Chapter 13
Basic Thought Processes

Every variation of the human mind is a potential source of understanding of how the mind works and develops. Proponents of the modularist-nativist hypothesis saw in autism such potential, a natural experiment that promised to reveal valuable insights into the nature of human cognition. They erred, however, in their interpretation of this information, seeing in it a confirmation of their hypothesis of innate abilities and innate modular organisation. This error was not at all an unreasonable one. The selective impairment of abilities involving social interaction and communication in autism indeed seems to indicate that social and non-social domains are served by separate mechanisms. This seems to be further supported by the complementary situation in certain kinds of mental handicap, in which social intelligence functions well while other areas are impaired. But, as we have seen, autism soon confronts us with facts that the modular hypothesis cannot explain, and the illusion of innate modularity, like the illusion that the earth is flat, gives way to a more complex but infinitely more elegant explanation. Now, having presented a developmental explanation and examined many of its implications for autism, let us see what autism can teach us about normal human cognition and cognitive development.

1. Executive Functions and Central Coherence

Thus far, our explanation of autism has been confirmed by the successful accounts it has provided firstly for the core traits and secondly for many of the peripheral ones. There remain, however, several important traits that have not yet been explained. Perhaps the most problematic are deficits in Executive Functions and Central Coherence. As the most universal of autistic traits outside the core three areas, they demand explanation. Their apparent lack of relationship to social behaviour, however, has posed a problem for all earlier theories. Unlike the discovery that autism involves deficits in Theory of Mind, which was consistent with the general social and emotional nature of the syndrome, the discovery of deficits in Executive Functions and Central Coherence came as a surprise and has persisted in eluding explanation.

At first, deficits in social learning do not seem to offer any better solution than the other theories. Not only are they not essentially social, Executive Functions and Central Coherence do not seem to be the sort of skills or behaviours that are acquired through social learning. Planning, keeping focussed and putting individual elements into context are general ways of approaching the world. They are not specific skills but mental processes that pervade human cognition and behaviour. Indeed, they do not seem to be learnt or developed at all, but to be innate abilities that emerge during childhood. Other evidence, too, seems to imply biological origin, in particular, the similarity to deficits sometimes found in adults who have suffered brain damage.

But when we recall the profound effects that social learning has on emotions and sensations, which seem even farther removed from social influence than these, we realise such appearances can be misleading. Feelings and behaviours that are not subject to voluntary control and even those that are inaccessible to conscious introspection can nonetheless be modified by external factors, including social learning, during the course of development. The same might be true of Executive Functions and Central Coherence.

The reason earlier studies were unable to find any connection between the main traits of autism, which are social, and deficits in Executive Functions and Central Coherence, which are not, is that the sort of connection they were looking for was one that was affecting the individual’s thinking at the time of performance. The assumption was that there was some characteristic of autism that was

impairing the child's ability to organise activities or put them into context. But if instead we direct our attention to the effect of autism during the course of development, we soon see ways in which deficits in social learning result in compromised acquisition of these cognitive skills.

Let us begin by re-examining education. We find that throughout, the child is being taught and trained in patterns of reasoning belonging to these categories. At first, he is taught how to sort and arrange physical objects. This early training is informal and unintentional. Simply by living in a house where people eat in one room and sleep in another, where cutlery is kept in a drawer and dishes in a cupboard, his thinking is being moulded. Even more so if he is trained to put away his toys in one place and get his clothing from another. He is also given the rudiments of planning. Whether he likes it or not, his life follows certain schedules, and his brain grows and develops accordingly. While this familiarity with certain patterns does not, in itself, constitute planning, a foundation is being formed upon which planning behaviours can later be built.

As he gets older, training becomes explicit, not only in school but also in informal social situations, in which he is criticised and corrected if he does not live up to cultural standards. He learns to organise facts and concepts, to draw conclusions, to plan activities and to construct strategies for achieving goals. He is trained to focus his attention and not let his mind wander, and to complete assigned tasks without being distracted. Indeed, it is hard to find any aspect of Executive Functions that is at no point the subject of training or instruction.

The tasks he is required to complete in school are exercises by which he is trained in broader cognitive skills. When a student is taught how to make an outline before writing an essay, it is not organisation of essays alone that he is learning. He is being trained to organise his thought processes themselves. Whether or not his teacher is aware of it, the real subject of organisation is the agent, not the product, for by learning to perform an activity the student himself is transformed. Given the profound influence of training and education on these areas of cognition, it is clear that if social learning is compromised, as it is in autism, these fundamental aspects of cognition will not develop normally.

Much earlier, in discussing common sense, we noted that even things that a sufficiently intelligent individual would eventually discover by himself are not normally attained by independent discovery but rather by social learning. To be a member of a group gives one the advantage of being the beneficiary of knowledge and techniques developed and refined over the course of many generations. These include not only solutions to specific problems but general methods of reasoning as well. Though not always optimal, culturally accepted methods of thinking are generally valid and at least sufficiently effective to be used for most practical purposes, for were they not so, they would long ago have been abandoned. So here too, by means of social learning normal children get a head start in their cognitive development by acquiring effective methods of thinking and organising behaviour, while children who have deficits in social learning lag behind. Let us now examine some specific Executive Functions and compare how they develop in normal children, with the help of social learning, and in autistic children without it.

1.1 Attention to Detail in Normal and Autistic Development

The common factor in Executive Functions and Central Coherence, as we explained earlier, is *organisation*. Central Coherence involves organisation of experience, Executive Functions involve organisation of behaviour and cognition. Organisation of behaviour includes such things as making and following schedules, arranging the sequence of performance of activities, determining or assigning priorities and keeping on task. Organisation of experience and cognition includes finding relationships and patterns among elements of perception and of thought.

The autistic mode is characterised by attention to details at the expense of context, which adversely affects any kind of organisation in which relating elements to their context is involved. Organisation that involves simply relating one element to another may or may not suffer as well. Those who become fixed on the detail to which they are attending and cannot shift to other details find it difficult to look at two elements at once and see a relationship between them, while those who are deficient only in attention to context but are able to shift freely from one detail to another are not impaired in this kind of reasoning. Children who excel at jigsaw puzzles and reproduction of patterns, for instance, are able to think about more than one detail at a time and see relationships between them even if they cannot relate details to context.

Attention to details rather than context is not, however, unique to autism. It is the normal mode for infants and small children. When an infant explores an object, whether by looking at it, feeling it, or putting it into his mouth, he experiences one part and one aspect of it at a time. There is no act of composition or of fitting sensations into a larger context. In that every child was once like this, the autistic child's abnormality is that his behaviour has not advanced in certain of the ways that the behaviour of most other children has. That is not to say that he has not advanced at all. On the contrary, he has advanced significantly in other ways, and that is why autistic behaviour is unique. It is neither the behaviour of a normal child nor of an infant. Unlike the infant, the autistic child has many complex structures, which, in appropriate situations, can serve as objects of attention. Most autistic children have ceased putting objects into their mouths to explore them, and even those who continue this mode longer than normal children are, at the same time, developing other modes of exploration, making the totality of their behaviour very different from that of an infant. While their inclination continues to be to attend to details, the details to which they direct their attention are no longer limited to elementary sensations like taste or temperature but more often small but nonetheless complex combinations such as individual physical objects.

