

Board game for neuroscience enthusiasts

# BRAIN BATTLE



Hello, neuroscience enthusiast!

Get ready for this board game to take you and your team into the fascinating world of our brain, where you will find out about a great variety of tasks it carries out while we go about our everyday life. Alongside competing against the opposing team to claim your areas of the brain, you will also be presented with fun facts about the vital functions of this fascinating organ. The board game is suitable for **four or more players** and can be used as one of your team building activities in your company, club, or society.

For the curious among you we have attached a list of the scientific literature referenced in the game, where you can find more exciting information about the functioning of the brain.

We are happy to receive your constructive feedback to help us further develop and improve this board game. Should you come up with any ideas or comments while playing the game, please feel free to email us at the following email address: **[sinapsa.senior@gmail.com](mailto:sinapsa.senior@gmail.com)**.

Have fun twisting your brain!

*Slovenian Brain Awareness Week Organization Team  
SiNAPSA, Slovenian Neuroscience Association*



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**arrs**

JAVNA AGENCIJA ZA RAZISKOVALNO DEJAVNOST  
REPUBLIKE SLOVENIJE

Special thanks go to Slovenian comic drawer Bernard Kolle for play board design.



## Game instructions

The game is based around the **playing board** that depicts the brain, which is divided into seven basic brain regions. Each brain region is color coded and has a corresponding **white playing field(s)**. The **color** of each brain region also **matches** the color of activity cards. Each activity card has an interesting fact about the area of the brain and instructions for performing activities.

Before you start the game, players must be divided into **two teams** of at least two players each. Each team takes **nine tokens of the same color**. The team that rolls a higher number on the die begins the game by choosing any of the nine playing fields. **One team member** picks up a matching activity card and **reads out** the fun facts and instructions for the task.

**⚠ Warning:** It is crucial that only **one member** of the team **reads the instructions** on the activity card, as some reveal answers. In this activity, the person reading the instruction does not participate in the activity. The answers must not be disclosed to teammates until the end of the activity.

The two teams compete, and **the winning team claims the brain region** (i.e., playing field) by **placing one of their tokens** on the playing field. The winning team then chooses a new playing field which it wants to conquer next. The game continues until all the fields have been claimed. The team with a **higher number of claimed fields** wins the game.

Each time you play the game, use only **one activity card** for each playing field. This allows you to play the game multiple times. You can also adapt and make up your own passwords to certain activities, such as the pantomime, verbal fluency, cognitive flexibility, and free association.

The game board, tokens, activity cards and game materials for certain activities were prepared in the **Game Materials**. Some materials are also likely to be found at home – for example, a die.

### Disclaimer:

The board game involves physical activity which may pose a risk to those with cardiovascular diseases, conditions and risks, and those with pain in joints and bones. If your doctor has discouraged engaging in exercise, skip any activity you feel may be harmful to you. If you feel pain, dizziness, or shortness of breath at any point during an activity, stop engaging in the activity and consult your doctor.



