Appendix C
The Process of Mental Development:
How Your Brain Becomes Your Mind

Initial Perspectives

Because the brain is a mass of complex circuits of neurons (brain cells) that are organized into specialized areas responsible for specialized functions, it is very similar to the computer. In order to function properly, however, computers must be programmed—that is, instructions concerning how they are to operate must be fed into them. The brain is similar to the computer in this respect. Even though some circuits that enable mental activity are inborn, most mental operations must be learned or programmed into our "organic computer." As these "programs" are learned, the brain, in effect, becomes the mind.

The process of mental development involves acquiring the abilities for sensory-motor coordination, visual and verbal interpretation, learning, speech, thought, reading, and self-awareness. We discuss this process in some depth for several important reasons.

First, how well the mind has been developed during the early years of life is critical to mental efficiency and effectiveness in the adult. Thus, if we are to concern ourselves with better adult mental development, then we must also be concerned about better mental development when the process begins—in the child, adolescent, and young adult. Better mental development during these stages is the direct responsibility of parents and teachers, whose influence has lasting impact on the individual. Conscientious parents and teachers will find in this chapter many valuable tools and insights that can be used to monitor a child's progress and purposefully improve it whenever possible.

Second, it is true that we are what we are because of the influences of heredity and environment. In fact, most people have been relatively passive factors in their own personal development—especially during the formative years. This does not mean that children, adolescents, or young adults do not interact with their environment. But it does mean that we are usually unconscious of the process of mental development, have not completely understood it, have not really known how to improve it, and therefore have not been able to become active factors in the process. If, then, the process is better understood by parents and teachers, they should be better able to teach the maturing individuals certain principles that will enable them to be more active influences on their own development.

Third, we all have our own expectations regarding what we can get out of life. These expectations are greatly influenced by our estimation of our abilities to get what we want. Thus, if we assume that our abilities are static and cannot be improved, we will also tend to assume that we can get no more from life than we presently expects. If this is the case, the incentive to go after what we really want from life is significantly diminished. It is in this manner that assumptions about personal development can adversely affect one's motivation level. This appendix demonstrates, however, that mental abilities can be further developed. Therefore, rather than considering who we are and where we are, we should anticipate who we are becoming and where we are going—in the knowledge that higher expectations can be achieved.

Fourth, a better understanding of the developmental process actually enables us to become more purposeful, active factors in our own further development. The background presented here is input for better understanding and using the principles and techniques of later chapters.

Fifth, in Chapters 2, 6, and 8 we discuss the formation of various personal traits and behavior patterns. The process of mental development has very significant influences on those processes. This appendix assists the reader in evaluating his or her present levels of personal traits by providing insights into the influences of mental development.

Recommendations

Again, skim the chapter briefly to get an idea what is in it and where it is going. Next, read for detail, paying particular attention to emphasized points. Then review it, taking special notice of points that you wish to remember. Making notes to yourself in the margins is always a good idea. Your thoughts will be better recorded in memory, and later review and recall will be easier.

Detail is presented here for the benefit of parents, teachers, and instructors. However, it can be covered in abbreviated form for those to whom the detail may be less necessary. Instructors can accomplish this by tracing through the process using ***Figure C.6*** on page C-16, while making reference to details that deal with vocabulary, reading, speech, and logical thought.

Reviewing What You Already Know

In orderto clarifyin yourown mind whatyoualready know so that the material will be more meaningful, fill in or mentally answer the following questions.

1. The development of our abilities and other behavior patterns has been influenced to a very large extent by these two factors: _____ and _____.
2. The ability to focus one's senses on stimuli (so that the resulting impulses will be recorded in memory) requires the development of _____ - _____ _ co-ordination.
3. What types of things are generally best learned using the part to whole method of learning?
4. The ability to speak requires the use of information recorded in three basic areas of memory: _____ , _____, and _____.
5. What types of things are generally best learned using the "whole to part" method of learning?
6. Learning to read involves conditioning "mental sets" for eye movement and simultaneous verbal and visual _____ .
7. One's value system is learned. T / F
8. For a child's mind to develop, whose behavior is necessary? The child's? The adult's? Both? Why?
9. [Propositional logic - class logic - perception] is the ability to associate objects or activities based on shared characteristics - an ability which stems from learning to perceive both similarities and differences amongst objects and activities.
10. A good _____ is an essential tool if one is to reason effectively about concepts and other symbolic or subjective constructs.
11. There are three basic types of patterns of interconnected neurons (brain cells) organized during the process of mental development. The first are those that represent the abilities involved in learning (acquiring and storing information). The second are the patterns that represent what has been learned (recorded in memory). The third are those that constitute the mental abilities involved in using what has been learned. True / False
12. Arrange the following steps of mental development in their normal chronological order by numbering them from 1 (first) to seven (last).

    __ability to perceive similarities and differences amongst objects and activities;

    __ability for speech;

    __formation of basic sets or patterns of interconnected neurons that enable sensory-motor coordination;

    __accumulation of repertoire of visual information;

    __ability for the use of propositional logic;

    __ability to read;

    __accumulation of repertoire of verbal information.

13. Are the above abilities ever developed to their full potential? Why, or why not? If they are not, can they be further developed?
14. Do you think that the above abilities can be over-developed in a child? In an adult?
15. Which of the above abilities contribute to the development of one or more of the others?

General Preview

A child is born with certain integrated, but unlearned patterns of behavior such as sucking, crying, and swallowing. He is also born with the nervous system apparatus for random or involuntary movement of fingers, hands, arms, legs, eyes, and so forth. In addition to these inborn potential capacities for physical (motor) activities, he inherits from his parents potential capacities for intellectually-oriented abilities such as perception, learning, reading, thought, and speech. These potential capacities have inborn upper and lower limits within which the abilities can eventually develop. But regardless of inherited potentials, they must be developed—or learned. As we will show, the depth and breadth of this mental development will be greatly determined by the human being's interaction with his environment.

We said in Appendix B that learning is a matter of organizing or interconnecting memory area brain cells into patterns that represent some perception or enable some activity. Visual information is recorded in **visual** areas of memory. Auditory (or verbal) information is recorded in **auditory** areas. Sensitivities resulting from one's own muscular movement are recorded in **motor** areas of memory. Although tastes' and odors' impulses are also recorded in separate memory areas, in this chapter we will be especially concerned with the first three basic areas of memory—motor, visual, and auditory.

Several basic processes occur during mental development. First, a child learns to co-ordinate the movement of his eyes and hands. This allows him to reach for, grasp, and manipulate objects under visual control. In addition, it allows him to focus visual and tactile (touch) sensory organs on objects at the same time. As he does so, he can begin to record sensory impressions in visual (and other) areas of memory. Thus, learning sensory-motor coordination enables the learning of additional information, which in turn will be used to interpret what he subsequently senses.

Sensory-motor co-ordination also enables a child to turn his head toward sounds. When he focuses on auditory stimuli, he begins to accumulate records of auditory impressions in auditory areas of memory. These recorded sensitivities will give greater meaning to subsequently sensed sounds such as adult speech.

As a child watches adults behave and listens to their speech, he begins to associate objects and activities with the words (sounds) that symbolize them. These associations will also be recorded in memory, and will enable his comprehension of language. His vocabulary will expand rapidly, giving him the tools for defining and describing in more specific terms what he sees, hears, or otherwise senses.

While language comprehension is increasing, the child begins to imitate adult sound patterns involved in speech. As he uses speech muscles, he records feedback impulses from nerves in the muscles in motor (speech) areas of memory. In order to speak voluntarily, he will learn to use what has already been recorded in his visual, auditory, and motor areas of memory. First he will think what he wants to say by juggling verbal, visual, or motor information back and forth between memory and reasoning areas. Then he will activate previously recorded patterns in motor areas of memory that represent his ability to speak what he is thinking.

Next, he will learn to read by using information recorded in motor, auditory, and visual areas. Reading involves coordination of eye movement from word to word with simultaneous interpretation of visual and verbal impressions communicated by the words.

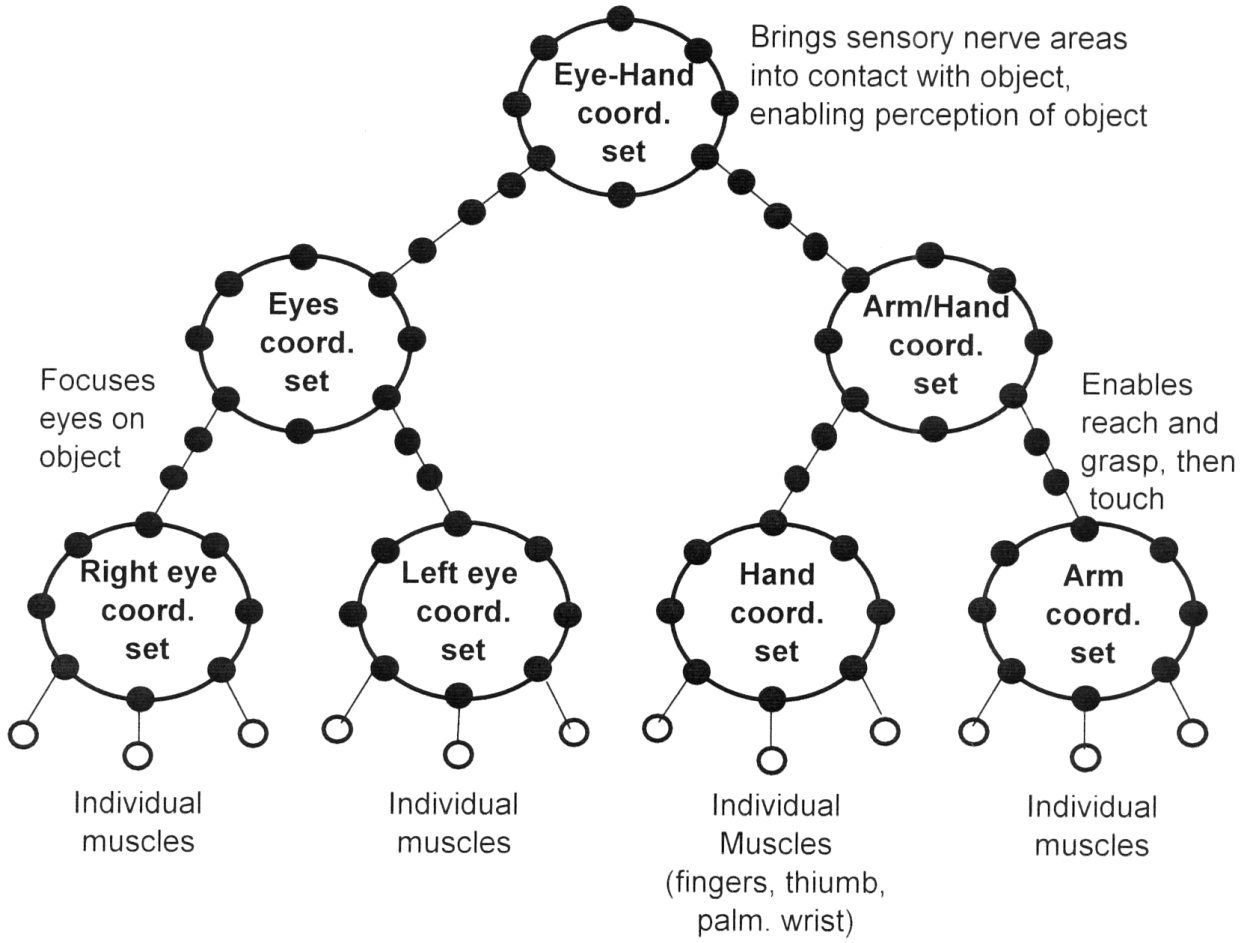
In yet later stages of development he will begin to understand and learn ideas, concepts, and other subjective or contextual constructs, which cannot be seen or touched. He increasingly distinguishes himself from his environment, thereby developing an identity or self-image. Values, personality traits, and other complex behavior patterns will continue to develop as he makes increasingly complex responses to his environment.

