MOVEMENT ASSESSMENT OF INFANTS
A MANUAL

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Copies of the MAI Manual and MAI Scoring Sheets may be ordered from:
Movement Assessment of Infants
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PREFACE

The concept and basic format of the Movement Assessment of Infants (MAI) was initially developed by Lynette Chandler in 1975 when she was head of the Physical Therapy Department at the Clinical Training Unit of the Child Development and Mental Retardation Center (CDMRC) of the University of Washington. The MAI was created out of the need for a uniform approach to the evaluation of high-risk infants. Throughout the past five years, the MAI has been one of the primary instruments used in the examination of four-month-old infants in the Neonatal-Intensive Care Unit Follow-up Clinic (NICU-F) of the CDMRC. During this period, the MAI has been continually modified and refined in order to improve its accuracy in identifying motor problems and its effectiveness in gathering information on motor development. It is being printed and distributed now in response to urgent requests, but the authors anticipate further revisions as it is used more extensively and in a wider variety of clinical, academic, and research settings. We would appreciate your comments and suggestions to assist us in evaluating the MAI and in making it a more valuable clinical tool. A critique form is provided for your convenience in responding.

The authors would like to express their deepest appreciation to everyone who has encouraged and supported them in the development of the MAI. In particular, we want to express our thanks to Nancy Robinson, Ph.D. for her advice and encouragement, to Clifford J. Sells, M.D. for his support, to Forrest C. Bennett, M.D. for disseminating information regarding the MAI to the medical community, to Connie Nakao, R.N. for teaching us to listen to the parents, to Ken Westby for his patience and willingness to type yet another draft, and to Janell Douglas for her enthusiasm in managing the clinic and for her assistance in helping us design a workable scoring sheet. Most of all, we want to express our sincere gratitude to the parents of the many babies whom we examined in the NICU-F Clinic. We thank the parents for their trust in allowing us to handle their babies, for their honesty in expressing their thoughts and feelings, for their time, and for all they have taught us about infants.

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INTRODUCTION

GENERAL INFORMATION

Definition

The Movement Assessment of Infants (MAI) provides a detailed and systematic appraisal of motor behaviors that occur during the first year of life. The test evaluates muscle tone, primitive reflexes, automatic reactions, and volitional movement.

Uses

The Movement Assessment of Infants can be used as follows:

1. To identify motor dysfunction in infants up the age of twelve months.
2. To establish the basis for an early intervention program.
3. To monitor the effects of physical therapy on infants and on children whose motor behavior is at or below one year of age.
4. To aid in research on motor development by using a standard system of movement assessment.
5. To teach skillful observation of movement and motor development through evaluation of normal and handicapped children.

Precautions

In administering the Movement Assessment of Infants, the following precautions and limitations should be observed:

1. The MAI should not be used to predict a child's long-term motor development.
2. The information gathered by the use of the MAI does not identify the causes of a movement deficit and is not intended to provide a diagnosis.
3. The expertise and support of the interdisciplinary team are required for a comprehensive evaluation. Clinical signs which are not listed in the MAI, such as feeding problems and dysmorphic features, should be further assessed.

TEST MATERIALS

MAI Manual

MAI Scoring Sheet (See Figure 1.)

Table, minimum size 48" x 30" x 30"
The table top should be free of distracting designs and should be high enough to allow the child to sit on the parent's lap so that the child's elbows are at table level and so that the child's knees can move freely under the table.

2 chairs

Rectangular cushion, minimum size 30" x 24" x 3"
The cushion should be firm and covered with plain, washable fabric.

3 cotton baby blankets

3 cloth diapers

6 one-inch cubes

Supply of 3/16-inch-diameter pellets
The pellets must be non-toxic and digestible in case the child swallows one.

1 small bell

1 rattle with small handle

1 2½-inch-diameter red ball

1 4-inch-diameter red ring, wooden or plastic, on a 12-inch string

1 flashlight with red light
The maximum diameter of the lens should be 5/8".

A few extra toys to use before testing or to encourage mobility. One of the child's favorite toys may be used.

Disinfectant soap
All materials must be thoroughly washed and rinsed before and after testing.

Scoring Sheet
for
MOVEMENT ASSESSMENT OF INFANTS

Figure 1

Name_____ Date of exam_____

Birth date_____

Case number_____ Chronological age_____

Gestational age_____

Examiner_____ Corrected age_____

MUSCLE TONE

Items 1-6, 9, and 10 should be coded by the scale below.
Code items 7 and 8 as explained in the instructions for these items in the manual.

0 - Item omitted
1 - Hypotonic
2 - Greater than hypotonic but less than normal
3 - Normal
4 - Greater than normal but less than hypertonic
5 - Hypertonic
6 - Fluctuating, variable

		Distribution Variations		Asymmetries		
		Upper	Lower	Left	Right	
____	1. Consistency	____	____	____	____	1.
____	2. Extensibility	____	____	____	____	2.
____	3. Passivity	____	____	____	____	3.
____	4. Posture in Supine	____	____	____	____	4.
____	5. Posture in Prone	____	____	____	____	5.
____	6. Posture in Prone Suspended	____	____	____	____	6.
____	7. Asymmetry					
____	8. Distribution Variation					
____	9. Summary of Tone - Extremities	____	____	____	____	9.
____	10. Summary of Tone - Trunk	____	____	____	____	10.

PRIMITIVE REFLEXES

Items 1-12 should be coded by the scale below.
Code items 13 and 14 as explained in the instructions for these items in the manual.

0 - Item omitted
1 - Integrated or not elicited
2 - Incomplete response
3 - Complete response
4 - Dominant

		Asymmetries		
		Left	Right	
____	1. Tonic Labyrinthine Reflex in Supine	____	____	1.
____	2. Tonic Labyrinthine Reflex in Prone	____	____	2.
____	3. Asymmetrical Tonic Neck Reflex - Evoked	____	____	3.
____	4. Asymmetrical Tonic Neck Reflex - Spontaneous	____	____	4.
____	5. Moro	____	____	5.
____	6. Tremulousness	____	____	6.
____	7. Palmar Grasp	____	____	7.
____	8. Plantar Grasp	____	____	8.
____	9. Ankle Clonus	____	____	9.
____	10. Neonatal Positive Support	____	____	10.
____	11. Walking Reflex	____	____	11.
____	12. Trunk Incurvation (Galant)	____	____	12.
____	13. Asymmetry			
____	14. Summary of Primitive Reflexes			

AUTOMATIC REACTIONS

Items 1-14 should be coded by the scale below.
Code items 15 and 16 as explained in the instructions for these items in the manual.

0 - Item omitted
1 - Complete and consistent response
2 - Incomplete or inconsistent response
3 - Partial response
4 - No response

			Asymmetries		
			Left	Right	
____	1.	Head Righting - Lateral	____	____	1.
____	2.	Head Righting - Extension	____	____	2.
____	3.	Head Righting - Flexion	____	____	3.
____	4.	Landau	____	____	4.
____	5.	Rotation in Trunk	____	____	5.
____	6.	Equilibrium Reactions in Prone	____	____	6.
____	7.	Equilibrium Reactions in Sitting	____	____	7.
____	8.	Equilibrium Reactions in Vertical Suspension	____	____	8.
____	9.	Downward Parachute	____	____	9.
____	10.	Protective Extension - Forward	____	____	10.
____	11.	Protective Extension - Side	____	____	11.
____	12.	Protective Extension - Backward	____	____	12.
____	13.	Placing of Feet	____	____	13.
____	14.	Placing of Hands	____	____	14.
____	15.	Asymmetry	____	____	15.
____	16.	Summary of Automatic Reactions	____	____	16.

VOLITIONAL MOVEMENT

Items 1-23 should be coded by the scale below.
Code items 24 and 25 as explained in the instructions for these items in the manual.

0 - Item omitted
1 - Complete and consistent response
2 - Incomplete or inconsistent response
3 - Partial response
4 - No response

			Asymmetries		
			Left	Right	
____	1.	Hearing	____	____	1.
____	2.	Visual Following	____	____	2.
____	3.	Peripheral Vision	____	____	3.
____	4.	Vocalization	____	____	4.
____	5.	Head Centering	____	____	5.
____	6.	Head Position - Anterior/Posterior	____	____	6.
____	7.	Head Balance	____	____	7.
____	8.	Active Weight Bearing Through Shoulders	____	____	8.
____	9.	Open Hands	____	____	9.
____	10.	Hands to Midline	____	____	10.
____	11.	Large Grasp	____	____	11.
____	12.	Small Grasp	____	____	12.
____	13.	Reaches Out	____	____	13.
____	14.	Combines	____	____	14.
____	15.	Transfers	____	____	15.
____	16.	Back Straight in Sitting	____	____	16.
____	17.	Active Use of Hips	____	____	17.
____	18.	Rolling	____	____	18.
____	19.	Prone Progression	____	____	19.
____	20.	Sits When Placed	____	____	20.
____	21.	Coming to Sit	____	____	21.
____	22.	Coming to Stand	____	____	22.
____	23.	Walking	____	____	23.
____	24.	Asymmetry	____	____	24.
____	25.	Summary of Volitional Movement	____	____	25.

PROCEDURES

Test Environment

The room where the test is given should be pleasant and should be a place where the child and the parent can be at ease. The area should be large enough to include the required furniture and to provide open floor space for children who are crawling, creeping, or walking. A small sofa, foot stool, or coffee table is useful when observing children who are pulling to stand. The lighting should be good, and the temperature should be warm enough so that the child will be comfortable when undressed. Activity, noise, and other distractions should be minimized; the examiner should avoid wearing a white uniform, bright clothing, or jewelry which might distract the child.

