ADAPTIVE STRESS AND THE DEVELOPMENT OF LEARNING CAPABILITIES

by

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ABSTRACT

This extended literature review considers stress and stress responses in early development which could have an impact on learning capacity. The type of challenge which evokes the responses is termed ‘adaptive stress.’ It arises when, in the course of development, individuals experience for example a nutrient, experience or behaviour that their adaptive systems do not lead them physiologically or consciously to expect. It is also asserted that individuals are differently adaptable; for some, adaptive stress is a more serious issue than for others, and the degree of adjustment required varies with that difference. Adaptive adjustments are made in order that equilibrium be maintained and survival ensured. Survival is the object of adaptation; thus learning, as a subset of capacities in human beings, may take second place and may be compromised where the limit of adaptability has been in some way exceeded. However, survival itself ‘buys time’ for individuals to come to know their child’s or their own adaptive strategies, in theory to learn how to ameliorate the said compromises, and to optimise learning capacity within the learned parameters. The thesis is found to be supported in the published literature and it is concluded that it could form the basis for further research.

This thesis is dedicated to Aaron, Georgie, John and Eliza, and to
Professor Gary Thomas, all of whom have supported and encouraged me far beyond expectation

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INTRODUCTION

In this thesis I shall develop an approach to learning and learning difficulties that uses the concepts of adaptation and expectation to evaluate potential sources of stress for the developing child. I shall employ a broad definition of stress, which may be called adaptive stress, and consider how parents and educators might employ this concept to optimise learning outcomes.

Through their development and behaviour, babies and young children manifest the "*delicate but powerful dialogue between genetics and the environment: the experience of our species from eons past interact[ing] with the experiences we have during our lifetime"* (Sylwester1992, p. 21). The challenge for parents and later, teachers, may be in learning to 'read' what they see; to interpret, at least in some measure, the signs continually given out by individual young people, in order to maximise, as best one can, their potential to learn, to mature, to be themselves.

In this thesis I suggest that an awareness of recent advances in the sciences generally and in particular in the field of evolutionary psychology, can help in this endeavour. I shall explore the hypothesis that an awareness of issues relating to adaptation, the process by which all organisms and hierarchical groups of organisms change over time in order to maximise their chances of survival, may help the parent/carer/educator to serve the best interests of children and to assist with the fulfilment of their potential. I shall include the roles of all of the individuals who share this concern, including educators, parents and carers; the latter because this investigation includes the very earliest stages of a child's life, from conception onwards.

I will generally apply the word 'adaptation' to "*individual organisms, to denote the 'propensity to survive and reproduce' in a particular environment*," that is, referring to "*short-term physiological adjustments by phenotypically plastic individuals*" (West-Eberhard 1992, p. 13). I shall not adhere to Ernst Mayr's strict insistence on adaptation as "*a completely a posteriori phenomenon…in every generation, all individuals that survive the process of elimination are de facto "adapted" and so are their properties that enabled them to survive*." (Mayr 2002, p. 166) Rather I shall use it to refer to the ongoing responses 'devised' by an individual organism to help it maintain integrity in the face of constant change in its internal and external environments, and to make use of the changing stimuli it encounters in order to develop its capacities to the full. These responses of individual organisms are crucial to their 'success' or 'failure', that is, their ability to thrive. It is this thriving after all, or a child's failure to thrive, that chiefly concerns professionals in the fields of education and special education, and I suggest that what is needed is a conceptual framework to facilitate the ability to read these responses, analyse their effect on an individual's ability to learn, and work with them to optimise the same.

To build this conceptual framework, I would first of all agree with Gregory Bateson that what is useful in situations where learning is the goal is a kind of *biological epistemology*—a way of seeing that is informed by biological knowledge. For Bateson, epistemology is already rooted in scientific understanding. His own definition is: *"A branch of science combined with a branch of philosophy. As science, epistemology is the study of how particular organisms or aggregates of organisms know, think and decide [italics his]. As philosophy, epistemology is the study of the necessary limits and other characteristics of the processes of knowing, thinking and deciding*" (Bateson 1979, p. 242). As educators faced with the responsibility of educating a child, this is what we attempt to do: to try to understand (know), analyse (think) and act (decide) upon

educative problems. I suggest that these endeavours will be more likely to be successful if they are rooted in biological understanding.

But Bateson's work, though insightful and illuminating, is in some ways rather narrowly abstract. For a broader and more recent perspective on learning from a biological point of view, one must turn to the body of work known as Evolutionary Psychology. Again it comprises the combination of two sciences—evolutionary biology and cognitive psychology.

Picking up Fodor's (1983) concept of the modularity of the mind—that it is made up of many special purpose programmes, or modules, each with separate operating systems—Barkow, Tooby and Cosmides (1992) propose a complex, multi-modular mind, whose parts function smoothly together to process information (Evans 2005, p. 41). The authors ask how the many parts of the mind evolved. Some modules are shared with distant ancestors, while some are more distinctively human; to investigate these, they look at the environment inhabited by our forbears after their lineage split from that of the chimpanzees, about six million years ago (ibid p. 45). When these ancestors began to migrate away from the African savannah about 100,000 years ago, their environments changed as they moved and established new settlements. But 100,000 is only about 5,000 generations, and that is not enough time for evolution to bring about any major changes to genetic structures; thus modern day humans are for the most part genetically very similar to those original migrants. According to evolutionary psychologists, we must look to the environment and social structures of these very early humans to gain insights into our own learning and behaviour.

Barkow, Cosmides and Tooby (1992), in their manifesto for the field of evolutionary psychology, are at pains to point out that this approach is a conscious attempt at the alignment of the social sciences with the 'hard' sciences such as biology, chemistry and physics. *"…This new field, by focusing on the evolved information—processing mechanisms that comprise the human mind, supplies the necessary connection between evolutionary biology and the complex, irreducible social and cultural phenomena studied by anthropologists, sociologists, economists and historians"*(ibid p.3). The authors continue, *"Conceptual integration—also known as vertical integration— refers to the principle that the various disciplines within the behavioural and social sciences should make themselves mutually consistent, and consistent with what is known in the natural sciences as well"(Barkow 1980b,1982, 1989a; Tooby and Cosmides, 1992).* (Barkow, Tooby and Cosmides 1992, p. 4) They say that the natural sciences are already consistent; *"A compatibility principle is so taken for granted in the natural sciences that it is rarely articulated, although generally applied; the natural sciences are understood to be continuous"(*ibid). However,

> Such is not the case in the behavioural and social sciences. Evolutionary biology, psychology, psychiatry, anthropology, sociology, history and economics largely live in inglorious isolation from one another….The behavioural and social sciences borrowed the idea of hypothesis testing and quantitative methodology from the natural sciences, but unfortunately not the idea of conceptual integration (Barkow 1989a, Tooby and Cosmides 1992)(ibid).

I would suggest that education could be added to their list of endeavours that are practised in isolation. For most of the twentieth century and for various reasons, the social sciences remained aloof from the others, with the understanding that to see social and behavioural phenomena in

terms of the hard sciences amounted to a reduction of human capacity to 'mere' movements of chemicals and electrical impulses. But Tooby and Cosmides stress that this is a misconception. The mechanisms of physiology are so complex and subtle as to encompass social and behavioural phenomena without restricting or restraining them; rather they *enable* behavioural and social manifestations of human potential.

For this reason Patterson's recommendation to educators in his Foreword to Sylwester (1995) is almost inescapable:

> I think we must take Sylwester's lead and educate ourselves about the development, organization and operation of the brain. We have a lot of catching up to do…Scientific discoveries will continue regardless of our response, but the loss will be great if we do not actively seek to learn about brain research to improve teaching and learning in our schools (Sylwester 1995, p. vi).

Returning to Sylwester's concise definition of learning—that it is a "*delicate but powerful dialogue between genetics and the environment*"—it is clear that 21st century understandings of genes/environment interaction have many implications for parents and educators. For most of the twentieth century, debates about what drives development were characterised by dichotomies such as nature/nurture, genes/environment, biology/culture, the prevailing theories explaining phenomena by "*seeking causes in the child, in the environment, or in some combination of the two*" (Dent-Reed and Zukov-Golding 1997, p. 3). Explanations were hindered by relativistic thinking, in terms of an active or passive child in conjunction with an active or passive environment. Gesell and McGraw, for example, hypothesised that both child and environment were relatively passive, (Gesell 1939, McGraw 1932, cited in Dent-Reed and Zukov-Golding

1997) whilst a "*passive child and an active environment are assumed by both behaviorism and psychodynamic theory*" (ibid).

Most twentieth century perspectives share certain assumptions about organisms and environment that come from a Neo-Darwinist stance, which may in turn be summarised with the help of two maxims:

a) genes control physiology and behaviour over the course of development, and b) organisms survive by adapting to a pre—existing environments...Environmental variations affect evolution of individual development, but it is always the organism that evolves, rather than the organism— environment system...In this view the environment is both distant from organisms and autonomous in relation to them. (Ho 1991)(ibid p. 4).

Psychological theories also harbour an assumption of separation between organism and environment. The prevailing view "*...requires that mechanisms inside the child mediate between mind and body, controlling behaviour and development...but this dualism or separation of one from the other precludes adequately explaining behaviour or development*" (ibid p. 5). There is therefore growing dissatisfaction with this type of theory, and research in the last twenty years has led "*...to the understanding that organisms and the environment do not 'interact' or cause each other...Organisms and environment form reciprocal wholes, in which each plays a complementary role: organisms act and adapt, environments support and surround* (ibid p. 7). I would add here that the latter description of environments seems to hark back to Walter Cannon's 'polyanna' view of the world (see Richards 1970, p. 55); environments can also attack and engulf for example, even when they are forming 'reciprocal wholes.' But going back to the subject of genetic 'blueprints,' Dent-Reed and Zukov-Golding continue:

The problem with assuming pre-existing plans as the source of organisation in the organism or in the development of the organism is one of infinite regression. The result is a futile search for the 'head' decision maker. Such plans never actually explain the source of behavioural organisation. Finite physiological mechanisms and anatomical architecture cannot contain the infinite possibilities available in emerging behaviour (Read 1985; Shaw and Bramford 1977, cited in Dent-Reed and Zukov-Goldring 1997, p. 8).

In biological anthropology a similar point is made. Development is not something that 'happens' to a figure in a ground, at a particular time; "*the biological process of becoming an organism continues through the life course; it is life*" (Ingold 1991a, cited in Dent-Reed and Zukov-Goldring 1997, p. 8).

An emerging set of theories has thus taken a less relativistic view, known as a 'systems' approach to development. This set includes the approaches known as ecological realism; dynamic systems; and epigenetic systems. These assert in different ways that "*...the effects of organism and environment are inseparably linked: they do not make separate contributions to development...organisms and environments form reciprocal wholes, in which each plays a complementary role...These scientists ask:* ***How*** *(*emphasis mine*) do organisms adapt and environments surround*?" (Dent-Reed and Zukov-Goldring 1997, p. 9). See Dent-Reed and Zukov-Goldring 1997 for a full discussion of the merits and demerits of the approaches mentioned above.

Oyama et al (2001) have also criticised theories continuing to use the tradition nature/nurture vocabulary. In their view, efforts have been made to conceptualise the developmental process as an interaction between the two; yet these have done little more than reduce the argument to quantities and proportions within the dichotomy (Oyama et al 2001). However, as I have said, rather than continuing to force these beleaguered terms into inappropriate service, some researchers have rejected the dichotomy in a more radical way, and have come to conceptualise both development and evolution as "*processes of* ***construction*** *and* ***reconstruction*** [emphasis theirs] *in which heterogenous resources are contingently but more or less reliably reassembled for each life cycle*" (Oyama et al 2001, p. 1).

For these researchers, there is no one locus of control in development, and neither is there a quantifiable splitting of two loci. Rather, every element is seen to be dependent on every other. "*Oyama has argued that if these vexed terms* [nature and nurture] *are to be retained, then 'nature' should refer simply to outcomes, and 'nurture' to the processes that produce, maintain and alter these outcomes"(*Oyama 1985, cited in Oyama et al 2001, p. 8). In this approach, a wide range of resources is understood to be inherited, including such diverse elements as DNA, nutrients, temperature, and child care practices (Oyama et al 2001, p. 4). A new organism constructs its niche and is constructed by it; every variable depends on every other.

This, then, is the DST-derived picture of adaptation and adjustment. But how is it possible to conceptualise education in such a shifting, nebulous scene? We cannot see it in the conventional way. Considering DST's habit of deconstructing traditional boundaries between concepts and disciplines, Ingold advocates an obviation approach: "*the human being is not a composite entity made up.of separable but mutually complementary parts, such as body, mind and culture, but*

rather a singular locus of creative growth within a constantly unfolding field of relationships" (Ingold 2001, cited in Oyama 2001, p. 256.) He sees education as a process of

> guided rediscovery, where what each generation contributes to the next are not rules and representations for the production of appropriate behaviour but the specific conditions of development under which successors, growing up in social world, can build up their own aptitudes and dispositions….The process of learning by guided rediscovery is most aptly conveyed by the notion of *showing*...Learning in this sense is tantamount to what Gibson (1979, p. 254) called an "education of attention"…we learn to perceive by a fine—tuning or sensitization of the entire perceptual system[1]...Through this process the human being emerges…as a center of awareness and agency whose processes resonate with those of the environment (Ingold 2001, p. 272, cited in Oyama et al 2001.

The systems view also informs Ridley, who notes that in current discourse, the notion that genes provide 'fixed' programmes of information is no longer accepted. Curiously, his language harks back to a more dualistic approach which in many ways contradicts his message; however, leaving that aside, we can nevertheless benefit from his explanation:

> Genes themselves are implacable little determinists, churning out utterly predictable messages. But because of the way their promoters switch on and off in response to external instruction, genes are very far from being fixed in their actions. Instead, they are devices for extracting information from their environment. Every minute, every second, the pattern of genes being expressed in your brain changes, often in direct or indirect response to events outside your body (Ridley 2003, p. 248).

In terms of education, Parents and teachers are of course *parts* of a child's environment. Ridley suggests that the way adults behave with respect to the child can alter the expression of the child's genes from moment to moment. It is not, as has been previously assumed, that a genetic

expression is fixed. It is malleable; Ridley even suggests that nature is *more* malleable than nurture. Referring to the Human Genome Project, he writes,

> The discovery of how genes actually influence human behaviour and how human behaviour influences genes, is about to recast the [nature v. nurture] debate entirely. No longer is it nature versus nurture, but nature via nurture. Genes are designed to take their cues from nature. To appreciate what has happened you will have to abandon cherished notions and open your mind. You will have to enter a world where your genes are not puppet masters pulling the strings of your behaviour, but puppets at the mercy of your behaviour; a world where instinct is not the opposite of learning, where environmental influences are sometimes less reversible than genetic ones, and where nature is designed for nurture…The more we lift the lid on the genome, the more vulnerable to experience genes appear to be (Ridley 2003, p. 3-4).

And if genes are 'vulnerable,' it must matter what adults do in relation to children; how we behave, what our assumptions are, what sort of interactions we have. Of course, no parent or educator would ever have said that it *doesn't* matter, though Rich-Harris (1998) has suggested that parents matter less than common experience would lead one to suppose. But assuming that what adults do in relation to children *does* matter, yet keeping in mind the shifting, non-relative quality emerging from new research, what sort of understanding can inform these interactions?

I suggest that the study of adaptation is a rich resource in this respect, particularly through the interrelation of questions referring to adaptation at the level of both individual and species: 'How do individuals adapt at the beginning of life?' and 'What are we as a species adapted to, or for?'

In general, "*adaptability, in the sense of the capacity to act flexibly and to respond to very different environmental circumstances, to different social contexts and to different technical*

problems, is a characteristic of the human species…" (Harrison and Morphy 1998, p.v). Further, it is important to note that adaptations occur in particular contexts, and over periods of time. As Ernst Mayr states, "*New adaptations are ordinarily acquired quite gradually*" (Mayr 2002, p.172.) A revolution in context, that is a sudden and pervasive change, triggers adaptive processes, and these take time. Equally, the time spent in the milieu before the change must also be taken into account. In general, the longer a population is in a milieu, the better it will be adapted to it. Adaptation is physiological work; thus if the original state obtained for much longer than the new one, there is the implication that the pre-revolutionary context will remain that which a population is better adapted to, for some period of time after the revolutionary event. Though outwardly the milieu has changed, for most individuals the genetic structure will still be the same; the old milieu is still physiologically 'expected'.

The Contribution of Evolutionary Psychology

As Barkow et al state, referring to contributed papers in their seminal work setting out the tenets of Evolutionary Psychology, The Adaptive Mind (1992), *"[An] assumption made by most of the contributors is that the evolved structure of the human mind is adapted to the way of life of Pleistocene hunter-gatherers, and not necessarily to our modern circumstances*" (Barkow, Tooby and Cosmides 1992, p.5). This is an assumption that needs explanation, and the authors accomplish this persuasively. It is therefore worth quoting at length:

> What we think of as human history—from, say, the rise of the Shang, Minoan, Egyptian, Indian or Sumerian civilizations—and everything we take for granted as normal parts of life—agriculture, pastoralism, governments…and so on—are all the novel products of the last few thousand years. In contrast to this, our ancestors spent the last two million years as Pleistocene hunter-gatherers, and, of course, several hundred million years before

that as one kind of forager or another. These relative spans are important because they establish which sets of environments and conditions defined the adaptive problems the mind was shaped to cope with: Pleistocene conditions, rather than modern conditions. This conclusion stems from the fact that the evolution of complex design is a slow process when contrasted with historical time. Complex, functionally integrated designs like the vertebrate eye are built up slowly, change by change, subject to the constraint that each new design feature must solve a problem that affects reproduction better than the previous design. The few thousand years since the scattered appearance of agriculture is only a small stretch in evolutionary terms, less than 1% of the two million years our ancestors spent as Pleistocene hunter-gatherers. For this reason, it is unlikely that new complex designs—ones requiring the co-ordinated assembly of many novel, functionally integrated features—could evolve in so few generations (Tooby and Cosmides 1990a, 1990b). Therefore, it is improbable that our species evolved complex adaptations even to agriculture, let alone to post-industrial society. Moreover, the available evidence strongly supports this view of a single, universal panhuman design, stemming from our long-enduring existence as hunter-gatherers.[2] If selection had constructed complex new adaptations rapidly over historical time, then populations that have been agricultural for several thousand years would differ sharply in their evolved architecture from populations that until recently practised hunting and gathering. They do not (Barkow, 1980a, 1989a, 1990).

Accordingly, the most reasonable default assumption is that the interesting, complex functional design features of the human mind evolved in response to the demands of a hunting and gathering way of life. Specifically, this means that in relating the design of mechanisms of the mind to the task demands posed by the world, “the world” means the Pleistocene world of hunter-gatherers….Finally, it is important to realise that behaviour generated by mechanisms that are adaptations to an ancient way of life will not necessarily be adaptive in the modern world (Barkow, Tooby and Cosmides 1992).

Rather, the degree of deviation encountered from that ancient way of life suggests the amount of adaptive work to be done.

Physiological Expectation

The ‘individual’, then, can be seen as (though not reduced to) a mutual, many dimensional interaction between inherited material which relates and refers to what may be encountered, and that which is actually encountered in the course of an individual’s development. The inherited material will relate to that which is ‘expected’, that is, the context in and along with which our minds evolved: the Pleistocene world of hunter-gatherers. These relations and references are based on the accumulated experience of a species over evolutionary time. And evolutionary time, in relation to an individual human life, with its encounters, responses, behaviours and so on, is undoubtedly long. Dawkins, using more mechanistic language but nevertheless making a valid point, explains the ramifications of this relationship:

> Genes work by controlling protein synthesis. This is a powerful way of manipulating the world, but it is slow…The whole point about behaviour, on the other hand, is that it is fast. It works on a time-scale not of months but of seconds and fractions of sections…Genes don’t have reaction-times like that…[They] can only do their best *in advance* by building a fast executive computer for themselves, and programming it in advance with rules and ‘advice’ to cope with as many eventualities as they can ‘anticipate’. But life, like the game of chess, offers too many different possible eventualities for all of them to be anticipated. Like the chess programmer, the genes have to ‘instruct’ their survival machines not in specifics, but in the general strategies and tricks of the living trade.
>
> As J.Z. Young has pointed out, the genes have to perform a task analogous to prediction. When an embryo survival machine is being built, the dangers and problems of its life lie in the future. Who can say what carnivores crouch waiting for it behind the bushes, or what fleet-footed prey will dart and zig-zag across its path? No human prophet, nor any gene. But some general predictions can be made (Dawkins 1989, p. 54-55).

The working assumption of evolutionary psychology is that what is ‘generally predicted’ by the genes would be a milieu akin to the world of the Pleistocene hunter-gatherer. When that which is

encountered is at variance with what is ‘anticipated’ or ‘expected’, the organism must somehow handle the information.

