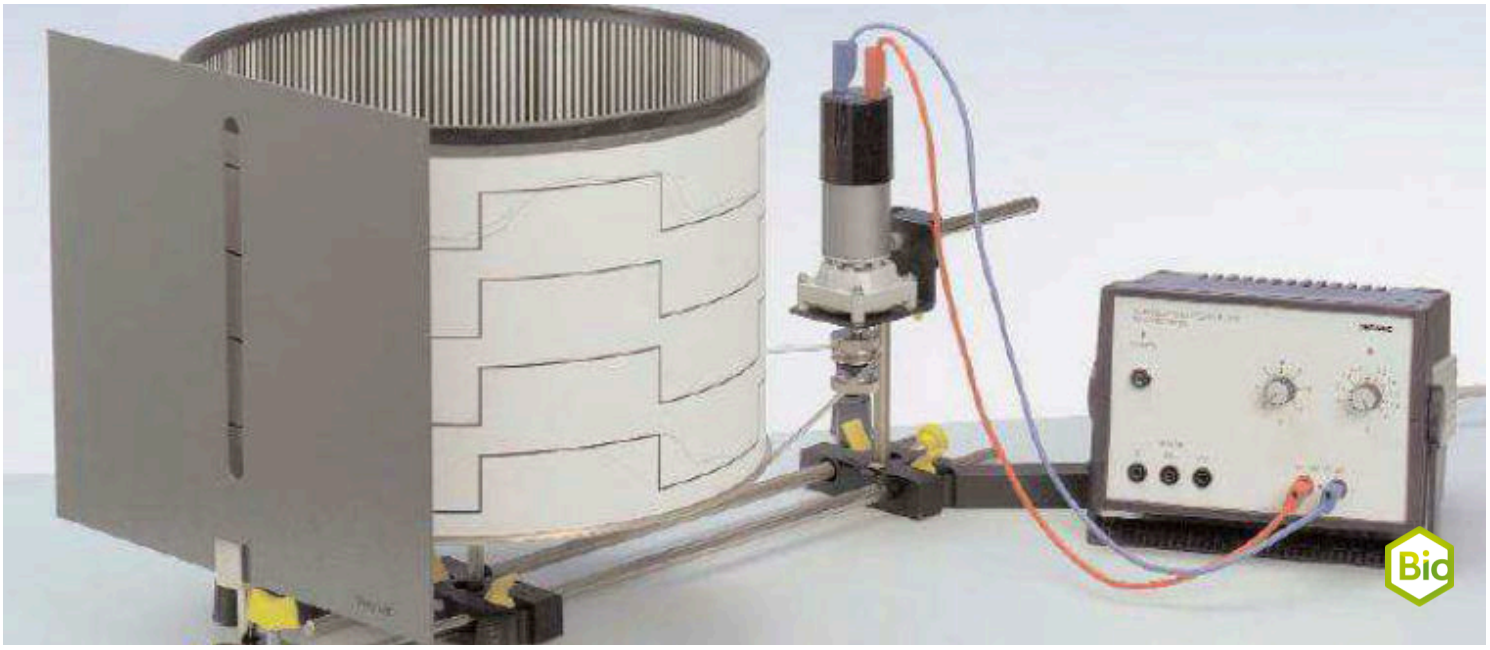
Test of human responsiveness



Biology | Human Physiology | Other Senses

Applied Science | Medicine | Physiology

Difficulty level	Group size	Preparation time	Execution time
easy	1	10 minutes	20 minutes

This content can also be found online at:

http://localhost:1337/c/615af93c3b0beb0003f80922

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General information

Application

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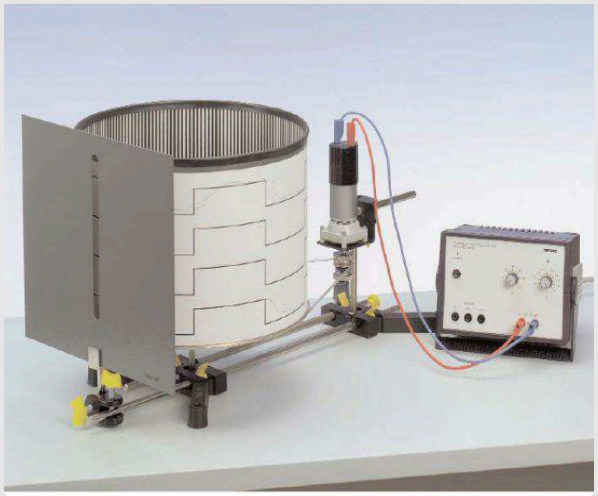

