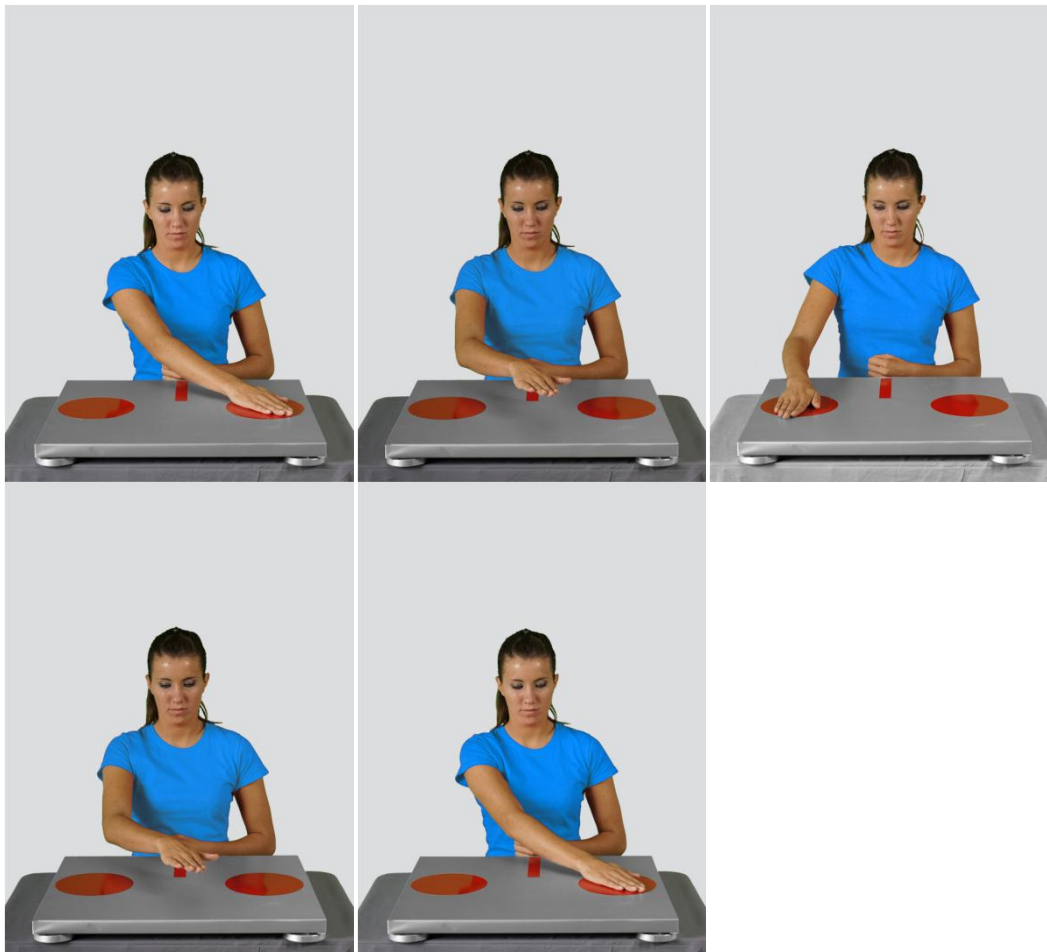


MODULE: TAPPING

BRIEF DESCRIPTION:

Speed/accuracy trade-off regards any movement where accurate termination or change of movement direction is of importance. It describes the reciprocal relation where increased speed of movement reduces its accuracy and vice versa. Moreover, reducing the size of the target area, where movement direction changes or terminates, causes decline in speed in order to maintain accuracy. On the other hand, if there is no special requirement for precision, the same task can be used to measure the maximal frequencies of the cyclic movements done by the same extremity. This basic principle implies directly to sports and every day movements such as basketball throwing, passing, precise leg positioning during locomotion etc.