This has been a brief, general perspective for fitting together the more in-depth discussion that follows. It has shown that mental development is a learning process in which measurable changes in behavior occur. It is also a sequential process—that is, some patterns or abilities must be learned in order for others to be learned. And it is also a cumulative process—that is, each acquired ability contributes to the further development of the others. During the entire process, behavior becomes increasingly complex.

Forming Visual Perceptual Abilities

From the moment of birth, sensory nerves begin sending impulses to sensory areas of the brain. If sounds or movements in the infant's surroundings are particularly intense or novel, messages to the brain may evoke involuntary eye movement in the general direction of the stimulus. However, what the infant first "sees" means nothing to her. She cannot focus upon any particular visual arrangement in space, nor can she meaningfully distinguish one object from another. What she sees is a formless, meaningless

Figure C.1: Conceptual Model of a Hierarchy of Neuronal Patterns Representing Sensory-Motor (Eye-Hand) Coordination for Focusing Senses on Objects
(Patterns are recorded in motor areas of memory.)



void. What she hears is meaningless, also. Should she touch something as her arms and hands move about randomly, that, too, will have no meaning.

In order for her sensations to be interpreted, she must record meaningful information in various areas of memory with which subsequent sensations can be associated. This requires that she learn to focus attention on objects, activities, or sounds so that distinguishable sensitivities will be recorded. Such focus of attention will occur when, for example, her eyes and hands randomly come into contact with an object at the same time—allowing her to detect a form and separate it from a meaningless background. Thus, in order to experience and learn more about her environment, the child must first progress from random eye and hand (and arm) movement to voluntary movement under visual control. She must be able to reach for, grasp, and manipulate objects at the same time she is looking at them. Such activity constitutes "eye-hand co-ordination," wherein the eyes help guide hand and arm movement to visual stimuli that can also be touched. It is a major example of "sensory-motor coordination."

Forming Patterns or "Sets" of Neurons That Represent (Constitute) Abilities for Sensory-Motor Coordination

Figure C.1, explained below, is aconceptualdiagram that illustrates the developing hierarchy of brain cell patterns that constitute increasingly complex patterns of mental activity and the abilities they represent.

As random movement of eyes occurs in the infant, impulses generated in nerves in the eyes' muscles are being recorded in motor areas of memory. A separate representative pattern is recorded for each individual muscle's movement. These separate patterns are conceptually depicted at the bottom left side of ***Figure C.1***.

Also being recorded in motor areas of memory are the separate patterns that represent the movement of each individual muscle in each finger, thumb, palm, and wrist. Since there are several muscles in each arm, random movement produces recorded patterns in motor areas for each's separate movement. These separate patterns are illustrated on the bottom right side of ***Figure C.1*** .

Once these individual patterns have been organized separately in motor areas of memory, they can then be voluntarily activated to produce purposeful eye, hand, and arm movement. That is, the patterns of recorded impulses can be connected to **motor** areas that in turn will translate the impulses into messages that will trigger movement in particular muscles or groups of muscles. However, the patterns representing movement of individual muscles cannot all be activated simultaneously. If they were, movement would be erratic and uncontrolled. The movement of more than one muscle at a time must be sequenced, controlled, or coordinated.

The "motor" part of sensory-motor co-ordination is learned as the impulses of groups of muscles moving in a sequence at one time are recorded in memory. *For example*: Coordinated movement of the hand requires activation of recorded impulses that represent controlled, coordinated movement of "sets" of separate patterns representing movement of individual muscles in fingers, thumb, palm, and wrist. Thus, the representative control and co-ordinating pattern for movement of this group of muscles can be thought of as the "hand coordination pattern or set." Controlled movement of the arm also involves the formation of patterns in motor areas of memory that represent control and coordination of a set of individual arm muscles' representative patterns. Similarly, controlled movement of arm and hand muscles together requires coordination of both arm and hand coordination sets—by a higher-level control and coordination set. As shown in ***Figure C.1***, there is a yet higher "set" for coordination of simultaneous eye, hand, and arm movement.

We learn allcomplex muscularactivityin much the same manner as above. As an example, consider how you are generally taught to swim using the Australian Crawl stroke. The complicated activity of arms, legs, head, and breathing apparatus cannot be accomplished together from the start. One must begin by practicing basic movements and recording them in memory one at a time. Once they have been learned, they can then be practiced together in a coordinated fashion. First, you will learn to turn the head to the side (and out of the water) and breathe in. You then turn your head back under the water and expel the breath. You practice these movements to record them in motor areas of memory until they become a habit. Next, perhaps standing in water up to your shoulders, you practice reaching one arm out before you while bringing the other arm back to pull you through the water, alternating the motions. Having learned the stroke, you then combine head and breathing activities with arm movements. You practice until you can coordinate taking a breath as the arm is brought out of the water to begin the next stroke. Then, perhaps holding on to the side of the pool, you float in the water and practice the legs' "flutter kick." When the coordinated movement of both legs has been learned, you are ready to practice the combined kicking, breathing, and stroke actions. Doing so conditions a "higher" set of patterns for controlling and coordinating the separate "lower" sets.

Learning the separate activities (sets) involved in the total activity (the overall control and coordinating set) is a method of learning that applies to most, if not all, muscular activities. It is called the "part to whole method of learning." It is used when learning to walk and run, play the piano, and to play golf or tennis. Each individual part is learned before all parts can be put together into the whole coordinated muscular activity. This is a key to learning physical activities or abilities more easily, quickly, and effectively.

The "sensory" part of sensory-motor coordination is also necessary to the infant's initial purposeful, coordinated movement. As he moves muscles voluntarily, sensory information (kinesthetic feedback) is generated by nerves in muscles. These impulses tell his brain whether or not the movement was as rapid and/or as great as he desired. In addition to muscular feedback, the act of watching his hand or arm move also provides sensory information which tells him whether or not the movement is being executed as intended. Both types of sensory information enable him to correct for error. Reaching for a pencil, for example, would be difficult without being able to see movement of the hand toward the pencil and feel how the muscles are responding.

Thus, the child firstlearns patterns forsensory-motor coordination that will enable him to focus visual and tactile sensory organs on stimuli at the same time—voluntarily and under visual control.

Interpreting and Recording

Once the child has learned eye-hand co-ordination during the first year, she is able to start learning to perceive meaningful objects in her environment. By bringing both eyes and hands into contact with an object simultaneously, she experiences both visual and touch sensitivities. Because both types of sensitivities are related in space and time, she begins to form impressions in memory of form, shape, size, edges, corners, and so forth. Therefore, the sense of touch helps form visual impressions which will be recorded and give more meaning to subsequent visual sensitivities.

At first there is a tendency to perceive only a whole object—or perhaps just one particular part of an object. However, as her repertoire of visual impressions grows, she becomes more able to discern additional details of objects. For a while, the sense of touch will also be important to this phase. It helps call attention to differently shaped areas of the object. Thus, her attention will first be focused on the whole object, then to a different part, next perhaps to another part, back and forth between parts, and perhaps back and forth between the parts and the whole. This type of learning activity is called the "whole to part method of learning." It is how we generally perceive, interpret, and record **visual** arrangements. Since attention cannot focus on more than one such arrangement at a time, focus must occur in some sequence. So just like sensory-motor coordination involved in eye-hand movement, the child is learning visual perceptual sets. These sets coordinate sensory, motor, and interpretive processes.

As the repertoire of visualsensitivitiesrecorded in memory grows, the infant needs to rely less and less on the sense of touch to be able to discern shape, size, distance, location, and so on. Such progress is necessary if she is to be able to perceive motion and changing spatial arrangements that indicate an activity occurring nearby, but out of reach.

It should be kept in mind thatallthese sensitivitiesare constantly being recorded. This means that each new sensitivity has more meaning than the last. And the more meaningful the sensitivity, the better it will be recorded, and the better it will be learned. This is partially why a child appears to be a veritable "sponge" when learning during the first few years. Her abilities for perception and learning are actually increasing at an increasing rate.