# Game materials

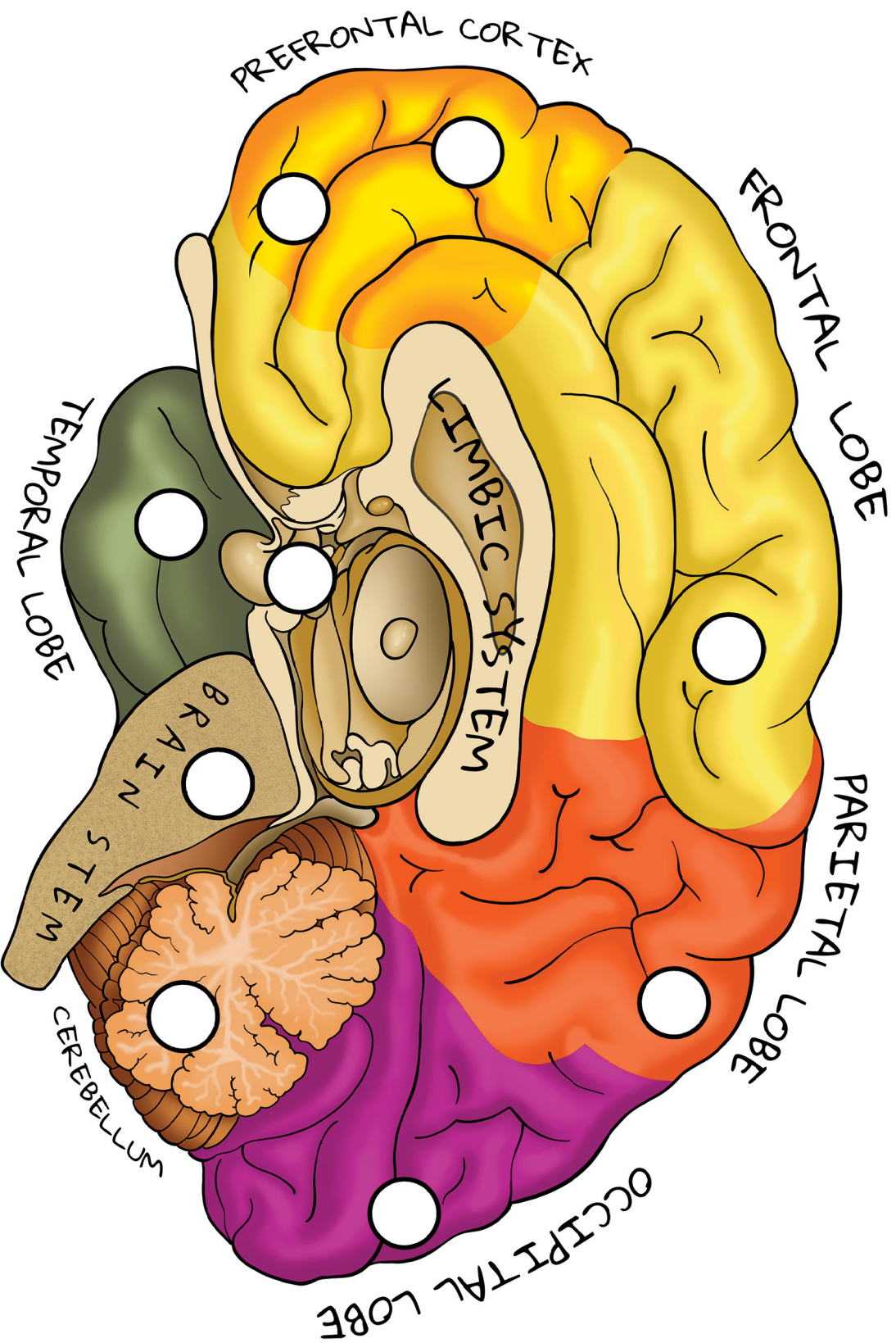
## Tokens



## Playing board

On the next page.

# BRAIN BATTLE



# Activity cards

## Stare and survive

BRAIN STEM

Do you remember playing the staring contest in school? We held our eyes open so long our eyes began to sting and water, at which point we had to give up and blink. Blinking is a part of the **corneal reflex**. When we touch the surface of our eyes, the nerve signal travels down the trigeminal nerve to the brain stem, and back through the facial nerve to the facial muscles. This initiates a blink. **Test yourself on the staring contest again!** Choose one player from each team. *The first one to blink loses.* Holding your eyelids is cheating! No materials are required for this task.

## Hold your breath

BRAIN STEM

Brain stem is located at the junction of the spinal cord and the brain. You may know that following a head injury, a doctor will shine a light in the eyes of the patient. This is to check the **pupil reflex** (where greater light intensity causes the pupil to constrict), as abnormal function may indicate damage to the brain stem. The region is also important for **maintaining consciousness, controlling the sleep-wake cycle, heartbeat, eating and breathing**. **Test your ability to hold your breath!** Inhale deeply and begin holding your breath. *The team of the player that holds their breath the longest wins.* No materials are required for this task.

