Peace Magic Grid

unplugged QUEST

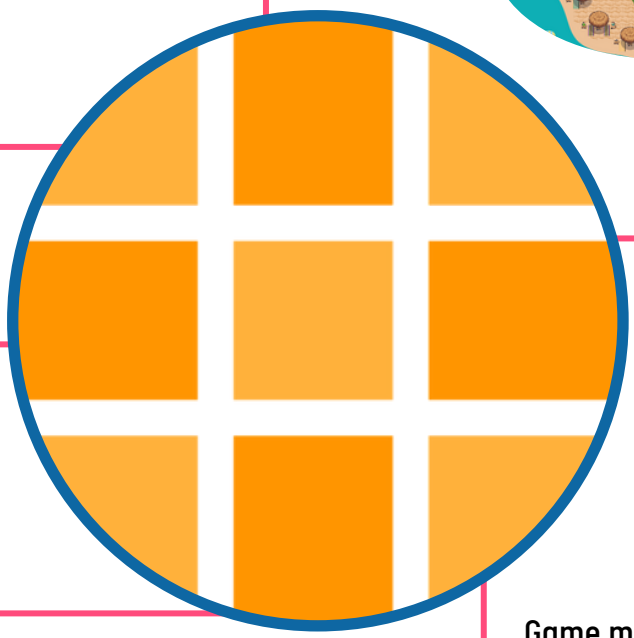
Through the activity "Peace Magic Grid" you can introduce the concept of parity to detect and correct errors using "error correcting code". This activity introduces methods of detecting and correcting errors in data and links them to computer practices. Indeed, information circulating in the digital world can be false and data transmitted over networks can be altered. In parallel, the messages of the challenge will open up discussions and lead to reflection on aspects of citizenship. Topics such as poverty, environmental protection, equality, non-discrimination, etc. will be addressed.

Territory 1 - The Peaceful Island

Printable resources attached: printable grids

Additional materials needed: paper, scissors, coloured paper for cutting squares

Total duration: 60 min.



Inspired by: CS Unplugged

CS UNPLUGGED
Computer Science without a computer

Linked SDGs

Learning objectives

- Reasoning
- Acquiring tools and methods
- Adopting ethical and responsible behaviour
- Being informed in the digital world, mobilising digital tools
- Acquiring a moral awareness

Game modalities

- 6 - 12 years old
- In the classroom
- Reading perfectly
- At home

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Pedagogical interest and topics targeted

Introduction to the game idea: data transmission and parity check principle. Digital tools and devices are based on coding information. Very often errors can occur when digital information is stored or transmitted. Circulating information in the digital world can be false and data being transmitted over networks can be messed up. This activity explores how to detect and correct errors in data and information transmission, and link them with computational practices.

Misinformation in the modern world: By definition, misinformation means "incorrect or misleading information or elsewhere false information that is spread, regardless of intent to mislead". Misinformation could be due to the human factor or computer/machine factors. It could lead to forming opinions and acting on the basis of distorted information which may have different degrees of negative effects. To protect as much as possible from the event of misinformation, programming data detection algorithms are being created and applied. If there wasn't error detection and correction then unexpected errors in data would be common, and digital devices wouldn't be used to store anything important. Computers wouldn't be reliable. Transmitting data over long distances (e.g. from space probes) would be particularly unreliable, since it can take minutes, or even days, for data to arrive, and it's not feasible to request it to be retransmitted if it has had interference.

Enhancing computing & reasoning skills, misinformation and information flow: In the first place, the challenge allows the children to understand how different computational devices, digital tools and applications work to ensure information is trustworthy. It may apply to automatic troubleshooting for computers, music plates, storing information in databases, backup, etc. This would lead to a discussion of the importance of avoiding misinformation and how it may harm the modern world. The main aspects of digital information transmission may be outlined in class.

Students' **critical thinking** is enhanced by demonstrating how to describe a problem, identify the important details for solving the problem, and break it down into small, logical steps so that they can then create a process which solves the problem, and evaluate this process. These skills are transferable to any other curriculum area but are particularly relevant to developing digital systems and solving problems using the capabilities of computers. Each pattern in the parity check can be transformed into binary information. In particular, the squares in the grid represent bits (binary digits).

