PART III
Chapter 8
Towards a New Theory of Autism

1. Ambiguity of Causal Relationships

With this background we are ready to attempt a new explanation of autism. Perhaps the greatest source of confusion in understanding autism is the ambiguity of *causal relationships*. The characteristics of autism, as outlined in Chapter Two, are well established and fairly well understood. It is the relationship between them that is problematic. Is one of them the source of the others, and if so, which is it, or are all derived independently from some other common factor?

1.1 Language, Social Interaction and Regularity

Various causal relationships seem plausible. Failure to develop language in the normal way might be the primary deficit. Certainly, the lack of language or its delayed or deviant development is the most blatant of autistic traits. It is often the first noticed, and abnormalities in language persist as development continues. While no theory explicitly claims language to be the root of all the other abnormalities, much therapy is directed at language, and there is an unstated assumption among many parents and therapists that if only this problem could be overcome the rest would fall into place. This is not unreasonable. Deficient language skills obviously interfere with social interaction. Indeed, social interaction is adversely affected by any deficit in communication. Deafness, which is the most extreme communication deficit, invariably results in difficulty socialising with the hearing community. Failure to socialise and to interact normally with others then has the secondary effect of compromising acquisition of socially related skills. Abnormal social interaction in autism and other social problems might therefore be caused by language deficits, which might in turn be the result of a specific deficit in the ability to learn language.

But perhaps it's the other way around. Lack of social interaction could be the cause of language deficits, because it is through social interaction that language is acquired. Infants' first language develops from proto-linguistic exchanges of smiles, gestures and vocalisations with their caregivers. It is in the course of this early social behaviour that infants begin to recognise caregivers' vocalisations and produce their own first words. Infants do not know that these sounds have meaning. To make this momentous discovery they must attend to them for an extended period of time until they become familiar with them and can begin to recognise patterns and relationships. Even then, language is social, not referential. Vocalisations are associated with people doing things. They do not refer to objects or actions as words do for the mature speaker.

Even after the child grasps the referential meaning of words, the social aspect of language continues to be a central part of language use and development. As the symbolic aspect of language gradually develops and increases in importance, it supplements but never replaces the social one. Even for the adult, who can and does use language for practical purposes as well, interaction with other human beings remains primary. For most adults, whether they realise it or not, chatting and socialising are more important uses than conducting business and discussing technical issues. Moreover, throughout childhood, social interaction with caregivers and peers continues to be the context of language development. A child does not increase his vocabulary or learn to express himself by sitting alone and playing with his blocks. Even after he learns to read, most of his verbal development takes place not through reading but through social interaction. So it is understandable that children who, for whatever reason, do not interact socially, fail to develop language in the normal way.

The relationship between social interaction and resistance to change presents a similar ambiguity. Rigid insistence on schedule, diet or dress, intolerance of change, compulsiveness and unusual repetitive behaviours characteristic of autism all interfere with social interaction. A child who will eat nothing but macaroni and cheese cannot participate in birthday parties and picnics or even eat in the school lunch room. Such behaviour is also detrimental to social acceptance. A child who constantly flaps his hands will be ridiculed and rejected by other children. Insistence on regularity therefore interferes with normal socialisation in two ways, by preventing the child from joining society and by discouraging society from accepting the child.

On the other hand, though it is less obvious, impaired social interaction is one of the factors that contributes to the emergence of rigid and compulsive behaviour. In his need for regularity, the autistic child is not unlike other human beings. All human beings need and crave regularity, and for good reason. It is necessary for adaptive functioning, and therefore for survival. For lower animals such as insects, whose behaviour is innately determined and therefore fixed except for minor variations, it makes little difference whether the environment is regular or not. If it is compatible with their innately determined behaviour they will survive, and if not they will perish no matter how regular it is. But the behaviour of higher animals is flexible. It can be modified by the individual to adapt to environmental conditions and to the current situation. For intelligent beings such as humans, that entails decision making, and to make a decision one must be relatively confident about the outcomes of the various possible actions. They therefore prefer environments that are regular and familiar, in which they can predict what will happen next and decide what to do about it. If the environment is constantly changing, it is impossible to adapt to it, for what was beneficial yesterday may be harmful today. Without being able to predict what will happen next, they become confused and are left helpless and distressed.

Desire for regularity is therefore a survival mechanism. It is found on two levels. First, there is an innate preference that does not involve rational thought, a tendency to gravitate towards the familiar, which has the effect of directing the individual to experience situations that are regular. In these situations not only can it function more effectively, but the learning that it derives from them is more likely to be relevant in the future and therefore more useful. Superimposed upon this natural inclination is an acquired preference derived from experience dealing with the world in regular situations and chaotic ones. Aside from the practical benefits of regularity, the mental energy necessary for simply processing sensations, even if no action is being taken, is less in situations that are regular and therefore predictable than in those in which one is constantly facing the unexpected. Any higher animal can be driven mad if the rules are changed too often.

These effects do not require conscious recognition or understanding. The animal or small child cannot understand why it prefers that things remain the same or why it becomes distressed when there are unexpected changes. Indeed, they may suffer even more severely than an adult in a similar situation. They cannot control their feelings because they cannot understand them.

A large degree of the required regularity is provided by the physical world. Fire always burns and water always flows downward. The sun rises each morning and sets each evening. But that regularity is not complete. Such things as wind, rain and the behaviour of living creatures cannot be predicted with certainty. An important supplement to the regularity of the physical world is provided by society. Society imposes order on objects, space and time. Social status, dress codes and manners guide the individual in his behaviour towards others, relieving him of the need to analyse each situation anew, thus simplifying the decision process. Dividing space into territories, each with its own set of rules, tells him what he can do where. Schedules make the future more predictable. Society increases regularity by limiting the vast range of physically possible behaviours to a much narrower range of culturally acceptable ones. While, on the one hand, this severely restricts the individual’s freedom, it more than compensates for that by making

it easier for him to make decisions, and in fact gives him more freedom by enabling him to engage in certain activities in the appropriate places without interference.

