RESOURCE

Climate Change and Critical Thinking

This resource is a professional development activity on the theme of critical thinking, based on examples in the field of climate change. It is primarily aimed at teacher trainers and uses a card game to develop critical thinking skills about climate change information. It is also possible to engage students aged 15 to 18.

OVERVIEW

Using an escape-game-themed card game, participants seek to correctly match fallacious statements about climate change with the scientific arguments that counter them. In doing so, they realize the biases present in these fallacious arguments and the sometimes challenging task of addressing them. Participants then explore various disinformation strategies and discuss the possibilities for addressing this topic in the classroom. This game is greatly inspired by the game «Unfake»: a French card game created by Guillaume Berthelot, a science teacher in a French middle school, for his students.

This workshop uses a serious game, which can sometimes cause the playful aspect to overshadow the scientific content. The cognitive effort required to participate in the game and the urgency to finish on time can limit the acquisition of new knowledge. Therefore, it is absolutely essential to follow the game with a debriefing session; without it, participants may remember only the playful aspect of the experience and not the scientific content. This debriefing phase is crucial for gaining perspective and is explained on page 10**.**

Summary

— If you are not familiar with the concept of a serious game, you can watch the video «The differences between serious games, gamification and game-based learning» by Grendel Games**.**

Resource for Teacher Training
Teachers with students aged 9 to 18 years
Students aged 15 to 18 years

Duration: 3 hours

Subjects
Natural sciences, social sciences, philosophy, media and information education, citizenship education, environmental education

Pedagogical Approach
Serious game

United Nations Educational, Scientific and Cultural Organization

Office for Climate Education
UNDER THE AUSPICES OF UNESCO AND THE FOUNDATION LA MAIN À LA PÂTE

Information on the resources developed by the OCE is available at oce.global.

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RESOURCE TYPE
Professional development resource

PUBLIC
Teachers with students aged 9 to 18 years
Students aged 15 to 18 years

DURATION
3 hours

SUBJECTS
Natural sciences, social sciences, philosophy, media and information education, citizenship education, environmental education

KEYWORDS
Critical thinking, fake news, disinformation, bias, scientific method, climate skeptics, scientific consensus, gamification in education, inoculation strategy

PEDAGOGICAL APPROACH
Serious game

KNOWLEDGE GOALS

— Identify and explain some biases used in climate-skeptic discourse
— Understand the principles of the scientific method, which account for its robustness
— Discover the level of scientific consensus regarding climate change

SKILL GOALS

— Develop critical thinking skills
— Know how to counter some fallacious arguments
— Collaborate to solve puzzles
— Implement an inoculation strategy in teaching
— Become familiar with the basics of educational gamification

REQUIRED MATERIAL

FOR GROUPS OF UP TO 5 PEOPLE:

— A set of 72 cards, arranged in ascending order according to the numbers on the back, with the smallest at the top of the deck. The Z card, being the only one not identified by a number, is placed on top. (downloadable here)
— A copy of the "rule guide" file (can be laminated for reuse): Appendix 2
— Access to the animation (online or downloadable here): on a tablet, smartphone, or computer

PER PERSON

— A copy of the "summary sheet": Appendix 1

WORKSHOP PROCEDURE

- 5 min – Welcome and Introduction
- 25 min – Presentation of the Rules
- 1h30 (Maximum) – Game Phase
- 10 min – Break
- 1h – Scientific Briefing and Questions

Scan the QR Code to access the application «Climate-Conspiracy»

PART 1

Introduction of the Game

- **DISCUSSION WITH PARTICIPANTS: EVALUATING THEIR EXPERIENCE**

This phase engages all participants in a group discussion. The trainer begins by asking teachers if they have encountered instances where students presented them with misinformation regarding climate change, and if so, the challenges they faced. This can lead to a discussion about certain arguments that are sometimes difficult to refute. These arguments may be related to climate change or other topics such as evolution, vaccination, or any other subject that may give rise to conspiracy theories.

- **PRESENTATION OF THE GAME PRINCIPLE**

This workshop uses a serious game as an educational tool to encourage participant engagement and foster meaningful exchanges. The trainer explains that the objective of the training will be to develop scientific arguments to counter certain fallacious statements, presented in the form of a collaborative escape game. The scenario is as follows: Your uncle is organizing a climate-skeptic conference aiming to disprove the existence of climate change. You will have 1 hour and 30 minutes to search your uncle's office, using the cards as aids. Your mission: Debunk all the fallacious statements one by one to obtain the code for your uncle's DEZOOM video session and stop the conference.

Scan the QR Code to access the application «Climate-Conspiracy»

- **GAME ELEMENTS**

The game is played in groups of 4 to 5 people. Each group receives a pack of 72 double-sided cards, pre-printed and a computer or tablet with the "Climato-Conspiracy" application, all available on the OCE's website, as well as a guide to the different types of cards (**Appendix 2**).

Participants will need paper and pencils for certain puzzles.

- **EXPLANATION OF THE RULES**

THE PROCESS

- All cards are placed **face down** in the center of the table.

- Cards should only be consulted when **explicitly requested** (because a puzzle has led to this, or because its number appears).

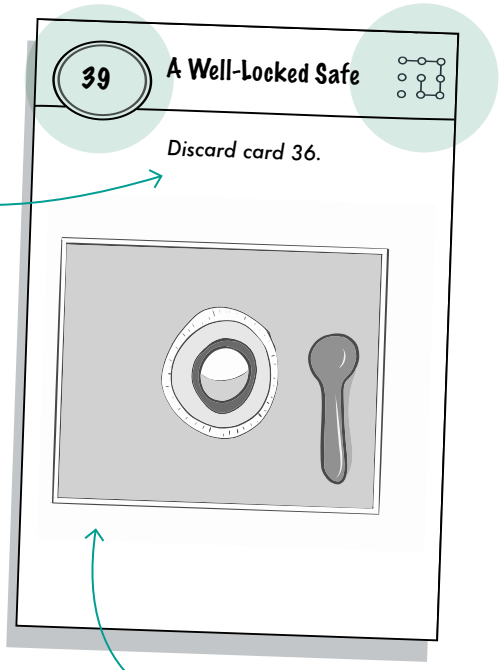
- This game is **collaborative**, so team members must communicate to solve the puzzles.

- "Game Over": The only way to lose this game is to reach **the end of the countdown without having gathered and correctly matched all the scientific and fallacious arguments**.