Time

Allow a maximum of one-and-one-half-hours for testing and scoring. Under optimum conditions, testing can be completed in 30 minutes and scoring can be completed in 30 minutes. The extra half-hour should be scheduled to talk with the parents and to accommodate the child's needs for feeding, rest, and reassurance.

Rapport

The child should be accompanied by a parent or by some other primary care-giver who will remain with the child throughout the evaluation. The examiner should make every effort to elicit the child's best performance and should be aware that responses are influenced by the child's well-being and willingness to participate. If possible, testing should be scheduled at a time that the parent indicates is best for the child. A child who is too irritable to complete the test should be given another appointment. Consistent intolerance for testing on repeated examinations should be explored further with the interdisciplinary team.

Considerations During Testing

Present test items so that the stress on the child is minimized. There is no set order for administering test items. Items that require the most concentration, such as manipulating the pellet, should be presented when the child is in the most favorable mood; items that are most likely to distress or irritate the child, such as tests for the Moro and the ATNR, should be deferred to the end of testing. Grouping of items by test position of the child is suggested in order to avoid tiring the child. Be prepared to modify the order of testing if the child shows restlessness, irritability, loss of attention, or fatigue; however, changes should not be made in the specific method of presenting each test item. The examiner should also observe the child's spontaneous activity; an infant can be observed while on the cushion, but a child who is able to turn over should be placed on a blanket on the floor. Throughout testing, maintain a symmetrical position in relation to the child, except when observing from the side.

General Observations

The examiner should be well informed about child development in areas such as vision, hearing, language, parent-child interaction, sleep habits, and nutrition because these factors influence motor performance and in turn are influenced by motor development. Examinations should include exploration of these

areas through interview and observation. Concerns should be reviewed with the interdisciplinary team for more specific evaluation.

Calculating Child's Age

In completing the information at the top of the scoring sheet, age should be corrected for the premature child, but not for the post-term child. The following method is used for calculating corrected age. In this calculation, a term pregnancy is considered to be 40 weeks; a month is considered to be 30 days.

Chronological age = Date tested minus Date of birth

	year	month	days
Date tested	____	____	____
Date of birth	____	____	____
Chronological age	____	____	____

Corrected age = Chronological age minus Days of prematurity

Days of prematurity =

(40 weeks minus gestational age in weeks) x 7

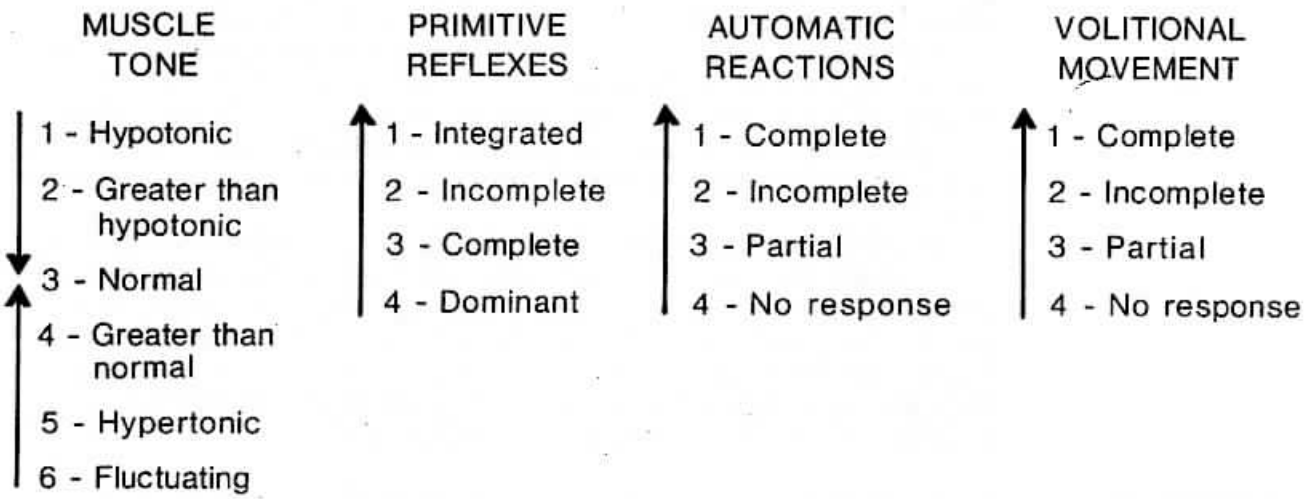
	year	month	days
Chronological age	____	____	____
Days of prematurity			____
Corrected age	____	____	____

Corrected age is used when interpreting test results.

RECORDING AND SCORING

Rating Scale

Numerical rating scales have been designed for each of the four sections of the MAI. The four sections are Muscle Tone, Primitive Reflexes, Automatic Reactions, and Volitional Movement. The scales are shown at the beginning of each section in the manual and at the beginning of each section of the scoring sheet. Descriptive names for each rating have been provided for guidance in understanding the test. The arrows in the following diagram indicate the pattern of scoring in each of the four sections.



In the section on muscle tone, a score of "3" represents normal tone; any other score on muscle tone represents a deviation from normal. In the sections on primitive reflexes, automatic reactions, and volitional movement, a score of "1" represents the most mature response. Therefore, in the section on muscle tone, the arrows show the gradation from hypotonic to normal tone and from hypertonic to normal tone. In the other three categories, the arrows represent the expected sequences of development.

The descriptive names on the rating scales do not provide the directions for scoring the test items. Each item has its own set of criteria for scoring. Scoring should be done only by applying the criteria for the specific item. Scores are recorded in the spaces to the left of each item on the scoring sheet.

Scoring of all items must be on the basis of performance actually observed by the examiner; however, it is important to acknowledge

and to note a parent's report of activities performed at home. A score of "0" is used only when the test item is not administered because of physical or structural obstacles, such as casting; because the child's behavior is incompatible with testing; or because the examiner fails to observe a response. The examiner should make every effort to avoid giving a score of zero.

Recording and Scoring of Asymmetries

In all four sections of the test, the examiner should be aware of the possibility of finding asymmetrical responses and should note the special column provided for recording left/right asymmetries. An asymmetrical response is defined when the examiner gives numerically different scores for the left and for the right sides. When numerically different scores are recorded in the column under Asymmetries, the less favorable of the two scores is entered for the test item at the left side of the form. In the section on muscle tone, the less favorable score is the score that deviates the most from the normal score of "3"; if the scores deviate an equal amount but in opposite directions, e.g., 2 and 4 or 1 and 5, the higher number is considered to be the less favorable score. In the sections on primitive reflexes, automatic reactions, and volitional movement, the higher number is considered to be the less favorable score.

The columns for Asymmetries should be used only when there is a numerical difference between the left/right scores given for one item. In assessing an individual item, the examiner may observe a qualitative difference between the left and right sides, but both sides meet the same criteria for scoring. This qualitative difference does not constitute an asymmetrical response in numerical scoring; however, it should be noted in the child's record.

Recording and Scoring of Distribution Variations in Muscle Tone

In the section on muscle tone, the examiner should also be aware of the possibility of finding distribution variations and should note the special column provided for recording upper/lower extremity distribution variations. A distribution variation is defined when the examiner gives numerically different scores for the upper and lower extremities. The method for scoring is the same as that described for asymmetries in muscle tone.

TRAINING OF EXAMINERS

Examiners

The Movement Assessment of Infants is designed to be administered by physical therapists, occupational therapists, physicians, nurses, psychologists, and others who also have specialized knowledge and experience in infant development. Formal training in the administration of the MAI is strongly recommended for examiners who will be using this assessment in research projects; those who are interested in obtaining this training should contact the authors. Those who intend to use the MAI in a more general clinical setting must be thoroughly familiar with the manual and must use the MAI to test normal infants at various ages in order to appreciate the range of responses. Studying the test in teams of examiners and frequent checks of inter-rater reliability are necessary for accurate use of the MAI.

EVALUATION OF TEST

Four-Month Profile

The Movement Assessment of Infants provides a record of observed infant behavior. In order to make a statement about an infant's status, test performance should be compared to that seen in normal infants of the same age; however, the MAI has not yet been normed. Instead, a profile for normal four-month old infant motor behavior has been developed. (See Figure 2.) Each possible score for every item on the MAI has been designated as normal or questionable for a four-month-old infant. For each item, all questionable scores are listed in a profile on the far left side of the scoring sheet. When a child receives a score that is considered to be questionable, one high-risk point is given and is recorded by circling the corresponding number in the profile. For example, the Tonic Labyrinthine Reflex in Supine is thought to be questionable if it is evaluated as incomplete (a score of 2), complete (a score of 3), or dominant (a score of 4). Therefore, in this item, a score of "2", "3", or "4", would equal one high-risk point and the corresponding number would be circled in the high-risk profile. High-risk points are added and recorded in the rectangular box for each section. The high-risk scores for all four sections are then added to establish the total high-risk score which is recorded in the rectangular box at the top of the scoring sheet. (See Figure 3.)

The normal and questionable ratings for each item were determined by the authors. Their decisions have been made on the basis of educational experience, review of the literature noted in the reference list, and years of pediatric experience.

