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AMERICAN CONGRESS OF
REHABILITATION MEDICINE

Evidenced-Based Interventions for Impairments of Memory

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ACRM AMERICAN CONGRESS OF REHABILITATION MEDICINE

Improving lives through interdisciplinary rehabilitation research

DISCLOSURES

Thomas F. Bergquist, Ph.D., ABPP-CN
Has no financial or other interest to disclose

FIRM and ACRM staff have no financial or other interest to disclose.

This CME activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education thru the Joint Sponsorship of the Institute for Medical Studies (IMS) and ACRM. IMS is accredited by the ACCME to provide continuing medical education for physicians.

Learning Objectives

- Identify the general guidelines for the use of external memory strategies.
- Define and state the training stages in Memory Notebook procedures.
- Identify types of external memory devices and aids.
- State the procedures for the treatment strategies for severe memory impairment
- Define and state types of metacognitive strategy training for memory impairment.

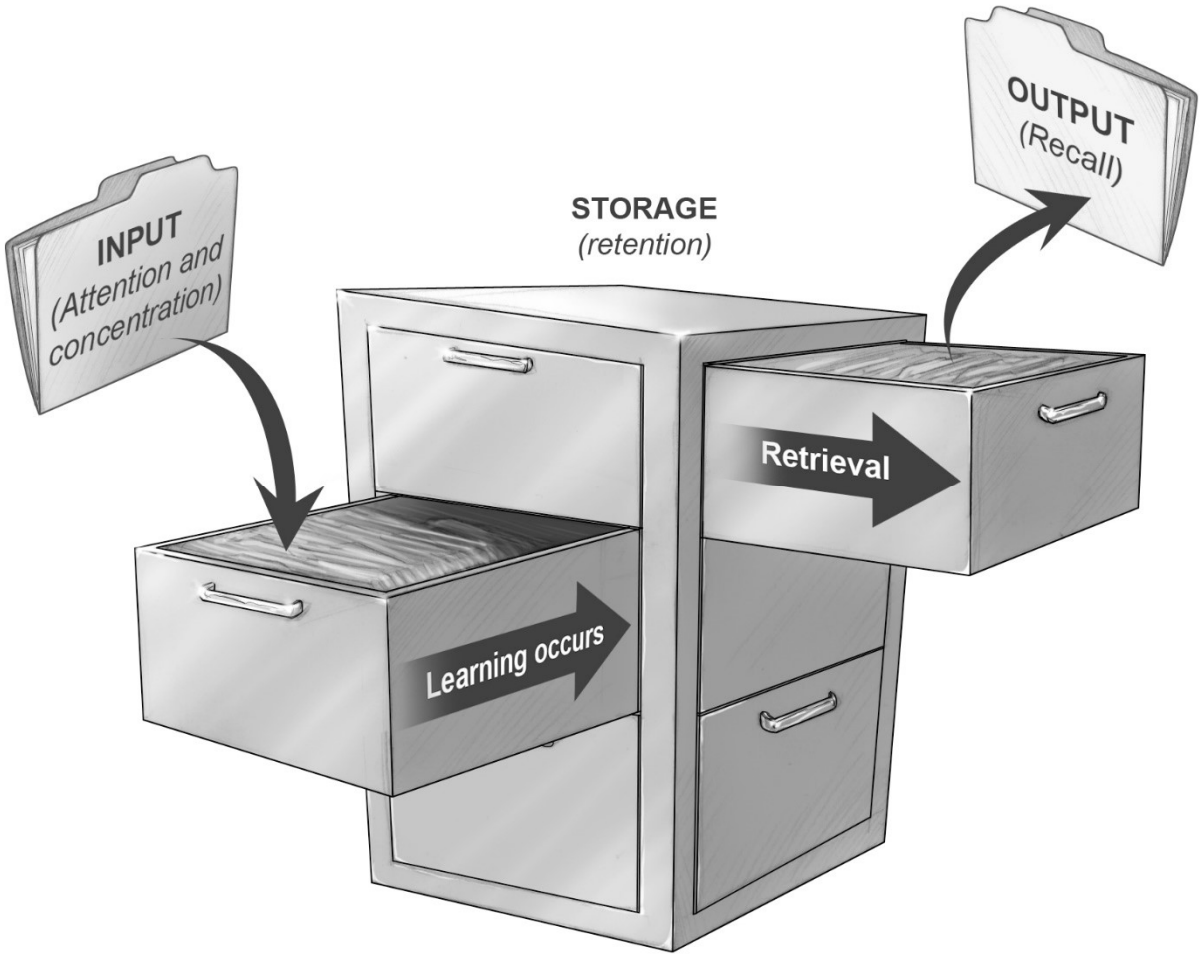
Outline for the Presentation

- Overview of Memory Systems
- BI-ISIG Recommendations for Memory Impairment
- Determining which Approach to Use: External Compensations or Strategy Training?
- External Compensations
- Strategies for Severe Memory Impairment
- Memory Strategy Training

Components of Memory

(Sohlberg & Mateer, 2001)

