) is judged by the clinician to be due in large part to 'psychological factors' and is 'out of keeping' with what is 'expected' for the degree of tissue damage. This is of course entirely subjective and based on the experiences and prejudices of the clinician. Feigned pain expression in factitious disorder or malingering is clearly maladaptive and can only be proven with evidence of conscious intent.

'Pain measurement tools' such as the VAS, questionnaires (eg Magill or neuropathic pain scale) or pain behavior scales (neonatal or dementia) don't actually measure 'pain' but attempt to access, quantify [Visual Analogue Scale (VAS)] or qualify (burning, stinging) certain 'dimensions' of pain expression, in an organized and scientific fashion.

THE FUNCTION OF PAIN EXPRESSION?

Why is it important that a person in pain expresses their internal experience to the outside world? Other (efferent) responses to pain make sense: withdrawal from a noxious stimulus, resting an injured body part and learning to avoid the circumstances of tissue injury in the future (conditioning).

But why 'tell' someone about your pain and why express pain behaviours?

The expression of pain (language and behaviours) may serve to evoke empathy and help from others which obviously aids in survival. Pain expression may also be of societal advantage in humans (and perhaps in animals, using vocalization and behaviours), by warning others in the group of the circumstances of an individual's tissue injury (stay away from that thorn bush which caused *me* such pain).

Transmission of such warning information requires a 'common language of pain', an understanding of what pain 'means' and its consequences, which is learnt by individuals through personal experience (and perhaps by observing and talking with others in pain) and perhaps is in part 'imprinted' genetically. However in some cases, exposure to maladaptive pain expression, especially in childhood (parents in pain) may serve to propagate abnormal pain responses.

In the modern world, health care providers assess (and sometimes 'judge') a person's pain (qualities, intensity, legitimacy) and formulate treatment plans, based on the synthesis and interpretation of a wide range of information including pain expression (reports and behaviours), pathology (certainty of diagnosis), chronicity, mood, affect and social factors such as age, gender, ethnicity and compensation status.¹

In recent years 'the narrative' or 'stories' (in their own words) of persons in pain has been recognized as extremely important in gaining a more complete 'understanding' of their experience.

"Those who have learned by experience what physical pain and bodily anguish mean, belong together all the world over; they are united by a secret bond." (Albert Schweitzer)

THE CLASSICAL FUNCTION OF PAIN: NATURE'S ALARM SYSTEM.

Nociception and pain are highly preserved in phylogeny and must obviously be of evolutionary advantage (see pain and evolution below). Humans with congenital pain insensitivity have a considerably shortened lifespan due to unrecognized serious injury.

Pain is accepted as the 'alarm system' for actual or potential tissue damage which is necessary for survival.

Nociception is the *afferent* arm of the system which 'triggers' pain. Pain is the actual 'alarm' which (by virtue of its various sensory and emotional 'dimensions') in turn evokes *efferent* responses in the organism to avoid or limit actual or potential tissue damage immediately and in the future (conditioning) and also 'pain expression'.

'Dimensions' of the pain-alarm include the '*sensory-discriminative*' (my 'searing' left arm...), '*cognitive-evaluative*' (...is injured by the saber toothed tiger which is dangerous and threatening), '*affective-emotional*' (...this is unpleasant and I'm scared), '*motivational-motor*' (...I must do something; escape?), '*conditioning*' (I should avoid the saber toothed tiger in the future) and even the '*spiritual-existential*' (I got way with my life).

However not all pain reflects the paradigm of an adaptive alarm system. Chronic (persistent) nociceptive (rheumatoid arthritis) pain, neuropathic pain, idiopathic (dysfunctional) pain syndromes (fibromyalgia, somatoform disorders) and cancer pain provide no obvious survival benefit and represent an alarm system that's gone 'haywire'.

THE RESPONSE TO THREAT: PAIN, ANXIETY, FEAR, DEPRESSION AND SUFFERING.

