

GALILEO, BACON AND KEPLER: "TRAVELLING IN SCIENCE"

BETWEEN REALITY AND IMAGINATION



Preface

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Project: VAST: Values Across Space & Time

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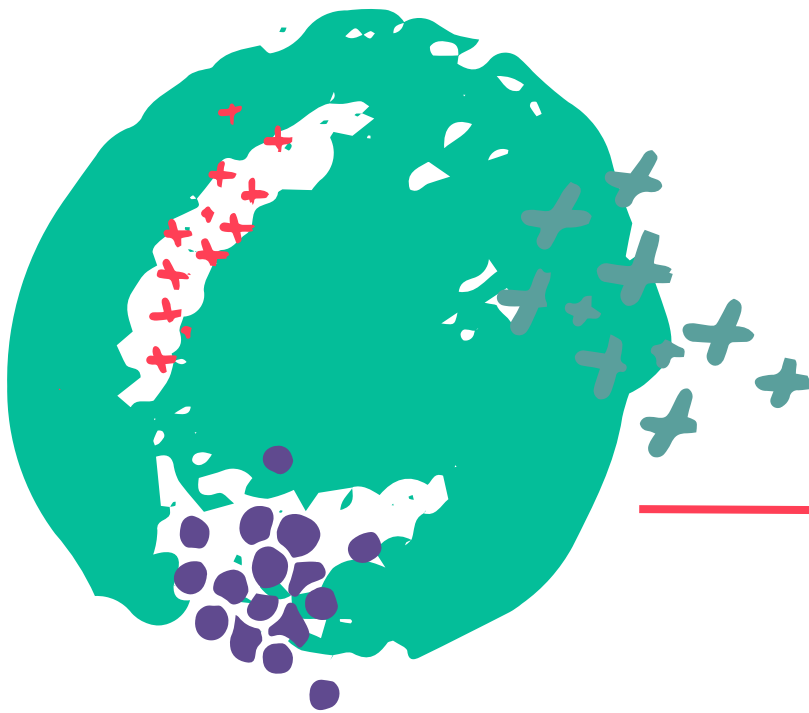
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overview

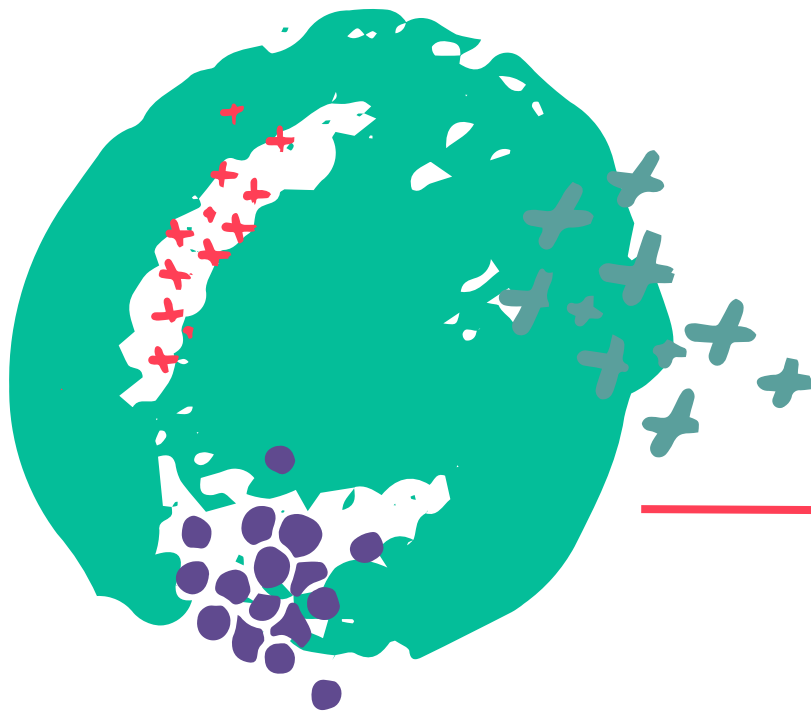
The H2020 European research project VAST- Values Across Space & Time is a collaboration among the National Center for Scientific Research 'Demokritos' (Greece), National and Kapodistrian University of Athens (Greece), the Athens & Epidaurus Festival (Greece), Università degli Studi di Milano (Italy), Fairytale Museum (Cyprus), Museo Galileo (Italy), Universidade NOVA de Lisboa – NOVA (Portugal) and Semantika (Slovenia).