Test setup

Just as in many technical processes, feedback reactions between the output and input values also occur in many biological processes. Since many disturbing influencing factors affect biological systems, control loops of this type enable the establishment of a balance (homeostasis). The parts of a biological control loop (as in this experiment the receptors, neurons, synapses, effectors) require a certain time for signal transmission. The time between the onset of the disturbance (stimulus) and the response is called delay time.

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Other information (1/4)

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Previous

Pupils and students should be familiar with the stimulus development and stimulus transmission of the nervous system. It is also useful if they know that stimuli can be blocked or inhibited by various influences (alcohol, drugs, ...).

Principle

In this test, the subject follows a right-angled curve on a slowly rotating drum with the aid of a felt-tip pen inserted in a slot. In this reaction test, the delay time is determined.

Other information (2/4)

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Learning

Students should recognize that there is always a lag time in human reactions. They will also identify the influence of various internal and external factors on the delay time.

Tasks

Students will be asked to take a reaction test and analyze various parameters and examine the influence of various factors.

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Other information (3/4)

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Information on observations and results

As with many technical processes, the output values revert to the input values in the course of many biological functions. With the many disturbing influences that affect biological systems, a feedback response (control loop) of this type, allows equilibrium. The components of a biological control loop (receptors, neurons, synapses, effectors) require a certain amount of time to transmit signals. This time between the onset of a perturbation (stimulus) and the reaction it triggers is called the delay time. Only after the delay time has elapsed does the system move more or less rapidly from its old equilibrium towards the new equilibrium position. If this equilibrium position has not yet been reached when the next disturbance occurs, the system can no longer compensate for the action of this disturbance: the frequency range for disturbance effects is exceeded.

Other information (4/4)

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Information on observations and results

- To calculate the delay time, the displacement (in cm) between the jumps on the curve and at points where the curve is drawn in which the subject moves up and down is measured. The displacement divided by the speed of the drum (in cm/s) gives the displacement time in seconds.
- To calculate the cycle time, the distance between the end of the displacement time and the place where the line drawn by the subject is straight again is measured. As with the displacement time, this distance is divided by the speed of the drum.
- The mean displacement time is calculated from 10 individual measurements per speed. This mean value represents the reaction time for the speed in question. Depending on the subjects (state of mind, alcohol consumption, age, etc.) and the experimental conditions (noise, etc.), it varies from 0.1 to 0.5 seconds.

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Safety instructions

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- The general instructions for safe experimentation in science lessons apply to this experiment.

Theory

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Just as in many technical processes, feedback reactions between the output and input values also occur in many biological processes. Since many disturbing influencing factors affect biological systems, control loops of this type enable the establishment of an equilibrium (homeostasis).

The parts of a biological control loop (like the receptors, neurons, synapses, effectors in this experiment) require a certain time for signal transmission. The time between the onset of the disturbance (stimulus) and the response is called delay time.

Depending on the strength, an external effect such as a loud noise or a touch can have a strong or less strong influence on the reaction time. The effect also varies in strength from person to person, so that an individual reaction delay will occur in each subject.

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Equipment

Position	Material	Item No.	Quantity
1	Strobe drum	65976-00	1
2	Reaction test sheets, set of 20	65976-02	1
3	Motor with disk holder	11614-00	1
4	PHYWE Power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1
5	Connecting cord, 32 A, 750 mm, red	07362-01	1
6	Connecting cord, 32 A, 750 mm, blue	07362-04	1
7	Support base, variable	02001-00	1
8	Plate holder	02062-00	1
9	Boss head	02043-00	2
10	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00	1
11	Support rod, stainless steel, 500 mm	02032-00	2

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Structure and implementation

Structure (1/2)

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- The stroboscopic drum is fixed in a hole of the stand base and the 500 mm long stand rods are inserted into the base from the side.
- The 250 mm long rod is attached to the other hole of the tripod base. The motor is clamped to this rod by means of a right-angled clamp so that the motor pulley is at the same height as the bottom of the drum.
- The drive belt is then attached and tightened. In order to keep the distance between the motor and the drum constant, the stand rods, which were inserted on the side of the stand base, are securely fastened with the yellow levers.
- A plate holder is attached to one of the 500 mm long rods with a right-angled clamp (the adjustment screw of the plate holder surface inwards). The screen is connected so that the slot is exactly vertical and the screen does not touch the drive belt.

