

METHOD AND SYSTEM FOR ANALYZING TRANSITIONS BETWEEN PSYCHO-PHYSIOLOGICAL STATES OF INDIVIDUALS

This patent application claims a priority from a Chinese patent application No. 201510045365.0, filed on January 29, 2015, and named “method and system for analyzing transitions between psycho-physiological states of individuals”, the content of which is incorporated by reference herein in its entirety.

Field of Invention

This invention is related to biomedical engineering, and more specifically to a method and system for analyzing transitions between psycho-physiological states of individuals.

Background

When human body is subjected to external stimuli or internal mood swings, the activity in the sympathetic nervous system changes. This leads to sympathetic sweat gland activity changes, resulting in skin resistance changes. In general, the greater external stimuli or internal mood swings, the more active sympathetic nervous, the greater increased secretion of sweat glands; therefore, skin conductivity enhances and skin resistance decreases. On the contrary, in a calmness state, sympathetic nervous system is inhibited and sweat activity is weakened; therefore, skin conductivity decreases and skin resistance increases. Applying this principle, by analyzing changes in human skin resistance, transition between human psycho-physiological states can be evaluated.

Based on this principle, the Chinese patent CN201410128494.1, method and system for analyzing human emotional state based on human skin resistance measurement, discloses a method and system to analyze human emotional state, using changes in resistance value, slope, and state duration to reflect emotion. Numbers are used to

quantify excitement levels. The method is mainly used for test subjects in normal life and work state, to precisely quantify the excitement level. However, this method can not detect whether the transition from normal life and work state to other psycho-physiological states of test subjects happens or not.

While in some cases, we need to evaluate transitions between psycho-physiological states of test subjects. Psycho-physiological states include normal life and working state, micro-sleep state, and sleep state. The so-called micro-sleep state refers that, when human become tired, parts of brain cells temporarily fall into a episode of sleep. Research scientists think this phenomenon can explain that, when human become tired, there always is short circuit or unconscious of the brain. From a more scientific explanation for micro-sleep, during a fraction of 3 to 14 seconds, brain wave activity in 4-7Hz overthrows brain wave activity in 8-13Hz. MRI analysis showed that, in micro-sleep state, activities in thalamus, midbrain, and the posterior cingulate cortex areas decrease, while activities in frontal, posterior parietal cortex and parahippocampal areas increase. Transitions between psycho-physiological states can also lead to change in skin resistance. Compared to the skin resistance change in normal life and work state, the skin resistance change in micro-sleep state and sleep state has its specificity. Meanwhile, higher accuracy is required in micro-sleep state or sleep state evaluation application, for example, micro-sleep state evaluation for vehicle drivers. No prior art has been found to precisely evaluate transitions between psycho-physiological states of test subjects by analyzing the specificity of skin resistance change in different psycho-physiological states.

Summary of the Invention

To overcome the deficiencies of the prior art, the present invention provides a method and system for evaluating transitions between psycho-physiological states of individuals and to evaluate psycho-physiological status more precisely.

Based on the first aspect of the present invention, the present invention provides a method for evaluating transitions between psycho-physiological states of individuals. The method comprises: parameter initialization, the human skin resistance data collection, data analysis, and the evaluation output of psycho-physiological state transition, wherein the human skin resistance data analysis comprises:

pre-processing skin resistance data collected from test subject;

inputting the data in a logarithmic process to get the current logarithmic value of skin resistance;

averaging the logarithmic value of skin resistance in the previous window right before the current value to obtain the average logarithmic value of skin resistance in the previous window, $MeanSum(i)$ wherein window size is $WinLength$;

obtaining the difference in logarithmic values, $Diff(i)$, that is, the difference of the current logarithmic value of skin resistance, $\ln(data(i))$, and the average logarithmic value of skin resistance in the previous window, $MeanSum(i)$;

obtaining the absolute value of $Diff(i)$ to get $AbsDiff(i)$;

inputting $AbsDiff(i)$ into a convergence function to get the convergence value, $MeanDiff$;

evaluating transition between psycho-physiological states based on $MeanDiff$.

