Nonverbal indicators of pain

*Commentary on **Key** on Fish Pain*

Simon van Rysewyk
School of Philosophy
University of Tasmania

Abstract: In discussing fish pain, Key (2016) privileges pain in humans — "the only species able to directly report on its feelings." Human experience of pain is not necessarily best reflected by verbal self-report, however. Neural responses to noxious stimuli are influenced by individual differences and by context. Nonverbal pain displays such as facial expressions reflect part of the neural response to noxious stimuli. Most mammals have a specific facial grimace reflecting pain. If fish have a somatic expression of pain, the development of a reliable and accurate somatic pain scale specific to fish could make a contribution to the debate about fish pain.

Simon van Rysewyk simon@rirl.org, based in Singapore, does medical writing for the Observational and Pragmatic Research Institute. He is University Associate at the Department of Philosophy, University of Tasmania. He is interested in the impact of perceived meanings on patient-reported pain outcomes.
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According to Key (2016), in non-human animals, pain is typically inferred by human observers from nonverbal behaviors, which can be problematic for establishing pain "when the reliability and validity of the behavioral tests are questionable." Key privileges pain in humans because they are "the only species able to directly report on its feelings." This view of self-report as directly reflecting the experience of pain deserves more thought.

Human observers of other humans in pain rely on nonverbal behaviors more than on verbal behaviors to judge the credibility of pain displays (Poole & Craig, 1992), perhaps because they are less susceptible to response biases. Verbal self-report is not necessarily a valid index of pain; it can be modified by people's understanding of how their words may be interpreted by observers. Acute noxious stimuli activate several brain areas in humans, but this activation does not necessarily correspond to self-report of pain (e.g., Bornhövd et al. 2002). With noxious stimuli of the same intensity, individuals may differ in their self-reports of pain intensity (Coghill et al. 2003) as well as in their internally regulated nonverbal reactions (Apkarian et al. 2005). Nonverbal behavioral symptoms of pain can be involuntarily inhibited or amplified depending on circumstances (Melzack & Wall 1988; Williams 2002). These studies provide evidence that neural responses to noxious stimuli depend partly on individual differences and context that may not be reflected in verbal self-report (Hadjistavropoulos et al. 2011).

In many studies on pain in humans, self-report consists of retrospective rating of pain, which in turn involves memory. Psychophysical studies suggest that memory traces of painful sensory information may not be entirely accurate (Rainville et al. 2004). Registering and storing pain-related information in memory also relies on some, but not necessarily all, pain-activated neural areas (Albanese et al. 2007). This suggests that neural activation patterns to acute pain may partly reflect memory effects rather than just pain (Hadjistavropoulos et al. 2011).

The most specific nonverbal pain indicator in humans is facial expression (Williams, 2002). Facial expressions of pain are evolved reaction patterns distinct from other emotional expressions (Simon et al. 2007). In a functional magnetic resonance study, Kunz et al. (2009) reported that "facial pain displays do reflect at least in part the activity within nociceptive pathways that is not fully captured by pain reports." Hadjistavropoulos et al. (2011) suggest that nonverbal expression of pain is part of the neural response to noxious stimuli not associated with verbal self-report.

It is now clear that the mouse (Langford et al. 2010), rat (Sotocinal et al. 2011), rabbit, (Keating et al. 2012), horse (Dalla Costa et al. 2014) and cat (Holden et al. 2014) make a specific facial grimace following noxious stimulation. Based directly on human facial pain scales (Williams, 2002), highly reliable and accurate facial grimace scales for these species have been developed. Given the limitations of self-report overlooked by Key in his target article, and the evidence specifically linking nonverbal expression of pain and neural responses to noxious stimuli, it seems relevant to ask whether fish have a specific detectable somatic response following noxious stimulation that is analogous or even homologous to the mammalian pain grimace. A reliable and accurate somatic response scale specific to fish could contribute to several aspects of the fish pain debate, including the assessment of different analgesics and anesthetics administered to fish (Sneddon 2009).

References

Albanese, M. C., Duerden, E. G., Rainville, P., & Duncan, G. H. (2007). Memory traces of pain in human cortex. *The Journal of Neuroscience, 27,* 4612–4620.

Apkarian, A. V., Bushnell, M. C., Treede, R. D., & Zubieta, J. K. (2005). Human brain mechanisms of pain perception and regulation in health and disease. *European Journal of Pain, 9,* 463–484.