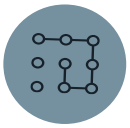
- It is strongly recommended to have a way for participants to **take notes** during the game.

THE ANATOMY OF A CARD

Some cards indicate an immediate **action** to be taken.



Each card is identified by a **number**. You should only look at a card if you have been explicitly invited to retrieve it from the deck!



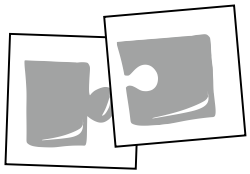
Some cards are of a specific type, indicated by a **pictogram**.

Each card is used only once! If you are stuck, do not hesitate to ask for a **clue** to help solve the puzzle of the card in question via the application.

Image for finding clues, orientation, visualizing actions, documents, etc.

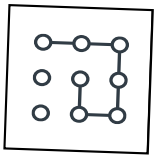
CARD TYPES

Show and explain the rule guide with the different pictograms (**Appendix 2**), which will be distributed during the game phase.



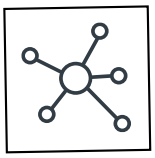
OBJECTS

Interact with other objects by combining them (adding the numbers to find the new card to draw)



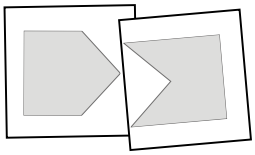
CODES

Card **number** in the **"Unlock" section** of the application to enter the code



INTERACTIONS

Card number in the **"Interaction" section** of the application to access the content



ARGUMENTS

Fallacious statement and scientific argument cards to be correctly matched

ERROR

Wrong Combination
> You lose a minute!

Discard the cards when specified.

THE APPLICATION

Present **the function of each button** on the application that will be used by the participants during the game.

CODE

Click on this button when a card is locked and you have obtained the code to unlock it.

INTERACTION

Click on this button when a card with this pictogram appears, to access its multimedia content.

PENALTY

Click here if you encounter an **error card**!

HINT

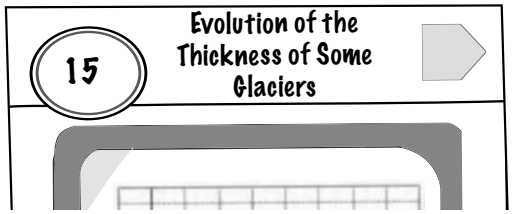
This button gives you access to hints if you are stuck. This does not result in a penalty.

FINAL CODE

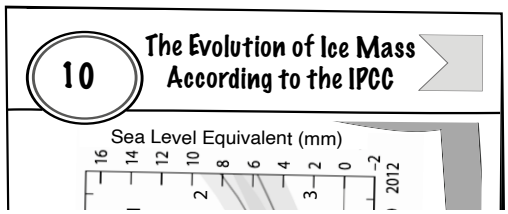
Click this button once all arguments and counterarguments have been found and correctly matched, to enter the final code and stop the video conference! Be careful, a mistake will result in a penalty!

THE FINAL OBJECTIVE

The final objective is to gather and correctly match the 5 fallacious statements with the 5 scientific counterarguments. These statements are discovered throughout the game and must be set aside for reference to at the end.



5 Fallacious Statements



5 Scientific Arguments

When a match is made, add the numbers of both cards and draw the card with the resulting total.

The **"final code"** button allows you to enter the obtained code at the end of the game.

The other cards have no specific role.

SCIENTIFIC INSIGHTS

WHAT ARE THE BENEFITS OF PLAYING IN CLASS AND IN TRAINING?

Integrating games into a learning framework embeds disciplinary concepts within a playful context, appealing to those who might be put off by a traditional classroom setting, and also allows for diversifying learning methods. Additionally, this approach often leads to increased motivation, driven by the desire to win (competition). Moreover, games provides learners with the opportunity to experiment and make mistakes without fear of failure, while also encouraging peer interactions.

Escape games or escape rooms have characteristics that make them particularly immersive, making them extremely engaging learning tools. Five key features can be identified[1]:

Escape: In a virtual setting, as in our example, the idea of escaping something presents both a challenge and a goal.

Urgency: The game is time-bound, with time being the players' main adversary.

Puzzles: Puzzles form the core of an escape game, featuring varying levels of difficulty and offering a sense of accomplishment when a puzzle is solved (advancing progress in the game).

Teamwork: An escape game cultivates skills such as collaboration and cooperation, as players may not all possess the same information or thought processes.

Education: In an educational game, there is a constant balance between the gaming and non-gaming elements. The game provides immersive experiences, while the non-gaming aspects involve integrated disciplinary or cross-disciplinary concepts. This dynamic necessitates a debriefing phase, as the playful immersion often shifts the focus away from the discussed concepts.

These five characteristics, which are found in the game "Climate-Conspiracy," are integral to any educational escape game.

[1] «S'capade pédagogique avec les jeux d'évasion», Mélanie Fenaert, Patrice Nadam, Anne Petit, Ellipses 2019

PART 2

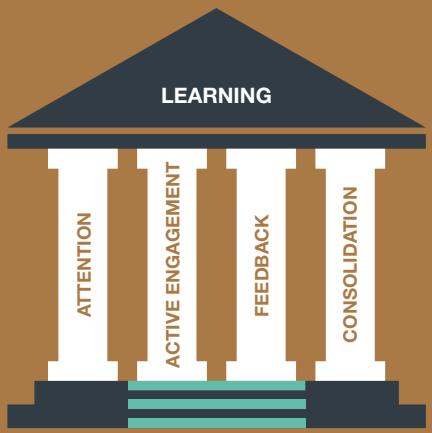
Game Phase

After ensuring that everyone understands the rules, the trainer asks the participants to form teams of up to 5 people (with a minimum of 3). Each team receives a pack of cards, a rule guide, and access to the application.

Participants will play independently throughout the game but can seek assistance from the trainer, who circulates among the teams, if they find themselves truly stuck. It is **essential that the trainer be well-acquainted with the game, or at least have the sheets summarizing all the puzzles and their solutions printed out and on hand**.

However, the trainer's role is not to provide the solutions to the puzzles but to guide the reflection, for example, by emphasizing certain cards for detailed examination. The trainer also monitors the timers to track the progress of the different teams.

ⓘ It should be noted that we have set the timer for 1 hour and 30 minutes, but in the vast majority of cases, participants manage to finish the game in 1 hour.



