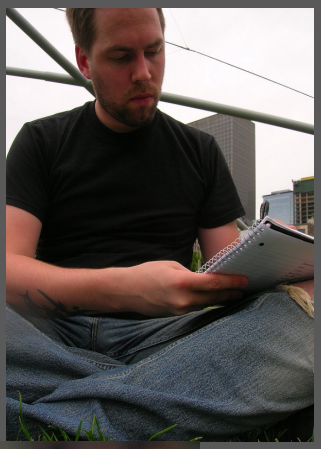
School of Human Communication Sciences, La Trobe University

Kingsbury Drive
Bundoora, VIC3086
Phone: 03 94792088
Fax: 03 94792088
E-Mail: m.rose@latrobe.edu.au
Web: Latrobe.edu.au

Miranda Rose, PhD
& Michelle Attard



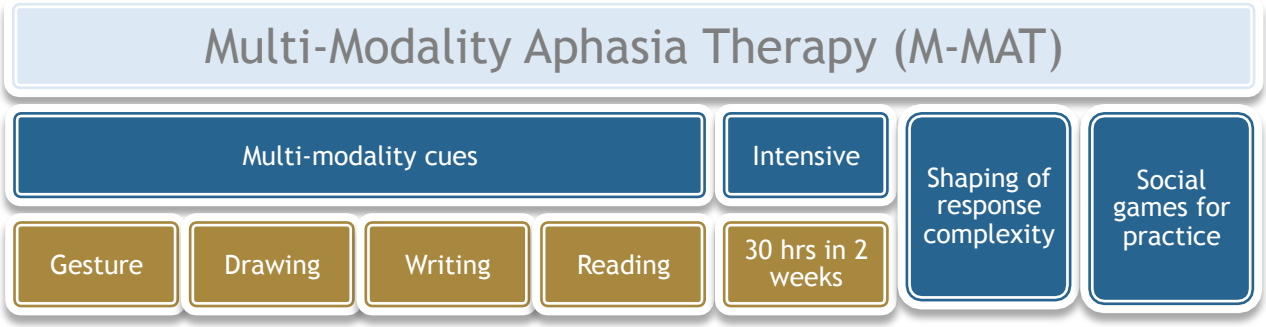
M-MAT PROCEDURE MANUAL

2011

Table of Contents

Introduction

Multi-modality aphasia therapy (M-MAT) (Rose & Attard, 2011) is a behavioural treatment for aphasia. It has four key elements: high intensity of practice (30 hours over 10 days) (*massed practice*); shaping of responses (gradually increasing complexity of spoken targets in line with participant mastery); a social imperative to produce speech (game-based interactive tasks); and rich multi-modality cueing (gesture, writing word, drawing, reading word). The primary aim of M-MAT is **improved spoken production and oral communication**. However, gesture, drawing, and writing are also practiced in M-MAT and could be used as alternative methods if spoken communication fails. M-MAT is based on Luria's (1972) principles of intra- and inter-systemic facilitation, and underpinned by the "embodied view" of language processing. In the embodied view, there is frank interaction between perception/action and higher cognitive processes such as language and thought (Jirak, Menz, Buccino, Borghi & Binkoski, 2010). This rich and functional interplay between linguistic, perceptual, and gestural systems has been supported by recent neuroscience, which emphasises the co-activation of related systems during various tasks (see Pulvermüller & Berthier, 2008 for a detailed summary). In a recent meta-analysis of studies examining embodiment theory, Jirak and colleagues (2010) argued that there is good evidence to support activation of the primary motor, supplementary motor, and premotor cortices during language processing. Such cross-modal interaction may afford a processing advantage through motor activity for the damaged linguistic system in aphasia.



Constraint-induced aphasia therapy (CIAT) (Pulvermüller, 2001) and its variants—constraint-induced language therapy (CILT) (Maher et al., 2006), Constraint-induced aphasia therapy plus (CIATPlus) (Meinzer, Djundja, Barthel, Elbert, & Rockstroh, 2005) and Intensive Language Action Therapy (ILAT) (Pulvermüller & Berthier, 2008)—share three key elements with M-MAT: high

intensity of practice (*massed practice*; 30 hours over 10 days); shaping of responses (gradually increasing complexity of spoken targets in line with participant mastery); and a social imperative to produce speech (game-based interactive tasks). Importantly, M-MAT contrasts considerably from the fourth key element of CIAT: constraint of responses to the spoken modality only (visual barriers and restriction/discouragement of non-verbal compensatory communication) and repetition cues only. CIAT is based on Constraint-induced Movement Therapy (Taub, 2004) and principles of neuroplasticity that aim to improve spoken communication by preventing learned non-use of oral communication (Taub et al., 2006) and harnessing the Hebbian learning principle of "what fires together, wires together" (Hebb, 1949).