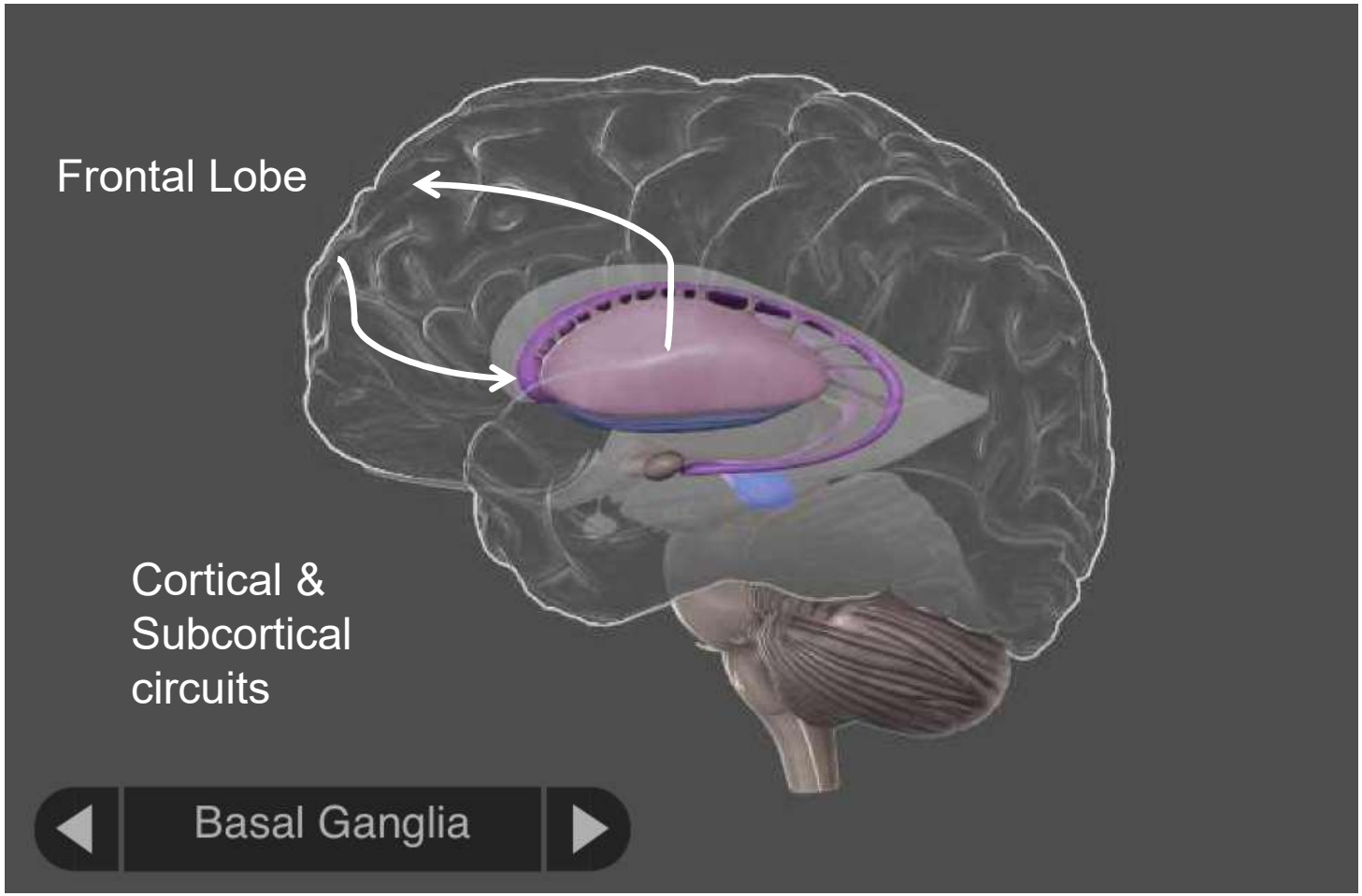
Memory Process



Neuroanatomy of Memory

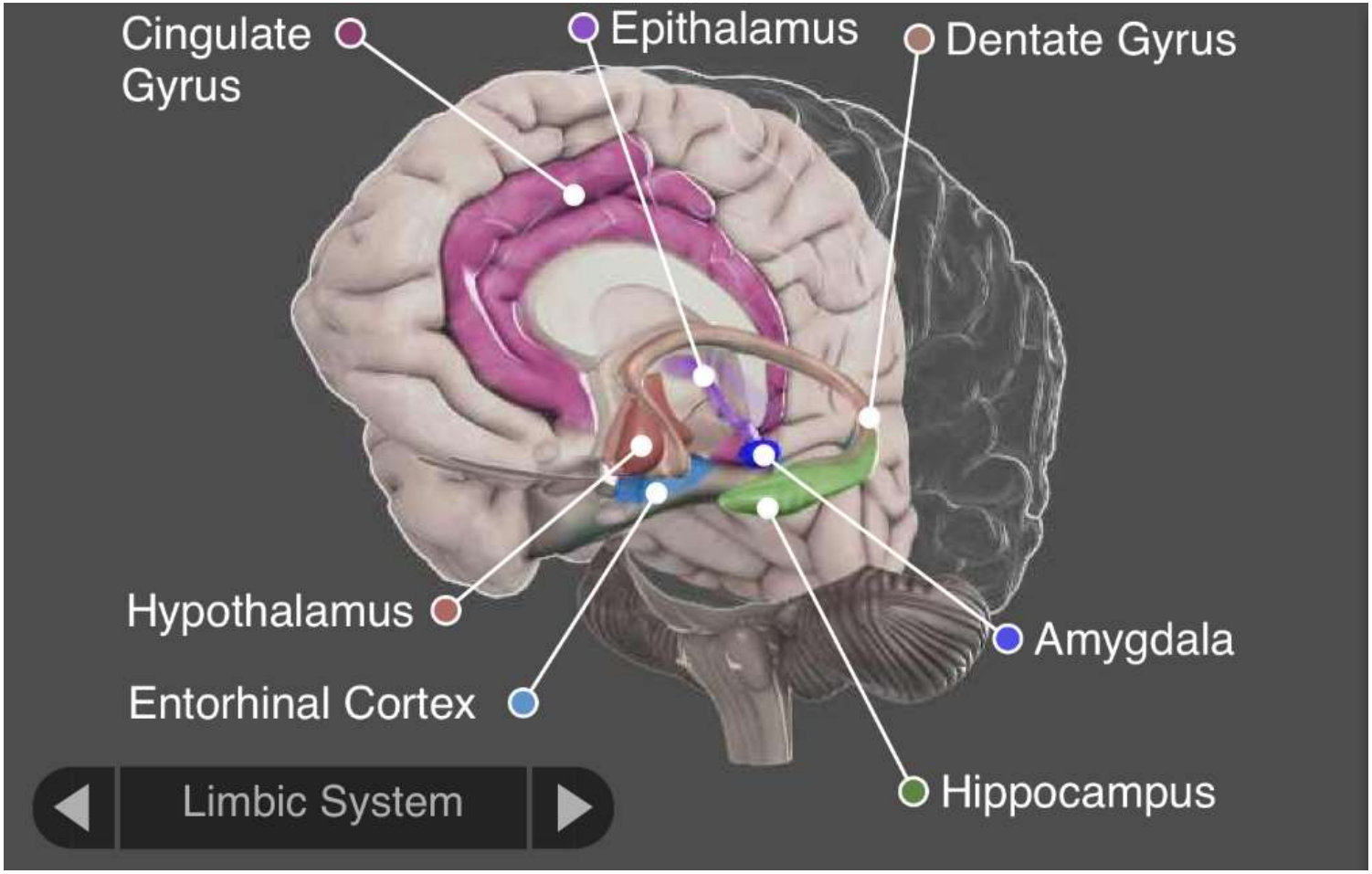
BRAIN REGION	MEMORY FUNCTION
Frontal Lobes	Retrieval
Subcortical Region (hippocampus, amygdala, striatum)	Declarative memory (facts, events)
Cerebellum, basal ganglia	Procedural memory for motor learning

Neuroanatomy of Memory



(3D Brain HQ)

Neuroanatomy of Memory



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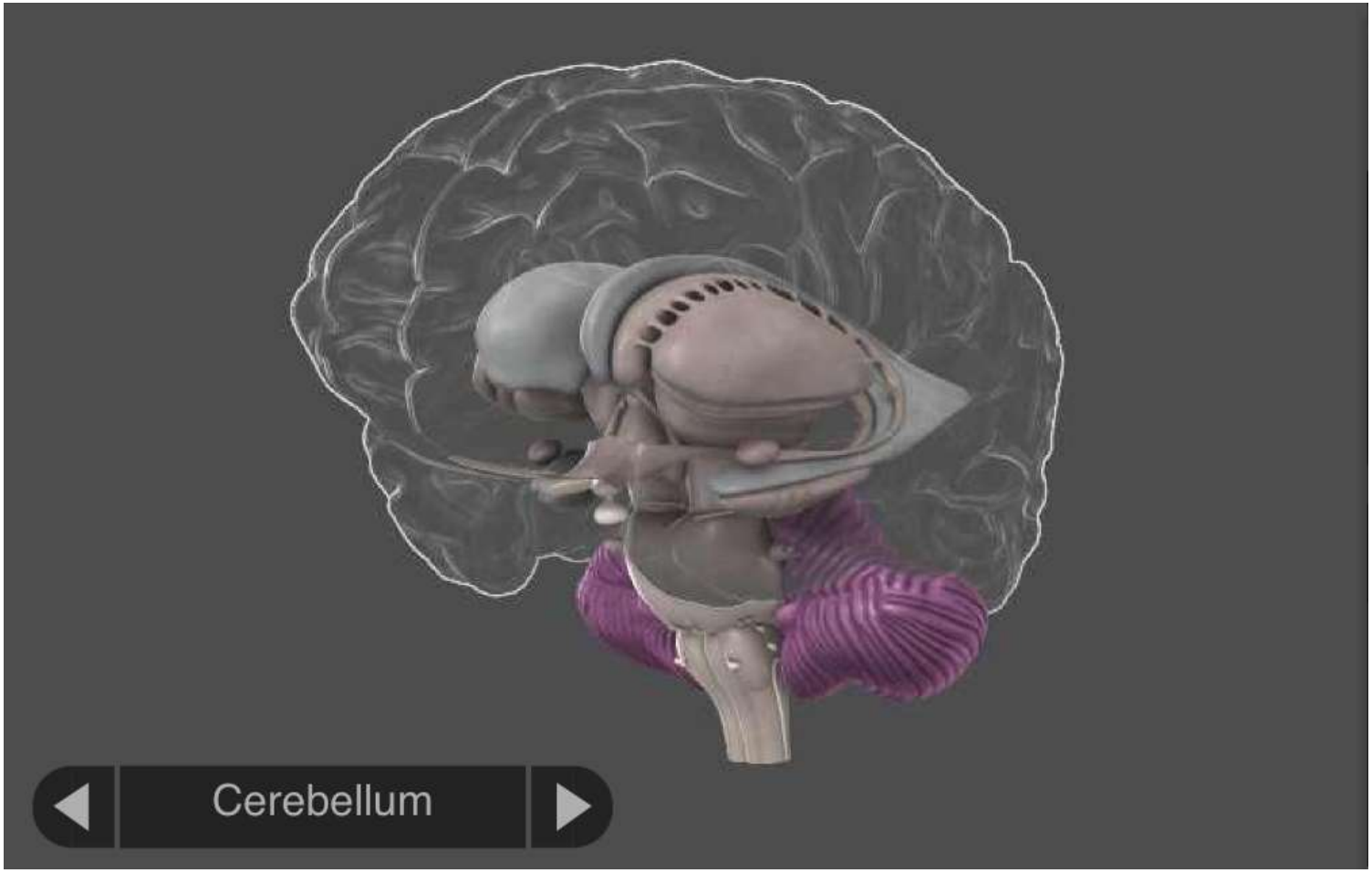
Neuroanatomy of Memory



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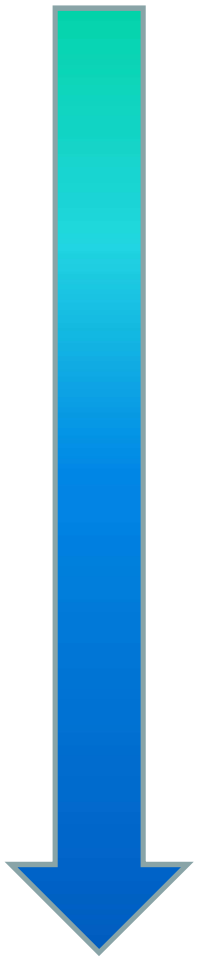
Stages of Memory Processing



- Registration (sensory memory)
- Short-term memory
  - Immediate memory
  - Working memory
  - Rehearsal
  - Intermediate memory
- Long-term memory
  - Consolidation
  - Learning

(Lezak, 2012)

Registration

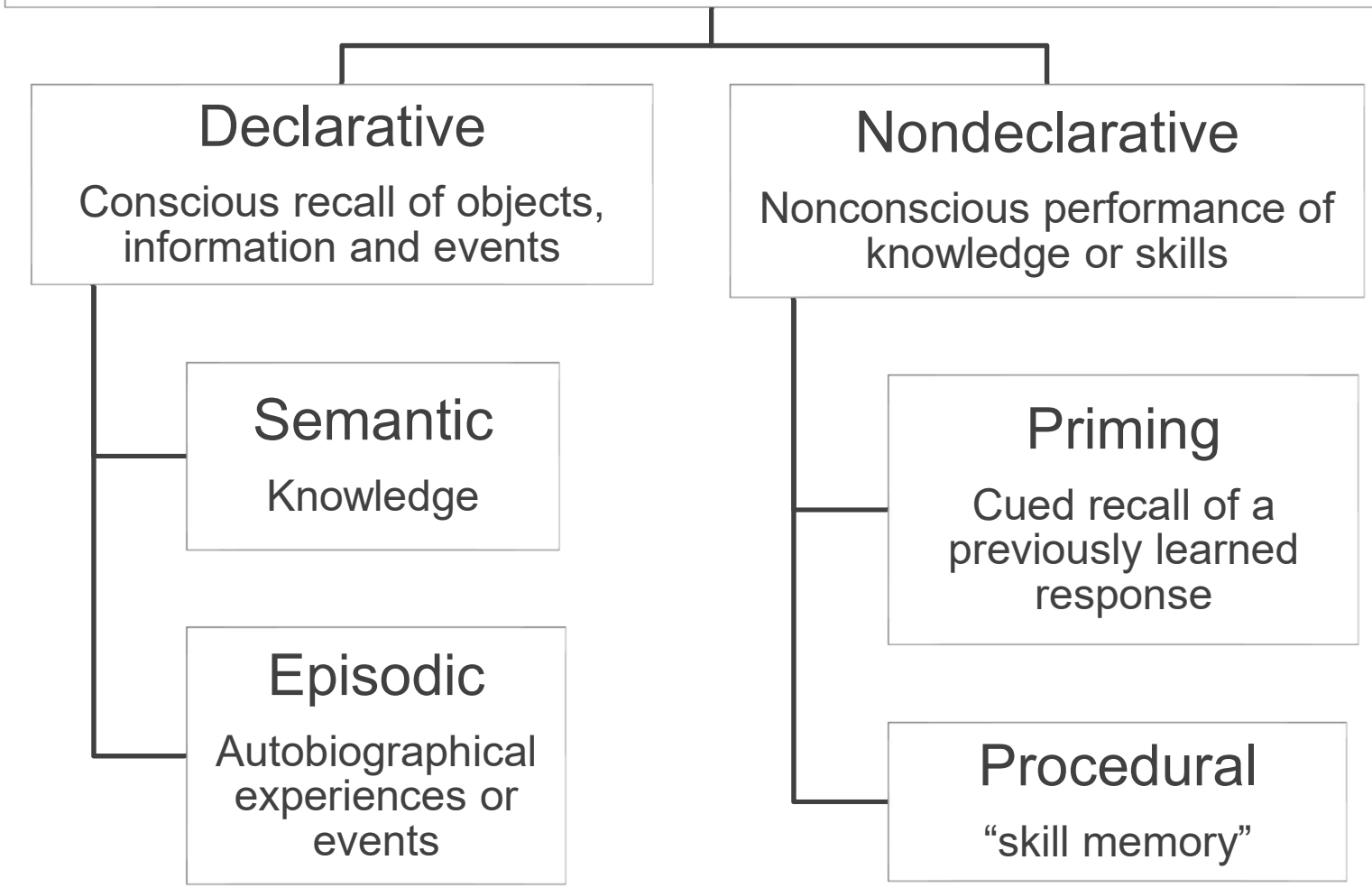
- Holds large mounts of data for seconds
- Modality specific (e.g., visual, auditory)
- Influenced by affect, set (perceptual and response predisposition), and attention-focusing processes