The 4 Pillars of Learning
According to Neuroscience

SCIENTIFIC INSIGHTS
ESCAPE GAMES AND THE PILLARS OF LEARNING

According to Stanislas Dehaene[2], «*cognitive sciences have identified four main factors for successful learning: attention, active engagement, feedback, and finally, consolidation.* ». This is illustrated in the diagram to the left.

Escape games address these four pillars effectively. As you will notice during this activity, they require particularly strong engagement and sustained attention throughout the game. Feedback is provided immediately after solving a puzzle (or failing to solve a puzzle) through clear messages. The consolidation phase occurs during the debriefing stage, which is the most important step.

[2] «Apprendre ! Les talents du cerveau, le défi des machines», Stanislas Dehaene, Odile Jacob 2018

PART 3

Debriefing Phase

Once the game is over, the trainer asks the participants to keep in front of them the game cards depicting the fallacious arguments and their associated scientific counterarguments. These cards will serve as the basis for the debriefing.

- **FEELINGS DISCUSSION (MAXIMUM 5 MINUTES!)**

The exchange begins with a discussion of emotions. The trainer asks participants to share how they felt while playing the game and to highlight moments they found more challenging. This stage should be brief but is nonetheless crucial.

- **TEACHING PHASE: REVIEWING THE PUZZLES (5 MINUTES)**

In this phase, the trainer revisits the associations between the fallacious arguments and the scientific data that counter them. Participants are asked to discuss the arguments that were paired together, explain why these arguments are fallacious, and reflect on any elements that may present challenges (for example, if they anticipate students struggling to refute an argument).

The trainer distributes the summary sheets categorizing biases for each argument (**Appendix 1**).

Below are the cognitive biases employed by the fallacious arguments introduced in the game.

SELECTION BIAS

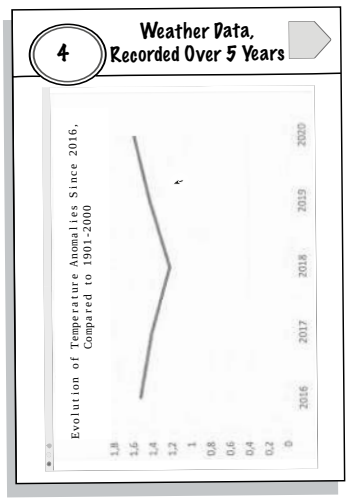
Only a part of the information is chosen and highlighted to **reinforce** the argument, including:

- Temporal Selection
- Spatial Selection

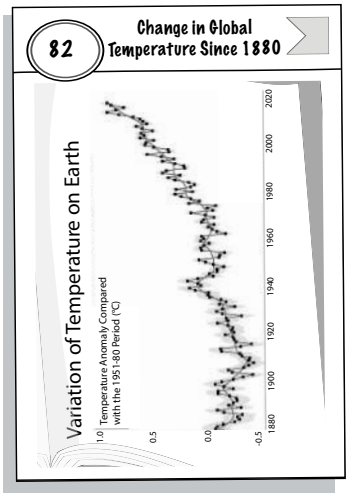
Information that does not align with the desired conclusion is subsequently ignored.

Example:

The recorded weather data over 5 years indicates a relatively stable temperature. However, when considering global trends over the long term, there is indeed an increase in temperature over time.



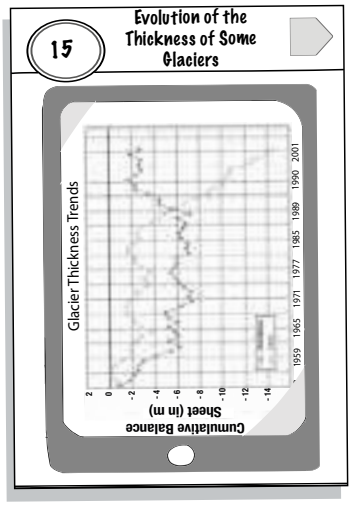
VS



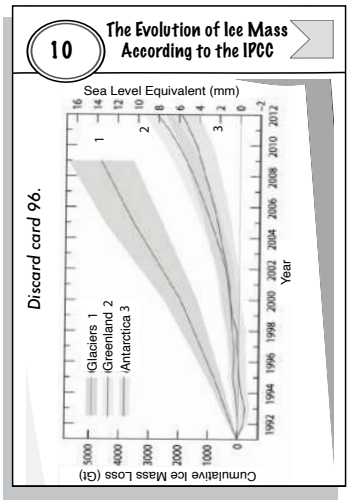
Fallacious Argument ***Scientific Counterargument***

Example:

Since 1963, Scandinavian glaciers have gained mass, while glaciers worldwide have lost mass over time.



VS



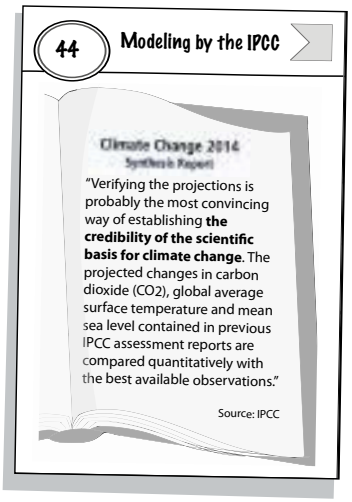
Fallacious Argument ***Scientific Counterargument***

FALSE DILEMMA

Reducing a situation to only two choices, when reality is much more complex.

Example:
The argument that "warmists" rely solely on models and cherry-pick input data to support their viewpoint, whereas "climate skeptics" believe in observations. However, the projections presented in IPCC reports are constantly compared with climate observations.

VS



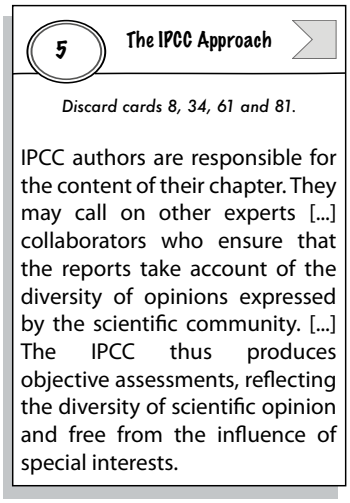
Fallacious Argument ***Scientific Counterargument***

FALSE EQUIVALENCE

Undermining rigorous scientific inquiry by denying the collaborative, complex, and lengthy process of the scientific method and assigning equal value to all discourse, including opinions.

Example:
The argument for openness and creativity, suggesting that the IPCC disregards dissenting voices (and therefore opinions). However, the IPCC follows a collaborative process, calling on various experts and ensuring that publications are free of any personal bias.