But these social orders are extremely complex and require years to learn. The ease with which normal children accomplish this belies the great amount of work involved. Their success is due, in a large part, to their constant interaction with other human beings, so that much of the child's time is spent in informal instruction and practice. If, however, a child does not interact normally, he fails to learn even the basics of social order, so human behaviour remains chaotic and unpredictable. Rather than providing regularity and comfort, it becomes a source of confusion and irritation.

Since a certain level of regularity is a biological necessity, the organism will achieve it in whatever way it can. Children who do not partake of the regularity of human society almost invariably compensate by providing regularity of their own. Each creates a regular world for himself, one in which he can function with confidence. More intelligent and mature autistic individuals accomplish this by insisting upon unchanging arrangements of their living quarters and possessions, performing their daily tasks according to fixed routines, and maintaining strict schedules. Those who are either too young or not sufficiently intelligent to do this can at least regularise sensation by hand flapping and other self-stimulation. Even meaningless behaviour such as this is soothing in that it makes the world more regular.

Though there are no apparent direct connections between regularity and language, the connection via social interaction makes it possible for any one of these areas to influence the other two. It is therefore conceivable that the primary cause of autism lies in any of these three areas.

1.2 Other Ambiguities

The question of whether autism is at root a cognitive or an emotional disorder presents a similar ambiguity. Here again, both explanations are plausible. Cognitive and emotional development continually contribute to one another. As the child understands himself and others better, his emotional experience of life changes. If he understands that humans have thoughts and feelings, his emotional reaction to them will be different than if he does not. His feelings and emotions, on the other hand, profoundly influence his cognitive development. If he enjoys interacting with other people, he will learn about them in the course of interactions, but if he does not, he will interact less and learn less.

Confusion about causal relationships was one of the sources of the error of the psychogenic theory. Failure of autistic children to form normal interpersonal relationships was attributed to cold and aloof behaviour of parents. Later research showed that it was rather the innately produced aloof behaviour of the child that discouraged caregivers' attempts to interact with him.

These relationships are particularly ambiguous because no one of them clearly precedes the others, so it is impossible to assume, as one otherwise would, that the earlier is the cause of the later. Social interaction and language normally develop at around the same age and proceed side by side. It is during the second year of life, at the time that language is normally beginning to develop, that autism generally first becomes apparent. During this period parents notice not only that the child is not beginning to speak as others do, but also that he does not respond and relate to humans in the way that is normal for his age.

2. Reciprocal Relationships

When such causal ambiguity is found, as it is not only in autism but in many other natural phenomena, it is often because the relationship is not *unidirectional* but *reciprocal*. The several phenomena are bound together in a relationship in which each contributes to and reinforces the others. Whether one began first and caused the others or several arose independently, once all are present they reinforce one another, perpetuating each other so that they continue when otherwise they might have died out. In such situations,

the cause of their present state lies not in any single one of them but in the relationship between them. Applied to autism, this means that the cause may lie neither in an inherent deficit in language abilities nor in one in socialisation, but in the way they affect one another. There may be something about the relationship between language and socialisation in these individuals that makes them develop in this abnormal way. Or it may be neither cognitive nor emotional, but involve the relationship between the two. Indeed, many more kinds of causes become possible.

2.1 Systems

Whenever there is a reciprocal relationship, each element affects not only the others but itself as well, which may result in *positive feedback*. Language advances facilitate socialisation, and improved socialisation makes more advanced language acquisition possible. Adoption of cultural norms helps satisfy the need for predictability, which makes personal idiosyncratic routines unnecessary and facilitates further socialisation and increased conformity to social norms. Factors bearing such a relationship to one another cannot be studied separately, because no single one can be understood without the others. Together they comprise a *system*.

A system is a collection of components that affect one another. These components may be *physical* entities such as organs or *functional* ones such as the ability to speak or to predict the behaviour of others. Systems are characteristic of living organisms. Every organism is itself a system, composed of many interconnected subsystems. Since, due to the multiple interconnections, what a component does tends to ultimately affect itself, systems involve feedback of one kind or another. Some feedback is *positive*, meaning that it leads to strengthening or repetition of the same kind of activity, and some is *negative*, meaning that it inhibits that activity or limits it. In many cases, there is a complex combination of positive and negative feedback going on at the same time. It may, for instance, strengthen the original component, which is positive, but also modify it, which is negative. Conceptually, however, the dynamics of systems can be understood in terms of the two basic feedback relationships, positive feedback, in which a change in a component causes it to continue to change in the same direction, and negative feedback, in which it causes it to stop changing or to alter the direction of change.

Feedback is an integral and necessary part of life, because life is, by definition, dynamic. Every organism is continually growing and changing. Not only during the period from birth to maturity but afterwards too, as long as an organism is alive it is continually rebuilding and modifying itself. That growth and change must be regulated and guided. Whatever has already been accomplished must in some way affect what will be done in the future. The need for control and regulation cannot ultimately be fulfilled by a separate mechanism, because that mechanism would itself then need to be regulated, which would lead to an infinite regress. Above all, it cannot require awareness or conscious direction toward a goal. It is only by feedback within the system itself that it is possible. It is the structure of the system itself that makes it self-regulatory.

The initial cause of change in either positive or negative feedback may be internal or external, from within the system or from outside of it. Negative feedback is characteristic of homeostatic systems. It may be in response to an external disturbance that has disrupted the equilibrium of the system or to an internal process that has gone too far. Its function is to maintain the system at or close to a constant state. When the system deviates from the desired state, negative feedback has the effect of pulling it back. Thus an animal feels hungry when there is insufficient food in its digestive tract and is impelled to search for food and eat, and when it is full it feels satiated and stops eating. The feedback “tells” the system it has gone far enough and should stop what it is doing.

