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Designs for Strong Minds' Cognitive Rehabilitation for Mild or Moderate Posttraumatic Head Injuries

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After posttraumatic head injuries, patients undergo various therapies, depending on the nature and severity of their injuries. Patients who were high-functioning, successful adults may do extremely well with these therapies, but can become frustrated when they cannot return to work or they have trouble functioning at what they would consider an acceptable level. These patients may find it difficult to read or concentrate or to perform daily tasks, such as grocery shopping or cooking. Some have trouble keeping track of time, organizing their day, or remembering conversations. Because these patients can score within the normal range on cognitive tests, they are frequently advised to learn to live with their dysfunction, but left untreated they cannot return to professions that require high processing speeds, complex analysis, and accurate working memory. Through *Designs for Strong Minds* (DSM), we have had great success helping these patients overcome their frustrations and function at much higher levels.

To understand how and why DSM works with posttraumatic head injury patients, the author first discusses how posttraumatic head injuries affect cognition. The author then discusses how to address secondary brain damage, and finally looks at how DSM works with these patients.

Posttraumatic head injury and cognition

Posttraumatic head injuries may leave patients with physical, emotional, and cognitive symptoms that are attributable to secondary brain damage, such as chronic pain, migraines, general fatigue, nausea, fainting spells, loss of equilibrium, disorientation, hypersensitivity, feelings of fear, shame, humiliation, worthlessness or helplessness, depression, anxiety, irritability, memory

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deficits, inability to follow sequential instructions, comprehension dysfunction, compromised reading and writing ability, and attention disorders.

The plasticity of the human brain is both its power and its weakness. Although the life-sustaining parts of the human brain are ''hardwired,'' the cognitive parts (located in the neocortex) are not. The part of the brain that allows people to think, to plan, to hope, to dream, to understand language and math, and to recognize themselves and others is highly malleable. It allows them to change their minds and control their behavior, but it is also this part that suffers the greatest loss from brain injury.

Much to the frustration of doctors and patients alike, cellular damage is microscopic and may be diffuse throughout the brain so that conventional scanning technologies such as CT, MRI, electroencephalogram, positron emission tomograph, electronystagmogram, and vestibular testing frequently come up negative.

Addressing secondary cognitive brain damage

As tragic as any traumatic brain injury is, high-functioning adults may suffer the most psychologically. As Dorothy Gronwall and P. Wrightson wrote in *Mild Head Injury* [1]:

> Although high-functioning adults can still score within the normal range on cognitive tests, they do not do so ''in a normal fashion. Normal subjects do not need two hours of sleep after the test session to fully recover from the effort, nor do they need to take two to three days to recover fully.''

Unfortunately this ability to achieve an average score is too often interpreted by the medical community as something highly competent people should be able to live with. Left untreated they cannot return to professions that demand high processing speeds, complex analysis, and accurate working memories. As Dr. Jeri Morris wrote in *Handbook of Clinical Health Psychology* [2]:

> Clients typically have little understanding of their metacognition prior to the acquisition of brain impairment. Because much of our cognitive functioning is automatic, they had little reason to consider meta-cognitive processes in everyday life. As a result, after experiencing a brain injury or the onset of a neurologic illness, many have little sense that they have a problem in functioning, even when that problem is quite apparent to others and, in fact, is interfering in their life. Some, for example, may be accustomed to having a good memory and excellent problem solving skills and may assume that they continue to have those abilities. It is impossible to work on a problem that one does not know one has. Others may know they have some cognitive problem but have little idea of specifically what that problem is. It is not likely that one can solve a problem they cannot understand.

By the time posttraumatic head injury patients notice that their memories are not what they used to be or that they have difficulty thinking through a problem they could once have easily solved, massive brain damage has occurred on a microscopic level. Because their symptoms are medically unverifiable and therefore untreatable, they are usually dismissed as the walking wounded, destined to suffer the pain, frustration, and humiliation of not knowing how much longer their condition will last or how much worse it will become.

Using a very-high-field MRI scanner, Dr. Keith Thulborn [3] has observed the brain of a patient who suffered an injury to the Wernicke area (in the left cortex that makes spoken language understandable) initially ''rewire'' itself first to the right cortex and then back to an adjacent area on the left side even though the Wernicke area remained damaged. This process of rewiring demonstrates the plasticity of the human brain given the right conditions.

The key to the rewiring process is the same that occurs in any form of learning or memorization: attention, intention, and rehearsal.

Regarding attention, Ian Robertson [4] suggests:

> Brain sculpture needs your active attention. Indeed, research with animals shows this quite clearly: brain areas that are passively stimulated aren't sculpted by experience. Brain sculpture generally only happens when attention is paid to that stimulation. What's more, the attention circuits of the brain are based largely in the frontal lobes and it is these that are crucial for the remolding of the trembling web of connections during the learning of new skills, whether they relate to work, sport or home.

The patient and any therapist must clearly focus their efforts on the areas that require rehabilitation.

Intention is the process that allows transference of learning from one situation to another. Again, according to Dr. Jeri Morris in *Handbook of Clinical Health Psychology* [2]:

> The fact is that most individuals in treatment programs, even those specifically designed to treat cognitive deficits, have no understanding of the actual goals of their own treatment. They may be given a list of deficits (eg, short-term memory problems; visuospatial deficits) for which they have no understanding and to which they cannot connect to everyday functioning. As a consequence, treatment often seems irrelevant. Ask clients in a full-day cognitive treatment program what they did during the day and they typically will reply, ''I went to speech therapy,'' or ''I went to occupational therapy.'' Asked further to explain what they did in those treatments, they will say, ''I worked in workbooks,'' or ''I cooked brownies.'' To the clients, these activities bear no relation to their lives and are dismissed as unimportant.

Patients must become partners in the treatment and know why they are going through any particular therapy.

The final step is rehearsal, which is a recurring process that activates different neurons within a network to fire and thus strengthen and broaden the network as a whole. The treatment must involve repetition so that the cognitive behavior becomes habitual.

Designs for Strong Minds and cognitive rehabilitation

The human mind is a malleable instrument that we can modify to perform with and adapt to the constantly changing circumstances of our lives. Reuven Feuerstein [5] explains that the cognitive behavior of the human organism represents an open system amenable to meaningful structural change. On the physical level, Marian Diamond [6] suggests that the structure and abilities of the cerebral cortex can be changed throughout life by enriching sensory environments.

The DSM program is based on a neurocognitive model that uses attention, intention, and rehearsal to implement learning and behavioral change. What differentiates DSM from other cognitive-based programs is its use of mediation and its large variety of increasingly complex visual puzzles that are organized by logical structures.