M-MAT also contrasts with Promoting Aphasic Communication Effectiveness (PACE) (Davis, 2001). PACE encourages interaction and message transfer in whatever modality is achievable for the person with aphasia. Thus, treatment focuses on using multi-modality response modes rather than aiming for oral communication. Further, feedback and cueing from the therapists focus on communication success and multi-modality options rather than assistance in oral production (see Rose, in press for a full review of these issues and contrasts).

Schedule

Three and ¼ hours of treatment are provided each day, with refreshment intervals (totalling 45 minutes) at each hour, 4 days a week, over 2 weeks. Thus, the participants receive a total 32 hours of contact (26 hours of specified treatment plus 6 hours of group social interaction during breaks).

Daily Schedule	Time
Probe assessment	9.40-10.00
Treatment Part 1	10.00-11.00
Morning tea	11.00-11.20
Treatment Part 2	11.20-12.35
Lunch	12.35-1.05
Treatment Part 3	1.05-2.05
Home tasks/Goodbyes	2.05-2.15

Set-up

Groups can be formed with 3-5 participants. Participants sit together around a square or round table alongside the therapist/s. Room temperature, ambient noise and lighting should be conducive to comfort and concentration. Participants with hemiplegia are offered a cardholder so that they can easily arrange and see their therapy materials. This also prevents participants from viewing one another's materials. Refreshment breaks are important for participant comfort and for social activity.

Treatment Goals

Determining treatment goals for individual participants requires assessment that reveals:

1. The integrity of the phonologic, semantic, and syntactic systems in reading, writing, auditory comprehension and oral expression. We use:
    a. Western Aphasia Battery—Revised for overall aphasia severity and levels of strength/weakness in major modalities
    b. Boston Naming Test
    c. Pyramids and Palm Trees Test—Three Pictures Version
    d. PALPA 53
    e. Story re-tell (Cinderella)
    f. Twenty-minute conversation sample
2. The presence and degree of verbal, oral, and limb apraxia
    a. Apraxia Battery for Adults
    b. Test of Oral and Limb Apraxia—Gestured Pictures Subtest
3. Nonverbal reasoning and visual memory
    a. Raven's Coloured Progressive Matricies
    b. Rey-Osterreith Complex Figure Test
4. Mood and perceived communication abilities
    a. Aphasia Depression Rating Scale
    b. Stroke and Aphasia Quality Of Life Test
    c. Communicative Effectiveness Index
5. Participants' major communication goals/activities
    a. Discussion and negotiation of targets

Where ***word retrieval*** presents as a major issue, we investigate the impact of grammatical class (noun vs. verb), frequency, and imageability on production. The OANB provides a good stimuli set to enable this assessment. Items for treatment are then arranged according to levels of participant difficulty as evidenced on their OANB performance. Noun and verb retrieval becomes the major focus of intervention according to relative need.

Where word retrieval is relatively spared, but ***sentence production*** is limited (e.g., to single nouns, verbs, simple SV constructions), sentence level work becomes the target (see table below). This begins at SV and SVO constructions building to SVOO and SVO –conjunction- SV coordinated sentences.

Stimuli

The stimuli consist of black-and-white drawings of common objects, animals, action verbs, and scenes involving action between one or two people. These can be drawn from the International Picture-Naming Project (Szekely, Jacobsen et al. 2004), Object and Action Naming Battery (Druks & Masterson 2000), and Snodgrass and Vanderwart Pictures (Snodgrass & Vanderwart 1980). Action photos can also be sourced from existing studies, (e.g., Meinzer et al., 2005). The pictures are formed into single-sided playing card-sized pictures and then laminated for durability. In order to prevent participants seeing the images through the reverse side during card game activities, the paper thickness should be 140 GSM or higher.

Tasks and Target Hierarchies

There are **6 major tasks** used in M-MAT.

