

Functional Analysis of MINI-Q II positions, and Use with Live Z-scores

A Window to 4-channel EEG Assessment and Training

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Introduction

The MINI-Q II provides 8 positions, each selecting 4 channels. With a rear pushbutton, a 9th position is available. The sensors for the positions are:

Position	Active 1	Active 2	Active 3	Active 4
1	Fz	Cz	T3	T4
2	F3	F4	O1	O2
3	C3	C4	F7	F8
4	P3	P4	T5	T6
5	Fp1	Fp2	Pz	Oz (not 10/20)
5a	T3	T4	Pz	Oz (not 10/20)
6	O1	O2	C3	C4
7	F7	F8	F3	F4
8	T5	T6	Fz	Cz

In addition to taking EEG data for evaluation, the MINI-Q II can also be used for training. In each position, a particular set of sites and connections is used.

In each position, the MINI-Q II provides 4 sites, and 6 connection paths between them. By using particular MINI-Q II positions for training, it is possible to target specific brain functions in an efficient manner, and train all 4 sites.

When used with the Live Z-score training capability, it is possible to train all 4 sites, in addition to their 6 interconnections. This provides an efficient means to target specific functions. When used with 4 channels, the live Z-score software provides 248 training variables as z scores:

For each channel, for each of 8 bands: Absolute and relative power ($4 \times 16 = 64$ z-scores)

For each channel: 10 power ratios ($4 \times 10 = 40$ z-scores)

For each pair of channels (6 pairs) coherence, phase, asymmetry. ($6 \times 24 = 144$ z-scores)

The following pages detail the brain locations and functions accessed by each MINI-Q II position, based upon the cited paper by Walker et. al. (2007) Each position provides a “window” into the trainee’s brain, with unique capabilities for assessment and training. By referring to these charts, along with the live z-scores, it becomes possible to monitor and train specific brain functions using 4 channels in a convenient and optimal manner.

Functional Analysis of MINI-Q II positions

Based upon the following detailed explanations, each of the 9 possible MINI-Q II settings becomes a “window” into particular aspects of brain function. When the brain is analyzed by taking sets of 4 channels in particular patterns, each pattern demonstrates a particular set of brain functional elements, and their interactions.

For purposes of general understanding, it is possible to classify each MINI-Q II position in terms of the brain activities that it reflects, and how these are integrated into the overall function of the brain. In addition, by considering the effects of hypo- or hyper-coherence in each possible pair, it is possible to address modular interactions, and place them in the context of clinical signs.

Each of the positions is described in detail on one of the following pages. For a summary account of their properties, the following nomenclature can emerge. For the benefit of succinctness, each position is further identified with an overall role, and a role “image” of that brain subsystem, the role that it subserves. It is anticipated that this interpretation will be of value in clinical assessment, and management of trainees, in cases in which particular functional subsystems can be identified for purposes of optimizing clinical outcomes.

Position	Brain Site(s)	Functional Aspects	Overall Role
1	Frontal; Temporal	Remembering and Planning	Goalsetting; “Captain”
2	Frontal; Occipital	Seeing and Planning	Lookout; “Guide”
3	Central; Frontal	Doing and Expressing	Outward Expression; “Actor”
4	Parietal; Temporal	Perceiving and Understanding	Interpreting the world; “Scholar”
5	Prefrontal; Parietal	Attending and Perceiving	Observer; “Owl”
5a	Temporal; Parietal	Remembering and Perceiving	Ponderer; “Sage”
6	Occipital; Central	Seeing and Acting	Outward Actions; “Hero”
7	Frontal	Planning and Expressing	Planner; “Oracle”
8	Temporal; Frontocentral	Understanding and Doing	Skilled; “Adept”

It is evident based upon this arrangement that this method provides a useful way to separate out functional subsystems in the brain, and to assess and train them in a systematic manner, using 4 channels of EEG. Depending on the outcome of the entire MINI-Q (or QEEG) analysis, it becomes possible to define the functional aspects that are addressed by each of the possible MINI-Q II positions, and to design training protocols around them.

This analysis does not take into consideration the possibility of peak-performance or mental-fitness applications, such as alpha synchrony, coherence training, activation (“squash”) training, or disruptive training such as bihemispheric. These areas can be further pursued using this method, to design protocols that optimize brain function in specified subsystems, toward specific goals.

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Data from: Walker, J.E., Kozlowski, G.P., and Lawson, R. (2007) A Modular Activation/Coherence Approach to Evaluating Clinical/QEEG Correlations, *Journal of Neurotherapy* 11(1) 25-44.