VS

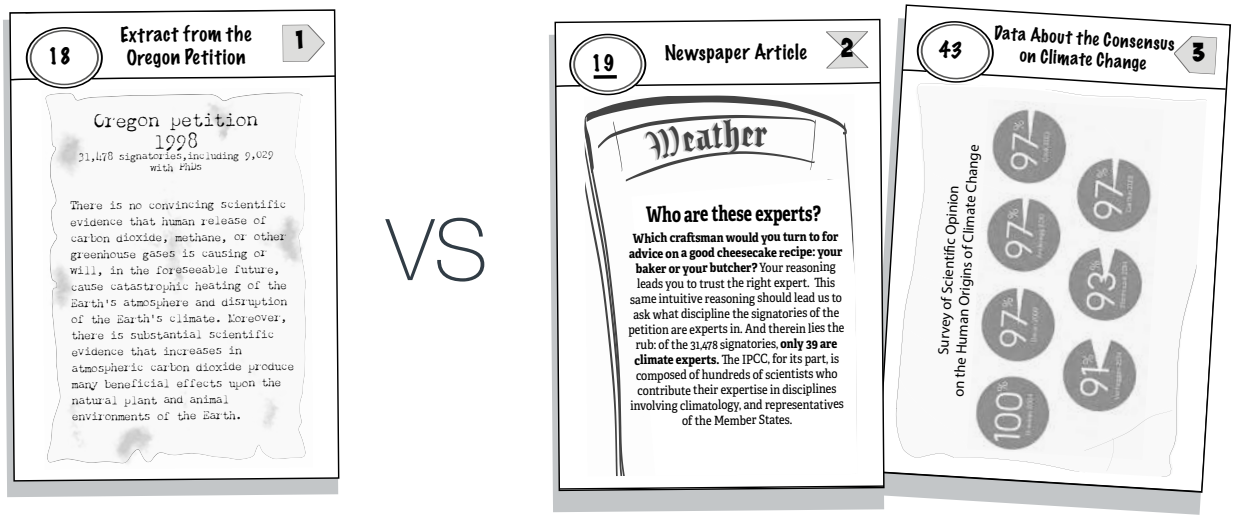


Fallacious Argument ***Scientific Counterargument***

APPEAL TO POPULARITY OR TO AUTHORITY

An argument is more readily believed when supported by a large number of people or by an influential or "expert" figure.

Example:
Of the 31,478 signatories of the Oregon Petition, only 39 are experts in the subject, whereas the IPCC brings together several hundred experts in climatology.



Fallacious Argument ***Scientific Counterargument***

The IPCC research community works together to produce reports on climate science, as seen in the photo below during the adoption of the special report on global warming of 1.5°C in 2018.

PART 4 (OPTIONAL)

The Example of the Oregon Petition

Once the scientific and fallacious arguments have been correctly identified and matched, we can reflect on how easily some of these discourses may be believed.

In this case, we will use the example of the **Oregon Petition** (shown below and referenced on card 19).

Dating back to 1998, this petition, also known as the "Global Warming Petition," was championed by Dr. Frederick Seitz, the former president of the American Academy of Sciences. The petition aimed to persuade the U.S. Government to reject the 1997 Kyoto Protocol.

Essentially, the text claims that greenhouse gas emissions resulting from human activities have no impact on the climate, and that the increase of carbon dioxide in the atmosphere is actually beneficial for plants and animals. It was ratified by 31,487 "American scientists," of whom 9,029 hold a PhD.

Here are some questions the trainer might ask:

— Would you be willing to sign this petition?

— Would you take it seriously?

— Why trust the IPCC reports over this petition?

The following points emerge from a more detailed analysis of the petition (false or misleading points and their explanations are highlighted in green).

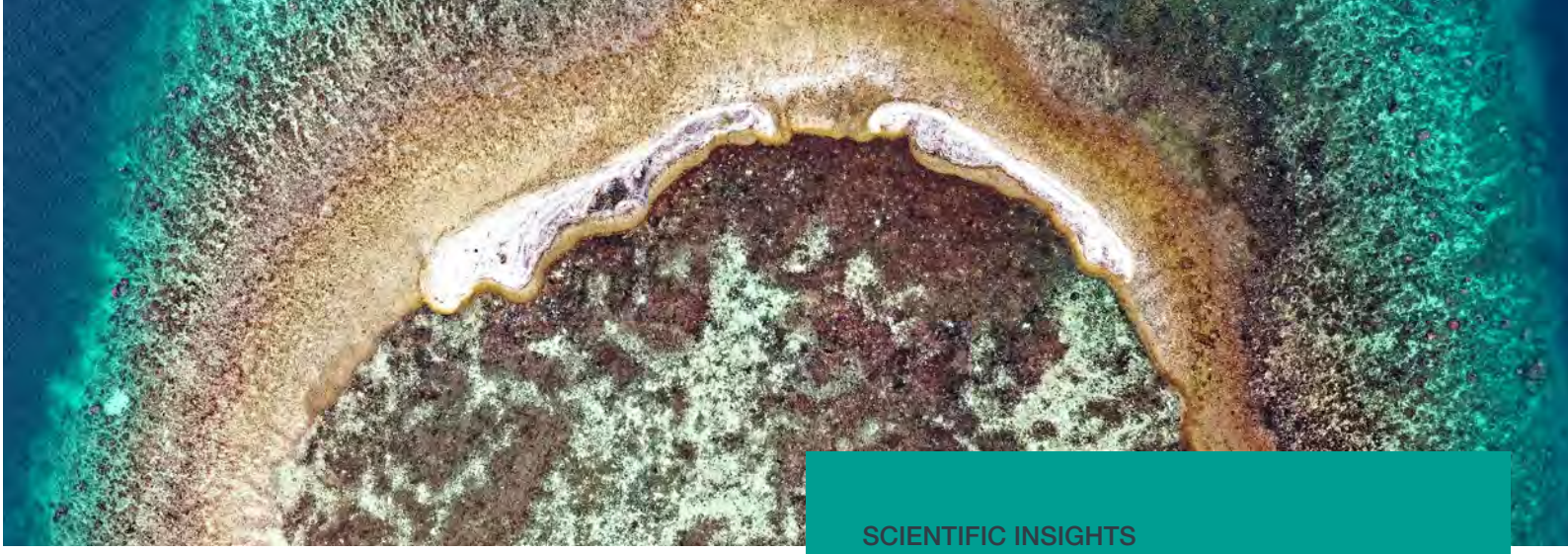
GLOBAL WARMING PETITION PROJECT

Umbrella term

31,487 American scientists have signed this petition, including 9,029 with a PhD

Might seem like a lot (popularity)

What field? (pseudo-experts)



After examining the petition, the trainer can discuss the insights gleaned: **certain persuasion strategies are particularly effective at attempting to mislead us.** Here are the strategies employed:

— Feigning the existence of dissent within the scientific community
— Feigning scientific expertise (appeal to authority)
— Feigning transparency and honesty
— Sowing doubt about current knowledge by emphasizing its lack of 100% certainty and highlighting the ongoing evolution of scientific understanding...

