Mind Games

The Aging Brain and How to Keep it Healthy

Kathryn C. Wetzel, PhD
Kathleen M. Harmeyer, MS

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To Glenn, my father, the ubiquitous thaumaturgist
and
To Keith, for his unwavering devotion and support.
Kathleen

To my husband Lew, daughter Shara, and mother Virginia.
and
To God, through whom all things are possible.
Kathryn

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Printed in Canada

1 2 3 4 5 6 7 8 9 10 x x x 05 04 03 02 01 00 99

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Library of Congress Cataloging-in-Publication Data

Wetzel, Kathryn C.
Mind games: the aging brain and how to keep it healthy / by Kathryn C. Wetzel and Kathleen M. Harmeyer.
p. cm.
Includes bibliographical references and index.
ISBN 0-7668-1280-4
1. CognitionÑAge factors. 2. MemoryÑAge factors. 3. Human information processingÑAge factors. 4. AgingÑPsychological aspects. I. Harmeyer, Kathleen M. II. Title.
BF724.55.C63 W48 1999
155.67'13Ñdc21 99-39159

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Note:
According to D. Warner Schaie, while minor memory lapses and some slowing of mental processes are normal aspects of the aging process, in some people they could be early signs of depression or dementia. Individuals who have serious concerns about memory losses or losses in other cognitive skills should seek professional help from a psychologist or psychiatrist.

PREFACE

Attention All People Over 40!

WHY YOU SHOULD READ THIS BOOK

Regardless of your age, have you ever experienced what may be affectionately described as Òsenior moments?Ó For example, have you

- ¥ Checked three or four times to make sure that the same appliance is turned off before you leave home?
- ¥ Tried to use a word in your conversation that you know you know but cannot recall?
- ¥ Walked up and down the parking lot looking for your car, with the grocery sacker tagging along behind?
- ¥ Forgotten someoneÕs name you just met, even though you were rehearsing it while you were walking away?
- ¥ Had someone tell you that you do not correctly remember what he or she told you?

Or, you may be apprehensive of your ability to adapt to new situations. Are you concerned that rusty brain cells may prevent you from successfully

- ¥ Moving to a new home or city?
- ¥ Joining a special-interest group to meet new friends?
- ¥ Earning a degree or enrolling in a continuing-education course?
- ¥ Applying for a new job?
- ¥ Managing your business and/or life?

Well, if you answered ÒyesÓ to any of these questions or have similar worries in your life, itÕs not hopeless. This book is just what you need. It explains why these Òsenior momentsÓ occur and how you can take charge of your mental agility. You just need to exercise those brain cells to become more mentally alert and agile. Athletes train and maintain their bodies in peak operating condition. You need to train and maintain your brain. Keep in mind Ñ pardon the pun Ñ that this text is not just a book to improve your memory. It is designed to give you pertinent information regarding the quality of your life.

YouÕll find information such as

- ¥ Why certain aspects of your thinking processes are more finely tuned than others
- ¥ What the latest learning theory is, explained in layperson Õs terms, based on recent brain research
- ¥ How diet affects your memory and capacity to think
- ¥ How physical exercise relates to mental exercise
- ¥ Why research regarding the effects of aging is, in many cases, seemingly contradictory
- ¥ How the suggested strategies, games, and activities can increase your thinking and memory capacity
- ¥ Exactly how to regain and maintain your mental agility

WeÕll guide you through the learning-style preferences and the mental-processing modes that will promote the

most mental growth for you. YouÕll be able to apply these learning techniques and strategies to all aspects of your lifeÑ excelling at work, returning to school, learning a hobby, overcoming drastic changes in your health, and more. This book is designed for middle-aged adults, senior citizens, healthcare professionals, and home caregivers.

THE RESEARCH BASIS

The Seattle Longitudinal Study, a program conducted for more than 40 years by K. Warner Schaie, PhD., an Evan Pugh Professor at Pennsylvania State University, charted the course of selected cognitive abilities as the study population aged. After noting the decline in mental acuity in elders, Schaie, along with Dr. Sherry Willis, instituted a five-hour training session with specific mental exercises. The exercises addressed inductive reasoning techniques and spatial relationship skills, among others. After that period, the majority of the people trained demonstrated that they had regained and could continue to maintain the same mental agility they had exhibited 14 years ago.

Based on SchaieÕs work, the results of comparable research, and our combined 47 years of teaching expertise, this text is designed to assist you in regaining and maintaining the mental agility you may have lost. It also will help you successfully pursue lifelong learning.

HOW TO USE THIS BOOK

Chapter 1 begins with a look at how you as an individual prefer to learn. Chapters 2 through 4 continue with a physical description of how the brain functions. You then examine the effects commonly associated with the aging process (Chapter 5) and then rapidly proceed to specific measures you easily can use to regain and maintain mental agility (Chapters 6 and 7). This text builds a concrete foundation by explaining the premise on which all of the learning and retention strategies are based.

If you are a sequential learner (one who starts at the beginning and performs each step along the way), you will progress through the chapters, and by the time you reach Chapter 6, you will fully understand the relevance of the games, exercises, projects, hobbies, and activities the text recommends. Nonsequential learners (those who look for a specific topic and start there) who skip directly to Chapter 6 will discover many references back to explanations in earlier chapters. As you become more interested in the material presented, you easily can refer back to the applicable foundation theory.

Whether you are a sequential or nonsequential learner, we strongly recommend that you eventually read all of the chapters to receive the full benefit of the information.

We present key concepts at the beginning of each chapter. After you identify a favored learning style, icons direct you to the appropriate learning activity. For example, numerous diagrams, photographs, and illustrations guide the learning for readers who have difficulty visualizing information from text. Inserts highlight special enrichment concepts and role-model experiences.

To support the text, we have set up a Web site with animations that are keyed to text explanations. Interactive games for mental exercises described in the text also are available on the Web. All of the exercises, games, and learning strategies directly affect specific areas of the brain and allow for growth and development of widely applicable learning and retention skills. You will find a supplement at the Web site with teaching strategies and ideas applicable for a classroom setting or discussion group. Visit www.mentalagility.com .

MIDDLE-AGED ADULTS, SENIOR CITIZENS, AND ELDERS

If you want to dust off your brain cells and fine-tune your thinking processes, you can practice these learning strategies anywhere at any time. You may initially read and prac-

tice the exercises and games included in this text at home, while at the hairdresserÕs or barberÕs, or even in bed before you go to sleep. However, after you understand the reasoning behind the techniques, you will begin applying them to situations independent from the book Ñ while at work, driving, fishing, or shopping. If you practice these techniques, they will make a difference in your life and improve the quality of your lifestyle. You will feel in control again.

HEALTHCARE PROFESSIONALS AND HOME CAREGIVERS

This text supports a continuing-education class on assisting seniors to regain their mental acuity. The material is presented clearly in laypersonÕs terminology, laced with humor and everyday application strategies. Students in the class will enjoy group discussions of their experiences. The exercises and activities in this book easily may be adapted to group activities.

For those of you who care for another person in the home, this book can help provide assistance in explaining the reasons for that personÕs apparent decline and in selecting activities to help reverse the process.

Healthcare professionals serving the elder population may use this text to supplement the daily routine of their elderly patients in group sessions. Some elderly patients may prefer to use the text on an individual basis instead of in a classroom setting. If your patients have physical complications and cannot read, you should read through the entire book prior to meeting with them about this topic. Explain Chapters 1 through 4 and help them with the tests on learning preferences in Chapter 1. It might help them to know many of the aspects of aging, such as why food doesnÕt seem to interest them as it used to. YouÕll find this information in Chapter 5. As the healthcare giver, you will need to evaluate your patient and choose appropriate exercises, games, and activities from all the chapters, but especially those in Chapters 4, 6, and 7.

SUMMARY

This book gives you proven techniques that will help rejuvenate the minds of those who perform the exercises. It is based on solid university research that produced stunning results. Humor is beneficial to mental health, so remember to have fun while you are doing these exercises.

ÒThe intelligent man is one who has successfully fulfilled many accomplishments, and is yet willing to learn more.ÓÑ Ed Parker

ACKNOWLEDGEMENTS

A million thanks to our families who did everything else, while we wrote.

Special thanks to Tom Reppenhagen, Sharon Mulgrew and Myan Baker, for key contributions to the process. And to Rosemary Austin, who worked all the exercises.

Thanks to the people who helped with the publishing process, including our editors, Marlene Pratt, Maria Perretta; our art coordinator, Jay Purcell; and our production editor, Beth Brown. Thank you for supplying PET scans, Dr. Marcus Raichle and Dr. John Mazziotta. And to Nancy Klingsick who never said no. And to influential teachers, Colleen Pierre and Fran Lannon.

Thanks for graciously allowing us to photograph you: Glenn Austin, Rosemary Austin, Billie Ballard, Buddy Ballard, Debra Baze, Virginia Chestnut, Jesse Coon, Dorothy DiMaio, Marguerite Empie, Chuck Gibson, Jacque Gibson, Bob Gifford, Rita Gifford, Janet Harter, Khabir, Leo LaBorde, Gene McLane, Helen McLane, Victoria Mok, Sharon Mulgrew, Antonio Salazar, Bryan Umeki, Doris Waller and Brackston Yarborough who assisted with the photographs of Leo LaBorde.

Sincere thanks to our talented photographers, Amy Aldrich, Winfield Leitzer, and Henry Ortega. And for invaluable moral support, Carrol Spears, Aimee Martin, and Bobby May.

Chapter

1

The Learning Styles of an Agile Mind

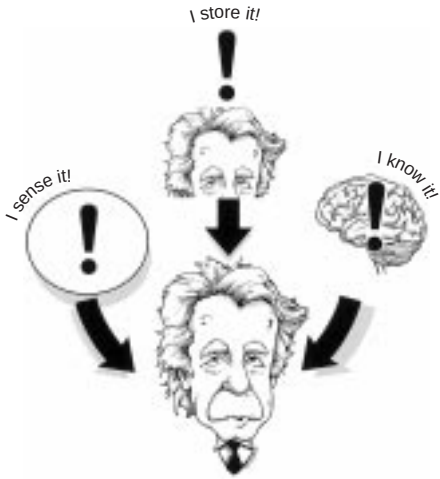
Discover How You Capture, Select and Store Information

KEY CONCEPTS

How We Capture Information
How Memories Are Made
Learning Styles
Learning Styles Investigation
Using Learning Style

INTRODUCTION

You are bombarded with information every waking moment. Once selected, some information passes from immediate memory Ñ that is, what you can senseÑ into short-term or holding memory. Finally, a small amount of the original information makes it to permanent long-term memory. The final move to long-term memory is what we call learning. In this chapter, you will learn how information is captured, selected, and stored.



CAPTURING INFORMATION

You obtain information through your five senses: sight, hearing, touch, smell, and taste. Imagine yourself watching a television program about your favorite hobby. You see and hear the information. You receive this information in an auditory manner (you hear it) and visually (you see it). These delivery methods, using only two of your five senses, are how the majority of people believe information is taught and learned. The truth is that a great deal of information is conveyed to you through your other senses: smell, taste, and touch. Olfactory (smell) and gustatory (taste) sensations are more rarely used in formal learning activities than hearing and sight. However, people rely extensively on these senses in the home and at work (detecting smoke, gas leaks, cooking, and so on). You know the old adage, ÒThe way to a manÕs heart is through his stomach!Ó

Your sense of touch also tells you a great deal about the world around you. You use it to check a childÕs temperature, the fineness of your handiwork, or the carÕs vibration. Your sense of touch is intricately involved in your kinesthetic (motor) skills with which you write, learn a new hobby, drive, get dressed, and many, many other physical activities. Some emotional information is communicated through touch, such as a gentle pat or a warm, loving hug.

MAKING MEMORIES

Imagine yourself at an elegant party. People are talking, dishes and utensils are clinking, and music is playing softly in the background. Soft candlelight illuminates silk-covered furnishings while the aroma of dinner fills the air.

All of these impressions saturate your five senses, which trans-fer as much information as they can to the brain via what is called the sensory store. These fleeting sensations remain for only a few milliseconds before the majority of the sensations are lost and only a small subset is passed on to short-term, or working, memory (STM). The information is lost within 15 to 30 seconds if not selected for closer consideration. If you were not paying attention to a conversation, you could reconstruct a recent comment if asked within this 15 to 30 second window. However, after this brief interval of time, you must begin to organize and rehearse the information you want to store in long-term memory (LTM). The process of learning new information does not stop when we go to sleep. Recent research indicates that sleep is essential to the formation and efficient storage of memories. As we sleep, the brain appears to replay the activities of the day, reactivating old and activating new brain cell connections. With proper encoding and retrieval strategies, information that is stored in LTM is considered relatively permanent because it can be recalled years later.

Sleep is essential to the formation and efficient storage of memories.

The overwhelming mode of human communication is a mix of verbal and visual information. Figure 1-1 shows brain images, which demonstrate the different parts of the brain that are active when listening to words and looking at words.

Notice that if material is presented orally, the brain reacts as shown in Figure 1-1a, whereas if material is presented visually, the brain reacts as shown in Figure 1-1b.

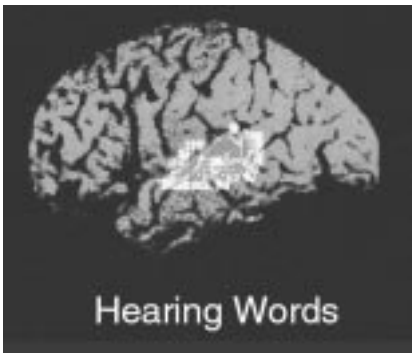


Figure 1-1a Hearing Words Figure

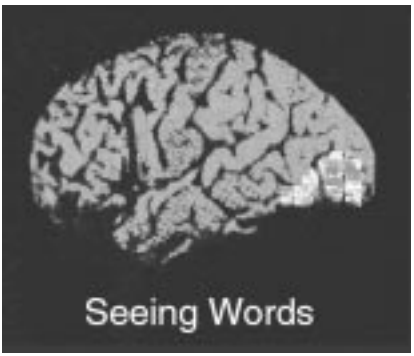


Figure 1-1b Seeing Words Figure

LEARNING STYLES

auditory learner Ñ one who prefers to listen to new information.

visual learner Ñ one who prefers to see new information.

kinesthetic learner Ñ one who prefers to practice new information.

Some people prefer to listen to new information and are called auditory learners, whereas others prefer to see the new information and are described as visual learners. If you listen primarily to words on the radio, on television, and in conversation, the sections of your brain that are activated (Hearing Words, as shown in Figure 1-1a) become stronger, just as the specific muscles a body builder exercises grow stronger. Similarly, when you see the words, the sections of your brain that are activated (Seeing Words, as shown in Figure 1-1b) become stronger.

Still other people prefer to write down new information or to practice a new skill and are classified as kinesthetic learners. You may prefer to learn using only one of the auditory, visual, and kinesthetic techniques. The white areas in Figure 1-2 show the regions of brain activity for auditory, vi-

sual, and kinesthetic (motor) stimulation. Different areas of the brain respond to different delivery formats.

In this text, you will see several PET scans, so a description of the technique might be helpful. A radioactive substance with a short half-life is injected into the bloodstream using glucose as the carrier. The radioactivity allows external monitoring of the metabolism of the brain. Sensors around the volunteerÕs head monitor the radioactivity. Computers convert the information into two-dimensional images. The more active an area of the brain, the more glucose it uses, and the brighter the color. In black-and-white pictures, the more active areas show up whiter. The other areas of the brain are not dormant. They are simply not as active.