The function of positive feedback is very different. Whereas negative feedback maintains the system in a stable state, positive feedback enables it to grow and improve. When the system changes in a

beneficial way, positive feedback directs it to continue to change in that direction. The dynamics of systems that are undergoing positive feedback therefore differ significantly from those of systems undergoing only negative feedback. Unlike homeostatic systems, in which the same interactive process is repeated over and over again and each episode of disturbance and re-equilibrisation is like the others, here, as the system as a whole advances, the constituent parts themselves as well as the relationships between them are continually changing, so the interactions are never exactly the same. Furthermore, the change is cumulative, always in the direction of growth and improvement. The system as a whole is constantly advancing.

2.2 States

In some cases, a system goes through discrete steps, advancing from one to the next. In others there is a continuum of progress without any clear divisions. In both cases, the system can, at any moment, be described as being in a certain *state*, being the totality of its qualities at that moment. In those cases in which there are not clear divisions, however, it is understood that it does not actually remain in that state but only pass through it. When, in the following discussion, we describe systems as being composed of sequences of steps, it is to be understood that in those that are continuous the steps are not really discrete but only transitory states.

The course of change of a system can be compared to a game of chess. From any position in a game of chess there are only a limited number of possible next positions. So too, at any state of a system, the possible next states are strictly limited. Though there may be countless possible future states which can be attained by means of appropriate sequences of intermediary states, there are only a very few that can be reached directly. This is true even of systems that are nor governed by finite sets of explicit rules like chess. Even in situations in which the possible next positions are themselves unlimited, they are only a small subset of the entire universe of possible states of the system.

We note furthermore, in much the same way as we did in the preceding chapter concerning the formation of structures, that the path from one state to another need not be unique. As is true in chess, there can be several possible sequences of intermediary states leading from one state to another. And as in chess, since there are so many possible available states, there is great flexibility. The development of one individual may go in a very different direction from that of another. Unlike chess, however, in the development of a growing organism intermediary states are not simply temporary positions. Even after the organism has passed beyond a state, the effect of that state remains and contributes to later ones that are built upon it. It is, indeed, incorporated into the later ones. Learning multiplication is not just one in the sequence of moves that leads up to understanding prime and composite numbers. It is an essential and integral part of those concepts.

As we discussed earlier concerning structures, sequences that involve scaffolds may be significantly shorter than those that do not, because the scaffold can boost the system up and bypass some of the intermediary states. Consider, for example, the development of concepts of respect and insult. A child who does not understand respect and politeness cannot feel insulted. If, however, such a child notices the reactions of others in certain situations and imitates them, he begins to behave as if he felt insulted. He also begins to feel that something is wrong in those situations even though he does not understand what it is. These negative feelings contribute to his eventual understanding both of insult and of respectful behaviour. Thus imitation of superficial behaviour is a scaffold in the development of deeper concepts of interpersonal relations. Training is another scaffold. Together they are more effective than either one alone. The child who imitates these responses in addition to being trained in respect and polite behaviour learns the concepts more quickly than the one who is trained but does not imitate.

2.3 Cycles

The interrelationships of the components of a system and the different kinds of feedback make several different kinds of processes possible. Some are linear, in which an initial event sets a chain of intermediary events into motion, culminating in a final result. For example, when the body is wounded there is a complex chain of events by which the blood coagulates and finally the wound heals. Once the wound is healed the process is completed and stops. Other processes are cyclical. There is no final event in the chain, because certain events cause events earlier in the chain to be repeated, setting it into motion again. It is the positive feedback relationship that makes such cyclical processes possible. Hunger and satiation is a familiar cyclical process. The negative feedback of satiation is only temporary. The very fullness that causes the organism to stop ingesting also triggers the process of digestion which eventually empties the belly and causes the feeling of hunger to return and ingestion to begin again. Unlike the healing of a wound, eating is never over.

Cyclical processes are especially characteristic of the growth and of the progress of a system. Change in one or more components initiates a chain of changes in others which results in raising the entire system to a higher state. But that new state, in itself, causes changes in certain of those components, setting another chain of changes into motion. Although most cyclical processes do eventually slow down and stop, they differ from linear processes even in their cessation in that by the time the process has been completed, each component has come into play many times, each time on a higher level. Each cycle involves more or less the same components as the one before it, interacting in more or less the same ways, but each now altered slightly as a result of the previous cycle itself. In the course of many cycles, the components and how they interact with one another can change radically. New components can also enter the system in later cycles, and old ones that had been active in earlier cycles can cease to be involved.

In attempting to understand a biological phenomenon such as autism, one of the important questions is whether it is produced by a linear causal chain or by a cyclical feedback process. All of the theories of autism that we discussed above assumed the aetiology to be linear. Thus, for example, lack of innate Theory of Mind was claimed to cause inability to understand behaviour of others, which then caused inability to correctly learn language. In our analysis of the interrelationships between various traits of autism, however, we saw several paths of potential positive feedback, implying a cyclical process. If, indeed, it is such a process that gives rise to autism, then the fundamental error of earlier explanations lay in their failure to recognise this cyclical nature.

2.4 Characteristics of Cyclical Processes

Before we can evaluate the hypothesis that the aetiology of autism involves a cyclical process, we need to gain a better understanding of cyclical processes in general. There are significant differences between linear and cyclical processes. In a linear causal chain, each step must in itself be sufficient to bring about that which follows from it. Thus for certain animals under certain conditions a broken leg can lead to death, because it is a sufficiently severe handicap to prevent them from moving quickly, which interferes with their ability to get food, resulting in malnutrition and eventually starvation. The broken limb alone can therefore be considered the cause of its death, albeit indirect. In other cases, several factors such as competition and natural enemies combine to produce the result. Whether it is a single factor or a combination of factors, each step produces the next. But if one step, whether consisting of a single factor or a combination of factors, is insufficient to cause the next, the chain will be interrupted. An injury that is too small to interfere with getting food or other activities necessary for survival will not cause death. The injury will heal and the animal will recover.