MINI-Q II Position: 1

“Remembering and Planning”

Sites: Fz Cz T3 T4 “Frontal Midline and Temporal Lobes”

Summary: This position provides a primary window to motor planning of the lower extremities, sensorimotor integration, and logical and emotional memory formation and storage. Secondary functions include phonological processing, hearing, and ambulation.

10/20 Territory Modules	Principal Function	Other Functions
Fz	Motor planning of both lower extremities (BLE) and midline	Running, Walking, Kicking
Cz	Sensorimotor integration both lower extremities (BLE) and midline	Ambulation
T3	Logical (verbal) memory formation and storage	phonological processing, hearing (bilateral) suppression of tinnitus
T4	Emotional (non-verbal) memory formation and storage	hearing (bilateral), suppression of tinnitus, autobiographical memory storage

Coherence	Result of Hypocoherence	Result of Hypercoherence
Fz-Cz	Less efficient midline motor action/midline sensorimotor integration	Lack of flexibility of midline motor action/midline sensorimotor integration
Fz-T3	Less efficient logical memory/midline motor actions	Lack of flexibility of logical memory/midline motor actions
Fz-T4	Less efficient emotional memory/midline motor actions	Lack of flexibility of emotional memory/midline motor actions
Cz-T3	Less efficient logical memory/midline sensorimotor integration	Lack of flexibility of logical memory/midline sensorimotor integration
Cz-T4	Less efficient emotional memory/midline sensorimotor integration	Lack of flexibility of emotional memory/midline sensorimotor integration
T3-T4	Less efficient logical memory/emotional memory	Lack of flexibility of logical memory/emotional memory

MINI-Q II Position: 2

“Seeing and Planning”

Sites: F3 F4 O1 O2 “Frontal and Occipital Homologous Sites”

Summary: This position provides a primary window to motor planning of the upper extremities, motor actions, and visual processing. Secondary functions include fine motor coordination, mood elevation, pattern recognition, and visual sensations and perception.

10/20 Territory Modules	Principal Function	Other Functions
F3	Motor planning right upper extremity (RUE)	Fine motor coordination, mood elevation
F4	Motor planning left upper extremity (LUE)	Fine motor coordination (left hand)
O1	Visual processing right half of space	Pattern recognition, color perception, movement perception, black/white perception, edge perception
O2	Visual processing left half of space	Pattern recognition, color perception, movement perception, black/white perception, edge perception

Coherence	Result of Hypocoherence	Result of Hypercoherence
F3-F4	Less efficient motor actions RUE/motor actions LUE	Lack of flexibility motor actions RUE/motor actions LUE
F3-O1	Less efficient motor actions RUE/visual sensations R	Lack of flexibility of logical memory/midline motor actions
F3-O2	Less efficient motor actions RUE/visual sensations L	Lack of flexibility of emotional memory/midline motor actions
F4-O1	Less efficient motor actions LUE/visual sensations R	Lack of flexibility of motor actions LUE/visual sensations R
F4-O2	Less efficient motor actions LUE/visual sensations L	Lack of flexibility of motor actions LUE/visual sensations L
O1-O2	Less efficient visual sensations R/visual sensations L	Lack of flexibility of visual sensations L/visual sensations R

MINI-Q II Position: 3

“Doing and Expressing”

Sites: C3 C4 F7 F8 “Mesial Motor Strip and Lateral Frontal Homologous Sites ”

Summary: This position provides a primary window to sensorimotor integration, and verbal and emotional expression, motor actions of the upper extremities, visual sensations, verbal/sensorimotor integration, and verbal/emotional expression. Secondary functions include alerting and calming responses, handwriting, drawing, and mood regulation.

10/20 Territory Modules	Principal Function	Other Functions
C3	Sensorimotor integration right upper extremity (RUE)	Alerting Responses Handwriting (right hand)
C4	Sensorimotor integration left upper extremity (LUE)	Calming Handwriting (left hand)
F7	Verbal Expression	Speech Fluency Mood Regulation (cognitive)
F8	Emotional Expression	Drawing (right hand) Mood Regulation (endogenous)

Coherence	Result of Hypocoherence	Result of Hypercoherence
C3-C4	Less efficient sensorimotor integration RUE/sensorimotor integration L	Lack of flexibility of sensorimotor integration RUE/sensormotor integration L
C3-F7	Less efficient verbal/sensorimotor integration RUE	Lack of flexibility of verbal/sensorimotor integration RUE
C3-F8	Less efficient emotional expression/sensorimotor integration RUE	Lack of flexibility of emotional expression/sensorimotor integration RUE
C4-F7	Less efficient emotional expression/sensorimotor integration LUE	Lack of flexibility of emotional expression/sensorimotor integration LUE
C4-F8	Less efficient emotional expression/sensorimotor integration LUE	Lack of flexibility of emotional expression/sensorimotor integration LUE
F7-F8	Less efficient verbal/emotional expression	Lack of flexibility of verbal/emotional expression

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MINI-Q II Position: 4

“Perceiving and Understanding”

Sites: P3 P4 T5 T6 “Parietal and Posterior Temporal Homologous Sites ”

Summary: This position provides a primary window to perception and cognitive processing, spatial relations, and logical and emotional understanding, memory, and perceptions. Secondary functions include spatial relations sensations, calculations, multimodal interactions, and recognition of words and faces, and auditory processing.