The trainer then explains that these tactics fuel our doubts. This is a key aspect of climate skeptic discourse, which often employs a **strategy of doubt**[3]. Doubt is portrayed as inherent to science, suggesting that it is valid to challenge established scientific knowledge and even integral to scientific progress, making it particularly insidious at times. However, several counterarguments can be made against these discourses. For example:

— Climate skeptic articles typically do not undergo the **peer-review process**, which is fundamental in science.
— Scientists aim to establish **provisional truths**, while many climate skeptic discourses are promoted by industries seeking to distract from and delay the acceptance of scientific facts.

It is crucial to remain vigilant about the use of scientific language and terminology (graphs, data tables, etc.) in these discourses.

SCIENTIFIC INSIGHTS

THE ROLE OF THE IPCC, A DEMOCRATIC BODY[4]

The Intergovernmental Panel on Climate Change (IPCC) was created in 1988 by the United Nations (UN). The role of IPCC scientists is to assess existing knowledge on climate change, not to conduct new research. IPCC experts, whether from natural sciences, economics, or political sciences, are appointed by governments, thus ensuring their recognition as experts. The interactions among scientists regarding study findings constitute a comprehensive peer-review process. At the general assemblies where the summaries for policymakers are approved, various profiles, not limited to scientists, are present. Each formulation in the reports undergoes line-by-line validation through voting, constituting a democratic process. The mention of uncertainties is a new approach, which, if misunderstood, could inadvertently support certain fallacious discourses.

The collaborative nature of the IPCC's work is highlighted in the game, in the puzzle where players must collect the four photo fragments to uncover this scientific argument.

Valérie Masson-Delmotte, former co-chair of IPCC Working Group I, uses a metaphor to illustrate the work of the IPCC, comparing it to a pointillist painting. Each study taken independently, like a point in this painting, makes no sense: one must compile all the results to obtain a reliable picture of the climate data.

[3] The strategy of doubt was highlighted by Naomi Oreskes in her book "Merchants of Doubt." For more information, see "Against the Merchants of Doubt, Long Live Ecology!" by Jean-Paul Deléage.
[4] These insights are derived from discussions between the "Cahiers Philosophiques" and Anouk Barberousse, a philosopher of science: "Le GIEC, une communauté d'expertise originale."

PART 5

Defining Critical Thinking

- **CRITICAL THINKING IS NATURAL**

From these reflections, the trainer can propose that the participants define critical thinking. By noting the suggestions made, it becomes apparent that critical thinking is often equated with the ability to question. The trainer then provides a definition: "Critical thinking is natural; it denotes the ability to evaluate information:

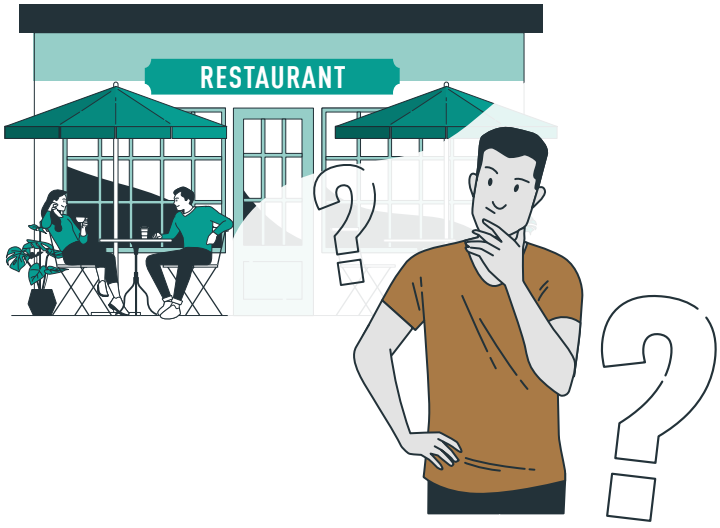
— the supporting evidence, the plausibility and coherence of the contents;
— the correct formulation of arguments (which do not violate the laws of logic);
— the reliability of information sources (both their expertise and the absence of motivation to lie or manipulate us);
— based on this foundation, we can gauge the trust we place in information. Critical thinking manifests as enlightened trust, far from any generalized skepticism."

Given the particular value we attribute to scientific consensus, which represents the highest level of proof from a scientific perspective, we, as citizens, can place our trust in the IPCC reports.

- **HOW DOES THIS APPLY TO OUR DAILY LIVES?**

The trainer proposes an "everyday life" situation involving a decision and notes the participants' responses: "*You are standing in front of a restaurant that you've never been to before. How do you decide whether or not to eat there?*"

In reality, there are several criteria governing this choice.



— Evaluation of Content and Evidence — Based on a Certain Impression

It looks good. I know this type of restaurant, and there are a lot of people inside, which could be a good sign that it's a popular place, but it could also be a restaurant for tourists.