Moreover, general concepts of **mathematics and logic** (odd and even numbers i.e. parity) are confirmed.

Open discussion on citizenship, sustainability, and SDGs: All the activities proposed in the Unplugged quests have been developed to enable teachers to open discussions on societal questions in the classroom. In the case of the "**Peace Magic Grid**", we would like to propose you use the grids for correcting messages, sentences and words related to the modern world challenges such as poverty, climate, insufficient resources, pollution, equality, human rights, etc. By solving their own grids, students will become familiar with famous quotes which will make them reflect on the different world today's problems. They can discuss these in class or at-home about these challenges, their core causative agents, what is currently done to address them and what students can do to contribute to solving them.

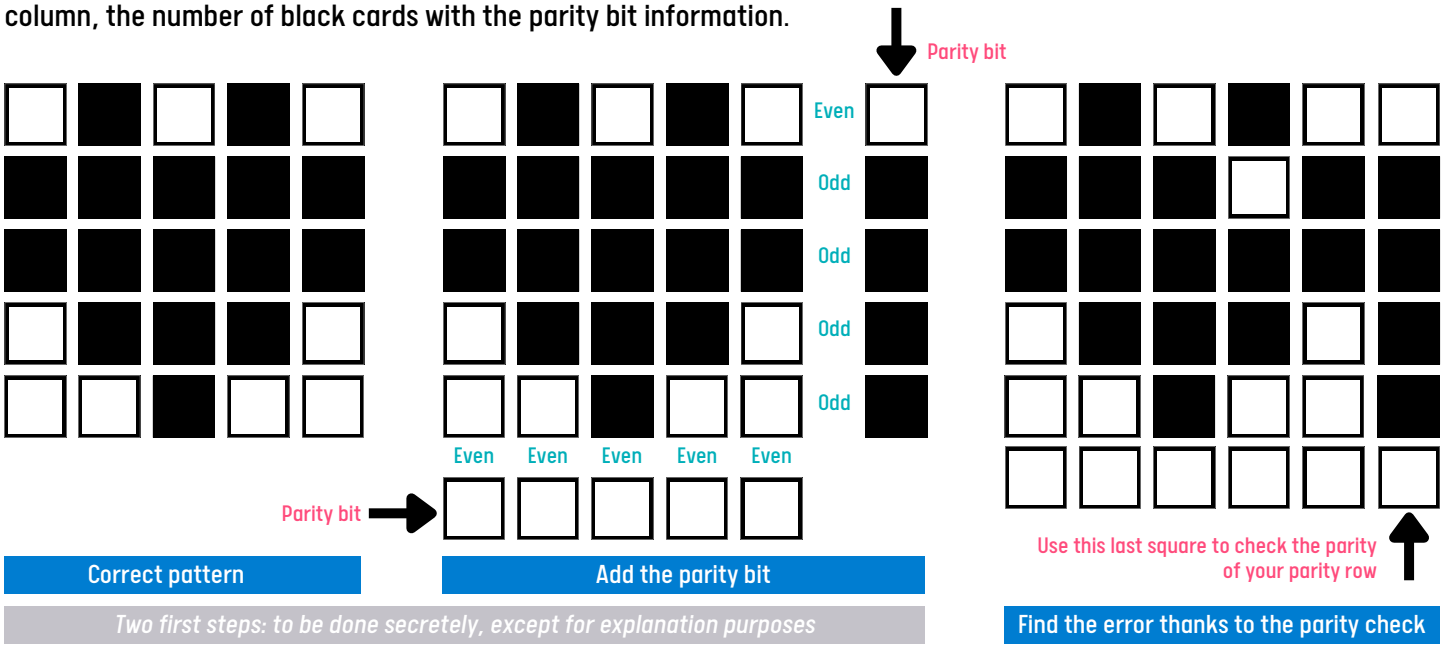
Game rules

Game narrative. The parity check activity serves for children to approach key questions on computing:

- Why is it important for computers to be able to detect if the data received is the same as the data sent?
- What if I sent you an email that said you could now have Monday off school, but when you received it, there was some electrical interference and a bit was changed from off to on so that the word "now" became "not". What would your reaction be?
- Can computers correct these sorts of mistakes automatically, and how would they do that?