10/20 Territory Modules	Principal Function	Other Functions
P3	Perception (cognitive processing) right half of space	Spatial Relations Sensations Multimodal sensations Calculations Praxis Reasoning (verbal)
P4	Perception (cognitive processing) left half of space	Spatial Relations Multimodal Interactions Praxis Reasoning (non-verbal)
T5	Logical (verbal) understanding	Word Recognition Auditory Processing
T6	Emotional understanding	Facial Recognition Symbol Recognition Auditory Processing

Coherence	Result of Hypocoherence	Result of Hypercoherence
P3-P4	Less efficient perceptions R/perceptions L	Lack of flexibility of perceptions R/perceptions L
P3-T5	Less efficient logical memory/perception R	Lack of flexibility of logical memory/perception R
P3-T6	Less efficient emotional memory/perceptions R	Lack of flexibility of emotional memory/perceptions R
P4-T5	Less efficient logical memory/perceptions L	Lack of flexibility of logical memory/perception L
P4-T6	Less efficient emotional memory/perceptions L	Lack of flexibility of emotional memory/perceptions L
T5-T6	Less efficient logical memory/emotional memory	Lack of flexibility of logical memory/emotional memory

MINI-Q II Position: 5

“Attending and Perceiving”

Sites: Fp1Fp2 Pz Oz “Prefrontal Homologous, and Posterior Midline Sites ”

Summary: This position provides a primary window to logical and emotional attention, perception, and visual processing. Secondary functions include planning, decision making, task completion, sense of self, self-control, and route finding.

10/20 Territory Modules	Principal Function	Other Functions
Fp1	Logical Attention	Orchestrate network interactions planning Decision making Task completion Working memory
Fp2	Emotional Attention	Judgement Sense of self Self-control Restraint of impulses
Pz	Perception midline	Spatial Relations Praxis Route Finding
Oz (not a 10-20 position)	Visual processing of space	Primary visual sensation

Coherence	Result of Hypocoherence	Result of Hypercoherence
Fp1-Fp2	Less efficient integration of logical/emotional attention	Lack of flexibility of integrating logical/emotional attention
Fp1-Pz	Logical attention/midline perception	Lack of flexibility of logical attention/midline perception
Fp1-Oz	(no data)	(no data)
Fp2-Pz	Less efficient emotional attention/midline perception	Lack of flexibility of emotional attention/midline perception
Fp2-Oz	(no data)	(no data)
Pz-Oz	(no data)	(no data)

MINI-Q II Position: 5a (rear pushbutton OUT)

“Remembering and Perceiving”

Sites: T3 T4 Pz Oz “Temporal Lobes, and Posterior Midline ”

Summary: This position provides a primary window to logical and emotional attention, perception, and visual processing. Secondary functions include planning, decision making, task completion, sense of self, self-control, and route finding.

10/20 Territory Modules	Principal Function	Other Functions
T3	Logical (verbal) memory formation and storage	phonological processing, hearing (bilateral) suppression of tinnitus
T4	Emotional (non-verbal) memory formation and storage	hearing (bilateral), suppression of tinnitus, autobiographical memory storage
Pz	Perception midline	Spatial Relations Praxis Route Finding
Oz (not a 10-20 position)	Visual processing of space	Primary visual sensation

Coherence	Result of Hypocoherence	Result of Hypercoherence
T3-T4	Less efficient logical memory/emotional memory	Lack of flexibility of logical memory/emotional memory
T3-Pz	Less efficient logical memory/midline perception	Lack of flexibility of logical memory/midline perception
T3-Oz	(no data)	(no data)
T4-Pz	Less efficient logical memory/midline perception	Lack of flexibility of logical memory/midline perception
T4-Oz	(no data)	(no data)
Pz-Oz	(no data)	(no data)

MINI-Q II Position: 6

“Seeing and Acting”

Sites: O1 O2 C3 C4 “Occipital and Motor Strip Homologous Sites ”

Summary: This position provides a primary window to visual sensory processing, and sensorimotor integration of the upper extremities. Secondary functions include pattern recognition, perception of color, movement, black/white, and edges, alerting and calming responses, handwriting, and logical and emotional memory and perception.