In summary: As we learn mental "sets"involved in sensory-motor coordination, we are developing the abilities necessary for focusing sensory organs on specific objects and activities in the environment. This enables us to perceive more of our environment and to record sensitivities that will give more meaning to subsequent perceptions. Therefore, patterns in memory can be of two types to this point: (a) patterns (or sets) that represent and enable perception and accumulation of knowledge and information; and (b) patterns in various memory areas which represent the knowledge or information itself. Both types are learned. Both types represent recorded information. But the first type enables the learning of the second.

With this frame of reference, ask yourself these questions

1. How well do you perceive and learn new information of a visual nature? Do you observe rather than just see—by purposefully focusing attention to the whole visual arrangement, and then to the parts? Do you interrelate the parts to each other and then back to the whole? If you are like most people, you generally do this—but not necessarily on purpose. If you think that something of a visual nature is important to remember, think about using the "whole to part (and back to the whole)" method of learning.
2. How meaningful are new visual sensations to you? This is essentially asking how much you already know that will give more meaning to new sensations. The more meaningful they are, the better and more easily they will be recorded and learned.
3. How well are you contributing to your child's mental development in this area? Do you provide stimuli that will encourage her attention to, and interaction with, objects and other visual arrangements? In other words, are you conscientiously helping her to develop perceptually-oriented mental sets such as sensory-motor coordination? Are you providing stimuli which will enrich her repertoire of visual information and motor skills?

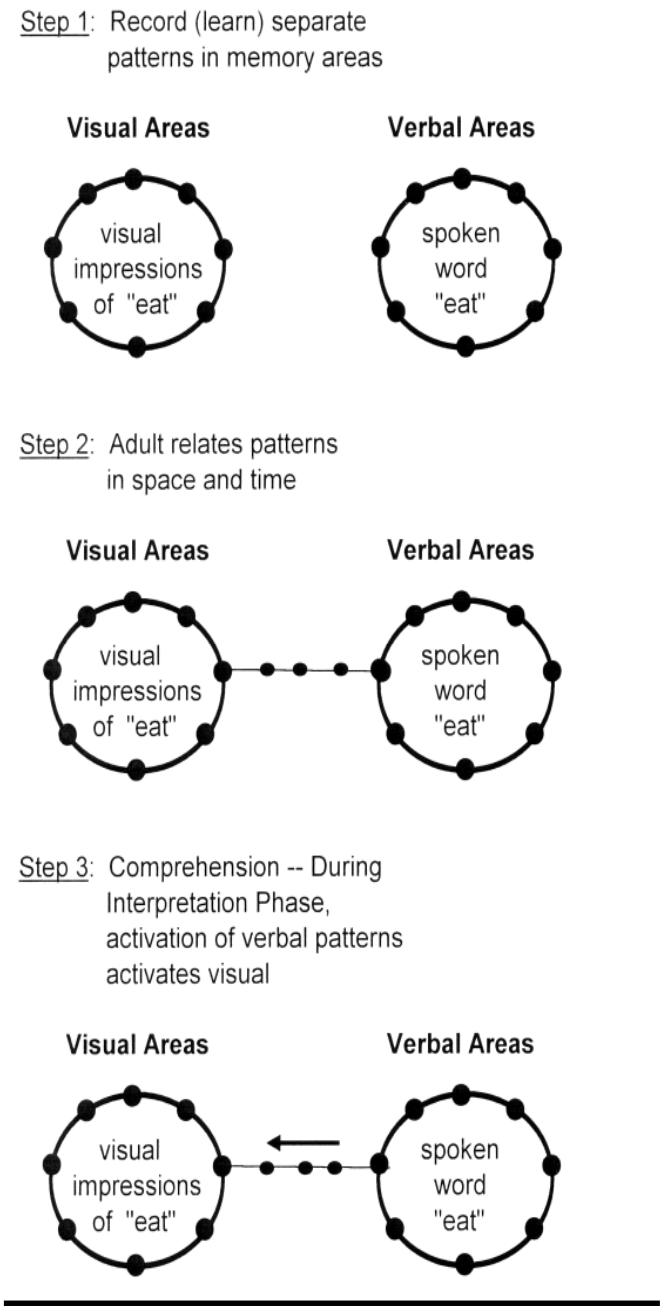
Forming Verbal Interpretation and Speech Abilities

Learning to Comprehend Language

Patterns of sounds arranged into words onlysymbolize some object or activity. Since the ability to hear is inborn, the child hears symbolic patterns and records the verbal sensitivities in auditory areas of memory. However, they are relatively meaningless to him, even though he has already recorded impressions of the object or activity that the word symbolizes.

Take the word "eat," for example. He hasbeenseeing people eat, and these visual sensitivities have been recorded in visual areas of memory. When he has heard the word

Figure C.2: Steps 1 through 3



"eat," verbal sensitivities have been recorded in auditory areas of memory. (See Step l)

But he does not necessarilyassociate the spoken word with the visual impressions. So, you could say the word "eat" all day long and it would have no meaning to him—unless you demonstrate visually what the word represents as you say the word. When you do so, you associate or relate these patterns in space and time for the child. You are actually helping him interconnect recorded patterns of visual and verbal sensitivities by simultaneous association. As the verbal and visual stimuli are repeated together over and over, the interconnection becomes "stronger." You might say that it becomes "imprinted" in memory. (See Step 2)

Thus, when the child hears the word, he begins to "see" what it symbolizes in his "mind's eye." Since the verbal and visual patterns in memory for an object or activity are interconnected, activation of the verbal pattern during interpretation results in activation of the visual pattern. This is how the mental activity that makes language meaningful is learned. (see Step 3)

We should also note that, because of these patterns'interconnections, the child can also "hear" the word in his "mind's ear" when he sees the corresponding object or activity. This will become important as he learns to speak and to read.

Earlier we showed that the sense of touch helped make visual arrangements meaningful. And we also showed how sensory-motor co-ordination made touch sensitivities and visual sensitivities possible. These permitted the child to identify objects and activities and to record sensitivities in visual areas of memory. Now, with the help of adult association of symbolic words, what has been recorded in visual areas enables the child to comprehend spoken language.

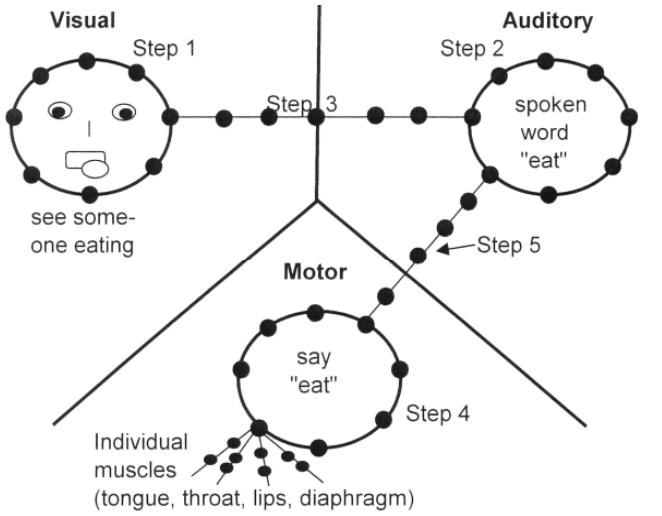
Therefore, the adultmustbehave ashe speaksso that behavior will be associated with the symbolic words. Do you do this with your child?

Forming the Abilities for Speech

The ability to make sounds is inborn. However, early sounds such as crying are involuntary. Making them does not require conscious coordination of muscles in the lips, tongue, throat, or diaphragm. Making sounds voluntarily for the purpose of communicating must be learned. This requires the development of neuronal patterns that represent (constitute) and enable the coordination of mental activities involved in speech. It also requires that there exist a repertoire of verbal patterns that represent objects and activities symbolically. We explored the development of the latter in *Appendix B.*

The development process for voluntarysound-making has a sequential nature. Crying leads to non-crying sounds (month l)—which leads to babble (about months 3 through 6)—which leads to varied babble (about months 7 through 9)—which leads to imitation of adult sounds (about months 10 through 12)—which leads to some words and jargon (about months 18 through 24). It is during this last period

Figure C.3; Steps 1 through 5



that the child learns to talk. He has learned to make sound patterns that correspond to adults' patterns.

Thus, to a great extent learning to speak is a matter of the child's imitating adults. As he hears language at earlier stages, he records sound sensitivities in auditory areas of memory. As he randomly imitates these sounds, he is using his diaphragm, throat, lip, and tongue muscles. When he does, messages are sent back to the brain, and these motor sensations are recorded in memory (motor) areas for speech. Since he tends to imitate a sound pattern immediately after hearing a word, auditory patterns for the spoken word, "eat" become interconnected with speech patterns in motor areas of memory that represent saying "eat." The two separate patterns are interconnected because of their contiguous relationship in space and time.

Now, putting everything together, the child has patterns in visual areas representing sensitivities of someone eating. (Step 1)

He has patterns in auditory areas of memory representing the spoken word, "eat." (Step 2)

These patterns have already been organized and interconnected. (Step 3)

He has developed organized patterns in motor (speech) areas of memory, which represent his ability to form separate sounds into the spoken word, "eat." (Step 4)

Because he imitated word sounds when he heard the word, motor patterns for speaking the word have become interconnected with the auditory patterns in memory. (Step 5)

Because all these patterns are interconnected between memory areas, several activities can occur. First, if he hears the word "eat," he forms the picture of someone eating in his "mind's eye." Upon understanding the meaning, he can voluntarily speak the word. Second, if he sees someone eating, this activates the visual patterns in memory and he can understand what is happening (interpretation). But since visual and auditory patterns are interconnected, he can also "hear" the word in his "mind's ear." Since this pattern is linked to the corresponding speech pattern, he can also say the word "eat" voluntarily. Thus, language has been the bridge between visual perception and the ability to speak.