Value of High-Risk Scores

The value of high-risk scores was studied using the data on 35 infants who were tested at four months and again at one year. In this study, by one year of age, twenty-seven infants proved to have normal movement and eight infants were diagnosed as having cerebral palsy. Most children with normal movement received from 0 to 7 high-risk points in the four-month evaluation. The children with cerebral palsy generally received 13 to 26 high-risk points in the four month evaluation. There were six children, four normal and two with cerebral palsy, who scored in the mid-range of 8 to 13 high-risk points. (See Table 1.) Therefore, if infants with a high-risk score of 8 or higher had been designated as having cerebral palsy at four months of age, four children would have been identified incorrectly as having cerebral palsy. No infant with cerebral palsy would have been incorrectly identified as normal. Two of the normal infants with middle-range scores at four months were hypotonic and accumulated the high-risk points in the section on muscle tone. A third normal infant with middle-range scores at four months had been scored as having variable tone and also accumulated the high-risk points in the section on muscle tone. The prognostic value of high tone and low tone as seen in four-month-olds is presently being compared.

Because some of the criteria for individual test items have been rewritten since the original study, the total of the high-risk

scores now seems to be higher for all infants tested. This change alters the predictive ranges of the early study and new ranges are being studied. At the present time, therapists at the Child Development and Mental Retardation Center use the profile to identify specific concerns about a child at four months.

Inter-rater Reliability

Data is currently being collected on inter-rater reliability. Two aspects of reliability are reviewed: the high-risk-score inter-rater reliability and the individual-item-score inter-rater reliability. The therapist who gives the test to the infant establishes the initial item scores for the infant's record. Subsequently, a score may be altered on the basis of the other observers' opinions. The final concensus score is recorded for the infant. The scores of all examiners are then compared with the concensus score to establish individual reliability. Inter-rater reliabilities of 90 and above are regularly achieved.

Scoring Sheet
for
MOVEMENT ASSESSMENT OF INFANTS
with
Four-Month Profile

Figure 2

Name _____ Date of exam _____

Case number _____ Birth date _____

Examiner _____ Chronological age _____

Gestational age _____

Total risk score ☐ Corrected age _____

MUSCLE TONE

Items 1-6, 9, and 10 should be coded by the scale below.
Code items 7 and 8 as explained in the instructions for these items in the manual.

0 - Item omitted
1 - Hypotonic
2 - Greater than hypotonic but less than normal
3 - Normal
4 - Greater than normal but less than hypertonic
5 - Hypertonic
6 - Fluctuating, variable

			Distribution Variations		Asymmetries		
			Upper	Lower	Left	Right	
1 2 4 5 6	____	1. Consistency	____	____	____	____	1.
1 2 4 5 6	____	2. Extensibility	____	____	____	____	2.
1 2 4 5 6	____	3. Passivity	____	____	____	____	3.
1 2 4 5 6	____	4. Posture in Supine	____	____	____	____	4.
1 2 4 5 6	____	5. Posture in Prone	____	____	____	____	5.
1 2 4 5 6	____	6. Posture in Prone Suspended	____	____	____	____	6.
3 4	____	7. Asymmetry					
3 4	____	8. Distribution Variation					
1 2 4 5 6	____	9. Summary of Tone - Extremities	____	____	____	____	9.
1 2 4 5 6	____	10. Summary of Tone - Trunk	____	____	____	____	10.

☐

PRIMITIVE REFLEXES

Items 1-12 should be coded by the scale below.
Code items 13 and 14 as explained in the instructions for these items in the manual.

0 - Item omitted
1 - Integrated or not elicited
2 - Incomplete response
3 - Complete response
4 - Dominant

			Asymmetries		
			Left	Right	
2 3 4	____	1. Tonic Labyrinthine Reflex in Supine	____	____	1.
2 3 4	____	2. Tonic Labyrinthine Reflex in Prone	____	____	2.
3 4	____	3. Asymmetrical Tonic Neck Reflex - Evoked	____	____	3.
3 4	____	4. Asymmetrical Tonic Neck Reflex - Spontaneous	____	____	4.
3 4	____	5. Moro	____	____	5.
3 4	____	6. Tremulousness	____	____	6.
3 4	____	7. Palmar Grasp	____	____	7.
4	____	8. Plantar Grasp	____	____	8.
3 4	____	9. Ankle Clonus	____	____	9.
3 4	____	10. Neonatal Positive Support	____	____	10.
3 4	____	11. Walking Reflex	____	____	11.
3 4	____	12. Trunk Incurvation (Galant)	____	____	12.
3 4	____	13. Asymmetry			
3 4	____	14. Summary of Primitive Reflexes			

☐

AUTOMATIC REACTIONS

Items 1-14 should be coded by the scale below.
Code items 15 and 16 as explained in the instructions for these items in the manual.

0 - Item omitted
1 - Complete and consistent response
2 - Incomplete or inconsistent response
3 - Partial response
4 - No response

			Asymmetries		
			Left	Right	
3 4	____	1. Head Righting - Lateral	____	____	1.
2 3 4	____	2. Head Righting - Extension	____	____	2.
3 4	____	3. Head Righting - Flexion	____	____	3.
4	____	4. Landau	____	____	4.
4	____	5. Rotation in Trunk	____	____	5.
4	____	6. Equilibrium Reactions in Prone	____	____	6.
	____	7. Equilibrium Reactions in Sitting	____	____	7.
	____	8. Equilibrium Reactions in Vertical Suspension	____	____	8.
	____	9. Downward Parachute	____	____	9.
	____	10. Protective Extension - Forward	____	____	10.
	____	11. Protective Extension - Side	____	____	11.
	____	12. Protective Extension - Backward	____	____	12.
3 4	____	13. Placing of Feet	____	____	13.
3 4	____	14. Placing of Hands	____	____	14.
3 4	____	15. Asymmetry	____	____	15.
3 4	____	16. Summary of Automatic Reactions	____	____	16.

VOLITIONAL MOVEMENT

Items 1-23 should be coded by the scale below.
Code items 24 and 25 as explained in the instructions for these items in the manual.

0 - Item omitted
1 - Complete and consistent response
2 - Incomplete or inconsistent response
3 - Partial response
4 - No response

			Asymmetries		
			Left	Right	
4	____	1. Hearing	____	____	1.
3 4	____	2. Visual Following	____	____	2.
3 4	____	3. Peripheral Vision	____	____	3.
4	____	4. Vocalization	____	____	4.
2 3 4	____	5. Head Centering	____	____	5.
3 4	____	6. Head Position - Anterior/Posterior	____	____	6.
3 4	____	7. Head Balance	____	____	7.
3 4	____	8. Active Weight Bearing Through Shoulders	____	____	8.
3 4	____	9. Open Hands	____	____	9.
3 4	____	10. Hands to Midline	____	____	10.
	____	11. Large Grasp	____	____	11.
	____	12. Small Grasp	____	____	12.
	____	13. Reaches Out	____	____	13.
	____	14. Combines	____	____	14.
	____	15. Transfers	____	____	15.
4	____	16. Back Straight in Sitting	____	____	16.
4	____	17. Active Use of Hips	____	____	17.
	____	18. Rolling	____	____	18.
	____	19. Prone Progression	____	____	19.
	____	20. Sits When Placed	____	____	20.
	____	21. Coming to Sit	____	____	21.
	____	22. Coming to Stand	____	____	22.
	____	23. Walking	____	____	23.
3 4	____	24. Asymmetry	____	____	24.
3 4	____	25. Summary of Volitional Movement	____	____	25.

Scoring Sheet
for
MOVEMENT ASSESSMENT OF INFANTS
with
Four-Month Profile

Figure 3

Name _____ Date of exam 7-20-1979

Case number _____ Birth date 1-10-1979

Examiner _____ Chronological age 6 mos. 10 days

Gestational age 31 weeks

Total risk score 23 Corrected age 4 mos.- 7 days

MUSCLE TONE

Items 1-6, 9, and 10 should be coded by the scale below.
Code items 7 and 8 as explained in the instructions for these items in the manual.

0 - Item omitted
1 - Hypotonic
2 - Greater than hypotonic but less than normal
3 - Normal
4 - Greater than normal but less than hypertonic
5 - Hypertonic
6 - Fluctuating, variable

		Distribution Variations		Asymmetries		
		Upper	Lower	Left	Right	
1 2 (4) 5 6	4 1. Consistency					1.
1 2 (4) 5 6	4 2. Extensibility					2.
1 2 4 5 (6)	6 3. Passivity					3.
1 2 (4) 5 6	4 4. Posture in Supine					4.
1 2 (4) 5 6	4 5. Posture in Prone					5.
1 (2) 4 5 6	2 6. Posture in Prone Suspended					6.
3 4	1 7. Asymmetry					
3 (4)	4 8. Distribution Variation					
1 2 (4) 5 6	4 9. Summary of Tone - Extremities					9.
1 2 4 5 6	3 10. Summary of Tone - Trunk					10.

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PRIMITIVE REFLEXES

Items 1-12 should be coded by the scale below.
Code items 13 and 14 as explained in the instructions for these items in the manual.

0 - Item omitted
1 - Integrated or not elicited
2 - Incomplete response
3 - Complete response
4 - Dominant

		Asymmetries		
		Left	Right	
(2) 3 4	2 1. Tonic Labyrinthine Reflex in Supine			1.
2 3 4	1 2. Tonic Labyrinthine Reflex in Prone			2.
3 4	2 3. Asymmetrical Tonic Neck Reflex - Evoked			3.
(3) 4	3 4. Asymmetrical Tonic Neck Reflex - Spontaneous			4.
(3) 4	3 5. Moro			5.
3 4	1 6. Tremulousness			6.
3 4	2 7. Palmar Grasp			7.
(4)	4 8. Plantar Grasp			8.
3 4	1 9. Ankle Clonus			9.
(3) 4	3 10. Neonatal Positive Support			10.
3 (4)	4 11. Walking Reflex			11.
3 4	2 12. Trunk Incurvation (Galant)			12.
3 4	1 13. Asymmetry			
3 (4)	4 14. Summary of Primitive Reflexes			

7

AUTOMATIC REACTIONS

Items 1-14 should be coded by the scale below.
Code items 15 and 16 as explained in the instructions for these items in the manual.