10/20 Territory Modules	Principal Function	Other Functions
O1	Visual processing right half of space	Pattern recognition, color perception, movement perception, black/white perception, edge perception
O2	Visual processing left half of space	Pattern recognition, color perception, movement perception, black/white perception, edge perception
C3	Sensorimotor integration right upper extremity (RUE)	Alerting Responses Handwriting (right hand)
C4	Sensorimotor integration left upper extremity (LUE)	Calming Handwriting (left hand)

Coherence	Result of Hypocoherence	Result of Hypercoherence
O1-O2	Less efficient visual sensations R/visual sensations L	Lack of flexibility of visual sensations L/visual sensations R
O1-C3	Less efficient sensorimotor integration RUE/visual sensations R	Lack of flexibility of sensorimotor integration RUE/visual sensations R
O1-C4	Less efficient sensorimotor integration LUE/visual sensations	Lack of flexibility of sensorimotor integration LUE/visual sensations
O2-C3	Less efficient sensorimotor integration RUE/visual sensations L	Lack of flexibility of sensorimotor integration RUE/visual sensations L
O2-C4	Less efficient sensorimotor integration LUE/visual sensations	Lack of flexibility of sensorimotor integration LUE/visual sensations
C3-C4	Less efficient sensorimotor integration RUE/sensorimotor integration L	Lack of flexibility of sensorimotor integration RUE/sensorimotor integration L

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MINI-Q II Position: 7

“Planning and Expressing”

Sites: F7 F8 F3 F4 “Full Frontal Lobes Homologous Sites ”

Summary: This position provides a primary window to verbal and emotional expression, motor planning of the upper extremities, and motor actions. Secondary functions include speech fluency, mood regulation, and fine motor coordination.

10/20 Territory Modules	Principal Function	Other Functions
F7	Verbal Expression	Speech Fluency Mood Regulation (cognitive)
F8	Emotional Expression	Drawing (right hand) Mood Regulation (endogenous)
F3	Motor planning right upper extremity (RUE)	Fine motor coordination, mood elevation
F4	Motor planning left upper extremity (LUE)	Fine motor coordination (left hand)

Coherence	Result of Hypocoherence	Result of Hypercoherence
F7-F8	Less efficient verbal/emotional expression	Lack of flexibility of verbal/emotional expression
F7-F3	Less efficient verbal/motor actions R	Lack of flexibility of verbal/motor actions R
F7-F4	Less efficient verbal/motor actions L	Lack of flexibility of verbal/motor actions L
F8-F3	Less emotional expression/motor actions RUE	Lack of flexibility of emotional expression/motor actions RUE
F8-F4	Less emotional expression/motor actions LUE	Lack of flexibility of emotional expression/motor actions LUE
F3-F4	Less efficient motor actions RUE/motor actions LUE	Lack of flexibility motor actions RUE/motor actions LUE

MINI-Q II Position: 8

“Understanding and Doing”

Sites: T5 T6 Fz Cz “Posterior Temporal and Frontal Midline ”

Summary: This position provides a primary window to logical and emotional understanding and memory, motor planning of the lower extremities, and sensorimotor integration. Secondary functions include word recognition, auditory processing, recognition of faces and symbols, running, walking kicking, and ambulation.

10/20 Territory Modules	Principal Function	Other Functions
T5	Logical (verbal) understanding	Word Recognition Auditory Processing
T6	Emotional understanding	Facial Recognition Symbol Recognition Auditory Processing
Fz	Motor planning of both lower extremities (BLE) and midline	Running, Walking, Kicking
Cz	Sensorimotor integration both lower extremities (BLE) and midline	Ambulation

Coherence	Result of Hypocoherence	Result of Hypercoherence
T5-T6	Less efficient logical memory/emotional memory	Lack of flexibility of logical memory/emotional memory
T5-Fz	Less efficient logical memory/midline motor actions	Lack of flexibility of logical memory/midline motor actions
T5-Cz	Less efficient logical memory/midline sensorimotor integration	Lack of flexibility of logical memory/midline sensorimotor integration
T6-Fz	Less efficient emotional memory/midline motor actions	Lack of flexibility of emotional memory/midline motor actions
T6-Cz	Less efficient emotional memory/midline sensorimotor integration	Lack of flexibility of emotional memory/midline sensorimotor integration
Fz-Cz	Less efficient midline motor action/midline sensorimotor integration	Lack of flexibility of midline motor action/midline sensorimotor integration