There are several main reasons a child learns to speak. First is the propensity to imitate. But there must be something to imitate. So actually, early abilities for language perception and speech are almost totally dependent upon adult speech and associable behavior. These are first imitated and eventually learned as recorded sensations and their interconnections are reinforced through repetition. **Adults set the example**. They help form the interconnections between patterns by associating stimuli simultaneously in time and space. Therefore, adult imitation of baby-talk does not set an example. It merely reinforces incorrect responses—and these incorrect responses will be learned and reinforced unless the adult continues to reinforce correct responses and corrects improper responses. However, being able to either reinforce or correct developing patterns means that, unless a child responds to his environment, adults have little basis for monitoring progress and either (a) reinforcing proper responses, or (b) trying to correct improper responses.

Stop for a moment to consider your influence on your child's development of these abilities. Are you contributing to his development as well as you might?

A second reason a child learns to speak is to be able to communicate needs or desires that he cannot fulfill for himself. Crying won't get him a particular object or plaything. Neither will it tell the adult that what he really wants is ice cream instead of pudding. Most parents can interpret a child's crying or other behavior to some extent and perhaps provide what he wants. However, by not anticipating his needs, and by encouraging him to communicate, there is more incentive to learn to speak. How well do you contribute to your child's development in this respect?

A third reason we learn to speak is to be able to otherwise influence or manipulate our environment. We must often persuade others to do something that we want them to do—for us or for themselves. However, not until about age five can the child be logical enough to argue or persuade successfully. So he often resorts to whining or crying. Ask-

ing her "why" he wants something helps her to become more logical and adept at persuasive communication. Do you do this?

Vocabulary and Interpretation

Perceptual abilities sharpen as more objects are seen and more words are heard. The more information represented in patterns in various memory regions, the more meaningful each successive experience will be. Meaningfulness occurs, as mentioned in *Appendix B*, in *interpretive* areas—in conjunction with memory.

In turn, the more meaningful the new experience, the better these sensations will be associated and interconnected with what is already in memory. And the better sensations are recorded, the better they are learned.

From about age two forward the child develops an increasing facility for discerning similarities and differences among objects and activities. However, in order to recognize similarities and differences, it is necessary to be able to describe or define characteristics and/or uses of each object and activity perceived. This requires learning a vocabulary of *words for characteristics* and the *descriptive words that correspond*. *For example*:

Table C.1: Vocabulary for Description

Words for Characteristics	**Corresponding Descriptive Words**
size	large, small, big, fat, little
shape	round, flat, square, pointed, sharp
color	red, blue, green, dull, bright, dark
texture	smooth, rough, hard, soft, slippery
weight	heavy, light
height	tall, short, high, low, small
intensity	bright, dull, loud, soft, quiet, hot
uses	eating, drinking, playing, making something
speed	quick, fast, slow
how you feel	good, bad, sick, happy
how you do something	well, fast, slowly, carefully, quickly
and so on....	

A growing vocabulary of nouns and adjectives aids perception of objects and their characteristics and uses. A growing vocabulary of verbs and adverbs assists interpretation of activities' characteristics. Thus, language gives enhanced meaning to nearly all of what we sense. Since we think largely in terms of language, it is also a tool that enables thought. We will discuss this topic and the implications in the chapter on improving thought processes.

Stop for a moment and consider these questions:

How well are you contributing to your child's development of abilities for perception and interpretation, memory, and thought? Are you helping to enrich his vocabulary and language skills? What have you learned above that might assist you to better develop your child's mind?

How about you yourself? How good is your vocabulary? How well can you describe, interpret, and think about your environment? Not as well as someone with a larger vocabulary than yours. A larger vocabulary is basically a broader "frame of reference" for understanding and thinking about relationships among things in the environment. This is one reason that we have not grossly oversimplified the vocabulary and frames of reference in this book. If we had, it would not be a favor to the reader.

Additional Perspectives

What percentage of your knowledge about your environment do you think you learn visually? A commonly quoted figure is as much as 90%. We are much more visually oriented in adapting to our environment. Why do you think that this could be true?

As you look down a street, you perceive hundreds of objects in each fraction of a second. You may have to focus on the entire scene and then focus on separate parts of the scene, but you are still seeing more things in your field of vision than you can pay attention to at one time. You actually perceive at unconscious levels what you have not focused upon consciously. And you record what you have perceived both consciously and unconsciously. So, visually at least, you learn more unconsciously than you are perhaps aware. This is why something may seem familiar to you even though you can't quite recall having seen it.

Although it is somewhat out of context, let us use this point to explain something of interest to ESP fans. You unconsciously perceive and record a person's slightest body movements ("body language"), voice inflections, and other mannerisms that often go unnoticed at conscious levels. These phenomena can occur as the person is talking about what is on his mind. If you are around this person very

much, you can unconsciously record and interrelate particular mannerisms with what the subject talks (thinks) about. Therefore, having sensed these unconsciously learned visual "cues," after a while it can become possible to sense what that person is thinking. So in this particular instance, the phenomenon of telepathy or "mind reading" is not so much a matter of having a "sixth sense" as it is a matter of unconscious perception and interpretation.

Another reason we learn more visually is because learning things through language takes much longer. Since speech speed for most people is about two hundred words per minute, it would literally take hours for someone to describe verbally the street scene that you perceived visually and recorded in a split second. This would be true even if it were not for unconscious learning. "A picture is worth a thousand words."

Visual modes of learning may predominate, but **verbally oriented learning is necessary for learning and thinking about concepts and ideas that *cannot be seen***. Without language we could only interpret and think about concrete (physical) things. We could have little if any concept of politics, philosophy, sociology, theology, and many other abstract or subjective constructs. In addition, language gains importance from the fact that it provides a means for identifying and interpreting characteristics of what we see. And of course, if it were not for language, we could not communicate complex ideas and information among ourselves. So even though we learn more visually, language is just as important to us.

Forming Abilities for Reading

Reading is a learned ability to perceive and interpret or "decode" graphic symbols. The symbols, or letters arranged into words, are not comprehended unless there is already information in memory that can interpret them and give them meaning. From what you have learned already, what recorded sensations in what areas of memory do you think are involved? Visual? Auditory? Motor? If you said, "all three," you are correct. How do you think these patterns are interconnected? In what sequence do you think they are associated? Let's follow the sequence as we did earlier for visual and verbal learning. It is quite similar and is a progression from earlier discussions.

Comprehension of Graphic Symbols

By about age five, the child has developed basic patterns and sets which will enable her to learn to read. She has developed sensory-motor abilities (sets) for focusing sense organs on visual and verbal stimuli. She will use these sets to focus on printed words. She has been recording visual sensitivities in visual areas of memory. These will be used to give words meaning. And from hearing adult conversation, she has been recording sound patterns in auditory areas of memory—patterns that represent objects, activities, and ideas. These, too, will be used to give words meaning. Adults have helped her associate or interconnect the separate visual and verbal patterns. So by now, when the child hears the word "eat," she forms a visual impression of a person eating. Or, if she sees a person eating, she will get an impression of the word "eat" in her mind's ear.

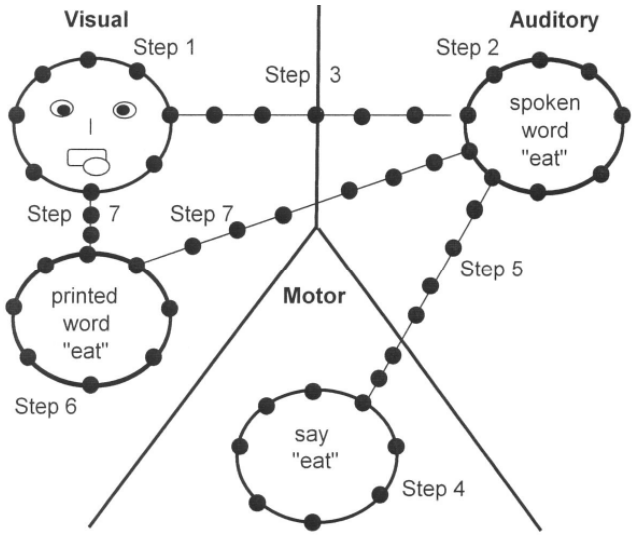
Next she is taught the alphabet and the sounds of vowels and consonants. More information is being recorded in visual and verbal areas of memory. Then letters are combined into words, and the arrangement of letters is imprinted in visual memory areas. E - a - t soon becomes eat. But "eat" has no meaning unless it can be associated with something already in memory. Parents and teachers help form these interconnections or associations between patterns by either saying the word "eat," or showing a picture of someone eating at the same time attention is being directed to the graphic symbol. Interconnections form because of the **contiguity of these sensations in space and time**.

You will recall from ***Figure C.3*** (page C-8) that Steps 1 through 5 have already occurred. The child now associates visual impressions of someone eating with the word "eat," and vice versa. In addition, she can say the word "eat" when she senses visual or verbal impressions. She can also say the word if she thinks (ideates) about eating when she is hungry—in order to communicate a need.

Next she is shown the printed word and the sensations are recorded in visual areas of memory. (Step 6) Adults help her imprint the associations or interconnections between the printed word "eat" and the visual and verbal impressions (or patterns) previously formed. (Step 7) Therefore, when she reads the printed word, these visual sensations can be interpreted in both visual and verbal modes. She comprehends in her "mind's eye and ear."

The above is particularly true of objects and activities that printed words represent. But what of ideas, concepts, and subjective or symbolic words such as "good," "bad," "philosophy," "politics," "free," and so forth? These words are mostly interpreted in conjunction with auditory areas of memory, since they are more verbally oriented constructs. However, because we can see political processes and people, "good" and "bad" people, and other visual impressions

Figure C.4: Steps 1 through 7



associated with subjective or conceptual terms, even verbally oriented impressions can also have associated visual meaning.

Although we have not shown it in ***Figure C.4***, "eat" and other words like it are also associated in memory areas with patterns representing motor abilities for eating (i.e., chewing and swallowing). Thus we can comprehend what we read in the same three modes in which we think—visual images, language, and motor activity.