There is, therefore, a highly significant difference between the autistic child and the infant. The infant attends to details because he has no other option. There is nothing else in his repertoire, either conceptual or functional, to which he is able to direct his attention. He cannot yet recognise relationships because he is still not sufficiently familiar with the individual parts themselves. He cannot yet conceive of such relationships or construct such larger complex units. Similarly, planning is impossible for him because he has not yet become familiar with the individual steps. The autistic child, however, is familiar with the individual parts, knows larger units, and knows the patterns into which elements can fit and the sequences in which events occur. Why, then, does he still tend to direct his attention toward the smaller and simpler elements? Why does he fail to develop the more advanced behaviour of which he is now capable?

1.2 Early Development

To understand this aspect of autism it is necessary to first understand how Executive Functions and Central Coherence develop in normal children. Why does the normal child's attention shift from elementary sensations, which are, after all, the most immediate, the most salient, and demand the least mental energy, and become directed instead to context and relationships? Does recognition of larger units in itself make the individual elements less interesting and for him? Does he find larger units compelling, irresistibly attractive? And if so, why? If we can understand normal development, then perhaps we shall be able to understand why the autistic child is different and why he is slower to make this transition.

Let us begin by examining the evolution of perception. Initially, perception consists of elementary sensations. Some are derived from small parts, such as the particular part of the object

that the infant's lip or finger is touching at the moment. Others, such colour, may be derived from the whole object at once even though it is composed of many distinct parts, because the sensation derived from all of them is the same. When an infant looks at it and notices that it is red, he is not identifying the parts individually and integrating them into a whole. He has, rather, ignored the spatial division because his attention has been drawn to the aspect of colour alone. Elementariness is therefore a matter of simplicity and immediacy, not physical smallness or spatial limitation. In that the infant has not yet developed patterns of mental processing, his perception consists of elementary sensations.

As the infant becomes familiar with elementary sensations, he forms mental structures corresponding to the physical relationships that he experiences between them. Thus he forms a mental structure combining the feel of the breast with the taste of the milk. Elements are thereby integrated in various ways and complex units of perception are formed. This is a cumulative developmental process of the sort described earlier in which complex units composed of elements are themselves combined into ones that are progressively more complex.

This integration and composition is always active, never passive. Whether or not it is performed consciously, it is never something that *happens* to the child but always something that he *does*. For the most fundamental compositions, such as the formation of the concept of a physical object, the effort of physical interaction with the external object is sufficient to produce the internal structures and to combine them until behavioural and then conceptual units are formed. More complex compositions involve not only the current physical interaction but also mental activity, such as comparison to structures formed during earlier experiences. Even though mental activity itself cannot be observed, it becomes evident in subsequent behaviour.

The formation of mental structures changes perception itself. Sight, hearing and other sensations are processed differently than they were before. The child now recognises not only elements but also complex units. Even though it may not be appropriate to call these structures "theories" until they have become conceptual, the change brought about by this initial behavioural integration affects not only behaviour but also perception and thought.

1.3 Direction of Attention

Once the infant has more than one structure that can be applied to a given situation, choice becomes possible. He now can and indeed must choose to which to direct his attention and which behaviour to perform. Choosing and directing are essentially new activities that he begins to perform at this point and that will become an increasingly important part of his behaviour from now on.

As he is repeatedly confronted with this need, he develops general rules for making choices. Among them are preferences for certain kinds of structures and certain levels of complexity. For the normal child, these rules are derived from a combination of physical experience and social learning. Certain choices are dictated by practicality, others are moulded socially. By interacting with others, the child's attention becomes directed to the same aspects of experience as theirs is. Over the course of time and through numerous interactions, patterns of attention are learnt, internalised, and carried over into the rest of his behaviour. He becomes inclined to direct his attention the way they do even when he is not interacting with them.

Among the patterns children learn socially is *preference for larger units over smaller ones*. In most situations this is beneficial both for current functioning and for future cognitive development. A human being is limited in the number of separate units he can manipulate at one time. Composite units are tools for circumventing this natural limitation. When several elements are combined into a unit, it becomes possible to treat them as a single entity, so it is no longer necessary to attend to each

of the elements individually. By attending to just a few complex units, he is able to see relationships that would not have been possible if he needed to attend to the components one at a time. Since understanding involves seeing relationships, and the more complex the relationships the greater the potential for understanding, this increases his mental ability many fold.

Guiding the child to direct his attention to larger units is thus one of the many ways that social learning furthers cognitive development. But, though this preference is so overwhelmingly advantageous that every culture eventually incorporates it, it is not without its price. There are certain activities such as block designs and jigsaw puzzles for which attention to detail is better. Children who have not been culturally moulded in this way may therefore excel at these tasks while being deficient at other more common ones. Indeed, the advantages that each of these groups has over the other reminds us that of the various levels of unit size, there is no single one that is best in all situations. For certain tasks one level is best, for others a different one. The most powerful mode is that which is not fixed at a single level but has the flexibility to direct attention to different levels for different tasks. A child, however, must begin by learning one that is most generally useful, which he can later fine-tune to his own personal needs and inclinations.

1.4 Transmission of Techniques of Thinking

Most cultural moulding of thought is accomplished not by explicit training but implicitly by moulding behaviour. By observing and imitating adult behaviour, the child forms, in his own mind, the thought-structures that are implicit in it. Simply by living in the ways prescribed by their culture, adults are constantly teaching children the culture's methods of thinking. Even the kinds of games that are current in a culture are related to its fundamental cognitive methods, so playing helps members improve skills they will use in other cultural activities. An extensive and complex system of thought, underlying all the diverse aspects of life, is thereby transmitted from one generation to the next without either intentional teaching on the part of adults or intentional learning on the part of children.

The independence of this natural process from intention and control makes it invisible to its participants. Although all adults have, during the course of their lives, played the roles of both student and teacher, few are aware of it. On the contrary, most imagine that children's mental development is simply a matter of biological maturation in which thought gradually becomes more powerful and accurate. Moreover, since most adults believe methods of reasoning to be absolutes and do not realise to what extent they vary from one culture to another, they consider the changes they observe in the child's thinking as he matures as improvements by absolute standards, never suspecting that what appears to be increasing correctness of the child's thinking is really its increasing approximation of the norms of their culture and therefore the ways they themselves think.

It is comparison of modes of thinking and organisation of different cultures that reveals the role of social moulding in the development of the individual's system of reasoning. The profound variations among cultures preclude not only biological origin but also pressure of specific environmental needs, since cultures inhabiting similar environments nonetheless reason differently. What we see rather is a variety of modes, all of which are sufficiently effective to be acceptable, of which each culture has adopted certain ones and perpetuated them. The establishment of effective modes of thinking is thus like other challenges facing human beings, that are solved differently by different cultures.

Once a culture has adopted a particular mode of thinking, it proceeds to develop around it, and the various methods become integrated into a more or less consistent system. This integration makes learning easier, because skills and knowledge acquired in learning one part of the system can then be

applied to other parts. The system of thinking of the culture, along with other aspects of the culture, comprise the social environment of its members as the laws of nature comprise the physical environment.