Furthermore, the said convergence function is

$$MeanDiff = \alpha \times MeanDiff + (1 - \alpha) \times AbsDiff(i)$$

wherein α is the convergence parameter with $0 < \alpha < 1$.

This function is the convergence function which only deals with the current value of $MeanDiff$. Thus, no historical value is stored during iteration. $0 < \alpha < 1$ is the convergence parameter. Its value determines the convergence speed where convergence speed is higher if α is closer to 1.

Furthermore, the said evaluation criteria based on $MeanDiff$ to determine transition between psycho-physiological states are

if $MeanDiff > MeanDiff_{microsleep}$, the test subject enters the normal life and work state;

if $MeanDiff_{microsleep} \geq MeanDiff > MeanDiff_{sleep}$, the test subject enters the micro-sleep state;

if $MeanDiff \leq MeanDiff_{sleep}$, the test subject enters the sleep state;

wherein $MeanDiff_{microsleep}$ is the threshold to evaluate the transition from the normal life and work state to the micro-sleep state and $MeanDiff_{sleep}$ is the threshold to evaluate the transition from the micro-sleep state to the sleep state.

Furthermore, $MeanDiff_{microsleep}$ and $MeanDiff_{sleep}$ are set to different values according to different physical body conditions of individuals; assessment of different physical body conditions is based on two parameters below,

$$mSlope_{up} = \max \left\{ slope = \left(data(i + StepSize - 1) - data(i) \right) / StepSize \mid i = 1, 2, \dots \right\}$$

$$mSlope_{down} = \max \left\{ slope = \left(data(i) - data(i + StepSize - 1) \right) / StepSize \mid i = 1, 2, \dots \right\}$$

wherein $slope$ is the average changing rate of skin resistance which is calculated according to values of the two ends of the resistance data curve within a window and the window size, $data(i)$ is the skin resistance at time point i , $data(i + StepSize - 1)$ is the skin resistance at time point $i + StepSize - 1$, $StepSize$ is the window size;

$mSlope_{up}$ is the maximum value among forward slopes of all i time points; the forward slope refers that the slope is calculated by using the last skin resistance value, $data(i + StepSize - 1)$, minus the first skin resistance value, $data(i)$, within the window.

$mSlope_{down}$ is the maximum value among backward slopes of all i time points; the

backward slope refers that the slope is calculated by using the first skin resistance value, $data(i)$, minus the last skin resistance value, $data(i + StepSize - 1)$, within the window, if $mSlope_{up} > \delta$ AND $mSlope_{down} > \delta$, the test subject has relatively sensitive body; if $mSlope_{up} < \delta$ OR $mSlope_{down} < \delta$, the test subject has insensitive body, wherein δ is the assessment threshold whose value is related to the window size, $StepSize$.

Furthermore, the said parameter initialization comprises:

setting $WinLength$ to 100, skin resistance sampling rate to 50Hz, the initial value of $MeanDiff$ to 0.03, α to 0.999;

setting window size $StepSize$ to 10, δ to 15;

setting $MeanDiff_{microsleep}$ and $MeanDiff_{sleep}$ to 0.0006 and 0.0002, respectively, for individual with relatively sensitive body, and $MeanDiff_{microsleep}$ and $MeanDiff_{sleep}$ to 0.001 and 0.0005, respectively, for individual with insensitive body.

Furthermore, the said evaluation result of the psycho-physiological states is reported to users through sound, light, vibration, or smell.

Furthermore, the said collected human skin resistance data is obtained from the collected skin conductance data where the resistance data is calculated as the reciprocal of the conductance data.