Motor Activity in Reading

The ability to read doesn't just involve comprehension or ideation based upon interpretive processes in the brain. Comprehension is only half of the ability. The other half is learning the motor activity for movement of the eyes from one word or group of words to the next. Attention, however, cannot be shifted to the next word until the previous word (or group of words) has been interpreted. Therefore, eye movement and interpretive processes must be coordinated. This means that a "higher set" of patterns must be learned—a set that coordinates and monitors both "lower sets." Thus, the speed and efficiency with which a child (and we) can read, is dependent upon the speed and efficiency of this higher set.

If the printed word "eat" is seen, what patterns in what areas of memory can be simultaneously "activated" because of interconnections? Visual? Verbal? Yes, both. Any other(s)? Again, yes. Remember that verbal patterns for words are also connected to patterns in motor areas of memory for saying the words. This is why we have a tendency to "hear" words as we read them and also to "speak" them to ourselves.—that is, to "*subvocalize*." Subvocalization involves moving our lips, tongue, and other vocal apparatus. almost imperceptibly. Therefore, if you tend to "hear" or "speak" to yourself as you read, you slow your reading speed to speech speed. Speech speed is a slow 200 words per minute, which is poor for the average person. 260 words per minute is considered good, and 400 words per minute is considered excellent. However, you can learn to read at least 900 words per minute. Some people can even read several thousand words per minute—with proper training. To do so, they must unlearn bad habits (sets) such as subvocalization and word by word reading, and replace these sets with more efficient coordination of motor and perceptual abilities. Speedreading courses are designed to accomplish that.

Reading is one of our most important abilities (or "set" of abilities). It lets us learn about objects, places, people, events, and activities that we cannot experience ourselves. It is also a vehicle just as language is for learning about subjective or contextual constructs that cannot be seen or touched. So, the more we read, the more we learn. And the more we learn, the more meaningful new information of any sort will be. Moreover, the more meaningful information is, the better it will be learned and later recalled.

How about your reading abilities? Do you still perceive graphic symbols word by word. This is how a child reads—until she learns vocabulary and sentence structure better. This is how she reads—unless she is taught more advanced mental sets involved in reading. Even most college students only read about 1.1 words per eye fixation. With training, they could perceive three, four, five, and more at one time! And do you "hear" what you are reading? Do you speak the words to yourself? How many words per minute can you read ....and do so without losing your comprehension?

If you are a parent or teacher, ask these same questions about your children. Are you contributing as well as you might to the development of more effective, efficient reading habits (sets of neural patterns)?

Additional Behavioral Sets (of Interconnected Neural Patterns Constituting Abilities)

Other types of advances are made during childhood. Through dialogue with the adult word, the child's attention is increasingly directed to symbolic constructs such as ide-

as, concepts, and contextual relationships among things, activities, and people. Love, religion, politics, and philosophy of life are among these. As already mentioned, language plays a primary role in communicating contextual or subjective constructs. So does adult behavior, with which words must often be associated to be comprehended.

In the same vein, attention is also turned to subjective values and attitudes. Here again the child learns from the adult to a great extent. The child does not know what is "right" or "wrong," "good" or "bad," "forgivable" or "unforgivable," or "acceptable" or "unacceptable" behavior—unless adults set the example. As adults behave and talk about their behavior, the child learns to associate, for example, "good" or acceptable behavior with what the adult world feels is "good" or "acceptable." However, learning of this nature also requires that he behave overtly. Unless he makes physical responses that can be seen by adults in a particular situation, adults cannot respond in ways that will imprint the proper behavioral patterns. They cannot reward proper responses or contradict improper behavior and try to effect a corrective change. This interaction between child and adults is known as "*socialization*." The child is learning social norms and customs. He is learning how to approach and get along with other people.

Adult subjectivism also contributes to the child's self-awareness. She has been confusing herself with the world around her. But, as she begins to recognize thoughts and impressions as her own, and recognizes that she relates to people and things, an identity or self image develops. Perception of ourselves and how we adapt to things and people in the environment are influenced by many internal and external factors.

A child increasingly attempts to manipulate, adapt to, cope with, or otherwise influence the environment in order to fulfill needs, desires, or interests. As he behaves, the environment tells him whether he has been successful, only partially successful, or unsuccessful. For example, if he is good at a sport, spelling, or arithmetic, he is rewarded by praise and personal satisfaction. If he has learned how to relate with other people and has developed other pleasing characteristics, other persons will react favorably toward him. Success is more satisfying than failure, since failure often brings punishment, social disapproval, frustration and anxiety. Thus, overt behavior generally elicits some kind of "feedback response" from the environment or from within ourselves. This feedback then triggers emotional reactions which either do or do not reinforce the use of a particular behavior pattern. If it is reinforced, there will be a natural tendency to use it again in a similar situation. We as adults are no different than the child in this respect.

But our perception of internal and external feedback is not altogether objective. Emotional reactions such as satisfaction, pride, and other forms of pleasure do reinforce the self image and the use of particular (developing) behavior patterns. But when we experience failure, fear, disappointment, anxiety and frustration, these tend to challenge our self image. We learn to maximize pleasure and minimize pain by either (a) adjusting and improving abilities and other behavior patterns, and/or (b) protecting our conscious awareness from painful perceptions of ourselves that conflict with our self image. In the latter case, we capitalize on our strong characteristics and excuse or rationalize our weaknesses. We also form "mental blocks" at unconscious levels to protect self-awareness from "failure feedback." Some call these behaviors "defense mechanisms." Others refer to the process of their formation as "armoring." We use them both unconsciously and consciously.

Values, personality traits, interests, and other behavior patterns—and how they all develop—are the subjects of Chapter 2..

Now, apply this discussion to looking into yourself. How honest and detailed is your perception of yourself? Can you think back to your own development of these behavior patterns? Have you been recognizing the parental and other environmental influences upon your mental development?

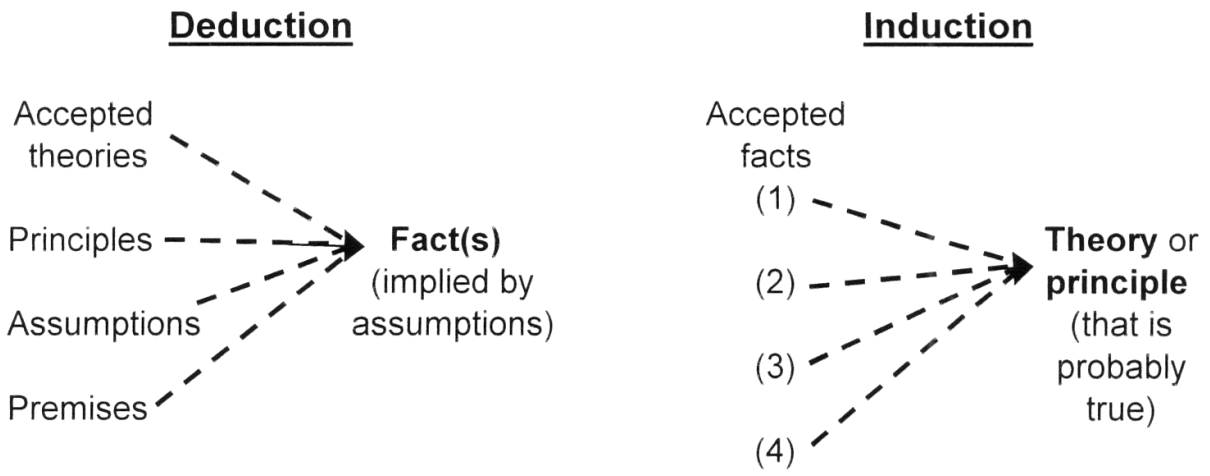
How about your children? Can you give yourself a good mark for contribution to their development? Have you done all you could? Will you now do better?

Thinking

Thought is undoubtedly our most complicated mental activity. One can think about a present situation (*ideation*), or one can think about something totally unrelated to a present situation (*imagination*). Thinking is chiefly concerned with solving problems and making decisions regarding obstacles to goal or desire fulfillment. It occurs when learned responses do not correspond to, or are inadequate for, some new situation. Thus, thinking is usually goal oriented.

The word "thinking" also includes other varieties of behavior. "Creative imagination" (or insight) is the process by which existing information patterns in memory are associated into new ideas, concepts, or inventions. Thus, creative imagination can be a matter of goal-oriented problem solving. On the other hand, "autistic thinking" (or day-dreaming) only creates an imaginary world more satisfying than reality. Thus, it is not particularly goal-oriented.

Figure C.5: Illustrations of Deductive and Inductive Logic



As previously mentioned, we think in terms (modes) of visual images, language, and motor actions. We often think by carrying on imaginary conversations with ourselves, through which weave images in the "mind's eye," language in the "mind's ear," and also motor impressions. This activity could not occur if it were not for the earlier development of the abilities discussed to this point. To use previously learned information and abilities, we must use our abilities to reason logically and to juggle information back and forth between memory and reasoning areas.

Logical Reasoning

We use our ability for logical thought to arrive at plans and at solutions to problems, and to test the correctness or adequacy of the plans or solution before they are actually used. This matter of "proof" is largely due to social convention. It is very often the case that others must be persuaded that the plan(s) or solution(s) is/are appropriate before any action is taken.

Before exploring the development of this ability, let us first describe the two basic types of logic:

l. *Deductive Logic*: This is a matter of drawing a conclusion that something (a fact) must be. The conclusion is based upon accepted general principles, statements, or assumptions. Conclusions are certain because they are implied by the assumptions.

For example:

All monks are poor. (Premise)
Some Englishmen are monks. (Premise)
Therefore, some Englishmen are poor. (Conclusion)

Notice that the conclusion is based upon putting these people into groups because of *characteristics that are shared*.

2. *Inductive Logic*: This is a matter of drawing a conclusion that something is or may be operating—such as a principle or theory. In this case, study and comparison of accepted facts leads to derivation of a theory. One seeks to provide a true statement concerning all objects of a class by examination of a sample of a few objects in that class.

For example:

There has been a test every Tuesday so far this semester — (fact).
There has been no apparent reason to change this policy since last Tuesday — (fact).
Therefore, there will (probably) be a test this coming Tuesday (conclusion).