In a positive feedback system, however, a result can be obtained even when no single factor alone or even several factors together is strong enough to produce it. When factors are part of a system in which a cycle is repeated over and over again, significant changes can be achieved gradually by very small steps. It is not necessary for the system to advance from the bottom all the way to the top in a single bound. All that is required is that the combination of all components together at any moment be strong enough to affect some degree of change, no matter how small. By raising the level just a little bit, they then become capable of raising it yet a bit farther on the next step. Through this continual advancement by small degrees, by cycles repeated many times over an extended period of time, the entire system is eventually raised to a significantly higher level.

The same can be true of deterioration. A minor injury may put only a small amount of strain on the organism and only interfere slightly with its nutrition, but if that lack of nutrition weakens it, slows down healing, and makes it even more difficult for it to get food, a cyclical process may begin that causes gradual deterioration and eventually death. Each small factor therefore gains new significance by belonging to a cyclical feedback system, because the dynamic nature of the system can multiply its effect. It is not just additive, like the proverbial straw that breaks the camel's back.

2.5 Complexity and Variety

Systems vary in *complexity* and in the *variety* of kinds of components of which they are composed. Some involve components that are all of a single type, others involve a combination of different kinds. In the reciprocal relationship between *confidence*, which is a feeling or attitude, and *competence*, which is an ability or collection of abilities, we see a system involving two essentially different components. Confidence in one's ability enhances performance, thus contributing to actual competence, while the experience of successful performance increases confidence. By reinforcing the other, each indirectly reinforces itself. The confident student learns more and the confident worker performs closer to his potential. They are also more positive and generous in evaluating their own performance, which further reinforces their confidence. Conversely, lack of confidence and the resulting anxiety and nervousness divert mental energy from effective learning and working. The resulting poor performance reinforces lack of confidence. Thus both confidence and lack of confidence produce positive feedback, each in a different direction, which makes both self-perpetuating.

However, confidence is only one of many factors that contribute to successful learning and development of competence, and competence is not the only factor that engenders confidence. Praise, encouragement, and other kinds of social support can boost confidence, while disapproval can undermine it. Training and practice, as well as natural aptitude, are the original sources of competence. Thus there are also external factors that contribute to the motion of the system. There are also internal dampers. Overconfidence can lead to lack of effort, thereby to poor learning and performance. On the other hand, anxiety caused by lack of confidence can stimulate increased effort which, if successful, can increase competence. Thus the competence-confidence system illustrates some of the complexity that can be concealed within an apparently simple system.

2.6 Cognitive Development as a Positive Feedback System

Although positive feedback is involved in many biological processes, it is particularly characteristic of cognitive development, because in cognitive development the products, the cognitions formed, are the very mechanisms of the system itself. Any change will therefore tend to affect how the system itself functions in the future. Each cognition acquired serves not only as a foundation for more advanced ones,

but also as a tool to be used in their acquisition. It is therefore more than a process of accumulation, piling one upon the other.

Earlier, we defined learning as a specific kind of cognitive development in which an organism interacts with something outside itself. This interaction and subsequent incorporation of external components into the cycle itself makes learning cycles more complex than other cognitive cycles. There are more possible routes of feedback in learning cycles. In particular, whatever is drawn into the system from outside, that is, whatever is learnt, contributes to future learning because it makes it possible to interact with the environment and learn from it in new ways. When a child begins to learn language, he first learns simple words and short phrases. After a while, he uses these to comprehend and then to produce simple sentences and to describe concrete situations. Then, by using these to express himself and understand others, he gradually becomes able to comprehend and to produce complex sentences and to express abstract concepts. Each level of language acquisition lays the foundation that makes the next step possible.

Accurate understanding of the world, too, is achieved by a gradual cyclical processes which involves learning and reasoning. First there are just rough ideas. These serve as working models for interacting with the world, and through those interactions the ideas themselves are gradually improved. The parts that are consistent with experience are confirmed and strengthened and those that are not are corrected, so understanding of the world becomes increasingly accurate. Improved ideas then become the basis for better interactions. Cycles therefore typically involve a combination of concrete functional ability and abstract concepts. The earliest cycles generally involve only concrete relationships. When the child first tries to fit pieces into a shape-board, he does not yet have the abstract concepts of shape, of size or of matching. He has only the idea that sometimes a piece fits in and sometimes it doesn't. As he experiences success and failure at getting pieces into holes, these abstract ideas begin to form. This moulding of cognition around behaviour is one of the characteristics of human intelligence. Once abstractions are formed, influence in the other direction begins. Behaviour takes into account not only past concrete experience, but cognition as well. When presented with a new shape, the child immediately fits it into the correct hole. Behaviour and cognition have been united and become a system.

Mental development therefore involves many different systems that are constantly evolving, merging with one another and spawning new systems. Some involve consciousness and propositional knowledge, some abstraction, and some are entirely concrete. A mental ability need not be conceptual to contribute, as long as it is *functional*. It is not necessary to know a name for it, to be able to describe it, or even to be consciously aware of it, but only to be able to use it, for it is *use* that prepares the way for the next step. Once a person is able to do something, whether or not he understands what he is doing, that skill becomes part of the system and can contribute to the development of new skills and cognitions. Use of simpler, more primitive concepts in thought or action makes the construction of more complex ones possible. Thus, in learning mathematics, it is the *practice* of each operation that prepares the way for the acquisition of the next. For most children, the grasp of addition is at first only functional. They do not understand what they are doing or why. The ability to perform the operation correctly and consistently, in itself constitutes the knowledge. Then, as the child practises the skill of addition he has now acquired, the concept of multiplication begins to form in his mind, either by his own discovery or through the guidance of his teachers. This new concept, too, need only be functional. He becomes familiar with certain patterns of numbers that he encounters when adding a number to itself several times. Once he attains the skill of multiplication, another cycle has begun. He practises it and moves on to a new concept such as division.