Begin to notice how you prefer to have information presented. You may prefer to use a combination of auditory, visual, and kinesthetic (motor) methods. For example, you might repeat a written list aloud while marking items off on your fingers. Do you want someone to give you written directions rather than to tell you how to get somewhere? Would you rather listen to a book on tape than to read a book? Do you move or shift around, adjust your tie, twirl your hair, or otherwise ÒfidgetÓ when concentrating? Do you believe you are an auditory, visual, or kinesthetic learner?

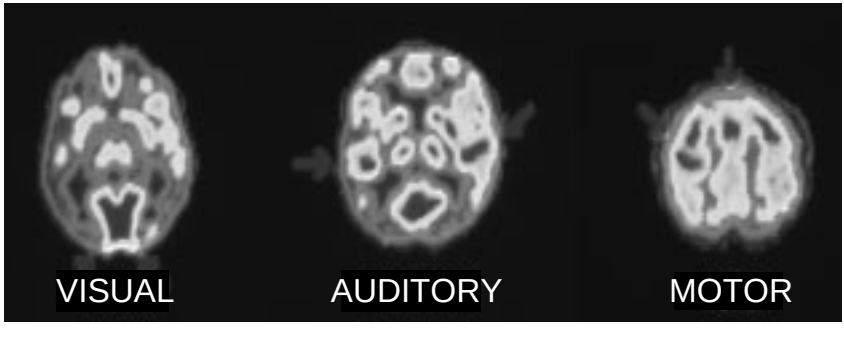


Figure 1-2 Brain activity for visual, auditory, and kinesthetic stimulation

Suppose for a moment that you have purchased a piece of furniture or a toy that requires assembly.

Visualize the contents of the box. Usually there are parts and a set of directions. How do you attack this problem? Do you

1. Read the directions thoroughly and/or study each diagram before beginning assembly?
2. Read the directions aloud or ask someone to read them to you as you put it together?
3. Look at the parts, ignore the directions, and start to assemble it right away?

If you selected number 1 as the action you would most likely take, it is conceivable that you have a visual learning preference. An auditory learner may prefer to hear the instructions or speak them aloudÑ number 2. The kinesthetic learner knows how the pieces fit together and jumps right in Ñ number 3.

The following table describes some of the characteristics typically displayed by the three types of learners. Take just a few minutes, using your own self-awareness and the table. Try to decide whether you would describe yourself as an auditory, visual, or kinesthetic learner.

Auditory Learner	Visual Learner	Kinesthetic Learner
Often described as a talker	Watches the faces of talkers	Likes to move around a lot
Quickly learns words to songs	Can Òsee Ó where something is located	Likes to touch things
May reverse b-d or p-q when writing	May misinterpret spoken words	Does not like to read directions
May not enjoy writing	Would rather write things down	Would rather write things down
Keeps poor track of time	May have a good sense of color	Lives in the present. Poor sense of time
May get lost in new territory	Mind may wander while listening to others talk	Restless. Paces while on the phone
May not be adept at reading body language or facial expressions	Likes symmetry	Learns best by doing
Favorite phrases: ÒThat sounds good.Ó ÒI hear you.Ó	Favorite phrases: ÒI see.Ó ÒI get the picture.Ó	Favorite phrases: ÒI feel . . .Ó ÒI need to get a handle on.Ó

So what did you decide? Are you primarily an auditory, visual, or kinesthetic learner?

Here are some very brief summaries of the three learning styles:

- Visual learners want to see the information written down or watch someone else demonstrate what is required.

Auditory learners prefer to hear information and like to repeat things aloud when trying to remember something.

Kinesthetic learners want to be physically involved in the learning experience and prefer Òlearning by doing.Ó

These three preferences of receiving and presenting information are called modalities of learning.

Figure 1-3 shows the proportion of each learning style type in the general population. As you can see, most people prefer to learn when the information is presented visually.

Now sit back, grab a pencil, and answer the questions on the following learning-style assessment. It will help you to confirm your opinion of your learning preferences.

LEARNING-STYLE INVESTIGATION

In each case, choose the numbered item that is most like you. In some cases, none will be exactly like you. In other cases, several will be like you. Try to choose only one in each case.

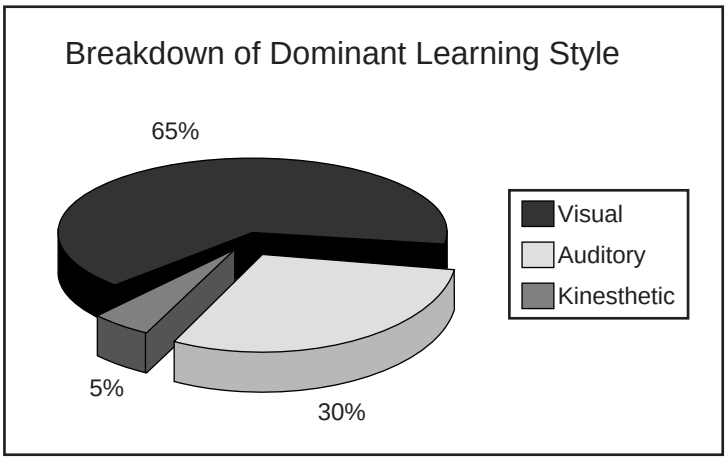


Figure 1-3

Case 1: I have an interest in learning to play golf. To explore this interest, I might find one of the following to be the most effective way to get started. It is most like me to

1. Talk to people who play golf to hear what they have to say
2. Take some lessons or hit a few balls at the driving range
3. Read books and magazines about it, get videos, and watch golf matches on TV

Case 2: A youngster wants me to learn how to use his computer to play games with him. To learn how to use the computer, I probably would select this as the first activity:

1. Read up on how to use a computer
2. Have someone tell me how to do it
3. Take a hands-on course at the public library, community college, or local computer store

Case 3: I am sitting with a child who is holding her favorite board game. She would like me to play with her. To learn the game, I would

1. Play the game and figure it out along the way
2. Have the child explain the rules to me
3. First, read the instructions to the game

Case 4: I have learned that there are wonderful ways to improve my mind. All of the following are good examples. The one I would choose to do first is

1. Read a new book
2. Participate in a discussion group
3. Learn a new craft

Case 5: To get exercise, I decide to take up walking. My ideal walk would be

1. On a treadmill so that I can watch TV or read while I walk

2. Walking with a radio to keep me company
3. Walking itself is so nice that I donÕt feel a need to do anything else

Case 6: The kinds of words I might use are

1. ÒLook at this.Ó ÒSee you later.Ó ÒOh, I see.Ó ÒWhat a sight!Ó
2. ÒHere. . . Ó Òget it.Ó ÒStay in touch.Ó ÒWhat an upheaval!Ó
3. ÒListen . . . Ó ÒI didnÕt catch that.Ó ÒIÕll call you.Ó ÒWhat a ruckus!Ó

Case 7: People point out that I

1. Doodle on my papers
2. Fidget in my seat or am always fooling with some object
3. Hum, mutter, or read aloud

Case 8: When I assemble a model airplane or another toy, I prefer to

1. Put the toy together, occasionally looking at the directions
2. Read the instructions out loud first, and then talk to myself during assembly
3. Read the instructions and look at the pictures, and then assemble it step by step

Case 9: To communicate with a friend, I would rather

1. Pick up the phone and have a conversation
2. Visit in person
3. Exchange letters or e-mail

Case 10: When I read a book,

1. I imagine myself as the hero or heroine. I create the scene in my mind in every detail used by the author

2. I notice the way the words flow and fit together like poetry
3. I like to get very comfortable first

Case 11: When I read a book,

1. Sometimes when I read a long sentence, I repeat it out loud to help me understand it
2. I like the way the book feels in my hands
3. I get lost in another world and lose track of time

Case 12: My idea of a good time is

1. Playing a rousing game of charades or other activities
2. Watching a great movie or reading a fine book
3. Going to a musical concert or singing with a group

Case 13: When someone is giving a speech

1. I am content to sit and listen
2. I look around the room to see what else is going on
3. I get agitated at having to sit still for a long time

This is the end of the assessment. In the next section, yo score yourself and be able to determine your dominant learning style.

LEARNING-STYLE INVESTIGATION RESULTS

You may have noticed that it was difficult to select just one of the choices. In some cases, you probably wanted to select two or more choices; in others, none matched your style at all. In the following cases, you will find a learning style that typically favors each of the choices you made. Count the number of auditory, visual, and kinesthetic choices you made. This will give you an indication of which learning style you prefer.

Case 1
1: Auditory
2: Kinesthetic
3: Visual

Case 2
1: Visual
2: Auditory
3: Kinesthetic

Case 3
1: Kinesthetic
2: Auditory
3: Visual

Case 4
1: Visual
2: Auditory
3: Kinesthetic

Case 5
1: Visual
2: Auditory
3: Kinesthetic

Case 6
1: Visual
2: Kinesthetic
3: Auditory

Case 7
1: Visual
2: Kinesthetic
3: Auditory

Case 8
1: Kinesthetic
2: Auditory
3: Visual

Case 9
1: Auditory
2: Kinesthetic, Visual, or Auditory
3: Visual

Case 10
1: Visual
2: Auditory
3: Kinesthetic

Case 11
1: Auditory
2: Kinesthetic
3: Visual

Case 12
1: Auditory, Kinesthetic, or Visual
2: Auditory or Visual
3: Auditory

Case 13
1: Auditory
2: Visual
3: Kinesthetic

So did the learning-style quiz confirm your previous opinion as to your learning preference, or did you learn something else about yourself? Your dominant style is the

one for which you counted the highest score. The other two styles probably did not have a score of zero. So, there are some situations where you prefer to use the other two styles.

One of the authors typically tests as visual (when forced to select just one choice) but knows in her gut that she is strongly kinesthetic as well. She hasto write things down to learn them, and if she does not do the driving cannot return to a location. Most people, in fact, rely on these three techniques to different degrees at different times. For example, to remember an errand that must be run, you may repeat it to yourself several times, while a trip to the hardware store for supplies may prompt you to write a list. You can train yourself to rely extensively on more than one modality to process information and create memories. The more you combine these modalities, the more efficient you will be at storing and recalling information.

USING LEARNING STYLES

To use your brain more fully, you need to use combinations of these methods to learn and recall pertinent information. Using a combination of visual and auditory methods creates more connections in the brain than using just one method. The more connections you use to store information, the more likely you will be able to recall it when required.

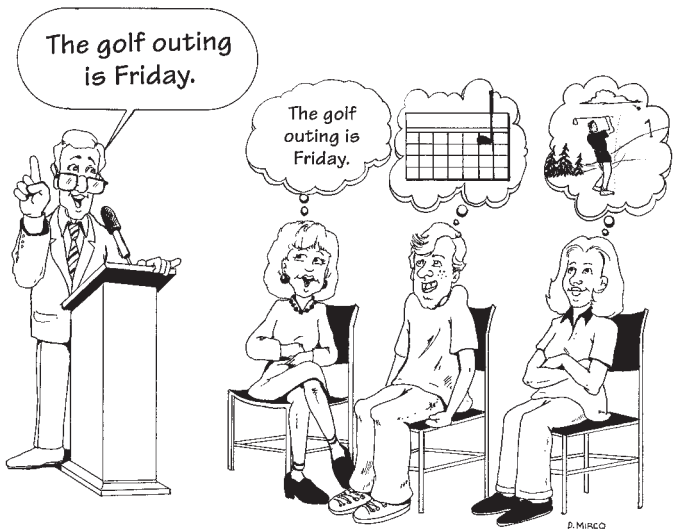
A friend of ours repeats to herself the thing she is trying to remember to do in an interesting rhyme or pattern (auditory), writes it down on a piece of paper and puts it next to her place mat where she will see it (visual and kinesthetic), and then tells her husband to remind her (auditory). The interesting thing is that she knows her husband will never remind her (he wonÕt remember later), and he knows she doesnÕt really expect him to remind her (so he doesnÕt bother storing it). She never forgets anything! Are you surprised?

Why is it important in everyday life to be aware of learning preferences? We often think of learning as taking place in a formal environment such as a classroom or work. Nevertheless, we learn new information every day. Sometimes

we are trying to learn and remember the errand we must run later in the day (and can forget afterward). Sometimes it is the new phone number of our best friend (which we do not want to forget).

Many times, we are not learning the information. We want someone else to remember something. If you notice the little signals indicating someoneÕs dominant learning preference, you can present the information in the style that person needs.

The authors were part of a team conducting a national workshop for engineering professors. One of the things we taught them was to identify their learning style. One of the professors confessed that he was strongly kinesthetic. But what he thought so funny was that he now understood why his students would be so frustrated. They would come up to him after class, and no matter what the question was, he always tried to draw some sort of a picture to represent the question. They did not want a picture; they wanted him to clarify what he had said earlier. He needed to adjust his presentation style to match his studentsÕ learning style.



How auditory, visual, and kinesthetic learners think.

Photo courtesy of Winfield Leitzer

Older and Wiser

Glenn Austin, 77, learned about genealogy shortly before he retired as Director of Contracts for a division of Martin Marietta Corporation. Since then, to forward his avid interest, he has learned how to use vital records and census records (visual), paying attention to different spellings of the same-sounding names (auditory). He learned how to use the Family History Centers of the Mormon church; immigration, naturalization, military, and cemetery records; city directories; and many other information sources (visual) and search strategies (kinesthetic).

He learned how to use a computer (kinesthetic) for searching electronic bulletin board systems, e-mail, and the Web. He has met new people (auditory) and shared information through queries (visual), which are special requests made by genealogical researchers to each other.

Glenn finds the analysis of the data collected the most challenging element a real-life detective activity.

Now he is able to apply his knowledge of computers to do new things, such as word processing (kinesthetic) to help keep minutes for his condominium board.

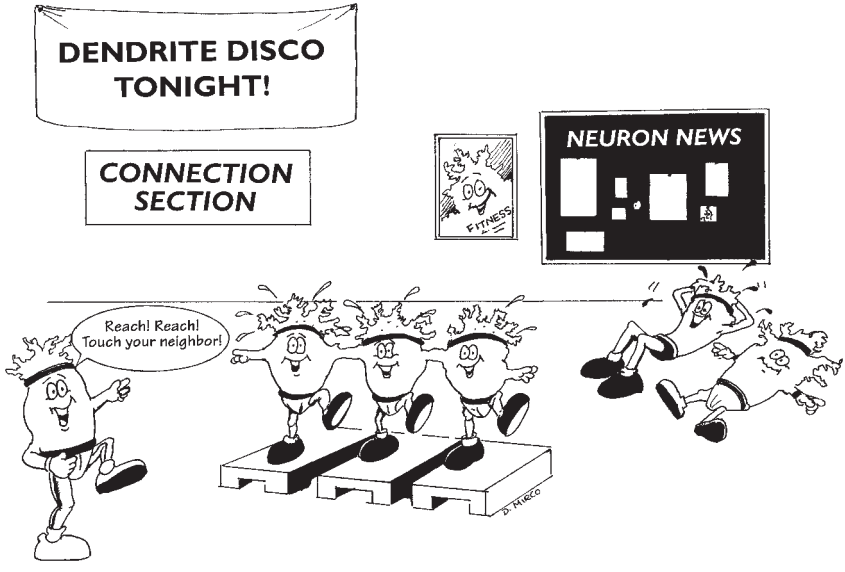
Glenn says, ÒGenealogy is the most fascinating thing IÕve ever done!Ó He is growing new brain connections at a rapid rate!