Variation in Adaptability

This then suggests another dimension, which is individual variation; some individuals appear to be more adaptable, better able to handle information about difference-from-expectation, than others. One organism is ‘less adaptable’ than another, more dependent upon the encounter matching or being similar to the expectation. One could in fact postulate an ‘adaptability spectrum’ reflecting these varying dependencies. Where that which is encountered deviates past a certain threshold from the expected, the level of physiological stress rises, with varying manifestations of that stress in behaviour.

The question then arises, why should some children be more adaptable, in this sense, than others? Why should some get through challenges relatively unscathed, while others are affected adversely? Children are more adaptable if upon encountering deviation from their physiological expectations, they are able to perceive the encountered thing or event ‘metaphorically’: as if their systems say, ‘Yes, this can stand for that, this is acceptable.’ They are less adaptable if they perceive the encountered as necessarily other: ‘This is different from that and cannot stand for it. What I encounter must be close to what I expect.’

But why should these variations exist? Belsky’s answer, which I have discussed on page 71, is a good start: “*…It might make most sense for natural selection to preserve genes for various versions, or morphs, of the species*” (Belsky 1997, p. 184-85). Children respond in different

ways to challenges because variation, different possible scenarios in the population for development, maturation, reproduction and so on, make survival on the grand scale more likely, make the system more robust.

Further, if we look at this question even more closely, perhaps it is not that some children are 'more adaptable,' even in the sense I have suggested, than others. Rather, some children's adaptive patterns result in compromises that cause them obvious difficulties, whereas other children's patterns result in compromises that cause them less obvious difficulties. In one sense all human beings undergo a limitation process, a compromise, as they adapt to their surroundings in order to survive; and yet, can survival really be called a compromise? It buys individuals time to experience life and to know themselves and their adaptive structures. As far as that goes, then yes, human beings are more or less adaptable. But if the person's goal is not simply to survive, but also to be whole, then there is a challenge inherent in the compromise—to know oneself, to lose the unnecessary aspects of these adaptive patterns as one matures and to experience not just life but also wholeness in life.

From this perspective, everyone adapts, with more or less obvious difficulty. Further, if this is the case, then one may be led to question the idea of a child's being 'at risk' of developing a limiting response to adverse experience. To entertain this concept we have to divide the human population into those who are 'at risk of being less adaptable' (already an awkward construct) and those who are not, when in fact the process of adaptability are so ubiquitous as to be almost identical to life itself. Every child needs to adapt, and therefore every parent needs to be aware of adaptive processes and the signals their children give as to what constitutes a challenge for them. Ideally, vigilance of this kind would be enjoined by the most basic education plans for all

parents, as ‘normal’ as knowledge of how to wash babies or support their heads. The social stigma, psychological consequences (such as parents’ fear and anxiety about their role in raising an ‘at-risk’ child) and other iatrogenic effects of being designated ‘at-risk’ which began to be identified in the late 1960s and early seventies (see Alberman and Goldstein 1970; Oppé 1967) would then be removed, and the concepts made available to benefit all families, whether any ‘risk factors’ have shown up heretofore or not. However, the literature on this subject is vast, and an in-depth evaluation of it in relation to the theory of adaptive stress might be a useful topic for further research.

Questions may also arise as to the amelioration of the effects of a challenging encounter upon a child, after the fact. This is a difficult area, which is addressed by a number of therapeutic methodologies, some of which appear to help some children, sometimes. Nutritional challenges, for example, may be addressed via carefully managed diets, while early developmental difficulties are addressed by Neurodevelopmental Therapy as practiced by Goddard and her colleagues, and, in a different way, by practitioners of the Raviv method; birth trauma has been addressed by psycholanalytic practitioners following on from the work of Otto Rank (1929); and so on. But a review of the effectiveness of these is beyond the scope of this paper. My view is that an understanding of the principles of adaptive systems as I have outlined them here may best help to prevent difficulties arising. They may also suggest a coherent view at the level of adaptive systems, from which the perceived effectiveness, or not, of these therapies, may be understood. The principles may also provide a blueprint for a path towards amelioration after the fact in the sense of ‘returning’ to healthful practices based on an individualised understanding of what we are adapted for. It provides a context, for, for example, diets which recommend the removal of foods such as wheat and dairy products. These are discussed in Chapter Three.

I shall return briefly to a consideration of some of these concepts and to the literature on 'at-risk' categories in the Conclusion. But I would like at this point to look at the concept of stress, as relevant to the chapters that follow.

Stress—its nature and relevance

In his writings on the scientific analysis of stress, Hans Selye defines stress as *"The non-specific response of the body to any demand made upon it"* (Selye 1974, p.14). He continues,

> To understand this definition we must first explain what we mean by *non-specific.* Each demand made upon our body is in a sense unique, that is, *specific.* When exposed to cold, we shiver to produce more heat, and the blood vessels in our skin contract to diminish the loss of heat from the body surfaces. When exposed to heat, we sweat…Yet, no matter what kind of derangement is produced, all these agents have one thing in common; they also increase the demand for readjustment. This demand is non-specific; it requires adaptation to a problem, irrespective of what the problem may be.
>
> In other words, in addition to their specific actions, all agents to which we are exposed also produce a non-*specific* increase in the need to perform adaptive functions and thereby to re-establish normalcy. This is independent of the specific activity that caused the rise in requirements. The non-specific demand for activity as such is the essence of stress" (Selye 1974, p.15).

Being non-specific, it is in a sense a *meta*-response; it represents a higher level of abstraction in the *hierarchy* of responses. Its information is *about* the specific responses, rather than being one of them. (cf Bateson on logical hierarchies, below) Recent discoveries in genetics also point to the existence of *meta*-information. Some genes, for example, are regulated by other genes: *Hox*

genes are the recipes for proteins called 'transcription factors', which means that their job is to 'switch on' other genes…Each transcription factor is itself a product of another gene somewhere else in the genome. The function of many genes is therefore to help switch other genes on or off (Ridley 2003, p. 31-32). Again, the information carried in these genes is *about* the functioning of the other genes. It is *meta*-information.

I shall return to this later, but again for now it may be enough to say that each individual therefore manifests a unique generalised state of adaptation, relevant to the time and events of the 'revolution', or departure from the expected state of the milieu, and determined also by his or her degree of adaptability.

Thus the discontinuity between what an organism 'expects' and what it encounters, along with the 'placement' of that threshold, I propose to call 'adaptive stress'. With this concept in place it becomes possible to enquire about the relation between adaptive stress and the processes and mechanisms of learning. Following a discussion (chapter 2) of issues forming the basis of the argument, I will look at five areas relevant to the beginning and first few years of life. These comprise chapters three to seven:

3. Nutritional Stress

4. Birth-related Stress

5. The Immediate Post-partum Period

6. Freudian Concepts Relevant to Early Experience

7. Early Movement and Play

8. Conclusion

The aim of this thesis then is to develop a conceptual framework for understanding adaptive stress and its significance. I shall develop this framework by reference to the relevant literature. Related to this aim is the aspiration that this framework could form the basis for further empirical work and could serve as guidance for parents and educators, to help them place their ongoing observations of a child, and perhaps to inform their thinking, attitudes and decisions. It is my hope that it may help one day to determine a path toward, as Csikszentmihalyi (1988) put it, ‘optimal experience.’

CHAPTER 1

METHOD AND FURTHER THEORETICAL FOUNDATIONS

The idea of adaptive processes in the individual as a general 'causative'[3] factor in relation to learning capabilities, and that an individual's adaptive capacity could be challenged and even exceeded, developed in my mind over many years of teaching and working with students with special needs. I hypothesised that demands placed upon the adaptive system could be such that, in development, adjustments have to be made, and in this process of adjustment learning capacities could be compromised; as if the message were something like 'I cannot take in this new information as I am already occupied to the limit of my adaptive capacity,' or 'I am already adjusting to factor *x*, I cannot adjust to factor *y* as well.' I then began to formulate this as a question of 'physiological attention.' Could one interpret and re-state the message above as 'If the interior or physiological attention is occupied to *x* degree, it is not available for learning, to a related degree'?

The relation between adaptation and learning had been set out, and superlatively so, by Gregory Bateson, in his 1979 book, Mind and Nature. He writes:

We face then, two great stochastic[4] systems that are partly in interaction and partly isolated from each other. One system is within the individual and is called *learning*; the other is immanent in heredity and in populations and is

called *evolution.* One is a matter of a single lifetime; the other is a matter of multiple generations of many individuals.

…These two stochastic systems, working at different levels of logical typing, fit together into a single ongoing biosphere that could not endure if either somatic or genetic change were fundamentally different from what it is.

The *unity* of the combined system is *necessary* (Bateson 1979, p. 162).

His book is an explanation of and an argument for this unity, which I cannot hope to summarise here. But, this being assumed—that the two are parts of one system—it is surely no surprise that one process should inform the other; that the process of adaptation should have bearing on the process of learning. The latter would include potentially infinite examples of specific learning as well as the higher order or meta-learning which can be called 'capacity to learn.' I began to look for traces of this meta-learning, and particularly the type of meta-learning that expresses a relationship, whereby an expected or unexpected encounter is followed by an actual encounter. This is explained more fully in the Introduction, but, to summarise again, the collective genetic memory of a species includes information about expected classes of encounters. However, encounters may occur which depart from the expected. These must then be attended to, or adjusted for, and these adjustments require some kind of attention and possibly a certain amount of time.

Let us take as an analogy the experience of an event planner who knows she will be leaving the post and so writes down a set of instructions for the new employee. She tries to foresee all eventualities. But inevitably something happens to the new recruit that is not included in the instructions. It is not expected and therefore not prepared for. For example, an event planned for older people would take into account mobility issues, special diets, the need for the event to be

within in certain time frame, and so on. But then someone arrives with a baby, whose needs must also be met. Where can the mother and baby go to attend to these needs? What facilities have we? No doubt something can be arranged, but it has to be *attended to*, by the planner. Time and attention are taken. The planner may therefore miss crucial information given out at that time, or miss the cue to give out information herself. Now imagine that something different but similarly unexpected happens at every such event, and each time, because the event is not in the instructions, the planner is unprepared. Each time, then, a problem of missed information may arise. We have a pattern here of expectation followed by an expected or unexpected encounter, followed by adaptation or adjustment.

I considered the possibility that 'adjustment' could have either positive or negative effects, or both. Adjustments could for example enhance survival, yet compromise learning. With that in mind I began to articulate the theory according to four assumptions:

1) that inherited information, based on past collective experience, includes that which refers to possible future interactions-in-environment

2) that longer periods of time afford more opportunities for optimal adaptation than shorter periods of time

3) that the mode of interaction-with-environment in which our species has existed for the longest period of time is that of the hunter-gatherer, and

4) that we are more likely to be better adapted to the hunter-gatherer mode of interaction-with-environment than to other, more recent modes.

The theory then states that experienced deviations from the hunter-gatherer mode would require some sort of adjustment on the part of the individual. Each would have to adjust, interpret and

adapt the interactions between the interior messages and those from the environment. For some individuals—those who are 'less adaptable'—the deviation would be sufficient to be considered 'stress'. For these individuals the stress would require attention at some level, whether physiological or conscious; their attention would be occupied to that degree and therefore unavailable for new learning to that or a related degree. For those who are 'more adaptable' the deviation would not be sufficient to be considered 'stress' and therefore would not necessitate special attention, or would not necessitate it to a significant degree. For both cases I employed the term 'adaptive stress.'

An important adjunct to this theory is the idea of a 'spectrum of adaptability', which acknowledges that some individuals are more adaptable than others. A deviation from expectation would be responded to as 'insignificant' by some, yet 'highly significant' by others. I shall return to this point later.

Formulation of the Theory and Investigative Method

But at the point of formulating the theory, questions arose such as, 'what thought processes am I using in its formulation? How sound or unsound are these processes? Do they contain obvious errors or logical fallacies, or would they be supported by a comprehensive study of the published literature?'

This latter question became the basis for the method I have followed in the course of this investigation. Although the majority of research begins with a short search through the literature on the chosen subject, and then continues to an empirical investigation, I chose to focus on the

literature search itself, to extend and expand it to include discussions of work in a wide range of disciplines. As mentioned in the Introduction, these include Educational Theory and Psychology, Nutrition, Evolutionary Psychology, Freudian Psychology, Anthropology, Sociology, Obstetrics, Nursing, Education and Special Education. There was too much material simply to deal with it in one chapter, and a quick review would not have yielded the depth of understanding that I was seeking. The ideas needed to be drawn together from these different disciplines and brought into clear and coherent form, then reviewed and analyzed before any suggestion of empirical work could be brought forward. I concluded that an extended literature search was the most appropriate form for the investigation to take at this stage. It would either support the theory and suggest ways forward in terms of empirical work, or refute it by making clear the errors employed in formulating it.

I began to look for the pattern mentioned above at each stage of the developmental timeline, and because human development is studied in many ways, I looked for the pattern across a wide range of disciplines.

I refined the search by imposing the element of time and the context of human development from conception to pre-school age. This imposition followed from my initial stance as a therapist/educator, my overriding concern being the development or, by contrast, compromise of learning capacity in children.

The developmental timeline itself gave me foci corresponding to the major encounters in the early years, that is, nutrition *in utero*, the birth experience, the experience of care in the in-arms

period, and of movement and play. These foci are perhaps arbitrary, and the reader may no doubt be able to point out many others of importance. But these are the ones that have appeared most relevant here.

This thesis is concerned, then, with the development of a framework for understanding the place of adaptive stress in learning and in failure to learn. My concern is with the paucity of understanding concerning this as a source of difficulty. Most analyses of learning failure, in my experience, seek straightforwardly teleological accounts of learning failure (see Thomas and Loxley, 2007 for a critique), trying to find—as in many psychological accounts—hypothetical constructs such as memory deficit, or—as in more sociologically constructed accounts—sources of failure in social or institutional systems.

Bateson's more ecological account, by contrast, draws together different kinds of information and his lead has of course been developed in much of the work I have cited thus far. This development in the understanding of the provenance and the role of stress, however, has not been drawn upon in the context of learning difficulties and it is the lacuna in the literature which I wish to address in this thesis, developing a model for framing the role of stress in learning failure. I therefore intend to review the relevant literature in this thesis with a view to synthesising some varied understandings about the role of stress and formulating a concept of adaptive stress. In having done this, my recommendations will not be straightforwardly practical but will relate to the direction of further research. Given the frameworks or models which I hope to be able to propose, further research will be able to test and possibly draw from these.

One of my theoretical guides in the development of this literature based synthesis is in the ideas of Charles Peirce and in particular his promotion of the idea of abduction as a search method. He "*suggests that it involves surveying a number of phenomena, observing patterns, and forming an explanatory or causal hypothesis*" (Proctor and Capaldi 2006, p. 73). This is the search method I have employed in the formulation of the theory of adaptive stress. Proctor and Capaldi continue, "*Essentially, the scientist is saying that if this generalisation were true, then the world would be as she observes it*" (ibid).

The authors also state that a second important idea in abduction as a method is a test of the hypothesis in the context of competing hypotheses, as theories cannot be well evaluated in isolation. The abductive method, then, seems by this account to include its own evaluation—it is a valid method *if* it includes a comparison of the theory in question with its "*extant rivals,*" as Laudon (1997, cited in Proctor & Capaldi 2006) put it.

Proctor and Capaldi's third element of abduction is as follows :

We not only evaluate theories in the context of other theories, but we attempt to come to a global conclusion as to which of the theories best satisfies the evidence at hand. This procedure, known as *inference to the best explanation*, was first suggested by Harman (1965), although Thagard (1988) indicates that it was used informally for centuries before" (Proctor & Capaldi 2006, p. 76).

Laudan warns that without this third element, a theory cannot be pursued. It is not enough that a theory solves certain problems well, or is highly progressive. "*Only when we compare its*

effectiveness and progress to that of its extant rivals are we in a position to offer any advice about which theories should be accepted, pursued or entertained" (p. 86), cited in Proctor and Capaldi 2006, p. 76).

Thus I am using the abductive method to develop a sound theory of adaptive stress, and using inference to the best explanation to test the soundness of the method itself.

In order to be sure of the soundness, then, of the method employed in formulating the theory of adaptive stress, one is given the task of presenting rival theories. Rivals would be those dealing with questions such as 'how is adaptation related to the development of learning capacity in early life?' or 'how does adjustment to an unexpected encounter affect the ability to take in new information?' And this creates a problem, as I have not been able to find any other theories addressing these issues across the developmental time-line. However, theorists addressing these issues in a partial manner could perhaps serve to stand for comparison.

A Peircean Theory of Learning

It is the contention of Wells that Charles Peirce (1839-1914), in formulating his concepts of the 'Dynamics of Belief and Doubt,' the 'Fixation of Belief' and the 'Habits of Belief,' formulated at the same time a composite theory of learning (Wells 2007, p.1). Peirce's work is particularly interesting as it is relevant both for the construction of this thesis and also for the insights he offers on learning itself. He is concerned with how beliefs and thus rigidities develop in an individuals' inner and outer worlds; rigid beliefs, as unquestioned habits of response, can compromise the ability to take in new information, [i.e. learning] and Peirce recommends

allowing doubt and questions to remain unresolved for as long as possible. As Wells puts it, "*The great danger of any belief is that it terminates inquiry*" (Wells 2007, p.4). In Peircean terms, then, learning can be best accomplished by staying open to multiple possibilities for the resolution of doubts or questions, rather than responding to encounters by formulating beliefs, which then create limiting structures in the mind. Remaining consciously open in this way could probably serve as an analogy to physiological openness, or adaptability.

Peirce makes the point that beliefs are easier to hold than doubts; beliefs are comfortable and doubts uncomfortable, such that there may be a tendency in any group of people to seek comfort in beliefs rather than tolerate the discomfort of unresolvedness. Yet the latter undeniably yields better results: "*As a rule of thumb, the longer we are able to leave a doubt unresolved—the greater our toleration for the irritation of doubt—the more likely its ultimate resolution will withstand thorough analysis*" (Wells 2007, p. 5).

So Peirce is discussing how we build barriers against new learning and, conversely, how we refrain from doing this by accepting the discomfort of unresolved issues and thus remaining open to new learning. Again, this is in the realm of conscious belief; or rather, it relates to both unconscious and the conscious realms: the more toward remaining open individuals allow themselves to go, the more they are consciously addressing and being aware of unconsciously held beliefs and refraining from allowing them to dominate the possibilities for learning. His theory of learning, if that is what he intended it to be, is thus compatible with that of this thesis, but is less comprehensive, dealing, as it does, only with conscious and unconscious thought processes and not with the other issues relevant to learning and adaptation, particularly those related to physiology, that I have outlined below.

It is interesting, though, that "issuing a command to one's future self," mentioned above, is so like the concept of genes as 'instructors' with regard to an organism's future encounters. And thus here we enter again the unconscious realms of adaptation and survival—physiological processes, that also, according to the hypothesis I am putting forward, influence the degree of openness to new encounters or new learning.

Bateson's Theory of Learning

And this brings us back to Gregory Bateson as the source of another possible rival theory of learning. Bateson sees survival and learning as linked by concepts of 'information.' Survival, he says, "*…depends on two contrasting phenomena or processes, two ways of achieving adaptive action. Evolution must always, Janus-like, face in two directions—inward toward developmental regularities and physiology of the living creature and outward toward the vagaries and demands of the environment*" (Bateson 1978, cited in Harries-Jones 1995, p. 77).

An individual survives if the information exchange, or conversation, between these two realms is sufficiently rich, that is, both varied and accurate; and if the organismic process of the body are able to respond sufficiently well to the news, or information, provided in that conversation.

But what if there is too much news of difference—too much for the adaptive system to cope with? Or what if survival, won via the interpretation of that news, is bought at the cost of the ability to remain open to new learning? To understand Bateson's ideas about learning, we need to look at how he developed them, and how his development of them took the course it did in his lifetime.

Early in his career (1950s and 60s), Bateson had espoused a theory of learning based on Bertrand Russell's understanding of logical types, and had categorised learning into 4 groups: Learning 0, I, II and III. Very briefly, 'Learning 0' is direct intake of stimuli; 'Learning 1' enables interpretation of Learning 0; 'Learning II contextualises the experience of Learning I; Bateson called this 'deutero learning'. 'Learning III' contextualises Learning II: learning about learning to learn. Many problems in learning, he said, can be traced back to errors of this sort of logical typing. In trying to learn new behaviours, for example, an error would be simply to try to change the behaviours concerning the direct intake of stimuli, whilst the problem has its source in a higher level: it is a problem *about* the taking in of the stimuli. (Bateson 1968). Bateson spent a great deal of time working with these concepts (Harries-Jones 1995, *n7*.p. 289-90.) But by the 1970s Bateson had moved on from the rather ladder-like structures of logical typing, to a much more complex and holistic view of learning, one which took into account the contexts of biology and evolution (a fact seemingly not recognised by educationalists today who still refer to Learning 0-III as 'Bateson's Levels of Learning' (see Atherton 2009, Visser 2003)).Harries-Jones explains, "*What Bateson was groping for was a common set of principles which would be suitable to describe adaptation in the biological sense of the term, which would account for cultural habits or customary behaviour, and which would also hold true for the psychological phenomenon of 'habituation*' "(Harries-Jones 1995, p. 110). Habits appeared to depend on context, and learning about context is an abstract sort of learning:

…but it is the more abstract ideas of context that tend to sink in, become less conscious and 'habituated' than most. As contexts sink into habits, they become more difficult to disrupt, more difficult to change, because new information has become organised around the habituated contexts. To change habituated contexts involves changing

a whole field of superficial ideas which a person does not usually want to disturb because people do not want continually to think through problems that they have thought through before (ibid p. 112).