2.7 Collective Cognitive Development

It is informative to note the similarities and differences between the development of an individual and of a culture, in this case, between the individual's cognition and behaviour and the science and technology of the culture. Both are cyclical, but two important differences make the latter easier to observe. First, its progress is much slower. The mathematics that a college student has learnt by the time he is eighteen took Western Civilization over two thousand years to develop. Second, it is essentially external and public. Each step becomes manifest by its expression in social institutions of one sort or another. For these reasons there is continual documentation of the course of development, making it possible to trace the evolution of a concept or technique over years and centuries. It is clear how the advanced forms evolved from simpler, less accurate ones. The Newtonian theory of planetary motion was only possible because of the mathematical and astronomical theories that immediately preceded it. Those were possible because of the medieval theories, which in turn rested upon Aristotelian and classical mathematics and astronomy. Sometimes we find the same steps in the development of the individual as we do in the development of the culture. Most children think heavy objects fall faster than light ones. More often, however, the similarity lies not in the particular steps but in the general course of development.

3. The Development of Perception and Thought

Cognitive development involves many different kinds of changes. Acquisition of new abilities, though perhaps the most obvious, is only one. There are also changes in *perception* and *thought* which affect three important parts of the process of cognitive development, *recognition*, *interest* and *attention*.

3.1 Recognition

An intelligent being notices only those things that fit into its current mental structures, for it is the act of processing sensations mentally that constitutes perception. A person who has never studied music does not notice what key a piece is in. Even if someone tells him, he does not know what they mean. He has no mental structure to fit it into, and anything that does not fit into any of a person's mental structures, that cannot be processed by any of his mental mechanisms, is essentially unnoticeable. Though he experiences physical sensations, he cannot perceive it. We say it is not *meaningful* to him. To be meaningful, defined in this way, does not require abstract understanding. As long as there is something that he can do with it, as long as there is a structure, even if it is just one of concrete intelligence, into which he can fit it, it is meaningful. It need not be conceptual as long as it is functional. Indeed, for animals who have little or no abstract intelligence, meaningfulness is entirely functional. It is those things with which they can interact behaviourally that are meaningful for them. Those things alone constitute their world. The mouse does not notice the writing on the box as it gnaws through it, though its eyes cannot fail to register the visual sensations.

Each new stage of mental development therefore brings with it the possibility of perceiving and utilising more things in the environment. Things that may have been present all along but for which there were not yet appropriate mental structures can now contribute to future development. Sensations and experiences that were previously meaningless can now be perceived and understood in new ways. Every new cognition, every new or augmented structure, whether in behaviour or understanding, gives one the potential of noticing aspects of the world that previously had no significance.

It also becomes possible to distinguish things that had until then seemed identical because there had been no basis by which to differentiate between them. To the small child, all coins are pennies and all writing is scribbling. Until a child learns multiplication and division, prime numbers can have no significance for him. But once he learns these operations, he can look at numbers and say, "Look! These are even, these are odd! These are perfect squares, these are prime!"

The same thing happens when a child learns language. The foundations of are laid in infancy, as he becomes familiar with the sounds his caregivers make. These sounds become part of the mental structures by which he interacts with them. Once he has become familiar with them and attends to them, he can begin to distinguish them from one another. It is only after that that he becomes able to notice that different sounds are associated with different situations, actions and objects.

3.2 Interest and Attention

The ability to notice and recognise something makes it possible to direct attention toward it. We shall refer to the tendency to direct attention toward something as “interest”. This is an extension of the usual meaning of interest, which generally involves desire to know about something and at least some kind of conscious direction toward it. Here, we are including a variety of behaviours, some innate and some learnt, that involve direction of attention, but not necessarily curiosity or conscious intent. For example, the sight of a snake slithering across the ground quickly draws one’s gaze. For many animals and perhaps humans as well, this response is innate. Similarly, there is an innate response to the sight of a pair of eyes directed at the subject. We are including all these, even though they are not consciously mediated. For human beings, this sort of interest response need not be innate. On the contrary, it is acquired readily for anything whose presence involves sudden danger. Another kind of interest and attention response is attraction to sights or sounds associated with pleasurable experiences. One is drawn to gaze at tasty food, and enjoys continuing to look at it because he is reminded of the pleasure of eating it.

New stages of cognitive development therefore bring with them not only new knowledge, understanding and ability, but also new dispositions, in particular, *interest* and *attention*, new kinds of motivation to interact, and through new interactions, new learning. Through learning one becomes able to recognise new things. They become subjects of interest and he attends to them and interacts with them. Through interaction he learns and becomes able to recognise yet more things, and the cycle begins again.

3.3 Cognitive Techniques

New stages can also involve new cognitive techniques, new ways of thinking and reasoning, of combining one existing structure with another. New patterns of reasoning generally form first in specific areas, as we discussed earlier, but once a new pattern has been formed it can be extended and applied to others, and eventually generalised. Thus when an English-speaking student of German notices that in cognates, German often has an “s” where English has a “t”, he begins to use this rule to try to understand German words that he does not yet know. From examples he derives a rule, and uses the rule to help understand new experience. He may then go on to construct a meta-rule. Having found that these sounds relate this way, he looks for other such pairs, such as “g” and “y”.

One important cognitive technique that is acquired rather late is *conscious analysis*, breaking down something into its component parts. Children only recognise parts when they are already familiar with them separately. If they are familiar with something only as a whole, they do not think of analysing it. When a small child learns to do something new, he tries to do the whole thing at once, no matter how complex or difficult it is. An adult, however, knows that it is easier to learn one small part at a time, so when he wants to learn a new skill such as piano technique or getting along with other people, he analyses the parts of the new skill so that he can practise them separately. The act of analysis is essentially internal. It is not like learning, in which the environment contributes new information. It consists of taking what is already known, in this case the skill that one has observed and wants to learn, or the problem that he wants to solve, and breaking it down into parts. Once such a technique has been acquired, it becomes a component of future cycles, making them very different from earlier ones.

3.4 States, Processes, and Driving Forces

When analysing a developmental system, there are three aspects that must be addressed. One is the *current state* of the system, consisting of such things as current abilities and knowledge. Another is the *process by which the system changes its state*, which includes activities such as learning and improving skills by practice. A third is *driving forces*, the *motivations and inclinations* within the system that activate those processes and thereby propel it to change. Most systems have broad ranges of processes of change and of driving forces, but at any moment only a portion of them are actually functional. The actual processes and motivations by which a system changes, that is, that are part of the current cycle, are therefore dependent on the current state of the system.