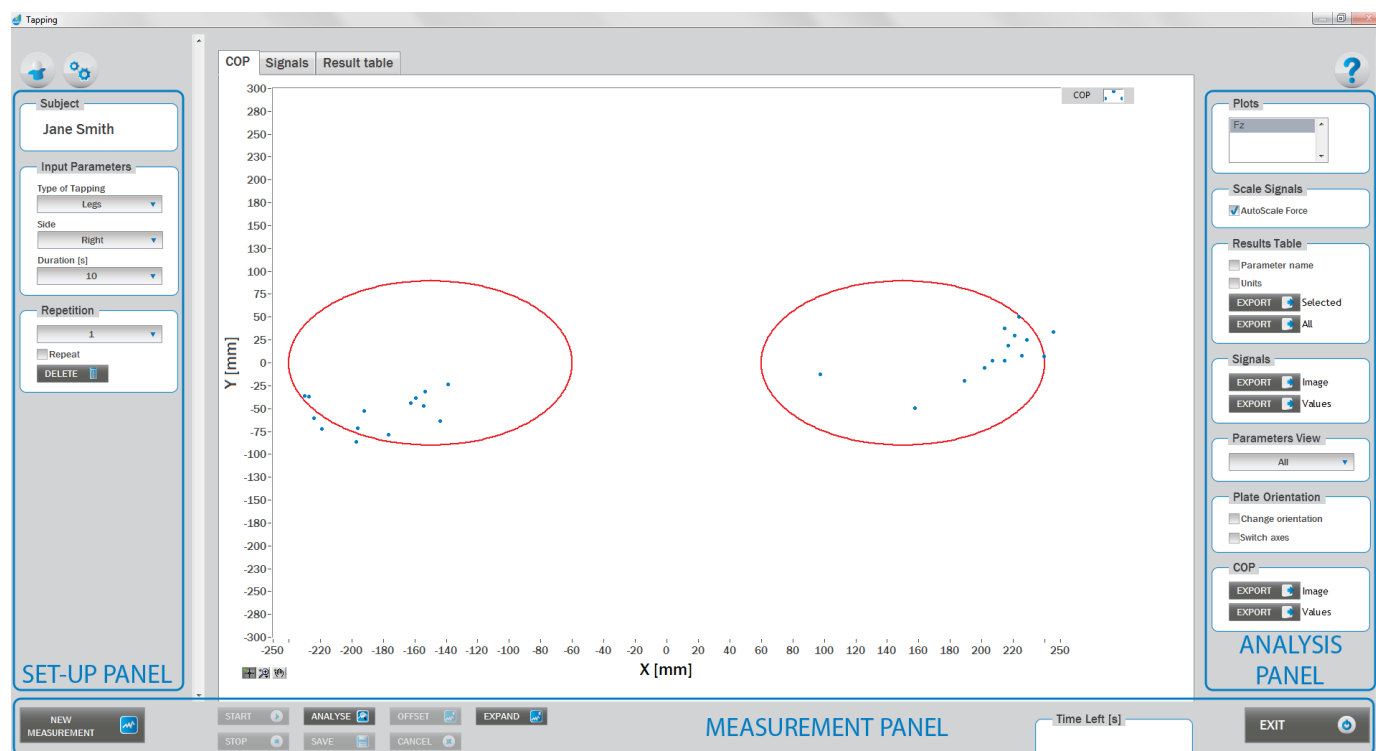
The ability to produce fast and accurate movements is readily measured by a simple tapping test. Alternating or discrete arm or leg movements can be used depending on the focus of interest. The subject is seated on a chair in front of the force plate; the latter installed at the table level or on the floor. In the initial position the non-dominant limb is positioned in the middle position in front of the force plate and the measured limb is positioned into a target space on the contralateral side. Subject's goal is to tap opposing target spaces (i.e. left-right-left-right-etc.) with the chosen extremity as fast and as accurate as possible. The difficulty of the test can be increased by decreasing the size of the target space.



When the Tapping module opens, the existing measurements of the selected subject inside the current Visit are displayed and the user can review it (see section Analysis for details). If no measurements have yet been done for this subject, then only the option to start a new measurement is enabled. In order to begin a new measurement, click New Measurement button and select the Input Parameters to exactly define the measurement task.

When the New Measurement button is selected for the first time after entering the Tapping measurement module, the force plate is initialized. After the automatic initialization process is finished, the zero offset must be done (follow the instructions on the pop-up message). The plate must be unloaded during the entire initialization and zero offset procedure. This procedure is performed every time you enter the Tapping measurement module. Zero offset can be repeated any time manually by pressing the Offset button, otherwise the automatic zero offset is done every 30 minutes.

BASIC FUNCTIONS:



SET-UP PANEL:

SUBJECT

Name

The selected subject.

INPUT PARAMETERS

See Selecting Input Parameters section for details.



REPETITION

Repetition

Number of repetitions for the selected Input parameters.

