

Facial expression of pain: "Just So Stories," spandrels, and patient blaming

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Abstract: Facial responses to pain might be the result of evolution but Williams' interesting "Just So" story provides no convincing evidence for her hypothesis. Contrary to her hope, casting facial action in an evolutionary perspective will probably not reduce the common practice of health care professionals blaming patients for their problems; instead, it may discourage appropriate treatment.

Williams has done a thorough and creative job of assembling and integrating the extant data on facial expression and has shown that these data can be interpreted in evolutionary terms. She argues that such an approach could reduce the common and pernicious practice of blaming patients who have chronic pain.

However, Williams presents scant evidence that facial expression is the result of evolution and no evidence that patients would be better treated if facial responses were shown to be evolutionary. Williams alludes to the argument of Gould and Lewontin (1979) who have objected to "Just So Stories" in evolutionary psychology. "Just So Stories" as Kipling (1912) originally told them, are stories about characteristics of various animals and how they developed. For example, "How the Whale got his Throat" tells the story of how a shipwrecked sailor – when swallowed by a whale – created baleen by cutting up his shipwreck and making a grate in the whales' throats so that whales could not eat people. These fanciful stories are wonderfully entertaining, post hoc explanations that have as their justification the joy, not the scientific enlightenment, they bring to the reader.

Williams' evolutionary account of facial response to pain is a great story, but I could not find in it the evidence that facial responses to pain are of evolutionary origin. Williams sets up operant conditioning as the only logical alternative and shows that operant conditioning cannot explain the emergence of facial expressions to pain. Her dismantling of operant conditioning is well done, but unnecessary. Most people who have seen infants produce facial expressions of pain at one hour after birth, need no convincing that reinforcement is not the major element in the development of facial responses to pain. What is needed to make Williams' argument convincing is evidence that facial expressions have changed in response to evolutionary pressure. The argument that communication of pain has current survival value is well made by Williams, but is not sufficient to show this is how it developed. Darwin (1873) discussed "correlations of growth," and, even more eloquently, Gould and Lewontin (1979) pointed out that behaviour might develop as a side effect, rather than as a direct effect, of evolution. Gould and Lewontin (1979) borrowed the architectural term "spandrel," which refers to the triangular space created when an arch is placed in a rectangular wall. Spandrels are often the site of elaborate decoration. They point out that spandrels are the by-product of the development of arches. That is, they were not developed for themselves, but came along with the development of arches. Similarly many features that are attributed to evolution are simply the by-product of other evolutionary changes and not the product of evolution itself. Gould (1997) suggests that there are two main ways of determining if a feature is a primary result of evolution or a secondary by-product. The first way is by evidence of an actual historical order of events. So, in our case, we would want to know when facial action for pain arose in the evolution of humans. This is unlikely to be available, as there is not likely a fossil record of pain faces. The second method, which is more likely to be useful in the case of pain facial expression, but is still inferential, is to use current examples of anatomy and behaviour across species that are more or less close to humans in evolutionary terms. This method could yield an inferred historical

record. For this we need extensive cross-species studies that, as Williams notes, are not available at this time.

My own, personal, anecdotal, observation suggests that many mammals, at least the domestic and lab animals, and many non-mammals do not have facial expressions for pain. The most interesting data would, however, be from the lower and higher nonhuman primates.

So the question remains: Are facial actions evolved, or just an accidental spandrel left over from chance factors? Williams suggests a possible candidate, namely the close proximity of the motor and pain areas of the human brain. At this time, it is unclear why humans use facial expression rather than relying on the more common vocal and other behaviours that other animals use to signal pain. The answer will likely never be answered definitively, but additional data might make the story more convincing.

If facial pain expression were evolved, would it make a difference to the management of pain? Williams seeks an evolutionary explanation for facial pain expression because she believes that an evolutionary approach will overcome the dominant operant approach. She suggests this approach is too frequently applied and overemphasizes the benefits or gains that patients have from pain, and disregards the costs that patients in pain must endure. She hopes to use an evolutionary approach to reduce the preoccupation that many clinicians have with malingering, and to combat the ignoring of patient complaints and the under-treatment of pain. I share Williams' concern about doctors blaming patients for their condition, and about the preoccupation with unjustified and untherapeutic search for malingering. An additional patient-blaming tactic is to ascribe psychological causes as the source of pain.