The project envisions to study the dissemination of the European values (such as freedom, democracy, equality, tolerance, dialogue, human dignity, the rule of law) in space and time through the use of digitised materials and intangible cultural artefacts as well as to explore the communication, reception and perception of these values in the modern era. For the purposes of this research, three pilots have been described concerning: 1. the theatre/ancient drama, 2. the scientific texts of the 17th century, 3. the fairy tales.

A digital platform has been developed, as part of the project, with open access to citizens. In this platform, values-related scientific and educational materials and research evidence/results will be posted, as well as various tools for scientific and research study.

Do not miss visiting!

The current activity aims to explore the works of historical science figures - Galileo Galilei, Johannes Kepler, and Francis Bacon - to deepen students' understanding of the evolution of scientific thought, inspire curiosity about the world, and promote discussions on values like progress, experimentation, and evidence-based decision-making, especially in the context of modern challenges posed by technology.



activity

Institution

Museo Galileo (Institute and Museum of the History of Science)



Audience

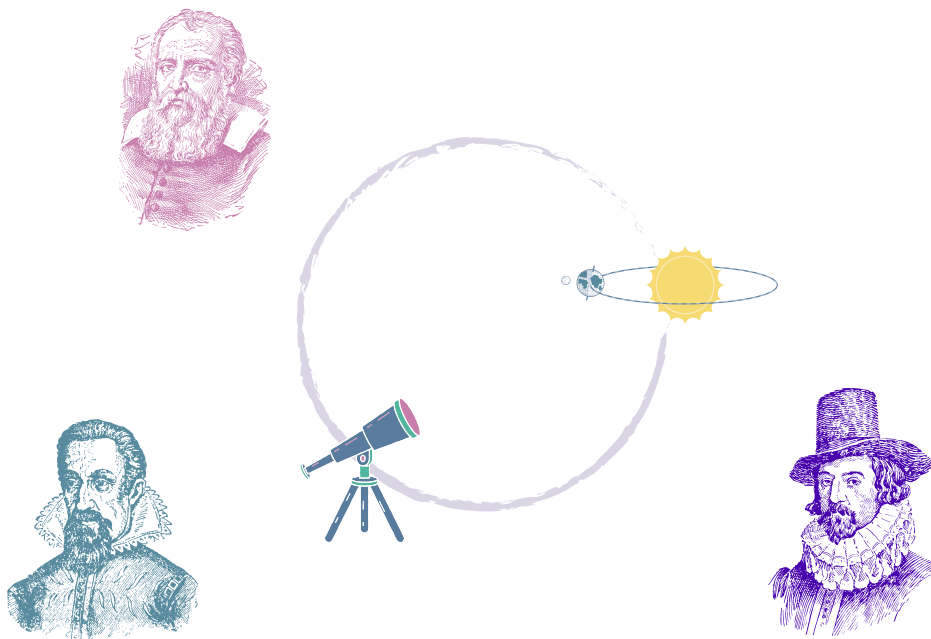
16 to 18 years old

Title

Galileo, Bacon and Kepler: "Travelling in Science" between reality and imagination.

Description

The activity aims to explore the works of three notable historical figures in the history of science: Galileo Galilei, Johannes Kepler and Francis Bacon. By examining the discoveries, instruments, and contributions of these individuals, the activity seeks to deepen students' understanding of the evolution of scientific thought and inspire their curiosity about the world around them. In addition to promoting scientific learning, the activity also aims to foster meaningful discussions about a range of values that are associated with the concepts of 'journey', 'discovery', and dialogue with 'others'. These values, which include progress, experimentation, science for the benefit of society, knowledge, and the importance of evidence over authority, are critical to our understanding of the world and our ability to make informed decisions about the future. Through these discussions, students will be encouraged to contemplate contemporary issues that society is facing, including the impact of technology on our world.