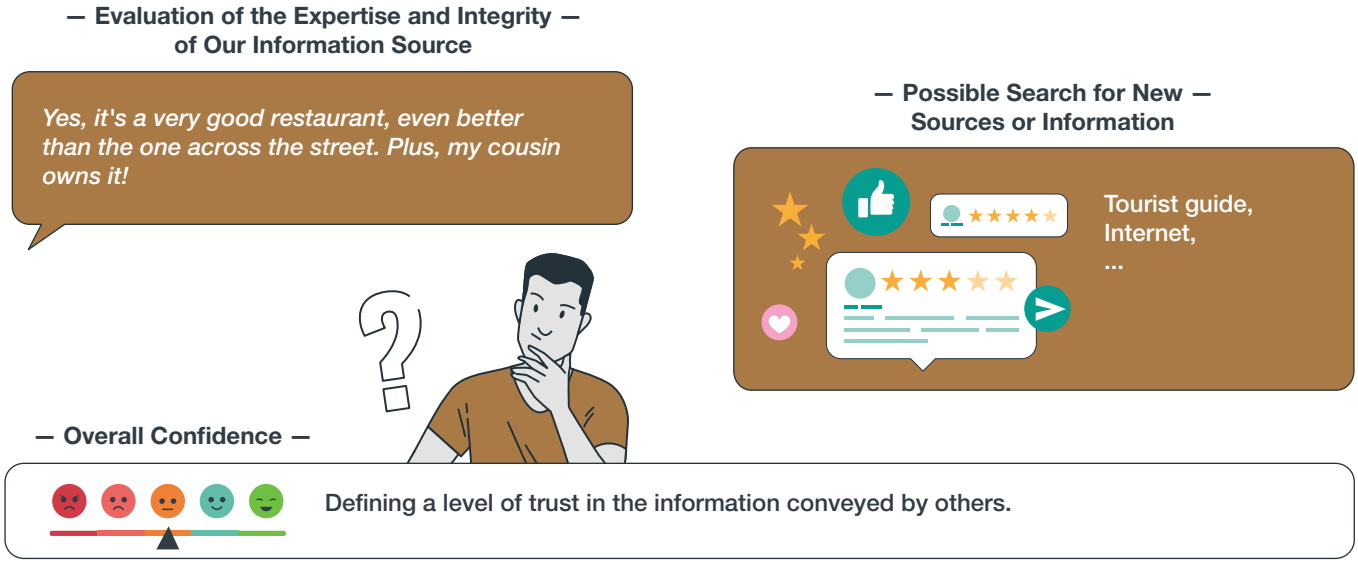
— Confidence in Our Judgement —

It smells good, but I'm so hungry it's hard for me to judge right now.

— Overall Confidence —

Mentally, we define the trust we have in relation to all these criteria.

All these parameters are unique to us, but in many cases, we cannot gather the information on our own and are forced to rely on others. But whom can we trust? Here are some factors that help us decide:



- **BUT THEN, WHY DO WE FAIL?**

In reality, we do not fail that often; we generally know whom we can trust.

Failures occur mainly because the natural mechanisms of critical thinking are not infallible: they are neither perfect nor absolute and often rely on shortcuts. Moreover, these mechanisms have not been updated with current knowledge, so having a doctorate or being a scientist is not enough to make someone an expert.

Such "flaws" can be exploited by well-crafted communication campaigns, as seen with the Oregon Petition.

- **OTHER FALLACIOUS ARGUMENTS**

The trainer can then present other fallacious arguments, summarized in five main types in Part 3:

— **False Experts:** Presenting an unqualified person or institution as a credible source of information. People tend to attribute more expertise to those they agree with, leading to a distorted perception of the scientific consensus.

— **Faulty Logical Reasoning:** Arguments where the conclusion does not logically follow from the premises. This includes confirmation bias, which favors evidence supporting our beliefs, and the "straw man argument", which misrepresents or distorts an argument to make it easier to refute, often by focusing on weaker aspects and ignoring stronger points.

— **Impossible Expectations:** Demanding unrealistic standards of certainty before acting on scientific evidence.

— **Cherry-Picking:** Carefully selecting data that seem to confirm a stance while deliberately ignoring data that contradicts it.

— **Conspiracy Theories:** Believing in a secret plan to implement a harmful project, such as the concealment of a truth. People who deny science are more likely to exhibit conspiratorial thinking; 20% of Americans and 15% of Britons believe, to some extent, that climate change is a hoax.

These arguments are the most frequently found in climate skeptic discourse.

PART 6

With the Students

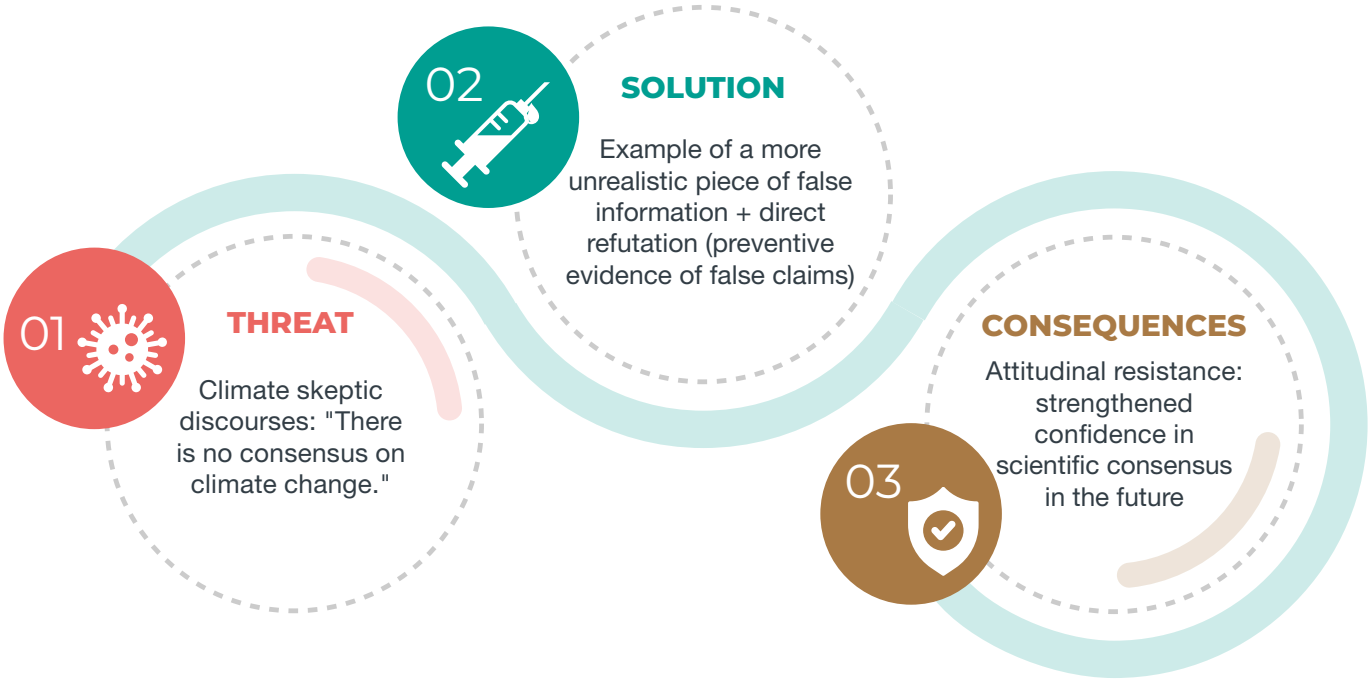
The trainer then presents the "Psychological Inoculation Strategy,"[5] an approach to use with students, which is the same as the one used in the scientific insight of this training.