Bateson began to incorporate cybernetic principles into his ideas about learning, notably those of Ashby, and proceeded with the notion that

processes of adaptation are related to 'context,' describing the latter as transforms of different levels of difference. In this sense, learning has a definite analogy to levels of behaviour promoting survival in evolution. The 'what' in both human learning and in evolution…was some form of mapping of variety and difference, incorporating a difference contexts and levels of context (ibid).

Harries-Jones continues, showing that this mapping, in Bateson's view, is

…not equivalent to a signal bearing direct adaptive information for the organism. Instead the signal is 'about' conditions outside the organism. While there is always some direct stimulus from the environment to the organism, stimulus-response does not describe the relation between the organism and its environment. What an organism senses in its immediate environment is a signal which its sensory receptors recode, converting direct signals into a transform of difference. The transform of difference permits the context of learning to be taken into account (ibid, p.113).

Bateson is illuminating here, in a very interesting and useful way, the subtle conversation between individual and environment to which I alluded above. But to my knowledge Bateson never turned his theory of learning in the direction of development and early life. He became more concerned with environmental issues, and the capacity of adults to change their behaviours, as individuals, and also as institutions, nations and so on, toward a more sustainable relationship

with the natural world. So although Bateson's 'map' covers some similar ground, it is not as comprehensive as the present theory, nor as useful for evaluating adaptive processes and stresses in early life and their effect on learning capacity.

Atherton and Problematic Learning

Atherton, however, took his interest in Bateson's early learning theory into the realm of learning and learning problems, or 'resistance to learning.' Like Bateson and Peirce, he looks at 'habituated contexts', where a set of learned relations is difficult to change. He contrasts 'additive learning,' in which new knowledge or skills are added to an existing repertoire, with 'supplantive learning,' in which previous ways of acting or prior knowledge are called into question or even replaced. The latter is the more costly, psychologically, as it entails loss. "*Implicit*," says Atherton, "*in the present discussion is a model of the learner as a survivor. This may appear too banal an assumption even to record, but it does have a number of implications*" (Atherton 2008, p.2). First, it focuses on the survival-value of the learning for the individual; and second, it "*opens up.the possibility of drawing on the theory of survival—evolution theory—to locate experience in its context*" (ibid).

Thus a threatening experience for a person who has little adaptive capacity may result in the formation of new defensive withdrawal structures in the individual's psyche, or the bolstering of old ones, such that survival is bought at the price of decreased availability for new learning. Atherton uses the phrase "*problematic supplantive learning*" to describe this strategy/dilemma. He is addressing issues which occur in adult education, thus the 'problem' manifests as unwillingness to change existing habits. But it may also be possible to see the 'supplanting' as

supplanting an expected situation, eg the ordinary priority of learning, where survival is not in question. But if survival *is* in question, then the tables are turned, and learning must come second. Further, if these reversed priorities occur too often, it is possible that certain aspects of development would be compromised.

To summarise Atherton: his study of problematic learning in adults provides a useful perspective, particularly the concept of problematic supplantive learning, which highlights the crucial relationship between learning and survival. He worries that his model of learner as survivor "*may be too banal an assumption even to record,*" (ibid) but his assertion that it nevertheless has a number of implications would be confirmed, I believe, by the findings set out below. However, because the subjects of his research are adults, his theory is only partially applicable to the present investigation of the development or compromise of learning capacity in early life.

Summary of 'Rival' Theories

Aspects of work of all three writers here discussed would appear to support the contentions of this thesis. Although Bateson ultimately took his research in a different direction, the direction taken here would appear to be compatible with the ideas he set forth in his lifetime. Parts of Charles Peirce's theory of learning can also be seen as supportive, as can Atherton's paper on problematic learning. However none of these can be said to draw together the theoretical threads their arguments imply, nor to weave them into a sound fabric, that is to say a coherent, if ever partial, view of learning and adaptation in very early life.

This short survey of the 'extant rivals' to the theory of adaptive stress fulfills, then, the requirement for 'inference to the best explanation' in the formulation of a theory by the abductive method. This would suggest that my use of the abductive method is as sound as possible, given the constraint imposed by the small number of rival theories, not to mention their partiality, to which the theory of adaptive stress might be compared.

Conclusion

The nature of my investigation as it unfolded suggested the use of an extended literature search across a wide range of disciplines to test the validity of my way of thinking about evolution, adaptation and the development of learning capacity. I have employed abduction as a search method, and have validated it as a method in this case through the process of inference to the best explanation, comparing theories formulated by Bateson, Peirce and Atherton which partially rival the adaptive stress theory for effectiveness in analyzing the development of learning capacity.

CHAPTER 2

NUTRITIONAL STRESS

"The origin of all common characteristics must be sought in pre-agricultural times"

-Washburn and Lancaster 1968

I have suggested the principle that, when individuals experience, in their encounters with their environments, a deviation from that which they are adapted for, there is some degree of accompanying challenge or stress. The question must therefore be asked, what *are* we adapted for? What constitutes 'environment,' and what sorts of environments are we best adapted for?

Our experience of life begins when we are no more than a fertilised egg, then a collection of cells. What we 'encounter' at this stage are nutrients circulating in our mother's body—that is, our encounters are of a chemical nature. What sort of encounters would our adaptive systems expect? In other words, what sorts of diets are our systems best adapted for?

To address these questions I return again to the hypothesis that what we are adapted for is that which we, as *Homo sapiens*, have experienced for the longest time. And there is no doubt that in terms of nutritional culture we have lived as hunter-gatherers for far longer than as pastoralists or agriculturalists.

The genus *Homo* has existed for some 600,000 years, and agriculture has been important only during the last four thousand years. Even 6,000 years ago large parts of the world's population were non-agricultural, and the entire evolution of the earliest populations of *Homo erectus* to the existing races took place during the period in which man was a hunter. The common factors that dominated human evolution and produced *Homo sapiens* were pre-agricultural. Agricultural ways of life have dominated less than one percent of human history, and there is no evidence of major biological change during that time (Washburn and Lancaster 1968, p. 293).

Indeed, the term hunter-gatherer describes all forms of life prior to the human pastoral/agricultural revolution of 8-10,000 B.C.[5] As Tudge puts it:

> Our bodies do not simply reflect the fact that we choose to call ourselves 'human'.
>
> —— before we were human we were non-human primates
>
> —— before we were primates we were non-human mammals
>
> —— before that we were non-mammalian vertebrates
>
> —— and before that, we were non-vertebrate animals
>
> —— and so on all the way back.
>
> Indeed, in our genes, we can still see the tracks of ancestors that were still microbial …We carry all this genetic and physiological baggage around with us. (Tudge 1999a, p. 2)

And, to continue the 'baggage' metaphor, when we pack our bags to go on a journey, we pack according to our expectation of what we will encounter; genetics and physiology *are* expectation.

We must ask, then, what sort of diet, which nutrients, would our systems expect as hunter-gatherers?

Because hunter-gatherers today have often been pushed to more marginal, less desirable lands than they would once have occupied, and most have adapted their practices in some way to the agricultural-industrial world around them (whether by choice or not), they may not give an entirely accurate picture of pre-agricultural life. But they can nevertheless give some idea of what our ancestors ate. The most obvious difference between our diet and theirs is of course the lack of grain and dairy products; hunter-gatherers, at least by the late Upper Paleolithic and Mesolithic (Washburn and Lancaster 1968), made their living from fruit, vegetables, nuts, seeds, fish, eggs and meat.

The San, or Bushmen, for example, as noted by Lee in 1968, consumed principally the following animal species: wart hog, kudu. Duiker, steenbok, gemsbok, wildebeest, springhare, porcupine, ant bear, hare, guineafowl, francoline (2 species), korhaan, tortoise. and python. (There are, of course, infinite variations: the author notes for example that "*such animals as rodents, snakes, lizards, termites and grasshoppers, which in the literature are included in the bushmen dietary (Schapera 1930), were despised by Bushmen of the Dobe area*," where he was working.) As for plant foods, they include eighty-five species in the following categories: "*fruit and nut, bean and root, fruit and stalk, root/bulb, berry, resin, leaves, seed/bean"* (Lee 1968 p. 34).

In Australia, an account from 1841 of the diet among aboriginals cited, for further example:

ANIMAL FOODS

6 sorts of kangaroo

5 marsupials smaller than rabbits

2 species of opossum

9 species of marsupial rats and mice

dingoes

1 type of whale

2 species of seal

birds of every kind including emu and wild turkey

3 types of turtle

11 kinds of frog

7 types of iguana and lizard

PLANT FOODS

29 kinds of root

4 kinds of fruit

2 species of cycad nut

seeds of several leguminous plants

2 kinds of mesembrianthemum

7 types of fungus

4 sorts of gum

2 kinds of manna

flowers of several species of Banksia

eggs of every species of bird and lizard

(Clark and Hindley 1975, p. 26-27).

The cultivation of grain simply does not exist in these cultures, and with very limited domestication of animals, consumption of milk in any form is so negligible as to remain unmentioned.

Seeds, however, are mentioned, and they play an important role in the change from hunting economies to agricultural ones. For societies that developed agriculture, seeds represented a crucial turning point in the enormous alterations in diet and culture that came with the cultivation of grain. Wheat, after all, is nothing but the seed of a type of grass. As Bronowski reminds us, "*Before 8,000 BC wheat was not the luxuriant plant it is today; it was merely one of many wild grasses that spread throughout the Middle East* (Bronowski 1973, p. 65). And the seed of such grasses

may have been a particularly important addition to the human diet because they are abundant and can be stored easily. Since grinding stones appear before agriculture, grinding and boiling may have been the necessary pre-conditions to the discovery of agriculture….Grinding and boiling were certainly known to pre-agricultural people. (Washburn and Lancaster, p. 295)

So it is in the late phases of hunting and gathering (see Piperno et al 2004) that seeds and grains are known and utilized, though not to the extent that we see in agricultural societies. In the bushmen study, meat accounted for thirty-three percent of caloric intake, while nuts and vegetables comprise sixty-seven percent; but Lee observed that seeds and beans were considered

"*problematic: edible but not seen to be eaten*" (Lee 1964, p. 34). Seeds had entered their culture as *possible* foods, thus must have been eaten at one time or another, but remained in the margins of their culinary repertoire.

In the New World, the initial utilization of seeds followed in the tracks of game animals.

There is widespread evidence that hunter-gatherers often took advantage of caches of seeds, nuts, and bulbs stored by the animals that they were hunting. Historically, Pawnee and Winnebago women would appropriate pounds of ground beans found in the store of meadow voles during the winter. Lewis and Clark saw Northwestern Indians robbing muskrat nests for the tubers of aquatic arrowheads, known as tule potatoes. The Seri and Yaqui Indians of the Sonoran Desert would unearth caches of mesquite pods sequestered by pack rats. While gathering up.the pods from the rodents' middens, they would catch, kill and roast as well any pack rats they happened to find. (Nabhan 1989, p.14).

Thus if we are looking for deviations from expected ancestral fare, we might find it not necessarily in the *presence* of seeds or grains, but in their *preponderance* in the modern diet.

The second thing to note about the transition to agricultural life is that it meant a reduction in dietary diversity. Hunter-gatherer diets in all but the most inhospitable of climates are very diverse; much more so than our own, industrialised, diets. Among the !Kung bushmen, for example, eighty-five species of vegetable are considered edible and are available, with twenty-three species making up ninety-five percent of their diet; fifty-four species of animal are eaten, with seventeen hunted regularly. More generally, "*Of the four thousand or so edible plant species that have fed human societies at one time or another in the past, only one hundred and*

fifty are widely cultivated today and just three of them provide sixty percent of the world's food. Today our choice of foods is limited to about thirty species, and for many the choice is even more restricted "(Fallon 2001, p. 57).

Indeed, according to Audette, "*modern man gets ninety percent of his calories from just twenty species of plants and* (italics mine) *animals*" (Audette 1999, p. 40). The wide variety in hunter-gatherer diets, at least in times of plenty, ensures a healthy supply of the vitamins, minerals, and trace elements with which we are told to supplement our diets today. The absence of that variety may well register as 'problematic' to our adaptive systems, which expect and in a sense 'plan for' much greater diversity. Tudge speculates:

> Suppose, now, that this general hypothesis is right: that the many mechanisms of our bodies are indeed adapted to a range — possibly a huge range — of chemical agents produced by plants, fungi, and microbes that it can survive without (ie, we are not talking simply about the recognised vitamins) but which it nonetheless would benefit from.
>
> Suppose it is the case too — and it undoubtedly is the case — that science has hardly begun to explore this range of agents, at least not in an orderly way, largely because it never occurred to anyone to do so. After all, this hypothesis springs from evolutionary biology; and biochemists and nutritionists are not, for the most part, evolutionary theorists…
>
> That is, the specific hypothesis is that our nervous systems evolved in the presence of a range of peculiar materials produced by plants, and functions better in their presence — just as our bodies in general have evolved to function best in the presence of oxygen. Our nervous systems are now deprived of many essential or quasi—essential agents, largely because our diet is no longer based on a range of wild plants (Tudge 1999b, unpaged)

It is interesting to note in passing that most of Clark and Hindley's list of aboriginal ingredients does not include much of what a person in the west would call 'food'—we do not eat, nor

probably could we force ourselves to, the eggs of lizards, the meat of marsupial mice, or any kind of grub or snake (Clarke and Hindley 1975 p. 27). In fact it is worth observing the responses to new foods on both sides of a 'first contact', that is, the first meeting between an aboriginal society and a visiting party from an agricultural or industrialised one. A recent account, for example, describes the meeting of a party of Europeans and Americans with a previously uncontacted population in the interior of Papua New Guinea. The narrator is one of the former, and is offered a meal of what Clark and Hindley would have called 'non-food':

In the morning…I awoke to a hideous breakfast. Our hosts brought us a large plate piled high with tiny roasted legs, so small that we had to eat about thirty of them to satisfy our hunger. They had a vile taste, a cross between stale pork and licorice.

"A rare treat," Yanbu informed us jovially. "Mouse legs!" (Osborne 2005).

The narrator's response, informed by a broad experience of many cultures, was naturally less visceral than that of his hosts. He describes later his attempt to offer them what *he* considered 'food':

I then offered them some malted biscuits. With extreme caution, they held them up.to the candle, turned them over, inspected them gravely, then stuck out their tongues to touch the surface. They were nonplussed and suspicious. Then, egged on by Yanbu, they bit off morsels.

The Kombai have a discreet way of spitting. They form a blob of saliva on their lips, lean over, and then let it fall silently.

"It makes me want to vomit," Mamandeo said.

Next, a spoonful of white sugar. They nibbled at it and then, with disgust, went through the same spitting motion.

"It makes us want to vomit," Mauraga said.

We tried a simple cup.of water next. But the plastic of the cup.upset them, the feel of it against their lips. They spat out the water.

"It makes us want to vomit," Andono said (Osborne2005).

Anecdotes of this kind can give us a clue to the kind or degree of adaptation that might be needed to assimilate completely new foods, foods so different from the expected fare that they would seem to be from a different era, or from another world.

To return to the question of diversity, Washburn and Lancaster (1968) have also noted that it was in the last phase of the non-agricultural period that diets were the most diverse. Along with the grinding and boiling technologies emerging in the Upper Paleolithic and Mesolithic periods (the last 10-15,000 years before the advent of agriculture), came a new ability to utilize the resources of rivers and seas. Both swimming and boat building belong to this period (ibid); thus bodies of water ceased being barriers and became roads as well as sources of nutrition. Coastal areas then become highly desirable places to live:

Why would biology explore every conceivable and often poverty stricken food resource, and leave what is perhaps the richest untapped?…It makes more sense to say that…one branch of the hominids found that the sea offered a wealth of food and a way of life that was congenial….This species would have taken to the shores of the freshwater lakes and rivers as well, and the adoption of an aquatic habitat would not have cut them off from other supplies of food, for the coastal regions, with their high humidities and ample rainfalls, offer equable climates and a rich growth of fruits and other vegetation. The estuaries would have been sites of particular value because it is here that the marine food chain begins in earnest, fertilised by the trace elements and minerals washed off the land, and it is here that early man could have had an abundance of food and fresh water (Crawford and Marsh, p. 163).

Crawford and Marsh go on to explain how coastal areas were able to provide their inhabitants with both of the two types of nutrient essential for optimum development—the Omega 3 and Omega 6 type fatty acids. As these are extremely important to any understanding of evolution and nutrition, I shall take a moment to explain what these are.

Whilst an understanding of the need for protein and vitamins in the diet has been recognised for many years, further understanding was hampered for most of the twentieth century by the lack of a technological means for measuring the more subtle mechanisms at play in dietary chemistry. But in recent years the most important group of chemicals under investigation with new techniques has been the essential fatty acids.

> These are used to build structural lipid in a similar way in which essential amino-acids build protein. Structural lipids construct cell membranes. The point about these lipids is that they are quantitatively the most important soft tissues. They account for 50-60% of the material used to construct the brain. They also have special significance in other 'membrane-rich' systems, the most relevant to our discussion being the network of blood vessels. The word 'essential' is here used in the same sense as in essential amino-acids: man and other species need them to build tissues and to reproduce but cannot make them. They are literally essential: indeed they may well be of more importance to our health performance than even protein (Crawford and Marsh 1989, p. 119).

They continue later: *"Laboratory work showed that the brain did not use just any old neural fatty acid but a consistent balance of 1:1 of both the Omega-3 and the Omega-6 families. So not only were these special fatty acids important to build brains, but the balance between the two families seemed relevant"* (ibid p. 181).

Because these EFAs cannot be made in the body, they must be obtained from food. The two 'parent groups' of EFAs are linoleic acid (Omega 6) and alpha-linolenic acid (Omega-3), and they are best consumed in an approximately 1:1 ratio (ibid) their derivatives are, respectively, arichidonic acid and docosahexaenoic acid. The best sources of these are the seeds and leaves of certain plants, and certain types of sea and freshwater foods.

Arguing for the coastal habitation of early man, Crawford and Marsh suggest:

> Had he occupied the vacant niche between land and water…he would have had available Omega-6 fatty acids from land seeds, protective anti-oxidants, and concentrations of arachidonic acid preformed, from small land mammals, from freshwater foods and coastal seafoods as well as from marine mammals. He would also have had an abundance of docosahexanoic acid which is missing in the food chain of large land mammals. The land/water interface was an incredibly rich ecological niche which would otherwise have been unexploited. To achieve a ratio of 1:1 would have been no problem (ibid p. 183-184).

For our purposes the important question is not whether early man evolved in a shore or savannah habitat, but what he ate while he was becoming what he is; but Crawford and Marsh give us a useful picture for visualising the context of what is emerging today as the 'best-odds' diet for human beings. It has become clear that EFAs are important and necessary; the authors' view of human origins helps to explain why that might be.

As far as learning difficulties are concerned, there is ample evidence to suggest that a lack of these fatty acids in the diet has negative effects on development.

Without a dietary source of docosahexanoic acid (DHA) it is unlikely (though not impossible) that visual and neurological development will be optimal during the first few years of life. Thus, despite the known ability of infants to convert ALA to DHA, the capacity of this pathway is commonly, if not always, insufficient to meet the needs for DHA. This results in low brain DHA and neurodevelopmental symptoms in infants not given dietary DHA. The need for DHA may or may not exist in healthy adults, but it is clearly "conditionally indispensable" in infants. A crucial point is that the ability to make some DHA does not prevent a need to provide DHA in the diet, because the pathway to make DHA has insufficient capacity to meet the developmental needs for DHA in humans (Cunnane 2005, unpaged).

Studies of the possible link between DHA and specific learning difficulties include Richardson and Puri 2002. The authors tested the prediction that relative deficiencies in highly unsaturated fatty acids (HUFAs, including DHA) may underlie some of the behavioral and learning problems associated with attention-deficit/hyperactivity disorder (ADHD) by studying the effects of HUFA supplementation on ADHD-related symptoms in children with specific learning difficulties (mainly dyslexia) who also showed ADHD features. They concluded that HUFA supplementation appears to offer significant benefit in alleviating many ADHD-related symptoms in children with specific learning difficulties, and suggest further studies. Corroborating these results are Colgan and Colgan 1984, Sinn and Bryan 2007, Osendorp.et al 2007, Stanstead et al 1998, and many others.