To be able to understand how to detect and correct errors, we use the **parity check**. By definition of Technopedia, a parity check is: "the process that ensures accurate data transmission between nodes during communication. A parity bit is appended to the original data bits to create an even or odd bit number". In our unplugged quest version, we have decided to make children detect errors in key messages and to open discussion on additional topics if the teachers want.

Game rules: To understand error detection, we will use grids drawn on any material you want - on a whiteboard, on paper, or printed thanks to the material given in the printables section. **Grids are composed of white squares** (being filled in with letters in our case but you can also put numbers, images, or left them blank), on which **the teachers or the pupils themselves can draw a pattern, using black cards** (colouring directly on the whiteboard in black, cutting small pieces of coloured paper, using magnets ...). In our case, the black cards are used to **display a sentence among a grid of letters** or you can also use them to perform pixel art for instance. Once the pattern composed of the black cards will be defined, the person in charge of designing the grid will **secretly add one last column and one last line acting as our parity bit to each row and column.** If you have an **odd number of black cards** in a row, you add **another black card to the row in the parity bit** column; if you have an **even number of black cards** in the row, **left the parity bit column in white**, to keep it as an even number. **Perform the same work column per column** and put this information in the **final parity bit row**. Once this work is done, still in secret, within the patterns, **introduce an error** (either adding or removing a black card) to the grid without changing the parity bit. The game starts here, up to your pupils to find back, performing a parity check, **which card has been moved, added or removed to reveal the correct information by comparing, row by row and column by column, the number of black cards with the parity bit information.**



Game rules

<u>Game settings options in the framework of the Unplugged Quest</u>:

- **Option 1.** Every group / individual player discovers **one word of the message** and then **the whole class come together and arranges the message in the correct order**. This already warms them up for contemplating the societal challenge, posed by the message. The teacher guides the process of **finding the right word order**, mitigating the discussions and giving directions. **Once the message is discovered the teacher starts an open discussion, providing students with some important information on the topic.**

- **Option 2.** Every group / individual player discovers **one full message**. The messages are **interrelated** and disclose different aspects of a modern challenge. The class gathers together and **presents the messages they have found**. Each group **interprets the message they have and then the whole class tries to make the connections** between the problems. **The teacher moderates the whole process** by giving **guiding questions** and **explaining general aspects** of the problem.

<u>Playing the game in the classroom step by step:</u>

- In the full classroom, the teacher explains **how parity check works** on a **simple grid display on the whiteboard** and explains **how work the parity bit column and row**. The teacher can use a grid with one word, or the pattern grid given above. Teachers can also follow the steps presented in the **CS Unplugged activity** as an introduction (available here: https://www.csunplugged.org/en/topics/error-detection-and-correction/unit-plan/parity-magic/)
- The teacher describes in a nutshell general aspects of the information transmission and why error detecting is important and helpful in verifying given information.
- Once the logic behind parity check is well understood by students, the teacher splits the class **into small groups of 2/3 pupils or individually.**
- The teacher distributes **pre-prepared mistaken grids**.
- In groups (or individually), students in their role of reporters **find and correct the error in the grids they are provided**.
- Once the information is discovered, the whole classroom gets back together to **present their word/message**.
- Students discuss the **strategies** used to achieve the results. This way, **self-reflection and metacognition** are promoted and strategies that can be applied to other contexts are evidenced.
- **The teacher starts and moderates an open discussion on the topic of the hidden message(s).**

<u>Role of the teacher and game organisation</u>:

- The teacher explains the principles behind parity check on a simple grid (adding a row and a column with the parity information).
- The teacher describes the principles of information transmission and error detection and its application in modern world.
- The teacher supports the process of error correction in the groups (or individually).
- The teacher receives the groups'(the individuals') grids and moderates their presentations in class.
- The teacher provides general information on the topic of the discovered message(s) and moderates open discussions

Game rounds

Phase 1 - Explain how the correction code works

Initially, the game can be played with simple grids (containing up to 5-6 rows and columns) displaying one word to be discovered by each group/individual (depending on the conditions under which the game is played - in class or at home). **The grids contain only one error as it is not possible, using the detector code, to detect multiple errors with certainty. Do not try to create multiple error grids. If you want to increase the complexity of the task, such as with a word to be recomposed, you should create several small grids.**

In the whole class, the teacher explains how the parity check works on a simple grid on the whiteboard and explains how the parity bit works in columns and rows. The teacher can use a single word grid, or the patterned grid given above. Teachers can also follow the steps presented in the CS Unplugged activity as an introduction (available here: https://www.csunplugged.org/en/topics/error-detection-and-correction/unit-plan/parity-magic/).