Inspired by Reuven Feuerstein, DSM builds on the mediated learning techniques of Feuerstein's Instrumental Enrichment and Autoplastic Enhancement to help individuals think about thinking and to maximize their potential by eliminating extraneous pressures. DSM uses mediation to direct the patient's attention to specific information. A mediated learning experience takes place when an individual positions himself or herself between a person and the stimuli impinging on that person and mediates, transforms, reorders, organizes, groups, and frames the stimuli in the direction of some specifically intended goal and purpose. The mediator acts as an external frontal lobe. Mediation enables transference of learning because it makes the learner consciously aware of:

- The inherent structure of the problem
- The intended goal
- The relevant information

Because the cognitive exercises do not tap past knowledge, they allow the patient to think, to explore, and to isolate known from unknown, which are prerequisites for cognitive change.

Another attribute that distinguishes DSM from other therapies is that it focuses first on the patient's functional abilities preinjury. These injuries are likely to have exacerbated any cognitive weaknesses that patients may have had preinjury, so it is important to know how they functioned preinjury to be able to help them learn postinjury. If the patient had trouble dealing with

ambiguity preinjury, they are likely to have even more trouble postinjury, and standardized cognitive tests do not address this issue. For example, the spouse of an engineer had complained that after the injury the patient was not reading newspapers or books, which at first seems alarming. On further investigation we discovered that it was something the patient did not enjoy doing preinjury; the problem was not caused by the injury but was exacerbated by it.

Unlike most training programs that emphasize either standardized procedures (eg, answering telephones, filling out forms, baking brownies, and so forth.) or lateral thinking (eg, role-playing, teamwork, thinking outside the box, and so forth) DSM uses mediation and a large variety of visual puzzles organized by logical structures to enhance conscious recognition of various logical structures that have long been associated with intelligent behavior, specifically:

- Conditional reasoning
- Bi-conditional reasoning
- Analytic perception
- Classification

DSM puzzles and methods tap into the human visual systems. They use graphic puzzles to develop and enhance alternative ways of thinking and doing. To solve the puzzles the learner has to visualize the conditions that make some answers logical and others illogical. In this way the learner experiences both the depth and breadth of neurocognitive restructuring. The organization of materials and the rehearsal present opportunities to create new neural networks the brain needs for permanent change. Throughout the process DSM mediators encourage learners to engage in an internal dialog that transforms the lesson into a meaningful experience.

Understanding when, where, why, and how new learning can be applied creates usable knowledge that enables learners to:

- Recognize similarities in diverse situations
- Assess the ways in which situations are similar and different
- Formulate a plan of action in accordance with the assessment
- Analyze the degree to which the actions succeed or fail
- Gain insight into their own preferences and expectations

Most instruction imparts established theories or routines as a means of leading someone from knowing less to knowing more. With this kind of standard instruction, the learner never has an opportunity to explore the structure or examine the premise on which the lesson was built. Using visual puzzles that require bottom-up thinking to solve, DSM mediators guide learners through the backwaters of their own subconscious thought processes, allowing them to objectively think about how they think and habitually structure information.

Once people have learned to recognize their own organizational behaviors, they can more easily:

- Verbalize their rationale for doing something in a particular way
- Monitor their current level of understanding
- Determine when additional information is required
- Evaluate new information based on its consistency with what they already know and its relevance for achieving their intended goal
- Create analogies that help them and other people advance their understanding of the situation

Through intentional intervention DSM mediators lead learners to an awareness of how their assumptions influence what they see, how they think, and what they do.

The puzzles are not merely optical illusions. To solve them the learner has to visualize the conditions that make some answers logical and others illogical. In this way the learner experiences both the depth and breadth of neurocognitive restructuring.

In addition, multiple experiences requiring the same general strategy (rehearsal) broaden the learner's perceptual behavior. A wide variety of puzzles allow learners to explore new strategies for organizing information, generating options, making decisions, solving problems, and verifying solutions.

Unlike most learners who are conditioned to looking for correct formulas and single solutions, DSM learners develop "Expert Minds" that:

- Seek to understand the goal
- Organize the available information based on the goal
- Structure the problem so that the goal can be achieved
- Evaluate the solution's success at satisfying the goal
- Strategize more effective ways of achieving similar goals

Throughout the process DSM mediators encourage learners to engage in an internal dialog that transforms the lesson into a meaningful experience.

Experience how *Designs for Strong Minds* works

Although it seems counterintuitive, many people become less effective thinkers as they become more educated. Most formal education trains people to be efficient, learning routines so that tasks become hardwired. For example, once people learn to read they cannot help reading when faced with text. The message may be indecipherable if written in an unfamiliar language, but in most cases, words are identifiable and are not mistaken for decorative patterns or meaningless scratches.

The neurocognitive influence of education is strongly evident in how people draw a complex figure, such as the one shown in Fig. 1.

DSM uses complex figure drawings to determine how someone habitually organizes visual information. Participants are given different colored pencils

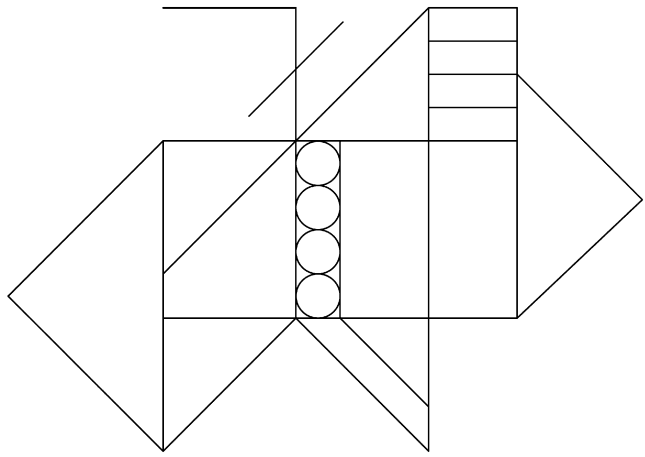

Fig. 1. Diagnostic complex figure.

in a prescribed order: red, green, blue, brown, black, yellow, purple, pink. The participant is then asked to copy the figure, switching colors every twenty seconds. We can compare how posttraumatic head injury patients approach this figure with how we know it is approached by people from similar professions who do not have posttraumatic head injuries. Although not everybody within a given profession draws exactly the same way, definite patterns can be ascribed to particular groups.