Anxiety is an emotional and physiological response in humans (and likely in other organisms) to a perceived (existential) threat, whereas *fear* is the same response to an actual threat.

Pain is very similar to the anxiety; to paraphrase the International Association for the Study of Pain (IASP) definition of pain, "*anxiety (fear) is an unpleasant physiological and emotional experience associated with actual or potential existential 'threat' or expressed in terms of such a threat.*"

Is pain a type of anxiety response? Anxiety (fear) is a response (fight-flight) when the viability of the whole individual is under threat; pain is a specific response where tissues are under threat.

Both anxiety and pain may be adaptive (fight-flight) or maladaptive (anxiety disorders such as PTSD; chronic pain).

Pain and anxiety/fear are similar in many respects. They share many of the same cognitions and emotions (threat, avoidance, catastrophization), language (suffering, anguish) and behaviours (facial expressions) and physiological responses (tachycardia, tremor, tearing).

Nociceptive and anxiogenic processes are linked neuro-functionally (eg limbic, amygdala) and share the same neurotransmitters and endocrine responses. Many of the maladaptive psychological states associated with chronic or pathological pain are linked to anxiety traits such as hypervigilance, fear avoidance, catastrophisation and obsessiveness.

Epidemiologically, there are correlations between anxiety disorders (such as panic or PTSD) and chronic pain conditions such as fibromyalgia, post-whiplash associated neck pain, complex regional pain syndrome, chronic post-surgical or post-trauma pain.

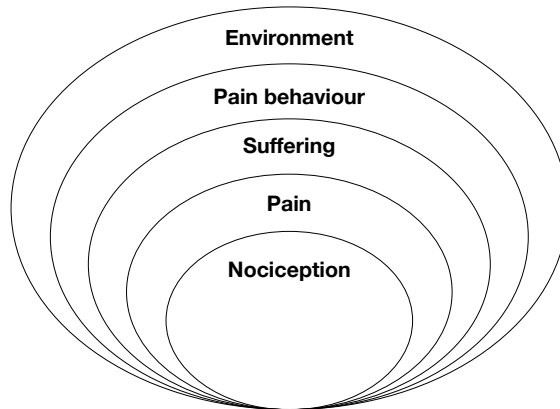
If pain or anxiety becomes overwhelming, the organism may not be able to 'fight or flight' and will 'withdraw' (helplessness), which in humans may be manifested by the vegetative symptoms of depression (and ultimate withdrawal in the form of suicide) and sometimes as dissociation (depersonalization) disorder. Patients with Post Traumatic Stress Disorder (PTSD) have described stepping out of their bodies (and sitting next to themselves on a couch) during times of intense pain!

Suffering

Suffering is an overarching term for those negative affective and emotional experiences associated with actual or threatened (existential) harm. Suffering is often seen simply as the emotional-affective dimension of pain (Loeser's onion: see figure 1 below) and is used as a synonym, but pain and suffering are different. "A broken bone can cause pain and suffering but a broken heart can cause suffering without pain."² After surgery or in palliative care, patients often report *suffering* more from nausea, shortness of breath or anxiety than from pain.

Suffering may be the ultimate affective and cognitive response to 'negative existential states' such as neglect, bereavement, loss, depression, anxiety or pain. Suffering can have physical, psychological, societal, ethical and religious dimensions and is often linked to developing a state of learned or inevitable helplessness (from which there is no escape).

Figure 1. The "onion of pain" concept of John D. Loeser³.



PAIN AND EVOLUTION.

We have already discussed the classical concept of pain as an alarm for tissue damage.

The nociceptive system has 'evolved' at least in higher animals, to 'amplify' nociception through the processes of peripheral and central sensitization which it makes sense (teleologically) for an alarm system to do.