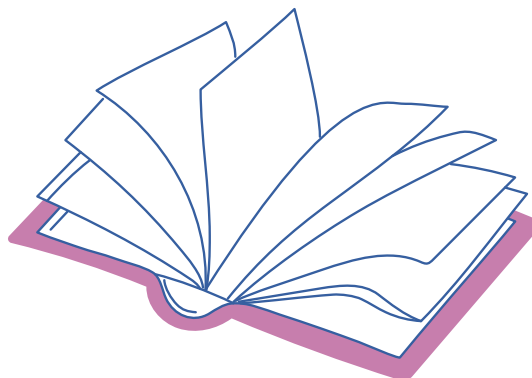


Educational Objectives



Through this activity the participants are expected to:

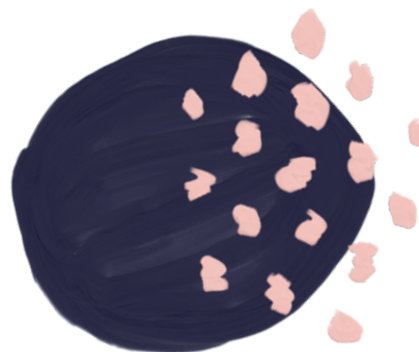
- 1 come into contact with 17th century philosophical debates and discoveries associated with the Scientific Revolution
- 2 understand the revolutionary significance of Galileo's astronomical discoveries, the importance of knowledge sharing demonstrated by the epistolary exchange with Kepler, and Bacon's idea of a utopian society
- 3 learn how the perception of certain values, like progress, experimentation, science for the benefit of society, knowledge , have changed from the past to the present, and what the scientific challenges of the 17th century were
- 4 exercise their critical thinking about current challenges in society and the ethical implications of scientific progress
- 5 understand concepts of the past by placing them in their historical context, without being bound by anachronistic notions tied to a contemporary point of view



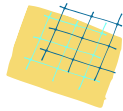
Expected outcomes

After completing the activity, the participants:

- 1 will have understood the contribution of these historical figures to the birth of modern science, both from a methodological and conceptual standpoint
- 2 will have an overview of the philosophical and cultural context in which the scientific production of well-known 17th century philosophers, astronomers, and mathematicians was formed
- 3 will have understood the challenges and ethical and moral implications underlying certain turning points in scientific progress
- 4 will have developed a new awareness, and ultimately new knowledge, by means of an interdisciplinary approach that incorporates science, literature, philosophy, and art as constituent parts of a unified knowledge system, also in relation to the museum collection
- 5 have worked together to argue regarding the timeless importance of certain values for the progress of modern society
- 6 will have realized that knowing our past is fundamental to be conscious global citizens and to shape a better future



Structure



Duration

150'- 180'

Educational materials/tools

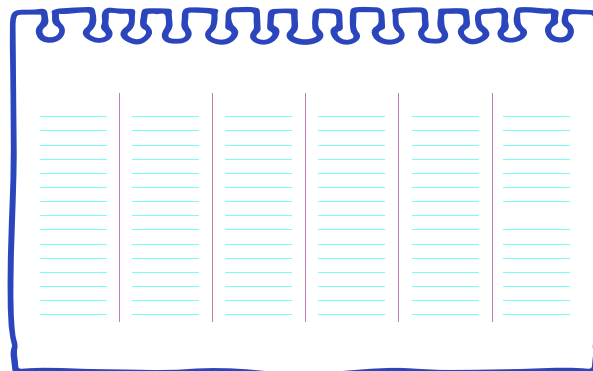
- Paper (or digital)pre-visit questionnaires for students and teachers
- Video teaser
- PPT projection with texts and images
- Discussion and reflection
- Learning through inquiry system and instruments replicas' manipulation
- Paper clouds to write down emotions
- Paper mind-maps for values
- Visit to the museum collection
- Paper (or digital) post-visit questionnaires for students and teachers

Educator/facilitator

1 educator/facilitator for up to 25 students

Target group

High school students up to 25 individuals per workshop



Modules/sections (design)

Pre-visit questionnaire	Described in pages:	11
Welcome	Duration:	10'
	Materials/tools:	Video
	Described in pages:	12
1st part of the activity	Duration:	20'
	Materials/tools:	PPT projection with excerpts and images
	Described in pages:	13-14
2nd part of the activity	Duration:	20'
	Materials/tools:	PPT projection, optical bench
	Described in pages:	15-17
3rd part of the activity	Duration:	15'
	Materials/tools:	PPT projection with images and excerpts
	Described in pages:	18