## Less is more

BRAIN STEM

**Physical exercise** stimulates the formation of new brain cells and connections between them, while also preventing their degeneration. Consequently, exercise **positively affects memory and mood**. Such benefits are greater with moderate exercise, which increases our heart rate and causes heavy breathing (e.g., walking, dancing, swimming). A part of the brain responsible for increased heart rate during exercise is the brain stem, which communicates with our heart through the **sympathetic** and **parasympathetic nervous system**.

You will need a **stopwatch** for this task. All players do 50 squats as quickly as possible. Immediately after, each member measures their heart rate by pressing on their wrist. Each team adds up the heart rates of all their members into a "collective heart rate". If the two teams are not equal in number of members, calculate the average. *The team with a smaller (collective or average) heart rate wins.*

## Throw the die

MESOLIMBIC PATHWAY



Do you ever treat yourself to dinner in your favorite restaurant after a long day at work? Have you noticed feeling content and satisfied after finishing the delicious meal? The reason for this is hiding in **dopamine** molecules released in the **mesolimbic pathway** - also called the **"reward" pathway**. While dopamine motivates us to perform everyday rewarding behaviors, this characteristic can also lead to **addiction** in gambling, drugs, etc.

A simple example of the function of the mesolimbic pathway is the following task. Each team throws the **die** 10 times. *The team with the higher sum wins.* How do the winners feel as opposed to the losers? A die is required for this task.

## Free association

HIPPOCAMPUS

**Creativity** is a highly desired ability in today's world. The **frontal lobe** and the **hippocampus** are some of the many brain regions involved in creativity. Free association is also dependent on the **connections between brain regions**, allowing us to quickly produce **solutions** and **associations**.

The person reading this card chooses one of the words below and says it out loud. Any member from the opposite must then quickly think of a word they associate with it. A different member from the first team then follows up with another association to the initial word. *This continues until one player cannot think of an association, takes more than 3 seconds to think of it, or repeats a previous association.*

Example: "book" (first player - Team A) - "paper" (second player - Team B) - "tree" (third player - Team A) - "pen" (fourth player - Team B)

Words: bicycle, submarine, pigeon, injury, decoration



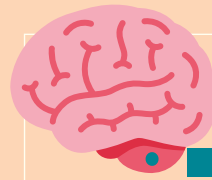
CEREBELLUM

## Balance



The cerebellum is found at the very back of the brain. It serves a range of functions, such as **maintaining balance, coordination of movement**, as well as **motor movement** (e.g., learning to play an instrument and cycling). Although it only takes up only 10% of the entire brain's volume, it contains around 50% of all neurons in the brain.

Each team chooses two contestants who perform the **yoga pose** found in **attachment Balance**. *The pair that is the first to accomplish the pose and holds the pose for 10 seconds wins.* No materials are required for this task.

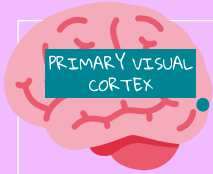


CEREBELLUM

## Walk the line

**One gram of alcohol consumed per kilogram of blood** is enough to cause slurred speech, **decreased ability to make decisions, uncoordinated movement**, and **poor balance**. It is alcohol's effect on the cerebellum that leads to such **dysfunction to our speech, cognition, and movement**. **Put your balance to the test with the following task!**

Each team forms a queue. In front of each queue, allow at least two meters of space and create a straight line on the floor (may be invisible). The first contestant in each queue **must spin around ten times** and then walk the line making small steps (heel touching toes). If their feet come off the line, they go back to the beginning, spin five more times, and attempt to walk the line again. When they successfully reach the end of the line, the next contestant in the queue can begin their turn. *The team whose members are first to complete the task wins.*

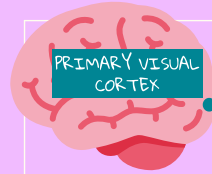


PRIMARY VISUAL CORTEX

## Visual perception

The primary visual cortex is made of more than 30 specialized areas playing important roles in visual processing. Studies on humans and animals have shown a division of these areas into **two functionally specialized pathways** that both begin in the **primary visual cortex**. The first is crucial for recognizing objects (therefore called the "what" or **ventral pathway**) while the second is important for recognizing spatial relationships between objects (and the self) in space (therefore called the "where" or **dorsal pathway**).

