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Delivery contents
Mindfield® eSense Skin Response Sensor
2 Velcro electrodes
Free App from Mindfield (from the App Store or Google Play)
Detailed instruction for efficient biofeedback training
Skin response in general

Skin response, also known as galvanic skin response (GSR), electrodermal response (EDR) or skin conductance (SC) is a measurement method based on bio-electrical properties of the skin. The eSense Skin Response applies a very small, safe and unnoticeable electrical voltage and resulting electrical current to the skin. Through the changes of this small current, we can measure the activity of the perspiration glands of the skin far below the threshold of self-perception.

In terms of physics, skin conductance is measured in µSiemens or symbolized as µS (where µ denotes a millionth and Siemens is the unit of conductance). “Skin resistance” is also a common term, simply denoting the inverse of conductance (1S = 1/Ω).

The activity of the perspiration glands is determined by the autonomic nervous system, which contains two major subunits: the parasympathetic nervous system and the sympathetic nervous system. The perspiration glands of the skin are solely controlled by the sympathetic nervous system, making them a good indicator for inner strain and stress. The sympathetic nervous system reacts to stress stimuli by activating all the “emergency functions” of the body, bringing it to a state of heightened responsiveness: Pulse and blood pressure are rising along with the glucose level in the blood and general alertness. With these changes comes the effect of “wet hands” on which our measurement relies.

We usually know those situations from our own lives as well. Think for example of a speech that you gave in front of an audience or a job interview. If in those situations you were excited, can you remember the cold, sweaty hands?

A scientific theory for this effect assumes that our ancestors needed the wet hands to have a firmer grip on things, for example in an escape or pursuit through difficult terrain. When the threatening situation is over, the parasympathetic nervous system becomes dominant: Pulse, blood pressure and glucose level are falling. The body enters a rest state to allow recuperation, and the hands become dry again.

The increased activity of the perspiration glands through a (stress) stimulus is easily visible through the associated increase in skin conductance. The stimulus can be mental or emotional strain, or taking a sudden, deep breath, or a startling action like someone unexpectedly clapping his hands or the loud drop of an item onto the floor. Just try it with the eSense, you will easily see the effects!

Stress and its vegetative symptoms can be greatly reduced through biofeedback training, where you intentionally work on lowering your skin response.
Skin response and biofeedback training

Skin response is a quite universal tool for biofeedback training. It is widely used in the therapy of anxiety, panic disorders and specific phobias. Further fields of use are high blood pressure, tinnitus and sleep disorders. If you suffer from a serious disorder or medical condition, always consult a professional physician or therapist, and do not attempt a treatment on your own. Biofeedback training is not an official recognized medical procedure. Hence the eSense Skin Response is not a medical device and may only be used for stress reduction training.

Measurements are done by placing two electrodes on two fingertips of the same hand. The dark-colored lower side of the electrode should be in good skin contact.

The goal of the feedback training is twofold: A reduction of the permanent, basic level of stress and a reduction of the immediate stress response to a particular stimulus. A biofeedback training consists of 4 training stages. Schedule for the first training about 60 to 90 minutes of free time in which you can conduct the training undisturbed and at a stretch. Hereafter you find an example sequence of a stress relief training.
Process of a training

1. A quiet, comfortably tempered room without phones and other sources of distraction, and convenient seating and clothing are the conditions needed for successful training. You should avoid all conditions that can make you sweat out of purely physical reasons, like intense physical activity before training or intense sunlight and heat. To obtain comparable results, you should try to keep your initial and ambient conditions constant through the series of training sessions.

2. Wrap the two electrodes around the upper or middle phalanges of your index and middle finger of the same hand. The dark lower side of the electrodes shall be in good skin contact. Using the non-dominant hand is advisable (e.g. the left hand for right handed people) because the skin tends to be a little less callused there. Attach the cables and wrap the tape another time around their clips to ensure a firm contact.

3. You should neither tape the electrodes too firm where you would block blood circulation, nor too weak, letting them slip and move around. Put your hand down onto a comfortable support where it can rest calm and relaxed.