1.5 Early Foundations of Executive Functions

Social learning guaranties that the normal child acquires the basic cognitive techniques of his culture. Long before he would be able to construct them himself and even before he can understand them, he is able to make use of complex modes of thinking that the culture has constructed over the course of its many years of development. As he internalises them, these culturally derived patterns serve as scaffolds for his own cognitive development, so they are of double benefit, facilitating current functioning and at the same time advancing future development. Compromised social learning is therefore a double handicap for the autistic child, making current behaviour more difficult and slowing down future development.

As in other areas of mental development, behaviour precedes cognition, concrete precedes abstract, and specific precedes general. A child learns “apple”, “banana” and “pear” before he learns “fruit”. He first learns particular instances or patterns of reasoning and then forms general rules. This social moulding of cognitive methods has already begun before the child reaches his first birthday. By watching the behaviour of human beings around him, his mind forms certain patterns. Even though they are only vague reflections of the actual behaviour and farther yet from the thoughts of those who performed it, during the years to come these perception-structures, formed in infancy, serve as sources from which the child draws as he develops his own behaviour and thought-structures.

For the autistic child, therefore, the roots of future deficits begin long before any abnormalities in behaviour can be observed. Failure to learn simple basic techniques and thought-patterns in early childhood makes it more difficult to learn complex ones later on. The cumulative nature of cognitive development makes the handicap in autism multiplicative, current learning deficits being constantly compounded upon the deficient system of reasoning resulting from those in the past.

In normal development, learning patterns of organisation is the foundation of Executive Functions and Central Coherence. The child who helps his mother wash dishes is learning not only the specific behaviour of washing dishes, but neatness, cleanliness and care of belongings. When, as an adult, he is careful to wash his dishes and put them away, it is not because he has retained the specific habit of washing dishes, but because he now values neatness and cleanliness. He keeps his car clean and his computer disk well organised even though these were not among the activities by which he was trained. From the specific acts practised as a child he learned general patterns of behaviour which he applies to specific situations in adulthood.

This sort of implicit training by imitation and internalisation of the behaviour patterns of others is the most important social source of patterns of thinking and behaviour. Executive Function techniques are learnt by experiencing adults behaving and approaching the world certain ways. Mummy says, “Now here’s your juice. Drink it while I make your cereal.” The child sees how she organises her tasks of giving him his breakfast. Of course, he does not think about it that way, but he does remember what happened, especially if it happens often, and the pattern becomes a paradigm for organising two activities. As he grows and gets to know the behaviour of his models better and better, he sees that planning, focussing, and other Executive Functions are not restricted to specific activities but are general modes of behaviour.

For the autistic child, however, this natural learning mechanism fails. Since his attention is not attracted to human beings, his experience of the situation is different. Not paying attention to his

mother as an agent, as a person who does things, his experience in this situation is just “First I get my juice, then I get my cereal” or even, “First juice, then cereal”. The fact that it is his mother that makes the cereal might not even exist for him. So, while the normal child, through awareness of the many activities of others that he witnesses, learns certain patterns of behaviour, the autistic child does not.

In addition to deficits in attention, which are primary, the autistic child also lacks the feelings of type and group identity. The normal child identifies with his parents, so they are models for him. He says, “Now I’ll make breakfast like Mummy”, “Now I’ll put away the shopping like Daddy”, so this serves as yet another motivation for learning specific behaviour patterns from which increasingly general ones can later be derived. But an autistic child who lacks these feelings may not consider behaving like others even when he does notice them. To such a child, the way other people do things and the way he does them himself are unrelated.

The most immediate result of failure to learn patterns of organisation is that the autistic child’s experience remains fragmented. He lacks patterns by which the various separate elements can be integrated. To some extent, this fragmentation continues to characterise autistic behaviour throughout life. Even the most intelligent autistic children, who create their own patterns, rarely achieve the wealth and complexity of patterns that normal children inherit from their culture.

And although intelligent autistic children eventually become sufficiently aware of other human beings to learn some patterns from them, they still lack the disposition to constantly restructure their own thinking to conform to the subtly evolving patterns of society, as normal children and adults do. The idiosyncratic ways in which they structure their thinking are therefore not only less complex but also less flexible because they are not in tune with any outside source.

Another reason development of Executive Functions proceeds less vigorously than normal is that the autistic child lacks social stimulation. For the normal child, social learning not only serves as a guide to show him how to think but also motivates him to expand his thinking methods. Human beings, both normal and autistic, rarely feel that there is anything lacking in their current methods. Even when faced with problems they cannot solve, it rarely occurs to them that revision of their thinking methods might be the way to a solution. Indeed, few individuals, adults or children, can even imagine ways of thinking that are different from their current ones. It is not the need to rectify shortcomings in current methods that keeps normal children constantly moving ahead, improving their methods of thinking, but interaction with adults and older children whose thought processes are more advanced than their own. Lacking that stimulation, the autistic child tends to stagnate. Thought and behaviour patterns, modified only by the needs of interaction with the physical world, remain simpler and closer to those of the infant, less developed and less structured. For some autistic children, cognitive development slows down and virtually comes to a halt. Others, thanks to a combination of aptitude, motivation and opportunity, are able to attain integrated thought independently and to continue to develop their own more advanced concepts and thought processes. Even very intelligent children, however, are liable to miss some of the important basic techniques that the normal child is guaranteed by social guidance.

1.6 Gaze-direction as a Scaffold for Focus of Attention

The physical act of gaze-direction is one of the main foundations of the mental act of focussing attention. Social learning is normally an important source not only of the *act* of gaze-direction itself, but also *awareness* of that act and voluntary *control* over it. Children learn when and how to focus their attention primarily by imitating the behaviour of others, and become aware both of the direction itself and of the voluntary control over it by attention-words and phrases such as “Look at”. Social

learning guarantees that attention behaviours are acquired at the appropriate ages. A child who fails to learn one of these behaviours by the expected age is soon corrected by caregivers and peers. In this way social learning moulds choosing, directing, maintaining and changing focus of attention, all of which are essential parts of both Executive Functions and Central Coherence.

Among the first attention-habits that every normal child develops is to direct his gaze toward whatever he is doing. Although the universality of this behaviour makes it seem innate, the ease with which it can be overcome contradicts innate origin. When, for whatever reason, practical, cultural or otherwise, an individual is prevented or discouraged from looking at what he is doing, he readily learns to perform the activity without looking, and henceforth feels no internal pressure to look. Were it innate, the nagging tendency to look would persist.

The development of this basic kind of gaze-direction is guided by a combination of practical and social forces. At first there is no coordination between vision and activity. The infant manipulates objects without looking at them. Soon he discovers that when he directs his gaze at an object while he is manipulating it, there are changes in the images that he sees, and that those changes are correlated with the movements of his muscles. Not only can the act of moving his hands produce tactile sensations, it can produce visual ones as well! First he learns to use his hands to produce visual stimulation and then to use visual monitoring to help direct the activity of the hands themselves. Visual monitoring develops into a habit which then tends to be applied more broadly than necessary, since even when it is not necessary it is rarely a disadvantage.