Visual
Registration
Sample

Short-Term Memory

- Immediate memory
  - Simple immediate span of attention (modality-specific)
  - Working memory: “temporary storage & processing system used for problem solving that take place over a limited period of time”
- Rehearsal
  - Repetitive processes to enhance the level of encoding and duration of a memory
- Intermediate memory?
  - 1-2 days but not “permanent”

Organization of Long-term Memory Systems



H.M. and Dr. Brenda Milner

Dr. Brenda Milner & Patient H. M.

Early Brain Research

- Dr. William Scoville surgically removed entire hippocampus
  - Cured seizures
  - No new memories after surgery
- Dr. Brenda Milner devoted career to studying Patient H. M.
  - Two types of memory: procedural / explicit

Other Types of Memory

- Prospective
  - Part of executive functions
  - Remembering to remember
- Source memory
  - Context in which something was learned

BI-ISIG Recommendations for Treatment of Memory Deficits

Practice Standard

Memory strategy training is recommended for mild memory impairments from TBI, including the use of internalized strategies (e.g., visual imagery) and external memory compensations (e.g., notebooks).

Practice Guideline

Use of external compensations with direct application to functional activities is recommended for people with severe memory deficits after TBI or stroke.

BI-ISIG Recommendations for Treatment of Memory Deficits

Practice Options

- For people with severe memory impairments after TBI, errorless learning techniques may be effective for learning specific skills or knowledge, with limited transfer to novel tasks or reduction in overall functional memory problems.
- Group-based interventions may be considered for remediation of memory deficits after TBI.

Approaches to Rehabilitation Memory

APPROACHES	TECHNIQUES	
EXTERNAL COMPENSATION	Orientation notebook	Errorless learning, spaced retrieval, chaining
	Electronic device	Cell phone, pager, alarms
	Memory notebook	
MEMORY STRATEGY TRAINING	Association Techniques	Visual-verbal association, visual-verbal schematics, visual peg method, Method of Loci
	Organizational & Elaboration Techniques	First letter mnemonics, semantic clustering, PQRST, use of humor, storytelling

Choosing the Right Strategy

Decision Tree for Treatment Planning In Memory Dysfunction

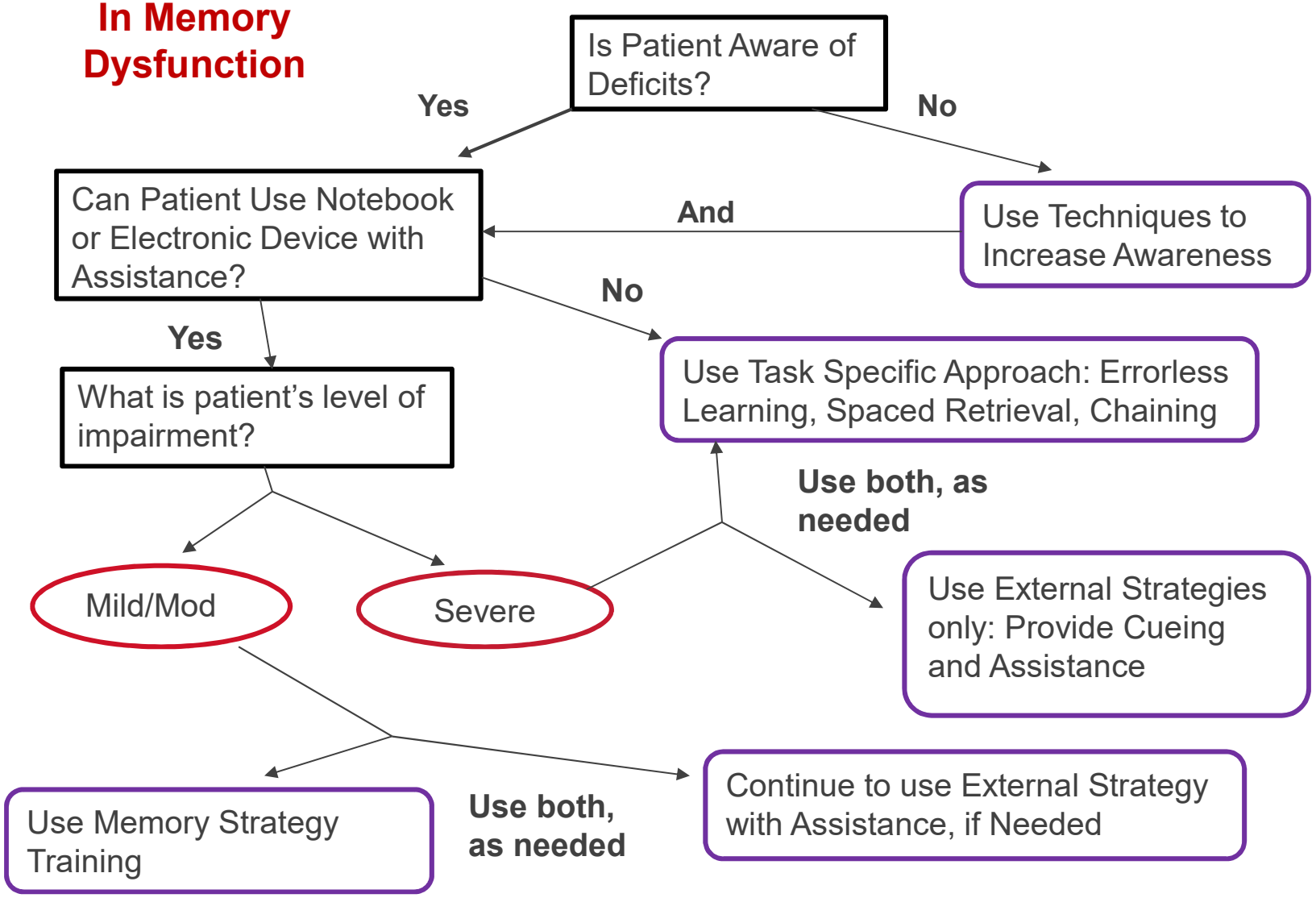
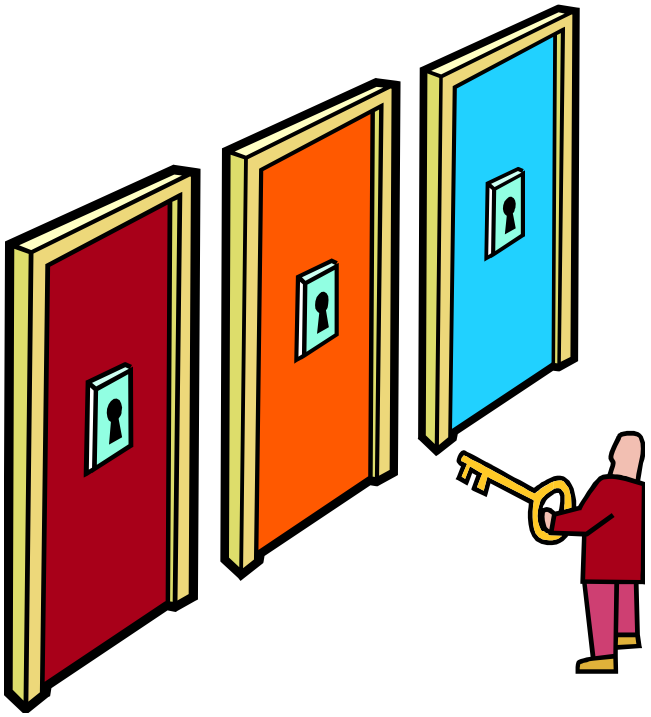


Figure 3.1

Considerations in Choosing a Strategy



- Severity of impairment
- Nature of the information to be remembered
- Functional, personally meaningful tasks
- Patient should understand, have input into goals and strategies- active collaboration.

External Compensations for Memory Impairment

Types of External Devices

- Notebooks
- Other written planning systems
- Electronic planners, PDA's
- Smart cell phones
- Computerized systems
- Auditory or visual systems
- Task-specific aids

Which Type of External Device?

1. The particular task the patient wishes to perform
2. The patient's goals, abilities, disabilities and preferences
3. The physical features (or limitations) of available technology: audio features, digital options, cost, downloadable apps
4. The environment in which technology is going to be used.
5. The familiarity to the patient.

General Guidelines for External Memory Strategies

- Constant and easy access to the external device or notebook.
- Training of all staff and family members in the use of device.
- Errorless learning techniques and use of procedural memory for severely impaired patients.
- Multiple learning & generalization trials.