Now that you have an idea of what your dominant style is, there are two things for you to do. First, if you need to learn some new information in a quick and thorough manner, plan learning activities that maximize your dominant style.

- ¥ If you are a visual learner, feast your eyes with images and lots of text.
- ¥ If you prefer to learn in an auditory way, try books on tape or recite your lessons aloud. Use your voice and your ears to help you use this preferred style.
- ¥ A kinesthetic learner will want to devise activities where movement and touch are required. Make models, write notes, and use your hands to describe things to others and yourself.

Second, learn to develop your skills in the other two, less-dominant, learning styles. Life events often require you to use your nondominant style and still be effective at retaining information. You may be reading a magazine article, which supports a visual learner. You may be in an auditorium listening to someone speaking, which supports an auditory learner. You may be in a hands-on class, which supports a kinesthetic learner. It will be useful to you if you can benefit from all three styles.

Accommodate your personal preferences and begin to include others. If you have never been an avid reader, for example, find a subject you enjoy and start reading. The more techniques you use to store information, the more connections within your brain youÕll create, and the more likely you will remember the information. (See Chapter 2, ÒThe Intelligent Mind,Ó for a more detailed explanation.) Exercise those brain cells! HUP, two, three, four. HUP, two, three, four . . .



ÒNo pain, no gain, no brain!Ó

One of the goals of the exercises in this book is to promote your development of all three modalities so that whatever situation arises, you will be able to maximize your acquisition and retention of information. In later chapters, you will have an opportunity to practice each of the three learning styles and increase your ease of use. In the meantime, fill in the following table with specific methods you can use to remember everyday examples of learning. Sometimes you need others to learn and remember something pertinent to your life, so we have included a few of those situations. Write as much as you can about how you will use these styles. We did the first one for you as an illustration. (Take a peek at that now.) You can use a combination of methods if you want, such as writing the item on a sticky note (kinesthetic) and sticking it where you will see it after work (visual reminder).

Learning Application	Visual	Auditory	Kinesthetic
Pick up bread after work.	Create a mental picture of picking up bread.	Repeat to yourself: put it into your head to pick up somebread.	Write it down three times on a piece of paperÑ get bread.
New phone number			
Lunch order for 10 visitors at work			
FriendÕs anniversary is next week.			
Car location in huge parking lot			
Your spouse needs to come home to meet the plumber.			
A friend is to pick you up at the airport.			

CONCLUSION

Using all of your learning-style possibilities exercises the various functional regions of your brain. You want to keep your seeing, listening, touching, smelling, and tasting skills fine-tuned and firing on all cylinders, like a well-tuned engine. In later chapters, you will have an opportunity to practice each of the three learning styles and increase your ease of use.

In this chapter, we emphasized your auditory, visual, and kinesthetic learning preferences. Remember the PET scans in Figure 1-2 that demonstrated the various areas targeted when processing information using the auditory, visual, and kinesthetic skills? In Chapter 2, you will discover that after the information passes into the brain, different areas are called upon to process the data.

REFERENCES:

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Chapter

2

The Intelligent Mind

Find Out How Your Brain Processes Information

KEY CONCEPTS

Brain Development
Multiple Intelligences
Memory and Its Acquisition
Multiple Intelligences Investigation

INTRODUCTION

Most of us are aware of how our body operates, ages, and repairs itself. We replace skin cells every day, for example, yet it takes approximately seven years before we have completed a full cycle and replaced all the old skin cells. It is also common knowledge that exercise benefits our overall health and can help us to resist the effects of aging on our bodies. Intimate knowledge of how our brain operates, ages, and repairs itself is not as common. Before you can take control of your mental processes, you must understand how the brain works.

In Chapter 1, ÒThe Learning Styles of an Agile Mind,Óyou explored the concept of the visual, auditory, and kinesthetic

learning preferences. While you were reading, whether or not you previously knew about the concept of learning styles, did you wonder why we have different learning preferences? Is one child born to be a visual learner, another an auditory learner, and still another a kinesthetic learner? Is this a preference we develop? Is it a preference we can influence or change?

To answer these questions, this chapter will tell you how the brain works. You will discover how your brain develops as you grow, and how different parts of your brain react while you are performing a variety of activities. You also will see how through disease, damage, or disuse, mental ability may be impaired or lost. This book is not intended to aid those who have lost mental ability due to disease or traumatic damage. However, it will show you how you can recover loss of mental ability as a result of disuse.

Many old notions about the brain and how we learn have been overturned during the past Decade of the Brain. It was commonly thought, for example, that we had only a fixed number of brain cells and that when we lost them to disease, trauma, or old age, we did not replace them in the way we renewed other body cells. We believed that brain cells could be destroyed but not replaced. We also anticipated that we would lose some of our mental agility as a normal result of the aging process. Brain research in this decade reversed those notions. Research just recently indicated that certain areas of the brain, such as the hippocampus, can generate replacement cells throughout your life span.[1] We also know now that we can grow new connections between the brain cells at a rapid rate if we use our brains in new and novel ways, regardless of our age.

In the same manner that understanding how an engine functions helps a mechanic to fine-tune a motor, understanding the functions of your brain will aid you in fine-tuning your mental abilities. Accordingly, some groundwork must be laid before delving directly into the many methods you can use to counteract the effects of aging on your mental processes.

GENERAL DEVELOPMENT OF THE BRAIN

LetÕs get started. Pictures of the brain are all around us in newspapers, magazines, and on television. Therefore, you probably already have a general idea of what the brain looks like. WeÕre going to probe deeply into the structure of the brain so that you will know precisely why we want you to practice certain strategies and techniques and exactly what is happening as you reinforce your mental agility. LetÕs start with some of the vocabulary and imagery needed to talk about and visualize brain structure.

neuronÑ nerve cell in the brain

The neuron is the basis of the brain. It is estimated that the brain contains 100 billion neurons, which is roughly equivalent to the number of stars in the Milky Way galaxy. [2] Each neuron is a nerve cell composed of a center, named the nucleus,with long, slender axons and short, bristly dendrites.

axonÑ messenger of the brain
dendriteÑ message receiver in the brain

Neurons communicate with each other by passing nerve impulses down the axon of one neuron. At the end of each axon is a minute gap called the synapse

synapseÑ gap between axon and dendrites

As the nerve impulse reaches the end of the axon, a chemical, called a neurotransmitter, is released into the synapse. On the other side of the synapse is a dendrite of another cell that acts as the receiver for the signal.

neurotransmitter Ñ a chemical released by the axon to send and store messages across a synapse

In Figure 2-1, you can see the path the message follows from one neuron to another. This message travels from one

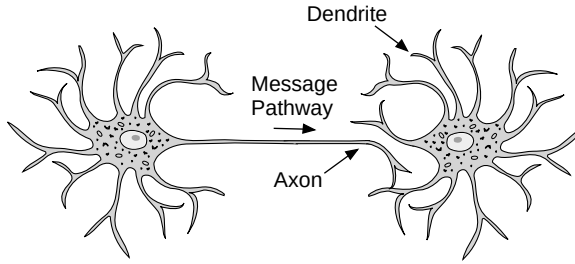


Figure 2-1 Connections between brain cells

neuron out its axon, is transmitted over the synapse, and travels up one of the dendrites of another neuron on its way to its destination. The message may be passed from neuron to neuron until it reaches the final destination. On the other hand, the neurotransmitters released into the synapse may alert multiple neurons at the same time. These message pathways are called connections.

connectionsÑ message pathways in the brain

Also present in the spaces between the neurons are trillions of glial cells, from the Greek word for glue. These cells support, sustain, and safeguard the neurons and may have a communications system of their own.

glial Ñ glue-like cells that form a support for the neurons

The neurotransmitter performs a critical function in the creation of these communications connections. Each time a message is transmitted between cells, the chemical that is released into the synapse physically changes the receptor dendrite. Bristly spikes build on the dendrite as a result of the interaction of the chemical neurotransmitter and the dendrite. It is the repetition of this chemical reaction along the message route that strengthens the connection. You will learn in Chapter 4, ÒDevelop a Brawny Brain,Ó how to use rehearsal to make a memory stronger. (Visit the Web site www.mentalagility.com to view an animation of this phenomenon.)

The basis for these communications connections already can be identified approximately 10 weeks after conception when the brain is merely one-half inch long. [3] Neurons begin pushing their way from the neural tube deep within the interior of the fetusÕs brain to the outside margins, with newer neurons pushing past older neurons. Neurons travel along glial fibers much like traveling down a highway toward their final destination with the assistance of proteins and chemical cues.[4] By five months into the pregnancy, the fetusÕs brain is now two inches long, and the migration of neurons to the outer layers of the brain is almost complete.[5]

Early Brain Development

During development, a babyÕs brain is a maze of neurons much different in structure from the adultÕs brain. One interesting example is vision development. To develop vision, nerve fibers from the retina must grow to extend far enough through the brain to reach the visual thalamus (see Figure 2-2), and from there, axons reach to the outer layers of the cortex, before the cortex even exists.

cortexÑ the folded outer layer of the brain

A study by Carla J. Shatz,[6] professor of neurobiology at Stanford University, demonstrated the existence of transient support ÒscaffoldingÓ in the developing brain that aids in developing vision but disappears after the brainÕs growth is finished. Special types of neurons, subplate neurons, suddenly appear just below the final destination at the visual cortex and function to bolster and direct the axons to their proper location. Then these subplate neurons disappear. These and other neurons that act as temporary support structures, along with the proteins and chemical cues previously mentioned, prevent the axons from wandering into incorrect areas and impairing brain functions. Some disabilities, such as cerebral palsy, autism, epilepsy, schizophrenia, and dyslexia are thought to be a result of wandering axons or improper connections.[7]

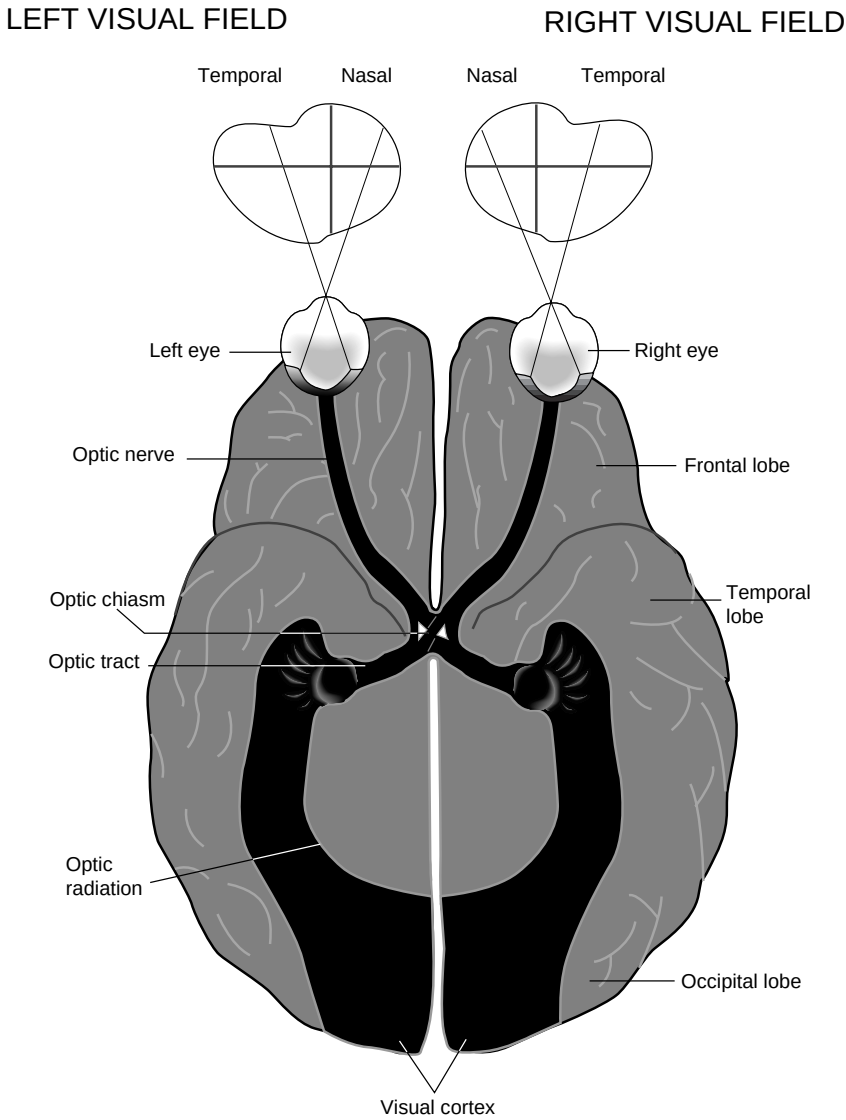


Figure 2-2 Pathway from retina to visual cortex

At birth, the brain weighs approximately three-quarters of a pound. The migrating axons have reached the correct general area but not necessarily the exact site. The neurons in the visual cortex alone form about 2,500 connections per

neuron at birth, and with proper stimulation, this rapidly increases to 18,000 connections per neuron after about six months. Stimulation, includ ing touching, speaking to the baby, and presenting different images, helps the brain increase efficiency and select correct sites. Research demonstrates that babies who are not stimulated have brains 20 percent to 30 percent smaller than normal.[8] This process of stimulation and mental reaction is much like fine-tuning a station on the old-style radio dial: If the message gets close to the proper site, but not exactly where it needs to be, the result is not as clear as if the tuning were exact. Each time the message is sent, the tuning becomes more effective, until at last, with sufficient testing of the connections, the signal is processed clear and free of static.

From birth, the baby learns to be efficient at transferring auditory, visual, and/or kinesthetic information. As you read to a child and point out the words, you are stimulating the auditory and visual aspects of learning. Taking a childÕs hand and tracing the letters reinforces the kinesthetic qualities. It is important that the child is exposed repeatedly to all the learning preferences in order to fine-tune the circuits used for each technique (more on that in just a bit). The more techniques the child can call upon during the school years, the more likely the child will be considered a success in the traditional school setting. The traditional school setting primarily supports visual and auditory learners.

As the brain learns what the correct representations are and which paths are most efficient at transmitting this information, it keeps the most-effective pathways and prunes the less-efficient ones. Connections, which are used on a regular basis and thus become fine-tuned, are retained, while other connections, which are inefficient or not used at all, are eliminated.[9] As many as 600 connections may be eliminated per seconddduring this pruning period. After the synapses and axons are operating correctly, the efficiency of the mental processing is dependent on genetic, environmental (including nutritional and sociological), psychological, and educational factors.[10]

The time after birth is extremely critical. For the first couple of years, the childÕs brain is most malleable. After approximately 8 to 10 years of age, the brain is not as adaptable to change. That is why young children who suffer brain injuries recover more quickly and completely than adults with the same brain injuries. We begin to develop our learning preferences before we reach school age. We already know whether we like to learn and how we want to go about it before we ever reach kindergarten. This is why the quality of the interactions of the parents or caregivers with the child are extremely critical to the learning process and the future success of the student. If you have been successful in learning in formal school settings, you probably are successful in real-life settings such as your job. If you have been unsuccessful in learning in the past, or if you are experiencing difficulty holding on to information from day to day, you can improve your capabilities. You can literally Òchange your mindÓ and be more efficient and reliable. But assuming you are an adult, you need to know the facts about how your brain operates in order to affect the processes. Please keep reading . . .

