

TEMPERAMENT

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Introduction

Although the term “temperament” does not have a consensual definition, most scientists would agree on the following sense meaning: A temperamental bias refers to distinctive patterns of feelings and behaviours that originate in the child’s biology and appear early in development.¹

Subject and Problems

The biological foundation of a temperamental bias is usually, but not always, genetic. In some cases it is the result of prenatal stress or infection to the pregnant mother which affects the fetus. An important source of the biological foundation of a temperamental bias is variation in the concentration of neurotransmitters and the density and location of the varied receptors for the large number of molecules that can affect brain function, including [glutamate](#), [GABA](#), [dopamine](#), [norepinephrine](#), [serotonin](#), [opioids](#), [acetylcholine](#), [corticotropin-releasing hormone](#), the sex hormones, [vasopressin](#) and [oxytocin](#).²

This claim implies a very large number of temperamental biases, most of which are unknown. Because it is not yet possible to measure the neurochemistry that is the basis of a temperamental bias, scientists rely primarily on specific behavioural profiles. The behaviours in infants and young children that are most often attributed to a temperamental bias are unusually high or low levels of irritability, motor activity, smiling, ease of regulating these responses, and a consistent tendency to approach or to avoid unfamiliar people, objects, and places.

Because the likelihood of a behaviour being expressed is controlled, in part, by the local setting and it is difficult for scientists to observe children in a number of settings, some psychologists administer questionnaires to parents asking them to describe the behaviours of their children and assume that these descriptions are, by and large, accurate. This assumption is not always valid because some parents are not sensitive observers of their children. The correlations between parental descriptions and direct behavioural observations of the comparable behaviours are low to modest.^{3,4} Therefore, it is better practice to combine parental reports with behavioural

observations but award priority to the behaviours.

A temperamental bias does not determine a behaviour because life experiences create an envelope of possible traits in children with the same temperament. By the second year a blend of the child's temperamental biases with the products of experience has produced a seamless tapestry making it difficult to detect the early temperamental biases of most children. The same behaviour could be the partial result of a temperamental bias or the product of experience alone. Not all shy children inherit a temperamental bias favouring that kind of response. Therefore, studies of adult temperaments, often based on questionnaire data, are open to criticism.

Research Context

Two of the many temperamental biases that have been studied most extensively refer to the typical behaviours of one- and two-year-olds to unfamiliar people, objects, and situations. About 10 to 20% of middle-class American children are consistently shy with strangers and avoidant of unfamiliar objects and situations. These children are called behaviorally inhibited. This group is contrasted with the 30 to 40% who show the complementary traits of approaching most unfamiliar events. These children are called uninhibited.⁵ Both kinds of behaviours appear to be partly heritable. These proportions of inhibited and uninhibited vary in different class, ethnic, and national groups. Although some members of mammalian species display actions that resemble inhibited and uninhibited children, we do not know if the biological bases for these groups resemble the bases in humans.

Independent studies by Kagan and Fox^{2,5,6} have revealed that these two styles of behaviour can be predicted by variation in vigorous motor behaviour and crying to unfamiliar visual, auditory and olfactory stimuli in four-month-old middle-class white infants. Four-month-olds who show high levels of motor activity and distress, called high-reactive, are likely to become inhibited. Infants who show low levels of motor activity and crying, called low-reactive, are likely to become uninhibited in the second year. High and low reactive are two infant temperaments that are presumed to be due, in part, to different thresholds of excitability in the [amygdala](#). This assumption is supported by the fact that older children who had been high reactive infants are more likely than low reactive infants to have higher and less variable heart rates.

Research Results

Continued study of these two groups through age 18 has revealed several interesting facts. American adolescents who had been high reactive infants report more unrealistic worries than most adolescents, including visiting new places, meeting strangers, entering crowds, and brooding over possible harm to the self or a parent, and more frequent bouts of depression.⁷ These properties are rare in adolescents who had been low reactive infants. Second, measurements of the brain anatomy and function revealed that the 18 year old high reactives had a thicker cortex in an area of the prefrontal region of the right hemisphere that projects to sites that mediate defensive postures to threat as well as an amygdala that was more reactive to the unexpected appearance of pictures of unfamiliar scenes.⁸ This evidence supports the belief that high and low reactive infants were born with different neurochemical profiles in the amygdala.

Although adolescents who had been high-reactive infants are at a slightly higher risk than most for developing social anxiety or depression, they are not at a higher risk for phobias to animals or blood. Low-reactives are at

a slightly higher risk for asocial behaviour. These outcomes require specific rearing conditions and local circumstances. Most children in both groups will not develop any mental symptoms or psychiatric illness.

A temperamental bias restricts the acquisition of a particular personality trait, rather than determine a certain profile. The probability that a high-reactive infant will not become an extremely sociable, spontaneous, relaxed adolescent, free of unrealistic worries is very high. However, the probability that this category of child will be a quiet, anxious introvert is low. Thus, the biology that is the foundation of a temperamental bias functions as a constraint on what is possible rather than as a determining force.

Conclusion and Implications

Parents should appreciate that each of these two temperamental types has advantages and disadvantages in contemporary society. A technological economy requires many adults who like to work alone, including computer programmers, historians, bench scientists, and mathematicians. These vocations allow adults to work in environments where they can control the level of uncertainty and keep unanticipated interactions with strangers to a minimum. High-reactives tend to avoid risk and, therefore, are less likely to drive at high speeds, experiment with drugs, engage in sex at an early age, or cheat on examinations.

Low-reactive, uninhibited children enjoy their share of advantages. Sociability and a willingness to take career and economic risks are adaptive in contemporary American society. The adolescent who is willing to leave home to attend a better college or accept a more interesting job is likely to gain a more challenging position than one who stays close to home because of a reluctance to confront the uncertainties of a distant place.

As children develop, their temperament makes a more substantial contribution to their private feeling tone than to the public personality they display to others. The chronic possession of a relaxed or tense feeling tone requires a more substantial contribution from temperamental biases than does a sociable or shy posture with others.

References

1. Rothbart MK. Temperament in childhood: A framework. In: Kohnstamm GA, Bates JE, Rothbart MK, eds. *Temperament in childhood*. Oxford, United Kingdom: John Wiley and Sons; 1989:59-73.
2. Kagan J, Snidman NC. *The long shadow of temperament*. Cambridge, Mass: Harvard University Press; 2004.
3. Seifer RA, Sameroff AJ, Barrette LC, Krafchuk E. Infant temperament measured by multiple observations and mother report. *Child Development* 1994;65(5):1478-1490.
4. Biship GS, Spence SH, McDonald C. Can parents and teachers provide a reliable and valid report of behavioural inhibition? *Child Development* 2003;74(6):1899-1917.
5. Kagan J. *Galen's prophecy: temperament in human nature*. New York, NY: Basic Books; 1994.
6. Fox NA, Henderson HA, Rubin KH, Calkins SD, Schmidt LA. Continuity and discontinuity of behavioural inhibition and exuberance: Psychophysiological and behavioural influences across the first four years of life. *Child Development* 2001;72(1):1-21.
7. Kagan, J. *The Temperamental Thread*. New York: Dana Press, 2010.
8. Schwartz CE, Kunwar, P. S., Greve, D. N., Moran, L. R., Viner, J. C. et al., Structural differences in adult orbital and ventromedial prefrontal cortex predicted by infant temperament at 4 months of age. *Archives of General Psychiatry* 2010; 67: 78-84.