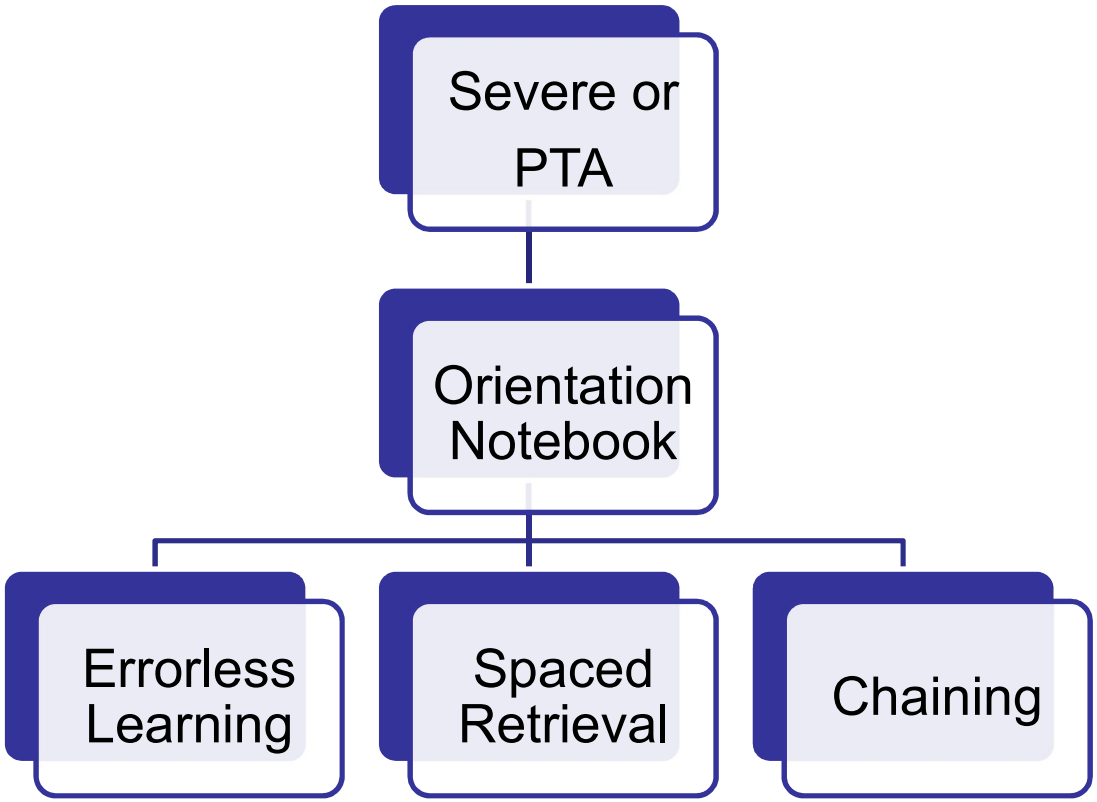
General Guidelines for External Memory Strategies, cont'd

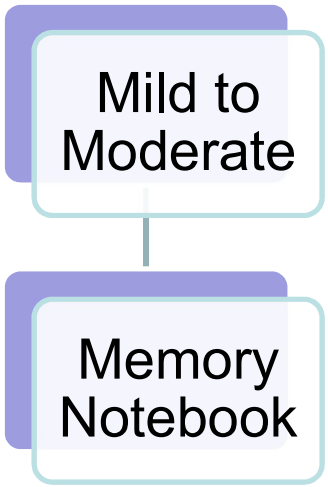
- Address any executive dysfunction.
- Apply external devices to functional tasks in the daily life of the patient.
- Use **cues** early in treatment and fade over time
  - Mild impairment: Rapid fading
  - Severe impairment: Gradual fading

Cue Types

- **Direct cue:** specific prompt given by someone other than the person with injury
- **Indirect cue:** general prompt given by someone else
- **Self-cue:** consciously cueing oneself; think about where info would be found
- **Independent routine:** person with injury automatically referring to calendar for info