For example, architects, engineers, and physicists tend to first focus their attention on the central image—shown as the red rectangle in Fig. 2. (The

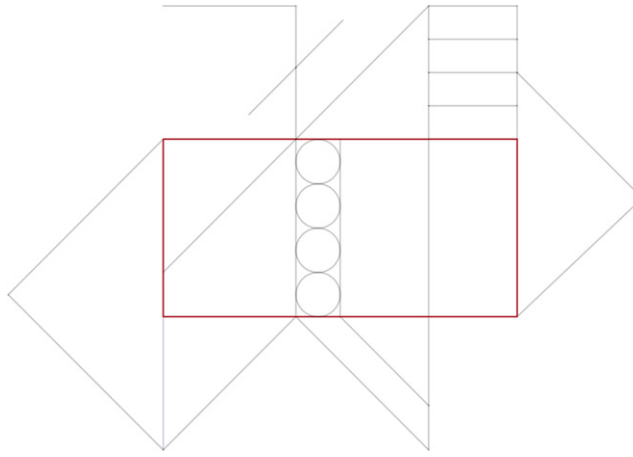

Fig. 2. Typical starting point for Systems' Thinker.

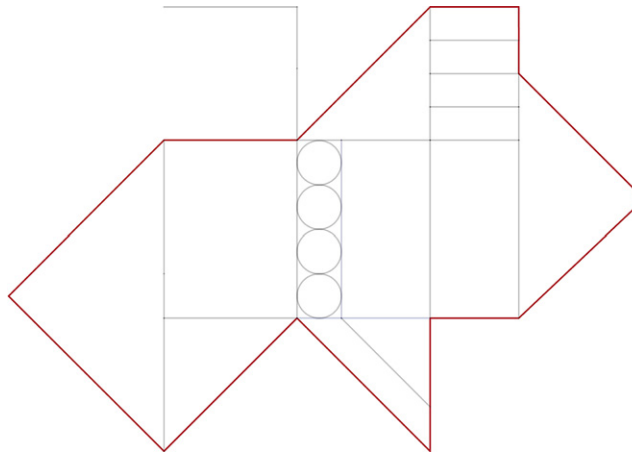

Fig. 3. Typical starting point for a Big Picture Person or Creator.

entire complex figure is given in the background to help orient the reader. In actual practice, the drawing is not traced, but made free-hand.)

Entrepreneurs view the complex figure in an entirely different way. In business they are people who "see the big picture." This behavior shows up in their drawings, as illustrated in Fig. 3.

Accountants and other people whose work requires a high level of organization are classic linear thinkers. If they usually read from left to right, they begin their drawings on the left and work systematically through to the right, as in Fig. 4.

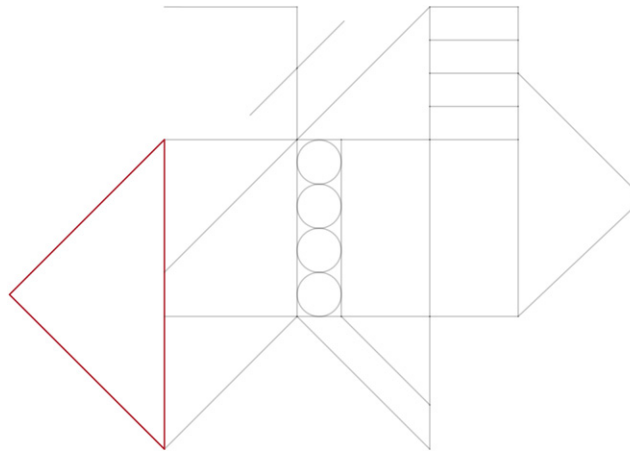

Fig. 4. Typical starting point for a Left to Righter—an Orderly Thinker.

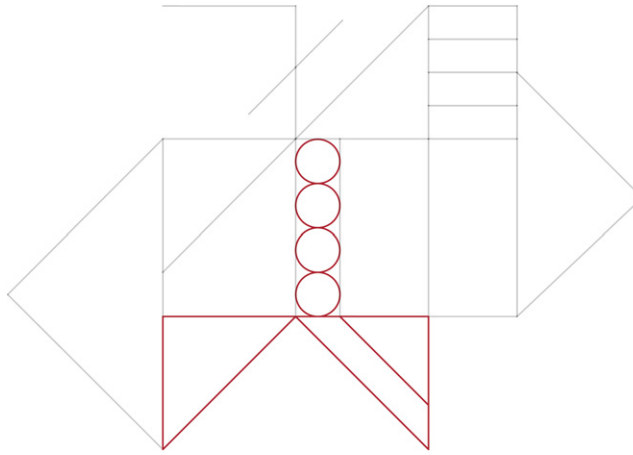

Fig. 5. Typical starting point for a Random Connector or a Disconnector.

Graphic artists, web designers, and product or package designers are apt to start their drawings anywhere they see a strong pattern, such as the triangles and the circles in Fig. 5.

More than just a curiosity, how people draw the complex figure reflects how they envision information—whether they focus on the parts or the whole, whether they think problems through logically or span boundaries with analogies. The more successful people have become within a given field, the more likely they are to become mentally rigid. Their brains become structured to see problems in only one way. By focusing on the difference between how a patient dealt with the world cognitively before injury and how they deal with it postinjury, DSM mediators can help bridge the gap, working with them to repair and rewire their cognitive processes so that they can again feel like they are functioning at what they consider to be an acceptable level. All patients discussed in this article had completed traditional cognitive rehabilitation programs at the time they began DSM work.

Because most people are not aware of their cognitive processes before injury, treating someone postinjury involves making them aware of the implicit rules that guide their thinking processes, such as comparing and contrasting alternatives, defining problems, generating alternatives, trial and error behavior, and so forth. In addition, postinjury, individuals tend to have lost their use of meta-cognitive conversation—the use of internal dialog that helps monitor behavior. For example, even though we may not be conscious of it, we all have a voice or voices inside of us telling us when to control our temper or how to behave in certain situations when faced with uncertainty or a challenge—it is what may prevent us from yelling at our boss or our children when we are frustrated with their behavior. In the DSM program, we encourage students to specifically describe complex geometric images; they must be specific and label what they see. This

description is how we begin to develop the meta-cognitive conversation that has been lost or compromised as a result of the injury.

Patients meet with a mediator once or twice a week for 2-hour sessions. During the 2-hour intervention, it is important to be vigilant to subtle changes, such as posture and breathing, that might indicate that the patient is experiencing anxiety. Anxiety, sometimes referred to as disequilibrium, transfers to the learning process and closes the door for learning, thus compromising the intervention. In the event of such disequilibrium, we have to modify the course of treatment and find an instrument that is not as challenging. The mediator must be cognizant of the delicate balance between being challenged and being overwhelmed. The more than 11,000 exercises we have created give us a vast selection from which to choose a less frustrating set of exercises.