Lack of dietary diversity, the lack of particular nutrients and fats which our physiology 'expects', can lead to real and identifiable learning pathologies. Thus it is the *absence* of diversity and the corresponding *presence* of the agricultural foods, for which the diversity of hunter-gatherer diets was abandoned, which here constitute a *deviation from expectation*, as outlined in the introduction.

Briefly restated, the concept is that, as we have spent the longest time eating according to the 'rules' of the hunter-gatherer diet, we are best adapted to these and that we are less well adapted to foods that have been introduced after the hunter-gatherer period. Again, according to Bronowski, "change in diet is important in a changing species over a time as long as fifty million years" (Bronowski 1973, p. 42); thus the time elapsed since the beginning of the agricultural revolution, some 10-12,000 years only, would suggest that our adaptation to the change could hardly be complete. As a species, it seems fair to say that we are still in the process of adaptation to the agricultural diet. As for individuals, those who survive the rigours of gestation and birth and emerge into a radically unexpected environment must struggle to maintain homeostasis in the face of that environment's constant challenges, and it is this kind of individual response to a problematic encounter that will most concern us here.

What 'harder' evidence is there, then, for stress caused by exposure to new, physiologically unexpected foods? What are the nutrients that pose problems for individual adaptive systems?

To address this question I shall turn first to the literature on the two agricultural products mentioned above, which are so very dominant in 21st century diets, and which are implicated in a wide range of health problems: wheat and cow's milk.

While some substances are considered either healthful or poisonous to a great majority of people, others occupy a grey area, being difficult to tolerate for a proportion of the population, whilst at the same time being nutritious and relatively easily digestible for others. Gluten (found in wheat and other grains) and casein (a milk protein) are the best known examples of the latter.

Allergy tests have revealed sensitivities to every food commonly eaten, but most prevalent are allergies to milk products and grains—precisely the two foods added to man's diet when he changed from the hunter-gatherer lifestyle to one of cultivation and domestication. The proteins of grain and milk, namely gluten and casein, are two of the hardest proteins for humans to digest (Fallon 2001, p. 56).

McCandless has written extensively on the relationship between gluten/casein sensitivities and the development of learning difficulties, autism in particular:

Many autistic children have an inability to digest gluten and/or casein…Alan Friedman, PhD.[6], and fellow researchers theorize that an enzyme vital for the digestion of these substances (DPP-IV) is missing…or is inactivated, possibly due to an autoimmune mechanism. Friedman's model posits that the absence or inactivation of the missing DPP-IV enzyme allows the accumulation in the body of opioid or morphine-like substances known as dermorphins. The buildup.and accumulation of those substances may be one reason that autistic children frequently appear "spaced out"…Regardless of Friedman's hypothesis, many autistic spectrum children have one or several food sensitivities as determined by food-allergy tests and by elimination diets. Most ASD children studied have been shown to have inflamed gastro-intestinal tracts, and it is believed that certain foods that the child is sensitive to, such as gluten and casein, irritate their intestines (McCandless2003, p.31).

This irritation is not just a cause of discomfort, but has far-reaching consequences for the brain:

Some autism researchers have published articles in the scientific literature about malabsorption, maldigestion, and the related findings of unusual proteins and peptides in the urine of people with autism(1). In many autistic children, those indigestible proteins and peptides come from casein and gluten; soy and corn can also be problematic.

Many peptide chains are flushed out in the urine. However, because many autistic children have leaky guts, an unacceptable amount of those substances can enter the bloodstream. Researchers…who found the unusual proteins

and peptides in the urine of autistic patients discovered that those substances, when carried to the brain, have an opioid-like effect with a potency several times that of morphine…

Paul Shattock, PhD., of the Autism Research Unit at the… University of Sunderland's School of Health Sciences, says his studies indicate that there is a "rough correlation between the amount of opioids in the bodies of autistic children and the degree of severity of their impairments" (Shattock 2001). These natural morphine-like substances seem to drug the children and interfere with motivation, emotions, perception, response and the normal development of their brains.

[1]See Shattock and Savery 1996; Shattock et al 1990.

(Ibid p. 45-46).

As of 2001, Shattock warned that evidence for the efficacy of dietary interventions was not conclusive, but noted also that the same would apply for virtually all medicines used to treat individuals with autism. Since 2001, some studies have shown positive results: for example a randomised, controlled study of a gluten-and casein-free diet undertaken by Knivsberg et al (2002), in which 20 children were put on the diet; their progress was 'significantly better' than that of the controls. Reichelt and Knivsberg (2003) also published an open study over four years, and a single blind controlled pair-wise matched intervention with a gluten free/casein free diet, confirming the positive result. However, an updated Cochrane Report (2008) concluded that

there is a lack of evidence to support the use of gluten and/or casein free diet as an effective intervention for persons with autism and also a lack of research on potential harms and disbenefits of such diets. Despite the problems of maintaining the integrity of such diets in the community it is possible to carry out randomised control trials to address these questions and more and adequately powered trials are needed in this area (Cochrane 2008, p. 2).

Even as recently as 2009, similar statements about lack of proof were made [eg Brown 2009], in a review of Aitken's 2009 book, Dietary Interventions in Autistic Spectrum Disorders: "*the scientific and research community has a long way to go to provide a solid evidence base for these types of treatments*" (Brown 2009, p. 103).

Because there is nevertheless a great deal of anecdotal evidence supporting the use of the GFCF diet, Shattock and others at the Autism Research Unit at the University of Sunderland have devised a protocol to guide parents who are not able to gain the support of their GP, who wish to attempt dietary interventions with their child. (see Appendix A). However, research continues, to study the effectiveness of the removal of dietary gluten and casein in the treatment of autism.

There is also ample material in the literature relating to diet and other, less severe, learning difficulties such as ADD/ADHD. In fact Shattock and Savery (1996), investigating metabolic disorders in people with autism according to the opiate excess theory, found unexpected results related to subjects with other learning difficulties. Both the autistic groups and the groups with other LDs showed patterns of elevated levels of certain peptides; the authors "*believe that these peptides are derived from an incomplete breakdown of certain foods and, in particular, gluten from wheat and some other cereals such as barley, rye and oats and from casein from milk and dairy produce*" (Shattock and Savery 1996, p. 2). They write,

…subjects with dyslexia consistently give a "positive" result. We have also found subjects who show some of the behavioural and psychological abnormalities, which may be within the same spectrum of disorders. These include Attention Deficit Disorder (ADD), Attention deficit Hyperactivity Disorder (ADHD) and also some types of

Obsessive Compulsive Disorder…Profiles from subjects with ADD and ADHD are now being studied in a more systematic way (Ibid).

Writers who dismiss the idea that diet can influence attention and learning at all, are now very difficult to find, and their influence outweighed by that of those who confirm the relationship. Amen, for example, insists, "*Dietary interventions are important in treating all types of ADD.…Over and over in my clinical practice I have found that diet matters*" (Amen 2001, p. 224). For all but one type of ADD/ADHD, Amen recommends a low-allergen diet, that is, one "*higher in protein and lower in simple carbohydrate, supplemented by calcium, zinc, magnesium and vitamins*." He continues, "*When I can convince my patients to eat this way, they notice better mood stability, better focus, less distractability, more mental stamina, and less drowsiness in the late morning and midafternoon*"(Ibid).

Conclusion

Theoretically, the diet we are best adapted to is that of the hunter-gatherer, that is, a diet which is in general very diverse and with only a small proportion of nutrients coming from grain or other agricultural products. Deviation from this physiologically expected nutritional milieu constitutes a challenge or stress to the adaptive system to some degree, with a significant proportion of individuals unable to process the 'deviant' nutrients. This inability can lead to a range of difficulties, including those affecting motivation, emotion, perception, response, general brain development, and thus, in consequence, the individual's capacity for learning. Evidence and writings from a range of sources would thus appear to corroborate the theory of adaptive stress in relation to nutrition, though further study is needed, particularly of gluten- and casein-free diets for individuals with learning difficulties.

CHAPTER 3

BIRTH-RELATED STRESS

In this chapter I shall discuss the birthing process and how mismanagement can create stress for the newborn. I shall proceed to discuss some neurological facets in the production of a stress response.

Birth, of course, is usually stressful to some degree. It makes tremendous demands on the bodies and emotions of both mother and baby, not to mention father and siblings; and even in the twenty-first century it challenges midwives and doctors. Some of that stress is expected—it *is* the birth process—but further, and much more damaging, stress can arise when things go wrong, or the process is mismanaged. And, once the baby is delivered (to use a word that is controversial[7]), the crucial neo-natal period[8] begins, and with it the beginning of a set of relationships vital to the health and well-being of all concerned, including, as I shall argue, the child's learning outcomes as he or she goes through life.

In Attachment, Bowlby's seminal study of emotional development, the author's first chapter is called 'Beginnings of Attachment Behaviour', but what he outlines as 'Phase 1' concerns neonates' ability to discriminate between people (Bowlby 1969, p. 320). This is already an event which refers to his development regarding others, and not mentioning his development in himself; like many researchers, Bowlby mentions birth only in passing, as the commencement of the phase which he views as significant, and not as an important experience *per se*. Clarke and

Clarke (1976) also fail to mention it in their study of adverse experience and resilience in the early years. Odent, however, has emphasized its importance throughout his career.

Following a *prise de conscience* in which he realised that many babies in Western, industrialised hospitals were being mistreated, Odent and his staff at the General Hospital in Pithiviers, France, in the 1970s, developed a non-intrusive style of delivery and care, based on the work of Frederic Leboyer (1974), that proved highly successful.[9] The protocols they gradually evolved for low risk deliveries included the following:

Birth process expected to be normal, thus very positive atmosphere

Low lighting, soft music in delivery room

Minimal use of language during labour and delivery

Absence of father from delivery room until last minute

Minimal use of drugs; anaesthetist and surgical staff available but out of sight

Nurse—midwife present as a 'calm, discrete and vigilant observer'(Odent 1984 p. 84)

Birthing pool available if wanted

Delivery position chosen by mother

Baby welcomed by mother, who holds and massages it immediately after birth

Mother and baby not separated

Essential continuity maintained (Odent 1984, 1986).

Dora Henschel, then Senior Midwifery Tutor at King's College Hospital, London, remarked after a visit to the birthing room at Pithiviers,

To my surprise no fierce cries pierced the tranquility of the room. The baby breathed quietly, had good colour and tone and slowly seemed to wake as if from a dream…To watch the serene expression on their faces as they opened their eyes and surveyed their new world was something new for me, as was the lack of fuss and commotion, the peace and joy, and the utter simplicity of the birth process (Henschel, cited in Odent 1984b, p. 10-11).

The standard protocols in use in most hospitals at the time, in which the birth process was heavily controlled and often interfered with by the obstetrician or conventionally trained midwife, tended to ignore the hormonal/emotional states of mother and baby, and concentrated on management of pain (by drug use), of microbes (by antiseptic environments) and of other physical events and needs. Kitzinger explains why no drugs for pain relief are offered at Odent's clinic:

If epidurals, the most effective form of pharmacological pain relief, were introduced, there would be strong case for introducing electronic monitoring, too…And once feeling has been blotted out, forceps would often become necessary. There is approximately a five-times-increased risk of having a forceps delivery when a woman has had an epidural… (Kitzinger, cited in Odent 1984, p.xxi).

She summarises: "*Once the body is interfered with, it becomes necessary to intervene in other ways"* (ibid). Further, when the mothers do have an epidural, the babies are often also affected by the drug and may arrive into the world groggy and unable to make vital connection with her. Or, they are whisked away from her immediately upon delivery, washed, weighed and dressed, all the while craving her attention and their first meal. In some hospitals they are kept in a nursery, allowed to cry for long periods of time and fed on a schedule determined by doctors. It is not difficult to surmise that neonates experiencing some or all of these will have had their expectations dashed—expectations regarding his entrance into the world, and the kind of birth

their genetic inheritance leads them to expect—if not extinguished. Unable to find relief, that is, to find what they expect to find, they try to find ways to cope. Liedloff imagines such a baby's experience:

> …the newborn infant is put in a box where he is left, no matter how he weeps, in a limbo that is utterly motionless…The only sounds he can hear are the wails of other victims of the same ineffable agony. The sounds can mean nothing to him. He cries and cries…No one comes. Trusting in the rightness of life, as by nature he must, he does the only act he can, which is to cry on. Eventually, a timeless lifetime later, he falls asleep exhausted (Liedloff 1989, p.70).

Obviously such a beginning is distressing for the babies. Their repertoire of signals is useless and they cannot communicate or control their situation in any way…they are stressed. But what does this mean?

For many years the concept of stress was rather limited, part of the emotional realm, unmeasurable and therefore not a subject for serious scientific investigation. But, as I mentioned in the Introduction, this state of affairs changed from the 1950s onward with Selye's identification of the stress response, or General Adaptation Syndrome (Selye 1956, 1974) and the increased understanding of stress as a biochemical phenomenon. The role of stress hormones began to be understood, and stress could now be seen not just as an emotional issue but also as a physiological one. Candace Pert took this line of thinking forward again in the 1970s with her discovery of receptors, the information-receiving molecules that are found attached to the oily outer membrane on the surface of a cell. They are sensors, picking up messages from other

molecules in the extracellular fluid, the ligands. Ligands are like chemical keys that bind to specific receptors, allowing information to enter.

> The receptor, having received a message, transmits it from the surface of the cell deep into the cell's interior, where the message can change the state of the cell dramatically. A chain reaction of biochemical reactions is initiated…and, directed by the ligand, begins any number of activities—manufacturing new proteins, making decisions about cell division, opening or closing ion channels, adding or subtracting energetic chemical groups like the phosphates—to name just a few. In short, the life of the cell, what it is up to at any moment, is determined by which receptors are on its surface, and whether those receptors are occupied by ligands or not. On a more global scale, these minute physiological phenomena at the cellular level can translate to large changes in behaviour, physical activity, even mood (Pert 1997, p. 24).

The ligands include the neurotransmitters, steroid hormones including stress hormones such as cortisol, and the peptides, which have a wider role in the regulation of life processes (ibid p. 25). Indeed because of this wider role,

> The responses they [the peptides] elicit can be maddeningly complex. This complexity has led to their being classified under a wide variety of categories, including hormones, neurotransmitters, neuromodulators, growth factors, gut peptides, interleukins, cytokines, chemokines and growth-inhibiting factors. I prefer a broad term coined originally by the late Francis Schmitt of MIT—*informational substances*—because it points to their common function, that of messenger molecules distributing information throughout the organism (ibid, p. 71).

For the purposes of this thesis, this line of research confirms that experience translates into information; and that information is not separate from physiology. There are physiological structures which are not just recorders of information, but which *are* information in physiological

form. Therefore an experience—and I shall take the important and literally transformational experience of birth as a case in point—translates as *state,* comprising what might previously have been seen as the separate elements of emotion/psychic condition and body/physical condition. And the effect of experience upon the organism can be tracked, the presence or absence of stress hormones and other informational substances marked and measured. Therapeutic implications have been noted by Odent (1984, 1986). For example, the effects of the behaviour of those who are participating in and managing the birth process, and the techniques and procedures they employ, could also be 'tracked' (though in this case usually not monitored mechanically, as this can itself be intrusive) and anything that causes the smooth progress of the labour to be inhibited, could be minimized in order to preserve as far as possible the mother's, and the baby's equilibrium.

Many studies have been done[10], for example, on the effects of electronic fetal monitoring.

> No matter what protocols were observed by the birth attendants, no matter what kind of populations were involved (high risk mother, low risk mothers, overall, Australian, American or European), it became clear that the only constant and significant effect of an electronic environment on birth statistics is to increase the rate of intervention in general, and caesarean section in particular.…It is now clear that an electronic environment is not neutral. We have to accept that we are mammals and that all mammals have some particular strategy so as not to feel observed at birth…To feel observed, even through the medium of a machine, alters the mother's physiological processes (Odent, 1993, cited in Odent 1984).

A number of studies (Singhi et al 1985, 1982; Lucas et al 1980; Milner and Hales 1965; Lawrence et al 1982) have also been done on the common practice of putting a glucose drip into the arm of a woman in labour.

> …it has been discovered only recently that glucose received in a drip can actually increase sensitivity to pain. Glucose also lowers the level of sodium chloride in the blood of both mother and baby. A low level of sodium chloride in the baby has the effect of making it breathe too fast. There is also evidence that a high level of glucose blocks the synthesis of prostaglandins, whose role is so important in childbirth. The baby reacts to the excess of sugar by activating its pancreas and secreting more insulin. The result is that after the birth the newborn baby is hypoglycaemic. This might help explain the increase in neonatal jaundice in the last ten years (Odent 1986, p. 134).

Stress in general was studied extensively by Hans Selye and his colleagues in the 1950s, 60s and 70s; and this work grew out of the previous establishment of concepts such as *homeostasis* (Cannon 1939)[11] and *milieu internel* (Bernard 1865, cited in Richards 1970). But Selye was eventually able to boil down the definition of stress to 'the non-specific response of the body to any demand" (Selye 1956, p. 55).

Since then the concept has evolved somewhat. MacEwan (2001), for example, now prefers that the concept of stress be broken down into two complementary meanings: 1) that which one encounters which causes distress and 2) the feeling one has when one encounters it. In coining new phrases to suggest a 21st century understanding of stress, he proposes that the word *stress* should be "*in reference to outside events only*," (McEwan 2001, p. 5) while the organism's response could be called '*allostasis'*. The word "*comes from the Greek root allo, meaning variable, and it emphasises the point that allostatic systems help keep the body stable by being*

themselves able to change" (ibid p. 6). McEwan continues, "*and for the last and bleakest definition of stress—when we're besieged to the point where the stress response system turns against us—consider the term 'allostatic load'"*(ibid p.5).

When fight or flight is what's required, the allostatic system is admirable indeed, "*one of the human organism's most powerful and sophisticated defenses*" (ibid p. 4). But "*increasingly, the situations that ignite the stress response are ones for which neither fight nor flight is an option—working for an overbearing boss, for example, or caring for a family member who is seriously ill. In these situations the stress response cannot help speed us toward a resolution" (ibid p. 7).*

Now this begins to sound very much like the situation in which a newborn who is cared for according to 'standard protocols' finds himself. He is, without question, helpless, except for the ability to cry; and if this is ignored, he is out of options. He is powerless to improve his situation.[12] Thus in McEwan's terms, he is carrying an allostatic load, and this has its effect upon his body and brain. The hippocampus, a centre for the formation and retrieval of memories, can be badly affected by an excess of the stress hormones cortisol and adrenalin. In times of stress the hippocampus actually shrinks in size and is inhibited in function.

But McEwan and his colleagues suggest that "*this may be the allostatic process attempting to ward off permanent damage by putting processes governed by the hippocampus, such as plasticity and neurogenesis, temporarily 'on hold'"* (MacEwan 2001 p. 122). But even if the 'on hold' theory is true, the negative effect of stress on memory, on being able to remember what we learn, clearly brings us into the realm of learning disabilities, and also suggests that LDs may be

in some way adaptive. In other words they may arise not because something is ‘not working’ or ‘going wrong’, but precisely because the system *is* working. The allostatic system is working to protect the brain from long term damage, thus maximizing the individual’s chances of survival. Survival, it hazards, is more important than learning this or that fact, or indeed in some cases anything at all. If the result of this physiological deliberation is a learning disability, the quality of that life is severely compromised. But there is a suggestion here that, knowing this allostatic process, we can work with it, preventing stress in the first place in as many arenas as we can, instead of considering the system malfunctional and trying to ‘correct’ it.

But again, we are looking at a period of time in the region of 2-3 days at most—a short episode in a person’s life. Can this event have far reaching effects upon a person’s ability to learn?

It is well known that problems at birth such as oxygen deprivation or trauma to the head can lead to life-long learning and co-ordination difficulties such as cerebral palsy. The brain is extremely sensitive to changes in oxygen level, and brain damage can occur when deprivation lasts no more than three or four minutes. Thus any protocol that minimises this kind of stress at birth can have beneficial, preventative effects that last throughout a person’s life. Indeed, Odent’s protocols are designed to minimise delays in the birthing process and thus also episodes of oxygen deprivation, since without a doubt mismanagement of labour can lead to delays, thus potential infant distress, thus stress-related damage.

But what about when there is no definite damage to the brain, yet learning disabilities are still present? Can birth practices influence the physiological context, or *milieu internel,* in which some forms of LD arise? The answer to that is a clear yes, for two reasons. One, with stress come

stress hormones, vital components of the body's chemical make-up; and two, conditions at birth can appear to 'set' chemical and hormonal levels, which become the *milieu internel*, or *terrain*, to use Odent's term (Odent 1986, pp. 31-38).