Williams does not explain how an evolutionary model will reduce patient blaming. Health professionals have, from ancient times, blamed patients for not getting better when treatments failed. Prior to the poorly applied, operant model that is currently used to blame patients, we had a poorly applied psychodynamic model that also blamed patients and emphasized secondary gain from pain. Of course our Freudian colleagues did not originate patient blaming. Prior to Freud, patients were blamed on grounds of moral weakness and before that, because of supposed possession by evil spirits. I believe that if facial reaction to pain were shown to be evolved, patients would continue to be blamed. Moreover, because of the general but erroneous perception that anything genetic cannot be modified by learning, it is likely that pain patients who did not get better would be seen to deserve blame because of their evolutionary inferiority; it is also likely that they would be denied the psychosocial treatments that have been shown to decrease disability and improve quality of life (Williams et al. 1966).

A behavior-analytic developmental model is better

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Abstract: Behaviorists accept, but go beyond, Williams' notion that there is an evolutionary origin to some unlearned pain behaviors. A behavior-analytic developmental model is a better fit for explaining the totality of pain behaviors. This model focuses on respondent-operant interactions and views much pain behavior as "mands" (i.e., demands). Behaviorally based explanations from the crying and social referencing literature support this model.

Virtually every behavior analyst would agree that facial expressions of pain probably have an evolutionary origin. Skinner (1969; 1984) wrote extensively on the phylogenetic basis of many human

behaviors and supported the notion of “unlearned” or “innate” behaviors in addition to learned ones. The main weakness of Williams’ article is her misunderstanding of “behaviorism,” as demonstrated by her following contradictory statements: “operant mechanisms act on unconditioned pain behaviors. But where the implicit assumption is of a *tabula rasa* at birth, operant mechanisms become the exclusive explanation for pain, invoked with minimal or no evidence” (target article, sect. 2). Unconditioned behaviors (responses) are, by definition, unlearned or innate. This contradicts Williams’ second statement that behaviorists make the implicit assumption of a *tabula rasa*. Skinner long ago addressed this misperception of behavioral theory in responding to a similar misunderstanding made by Breland and Breland (1961) when he said: “And it is a myth. No reputable student of animal behavior has ever taken the position ‘that the animal comes to the laboratory as a virtual *tabula rasa*.’” (Skinner 1969).

While Williams asserts that she only takes exception with the way behavioral theory has been misapplied to the clinical treatment of pain, and accepts other aspects of behavioral theory in general, her call for an evolutionary prewired account of the facial expression of pain makes it clear that she sees little utility in behavioral accounts and treatments of pain behaviors.

However, the issues Williams raises are better addressed by contemporary behavior analytic approaches (Novak 1996; 1998; Gewirtz & Peláez 2000). Behavior analysis provides more consistent, parsimonious, and empirical explanations of the development of behavior signaling pain and other emotions that emerge as a result of ontogenic and phylogenetic histories.

The available evidence on some specific pain behaviors, including facial vocal expressions, is that they have a phylogenetic source. As noted by Williams, infant facial expressions serve many functions that logically would have adaptive advantages. Primary among these functions is to signal to caretakers the existence of aversive stimuli. Animals (including humans) are born with many reflexes that have an apparent functional advantage for the species. These behavior-environment relationships are seen, in behavioral theory, to be the result of environmental contingencies that have worked, distally, in the history of the species. In behavioral terms, we have an unconditioned response (e.g., grimace) to an unconditioned stimulus (e.g., pin prick, stomachache). Although, as Williams points out, there is no consensus as to what constitutes a facial expression of pain, several of its phenotypic traits appear to be universal.

In the history of the species, the function of pain facial expressions – as of other pain behaviors – would evolve if they provided defensive functions, such as signaling the presence of harm-producing stimuli (including internal stimuli like pain). This is particularly functional for species with young, including humans with infants, who have limited repertoires of self-defensive behaviors, and survival reflexes that disappear quickly. Fixed responses to fixed stimuli, however, have limited utility over the course of a lifetime, particularly among species having long lifespans and inhabiting varied species-typical environments. These conditions give selection advantages to individuals in species who could also change responses to stimuli, or learn. While pain reflexes to unconditioned pain stimuli remain potent across the human lifespan, both respondent and operant learning are relevant to the shaping of pain behaviors.

In respondent conditioning, a neutral stimulus (e.g., lifting the child’s leg) occurring in close temporal proximity to the unconditioned pain stimulus (e.g., heel-stick) acquires a new function of being a conditioned stimulus that elicits pain behaviors (Goubet et al. 2001). Thus, eventually, just seeing a needle can make an infant cry.

Operant learning is the focus of most behavior-analytic approaches, as it is in Fordyce’s operant model of pain behavior, which is at the center of Williams’ criticisms. From a behavioral-developmental perspective, operant-respondent interactions are involved (Bijou & Baer 1961). Not only are pain stimuli unconditioned stimuli for reflexive pain behaviors, they are also primary

universal negative reinforcers. That is, because of phylogenetic contingencies, all members of the species are more likely to engage in behaviors that terminate, remove, eliminate, or avoid these aversive painful stimuli. Some of these negatively reinforcing consequences may be automatic, as when moving an injured limb relieves the pain stimulus. Other consequences may consist of socially reinforcing events, as when crying causes a parent to move a child’s injured limb to a more comfortable position. In addition to the negative reinforcement resulting from terminating the pain stimulus, positive reinforcement for pain reporting behaviors may occur, such as when the mother kisses the scraped knee of the crying child.