0 - Item omitted
1 - Complete and consistent response
2 - Incomplete or inconsistent response
3 - Partial response
4 - No response

				Asymmetries Left	Asymmetries Right	
(3) 4	3	1.	Head Righting - Lateral			1.
2 (3) 4	3	2.	Head Righting - Extension			2.
3 4	2	3.	Head Righting - Flexion			3.
4	3	4.	Landau			4.
4	3	5.	Rotation in Trunk			5.
(4)	4	6.	Equilibrium Reactions in Prone			6.
	4	7.	Equilibrium Reactions in Sitting			7.
	4	8.	Equilibrium Reactions in Vertical Suspension			8.
	3	9.	Downward Parachute			9.
	4	10.	Protective Extension - Forward			10.
	3	11.	Protective Extension - Side			11.
	4	12.	Protective Extension - Backward			12.
3 4	2	13.	Placing of Feet			13.
3 4	2	14.	Placing of Hands			14.
3 4	2	15.	Asymmetry			15.
3 (4)	4	16.	Summary of Automatic Reactions			16.

4

VOLITIONAL MOVEMENT

Items 1-23 should be coded by the scale below.
Code items 24 and 25 as explained in the instructions for these items in the manual.

0 - Item omitted
1 - Complete and consistent response
2 - Incomplete or inconsistent response
3 - Partial response
4 - No response

				Asymmetries Left	Asymmetries Right	
4	2	1.	Hearing			1.
3 4	1	2.	Visual Following			2.
3 4	1	3.	Peripheral Vision			3.
4	3	4.	Vocalization			4.
2 3 4	1	5.	Head Centering			5.
(3) 4	3	6.	Head Position - Anterior/Posterior			6.
3 4	2	7.	Head Balance			7.
3 4	2	8.	Active Weight Bearing Through Shoulders			8.
(3) 4	3	9.	Open Hands			9.
(3) 4	3	10.	Hands to Midline			10.
	4	11.	Large Grasp			11.
	4	12.	Small Grasp			12.
	3	13.	Reaches Out			13.
	4	14.	Combines			14.
	4	15.	Transfers			15.
4	3	16.	Back Straight in Sitting			16.
4	3	17.	Active Use of Hips			17.
	3	18.	Rolling			18.
	4	19.	Prone Progression			19.
	4	20.	Sits When Placed			20.
	4	21.	Coming to Sit			21.
	4	22.	Coming to Stand			22.
	4	23.	Walking			23.
3 4	1	24.	Asymmetry			24.
3 (4)	4	25.	Summary of Volitional Movement			25.

4

Table 1 Distribution of Children with Normal Movement and Children with Cerebral Palsy by Total High Risk Points at Four Months of Age (N=35)

Total High Risk Points	Number of Children with Normal Movement N=27	Number of Children with Cerebral Palsy N=8
0	5	
1	2	
2	5	
3	4	
4	1	
5	2	
6	1	
7	3	
8	1	1
9		
10		
11		1
12	2	
13	1	
14		
15		1
16		1
17		1
18		
19		
20		1
21		
22		
23		
24		
25		1
26		1

DIRECTIONS FOR TESTING

MUSCLE TONE

In this assessment, tone refers to the readiness of muscles to respond to gravity. Muscle tone that differs from the normal is a major concern in testing the motor development of infants. In this section, the examiner clinically evaluates tone in six ways. Tone is also assessed for asymmetry between left and right sides and for distribution variation between upper and lower extremities. There are two summary items.

Items 1-6, 9, and 10 should be coded by the scale below. Code items 7 and 8 as explained in the instructions for these items.

0 — Item omitted
1 — Hypotonic
2 — Greater than hypotonic but less than normal
3 — Normal
4 — Greater than normal but less than hypertonic
5 — Hypertonic
6 — Fluctuating, variable

A score of "6" is given when the child's tone shows definite fluctuation on the "1" to "5" scale.

1. Consistency.

Consistency refers to the relative firmness of muscle tissue which the examiner evaluates by palpation.

With the child supine and with the child prone, palpate the gastrocnemius-soleus, the triceps, and the biceps.

1 — Muscle feels soft; there is little resistance to pressure.
2 — Between 1 and 3.
3 — Muscle feels sturdy, but there is some yielding to pressure.
4 — Between 3 and 5.
5 — Muscle feels hard like a rock; there is little yielding to pressure.

2. Extensibility.

Extensibility refers to the capacity of a muscle to elongate when a quick stretch is imposed on it. Extensibility is evaluated by the relative resistance encountered as the examiner moves an extremity through a range of motion and imposes a quick stretch on the muscles being elongated. The muscle groups tested are the hip adductors, the ankle plantarflexors, and the muscles of the shoulder girdle and trunk which elongate when the arm is brought to an overhead position.

Place the child supine. Determine maximum passive range of motion for each area tested. Move the extremity through this range of motion using rapid short excursions to impose a quick stretch on the muscles being elongated.

Test the hip adductors in two ways:

- Position the lower extremities with the hips flexed to 90 degrees and held in a neutral position relative to rotation and abduction/-adduction. Allow the knees to flex. Abduct the hips simultaneously.
- Position the lower extremities with the hips held in a neutral position relative to rotation and abduction/adduction. Hold the knees extended and position the hips in full extension. Abduct the hips simultaneously. Repeat this procedure with hips flexed to varying amounts up to 90 degrees.

Test the ankle plantarflexors in two ways:

- Position the lower extremity to be tested with the knee flexed. Dorsiflex the ankle.
- Position the lower extremity to be tested with the knee extended. Dorsiflex the ankle.

Test the upper extremities one at a time. Stabilize the child's trunk. Bring the child's arm forward and up with the thumb leading.

1 — No resistance is felt.
2 — Slight resistance is felt throughout the range of motion.
3 — Normal graded resistance is felt throughout the range of motion.
4 — Greater than normal resistance is felt. The infant's maximum range of motion can be achieved only when movements are performed slowly.
5 — Strong resistance prevents movement through the full range of motion even when movements are performed slowly. A build-up of resistance is felt when a series of quick stretches is applied. Voluntary resistance by the child should be ruled out.

3. Passivity.

Passivity refers to the amount of flapping of the child's hand or foot when the examiner shakes an extremity, thereby imposing multiple quick stretches. This response may be difficult to interpret because the child may play with the examiner either by tightening or by letting the extremity fall.

Place the child in a well-supported position in supine or in sitting. Test all four extremities. Hold each extremity firmly immediately proximal to the wrist or ankle without restricting joint motion. Shake the distal part of the extremity quickly. Observe the range of movement and the number of excursions of the hand at the wrist and of the foot at the ankle.

1 — The extremity does not tighten at the wrist or ankle; the hand or foot continues to flap.
2 — The hand or foot flaps for many excursions but eventually the extremity tightens.
3 — The extremity tightens at the wrist or ankle after a few excursions of the hand or foot.
4 — The extremity may initially be stiff at the wrist or ankle but some flapping occurs.
5 — The extremity is stiff at the wrist or ankle; the hand or foot does not flap.

4. Posture in Supine.

Place the child supine on a firm surface. Observe the child's posture and movement.

1 — Child lies flat against the supporting surface. If child achieves an antigravity posture, it is not maintained. Movement is infrequent and appears to be weak.
2 — Child usually lies flat against the surface but can actively move away from the surface. Child assumes antigravity postures and maintains them for a short time.
3 — Child shows a variety of resting positions and moves away from the surface. Child assumes age-appropriate antigravity postures and maintains them with little effort. Movements are frequent and show varied combinations of individual limb movements.
4 — Child often lies in an excessively extended posture or in an asymmetrical posture; however, child can actively move away from these postures. Child approximates age-appropriate antigravity postures. Movements seem slow and stiff, and the variety of movements is diminished. When child is excited or distressed, extremities may move in total flexion or extension patterns.
5 — Child is pulled strongly into an extended or into an asymmetrical posture and appears to be uncomfortable. Child is pulled away from antigravity postures. Movements are infrequent, slow, and stiff. Extremities move only in total flexion or extension patterns.

5. Posture in Prone.

Place the child prone on a firm surface. Observe the child's posture and movement.

1 — Child lies flat against the supporting surface. If child achieves an antigravity posture, it is not maintained. Movement is infrequent and appears weak.
2 — Child often lies flat against the surface but actively moves away from the surface. Child assumes antigravity postures and maintains them for a short time. Child may hold joints stiffly in order to maintain a position.
3 — Child shows a variety of resting positions and moves away from the surface. Child assumes age-appropriate antigravity postures and maintains them with little effort. Movements are frequent and show varied combinations of individual limb movements.
4 — Child is often pulled into a flexed posture or exhibits elements of an overly extended posture; however, child can actively move away from these postures. Child approximates age-appropriate antigravity postures. Movements seem slow and stiff, and the variety of movements is diminished. When child is excited or distressed, extremities may move in total flexion or extension patterns.
5 — Child is pulled strongly into a flexed posture or exhibits a strong extensor posture; child appears to be uncomfortable. Child does not assume antigravity postures other than in a total extensor pattern; otherwise, child is pulled into gravity. Movements are infrequent, slow, and stiff. Extremities move in total flexion or extension patterns.