But for the normal child it is ultimately social learning, not practicality, that establishes visual monitoring of activities as the standard mode. People around him generally look at what they are doing whether they need to or not. He watches them and does the same. Autistic children, however, being less influenced by social learning, develop patterns of gaze-direction independently. These may deviate to a greater or lesser extent from the norm. Some look at what they are doing more than necessary the way normal children do, while others only glance briefly and then look away. Not having learnt that they are ‘supposed to’ be looking, they discover on their own how much looking is comfortable for them and don’t bother to do any more.

Abnormal gaze-direction in autism, other than cases of severe mental handicap in which inability to process sensory input precludes focussing, is therefore due not to deficits in aptitude but to lack of social moulding. These abnormalities of behaviour, however, are less significant than those of cognition that accompany them.

1.7 Some Qualifications

By adolescence, most autistic children whose intelligence is normal or above have transcended any serious deficits in Executive Functions. By adulthood they have become aware of most of the normal thinking techniques and adopted them when necessary, so only negligible traces of early idiosyncratic methods of thinking remain. Like the normal child, the autistic child has gone through an extended process of cognitive development during which his methods of thinking have been revised over and over again until they have reached a close approximation of those of his culture. The intelligent autistic adult’s Executive Function skills therefore fall within the normal range, although perhaps lower than they would be in a normal adult of comparable overall intelligence.

There are, moreover, three factors that minimise the divergence between autistic and normal thought, even for those who are mentally impaired. Since both autistic and normal children are members of the same species, their nervous systems, the biological foundations of methods of thinking, are, for the most part, similar. Furthermore, they develop under the same physical restrictions, which limit the kinds of thinking that they can adopt. Lastly, no autistic child is entirely

free of cultural influence. Even without directing his attention specifically toward human beings, every autistic child necessarily interacts with them in his daily activities. He also interacts with artefacts whose forms reflect the ways of thinking of those who created them. His thought processes are therefore profoundly moulded by those of the culture within which he lives. So for both internal and external reasons, the ways of thinking of the autistic child are never entirely different from the ways of those around him.

1.8 The Onset of Executive Function Deficits in Autism

As we have already explained, deficits in Executive Functions and Central Coherence do not appear until after other autistic abnormalities have long been evident. Until this point in our discussion the only significance of this observation has been that these deficits could not be the source of the others. Now, however, we can see the reason. Since Executive Functions and Central Coherence cannot begin to develop until the child has formed multiple levels of complex structures, they do not appear until relatively late. So if, with respect to Executive Functions and Central Coherence, the autistic child is not noticeably different from the normal child during the very early years, it is because neither has yet built up a sufficiently complex cognitive system to be able to apply them in any significant way. The only patterns of organisation, planning and direction of attention that are attained during this early period are simple ones that can be developed through direct interaction with the physical world, and in these the autistic child is at no disadvantage.

But once the child has amassed a large variety of complex structures of different levels, it becomes necessary for him to regulate behaviour and thought according to context, as well as to recognise relative importance and devote attention accordingly. None of these are at all simple. There may be many radically different ways of assigning importance and many simultaneously existing contexts to choose from or to ignore. It is at this point that physical learning is no longer sufficient and the child needs the guidance of social learning as well. This, therefore, is the point at which the autistic child's Executive Function skills begin to lag behind those of normal children.

Numerous factors combine to determine which Executive Functions are acquired, how quickly and to what degree. The most important are obviously severity of autism and cognitive aptitude, followed closely by dedication and skill of caregivers and teachers. With appropriate training, an autistic child can achieve levels close to those of normal children of comparable aptitude, while without special guidance even mildly autistic children of normal intelligence generally lag behind their peers.

Since no autistic child is completely devoid of social learning, as long as intelligence is not too far below normal, some socially derived Executive Functions will be acquired. Most intelligent autistic children also continue independent development of Executive Functions along with the ones they learn socially. Ability to discover methods of thinking independently, however, can also have a negative effect, because the intelligent autistic child who has developed his own methods is liable to ignore those of others and not adopt them even when he is aware of them. And since independently discovered methods are generally inferior to cultural ones, he will tend to remain below normal children of comparable intelligence.

This abnormal course of development might be the source of the unusual interest in ordering and arranging often found in autism. For the normal child, methods of ordering and categorising are skills that are learnt from others. Since he generally acquires them before he needs them, they are rarely a challenge. He performs them as a matter of course and is rarely even aware of them. But for the autistic child who does not learnt them this way, they are not attained so easily, and considerable effort may be needed to organise experience. Organisation is a challenge, which makes

it fascinating, and that fascination may remain even after the challenge has been transcended and the necessary skills have been acquired and established.

1.9 Perseveration and Change: What Do You Do Next?

Quite early in our discussion of social learning we explained desire for regularity and resistance to change as ways of making the world more stable and predictable. We saw how failure to participate in social interaction leaves the autistic child unable to understand the behaviour of those around him, and makes the world seem chaotic and frightening. Within this chaos, regularity in his personal surroundings and schedule offers him a degree of security, an anchor he can rely on.

Perseveration, continuation of the current activity and resistance to interruption or change, appears at first to be part of this. The similarity, however, may be only superficial. Perseveration may have a fundamentally different aetiology and significance. Continuing the same activity does not, in itself, regularise the environment. If a child has a repertoire of ten activities, all of which he enjoys and with which he is comfortable, his world is just as regular and predictable when he is engaged in one as in another. Persisting in the one he happens to be doing at the moment rather than switching to another does not, therefore, help make his world more regular or comfortable. As long as he is in control of what he chooses to do, he is as comfortable doing one as another.

To understand perseveration we need to begin by asking the more basic question of how a human being chooses what he is going to do next. In some situations there is an event, internal or external, that calls for a certain activity. The door-bell rings so he goes to the door; he feels hungry so he gets something to eat. For a child, the event may consist simply of being reminded of something. He happens to notice a toy that he likes so he takes it and plays with it. But what does a human being do when nothing occurs to direct him? All other things being equal, the two most likely options are either to do nothing at all or to continue whatever activity he was doing most recently. This second may indeed be the most natural. The act of doing something can itself be seen as a directing event, but unlike the events mentioned above, this one calls not for a response but for a repetition. Of all possible activities, the one most vivid and prominent in his mind is the one most recently performed, so continuation of the current activity is a natural default.

The tendency to repeat and continue the current activity can be seen as a factor in various kinds of human behaviour. People who are eating tend to continue to eat even after their hunger has been satisfied. A normal adult will not sit down and read a book for just a minute, then get up and listen to music for a minute and then play a computer game for just a minute. Once he has begun one of these activities he will usually continue it for a while. The behaviour of infants, in which an action is often repeated several times in succession, shows the same tendency in a different way. This is an even purer form, since unlike adults, for whom the conscious decision to perform the activity is also a factor in its continuation, the infant has neither planned to perform it nor does he feel any conscious commitment to his original decision.

Actions are not, however, repeated indefinitely until either something else comes up or the agent has no energy left to act at all. Sooner or later they are spontaneously abandoned. One reason is that this default is opposed by another human quality, *boredom*. After doing the same thing for a while, a human being becomes tired of it and wants a change. The time spent on an activity when there is no interruption is therefore a compromise between these two. It varies according to the activity, the underlying personality of the individual, and his mood at the moment.