1. **Fish:** In the game "Fish" participants are trying to gather as many pairs of cards as possible. Each player is dealt 6-7 cards and the remainder of the cards form a central pile. Players take turns to ask the person opposite them if they have a particular card. The responder must answer "Yes" or "No" to the question. Participants must give over the card if they have it in their hand and are asked for it. The requesting player then gets another turn and continues requesting cards until they are denied. Once denied, the requester picks up a card from the central pile. The play then moves to the next player.
2. **Memory:** In "Memory" all cards are turned faced down on the table. Players take turns to turn over 2 cards at a time, aiming to make a pair. They must name each card they turn over. If they get a pair, these cards are removed from the table and count as a point for the player. The winner has the most pairs of cards.

3. **Snap**: In "Snap", the pack of cards are dealt between all players. Players take it in turns to place a card down on the table (centrally) and rapidly name it as they do so. The next player does the same. When two identical cards are placed one after the other on the pile, the first person to snap their hand on the pile wins the pile of cards. The winner gathers the most cards.
4. **"Who am I?":** In "Who am I?", players are guessing the occupation/hobby of the card holder. A player takes a card from the pile and identifies to themselves the object/action pictured. The other players take turns in asking the card holder a general question to try to identify the activity. For example, the player may have the card "camera". Players ask questions such as "Do you work inside or outside?, "Do you need a tool?", "Is this a risky job", etc. Play continues around the table once the card context/occupation has been guessed.
5. **"I went shopping/I went walking…":** In "I went shopping", players select a card and state "I went shopping and bought a ……..*(name the object e.g., "pot")* or "I went walking and saw…..". The next player then adds their card name…. "I went shopping and bought a pot and some cheese". Play continues until memory fails.
6. **Naming with a commercial board game:** Players play a commercial game such cribbage, snakes and ladders, ludo, bingo, and so on. They pick up a card from a central pile before each turn and name item before rolling dice and moving counters in the commercial game.

There are three hierarchies of complexity used within each task that manipulate the difficulty of the target responses. These are detailed in the following noun, verb, and sentence tables:

Stimulus and Syntactic Complexity Levels ***Nouns*** *(adapted from Kirmess and Maher, 2010)*

Level	Syntactic Complexity	Example Target
1	Noun	"Couch?"
2	Carrier phrase[1] + Noun	"Do you have a couch?"
3	Carrier phrase + Adj + Noun	"Do you have a red couch?"
4	Carrier phrase + Adj + Adj + Noun	"Do you have a large, red couch?"

[1] The carrier phrases include: "Do you have a…", "I want/need a…", and "I bought/saw/have a…". The participants are encouraged to produce accurate carrier phrases with as much support as required, although incompleteness and/or incorrect use of morphology is accepted if the target is correct.

Stimulus and Syntactic Complexity Levels ***Verbs***

Level	Syntactic Complexity	Example Target
1	Verb	"Running?"
2	Carrier phrase[1] + Verb	"Do you have: catching?"
3	Carrier phrase + Sub + Verb	"Do you have: the boy is catching?"
4	Carrier phrase + Sub+ Verb + Object	"Do you have: the boy is catching the ball?"

[1] The carrier phrases include: "Do you have a…", "I want/need a…", and "I bought/saw/have a…". The participants are encouraged to produce accurate carrier phrases with as much support as required, although incompleteness and/or incorrect use of morphology is accepted if the target is correct.

Stimulus and Syntactic Complexity Levels ***Sentences***

Level	Syntactic Complexity	Example Target
1	Carrier phrase [1] + Sub + Verb	"Do you have The girl is sweeping?"
2	Carrier phrase + Sub + Verb + Object	"Do you have the girl is sweeping the floor?"
3	Carrier phrase + Sub + Verb + Object + Object	"Do you have the girl is sweeping the floor with the broom?"
4	Carrier phrase + Sub + Verb + Object + Object +conjunction SV	"Do you have the girl is sweeping the floor with the broom because it is dirty?"

[1] The carrier phrases include: "Do you have a…", "I want/need a…", and "I bought/saw/have a…". The participants are encouraged to produce accurate carrier phrases with as much support as required, although incompleteness and/or incorrect use of morphology is accepted if the target is correct.

Which Tasks and When?

Intensive treatment programmes require close attention to participant motivation and possible fatigue. Generally, tasks are practiced for the duration of a 60-minute session unless participant motivation wanes. A positive, upbeat atmosphere is encouraged. Humour and encouragement are offered wherever possible. Achievements are openly celebrated and progress charted.

Card sets are alternated throughout the treatment sessions: nouns first, verbs second, nouns third (or sentences if participants are working at that level), etc.

The decision to move up a complexity level step within a noun, verb, or sentence-level task is based on participant performance. Generally, once a participant is reaching 80% correct at a particular level during a 60-minuter session, they can attempt performance at the next complexity level step.