6. Posture in Prone Suspension.

Hold the child suspended in the air in a prone position with your arms under the trunk. Observe the child's posture and movement.

1 — Child drapes limply over examiner's arms and shows no active movement.
2 — Child attempts to assume an age-appropriate posture but collapses over examiner's arms.
3 — Child assumes an age-appropriate posture and maintains this posture with apparently little effort. Child moves easily in and out of the posture.
4 — Child is often pulled down over the examiner's arms or exhibits an overly extended posture. Child approximates an age-appropriate posture. Extremities look stiff at times but show movement.
5 — Child is pulled strongly down over the examiner's arms or exhibits an overly extended posture with no variability in extension pattern. Movements are infrequent, slow, and stiff.

7. Asymmetry.

This item summarizes the number of asymmetries and shows whether the asymmetries suggest a consistent pattern. Review items 1-6 and count the number of items in which asymmetries have occurred. Determine whether the less favorable score for each item is in the left or in the right column.

1 — No asymmetries.

2 — One asymmetry.
Two asymmetries with one less favorable score in each column.

3 — Two asymmetries with both of the less favorable scores in the same column.
Three asymmetries with two less favorable scores in the same column.
Four asymmetries with two less favorable scores in each column.

4 — Three asymmetries with three less favorable scores in the same column.
Four asymmetries with three less favorable scores in the same column.
Four asymmetries with four less favorable scores in the same column.
Five or more asymmetries.

8. Distribution Variations.

This item summarizes the number of distribution variations and shows whether the distribution variations suggest a consistent pattern. Review items 1-6 and count the number of items in which distribution variations have occurred. Determine whether the less favorable score for each item is in the upper or in the lower extremity column.

1 — No distribution variations.

2 — One distribution variation.
Two distribution variations with one less favorable score in each column.

3 — Two distribution variations with both of the less favorable scores in the same column.
Three distribution variations with two less favorable scores in the same column.
Four distribution variations with two less favorable scores in each column.

4 — Three distribution variations with three less favorable scores in the same column.
Four distribution variations with three less favorable scores in the same column.
Four distribution variations with four less favorable scores in the same column.
Five or more distribution variations.

9. Summary of Tone - Extremities.

This item is not a summary of numerical scores. It is intended to reflect the examiner's impression of tone in the extremities.

1 — Hypotonic.
2 — Greater than hypotonic but less than normal.
3 — Normal.
4 — Greater than normal but less than hypertonic.
5 — Hypertonic.
6 — Fluctuating, variable.

10. Summary of Tone - Trunk.

This item is not a summary of numerical scores. It is intended to reflect the examiner's impression of tone in the trunk.

1 — Hypotonic.
2 — Greater than hypotonic but less than normal.
3 — Normal.
4 — Greater than normal but less than hypertonic.
5 — Hypertonic.
6 — Fluctuating, variable.

PRIMITIVE REFLEXES

This section assesses primitive reflexes which are normally present for brief periods of time during infant development. When primitive reflexes are retained, the child may have difficulty performing movements which conflict with dominant reflex patterns; therefore, the child who retains primitive reflexes may show movement deficits.

Items 1-12 should be coded by the scale below. Code items 13 and 14 as explained in the instructions for these items.

0 — Item omitted
1 — Integrated or not elicited
2 — Incomplete response
3 — Complete response
4 — Dominant

A score of "1" is given when the reflex cannot be elicited or when the reflex has already been integrated into volitional activity. A score of "2" is given when some components of the reflex are seen; however, the response may be inconsistent. A score of "3" is given when all components of a reflex are present; the response may be inconsistent. A score of "4" is given when a reflex appears to dominate the child's movement or when the examiner observes the reflex pattern repeatedly throughout the assessment with minimal or no stimulus.

1. Tonic Labyrinthine Reflex in Supine (TLR - Supine).

Observe the child's posture and movements in supine. When the TLR -Supine is present, arching of the neck is seen, rotation of the head is often observed, and retraction of the shoulder girdle may be evident. In addition, the child appears to be pressed against the surface by gravity at the head, hips, and/or heels. There may be extension of the trunk and persistent plantarflexion of the feet.

Place the child supine with feet towards you. Test for the TLR - Supine by gently moving the child's head, shoulders, and hips against gravity. When the child's head is cradled in your hands, the presence of the reflex may be felt by a thrusting back of the child's head. When the child's shoulders are cradled and moved upwards against gravity, the reflex is felt by a retraction of the shoulders. When you lift the child's hips and bring the knees toward the chest, the reflex is felt in a resistance to trunk flexion. The child who does not have the TLR allows the head, shoulders, and hips to remain cradled without resisting. The TLR - Supine should not be confused with the voluntary "bridging" activity of a child.

1 — There is no arching of the neck; the neck is flat against the surface. There is freedom of movement of the head.
2 — There is occasional arching of the neck and/or some retraction at the shoulder girdle.
3 — There is arching of the neck and retraction of the shoulder girdle. There may be rotation of the head and extension of the trunk.
4 — Arching of the neck, rotation of the head, retraction of the shoulder girdle, and extension of the trunk dominate the child's movement. The ankles may be plantarflexed.

2. Tonic Labyrinthine Reflex in Prone (TLR - Prone).

Observe the child's posture and movements in prone. The TLR - Prone is seen in a pulling down of the head and trunk into a flexed position with flexion of the upper and lower extemities.

Place the child prone with feet toward you. Test for the TLR by gently lifting the child's head and shoulders. A pulling down of the head into flexion and/or protraction of the shoulder girdle indicates the presence of the reflex. Be careful to distinguish between children who have a TLR - Prone and those who are demonstrating normal physiological flexion or low tone. Pay particular attention to any report that the child does not like to be placed prone; this observation may indicate that a TLR - Prone is present.

1 — Head and shoulder girdle are not pulled into flexion and examiner does not feel resistance to passive lifting of head and shoulder girdle.
2 — Influence of flexion pattern is seen. Initial resistance can be felt to passive lifting of head and shoulder girdle.
3 — There is a pulling into flexion of the head, protraction of the shoulder girdle, and flexion of the upper and lower extremities; however, this pattern is not dominant.
4 — Head, trunk, and limbs are pulled into a flexion pattern which the child cannot actively overcome. Child's arms usually are caught under the body.

3. Asymmetrical Tonic Neck Reflex - Evoked (ATNR - Evoked).

Place the child supine with head toward you. Rotate the child's head approximately 90 degrees to one side and hold for 5 seconds. If the reflex is present, the arm and leg on the face side will extend and the arm and leg on the skull side will flex; the child assumes a "fencing" position. Be aware of any resistance in the arms and legs to passive movement. Evaluate this item by the response seen in the arms, and score the ATNR with reference to the face side. For example, an ATNR to the right is seen when the face is turned to the right.

1 — The "fencing" position is not observed when the head is turned.
2 — The "fencing" position is incomplete and brief when the head is turned.
3 — The "fencing" position occurs consistently when the head is turned; however, the infant can move out of the reflex posture while the head remains turned.
4 — The "fencing" position occurs consistently when the head is turned. The infant cannot move out of the reflex posture while the head remains turned. The ATNR is obligatory.

4. Asymmetrical Tonic Neck Reflex - Spontaneous (ATNR - Spontaneous).

Place the child supine and encourage the child to rotate the head approximately 90 degrees to one side. If the reflex is present, the arm and leg on the face side will extend and the arm and leg on the skull side will flex; the child assumes the "fencing" position. Evaluate this item by the response seen in the arms. Score the ATNR with reference to the face side. For example, an ATNR to the right is seen when the face is turned to the right. Observe and record the ATNR - Spontaneous at any time throughout the testing session.

1 — The "fencing" position is not observed when the head is turned.
2 — The "fencing" position is incomplete and brief when the head is turned.
3 — The "fencing" position occurs consistently when the head is turned; however, the infant can move out of the reflex posture while the head remains turned.
4 — The "fencing" position occurs consistently when the head is turned. The infant cannot move out of the reflex posture while the head remains turned. The ATNR is obligatory.

5. Moro.

While standing in front of the child, cradle the child's head in your hands. Bring the child to a semi-sitting position. Lessen the support to the head so that the child's head is dropped from this position and caught again after a brief drop backwards. Parents should be forewarned that you are going to carry out this maneuver and the child should be in a calm state. The Moro is seen in sudden extension and abduction of the upper extremities with opening of the hands; this response is followed by flexion of the upper extremities to midline.

1 — The Moro is not elicited.
2 — There is extension and abduction of the upper extremities with no return to midline.
3 — There is extension and abduction of the upper extremities followed by flexion to midline.
4 — The Moro is seen frequently throughout testing. This reflex is often spontaneous.

6. Tremulousness.

Count the number of times tremors occur throughout the testing period of approximately thirty minutes. Tremors generally occur in chin, tongue, lips, and upper extremities.

1 — No tremors occur.
2 — 1 to 5 instances of tremors are observed.
3 — 6 to 10 instances of tremors are observed.
4 — 11 or more instances of tremors are observed.

7. Palmar Grasp.

Place your index finger in the infant's palm from the ulnar side and press on the palmar surface. Applying traction may give a clearer response. The reflex is an involuntary flexion of the infant's fingers around your finger.

1 — Grasp reflex is not elicited or the infant grasps your finger voluntarily.
2 — Grasp reflex lasts less than 5 seconds.
3 — Grasp reflex lasts more than 5 seconds.
4 — Infant maintains fists tightly clenched throughout the testing session even though the examiner makes no attempt to elicit the reflex.