The teacher describes in a few words the general aspects of information transmission and explains why error detection is important and useful for checking the given information.

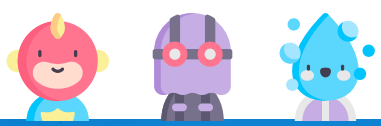
Phase 2 - Starting to correct simple grids

Once they understand the logic of the game, the players focus their attention on finding the hidden word. If the game is played with children under the age of 7-8, they may not have a full grasp of the letters and the teacher may need to help them identify the letters and the word itself. For younger children, patterns or drawings are preferable.

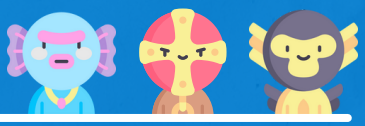
The teacher divides the class into small groups of 2/3 pupils or individually. The teacher distributes error grids prepared in advance. In groups (or individually), the pupils, in their role as reporters, find and correct the error in the grids provided to them.

Phase 3 - Gather and discuss

Once the information has been discovered, the whole class meets to present their word/message.
Pupils discuss the strategies used to obtain the results. In this way, self-reflection and metacognition are encouraged and strategies that can be applied to other contexts are highlighted.
The teacher initiates and facilitates an open discussion on the topic of the hidden message(s).



Going further



Topic 1 - Parity Check

- Definition of a parity check by Technopedia: https://www.techopedia.com/definition/1803/parity-check
- A comprehensive approach to explaining parity check to children in a playful way could be found on the CSUNPLUGGED webpage, the Parity Magic game here: https://www.csunplugged.org/en/topics/error-detection-and-correction/unit-plan/parity-magic/
- Odd and even numbers, parity bit for kids: https://www.youtube.com/watch?v=2bl4E3Zbzdk
- Parity bit and binary numbers: https://www.mathsisfun.com/definitions/parity-bit.html#google_vignette

Topic 2 - Misinformation & Fake News

- You may wish to refer to other Unplugged quests, e.g. ***The Perfect City, Clay and Sculpture***
- Read more about misinformation and the importance to teach children to identify it from UNICEF: https://www.unicef.org/globalinsight/stories/digital-misinformation-disinformation-and-children
    - Further materials about how to teach children about fake news: https://www.bbc.co.uk/bitesize/articles/zmvdd6f
    - https://www.bbc.co.uk/bitesize/articles/zmvdd6f; https://www.nationalgeographic.com/family/article/teaching-kids-about-fake-news-and-photos; https://www.theschoolrun.com/teaching-kids-fake-news

Topic 3 - Societal Challenges

- You may wish to refer to other Unplugged quests, e.g. ***Good Ways, Cookies and Peace, Pop-up City of the Future, Plastic Continent, Farm in the City, etc***
- Teaching children about citizenship & human rights in lessons and games: https://www.icivics.org/teachers
- Teaching children about poverty: https://www.compassion.com.au/blog/how-to-teach-children-about-poverty

Topic 4 - Environmental Challenges

- You may wish to refer to other Unplugged quests, e.g. ***Pop-up City of the Future, Plastic Continent, Farm in the City***.
- Teaching children about environment in theory and experiments: https://www.kindergarten-lessons.com/environmental_education_for_kids/
- Facts about the environment for children: http://gogreencyclopedia.blogspot.com/2013/09/50-facts-about-your-environment-for-kids.html

Printables

Teachers may choose between different sets of materials to perform this game. Below are presented several starting from least costly to more advanced.

Simple set of materials:

- White board with magnet black squares / luminated black squares with double-sided tape
- Printed paper grids (to print from current suggestions or produce your own);
- Printed black (or different color/picture/etc.) squares with the same size as the squares on the grid;
- *Optional:* tape or double sided tape to stick better the black squares.