At the conclusion of each session, patients are given packages of paper and pencil exercises, which allow them to rehearse the skills to which they were introduced (approximately 5–7 hours of materials per week). The patient must return to the next session with the materials, regardless of whether or not they were completed. Much can be learned from the process used to complete the tasks and the types of exercises left incomplete. An error analysis provides invaluable information about hidden or untapped weaknesses that must be addressed using more direct cognitive tools. The exercises provide a path for the next intervention. We gradually increase the complexity of the exercises to strengthen all cognitive weaknesses or deficiencies.

Patients typically begin to recognize changes after 18 hours of cognitive intervention. Among the first notable changes reported are improved accuracy in depth perception, reduction of dizziness and sleep disturbance, a re-emergence of the meta-cognitive conversation, and an increased ability to concentrate. After 36 hours of cognitive intervention, patients typically report a marked reduction in stimulus overload, an increase in energy, preplanning behavior, increased attention span, optimism, and an improvement in memory. After 54 to 72 hours of cognitive treatment, patients report a feeling of "returning to themselves"—dramatic improvements in organizational skills, multitasking, self-confidence, and tolerance for stress.

Case notes

Below are my case notes, to illustrate how Designs for Strong Minds works.

In a recent case, a client came to see me after two brain surgeries to remove a tumor. At his initial office visit, he repeated the same thing almost like a broken record, without any awareness of what he had said previously. He had no meta-cognitive conversation, and he could not think before performing a task or doing something. Basically, he had no systems to structure his life—he could not organize information or function on a daily basis. (Patient is a 33-year-old man with postgraduate credits).

Session 1. He connected dots randomly on orientation in space exercises. He could not remember instructions, dates, times, and so forth. He could not remember what happened last week.

Session 2. Part–whole relationships were difficult. He complained about living mindlessly. We focus on exercises that will help him develop a system and be mindful.

Session 3. Spatial skills are highly compromised, giving him tremendous difficulty with "dot" exercises. He has no system of organizing or storing pieces of information. He skipped many pages of the dot exercises because he was "stumped."

Session 4. He worked on analytic perception and progression exercises and had trouble maintaining focus.

Session 5. He worked on spatial relationships, which were difficult for him. We worked on setting up a notebook to help his organizational skills. He worked through dot exercises that once stumped him.

Session 6. He worked on spatial relationships skills to emphasize increasing concentration and focus.

Session 7. We continued our work on spatial relationships, which seemed to be easier for him. There were fewer instructions on the pages he worked on, and the ease with which he did the exercises indicates great facility with them.

Session 8. We worked on visual imagery progressions, which were difficult for him. In our work with the dot exercises, we focused on tolerating disequilibrium and watching the details. He has begun to group dots and look for patterns that allow for quick recognition.

Session 9. He continues to have trouble decoding written information, even with two variables. He cannot complete moderately complex word problems. He is doing a wonderful job documenting his internal dialogue on the visual imagery progressions, though when he gets overwhelmed he skips the difficult ones.

Session 10. We worked with visual progressions, identifying the rules and applying them to the next step. He is having difficulty with these exercises but continues to articulate and to document his thinking. The complex word problems continue to be difficult.

Session 11. We worked with complex visual imagery exercises. He is pleased when he gets "a pattern that he could not previously see." The orientation in space and the dot exercises are finally getting easier for him. He still needs to rotate the page to reproduce the complex shapes correctly.

Session 12. He reports that he is seeing the dots better than ever. He is now seeing the dot configurations as a relationship rather than as disparate, meaningless dots. He has moved on to complex dot patterns, and he is working through them with relative ease. We worked on figural analogies with two to three variables, which involve documentation, analysis, application, prioritizing choices, distinguishing

relevant from irrelevant information. The visual rotation exercises are allowing him to see that everyone's perception is different.

Session 13. We worked on decoding written information with two variables. He is having trouble incorporating and using the cues provided in these exercises. Instead of using the pre-made charts, he prefers making his own chart to solve the problem.

Session 14. We worked on complex story problems, decoding written information. He is able to work with the prepared charts without needing to make his own. We discussed organizational strategies, specifically the use of mind-mapping as a way to record and organize complex ideas.

Session 15. We continued to work with complex story problems, involving deductive reasoning story skills with three variables. He is finally beginning to integrate and use the "frames of reference" given in the problems to help solve them. He continues to be able to use the premade charts to solve the problems with much less documentation necessary. The dots exercises are becoming increasingly more complex and though he finds them difficult, his pre-planning behavior is allowing him to make fewer mistakes.

At the beginning of the treatment, the patient moved back home with his parents. He was unable to care for himself; he could not keep track of time, shop, cook, or remember to write things down. His self-esteem and confidence were at an all-time low. He was depressed and lacked motivation. He could not keep track of appointments and fought the use of a calendar or any paper-and-pencil intervention. After 15 2-hour, biweekly sessions plus 3 hours of weekly independent work, the patient was able to return to his apartment and part-time work. He determined that there was a more lucrative employment opportunity in another state. I must admit that when he sought my opinion, I encouraged him to stay in the Chicago area for me to provide support while he tackled the complexities of returning to full-time work. He flew to the west coast, interviewed, and found a position and a place to live. He has been living on the west coast successfully for the past 9 months.

Let us consider yet another example of a high-functioning posttraumatic head injury patient, an account executive at a large accounting firm. Because accountants tend to be detail oriented, my client wanted to regain his mastery of the details within his world but was prevented from processing information in the same detailed way because of his injuries. To help the accountant bridge this gap, a DSM mediator begins with exercises that address recognizing details between two images to reinitiate the individual's attention to detail. As this becomes more habitual, the exercises become more complex in nature and ambiguity is introduced. Once ambiguity is introduced, the client needs to enlist the meta-cognitive conversation to negotiate the indecision and decide on an answer about the details. In addition, he needs to relearn to differentiate when details are important and when they

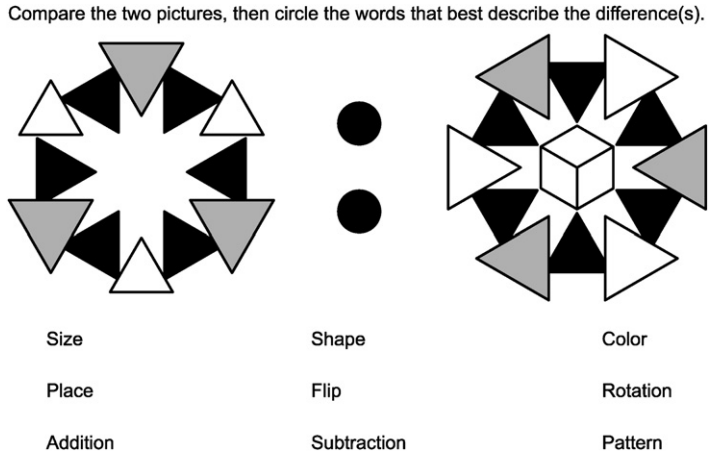

Fig. 6. Comparisons—Beginner Level.

are not based on the goals of particular activities and tasks. This objective can be accomplished through comparison puzzles (Fig. 6).[1]

Once the accountant can label complex details that help him navigate the comparison exercises, we then move on to analogies that help him to identify rules that can be applied to new situations. The analogies give the individual the opportunity to abstract the underlying structure of a process, such as a social situation or a task. Analogous thinking allows people to span boundaries, challenge assumptions, and generate new ideas, all of which enhance strategic thinking, innovation, and communication. An example of an analogy puzzle is given in Fig. 7.