4. Start the application, and have a first glance on the values. If they are below 1µS, the electrical contact through the clip is bad, or your skin is very dry and eventually callused. Check the contact clips or change your hand or the position of the electrodes, if necessary.

5. In comparison with other biofeedback techniques, you will need fewer sessions for a reliable success. 6-10 sessions should be sufficient. To keep
focused throughout the entire session you should limit session length to about 15 minutes. If you start feeling tired while training, you should shorten your sessions and practice more often instead.

6. For the interpretation of the measurement we distinguish between “tonic” and “phaseal” effects. The tonic component is the longer-term average of skin conductance and its development during one session. Values for the tonic level can vary between 1 to 15 µS, depending on the individual and the situation. In contrast, rapid changes (fluctuations) of skin conductance, often caused by a sudden stimulus but also appearing spontaneously, are the phaseal component of the skin response. The stimulus causing a phaseal effect can be internal (thoughts, memories, and emotions), or external (images, sounds, and events).

7. In a state of heightened excitation, both the general tonic level and the rate of spontaneous fluctuations is increased. With low excitation and rest comes a lower tonic level and fewer spontaneous fluctuations.

Example situation for rising excitation:
Example for a consecutive rest phase:

First stage (observe and experiment, determine your initial status)

1. Record your baseline state for 10 minutes at rest without influencing the measurement. Relax as best as you can and do not watch the measured values for the whole 10 minutes, as it would compromise a true baseline measurement.

2. Have a look at the complete curve and its average tonic level. Does it rise or fall in certain phases, or is the general level constant throughout the measurement? How would you judge your ability to relax during the exercise? Maybe you can already find dependencies between the objective measurement and your subjective feelings of relaxation or excitation? If you find no connection, don’t worry, you surely will during the sessions to come. Keep notes on the general level of the curve and the approximate number of fluctuations per minute in order to know your initial training status. Keep in mind that your daily condition can affect the measurement. You can send the measured values to your email address using the respective function of the application.

3. If you find your skin conductance continuously rising without any reason, you may have attached the electrodes too firmly, making you sweat beneath. At this point, the humidity should be directly noticeable. If necessary, dry your hands and reattach the electrodes with a little more slack.
Second stage (targeted Biofeedback training with the skin response)

1. The second stage consists of multiple sessions. These sessions should always follow the following scheme. You shall now exercise conscious relaxation with the feedback signal.

2. Start the measurement and watch the values for a while. Then try to bring them down through active, conscious intervention. There are many ways to do this, like breathing in a controlled and calm pattern, techniques of muscle relaxation or autosuggestion. The exact way is up to you, your knowledge on relaxation and your will to experiment. The device gives you real-time feedback of even the smallest effects. The training can reduce the tonic level of skin conductance, and the immediate reaction to stimuli.

3. Both the intensity of a stimulus and its subjective significance will influence the amplitude of the consecutive skin response. The stimulus can be internal in nature (thoughts, memories, and emotions), or external (images, sounds, and events). Inevitably, it will happen to you that you feel unable to relax, for example because of negative thoughts. If you notice a rising skin response as a result, try to bring it down again. Taking a deep breath brings up the skin response as well, so try to bring it down again.

4. The second stage is about lowering the tonic level of skin conductance, and bringing it down after a stimulus. So you’re training to lower your general stress level, as well as your ability calm yourself down after a stressful situation.

Third stage (deliberate provocation, relaxation and stress coping)

1. We will now actively use stress stimuli (stressors) to improve your ability to deal with them. Because of its immediate feedback and sensitivity, skin response is particularly useful tool to work with direct provocation. It helps to know that the amplitude of the skin reaction is proportional to the intensity of the stressor.

2. The training begins with a period of rest, so start the measurement and relax for a couple of minutes.

3. Now a selective stressor should be applied. This can be a certain thought, sound or image with a negative connotation. Almost every person knows
certain things or situations that cause distress for him or her. As an example: If you have trouble speaking out loud before a larger group of people, try to imagine the situation and hold a speech before them. Under the influence of such a stressor you are likely to see a surge in skin response. Try to relax to bring it down again and reduce the spontaneous fluctuations.