Based on the second aspect of the present invention, the present invention provides a system to evaluate transitions between psycho-physiological states of individuals, wherein the system contains medical sensor heads, a bridge circuit for measuring human skin resistance/conductance, an amplifier circuit, a A/D converter circuit, a CPU, and a human machine interactive interface, wherein

the said bridge circuit for measuring human skin resistance/conductance is

configured to measure human skin resistance/conductance data;

the said CPU is configured to execute any method according to any one of above methods to evaluate transitions between psycho-physiological states of individuals;

the said human machine interactive interface is configured to report the evaluation result to the user.

Furthermore, the said CPU is micro computing unit, mobile communication devices, mobile computing devices, or desktop computer equipment.

Furthermore, the said human machine interactive interface includes voice module, display module, vibration module, or smell generation module.

In the method of the present invention, two windows are used, with window sizes of *WinLength* and *StepSize*. *WinLength* is used in the comparison of the current resistance value and the previous resistance values. *StepSize* is used in the assessment of different physical body conditions.

The present invention is based on the special feature in different psycho-physiological states and uses human skin resistance changes to evaluate transitions between psycho-physiological states of individuals, including the transition from the normal life and work state to the micro-sleep state, the transition from the micro-sleep state to the sleep state, or the transition from the micro-sleep state or the sleep state to the normal life and work state. There is a high practice value to evaluate the transition between psycho-physiological states. Take the transition from the normal life and work state to the micro-sleep state as example. To evaluate the transition between psycho-physiological states can be used to prevent accidents in the repeatable jobs with high intensity and high risk, such as, car drivers and heavy machinery operators. To evaluate the transition between psycho-physiological states can also be used to evaluate the degree of attention of students and audiences, so as to adjust teaching methods and

to keep them focused.

The invention applies an adaptive algorithm, which sets different analysis parameters to different users depending on their physical conditions, in order to overcome the individual difference problem and to evaluate psycho-physiological status more precisely.

Brief Description of the Drawings

Figure 1 shows transitions between psycho-physiological states of individuals.

Figure 2 shows flowchart of data analysis of the invention.

Figure 3 shows window partition of the invention.

Figure 4 shows data analysis of the invention, (a) the skin resistance data in one experiment, (b) the logarithmic data in one experiment, (c) the absolute value of the difference in logarithmic data in one experiment.

Figure 5 shows the systematic framework of the invention.

Figure 6 shows the *MeanDiff* data change in one experiment.

Figure 7 shows the micro-sleep state evaluation in one experiment.

Figure 8 shows the sleep state evaluation in one experiment.

Detailed Description of the Invention

The present invention is further explained in details with drawings and examples.

Example 1

Figure 1 shows the transitions between psycho-physiological states of the present invention, including the transition from the normal life and work state to the micro-sleep state, the transition from the micro-sleep state to the sleep state, and the transition from the micro-sleep state or the sleep state to the normal life and work state.

The method for evaluating transitions between psycho-physiological states of individuals in the present invention comprises steps of: parameter initialization, the human skin resistance data collection, human skin resistance data analysis, and the output of psycho-physiological state transition evaluation.

Figure 2 is the flowchart of human skin resistance data analysis in the present invention, including pre-processing, logarithmic operation, window processing, difference in logarithmic values, convergence value calculation, and psycho-physiological states transitions analysis. In the experiment, firstly read the skin resistance data from test subjects and pre-processing the data. Then, input the data into a logarithmic operation to get the current logarithmic value of skin resistance. The window processing produces the average logarithmic value of skin resistance in the window. The difference in logarithmic values is the difference of the current logarithmic value of skin resistance and the average logarithmic value of skin resistance in the previous window. Input the difference in logarithmic values into a convergence function to obtain the convergence value after a period of time. The convergence value is the evaluation criteria of psycho-physiological states transition. Below is detailed explanation of each step.