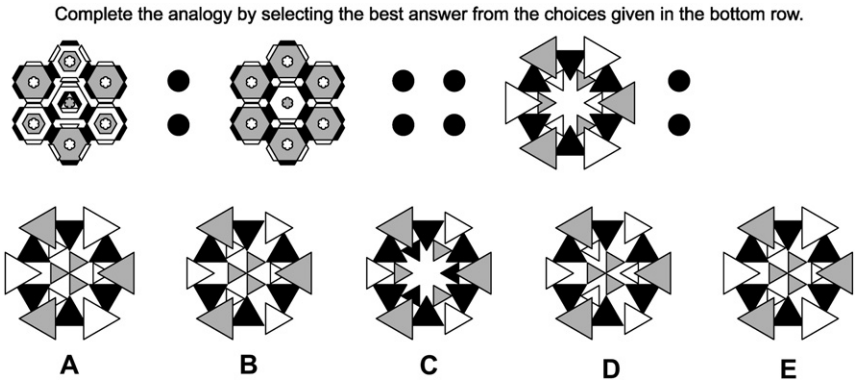

Fig. 7. Analogies—Intermediate Level.

[1] Please note that the exercise examples that follow are meant to engage the reader and reflect exercises at an advanced level of treatment. To see more DSM exercises at all levels, please view our websites: www.DesignsForStrongMinds.com and www.DSMexercises.com.

Progressions

Once the patient can habitually identify rules and apply them, we then move on to progressions, which require that the patient compare, contrast, and identify rules that dictate a change and predict the next step based on the identified rules. What differentiates the progressions from analogies is the sequence—rather than just abstracting the rule, the patient needs to consider the order of the sequence and make more complex decisions. Progressive thinking is associated with the cognitive skill of pattern detection—the means by which people relate past events to present circumstances and future possibilities. Effective thinking requires the ability to perceive temporal and logical relationships, detect change, and compare expectations to reality. The total inability to detect patterns is referred to as an "episodic grasp of reality." The inability to perceive progressions prevents people from making sense of recurring events and recognizing the small discrepancies that accumulate into major crises. Progression puzzles, such as Fig. 8, allow practice in:

- Visualizing goals
- Identifying what is relevant to achieving those goals
- Establishing a step-by-step plan of action for realizing goals

Part–whole relationships

After progressions, we move to part–whole relationships (Fig. 9), which demand that the individual break the whole into its parts and identify salient characteristics to solve the problem. Part–whole relational thinking allows people to adjust their behavior without losing sight of the big picture. People who have this cognitive skill are better able to adapt to diversity and can depersonalize conflicts. Understanding part–whole relationships contributes to the sense of continuity that begins with progressive thinking. A strong sense of continuity is vital to:

- Achieving personal and professional satisfaction
- Making good decisions
- Working effectively in diverse cultures
- Managing conflicts
- Communicating effectively

Categories

After part–whole relationships, we move on to categories, which require the client to identify salient characteristics that belong to a certain group. These exercises require the cognitive abilities to compare, contrast, identify a rule, recognize a sequence, and appreciate the relationship between the images as they are sequenced. Categorical thinking helps people generate new

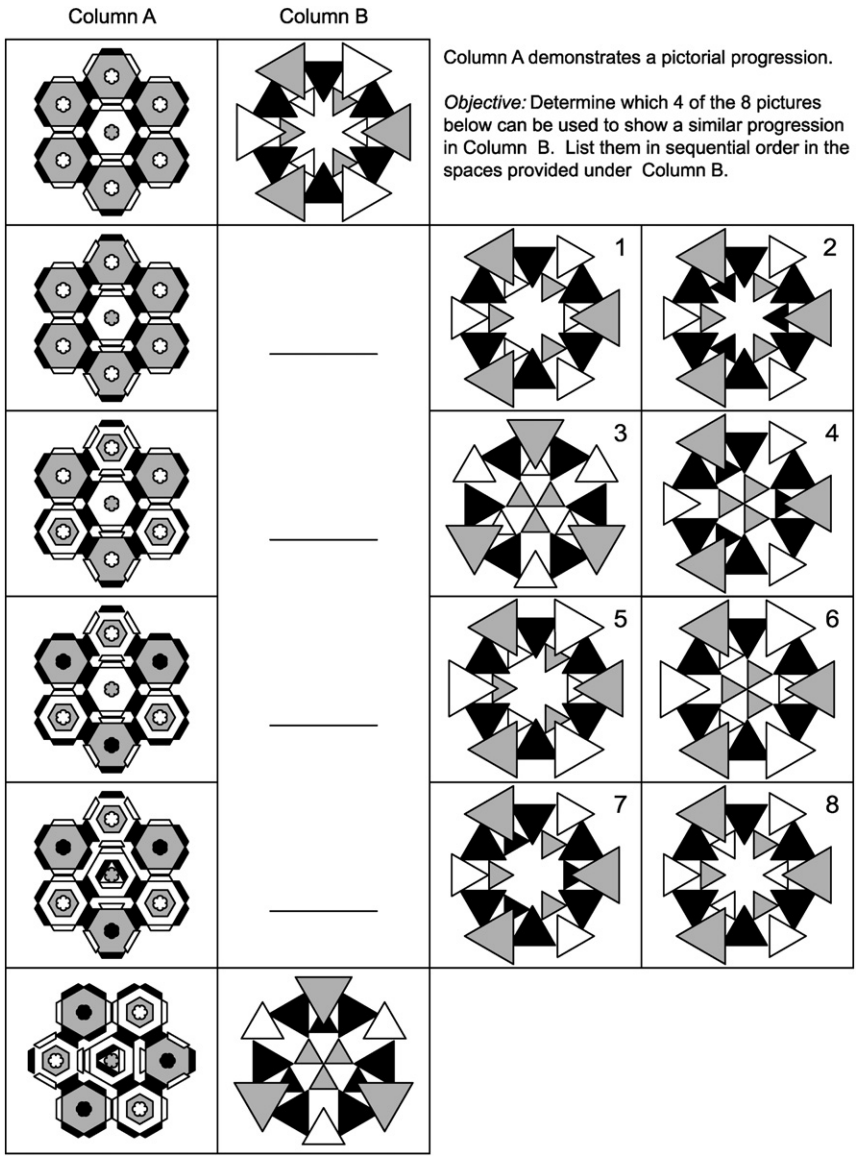

Fig. 8. Progressions—Advanced Level.

knowledge and envision new possibilities. The intentional sorting, classifying, and categorizing of information can generate new insight into established assumptions and expectations, which provides a framework for storage and retrieval of details and larger concepts, therefore improving memory. Fig. 10 illustrates a categorical puzzle.