This strategy involves presenting the main techniques used in disinformation campaigns, allowing individuals to become familiar with these techniques before encountering them. It can be likened to vaccination: to develop resistance and produce antibodies against a virus *(the threat*), inoculation involves administering a dose of the weakened virus (*the solution*).
In this context, to develop an attitudinal resistance to climate skeptic discourse, one can present an unrealistic piece of false information, refute it directly, and explain the reasons for the refutation.

When using this strategy, it must be accompanied by explicit warnings, especially when fallacious arguments are involved, and must clearly explain the deceptive techniques that are being used.

To help students develop "good reflexes" when evaluating information, here are some questions they might ask themselves:

— Is the content plausible based on what I know?
— Are the arguments relevant to the topic being discussed?
— Is the supporting evidence of good quality? Are there many supporting pieces of evidence?
— Are the sources clearly identified?
— Are the sources reliable, in the sense that they are competent, and considered to be an expert in the field?
— What are the sources' intentions? Do they have any conflicts of interest?
— Do different reliable sources agree with this information?



[5] Van der Linden, S., Leiserowitz, A., Rosenthal, S., Maibach, E.: Inoculating the public against misinformation about climate change. Glob. Chall. 1(2), 1600008 (2017)

Conclusion

We naturally possess critical thinking skills. We constantly evaluate information, often unconsciously, considering:

— The information, both in terms of content and form: plausibility of the content, relevance, supporting evidence.
— The credibility of the source: their expertise, competence, and integrity (or lack of conflicting interests), making sure to cross-reference multiple sources (hence the importance of consensus!).
— The level of associated uncertainty: our knowledge of the subject matter and the inherent uncertainty related to the information itself.

Our natural critical thinking ability must be nurtured and guided by additional knowledge and more advanced criteria than what we use instinctively.

This must be done progressively and over the long term, throughout schooling.

— In all subjects, especially scientific ones;
— Using the "Inoculation Strategy": instilling critical thinking in small doses (over different lessons rather than having a single dedicated lesson), enables students to be prepared to confront disinformation when the situation arises.
— Concretely, by using examples that students can relate to;
— Explicitly, by making it one of the goals of the lesson and discussing it with the students.

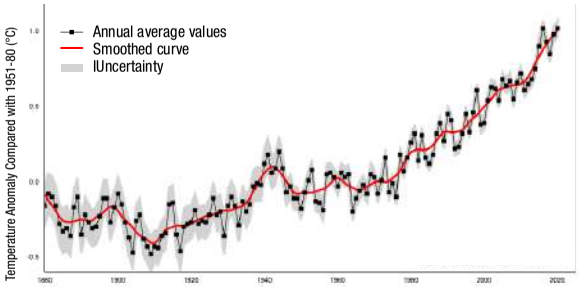
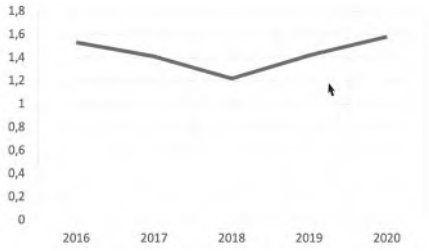
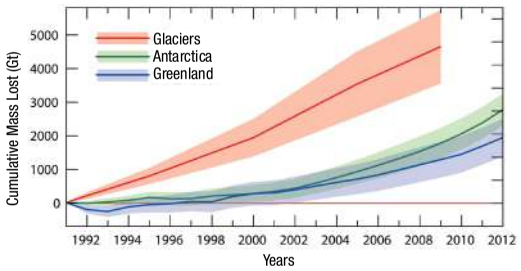
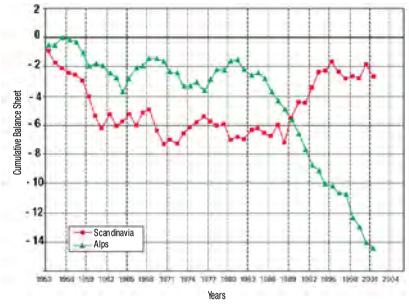
To Go Further

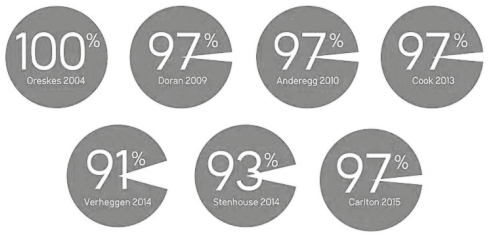
PUBLICATIONS :

The Debunking Handbook – John Cook, Stephan Lewandowsky, 2020.

Merchants of doubts – Naomi Oreskes, ed. Bloomsbury Press, 2010

Appendix 1:
SUMMARY OF FALLACIOUS ARGUMENTS AND SCIENTIFIC COUNTERARGUMENTS

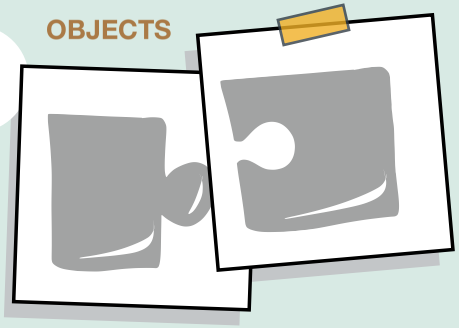
SCIENTIFIC COUNTERARGUMENT	FALLACIOUS ARGUMENT	BIAS USED
A clear increase in global temperature since 1880 (about 1.07°C)) Variation of Temperature on Earth  Source : NASA See card 82)	5-year meteorological data recording shows relatively stable temperatures Evolution of Temperature Anomalies Since 2016, Compared to the Period 1901-2000  Source : NOAA (See card 4)	**Selection Bias** : cherry-picking data to support an argument, while ignoring information that doesn't align with the desired conclusion. In this case, it's a **temporal** selection bias, since it only takes into account a period of 5 years. Climate science, on the other hand, gathers **numerous data over a long time period** (150 years) as evidence of the reality of global warming.
The projections presented in the IPCC reports are constantly compared with climate observations. (See card 44)	"Warmists" rely solely on models, and cherry-pick input data to support their viewpoint, whereas "climate skeptics" believe in observations. (See card 46)	**False Dilemma Bias** : reducing a situation to only two choices, when reality is much more complex. Climate modelers do not exclude observations; **these models are constantly calibrated against field data**.
The entire cryosphere worldwide is seeing its surface decrease (glaciers, ice caps, ice sheets). Evolution of the Mass of Glaciers and Polar Ice Caps  Source: IPCC Report, 2014 (See card 10)	Scandinavian glaciers have gained mass since 1963.  Source: IPCC Report, 2014 (See card 15)	**Selection Bias**: cherry-picking data to support an argument, while ignoring information that doesn't align with the desired conclusion. In this case, it's a **spatial** selection: the case of Scandinavian glaciers is selectively chosen because they are indeed gaining mass. However, an exception cannot be used as a rule; **on a global scale, glaciers are losing mass** (about 4000 Gt in 18 years).