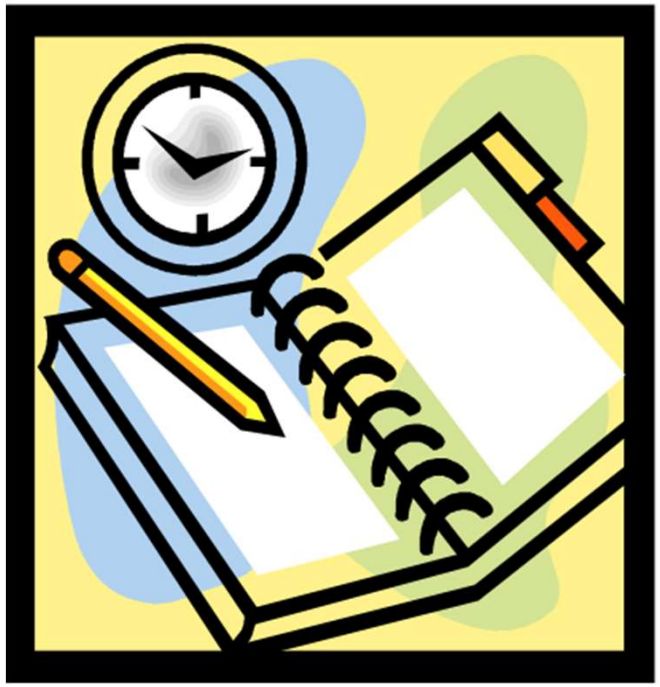
Memory Notebook Types

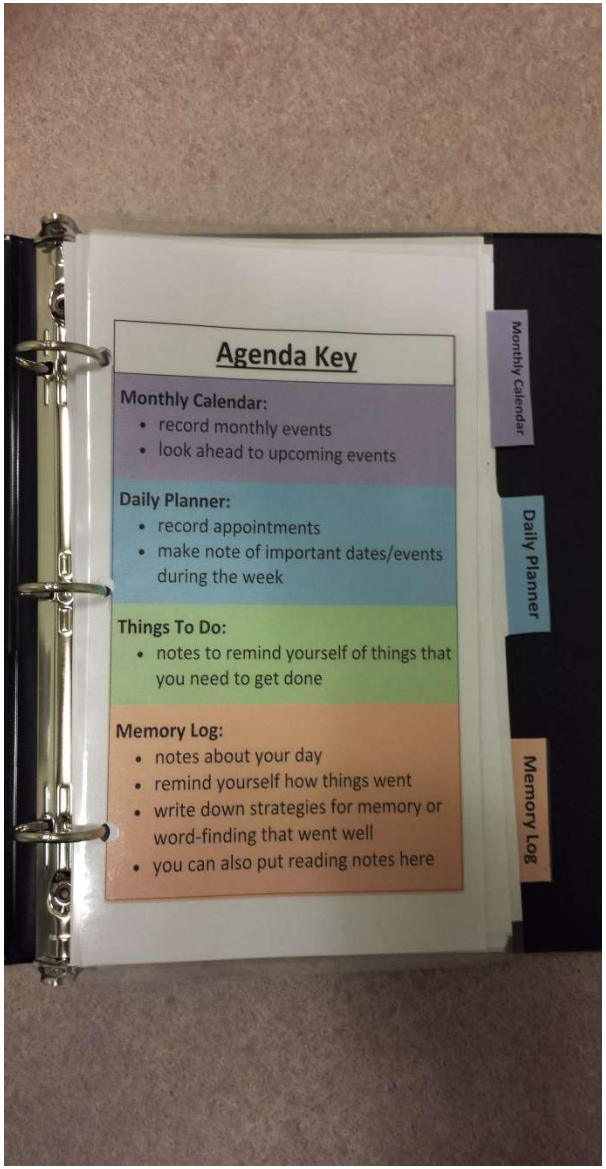


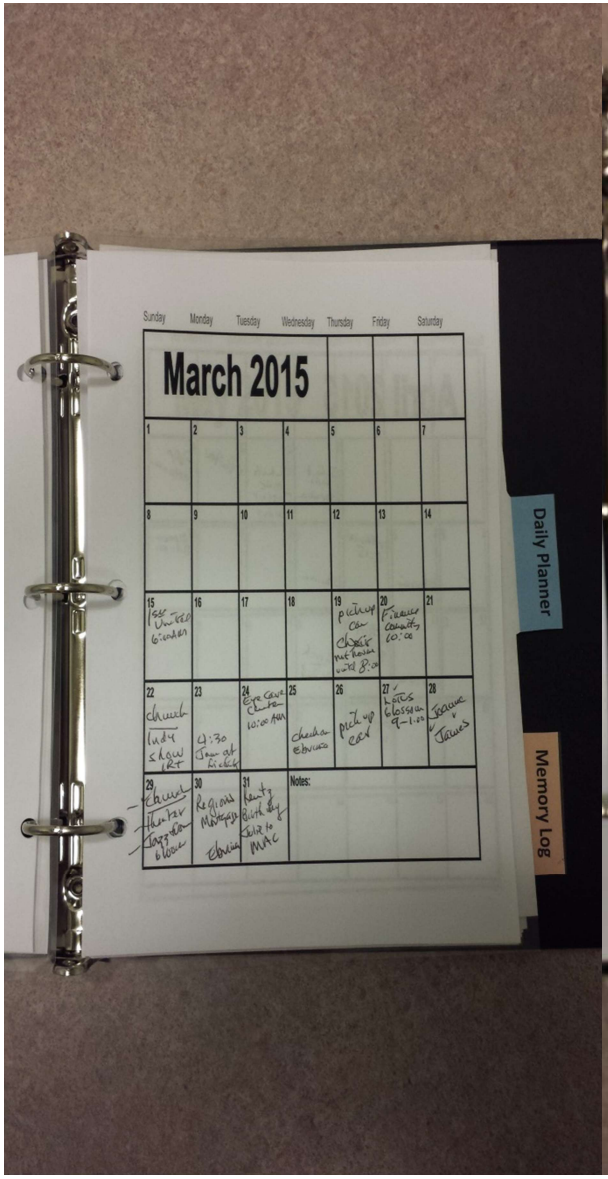


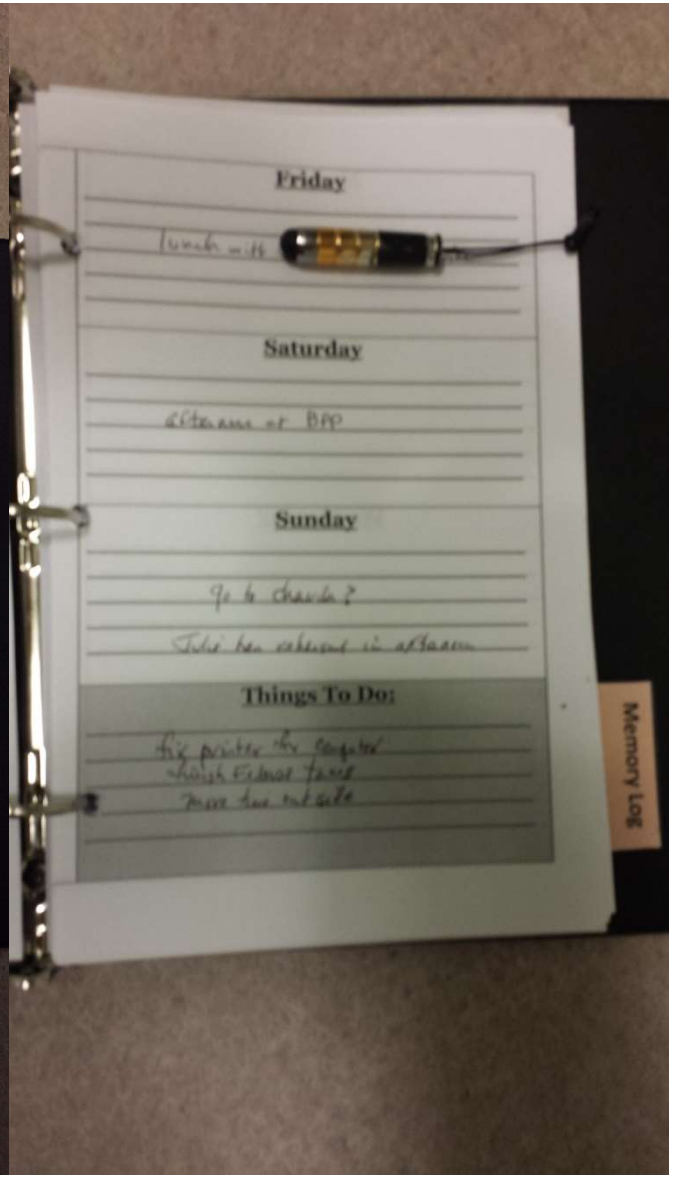
Memory Notebook

- Comprises the core of external memory compensations, along with electronic devices.
- Possible sections:
  - Things to do
  - Memory log
  - Daily schedule
  - Homework
  - History and background
  - Handouts
  - Contacts

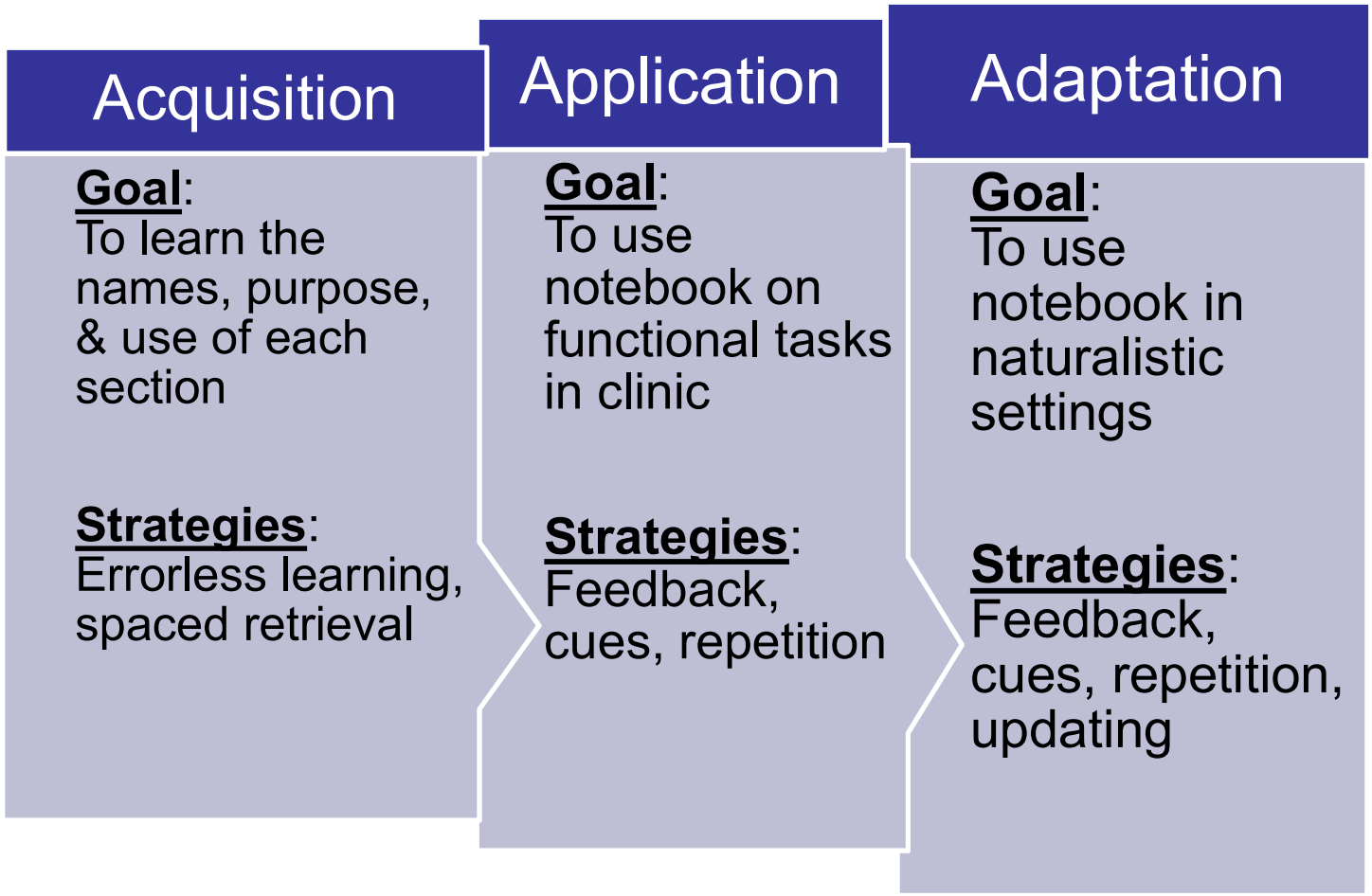



Agenda Key
Monthly Calendar:
• record monthly events
• look ahead to upcoming events
Daily Planner:
• record appointments
• make note of important dates/events during the week
Things To Do:
• notes to remind yourself of things that you need to get done
Memory Log:
• notes about your day
• remind yourself how things went
• write down strategies for memory or word-finding that went well
• you can also put reading notes here
Monthly Calendar
Daily Planner
Memory Log


Sunday Monday Tuesday Wednesday Thursday Friday Saturday
March 2015
Notes:
Daily Planner
Memory Log


Friday
Saturday
Sunday
Things To Do:
Memory Log

Stages in Memory Notebook Training



(Sohlberg & Mateer, 2001)

Acquisition Stage

Level of severity determines which strategies are utilized.

- Errorless Learning
- Spaced Retrieval

- Question & Answer Rehearsal
- Knowledge Questions

Acquisition Stage

Question & Answer Rehearsal Samples

- In what section of your Memory Notebook do you plan evening activities?
- In what section of your Memory Notebook do you record future appointments?

Knowledge Questions

- You should review what you have recorded in the book when _____
- You should write in the Memory Log when _____

Application Stage

- Memory notebook is integrated into various structured activities, with the clinician.
- Tasks are chosen for functionality and relevance for each person
- Cuing is provided for client learning and success

Adaptation Stage

- Applies skills learned to tasks and responsibilities in naturalistic settings – outside the clinic.
- External device is functionally integrated into daily routines to:
  - Document information, activities
  - Support prospective memory
  - Organize tasks

Sample Tasks

- Using device to remember to perform a future action:
  - Bring your iPhone to the next therapy session.
  - Tell your family member 1 thing you did at therapy today.
- Using device to store/retrieve sets of information:
  - Dates of upcoming medical appointments.
  - Names and types of medicine used.
- Using device to report information from events/activities:
  - Reporting activities from a visit or past weekend.
  - Reporting information from a work meeting.

Updating and Cleaning Routine

Develop a designated time for review, updating and cleaning of the notebook.

Sequence of Steps:

- Remove old log sheets and place in file.
- Put in the new sheets - logs
- Double check work
- Check the calendar to add any upcoming events

Scoring and Documentation

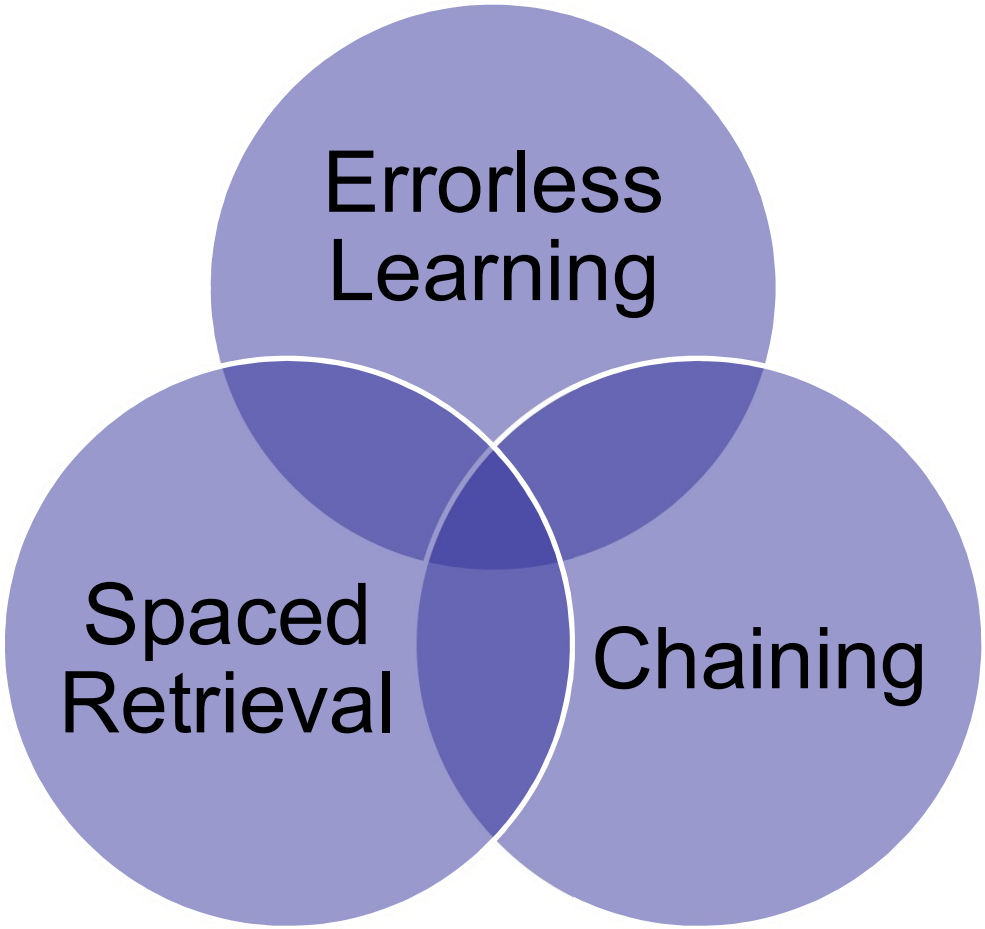
1	• Patient was unable to initiate
2	• Patient needed moderate assistance to record & retrieve information during session
3	• Patient needed minimum assistance to either record or retrieve information during the session
4	• Patient independently recorded & retrieved all relevant activities and information during the session