Repeat

If checked, the selected repetition is replaced when the new measurement is performed.

Delete

Delete the selected repetition.

ANALYSIS PANEL:

PLOTS

Plots

The list of all channels. The selected channels are shown on the graph.

SCALE

AutoScale Force

If checked, the vertical scale of the graph is adapted to the maximum and minimum value of all force signals.

RESULTS TABLE

In the Result Table panel, result parameters from Result table tab can be exported into clipboard, CSV or TXT format. Format of the file can be set in settings window under export section. For details about setting the parameters refer to Settings Section.

Parameter Name

Parameter name will be included.

Units

Units of the parameters will be included.

Export Selected

By clicking on Export Selected button only the parameters that are selected in the table will be included.

Export All

By clicking on Export All button all parameters from the table will be included.

SIGNALS

In the Signals panel, image or values (row data) of acquired signal can be exported. Image and values can be exported with different parameters, which can be set in Settings window under export section. For details about setting the parameters refer to Settings Section.



Export Image

Export the image of signals (as visible on the graph on the Signals tab) into the clipboard. Image can be pasted in any image editor.

Export Values

Export values (raw data) of signals (as visible on the graph on the Signals tab) into CSV or TXT format. Format of the file can be set in settings window under export section. For details about setting the parameters refer to Settings Section.

PARAMETERS VIEW

In the Parameters View panel, calculated parameters which are displayed in the result table can be set. By default, all and basic view are available. Basic view contains preset parameters and cannot be changed. Custom view can be defined, by clicking »Manage...« button.

To create a new view click on add button and enter the name of the view. Parameters included in the view are selected by checking the checkboxes next to them. To confirm the changes click save.

COP

In the COP panel, image or values (row data) of acquired signal can be exported. Image and values can be exported with different parameters, which can be set in Settings window under export section. For details about setting the parameters refer to Settings Section.

Export Image

Export the image of signals (as visible on the graph on the Signals tab) into the clipboard. Image can be pasted in any image editor.

Export Values

Export values (raw data) of signals (as visible on the graph on the Signals tab) into CSV or TXT format. Format of the file can be set in settings window under export section. For details about setting the parameters refer to Settings Section.

PLATE ORIENTATION

Change orientation

Plate orientation is changed for 180°.

Switch axes

Switches the X and Y axes without moving the force platform.

MEASUREMENT PANEL

New Measurement

Starts with a new measurement.

**Start**

Starts the measurement.

Stop

Stops the measurement.

Save

Saves the measurement.

Cancel

Cancel the last measurement.

Offset

Makes zero offset. Note that the force platform must be unloaded during the process.

Analyse

Performs the analysis.

Collapse

Collapses the graph and the side panels are shown.

Expand

Expands the graph and the side panels are hidden.

Time left [s]

Time left to the end of measurement.

Exit

Closes the measurement module.