Choose one person in each team. In an alternating way, the pair describes random objects in the room to both teams (e.g., its round, red, big/small, etc.). Both teams guess simultaneously. The first person to correctly guess an object earns a point for their team. *The game is repeated three times - the team with more points wins.* No materials are required for this task.

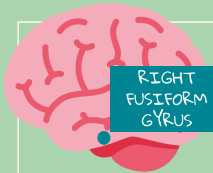


PRIMARY VISUAL CORTEX

## Spot the difference

**Visual attention** works like a spotlight - the focus of the "spotlight" or attention is processed faster and more accurately, while other areas are unattended. The sensory cells that process the area of vision that we are focusing on increase their activation and synchrony with surrounding cells. Visual attention is crucial for forming a **mental representation of the object** we are looking at. However, it may not always be enough to notice all the stimuli in our field of vision. **"Change blindness"** is a phenomenon where large changes in the environment are not noticed if those changes occur while **attention** is briefly **disabled** - such as if a picture flashes or a theatre scene changes but we don't notice that the actor has changed as well.

Have a go at testing your visual attention! In **attachment Spot the difference**, either click on the link or find the differences between the pictures given in the attachment. *The team that is the first to find all the differences wins.*



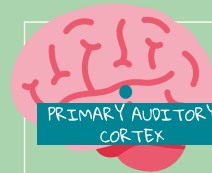
RIGHT FUSIFORM GYRUS

## Who am I?



Did you know there are people that can't recognize people's faces? This is known as **prosopagnosia** or face blindness. The brain area associated with this disorder is the **right fusiform gyrus** found in the lower part of the **temporal lobe**. Although patients cannot recognize faces, they are able to recognize individual facial features (such as mouth, nose, or eyes). They often rely on non-facial cues to identify people (e.g., voice, hair color, clothes).

There are photos of celebrities in **attachment Who am I?**. Each team writes down the names of the people in the photos. *The first team to guess all the names wins. If neither of the teams identifies everyone, the team with more correctly identified celebrities' wins.*

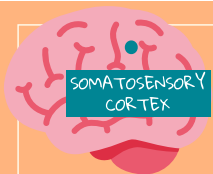


PRIMARY AUDITORY CORTEX

## Read my lips

The primary auditory cortex is found in the upper part of the **temporal lobe**. The neurons in the cortex respond to a **specific pitch**. In addition, the auditory cortex is also important in perceiving **loudness**. An interesting part of hearing is also its **overlap with other senses**. An example of this is the cocktail party effect - it's easier to understand what a person is saying if you can see their lips! Such an overlap between the two senses especially helps **dyslexic people**.

In **attachment Read my lips** you will find some random sentences. Each team chooses a player who will try to guess the sentence without hearing it. They will need earphones, headphones, or earplugs for this to work. *The team with most correctly guessed sentences in three minutes wins.* If they get stuck on a sentence, choose a different one after 30 seconds. You will need **earphones** or **earplugs** for this activity.

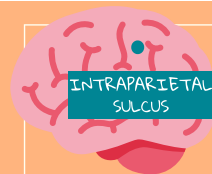


SOMATOSENSORY CORTEX

## Guess the object

Somatosensory cortex is a region in the parietal lobe responsible for processing sensory information of the whole body. Some people have difficulties **recognising objects by touch** - this is called **astereognosis**.

