

developed gender differences in face processing based on experience. This question makes research with infants, who have less experience interacting with the relevant stimuli, critical for testing Vigil's hypothesis. Recently, LoBue and DeLoache (in press) did examine the detection of affective facial expressions in 8- to 14-month-olds, but found no gender differences. Further research in this area is needed in order to examine Vigil's claims more thoroughly.

Future research in other areas of development might also be informative for the SRFB. For example, Vigil suggests that females are better at posing affective facial expressions than are males. If so, this should also be true for children. Further, gender differences in infants' preferences for different kinds of faces might be an important consideration for future research. For example, Lutchmaya and Baron-Cohen (2002) reported an important gender differences in 12-month-old infants' looking preferences. They found that when infants were presented with videos of moving cars or moving faces in a looking-preference experiment, infant boys preferred to look at the cars over faces, while infant girls preferred to look at faces over cars. This result supports Vigil's claims and may warrant further investigation.

In conclusion, developmental findings on gender differences in the detection of affective facial expressions provide partial support for Vigil's view that females should detect affective facial expressions more quickly than do males. Research with infants and young children could provide further information relevant to assessing the SRFB.

The other side of the coin: Intersexual selection and the expression of emotions to signal youth or maturity

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Abstract: Vigil summarizes sex-related differences in emotivity, and presents a psychological model based on the restrictive assumption that responses to stimuli are dichotomous. The model uses for support the concept of intrasexual selection, but ignores intersexual selection. An alternative hypothesis might be that emotivity signals age: maturity in men and youth in women. Integration requires considering all evolutionary biology, not just agreeable concepts.

Vigil is to be applauded for tackling such a large and complex topic as the differences in emotivity between the sexes and for attempting to produce a model that reconciles psychological and evolutionary approaches. Vigil's summary of these differences (target article, sect. 3.2) is written crisply and directly, and will be a useful reference for anyone working in this area. With some adjustments and additions, his model or a derivative of it might successfully merge evolutionary and psychological approaches.

The model assumes that "approach" and "avoid" are the only possible responses to external stimuli. However, animals often respond to stimuli by taking a "wait and see" strategy to obtain more information. Second, to use Vigil's examples, food may be laden with toxins, and mates may sometimes become predators, so organisms seldom face a dichotomous choice, but rather must monitor many requirements and make the appropriate trade-offs. Third, even when it might be ultimately desirable to avoid a stimulus – for instance, a predator – there might be several viable short-term responses. The potential prey might freeze to avoid detection. If it is already being stalked, it might

simply inform the predator that it has been seen so the latter can no longer mount a surprise attack. If the predator does attack, the best response might be to stand and fight. It is even more complex when, instead of responding to predators, animals must respond to highly social conspecifics with common and conflicting interests. Hence, the model would be stronger if it recognized that most responses to social stimuli probably fall within a large grey area between "avoid" and "approach."

Vigil then applies the model to sex-related differences in emotivity, using for support the concepts of intrasexual competition (Darwin 1871) and reciprocal altruism (Trivers 1971). The model would be stronger if it also considered related concepts, such as intersexual selection (Darwin 1871) and the ensuing sexual conflict (Trivers 1972). Vigil points out that most social interactions are with members of our own sex, and women have more intimate relationships and with fewer individuals than men do, and he attributes these patterns to sex-related differences in philopatry. It might be worth also considering that variance in reproductive success is higher for males than for females, so competition among males is stronger than among women, not just different in its style and in its setting. Second, one must also wonder why displaying emotions might be more useful in more intimate situations. The opposite could be argued. Powerful leaders throughout history, who happen to have been mostly male, demonstrate that displaying emotions can be a powerful means of controlling and motivating the masses. Third, as a sexually reproducing species, there is only one way for our genes to make it to the next generation – by interacting with the opposite sex. Maybe the model could incorporate intersexual selection (a.k.a. epigamic selection or mate choice) instead of focusing solely on intrasexual competition. Finally, sexual relationships are a constant struggle between common and conflicting interests. Within every sexual relationship, there is the potential for cooperation but also for deceit, manipulation, and exploitation. An enormous body of work over the past 40 years has been based on that premise (Andersson 1994; Arnqvist & Rowe 2005; Low 2001; Majerus 2003; Trivers 1972). It is peculiar that a treatise on the differences in emotivity between the sexes would not consider the one emotion that for millennia has provided a livelihood for thespians, singers, poets, and playwrights; humanity's greatest and most wonderfully labile and complex emotion and obsession: romantic love.