4th part of the activity	Duration: 20'	Materials/tools: Telescope replica, paper clouds, pens or markers	Described in pages: 19-20
5th part of the activity	Duration: 15'	Materials/tools: PPT projection with images and excerpts	Described in pages: 21-22
6th part of the activity	Duration: 20'	Materials/tools: A3 paper mind maps & coloured markers OR mind map mobile app	Described in pages: 23-24
7th part of the activity	Duration: 30'	Materials/tools: -	Described in pages: 25
8th part of the activity	Duration: 20'	Materials/tools: Paper questionnaires, pens	Described in pages: 26
Farewell - Activity evaluation	Described in pages: 27		

Pre-visit questionnaire for students and teachers

Designed with anonymity in mind, yet linkable to the corresponding post-visit questionnaire through a unique code chosen by the participants, the pre-visit questionnaire (Appendix I) for students serves to collect different types of data.

These include demographic information, insights into students' cultural background, and expectations along with current perceptions of certain values found in selected 17th-century scientific texts, both within the texts themselves and in everyday life.

A brief questionnaire for teachers (Appendix II), on the other hand, is administered to provide the cultural and demographic context for the final evaluation phase.

Note: The purpose of these questionnaires is twofold: firstly, to understand the perception of values in a situation that has not yet been influenced by external factors (in this case the museum activity). Secondly, to relate this to the post-visit questionnaires to determine if there has been a change in awareness towards this topic and if there has been a modification in the perception of the values themselves, making it possible to simultaneously assess the effectiveness of the activity.

A. Introduction (5')

Welcome to the participants & information about the activity.

B. Ice breaker activity (5')



Video teaser: introducing the values
(<https://youtu.be/C1FVm7IRNjA>)

We show a brief video that utilizes a series of visual and auditory stimuli to capture the students' attention and highlight key words that will be the focus of discussion during the activity. As we transition from images of portraits, works, and ancient tools of those who contributed to the Scientific Revolution, to the new astronomical instruments that have allowed us to deepen our understanding of celestial objects, we aim to initiate a discussion on fundamental values such as knowledge, freedom of thought, experimentation, and progress.

Note: Using a short video to start the activity is useful to capture the attention of students because it is a means that makes the experience more engaging and stimulating. Music can create an emotional atmosphere, images can help visualize concepts, while texts can provide additional information and insights. Moreover, employing diverse media enables multimodal learning, catering to various sensory channels, which proves especially beneficial for students with distinct learning preferences.

1st part of the activity: *Three famous "travelers" of the past*

In this part, the group will learn about three illustrious scientists, Galileo Galilei, Johannes Kepler and Francis Bacon and the period in history known as the Scientific Revolution, that saw the development of new scientific methods and instruments and had a profound impact on society, as it challenged traditional beliefs and ways of thinking, leading to new ideas and innovations that transformed the world. This will lead to a shared discussion on contemporary reality and the current role of the scientific community.



Discussion

We learn from newspapers, TV, and social channels that our sky is becoming a web of roads crossed by artificial satellites, that private and public companies have been trying to colonize the sky as well as to invest scientific and economic resources in the search for "other Earths" that could be inhabited or could host living beings in a near future. But when and why did human beings start traveling into the sky? What role did scientific instruments play in these celestial travels?

Following an inquiry-based approach, the educator/facilitator starts asking general questions, related to the context being addressed, with the aim to create a familiar environment that makes students feel at ease and thus free to express themselves. Since the common thread of the theme being discussed is travel, either real or imaginary, the educator/facilitator also asks if any of them love to travel and have ever taken an imaginary journey.



Discussion

Afterward, we use a projected PowerPoint presentation to initiate a discussion on the Scientific Revolution period. Over the course of 100 years, a new conception of the world and nature emerged, with science assuming the role of a cultural glue that allowed Europe to become a place of shared values. The end of anthropocentrism was witnessed, and instruments became increasingly important for knowledge, capable of revealing new truths compared to established dogmatic ones. This period is characterized by the contributions of three representative figures: Galileo, who demolished the Aristotelian distinction between the terrestrial and celestial worlds; Kepler, who shifted from circular to elliptical motion of the planets; and Bacon, who promoted an empirical and experimental knowledge, the idea that science should be based on accurate and reproducible observations.

We begin with a brief overview of pre-telescopic astronomy to provide a context for understanding the historical milieu.