Behavior analysts (Hayes & Hayes 1992; Michael 1984; Novak 1996) apply Skinner’s analysis of verbal behavior to these situations where the behavior is maintained by the mediation of a speaker who understands the function of the speaker’s behavior. Therefore, the operant function of much pain behavior is that of a “mand,” or demand for removing the pain stimulus. As Williams suggests, both speaker and listener must be involved, but from a behavior-analytic stand, these behaviors are learned (Gewirtz & Peláez-Nogueras 1992a). Note that behaviors might have both respondent and operant components contemporaneously. The development of crying behavior, which has the advantage of bringing assistance from a greater distance than facial expression, follows this pattern of transition from respondent to operant crying. A cry of pain is among the universal distinctive cries of human neonates. Although pain crying is distinct, these differences are small (Fuller 1991), and parents (especially mothers) quickly learn to identify and respond to their own infants’ pain cries (Wiesenfeld et al. 1981). The original respondent crying may be shaped into operant behavior reinforced by either positive or negative reinforcement. Operant crying may grow to be so problematic that it becomes the focus of clinical intervention (Étzel & Gewirtz 1967; Gewirtz & Boyd 1977; Hart et al. 1964). The effects of intermittent positive, social reinforcement by parents with regard to crying have been demonstrated in laboratory studies that explain the formation of infant attachment patterns to their mothers, and the conditioning of separation protests (Gewirtz & Peláez-Nogueras 1991).

Like Williams, Campos (1983) has postulated that the responses and perceptions comprising social referencing are “prewired” (i.e., unconditioned). As an alternative to that nativistic theory, Gewirtz and Peláez-Nogueras (1992b; Peláez-Nogueras 1992) demonstrated that infant social referencing results from the infant’s contingency-based learning. That is, in contexts of uncertainty, maternal expressive facial cues of joy and fear come reliably to predict positive or aversive consequences for the infant’s operant (reaching) responses. Using a conditioning-reversal (ABAB) design with eighteen 4- to 5-month-old infants who showed no social referencing, Peláez-Nogueras (1992) demonstrated that maternal emotional facial expressions can become conditioned cues for infant referencing. Initially, during pretreatment/baseline assessment, no difference existed in the incidence of infants reaching for ambiguous objects following either maternal joyful or fearful facial expressions. However, in the next phase, the infants learned to reach for ambiguous objects when reaching was cued by a joyful maternal facial expression and followed by extrinsic positive reinforcing consequences, and to avoid those ambiguous objects when reaching was cued by a fearful maternal expression and followed by extrinsic aversive consequence contingent on their reaching. In the third phase of the experiment this differential reaching pattern in the presence of the two facial-emotional expressions were extinguished. Finally, in the last phase, the cues recovered their predictive power when contingent reinforcement was reintroduced. These results supported the hypothesis that maternal facial emotional expressions serve as conditioned cues for infant social referencing and their reaching or avoiding responses in ambiguous contexts.

In the same manner, infants learn to use their mother’s facial expressions as signals. One can easily observe the social referencing

of toddlers who fall, look to their mother's face for a cue as to whether to get up and go on, or cry. In turn, the toddlers' facial expressions of pain are likely to serve as signals for the parents. These behaviors are subject to reinforcement by parents who typically relieve pain, and whose behavior is concurrently shaped by the child's termination of the grimaces and crying. Therefore, some long-term pain behaviors may be the result of direct pain stimuli, but they may also be the result of an operant history of reinforcing pain behaviors, as initially formulated by Fordyce.

In sum, the goal of behavior analysis is to identify the functional relationships between pain behaviors and their maintaining contingencies, both distal phylogenetic and proximal ontogenic contingencies. We believe that the existing, well-established principles of behavior analysis are sufficient to account for the wide range of pain behavior phenomena. Compared with the evolutionary account proposed by Williams in the target article, we believe that behavior analysis provides both a more parsimonious account of the source of pain behaviors, and a more efficacious program for their clinical treatment.

"Mindscoping" pain and suffering

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Abstract: No adequate evidence exists for the evolution of facial pain expression and detection mechanisms, as opposed to social-learning processes. Although brain affective/emotional processes, and resulting whole body action patterns, have surely evolved, we should also aspire to monitor human suffering by direct neural measures rather than by more indirect indices.