Perseveration in autism therefore belongs to a normal pattern of human behaviour. It differs in degree but not in kind. Firstly, there is a greater tendency to fall into patterns of repetition, secondly, the duration of repetition is generally longer, and thirdly, repetition is more resistant to distraction.

This pattern is not simply a failure to transcend the undeveloped behaviour of the infant, because in all but the first, autistic behaviour differs from infantile behaviour as well. The infant is easily distracted, and even without distraction he rarely remains at the same activity very long. The one similarity is that the infant, too, has a greater tendency to fall into patterns of repetition so he, too, spends more time at repetitive activities. Even that similarity may only be superficial. One reason the infant falls into repetition more often than the normal adult may be that to him, the world is all new and interesting. He is constantly discovering new things, and when he discovers something that is new to him he repeats it because he finds it interesting and exciting. If, as he repeats it, he learns and discovers something new about it, it becomes more interesting yet. Not so autistic repetition. The same activity may be the subject of repetition for many years. It is neither novelty nor discovery that prolongs it.

Let us therefore examine the reasons that the normal child's tendency for repetition becomes weaker as he develops. Aside from physical objects becoming less novel and less interesting as he becomes familiar with them, the normal child is becoming more aware of other human beings and more coordinated with them. As he does, he becomes more responsive to them and more inclined to abandon what he is doing and join in their activity. At the same time his repertoire of behaviours is expanding, largely through social learning, so he spends less time at each one. We immediately recognise both of these as areas in which the autistic child is deficient.

Beyond these are two more differences between the autistic and the normal child that are unlike those we discussed earlier in other contexts. Among the things that the normal child learns socially are *patterns of activities*. Within a pattern, one action follows another in a predetermined regular way. When an individual is carrying out such a pattern, repetition of the immediately previous action is no longer the default. The pattern itself has replaced it. At any step in the pattern, the following step becomes the default. There is no need for any event to suggest a different action, because the pattern tells him what to do next, overriding the natural tendency to repeat the most recent.

The normal child also learns cultural conventions of how long to continue certain kinds of activities in certain situations. By imitating the behaviour of others he learns not to spend too much time watching the record turning on the gramophone even though he finds it fascinating. Conversely, he learns to continue practising his lessons even when he feels tired and bored. The latter is, of course, the more difficult of the two, and considerable coercion is often required to gradually stretch the child's attention span. Here too, however, the normal child is aided by social attraction. His desire to be like other children makes him willing to accept coercion. When he looks up from his desk in the classroom and sees the heads of all the other children down, his boredom is opposed by his aversion to being different, and he turns back to his work.

The autistic child differs in all four. He is not attracted by other human beings, so he is not as aware of or responsive to them. His repertoire of behaviours tends to be narrower than that of the normal child, so he is more likely to choose the same ones and stick to them. And having learnt fewer activity-patterns, he finds himself more often in situations in which he has none to tell him what to do next or how long to continue what he is doing.

In addition to these deficits, since the autistic child is less distracted by others, focussing on his own activity and sticking to it becomes a habit that he develops and reinforces over time. While the normal child is developing and strengthening patterns of coordination with others, the autistic child is developing patterns of independent activity. He has a greater tendency to turn informal activities performed for only a few minutes into extended rituals and for those rituals to become increasingly rigid. At first, he takes a few marbles and rolls them on the floor in arbitrary ways. Before long he has developed a specific order of colours and paths. As the activity becomes more established and more complex, it becomes more interesting and he becomes more deeply involved in it. It may now

take considerable time to complete all the steps in the ritual, and failure to complete them, once begun, is a serious disruption of "the way things should be".

The autistic child's activity patterns are also less flexible because, not being derived socially, they are not connected to any external source by which they can be modified. While the normal child's behaviour and thought retain a connection to their social source and always remain open to modification from it, the autistic child's are independent.

Seen this way, perseveration is another example of self-direction and lack of coordination with others. The autistic tendency for perseveration reveals how much the behaviour patterns of normal children, in which a variety of activities follow one another in a standard order, are derived from social learning.

2. Time, Cause and Symbol

There are certain concepts that radically alter the way an individual thinks, and indeed, the very way he experiences the world. The structures an individual who has these concepts creates from the elements of sensation are unlike those created by one who lacks them. Among them are the concepts of *time, cause* and *symbol*. These are universal aspects of mature human thought. Although the exact forms these concepts take vary from one culture to another, in no culture are they absent.

2.1 Time

The infant lives in the world of the present. Even after he has begun to interact with other human beings and develop relationships with them, he still has no framework into which to put his memories and expectations. The naive adult does not realise this. He takes his own concept of time for granted, so he is unaware of how different the infant's world is from his own. He assumes that children have the same concepts of past and present as he does. These concepts seem so basic and obvious to him that it is hard for him to imagine a human being lacking them. This error is not, however, simply a matter of ignorance and naiveté, for there is much in children's behaviour that reinforces it. In particular, the small child's imitation of time-related words and expressions produces the illusion that he understands time the way adults do. It is only by careful observation of children's use of these words that it becomes clear that at first they are just superficial imitation, and only after a long period of development do they come to represent mature time-concepts.

The child's grasp of temporal relationships develops gradually. As in other areas of mental development, behaviour precedes cognition. The child acquires skills involving time before he understands it conceptually. Achieving a clear idea of the passage of time and becoming able to put past events into relationship with one another takes several years, during which the child passes through many levels of partial understanding. At first, the infant does not even have historical memory. He might look at a bell and, having rung it before, think, "That is something that *could* ring," but he is not yet able to think, "That is something that *did*, indeed, ring, even though it is not ringing now." That comes later. Later yet he becomes capable of sequential structuring, of thinking of one event happening after another. After that he develops a concept of passage of time, of some events happening long ago and others more recently. Finally he develops a frame of reference within which events can be arranged.

This development can take a variety of different paths, in most of which social learning plays a central role. Social games draw the infant's attention to time and guide him in how to structure it. Children who do not participate in interactive games therefore miss some of the early preparation for the construction of time concepts. By the end of the second year, language has begun to mould the

child's thinking, helping him process his raw experience of passage of time and events. Words like "now", "later", "before" and "after" contribute to the formation of concepts of relative time. "Morning" and "night" transform the experience of light and darkness into temporal units. Clocks and expressions like "five-o'clock", "six-o'clock" and the word "time" itself help the child form concepts of duration of time.

The child's thinking is moulded by imitating the ways that adults use time-words. The first to develop are the concepts implied by the words themselves. These he then expands until he attains the more general time-concepts recognised by the culture in which he lives, which he derives from the combination of words, behaviours and other cultural institutions. We shall call the initial concepts that develop directly, whether from experience or from social learning, *kernels*. They are like seeds of crystals, but unlike crystals, the broader concepts do not grow by themselves but are constructed by the child's active processing.

Social learning is especially important in the construction of time-concepts because so little of that structure is provided by experience itself. This is in sharp contrast to space-concepts, which develop almost entirely through physical experience. The only time-kernels a child gets directly from experience are the relationships between events that follow soon after one another, in which the image of the first is still fresh when the second occurs. It is therefore in developing concepts of time, not space, that autistic children, especially those who acquire language late, are at a disadvantage.