I have briefly discussed stress hormones above, and as for the *milieu internel* or *terrain*—these refer to an individual's general level of health or well-being—in other words to the state of his *primal adaptive system*, another of Odent's concepts. The primal adaptive system is made of the primitive or primal brain, the hormonal system and the immune system (Odent 1986 p. 163), working together in an integrated fashion:

> It is during fetal life, the time around birth and infancy, that the different parts of this system develop and regulate and adjust themselves. At the end of infancy, the primal adaptive system has reached maturity. I call primal health the balancing of the set point levels, which have been reached by the end of infancy. To understand what set point levels mean, think of a central heating thermostat. You set the thermostat to a particular temperature at the beginning of the day, and the heating reaches the temperature you have set. It is similar with our hormonal levels, which have to be set at the beginning of life and which continue to 'switch on' at the set level. Thus, primal health is built at the time when the baby is closely dependent on its mother, first in the womb, then during childbirth, and then during the period of breastfeeding. Everything which happens during this period of dependence on the mother has an influence on this basic state of health, this primal health (Odent ibid, p.15-16).

Thus, though birth itself does not occupy a great deal of time in a person's life, it is a crucial event in the 'period of dependence', when the primal brain, the hormonal system and the immune system are regulating and adjusting themselves, and so may have lasting influence upon a person's basic physiological makeup. I would further suggest that, though important, it is not necessarily that the 'set point levels' are absolute; rather that they are a part of the orderly

functioning of the body, and one needs to know something about these levels in order to work with them as one goes through life. Odent: "*Culture, environment, and social conditioning will have greater effect on any individual than what happens during a few early "critical" periods, and can certainly compensate for anything lacking at the start…But why not make the start as positive as possible? Why not increase everybody's chances?*" (Odent 1984, p. 78).

Conclusion

It is surely the responsibility of parents and birth professional to minimise stress in the birth process, and in this chapter I have argued that a wider definition of stress than is commonly in used would change how certain aspects of the birthing process are managed, to the general advantage of all concerned. The stresses in question here are much deeper than would be commonly acknowledged. They are not just stresses to do with gross complications at birth, but those which occur *for the infant* in the course of what would appear to most observers as a 'normal' birth and first few days post-partum. What has become 'normal' practice (sometimes now even called 'traditional' because it has been the case for a generation or two) is evolutionarily highly abnormal, in fact quite deviant, and considered thus by the physiologies of many infants encountering it.

Newborns expect what their genes instruct them to expect. They will therefore be meeting, in many cases, the unexpected, stressful series of events that increasingly became the norm during the last century, and will continue doing so until such time, as Odent proposes, and where birth is concerned, we come to "*the end of the electronic age*". These babies are at the avant-garde of the adaptive process, and must be viewed as such. Their physiology is ancient, yet they must

encounter new and unexpected circumstances and experiences with every breath, every moment that passes. If those in the infants' environments, that is parents, carers and professionals, are able to view them like this, it should be possible to minimise stressful encounters, and allow them to develop in a manner as closely attuned to their physiological expectations as can be arranged.

Though much work remains to be done in understanding learning problems and their prevention, there is evidence to make the connection between stressful experiences and their physiological correlates, and that these comprise altered physiological states that have direct deleterious effects on the functioning of the brain, the endocrine, and immune systems, all of which play major roles in the learning process.

CHAPTER 4

THE IMMEDIATE POST-PARTUM PERIOD

Opinions vary widely as to the importance or significance of the immediate post-partum period (IPPP), relative to subsequent development. Odent (2005) and others (Colson 2000; Colson and Hawdon 2002) consider the period crucial and thus see its inherent dangers, particularly the failure of bonding between mother and baby, as acute. For Odent, the sight of an Eastern European nursery full of newborns, far from their mothers, their cries unattended unless they happened to be expressed at the appointed feeding or changing time, was enough to precipitate the *prise de conscience* which inspired his later work on naturalising hospital and home procedures for the beginning of life (Odent 1984, 1986, 2005). Many of his recommendations are now standard practice in hospitals throughout the developed world, including delaying the cutting of the umbilical cord, and allowing mother and baby to be together uninterrupted for the first hour so that nursing can be begun and, in his view, emotional security established.[13]

Odent (1986) cites classic experiments carried out in the 1960s and 70s which amplify and illustrate the effects of perceived helplessness upon the subjects' abilities to cope with stress. When Seligman's dogs understood that nothing they did made any difference to the electric shocks they received, they exhibited the behaviour now known as 'learned helplessness': they stopped trying to escape and simply cowered in the corners of their cages (Seligman 1967, 1980). Laborit subjected pairs of rats to electric shocks and found that if they were able to fight

each other, they were protected from a rise in blood pressure; but if they were separated when shocked, so that they could neither fight nor run away, their blood pressure rose (Laborit 1979, cited in Odent 1986). To describe this behavioural/hormonal/immune response Laborit coined the phrase 'inhibition of action.' For Odent, this link between physiological systems is crucial, and experiments such as these underline the pervasive effect upon individuals of the perception that they have no control over what happens to them.

The relatedness of these experiments to the experience of human infants is clear: human babies are very likely to feel helpless because in many ways they are. Apart from their voices, they have no way of controlling or otherwise influencing their encounters, and it would follow that the IPPP would be the period of maximum feelings of helplessness for newborns. Thus Odent's emphasis on a protective non-disturbance of the naturally regulated flow of hormones and correlative behaviours between mother and newborn in the immediate post-partum period (Odent 2005, 1986). His view is backed up by studies tracking the presence or absence of oxytocin, a hormone involved in birth, breastfeeding and sociability, among other events and behaviours (Chard et al 1971, cited in Odent 1986; Martin and Voigt 1981; Vizi and Volbekas 1978, both cited in Odent 2005), and which has been called the 'hormone of calm and connection' (Uvnäs Moberg 2003). Its presence, promoted by non-disturbance or at least non-intrusive care of mother and baby, and sensitive, responsive care of the baby by the mother herself, enables a smooth transition for the newborn; its suppression or absence usually indicates some form of stress, which has its own marker, adrenalin (Odent 1986). Adrenalin is associated with defensive actions such as fighting and running away, and inhibits birth, breastfeeding and bonding. Odent's method is to provide the right environmental stimuli to encourage the presence of oxytocin and to avoid the stresses that result in the production of adrenalin. Uvnäs Moberg, whose work has

centred on oxytocin, also notes its involvement in learning processes later on (Uvnäs Moberg 2003, pp.70-72).

But to return to Odent's three words mentioned above, "emotional security established". These are, in short, much more controversial than they may first seem. There exists in the literature a broad spectrum of beliefs about what emotional security might be, how it might be established and cultivated, and, with that aim in mind, the significance of developmental periods and their importance. Some, including Odent (1984), though he is not quoted here,

> posit that there is a critical period, within the first two years of life, or earlier, during which lack of attuned interactions between infants and key carers permanently affects brain development, specifically, the part of the brain responsible for emotional self-regulation and understanding of others (Schore 1994, 1999; Gerhardt 2004, 2005). In the 1930s, 'critical period' was used by embryologists to denote points in cell development at which cells could be induced to take one pathway rather than another and after which no such inducement could influence them to revert or change direction (Speman 1938). According to Bruer (2001), it is this understanding of the term that appears to have been adopted in the current field of developmental neurobiology (Barrett 2006, p.225).

It refers to apparent 'windows of opportunity' during development, where infants are especially receptive to certain environmental inputs, and is associated with:

Very short time periods

Very strong effects of environmental conditions

Irreversible or permanent effects (ibid).

As Bowlby, the originator of Attachment Theory, explained in 1969,

> …not only in man but in many other species as well, great changes are found commonly to occur during the ontogeny of behavioural systems. In some species and for some behavioural systems these changes are environmentally stable, namely their course is not greatly influenced by variations of environment met with during development. In other species and for other behavioural systems the changes are environmentally labile and the form they take in the adult is much influenced by environmental variation. In such cases the period during which they are sensitive to change in the environment is often of only limited duration, and is termed a 'critical phase' or 'sensitive period'. Sensitive periods for different behavioural systems occur in different species at different points in the life-cycle. As a rule, however, these points occur relatively early in life and in some instances they occur before the system itself is functional (Bowlby 1969, p. 186).

However, it is important to note that Bowlby, though famously concerned with emotional security, bonding, and/or attachment, never gave the very first phase of life much special attention. He considered the first two or three *years* crucial; the first forty hours were evidently seen as simply the beginning of that longer attachment phase. Further, Sluckin, Herbert and Sluckin (1983), after a thorough analysis of the experimental literature on attachment and bonding, concluded that "…*research findings reveal no critical period for maternal bonding, and these findings strongly indicate that maternal attachment—like child-to-adult attachment—develops in most cases slowly but surely*" (p. 97).

More recently, Barrett's exhaustive study of Attachment Theory, whilst retaining a positive stance toward the concept of attachment, nevertheless is wary of its dangers and difficulties, and warns that experimental methods used in researching it may be inadequate: "*We cannot be confident that the instruments employed in attachment research to date have been sufficiently*

refined to capture the true adaptive significance of the full range of variability in patterns of attachment" (Barrett 2006 p. 336). She also argues more generally that

> Bowlby's theory was not fully fleshed out in every respect and certain aspects have not withstood rigorous tests. In a sense, because Bowlby does not appear to have intended it to be a static account but one that could, like his concept of 'working models' evolve in response to new evidence, it may be more aptly described as a framework, rather than as a theory. As a framework for exploring further and for seeking to understand more deeply what the conditions are that promote the healthiest social and emotional development, it still seems to hold much promise. Its central message, that both children and adults need others to inform their constantly evolving sense of who they are and what they have to offer, seems sensible on both intuitive and logical levels…However, as we have suggested…there are still many questions that have not been answered and there is still considerable room for further work to be carried out if the full value of Bowlby's approach is to be realised (ibid p.336-7).

Much work remains to be done on the usefulness of Attachment Theory, which, though it was highly influential in the second half of the last century, is almost always difficult to test[14]. Its usefulness is therefore problematic (ibid), if not impossible, to prove experimentally. In fact, experimental results gradually mollified Bowlby's stance, and by the 1980s the word 'critical' was often dropped, and 'sensitive periods' were understood to be characterised by

> Longer, far more variable and ill-defined time periods
>
> Greater susceptibility to particular environmental influences
>
> Effects that could be modified or even reversed by subsequent experience (ibid p. 225).

This 'softer' stance is elaborated by Greenough, et al. Introducing their concept of *experience-expectant behaviour*, they ask:

> An important question is *why* there are experience-expectant or sensitive periods in sensory development. On the surface, it may not make much evolutionary sense to have designed an organism that will be forever impaired in its

sensory performance if the proper sorts of experiences do not occur at relatively specific developmental time points. The offsetting advantage seems to be that sensory systems can develop much greater performance capabilities by taking advantage of experiences that can be expected to be available in the environment of all young animals (Greenough, Black and Wallace 1987, p. 542-543).

Bruer and Greenough (2001, cited in Barrett 2006) explain further:

Typically, sensory and motor systems (e.g. vision, audition, first language learning in humans) develop in part by experience-expectant processes. In the overwhelming number of cases these systems develop normally because the expected, required experiences are reliably present in any typical human environment and readily available to all typical members of a species in their typical environments (Bruer and Greenough 2001, pp. 210-211, cited in Barrett 2006, p. 226).

The concept of 'typical human environment' with its 'typical members' needs some attention here. It is related to Bowlby's (1969) 'Environment of Evolutionary Adaptedness', or EEA, defined by Barkow, Tooby and Cosmides as "*the enduring properties of the environment in which [an organism] evolved*" (Barkow, Tooby and Cosmides 1992, p. 69). Bowlby situates his concept in the larger understanding of evolution and adaptation. He discusses adaptation first in plants, paraphrasing Darwin,

who showed that the detailed flower structure of each species of orchid is such that one particular species of insect is attracted to it and, following visits by the same insect to different flowers, during which it comes into contact with special parts of each flower, fertilization of the orchid seed is achieved. These studies showed clearly…that biological structure is unintelligible unless it is considered in terms of species survival within a very particular environment (Bowlby 1969, p. 80).

Continuing in the same vein, he explains the expanded behavioural dimension in animals:

Darwin was also explicit that what was true of the parts of a flower was true also of the behaviour of animals. In a chapter of *The Origin* (1859) entitled 'Instinct' he notes that each species is endowed with its own peculiarities of anatomy, and emphasizes that 'Instincts are as important as corporeal structure for the welfare of each species.' Translated into the terminology used in this chapter this would be rendered as 'environmentally stable behavioural systems are as necessary as morphological structures for the survival of each species (Bowlby 1969, p. 80).

Clearly, adaptation has many dimensions. Bowlby's EEA includes physical environment as well as behaviour, and the behaviour of an individual infant may more accurately be described as the behaviour of a '*mother-infant dyad'*(Ziv et al 2000, Chappell and Meier 2004), the two being considered as one, since human infants do not attain independence from their mothers or other carers for many years. He continues (emphasis his):

…the only relevant criterion by which to consider the natural adaptedness of any particular part of present-day man's behavioural equipment is the degree to which and the way in which it might contribute to population survival in man's primeval environment…What matters here is that, if man's behavioural equipment is indeed adapted to the primeval environment in which man once lived, it is only by reference to that environment that its structure can be understood (Bowlby 1969, p. 87-88).

Barrett's concept of EEA, however, is more abstract. She describes the kind of experience required of (expected in) an EEA as "*non-specific and rarely absent from human societies world-wide, (e.g. exposure to light, sound, warmth, space, and other people)"* (Barrett 2006, p. 227)

and quotes Bruer: "*Experiences like these are so overwhelmingly likely to occur that nature has bet successfully on them for eons…It is only when there are severe genetic or environmental aberrations from the normal that nature's expectations are frustrated and neural development goes awry"* (Bruer 1999, p. 108-9, cited in Barrett 2006, p. 227).

Thus an environmental aberration of this kind could consist of growing up without light, sound warmth, space, other people etc. The question is whether subsistence activities—for our purposes, the kind of subsistence activities that characterised all creatures until the advent of agriculture, as well as behaviours that seem to accompany them—would be included in the category "non-specific and rarely absent from human societies." Hunter-gatherer activity was, as I have said, generalised throughout the animal kingdom until approximately 12000 BC; and it was never absent from human societies before that time. Hunter-gatherer circumstances and behaviours could perhaps therefore have been evolutionarily 'assumed' and such experiences considered elements of 'experience-expected' rather than experience-dependent' development, the latter being Greenough et al's (1987) term for development that occurs through experiencing variable encounters, specific to time, place and circumstance (Barrett 2006). Does the relatively sudden replacement of hunter-gatherer activities with agricultural ones constitute an "environmental aberration"—a frustration of physiological expectations—such that neural development could be compromised in some individuals?

It may be that the key to addressing that question may be the word 'some'. The difference between 'experience expected' and experience actually encountered may be insignificant to some individuals, who are relatively more adaptable in the face of change, whilst other, less adaptable, individuals may require something much closer to what is expected. For them, a

departure from the expected constitutes some degree of stress. EA Smith, in his comment on the EEA, fails to take into account this kind of variation in adaptability. He questions the view that our cognitive systems "routinely produce maladaptive output under modern conditions":

> Along with other critics (e.g. Foley 1996; Irons 1998; Strassmann and Dunbar 1999), I find the EEA/adaptive lag thesis not so much wrong as ambiguous and oversimplified (Smith 1998; Smith et al 2001) …The widely propounded view that we possess "stone-age minds" ill-suited to the novelties of the modern world, that we endlessly replay Pleistocene scripts in urban jungles regardless of their maladaptive consequences—that we are, in effect, prisoners of our evolved adaptations to past environments—strikes me as a fundamental misconstrual of human adaptation. Our genus evolved in the context of radically fluctuating environments driven by the stochastic nature of Pleistocene climate. Our ancestors, even at the Homo erectus stage, managed to colonize a far broader range of habitats than any other primate species. By the time modern forms of Homo sapiens emerged, but long before the development of agriculture, we were able to flourish in every major terrestrial habitat on the planet, from Amazonia to Greenland...
>
> In order to accomplish this, our ancestors must have been able radically to refashion their diets, technologies, social organizations, mating systems, and cosmologies to adapt to each new environment. In fact, the ethnographic and archaeological evidence makes clear that they did so rapidly and repeatedly… Human behavioral diversity is immense, and utterly dwarfs that of other species. The spatiotemporal patterning of this variation, plus the ease with which people adopt the norms, beliefs, and practices of others, make it abundantly clear that very little of it is due to varying genetic endowments (with obvious exceptions, such as adult lactose tolerance). Instead, this behavioral diversity is due to evolved capacities of the human psyche to generate novel responses to adaptive problems. This set of capacities has been termed "open programs" (Mayr 1974) and "the cognitive niche" (Tooby and DeVore 1987) (Smith 2007, unpaged in web version).

Smith's "exception", lactose intolerance, as I have argued in chapter two of this thesis, may actually point the way to a more comprehensive view, which does take into account the idea of variable adaptability.

But more generally, the suggestion of capacities to generate novel responses to adaptive problems—Mayr's "open programmes" and Tooby and Devore's "cognitive niches"—requires one of Bateson's (Bateson 1972, 1981) 'steps back' to a previous logical level; that is, these are capacities *about* capacities. They are not about responses to *this class* of novel encounters, but about responses to the class of *all classes* of novel encounters. They refer to novelty itself. And once we see that the logical type of this capacity is different from all of those it includes, as it were, as 'members', we can analyse it appropriately, and hypothesise a range of capacities, a range of adaptabilities, distributed through a population. Belsky makes a start at this in his 1997 paper on externalising behaviour. Though we are not particularly concerned with the latter here, I will leave in his references to it for simplicity's sake:

> Consider for a moment the "goal" of evolution—the production of organisms capable of successfully reproducing themselves—and then consider the varied ways in which this goal might be accomplished in the myriad environments in which an organism might someday find itself. Put simply, it might make most sense for natural selection to preserve genes for various versions, or morphs, of the species…Would it not make biological sense, then, for the human species to evolve in a manner that produced variability not only in the heritability of externalising behaviour, but also [in responses] to environmental influences?…Because the biological goal of life is to disburse genes into subsequent generations, and because the ecological niches in which descendents will function and reproduce is always at least somewhat uncertain, it would seem to make sense for evolution to have crafted parents to produce offspring that vary in terms of the ecological niches in which they could flourish and successfully reproduce…It is difficult to imagine that natural selection had not produced in humans a species that would generate such variation. The fact that as a species we are highly susceptible to learning and evince much less instinctual behaviour than do other species does not necessarily mean that all individuals are equally responsive to environmental inputs (Belsky 1997, p. 184-185).

I have briefly considered some of the ramifications of this point in the Introduction, including some of its overlap with the literature on 'at-risk' categories, and shall return to it again in the conclusion. But for the purposes of this chapter, it suffices to propose that, if individuals are differently adaptable, then the relative importance of the postpartum period, or indeed any other developmental period, would vary with that difference. For an individual whose range of adaptability is very small, the postpartum period, with its major physiological changes (see below), may constitute a significant challenge, while the opposite would be true for an individual whose range of adaptability is large.

In light of the idea of a range of adaptabilities, then, it would hardly be controversial to suggest that the neonatal period, keeping in mind the afore-mentioned cautions with regard to attachment theory, is one in which newborn and mother are due special care and consideration in order to optimise the important transition from fetus to neonate.

The IPPP and its challenges

Physiologically, the IPPP is transitional, characterised by major changes to the functioning of all of the baby's body systems. Colson (2002) notes that discontinuity, disruption and separation are the watchwords in this transition; that inevitably the newborn must undergo change to a degree that is almost unimaginable, involving acute adaptations to thermal, cardiovascular, pulmonary, vestibular, immune and metabolic adaptation systems.

The management of these numerous changes has implications for as many health benefits/problems, including cognitive/acuitive functions (Lawrence 1999).

For parents and health professionals, the major ‘management’ decisions immediately following delivery are 1) the physical handling of babies, 2) nutrition and 3) sleep. Each decision is relatable to a spectrum of possibilities, which may be defined by their closeness or distance from an encounter ‘expected’ by the baby’s inherited physiological mechanisms; though carers may be unaware of that relation, and indeed the ‘expected’ encounter may be quite unknown, remaining to be discovered, or re-discovered by carers and health professionals.