The Adult Brain

By the time the baby becomes an adult, the brain weighs approximately three pounds. This increase in weight is due to the increase in neuron size and the tremendous increase in the number of connections formed among the neurons since birth. Imagine trying to take billions of neurons formed in layers and trying to fit them into the skull. It is similar to trying to fit a piece of newspaper into a small box. Crumpling it in on itself would be a good solution. The layers of neurons form the gray matter and enfold the trillions of axons passing through the brain and interconnecting the neurons. The myelin sheaths covering the axons are white; this region therefore is described aswhite matter.[11] The cortex makes up 80 percent of the brainÕs volume and is the convoluted mass normally imagined when the word ÒbrainÓ is mentioned.

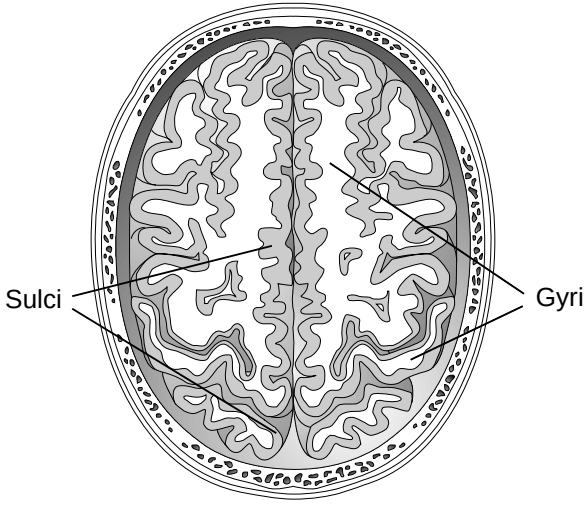


Figure 2-3 Top view of the brain showing both hemispheres

The grooves and folds, named sulci and gyri, respectively, that appear on the surface of the cortex are used as landmarks or reference points to locations within the brain (see Figure 2-3).

sulci Ñ grooves in the cortex
gyri Ñ folds in the cortex

One of the deepest of the sulci divides the cortex from the front to the back into two hemispheres. The two hemispheres are connected primarily by a thick bundle of nerves named the corpus callosum. (See Figure 2-4).

Just as bodies have the same general configuration (the head boneÕs connected to the neck bone, the neck boneÕs connected to the shoulder bone . . .), everybodyÕs brain has the same anatomical parts. Each of us has two hemispheres, a corpus callosum, grooves, and folds. These grooves (sulci) and folds (gyri) are so standardized in location that they are used as landmarks or reference points to locations and activities within the brain.

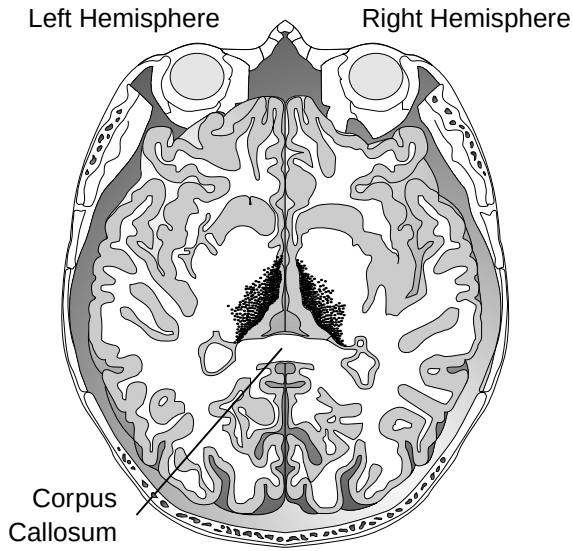


Figure 2-4 The hemispheres and their bridge, the corpus callosum

Brain Function Location

Some functions carried out by the brain have been identified as to location. The more basic functions of life, such as breathing, are located close to the base and the spinal column in the brainstem. The cortex handles the higher-reasoning skills, such as language, math, and musical abilities; and the appreciation of humor.

The Hemispheres

Common phrases overheard these days are *right-brained* and *left-brained*. These phrases refer to the primary location for specific mental activities within the brain structure (see Figure 2-5). The left hemisphere communicates with and controls the right side of the body, while the right hemisphere communicates with and controls the left side of the body. Although both hemispheres communicate with each other and share some functions, one hemisphere is considered dominant. The dominant hemisphere is the site for thought processes more involved in detailed and sequential analysis.

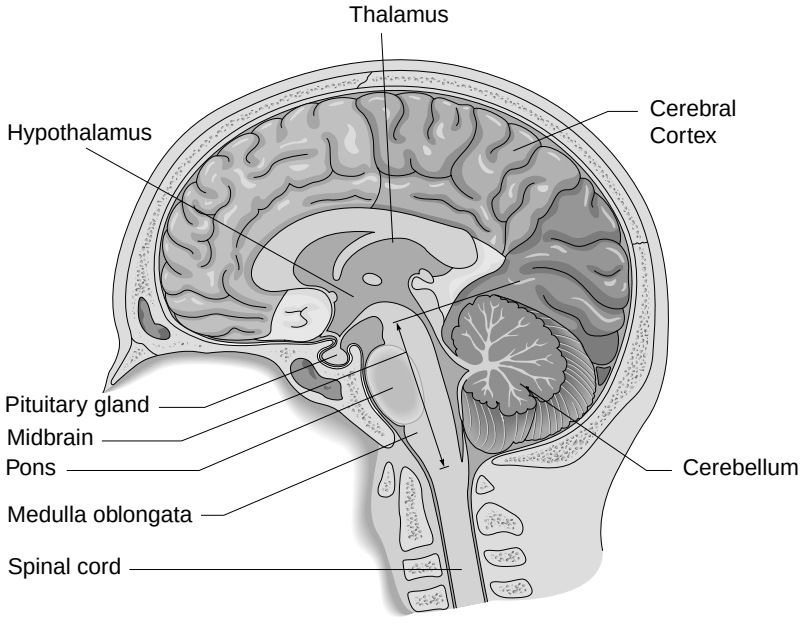


Figure 2-5 Basic structure of the brain

Whichever hemisphere is dominant, it is the other hemisphere that holds appreciation of forms and humor, mental arousal, physiological readiness to respond, orientation in space, recognition of voice timbre, musical talent, and appreciation of things that do not lend themselves to verbal descriptions.[12] This hemisphere is considered to be the home site for global thought processes that can be described as the ÒAha!Ó response, which is exhibited when a sudden understanding of a concept occurs without the ability to describe how the understanding was achieved. It often is assumed that the left hemisphere controls the verbal and analytical processes, while the right hemisphere handles the artistic, emotional, abstract relationships. This is true for only a portion of the population.

There are some clues, however, as to which hemisphere is dominant. Approximately 99 percent of the right-handed population and 56 percent of the left-handed population

write with the hand in a noninverted position. One percent of the right-handed population and 44 percent of the left-handed population write with the hand in an inverted position (see Figure 2-6). Dr. Jerre Levy performed experiments that revealed that the inverted hand position is a biological marker indicating that the hemisphere considered dominant for analytical specialization is on the same side as the writing hand. For those people who write with the hand in a noninverted position, the hemisphere opposite that hand is dominant. For discussion purposes, and because it is the case for most of the population, we will consider the left hemisphere of the brain to be the site for verbal and analytical abilities for the rest of this text.

We have all heard jokes regarding the differences between men and women. There is a biological basis for many of the qualities men and women find confusing about each other. For example, men and women differ at a very basic level from the description just given for the dominant hemisphere. While menÕs verbal abilities are predominantly

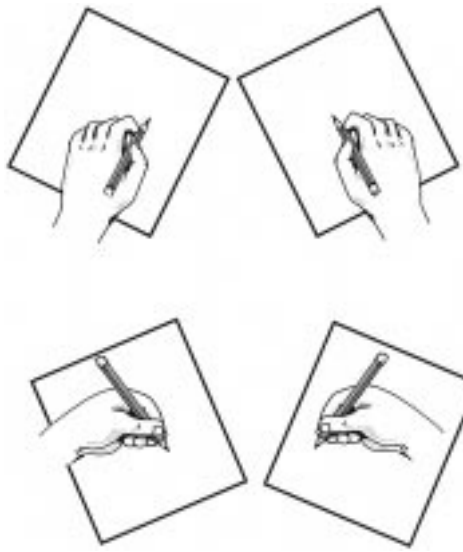


Figure 2-6 Hand position as a marker for hemisphere dominance

stored in a centralized location in the left hemisphere, a womanÕs verbal abilities are more diffusely located on both sides of the brain. This might explain why men have a slightly more difficult time expressing their emotions. They have to get the emotional information from the right hemisphere across the primary bridge (corpus callosum) to their verbal abilities in the left hemisphere, whereas women have some verbal abilities already located on the same side as their emotions.[13] See Chapter 3, ÒTeach Your Brain Agility,Ó for more details of gender differences.

Each hemisphere is further divided into lobes.

Each lobe has generalized functions. The frontal lobes have the capability to plan for the future, control movement, integrate emotional responses, and produce speech. The parietal lobes receive and process information received from the senses Ñ such as pain, taste, and smell Ñ and are involved with logic and mathematical processes. The occipital lobes handle vision. The temporal lobes hear and interpret language, tones, sound patterns, and music; and participate in emotion. The limbic lobe is responsible for sexual, emotional, and memory processing[14] (see Figure 2-7).

Researchers at the University of TorontoÕs Baycrest Center for Geriatric Care announced that the frontal lobes are where humor is processed. People with a brain injury to a frontal lobe donÕt get punch lines. They prefer slapstick

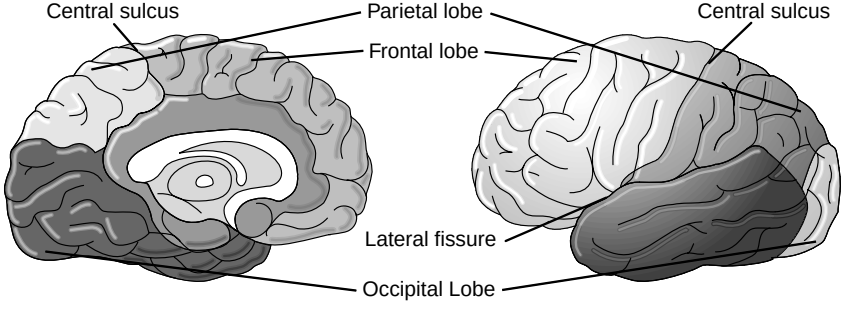


Figure 2-7 Side and central cross sectional views of the lobes

humor! The people with damage to that area had difficulty selecting the correct response to a joke similar to this one:

A teenager is being interviewed for a summer job.

ÒYouÕll get $50 a week to start off,Ó says his boss. ÒThen after a month, youÕll get a raise to $75 a week.Ó

Punch-line selection:

A. ÓIÕd like to take the job. When can I start?Ó (straightforward logical choice)
B. ÒThatÕs great! IÕll come back in a month.Ó (correct funny choiceÑ original punch line)
C. ÒHey boss, your nose is too big for your face!Ó (slapstick endingÑ right-frontal damaged patients are likely to choose this one)[15]

Now that we have led you through a discussion of the brainÕs general anatomy and structure, letÕs talk about the brain, learning, and intelligences so that we can apply this information to our learning capability. You know your abilities and talents. Maybe you are talented at fixing things, cooking, writing, solving crossword puzzles, cheering other people up, or gardening. Before you begin reading about intelligences (and all these ÒtalentsÓ are actually forms of intelligence), review your skills and abilities. Then see whether you recognize yourself in any of these intelligences. The following facts and figures will provide you with some interesting information if you have ever dealt with someone who has had a stroke or other brain injury.

MULTIPLE INTELLIGENCES

Seven Intelligences

Linguistic	Bodily-Kinesthetic
Musical	Personal
Logical-Mathematical	Naturalist
Spatial	

As a framework for our discussion of more specific capabilities of the brain, we will use Howard GardnerÕs theory of

multiple intelligences.[16] Gardner feels that too much importance has been placed on the types of skills and talents required to score well on standardized intelligence tests. A person who scores a high intelligence quotient (IQ) does so as the result of performing well on certain linguistic, spatial, and mathematical tasks. Gardner holds that there are at least seven intelligences that should be valued equally: linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, naturalist, and personal (which includes interpersonal and intrapersonal).

We will designate general sites for each of these mental activities within the brain. Remember that we are choosing the left hemisphere as the dominant hemisphere. If you are right-hemisphere dominant, you should switch the designated locations shown here to the other side of the brain. Also, when we discuss an activity (for example, mathematics), we will point out the area in which research shows the activity is concentrated. However, when you actually ÒdomathÓ in a practical application, other areas of the brain, such as language and spatial abilities, usually are involved. One area is not independent of the others.

Linguistic Intelligence

ÒThe Father of Waters rolls unvexed to the seaÓ was General GrantÕs telegraph to President Lincoln on the fall of Vicksburg during the Civil War. What a melodic, stunning report. Someone not so facile with the language might have said, ÒEnemy defeated at Vicksburg. Mississippi River now under Union control.Ó Lincoln, himself, days later while delivering the Gettysburg Address, used the robust passage ÒFour score and seven years agoÓ to replace the austere phrase ÒIn 1776.Ó

Some people, such as Grant and Lincoln, possess such a high linguistic intelligence that their ability to create finely crafted sentences progresses beyond precision and accuracy into the realm of an art form. Whereas the left hemisphere specializes in understanding literal meaning, there is good evidence that the right hemisphere helps in understanding and generating metaphors, humor, and irony. Subjects with damage to the right hemisphere understand words in an extremely

literal manner. When asked to show appreciation for a performance and Ògive someone a hand,Ó they would try to find a toy hand to give. When asked to complete jokes, the result would be senseless, awkward, and not in the least humorous.[17] The creative ability and imaginative use of words, located largely in the right hemisphere, is the essence that raises technical merit to a creative painting of pictures that evoke strong emotions and vivid interactions.

Photo courtesy of Khabir the Storyteller, P.O. Box 33191, Indianapolis, IN 46203

Khabir the Storyteller relates African and African-American stories and folktales in the oral tradition. Khabir may spin traditional African folktales in the style of the griot, he may use first-person interpretation in the character of Martin Delany (an African-American Civil War officer), or he may use some other character. In any case, audience participation is an essential pa of KhabirÕs presentations. Khabir, at 50 years old, has been a p fessional storyteller for 10 years.

ÒI like sharing stories that enhance understanding of African and African-American history and culture and reinforce good social values,Ó Khabir says.

He likes to use stories that are stimulating, sometimes humorous, and presented in an entertaining way.

According to Gardner in *Frames of Mind*, everyone can aspire to master four main objectives:

1. RhetoricÑ use of language to convince another individual that your opinion is correct
2. MnemonicÑ use of language to remember other information
3. Explanation Ñ use of language for teaching and learning
4. Metalinguistic Ñ use of language for analyzing previous statements for clarification or correction

Mastery of language and its uses requires expert knowledge and use of phonology (word sounds that interact), semantics (the meaning of words), and syntax (rules of word order to use as expected or changed to draw attention to a particular idea or image). Individual elements of a task (in this case, phonology, semantics, and syntax) may be localized within a specific area of the brain. These elements and their respective areas are activated in any number of combinations to complete that task.