2.2 Cause

One of the most important fundamental ways in which experience is interpreted is the attribution of causal relationships. The dependency of cause-concepts upon social learning is slightly less than that of time. Situations that lend themselves to causal interpretations are encountered so often, and these interpretations prove so consistent with subsequent experience, that even without social learning any sufficiently intelligent human being would eventually begin practising behaviours implying cause and would arrive at some kind of cause-concept. For the normal child, however, only the very first steps are achieved by independent discovery. The rest is acquired largely through social learning.

The infant hits the toys in his crib and they move. At first neither conceptually nor behaviourally does he think of this as *cause* but only as *expectation*. When he repeats the motion, it is not with confidence that it will produce the same result but only with hope that it will happen again. Expectation-structures of this sort, in which the occurrence of one event evokes the expectation that a certain other event will follow, have already begun to develop by this time, and at first the hit-move structure is just another one of them. Gradually, however, cause-structures become differentiated from expectation-structures. Some sequences of events remain only likelihoods, while others occur so consistently that they become certainties. From this second category the concept of cause develops.

It is in this process of development of early proto-causal structures that social learning soon begins to contribute. The first contributions are already being made in infancy, before the child has acquired language. Social interaction directs his attention to those aspects of situations that are relevant to cause and effect. Attention to appropriate aspects is essential for seeing causal relationships, for if a child does not attend to the relevant aspects of the situation, and especially if his attention is drawn instead to aspects that are not relevant so that he ignores the relevant ones, he will not notice the causal relationship or even realise that any causal relationship exists.

Social interaction also moulds the child's behaviour so that sequences of events that involve causal relationships are treated differently from those that do not. These then become kernels of causal behaviour, and upon that behaviour causal-concepts are later built. In some of these behaviour

patterns the child's own actions make other things happen, in others they are responses to events in anticipation of results. In all, however, one event follows another, and by behaving this way he begins to form corresponding concept-structures.

Later, as the child learns language, causation words such as "because" and "why" and statements indicating the action of one entity on another, such as, "Don't throw it on the floor! You'll break it!" direct his attention not only toward aspects but also toward relationships. Behaviours and words serve as scaffolds for the development of concepts of cause. The vague realisations of connections between events, that the infant constructed through physical interactions, he now begins to see as clear relationships by the application of these forms.

Conversational forms train the child to think in certain ways. The "why-because" form implies firstly that there are reasons for things, secondly that those reasons can be known, and thirdly that sometimes one person knows them when another does not. By learning this form he is also trained in the specific thought and behaviour patterns of looking for reasons and asking questions. None of these are innate. Without them, a child might consider whatever is not known simply as an unknowable mystery. Once learnt, the question-asking pattern is reinforced by various kinds of rewards including praise, acquisition of valuable knowledge, and the simple pleasure of social interaction. In ways, learning to ask questions is similar to learning to tell stories. First the child learns the pattern of story telling from adults and older children. Then he imitates it, and as he does, he is rewarded by various kinds of pleasure and satisfaction. He therefore continues to practise it, and as he does, his story-telling skills improve.

Even though the concept of cause is less dependent upon social learning than that of time, in some ways the contribution of social learning to the cause-concept is greater. To recognise a temporal relationship there is no need to pay attention to any particular aspect. The juxtaposition of events is all that must be noticed. But to notice a causal relationship it is necessary to pay attention not only to the events but also to the appropriate aspects.

It can be hypothesised that although deficits in behaviour do not appear until later, the autistic child has already begun to fall behind in the development of concepts of cause and other meaningful relationships before his first birthday. During the following years there is a lag in the recognition of certain kinds of relationships and consequently in the processes of cognitive development that follow from them. Typically, causal descriptions do not appear in speech at the normal age, and the child gives no indication of comprehension when he is presented with causal explanations by others. Fear, anxiety and bewilderment in various situations indicate lack of basic understanding of reasons. Even factors as salient as pain may sometimes go unnoticed without social guidance. Some autistic children habitually hurt themselves while playing because they do not realise that it is their own actions that are causing them pain. (This should not be confused with pain felt in self-stimulation, which the child enjoys and causes intentionally, or with sensations that others would consider painful but he does not.)

But unlike the mentally handicapped child who has an essential deficit in aptitude, the autistic child's deficits in these areas are only temporary. Provided intelligence is otherwise normal, all are eventually transcended. Independent discovery, while slower than social learning, is sufficient to assure the eventual grasp of cause and effect. Occasionally, pivotal events in which a child experiences a flash of insight are witnessed by parents and caregivers. He suddenly becomes aware of the connection between an action and its painful consequences and abruptly stops. Some children have been observed to proceed to test their 'hypothesis' by trying it out once or twice, and then, satisfied that it is correct, never repeat it again.

2.3 Symbol

The course by which the normal child acquires symbol is similar to those by which he acquires time and cause, beginning with behaviour, followed by rough concepts, and then proceeding gradually to concepts that are more refined and precise. However, unlike time and cause, symbol has no basis in physical experience. Symbols and symbolising-behaviour are structures created entirely by human beings. Normally, therefore, their only source is social learning.

Though it might be hypothesised that the human being has an innate disposition to create symbols, which would provide a neat explanation both for the origin of the first symbols and for the consistency with which normal children succeed in learning them, there is no evidence for the existence of such a disposition. All human children grow up surrounded by symbols, and both the symbols they produce and the ways they use them are always similar to those of the culture in which they have been raised. The evidence indicates, rather, a process of learning and development driven by social motivation.

Nor is it necessary to postulate deficits in innate symbolising-disposition to explain symbolisation-deficits in autism. The autistic child's lack of interest in human beings and therefore his lack of inclination to be moulded by social learning is sufficient to account for his failure to produce and use symbols normally. Like normal children, the autistic child lives in an environment filled with symbols and symbolising, and like normal children, he has all the aptitudes necessary for learning them himself. But although most autistic children of normal intelligence notice general symbolising-behaviour around them sufficiently to adopt the basic symbolising-pattern themselves by the time they reach school age, they do not pay sufficient attention to reproduce them accurately, so the symbolisation systems they develop vary to a greater or lesser degree from culturally standard ones. They make up their own words and phrases, make idiosyncratic use of ones they have heard, and attach their own symbolic significance to things around them. Many speak so indistinctly that only their parents can understand them. They have reduced the language they hear around them to a bare skeleton. That is all they notice when they listen, and that is all they reproduce. None of this is, in itself, abnormal. Many children do these sort of things during the early stages of learning language and other cultural symbolising behaviours, but to a lesser extent, and they achieve the standard forms sooner, so it does not continue as long. The difference in autism is therefore quantitative, not qualitative.

2.31 Correlations between Symbol and Language

Not surprisingly, since language is itself a kind of symbol, there tends to be a correlation between acquisition of language and of other kinds of symbol use. It is important, however, to recognise the distinction between true symbolism, in which symbols are understood as representations, and functional use of symbols, in which they are simply tools. Needless to say, in Asperger Syndrome and even in autism with mild mental handicap, both language and other kinds of symbols are understood conceptually as they are by normal children. In cases of moderate or severe mental handicap, there is a wide range. Most autistic children who are moderately or severely mentally handicapped have some language comprehension. Many are capable of learning to use picture cards or hand signals to make requests and some even of limited speech. For some, however, these are simply "buttons" they press to get what they want. Though it may appear to be symbolism, it is really just behaviour learnt by reinforcement but devoid of symbolic meaning. This may sometimes be the case even where mental handicap is only moderate. Though symbols are used proficiently, they are not understood conceptually but remain only functional. On the other hand, even in severe mental handicap there can sometimes be true symbolisation. If the sound, sight or behaviour that

constitutes the symbol is recognised as distinct from the goal, it may be considered true symbolisation even though it is not understood conceptually.

