The Stroop effect with Cobra SMARTsense (lie detector)

Biology | Human Physiology | Other Senses

Difficulty level	Group size	Preparation time	Execution time
medium	2	10 minutes	20 minutes

This content can also be found online at:

http://localhost:1337/c/6315decd13aa4c0003fd3707

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

PHYWE

Teacher information

Application

PHYWE

By measuring skin conductivity (as well as recording other parameters such as blood pressure, pulse, respiration), a polygraph (colloquially known as a l**ie detector**) can be used to determine whether someone is telling the truth. However, the device does not directly indicate whether someone is lying or telling the truth, but someone is still needed to interpret the measurement output.

The principle of the lie detector is best demonstrated by asking students to answer difficult or unpleasant questions or by having them sing a song. Quantitative measurements, on the other hand, are best demonstrated with the **Stroop effect** experiment.

The experimental set-up consists of a sensor that is connected to two fingers -- this makes the experiment easy to perform.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Other teacher information (1/3)

PHYWE

Prior

Students should know that liquids are conductive.

Other teacher information (2/3)

PHYWE

The use of the sensor as a lie detector serves as an introduction to the Stroop effect experiment. Detailed background information on this experiment can be found in Wikipedia. It gives an insight into the autonomisation of processes of the brain.

The human body shows not only perceptible or visible reactions to an increased requirement for concentrating, but also invisible ones such as the increase in skin conductance.

Increased requirement for concentration can also be shown when solving maths problems like calculating fractions or doing complicated multiplications.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Other teacher information (3/3)

PHYWE

Learning

Influence of concentration on peripheral physiological variables such as skin conductance.

Tasks

1. Evidence of altered concentration when reading aloud a black/white word series compared to a coloured word series.
2. Evidence of altered concentration when recognising colours in a series of rectangles compared to coloured words.

Click here to download the template for conducting the experiment

Safety instructions

PHYWE

No special safety precautions are required as this electrophysiological sensor is to be used without connection to the mains. Just note that it is only used when it is not connected to the mains voltage!

Make sure that the students do not move during the measurement. Even small movements, such as raising a hand, can falsify the measurement.

The sensor is not approved for diagnostic purposes, but was designed exclusively for teaching purposes.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

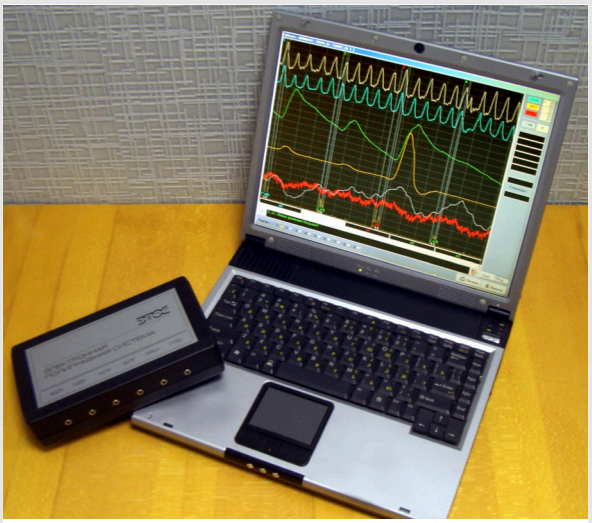
info@phywe.de
www.phywe.de

PHYWE

Student information

Motivation

PHYWE



Polygraph (lie detector)

A lie detector measures blood pressure, pulse, respiration and the electrical conductivity of the skin and tries to deduce the truthfulness in an interrogation from this.

In this experiment, we use a sensor that measures the conductivity of the skin, i.e. the property of the skin to secrete sweat under pressure situations. Since sweat contains electrolytes that are electrically conductive, the intensity of sweat secretion can be measured.

The principle of the lie detector is best demonstrated by asking you difficult or unpleasant questions or asking you to sing a song. The actual purpose of this experiment, however, is to perform quantitative measurements in order to investigate the so-called Stroop effect.