Strategies for Severe Impairment

Strategies for Severe Memory Impairment: Overview

- Appropriate for clinically important functional skills training, e.g., safe transfers
- Domain specific learning; limited generalization
- Attempts to maximize functioning through recruitment of procedural memory

Effective Strategies for Severe Impairment



Errorless Learning

- Presents information in a way that minimizes the possibility of making mistakes.
- Therapist presents simple information, and requests the patient to immediately repeat.
- More effective when combined with spaced retrieval or with chaining techniques.

Errorless Learning Training Samples

a. “The names of the notebook’s sections are the schedule, the memory log, and…. What are the names of the sections of your notebook?”

b. “The schedule section of your notebook is for you to record your appointments for the day. What do you record in the schedule section?”

c. The things to do section of your memory notebook is for you to record things you need or want to do that day. What do you record in the things to do section?”

Orientation Page

- Single sheet with all personal information or clinically-relevant information
- Errorless training used in training
- Patient trained to refer to the book/page to answer her/his OWN questions
- Orientation page/book transitioned into MEMORY book when patient ready

*See Form 3-2, page 50 of the Manual for an errorless learning protocol for basic orientation

Orientation Page - *Sample*

Name:_____ **Date:**_____

My name is _____

I am _____ years old

I was born on _____

My phone number is _____

Right now I am in the city of _____

The date today is_____

Right now I am at a _____

I was injured on _____

The kind of injury that I have is a _____

(Others, as driven by the patient's questions)

Error Elimination Techniques

- Break down the targeted task into small, discrete steps or units.
- Provide sufficient models before the client is asked to perform the target task.
- Encourage the client to avoid guessing.
- Immediately correct errors.
- Carefully fade prompts.

Spaced Retrieval

- Variation in errorless learning
  - patient asked to retain information over progressively longer periods of time e.g., immediate, 15 sec, 30 sec, etc.
- If errors, reduce time between intervals
- Interval time can be quiet or filled with tasks/conversation
- Can be effective for learning specific information (names, room numbers), or strategies (e.g. memory book strategies)

*See Form 3-3, page 51 of the Manual for a spaced retrieval protocol

Form 3-3 Spaced Retrieval Training Protocol

Patient Name:_____ Date:_____

1. Immediate

"Today we are going to practice remembering my name. My name is _____. What is my name?"

Trial 1 _____ Trial 2 _____ Trial 3 _____ Total Correct _____

If a patient responds incorrectly at immediate recall, simply repeat the statement. Once a patient is correct on trial 1, 2, or 3, proceed to short delay

2. 15-Second Delay

"Good. I want to help you see if you can remember my name for a longer period of time. Let's try again and see if you can remember my name after 15 seconds. My name is _____." After a 15-second delay, the therapist would then ask "What is my name?"

Trial 1 _____ Trial 2 _____ Trial 3 _____ Total Correct _____

If a patient responds incorrectly at short delay, say "Actually my name is _____." After a 15-second delay, the therapist would again ask "What is my name?" If the patient cannot remember the therapist's name after 15 seconds, it may be appropriate to try a 5-second or 10-second delay. Once a patient is correct on trial 1, 2, or 3 with a 15-second delay, proceed to a 30-second delay.

3. 30-Second Delay

"You are doing well remembering my name for a longer period of time and that's the idea. I would like to see if you can always remember my name. Let's see if you can remember my name after 30-seconds. My name is _____." After a 30-second delay, the therapist would then ask "What is my name?"

Trial 1 _____ Trial 2 _____ Trial 3 _____ Total Correct _____

If a patient responds incorrectly at long delay, say, as at short delay: "Actually my name is _____. What is my name?" If the patient completes the task successfully without making three errors at any of the delays, spaced retrieval is appropriate.

Form 3-4 Spaced Retrieval Record Form

Patient Name:_____ Date:_____

Information being presented: _____

	Delay in: ____Seconds ____Minutes														
Trial	**Imm**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**10**	**12**	**16**	**20**	**24**	**28**	**32**
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															

The user can indicate if the recall was correct or incorrect for each trial by placing a (+) or (-) in box corresponding to the delay interval. Obviously, the delay interval can be modified according to the patient need.

Spaced Retrieval: Advantages

- Takes advantage of ‘distributed practice’ by spreading the learning trials over a period of time.
- Can be effective to train people with severe memory impairments to remember specific information.

  (1) Strategies, e.g., memory notebooks,

  (2) Simple therapeutic procedures (swallowing, transfers, etc.)

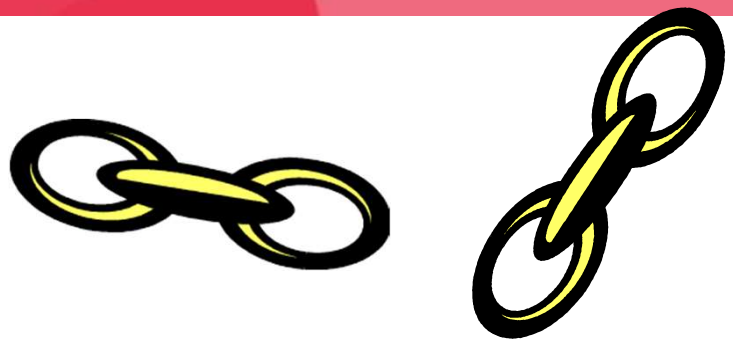
  (3) Concrete information such as names, of people/places.

  (4) Locations of importance (e.g. room number, facility name)
- Generalization is not expected.

Spaced Retrieval Resources

- Screening Test – assists with determination of patient's appropriateness for technique
- Training Sheet – Assists with data management for determination of time intervals.
- See: Brush J & Camp C. A Therapy Technique for Improving Memory: Spaced Retrieval. Meyers Research Institute. http://store.myersresearch.org/thteforimmes.html

Chaining Technique



- Method of teaching patients to perform sequences by means of procedural memory.
- Complex tasks analyzed into multiple steps
- Each step is taught as an isolated unit, automatically with errorless learning, and mechanically linked to other steps
- Each step serves as a cue for the next step
- Occurs without conscious or deliberate intent

*See Form 3-5, pages 54 and 55 for protocol using errorless learning

Forward and Backward Chaining

- Forward chaining:
  - Patient begins with the first step in the sequence and is guided in performing it.
  - Once successful, the second step is introduced and patient performs both together, thereby linking them.
  - This continues forward until task is complete.
- Backward Chaining:
  - Patient begins with the last step in the sequence.
  - Once successful, next to last step is introduced, thereby linking them.
  - This continues backward until patient can perform all steps in sequence.

Form 3-5 Chaining Worksheet Using Errorless Learning

Patient Name:_____ Date:_____

Task: _____

Steps involved in the task:

1) _____
2) _____
3) _____
4) _____

INSTRUCTIONS: FORWARD CHAINING (FOR A FOUR-STEP TASK)

(1) Demonstrate all steps in the task sequence and label each step as you do.

Say: "When you need to (perform specified task), you should do steps __1__, __2__, __3__ and __4__."

Do: Perform the task for the patient.

(2) Teach step one.

Say: "When you need to (perform specified task), you should begin by __1__. What should you do when you need to (perform specified task)?"

Do: Guide patient, as needed, through performance of step one.

(3) Teach step two.

Say: "After you do __1__, you should do __2__. What should you do after you do __1__?"

Do: Guide patient, as needed, through performance of step one and two together.

(4) Teach step three.

Say: "After you do __2__, you should do __3__. What should you do after you do __2__?"

Do: Guide patient, as needed, through performance of step one, two and three together.

(5) Teach step four.

Say: "After you do __3__, you should do __4__. What should you do after you do __3__?"

Do: Guide patient, as needed, through performance of step one, two, three and four together.