The specific areas designated for these three elements are shown in the figure. These areas are referred to as BrocaÕs area (linguistic production) and WernickeÕs area (comprehension of linguistics). The area for processing sign language is located just below WernickeÕs area[18] (see Figure 2-8).

These areas are not the only ones used for linguistics. Marble-sized areas of neurons, primarily scattered through the left temporal and parietal lobes, specialize in functions such as nouns, individual rules of grammar, and production of verbs. You might be interested to know what parts of the brain exhibit the most activity when thinking and speaking words.

S Musical Intelligence

Interest in music may be expressed in different forms: listening to music, performing music, and composing music. While some people just Òmuddle through,Ó composers are

described as constantly hearing in their minds the notes and tones of their lives. It is not an act of will but rather a way of life, much like breathing or walking for those of us not so blessed.

Many children generate spontaneous songs in their early years, but by the age of six or seven, this ceases for the majority. Children then seem to rely primarily on the standardized tunes they are taught. Only a few continue to create music.

Most of the information available on music generation comes from observing musicians who have experienced physical trauma to the brain as a result of stroke or other brain damage. Damage to the left hemisphere exhibits *aphasia* (verbal-production impairment) or *amusia* (musical-production impairment). Subjects could talk coherently and not be able to function musically (amusia) or not be able to verbalize (aphasia) and still perform or compose. Some people documented in literature have had strokes that affected the left side of their brain, leaving them unable to speak a single word; yet they could sing song after song. Sometimes they required a trigger mechanism, depending on the damage, such as another person starting the song or a record to give them a Òjog.Ó

Although Dr. WetzelÕs grandmother was not a documented case, her experience is germane. She could not respond verbally to any question but could sing her gospel hymns for hours. However, she needed to hear a recording to get her started. In addition, AlzheimerÕs patients are often able to sing or play an instrument long after their recognition of friends and families has passed.

Although one of the main areas that facilitates music production also assists in verbal skills, music seems to be of the form of a symbolic or graphic system as opposed to an alphabetic, semantic system and thus is related closely to mathematical skills.

PET scanning was used in a study performed on 10 right-handed performers, each with at least 15 years of experience and self-rated as good to excellent sight readers. The study included two categories common to all instruments: sight reading and playing the instrument. [19] For this study, the in-

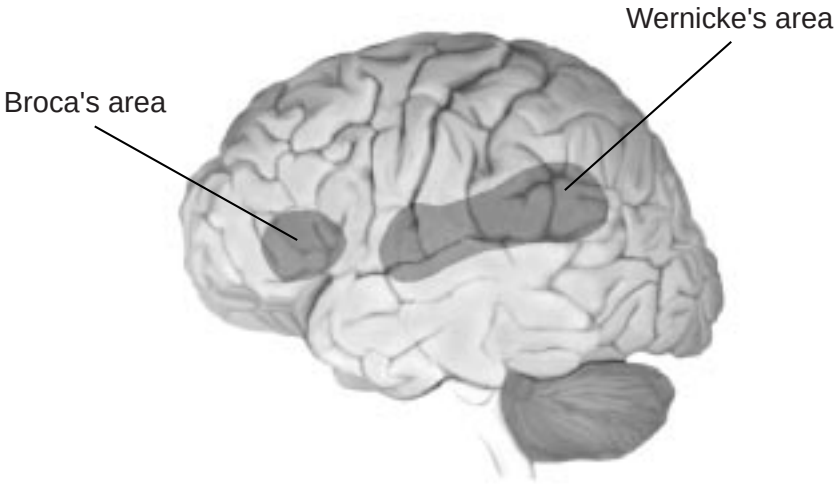


Figure 2-8 Location of BrocaÕs area and WernickeÕs area.

strument was a keyboard. Reading a musical score without playing operates both hemispheresÕ visual centers, as expected. Instead of stimulating the linguistic centers, the left occipitoparietal junction, normally used when processing spatial information, is activated. This agrees with the manner in which musicians use distance between notes on the staff to locate the next pitch and supports the theory that spatial abilities are fundamental to musical intelligence. As a matter of fact, the distance from the area of the brain activated when listening to low C to that area activated when listening to middle C is the same distance as that from the area listening to middle C to that listening to high C. [20]

The drawing in Figure 2-9 indicates the areas activated when listening to scales. Notice that listening to a musical composition (as opposed to the predictability of scales) activated the same cortical areas and an additional arc in the right hemisphere. Listening to music (scales being classified as practice, not music) affects the emotional and imaginative areas of the right hemisphere, whereas scales do not.

You can see the areas fundamental to playing music. Music requires fine motor control, and the picture shows the

Figure 2-9 Left: Listening to scales. Center: Listening to musical scores. Right: Playing music

primary motor and premotor areas active. Although music processing is located in both hemispheres, the more experienced a musician becomes in processing musical tones, the more the process seems to be located in the left hemisphere.[21] As skills become activated automatically, as opposed to having to concentrate on how to perform the action, they are considered rote performances and become located in a separate area of the brain in the left hemisphere.

The area of the brain thought to lift the technically correct performer to the level of an artist is the right hemisphere. Many people can play adequately, but this does not indicate a creative instinct. Those composers and performers who hear their lives as musical interludes have a depth of activation in the right hemisphere that may at various times seem a blessing or a burden.

@ Logical-Mathematical Intelligence

A pure mathematician deals not so much with numbers, as we remember our arithmetic classes, but with extreme abstractions that are built with reasoning and many lines of proofs into even more abstract results. To many people, these abstractions often seem to have no reference to the ÒrealÓ world. It may be difficult for many people who have had bad experiences in the past, to think of mathematics as a potential art form. However, as is the case with the other intelligences discussed so far, the creative genius that sparks new theories and applications seems to reside in the right

hemisphere. (A lot of readers would simply like to know where the average mathematical skills are based!)

The only available information regarding the location of mathematical abilities is from observation of those individuals who have suffered damage to the brain through an accident or stroke, or who required surgery. Gerstmann Syndrome is the designation for damage to the left parietal lobes and the temporal and occipital association areas adjoining them (part of the angular gyrus). Damage to these areas reduces the ability to orient oneself in space, understand certain grammatical structures (such as prepositional phrases and passive constructions), tell left from right, and perform numerical calculations. It also creates difficulty in drawing. The syndrome is characterized by damaging effects to the association cortexes in the posterior areas of the dominant hemisphereÑ those associated with recognizing ordered arrays and patterns visually (see Figure 2-10).

Deficits in calculation abilities can be grouped into three main categories:

1. Alexic and agraphic acalculia Ñ difficulty in reading and writing numbers
2. Spatial acalculia Ñ difficulty in dealing with the spatial organization of written numbers
3. Anarithmetria Ñ difficulty with the calculation itself

The first two types of deficits (difficulty in visualizing numbers) are linked to the visual system and/or associative memory areas. Damage to the posterior portion of the left hemisphere, near WernickeÕs area, results in the calculation disability.

Essential to the logical-mathematical ability, the frontal lobes play an important part in organization skills. The ability to plan a strategy to achieve a specific goal is housed in this area. Damage to the frontal lobes leaves an individual with not only an inability to plan a problem-solving strategy but also the inability to set goals and follow through in everyday life.

Figure 2-10 Area for mathematical calculation

The ability to handle mathematics successfully is somewhat dependent on the strength of the individualÕs spatial abilities (as in music). Also of importance is the ability to understand fully numerical relationships and concepts. Because this requires a sense of intuition and feeling instead of sequential proof, this ability is lodged in the right hemisphere. Again, this is rather similar to the organization of the brain when dealing with music. Music seems to lend a sense of order and beauty to expressions that mathematicians and scientists enjoy and appreciate. Teaching young children a musical instrument or exposing them to music, especially the classics, helps to organize their thought pro-cesses and make children more successful in mathematics.[22]

Spatial Intelligence

Second only to research on the linguistic operations of the brain is research regarding spatial abilities. Perhaps so much research is available on spatial abilities because it is some-

thing, like language, that we are all called upon to use. In addition, this is one of the primary mental abilities often tested on IQ tests.

An example of spatial abilities is the capability to answer the question, ÒIs the top of a horseÕs tail located above or below the level of its chin?Ó To answer the question, you must visualize
the horseÕs formation. Spatial skills consist of abilities to

1. Experience the world in three dimensions.
2. Understand scale models and recognize objects in unusual orientations.
3. Recall visual images in rich detail.[23]

The posterior (rear) portions of the right hemisphere are more crucial for spatial reasoning, although damage to the left hemisphere can cause a slight decrease in this ability. For most individuals, the right hemisphere is dominant (see Figure 2-11).

In general, men perform better at spatial tasks, especially rotation of objects, mathematical reasoning, and navigating through a route. Studies have been performed using men and women with normal hormonal levels and women who were exposed to prenatal and neonatal doses of the hormone androgen (due to genetic defects or the pregnant mother taking steroids). The increased spatial abilities apply to the women exposed to androgens early in development. Women who had not been exposed to the hormone did not perform as well. However, they did perform better at matching items, arithmetic calculation, recalling landmarks on a route, and precision tasks. They also showed greater verbal fluency.

Because the hormone testosterone is present in both men and women (at different levels), the next question raised is whether a direct relationship exists between the level of testosterone and spatial ability. Is there an optimum level of the hormone for increased spatial abilities? There is a range on the high end for womenÕs normal levels and the low end

Figure 2-11 Location of spatial ability in both hemispheres (right dominant)

for menÕs normal levels that is optimum. Too high on the menÕs scale or too low on the womenÕs scale reduces the spatial abilities. An individualÕs spatial abilities also fluctuate during the normal hormonal cycles for women and men (testosterone levels for men are lower in the spring than in the fall).[24]

Bodily-Kinesthetic Intelligence

Not often regarded as an intelligence, body intelligence is the ability to use the body in highly differentiated and skilled ways and the ability to use other objects skillfully.[25] Examples include acting, the skilled movements of the hands and fingers of an instrumentalist, ballet, and gymnastics. Figure 2-12 shows the primary areas for motor skills and control.

The Supplementary Motor Area (SMA) predetermines the general path of a movement or series of movements. Even as

simple a task as waving good-bye can become impossible to perform and impossible to learn if the SMA is damaged. [26] The premotor cortex and the basal ganglia aid in the planning and implementation of the path of the movement. The posterior parietal lobe, important in spatial ability, interacts with the premotor cortex.

The process of movement actually is accomplished with two loops through the system: a complex loop and a motor loop. The complex loop begins with instructions from the frontal lobes. The instructions then are fed through the basal ganglia and caudate nucleus portions and are sent to the thalamus. Then the information is fed back through the frontal lobes and into the motor loop. The motor loop begins with M1, where fine motor control is located. Some of the neurons located in M1 have direct access to the spinal column. The cerebellum is included in the pathway, because it appears to be the site of automatic motor responses (those skills that are Òsecond natureÓ).

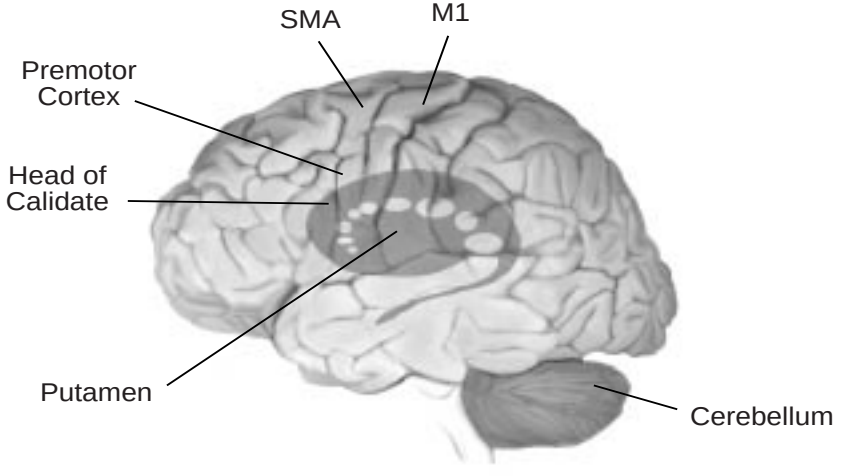


Figure 2-12 Location of the motor control system

Photo courtesy of Amy Aldrich

Automatic Motor Response

Ball Room Dancing is an example of automatic motor response (AMR). Sharon Mulgrew and Bryan Umeki have practiced their dancing so often that they now are operating from AMR. At the beginning, they had to concentrate deeply to learn the movements. It is this AMR feature of their brains that allows them to finally enjoy dancing.

While learning to drive, one of the authorsÕ sisters complained that is was hard to work the manual transmission. Her dad quipped that it would be hard at the beginning, but after a while, it would become automatic.

Some activities are performed so often that they become automatic motor responses (such as actions performed by a skilled typist or pianist). The reactions are too quick for true interaction between the stimulus (typing an ÒaÓ) and the reasoning abilities (Where is the letter ÒaÓ on a keyboard? There it is. Hit it.). When children first begin to write, the shapes and drawing mechanisms for each letter are matters of intense concentration. After years of practice, writing becomes automatic. The movements are stored in memory as

a single associate memory, ready to access and process in a fraction of a second. These memory associations, thought to be stored in the cerebellum, are like computer routines. The instructions are carried out in a specific order at an extremely rapid pace.

Sometimes skills become so automatic that it is difficult to explain the details to someone else. And slowing down the actions to explain the details often causes an error in the process. This explains why most people have difficulty writing with their opposite hand. The instructions in your brain are for the directions and movements of the dominant hand, and at times, you would have to move in a different manner for the other hand.[27]

M Personal Intelligence

Personal intelligence is one of the less distinct and comparable intelligences. Personal intelligence consists of intrapersonal and interpersonal knowledge. Intrapersonal knowledge is knowledge of self Ñ an ability to draw upon, evaluate, and symbolize your own feelings. Examples of intrapersonal experts might be a novelist or a wise elder. Interpersonal knowledge incorporates knowledge of relationships among people; the ability to notice details of othersÕ feelings, facial expressions, and tone; and the ability to influence others. Examples of interpersonal experts are politicians, teachers, and counselors.

The frontal lobes are the meeting place between the information from the posterior regions (involved in processing sensory information, including perceptions of others) and the limbic system (involved in motivational and emotional functions). Frontal lobes are where the self meets the outside world and the knowledge of self appears to reside. Noticing body language is a major component of interpersonal knowledge. The ability to notice fine details of the face and expressions is activated in the posterior region of the right hemisphere. This is the same area used to process spatial abilities. (Spatial abilities seem to be important for most of the intelligences.)

The intimate knowledge and understanding of your inner self, combined with foresight and insight, are essential to interpersonal and intrapersonal expertise. Your emotional behavior and personality, in combination with expert evaluative skills (judgment) also are critical to your relationships with others. Figure 2-13 indicates the areas of the brain that regulate these skills.

Self-knowledge can be misleading. Take young children, for example. At the age of 6 or 7, children become concerned with the acquisition of skills and knowledge. Peer pressure and the need to please oneself and oneÕs parents become quite influential. Influence by others that can be destructive at times may include adults and other children dissuading a young girl or boy from an interest in a nontraditional role. The child begins to doubt his or her own interests and abilities and chooses a secondary, more acceptable goal. The personal intelligence might be the one most important for each personÕs satisfaction with life.