4. Alternate phases of relaxation and stress stimuli during the session. After three or four rounds you should finish the session with a relaxation phase. Don’t overstrain yourself. Perform multiple sessions over a longer period of time, until you have the impression that you stress response is significantly reduced or you recover quicker after a stress situation.

Fourth stage (transfer, relaxation without feedback)

1. Now you can check if you can achieve improved relaxation with lower skin response levels and less fluctuations even without feedback. Record a 10-minute baseline without watching the measurement while relaxing as best as you can. Afterwards, compare it to the baseline measurement from the first stage. Your overall level of skin conductance should have dropped, and/or the spontaneous fluctuations should have reduced. Your daily condition can affect the measurement a lot, so repeat the record of the baseline later again if you feel you had an unusual day.

2. As a more challenging transfer exercise, exert stress stimuli on yourself like in third stage, but this time without the aid of the feedback. Try to maintain your calm and relaxation, and check afterwards if you succeeded. Have you been able to keep your skin conductance comparatively low and limit the amount of fluctuations, even without the immediate feedback? If you’re able to do this, and your baseline has also dropped in comparison to the first stage, you have successfully completed the stress reduction training. When you encounter stress situations in everyday life, recall the training situation, and use your new skills to stay relaxed. Skill comes with practice!
Functions of the free eSense Skin Response App

General View

- Scale for skin conductance (µS)
- Moveable training thresholds for the color gradient (green to red)
- Momentary value
- Instructions and help
- Start and stop of the recording process
- Indicator for rising or falling values
- Time elapsed
- Momentary value
- Overall minimum
- Overall maximum
- Difference between minimum and maximum
- Last 60 second's average value

Display on iPhone® in vertical format

- Same values like in vertical format
- Moveable training thresholds for the color gradient (green to red)

Display on iPhone® in horizontal format

- Start and stop of the recording
- Indicator for rising or falling values
- Time scale in seconds
Moveable training thresholds for the color gradient (green to red)

Scale for skin conductance (µS)

Momentary value

Display on Android™ in vertical format

Start and stop of the recording process

Indicator for rising or falling values

Time elapsed

Momentary value

Overall minimum

Overall maximum

Difference between minimum and maximum

Last 60 second’s average value

Instructions and help

Same values like in vertical format

Moveable training thresholds for the color gradient (green to red)

Display on Android™ in horizontal format

Indicator for rising or falling values

Start and stop of the recording

Time scale in seconds
Set up of animation

Sweep your finger over the display to change between the horizontal format and the animation.

Double tap on the animation to maximize it.

Move two fingers together (“pinch”) to shrink the animation to original size.

Falling skin conductance keeps the animation going, while rising values will stop it.

You want to bring your skin conductance down, so keep the animation going!

Tap on Custom Video to choose your own video, an on Default Video to return to the standard video.

Display on iPhone®

Display on iPhone®

Display on Android™
When using iOS, your custom video must be in the "Camera Roll".

Here's how you add a video to it:

1. Send the video to yourself in an e-mail.
2. Open the e-mail in the Mail app.
3. Download the video.
4. Click and hold the video and select "Save to Camera Roll."
5. Now you can select the video from within the eSense app.

A list of supported video formats for iOS can be found here: http://www.apple.com/de/iphone/specs.html

When using Android, your video must be in the "Gallery."

Here's how you add a video:

1. Send the video to yourself in an e-mail.
2. Open the e-mail in the Mail app.
3. The video will be shown as an attachment. Click the dots on the right edge of the attachment and select "save."
4. The video is now in the Gallery and can be loaded by eSense.

As an alternative, you can use Dropbox:

1. Move the video into your Dropbox.
2. Select the video from the Dropbox and export it onto the SD card in the "Movies" folder (in the Gallery)

A list of supported video formats for Android can be found here: http://developer.android.com/guide/appendix/media-formats.html
Configuration of auditory feedback

Audible Feedback on/off
You can always hear sounds from other Apps in the background.