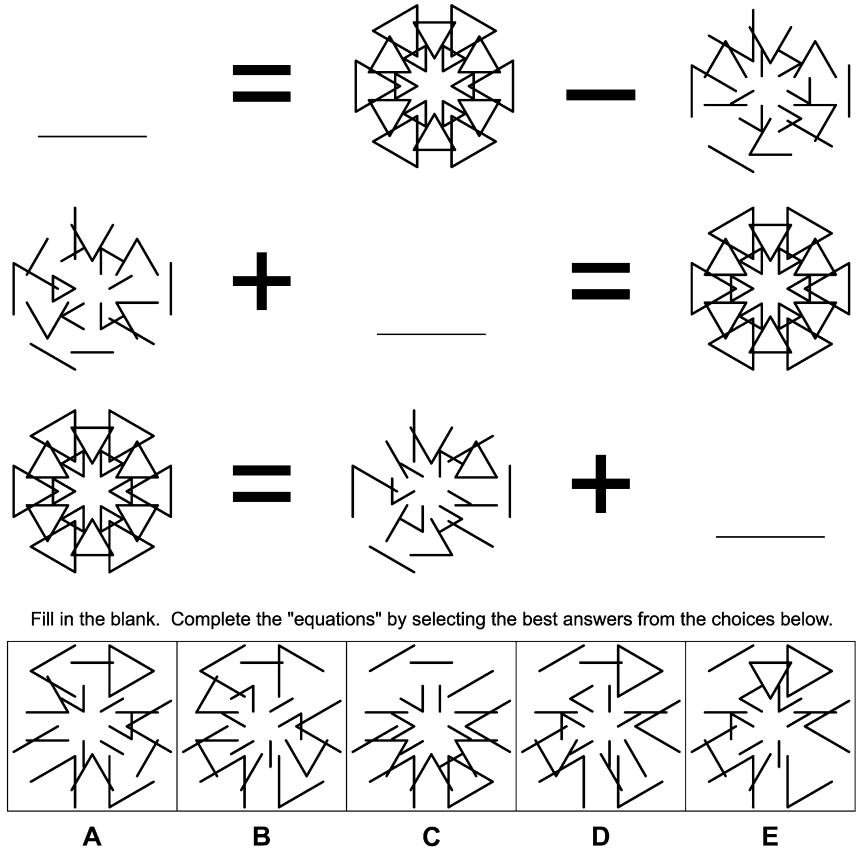

Fig. 9. Part–Whole Relationships—Advanced Level.

Following this progression of DSM treatment, mild to moderate posttraumatic brain injury patients are able to address their daily needs without the frustration that they felt before treatment. Mild to moderate posttraumatic head injury patients often lose the ability to subconsciously negotiate their way through their daily activities. What once came naturally now requires conscious thought. The goal of the DSM treatment is to give patients the tools to navigate their environment and tolerate the uncertainty and the multisensory input presented by everyday life, including the workplace.

Designs for Strong Minds and online cognitive rehabilitation

To date, we have developed three interactive online-based applications of DSM exercises at www.DSMexercises.com: Variables, I-Ching Variables,

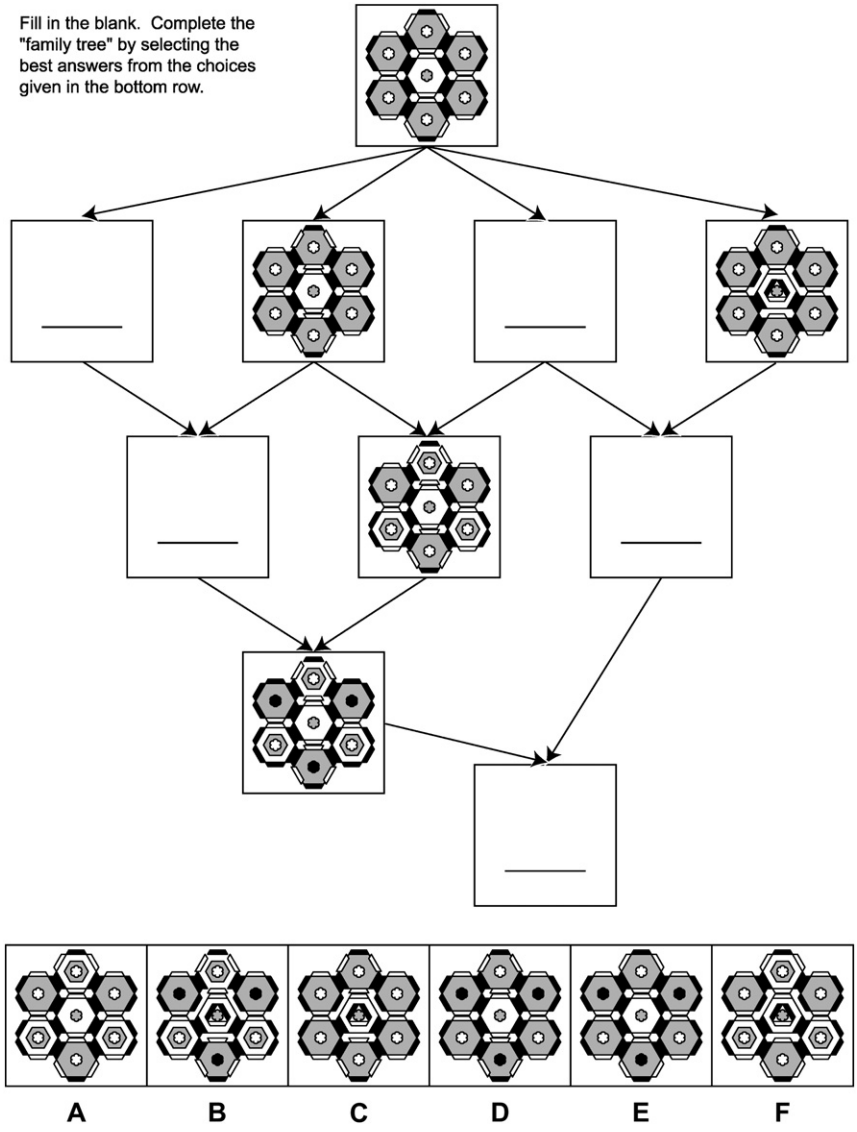

Fig. 10. Categories—Expert Level.
(Answers to the puzzles in Figs. 6–10 are given in Figs. 11–15.)

and NASA Critical Thinking Game. We continue to develop additional interactive exercises for that Web site, which will be made available soon. The online-based games provide progressive cognitive training at the patient's fingertips for use in conjunction with rehabilitation or independently.