When mating, men have been selected to be relatively more concerned with quantity and women with quality (Betzig 1986; 1993; Buss 2003; Helle et al. 2008; Murstein 1986). Men compete for resources mostly with other men, but they also compete for the attention of women by displaying, emphasizing, and exaggerating their strength, status, and wealth. In contrast, women compete for high-quality males by displaying, emphasizing, and exaggerating their potential fecundity, beauty, and/or youth, all of which are highly positively correlated. Emotional displays are signals, and as such, their purpose is to persuade, cajole, and manipulate the intended receivers (Maynard-Smith & Harper 2003; Searcy & Nowicki 2005). There is nothing more potentially deceptive than a simple smile. A new hypothesis suggests itself: emotivity, or lack thereof, might be yet another way to attract the opposite sex. Given that children are more emotive than adults, men might conceal their emotions as a way to display their strength and maturity. In contrast, women might express more and more variable emotions in order to display their youth. In any case, consideration of intersexual selection offers a different and more complete perspective.

Vigil's social framework of emotions consists of a two-dimensional construct with "trustworthiness" on one axis and "capacity", or, perhaps more aptly, "ability", on the other axis. This conceptualization is similar to Leary's (1957) model, which had "love" and "dominance" as the two axes. Just like Leary's model, Vigil's is reasonable, interesting, and compelling, and it could have been derived without any knowledge of evolutionary biology. In

applying the model to sex-related differences in emotions, evolutionary concepts are used only for support, not for illumination. Unfortunately, integration must encompass all evolutionary biology, not just selected concepts that agree with the model. If anything, the model highlights the fact that some areas of psychology and evolutionary biology, despite over 50 years of progress and a mutually acknowledged desire for integration, might be getting closer but are still entrenched in their own ways of thinking.

Following Darwin's (1872) pragmatism, Vigil addresses the *expression* of emotions, not emotions *per se*, as the latter are more difficult to observe, quantify, and classify (e.g., Nesse & Ellsworth 2009), and anyway, can only affect fitness when they alter behaviour. This important distinction might help us merge evolutionary and psychological approaches by allowing us to abandon arbitrary conceptualizations of what is inside a mind – the sensation of emotions – and instead lead us to focus on their ecology and functions. It is ironic that, evolutionarily, it only matters what emotions do, not how they feel.

Cry baby cry, make your mother buy? Evolution of tears, smiles, and reciprocity potential

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Abstract: In this commentary, the idea of reciprocity potential indicators is tied in with ultimate accounts on sex differences in social sensitivity. It is proposed that, rather than crying, smiling is a more likely cooperative signal. The possibility of coevolution and polymorphism in perceptual and signalling systems are also discussed briefly, with a reference to Theory of Mind and Machiavellianism.

Although Vigil provides a very plausible ultimate account on the evolution of sex differences in emotionality based on male philopatry and female dispersal, some of the premises of the socio-relational framework of expressive behaviours (SRFB) remain less convincing. The two main aspects of the model circle around advertising capacity (relating to masculine dominance behaviours) and trustworthiness (relating to feminine emotional expressions), which Vigil ties in with numerous examples from diverse literature. While dominance cues might provide the observer with information about the importance of the actor as a social partner, the idea that emotive signals such as crying have evolved as a display of trustworthiness is less compelling.

