

The pain of altruism

Barbara L. Finlay¹ and Supriya Syal²

¹ Department of Psychology, Cornell University, Ithaca, NY, USA

² Department of Psychology, University of Toronto, Toronto, Canada

Sociality and cooperation are benefits to human cultures but may carry unexpected costs. We suggest that both the human experience of pain and the expression of distress may result from many causes not experienced as painful in our close primate relatives, because human ancestors motivated to ask for help survived in greater numbers than either the thick-skinned or the stoic.

Pain is more than sensation alone, in that it includes the motivation to make itself stop. The basic function of pain is likely to be common to all vertebrates, or perhaps all mobile animals, causing an individual to stop traumatic activities or attempt to escape damaging situations. Post-trauma, pain reminds animals to avoid further injury and encourages rest and recuperation as far as the requirements of survival allow.

In 1993, Patrick Wall used this functional conceptualization of pain to give an interesting account of placebo effects from religious to medical settings [1]. The feeling of pain in humans produces information flow to neural regions that generate both sensations and motivations [1]. He argued that the alleviation of pain can result via cessation of sensation (nociceptive pathways) or via fulfillment of motivation (affective pathways); that is, placebos work because they motivate successful help seeking, independent of any direct action of the helper on the cause of the pain. Since Wall's proposal, the direct pharmacological effects of placebo on pain sensation via opiate pathways have been repeatedly demonstrated [2]. Here we extend Wall's functional account of pain more broadly to the interaction of pain with stabilized altruism in human cultures. We argue that, over evolutionary time, several stimuli and situations that are painful in neither mammals generally nor in our primate relatives particularly have come to be experienced as pain in humans, accompanied by obvious distress that serves to elicit help from others. In humans, our domesticated species, and perhaps other highly social animals, soliciting help may allow survival in otherwise fatal situations.

Our claim is distinct from the numerous demonstrations of the contextual and social modification of pain sensation and from the placebo effect itself, although these aspects will necessarily intertwine. It neither supports nor contradicts any claim that pain and suffering are different in humans because of social learning, the ability to predict pain, or an understanding of the consequences of trauma. Rather, we argue that the primary circuitry of pain and

malaise has been changed in human evolution in cases where getting help from others would be useful, because those who did survive. The evidence in support of this argument, although indirect, is surprisingly extensive and varied. We begin with the illustrative case of 'obligate midwifery' in humans. Additional evidence to be considered includes the modification of adult human social communication to exhibit distress [3], sex differences in pain sensitivity and help seeking [4], the well-known independence of pain from explicit tissue damage [5], the expansion of viscerosensitive representation in the cortex, particularly in the insula (Box 1) [6], and, finally, studies showing that the presence of significant others can increase reported pain in some cases while decreasing it in others [7]. Finally, we include in this argument not only the explicit pain accompanying somatic tissue damage, but also the pain and malaise associated with the aftermath of such damage, infection, or disease. The recent acknowledgment of how little the post-traumatic inflammatory response of the 'mouse model' [8] resembles the extended and amplified reaction in humans may be integrally related to the help-expectant 'pain of altruism'.

The pain of childbirth is religiously, medically, and culturally enshrined in Western culture, but even with cultural modifications it has pervasive cross-cultural universals. Surprisingly, the presence of assistants rather than essential difficulty distinguishes human birth from birth in great apes and monkeys, as detailed in Trevathan's landmark book *Human Birth: An Evolutionary Perspective* [9]. A common assumption is that the exceptional pain of human birth is the result of its unusual physical difficulty, given humans' large head and the modification of the pelvis for walking, and damage often occurs at the point of birth, where mortality of both infant and mother is quite high. Curiously, however, the labor pains associated with the dilation of the cervix occurring for the multiple hours anticipating delivery produce no particular tissue damage. No one contests the true pain of the labor leading up to birth nor considers it a cultural construct, although it is the object of much cultural attention. Furthermore, great difficulty in parturition is not unique to humans among primates, nor mammals. For example, due to head and body scaling, it is the smallest monkeys – marmosets – that have the greatest cephalopelvic disproportion and mortality associated with parturition [10]. Large ungulates give birth to exceptionally large-headed and -hooved offspring with little if any announcement of distress and both mother and offspring are developmentally and physiologically prepared to move off immediately, presumably due to the dangers of predation. It is the routine presence of assistants at human birth that is its most unusual feature.

Corresponding author: Finlay, B.L. (blf2@cornell.edu).

1364-6613/

© 2014 Elsevier Ltd. All rights reserved. <http://dx.doi.org/10.1016/j.tics.2014.08.002>

Box 1. The changing neuroanatomy of pain

The greater neocortical representation of body state may be a useful adjunct to the social communication of pain and malaise. Work by Craig has expanded understanding of viscerosensation from concentration on somatic pain to how multiple aspects of body state are integrated with cognition and behavior via their representation in the insular cortex [6]. Whether the insular representation is a special adaptation in humans [6] or an expected allometric progression in a large brain [15], the outcome is the same. Many features of pain sensitivity are intrinsically 'predictive', with some predictions laid down by evolution and some by individual experience. For example, a painful thermal stimulus, hot or cold, need not have produced tissue damage to induce withdrawal, such as we have argued may also characterize early labor pain. The more extensive insular representation of body state may allow a more dynamic, predictive, experience-based modulation of pain states than possible in other, smaller brains, from basic time course to social contextualization. Empathetic responses to pain must certainly employ this circuitry. We emphasize again, however, that it is not this cortical elaboration of viscerosensitive circuitry that we propose, but an evolutionary reassignment of some stimuli or states as painful, coupled to response systems that elicit help. However, the elaborated insular cortex representation of the body state provides context, in several senses.