The evolution of Diffuse Noxious Inhibitory Control (DNIC) also makes sense. It provides analgesia for 'fight or flight' during situations of tissue damage (stress-induced analgesia) (as observed by Henry Beecher in soldiers on the beaches of Anzio during WWII, who didn't feel pain from their horrendous war injuries) and also tonically 'dampens-down' the potentially overwhelming barrage of nociceptive traffic associated with everyday life, particularly from musculoskeletal and visceral organs (so we don't feel our ischiums whilst sitting on a chair).

'Making' a tissue injury *more* painful (hyperalgesia, allodynia) is adaptive, encouraging the organism to rest the injured body part (promotes healing) and drawing attention to it. Pain and hyperalgesia also teaches (conditions) the organism to avoid the circumstances of tissue injury (such as the saber toothed tiger) in the future. Interestingly, humans and animals demonstrate *opioid induced hyperalgesia* (OIH) and this phenomenon is also well preserved in phylogeny. What is the evolutionary purpose or benefit of OIH? One theory is that the initial surge of endogenous opioids released during tissue injury produces analgesia allowing the organism to escape from injury and later produces hyperalgesia, with outcomes listed above.

Phylogeny: primitive and modern nociceptive pathways

In broad terms, nociceptive information is transmitted and processed by two systems in phylogenetic, functional, anatomical terms.

The most 'modern' nociceptive pathways (*neo-nociceptive*) in the spinal cord and brain are located *laterally*, terminating at higher levels of the brain and are associated with rapid transmission and increased sensory discrimination (fast, sharp and well-localized pain). This is best represented by transmission of cutaneous nociception ('pain') via the (lateral) *spinothalamic* tract (STT). It is interesting to note that the STT is sub-divided into a *neo-STT* (lateral & fast) and *paleo-STT* (medial & slow).

The more 'primitive' nociceptive pathways (*paleo-nociceptive*) are located *medially* in the CNS, terminating at lower levels of the brain and are associated with slower transmission, reduced sensory discrimination and increased emotional, autonomic and behavioural responses (slow, dull, poorly-localized and 'emotive' pain).

Examples of paleo-nociceptive pathways include the dorsal columns, spino-parabrachio-amygdaloid and spino-hypothalamic tracts, which terminate principally in the brainstem and midbrain (paleo-cortex). Visceral nociception is usually transmitted via these pathways which is reflected by the qualities of visceral pain; poorly-localised (diffuse & aching), slowly responsive with significant autonomic (nausea, vomiting, sweating), emotional (limbic) and behavioural components such as anxiety, fear, vocalizations (groaning), motor inertia and withdrawal (curling up in a ball with a kidney stone or migraine).⁴

The *neo-nociceptive* system reflects a higher organism's (eg mammal's) capacity to rapidly localize, characterise and respond to a tissue threat at its interface with the environment, the skin. Development of this rapidly responsive system may reflect natural selection due to an obvious survival advantage.

The *paleo-nociceptive* system doesn't seem to provide any advantage in saving an organism from external tissue threat, except perhaps for autonomic and flight responses (fight or flight). And what is the survival advantage of visceral nociception ('pain') transmitted by this primitive system? If an organism has visceral pathology serious enough to cause pain, survival is unlikely. What is the point of having an alarm for internal tissue threat (visceral pain) when the organism can't really do much about it?

Visceral pain may provide a survival advantage in some circumstances. If pain is caused by ingestion of a poisonous plant or food for example, it might teach the organism to avoid this in the future. In humans, the highly 'emotive' features of visceral pain may evoke sympathy and help from others in the 'tribe'. Conversely, in situations where there is little chance of survival (such as a bowel obstruction or perforation), the expression of visceral pain behaviours (curling up in a ball) may signal the 'tribe' to let the victim 'lay down and die', thus not impeding the progress of the group as a whole. What then is the 'advantage' of labour pain? One may speculate that the highly emotive and motor-inertial features of labour (visceral) pain, forces the woman to stop, rest and prepare for delivery and engenders help from others during this process.