1. Pre-Processing

Due to the prescribed measurement range of the skin resistance data collection device, the collected value may go beyond the range of measurement. Or due to the poor contact, there would be resistance data which is considered as disconnection by default. Thus, need to pre-process the collected data. Replace the short term resistance data which is considered as disconnection with the previous resistance data. Next, at the moment when the finger just touches the data collection device, there would be unstable burr signal. The burr signal will also be filtered out in pre-process. Figure 4 (a) shows the skin resistance data from one experiment.

2. Logarithmic Operation

To better indicate the intensity of changes in the skin resistance, the natural logarithm value of the skin resistance data after pre-processing is calculated. $data(i)$ is the current skin resistance data after pre-processing and $\ln(data(i))$ is the natural logarithm value. Figure 4 (b) shows the logarithmic data in one experiment.

3. Window Processing

To analyze the resistance is to evaluate the state transition of test subjects. If single data value is used in analysis, the change of the instant data will be considered as psycho-physiological states transition. Thus, the noise in the data has a big impact on the analysis results. In the next step to calculate the difference, if there is a strong noise in the previous resistance data, the difference value will contain errors. As a result, a certain window is chosen to average and to reduce data fluctuation for easier analysis. Figure 3 is the schematic diagram of window partition.

Apply the logarithmic operation for all resistance data in the window with window size, $WinLength$, the logarithmic values are respectively $\ln(data(i - WinLength))$, $\ln(data(i - WinLength + 1))$,, $\ln(data(i - 1))$, $\ln(data(i))$. Take the average of all logarithmic data in the previous window right before the current data. The mean value of the logarithmic data in the previous window right before the current data, $MeanSum(i)$, is calculated as

$$MeanSum(i) = \left(\ln(data(i - WinLength)) + \ln(data(i - WinLength + 1)) + \dots + \ln(data(i - 1)) \right) / WinLength$$

(Equation 1)

The said window size, $WinLength$, is set to 100. The skin resistance data sampling rate is set to 50Hz, that is, one window contains data within two seconds.

4. Difference in Logarithmic Values

The reason to perform logarithmic operation is that, by calculating the difference in the two logarithmic data, the difference value actually reflects the difference in the ratio of the two skin resistance values. The difference between the current logarithmic value of skin resistance and the mean value of the logarithmic data in the previous window, $Diff(i)$, is calculated as

$$Diff(i) = \ln(data(i)) - MeanSum(i) \quad (\text{Equation 2})$$

The absolute value of the difference in logarithmic values, $AbsDiff(i)$, is calculated as

$$AbsDiff(i) = abs(Diff(i)) \quad (\text{Equation 3})$$

Figure 4 (c) shows the difference in logarithmic data in one experiment.

5. Convergence Value Calculation

Define a parameter, $MeanDiff$, and the convergence function as following.

$$MeanDiff = \alpha \times MeanDiff + (1 - \alpha) \times AbsDiff(i) \quad (\text{Equation 4})$$

With the convergence function, $MeanDiff$ reflects the cumulative change of the absolute value of the difference in logarithmic values, $AbsDiff$. The initial value of the said $MeanDiff$ is set to 0.03. α is set to 0.999.

6. Psycho-Physiological States Transitions Analysis

Under the normal life and work state, any small change in mood can lead to change in the difference between the current logarithmic value of skin resistance and the mean value of the logarithmic data in the previous window, that is, the absolute value of the difference in logarithmic values $AbsDiff$ value is large. Thus, $MeanDiff$ of the convergence function cannot converge to a small value. Under the micro-sleep state, the human nervous system is relatively suppressed and skin sweat glands become steady in short-term. This reduces the absolute value of the difference in logarithmic

values *AbsDiff* value and therefore *MeanDiff* of the convergence function can converge to a small value. Passing the micro-sleep state, under the sleep state, the absolute value of the difference in logarithmic values *AbsDiff* value becomes even smaller and reaches to near-zero value. *MeanDiff* of the convergence function can converge to a much smaller value. From the micro-sleep state or the sleep state back to the normal life and work state, the nervous system returns to excitement instantly and sweat gland secretion increases. The absolute value of the difference in logarithmic values *AbsDiff* value increases instantly and *MeanDiff* of the convergence function increases instantly.