Each team puts ten random objects in a box or a bag. A player of the opposite team reaches into the box/bag and attempts to identify the different objects by touch only. *The team of the player who guessed more objects wins.* In **attachment Guess the object** you will find list of materials required for this task.

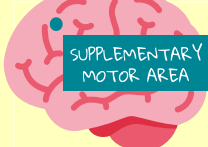


INTRAPARIETAL SULCUS

## Numbers

When a brain injury, such as a stroke, affects the parietal lobe, it can cause **acalculia** - an **inability to process numbers** and **carry out calculations**, while other cognitive abilities (e.g., reading) stay intact.

In a sudoku, each number appears only once in each column, row, and square. *Each team copies the sudoku below on a piece of paper - the team that solves it first wins.* Sudoku can be found in **attachment Numbers**.

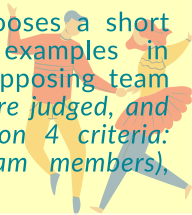


SUPPLEMENTARY MOTOR AREA

## Choreography

Did you know that learning a dance by following and imitating your dance teacher is made possible by a special type of nerve cells (neurons) called **mirror neurons**?

**See how they work!** Each team chooses a short choreography on YouTube (find examples in **attachment Choreography**) for the opposing team to learn in ten minutes. *The dances are judged, and the winning team is decided based on 4 criteria: movement coordination (between team members), difficulty, creativity, humor.*



BROCA'S AREA

## Pantomime

Did you know that it is possible to lose the ability to speak and understand speech? This is called **aphasia** and is caused by damage to the areas of the brain involved in speech, often due to stroke. One such region is **Broca's area**, which is important for **speech production**. In the game below, you will also temporarily lose your ability to speak.

Choose one person who will perform the pantomime (can be the person reading this). This person represents a patient with aphasia. Choose one of the options listed in **attachment Pantomime** and mime all three words. You have four minutes. *The team that guesses more words in this time limit wins.*

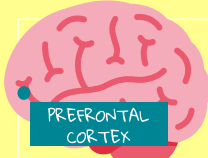


FRONTAL LOBE

## Logic thinking???

While logical thinking requires activity of the entire cerebral cortex, it largely involves areas of frontal lobe. In contrast to popular divisions to the left and right side of the brain, both halves are important for logical thinking. The firing rate of neurons can be described by different brain waves. **Beta waves** (with high frequency and small amplitude) are generally detected during the **active wake state**. They are associated with **logical thinking, concentration, and memory**. Beta waves are particularly frequently detected in those experiencing anxiety, while they are less frequent while daydreaming, in people with attention difficulties as well as depression.

Read the riddles found in **attachment Logical thinking** out loud. The team that is quicker to correctly guess the answer wins a point. *The team with a higher number of points wins.*



PREFRONTAL CORTEX

## 30 objects

Have you ever wondered why it is so easy to remember postcodes and telephone numbers? The reason for this is hiding in our **working memory**, which functions like a notebook in which we might write a postcode that we have to keep in our mind for a moment. Doing this, it allows us to hold and manipulate a small number of items for a short period of time. Typically, only **5 to 9 items** can be stored in working memory - the length of e.g., a postcode!

Put your working memory to the test: there are 30 random objects on the photo in **attachment 30 objects**. The teams have 20 seconds to remember as many objects as they can. During this time, team members must not communicate or write down the objects. After the 20 seconds, each team writes down as many objects as they can remember on a piece of paper. *The team that has remembered more items wins.*




PREFRONTAL CORTEX

## Rock, paper, scissors

Rock, paper, scissors is a popular game that involves **changes in strategy**. Such ability to change behavior is complex as it requires **working memory** and **stopping the previous response**. Rules and goals need to be held in working memory while the previous behavior/response is inhibited, and a new one chosen. An important part of changing strategies is also **using feedback from the environment** (e.g., opponent's responses in rock, paper, scissors) as well as **monitoring one's process of choosing a new strategy** - also known as **metacognition**.