8. Plantar Grasp.

Place your thumb on the ball of the infant's foot and apply pressure for five seconds. The reflex is an involuntary flexion of the infant's toes. This reflex may also be seen in flexion of the toes when the child is placed in standing.

1 — Plantar reflex is not elicited.
2 — Plantar reflex lasts less than 5 seconds.
3 — Plantar reflex lasts more than 5 seconds.
4 — Infant's toes claw throughout the testing session even though the examiner makes no attempt to elicit the reflex.

9. Ankle Clonus.

Place the child supine with lower extremity to be tested flexed at the hip and knee. The infant should be relaxed. Gently but rapidly dorsiflex the ankle. The reflex is seen in a rhythmic, alternating flexion and extension of the foot at the ankle. The number of beats should be counted.

1 — Ankle clonus is not elicited.
2 — There are 1 to 5 beats following the quick stretch at the ankle.
3 — There are 6 to 10 beats following the quick stretch at the ankle.
4 — Ankle clonus is sustained as long as the ankle is maintained in dorsiflexion.

10. Neonatal Positive Support.

Hold the child in a vertical position and gently lower the child toward a firm surface until pressure is placed on the balls of the feet. A stiffening in extension of the lower extremities indicates the presence of this reflex. Mature weight bearing in supported standing is noticeably different from the rigid quality of the positive support reflex. If child exhibits astasia, a score of "1" is given.

1 — The reflex is not elicited. Child may sustain weight while alternately flexing and extending hips, knees, and/or ankles.
2 — There is stiff quality in weight bearing. Child stands with knees in extension and with heels down on supporting surface.
3 — There is marked extension of the lower extremities in weight bearing. Child frequently bears weight on toes but is able to stand with heels down on supporting surface.
4 — There is persistent and marked extension at the hips and knees with plantarflexion.

11. Walking Reflex.

Hold the child vertically in a standing position and tilt the child slightly forward. The walking reflex is characterized by simultaneous hip and knee flexion and ankle dorsiflexion of the forward extremity. There is no balance response in this stepping.

1 — The reflex is not elicited. Child may voluntarily walk with one or both hands held.
2 — The reflex is present with one, two, or three steps taken.
3 — The reflex is present with four or more steps taken.
4 — The reflex is strongly present with consistent stepping forward as long as the stimulus is applied.

12. Trunk Incurvation (Galant).

Hold the child in prone suspension over the palm of your hand. Run your thumb beside the spine from the shoulder to the buttocks. The reflex is indicated by lateral trunk flexion toward the stimulus.

1 — The reflex is not elicited.
2 — Slight lateral trunk flexion is seen in wrinkling of the skin on the same side as the stimulus.
3 — There is lateral trunk flexion resulting in a concavity of the trunk on the same side as the stimulus.
4 — There is a brisk and marked flip of child's hip toward the side of the stimulus.

13. Asymmetry.

This item summarizes the number of asymmetries and shows whether the asymmetries suggest a consistent pattern. Review items 1-12 and count the number of items in which asymmetries have occurred. Determine whether the higher score for each item is in the left or in the right column.

It has been observed that a strong ATNR may indicate a deficit on the skull side of the child's body rather than on the face side. Therefore, a pattern of asymmetries established by the other reflexes should not be absolved by an apparent inconsistency in the ATNR - Evoked or in the ATNR - Spontaneous. If the reflexes other than the ATNR show a predominance of higher scores in one column, asymmetries noted in the ATNR should be counted as part of the consistent pattern on one side.

1 — No asymmetries.

2 — One asymmetry.
Two asymmetries with one higher scores in each column.
Three asymmetries with two higher scores in the same column.
Four asymmetries with two higher scores in each column.

3 — Two asymmetries with both higher scores in the same column.
Five asymmetries with three higher scores in the same column.

4 — Three asymmetries with three higher scores in the same column.
Four asymmetries with three higher scores in the same column.
Four asymmetries with four higher scores in the same column.
Five asymmetries with four higher scores in the same column.
Five asymmetries with five higher scores in the same column.
Six or more asymmetries.

14. Summary of Primitive Reflexes.

This item is not a summary of numerical scores. It is intended to reflect the examiner's impression of the child's primitive reflexes in relation to the child's age, the testing situation, and other relevant factors.

1 — Primitive reflexes appear to be normal.
2 — Integration of primitive reflexes appears to be delayed.
3 — Integration of primitive reflexes appears to be delayed and suggests possible abnormality.
4 — Primitive reflexes are abnormal.

AUTOMATIC REACTIONS

Automatic reactions include righting reactions, equilibrium reactions, and protective extension reactions. Righting reactions serve to right the head in space so that the eyes are on a horizontal plane, or they serve to restore the body parts to a normal alignment following rotation. Equilibrium reactions are the postural adjustments of the head, trunk, and extremities when the body is moved over the supporting surface or when the supporting surface is moved under the body; therefore, equilibrium reactions serve to maintain the body in an upright position. Protective extension reactions of the upper extremities provide protection for the body when the equilibrium reactions are not sufficient to prevent falling during rapid displacement.

Items 1-14 should be coded by the scale below. Code items 15 and 16 as explained in the instructions for these items.

0 — Item omitted
1 — Complete and consistent response
2 — Incomplete or inconsistent response
3 — Partial response
4 — No response

A score of "1" is given when the full automatic reaction is present and is repeatable. A score of "2" is given when all components of the reaction are elicited; however, they may not occur simultaneously, may not have a full range of movement, or cannot be repeated. A score of "3" is given when only some of the components of the reaction are elicited. A score of "4" is given when none of the components of the reaction is present.

When observing lateral righting and equilibrium reactions in items 1, 6, 7, and 8, score the side of the body which shows the active response, not the side to which the child is tipped.

1. Head Righting - Lateral.

Hold the child in vertical suspension facing away from you. Support at the sides of the trunk and tilt the child slowly to one side to a 45 degree angle. Observe the response of the head. Repeat this procedure at least twice to each side; between trials, pause to stabilize the child in midline.

1 — Child consistently corrects head to vertical position.
2 — Child holds head in alignment with body; if moved gently, child may correct head to vertical position.
3 — Child momentarily tightens muscles through the neck but does not consistently bring head into alignment with body.
4 — Child does not attempt to align head with body.

2. Head Righting - Extension.

Place the child prone and observe from the side for at least 30 seconds.

1 — Child easily raises head in midline to face vertical and maintains this position.
2 — Child lifts head to face vertical but cannot sustain this position. Head may not be held in midline.
3 — Child lifts head but does not achieve face vertical position.
4 — Child does not lift head or makes futile attempts.

3. Head Righting - Flexion.

Place the child supine with feet towards you. Hold the child at the wrists. If instability or weakness of the shoulder girdle is suspected, hold at the upper arms. Slowly pull the child to a sitting position; allow maximum active participation by the child. Observe the response of the head. If the child's fear of strangers appears to be interfering, ask a parent to perform this item.

1 — Child tucks chin in towards chest through the entire movement from supine to sitting. There may be a slight initial head lag.
2 — Child does not tuck chin but holds head in line with body throughout the entire movement. There may be a slight initial head lag.
3 — Child holds head in line with body through only a portion of the movement.
4 — Child may momentarily tighten muscles through the neck but does not align head with body.

4. Landau.

Hold the child in prone suspension with support under the trunk between the shoulders and pelvis. Observe the action of the head, back, and hips. This response can be encouraged by gently raising or lowering the child; in doing so, maintain the child in the horizontal plane. Extension of the back and legs should be active and mobile and not stiffly hypertonic.

1 — Child raises head above the horizontal line of the back, extends trunk, and symmetrically raises hips into a fully extended position.
2 — Child extends head and back but does not achieve extension at hips.
3 — Child raises head to a horizontal line with the back but does not extend the head above this level.
4 — Child may attempt to lift head but does not achieve a horizontal line with the back.

5. Rotation in Trunk.

Place the child supine with feet toward you and encourage the child to roll to prone. If the child rolls independently, look for distinct rotation between pelvis and shoulder girdle followed by realignment. If the child does not demonstrate definite trunk rotation or does not roll independently, try to rotate the trunk by flexing the child's hip and knee and bringing the leg across the body. Note limited or excessive mobility in trunk rotation as well as the child's ability to realign the shoulders with the pelvis by rolling to prone. The emphasis in this item is on quality of trunk rotation and not on the skill of rolling.

1 — When the child rolls independently from supine to prone, there is distinct rotation between pelvis and shoulder girdle, followed by realignment.
2 — When the examiner rotates the child's trunk, the child actively realigns the pelvis and shoulder girdle and rolls to prone.
3 — When the examiner rotates the child's trunk, the child cannot realign the pelvis and shoulder girdle, but normal mobility is present.
4 — Examiner cannot passively rotate the child's trunk.

6. Equilibrium Reactions in Prone.

Place the child prone on the cushion with feet toward you. Tilt the child to one side by raising one end of the cushion. Guard the child to prevent a fall but do not support the child's body. Observe the response of the head, trunk, and extremities on the uphill side. Head righting is a component of the equilibrium reactions but the focus of attention in this test is on the response of trunk and extremities. Repeat this procedure at lease twice to each side; between trials, stabilize the child in midline. For the child who is already creeping, a score of "1" is given.

1 — Child exhibits a "C" curve of the trunk, concave to the uphill side, righting of the head, and abduction of the arm and the leg on the concave side of the trunk.
2 — Child exhibits incomplete trunk incurvation and incomplete extremity counterbalancing with some degree of head righting.
3 — Child exhibits minimal wrinkling of the trunk on the concave side with some degree of head righting. There is little or no extremity counterbalancing.
4 — Child makes no correction of trunk or extremities.