To speculate further on visceral pain and evolution, it is interesting to note that the brain has no nociceptors and solid organs such as the liver have relatively few. This may reflect the fact that tissue damage in these vital organs is usually incompatible with survival.

The response of various nociceptive ion channel-receptors such as TRPV1 or TRPM8 to organic substances such as chilli (capsaicin) or menthol respectively, may represent adaptation to protect against environmental tissue toxins, especially from plants.

PAIN IN THE FOETUS, INFANTS AND ANIMALS

It was not too long ago that infants underwent circumcision without anaesthesia or analgesia, in part due to the belief that they would not experience pain due to immature neurological development. This is now patently untrue and inhumane, as their expression of pain-related behaviours and associated physiological responses makes it likely that they *do* experience pain. The same holds true for other non-verbal humans (dementia, locked-in syndrome) and indeed for animals. There is also evidence that painful experiences in early life (heel prick, circumcision) are linked with increased pain responses later on. More controversially (especially in context of the abortion debate) is the issue of foetal pain and consciousness. There is some consensus amongst neurobiologists that the human foetus is capable of experiencing pain beyond the first trimester.⁵

Although there is debate on the nature of pain in animals, evidence of pain expression (behaviours, vocalizations) and of nociceptive processing similar to humans (they are after all, models for pain research), supports the assumption that animals can at the very least, experience "unpleasant sensory and emotional" states similar to pain. Pain is almost certainly experienced in all mammals and likely in most vertebrates and in higher invertebrates such as the octopus. There are interest groups and even legislation in some jurisdictions for the humane treatment of fish (during angling) and crustaceans, given evidence that they exhibit at least rudimentary responses to noxious stimuli. The IASP has a special interest group for pain in non-human species and veterinary anaesthesia and analgesia reflects human practice.

CONCEPTS OF PAIN

"If for example fire comes near the foot...just as by pulling at one end of a rope makes to strikes at the same instant a bell which hangs at the other end." (Descartes)

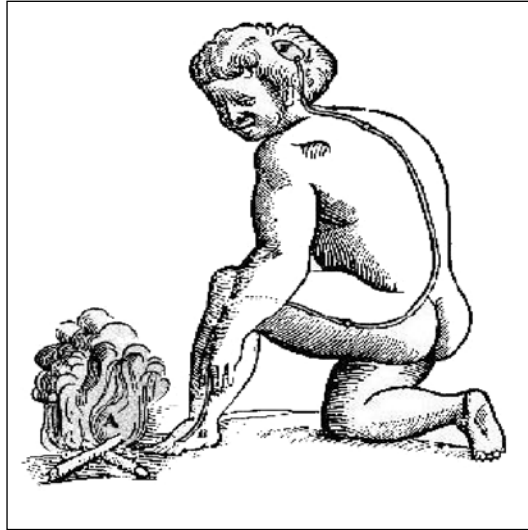
In the 17th century, Rene Descarte conceptualized pain as a sensation generated in the body (by tissue injury) which is transmitted (via a 'hard-wired' system) to the brain where it is perceived.

In this model, the brain is essentially a passive pain monitor (an alarm bell) and the intensity of the pain reliably reflects the amount of tissue damage. Such thinking was quite advanced in the 17th century and reflects aspects of nociceptive anatomy and physiology we still know to be true today.

However in the mid 20th century it became clear that 'cutting the wires' (neuroablation) or even destroying parts of the 'alarm' (brain) more often than not failed to treat pain, thus undermining the Cartesian model as did the phenomenon of phantom pain. Modern neurophysiology, psychology and functional imaging reveals that the brain is not a 'passive monitor' or alarm bell, but is a complex, plastic, self-organizing and self-referential system which moulds, modifies and generates all manner of perceptions, including pain⁶.

The Cartesian model of pain.

resupply pic,
low res



The pain neuromatrix and the virtual body-self (Melzack)

“Admiral Lord Nelson had a (painful) phantom hand, the presence of which convinced him of the immortality of the soul.” (W Gooddy)⁷

Pain is experienced in the virtual body of the self.