Schön provides a useful, very brief history of infant care, outlining changes over time in the kinds of decisions that parents and carers have made, beginning with aboriginal or hunter-gatherer cultures, and continuing to pastoral, agricultural and industrial societies. She uses the term ‘natural parenting’ to refer to the hunter-gatherer model, and as she summarises a long period of history very succinctly, it is worth quoting at length:

It is generally assumed that infant care during most of human history followed principles of an approach based on constant contact and continuous care[15], which was most adaptive in the context of hunting and gathering, the mode of subsistence which prevailed during an estimated 99% of our species’ history (Barkow et al 1992, p.5 and 323; Fagan, 2002, e.g. p. 122, Lozoff and Brittenham, 1979). A review of the child-rearing practices of the few remaining hunter-gatherer societies in the tropics provides details of the used approach. All of the 10 tropical foraging groups examined by Lozoff and Brittenham (1979) carried or held their infants more than 50% of the day before the onset of crawling, and mother and child slept in the same bed or room in all cases. The mother was the principal caregiver, and weaning did not usually take place before the child’s second birthday or well after (true for 86% of the societies). Furthermore, immediate response to infant crying was the rule, and care was generally affectionate. Similar infant care patterns were also found among the 176 other nonindustrial societies reviewed by Lozoff and Brittenham (1979). These were not hunter-gatherer societies, as they engaged in subsistence activities such as

agriculture, fishing or herding, which are more recent developments, having been used during less than 1% of our species history. Co-sleeping of mother and child in the same bed or room, extended nursing, and highly responsive care were also typical in the majority of these cultures. However, what distinguished this subsample from the nomadic hunter-gatherers is that only 56% of them (vs. 100% of the hunter-gatherers) provided their children with close physical contact for more than half of the time during infancy.

In modern-day industrialized countries these practices have been mostly abandoned or at least greatly attenuated. They have been replaced by a more detached approach to infant care, characterized by less maternal involvement and an apparent concern about issues such as overindulging and spoiling the infant or encouraging too great a dependence of the child on the caregiver. While child-rearing practices during most of pre-industrial European history were still much in accordance with natural parenting principles, societal changes in attitude that began in the 18th century and were accelerated by the industrial revolution led to a profound transformation in parenting attitudes by the early 20th century (review presented in Thevenin 1987, p51-63) (Schön 2007, p143-44).

She then describes aspects of modern family life familiar to us—the advent of the nuclear family, emphasis on independence and a concern for 'spoiling', separate sleeping arrangements, the introduction of baby carriages, which reduced the need for infant carrying, bottle feeding, medicalised childbirth and so on. Schön's paper constitutes a comprehensive review of neonatal practices worldwide with a view to addressing her basic research question, "What is the ideal way to care for infants?" (ibid p. 103). I shall summarize some of its main points below, in order to bring out and develop further those concerned with the development of learning.

To begin, Schön spells out her question in more detail:

Although socialization has always aimed to mold children to fit a particular society at a certain time in history, the fundamental needs of a young infant, especially during the first few months of life, are universally the same: adequate nutrition, sufficient sleep, and fulfillment of basic emotional needs. This leads to the question of whether

any of the known child-caring approaches succeeds better than the others in providing the young infant with an optimal environment for physical and psychological growth (ibid p. 103).

She contrasts the prevalent model of infant care in the industrialized West with a version prevalent throughout the world before industrialization and indeed before the advent of agriculture:

On a practical level this results in the infants being kept in close physical contact to their mothers for most of the day until the children start to become mobile, after which physical contact gradually lessens. During the day the infants are carried on the caregivers' bodies, in the front, back or on the hip, frequently with the help of a carrying device, and at night they sleep next to their parents. The children are breastfed on demand for at least 2-4 years and the process of weaning is child-led. Co-sleeping of parents and children may continue for years. Although many aspects of natural parenting [as it is often called] are already currently implemented by many Western parents in varying degrees, approaches that combine all of its elements are nonetheless rare in the contemporary West (ibid p.103).

On that last point I would add here that the issues I have raised in previous sections in this thesis could be seen as an expansion of this approach, such that to "combine all of its elements", as Schön suggests, implies taking into account nutritional and other variables during gestation as well as an awareness of intrusive/nonintrusive birth practices; and if the ideas were to be continually addressed throughout the parenting/education cycle, as I suggest, the approach could be considered to be expanded even further.

It is also noteworthy that in almost all accounts of non-industrialised childcare practices, it is not usually the mother only who carries and looks after the baby (see for example Wannenburgh

1979; Hewlett and Lamb 2005; Konner 1976). Babies are passed around to a variety of caregivers in their extended families and communities, from fathers to grandmothers, older siblings, their friends and so on. The adaptive stress approach would not therefore engender anxieties about the negative effects of non-maternal childcare *per se;* though what goes on in a childcare setting would certainly come under scrutiny.

But to return to Schön: she first looks at the evolutionary context of caregiving, specifically the function of crying, and cites Bell and Ainsworth's (1972) view that crying is one of a suite of adapted attachment behaviours, which have become part of a genetically programmed repertoire of the species through performing a significant survival-promoting function for individual, population and/or species in the environment in which the species evolved—and indeed continue to perform such a function in the present environments occupied by the species (Bell and Ainsworth 1972, p.1186, cited in Schön 2007). She also notes that "*in a species where the progeny is as helpless as that of the human, attachment behaviour on the infant's part alone is not sufficient to ensure continued existence; only in combination with reciprocal maternal behaviour is its protective function maximized* (Schön 2007, p. 106). She continues,

> As these conditions prevailed during most of our evolutionary history, survival-promoting behaviours associated with this evolutionary context, such as crying in infants, became a natural part of the human genetic makeup. Physically, modern human infants have changed very little since these times. Therefore, newborns today will insist on continuous care as vehemently as they did hundreds of thousands of years ago…If some caregivers assume that constant physical contact is no longer necessary for an infant's smooth development, this may well be true in terms of present-day living conditions, but it is nonetheless in conflict with what infants have been biologically adapted for (ibid).

Evolutionarily, human infants are classified as 'carried young,' as opposed either to 'cached', or precocial, that is, able to follow their mothers soon after they are born (ibid p. 106), and Schön provides evidence from diverse sources to support this classification. She does the same for breastfeeding and co-sleeping; though there are known exceptions, there is little to suggest that these were *not* the prevalent mode in infant care before the 20th century. She also makes the point that humans are 'exceptionally immature' at birth:

> A caretaking style that encourages continued contact between mother and child for the first few months after birth …presents the infant with an environment approximating that prior to birth, therefore making the transition and adaptation to extrauterine life as free from abrupt changes as possible. In fact it has been proposed that…gestation is not complete with birth but needs to be completed outside the womb as a form of *exterogestation* (Bostock 1958a, 1958b, 1962; Montagu 1986, p.49-57 and 293-294). Bostock (1962) suggested that gestation should be considered complete at around the age of nine months, when effective crawling commences (Schön 2007, p. 110).

More recently, Commons and Miller (1998) emphasise the importance of the first 6-9 months for subcortical learning—that is, learning that takes place before the development of the ability to carry out conscious, deliberate actions. Much emotional and interactive behavior is learned during the first 6-7 months of life, and much of this learning takes place sub-cortically. According to Emde and his colleagues (1976) as well as others (Fischer and Rose 1995), seven to nine months is the time of a major bio-behavioral shift. During this shift, changes take place in the frontal lobes of the cortex such that the cortext becomes more involved in planning and carrying out deliberate actions. These changes involve both myelination of the frontal cortex, the growth of connections between that area and other brain areas, and the death of some of the extra neurons present in these areas. Therefore we would infer that before this biobehavioural shift is

the period during which subcortical learning might be most prevalent (Commons and Miller 1998).

However, it is not only emotional and interactive behaviour that is learned before the cortex matures enough to allow the infant to display the organizational and executive functions associated with this part of the brain. Goldman-Rakic et al have found, somewhat counter-intuitively, that the pre-frontal cortex develops *concurrently* with the structure associated with lower brain functions, implying the importance of the early post-partum period relative to later-developing intellectual skills:

> A commonly held principle of brain development is that it proceeds in a hierarchical temporal sequence, with phylogenetically older structures maturing before newer regions (e.g. Flechsig 1920; Greenfield 1991; Yakovlev and Lecours 1967). The hierarchical scheme holds true when examining the "vertical" axis of brain maturation, which proceeds in a caudal to rostral sequence, or from spinal cord to brain stem, brain stem to thalamus, and thalamus to cortex. The hierarchical scheme for development of cortical regions is appealing because of the seemingly early development of sensory capacity and the later development of human rational thought and cognitive abilities. [But] quantitative analysis of synaptogenesis in nonhuman primate cortex has caused us to question this assumption and take a new view of the cerebral cortex as an integrated and unified structure that develops as a "whole cloth" (Goldman-Rakic 1978b). The whole cloth view [approaches] the cortex as a woven tapestry in which the entire piece emerges by progressive addition of threads to all portions simultaneously…(Goldman-Rakic et al 1997).

This would seem to underline the idea that the IPPP does have significance for capacities that manifest later. The conscious, executive functions do not just develop as they appear in a child's behaviour, but develop from conception onwards, along with all other brain functions. How then

would the theory of adaptive stress relate to the IPPP? How can carers optimise learning capacities in this period?

I return here to the model of infant care in pre-agricultural societies sketched by Schön, above, and to the notion that human infants conform to the type known as 'carried young.'

> In Montagu's (1986) view, the environmental conditions during [the] period of exterogestation should mimic those within the womb as much as possible—that is, the child should be kept in close contact with the mother's body in a tight and warm embrace…Other researchers have also expressed the view that that continued stimulation of a kind similar to that during the fetal period would facilitate neonates' adjustment to their new environment (Gatts, Fernbach, Wallace, and Singra 1995; Ourth and Brown 1961)(Schön 2007, p. 110).

This view has been effectively developed and practised in hospitals caring for premature babies. Called 'Kangaroo Care (KC),' it was re-'invented' by Columbian Paediatrician Edgar Rey, in 1978, when the hospital in which he was working did not have enough incubators for its preterm babies. His technique was simply to give the babies to their parents for prolonged skin-to-skin contact. Dr Rey and his staff found that KC constituted "*an effective way to meet the baby's need for warmth, breastfeeding, stimulation and safety*" (UCL 1999-2005). KC was thereafter developed by H. Martines and L. Navarrete at the Instituto Materno Infantil in Bogota, and "*is now practiced in many developed as well as developing countries*" (Charpark, Ruiz-Pelaez, Charpark, and Rey-Martinez 1994; Sloan, Camacho, Rojas, and Stern 1994, cited in UCL 1999-2005). Research findings on KC relevant to our question about learning capabilities at later stages of development include:

-[Babies experience] longer alert states and less crying at six months (Whitelaw et al, 1988),

-Improvement of arousal and stress reactivity (Michelssohn et al., 1996)

-Prolonged and augmented breastfeeding rates (Charpark, Figueroa and Ruiz, 1998; Ramanathan et al., 2001),

-Faster growth rates and earlier discharge from hospital (Kambrani, Chdede and Kowo, 1999),

-Babies were more alert and more responsive (Feldman et al., 2002; Tessier et al.,1998),

-Higher developmental rates (Feldman et al., 2002),

-Babies improved their abilities to make understandable requests and to make appropriate responses to maternal stimulation (Tallandini and Scalembra, 2006)

-Following KC procedure being adopted by the mother, mother and father were more sensitive and less intrusive, the family style was more cohesive and positive, and it has shown a long term positive effect on the whole family environment (Feldman et al., 2003) (all cited in UCL 1999-2005).

Research on KC for full term babies has also been carried out. In their 1998 study, Gomez et al concluded by recommending KC in the delivery room "*as a safe and well-tolerated method for mothers and newborn infants which contributes to their well-being"* (Gomez et al., 1998). The only significant contraindications for KC appear to be "*dislodgement of venous or arterial lines or extubation*" (Black 2008, slide 14, cited in Gomez) and a possible increase in instability for very low birthweight babies (Engler et al., 2002, cited in Gomez). These exceptions notwithstanding, the predominance of positive result would be predicted by the adaptive stress hypothesis, both in that babies would 'expect' the womb-like conditions offered by KC, and that as newborns they would 'expect' to be carried for long periods of time as that type of carer-behaviour has been the norm for most of human history.

Another benefit of KC is that the close contact with the mother promotes breastfeeding. The superiority of breastfeeding over all other methods of feeding in the perinatal period is now well

documented (see for example Kavanaugh et al. 1997), and is encouraged in hospitals throughout the NHS. The association between duration of breastfeeding and later childhood cognitive ability has also been studied. Horwood and Ferguson (1998) found that, after correcting for maternal factors such as age and education,

> ...breastfeeding is associated with small but detectable increases in child cognitive ability and educational achievement. These effects are 1)pervasive, being reflected in a range of measures including standardized tests, teacher ratings and academic outcomes in high school; and 2) relatively long-lived, extending throughout childhood into young adulthood (Horwood and Fergusson, 1998, abstract).

Angelsen et al found that cognitive ability increased with the length of time an infant was breast-fed (Angelsen et al 2001), while other studies found that the perceived increases in IQ associated with breastfeeding were instead related to socio-environmental factors (Jacobsen, Chiodo and Jacobsen (1999), though they stress that this result should not be interpreted as detracting from medical benefits. But a later trial by Kramer et al eliminated socio-economic elements and provided much stronger evidence that lengthy breastfeeding has a beneficial effect upon cognitive development (Kramer et al 2008).

Both KC and breastfeeding are in any case consistent with care behaviours which may be said to be expected by newborns, and both have either positive or neutral effects on general and/or cognitive development. Thus they could be said to confirm these aspects of the adaptive stress hypothesis, and to suggest that where optimising learning capabilities is the goal, these care practices may well be part of the picture.

Another aspect of the IPPP mentioned by Schön is co-sleeping. Most research done on this topic concerns its safety, relation to Sudden infant Death Syndrome (SIDS) or implications for the development of independence in infants. Few studies analyse co-sleeping in relation to cognitive /intellectual development. Okami's 2002 study, however, does exactly this. Okami and colleagues carried out the first published longitudinal study of 'outcome correlates of parent-child bedsharing', including an analysis of cognitive competence at six years. Though the results were at first positive, subsequent analyses could only come to negative ('not harmful') or neutral conclusions. The authors explain that "*We discuss these results in light of widespread fear of harm caused by parent-child bedsharing. We suggest that such fears are without warrant if bedsharing is practiced safely as part of a complex of valued and related family practices*" (Okami, Weisner, and Olmstead 2002).

Conclusion

Though opinions vary as to the importance of the IPPP, some clarity may be brought to the situation by suggesting that individuals are differently adaptable, the importance of the period varying with that difference. Thus the neonatal period, keeping in mind the cautionary effects of some experimental results, may still be considered one in which newborn and mother are due special care and consideration in order to optimise the important transition from fetus to neonate. And though evidence does not absolutely confirm in every case the positive value of 'kangaroo-care', breastfeeding and co-sleeping—three child care practices that recall the normative practices of our species before that advent of agriculture, and which could be said to be 'expected' by infants for that reason—there is enough positive evidence to support the assertion that they are important elements of a suite of care practices that, along with the others described

in this paper, could be employed by parents and carers in their efforts to optimise learning capabilities.

CHAPTER 5

FREUDIAN CONCEPTS RELEVANT TO EARLY EXPERIENCE

Adam Phillips, in his opening remarks for an introductory work on Freud, says that Freud "*assumes, paradoxically, that the one thing the reader wants to do more than know, is not to know; that indeed, the very ways we go about knowing things is the form our greed for ignorance takes*" (Phillips 2006, p. xii). He illustrates by this Freud's view of how people deal with negative experience: we try to avoid it. From a very young age, we build psychic barriers to avoid negative experience; this preserves us from the effect of the experience, but also limits and inhibits us with regard to new learning, new experience.

So far in this thesis I have considered how parents and carers might avoid eliciting unnecessary adaptive mechanisms in their charges. In this chapter I would like to look at adaptive mechanisms that are often categorised as 'psychological,' what some of them are according to Freud and his followers, and how parents and carers might prevent these from arising in the children in their care. I shall suggest a re-interpretation of certain phenomena and shall show the relevance of that re-interpretation to learning and the optimisation of learning capacity.

Freud worked upon the assumption that some trauma had occurred in his patients' lives, which was not consciously remembered but which had come to drive their behaviour, or certain aspects of it. The nature of the traumas is various, and is perhaps immaterial to our argument; rather, one could say simply that there was an experience of 'not-rightness' which then had to be adapted to.

The experience of ‘not-rightness,’ particularly in early life, may be felt as emotional pain, and the ego resists feeling it, preferring in many cases to repress it or ‘store’ it in a part of the psyche which is unconscious. However, repression does not take away the effectiveness of the emotion. Instead of being rendered harmless, it makes itself known by appearing in a transmuted form. As Freud says, it is ‘acted out’ or ‘repeated’ (Freud 1914) in behaviours which eventually cause patients to seek treatment. The original trauma may not appear to the observer or analyst to be very severe, yet it has engendered a response from the patient which is serious enough to be called a “traumatic neurosis” (Freud 1920, p. 138).

Certainly, at the time Freud was working and writing, repression played a very great role in ‘normal’ bourgeois European life (see Michael Haneke’s 2009 film ‘The White Ribbon’ for a brilliant evocation of this). Much of early behaviour that is considered ‘normal’ now would have been considered ‘outrageous’ then and duly repressed. Yet, as I have tried to point out in earlier chapters, there are some aspects of ‘normal’ life in the early 21st century that may also be experienced as painful traumas by very young children. For some individuals—and I am here referring to the spectrum of adaptability mentioned in earlier sections—an occurrence that would not bother 90% of infants is nonetheless experienced as painful, even traumatic, to the other 10%, and the occurrence therefore triggers a defensive response within this minority group. I suggest that we can include within this class of occurrences those which I have called ‘deviations from expected encounters.’

The concept of expectation can provide us with a starting point for this exploration, as it has done in earlier chapters. Freud's view of expectation was an interesting one, elucidated as he takes his reader Beyond the Pleasure Principle (1920). He makes a distinction between *fear* and *fright*, and wonders why patients who suffer from war trauma exhibit very similar symptoms to those of patients in peacetime who have not experienced the 'raw mechanical force' (p. 138) of war:

> …the key causative element seemed to lie in the surprise factor, the *fright* experienced by the victim…The words 'fright', 'dread' and 'fear' are wrongly used as interchangeable synonyms, for they can be easily differentiated from each other in their relationship.to danger. 'Fear' represents a certain kind of inner state amounting to expectation of, and preparation for, danger of some kind, even though the nature of the danger may well be unknown. 'Dread' requires a specific object of which we are afraid. 'Fright', however, emphasises the element of surprise; it describes the state that possesses us when we find ourselves plunged into danger without being prepared for it. I do not believe that fear can engender a traumatic neurosis; there is an element within fear that protects us against fright, and hence also against fright-induced neurosis (Freud 1920, p. 138).

Fear requires some sort of fore-knowledge or expectation of an encounter, whereas "*fright can appear only in the absence of a state of apprehensiveness*."[16] (Freud 1920, p. 159) The apprehensiveness brings with it a state of readiness-to-encounter or *hypercathexis*, which, Freud says, helps the fearful individual to cope with the incoming stimulation. Fright, however, occurs when there is no such preparedness; the stimulation is entirely unexpected, its effects therefore more pervasive. It is related to the concept of shock, though they differ in one important way. "The essential thing about the shock is that it directly damages the molecular or even the histological structure of the nerve elements, [whereas] we for our part seek to understand its effects in terms of the breaching of the protective barrier around the psyche, and the new

challenges this gives rise to" (ibid, p. 159). An encounter, whether positive or negative, is more easily adapted to when it is expected. An unexpected encounter is not mediated by preparedness and so strikes harder and with more effect.

Interestingly, Freud hypothesises that dreams in which a negative experience is repeatedly re-visited may have a therapeutic effect, however unpleasant the process. "*These dreams*," he writes, "*seek to assert control of the stimuli* ***retrospectively*** *by generating fear—the absence of which was the cause of the traumatic neurosis in the first place*" (ibid). For Freud, generating fear is generating expectation of the frightful event; the expectation then becomes in a sense therapeutic, and the absence of expectation damaging.

The encounter which is unexpected and unprepared-for may be dealt with by the psyche in another way, however. Freud mentions the phenomenon of 'annexation'—by which he seems to mean a psychic process which both divides and joins.[17] Like a hotel annex, it is separate from the 'main building' of the psyche, yet it is assuredly still a part of it. The part of the psyche that experienced the unexpected trauma is 'cordoned-off', as it were, and is relegated to the unconscious, along with the feeling of pain that accompanied the experience. The self becomes divided to some degree. This division may easily be formed within our developmental time line, from conception to eighteen months.

Bakan (1968) explicates this notion of division. Using the Greek *telos* to denote a kind of purposefulness that may be attributed to unconscious processes, perhaps similar to the way I have used *expectation* above, and not attempting to resolve the larger question of mechanism v

teleology in nature, he considers the notion that pathology might involve '*multiple teleologic centres*.' He follows Selye (1956) in this line of thinking: "*…let us instead consider the possibility that in the healthy organism there is a higher telos tending to dominate all the lower telê, and that disease is to be conceived of as a decentralisation of this higher telos of the organism, and its loss of dominance over the lower telê* (Bakan 1968, p. 320).