We explore the ancient civilizations' representations of the universe, the Aristotelian cosmology, and the Ptolemaic system, which explain the geocentric model - the dominant theory for centuries. We then introduce Copernicus, who presented the heliocentric theory in his *De Revolutionibus orbium celestium* (1543). Galileo's findings elevated this theory, viewed with suspicion by the ecclesiastical authorities, beyond a mere mathematical conjecture, ultimately resulting in Galileo's abjuration and condemnation.

2nd part of the activity: *Galileo and his telescope*

- This part focuses on the revolutionary discoveries of Galileo and on the crucial role played by the improvement of the telescope



Discussion

In March 1610, Galileo published the *Sidereus Nuncius*, in which he claimed to have made incredible discoveries with an improved telescope. He observed mountains on the Moon, new ‘planets’ orbiting around Jupiter, Venus going through a full series of phases, and Saturn shaped like a three-body object. These extraordinary results were made possible, in part, thanks to Galileo's manual ability. He took the instrument, invented in Holland, which was little more than a ‘toy,’ and by perfecting its lenses, he turned it into a telescope so powerful for its time that it allowed for astronomical observations never before made. However, could Galileo be trusted? These discoveries seemed so surprising that Galileo's credibility was questioned. Was the telescope a tool that enhanced vision and expanded knowledge, or a means that created optical illusions?

Starting from the opening of the *Sidereus Nuncius*, read aloud by a volunteer, the question is posed: with what keywords is Galileo presenting his discoveries? The discussion then revolves around the absolute novelty with which Galileo aims to present his celestial observations, departing from the previous tradition, and asking the students what value emerges from reading this passage.

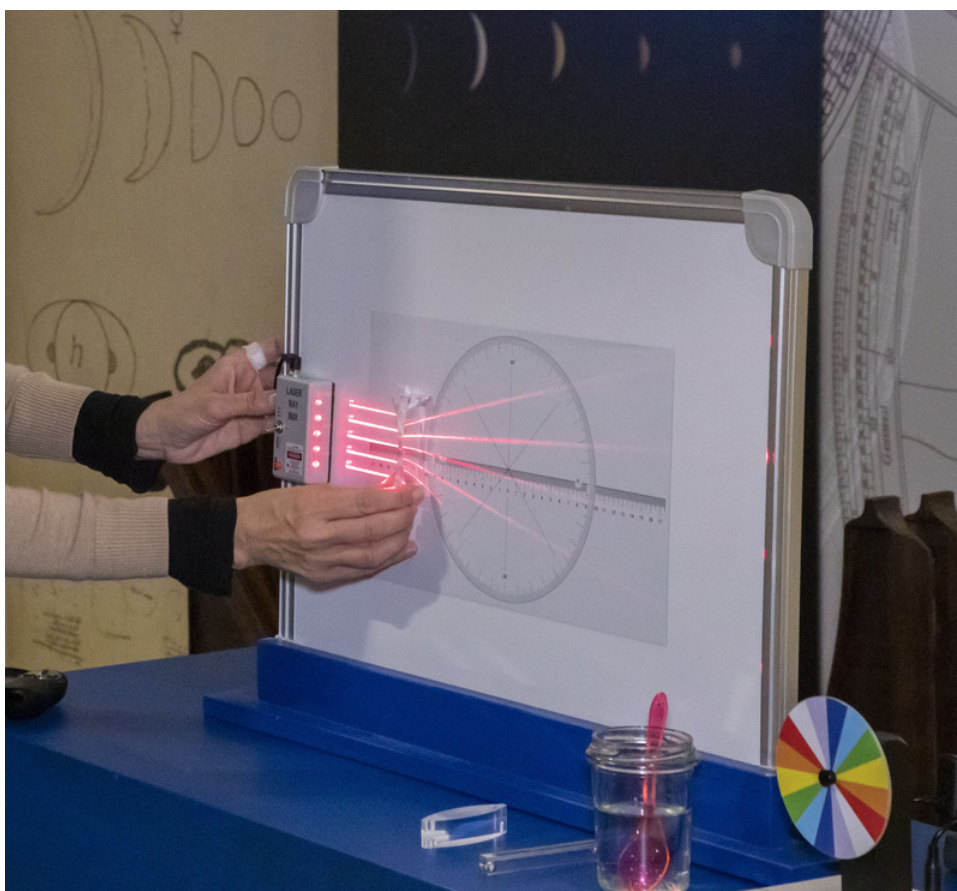
Reflections are made on the act of courage of a man who finds himself alone facing the universe, pointing a tool (previously used for other purposes) towards the sky. The courage of ideas that are not stopped by established dogmas.