The Variables games ask participants to compare neighboring images based on criteria, such as color, size, shape, number of objects, and direction. As the goal of the game changes, the player's approach to solving the problem must also change. Players engage in the game as a way of observing their own thought processes. The I-Ching Variables exercises are less complex than the Variables exercises, making them most effective in the early stages of rehabilitation of posttraumatic head injuries. The games can be played at beginning, intermediate, advanced, and expert levels. There are more than 9,000 opportunities to build and to strengthen attention, detail, and thinking skills.

The NASA Critical Thinking Game is designed to enhance attention to details, creativity and innovation. The NASA games provide rehearsal in relational thinking and exercise higher levels of visual imagery so that participants can retain more information and generate ideas. As the games progress, the puzzles become increasingly challenging. Thinking is a behavior analogous to learning a new sport or any new skill. With rehearsal and increased complexity, individuals habituate behaviors that transfer to all other activities so that they think smarter and faster everywhere.

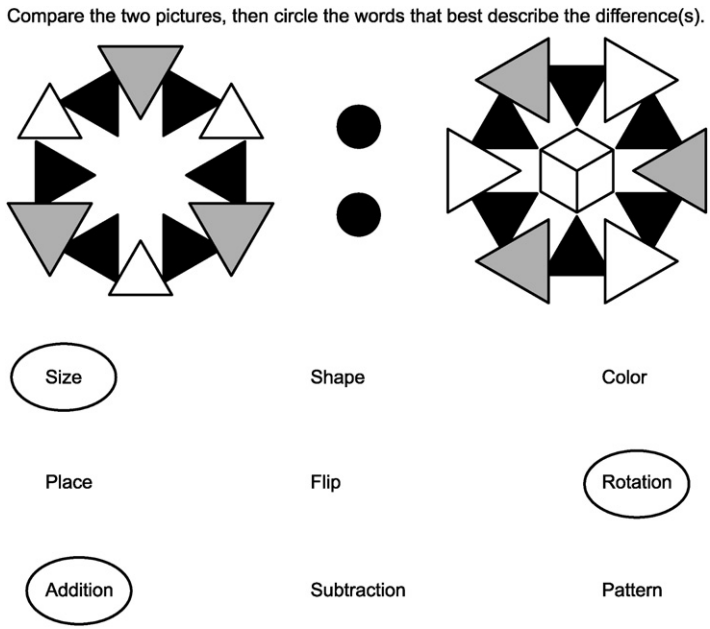

Fig. 11. Comparisons—Intermediate Level.

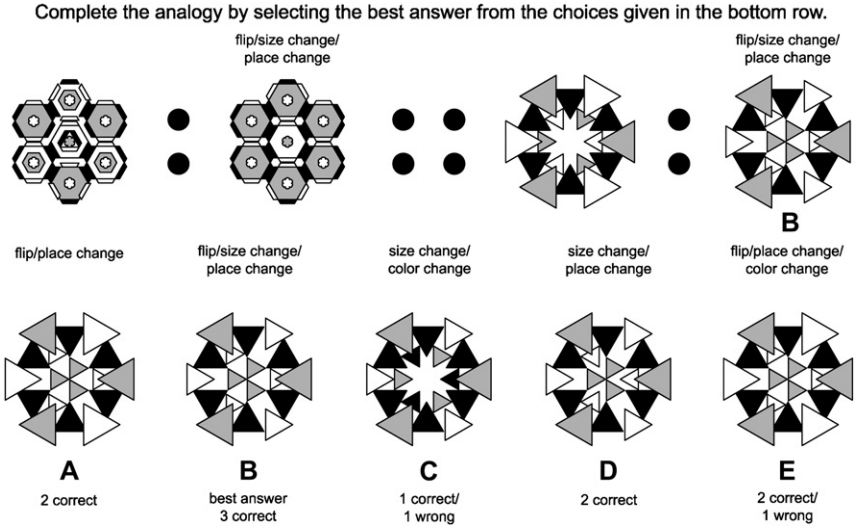

Fig. 12. Analogies—Intermediate Level.