Pain is a highly personalised sensory and emotional phenomenon which is ‘experienced’ in our internal world of the ‘self’ when our tissues are under threat, in turn motivating and conditioning us to take action to avoid tissue injury.

Some neuroscientists believe that our sense of ‘self’ resides in a ‘virtual body’ generated by a ‘neuromatrix’ in the brain, which is modulated by a constant stream of sensory (proprioceptive, thermal, nociceptive, visual and vestibular) and cognitive-affective inputs. In response, the neuromatrix generates ‘perceptions’ which we experience in our virtual self (a sense of ‘what is *me*’ [eg. *my* arm], position in 3-dimensional space, weight and volume of limbs, nausea, warmth, itch, pain) and also motor outputs.

Ronald Melzack proposed that the experience of pain is generated in the brain by a specialised sub-unit of the virtual body-self called the *pain neuromatrix* which anatomically-speaking, may include the somatosensory, prefrontal, cingulate and insular cortices and the thalamus.⁸

When sensory inputs into the neuromatrix are disturbed, abnormal experiences are generated in the virtual body-self, including phantom sensations and pain. With regional anaesthesia, the sudden loss of sensory input from a body part can produce strange sensory experiences such as phantom sensations (the ‘fat lip’ of a local anaesthetic dental block or ‘legs in lithotomy’ after a spinal block) and pain.

There is an interesting case report of a female who developed ‘phantom’ left-sided chest pain after a brachial plexus block of the right arm for shoulder surgery. As the arm became anaesthetized, the right hand was positioned over the left chest; on waking she reported chest pain which was similar to phantom pain she was also experiencing in her anaesthetised right hand. Both pains resolved after the local anaesthetic block receded.⁹

A patient recently reported a “...painful (right) hand growing out of my chest.” Following a traumatic partial amputation, he splinted his injured right hand tightly to his chest for many hours prior to surgery and subsequently awoke with his right hand ‘imprinted’ on his chest (Dr EJ Visser, 2009: personal communication).

There is evidence of distorted sensory and pain processing in Complex Regional Pain Syndrome (CRPS) and even in low back pain. Sensory-motor conflict (a mismatch of sensory input and motor output) to and from the neuromatrix is associated with the ‘generation’ of pain in the affected body part. The ultimate example of sensory-motor mismatch is following limb amputation with the generation of phantom sensation and pain. In CRPS and perhaps repetitive strain injury (RSI) or focal hand dystonia (in musicians such as violinists who make fine but strong motor movements) sensory-motor mismatch ‘generates’ pain and motor dysfunction in the affected limb, just like nausea is generated by the neuromatrix when there is vestibular-visual sensory mismatch in motion sickness.

PSYCHOLOGICAL AND PSYCHIATRIC MODELS OF (PATHOLOGICAL) PAIN

Psychoanalytical model

The Freudian School sees pain as one of the negative driving forces (Thanatos) and an expression of subconscious conflict.

Learning and behaviour theory models

Pain may be seen as a conditioning stimulus that 'teaches' the organism to avoid tissue threat and motivates appropriate avoidance and withdrawal behaviours.

Pain may also be seen as a conditioned *response* to a perceived tissue threat. *Operant conditioning* reinforces pain behaviours, such as the empathic response of a spouse to their partner's pain. In some societies, pain (corporal punishment or torture) is used as stimulus to modify and control behaviour. *Classical conditioning* reinforces associations between conditioning stimuli (such as an injury) and pain. Conditioning is also a major component of the placebo and nocebo responses.

The fear avoidance model sees pain as a *phobia* with reinforcement of pain-related cognitions (fears) and behaviours by exposure to perceived noxious stimuli such as physiotherapy or work.