Moving Through the Cueing Hierarchies

The M-MAT cueing hierarchy includes six steps in total. As the treatment objective is to facilitate spoken naming, the first step of the cueing hierarchy entails verbally announcing the items. At Level 2, the carrier phrase is required in spoken form only.

M-MAT Cueing Hierarchy—Example for Level 1

Step	Description
1	Participant verbally announces card (noun; e.g., "Couch"). If correct, move on to next card (starting at Level 1, Step 1 again) following partner's turn to announce card. If incorrect, go to Step 2
2 [1]	Ask participant to make an iconic gesture and say the word to announce the pictured item. If item named, move on to next card following partner's turn. If incorrect, go to Step 3
3 [2]	Clinician provides an iconic gesture model. If item named, move on to next card following partner's turn. If participant unable to name item, clinician provides item name and asks participant to repeat with gesture.
4	Ask participant to make a drawing[3] and say the word to announce the pictured item. Clinician provides refinement cues as necessary. Then go to Step 5
5	Clinician provides a written model (word; e.g., *couch*) + verbal model for the participant to read and copy. Then go to Step 6
6	The participant verbally repeats the name three times with the pictured item and written cue in view.

[1] Any approximation of the gesture is positively reinforced by the clinicians [2] Models are provided either to reinforce the gesture produced, or to indicate that the participant could more closely approximate the desired gesture in instances of incomplete or unrelated productions, or no production [3] Any drawing which highlights the characteristic features of the item is positively reinforced.

Gestures for the items are created spontaneously by the clinicians, and refined or adjusted based on the meaningfulness of the gestures and the participants' ability to produce them. The gestures are usually *iconic* (portraying a concrete action/object) (McNeill 1990). For instance, they

depict the use of the item, its shape and/or location, or a single characteristic element of the item. In the *drawing* step, the participants are encouraged to make a simple drawing of the item. The clinician provides refinement cues (such as verbal suggestions or a model) when a drawing does not clearly depict the target item. The *reading/writing* step involves the clinicians presenting the written word on a card as a prompt to the participants. Initially, the entire word is shown; once the participants indicate they are more familiar with the words, the clinicians began to apply shaping (e.g., showing the first letter of the word).

The name for each *newly-introduced* item is provided to the participants at Step 2 if they are unable to verbally announce the item at Step 1. As a method of shaping, the name for items *previously exposed* during treatment is provided at Step 3 if the participants are unable to verbally announce the item at Steps 1 or 2.

Home Practice

As part of a simple daily home program during each treatment, participants are assigned individualised transfer tasks including one or more items exposed during each session. This could involve making a request for an item or announcing the name of an item in a functionally relevant setting. For instance, when the participants are planning to have a quiet evening at home, it is suggested that the participants name some of the ingredients (trained items that day) as they are being prepared for dinner.

References

Attard, M., & Rose, M., (in press). The comparative effects of multi-modality aphasia therapy and constraint-induced aphasia therapy for severe chronic Broca's aphasia: An in-depth pilot study. *Aphasiology,*

Beeson, P. M., & Robey, R. R. (2006). Evaluating single-subject treatment research: Lessons learned from the aphasia literature." *Neuropsychology Review*, *16*(4): 161-169.

Benaim, C., Cailly, B., Perennou, D., & Pelissier, J. (2004). Validation of the Aphasic Depression Rating Scale. *Stroke, 35*(7): 1692-1696.

Bryden, M. (1982). Handedness and its relation to cerebral function. *Laterality: Functional asymmetry in the intact brain*. M. Bryden. New York, Academic Press: 157-179.

Busk, P. & Serlin, R. (1992). Meta-analysis for single case research: Single-case research design and analysis. T. R. Kratochwill and J. R. Levin. Hillsdale, NJ, Lawrence Earlbaum Associates Inc: 197-198.

Cherney, L. R. & Robey, R. R. (2008). Aphasia treatment: Recovery, prognosis, and clinical effectiveness. *Language intervention strategies in aphasia and related neurogenic communication disorders*. R. Chapey. Baltimore, Lippincott Williams & Wilkins: 186-202.

Dabul, B. (2000). *Apraxia Battery for Adults* (2nd ed.). Austin: Pro-Ed.

Damasio, H. (2008). Neural basis of language disorders. Language intervention strategies in aphasia and related neurogenic communication disorders. R. Chapey. Baltimore, Lippincott Williams & Wilkins: 20-41.