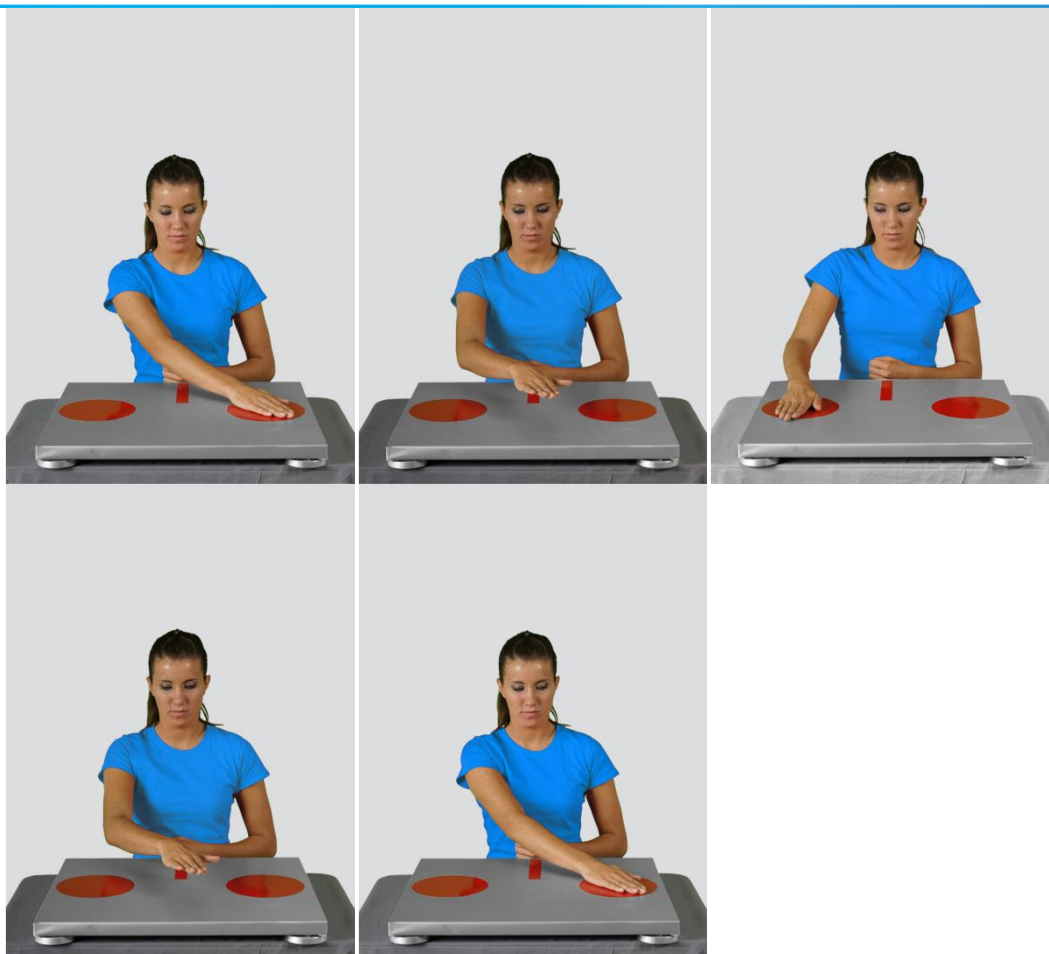
SELECTING INPUT PARAMETERS:

Before the measurement can start, the user has to choose some input parameters with which the measured motor task (tapping) is specifically defined. These parameters are important for further analysis, comparisons and reporting. The tapping characteristics are defined by the following parameters:

TYPE OF TAPPING:

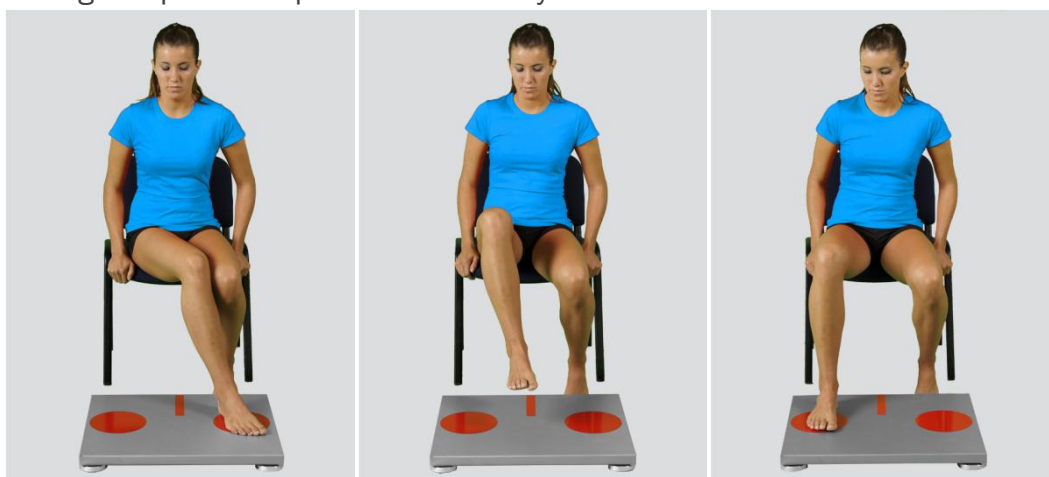
Arms

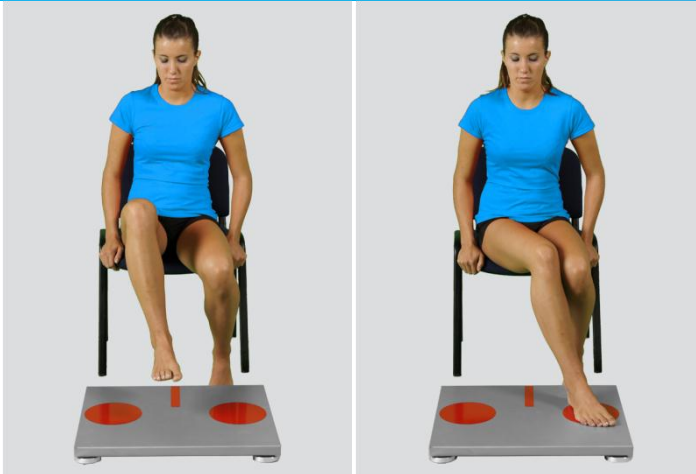
The subject performs the tapping task so that he/she is alternatively touching the left and the right marked area on the force plate with the same hand. The subject performs this cyclic arm movement with the highest possible speed and accuracy.



Legs

The subject performs the tapping task so that he/she is alternatively touching the left and the right marked area on the force plate with the same foot. The subject performs this cyclic leg movement with the highest possible speed and accuracy.





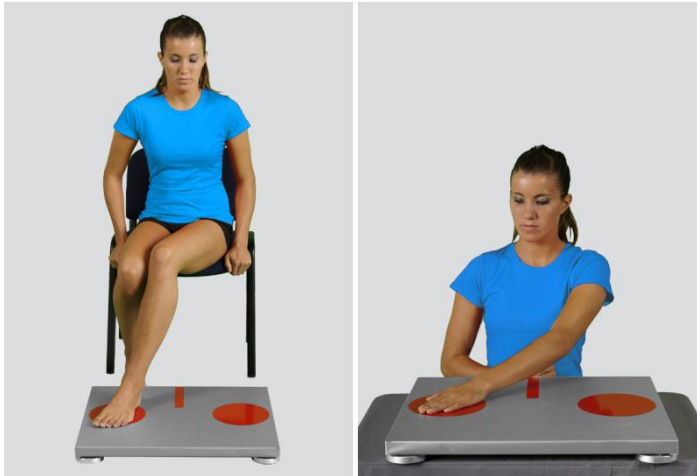
Other user defined

In the Settings panel of the main window of the software the user can define any other type of tapping (see Settings Section for details). After doing so, the newly defined input parameter will from then on appear as an optional choice under the Type of Tapping in the Tapping measurement module.

SIDE:

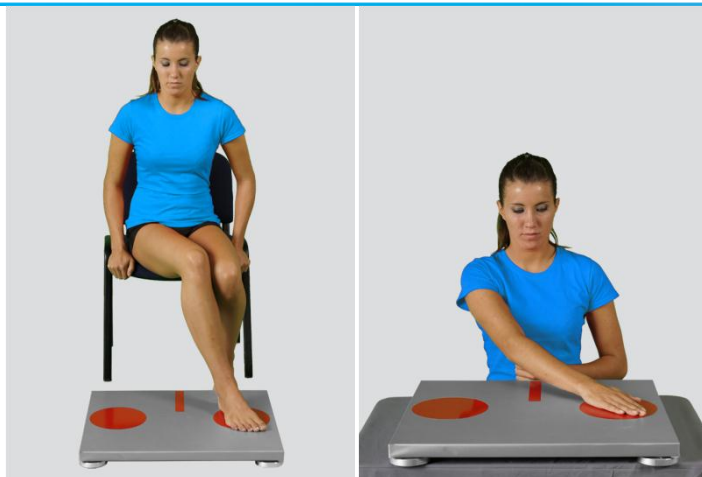
Left

The subject performs the tapping test with his/her left leg/hand.



Right

The subject performs the tapping test with his/her right leg/hand.



DURATION:

10/20/30/40/50/60/70/80/90/100 s

The user selects the duration of the Tapping test – either from the pre-set values or he/she can define other values (see Section Settings for details). After doing so, the newly defined duration of the quiet stance task will from then on appear as an optional choice under the Duration in the Tapping measurement module. The default duration is 30 s.