Meanwhile, different test subjects have different physical conditions. Some have relatively sensitive nervous system and sweat glands system and it is easier for them to reach excitement state. While, some have relatively insensitive body and it is more difficult for them to reach excitement state. To overcome this individual difference problem, set different analytic parameters in state transition evaluation for individual with different body conditions. To assess different body conditions, use window processing again with window size, *StepSize*, and analyze the data in the window to assess body conditions. Through shifting window, two parameters are calculated as following.

$$mSlope_{up} = \max \{ slope = (data(i + StepSize - 1) - data(i)) / StepSize \mid i = 1, 2, \dots \}$$

(Equation 5)

$$mSlope_{down} = \max \{ slope = (data(i) - data(i + StepSize - 1)) / StepSize \mid i = 1, 2, \dots \}$$

(Equation 6)

The rule to determine the different body conditions is defined as follows.

Physical Body Condition	Evaluation Criteria
Relatively Sensitive Body	$mSlope_{up} > \delta$ AND $mSlope_{down} > \delta$
Insensitive Body	$mSlope_{up} < \delta$ OR $mSlope_{down} < \delta$

The window size, *StepSize*, is set to 10 and δ is set to 15.

By setting different thresholds of $MeanDiff$ for different physical body conditions, the method can evaluate the transition between psycho-physiological states. For individual with relatively sensitive body condition, threshold $MeanDiff_{sen,microsleep}$ will be used to evaluate the transition from normal life and work state to micro-sleep state. Threshold $MeanDiff_{sen,sleep}$ will be used to evaluate the transition from micro-sleep state to sleep state. For individual with insensitive body condition, threshold $MeanDiff_{insen,microsleep}$ will be used to evaluate the transition from normal life and work state to micro-sleep state. Threshold $MeanDiff_{insen,sleep}$ will be used to evaluate the transition from micro-sleep state to sleep state. The rule to evaluate the transition between psycho-physiological states is defined as follows.

Physical Body Condition	Psycho-Physiological State	Evaluation Criteria
Relatively Sensitive Body	Normal life and work state	$MeanDiff > MeanDiff_{sen,microsleep}$
Relatively Sensitive Body	Micro-sleep state	$MeanDiff_{sen,microsleep} \geq MeanDiff > MeanDiff_{sen,sleep}$
Relatively Sensitive Body	Sleep state	$MeanDiff \leq MeanDiff_{sen,sleep}$
Insensitive Body	Normal life and work state	$MeanDiff > MeanDiff_{insen,microsleep}$
Insensitive Body	Micro-sleep state	$MeanDiff_{insen,microsleep} \geq MeanDiff > MeanDiff_{insen,sleep}$
Insensitive Body	Sleep state	$MeanDiff \leq MeanDiff_{insen,sleep}$

$MeanDiff_{sen,microsleep}$ is set to 0.0006. $MeanDiff_{sen,sleep}$ is set to 0.0002.

$MeanDiff_{insen,microsleep}$ is set to 0.001. $MeanDiff_{insen,sleep}$ is set to 0.0005.

Because the conductance is the reciprocal of the resistance, the analysis method in this invention is also applicable to evaluate the transition between psycho-physiological states based on change in skin conductance.

The present invention provides a system to evaluate transitions between psycho-physiological states of individuals, wherein the system contains medical sensor heads, a bridge circuit for measuring human skin resistance/conductance, an amplifier circuit, a A/D converter circuit, a CPU, and a human machine interactive interface.