¿ Naturalist Intelligence

Lately Gardner has been considering other forms of intelligences. The newest is that of naturalist intelligence. Not much has been written about this while Dr. Gardner refines his concepts. However, this much is clear: People who possess naturalist intelligence are attuned with nature. We sus-

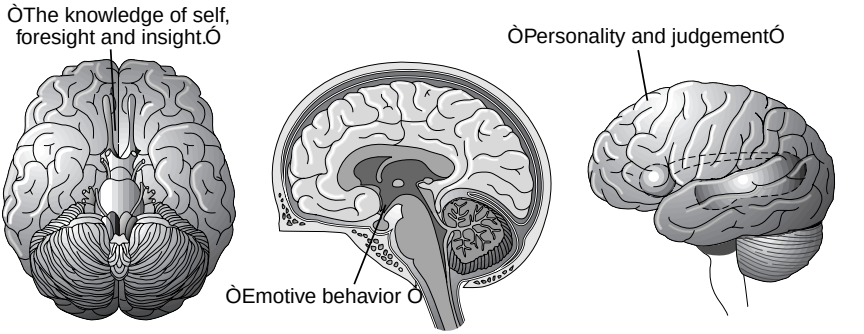


Figure 2-13

pect that they know the names of plants and animals. If they have auditory skills, they likely know birds by their calls. Weather is not a mystery to them. They are always aware of their surroundings and love to spend time outdoors. Their houseplants thrive, and their gardens are stunning. We look forward to learning more about the naturalist as Dr. GardnerÕs work progresses.

MEMORY

How do we acquire memories? The memory-formation system is made up of the hippocampus, the limbic thalamus, and the basal forebrain. Information is obtained through the senses, passed through the memory-formation system, and transferred to permanent storage in the outer layers of the cortex (see Figure 2-14). For information that you need on a temporary basis, nerve cells adjust existing proteins to hold the memory until you no longer need it. Then when the need is over, the neurons return to their original state, and you forget. If the information is something you want to store permanently, entirely new types of proteins are manufactured, new genes are Òswitched on,Ó and permanent changes to the connections in the structure of the brain are created.[28] So there is a difference in the brainÕs activation for a temporary piece of information, such as what you need to buy at the store, and a more permanent memory, such as your new telephone number.

Recent evidence indicates that the transfer of the information from the hippocampus to the cortex for permanent storage occurs while we sleep. For the maximum efficiency of memory transfer, you need to have deep sleep within the first two hours of sleep and rapid eye movement (REM) sleep later in the night, preferably toward the end of the sleep cycle. The same neurons activated earlier in the day, when the information first was introduced, fire in the same pattern and appear to download the information through the neuron connections to the cortex.

Photo courtesy of Winfield Leitzer

Older and Wiser

Rosemary Austin, 77, possesses naturalist intelligence. The Weather Channel is one of her favorites. She is very interested i and conscious of the times for sunrise and sunset, ocean tide moon phases, and the like. Her many and varied houseplants qua ify her for a Ògreen thumbÓ award. She never gets lost and alwa knows the shortest route to any destination.

She also possesses linguistic intelligence. Since retiring from successful teaching career, she has written several novels and very active in several romance writer associations.

No matter what our age, we can create new connections within the brain. It is repeated exposure to new information that grows these connections. The more connections we have, the deeper the brainÕs resources upon which to call. As adults, we can produce and fine-tune neuron connections much as a baby creates new connections after birth. We also can grow new cells, particularly in the hippocampus (the area helping us to store new memories and continue learning). Research such as the Seattle Longitudinal and Baltimore Longitudinal studies prove that not only can you maintain mental agility and performance as you age into your 80s and beyond, you

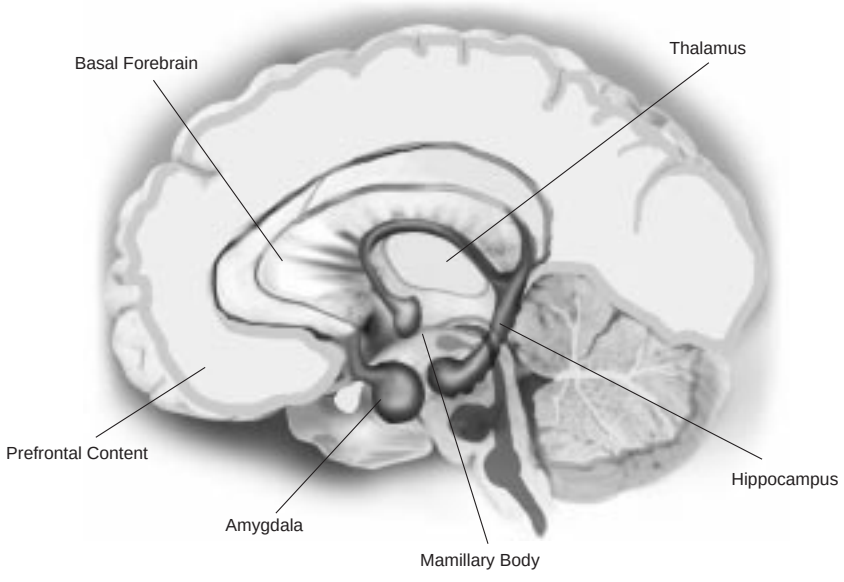


Figure 2-14 Memory storage systems

can regain performance levels you may have had in the past (see Chapters 6, ÒRegain an Agile Brain,Ó and 7, ÒEnjoy Your Ageless Mental Agility,Ó for more details).

Areas of processing that are used frequently increase in size and move into some of the surrounding areas previously allocated for other functions. If you donÕt use it, you do indeed lose it!

MULTIPLE INTELLIGENCES INVESTIGATION

Recall that Howard Gardner believes that there are at least seven intelligences that should be valued equally: linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, naturalist, and personal. Knowing your strengths will provide valuable information to you. First you will know what types of learning will come easily to you. Second, you will be able to understand, and learn to compensate for, the types of learning that are difficult for you.

Take a moment to speculate as to what your strengths might be. Choose three of the intelligences you feel you possess. Write them in the spaces below.

1. _____

2. _____

3. _____

The following sets of questions will help you to identify your own intelligence strengths. Place a check next to each sentence that describes you. Count the number of options you checked for each set of characteristics listed for each intelligence and place that number in the Totals column.

Intelligence	Indicators	Totals
Naturalist	___You notice patterns in nature. ___You know what the weather is supposed to be like. ___You know the names of many animals and plants. ___You recognize and classify minerals. ___You know what the phase of the moon is.	Total: _____
Bodily-Kinesthetic	___You enjoy activities where you can move about. ___You seldom injure yourself while exercising. ___You learn dance steps quickly. ___You would rather make something than read about it. ___You love to play sports rather than watch others play.	Total: _____

Logical-Mathematical

@

___ Puzzles and games are very easy for you to master.
___ Doing math is fun for you.
___ You are fascinated by machines.
___ You like to solve mysteries.
___ You tend to win arguments often.

Total: _____

Spatial

___ You seldom get lost.
___ You like to design new arrangements of furniture.
___ You can imagine what something will look like after it is built.
___ You like to do jigsaw puzzles.
___ You know whether or not a glass will overflow if you empty the rest of the milk bottle into it.

Total: _____

Linguistic

___ You love words.
___ Poetry is like music to you.
___ You have a large vocabulary.
___ You have written short stories, poetry or a novel.
___ You speak, read or understand several languages.

Total: _____

Musical

S

___ You sing, hum or whistle often.
___ You remember tunes easily.
___ You hear rhythm in everyday sound.
___ You play one or more instruments.
___ You have composed music.

Total: _____

Intrapersonal

M

___ You understand who you are.
___ You know your strengths.
___ You know your weaknesses.
___ You know what you want.
___ You are in control of your emotions most of the time.

Total: _____

Interpersonal

M

___You understand other people very well.
___You often become the leader in any group you join.
___ Other people tend to come to you for advice.
___You want to improve the human condition.
___You work well in a group.

Total: _____

Gardner thinks that we may have several intelligences and that we have all of them to one extent or another. If your totals are three or more, that indicates a strength in that intelligence.

With regard to GardnerÕs multiple intelligences, maximize your use of your dominant intelligences. Yet take the opportunity to develop those that are not your native intelligences. Intelligence is to a great extent learned. Experts still debate the Ònature versus nurtureÓ character of intelligence. While they debate, read on and see how much you can impact the quality of your intelligences.

We want you to be more aware of the activities of your marvelously designed brain. Often we donÕt appreciate being able to do something until we no longer can do it well or not at all. Picture how you felt when you couldnÕt breathe easily the last time you had a stuffy nose.

However, we want you to notice how you go about learning and what subject areas (intelligences) you prefer to learn, so that you can appreciate your mind, right now, and begin to exercise the various abilities of your brain.

The discussions regarding the various types of intelligences show that different parts of the brain are used for different functioning requirements. Some areas of your brain are stronger than others due to use. Remember as you use specific areas of your brain and they receive stimulation from the outside world, axons and dendrites in those areas are created and enlarged. But notice that if you exercise one of your skills, you still may be weak in other areas. That makes sense. If you are bench pressing weights to strengthen your arms and back, you will not be strengthening your legs. You need to exercise all areas of your body and so you also

Photo courtesy of Winfield Leitzer

Older and Wiser

After raising three children and working 16 years as a dry cleaner, Doris Waller, 53, looked for a change of pace. She had always enjoyed housekeeping, so she took on a job with a maid service. After a highly successful first year, Doris struck out on her own. Now she is president of her own housekeeping service D&W Cleaning, Inc., which serves professional offices and private homes. Doris has kept busy learning entrepreneurial skills for her expanding business. Her current task is mastering the computer so that she will be able to manage her own business matters.

A proud grandmother of six, Doris loves to keep active by dancing and taking long nature walks. An avid reader, she loves mysteries and keeps sharp by trying to figure out the mystery herself. SheÕll put the book down and rerun the action in her mind until she has a solution to the situation.

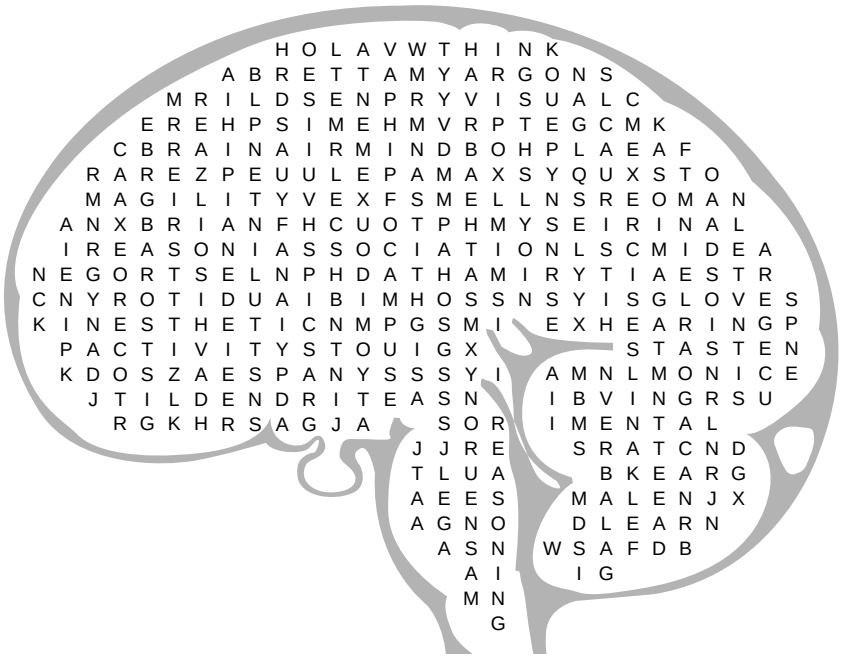
ÒIt helps,Ó she says, Òto think. I like to visualize into the distance what the place in the story looks like.Ó

Doris prefers reading to watching stories on television, because she finds TV boring. ÒItÕs all mapped out for you. ThereÕs little to think about!Ó

need to exerciseall areas of your brain. We will incorporate activities throughout the book to help you exercise all sections of your brain.

SEEK AND FIND PUZZLE

Here is a vocabulary activity that uses some of the words we define in this book. This puzzle is in the familiar Seek and Find format. Find the words in the array of letters inside the Òbrain.Ó The words may appear spelled forward or backward, up or down, as well as diagonally. When you find them, circle them or use a highlighter to identify them.



Seek and Find Word List

ACTIVITY	ESTROGEN	LEARN	SIGHT
AGELESS	EXERCISE	MEMORY	SMELL
AGILITY	GRAY	MENTAL	SPATIAL
ASSOCIATION	MATTER	MIND	SYNAPSE
AUDITORY	HEARING	MNEMONIC	TASTE
AXON	HEMISPERE	NEURON	TOUCH
BRAIN	HIPPOCAMPUS	PHYSICAL	VERBAL
CELLS	IDEA	REASONING	VISUAL
DENDRITE	KINESTHETIC	SENSORY	

The answer to this puzzle is on page 58.

SELF-QUIZ

In Chapters 1 and 2, you learned a great deal about how you learn and what your strengths are for acquiring new information. LetÕs take a moment to rehearse that knowledge. With this chapter, we introduce the self-quiz, a mechanism for organizing new knowledge and promoting long-term storage of it.

1Ð2, Check the response most like you:

1. My preferred style for learning is
   _____ auditory _____ visual _____ kinesthetic.
2. A secondary style I can use is
   _____ auditory _____ visual _____ kinesthetic.

3Ð5, Write in the blank.

3. An activity to increase proficiency in the third learning style might be _____
   _____
4. The nerve cells in my brain are called _____. (Hint: see page 21)
5. The message pathways that are created in my brain as I learn are called _____. (Hint: see page 21)

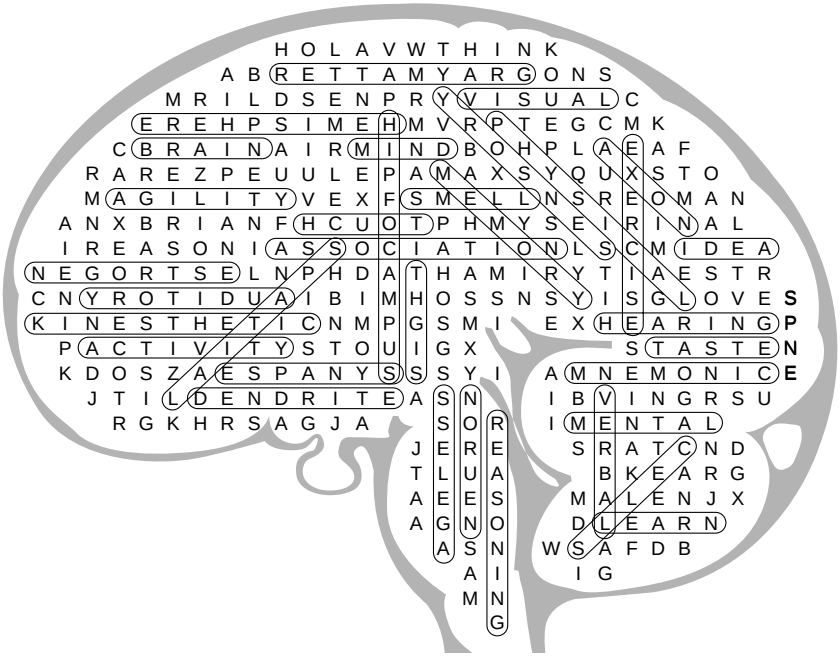
6, Check the responses most like you:

6. Of the seven multiple intelligences, my expertise lies in all of the following:
   ____Linguistic
   ____Musical
   ____Logical-Mathematical
   ____Spatial
   ____Bodily-Kinesthetic
   ____Personal
   ____Naturalist

7, Write in the blank:

7. An activity I might choose to increase my ability in one of the areas of multiple intelligences that at this time I do not possess would be _____
_____

Answer to the Seek and Find puzzle:



Seek and Find Word List

ACTIVITY	ESTROGEN	LEARN	SIGHT
AGELESS	EXERCISE	MEMORY	SMELL
AGILITY	GRAY	MENTAL	SPATIAL
ASSOCIATION	MATTER	MIND	SYNAPSE
AUDITORY	HEARING	MNEMONIC	TASTE
AXON	HEMISPERE	NEURON	TOUCH
BRAIN	HIPPOCAMPUS	PHYSICAL	VERBAL
CELLS	IDEA	REASONING	VISUAL
DENDRITE	KINESTHETIC	SENSORY	

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Chapter

3

Teach Your Brain Agility

Engineer Your Own Learning

KEY CONCEPTS

Environmental Effects on Learning
Emotional Effects on Learning
Social Effects on Learning
Gender Differences and Learning

INTRODUCTION

In Chapter 1, you determined your preferences for acquiring information: visually, auditorially, or kinesthetically. In Chapter 2, you learned more than you probably ever wanted to know about how your brain processes the information you obtain. Now one more aspect of the learning process, and you will be fully prepared to tackle the techniques and strategies we present in the following chapters. A complete understanding allows you to control your own learning processes in day-to-day living and the learning you will be experiencing as you read this book.