While other primates and mammals have been observed to protect a birthing mother at times, nonhuman primates do not seek or get assistance at birth; indeed, attempts by the prospective mother to isolate herself are more probable. By contrast, in humans, typically, 'ethnographic literature reports the presence of a birth attendant at parturition' [9], p. 110 and solitary birth is rare. In summary, an essentially neutral physiological event (cervical dilation) predicts a dangerous event (birth). We suggest that cervical dilation has become rivetingly painful to induce help seeking and all of its subsequent cultural elaborations in our social species. The offspring of those who sought help are more likely to be (with) us.

Humans have the distinct ability (unique among primates) to communicate distress through emotional tears [3]. Outside mother–infant interactions and alarm and distress calls as triggers for group flight or predator mobbing, the appearance of disability and distress in adult animals is something to be avoided in most natural situations (to avoid attracting the aggression of competing conspecifics or predators). In research on animal communication, an important consideration is the honesty of signals [11]. Particularly in this case, when the purpose of a signal is to recruit costly aid, the signal itself should be costly [12]. The interesting conclusion arises that pain and malaise themselves are the cost to the recruiting animal. Malingering, however, has not been entirely avoided.

There are two actors in the provision of help to the sick and hurt: those who seek the help and those who provide it. So far, we have discussed help seekers, but a helper must also respond. The prototypical occasion where protection and provisioning are provided in response to distress is in mother–infant interactions, although this response is shown by males in biparental care and, more generally, in the various cases of alloparenting [13]. In the case of

response to pain, the providers of help have become all adult humans (not only mothers), while other adults (not only infants) are recognized as legitimate help seekers. This argument is not limited to birth-centered pain and helping, as it can apply equally to broken legs and infections. However, the obligatory role of females in these instances of pain sensation and response, birth and infant care, may bear some causal role in the reported lower female pain thresholds and greater response to pain in others [4].

This new view of pain may help to sort out what has become an uninterpretable literature about how the presence of friends or strangers induces or relieves pain [7]. If, in an evolutionary sense, help from others is the root cause of some types of pain, determining whether environmental contingencies are factored into pain sensation is essential, in the same way that alarm calls are often contingent on the presence of conspecifics. An understanding of pain and disease, in the most basic physiological sense, may require a view of humans as help-seeking social animals. Any scientist who has done surgery on rodents will have noted the remarkable speed of their behavioral recovery compared with humans undergoing comparable procedures, yet only recently has a profound dissimilarity of the inflammatory response of rodents versus humans to trauma been described in the scientific literature [8]. Periods of extended illness, experienced as malaise, may be feasible only in species where individuals protect and provision one another for extended periods of time. In various animals, exhibition of 'sickness behaviors' can depend on the behavioral or social context [14]. Unwittingly, we may have performed an experiment with the answer to this puzzle: to our domesticated and companion animals, from cattle to cats, we have been applying the same selection regimens as we have applied to ourselves. Those species may now also 'benefit' from the pain and malaise evolving from the help that humans regularly offer them.

References

- 1 Wall, P.D. (1993) Pain and the placebo response. In *Experimental and Theoretical Studies of Consciousness* (Bock, G.R. and Marsh, J., eds), pp. 187–216, John Wiley and Sons
- 2 Buchel, C. et al. (2014) Placebo analgesia: a predictive coding perspective. *Neuron* 81, 1223–1239
- 3 Provine, R.R. et al. (2009) Tearing: breakthrough in human emotional signaling. *Evol. Psychol.* 7, 52–56
- 4 Mogil, J.S. (2012) Sex differences in pain and pain inhibition: multiple explanations of a controversial phenomenon. *Nat. Rev. Neurosci.* 13, 859–866
- 5 Craig, A.D. (2003) Pain mechanisms: labeled lines versus convergence in central processing. *Annu. Rev. Neurosci.* 26, 1–30
- 6 Craig, A.D. (2002) How do you feel? Interoception: the sense of the physiological condition of the body. *Nat. Rev. Neurosci.* 3, 655–666
- 7 Krahé, C. et al. (2013) The social modulation of pain: others as predictive signals of salience – a systematic review. *Front. Hum. Neurosci.* 7, 386
- 8 Seok, J. et al. (2013) Genomic responses in mouse models poorly mimic human inflammatory diseases. *Proc. Natl. Acad. Sci. U.S.A.* 110, 3507–3512
- 9 Trevathan, W.R. (1987) *Human Birth: An Evolutionary Perspective*, Aldine de Gruyter

- 10 Leutenegger, W. (1982) Encephalization and obstetrics in primates with particular reference to human evolution. In *Primate Brain Evolution* (Armstrong, E. and Falk, D., eds), pp. 85–95, Plenum Press
- 11 Dawkins, R. and Krebs, J.R. (1978) Animal signals: information or manipulation. In *Behavioural Ecology: An Evolutionary Approach* (Krebs, J.R. and Davies, N.B., eds), pp. 282–309, Blackwell Scientific
- 12 Zahavi, A. (1977) The cost of honesty (further remarks on the handicap principle). *J. Theor. Biol.* 67, 603–605
- 13 Isler, K. and van Schaik, C.P. (2012) Allomaternal care, life history and brain size evolution in mammals. *J. Hum. Evol.* 63, 52–63
- 14 Lopes, P.C. (2014) When is it socially acceptable to feel sick? *Proc. Biol. Sci.* 281, <http://dx.doi.org/10.1098/rspb.2014.0218>
- 15 Niewenhuys, R. (2012) The insular cortex: a review. In *Evolution of the Primate Brain: From Neuron to Behavior* (Hofman, M.A. and Falk, D., eds), pp. 123–153, Elsevier