PHYWE

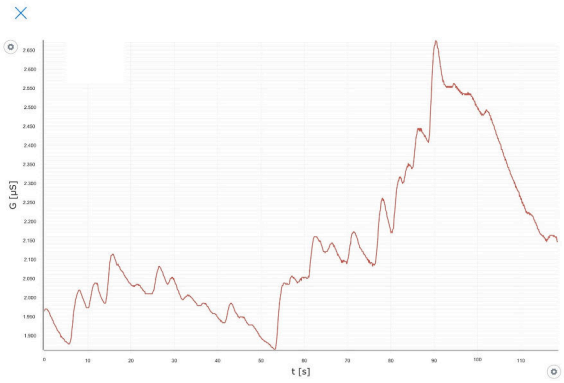
Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Tasks

PHYWE



Example of result: the higher the curve, the more strenuous the task (increasing perspiration)

1. Evidence of altered concentration when reading aloud a black/white word series compared to a coloured word series.
2. Evidence of altered concentration when recognising colours in a series of rectangles compared to coloured words.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Equipment

Position	Equipment	Item no.	Quantity
1	Cobra SMARTsense Skin Resistance - Sensor for measuring skin conductivity (GSR) 0 ... 10 µS (Bluetooth +USB)	12942-00	1
2	Set of 20 adhesive electrodes for Cobra SMARTsense ECG	12929-00	1
3	measureAPP - the free measurement software for all end devices	14581-61	1

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Structure (1/2)

PHYWE

For measurement with the **Cobra SMARTsense sensors** the **PHYWE measureAPP** is required. The app can be downloaded free of charge from the relevant app store (see below for QR codes). Before starting the app, please check that on your device (smartphone, tablet, desktop PC) **Bluetooth** is **activated**.

iOS

Android

Windows

Structure (2/2)

PHYWE

- Attach the two electrodes to the fingers as shown in the illustration.
- When sticking on the electrodes, make sure that they are not too loose, otherwise values cannot be measured or the sensor falls off. The dark contact surface touches the inside of the fingers.
- On the other hand, the electrodes must not fit too tightly either, otherwise sweating will occur, which will unjustifiably increase skin conductance significantly.
- Start measureAPP and select Cobra SMARTsense Sensor "Skin resistance". Skin conductance is displayed as a function of time during the measurement.

Experimental setup

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Procedure (1/2)

PHYWE

After the electrodes have been attached, e.g. to the ring and little finger, wait until a constant value is reached.

After a trial test to familiarise yourself with how the SMARTsense sensor measures, wait until the person-specific neutral skin conductance value is reached again. This may take some time, so patience is required for this step. Only now should a new series of measurements be taken.

*Tip: The test subject must **not** prepare, but instead jump into cold water!*

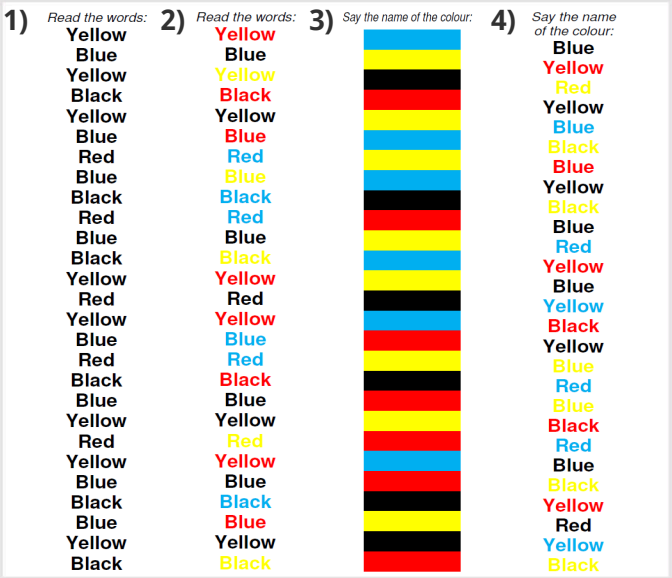
Caution: Touching the other hand will affect the test result!