I suggest that where this has relevance to learning capabilities is that, where the attention of the self—towards its own interior—is divided, that self is unable to give its full attention to the demands coming from the exterior. Its unconscious attention is always partly occupied, partly unavailable for learning, even when the individual's conscious desire is entirely directed towards that learning.

For Freud the therapeutic process requires the patient to bring his attention to bear upon itself, that is, upon the problem of divided attention: "He has to find the courage to focus his attention on the manifestations of his illness" (Freud 1914, p398). It is not by chance that he uses the word 'courage' here, as facing the trauma that engendered the splitting off certainly requires it. Paraphrasing Goldberg (1991, 1993), it requires the letting-in of the pain that has heretofore been avoided. Bakan, again following and expanding upon Selye, suggests that this agreement of the self to "not defend itself" may be the key to its overcoming the unwanted automatic responses which compromise an individual's capacity to give attention to and take in new information, that is, to learn.

So whilst therapy, for conscious adults wishing to address a psychopathology, can be said to be aimed at restoring a single voice for the individual, the ability to bring an integrated, united self to any encounter, I suggest that there are here too, implications for the optimisation of learning capabilities in developing children. But before I return to this, I would like to say a little about Freud's perplexing theory of the death instinct, and how it might relate to this theme.

I discussed in a previous chapter the work of Walter Cannon, dealing with the concept of homeostasis, and Hans Selye, whose main theme was stress and our responses to it. In Disease, Pain and Sacrifice (1968), Bakan synthesises and discusses their ideas in conjunction with those of Freud and Darwin. Like Richards (1970), he questions Darwin's and Cannon's assumption that all adaptations are 'individual-survival-positive', and agrees with Selye that it can be the adaptive survival strategies, meant to defend the individual from diverse harms, that in reality lead to harm themselves. Selye: "*Some diseases have specific causes, the direct actions of certain disease-producing agents, such as microbes, poisons, or physical injuries. Many more diseases are not caused by any one thing in particular; they result from the body's own response to some unusual situation"* (Selye 1956, quoted in Bakan 1968, p. 24).

Bakan concludes that there are some "*mechanisms in the organism which are individual-survival negative*" (ibid p. 25), that is natural systems in the body that work against the survival of the individual. "*Thus Selye's observations and conclusions come remarkably close to those associated with [Freud's] idea of the "death instinct…Selye has succeeded in showing in great detail how mechanisms in the organism bring about its own disease and death*" (ibid). He also notes that "*the death instinct, according to Freud, is evident in the compulsion to repeat*", and cites the phenomenon of an individual returning again and again to old traumatic thoughts, fears

or behaviours "*in opposition to his conscious intention, or even to his disadvantage…The way in which events take place automatically in the organism is what Freud identified as reflecting the work of the death instinct"* (ibid p. 29).

Over the years there have been numerous refutations of the usefulness of this concept. Macmillan (1997) surveyed the many judgements upon Freud, and remarked that Ernest Jones had pointed out in the 1950s that Brun's 1926 review of the biological literature had not found support for the death instinct. Thirty years later, Macmillan continues, Pratt (1958) cited numerous strong refutations, from as far back as the early 1900s, and the concept is not generally in circulation today. The compulsion to repeat is, however, a well-known phenomenon, which has been interpreted in non-Freudian ways since that author's first attempt to conceptualise it. There is undoubtedly a tendency in some individuals to get psychologically 'stuck', repetitively to be revisiting an earlier stage of life whilst simultaneously trying to negotiate the present. Rather than positing an unending backward slide to inanimate life and thus to death, as Freud did, could it not be possible that that repetition is for a healthful purpose—the repeated scenario is an image of what the individual is psychically adapted to; therefore the adaptive system seeks this out as the most likely situation to promote survival? Survival must always be the primary goal; but it also allows time to revisit this adaptive niche, to come to know it and oneself, and to go through the process of re-adapting to a healthier scenario, *so that* progress, maturation and learning can more efficiently take place.

The adaptive, defensive responses during development that Selye saw as 'individual-survival-negative' could be re-evaluated as strategies within healthful developmental progress, which, as I have mentioned before, in effect 'buy time' for individuals, so that they are allowed to survive in

a difficult situations, hopefully to come to know themselves and their psychic tendencies through time, experience, education and perhaps therapy. Bakan notes that Selye's findings "*lead him to at least one aspect of the psychoanalytic position, that there is a relationship between self-knowledge and therapy. His advice is "know thyself", essentially the advice of all psychoanalysis*" (Bakan 1968, p. 30).

It is of course also the motto of many an academic institution. It may be that the repetition compulsion could be re-characterised as showing evidence of a "self-knowledge" instinct or even an "education instinct".

But to return to the role of parents and carers: with regard to the fact that individuals can find themselves thus divided after an experience of some degree of unexpected trauma, what is the role of parents and carers in avoiding such a division in their own charges? How can learning capacities be optimised in view of this phenomenon?

I have set out in earlier sections the principle of an experienced deviation from an expected encounter, and the hypothesis that this deviation can lead to what I have called adaptive stress in some individuals. My considerations in this chapter of a Freudian approach to learning would seem to suggest that the idea of adaptive stress is both consistent with and is complemented by the expectations of psychoanalytic theory. Parents and carers do not know their children's stress-points at the beginning of life, nor do they know how they will respond to stressful encounters. They don't know what sorts of stimuli would induce a child to erect a "protective barrier around the psyche", such that learning capacity might be curtailed in future. That knowledge can only be

gained by careful observation over time. But until that knowledge is gained, it may be well to suggest cleaving as closely as possible to the provision of encounters that may reasonably be supposed to be expected by the baby's adaptive system, and introducing supposed deviations slowly and with due vigilance.

But, it may be argued, is this not too constrictive to parents, when a great many babies would not be troubled by encounters that deviate from expectation? Many babies appear to thrive on modern diets, have had intrusive births and continually encounter unprecedented phenomena, yet seem to 'do very well.' This point is addressed briefly in the Introduction, and I would re-iterate at this point that in any case a minority *are* troubled by the deviation, and would repeat the suggestion that carers could try early on in a comprehensive and detailed way to ascertain what stresses a developing child, and to what degree. A precedent for this type of activity has been set by Steven Gutstein, the founder of a strategy called Relationship Development Intervention, who recommends that school-age children with difficulty establishing relationships should keep a 'stress journal' in between sessions, to help them become aware of what stresses them (Gutstein and Sheely 2002, p.242. It may be that such detailed journal–keeping, from conception onwards, could help a great deal to focus parents and carers on their baby's responses to encounters, even those that would not normally be seen as 'stressful.' Thus a useful picture of 'give and take' in the baby's life—not only what they encounter but how they respond to a range of encounters, could be built up, and a 'virtuous feed-back loop' established, such that carers can swiftly alter their own behaviours, modify what the baby encounters, and so on, to avoid unnecessary stress and cultivate a sense of expectedness, rightness, contentment. Importantly, too, carers can work with the child as it grows and becomes more conscious of its own self, to develop its ability to respond optimally to stress, in ways that are healthful.

Again speaking of an adult patient, Freud suggested that he should see his illness/trauma responses as habits which exist for good reasons, and from which he might take something of real value for his life. And there are examples in the sub-genre of childhood memoirs in which the effect of great difficulty, if not abuse, is minimised, by parents' skilful shepherding through the traumatic time, such that the children learn to value even the trauma for what it eventually brings them. The recent memoir, The Greatest Gift (Bienkowski and Akers 2008), is one of these. But again my concern is not with the majority of children who would respond well to good treatment in a difficult situation, but those whose response to difficulty is organically more extreme, such that their own interior responses cut them off from learning possibilities, while parents can only watch, not seeing any reasonable cause for the behaviour, or not noticing it until problems appear later at school. By then, of course, the early formative period has passed, adaptive strategies have been devised, and walls erected that may not come down without resistance. And that is a painful process.

Conclusion

In this section I have considered the psychological approach to adaptation and stress of Freud and his followers. The importance given to early childhood in the psychoanalytic tradition is mirrored in the adaptive stress approach. Though some of Freud's ideas have been discounted in the years since their publication, some, such as his distinction between the traumatic experience of *fear* and that of *fright*, are relevant to the concepts of physiological expectation and adaptive stress. For Freud, fright and shock are related, though they differ in one important way: "*The essential thing about the shock is that it directly damages the molecular or even the histological structure of the nerve elements, [whereas] we for our part seek to understand its effects in terms of the breaching of the protective barrier around the psyche, and the new challenges this gives*

rise to" (ibid, p. 159). Thus the Freudian concept of a 'protective barrier around the psyche' in a useful one for evaluating some of the more subtle adaptations to stress, and the effect of these adaptations upon an individual's capacity to learn.

I have suggested that in order to help their charges avoid erecting troublesome interior barriers, parents could take a cautious approach with regard to their child's adapability at first, cleaving as closely as possible to the provision of encounters that may reasonably be supposed to be expected by the baby's adaptive system, and introducing supposed deviations slowly and with due vigilance. Stress diaries could also give a useful picture of 'give and take' in the baby's life—not only what they encounter but how they respond to a range of encounters. This could help to establish a 'virtuous feed-back loop,' such that carers can swiftly alter their own behaviours, modify what the baby encounters, and so on, to avoid unnecessary stress and cultivate a sense of expectedness, rightness, and contentment.

CHAPTER 6

EARLY MOVEMENT AND PLAY

In this Chapter I shall discuss the relation of movement and early play to the development of learning capabilities. I shall look in particular at typical development and disruptions to it which cause breaks in the expectation cycle that I outlined in Chapter 4. The issues I will cover include: the importance of crawling, with a look at left-right hemisphere integration and the primitive reflexes; freedom of movement and the Waldon approach; play in hunter-gatherer and other contexts, including physical, social, fine motor and symbolic play; and 'reading' in three dimensions.

The in-arms period ends when babies have had enough of it—they want to move on their own. Though they will in most cases return to their caregivers' arms from time to time during their daily activities, their need of such contact gradually decreases. The baby's first foray usually involves some sort of rolling, followed by a form of crawling, and I shall turn here to the importance of this stage. But to understand crawling, one must first look at early movement patterns in a more general way.

Introducing her book on the primitive and postural reflexes, Goddard writes, *"Learning, language and behaviour are all linked in some way to the function of the motor system and control of movement…Attention, balance and co-ordination are the primary A, B and C upon*

which all later academic learning depends" (Goddard 2002, p. xvi). Her work has focused on reflexes,

> a set of primitive reflexes designed to ensure immediate responses to [the] environment and to [a baby's] changing needs. Primitive reflexes are automatic, stereotyped movements, directed from the brain stem and executed without cortical involvement.
>
> They are essential for the baby's survival in the first few weeks of life, and they provide rudimentary training for many later voluntary skills. The primitive reflexes, however, should only have a limited life-span, and having helped the baby to survive the first hazardous months of life, they should be inhibited or controlled by higher centres of the brain. This allows more sophisticated neural structures to develop, which then allow the infant control of voluntary response (Goddard 2002, p. 1).

These reflexes begin to manifest as early as five weeks after conception, and normally they appear in strict order. They "*can act in two ways: either in a chain reaction, or with one reflex having an inhibitory effect upon another*" (ibid p.9) each giving way to the next when the appropriate level of neural maturity is reached. Thus the very first reflex is *withdrawal,* in response to touch, followed by the *moro* reflex, which is an involuntary reaction to threat. This in turn is replaced at the age of 2-4 months by the adult *startle* or *Strauss* reflex. Another pair of reflexes known as the *palmar* and *plantar* reflexes develops grasping and finger control. The next to emerge is the *asymmetrical tonic neck* reflex (ATNR): "*movement of the baby's head to one side will elicit reflexive extension of the arm and leg to the side to which the head is turned and flexion of the occipital limbs*" (ibid p.10).

Though there are at least fifteen recognised reflexes, I would like to focus for a moment on the ATNR, which may serve as an example of reflex action and its need for inhibition:

In utero the ATNR provides "*continuous motion which stimulates the balance mechanism and increases neural connections*" (Goddard 2002 p. 10), while DeMyer describes the ATNR in the neonate period as "the first eye-hand coordination to take place" (DeMyer 1980, cited in Goddard 2002, p. 11). By six months, however, the ATNR should have completed its task, making way for further, more sophisticated patterns. These allow more complex skills to be acquired. If the ATNR is not inhibited, it can interfere with the acquisition of skills such as crawling and walking. As Goddard notes, "*…it is impossible to crawl on the stomach with a fluent cross-pattern movement if the ATNR persists. Crawling and creeping are important for the further development of hand-eye co-ordination and the integration of vestibular information with other senses*" (ibid).

If the ATNR is still present when children are ready to walk, they may find that their "*balance is insecure. Movement of the head to either side will result in straightening of the limbs on that side, upsetting the centre of balance and insisting on homolateral movement*"(ibid). They may also find that they have difficulty crossing the midline of the body, and establishing preferred or dominant hand, leg or ear. Goddard's summary is apt: it is as if the child is "*fighting against a perpetual invisible force*" (ibid).

Many other retained reflexes may cause problems of this nature. In general, where reflexes are retained, "*the fundamental equipment essential for learning will be faulty or inefficient despite adequate intellectual ability. It is as if later skills remain tethered to an earlier stage of development and instead of becoming automatic, can only be mastered through continuous conscious effort*" (Goddard 2002, p. 2).

However, it is interesting to note research on certain care-giving practices, recorded in the literature on a number of societies in Africa. Takada(2005) and others (Konner 1973, 1976; Super 1976; Bril et al 1989, all cited in Takada 2005) described mother-infant interactions known as 'gymnastic behaviours,' in which "*caregivers frequently keep infants standing or jumping on their lap, beginning several weeks after birth*" (Takada 2005, p.289). He explains,

> Gymnastic behaviour induces the stepping reflex in an infant. This reflex, also called the "U-shaped" primitive reflex, is present at birth, but usually disappears within the first few months of life. Subsequently, the stepping response re-appears when the infant begins to stand and walk (Bly 1994; Cole and Cole 1993). Researchers have suggested that the first stepping reflex completely disappears, and that the early presence of this reflex is irrelevant to subsequent mechanisms involved in later independent walking (Bruner and Bruner 1968). However, Zelazo and his colleagues found that when caregivers continue to engage infants in 'gymnastic' exercises, infant stepping does not disappear. Additionally, such continuous exercises result in unaided walking at a younger age (Zelazo et al 1972; Zelazo 1983) (Takada 2005, p. 290).

Analysing his data, Takada summarises, "*…gymnastic behaviour induced the stepping reflex and prevented its disappearance in infants over two months of age. The finding supports the hypothesis that the stepping reflex is not innately programmed to disappear after a few months of life but is a flexible behaviour that will occur in certain situations (Thelen 1986; Zelazo 1983)* (Takada 2005, p. 290).

Evidence of a retained reflex supports Goddard's approach; but precocial walking would argue against her understanding of the detrimental effects of retained primitive reflexes. It may be that in certain cases, 'exercises' employed by caregivers to attain a particular goal, may be useful as intended; the 'gymnastic exercises' may help an infant to walk more quickly. But Takada does

not mention whether the acceleration also meant a reduction in the time spent in the crawling stage, nor does he mention the early walkers' progress, or lack of it, in later education.

Certainly, as regards crawling there is increasing evidence that

> Children who miss the vitally important crawling stage may exhibit learning difficulties later on. Crawling, a cross-lateral movement, activates development of the corpus callosum (the nerve pathways between the two hemispheres of the cerebrum). This gets both sides of the body working together, including the arms, legs, eyes (binocular vision) and the ears (binaural hearing) (Hannaford 1995, p.100.)

Other researchers noting the link between crawling and the development of learning skills include Anderson (1999), Pavlidis (1981) and Raviv (2005), the consensus being that crawling appears to be important in the over-all organisation of brain and body. Goddard affirms this in the following passage (referring to crawling as '*creeping'*, and using the word *crawling* to denote crawling with the belly and chest on the ground):

> Creeping is one of the most important movement patterns in the prolonged process of teaching the eyes to cross the midline. In addition to looking ahead, babies also learn eye-hand co-ordination from the movement of the hands. At times, the eyes focus from one hand to another, with the hands acting as moving stimuli. Later on this ability will be essential for being able to read without losing the words at the middle of the line and to visually follow the moving hand when writing. It is through creeping that the vestibular, proprioceptive and visual systems connect to operate together for the first time…
>
> The focusing distance and hand-eye co-ordination skills used in the act of creeping are at the same distance that the child will eventually use for reading and writing. It has been observed (Pavlides 1987) that a high percentage of children with reading difficulties omitted the stages of crawling and creeping in infancy (Goddard 2002, p. 23).

Acceptance of this principle, that early reflex and motor skill progression *are* important in relation to later learning, leads to the question, 'what can be done to ensure a smooth developmental progression, or at least a 'best odds chance' of doing so, through this sequence of reflexes and developmental stages?'

Although Goddard's book is mainly aimed at teachers and therapists, she also addresses parents, focusing on the pre-school years.

Besides love and discipline, freedom to move and freedom to play are two of the most important gifts parents can give to their child. If we want to make sure the baby learns to hold his head up, we put him on his tummy, sit in front of him and talk to him. If he does not want to turn over, we hold something bright to his side, so that he is motivated to turn. To help connect the vestibular system to body awareness, we play "This is the way the ladies ride" …In short, we do all the things mother have been doing for centuries" (Goddard 2002, p. 98).

She elaborates on the importance of movement:

Modern baby equipment has been a godsend for parents, but moulded baby seats, buggies and car seats should never replace the floor as baby's first playground.[18] It is time spent in free play on the floor that helps a child to learn control over his body and therefore gain confidence. On the floor there is freedom to move and to gain experience from different types of exploratory adventures that the child can't have from the confines of the chair.

While lying on the tummy, a baby first learns how to hold his head up. A few months later, he will learn how to roll from tummy to back and eventually how to achieve the sitting and crawling positions. In order to sit, the baby must pass through many stages of motor development: he achieves control over posture and gets mastery over balance, each stage heralding increased maturity of the central nervous system. If an adult places the baby in a sitting

position, that child cannot pass through these stages spontaneously, and may become afraid of falling because he does not know how to retrieve his balance by himself (ibid p.99).

Clearly, there is a fine line to be drawn between 'motivating' baby to get on to the next stage, and putting him in it bodily—the key element being that, if the parent's involvement is to be a benefit, the motivation and the actual action must remain the baby's. He is doing the work, because he wants to, and so forging new neural connections, and learning something that he needs to learn. Neither a parent nor a piece of equipment is doing the job for him.

Play

For most children, early efforts at independent movement gradually evolve into 'play.' Play is undoubtedly an immensely complex concept, which has been extensively written about from a wide variety of points of view. Bruner, Jolly and Sylva, for example, editors of the classic work, Play: Its Role in Development and Evolution (1976, 1985), divide the concept of play into four parts (The Evolutionary Context; Play and the World of Objects and Tools; Play and the Social World; and Play and the World of Symbols). Each of these has numerous sub-headings, such as Why Play Evolved in Animals and Man; Mastery Play; Playing Sex Roles and The Special Case of Games, and these are further sub-divided into the wide range of papers that make up the book, such as 'The Play of Animals'; 'A Theory of Play and Fantasy'; 'Male Barbary Macaques 'Help.with the Babies''; 'Country Games in the 1880s'; 'Combat in Child Art' and 'Play and Actuality', to name but a few at random. The subject is vast.

But I shall try to approach it as an outgrowth of the impulse to move, out and away from the sheltered world of infancy, into the more varied and challenging world at large. Following Kamei, whose rationale echoes that outlined earlier in this paper, I shall take as a model the play of hunter-gatherer children, "*because it may tell us something about human nature, which we acquired during long periods of hunting-gathering lives before the neolithic revolution, the beginning of agriculture*" (Kamei 2005, p. 344). Contrasts with other cultural models will be included as necessary.

Konner, writing about the !Kung and related peoples in Southern Africa, writes,

> During the second half of the second year, toddlers begin to play with other, mainly older, children…Given the modal group size of around thirty, peer groups in the strict sense—groups of children the same age and sex—were very unlikely and indeed were not observed. Play groups almost always consisted of both sexes and a range of ages. Among the adaptive functions suggested for these play groups [in an earlier paper] were facilitating relationships in two- to five-year-olds (bypassing the commonly observed Western developmental pattern of parallel play), socialization of younger children, practice of caregiving by older children, and lightening the mother's burden of child care…[The children] played in mixed-age, mixed-sex groups that meandered around the village, camp or the surrounding bush (Konner 2005, p. 29).