Again, notice that things have been classified, with the exception that all Tuesdays in the semester have not yet occurred. Induction deals with uncertainties and the future. However, just as in deduction, there

Table C.2: Characteristics of Things

Characteristic	Ball	Globe	Block	Box
shape	round	round	cube	long
edges	none	none	edges	edges
corners	none	none	corners	corners
color	red	multi	red	blue
size	big	big	small	small
material	rubber	paper	wood	paper
weight	light	light	light	light
use(s)	play bounce	learn	play build	play hold things

has been a degree of *generalization* from single objects to a group of objects with *shared characteristics*.

Developmental Phases

Inhelder and Piaget (1958) segmented the development of reasoning abilities into three general phases:

l. Prelogical Phase: Up to about age seven, the child makes somewhat contradictory statements concerning relationships or similarities between objects or activities. *For example*: "Chairs have legs and animals have legs, so chairs are animals." You can tell that certain patterns in memory have become interconnected because of some similar or associable characteristics. However, the conclusion is erroneous because the child has not identified the differences as well as the similarity. It is almost as though he stopped thinking about comparing of the objects once he recognized the similarity. This is partly because he is still learning the words for the objects and activities around him. His orientation is more or less toward nouns and verbs. However, he will learn to qualify his associations as he learns more specific nouns and verbs, and learns more adjectives and adverbs for more specifically defining and describing the objects (nouns) and activities (verbs).

   By the time he is about seven years old, he will have learned to perceive not only a whole object, but also the parts of an object, the uses, the shape, and other characteristics. A ball is no longer just a ball. It has color, it is round, and it has size and a use. It is a basketball, football, or baseball. A box is no longer just a box. It is a specific box having a certain color, shape, size, and use. Therefore, before he can compare and associate objects and activities, he must first learn the tools for defining and describing what he sees, hears, or otherwise senses. He must acquire an increasing vocabulary.

2. Appearance of Logical Reasoning as **Class Logic**: Because he has the tools for description or definition of his world, he can begin to compare objects and activities with greater facility. From about ages seven to eleven, he develops the ability to generalize about things' similarities and differences. He can compare the many characteristics of various objects and activities, and arrange things into classes based upon shared characteristics. Round things include balls, globes, and balloons. Things made of paper include boxes and napkins. He knows, too, that, even though globes are round like balls and are not very heavy, they are not the same thing. They share some characteristics, but there are many differences in terms of use, material, and so forth. He no longer sees just a similarity. He also perceives similarities *and* differences.

   Thus, he can generalize that because certain objects are similar in some respects, they can be included in a group or class (class inclusion). He can arrange things by size—from smallest to largest, or from lightest to heaviest. Arranging numbers in order also is an example of "*serial ordering*." He can perceive that a duck is to water what a bird is to air (*correspondence*). He has been learning that there are relationships between things, activities, and ideas.

   Have you ever had to take a test in which you arranged numbers in some logical order? Or had to determine which of several objects did not fit into a group? Or had to determine what objects corresponded to other objects? If you have ever taken an intelligence test, that is exactly what you have been asked to do.

   Intelligence tests measure the ability for **class logic**. However, they are measuring a good deal more than that, because the ability for class logic depends upon the level of development of other abilities. These include: (a) one's inborn ability to record new sensations to associable sensations already recorded in memory; (b) one's vocabulary of descriptive words for various characteristics; (c) the ability to visually perceive an object in its entirety and its parts. In short, it measures mental development within one's inborn upper and lower limits. But even though one may be born with naturally high intelligence, she can score a lower I.Q. (*intelli-*

gence quotient) than possible if her abilities have not been developed as much as they have been in other persons of her age. This means that by a certain age you should have the general levels of abilities that others of your age have. If you score higher than the norm, you are undoubtedly more mentally developed, and perhaps more naturally intelligent.

Now consider the implications for how well you can think. The more intelligent and mentally developed person will be able to solve problems and make decisions better than the less intelligent person (all other factors being equal). The better the reasoning abilities, the better one perceives relationships between various characteristics. It is difficult to think about the environment if it is not perceived and described as meaningfully as possible.

What are the implications for abilities to reason for a person with a college education as opposed to a person without this advantage? College is an environment for learning concepts and ideas involved in psychology, philosophy, sociology, economics, literature, political science, and so forth. You can answer the first question if you can answer this one: Can a person think as well about conceptual or contextual constructs if he has little familiarity with the vocabulary and the frames of reference associated with these areas? The answer must be "no," because one cannot think in specific rather than vague terms about what he cannot define or describe specifically. A college education provides a person with the tools for perceiving, comprehending, and thinking about aspects of his environment that cannot necessarily be seen or touched.

3. Logical reasoning development continues: A predisposition toward argument occurs during the eleventh through sixteenth years. ("Argument" here means the weighing of both sides of a question, rather than the dogged expression of one viewpoint.) This leads to abilities for formulating and testing alternative solutions using **propositional logic**. Examples of *propositional logic* include: "If A is true, and B is true, then C is or is not true." Or, "If I have solved a certain problem successfully before using this solution, and if this problem is similar to the past problem, then this solution should solve the present problem successfully." Or, "If the problem is that I do not have the necessary ability, and if I can improve that ability, then I ought to be able to solve my problem."

   Do the last two examples sound like one of the two basic types of logic? Which one? Which one deals with uncertainties and the future? In which is a conclusion formed using accepted facts? *Inductive logic*. Actually, you are using past experience and known facts to conclude something about the future—what might happen if you do something that you have done before, for example. Or, you may anticipate the consequences of a solution that you have not used before. But even though you do the latter, you are still using past experience and knowledge to assess whether or not your response will be successful before you use it.

   Being able to assess the outcomes or consequences of your actions is especially necessary for selecting appropriate behavior when a situation arises for which there is no learned solution or response. Put another way, we must be able to think when learned responses are not appropriate or adequate for solving a new problem. We must be able to anticipate, "What will happen if I ...."

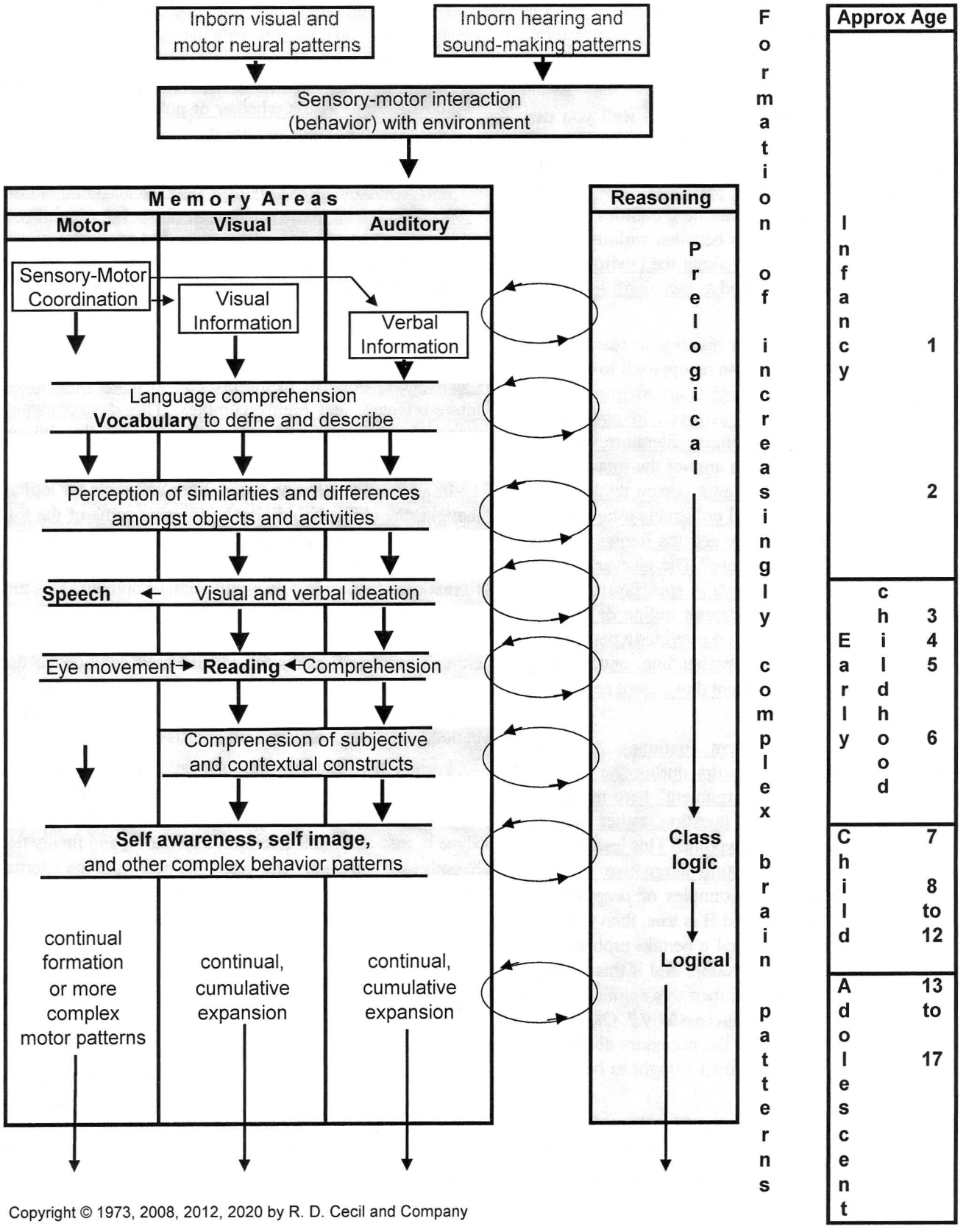
Thinking, then, evolves from being factual, concrete, specific, and oriented in the present, to being contextual, future-oriented, and highly complex. This developmental process is necessary if we are to cope successfully with our complex environment.