There are also external factors. Certain kinds of change require resources that must come from outside the system itself. Change by means of learning by definition requires external factors. A learning cycle can only take place when there is something in the environment that can be incorporated into current mental structures. There are also external motivational forces that cause an individual to exercise his potential to change even when there is no internal motivation. Some, such as encouragement and coercion, are social. Others are physical, such as the need to search for food. The environment is therefore another important factor in determining what direction a system will actually take.

4. The Social Learning System

We have already seen that the traits involved in autism bear reciprocal relationships, indicating that they belong to a system that involves some kind of feedback. Now we would like to identify that system and understand it. What we are looking for is not a system that is unique to autism, but one that is common to all human beings. It is one that is part of normal cognitive functioning and development, but which is different in the autistic child than in the normal one. Since autism involves deficits, it is a system that, in certain ways, does not function properly in the autistic child. We can expect to find that in autism some of the components, rather than reinforcing the others and thereby promoting normal functioning and development, fail to reinforce each other and may even interfere with one another instead. But since autism can also involve superior abilities and other abnormalities that are not deficits, it cannot be only a matter of dysfunction. We can therefore also expect to find routes of reinforcement and positive feedback that are different but not inferior.

Since the two areas that are most consistently and significantly abnormal in autism are *social interaction* and *language*, these must be among the main components of the system. We therefore need to understand the system by which normal children acquire language and by which they learn to interact with other human beings.

4.1 Early Development

This system cannot already exist at birth, because neither language nor social awareness is yet present. An infant does not relate to humans beings the way an adult or even a small child does. They are a source of food, and he learns early to turn toward them to search for it. Sometimes he finds their handling pleasant, sometimes not. They appear when he cries, and his crying is reinforced by the response it receives. But that crying is not an attempt to communicate with them. He does not think of them as conscious beings responding to his requests. Indeed, nothing in his behaviour indicates that he has any idea of consciousness. Nor is his crying an intentional effort to cause them to come, since he has not yet achieved even a primitive concept of cause and effect. At first he cries simply because that is his natural biological

response to discomfort. Only gradually, as that natural act of crying is reinforced by the relief that often follows it, does it become first an intentional act and then an act of communication.

Other behaviour, too, indicates lack of awareness of humans as conscious beings. His gaze is not like the gaze of an adult. When he looks into the eyes of his caregiver, it resembles a gaze of curiosity, not of rapport or communication. He does not look the way one adult looks into the eyes of another. There is no coordination and no indication of mutuality or sensitivity to the feelings of the other.

But even though there is neither social awareness nor intention to communicate, there are other forces at work that cause the development of social interaction to begin. Almost immediately after birth, as the infant touches his mother's breast, looks in her eyes and hears her voice, he begins to become familiar with the natural sounds, smells and rhythms of human beings. These are the first elements of social knowledge, and from them increasingly more complex social concepts will later be constructed.

Together with social knowledge, he begins to acquire social behaviour. As his mother cares for him and plays with him, he develops patterns of behaviour that match hers. From the start, his own behaviour is shaped by interaction. Some of the patterns he learns are universal human ones, some are standard cultural ones, and others are personal patterns of his mother and other caregivers. His behaviour begins to take on the standard forms of the culture of which he is to become a member, while at the same time he is beginning to learn not only the universal sounds and smells of all human beings, but also the specific ones of that culture. Later, complex social behaviour and social knowledge will draw upon the elements that he acquired at this early stage. Social moulding, too, will continue throughout life, each level building on those that preceded it. Eventually it will come to include social rituals such as manners, and social skills such as appreciation of the emotions and thoughts of others.

Through all of these he develops not only patterns of behaviour and understanding of the human world, but also coordination with other human beings. Coordination does not develop separately, but is achieved through the social activities in which he interacts with others and develops cognitive and behavioural patterns corresponding to theirs. The child first begins to become coordinated with his caregivers, then with friends, and then with society at large. Thus the development of coordination follows the course of expanding social interaction.

Central to the activities in which these early social skills develop are the exchanges of smiles and vocalisations between the infant and his caregiver. Through such activities as alternately gazing and looking away, observing and responding, grasping and releasing, he develops behaviour patterns that will form foundations for conversation and other forms of social interaction and coordination.

Whether or not development of behaviour and cognition are related reciprocally at the very beginning, reciprocal relationships soon form. Cognition influences behaviour, and behaviour influences the course that future learning will take. Learning leads to recognition which leads to interest and to attention, and these lead to further learning. Social skills and knowledge progress through increasingly advanced stages, each laying the foundation for the next.

4.2 Language and Communication

Within this primitive social interaction are also the beginnings of communication and language. Familiarity with the sounds produced by caregivers begins immediately after birth, but more is needed before language can develop. It is generally in the interactive games that caregivers play with him that the infant's first proto-words appear. At first the infant's contribution to these games involves non-verbal actions such as smiling, moving limbs and gazing, or natural vocalisations such as cooing. After a while he begins to produce speech-like sounds.

These first utterances are not requests or descriptions. They are not communication. When the caregiver sits with the infant and names his toys and the infant tries to produce the appropriate sounds, it

is not an exchange of information or even an attempt to learn. It is a social game. Indeed, from the infant's standpoint, eating, getting dressed, and other everyday activities that he does together with his caregivers are all social games. The language that he learns to use in them, even when it does begin to serve the purpose of communication, is still part of the game. Requesting is not just a way to get something. It is a way of interacting with another person. Language now joins earlier nonverbal communication such as stretching out his arms to be picked up. All serve the dual purpose of communication and social interaction.