This 'meandering' quality is also conveyed by Kamei's report. "*Normally*," he says, "*children play simply for the purpose of having fun with their peers and do not have any intention to teach or train themselves with a goal in mind*" (Kamei 2005, p. 345). Their play moves and flows around the place in which they live, reflecting their environment and culture, and expressing their individual and collective interests. Nevertheless, it is easy to see from Kamei's meticulous list of children's activities that at least some of their play would indeed train them and develop

skills needed later on in the adult world. It is hard to resist reproducing here a few of these rather charming pastimes:

Making a gun with a stem of papaya

Mouse-hunting with bows or spears

Termite gathering

Making a hut

Play cooking with inedible materials

Food-getting competition

Making eyelashes out of vines

Making and wearing false breasts

Playing with fire

Humouring babies

Group.play with songs

Dancing

Playing “aita,” a guitar with seven strings

Toy cars made out of banana leaves and stems

Mimicking drivers using chairs

Playing “songo,” a board game with stones

Everting their eyelids

Playing tag

Frolicking

Filling nostrils with beans

Playing with mud

Playing on the swings of an oil palm tree

Balancing a broom in their hands

The wide range of activities is striking here. By contrast, Healy (1998) notes the limited range of play activities children typically engage in, where their cultures are dominated by computers and other electronic play.

Geoffrey Waldon, an educationalist and researcher working in the 1970s and 80s, also noted the importance of the seemingly aimless, fundamental type of learning that takes place prior to any awareness of 'content' in play. He refers to play in which, for example, pre-school children simply move objects about, trying this and that with them, exploring their properties and behaviours:

...they [the children] are, for the most part, free to choose to do what they like and to do it in the way they like, just for the fun of doing it. In this way they are encouraged entirely by the satisfactions which accompany these activities… The child does everything for him- or herself. He chooses the behaviour from his store of experience; he initiates the action in his own time; its performance is reinforced, or rewarded, by the pleasure he takes in it, and in future it is likely to be chosen again because of the pleasure he has previously taken in it.

Whatever he does and how-so-ever he does it is good. Even if what happens is not quite what or how intended, it is still good.

Everything new he learns, grows out of what he has learned before and contains the essence of what has gone before. Therefore, the more soundly anything is understood, the richer and more varied the state of understanding,

the more probable it is to prove the source and foundation of wide-ranging and mature abilities in the future. (Waldon 1980, unpaged)

On a cultural note, it is interesting that Waldon assumes the preschooler's aloneness. He insists,

It must be noted that each of these children is playing all by himself. For this kind of play the actual presence of other people is not necessary. If they are there, their role need be no more than that of domestic animals or inanimate objects for this kind of experience-gaining, and so the child can behave as if completely alone (ibid).

One can only imagine that this kind of solitude would happen rarely in a society such as was described by Konner above. Wannenbrugh, also working in Southern Africa, described a baby's daily experience: "*Glowing in the light of a copper sunset, a baby who has been fondled, cuddled, teased and reassured by everyone all day, now returns to his mother's arms*" (Wannenburgh 1979, text accompanying photo no. 6). It may be that Waldon's aloneness is really a phenomenon of the nuclear family. Putting that aside, however, his point remains, that there is an important part of learning that requires only to be allowed to happen by itself, through the exploratory impulses of children themselves, without much interference from adults, who may be tempted to impose 'content' before it is appropriate. It is self-directed, constitutes its own reward and builds experience and basic awareness of relationships that will be drawn upon in later learning.

Optimising learning at this stage may therefore consist of letting babies and young children do what they want to do, as far as possible. If they want to climb up and down stairs, let them,

following along behind to prevent falls, but letting them do the work; if they want to build dens in the sitting room, then so be it, and so on. Every family will know its own limits.

Waldon has shown diagrammatically (Appendix 2) how he sees these activities moving naturally through to learning with 'content': matching, sorting, seriation, brick building and drawing (Waldon, 1982). He suggests that a change occurs at around fifteen months, characterised by a "massive gain of experience." Order and content make their appearance after a sufficient bank of experience has been obtained, through more or less free movement and play. This is Waldon's concept of "fundamental understanding." It is very curious, however, that the sixth activity he mentions, "coding," is not connected in the diagram to the preceding build-up of physical and mental experience. Waldon places "simple associations between perceptions" outside of the developmental sequence, and has it developing, inexplicably, all by itself from zero to fifteen months, into 'coding,' which develops again over time into the understanding and use of 'arbitrary symbols'. This separation is not explained in Waldon's publications.

However, I would like briefly to discuss this development of symbolic processing through the kind of 'three-dimensional reading' that naturally occurs in a hunter-gatherer setting as a child matures. Bird and Bliege Bird (2005), for example, describe children in the Western Desert of Australia engaging in their own hunting expeditions when left behind in camp by adults:

When children are left behind…they often decide to pick *kumpulpaja* or *jinyjawirri* or hunt lizards. Generally all children in camp, boys and girls, will forage together in the same group. Their efforts are highly praised by young and old alike, but their decisions about whether or not to forage and what to look for are not directly influenced by adults. Children fan out and search the sands between the rocks for recent tracks, and carefully follow signs of the

lizards to a likely den….When one child finds a promising den, then others may come to assist…(Bird and Bliege Bird 2005, p. 136)

The children must read the signs left by the lizards in order to find them, catch them, kill them, take them home, cook them and eat them (ibid p. 136; Napanankga 2005, cited in Bird and Bliege Bird 2005)—the last being a highly motivating reward, along with the praise of their peers and parents. The authors also note that these activities

require complex knowledge about where and when to hunt, and intricate strategies to search for, track and extract the prey. Tracking prey…requires hunters to synthesize complex information about goanna feeding and denning behaviours and their signatures across substrates that vary with location, season and weather conditions (Bird and Bliege Bird 2005, p. 144).

Foraging for plants also involves three dimensional reading. Child foragers in Madagascar looking for *ovy*, a wild tuber, 'read' complex, multi-year histories in the ground in an *ovy* patch to discern the size and numbers of tubers below, and the process of scanning the sand and leaf litter for information has a name, *mifaokovy.*

These few examples are of course not isolated, but are and have been repeated in almost infinite contexts all over the world, throughout our collective history. Symbolic processing is simply a part of life, and a very important part. One cannot help going back here to the point about diversity v paucity of young people's activities in hunter gatherer and information-age settings, respectively. It may be the absence of three-dimensional, outdoor sign seeking, or reading, in children's activities today, rather than the presence of alternative activities, which plays its part

in the development of difficulties in processing two-dimensional signs such as letters and numerals later on.

Conclusion

As babies move on from the in-arms period, they begin to move independently and later to play either on their own or with other children. Movement and play have been shown to be crucially important in the development of learning capacities, and there is some evidence that a lack of experience of some kinds of movement, particularly crawling, can be associated with learning difficulties.

Early learning and play in hunter-gatherer communities tends to follow a broad pattern of unstructured, fairly free movement and play among care-givers and peers, and Waldon has described the process of acquiring ‘fundamental understanding’ in play which has no particular content. He argues for the importance of this pre-content play and maintains that ‘fundamental understanding’ becomes with basis for further development in activities with more particularised content.

When hunter-gatherer children do move into foraging and tracking, they develop skills in three dimensional reading that have highly motivating goals, such as unanimous praise in their communities, and being able to cook and eat their finds.

This range of activities may pave the way for apprehension of two dimensional signs in later reading, yet these childhood activities are largely absent from the experience of most 21st century children.

Thus the adaptive stress hypothesis would suggest that to optimise learning capacities at this stage, babies' and children's play and movement contexts could be loosely arranged around hunter-gatherer models insofar as these offer the most propitious match of inherited 'template' to the 'expectations' of the environment. This would mean, if correct, offering frequent opportunities for unstructured, free movement and play with caregivers and children of varying ages, and wide experience of sign reading in the natural world.

CONCLUSION

In this thesis I have looked at sources of stress in early development which could have an impact on learning capacity, and have termed this type of challenge ‘adaptive stress.’ I have put forward the hypothesis that adaptive stress arises when in the course of development individuals experience something—for example a nutrient, a treatment, behaviour or interaction—that their adaptive systems do not lead them physiologically or consciously to expect. Essential to this proposition is the assertion that individuals are differently adaptable; for some, adaptive stress is a much more serious issue than for others, and the degree of adjustment that must be made varies with that difference. Generally, and in fact by definition, adaptation means that adjustments must occur in order that equilibrium be maintained and the best odds for survival ensured. Survival is the object of adaptation; thus learning, as a subset of faculties and capacities in human beings, may take second place and may be compromised where the degree of adaptability has been in some way exceeded. However, survival itself ‘buys time’ for individuals to come to know their own adaptive strategies, or for parents or carers to know their child’s, and in theory at least to learn how to ameliorate the said compromises, and to optimise learning capacity within the learned parameters.

In each section, dealing with four major stages of early development, along with some analysis and commentary, I have found significant support for the hypothesis in the available literature across a wide range of disciplines. In some cases, aspects of the argument are unresolved in the literature and have been shown to require further research. However, I have not found in the

course of my investigation any refutation capable of significantly undermining the overall approach.

I have found that some of the concepts and terms I used at the start of the research have needed refinement, and this process has greatly clarified my way of thinking about development and learning. The literature on Development Systems Theory (DST), which is discussed in the Introduction, has been a valuable part of this process. It has allowed me to explore a much more subtle way of conceptualising development than I employed at the start of the project, which will be at the centre of any work I do in this field in future. The Introduction reflects this transition from the dichotomous language of nature/nurture to the more wholistic expressions characteristic of the developmental systems approach, for example 'there is no one locus of control in development,' and 'a new organism constructs its niche and is constructed by it; every variable depends on every other.' This language is compatible with Ingold's description of the human being, in sum, as "*a singular locus of creative growth within a constantly unfolding field of relationships*" (Ingold 2001, in Oyama 2001, p. 256.), and as a "*center of awareness and agency whose processes resonate with those of the environment*" (Ingold 2001, in Oyama et al 2001, p. 272).

When I first encountered this type of description there seemed to be no foothold for a point of view from which any developmental event could be viewed, and therefore no possibility of understanding how to 'make a difference' to young people, in terms of helping to optimise their learning capacity. However I found that the concept of adaptive stress helped to provide the needed structure without compromising the subtlety of the developmental systems description. I believe this is because the subtlety lies in the realm of actual encounters (eg as above, 'every

variable depends on every other,') whereas the structure or pattern of expectation and encounter that I propose exists at a previous logical level, that of 'meta-encounter'; it is a pattern *about* encounters rather than being one itself. Its function is, then, to take note of perceived differences from what it 'expects,' and to set up adaptive responses accordingly.

There may be a key in the fact that that which is inherited (using DST's broad conception of the word) is by definition 'known', whereas the future, and all future encounters, are not. So there is a differential there, a difference between the two modes or states. This recalls Bateson's statement that "*the essence of epigenesis* [or embryological development] *is predictable repetition; the essence of learning and evolution is exploration and change*" (Bateson 1979, p.57). That which is there to be repeated is in some sense known; exploration and change refer to that which is unknown. Here then is the possibility of the perception of *difference* from what is expected. It may seen unnecessary to point this out, but there is also implicit the dimension of time, since the known is known because it has been experienced in the past, collectively, and the unknown is unknown because it has not yet been experienced. And when we are dealing with time we are dealing with spans, life-spans, and individuals, and therefore individual development. Which brings us into the domain of this thesis: the establishment of learning capacity and learning compromise through the developmental time-line, where a perceived difference between an expected and an actual encounter must be adjusted to in accordance with the level and style of adaptability of the person.

This simple 'meta-relationship', then, between an expected or unexpected encounter and what is actually encountered, takes place at a 'previous' logical level to any encounter as such and can be seen to underlie all such encounters. If we are able to interact with the processes of adaptation

at this level, in the ways I have described in this thesis, it may be possible to influence, at least in part, the course of the development of learning in a more effective way than has been possible until now. This would mean consistently and habitually 'inhabiting' this level of 'meta-relationship' or 'meta-encounter', in order to observe and respond from it.

Parents, carers and educators could observe an individual's developmental progress from conception onwards, keeping in mind the question 'What would their developmental systems expect now?' and 'What do we know so far about this individual's level of adaptability?' We could then consider how to minimise adaptive stresses in the course of development in the domains I have described, namely nutrition, birthing, the immediate postpartum period, and the beginnings of movement and play.

In the Introduction I suggested that the most effective response to the ideas put forth in this thesis might be in the realm of preventative education. As all newborns must adapt to the surroundings into which they are born, equally all parents and carers could undertake to understand these adaptive processes, to identify what sorts of encounters appear to be stressful for babies as they develop, and to work with the processes to optimise babies' experiences. The idea of a stress journal is a possible way forward, in which carers could focus their observations, noting down their charges' responses to encounters in the areas outlined here, and perhaps in others that suggest themselves. Those unable to keep a conventional journal may be able to use video footage to record their responses.

Let us take as an example a mother of two school age boys, one with severe dyslexia and the other with mild Asperger's Syndrome. Both are allergic to wheat gluten and have been plagued at school with a range of attention and learning difficulties. She is therefore keen to explore anything which might help her next child, which is on the way, to avoid or minimise learning problems. She attends a session given by her health visitor, which is offered to all mothers-to-be, whether their previous children have had difficulties or not. She is able to build helpful relationships with other mothers and is not anxious about being singled out as a mother of children 'with problems.' Her previous experience with her two children makes her an aware and attentive student. She is encouraged to keep a journal throughout her pregnancy and continuing through the newborn's early years, noting the baby's responses and reactions to encounters of all kinds. This focuses her awareness of the baby's adaptive patterns, helps her to become conscious of these patterns and to work with them. Her attitude is one of listening, noting and responding to the information the baby conveys. If she is worried by the baby's responses or behaviours, she seeks further help without delay, from her health visitor, GP, a nutritionist, or other practitioner, as appropriate. She builds a community of advisors and remains a keen observer herself of her child's needs and behaviours. She builds an ability to listen and to communicate well, which remains as a basis for the child's and indeed for the whole family's social relationships as he grows. The family is informed about the theory and is involved in working through plans for the baby's development, eg proposing a diet for the mother during pregnancy, planning for as non-intrusive a birth as possible, discussing bonding and carrying in the post-partum period, and thinking ahead to opportunities for movement and play as the baby develops, all informed by the understanding of expectation, encounter and adaptive stress. The two brothers could be included in these discussions and if possible brought

in as friends and collaborators for the new baby, to ensure a warm welcome and to avoid the exigencies of sibling rivalry.

Parents would need to understand and visualise what is essentially an invisible hunter-gatherer landscape and culture that is, according to the adaptive stress theory, expected to some degree by the baby's adaptive system, and it may be possible to use films or even to use computer technology such as that developed at Birmingham's VISTA Centre to create a programme to enhance their understanding. Using VISTA technology, they could observe virtual babies in different relationships and scenarios in hunter-gatherer cultures, being born and growing up, with content provided by anthropologists with detailed knowledge of these cultures. Further, it might be possible to use agent-based modelling techniques to 'instruct' individuals in a programme to behave according to different levels of adaptability, in milieux which deviate from the hunter-gatherer model to varying degrees. However, it would have to be made clear to parents that the modelling is only as good as the theory itself, and that the value of the modelling is to make the theory more understandable, not to assume or prove that it is true. That conclusion could only ever be reached through working with real people in present day situations, over time.

In summary, having formulated and investigated the theory of adaptive stress in this extended literature search, I am satisfied that it is based on sound principles, and supported in the published literature. I believe therefore that it could be useful as a basis for further research in future.

NOTES

[1]Montessori described early education in just this way at the beginning of the last century, though without the benefit of the technical knowledge informing Ingold's work.

[2] Robert L Kelly argues in his work that a generalised hunter-gatherer culture does not exist; rather there is enormous variation in lifestyles and cultures. See his The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways (2007).

[3] 'Causative' here is used advisedly, as I do not believe that conventional, lineal notions of cause and effect are useful in evaluating complex, global difficulties such as those involving learning.

[4] Bateson's own definition is "(Greek, *stochazein*, to shoot with a bow at a target; that is to scatter events in a partially random manner, some of which achieve a preferred outcome). If a sequence of events combines a random component with a selective process so that only certain outcomes of the random are allowed to endure, that sequence is said to be *stochastic*" (Bateson 1979, p. 245).

[5] Some estimates push this back as far as 28,000 BC (see Harris and Hillman 1989; Leigh (1992).

[6]The only reference I can find for Friedman is a response to an article printed in an online newsletter at www.list.feat.org/wa.exe?AZ=ind0006B&L=0&F=&S=&P=169.

[7] In his clinic in Pithiviers, Odent and his staff tried to avoid using the word 'delivery' because of the passivity it assumed as the mother's role. However, as there is no obvious substitute for it they, and I, use it advisedly.

[8] Following Odent, I shall use the word 'birth' to refer to the time of the onset of labour through to the establishment of bonding and feeding post-natally, this time representing the completion of the reproductive cycle.

[9] When Entering the World was published in 1976, the perinatal mortality rate was around 20 in 1,000; at Pithiviers the rate had fallen to 10 in 1,000 (Odent 1976).

[10] These include Kelso et al 1978; Wood et al 1981; MacDonald and Chalmers et al 1985; Leveno et al 1986; Prentice and Lind 1987; Freeman 1990; Pello et al 1991; Keirse 1993.

[11] "The coordinated physiological processes which maintain most of the steady states in the organism are so complex and so peculiar to living beings—involving, as they may, the brain and nerves, the heart, lungs, kidneys and spleen, all working cooperatively—that I have suggested a special designation for these states, *homeostasis*. The word does not imply something set and

immobile, a stagnation. It means a condition—a condition which may vary, but which is relatively constant" (Cannon 1939, p. 24).

[12] The most well-known studies of stress in inescapable situations were conducted in the 1960s by Martin Seligman, who coined the term 'learned helplessness', and colleagues. See Seligman and Weiss (1980).

[13] See below for a discussion of this concept.

[14] One of the notable exceptions being Ainsworth's Strange Situation procedure.

[15] As many mothers in pre-agricultural societies employ carers in different ways, 'continuous care' is taken as referring to a carer, not only to a parent.

[16] Adam Phillips notes that the German is *angstbereitschaft*—literally fear-preparedness.

[17] Phillips notes that the word used by Freud is *gebunden.* "The verb *binden* (past participle *gebunden*) is a key term in Freud's theory of the psyche—but it is not clear precisely how he visualised the metaphor, and it is therefore difficult to render it in English with any certainty; 'annex' seems the likeliest equivalent…(the *Standard Edition* opts for 'bind' and 'attach'). It is notable that in the course of the essay Freud twice feels obliged to enclose the word in inverted

commas, suggesting that he himself did not regard the concept as either self-evident or self-explanatory" (Phillips 2006, pp161-62).

[18] One has to assume here that she doesn't mean the floor of the car as playground, but that the car seat shouldn't be baby's default place back at home.

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Appendix A

The Sunderland Protocol

CEASE FIRE—REMOVE SOURCE OF OPIOD 'BULLETS'

Remove sources of casein and gluten from the diet. The effects of removing these from the diet are usually seen after three weeks for casein and three months for gluten.

PRELIMINARY AGREEMENT

Remove other foods thought to be a problem, for example, soya, tomatoes, avocado pears and beef

Test for allergies and deficiencies of vitamins and minerals, and give supplements, as appropriate

Treat parasitic organisms, eg yeasts, protozoa and bacteria

ACTIVE RECONSTRUCTION

Address lack of sulphation by using Epsom salts in the bath

Attempt to improve digestion of peptides using betaine hydrochloride and enzyme supplements (eg bromelain, SerenAid, EnZymaid—supplements that contain peptidase enzymes that are widely used in the United states for people with autism).

REASONING

One-to-one correspondence

Classification

Logical inference

Understanding spatial and functional relationships in three dimensions

Understanding spatial relationships in two dimensions

Use of tools

Use of arbitrary symbols

Noticing differences in form, size, orientation, hue, number, etc.

Registering similarities

Extrapolation

Praxic analysis and synthesis in three dimensions

Praxic analysis and synthesis in two dimensions

Establishing associations

'MATCHING'

'SORTING'

'SERIATION'

'BRICK BUILDING'

'DRAWING'

'CODING'

....27 months

j...

Pairing

Separating

Sequencing

Piling

Scribbling

Massive gain of experience

'CONTINUANT' or ongoing repetitive behaviours

f...

Rake
Use of spoon

...15 months

e...

Early Inertial 'Memory'

...12 months

Bilateral complementary use of 'limbs', appearance of 'choice'

Banging and scraping with held objects

Increasing use of space

Acquiring (picking up, etc.), disposing, striking one upon another

The Pattern of Development in General Understanding

Geoffrey Waldon 1982

Physically acting upon the surroundings

'FOCUSSING' of interest with whole body

Bodily integration

MOTIVATION

Increase of bodily movement

MOTIVATION

Simple associations between perceptions

a...

Early foetal movements

....0 months