In addition to learning the abilities and tools for logical thought, the child should also be learning some of the formal rules or methodologies of logic. For example, she should be learning to ask such questions as these: Is this information a fact, or is it an assumption or opinion? Has this observation always been true, or is it only true occasionally and under certain circumstances? Is this problem similar enough to past problems for which I have solutions to use those past solutions now? How many similarities exist between these two objects? How many differences? Can I include object A in a class with objects B and C?

Formal principles, methodologies, rules, and practices for problem solving must also be learned. Many if not most of us have learned that we should define a problem and analyze it, then formulate alternative solutions, and finally test hypothesized solutions and select the best from the alternatives (make a decision). Unfortunately, many of us have not been taught additional rules and principles that will be discussed in Chapter 4.

How about your child? Are you contributing as much as you can to her development of abilities for class logic and propositional logic? Are you teaching her to ask some of the questions we mentioned above when she is confronted by a problem? Is she learning to "think ahead" to the possible consequences of what she is about to do? Does she know the basic steps to use in solving a problem or making a decision? What, if anything, will you now do to influence better development of her thought capabilities?

Figure **C.6:** ***Conceptual Model of the Mental Development Process***



And what about you yourself? As you think back to your own development, can you identify areas that might have been better developed? Has under-development of one or more areas affected your development during later stages? Do you recognize that your thinking abilities may not be developed to their full potential? Do you understand that this is not necessarily your "fault," and that factors beyond your control were the causes? Are you already recognizing ways for improving your abilities?

"Keeping the Balls in the Air"

Underlying the use of thinking (reasoning) abilities and the use of formal frameworks for reasoning and problem-solving are additional mental abilities (sets of neural patterns). These are the abilities for juggling information back and forth between memory and reasoning areas. As we explained in *Appendix B*, this means retrieving information from memory, operating on it (reasoning), storing the results temporarily in memory, retrieving more information, reasoning about it, storing those results temporarily, retrieving results already stored and then reasoning about them to get a final answer. Of course, this process can go on and on for some time and be much more complicated than described here. The point is, however, that complicated operations cannot occur at one time. They must occur in some sequence, and this sequence of activity must be coordinated and controlled just as other mental activities we have discussed must be coordinated.

How much information a person can keep track of at one time during this process is a very difficult question to answer. The number of "balls that someone can keep in the air" depends upon many factors. Some of these are: (a) the complexity of interrelationships among the factors to be considered; (b) the number of factors to be considered; (c) a person's intelligence; (d) the complexity of problems that a person is accustomed to handling; (e) the amount of a person's knowledge available to juggle; (f) the amount of problem solving a person must do; and other factors that will be discussed in Chapter 4.

There are few if any people who know how well they reason and juggle information back and forth between memory and reasoning areas. Our bases for evaluation of these abilities are tests and problem-solving and decision-making performance. However, just because a person is intelligent and seems to be successful at solving problems does not necessarily mean that his thinking processes are anywhere near as good as they can be (as will be discussed further in Chapter 4). Our experience has been that most people believe that they think as well, if not better, than the next person. This just simply is not true. Perhaps the best way to be convinced of this would be to get into another person's mind for a day to see how much better or worse his thought processes actually are. Because this is an impossibility, we have tried here to pinpoint factors involved in thought and show that no one is able to think as well as it is possible for him to think. Many factors must and can be improved if we are to realize our full potential.

Recap and Additional Perspectives

Mental development is a sequential, cumulative learning process. Several basic activities occur within the mind. First, in memory areas, patterns are formed that represent abilities to focus sensory organs on stimuli, interpret what is sensed, and record the sensitivities in memory. Second, patterns are formed that represent what has been sensed and interpreted. These patterns constitute our repertoire of knowledge and information. Third, patterns are learned that enable the use of previously recorded information in motor, visual, and auditory areas of memory. These are the neural patterns involved in perception, thought, speech, reading, and other types of behavior. Some of these behavior patterns can be seen, some cannot. Because many patterns and sets of patterns are formed during the process of mental development, the process has often been referred to as "*patterning*."

The development process begins at birth and continues throughout life. Our knowledge and abilities are undergoing constant change—sometimes for the better, sometimes for the worse. Early stages of development are particularly important because the effectiveness and efficiency of each developing ability is highly dependent upon the effectiveness and efficiency of previously learned abilities. The more complex abilities are usually composed of relatively less complex abilities. So, in a sense, mental development itself is a matter of part-to-whole learning.

Let us review this process briefly and put all the stages into an overall perspective. We recommend that, while reading, you refer to ***Figure C.6***. It is a conceptual model that visually illustrates the sequence and interrelationships of the various aspects of mental development.

Certain sensory and motor abilities are inborn. These enable an infant to interact with his new environment. Random activity leads to the development of sensory-motor coordination, the representative patterns of which are formed in motor areas of memory. Coordinated abilities (neural patterns) for eye-hand movement and visual perception enable the recording of impressions of objects and activities

in visual areas of memory. The infant's repertoire of visual (and motor) information increases at an increasing rate.

As adults speak and behave, the child begins to develop a repertoire of verbal impressions which he starts to associate with visual impressions. Thus, she begins to comprehend language. A growing vocabulary not only gives greater meaning to visual and verbal perceptions, but it also increases her ability to define and describe in greater detail what she sees, hears, or otherwise senses. As she describes in more detail the characteristics of objects and activities in her environment, she is better able to distinguish similarities and differences among these things. Thus, she can begin to make some simple associations between similar objects or activities. She has entered the "*prelogical phase*" in terms of development of her reasoning abilities.

While she has been learning words and associating them with objects and activities, she has also been imitating adult speech. Neural patterns have been forming in motor areas of memory—patterns that represent activation of speech apparatus. These patterns, in turn, have been interconnected with patterns representing visual and auditory impressions of spoken words. Learning the coordinating and controlling mental patterns (or sets of patterns) for using all these lower-level abilities together results in the development of speech abilities. This opens the door for learning of all types. She can ask questions about new experiences and she can communicate her wants and needs.

Next, with a repertoire of motor responses, and visual and verbal information, she can learn to read. Visual impressions of graphic symbols become interconnected to the previously recorded patterns that represent what she has already heard and seen. She learns to move her eyes in a coordinated manner with simultaneous interpretive activity (ideational processes). Now she has yet another important tool for learning.

While learning more intellectually-oriented abilities, a child has also been developing more complex motor abilities. He began with eye-hand co-ordination, and has progressed through the crawling stage to walking. Other more complex voluntary movements will develop with practice and encouragement. Many of these more complex motor sets will not have to be under visual control, since he is learning to control and correct movement with the aid of *kinesthetic feedback* from nerves in his muscles.

During early childhood he begins to understand simpler conceptual and subjective types of information. Adults play a major role here, too. It is up to the adult to help the child associate what he sees and hears with words like "good," "bad," "happy," "love," "friendship," and so on. His comprehension of symbolic terms has been increasing ever since he began to comprehend language. As he continues to mature, and increasingly interacts with the adult world, he will comprehend more complex conceptual and subjective constructs.

With a repertoire of ideas, concepts, and both verbal and visual impressions, he is better able to distinguish himself from his environment. He becomes more aware of himself and begins to form a **self-image and identity**. This has occurred to some extent during earlier years, but he will further develop his self-image and identity very quickly during childhood and adolescence. These are important periods during which his values, personality traits, and interests will be greatly influenced by other people's reactions to his behavior.

Because knowledge and experience have increased rapidly, the child is better able to perceive and comprehend more complex relationships among objects, activities, and ideas or other conceptual constructs. This has all been leading to the ability for *class logic*. Next, the ability for *propositional logic* develops. Through increased experience in the environment, he has come to recognize that something happens as a result of his behavior. As a result, he begins to consciously anticipate what could happen before he carries out intended responses. The more information and experience he accumulates, and the more he considers it, the better he will solve his problems and make his own decisions.

As can be readily seen, all of these aspects of mental development are interrelated and interdependent. Motor abilities recorded in memory contribute to visual learning, speech, reading, thought (in terms of motor activity), and the learning of more complex motor abilities. What has been learned visually contributes to the development of abilities for more meaningful interpretation of new visual sensations and the abilities for speech, reading, and reasoning. Language has contributed to abilities for speech, reading comprehension, the comprehension of conceptual and subjective constructs, and reasoning. Reasoning abilities, in turn, contribute to further learning of visual, verbal, motor, and conceptual information and experience. Therefore, if any one ability is less than fully developed, others are certain to be less than fully developed, also.

In most people, some abilities are developed more than others. For example, a person can be more visually oriented in adapting to his environment. This can occur if her early environment was rich in visual stimuli, but relatively poor in verbal or tactile stimuli. Perhaps parents gave the child many things to play with, but did not talk to her often, encourage her to communicate, or behave around her as they talked. On the other hand, a person can be more motor-oriented in adapting to, or manipulating her environment. This

can be due to under-developed abilities for speech, vocabulary, and communicative or persuasive skills. Here, parents may have encouraged the child to be completely self-sufficient, rather than helping him develop the speech, communicative, and persuasive skills for getting things accomplished through other people. This could have adverse implications for those who aspire to leadership roles.

Then, too a person can also be more verbally oriented. This can be due to under-stimulation during childhood with visual and tactile stimuli. This type of person can speak persuasively and think about conceptual constructs with great facility, but may not be able to accomplish physically or motor-oriented activities particularly well. Where might you fit into this frame of reference? Where do your children fit? Why?

Pointers for Parents

If you are a parent, we hope that this discussion has made you more aware than ever just how much, and in what ways, you affect your child's development—even before he starts formal schooling. You set the example for your child. You make available various types of stimuli that will help him develop basic abilities for learning and thinking. You influence his adaptive orientation to his environment. You draw the relationships between objects, activities, and the words that symbolize them. You provide the stimuli that either encourage or discourage his behavior—behavior that can be monitored and either reinforced or contradicted and corrected. You are responsible for giving him the basic repertoire of information and the basic abilities on which more complex behavior patterns will be built.