These two functions of language never become completely separate. On the contrary, they continually contribute to one another. Improved communication through language makes new kinds of social interaction possible. The child can now ask for things and express his feelings. His caregivers point things out to him and tell him about them, they tell him what to do and comment on his actions. He can play new kinds of games, such as naming things and talking about them. In all of these, the pleasure of interacting with other human beings is a significant part of the motivation. Thus language becomes part of the system of social interaction, relating reciprocally to the other parts.

4.3 Social Learning and the Physical World

Language acquisition and social interaction are also both closely connected to other areas of cognition. During the first year, most of the infant's fundamental skills and knowledge of his body and his environment are derived from direct physical interaction, so social learning plays only a minor role. But once a rudimentary communication is achieved between the infant and his caregivers, more and more of his knowledge and behavioural competence is derived not from his own discovery but from what he learns from others. Initially it is from his caregivers, but when he begins to play with other children he acquires skills and knowledge from them as well. Later, during school years, teachers and peers become the main sources, and finally, in adulthood, society as a whole.

This new way of learning about the world has a radical effect on subsequent cognitive development, for from his social environment he learns not only facts about the physical world, but also attitudes toward it. He learns to consider certain things important and to attend to them, and to ignore others. He learns how to organise experience, how to make sense out of the chaos of natural phenomena that surrounds him. From that moment on, social interaction shapes how he perceives the world and what he learns about it.

This relationship between physical and social competence is reciprocal too. Not only does social interaction help him develop skills and knowledge of the physical world, those skills and knowledge help him interact. He can help Mummy clean the house and can play new games with his friends. World knowledge also contributes to the child's ability to understand the behaviour of other human beings and therefore to interact with them. The rough concepts of human beings and of desires and emotions that he began to construct during his first year were derived entirely from his own observation. Once he learns language, these concepts take a great leap as words such as "happy", "sad", "want" and "like" guide him to see both himself and other humans in certain ways. Words like "you" and "I" contribute to the development of a concept of self, while "why" and "because" help him develop a concept of causality. Social situations, such as being held responsible for his behaviour, contribute not only to sense of self but also of volition. When Mummy scolds him and says, "Why did you hit your brother?" he is guided to think of himself as having control of his actions. All these concepts, whether discovered independently or learnt socially, contribute to how he interacts with other human beings.

But while social learning helps him understand the world, it also limits his understanding of it. By directing his attention to certain aspects and not others, by organising the world in certain ways, it moulds his thinking. It picks out certain aspects of the world and invests them with importance, but ignores

others. One culture directs its members to view the world as inhabited by supernatural spirits and controlled by magical powers, another to see it under the control of impersonal natural laws. Culturally derived values also direct and restrict his behaviour by prescribing and even demanding certain ways of functioning. While none of these can be completely false and life-threatening, for had they been, cultures that adhered to them would not have survived, they may not be optimal. But whether a cultural pattern of thought or behaviour is beneficial or detrimental in the physical world, it is of paramount value in the social one, for to function within a group one must share, to some degree, its way of thinking and acting.

Language also serves as a scaffold, helping children make the step from one cognitive level to the next. By learning words and expressions that are beyond their comprehension, and by being trained, through social interaction, to use them correctly, children gradually construct new concepts. And by being trained to formulate new concepts, their future thinking is guided and directed. Concepts enable them to see new things in the world around them. At the same time, increased knowledge of the world contributes to their ability to understand language. They can understand the meaning of unfamiliar words from context because they know about the situations that are being described. Thus there are reciprocal relationships between language and nearly all other areas of cognition.

The parallel development of language, socialisation, and knowledge of the physical world is therefore not coincidental. All are interconnected, and their reciprocal contributions are essential for their development. During the course of childhood, these and other components become bound together to comprise a complex system which we shall call the “Social Learning System”. Among the fundamental requirements of this system are the abilities to learn complex behaviours, to communicate with other human beings, and to become coordinated with them. Social and language skills are therefore central parts of the system. World knowledge and skills are closely connected but not central.

4.4 Mechanisms of Social Learning

The distinguishing feature of social learning is that, unlike other kinds of learning in which the individual learns by his own discovery, in social learning he learns from other human beings. The content of social learning sometimes involves knowledge of human beings themselves, but often it does not. Conversely, knowledge of human beings is not always derived from social learning. It can also be derived from personal observation and experience. *Content* and *means* of learning are separate factors.

There are many activities by which social learning is acquired. The most obvious are *teaching* and *training*. In these, a more knowledgeable or skilled partner intentionally instructs the less developed one. The learner may or may not realise that he is being taught. There are, however, other ways that are less obvious, but are nonetheless of great importance. The most important is *imitation*. Most social behaviour is never explicitly taught, yet is acquired by all normal members of a society, generally by imitation of one sort or another. Some imitation is intentional. The child watches a parent or older peer do something and tries to do it himself. Sometimes, however, even the imitator is not aware of what he is doing. Having seen it done a certain way by others, he simply assumes that that is how it is done. It is by this unintentional imitation that many social institutions are passed on from one generation to another and perpetuated with neither specific mechanisms of transmission nor effort on the part of society. Accents and local patterns of speech are clear examples.

Cultures also mould the behaviour of their members by *evoking responses*. When a child behaves a certain way in response to the behaviour of others, their behaviour serves as a scaffold for his own. When the caregiver extends his open hand and the child responds by putting what he is holding into it, the child’s behaviour is being moulded. Some responses are to general patterns rather than to specific acts. Thus a child raised in a society in which dishonesty is the norm, in addition to adopting the practice of lying himself, which he does by imitation, develops an attitude of distrust for others.

Another more subtle route by which a person learns socially is through *interaction with artefacts*. Especially in modern cultures, artefacts make up much of the child's physical world. Since they were designed and constructed by human beings, their forms reflect the goals and favoured modes of behaviour of their creators. That they reflect goals is obvious. The form of a knife reflects the goal of cutting. As for favoured modes, laterality is a good example. Scissors and gramophones are made to be used by the right hand because that's the hand their makers wanted to use them with. By developing proficiency at the use of these artefacts, the child comes to adopt the goals and modes of his culture.