MEASUREMENT:

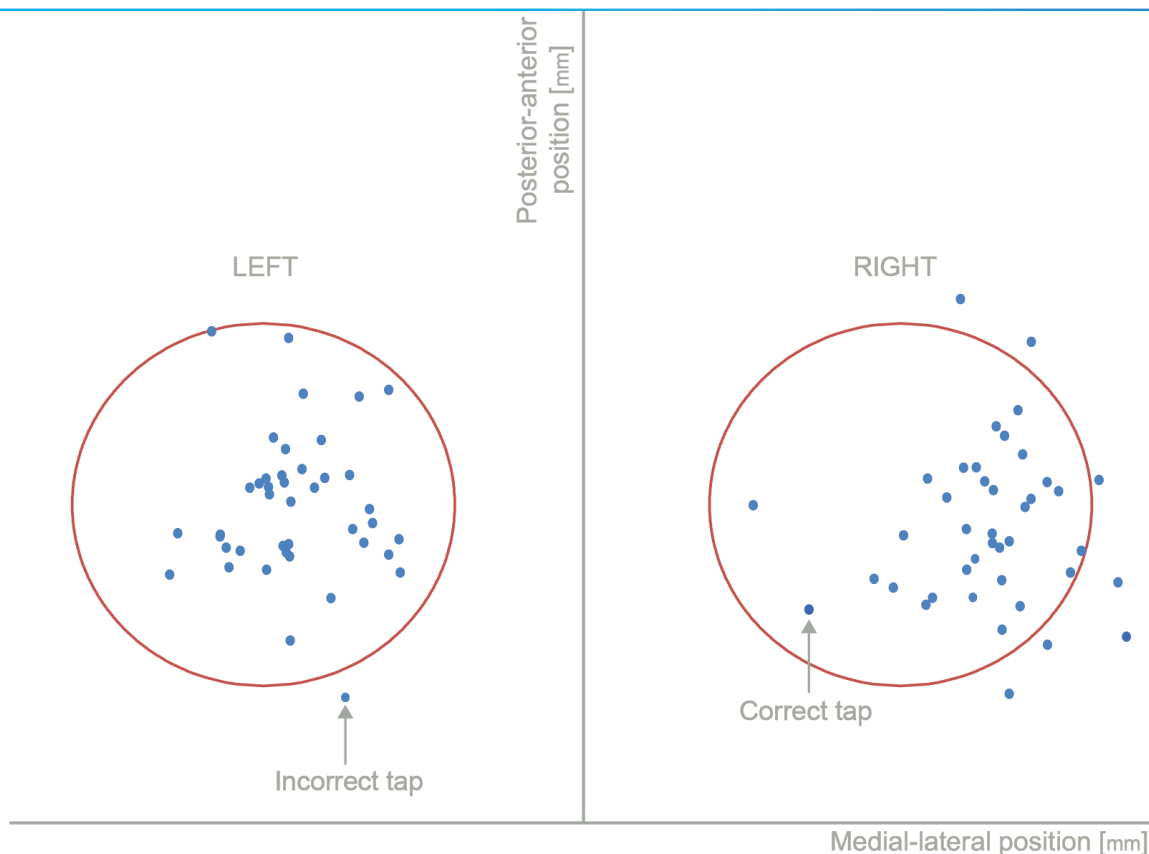
After selecting the input parameters, the subject acquires the initial position for the test – sitting in front of the force plate. After that, you give the verbal start signal to the subject to begin with the stamping task. Right after the subject begins with the task, click Start. After this, the software begins with the signal acquisition and the time left until the end of the test is displayed in the top-left corner of the screen. For details about this automatic acquisition please see Settings Section.

If you want to start a new measurement, click the New Measurement button and repeat the procedure. Before doing so, you can change the Input Parameters; if not, the Input Parameters of the previous measurements will be used. If you want to repeat a certain measurement, click on the drop down menu, select the repetition you want to replace and check the box Repeat. Then click Start and a pop-up window will ask you if you really want to repeat the measurement. Click OK if you want to repeat.

ANALYSIS:

Analysis enables you to check the signals of the ground reaction force (GRF) and the calculated parameters. Under the Signal tab you can see the signal of the vertical component of the ground reaction force – if chosen also the other two components. The precision of the taps can be seen from the COP graph in the COP tab. Under the Results tab you can see all calculated parameters. If you would like to export the calculated parameters use Export function in Result Table panel.

The number of taps performed in a given time interval is the measure of success. Additionally the COP plots give information on the accuracy and dispersion of the contact points.



CALCULATED PARAMETERS:

PARAMETERS OF SPEED

Number of all taps – total

The total number of the taps on the left and the right side of the force plate (their sum), regardless of their precision (i.e. no matter if the taps are inside or outside the target tap area).

Number of correct taps – total

The total number of those taps on the left and the right side of the force plate (their sum) that were performed inside the target tap area.