The question of symbolism is independent of that of communication. Unless a child recognises others as having thoughts of some kind, neither language nor other symbol use can be considered communication.

2.32 Culturally Learnt Techniques that are Needed for Language Comprehension

Over and above the basic act of symbolisation, symbol use involves certain of its own unique advanced thinking techniques. Acquisition of these techniques during childhood and adolescence is yet another way that the individual's thinking is socially moulded so that when he is an adult he will be able to participate as a member of his culture.

One of the basic skills is differentiating between the symbol and the thing it symbolises. While on the conceptual level, even many uneducated adults do not fully grasp this, and believe the words of their own language to be somehow intrinsically connected to the things themselves, on the basic functional level even children can generally tell whether it is the thing or the symbol itself that is intended. So if a teacher tells them to write a poem, they know very well they are not being told to write the words "a poem". Indeed, the awareness of this distinction and the possibility of confusion is sufficiently fascinating to children at a certain stage of their development to inspire jokes about the silly boy who mistakenly wrote the words themselves. But autistic children actually do make such mistakes, not because they are silly or lack the ability to reason or understand, but because they have failed to learn the socially-taught lessons of how to differentiate.

Another very different kind of skill, this one involving a technique of symbol use itself, is manipulation of symbols without knowledge of their meaning. This is used to a limited degree in spoken language, but becomes especially important in written language. A reader is often required to remember and work with a phrase for a short time before its meaning is clarified. For example, in the sentence, "While unsure of its location, the rescuers forged ahead to save the disabled ship" the reader needs to imagine someone being unsure of the location of something without knowing *who* or *what* they are. Even though it is only for a fraction of a second that this needs to be done, it requires a cognitive mechanism essentially different from the basic one for processing sentences in which the meanings of all the symbols are known in advance. Without this mechanism, a word whose meaning is not known at the time it is read cannot be processed at all, so instead it is simply discarded.

This thinking technique, in which symbols must be temporarily stored rather than being immediately translated into images, is used regularly in a very limited way in speech as well as in writing in languages like English in which adjectives precede nouns. When a listener hears the phrase, "the big dog" he cannot form an image of "big" immediately upon hearing it. Perhaps it's going to be "the big mountain", or perhaps only "the big flea". Such phrases, however, are so short that the adjective is still ringing in the listener's ears when he hears the noun, so they are experienced as if they were heard simultaneously.

This minimal use is so pervasive in languages like English that even autistic children who pay little attention to how others speak cannot fail to learn it. The more advanced version, however, can be problematic for them. Autistic adults who have not learnt it may find the sentence above unintelligible even though the very same words, arranged differently, would present no problem for them. Had the sentence been, "The rescuers were unsure of the location of the disabled ship, nonetheless they forged ahead to save it" they would have understood it without difficulty. That the reason is lack of social learning, not innate deficit, becomes evident when, after receiving specific

training, they become able to understand this kind of sentence structure just as well as normal readers do.

Thus we see that there is much more to symbolising than the simple act of using one thing to stand for another. Not only are there degrees of conceptual understanding, there are skills and techniques that make this already powerful tool more powerful yet. All of these are discovered, improved and perpetuated within cultures. Some are taught explicitly by teachers to students, others are imparted to members of each new generation by popular sayings and jokes or implied through patterns of behaviour. So too, time and cause. Each involves a complex developed social structure. Social learning guaranties that every member acquires at least the basics of those structures. Only the autistic child fails to absorb this social instruction, so he remains behind.

3. Concepts

One of the fundamental questions in cognition is how a human being attains concepts. His senses and even his behaviour provide him only with concrete data. No matter how complex the perceptual and behavioural structures that he forms are, they are not concepts. Even abstraction is not essentially conceptual. When a human or animal learns to respond one way to red objects and another way to blue ones, he has learnt to abstract one aspect, the aspect of colour, from the totality of the experience, but not necessarily to think conceptually about it. Where, then, do concepts come from?

3.1 The Development of Concepts

The nativist answer is that the human being is innately endowed with them. Specific concepts arise in the brain through biological development, and cognitive development consists of connecting them to sensory data. This implies an essential limitation on the objectivity of human perception, for if concepts are imposed upon experience rather than being derived from it, they might not be accurate representations of it at all. (This question can be compared to the philosophical question of the possibility of knowing the essence of the external world. The two questions are not, however, the same. Here we are dealing not with a metaphysical essence but only with sensation and cognition. It is therefore a scientific question, not a philosophical one.)

The apparently rapid acquisition of certain concepts such as “intention” has been cited in support of this hypothesis, but as we have already explained, there are multiple fallacies in these interpretations. More careful analysis of early behaviour reveals instead a gradual construction, beginning with vague concepts that are progressively refined. The nativist hypothesis is further contradicted by the existence of concepts such as “electric charge” and “atom”, commonplace among human beings today but unknown throughout most of human history, and therefore certainly not innate. The existence of new concepts such as these proves that human beings possess cognitive mechanisms for construction of concepts corresponding to experience. If so, innately granted fundamental concepts such as “physical object” and “intentional being” are unnecessary, because they too could be constructed by the same general mechanisms.

These general mechanisms for constructing concepts are already in operation at birth. Alongside the mechanisms for developing behaviour, whose effects are already observable during the infant’s first months, they are laying the foundations of an inner world of thoughts whose existence will not become evident until some time later. These two kinds of mechanisms, while separate, are continually contributing to one another.

During the first few weeks, the concepts that are constructed are too weak to be of much practical use, because the raw material that is available to those mechanisms is still too scant. These early concepts are also extremely unstable, constantly changing as new data are acquired. Even basic concepts such as “hunger” and “satisfaction” cannot be formed until the infant has experienced the relevant feelings enough times and in sufficiently varied contexts. But however rough and poorly formed, early concepts are a foundation from which more accurate ones can later be constructed. The main function of early concepts is therefore not to guide current behaviour but to begin the process that will eventually lead to the formation of later more useful ones.

Of the various ways in which early behaviour develops, there are two, *abstraction* and *synthesis*, which make the formation of useful concepts possible. In the first, the infant distinguishes behaviourally between qualities such as “soft” and “hard”. In the second he integrates separate sensations into unifying functional theories such as “blanket” and “human being”. Though in opposite directions, both lead to the kind of concepts that are useful in thinking about and understanding the world, and that can be applied to later experience.

Throughout childhood, behaviour becomes better adapted, and as it does, concepts become more accurate. And as behaviour and cognition become increasingly complex, it becomes possible to perceive more and more in the world and to construct corresponding concepts, so the child’s inner world expands many fold. This is an ongoing process of growth and revision. As new concepts are added they affect and sometimes radically alter old ones, and his conceptual world gradually evolves into that of an adult. Much of the turbulence of conceptual development is concealed by the accuracy of outward behaviour. The child produces the words he has heard from adults, but what they mean to him may be very different. Indeed, it is essentially impossible for him to completely comprehend what adults are saying because he lacks the concepts that the words represent to them.