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Structure (2/2)

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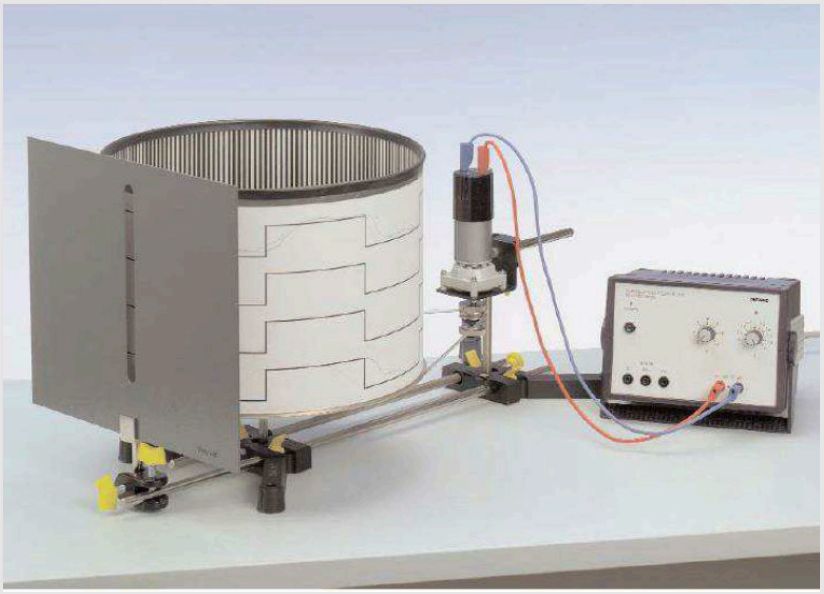
- A sheet of paper with rectangular curves (amplitude 3 cm, 10 jumps/m) is attached to the outside of the drum with a transparent adhesive tape.
- The motor is connected to the power output of the power supply unit via the two connecting cables. The voltage is first set so that the drum rotates three times per minute (= 3 / min = 5 cm/second).
- The figure on the right shows the experimental setup.



Procedure

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- The subject should first trace the top rectangular curve with a felt-tip pen through the slot for one complete rotation (10 jumps). The felt-tip pen should only be pressed gently on the paper to avoid slowing down the drum. After each jump of the curve, the subject should try to reach the new position as quickly as possible, even if this prolongs the transient phase.
- The drum speed is then gradually increased (10 cm/s, 15 cm/s, 20 cm/s) and a new rectangular curve follows by rotating at each step. The experiment is stopped when the speed becomes too high for the curves.
- The experiment can be repeated with the same subject under different environmental conditions (e.g. noise).
- It would also be interesting to repeat the experiment after drinking alcohol or other intoxicants. However, this reference is only theoretical in nature.

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Evaluation (1/3)

Drag the words to the right place.

As with many engineering processes, the _____ go _____ to the input values in the course of many biological functions. With the many perturbing _____ that affect biological systems, a feedback response (control loop) of this type, allows for _____. The components of a biological control loop (receptors, neurons, synapses, effectors) require a certain amount of time to transmit signals.

back
output values
influences
equilibrium

Check

Evaluation (2/3)

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What is the delay time?

- This time between the onset of a disturbance (stimulus) and the response that triggers it is called the delay time.
- This time between the beginning and the end of a reaction is called the delay time.
- The delay time cannot be defined.
- This time, which the subject needs to adjust to the sample, is called the delay time.

Check

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Evaluation (3/3)

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In which direction do alcohol consumption, noise and a bad state of mind shift the delay time?

- The delay time is extended. The reaction therefore occurs later.
- The delay time is omitted, there is a direct reaction.
- Noise and a bad state of mind increase the delay time, while increased alcohol consumption increases it.
- The delay time is shortened. The reaction comes about as sooner.

Slide	Score / Total
Slide 14: Biological control loop	0/4
Slide 15: Delay time	0/1
Slide 16: Shifting the delay time	0/1

Total 0 / 6

Solutions Repeat

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