Volume for negative Feedback
When values move in the wrong direction, the sound becomes quieter:

0% = mute
100% = undiminished volume

Feedback Direction
Decide if rising (“raise”) or falling (“lower”) values should count as success for the feedback.

Choose Song
Please choose any Audio file.

Feedback Response Time
Adjust how sensitive and quick the feedback will react to a changing direction (rising or falling) of the values.
Export and forward of measured values

After stopping a recording, you can transfer the measured values via e-mail (in iOS, you need an email account for this function).

5 values per second are saved to a CSV file where every line is a value, so 5 lines correspond to one second of measurement.

Click on “Submit values” to send a CSV (comma separated value) file to your personal or any other email.

The file can be processed in Microsoft Excel™ or Open Office.

Important note regarding iOS

The free eSense iOS app is not supported by iOS 11 anymore. Please use the new universal app instead under iOS 11.
Functions of the eSense Universal App

The eSense Universal App supplements the both free eSense Apps with additional functions. The settings are all combined in one menu. The Mindfield eSense Universal App is available in the Google Play Store (Android) for 1.99 Euro or in the Apple App Store (iOS) for free.

Beside the improved design and usability is the tone feedback and tactile feedback. Those give you more choices regarding the feedback. Therefore you can adjust your biofeedback-training individual to your wishes.

General view
Same values like in vertical format

Indicator for rising or falling values

Toggle Full screen

Time scale in seconds

Start and stop of the recording

Settings (Overview)

<table>
<thead>
<tr>
<th>Settings</th>
<th>Feedback Direction</th>
<th>Response time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback Direction</td>
<td>Lower</td>
<td>Short</td>
</tr>
<tr>
<td>Response time</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Feedback Direction
Decide if rising ("raise") or falling ("lower") values should count as success for the feedback.

Responsive time
Adjust how sensitive and quick the feedback will react to a changing direction (rising or falling) of the values.

Music Feedback
Volume for negative Feedback: When values move in the wrong direction, the sound becomes more quiet.

Tone Feedback
You can always hear sounds from other Apps in the background.

Tactile Feedback
Your device will vibrate as feedback.
### Choose Song
Choose any Audio file.

### Video
Select: In the Dropdown Menu, you can choose also “Custom”. You can choose your own videos from the hard drive of your device.

### Decimal separator
You can choose between point or comma.

### Time length X-Axis
You can set the time frame which is shown on the graph while measuring.

### Sample Rate (CSV Export)
This determines how many values per Second are recorded. More values (a higher value of Hz) creates more detailed data, but also increases the size of the download-file.
Tone Feedback

A new function of the Mindfield Universal App.

Volume for tone feedback
Set the volume for the tone feedback.

Tone range (from-to)
You can set the range in which the tone feedback will be active. We suggest choosing the wider range in the beginning and reducing it later if necessary.

Musical instrument
You can choose from several pre-installed instruments.

Just for Android: You can also choose your own tones. Choose “custom tone” (just visible in Android). You need to put suitable MP3-files into the folder “eSense tone files” which is located in the root of Android.

Interval
Set an interval for the tone feedback. You can choose different values between 1 and 20 seconds.
**Tactile Feedback**

Another new function of the Mindfield Universal App: Your device can vibrate in order to give you direct feedback about your training.

**Vibration interval**

Set how long your device will vibrate as feedback.

**Tactile Feedback Direction**

Decide if rising ("raise") or falling ("lower") values should count as success for the feedback.

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**New: Procedures**

A Procedure consists of several assembled modules. With this new feature you can build the perfect individual relaxation guide, a stress test, pre-defined biofeedback training or use it for research.

There are many possibilities. During a procedure, your skin response, respectively or temperature (depending on the eSense sensor you have) will be recorded and afterwards you see your results for each module and in total.

**Summary measured values**
We suggest you to test the demo-procedures which are included in the app. Those will give you a guided overview over the different modules and functions of the procedures.

**Edit or delete procedure**

To edit a procedure, simply swipe it to the left in the overview.