***Light instructions**: Choose or prepare a grid with a message / word and then print it out in as many copies as the groups/players are. Prepare/cut enough black squares to cover all necessary squares in all grids. Use the white board and sticky squares or magnets to demonstrate first the parity check principle.*

DIY set of materials:

- White board with magnet black squares / luminated black squares with double-sided tape
- Printed and luminated grids (to print from current suggestions or produce your own);
- Luminated and printed black (or different color/picture/etc.) squares with the same size as the squares on the grid;
- *Optional:* tape or double sided tape to stick better the black squares.

***Light instructions**: Choose or prepare a grid with a message / word and then print it out in as many copies as the groups/players are. Prepare/cut enough black squares to cover all necessary squares in all grids. Luminate them all. Use the white board and sticky squares or magnets to demonstrate first the parity check principle.*

Advanced DIY set of materials:

- *Optional:* White board with magnet black squares / luminated black squares with double-sided tape
- Wooden preset grids (to produce from current suggestions or your own) with a net of squares (see picture below);
- Cut wooden black (or different color/picture/etc.) squares with the same size as the squares on the grid;
- *Optional:* Printed different grids with the size of the wooden one to stuck between the wooden piece and net that compose the wooden grid.

***Light instructions**: Choose or prepare a grid with a message / word and then print it out in as many copies as the groups/players are. In a fablab / maker space prepare / cut with a laser wooden pieces to be covered by wooden net with empty squares. Use the spare squares from the net to cover where necessary for the game. Use the white board and sticky squares or magnets to demonstrate first the parity check principle. Contact the project if you wish to get some boards.*