Some parents are concerned that if they try to teach their child too much, and try to help her develop her potential abilities too fast, that she will not have a pleasant, carefree childhood. "She'll grow up soon enough," is a common parental attitude. We agree that childhood should be a happy time—if possible. And we agree that childhood is often wasted on children. On the other hand, what is childhood all about? Is it simply meant to be "fun and games?" Or is it a very important time of life during which the child must learn the information and tools for coping with an increasingly complicated world? We are inclined to argue on behalf of the latter case. The abilities learned during childhood and adolescence will become habits that can stay with a person the rest of his or her life. If these abilities are not developed as well as possible during the "formative years," the individual can be at a disadvantage as long as he or she lives. Parents and teachers, we believe, should do their utmost to develop abilities as fully as possible while the child's mind is open and ready to learn, and when it is not encumbered with bad habits and entrenched, inappropriate behavior patterns. This does not mean that adult activity must create drudgery for the child. Better mental development can be made fun by incorporating instructive principles into simple games, and by rewarding progress and successful responses with praise.

Research has shown that a child who has not learned to count, say the alphabet, and so forth before entering school, can catch up fairly quickly with children who have already learned these things. Does this mean that the advanced child has no real advantage? Not at all. The child who has learned more, and has developed abilities somewhat beyond those of his peers', has a larger repertoire of experience that will make any new experience more meaningful. If new information is more meaningful, it will be better learned. The better that basic abilities have been learned, the better and more easily that more complex abilities can be learned. A conscientious parent who tries to help develop his child's mind as best he can is giving that child a priceless legacy. Better mental development is a key to better performance and success in the adult world he will soon join all too soon.

The following is a review of some pointers for parents

l. Now that you have read this chapter, reread it and fix points of importance or interest in your mind. The better you understand what you are doing, the better you will do it.

2. Give the infant visual stimuli that will get his attention. Dangling, moving objects, or objects that make sounds do this best. Place objects within reach so that he can learn to reach for, grasp, and manipulate them. Use objects with varying size, shape, color, texture, and so forth. Start with simple objects, and as he develops eye-hand coordination and better perceptual abilities, graduate to more detailed objects.

3. Provide auditory stimuli that will encourage her learning to focus attention on sounds, thereby accumulating impressions in auditory areas of memory.

4. As he develops abilities for voluntarily moving his arms, fingers, hands, and legs, teach him simple muscular activities and graduate to more difficult sets of abilities. Demonstrate the activity giving him something to imitate. Reward his progress.

5. Help her associate visual and touch sensitivities by encouraging simultaneous focus of both senses on an object.

6. Help him focus his attention to the whole object, and then to its parts—to establish "whole to part" perceptual sets.
7. When you give him a ball and his attention has focused upon it, say "ball." When you are eating and he is watching you, say the word "eat." Try to help him form interconnections in memory areas between words and the objects or activities they symbolize.
8. Form the sounds in your words distinctly so that the sounds are not confusing. The child will attempt to imitate what she hears. Talk to her and encourage her babble and jargon. When she is trying to say a word, repeat it to her distinctly. Reward correct responses with a display of approval and/or affection. When she must be corrected, do not punish or withdraw affection. Rather than punish in some form, repeat the word and re-establish the example. Repeating baby talk back to her does not set a proper example—especially when she is ready to form words into phrases.
9. Start to use descriptive words as much as his visual and verbal comprehension will allow. Help him build his vocabulary of nouns, verbs, adjectives, and adverbs. Play games in which he must describe what he sees or hears or touches in terms of specific words for characteristics and specific corresponding descriptive words. For example: What is this? What is it for? Is it big? Is it round? What color is it? And so on....
10. Encourage her to communicate what she wants—to use language as much as she can to express herself. Don't anticipate her every need. Ask her to be specific in her description of wants or needs. Be interested in what she says. What she says is an indication of progress in various areas of development. It is also behavior that can be monitored, and can indicate that reward, reinforcement, or contradiction and correction is warranted.
11. If you have the time to teach the child how to read, start with the basics. The alphabet is first. Say the letter and show the letter. When the alphabet can be repeated and recognized, demonstrate the various sounds that letters or groups of letters can have. Then begin putting sounds (letters) together into words. Say the sounds and show the letters represented by the sounds. Pull the sounds together into the word and show the word at the same time. Ask her to repeat the word as she looks at it. Move on to more difficult words only when simpler words have been mastered.
12. When he becomes familiar with printed words, can recognize them without hesitation, and can interpret them readily, encourage him to fix attention on more than one word at a time. The point here is to help him graduate beyond word by word reading—but only when he is ready.
13. Introduce subjective or conceptual words and what they mean as the child is able to begin interpreting them. Take the time to explain them in visual terms as well as verbal terms—if visual explanation is possible. This will depend upon the word itself.
14. Call attention to the child's behavior patterns—especially his strengths. Try to be sensitive to whether or not he is developing too little or too much toward a particular adaptive orientation (visual, verbal, or motor). Try to reinforce and encourage a balance at the highest level of development of each. But be sensitive to the fact that you may be trying to push him beyond his inborn upper limits. This may only frustrate the child.
15. Help her learn special abilities and information. Encourage and reward progress. As she is better able to do something, her successful accomplishment will bring personal satisfaction resulting from recognition of her own progress. This will reinforce interest and continued practice.
16. Since her vocabulary for describing and defining what she sees, hears, and thinks is growing, emphasize its use. Ask her to compare various objects and activities. For example: What does not fit into this group? (Birds, chickens, ducks, cows) Then ask why. Ask what the similarities are—and the differences. Help her get into the habit of looking for both. Help her develop the ability for class logic.
17. Explain the differences between facts, opinions, assumptions, and theories. Help him to get into the habit of evaluating what he hears and reads in these terms.
18. Encourage the child to ask "why." And answer as best you can in terms he will comprehend. Don't put him off.
19. Encourage him to look for relationships among things and activities. How does one thing affect another? Let him try to answer his own questions about "why."
20. Many young people do not seem to consider the consequences of their intended actions before they act. Try to get the child in the habit of using propositional logic by reminding her to ask herself, "What will happen if I ...?" If she cannot answer this question through her own experience, give her the benefit of your own. However, let her develop a repertoire of experience to draw upon. Let her discover the possible appropriate responses to many situations. Here you can help by not being overprotective, depending upon the importance of the problem facing her. A person who has had few problems as

a child, and has not confronted themsuccessfullywith minimal adult assistance, will not be particularly well prepared to cope with the problems encountered in the adult world.

21. In Chapters 4 and 5 we stress the importance of learning how to learn and think, and how to structure learning and thinking situations. We suggest that you pass on to your children these principles and methods as soon as they are able to comprehend them. Practice the use of methods and disciplines with them. Practice makes their use second nature—a habit.

We have enumerated these pointsin a sequence that closely corresponds to the sequence of phases of mental development. However, you must understand the developmental process well enough to be able to determine when it is time to begin using each point. Each child is different. Each has different inborn limits to his or her potential. Each has a different rate at which he or she learns. Also, all parents are different in terms of how much they know, how much they converse, how well they can accomplish various activities, what is important to them, and so forth. All of these factors will influence how you yourself will apply the frames of reference presented here.

We suggest that as your children are able to understand some of what we have been discussing, you make them aware of the basic principles. You can translate this discussion into terms that they can comprehend and use. If you can help them to understand what is happening to them as they mature and develop mentally, you will be equipping them to become more active or participative influences on their own further development. Perhaps they will then have an advantage that many of us were not as fortunate to have.

Recommendations for Adults

You have learned that one can develop bettermuscular coordination by practicing simple movements (parts) and then practicing the parts together, eventually putting those parts together into a whole, coordinated activity. Coordination of motor responses is learned (developed). You have also been shown that reading abilities can be greatly improved by developing more efficient, effective mental abilities involved. You have seen that by increasing your repertoire of information, experience, vocabulary, and concepts, your subsequent experiences will be even more meaningful to you. The more meaningful your sensory impressions, the better they will be recorded in memory, and the more easily they will be recalled when their use is important to you.

These are just a few examples for again pointing out that you need not accept your present mental abilities as "given." Abilities develop, and they can be further developed in all of us. Whereas heredity and environment have been extremely important factors in our development, each of us can become a more active factor in our own further development. We will—if we really care about ourselves.

Let us review brieflysome of the specific pointsthat can be used to sharpen and further develop one's basic abilities.

l. Practice the "whole to part" method of learning when observing objects and activities. Focus attention on the whole and then to the parts. Then interrelate the parts to each other and back to the whole. Observe—don't just see.

2. Define or describe what you perceive in detail. Consider its various characteristics. If the object, activity, or information is particularly important to remember, relate it to other things with which it is associable in order to give it greater meaning.

3. Practice the "part to whole" method of learning for acquiring complex physical abilities or responses. Learn the parts first, and then combine them into the whole activity. Practice their combined use until the activity can be accomplished in a smooth, coordinated fashion.

4. Expand your vocabulary. Expand your repertoire of ideas and concepts. Get into the habit of looking for relationships amongst things, activities, and ideas.

5. Practice your communicative and persuasive skills. A larger vocabulary enables you to express yourself more effectively. Weighing both the "pros" and "cons" of a situation enables you to be more persuasive in making a point to others.

6. Practice reading groups of words at one time. Look for the total impression or thought communicated by each group of words.

7. With the frame of reference outlined in this chapter, ask yourself more often why you do what you do. Consider the influences of your own process of mental development on your personality, values, skills, and adaptive orientations to your environment.

8. Practice solving simpler problems in your head, weighing as many variables involved as possible. Tackling more complex problems in your head, however, can be frustrating. The mind cannot juggle too much information without the aid of paper and pencil and some of the techniques discussed in Chapters 4 and 5.

9. Sharpen your habit of thinking ahead. Ask yourself consciously, "What will happen if I _____?" Recall past
experiences and assess the probabilities of the possible outcomes or results of your intended actions.
10. If you have not already done so, get more into the habit of asking yourself, "Why?"

We will elaborate on many of these fundamental points throughout this book, because they underlie better performance and greater success in any role. So, if you are a parent, remember that you set the example for your children. So give this chapter the thought and use that **they** deserve. But also give these few points the thought and practice that **you** deserve.