You then see the blue pen-symbol to edit the module.

**Procedure editor**

**Procedure name**
Here you can name your procedure with a suitable name (in this example it is simply “test”)

**Decimal separator**
You can choose between point or comma.

**Sample Rate (CSV Export)**
This determines how many values per Second are recorded. More values (a higher value of Hz) creates more detailed data, but also increases the size of the download-file.

**Add Module to procedure**
Start to add modules to your procedure by pushing the + -sign!
Procedure editor with modules

You can change the order of the single modules by the arrows.

To edit a single module, simply swipe it to the left as well. (as shown here with the lower module)

The color of the modules in this overview is determined by your settings in the module editor.

Module overview and settings

The single modules can of course be edited as well.

Module Type
You can choose between a text, a video, an audio file, a fixation cross, an arrow or a bar graph.

Module duration
Set how long the module shall last. Simply swipe the slider to the left or right.

Module color
Determine the color of the module in the procedure editor.
Overview of the modules

Text module

This module shows a text which you can edit.

Picture module

The picture module shows either a standard picture from the app or a picture from your gallery.

Video module

In the video module you can choose either the standard video from the app or use your own video.

Fixation cross module

The cross changes its color depending on the conductance and provides direct biofeedback.

Audio module

The audio module is playing a relaxing song. You can choose your own music.

Arrow module

The arrow changes depending on relaxation and gives you therefore direct biofeedback.
Bar graph module

The bar graph shows you your current value and gives you direct biofeedback.

Export and forward of measured values

Archive Overview

The Mindfield Universal App contains also an archive, in which you can save your measurements and export them as well.

If you click on the export symbol on the top right, you can export the measurements as a .csv-file with all common apps (f.i. send over the Messenger, WhatsApp, email etc.) or simply save them on your device or in your cloud.
The data are exported as .csv-file (comma separated values). This format can be opened f.i. with Microsoft Excel or Open Office Calc (for free).

If you like to work with Google, Google Sheets can be an alternative to Excel for you. You can open your exported .csv-files, visualize and access them via the cloud easily from several devices. Google Sheets has almost the same functions than Excel and the interface is very similar as well.

**Notice:** It might happen that if you open the .csv-file with Microsoft Excel, your values are automatically formatted (f.i. as date). If this is the case, we suggest to open the .csv-file with Open Office (choose the Semicolon as separated by), save it as .xls-file and open this .xls-file again with Excel.

If you want to change the separator for the hundreds or thousands (f.i. from 1,000.00 to 1.000,00 or vice versa), then you can do this at File -> Options -> Advanced -> Editing options and clear the “Use system separators” check box.

Alternatively, you can also mark your values and change them under Home -> Editing -> Replace. In the search mask you can now search for , and replace them by . (see picture).
Supported devices Android

In general Android smartphones and tablets from Android 4.0 can be used with the eSense without complications.

Your Android device requires a 3,5mm jack (headphone jack) for external microphones which is built-in into most devices by default.

We suggest the Amazon Fire 7 as an affordable tablet to use with the eSense.

Supported devices iOS

The following iOS devices can be used with the eSense:

Apple® iPhone® from 4S
Apple® iPad® from 2nd Generation
Apple® iPod touch® from 5th Generation
Apple® iPhone 7 and iPhone 7 Plus (in combination with the included Lightning to 3.5 mm Headphone Jack Adapter)
Additional note iOS 7 (or higher): The eSense works through the microphone port. From iOS 7 or higher you have to allow explicitly that the eSense app may use the microphone port, otherwise it will not work. You are asked for this during installation, please answer with “Yes” or “Allow”. After installation you can make this setting manually: Allow the eSense app to use the microphone port in the system settings of your iOS device: Settings -> Privacy -> Microphone.
Electrode types

Velcro electrodes

- Easy to use
- Reusable
- Cheap
- Worse conductivity

You can order Velcro electrodes here: https://mindfield-shop.com/accessories/electrodes/eda-velcro-electrodes-for-measurement-of-skin-conductance-8-pieces.html