Memory Strategy Training

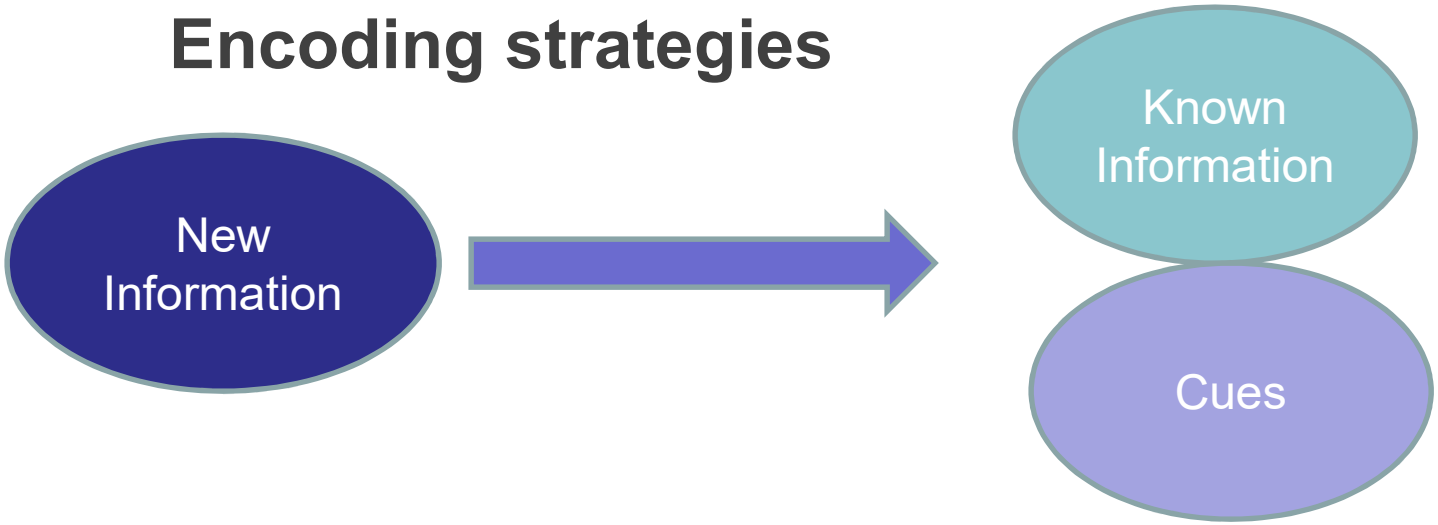
Memory Strategy Training

- Internal, self-instructional strategies for storage and retrieval of declarative information.
  - Verbal or non-verbal
  - Can be facilitated by external strategies

- Most effective for those with mild to moderate memory impairments

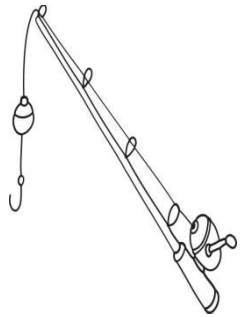
Memory Strategy Training

Encoding strategies



Retrieval strategies

Enhance patient's ability to find and retrieve information at the time of recall

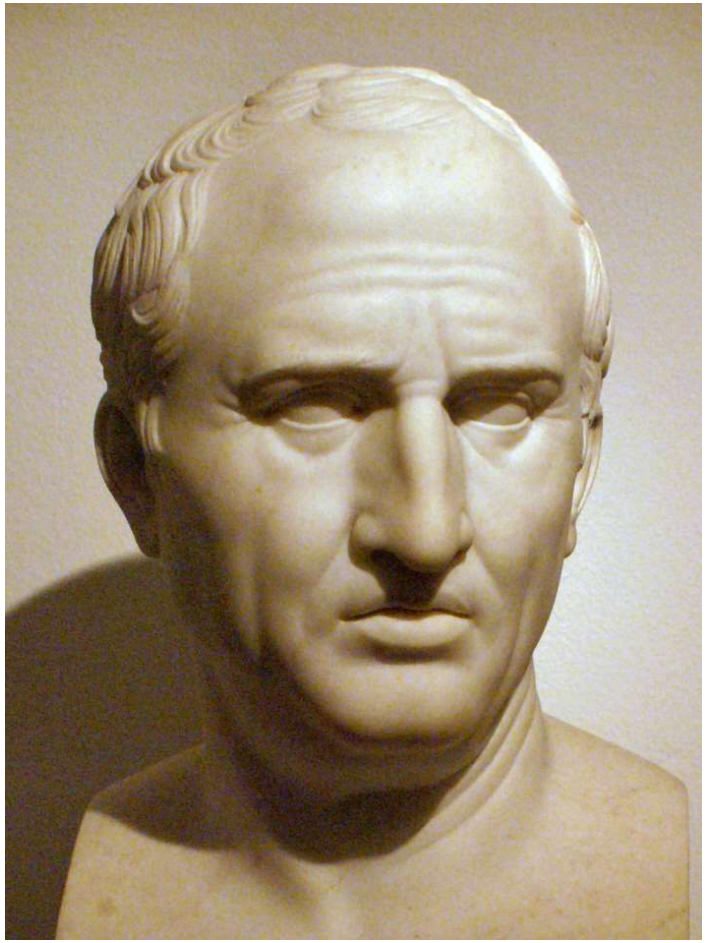


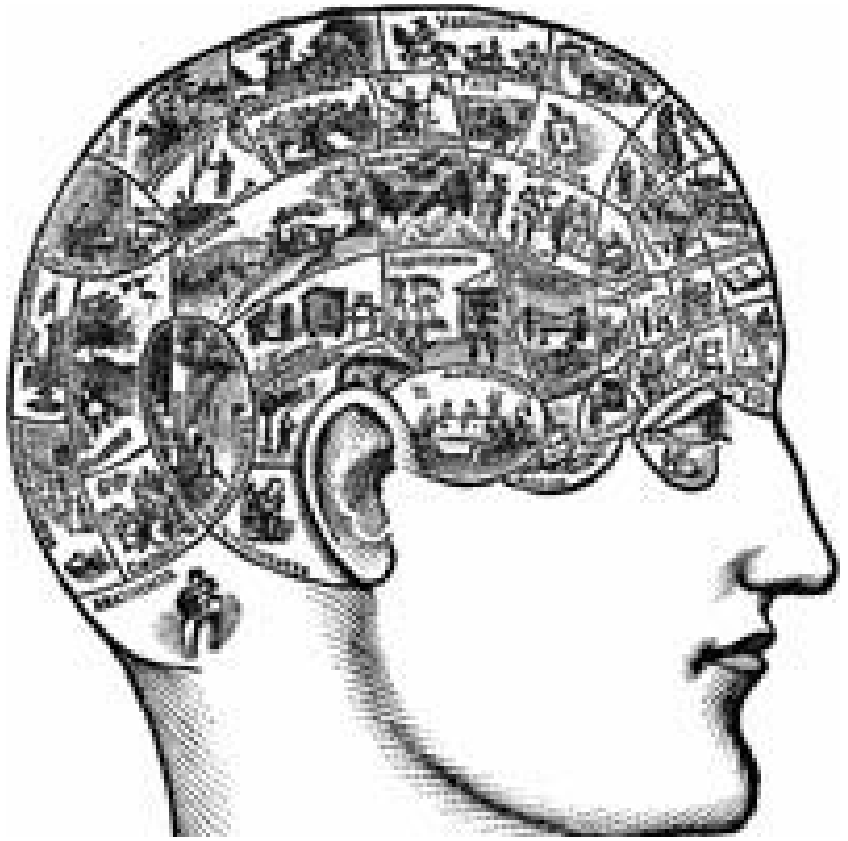
Types of Metacognitive Techniques

Association Techniques

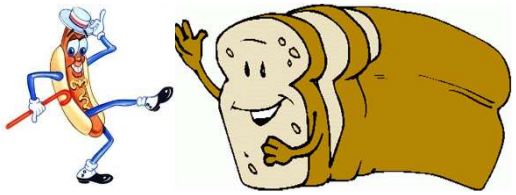
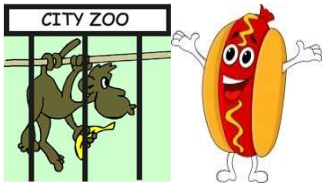
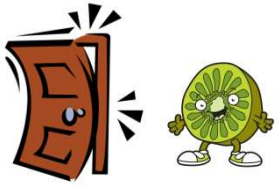
Technique	Description
Visual Peg Method	Target items are linked with a standard set of peg words which are already learned in a set sequence.
Method of Loci	Linking information to specific (external) visual reference
Visual Imagery	Linking information to specific (internal) visual reference
Absurdity	Humor and high levels of interaction make associations stronger

Method of Loci





Visual Peg Method Sample

Peg Words	Linked Word	Key Image
1 - Bun	Bread	
2 - Zoo	Hotdog Buns	
3 - Tree	Soda	
4 - Door	Kiwis	

Visual Peg Method

Jerome A. Yesavage, MD

GUSTAVUS

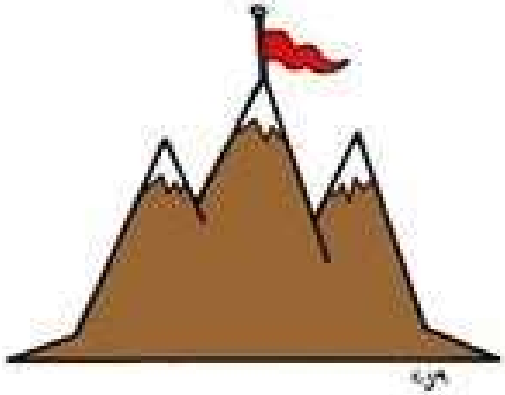
GUSTAVUS ADOLPHUS COLLEGE

Thomas F. Bergquist
Class of 1983
Student Number: 122

CRANIAL NERVE MNEMONIC

S = Sensory	M = Motor	B = Both

O	Olfactory	O	On	S	Some
O	Optic	O	Old	S	Say
O	Oculomotor	O	Olympus	M	Marry
T	Trochlear	T	Towering	M	Money
T	Trigeminal	T	Tops	B	But
A	Abducens	A	A	M	My
F	Facial	F	Finn	B	Brother
A	Acoustic	A	And	S	Says
G	Glossopharyngeal	G	German	B	Bad
V	Vagus Nerve	V	Viewed	B	Business
S	Spinal	S	Some	M	Marry
H	Hypoglossal	H	Hops	M	Money