**Play a tournament!** Choose a random player from each team - the pair plays a game of rock, paper, scissors. The winner then plays against another member of the opposite (currently losing) team. *The tournament continues in this way until the last pair has finished the game.* Find a model of the tournament in **attachment Rock, paper, scissors**.



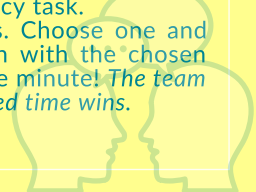
LEFT PREFRONTAL LOBE

## Verbal fluency

The **left hemisphere** of the brain is generally considered to be the dominant one for **language processing**. On average, women tend to perform better on verbal skills than men, while the opposite is true for **spatial orientation**. Sex hormones provide one reason for such differences in performance. Put your left prefrontal cortex to the test with this verbal fluency task.

Below you can find a string of letters. Choose one and write down as many words that begin with the chosen letter as you can think of. You have one minute! *The team that writes down more words in the limited time wins.*

Letters: K, C, G, S



PREFRONTAL CORTEX

## Cognitive flexibility

Cognitive flexibility is the **ability to switch between thinking** about different concepts and ideas. It is important for **reading, creativity, as well as mental health**. For example, in stressful situations, finding alternative solutions and thinking patterns is crucial for coping with difficulties and maintaining resilience.

Below you can find a string of words. Choose one and write down as many possible uses of the object. You have one minute! *The team that writes down more ways of using the object wins.*

Pen, Necklace, Book, Brick



# Task specific materials

## Balance



Picture of a yoga position

## Spot the difference

Picture for spotting differences:

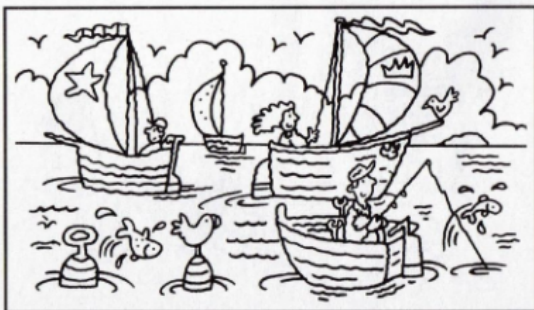
The following link takes you to an online game of spotting the difference between two pictures:

[https://www.digipuzzle.net/minigames/findthedifferences/animals.htm?](https://www.digipuzzle.net/minigames/findthedifferences/animals.htm?language=slovenian&linkback=../../education/games/index.htm)

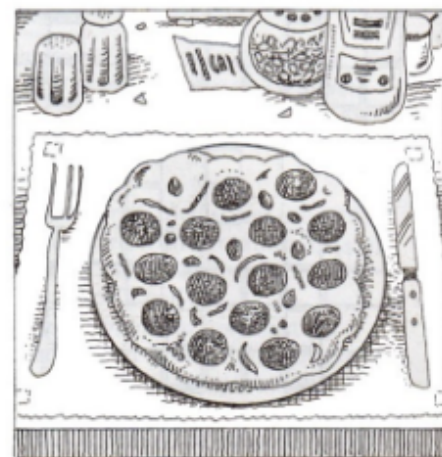
[language=slovenian&linkback=../../education/games/index.htm](https://www.digipuzzle.net/minigames/findthedifferences/animals.htm?language=slovenian&linkback=../../education/games/index.htm)

If you do not have internet access use one of the pictures below.

Find ten differences.



Find eight differences.



## Who am I?



## Read my lips

For this task you will need:

- Earphones/headphones/earplugs (that isolate noises from surroundings)
- List of sentences:

It's getting dark outside.  
Tomorrow is too late.  
The brain is one big mystery.  
I like your eyes.  
Hearing is an important sense.

One plus one is three.  
Oranges are juicy and sweet.  
Three thousand eight hundred and seventy-five  
Can I have some coffee?  
He reads five books per day.