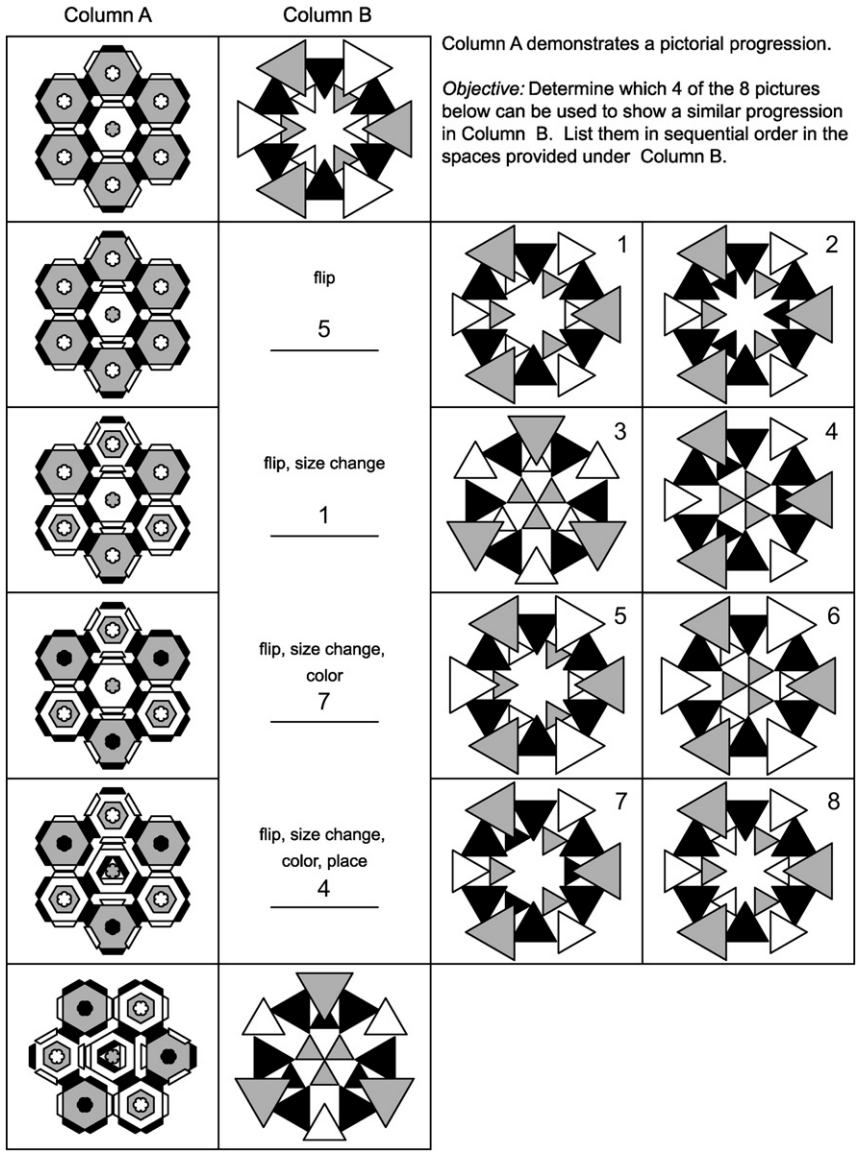

Fig. 13. Progressions—Advanced Level.

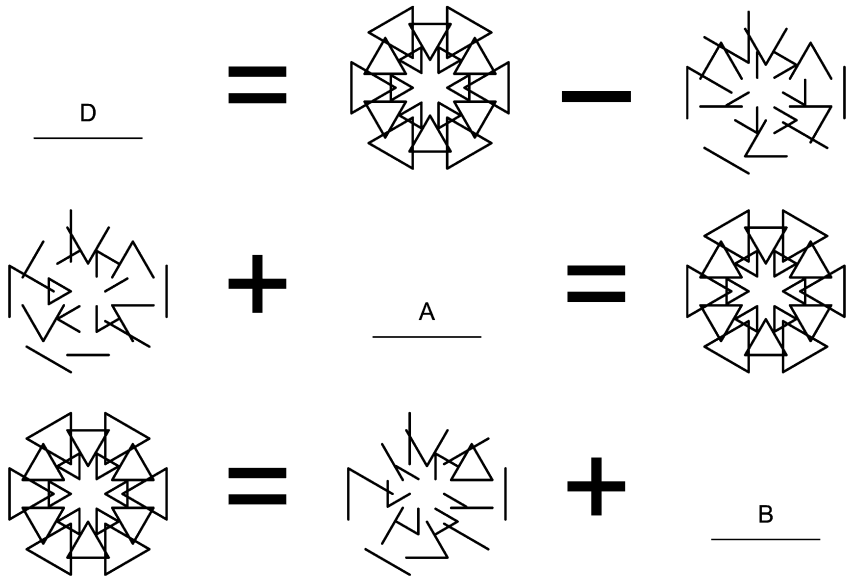

Fig. 14. Part–Whole Relationships—Advanced Level.

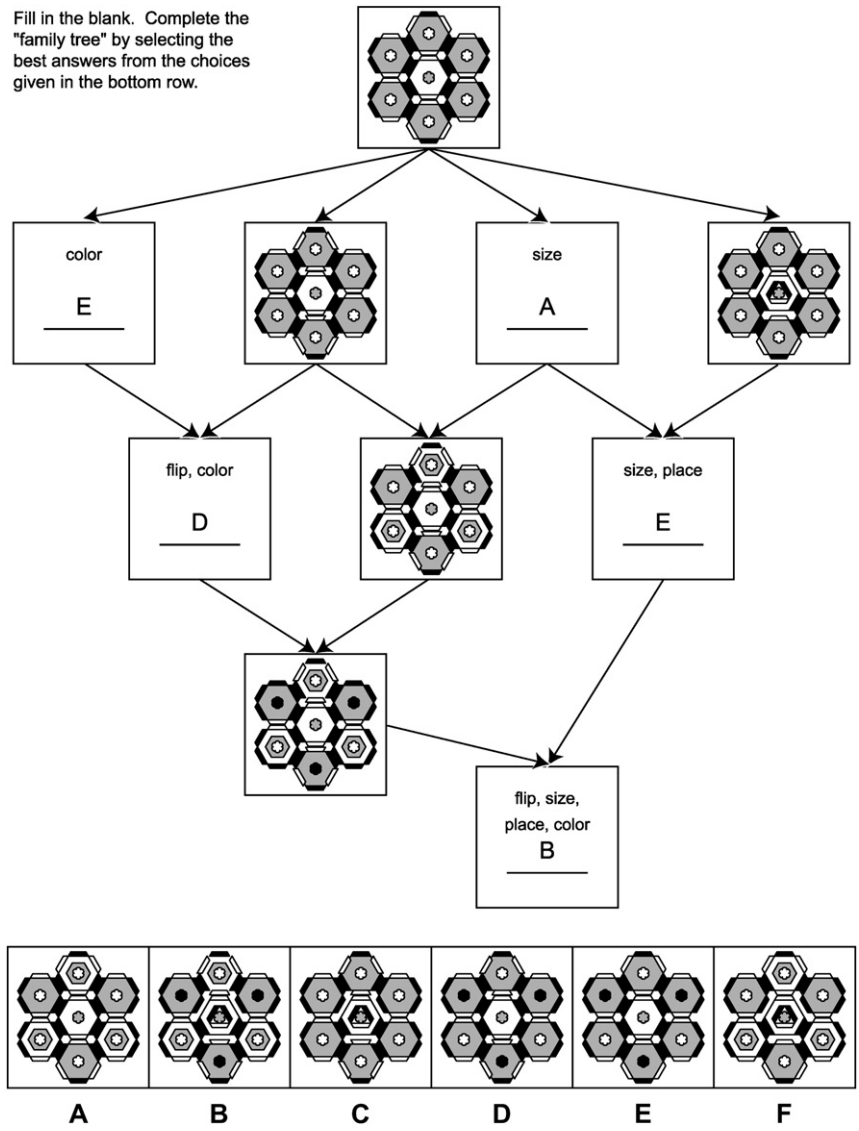

Fig. 15. Categories—Expert Level.

Summary

DSM puzzles and the DSM mediation technique are vital tools in helping previously high-functioning adults who have mild or moderate posttraumatic head injuries. DSM treatment focuses on the difference between how patients dealt with the world cognitively before injury and how they deal with it postinjury, helping them bridge the gap and working with

them to repair and rewire their cognitive processes so that they can again function at what they consider to be an acceptable level.

Using attention, intention, and rehearsal, the DSM treatment uses the brain's natural plasticity to increase the patients' cognitive ability, transforming them from passive recipients merely reacting to their environment to empowered individuals who again begin to generate information and ideas.

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