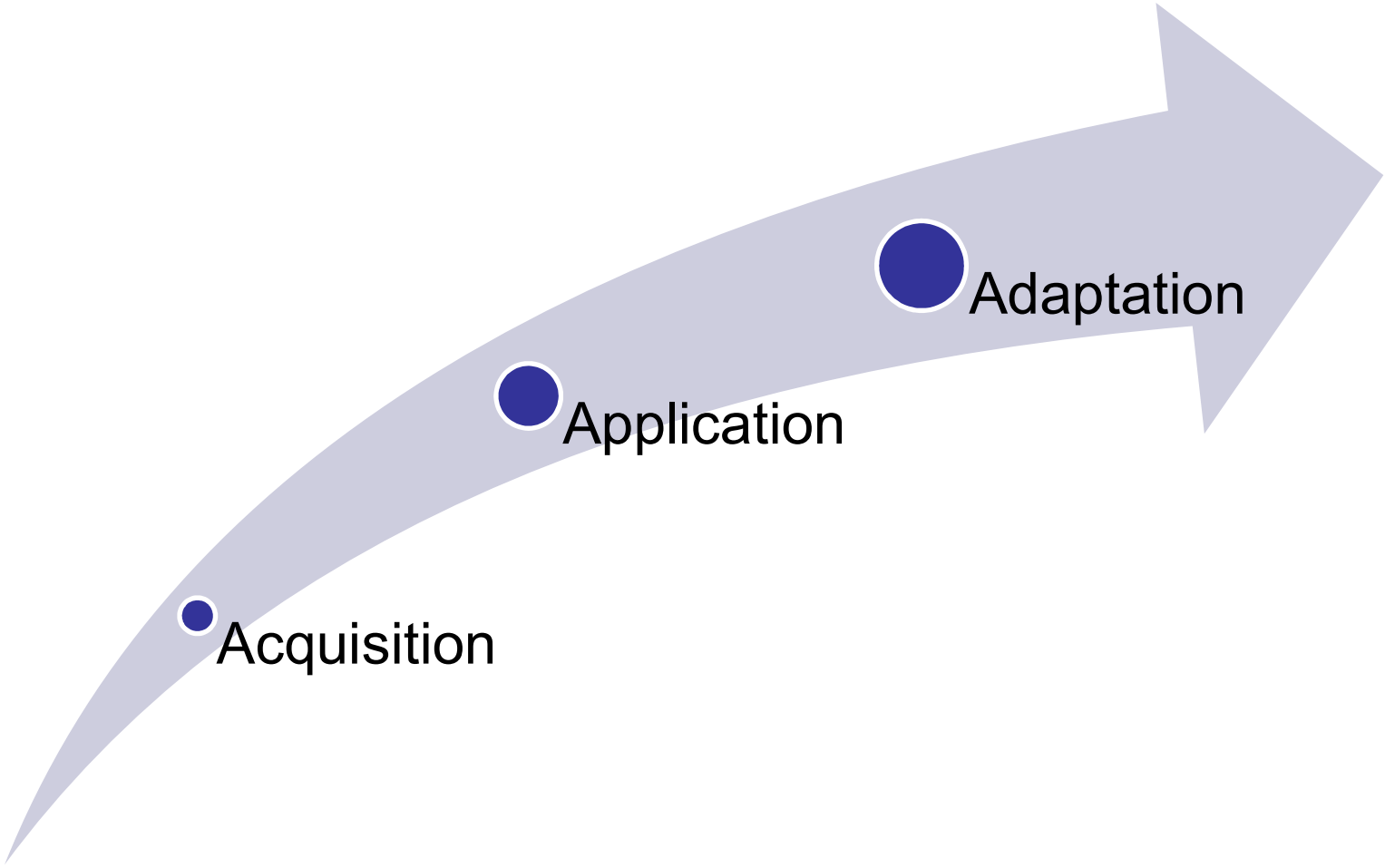


Organizational Strategies

Organizational Techniques

Technique	Description
First Letter Mnemonics	Use the first letter of each of a series of words to form a single word or pseudo-word. **HOMES** = **H**uron **O**ntario **M**ichigan **E**rie **S**uperior
Semantic Clustering	Grouping items in a list into smaller categories
PQRST	Self-instructional technique to learn and recall complex written information **P** review **Q** uestion **R** ead **S** tate **T** est

Stages of Strategy Training



Acquisition Stage

Step 1: Introduction to technique

- Psycho-education
  - Establish how the strategy will improve their overall effectiveness and independence.
  - Use examples of real-life use

Step 2: Learn the strategy

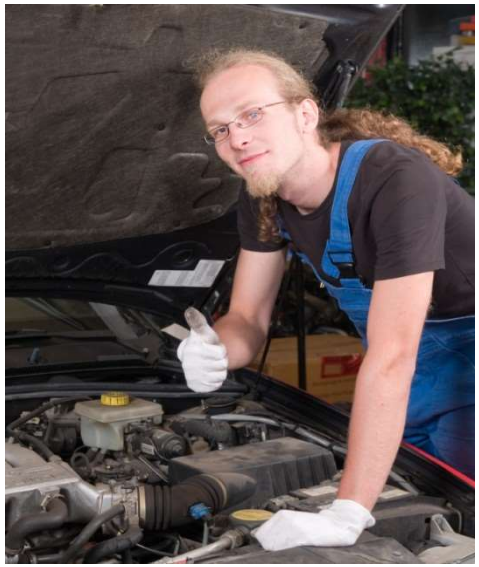
- Guide patient systematically through use of strategy
- Desired outcome for patients to be able to:
  - Describe the methods
  - Identify tasks and situation for use
  - Be able to recite the steps involved in applying the strategy

Application Stage

- **Practice** in simple ‘real-life’ or role-play scenarios
- **External support** begins with high levels and fades with success.
- **Recall periods** should gradually increase (24, 48, 72 hours, one week).
- **Levels of complexity/amount** should gradually increase.
- **Self generation** of techniques.
- **Feedback and discussion** from both therapist and patient on performance.

Adaptation Stage

- **Apply techniques** to more complex, functional and everyday tasks, outside the clinic.
- **Generalize** into ecologically valid environments and tasks.
- **Incorporate family** and significant others to facilitate and reinforce generalization.



Application & Adaptation Activities

Activity	Application	Adaptation
Face Name Association	Remembering names of the therapists or other patients	Remembering names of classmates, co-workers
Visual Imagery	Remembering story details recalling locations	Studying for a test, recalling appointments
Verbal mnemonics	Remembering grocery lists, to-do lists, steps involved in functional activities	Remembering grocery list when shopping, to-do list
Organization Strategy	Organizing details from a short article, remembering mock grocery store list	Encode essential details from lectures or textbook, recall items from grocery list by category
PQRST	Remembering newspaper article or job description	Remembering information from lecture or textbook

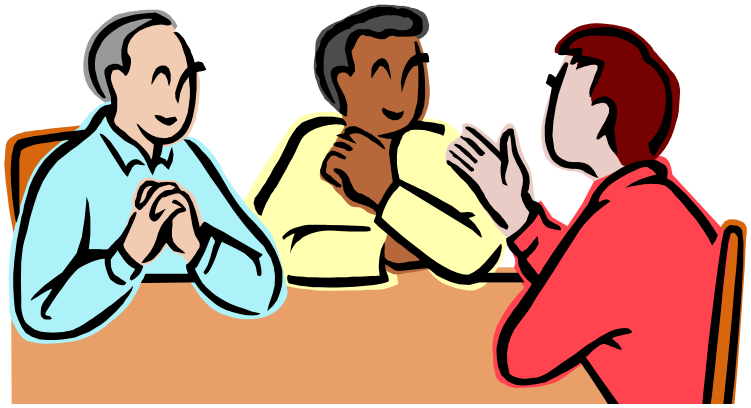
Summary of Metacognitive Strategies

- Only for those with mild or mild-moderate level of impairment.
- Client must self-initiate strategy use in real-life environments.
- Some strategies may be difficult to generalize in real environments due to slow processing speed or time pressures.
- Often used in combination with external strategies.

Memory Rehabilitation Group

- Model described by Thickpenny and Barker-Collow:

- Didactic teaching about memory and strategies
- Small group activities
- Discussions
- Problem solving
- Active use of strategies



- Curriculum based therapy group (Learning Modules); meets 2x/week for 4 weeks.

TEACH-M

- ‘an instructional package that facilitates learning and retention of multi-step procedures for persons with severe memory and executive function impairments’
- Research results support implementation across a wide range of tasks and contexts.
- Produced ecologically valid outcomes in timely fashion.

Ehlhardt et al, 2005; Sohlberg et al, 2005

TEACH-M Components

- Task analysis
- Errorless learning
- Assess performance
- Cumulative review
- High rates of correct practice trials
- Metacognitive strategy training

Ehlhardt et al, 2005; Sohlberg et al, 2005

Summary of TEACH-M features

- Errorless learning
- Task analysis
- Forward chaining
- Focus on 1 task in-depth
- Cumulative review
- Stimulus pre-exposure
- Prediction-reflection (meta-cognitive strategy)
- Instructor model/guided practice
- Multiple practice opportunities
- Spaced retrieval
- Carefully faded prompts
- Varied training examples
- Training to criterion

Ehlhardt et al, 2005; Sohlberg et al, 2005

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Thomas F. Bergquist
Class of 1983
Student Number: ???

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Memory Case Example

KH:
Personal and Medical history

- 54 y.o. married male
- Originally from Europe, but married to American and has lived in US for many years.
- College level education and worked as a project manager for area construction company.
- Sudden onset of worst HA ever
- CT found anterior left frontal area SAH and ruptured ACoA aneurysm
- Initial GCS = 6
- Underwent surgery for clipping and hematoma evacuation within days of admission
- Several weeks of hospital stay and 2 weeks of inpatient rehab focusing largely cognitive impairments.

- Psychometric Testing done ~ 1 year after onset showed profound memory impairments and mild executive dysfunction. Intelligence, visual spatial functions and language largely intact.
- Highly confabulatory and commonly stated that he had recently travelled to Europe to see his family there, when he has not been there in over a year.
- Mood stable, but became agitated when confronted about his confabulations.

KH:
Initial Course of Rehabilitation

- Started intensive outpatient SLP and OT shortly after hospital stay.
- Very pleasant in therapy, but came to therapy sessions thinking that he was coming to a work related meeting.
- Limited awareness of his problems.
- Confabulation continued and was a major focus of treatment.

What would you do in this case?

???????

KH:
Strategies developed during course of individual therapy

- Given level of memory impairments and level of unawareness, errorless learning used to help him learn to use external devices (e.g. phone and planner).
- Fact Sheet (orientation page)
- Planner
- Stop and think before giving answer
- “Real versus accurate memories”
- Used texts from wife as reminders of activities.
- Wife very involved in treatment process and modeled use of planner by always using it herself.
- Later started group based intervention: Powerful means of seeing that he is not unique in his problems and reinforcing use of planner and other strategies.

KH:
Current situation

- Was not able to return to work as a project manager.
- Volunteers in several settings in community
- Works part time in a supportive employment setting.
- Independently takes care of household activities
- Continues to regularly use planner and other strategies he developed in treatment
- Receives ongoing individual counseling to help with adjustment to changes in life.
- Active cognitive rehabilitation completed.
- Wife has been very supportive and remained so throughout his recovery.

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