In that language is an artefact, moulding of thought through word use is also in this category. Indeed, all social institutions are artefacts, whether or not they involve manufactured physical objects. Greeting rituals are artefacts that, among other things, shape a child's attitude toward other human beings. By learning to greet some people with greater respect than others he is trained to recognise social status.

Through social learning, the individual acquires the knowledge, skills and behaviour patterns of the group, or of individuals within it who are more competent than himself. His own becomes a copy of theirs.

4.5 The Significance of Social Learning in Human Development

Although social learning is found to a limited extent among many other species of mammals and birds, in man it becomes one of the central life activities. For the human species, social learning is essential for survival. The human infant has much to learn, and he must do it in a relatively short time. Unlike most other species, he is not innately endowed with the necessary life skills, so his survival is dependent upon successful learning. He must learn to recognise danger, find food, and care for other physical needs. Since he cannot possibly learn all these things independently, he is provided with a mode of learning by which he can acquire them by the time they are needed. He learns which plants are good to eat and which are poisonous without having to try them all and get sick or die. By imitating the expressions of his caregivers, he learns in which situations fear is appropriate and in which it is not.

Social learning also occupies the unique position of being the sole source of the skills needed to function within society itself. These are as important for survival as physical skills, because humans are social creatures for whom the existence of the individual is dependent upon his membership in a group. A human being cannot exist alone. Even after mastering all the physical skills of a mature adult, there remain many basic needs that cannot be provided by his own efforts alone. Not only in modern societies with complex divisions of labour, but even in primitive hunting and gathering societies, each individual is dependent upon the help and cooperation of the others. Over and above this, among the basic biological needs of the human being are social ones, which, by definition, can only be provided by others. Each individual must therefore learn to function within the social group.

But human society is extremely complex, and learning to participate in it requires years of training and practice. The average ten year old already knows how to eat with knife and fork, shop for groceries and carry on a conversation, but he has not yet become an acceptable dinner guest, cannot yet evaluate whether a purchase is worthwhile, and does not know what comments are appropriate in a particular social situation and which should be avoided. The differences between cultures, increasing with the complexity of the situation involved, indicate a cumulative process of learning in which each individual is trained, from infancy on, to become a participant in the culture of the social group in which he is raised. The biological system by which social behaviour is learnt must therefore be extremely powerful, for acquisition of so much essential skill and knowledge depends upon it.

4.6 Components of the Social Learning System

The activities and abilities that lie at the core of the Social Learning System are those by which human beings interact with one another. Among them are those involved in *language* and other kinds of *communication*, in *imitation*, and in *coordination* with other human beings. Close to this core is *competence in cultural conventions*, including conventional behaviours and attitudes, as well as knowledge of those parts of the physical world which the culture deems important. Also central to social learning are *motivational factors*, driving forces that keep the system moving.

Since social learning is so crucial for human survival, the mechanisms of social learning are exceptionally hardy. In the normal individual, all the necessary components are present at levels more than sufficient for proper functioning. Indeed, there is considerable redundancy. Each essential component is provided for by multiple mechanisms, so that even if one fails, there are others to fill its place.

In addition, the forces that drive social learning are stronger and more persistent than those of other developmental systems. The first is the innate *salience of certain human features*, in particular, the form of the human face and the sound of the human voice. These incline human beings from infancy to *notice* other humans. Together with salience are *attention responses* to these features. Not only do they notice them, they are also inclined to *direct their attention* to them. This innate attraction to human features and the resulting attention, present already in infancy and continuing throughout life, incline the individual to notice exactly those things that are necessary for social learning.

Second is the *reinforcement of social competence by frequent reward*. The rewards are of two sorts. First are the practical benefits. Since each individual is continually interacting socially with others, social skills are useful in everyday life, unlike skills such as making clothes and planting crops, that are only useful in limited situations. But over and above that, since social interaction is itself innately pleasurable, new social skills are practised just for the sake of doing them. Unlike arithmetic, which most children will not practise unless they are forced to, social skills are spontaneously practised, so they are continually being improved without any external pressure.

Like social skills, social knowledge is immediately beneficial because it can be readily applied to behaviour. It is rewarded and therefore practised. Consistently putting new knowledge into practice propels the Social Learning System from one cycle to the next. So, while in other kinds of learning the step from recognition to interest and attention often fails for lack of sufficient motivation and the system stagnates, here it moves continually forward. So over and above the cyclical nature that it shares with other learning systems, social learning is propelled by these additional sources of positive feedback, which gives it exceptional strength and momentum.

5. Autism as a Dysfunction of the Social Learning System

Although when intact the Social Learning System is very powerful, and although the human organism is designed in such a way that this system will function even when some of its components fail, its complexity and the many factors upon which it is dependent render it vulnerable to disruption in many ways. In those rare cases in which, in spite of the resilience of the system and the more-than-adequate biological provision for its proper functioning, one or more components are so severely impaired that the normal cyclical progress fails, the result is autism.

Autism is therefore an essentially different mode of development. In normal development, advances in the various areas contribute to one another; in autism, weakness in one hinders the others. The very same positive feedback that is the driving force of growth and improvement becomes destructive instead. To the extent that an infant fails to participate in social interaction with his caregivers, he fails to learn about them and to develop social skills. While he matures in other ways, socially he remains an infant. As other children reach new levels and develop in new ways, the autistic child is left behind. He has neither tools nor motivation to progress.

In normal children, effective functioning in each of the three areas, socialisation, communication and organisation of experience, reinforces the others. As the infant grows into a child and then an adult, each advance in socialisation contributes to further development of language, which in turn gives him greater ability to socialise. Assimilation into society provides him with a more regular environment, relieving him of the need to regularise it himself. Adoption of socially accepted norms of behaviour makes him a more welcome member of society. Autism is therefore failure of the system as a whole, not of the individual components separately.

In the following chapters we shall see how dysfunction of the Social Learning System accounts for all three main areas of autistic abnormalities as well as most of the others. We shall also explain some of the different kinds of autism in terms of different sources of disruption of the Social Learning System.