The Stroop effect can now be demonstrated with the following two variants:

Procedure (2/2)

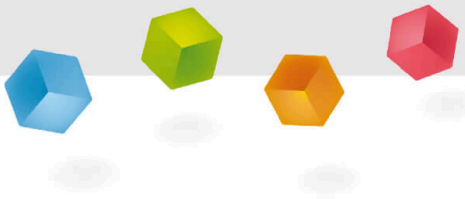
PHYWE

1. First, a series of words (black font/white background) is to be read out as quickly as possible (1). The increase in skin conductance is measured and the first measurement is stopped. Then a similar series of words is read out, but the words are coloured (2).
2. In the second variant, skin conductance when recognising colours is to be recorded on the basis of a colour row containing only the colours themselves in rectangles (3) and a word table in which the words are not coloured according to their literal sense (4). These tables should also be recited as quickly as possible.



PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

PHYWE



Report

Task 1

PHYWE

Compare the curves you recorded when reading out the black/white or coloured word series. Fill in the missing words:

It becomes clear that simple reading is a routine for the brain. A second measurement, where reading is complicated by [ ], requires a [ ] time. These additional pauses for reflection testify to a greater concentration, which can be detected in the curves for skin conductance. This connection between increased concentration due to irritation during reading and increased skin conductance is called the [ ] effect.

Check

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task 2

PHYWE

Compare the curves you made when naming the colour of the rectangles or coloured words. Fill in the missing words.

When recognising [ ], a non-autonomised process in the brain is tested. Compared to the first variant, the time required to read out the colours will be [ ] than the time required to read out the words. Nevertheless, the peak values of the second measurement for colour recognition are still [ ] than the values for pure colour recognition.

Check

Task 3

PHYWE

Explain your observations on experiment part 1.

- [ ] Simple reading is a routine for the brain.
- [ ] Reading the words is made difficult by their contradictory colouring and therefore takes a longer time.
- [ ] The shortened pauses for reflection testify to a lower concentration, which can be detected in the curves for skin conductance.

Check

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task 4

PHYWE

Explain your observations on experiment part 2.

- [ ] When recognising colours, a non-autonomised process in the brain is tested.
- [ ] Compared to the first experimental variant, the time spent reading out the colours will be greater than the time spent reading out the words.

Check

Task 5

PHYWE

What influence does the colour of a word have on skin conductance in case the word which is being read names a different colour than the one in which it is written, as when, for example, "yellow" is written in red?

- The skin conductance decreases.
- There is no influence.
- The skin conductance increases.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task 6

PHYWE

Can the determination of skin conductance be used to detect lies?

Yes, liars can be clearly incriminated, because skin conductance changes when lying.

No, it cannot be used to incriminate liars, because skin conductance does not change when lying.

The values only show the emotional reaction of the person, i.e. how much they "sweat". They cannot indicate why someone is sweating (lying, nervousness, fear).

Task 7

PHYWE

Are there characteristic curves of skin conductance for each person?

Yes, each person has a different number of differently active sweat glands and different thickness of skin, which means that each person has a different skin resistance.

No, there is only one characteristic curve of skin conductance, which is the same for all people.

There is a characteristic curve of skin conductance for women and one for men.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task 8

PHYWE

What influence would an unknown language or script have on the classical Stroop test?

An unfamiliar language or script would have less of a disturbing influence in the classic Stroop test, as it would not distract from the external appearance and this could be recognised even faster and better.

An unfamiliar language or script would have a greater disturbing influence in the classic Stroop test, as it would distract from the external appearance and make it even slower and more difficult to recognise.

An unknown language or script would have no influence on the result of the classic Stroop test.

Slide	Score / Total
Slide 16: Untitled: Fill in the Blanks	0/3
Slide 17: Untitled: Fill in the Blanks	0/3
Slide 18: Untitled: Multiple Choice	0/2
Slide 19: Untitled: Multiple Choice	0/2
Slide 20: Untitled: Single Choice Set	0/1
Slide 21: Untitled: Single Choice Set	0/1
Slide 22: Untitled: Single Choice Set	0/1
Slide 23: Untitled: Single Choice Set	0/1

Total 0 / 14

Solutions Repeat

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de