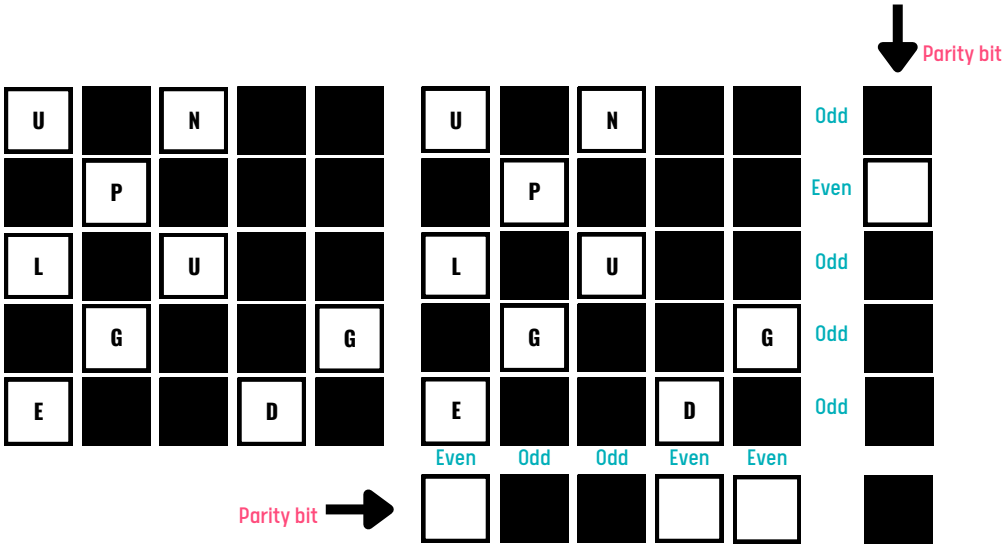
Examples of grids

Example 1: UNPLUGGED

Discussion points: The digital age, unplugged activities

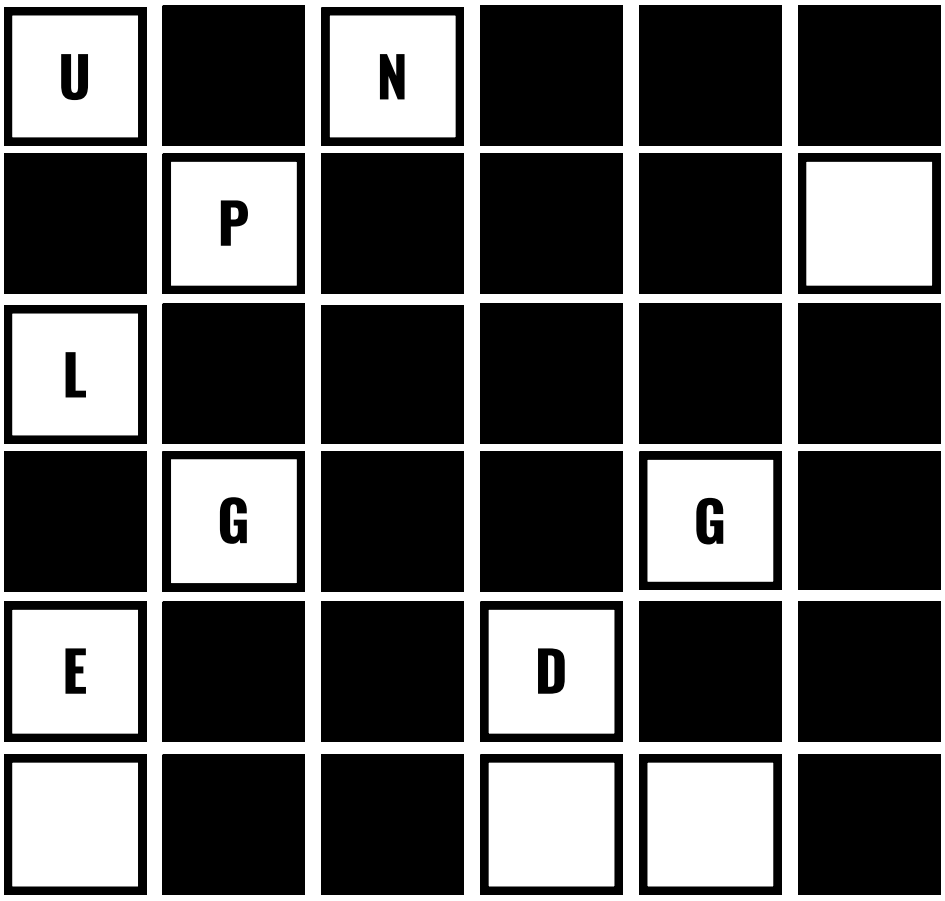
Correct model | **Add parity bit**

First two steps: to be done discreetly, except for the purpose of explanation



Introduction of the error - Student Grid

Cover the U with a black cover



Examples of grids

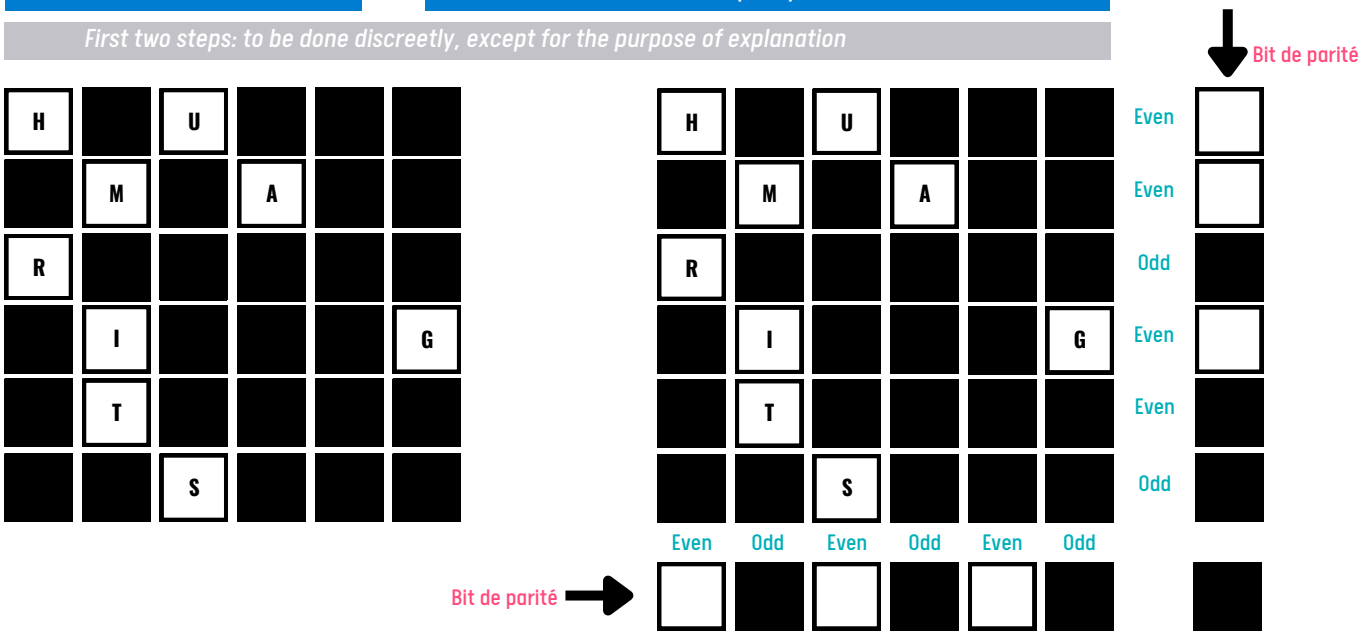
Example 2: Human rights