Number of incorrect taps – total

The total number of those taps on the left and the right side of the force plate (their sum) that were performed outside the target tap area.

Number of all taps – left

The total number of the taps on the left side of the force plate, regardless of their precision (i.e. no matter if the taps are inside or outside the target tap area).

Number of correct taps – left

The total number of those taps on the left side of the force plate that were performed inside the target tap area.



Number of incorrect taps – left

The total number of those taps on the left side of the force plate that were performed outside the target tap area.

Number of all taps – right

The total number of the taps on the right side of the force plate, regardless of their precision (i.e. no matter if the taps are inside or outside the target tap area).

Number of correct taps – right

The total number of those taps on the right side of the force plate that were performed inside the target tap area.

Number of incorrect taps – right

The total number of those taps on the right side of the force plate that were performed outside the target tap area.

Mean FRE from all paired taps [Hz]

The frequency of tapping calculated as the number of all (i.e. no matter if the taps are inside or outside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) divided by the measurement time.

Mean FRE from correct paired taps [Hz]

The frequency of tapping calculated as the number of correct (i.e. the taps performed inside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) divided by the measurement time.

Mean FRE from all paired taps – 1st interval [Hz]

The frequency of tapping calculated as the number of all (i.e. no matter if the taps are inside or outside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) in the initial time interval (i.e. start + the interval duration) divided by the duration of the initial time interval. The default duration of this interval is 3 s, but it can be changed in the Settings panel.

Mean FRE from all paired taps – 2nd interval [Hz]

The frequency of tapping calculated as the number of all (i.e. no matter if the taps are inside or outside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) in the middle time interval (i.e. mid-time $\pm \frac{1}{2}$ of the interval duration) divided by the duration of the middle time interval. The default duration of this interval is 3 s, but it can be changed in the Settings panel.

Mean FRE from all paired taps – 3rd interval [Hz]

The frequency of tapping calculated as the number of all (i.e. no matter if the taps are inside or outside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) in the final time interval (i.e. end - the interval duration) divided by the duration of the final time interval. The default duration of this interval is 3 s, but it can be changed in the Settings panel.

FRE endurance index – all paired taps [%]

The mean frequency of tapping in the middle (2nd) time interval divided by the mean frequency of tapping in the initial (1st) time interval. The mean frequencies are calculated as the number of all (i.e. no matter if the taps are inside or outside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) in the time interval divided by the duration of the time interval. The default duration of the time intervals is 3 s, but it can be changed in the Settings panel.



FRE fatigue index – all paired taps [%]

The mean frequency of tapping in the final (3rd) time interval divided by the mean frequency of tapping in the initial (1st) time interval. The mean frequencies are calculated as the number of all (i.e. no matter if the taps are inside or outside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) in the time interval divided by the duration of the time interval. The default duration of the time intervals is 3 s, but it can be changed in the Settings panel.

Mean FRE from correct paired taps – 1st interval [Hz]

The frequency of tapping calculated as the number of correct (i.e. the taps performed inside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) in the initial time interval (i.e. start + the interval duration) divided by the duration of the initial time interval. The default duration of this interval is 3 s, but it can be changed in the Settings panel.

Mean FRE from correct paired taps – 2nd interval [Hz]

The frequency of tapping calculated as the number of correct (i.e. the taps performed inside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) in the middle time interval (i.e. mid-time \pm $\frac{1}{2}$ of the interval duration) divided by the duration of the middle time interval. The default duration of this interval is 3 s, but it can be changed in the Settings panel.

Mean FRE from correct paired taps – 3rd interval [Hz]

The frequency of tapping calculated as the number of correct (i.e. the taps performed inside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) in the final time interval (i.e. end - the interval duration) divided by the duration of the final time interval. The default duration of this interval is 3 s, but it can be changed in the Settings panel.

FRE endurance index – correct paired taps [%]

The mean frequency of tapping in the middle (2nd) time interval divided by the mean frequency of tapping in the initial (1st) time interval. The mean frequencies are calculated as the number of the correct (i.e. the taps performed inside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) in the time interval divided by the duration of the time interval. The default duration of the time intervals is 3 s, but it can be changed in the Settings panel.

FRE fatigue index – correct paired taps [%]

The mean frequency of tapping in the final (3rd) time interval divided by the mean frequency of tapping in the initial (1st) time interval. The mean frequencies are calculated as the number of the correct (i.e. the taps performed inside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) in the time interval divided by the duration of the time interval. The default duration of the time intervals is 3 s, but it can be changed in the Settings panel.