SCIENTIFIC COUNTERARGUMENT	FALLACIOUS ARGUMENT	BIAS USED
IPCC authors are drawn from diverse fields of expertise, ensuring comprehensive reports that reflect the scientific community's views. The publications are therefore free from any particular interests. Source: IPCC document explaining how authors are selected (See card 5)	To remain open and respect creativity, one should avoid simply conforming to the majority's mindset. The IPCC should therefore entertain minor dissenting voices. (See card 87)	**False Equivalence:** undermining rigorous scientific inquiry by denying the collaborative, complex, and lengthy process of the scientific method and assigning equal value to all discourse, including opinions. This fallacious argument **equates an opinion to scientific knowledge** and undermines **the inherently collaborative nature** of IPCC publications. **The IPCC experts ensure that all voices are heard:** the choice of authors is as broad as possible. Only experts from the relevant fields are invited, and when a point is discussed, **a consensus** is reached through mutual listening and debate based on the full body of facts.
The signatories of the Oregon Petition are neither numerous nor experts on the subject; only 39 out of 31,478 are experts, whereas the IPCC gathers several hundred climate experts. "Between 2009 and 2015, the consensus regarding its anthropogenic origin was around 97%. In 2019, the analysis of 11,602 papers published on the subject revealed that 100% of the articles support the idea of a human cause of climate change." Scientific Opinion Surveys on the Human Origin of Climate Change  Source: Powell, J. (2019). Scientists Reach 100% Consensus on Anthropogenic Global Warming. Bulletin of Science, Technology & Society, 37(4), 183–184. (See cards 19 and 43)	**The Oregon Petition (1998)** 31,478 signatories, including 9,029 with a PhD. "There is no convincing scientific evidence that human emissions of carbon dioxide, methane, or other greenhouse gases will cause, or are likely to cause in the foreseeable future, catastrophic warming of the Earth's atmosphere and disruption of the Earth's climate. Moreover, there is substantial scientific evidence that increases in atmospheric carbon dioxide provide numerous beneficial effects on the natural plant and animal environments of the Earth." (See card 18)	**Appeal to Popularity or to Authority:** : an argument is more readily believed when supported by a large number of people or by an influential or "expert" figure. This fallacious argument uses the strategy of **'imitating' science**: a 'certain number' of scientists are showcased because they have signed the petition, a third of whom have PhDs (which gives the impression of scientific legitimacy). It also portrays climate change as a **controversy** within the scientific community. In reality, the number of scientists who have signed is actually low (only 31,000, compared to the vast number of scientists worldwide). Most importantly, they are not experts on the subject: there are only 39 among them, as opposed to several hundred involved with the IPCC. This could lead the general public to believe that a significant portion of the scientific community does not support the thesis of climate change. However, this is not the case: in 2019, out of more than 11,000 papers authored by scientists in the field, 100% supported the idea of human-caused climate change. Thus, **there is no debate among experts**.

Possible Actions

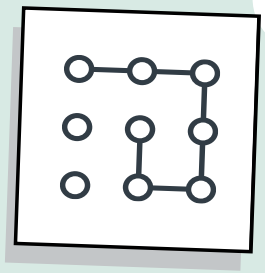
Summary of types of cards and possible actions

01 OBJECTS



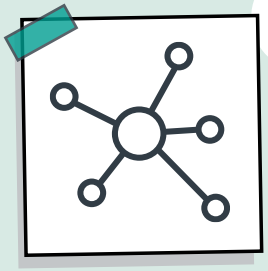
Add the numbers on the cards and draw the **corresponding card**

02 CODES



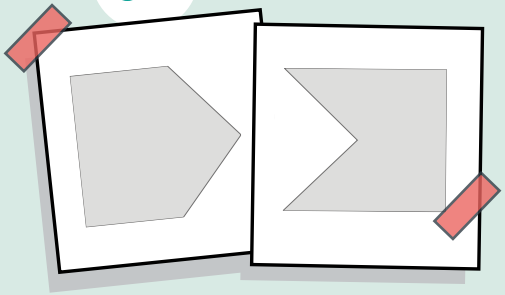
Enter the code into the app to unlock the object.

03 INTERACTIONS



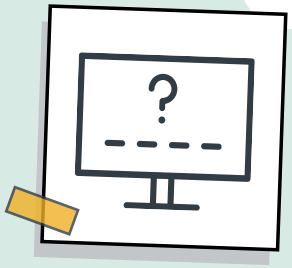
Click the button on the app to obtain additional content.

04 ARGUMENTS



Add the numbers on the cards and retrieve the corresponding card.

05 FINAL CODE



Enter the code once **all the numbers are obtained**.

Office for Climate Education

The Office for Climate Education (OCE), created in 2018, is an ambitious response to the Paris Agreement, which emphasizes the importance of climate change education in its Article 12.

A center under the aegis of UNESCO, an observer member of the IPCC, and co-coordinator of the *Greening Education Partnership*, the OCE leverages its dual scientific and educational expertise to support the Sustainable Development Goals. It fosters strong international cooperation among scientific organizations, NGOs, and educational institutions.

The OCE offers teachers worldwide high-quality, interdisciplinary educational tools based on IPCC reports. These tools emphasize active pedagogies (inquiry-based learning, project-based learning, etc.) and are adapted to local contexts. With the help of its partners, it provides professional development opportunities and on-the-ground support.

The OCE also assists education systems globally in implementing high-quality climate change education through expertise and pilot project deployment.

http://oce.global
contact@oce.global
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Campus Pierre et Marie Curie
4, place Jussieu
75005 Paris – France

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United Nations Educational, Scientific and Cultural Organization
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