Discussion points: peace, diversity, equity, equality

Correct model

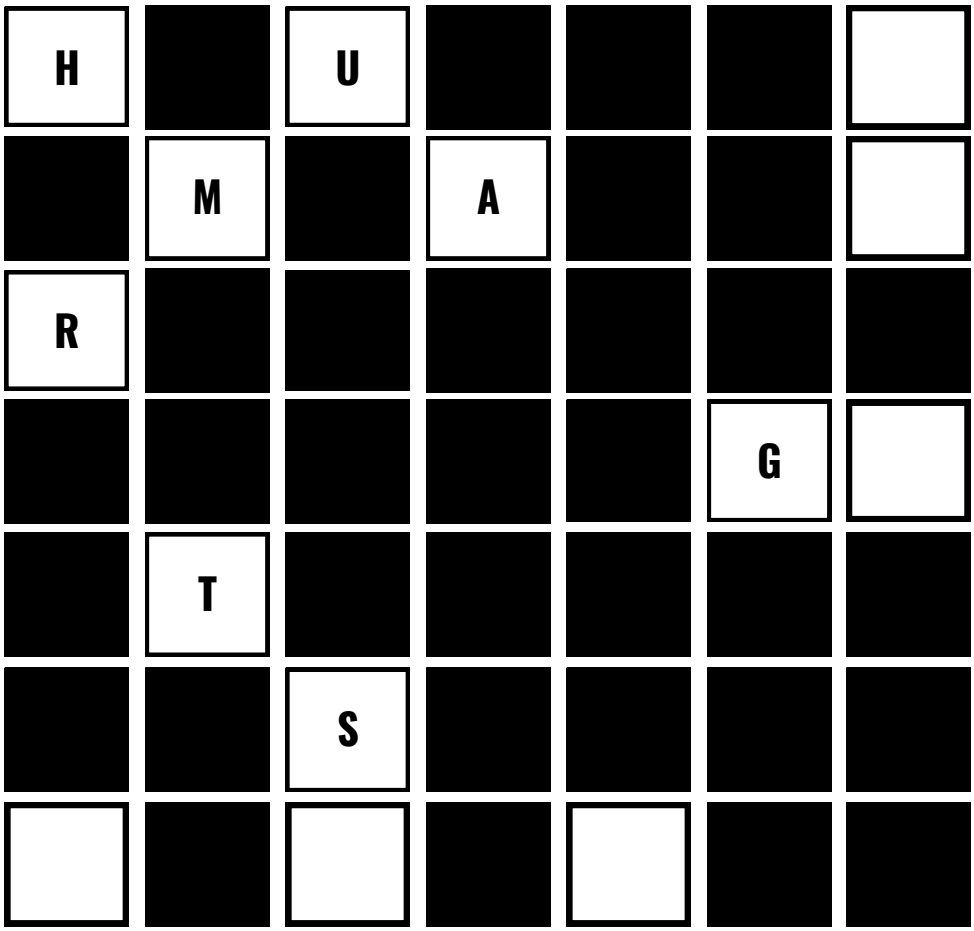
Add parity bit

First two steps: to be done discreetly, except for the purpose of explanation



Introduction de l'erreur - Grille élève

Cover the I with a black cover



Examples of grids

Example 3 - Correct these five grids with errors and find the correct word (the correct word to find is Peace written in pixel letters). Font source: https://fontmeme.com/polices/police-5x5-dots/