Figure 5 is the systematic framework of the invention, including medical sensor heads, the bridge circuit for measuring resistance/conductance, amplifier circuit, A/D converter circuit, control unit, and human machine interactive interface. Medical sensor heads and the bridge circuit for measuring resistance/conductance collect the human skin resistance/conductance. Then, evaluate transitions between psycho-physiological states based on change in human skin resistance/conductance and realize the analysis method of this invention. The said control unit could be any devices with data processing capabilities, such as, micro computing unit, mobile communication devices, mobile computing devices, desktop computer equipment, etc.

Example 2

Figure 6 shows the *MeanDiff* data in one experiment. According to the rule to assess different body conditions, the test subject has relatively sensitive body. Thus, thresholds, $MeanDiff_{sen,microsleep}$ and $MeanDiff_{sen,sleep}$, are used to evaluate the transition between psycho-physiological states.

Evaluating the situation that *MeanDiff* value becomes less than or equal to $MeanDiff_{sen,microsleep}$, the transition from the normal life and work state to the micro-sleep state happens. Figure 7 shows the micro-sleep state evaluation in one experiment. In the figure, the x-axis represents time. For the y-axis, 1 represents the

state when $MeanDiff$ value is less than or equal to $MeanDiff_{sen,microsleep}=0.0006$, that is, the micro-sleep state or the sleep state. For the y-axis, 0 represents the state when $MeanDiff$ value is more than $MeanDiff_{sen,microsleep}=0.0006$, that is, the normal life and work state.

Evaluating the situation that $MeanDiff$ value becomes less than or equal to $MeanDiff_{sen,sleep}$, the transition from the micro-sleep state to the sleep state happens. Figure 8 shows the sleep state evaluation in one experiment. In the figure, the x-axis represents time. For the y-axis, 1 represents the state when $MeanDiff$ value is less than or equal to $MeanDiff_{sen,sleep}=0.0002$, that is, the sleep state. For the y-axis, 0 represents the state when $MeanDiff$ value is more than $MeanDiff_{sen,sleep}=0.0002$, that is, the micro-sleep state or the normal life and work state.

Claims

1. A method for evaluating transitions between psycho-physiological states of individuals, characterized in that, the method comprises: parameter initialization, the human skin resistance data collection, data analysis, and the evaluation output of psycho-physiological state transition, wherein the human skin resistance data analysis comprises:

pre-processing skin resistance data collected from test subject;

inputting the data in a logarithmic process to get the current logarithmic value of skin resistance;

averaging the logarithmic value of skin resistance in the previous window right before the current value to obtain the average logarithmic value of skin resistance in the previous window, $MeanSum(i)$ wherein window size is $WinLength$;

obtaining the difference in logarithmic values, $Diff(i)$, that is, the difference of the current logarithmic value of skin resistance, $\ln(data(i))$, and the average logarithmic value of skin resistance in the previous window, $MeanSum(i)$;

obtaining the absolute value of $Diff(i)$ to get $AbsDiff(i)$;

inputting $AbsDiff(i)$ into a convergence function to get the convergence value, $MeanDiff$;

evaluating transition between psycho-physiological states based on $MeanDiff$.

2. The method for evaluating transitions between psycho-physiological states of individuals according to **claim 1**, characterized in that, the said convergence function is

$$MeanDiff = \alpha \times MeanDiff + (1 - \alpha) \times AbsDiff(i)$$

wherein α is the convergence parameter with $0 < \alpha < 1$.

3. The method for evaluating transitions between psycho-physiological states of individuals according to **claim 2**, characterized in that, the said evaluation criteria

based on $MeanDiff$ to determine transition between psycho-physiological states are

if $MeanDiff > MeanDiff_{microsleep}$, the test subject enters the normal life and work state;

if $MeanDiff_{microsleep} \geq MeanDiff > MeanDiff_{sleep}$, the test subject enters the micro-sleep state;

if $MeanDiff \leq MeanDiff_{sleep}$, the test subject enters the sleep state;

wherein $MeanDiff_{microsleep}$ is the threshold to evaluate the transition from the normal life and work state to the micro-sleep state and $MeanDiff_{sleep}$ is the threshold to evaluate the transition from the micro-sleep state to the sleep state.