The freedom of thought and expression has been a great achievement for Europe. Unfortunately, the situation is very different in other parts of the world. The current events are examined, and then the students are asked about their own experiences. We ask them: "Have you ever had thoughts or opinions that diverged from those of others, contradicting the prevailing viewpoint, and struggled to articulate them due to a fear of criticism or being misunderstood?"



Activity

To better understand Galileo's telescope, using an optical bench, the educator/facilitator shows the flow of light rays that reaches and passes through converging (or positive) and diverging (or negative) lenses, while confronting students about their properties, thus asking or giving them basic notions on optics. The students also receive a brief overview of future developments, from refracting to reflecting telescopes.



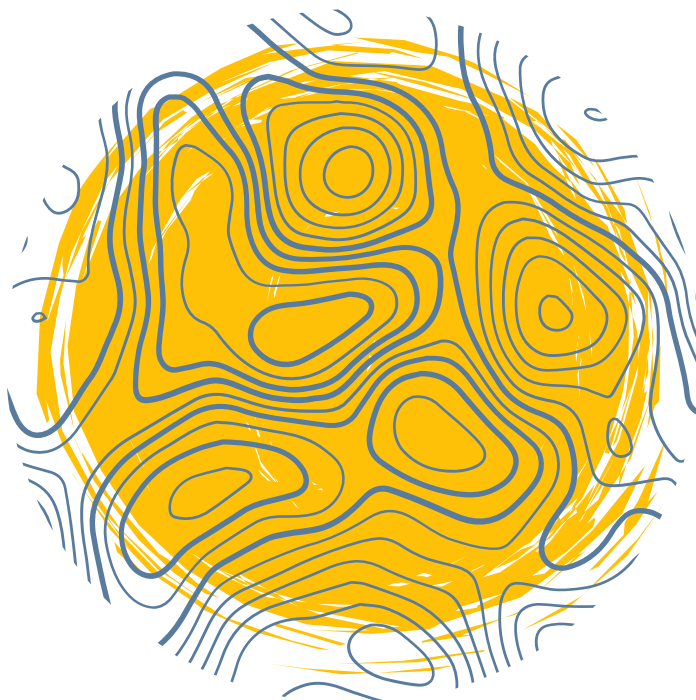


Discussion

We emphasize the fundamental importance of the relationship between science and technology, which was one of the key features of the Scientific Revolution. The new scientist was one who used increasingly precise tools and was able to merge "theory" with "technique." A researcher who validates theories through experiments carried out using instruments and objects. However, it is important to note that to create an instrument like the telescope, one also needs vision and great imagination to see a new world.

The comparison between Galileo's drawings and modern images of celestial bodies provides an opportunity to bring the topic into contemporary times and discuss experimentation, progress, and science in service of improving society.

We also reflect on the fact that giving equal dignity to practical operations implies ending the distinction between knowing and doing. Therefore, we ask students: "How important do you think this aspect was for the establishment of modern science? How much do you think progress in science and technology can contribute to improving the living conditions of citizens?"



3rd part of the activity: *Kepler's Dissertatio*



In this parts, we talk about Kepler's support for Galileo's discoveries.



Discussion

A few weeks after the publication of *Sidereus Nuncius*, Emperor Rudolf II's court astronomer Johannes Kepler, asked for an opinion, wrote a long letter to Galileo, published in Prague under the title *Dissertatio cum nuncio sidereo*, in which he applauded his sensational discoveries, although with some remarks. By having students read a few passages from Kepler's work, some key concepts of the new modern science, which are still highly relevant today, are addressed: the importance of observation over the principle of authority and speculation; the necessity to test and verify through experimentation theoretical ideas; the need for dialogue and cooperation to develop new insights and perspectives.

The motivation behind Kepler's approval of Galileo's discoveries, despite not having seen the telescope yet, is being investigated. The educator/facilitator raises some questions to stimulate critical thinking in the students, without influencing their answers. Why do you think Kepler hastened to endorse Galileo's findings? What was his purpose? How do his criticisms of Galileo serve that purpose? Through these questions, the educator seeks to foster in the students the ability to comprehend the most significant meaning of the text.

Galileo's discoveries were in line with the Copernican view of an ordered cosmos with the Sun at the center, and Kepler thus laid bare those cosmological implications on which Galileo had remained silent, without making any comments.