Once a core collection of stable concepts has been established, a second level of concept construction becomes possible. Now new concepts can be constructed from existing ones rather than directly from experience or behaviour. It is now also possible to construct concepts that do not correspond to anything in reality, so the range of possible concepts is expanded. The child also gains some conscious control over the construction of concepts. He can ponder difficult questions until he figures them out. This is similar to the control he gains over the development of behaviour when he is no longer at the mercy of circumstances but can practise a desired skill until he masters it. Unlike the small child who cannot think about learning to walk, when the older child wants to learn to ride a bicycle he can ask his siblings for help and can keep on trying even when he feels discouraged. And unlike the infant who feels abandoned and hopeless when his mother leaves the room, but has neither insight nor control over his feelings, the older child can try to understand why his friend is angry at him and what he can do to make up.

3.2 Foundations of Concept Development

Since concept-structures are derived from behaviour-structures, and behaviour-structures are formed by means of action, an infant cannot develop a concept unless he performs the appropriate behaviour. To develop the concept of a “physical object” the infant must interact with objects in his surroundings; to form the concept of a “mind” he must interact with human beings. There are several prerequisites for such interaction, including the *capacity* to interact and the *opportunity* and *inclination* to do so. Normally, all are amply present. Although at first the infant does not know how to interact, a combination of natural mechanisms guarantees that he will get the assistance he needs. Caregivers spontaneously behave in ways that initiate social interaction. Without the infant himself performing any action, the caregiver initiates actions such as feeding, holding and vocalising. Some

of these evoke innate responses in the infant, others simply stimulate him to become active and by his activity to form new behaviour patterns.

The infant, too, has certain innate spontaneous behaviours that evoke interactive behaviour in the caregiver. Innate behaviours such as smiling, laughing, cooing and crying evoke responses in adults, including vocalisations, smiles and other facial expressions and motions, especially when the infant's actions are accompanied by looking at the caregiver or are directed toward the caregiver in some other way. When an infant gazes into the face of an adult while smiling or vocalising, whether his smile is evoked by the pleasure he feels at the sight of some human feature or simply the pleasure of having a full belly, the adult is inclined to smile and vocalise in return. Thus, although he is unaware of what he is doing and certainly has no intention of achieving this result, the infant is already initiating social interaction and thereby furthering his own cognitive development. This interplay of natural behaviours produces fertile ground for mental development. Those of the infant are not consciously directed toward interaction and some do not even involve other human beings. Those of the adult are a combination of innate parenting behaviours and social interaction behaviours that he has developed during the course of his own life, drawing on the knowledge about human beings that he has acquired and the culturally appropriate ways of treating infants that he has learnt.

Concepts therefore develop through a combination of physical and cultural experience much as techniques of thinking do. While the physical world places firm restrictions on what concepts an individual develops just as it does on his techniques of thinking, within those restrictions there is still much room for variation. Within that space social learning, especially through language, plays the double role of catalyst and guide.

4. Coordination

In our taxonomy of intelligence, we recognised coordination as a distinct category. Like other kinds of human intelligence, human coordination is, for the most part, not innate but the product of learning and development. The human ability to coordinate with other animals, and in particular with horses, proves this conclusively. The skilled horseman is both sensitive to his mount and able to communicate his will to it in ways that can better be described as *directing* than *controlling*. Horse and rider function as a single being. This ability could not be innate, because human beings did not originally live together with horses. Moreover, the relationship between horse and rider is not like any of the relationships that exist between human beings, so while it might draw on abilities used in coordination with other humans, some of which might indeed be innate, in those ways that it is different it must have been developed.

Much earlier, we identified deficits in coordination with other human beings as the defining trait of autism. However, we rejected the hypothesis that lack of aptitude to coordinate was the primary cause. Among the reasons for that rejection was that other than the special kinds of coordination normal human beings have with one another, coordination is not necessarily deficient in autism. In particular, some autistic children coordinate very well with animals even though their coordination with human beings is poor.

These two phenomena, the normal pattern in which coordination with human beings excels other kinds of coordination and the autistic pattern in which that superior coordination with human beings is deficient but other kinds are not, indicate that autistic children share the normal innate aptitudes for coordination but, unlike normal children, do not develop them to a greater degree in activities involving other human beings. This can be explained by the difference in the strength of their interest in human beings. Innate interest in human beings both motivates and enables extra

development of coordination with them in normal children, while autistic children, lacking that special interest, develop in both equally, or perhaps even better in their coordination with non-human beings.

Although it might at first seem simpler to hypothesise that normal children have specific aptitudes for coordination with human beings in addition to the general ones, and that it is these special aptitudes that are lacking in autism, that would not explain why the autistic child does not apply the general aptitudes that he so ably uses to coordinate with horses, dogs and computer games to human beings as well. It cannot be because human behaviour is more complex and requires additional innate aptitudes, for though much of human behaviour is indeed complex, deficits in coordination found in autism involve simple aspects as well. That hypothesis would also involve hypothesising the existence of a new entity, while attributing poor coordination with human beings to deficits in interest does not, since deficits in interest in human beings are already known to be present in autism, so it is only a matter of proposing a causal connection between two known phenomena. The reason the autistic child does not become better coordinated with other human beings is simply that he does not pay enough attention to them.

Here again we become aware of the extent to which normal human behaviour is derived from development. Unlike flocks of birds, whose coordination in flight is derived from innate responses, human coordination is accomplished by developed behaviours. The reason for this difference, for the increased reliance on development, is clear. The vast complexity and variability of human behaviour in contrast to that of lower animals necessitates flexibility of coordinative behaviours. If human cultures are to have the capacity to adjust to varying circumstances, human individuals must be capable not only of learning different kinds of behaviours but also of coordinating with social groups whose group behaviours differ from one another. The coordination of members of a primitive hunting group is not the same as those of an army fighting a pitched battle, the crew of a sailing ship, or a medical team performing an operation. Such open-ended variation can only be achieved by a learning process. Moreover, since cultures are continually evolving and changing, the individual's coordination patterns can never be static. They must be actively maintained by continually adjusting to conform to those changes. That dynamic maintenance can only be achieved by constant interest and attention.

5. Conclusion - the Modularity of the Mind

We have already seen that the Social Learning System is essential for the human species. As beings whose behaviour is guided overwhelmingly by patterns that are developed during the course of growth of the individual and only minimally by innate ones, social learning relieves the individual of constructing effective patterns independently. We have seen, moreover, that normal children are endowed with mechanisms that align their minds with the collective mind of society and tap into the cultural knowledge bank. And we have also seen that these mechanisms are composed of components that are used in other areas of cognition and do not require unique aptitudes.

The phenomenon of autism, in which the Social Learning System does not function optimally, provides us with an opportunity to observe what human development is like without this crucial component. In this chapter, by contrasting normal and autistic behaviour, we have seen some of the ways that social learning profoundly moulds fundamental ways that human beings think and see the world, organise experience and approach problems.