## Guess the object

For this task you will need:

- Solid bag or box
- ten random items (little to medium size)
- Eye mask (not obligatory)

## Numbers

			<b>1</b>
<b>3</b>			
			<b>3</b>
<b>4</b>			

## Choreography

For this task you will need:

- internet connection with access to YouTube
- list of videos:
  - <https://youtu.be/YCDCwuGcEmA>
  - <https://youtu.be/-qJ0c1Frbko>
  - <https://youtu.be/Bc9BUXivkmE>
  - <https://youtu.be/9LU17JS9r9c>
  - <https://youtu.be/UQr79y06poU>
- assessing table:

	Team 1	Team 2
Movement coordination (1-10)		
Complexness of choreography (1-10)		
Originality (1-5)		
Humor (1-5)		
Points (/30):		

# Pantomime

List of words (choose one set – you can also adapt the words if needed):

a) laxative, surgeon, bingo

b) glasses turned upside down, pearls, popcorn.

# Logical thinking

Logical riddles:

a) To protect his country from enemies, the king decided to build a wall around the country. The height of the wall will be five meters, width three meters and length 500 km. If one cubic meter weights around 3000 kg, by how much will the Earth's weight increase when the wall is built?

b) I'm looking at a person on a photo. Who am I looking at, if I don't have any brothers or sisters, and the father of the person on the photo is the son of my father?

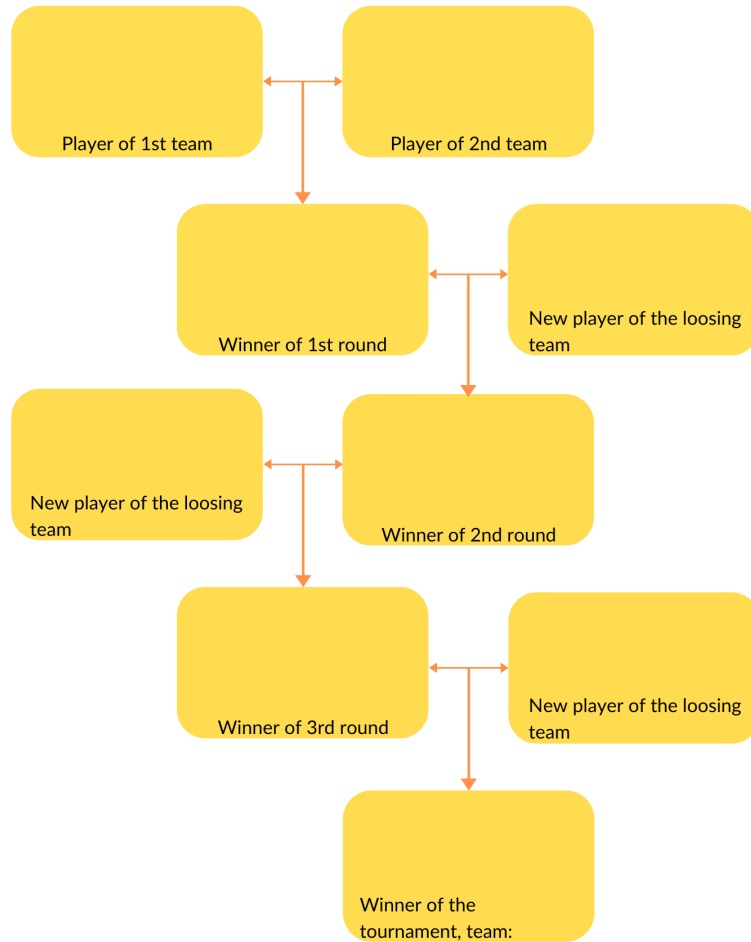
c) A man built a rectangle-shaped house. All outside walls of the house are facing south. A bear walks past the house. What color is the bear?

Correct answers: a) Zero b) My son c) White



# Rock, paper, scissors

Tournament guide:





## For the curious

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