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Sensitive periods in behavioural development

'Sensitive period', or one of its numerous synonyms, ought merely to refer descriptively to the evidence that an individual's characteristics may be most strongly influenced by a particular event at a certain stage in development. It should not suggest that other events exert their maximum influence at the same stage. Nor should it carry implications about what might have generated the descriptive evidence. Originally the term was used by embryologists to refer to stages in development when embryos were particularly likely to be influenced by poisons or other forms of environmental insult. Later it was applied to induction effects between cells, and later still, to the way experience affects social preferences in birds at a particular stage in development.[1]

The conviction that experience can exert a greater influence at some times in life than at others is deeply rooted in conventional thinking about humans. This notion about sensitive periods has been explicitly incorporated into accounts of language development[2] and the acquisition of many other human habits and skills.[3] However, it seems inconceivable that all the phenomena that attract the name 'sensitive period' or one of its synonyms, arise in the same way. Furthermore, it would be wrong to suppose that if certain changes can occur most easily at a particular stage in life, further changes are impossible later on. An interesting example of the way in which later experience can, under certain conditions, modify what normally develops early in life is provided by binocular vision.

The development of human binocular vision is seriously affected by squinting in the first 3 years. If it is not corrected quickly by surgery at this stage, the child's binocular vision is greatly impaired subsequently. If a squint develops at later stages, binocular vision is not greatly affected.[4] Similarly, the capacity of an eye to drive visual neurones in the cat's visual cortex depends on whether the eye received visual imput from about 1–3 months after birth.[5] If an eye is visually deprived during this period it virtually loses its capacity subsequently to excite the cortical neurones. Once established it is exceedingly difficult, on the one hand to reverse the dominance of one eye over the other or, on the other hand, to impair binocular vision in normally-reared subjects. Even so, an infusion of noradrenalin into the visual cortex of older cats can re-establish plasticity.[6] If normally-reared animals are monocularly deprived during the period of noradrenalin infusion, binocular control of the neurones is lost in the visual cortex of the hemisphere that was infused. No such change occurs in the visual cortex of the other hemisphere. This result is particularly interesting because high levels of stress are associated with rapid turnover of noradrenalin. Furthermore, plasticity of behaviour which is normally present in children and absent in adults may also occur at times of high stress later in life.

Sargant,[7] drawing on a wide variety of examples ranging from military brain-washing to psycho-therapy and religious conversion, noted the importance of creating great fear and excitement in the process of changing beliefs and reorganising a person's behaviour. John Wesley, for instance, would paint a terrifying picture of eternal damnation as part of the softening-up preparatory to actual conversion. Once the stress state has been introduced, Sargant argued, humans are much more susceptible to new influences on their behaviour. It is worth noting that the psycho-therapeutic technique of 'flooding' relies on making the patient extremely frightened in the presence of the object to which they have a strong phobia.[8] Contrary to what intuition might suggest, the patient's aversion for the object is greatly reduced in many cases. It may not be necessary to elicit fear with the object itself, and experimental work with animals suggests that an intense arousal of fear may be non-specific in its beneficial effect.[9]

In the classic case of imprinting in birds, it is now clear that the learning process itself terminates the period of sensitivity.[10] This is because imprinting restricts preferences to that which is familiar and as a result of being imprinted with one object the animal loses its sensitivity to others. The preference is protected by escape from, or indifference to, strange things. Under certain conditions, however, the protection can be stripped away and then the animal can be induced to modify its preferences again.[10] Such examples suggest that under special conditions behaviour which is difficult to change in adults may once again become plastic. Certainly, many modern writers argue that in children virtually no behavioural deficit induced by an early experience is irreversible.[11] So it is possible to resolve the apparent contradiction between the view that the young are specially susceptible to particular experiences at particular times and the view that adults can be rehabilitated.

In clinical circles there is sometimes a dislike of talk about sensitive periods in child development. It

may have sprung from the implied pessimism that once a child had missed the bus, nothing could be done for that individual. Even if that pessimism were justified, it would hardly be a creditable reason for averting our gaze, however much we might want to avoid upsetting patients with seemingly irreversible deficits. If the phenomena are to be understood, they must surely be studied. In any event, the evidence suggests that grounds for optimism are considerable. Furthermore, studies of sensitive periods, while they do not provide general principles or common mechanisms, are offering concrete examples of how developmental processes can work. The general point is that it is possible for distinctive features of behaviour normally to be formed at particular stages in development, and yet the processes generating those features can be reactivated at much later stages in the life cycle.

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