Cognitive model

Pain may be seen as dysfunctional cognitive state due to perceived tissue threat, similar to anxiety or fear. Dysfunctional cognitions common to pain and anxiety disorders include catastrophization, rumination, dependency and helplessness. Sufferers may have all sorts of inappropriate thoughts and theories about their pain (the internet mine field) most of which are unhelpful in promoting coping and acceptance of their pain.

Somatoform (pain) disorders

In somatoform disorders, psychological distress is expressed in terms of bodily symptoms including pain.

Pain disorder is a specific psychiatric diagnosis (DSM IV-TR) where pain is judged to be out of keeping with the presumed 'physical cause' and psychological factors are thought to be important, however pain expression is not intentionally feigned. Such a judgment is based purely on subjective clinical assessment. Pain disorder is not an 'all or none' phenomenon; it can be diagnosed in the presence of a 'physical' pain condition.

Pain disorder may be classified as a dysfunctional pain syndrome and is compatible with the IASP definition of pain ("*or described in terms of such damage*"), however it reinforces the 'mind-body or somatization versus sensitization dilemma' of pain (see below). It is sobering to note that 50 years ago phantom limb pain would have been classified as a pain disorder. Some authorities debate the merit and validity of this diagnosis, however it may be useful in the multidisciplinary treatment of pain patients with presumed psychological distress.

Somatization disorder is specified by pain in four or more bodily regions and other symptom clusters (neurological, gastrointestinal, reproductive). Hypochondriasis is 'illness worry' and in conversion disorder, patients present with signs and symptoms (usually neurological deficits) and sometimes pain where there is no clear physical cause. Finally factitious disorder and malingering are conditions where pain expression is feigned.

Chronic pain as a disease

Chronic or persistent pain may be seen as a disease in its own right, rather than just a symptom, with specific (bio-psycho-social) pathologies, signs and symptoms. Such a paradigm is supported by evidence for pain-related processes as diverse as central sensitization, allodynia and fear avoidance. Conceptualizing persistent pain as a chronic disease may be useful in raising the profile of this problem in society.¹⁰

Pain as a bio-psycho-social phenomenon

Engel promoted the concept that certain disorders such as pain could be considered as a bio-psycho-social phenomenon with causes and effects in these fields. It is unclear if this paradigm serves as a useful explanation of the pain phenomenon, but it may serve to guide multidisciplinary pain management in patients.

Philosophy and pain

Although pain has traditionally been considered within the domain of health-care and disease, it also impacts on other aspects of humanity, including philosophy, society and culture (including punishment and torture) and spirituality.

Mind-body dualism

Since the work of the philosopher Reneae Descartes in the 17th century, dualism of body and mind (brain) has formed the basis of medical thinking about perception and disease even to this day. Based on this paradigm, pain has been conceptualized as a problem or 'disorder' of either the body or the mind (so called mind-body dualism). The modern equivalent of this concept is that (persistent) pain 'existing' somewhere on a continuum between the end points of 'somatization' (pain in the mind) and 'sensitization' (pain in the body).

How the pain sufferer is treated depends where the clinician thinks they 'are' on this continuum. For example, is a patient's fibromyalgia syndrome 'driven' by psychological stressors (marital disharmony) or central sensitization? The pain presentation is the same but the treatment may be entirely different (psychotherapy versus pregabalin). However, mind-body dualism or the sensitization-somatization paradigm does not clearly explain or capture the complex experiential phenomenon that is pain, however it may, like the bio-psycho-social paradigm, serve as a way to organise multidisciplinary treatment.

Pain as an aporia.

Some philosophers consider pain as an (essentially) unexplainable, complex and unique experience of the self, existing in a realm (the aporia) that is impossible for an outside 'observer' such as a doctor, spouse, philosopher or priest, to truly access and understand.⁶ This isn't the same as saying that pain exists in the mind, or in the body for that matter. Such complexities in understanding what pain *is* are shared with trying to understand other experiential states such as consciousness, love, fear or death.