7. Equilibrium Reactions in Sitting.

Place the child in sitting. If the child is unable to sit independently, support at the sides of the trunk as low as possible. Tilt the child to one side so as to shift the weight over one hip; push gently at one shoulder, push sideways at the hip, or encourage the child to reach for an object held out to the side at shoulder level. Observe the response of the head, trunk, and extremities on the non-weight bearing side. As in item 6, the focus of attention is on the trunk and extremities. Repeat this procedure at least twice to each side.

1 — Child exhibits incurvation of the trunk on the non-weight bearing side, righting of the head, and abduction of the arm and the leg on the concave side of the trunk. Child must be able to sit independently.
2 — Child exhibits incomplete trunk incurvation and incomplete extremity counterbalancing with some degree of head righting.
3 — Child exhibits minimal trunk incurvation with head righting but no extremity counterbalancing.
4 — Child makes no correction of trunk or extremities.

8. Equilibrium Reactions in Vertical Suspension.

Hold the child in vertical suspension with the child facing away from you. Support at the sides of the pelvis and tilt the child to one side to a 45 degree angle. Observe the response of the head, trunk, and extremities. As in items 6 and 7, the focus of attention is on the trunk and extremities. Repeat this procedure at least twice to each side; pause to stabilize the child in midline. If the chld does not have sufficient trunk control to be held as low as the pelvis, a score of "4" is given.

1 — Child exhibits a "C" curve of the trunk concave to the upper side, righting of the head, and abduction of the arm and the leg on the concave side of the trunk.
2 — Child exhibits incomplete trunk incurvation and incomplete extremity counterbalancing with some degree of head righting.
3 — Child exhibits minimal trunk incurvation with some degree of head righting. There is little or no extremity counterbalancing.
4 — Child makes no correction of trunk or extremities.

9. Downward Parachute.

Hold the child in vertical suspension with the child facing away from you. Support at the sides of the trunk. Bring the child rapidly but gently downward until the feet touch the table surface. Observe the response of the lower extremities. Repeat this procedure at least twice.

1 — Child abducts and externally rotates hips, extends knees, and dorsiflexes ankles; child lands with a wide base of support.
2 — Child abducts hips, extends knees, and dorsiflexes ankles but lands with less than full range of abduction at the hips.
3 — Child abducts hips slightly but lands in a narrow stance. Child may plantarflex ankles.
4 — Child demonstrates no hip abduction and may even adduct hips so that legs or ankles cross.

10. Protective Extension - Forward.

Hold the child in prone suspension and rapidly lower the child head-first toward the testing surface. Observe the response of the child's upper extremities.

1 — Child moves arms forward, extends elbows, and catches weight on open hands.
2 — Child moves arms forward and extends elbows but supports weight on fisted hands or is not able to support weight.
3 — Child makes some attempt to move arms foward but does not actively extend elbows.
4 — Child makes no attempt to protect against fall.

11. Protective Extension - Side. facing away from you

Place the child in sitting. If the child is unable to sit independently, support at the sides of the trunk as low as possible. Push child gently but rapidly to one side. Observe the response of the child's arm on the side to which the child is pushed.

1 — Child prevents a fall with abduction of the arm, extension of the elbow, and support on open hand.
2 — Child abducts arm and extends elbow but supports on fisted hand or does not consistently prevent a fall.
3 — Child abducts arm but does not extend elbow. Child may land on forearm.
4 — Child makes no attempt to prevent a fall by abduction or extension of the arm.

12. Protective Extension - Backward.

Place the child in sitting. If child is unable to sit independently, support at the sides of the trunk as low as possible. Push child gently but rapidly backwards. Observe the child's ability to prevent a fall backwards.

1 — Child prevents a fall either by rotating trunk and supporting weight on open hand or by extending both arms backwards and supporting on open hands.
2 — Child either rotates trunk and extends one arm or extends both arms backwards; however, weight is supported on fisted hands or child does not consistently prevent a fall.
3 — Child partially rotates trunk but does not extend elbow. Child may land on forearm.
4 — Child makes no attempt to prevent a fall.

13. Placing of Feet.

Hold child close to you and facing away. Hold one leg out of the way while the other leg hangs freely close to a table edge and below the level of the table top. If there is no spontaneous response, maneuver the child so that the dorsum of the foot strokes the table edge in an upward movement. Be careful not to restrict the leg being tested.

1 — Child briskly brings the leg up to clear the table and places it down on the table. This motion occurs spontaneously as the leg approaches the table or it occurs immediately following the contact of the dorsum of the foot with the table edge.
2 — Child slowly brings the leg up to clear the table and may pause before placing the foot down on the table. This response does not occur spontaneously but occurs only after the dorsum of the foot has contacted the table edge.
3 — Child flexes the leg following contact of the dorsum of the foot with the table but does not extend the leg to place the foot on the table.
4 — Child makes no response to stimulation of the dorsum of the foot.

14. Placing of Hands.

Hold child close to you and facing away. Hold one arm out of the way while the other arm hangs freely close to a table edge and below the level of the table top. If there is no spontaneous response, maneuver the child so that the dorsum of the hand strokes the table edge in an upward movement. Be careful not to restrict the arm being tested.

1 — Child briskly raises the hand to clear the table and places it down on the table. This motion occurs spontaneously as the arm approaches the table or it occurs immediately following the contact of the dorsum of the hand with the table edge.
2 — Child slowly brings the arm up to clear the table and may pause before placing the hand on the table. This response does not occur spontaneously but occurs only after the dorsum of the hand has contacted the table edge.
3 — Child raises the arm following contact of the dorsum of the hand with the table edge but does not place the hand on the table.
4 — Child makes no response to stimulation of the dorsum of the hand.

15. Asymmetry.

This item summarizes the number of asymmetries and shows whether the asymmetries suggest a consistent pattern. Review items 1-14 and count the number of items in which asymmetries have occurred. Determine whether the higher score for each item is in the left or right column.

1 — No asymmetries.

2 — One asymmetry.
Two asymmetries with one higher score in each column.
Three asymmetries with two higher scores in the same column.
Four asymmetries with two higher scores in each column.

3 — Two asymmetries with both higher scores in the same column.
Five asymmetries with three higher scores in the same column.

4 — Three asymmetries with three higher scores in the same column.
Four asymmetries with three higher scores in the same column.
Four asymmetries with four higher scores in the same column.
Five asymmetries with four higher scores in the same column.
Five asymmetries with five higher scores in the same column.
Six or more asymmetries.

16. Summary of Automatic Reactions.

This item is not a summary of numerical scores. It is intended to reflect the examiner's impression of the child's automatic reactions in relation to the child's age, the testing situation, and other relevant factors.

1 — Automatic reactions appear to be normal.
2 — Automatic reactions appear to be immature.
3 — Automatic reactions appear to be immature and suggest possible abnormality.
4 — Automatic reactions are abnormal.

VOLITIONAL MOVEMENT

This section includes a selection of test items which are divided into the following four categories: responses to visual and auditory stimuli and sound production, gross motor control of head and shoulder girdle, gross and fine motor control of upper extremities, and gross motor control of trunk and lower extremities. These items have been selected because they are significant in analyzing the quality of a child's motor development during the first twelve months.

Items 1-23 should be coded by the scale below. Code items 24 and 25 as explained in the instructions for these items.

0 — Item omitted
1 — Complete and consistent response
2 — Incomplete or inconsistent response
3 — Partial response
4 — No response

A score of "1" is given when the volitional movement is fully developed. A score of "2" or "3" is given when the response is immature or is a prerequisite skill to a fully developed movement. A score of "4" is given when the response is not present.

1. Hearing.

With the child in supported sitting, stand behind the child and shake a rattle, ring a bell, or crumple a piece of paper a few inches away from the child's ear. Be careful that the child is not attracted visually by movement of your arm or test objects. Present the sounds alternately to each side. If the child does not turn to sounds while sitting, place the child supine and present the sounds again. In order to localize to a sound, a child must have some hearing in both ears. Any question about the child's hearing should be noted and the child should be referred for an audiological examination.

1 — Child turns consistently to sound on each side.
2 — Child turns to sound at least once to each side, but the response is inconsistent.
3 — Child may turn slightly in the direction of sound but turns equally often in the opposite direction; or the child may show other minimal responses to sound such as stilling, eye widening, or startling.
4 — Child does not respond to sounds presented.

2. Visual Following.

Evaluate visual pursuit with the child in supine. Observe the child's ability to track your face or a colorful object through a range of vertical and horizontal movement. Success at visual following depends on control of the head, on control of eye movements, and on motivation. Pay attention to problems in eye movement, such as strabismus. Any question about the child's vision should be noted, and the child should be referred for visual examination.

1 — Child consistently and readily follows an object through a full range of vertical and horizontal movement.
2 — Child focuses on object but may not follow in a complete range and frequently appears to lose sight of the object.
3 — Child occasionally focuses on object but tracking is not observed.
4 — Child does not focus on object.

3. Peripheral Vision.

Assess the infant's ability to see an object with peripheral vision and then to turn to it. Place the child in supine or in sitting. Stand in front of the child in order to observe the visual response. Extend your arms past the child's head. Bring a colorful object forward on one side. If the child stares at you and shows no interest in the test object, retest the child in the alternate position.

1 — Child consistently turns to look at object when it is at approximately a 45 degree angle.
2 — Child occasionally turns to object when it is at approximately a 45 degree angle.
3 — Child turns to look at object only when examiner brings it past the 45 degree angle. The response is inconsistent.
4 — Child does not turn to look at object.