Minimum FRE – all paired taps [Hz]

The frequency of tapping is calculated on the tap-to-tap basis for all (i.e. no matter if the taps are inside or outside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) based on the inter-tap time intervals. The minimum among the values is taken.

Maximum FRE – all paired taps [Hz]

The frequency of tapping is calculated on the tap-to-tap basis for all (i.e. no matter if the taps are inside or outside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa) based on the inter-tap time intervals. The maximum among the values is taken.

Min/Max ratio – FRE from all paired taps [%]

The ratio between the minimum frequency and maximum frequency defined from the analysis of all (i.e. no matter if the taps are inside or outside the target tap area) paired taps (left-side tap followed by the right-side tap or vice versa).

PARAMETERS OF ACCURACY AND DISPERSION

Dispersion of taps – total [mm]

Standard deviation of the taps` distances from the central point of taps on the same side of the force plate calculated for the left and the right side together. The central point of all taps is calculated as the average COP position of all taps on the same side of the force plate.

Dispersion of taps – left [mm]

Standard deviation of the taps` distances from the central point of taps on the same side of the force plate calculated only for the left side. The central point of all taps is calculated as the average COP position of all taps on the left side of the force plate.

Dispersion of taps – right [mm]

Standard deviation of the taps` distances from the central point of taps on the same side of the force plate calculated only for the right side. The central point of all taps is calculated as the average COP position of all taps on the right side of the force plate.

Dispersion of taps – 1st interval [mm]

Standard deviation of the taps` distances from the central point of taps on the same side of the force plate calculated the initial time interval (i.e. start + the interval duration). The default duration of this interval is 3 s, but it can be changed in the Settings panel.

Dispersion of taps – 2nd interval [mm]

Standard deviation of the taps` distances from the central point of taps on the same side of the force plate calculated the middle time interval (i.e. mid-time $\pm \frac{1}{2}$ of the interval duration). The default duration of this interval is 3 s, but it can be changed in the Settings panel.

Dispersion of taps – 3rd interval [mm]

Standard deviation of the taps` distances from the central point of taps on the same side of the force plate calculated the final time interval (i.e. end - the interval duration). The default duration of this interval is 3 s, but it can be changed in the Settings panel.

Dispersion endurance index – all taps [%]

Standard deviation of tapping positions in the middle (2nd) time interval divided by the standard deviation of tapping positions in the initial (1st) time interval. The default duration of this interval is 3 s, but it can be changed in the Settings panel.

Dispersion fatigue index – all taps [%]

Standard deviation of tapping positions in the final (3rd) time interval divided by the standard deviation of tapping positions in the initial (1st) time interval. The default duration of this interval is 3 s, but it can be changed in the Settings panel.

Accuracy of taps – total [mm]

The average distance of taps from the central point of the target area. The parameter is calculated for the taps on both sides of the force plate together.



Accuracy of taps – left [mm]

The average distance of taps from the central point of the target area. The parameter is calculated only for the taps on the left side of the force plate.

Accuracy of taps – right [mm]

The average distance of taps from the central point of the target area. The parameter is calculated only for the taps on the right side of the force plate.

Accuracy of taps – 1st interval [mm]

The average distance of taps from the central point of the target areas in the initial time interval (i.e. start + the interval duration). The default duration of this interval is 3 s, but it can be changed in the Settings panel.

Accuracy of taps – 2nd interval [mm]

The average distance of taps from the central point of the target areas in the middle time interval (i.e. mid-time $\pm \frac{1}{2}$ of the interval duration). The default duration of this interval is 3 s, but it can be changed in the Settings panel.

Accuracy of taps – 3rd interval [mm]

The average distance of taps from the central point of the target areas in the final time interval (i.e. end - the interval duration). The default duration of this interval is 3 s, but it can be changed in the Settings panel.

Accuracy endurance index – all taps [%]

The average distance of taps from the central point of the target in the middle (2nd) time interval divided by the average distance of taps from the central point of the target in the initial (1st) time interval. The default duration of this interval is 3 s, but it can be changed in the Settings panel.

Accuracy fatigue index – all taps [%]

The average distance of taps from the central point of the target in the final (3rd) time interval divided by the average distance of taps from the central point of the target in the initial (1st) time interval. The default duration of this interval is 3 s, but it can be changed in the Settings panel.