Finger clips (without gel)

- Easy to use
- Reusable
- Comfortable
- Worse conductivity

You can order the Finger clips here: https://mindfield-shop.com/gsr-finger-clips-without-gel-2-pieces.html
Gel electrodes (disposable)

- Easy to use
- Good quality of signal
- Useable just once

**Our prior recommendation**

You can order the gel electrodes here:

EDA gel electrodes (reusable)

- Best quality of signal
- Complex application
- Additional gel necessary

**For professional use**

You can order the EDA gel electrodes here:
**Possible electrode positions**

General information for the skin preparation (independent from the electrode type):
Skin preparation or skin cleansing is usually not necessary and also not recommended. It is enough to wash the hands, although the soap rather dries the skin and lowers the measured values. The same applies to the skin cleansing with alcohol. Only for especially greasy skin or when hand cream has been used recently, they should be freed of any oily residues by being washed with lukewarm water and alcohol (70%), if necessary.

**Velcro electrodes**

On direct skin contact of the silver electrodes surface, wrap the Velcro electrodes around the upper and middle phalanx of the index and middle finger. Then connect the press button wires with the electrodes. You can wrap the Velcro around the press button ends once again for a better stabilization of the wires, as shown in the right image.

**Gel electrodes**
We prevailingly recommend the single-use gel electrodes. There are three different possibilities of the areas of conduction, as shown in the images. All positions are equivalent. Simply connect the electrodes wire through the press button connectors with the electrodes.

**Finger clips**

These EDA finger clips are simply put on the fingertips of the index and middle finger. Then the press button wire of the eSense is connected with the electrodes (here, the wire should run forward towards the notch inside of the clips).

**EDA gel electrodes**

Due to the required adhesive surface of the skin, it is recommended to choose the thenar and hypothenar muscles as positions for the electrodes. First, the adhesive rings will be attached. Then the electrodes will be neatly filled with electrodes gel until full and put onto the adhesive rings after removing the outer protective foil. Finally, the press button wires will be connected.
Extending the cord of the eSense

If you wish to use a longer cord between the eSense and your smartphone or tablet, you can extend the original cord of the eSense with a common, 4-pin, 3,5mm jack headset extension cord. We have tested 3 cords that have worked well:

2m cord: http://amzn.to/2kJwqBM
0,5m cord: http://amzn.to/2kKEONs
110cm cord: http://amzn.to/2jJg1LZ

All three suggested cords cost between £ 6-8 and are available f.i. from Amazon. Alternatively you should be able to use other 4-pin cords as well.
EC Declaration of Conformity for the Mindfield eSense

in accordance with the following directive(s):

RoHS - Restriction of (the use of certain) hazardous substances (2011/65/EU)

The manufacturer

Mindfield Biosystems Ltd.
Hindenburgring 4
D-48599 Gronau
Germany

WEEE-Reg.-Nr. DE 24465971

hereby declares that the following product:

„Mindfield® eSense“

complies with all applicable essential requirements of the directives.

It is in conformity with the applicable requirements of the following documents:

DIN EN 60950-1 Information technology equipment – Safety – Part 1: General requirements (2011-01)

DIN EN 55022 Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (2008-05)

DIN EN 55024 Information technology equipment - Immunity characteristics - Limits and methods of measurement (2011-09)

Place: Berlin
Date: 12th of April, 2016

Niko Hübner-Kosney
Niko Hübner-Kosney, Managing Director

The Mindfield eSense have to be recycled as electrical waste according to the legal requirements.

WEEE-Reg.-Nr. DE 24465971
Contact

Manufacturer

Mindfield® Biosystems Ltd. · Hindenburgring 4 · D-48599 Gronau · Germany

Tel: + 49 (0)2565 406 27 27 · Fax: + 49 (0)2565 406 27 28 · E-Mail: info@mindfield.de

For questions, problems and in case of warranty please contact us preferably via email or visit our website at www.mindfield.de for more information

Please send never unprompted packages to us. Unfree returns will not be accepted and cannot be processed.

Your Notes

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