4. Vocalization.

Listen to child's vocalizations.

1 — Child makes one or more distinct, repetitive consonant sounds such as "ga-ga-ga," "ma-ma," or "ba-ba."
2 — Child makes one or more distinct consonant sounds such as "ga" or "da."
3 — Child makes one or more distinct vowel sounds such as "ah," "ae," "oo," "oh." These sounds may be heard in squealing or in cooing.
4 — Child makes throaty sounds.

5. Head Centering.

Place the child supine and observe the child's ability to look straight up without allowing the head to drift to the left or to the right. In the normal but immature response, the head is often turned but there is not a strong preference for the left or for the right side. Persistent head turning to one side should be recorded by placing an "X" in the left or right column under Asymmetries on the scoring sheet to indicate the side to which the child's face is more often turned. If the child is able to center the head while sitting, give a score of "1."

1 — Child centers head consistently.
2 — Child centers head and maintains this position while motivated to observe an object but usually lies with head tipped or turned to either side.
3 — Child is able to move head to midline but cannot maintain head centered.
4 — Child shows no ability to center head in midline.

6. Head Position-Anterior/Posterior.

Assess the child's ability to hold the head upright in supported or in independent sitting. Observe the extent of flexion or extension of the child's head from the side view.

1 — Head is consistently held in midline.
2 — Head is frequently held in midline, but there is some tendency for the head to be held in flexion or in extension.
3 — Head is held in flexion or is held in extension. In the extended posture, the child has the appearance of being led by the chin.
4 — There is no head control in the anterior/posterior plane.

7. Head Balance.

Observe the child's ability to maintain a stable head position in supported or in independent sitting.

1 — Head is stable consistently.
2 — Head is stable except when child is suddenly moved.
3 — Head bobs, but child has some ability to hold head upright.
4 — Head bobs and there is no head control.

8. Active Weight Bearing Through Shoulders.

Observe the position of the upper extremities when the child is in the prone position.

1 — Child bears weight on forearms or hands; elbows must be vertically in line with the shoulders or forward of the shoulders.
2 — Child can bring elbows in front of shoulders but often has elbows behind shoulders.
3 — Child has difficulty getting up on forearms; when on forearms, the elbows are held close to the body. When placed on forearms, child holds weight momentarily.
4 — Child will not bear weight on forearms even when placed. If child cannot be placed in this position because of a strong flexor pattern of the arms, a score of "4" is given.

9. Open Hands.

Observe the child's hands throughout testing. Developmentally, the child progresses from fisted hands, to flexed fingers, to the open hand position.

1 — Child has hands open; hand closing is voluntary.
2 — Child has hands closed but opens hands frequently, especially when looking at or reaching for an object.
3 — Child usually has hands closed and only occasionally opens them.
4 — Child does not open hands.

10. Hands to Midline.

With the child in supine and with the child in supported sitting, observe the child's ability to bring hands to midline.

1 — Child in supine frequently brings hands to midline and fingers one hand with the other.
2 — Child in supine will occasionally bring hands to midline.
3 — Child in supine does not bring hands to midline but will in supported sitting.
4 — Child does not bring hands to midline in either supine or supported sitting.

11. Large Grasp.

With the child in supported or in independent sitting, present a 1-inch cube. Observe the child's ability to grasp the cube.

1 — Child easily picks up and holds cube.
2 — Child picks up and holds cube in an awkward manner.
3 — Child does not pick up cube; however, when cube is placed in child's hand, child retains it in a palmer grasp with or without the use of the thumb.
4 — Child does not retain cube even when it is placed in the hand.

12. Small Grasp.

With the child in supported or in independent sitting, present a pellet. Observe the child's ability to grasp the pellet.

1 — Child uses a fine pincer grasp to pick up the pellet. Child picks up pellet with thumb and index fingertip.
2 — Child uses an inferior pincer grasp to pick up the pellet. Child picks up pellet with thumb and side of index finger or with thumb and two fingers.
3 — Child uses a raking grasp to pick up pellet. Child scoops pellet into palm with flexing motion of the fingers.
4 — Child cannot grasp pellet.

13. Reaches Out.

With the child in supine or in supported or independent sitting, present a dangling object. Observe the child's reaching skills.

1 — Child reaches out consistently to secure the object presented at arm's length.
2 — Child occasionally reaches out and grasps the object, but the object must be placed conveniently for the child.
3 — Child reaches out for the object but does not successfully grasp it.
4 — Child does not reach out. Any attempts are pre-reaching in nature.

14. Combines.

Present two objects to the child so that an object is held in each hand. Observe the child's ability to bring the objects together in midline..

1 — Child easily combines objects; for example, child may bang two blocks together.
2 — Child occasionally combines objects.
3 — Child inadvertently combines objects but does not repeat this skill.
4 — Child does not combine objects throughout testing.

15. Transfers.

With the child in supported or in independent sitting, observe the child's handling of an object.

1 — Child places object from one hand to the other using voluntary release. Object may not be trapped against a table top or other surface.
2 — Child appears to pull the object from one hand with the other hand. Object may not be trapped against a table top or other surface.
3 — Child accidentally exchanges object from one hand to the other. Object may be trapped against table top or other surface; child may use mouth when hands are close to face.
4 — Child does not exchange objects from one hand to the other.

16. Back Straight in Sitting.

With the child in supported or in independent sitting, observe back extension from the side view.

1 — Child sits independently with a straight back down to buttocks.
2 — Child sits independently with straight back through the thoracic area but has some rounding in the lumbar area.
3 — Child in supported or independent sitting will straighten the upper thoracic area.
4 — Child does not attempt to straighten back; child remains in a round back position.

17. Active Use of Hips.

With the child supine, observe the spontaneous movements of the child's hips.

1 — Child rounds buttocks off the mat and easily plays with knees; child kicks legs together and reciprocally.
2 — Child can round buttocks off the mat but does not play with knees; child kicks legs together and reciprocally.
3 — Child kicks but does not round buttocks off the mat.
4 — Child shows minimal movement of the lower extremities.

18. Rolling.

Observe the extent of the child's ability to roll independently.

1 — Child rolls supine to prone.
2 — Child rolls part way out of supine towards prone.
3 — Child rolls prone to supine.
4 — Child does not roll independently.

19. Prone Progression.

Observe the child's mode of independent progression.

1 — Child creeps on hands and knees or on hands and feet with reciprocal motion. There is forward progression.
2 — Child crawls on abdomen with reciprocal movements of arms and legs. There is forward progression.
3 — Child pivots on abdomen.
4 — Child makes no progression.

20. Sits When Placed.

Place the child in a sitting position on the floor. Observe the child's ability to remain in that position.

1 — Child consistently sits independently or is mobile into and out of independent sitting.
2 — Child sits without using arms for support, but examiner must guard the child against a fall.
3 — Child props self on arms in order to remain in sitting.
4 — Child does not sit independently or maintains the sitting position only briefly.

21. Coming to Sit.

Observe the child's ability to get into the sitting position independently. The child usually comes from the crawling or prone position, rotates the trunk, and sits down on one hip.

1 — Child independently achieves full upright sitting by using rotation and maintains sitting without arm support.
2 — Child sits on hip but is unable to rotate trunk back into a midline upright position; child still must support self on arms.
3 — Child does not get from prone to sitting independently but does use rotation to get from sitting to prone.
4 — Child uses no rotation in moving into or out of sitting.

22. Coming to Stand.

Observe the child's ability to come to a standing position at a low table or chair.

1 — Child uses kneel to half-kneel movements to achieve standing with separation of legs and with even distribution of weight on feet.
2 — Child uses kneel to half-kneel movements to achieve standing, but legs are not well separated and the child's weight is not evenly distributed on the feet.
3 — Child gets to standing but does not use half-kneeling movements.
4 — Child does not get to standing independently.

23. Walking.

Observe the child's independent walking.

1 — Child walks with a reciprocal gait.
2 — Child walks with a stiff but independent gait of more than three steps; child usually walks with arms in high-guard posture.
3 — Child walks with one or both hands held.
4 — Child does not walk.

24. Asymmetry.

This item summarizes the number of asymmetries and shows whether the asymmetries suggest a consistent pattern. Review items 1-23 and count the number of items in which asymmetries have occurred. Determine whether the higher score for each item is in the left or in the right column. Item 5 is counted according to the pattern of asymmetries established by the other volitional items.

1 — No asymmetries.

2 — One asymmetry.
Two asymmetries with one higher score in each column.
Three asymmetries with two higher scores in the same column.
Four asymmetries with two higher scores in each column.

3 — Two asymmetries with both higher scores in the same column.
Five asymmetries with three higher scores in the same column.

4 — Three asymmetries with three higher scores in the same column.
Four asymmetries with three higher scores in the same column.
Four asymmetries with four higher scores in the same column.
Five asymmetries with four higher scores in the same column.
Five asymmetries with five higher scores in the same column.
Six or more asymmetries.

25. Summary of Volitional Movement.

This item is not a summary of numerical scores. It is intended to reflect the examiner's impression of the child's volitional movement in relation to the child's age, the testing situation, and other relevant factors.

1 — Volitional movements appear to be normal.
2 — Volitional movements appear to be immature.
3 — Volitional movements appear to be immature and suggest possible abnormality.
4 — Volitional movements are abnormal.

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CRITIQUE FORM

How are you currently using the MAI?

Do you anticipate using the MAI in other ways?

Are there any items in which the scoring is not clear?

Suggested Revisions:

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