Druks, J. & J. Masterson (2000). An Object and Action Naming Battery. Philadelphia: Psychology Press.

Fastenau, P. S., Denburg, N. L., & Hufford, B. J. (1999). Adult norms for the Rey-Osterrieth Complex Figure Test and for supplemental recognition and matching trials from the extended Complex Figure Test. *Clinical Neuropsychologist, 13*(1): 30-47.

Goodglass, H., Kaplan, E., & Weintraub, S. (2001). Boston Naming Test. Philadelphia: Lippincott Williams & Wilkins.

Helm-Estabrooks, N. (1992). *Test of oral and limb apraxia*. Chicago; The Riverside Publishing Company.

Hilari, K. & Byng, S. (2001). Measuring quality of life in people with aphasia: The Stroke Specific Quality of Life Scale. *International Journal of Language and Communication Disorders, 36*(SUPPL.): 86-91.

Hilari, K., Wiggins, R., Roy, P., Byng, S., & Smith, S. (2003). Stroke and Aphasia Quality of Life Scale-39 (SAQOL-39): Evaluation of acceptability, reliability, and validity. *Stroke, 34*(8): 1944-1950.

Howard, D. & Patterson, K. (1992). The Pyramids and Palm Trees Test. Suffolk: Thames Valley Test Company.

Kay, J., Lesser, R., & Coltheart, M. (1992). Psycholinguistic Assessments of Language Processing in Aphasia. Hove: Lawrence Erlbaum Associates Ltd.

Kertesz, A. (2007). Western Aphasia Battery-Revised. San Antonio: The Psychological Corporation.

Kertesz, A. & McCabe, P. (1977). "Recovery patterns and prognosis in aphasia. *Brain, 100*(1): 1-18.

Kirmess, M. & Maher, L. M. (2010). "Constraint Induced Language Therapy in early aphasia rehabilitation." *Aphasiology, 24*(6-8): 725-736.

Lomas, J., Pickard, L., Bester, S., Elbard, H., Finlayson, A., & Zoghaib, C. (1989). The Communicative Effectiveness Index: Developmental and psychometric evaluation of a functional communication measure for adult aphasia. *Journal of Speech and Hearing Disorders, 54*(1): 113-124.

Maher, L. M., Kendall, D., Swearengin, J. A., Rodriguez, A., Leon, S. A., Pingel, K., et al. (2006). A pilot study of use-dependent learning in the context of Constraint Induced Language Therapy. *Journal of the International Neuropsychological Society* **12**(6): 843-852.

Masterson, J., & Druks, J. (1998). Description of a set of 164 nouns and 102 verbs matched for printed word frequency, familiarity and age of acquisition. *Journal of Neurolinguistics, 11*(4): 331-354.

McNeill, D., Levy, E., & Pedelty, L. (1990). Speech and gesture. Cerebral control of speech and limb movements. G. Hammond. North Holland, Elsevier: 203-256.

Morsella, E., & Krauss, R. M. (2004). "The role of gestures in spatial working memory and speech." *American Journal of Psychology, 117*(3): 411-424.

Pulvermüller, F., & Berthier, M. L. (2008). Aphasia therapy on a neuroscience basis. *Aphasiology, 22*, 563-599.

Rauscher, F. H., Krauss, R. M., & Chen, Y. (1996). Gesture, speech, and lexical access: The role of lexical movements in speech production. *Psychological Science, 7*(4): 226-231.

Raven, J. C., Court, J., & Raven, J. (1995). Coloured Progressive Matrices. Oxford, Oxford Psychologists Press.

Rose, M. (in press). Releasing the constraints on aphasia therapy: The positive role of gesture and multi-modality treatments. *American Journal of Speech Language Pathology*.

Snodgrass, J. G., & Vanderwart, M. (1980). A standardized set of 260 pictures: Norms for name agreement, image agreement, familiarity, and visual complexity. *Journal of Experimental Psychology: Human Learning and Memory, 6*(2): 174-215.

Szekely, A., Jacobsen, T., D'Amico, S., Devescovi, A., Andonova, E., Herron, D., et al. (2004). A new on-line resource for psycholinguistic studies. *Journal of Memory and Language*, *51*: 247-250.

van der Meulen, I., van de Sandt-Koenderman, W. M. E., Duivenvoorden, H. J., & Ribbers, G. M. (2010). Measuring verbal and non-verbal communication in aphasia: Reliability, validity, and sensitivity to change of the scenario test. *International Journal of Language and Communication Disorders, 45*(4): 424-435.