4th part of the activity: *Reconstruction of a Galilean telescope and reflection on emotions*

- In this part, students engage in the reconstruction of a Galilean telescope while expressing their emotions.
-



Activity

Cognizant of the fact that hands-on experience can enhance learning and deepen understanding, the class is divided into groups and tasked with reconstructing a Galilean telescope. By rebuilding this instrument, students have the opportunity to apply the optical concepts they have learned earlier and gain a practical understanding of the difficulties Galileo faced when conducting his own observations. Looking through the telescope allows students to replicate Galileo's visual experience, rendering the historical context more tangible and facilitating a deeper exploration of the concepts previously discussed.





Activity

Students are prompted to reflect on their emotions and thoughts as they reconstruct an instrument that represented a pivotal step in human history. Their ideas and reflections are recorded on paper clouds (Appendix V), which are then attached to a "Wall of Thoughts." This activity is designed to stimulate a new exchange of opinions among the students and encourage them to share their reflections on the experience.



5th part of the activity: *Bacon's vision*

- In this part unit, the group will be introduced to the figure of Francis Bacon, one of the most influential thinkers of the 17th century.



Discussion

One of the founders of the modern scientific method and empirical philosophy, Bacon argued that knowledge should be based on observation and experience, rather than theoretical speculation or tradition. Among the different facets of Bacon's figure, the operator focuses on his confident and emphatic announcement of the modern progress of science and the utopian vision of the scientific community described in the *New Atlantis*. In the text, Bacon imagines arriving in the utopic island of Bensalem following a shipwreck, where he discovers an advanced and pious society whose scientists seek to transform, alter, imitate, and reproduce reality for the improvement of people's lives. Discussing this good governance in which wise men, "merchants of light," also travel to acquire new knowledge and bring it back home, we have the opportunity to reflect on the importance of science for the public good and the absence of prejudice, and how this negative value can lead to a stagnation of knowledge and impede progress.

During the discussion, the importance of credibility and the impact of prejudices are explored, with students also being asked if they have ever felt victim to prejudice. These topics are relevant in light of the current perception that the scientific community often shows discordant opinions, particularly during situations such as the recent pandemic. The students are encouraged to reflect on how they perceive the scientific dissemination by the scientific community, and how important it is for scientists to communicate transparently and understandably. The importance of sharing knowledge and cooperation is also debated.

In addition, the discussion touches on Francis Bacon's trust in science as a knowledge that can improve the living conditions of citizens, and how science can serve the public good. This leads to the questions of whether dogmatic truths can hinder progress and expansion of knowledge, and whether the word "progress" always has a positive meaning, in the students' opinion.

6th part of the activity: *Group mind maps*

In this part, students collaborate in filling in mind maps.



Activity

In order to obtain useful results to populate or reinforce an ontology of values, we ask students to compile mind maps (Appendix VI). The exercise involves selecting one of the values explored during the museum activity (freedom of thought, dialogue, progress, experimentation, cooperation, science for the public good, equality among peoples) and fill in a series of balloons linked to the chosen value through a series of predefined semantic properties: 'equivalent to', 'opposite to', and 'consequence of'. High school students are given complete freedom to enter their own keywords without any suggestions or guidelines and are also encouraged to propose new semantic links as well.



Discussion

The ensuing discussion, in this case, depends entirely on the selected theme: it is a conversation that develops spontaneously in the exchange among students of the same group who must fill in the mind map, but it may also involve one of the reference adults, such as the teacher or the museum educator.



Activity

When the students complete the task, they can also choose to participate in a brief interview to explain their choices and potentially make new considerations



7th part of the activity: *Visit to the museum collection*



In this unit, the group visits the museum collection.



Activity

The group is guided through the museum galleries to view the original objects previously discussed during the activity, which enhances the connection between the addressed values and ideas and the museum collections. Specifically, the focus is on scientific instruments or representations that help understand the transition between the geocentric and heliocentric models.



Discussion

The discussion advances through the analysis of passages from Galileo's 1615 Letter to Madama Cristina of Lorraine, in which the scientist defends the freedom of research and asserts the independence of naturalistic inquiry from any interference by theological authority.

8th part of the activity: *Post-visit questionnaires*



In this last unit, students are asked to compile a post-visit (Appendix III) questionnaire.