The purpose of adult crying is still very much disputed. Crying is a communicative signal (Zeifman 2001) functioning differently in multiple contexts (Peter et al. 2001). However, it is debatable whether adult tears represent an honest signal of cooperative intentions, and whether crying is perceived as such by receivers of the signal. Although some forms of crying do signify vulnerability and a need of help (Frijda 1997), it is more likely to induce others to help without the expectation of reciprocity. In fact, research suggests that, although crying amplifies the perceived sadness in the face (Provine et al. 2009) and elicits emotional support from others, crying individuals are sometimes perceived negatively (Hendriks et al. 2008), and even labelled as being manipulative (Buss 1992; Frijda 1997). Moreover, empirical, cross-cultural evidence on sex differences in crying is sparse, and the relative importance of socialisation and culture versus biological processes is not clear. Rosenblatt et al. (1976), for

example, analysed sex differences in crying in 60 societies and found that in over half of the cultures, women did not cry more than men did. Ross and Mirowsky (1984) suggested that, rather than an evolved signal, crying in adults is socially conditioned behaviour, dependent on factors such as socio-economic status and sex-role identity of the individual. It is possible that crying in adults is an extension of attachment-related behaviour (Nelson 2005), but does not function as a signal signifying reciprocity potential.

Rather than crying, smiling is a more likely signal of reciprocity potential. Research has found that smiling is related to altruistic dispositions (Brown & Moore 2000; Brown et al. 2003) and is used in cooperative context (Mehu et al. 2007). Moreover, unlike crying, smiling induces trust and positive evaluations by the receivers of the signal (Mehu et al. 2008; Scharlemann et al. 2003). Sex differences in smiling and decoding of smiles could relate, ultimately, to the need to form reciprocal relationships with unrelated individuals. Females, both children and adults, are more expressive than males are (LaFrance et al. 2003; Provine 2000), and perform better in decoding emotional facial expressions (Hall et al. 2000; Rotter & Rotter 1988; Thayer & Johnsen 2000). Overall, females are better in processing and sending out signals that facilitate social interactions. At a neural level, a recent study found that when processing social information, females recruit areas containing mirror neurons more than males do (Schulte-Rüther et al. 2007), which could provide a possible proximate mechanism facilitating sex differences in social cognition. Ultimately, the superiority of women in reading and sending out nonverbal messages is probably a result of evolutionary pressures for heightened social sensitivity needed for competing and forming alliances in non-kin-based social networks.

The female advantage in sending and receiving social signals fits well with Vigil's idea of coevolution between perceptual systems aiding in identifying cooperators, and honest expressive behaviours in advertising trustworthiness. Ultimately, the coevolution could explain the problem of cooperation via the *Green Beard effect*, which postulates that altruists possess a conspicuous phenotypic behavioural of physical trait, which can easily be identified by others with the same characteristic (Dawkins 1976/1989). Although there is some evidence that people can recognise potential cooperators (Frank et al. 1993; Lyons & Aitken 2008; Pradel et al. 2008), not much is known about individual differences that might account for this ability. Moreover, it is possible that altruistic individuals are equipped with superior social intelligence, helping them in identifying the altruistic dispositions in others. There is some evidence that social intelligence in the form of Theory of Mind is related to self-rated cooperativeness (Paal & Bereczkei 2007), but it is unclear whether social intelligence is used when assessing the honesty of another person.

It is equally possible that evolution has produced polymorphism in perceptual and signalling systems, resulting in the existence of mixed strategies. Experimental work suggests that human populations consist of different cooperative types, which are under substantial genetic influence (Cesarini et al. 2008; Kurzban & Hauser 2005). Further research is needed in order to demonstrate how these types relate to individual differences in accuracy in assessing altruistic dispositions in others. Some individuals might be good in detecting trustworthiness, but not actually be trustworthy – a good candidate would be Machiavellian individuals (for the Machiavellian intelligence hypothesis, see McIlwain 2003; cf. Byrne & Whiten 1997). Others might, in turn, be trustworthy, but not competent in recognising the same trait in others (e.g., people with William's syndrome). It remains to be demonstrated how individual differences in social perceptiveness (e.g., Theory of Mind) and trustworthiness (e.g., Machiavellianism) relate to individual and sex differences in sending and receiving social cues.