Bornhövd, K., Quante, M., Glauche, V., Bromm, B., Weiller, C., & Büchel, C. (2002). Painful stimuli evoke different stimulus-response functions in the amygdala, prefrontal, insula and somatosensory cortex: A single-trial fMRI study. *Brain: A Journal of Neurology, 125,* 1326–1336.

Coghill, R. C., McHaffie, J. G., & Yen, Y. F. (2003). Neural correlates of interindividual differences in the subjective experience of pain. *Proceedings of the National Academy of Sciences, USA, 100,* 8538–8542.

Dalla Costa, E., Minero, M., Lebelt, D., Stucke, D., Canali, E., & Leach, M. C. (2014). Development of the Horse Grimace Scale (HGS) as a pain assessment tool in horses undergoing routine castration. PLoS One, *9*, e92281.

Hadjistavropoulos, T., Craig, K. D., Duck, S., Cano, A., Goubert, L., Jackson, P. L., Mogil, J. S., Rainville, P., Sullivan, J. L., Williams, A. C., Vervoort, T., & Fitzgerald, T. D. (2011). A biopsychosocial formulation of pain communication. *Psychological bulletin*, *137*(6), 910–939.

Holden, E., Calvo, G., Collins, M., Bell, A., Reid, J., Scott, E. M., & Nolan, A. M. (2014). Evaluation of facial expression in acute pain in cats. *Journal of Small Animal Practice, 55*, 615–621.

Keating, S. C. J., Thomas, A. A., Flecknell, P. A., & Leach, M. C. (2012). Evaluation of EMLA cream for preventing pain during tattooing of rabbits: changes in physiological, behavioral and facial expression responses. *PLoS One, 7*, e44437.

Key, B. (2016). Why fish do not feel pain. *Animal Sentience* 2016.003.

Kunz, M., Chen, J. I., Lautenbacher, S., Vachon-Presseau, E., & Rainville, P. (2011). Cerebral regulation of facial expressions of pain. *The Journal of Neuroscience*, *31*(24), 8730–8738.

Langford, D. L., Bailey, A. L., Chanda, M. L., Clarke, S. E., Drummond, T. E., Echols, S., Glick, S., Ingrao, J., Klassen-Ross, T., LaCroix-Fralish, M. L., Matsumiya, L., Sorge, R. E., Sotocinal, S. B., Tabaka, J. M., Wong, D., van den Maagdenberg, A. M. J. M., Ferrari, M. D., Craig, K. D., & Mogil, J. S. (2010). Coding of facial expressions of pain in the laboratory mouse. *Nature Methods, 7,* 447–449.

Melzack, R., & Wall, P. D. (1988). *The challenge of pain* (2nd ed.). London, England: Penguin Books.

Poole, G. D., & Craig, K. D. (1992). Judgments of genuine, suppressed and faked facial expressions of pain. *Journal of Personality and Social Psychology: Interpersonal Relations and Group Processes, 63,* 797–805.

Rainville, P., Doucet, J. C., Fortin, M. C., & Duncan, G. H. (2004). Rapid deterioration of pain sensory-discriminative information in short-term memory. *Pain, 110,* 605–615.

Siebeck, U. E., Parker, A. N., Sprenger, D., Mäthger, L. M., & Wallis, G. (2010). A species of reef fish that uses ultraviolet patterns for covert face recognition. *Current Biology*, *20*(5), 407-410.

Simon, D., Craig, K. D., Miltner, W. H., & Rainville, P. (2006). Brain responses to dynamic facial expressions of pain. *Pain, 126,* 309–318.

Sneddon, L. U. (2009). Pain perception in fish: indicators and endpoints. *ILAR journal*, *50*(4), 338-342.

Sotocinal, S. G., Sorge, R. E., Zaloum, A., Tuttle, A. H., Martin, L. J., Wieskopf, J. S., Mapplebeck, J. C. S., Wei, P., Zhan, S., Zhang, S., McDougall, J. J., King, O. D., & Mogil, J. S. (2011). The Rat Grimace Scale: a partially automated method for quantifying pain in the laboratory rat via facial expressions. *Molecular Pain, 7*, 55.

Williams, A. C. (2002). Facial expression of pain: An evolutionary account. *Behavioral and Brain Sciences, 25,* 439–488.