Not only do you have information-delivery sensory preferences, you have environmental, emotional, and sociological preferences.[1] These characteristics are controlled by theretic-ular system (physical needs and immediate environment), the

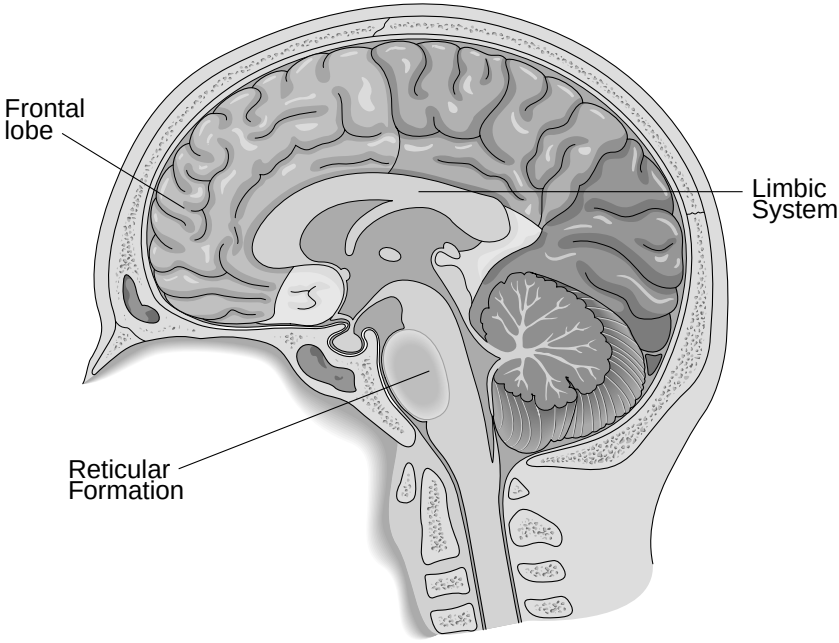


Figure 3-1 Control areas for environmental, emotional and sociological preferences

limbic system (emotionality), and the frontal lobe (sociological needs) of the brain (see Figure 3-1). For example, the reticular system functions to allow us to ignore distractions and concentrate on the task at hand. It is the subsystem used to ignore surrounding noises. It then causes us to pay attention to the noise when it changes. The limbic system is considered the source of emotional responses, and the frontal lobe has already been discussed in Chapter 2 as the seat of our knowledge of self.[2]

ENVIRONMENTAL EFFECTS

Your physical preferences include presentation styles, such as the size and legibility of the printed material, pitch or loudness of voices, and comfortable clothes in which to practice. Sometimes we canÕt remember things, or we

remember them incorrectly, because of the quality of the presentation. For example, if the personÕs voice who is giving you an address to remember is pitched too low or they mumble, you may not hear the address or you may interpret it incorrectly. Likewise, struggling to read small print may reduce your efficiency when storing material.

Whatever you need to do to reduce the drain on your energies and allow yourself to be more efficient in a learning situation, do it. Here are some strategies others have found successful:

- ¥ Try large-print books. If the book is not available in large print, some folks have purchased a handheld magnifying glass or bought reading glasses.
- ¥ Try books on tape. You can adjust the volume, and professional speakers have very clear, precise speech.
- ¥ If the problem is an auditory one, ask people to speak more clearly or to talk louder.
- ¥ Some people need to practice something by writing it down. You might try this technique. To help, you might begin to carry a small notebook in your pocket or purse.

We all feel that time is too precious to waste! We can be efficient with our learning strategies. If we absorb the information accurately the first time, we can save ourselves stress and worry. LetÕs find the fastest, most effective learning methods for you. After all, if we donÕt remember something important, we will be the one who suffers.

DonÕt spend time being frustrated by something that can be corrected.

Circadian Rhythms

The time of day affects your ability to function. This is a result of your personal biological rhythms. Circadian rhythms are cycles with a period of about one day.[3] Biological rhythms, especially the Circadian rhythm, are discussed in

more detail in Chapter 6, ÒRegain an Agile Brain.Ó You may describe yourself as a morning person, or you may recognize that you are most energetic in the afternoon. Circadian rhythms are becoming increasingly important in the medical field as studies indicate that matching medicinal administration, surgery, and cancer treatments to your circadian rhythm increases the success and survival rate.[4] One example of the circadian rhythm is that many individuals find their energy level to be at its lowest after lunch. In fact, in traditional Mexican cultures, a siesta is a normal part of their routine. We often assume this is a result of eating. But our energy level does not drop after eating breakfast or supper, so this may be a result of your particular circadian rhythm. Because of circadian rhythms, there are variations in learning readiness as well. Some studies indicate that as we grow older, we begin to prefer the morning hours when energy is at a peak. But this is not true for everyone; othersÕ energies may peak in the evening.[5]

Try to identify your time periods of peak performance. Schedule doctor visits or other important meetings when you are at your energy peak. Luncheons with business associates, relatives, or friends may be better rescheduled to breakfasts or dinners. You want to be at your best when interacting with others Ñ not only because you want to leave a good impression, but also because it will help you to interact mentally at a higher performance level.

A note about circadian rhythms: It is difficult to be sympathetic with someone who is two or three rhythms different from you. It takes patience and understanding to realize that this is a natural pattern, not an indication of another personÕs lethargy or excitability!

Circadian Rhythms Quiz

This assessment instrument can help you identify your circadian rhythms. Place a check next to the items in each category that are most like you.

Sleep Habits

1. _____I like to go to bed early, right after supper.
2. _____I like to go to sleep in the early evening.
3. _____I like to go to bed in mid-evening.
4. _____I like to go to bed after the late news.
5. _____I like to stay up late most of the time.
6. _____I am a night owl. I catch up on my sleep in the daytime.

Waking Habits

1. _____If I set the alarm clock for 7 A.M. or earlier, I often wake up before it goes off.
2. _____I like to get up about 9 A.M. or 10 A.M.
3. _____If I can sleep in, I usually wake up about 11 A.M.
4. _____I could sleep all morning.
5. _____I feel groggy if I have to get up before noon.
6. _____Wake me about 2 P.M.

Mental Peaks

1. _____I think best when I first get up in the morning.
2. _____I tend to do my best thinking in the midmorning.
3. _____Luncheon meetings are my best time to get things done.
4. _____I am at my best in the afternoon.
5. _____I put off weighty decisions to the evening hours.
6. _____Late-night hours are my most creative and productive.

Energy Rhythms

1. _____I wake up early and whistle or sing while getting dressed.

2. _____I start to get going about 10 A.M.
3. _____If IÕm up in the morning, not much gets done. But at lunchtime, I come alive.
4. _____I get a surge of energy in the afternoons.
5. _____I tend to make appointments for evenings, because I have the most energy then.
6. _____I would really like to work at night and be home during the day.

You may have noticed a pattern to the answer options. All responses to number 1 indicate that you function best in the early morning, 2 in the late morning, 3 midday, 4 midafternoon, 5 early evening, and 6 late at night.

In learning situations, many people want silence in order to concentrate, while others prefer background noise such as music. With the passing of years, a natural preference for background noise may interfere with our ability to learn as our hearing becomes less acute. If you are trying to concentrate and someone is making too much noise, ask that person to be a little quieter. Try earplugs if you need quiet.

Other Environmental Effects

Other environmental factors that affect our ability to process and retain information are temperature and light. If the surrounding temperature is too high or too low, we are uncomfortable, irritable, easily distracted, and our ability to concentrate lessens. As we age, we require better lighting in order to see more clearly. Proper illumination allows us to see a speakerÕs lips to assist our hearing, to read more easily and more quickly, and to perform tasks more accurately.

When you are experiencing difficulty concentrating, whether to memorize something or to recall something, check out your environment. Is the temperature comfortable or the light bright enough? Are there too many distractions? Are you struggling to hear or read? Do you need to move around or find a pencil and paper to doodle? You need to accommodate your natural preferences and requirements in

order to operate more efficiently. Even if something you want to do seems silly to others, do it. WouldnÕt you rather learn what you need to know?

EMOTIONAL EFFECTS

Mental abilities decrease more in people who experience negative emotions, such as depression, anxiety, bitterness, and anger, than in those who are happy or content with their lives. Robert Sapolsky, author of Stress, the Aging Brain and the Mechanisms of Neuron Death, theorizes that stress-related release of adrenal hormone bathes the neurons and eventually can damage the brain.[6]

Some of emotionÕs effects on the brain are merely distracting. Here are a few examples of those effects:

- ¥ Depression affects your motivation to remember, your ability to concentrate, and your perception of circumstances. It also can cause overreaction to slight lapses in memory.
- ¥ Moving to a new home can cause feelings of loneliness, grief, and an inability to concentrate.
- ¥ Retirement sometimes creates feelings of a lack of purpose, sadness, and a sense of loss.
- ¥ Often as we age, anxiety, loneliness, depression, and feelings of a lack of purpose increase.

These negative emotions cause us to disengage from life. Older adults should indeed become more concerned with the quality of life in their golden years. But they should not remove themselves from activities. Better that they recenter on what is important. Once we begin to withdraw from contact with others (perhaps because of ill health, a change in finances, moving to another location, or loss of a spouse), it is difficult to force ourselves to resume social interactions. People who regularly and actively engage in social interactions have better overall health and well-being than those who do not. And inactivity combined with little or no social contact

diminishes or eliminates the need to exercise those brain cells and to practice remembering.

First, get a checkup to eliminate any physical reason for negative emotions. Then try to get busy. Here are some suggestions:

- ¥ Join a support group.
- ¥ Enroll in interesting classes.
- ¥ Make a new friend and learn something new together.
- ¥ Interact!

Work to improve your outlook on life. It will improve your mental capabilities as well!

SOCIAL EFFECTS

Your personality and sense of responsibility affect not only your relationships with others, your job, and your hobbies, but also your learning abilities and style. Some people are very self-driven. They are more likely to be lifelong learners. Many tend to be independent learners and do not require structured classes with instructors to guide them. Other individuals are peer-oriented and often follow the lead of another in unfamiliar situations. They are more likely to benefit from the assistance of a formal teaching environment. They may be less likely to pursue learning throughout life without direct access to formal learning scenarios or the influence of a friend or spouse.

It is vital to your health and longevity to remain a lifelong learner. Research studies indicate that lifelong learners tend to take better care of themselves, to be more aware of current health issues and breakthroughs, and to show an increase in IQ.[7] The increased IQ is extremely pertinent to you. In fact, a study of identical twins demonstrated that when one twin had a noticeably higher IQ score, that twin always lived longer.[8]

People who are more intelligent tend to live longer than people who are less intelligent.

Photo courtesy of Winfield Leitzer

Older and Wiser

Bob Gifford, D.Ed., 79, was recruited into a volunteer program after retiring from 27 years with the county school system. He joined a group of enterprising people who helped other seniors prepare their income-tax returns in a program jointly sponsored by the American Association of Retired Persons (AARP) and the local Department of Aging. Eventually, Bob became the countywide coordinator of the program. He was busy recruiting volunteers, training them, managing paperwork, and reporting to the sponsoring organizations. Bob says that he found the work as challenging as his assignments in the workforce. The frequent changes in tax laws and the unique tax-related situations of many of the seniors kept him learning new things.

Bob spends the rest of the year working on other community projects. So much so that the local elementary school created a fitness trail and dedicated it in the names of Bob and his wife Rita. Now to keep up with two active grandchildren who live several states away, Bob is learning to use a computer. He quips ÒSurely e-mail is only the tip of our learning curve as we get acquainted with the full potential of cyberspace.Ó

Because most IQ tests measure your linguistic, mathematical, spatial, and logical deduction capabilities, start exercising those areas of your brain. If you donÕt want to take a formal class, use some word puzzle books, increase your vocabulary, start writing your life story, do logic puzzles, draw, paint, brush up on your math skills. Increase your intelligence. Increase the quality of your life.

GENDER DIFFERENCES

Our culture acknowledges equal opportunity for both sexes. However, the sexes are not equal. Some physical differences show up even before we are born. Gender differences are caused by the effects of both genes and hormones on the developing fetus. (See Chapter 2 for more details regarding the development of the prenatal child.) Genes alone do not determine the sex of a child. Appropriate hormonal levels must be present to ensure the proper growth of the fetus. These levels affect the internal wiring of the brain. For example, research indicates that individuals may have the chromosomes of a male, but without the necessary bathing of the fetus with male hormones at each of three critical periods during gestation, the child may appear physically female or may not be as traditionally masculine as expected[9].