There is probably no bigger issue for human and animal welfare than understanding and controlling pain and suffering. Amanda Williams has shared a wide-ranging evolutionary perspective on the sources of facial expressions that commonly accompany pain, and the associated psychological-communicative processes that, she suggests, may have evolutionary underpinning. It is an admirable call for more and better research, rather than a defining summary in a field where substantial evidence remains meager.

The practical issue is to develop external measures of internally experienced suffering, independent of pervasive social desirability and secondary gain issues that may affect outward emotional expressions. Williams favors the view that facial expressions function in a social-communicative role in addition to being an unconditioned consequence of the experience of suffering. Her approach leads to one clear prediction: Facial expressions of pain will be more evident in supportive social circumstances than in non-supportive ones. Indeed, since Kleck et al. (1976) have found fewer facial expressions of pain in the company of others, Williams suspects that those effects are due to the presence of strangers, who might be prone to take advantage of the situation, rather than the presence of friends, who would be more likely to help. Williams suggests there are evolved communicative tendencies that regulate such expressions; hence, the issue of detecting lying and deceit becomes essential for her analysis.

We leave aside the conspicuous dilemma that the modulation of facial expressions by social context, including possible deliberate manipulations, *still* presents many problems for using facial expressions as a "gold standard" for evaluating the intensity and duration of affective experience, at least in adults. Instead, we will focus on critical evolutionary questions that Williams' perspective brings to the fore: Is there evidence to choose between evolution and learning as explanations for the regulation and detection of pain expressions? We think not. And even if certain such processes

have been subject to some type of overall evolutionary pressures, we still have a long way to go to conclude that *individual* facial and perceptual components have been the objects of selection. Even as we respect Williams' struggles with such distinctions, we believe that most findings in evolutionary psychology, including those summarized by Williams, can at present be seen as largely reflecting learning-based processes – based perhaps on the reinforcing consequences of evolved affective processes, of which there are bound to be many.

Should we have any confidence in the assumption that "the pain face" evolved? Although Williams does not take a strong position on this, her extensive coverage of reliable pain action units could, without further clarification, be seen as an implicit acceptance that the expressions have undergone natural selection. Even though there may be substantial evolutionary underpinnings for many other facial expressions, such as smiling, which clearly facilitates certain social communications, one could easily suggest that the facial grimacing that accompanies acute pain may be part and parcel of a whole body defensive response (global flexor contraction) which may spill over into the facial musculature. From this perspective, pain may have highly predictable facial action units, without necessitating the conclusion that such expressions evolved in some ancestral deep time where the survival advantage of this or that face was penetrating into the genome. Williams herself asserts that evolutionary "selection operates at the level of function, not at the level of physical structures or behaviours that subservise the function" (target article, sect. 3). Perhaps for this reason, she focuses more of her efforts on the socio-cognitive rules that regulate facial displays, than on those that generate the displays.

We think it is quite reasonable to postulate that the *whole body* affect-linked expressions of pain have in fact evolved. This seems evident from the flailing and wailing of an infant in acute pain. Such responses are seen even in infant rats, whose facial expressions of pain would surely be lost on potential caretakers (albeit not their crying). Might not the facial accompaniments in creatures possessing the necessary facial muscles be evolutionary by-products of the global distress response, ones that can easily be molded by social learning, but by-products nonetheless? Therefore, while we accept that the global affective-distress response is surely evolved and full of internally experienced affective "meaning" for many animals, we would hesitate to accept the evolution of specific facial action units and related cognitive behaviors until simpler, more parsimonious affect-based learning interpretations have been evaluated and excluded.

In short, where evolution has generated global action patterns within the brain, the components of the patterns need not have been objects of selection with singular representations in the genome. Rather, they may be stable features of a general "instinctual" response tendency. We suspect there are many such broad-scale heuristic principles in mind/brain evolution, with the global responses generated by basic emotional systems comprising prime examples (Panksepp 1998). This is where modern evolutionary psychology may have already gone massively astray (Panksepp & Panksepp 2000). Although there are certainly various evolved emotional systems shared, in principle, by all mammals, the cognitive manifestations of those systems in their pervasive interactions with neocortical tissues that mediate general-purpose learning abilities may have few evolutionarily built-in strategies, except for conditional strategies to minimize distress and to maximize pleasure. The increasingly popular intellectual assumptions of mainstream evolutionary psychology are likely to remain in the realm of ideas and modest statistical trends, rather than of biological substance, for a long time to come. Most plausibility arguments in the area remain more heavily conceptual than empirical.

To take one final pain example – consider the phenomenon of limping. All vertebrates, when they have an injured leg, exhibit a limping gait that presumably has little, if any, intrinsic social communicative value. Either the limping reflects the effects of internally experienced pain on the central motor apparatus, or simply damaged peripheral structural supports. Very little about limping