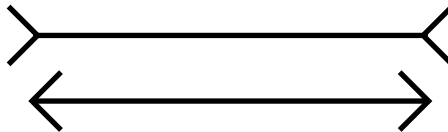
The only tool which the outside observer can use to try and 'access' the aporia of a person's pain is *language*. However pain sufferers and observers (such as health care providers) may use a different language with different meanings when exploring pain. Interestingly 'the pain narrative' (stories of pain) is being explored as a 'tool' for health care providers and philosophers alike to try and access the realm of the person in pain. The 'pain narrative' exchange between sufferer and observer (eg the doctor) modulates pain and may even be therapeutic (pain education, neuro-linguistic programming, understanding concepts of pain), although a dysfunctional exchange of language (your bulging discs have increased your pain) may prove counter-therapeutic.⁶

Pain as a quale.

The subjective qualities of conscious experiences such as pain, colour or music are known by philosophers as 'qualia' (raw feelings) which are difficult to attribute to physical processes and impossible for a third person to access or experience. Do we all experience the blueness of the sky, the taste of salt, Beethoven 5th symphony or indeed pain in the same way? We can never know.

The external perceptual theory of pain

According to this theory, pain is a perception associated with the (sensory) stimulus of bodily damage. As with other perceptions (such as vision) pain is subject to misinterpretation or 'illusion' (like the optical illusion of Muller-Lyer).¹¹



This model of (pathological) pain as an inaccurate or 'illusionary' perception may explain such puzzling phenomena as phantom pain or allodynia and may be a useful metaphor for pain sufferers to gain some understanding of their condition. However there is some debate as to whether pain in the absence of an external (perceptual) stimulus could be considered by definition, as an hallucination.

OTHER CONCEPTS OF PAIN

Alloplastic pain and whole-organism response to threat or stress

Alloplastic pain (APP) is proposed as term and model to describe pain which is neither nociceptive nor neuropathic in aetiology (based on current definitions and diagnostic technologies). The IASP update suggests an alternative term, 'dysfunctional pain'.¹² Examples of APP include fibromyalgia and somatoform pain and possibly opioid induced hyperalgesia, CRPS, some forms of headache, chronic low back pain or chronic post whiplash-associated neck pain.

APP means the 'other', 'changeable' pain and reflects complex, interactive and systemic (holistic) processes, occurring in-and-around the organism in pain. Such processes are likely to be active at a cellular, genetic, neurological (including psycho-cognitive & autonomic), immunological, endocrine and environmental level which together may be seen as *systemic core-pain responses*.

In evolutionary terms, organisms ranging from bacteria to humans exhibit a whole-organism response to 'threat or stress' which may be expressed in higher organism as a 'sickness response', including pain¹³. The development of APP may represent the persistence of this whole-organism survival response to cumulative tissue threat ('load') or stress, with sufferers becoming a kind of 'walking wounded', engendering help from others to 'share the load'.

Nociception, psycho-social 'yellow flags' or environmental factors could act as 'triggers' or 'drivers' for this response. Fibromyalgia, the so-called archetypal 'alloplastic' or 'dysfunctional' pain syndrome, exhibits many of the features of an acute sickness response (very much like a dose of the 'flu') including widespread pain, fatigue, cognitive dysfunction and behavioural withdrawal. It is likely that neuro-immune mechanisms (eg. cytokines) are particularly important in this process. Interestingly, a yet-to-be published epidemiological study showed that the probability of a patient developing persisting low back pain with disability increased cumulatively with the number of associated psycho-social stressors or 'yellow flags', perhaps reflecting some form of stress or threat 'loading'.¹⁴

As the term implies, *alloplastic* pain is potentially *changeable* by modulating systemic core-pain responses or the sickness response, using therapies as diverse as psychological or placebo techniques, physical therapies (including activity pacing) and immune or neuro-transmitter modulation.