4. The method for evaluating transitions between psycho-physiological states of individuals according to **claim 3**, characterized in that, $MeanDiff_{microsleep}$ and $MeanDiff_{sleep}$ are set to different values according to different physical body conditions of individuals; assessment of different physical body conditions is based on two parameters below,

$$mSlope_{up} = \max \{ slope = (data(i + StepSize - 1) - data(i)) / StepSize \mid i = 1, 2, \dots \}$$

$$mSlope_{down} = \max \{ slope = (data(i) - data(i + StepSize - 1)) / StepSize \mid i = 1, 2, \dots \}$$

wherein $slope$ is the average changing rate of skin resistance which is calculated according to values of the two ends of the resistance data curve within a window and the window size, $data(i)$ is the skin resistance at time point i , $data(i + StepSize - 1)$ is the skin resistance at time point $i + StepSize - 1$, $StepSize$ is the window size;

$mSlope_{up}$ is the maximum value among forward slopes of all i time points; the so-called forward slope refers that the slope is calculated by using the last skin resistance value, $data(i + StepSize - 1)$, minus the first skin resistance value, $data(i)$, within the window.

$mSlope_{down}$ is the maximum value among backward slopes of all i time points; the so-called backward slope refers that the slope is calculated by using the first skin

resistance value, $data(i)$, minus the last skin resistance value, $data(i + StepSize - 1)$, within the window,

if $mSlope_{up} > \delta$ AND $mSlope_{down} > \delta$, the test subject has relatively sensitive body;

if $mSlope_{up} < \delta$ OR $mSlope_{down} < \delta$, the test subject has insensitive body, wherein δ is the assessment threshold.

5. The method for evaluating transitions between psycho-physiological states of individuals according to **claim 4**, characterized in that, the parameter initialization comprises:

setting $WinLength$ to 100, skin resistance sampling rate to 50Hz, the initial value of $MeanDiff$ to 0.03, α to 0.999;

setting $StepSize$ to 10, δ to 15;

setting $MeanDiff_{microsleep}$ and $MeanDiff_{sleep}$ to 0.0006 and 0.0002, respectively, for individual with relatively sensitive body, and $MeanDiff_{microsleep}$ and $MeanDiff_{sleep}$ to 0.001 and 0.0005, respectively, for individual with insensitive body.

6. The method for evaluating transitions between psycho-physiological states of individuals according to any one of **claims 1-5**, characterized in that, the said evaluation result of the psycho-physiological states is reported to users through sound, light, vibration, or smell.

7. The method for evaluating transitions between psycho-physiological states of individuals according to any one of **claims 1-5**, characterized in that, the said collected human skin resistance data is obtained from the collected skin conductance data where the resistance data is calculated as the reciprocal of the conductance data.

8. A system to evaluate transitions between psycho-physiological states of individuals, characterized in that, the system contains medical sensor heads, a bridge circuit for measuring human skin resistance/conductance, an amplifier circuit, a A/D converter circuit, a CPU, and a human machine interactive interface, wherein

the said bridge circuit for measuring human skin resistance/conductance is

configured to measure human skin resistance/conductance data;

the said CPU is configured to execute any method according to any one of claim 1 to claim 5 to evaluate transitions between psycho-physiological states of individuals;

the said human machine interactive interface is configured to report the evaluation result.

9. The system to evaluate transitions between psycho-physiological states of individuals according to **claim 8**, characterized in that, the said CPU is micro computing unit, mobile communication devices, mobile computing devices, or desktop computer equipment.

10. The system to evaluate transitions between psycho-physiological states of individuals according to **claim 8 or claim 9**, characterized in that, the said human machine interactive interface includes voice module, display module, vibration module, or smell generation module.