From the time of birth, males and females exhibit different preferences and abilities. In general, men see better in bright light, and women see better in the dark. Women are more sensitive to changes in pitch. As an example, when a woman begins to be annoyed, most of the other women in the room will know this immediately by the tone of her voice. However, the majority of men will not be aware of her annoyance until the change in pitch is much more pronounced. It is not that they are not paying attention or ignoring the annoyed womanÕs signals; they just do not detect the slight variations as well as women do. The following table lists a few of the other common differences.[10]

Men	Women
See in a narrow field	Greater peripheral vision
Greater depth perception	Less depth perception
More sensitive to saltiness	More sensitive to sweets Greater preference for sweets
Better hand-eye coordination Better at spatial abilities, such as constructing 3D objects from a flat design	Better at reading facial features Prefer to turn a map so that it is oriented in the same direction as they are traveling
Give directions using north, south, etc.	Give directions using visual cues, such as Òturn right, thereÕll be a white house on the cornerÓ
Better at abstract mathematical theories and relationships (better at story problems)	Better at algebraic processes such as adding, dividing, etc.
More prone to verbal difficulties; almost all people who stutter are male	Better verbal abilities
4 out of 5 dyslexics are male	Learn to read and write faster Find it easier to master foreign languages

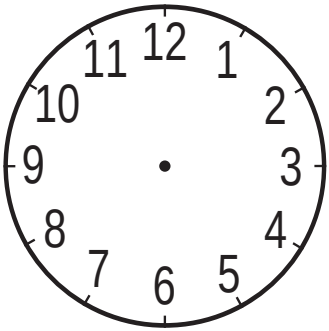
These differences in preferential skills and abilities begin to be noticeable soon after birth and continue into adulthood. These preferences affect our abilities to notice details and to communicate in our personal and professional lives; they even affect the strategies we use to achieve success in our choice of goals. These differences between the sexes do not make one sex better than the other. We are different and complement each other. As the French say, ÒViva la difference!Ó

SELF-QUIZ

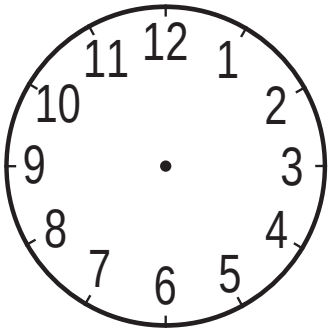
Were you aware of the many factors affecting your mental abilities? LetÕs take a few moments to review your lifestyle and preferences.

Circadian Rhythms

What time of day do you feel your energy. level is highest? Color in the times of day and night that you are most energized. Use the clocks shown.

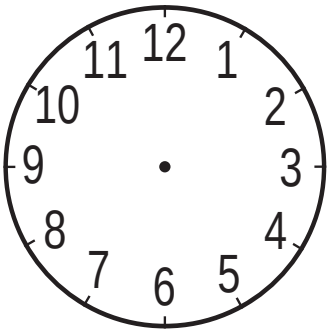


AM



PM

Color in the times of day and night that you have the least energy. Use the following clocks.



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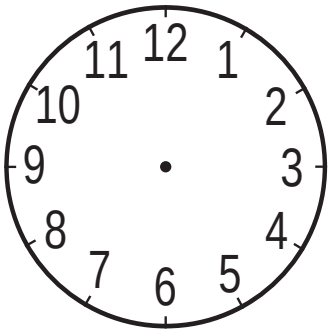

PM

Note these times. Perhaps you can reschedule activities that require high levels of mental capability to those times.

Distractions

Choose from the following list those items that are most like you

1. _____I am not distracted very easily. When I concentrate, itÕs hard to interrupt me.
2. _____Some noises interrupt my train of thought, such as these:_____
   _____.
3. _____I am easily distracted. I can do the following to minimize distractions while IÕm trying to think:
   _____
   _____.

When attempting to perform a task or remember a piece of information, distractions or background noise may make you forget where you were or what you were trying to remember. Start at the beginning and try again. Try to notice whether you forget what youÕre doing with or without distractions present. Be confident. It may not be memory lapses. Perhaps you simply got distracted from the task at hand.

Remembering

Notice what type of information you are concerned about forgetting. Be specific about whatÕs bothering you. For example, ÒHave I always been forgetful about meeting times or places? Names? Messages?Ó

List a few problem areas

1. _____
2. _____
3. _____

After you identify a problem area, try to decide why youÕve changed (unless you determine that you have always been forgetful!).

List some reasons why these areas you wrote about have become a problem:

1. _____
2. _____
3. _____

If youÕre worrying about becoming senile, ask others. Ask your friends. Ask them whether you seem to be forgetting more often than before.

Here are some questions you can ask about remembering:

1. _____Is the importance of remembering less acute?
2. _____Has job pressure been reduced?
3. _____Have I retired and am now ÒrelaxingÓ too much?
4. _____Did I pay enough attention to the information when I encountered it?
5. _____Am I grieving over the loss of a loved one?
6. _____Do I miss lost friends due to a recent move?

Here are some explanations that might help you understand some of the reasons you were forgetting things. Perhaps you lost a spouse to death or divorce, and you were in the habit of depending on that spouse to remember things for you. Grief may cause you to become more easily distracted. Often, when you think you forgot something, or youÕre accused of forgetting something, you simply did not pay enough attention to pass the information successfully to long-term memory and then create an association to retrieve it. Most information never makes it to long-term memory. Not paying adequate attention accounts for approximately 50 percent of reported memory problems. However, not only do you need to get the information successfully transferred to long-term memory, but you must be able to re-

trieve it. Thus, you need an incentive to make it worthwhile to concentrate, store the information, and create an association to retrieve it. The incentive may be job security, pride, or health, for example.

Chapter 4, "Develop a Brawny Brain," discusses various strategies you can use to reinforce your current learning techniques. Applications and games using various strategies are provided so that you can practice new techniques and refine old ones to improve and maintain your mental agility.

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Chapter

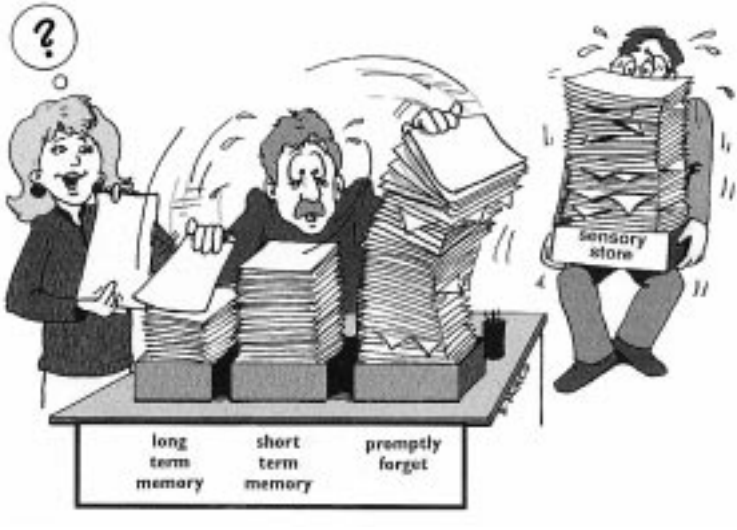
4

Develop a Brawny Brain

Build a Mental Agility Exercise Program

KEY CONCEPTS

Distractions and Attention
Information-Storing Preferences
Information-Retrieval Strategies
Information-Processing Activities



INTRODUCTION

You learned in earlier chapters how exercising your brain can improve your intellectual ability. In this chapter, weÕll introduce you to basic storage and retrieval techniques that you can use as part of your mental-agility exercise program. More advanced variations of these techniques and exercises are presented in greater detail in Chapters 6, ÒRegain an Agile Brain,Ó and 7, ÒEnjoy Your Ageless Mental Agility.Ó

Mental exercises can take many forms: brain teasers, games, puzzles, bridge, going back to school, and more. Learning something new, whether in a formal school setting or independently, is an excellent exercise. Distinct areas of the brain are activated as you graduate from a novice to a more experienced level in mastery of a technique or subject. Figure 4-1 is a PET scan that demonstrates the various areas of the brain that are energized and exercised when a linguistic technique is introduced. The subject is observed while still a novice and unpracticed, versus when he or she is experi-

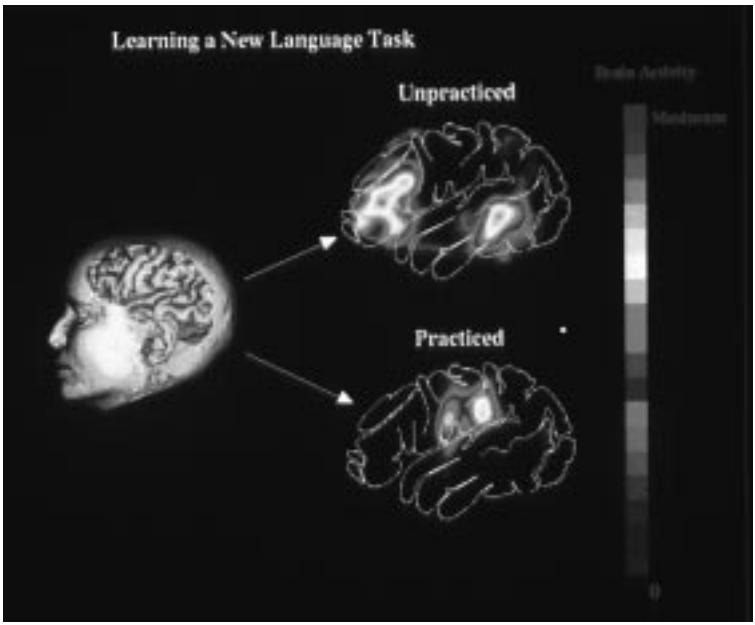


Figure 4-1 PET scan of brain activity of novice compared to expert

enced and practiced. Notice that as you become familiar with a topic, the area of the brain being used will change. Remember from the first two chapters, though, that the areas of the brain that are activated depend on what you are learning and how you are going about learning it.

Remember when you last learned something new? Perhaps it was learning a new dance step, making a new recipe, or trying to use a new piece of equipment. Try to think of that last thing you learned. Check as many as apply to you.

Did you have to:

_____ Learn new words?
_____ Memorize anything?
_____ Look up information?
_____ Ask someone for information?
_____ Practice anything?
_____ Explain what you learned to someone else?

Was it:

_____ Hard to learn?
_____ Not so hard to learn?
_____ Easy to learn?

Were you:

_____ Fascinated?
_____ Fearful?
_____ Fine?

Initially, you probably had to exert a lot of effort and concentration. People who are learning a new dance step, for example, find that it takes a great deal of concentration at the beginning. As you mastered the topic of interest, you likely required less conscious effort. Notice in Figure 4-1 how the PET scan demonstrates a decrease in the energy required to perform the task as the subject became more expert and

comfortable with the technique. The subjectÕs brain became more efficientÑ the same as your brain becomes more efficient as you become more expert.

As you became more interested in the subject, did you talk to other people about your newest interest and get their input? Perhaps you searched out information to make you more knowledgeable in the same topic or a related one. The benefits are quite broad. By talking to others, you exercise other areas of your brain, such as the intrapersonal or linguistic area. You also might have branched into other areas, such as the right hemisphere for a touch of imagination to become more innovative, or perhaps tapped into your spatial abilities.

In this section of the book, we are going to present various strategies to process information and learn something new. Be aware that by practicing these techniques in a learning situation, you are exercising many regions of the brain. You might feel rusty in the beginning, but remember that as you practice, the activity shifts into other areas of the brain, and you become more efficient as you become more practiced and relaxed. You wouldnÕt want to exercise only one area of your body, so be sure that you practice all the following techniques in various types of learning situations and exercise all of your brain. Also be sure to discuss and practice these techniques with your friends and family and exercise those linguistic, intrapersonal, and interpersonal skills.

INFORMATION PROCESSING

Information processingdescribes an active method for learning something new. It is very easy to allow new information to pass us by. It takes a dynamic analysis of the information to make sense of itÑ to move it from short-term to long-term memory. You must make the new information meaningful for your brain so that the ideas will become important enough to make their way to long-term memory. In this chapter, you will learn how to work with information so that you can better remember it.

When we were young, we preferred to use one hand more often than the other. Over time, we became skilled with that hand and rarely used the other hand except for balance or coordination with our dominant hand. We can perform gross motor skills with the other hand, such as opening a door or petting an animal. Without thinking about it, we simply use our dominant hand. Some people who have lost function in their dominant hand find that, with practice, they can become facile with their less-dominant hand. Their handwriting may never be as clear with the new hand, but it can be understood.

So it is with our preferred learning styles. Early on, we all found the best way for us to learn and, without thinking about it, applied that style to every situation. In Chapter 1, you learned what your dominant learning preference is, while in Chapter 2, you evaluated your natural intelligences. In this chapter you will explore supplementary ways to learn and how to develop your less-dominant learning styles and increase your use of the other intelligences. This information will provide you with a wide spectrum of fresh tricks to use when trying to learn something new!

You can assess your current information-processing skills before reading this chapter by taking the preassessment that follows. Then, after reading about how to learn more efficiently and practicing your new skills, you may reassess your processing ability with the postassessment at the end of this chapter.

INFORMATION-PROCESSING PREASSESSMENT

Directions: Read the following paragraphs. Then answer 10 questions about the information regarding Figure 4-2.

Suppose you are going to run some errands. You should drive to these places, because some have drive-in windows and you will have much to carry. You need to take six shirts and a suit to the cleaners, pick up shoes at the shoe repair, and get two birthday cards at the drugstore where you have to pick up a prescription.

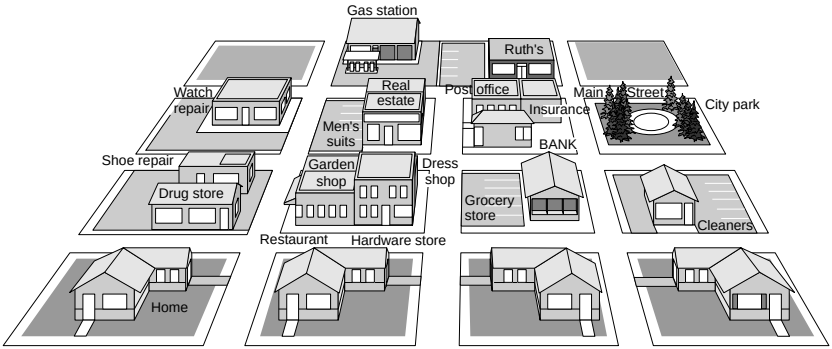


Figure 4-2

Your wristwatch is repaired and ready for pickup. You also need to get bread, ice cream, bananas, rice, and soup at the grocery store. You made a list, but somehow it got lost along the way. Your sister is waiting for you to pick her up at RuthÕs beauty shop. YouÕd better get going. The bank closes at 2:30 today, and you have to deposit your check.

Now answer the following questions, being sure not to look back at the information just reviewed.

Questions

1. What do you need at the grocery store?_____
   _____
2. Who is waiting at the beauty shop? _____
3. Did you need to go to the post office? _____
4. What is the name of the beauty shop owner?_____
   _____
5. What do you need to drop off at the cleaners? _____
   _____
6. What other places do you need to visit?_____
   _____
7. Which is closer to the post office, the bank or the drug-store?_____

8. What do you need from the hardware store? _____
   _____
9. Do you need to drop off the shoes at the shoe repair?
   _____
10. What do you need at the drugstore?_____
    _____

After you complete the questionnaire, check your answers at the end of this chapter in ÒSolutions to Exercises and Games.Ó

This is a very difficult exercise. DonÕt be discouraged if you couldnÕt answer every question. In the following sections, you will learn techniques for improving your ability to work with exercises similar to these. Move ahead with the notion that you are collecting new tools, looking for new ways to a solution, and listening for new tips.

DISTRACTIONS AND ATTENTION

It is vitally important to the learning process that we pay attention and do not allow ourselves to be distracted from the information we are trying to process. We are trying to get this information from short-term memory (STM) to long-term memory (LTM), and this requires the brain to restructure. (See Chapter 2 for details.)

LetÕs take, for example, the seemingly simple but amazingly complex task of learning another personÕs name as we are introduced. Many people are quite eager (and seemingly proud) to announce that they cannot remember peopleÕs names even if they have just been introduced. They can acknowledge that an introduction has taken place, but they have no recollection of the name of the person. Often, the problem is easy to diagnose. At the instant of an introduction, the personÕs name is in the sensory store. We should be making efforts to pass the personÕs name to STM and on to LTM. And indeed we are concentrating, but not necessarily