APP may be consistent with the concept of '[chronic] pain-as-a-(sickness response or systemic core-pain) disease' and challenges mind-body (dualist) and bio-medical paradigms, by recognizing that pain reflects complex systemic processes in the whole-person, ultimately resulting in a unique and individual experience. The paradigm of APP also challenges the concept of 'somatoform' or 'psychogenic' pain as 'problems of a faulty mind' and the implication that 'unexplainable' pain should be treated with suspicion and is somehow the 'fault of the patient'. It promotes belief in-and-of the patient in pain which is ethical and also therapeutic.

APP may be likened to a *sphere*, with its 3-dimensional surface reflecting the complex interaction of an infinite number of 2-dimensional 'facets', with its core forming an aporia (Dr S. Davies, 2009: personal communication).

Is pain a 'type' of anxiety (fear)?

As mentioned previously, the associations between pain and anxiety (fear) are many fold. Just as anxiety (fear) is an emotional and physiological response to a perceived *existential* threat (in other words, all the tissues are 'threatened'), perhaps pain is simply a specialized or adapted form of anxiety response associated with *tissue* threat.

CONCLUSION

Pain is much more than a sensory perception of tissue injury. Pain is a complex and unpleasant multidimensional experience of the self associated with perceived tissue threat. Pain is as difficult to understand as consciousness, love or anxiety and yet is pervades the existence of many living things on this planet and in particular the human condition.

"For all the happiness mankind can gain; is not in pleasure, but in rest from pain." (John Dryden, 1631-1701)

REFERENCES

1. Tait R, Chibnall JT, Kalauokalani D. Provider Judgments of Patients in Pain: Seeking Symptom Certainty. *Pain Medicine* 2009;10:11-34.
2. Morris D, Wilson P. The Challenges of pain and suffering. In *Clinical Pain Management: Chronic pain*. 2nd Ed. Wilson PR, Watson PJ, Haythornthwaite JA et al (Eds). Hodder Arnold, London, 2008. p89.
3. Loeser JD. Perspectives on pain. In: *Proceedings of the First World Congress on Clinical Pharmacology and Therapeutics*. Turner P (Ed). MacMillan, London, 1980.
4. Dostrovsky JO. Ascending Spinal and Trigeminal Nociceptive Pathways. In: *Pain 2005-An updated review: Refresher Course Syllabus*. Justins DM (Ed). IASP Press, Seattle, 2005.
5. Anand, KJS. Fetal Pain? In: *IASP Clinical Updates, 2006, Volume XIV, Number 2*.
6. Quintner JL, Cohen ML, Buchanan D, Katz JD, Williamson OD. Pain medicine and its models: Helping or hindering? *Pain Med* 2008;9:824-34.
7. W. Goody. Admiral Lord Nelson's neurological illnesses. *Proc R Soc Med*. 1970.
8. Melzack R. Evolution of the neuromatrix theory of pain. The Privithi Raj Lecture: presented at the Third World Congress of World Institute of Pain, Barcelona 2004. *Pain Pract* 2005;5:85-94.
9. Casutt M, Ekatodramis G, Maurer K, Borgeat A. Projected complex sensations after interscalene brachial plexus block. *Anesth Analg* 2002;94:1270-1.
10. Siddall PJ, Cousins MJ. Persistent pain as a disease entity: implications for clinical management. *Anesth Analg*. 2004;99:510-20.
11. Witonsky A, Whitman SM. Puzzling Pain Conditions: How Philosophy Can Help Us Understand Them. *Pain Medicine* 2005;6:315-22.
12. Loeser JD, Treede RD. The Kyoto protocol of IASP Basic Pain Terminology. *Pain* 2008;137:473-7.
13. Cohen ML, Lyon PC, Quintner JL. An evolutionary biology approach to chronic widespread pain (Fibromyalgia). Poster presentation at the Australia and New Zealand College of Anaesthetists ASM, Cairns, Australia, May 2009.
14. Maher C et al. "Update on diagnosis and prognosis of low back pain." Presentation at the Australian Pain Society, ASM 2009, Sydney, Australia.