Activity

Questionnaires for students aim to collect:

- Whether there has been a change in perception of the importance of certain values compared to before the visit
- Students' ability to recognize the presence of specific values within excerpts from 17th-century works (potentially strengthening experts' annotation)
- Whether the link between the scientific instruments shown and the expressed values has emerged
- Most important values in students' ideal society
- Satisfaction with the experience

Farewell - Activity evaluation



We summarize the most important points with students and ask the teachers to fill a post-visit questionnaire (Appendix IV).

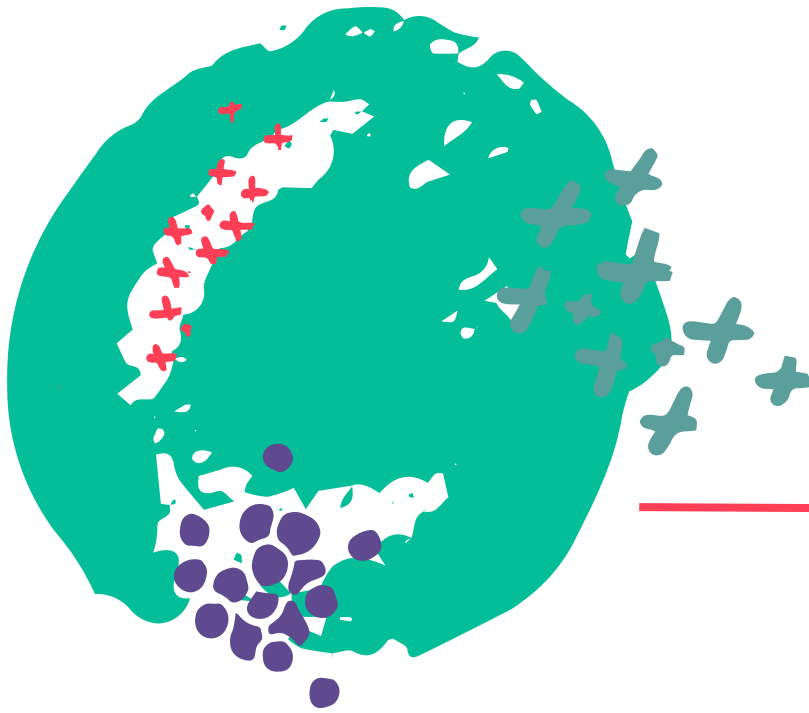


The purpose of this questionnaire is to understand:

- Whether the activity succeeded in stimulating a discussion on values among the students
- Whether it provided a broader perspective on scientific instruments
- Whether teachers believe that museums, as cultural institutions, can be a place for discussing the transformation of values in different eras
- If they believe that the digitization of experiences within the VAST Project can contribute to the study of values and their emergence in modern society
- Satisfaction with the experience

At the end we highlight the responsibility that museums have towards society, particularly towards younger generations, as they can contribute to the process of social transformation and the dissemination of shared values.





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APPENDIX - I

Pre-Visit Questionnaire for Students

Dear participant,

Thank you for the time you are dedicating to completing this survey. The questionnaire is anonymous, and your participation remains voluntary.

The survey results will be evaluated and utilized for research purposes, and to enhance the educational offerings of the Museum.

If you have any questions regarding the survey, you can contact us.

We truly appreciate your contribution!

UNIQUE CODE *	
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** Provide a unique code (word or number), different from those of all other classmates, and remember it to use in the post-visit questionnaire.*

Section 1 - Personal Information

1. How old are you?

2. What type of school do you attend?

- Artistic High School
- Classical High School
- Linguistic High School
- Music and Dance High School
- Scientific High School
- Human Sciences High School
- Technical Institute
- Vocational Institute
- Other

3. What grade are you in?
.....

4. Gender

- M
- F
- Other
- I prefer not to answer

5. Where do you live?

- Large City/Capital (>100.000)
- Suburb near a large city
- Small City (<100.000)
- Town or Rural Area (<30.000)

Section 2 - Museum Experience

6. What type of museums have you visited before?

- Art Museums
- Science and Technology Museums
- Natural History Museums
- Ethnographic, Anthropological, and Regional Museums
- Archaeological Museums or Archaeological Parks
- Historical Museums
- House Museums
- Military or War Museums
- Maritime or Oceanographic Museums
- Botanical Gardens
- Outdoor Museums (e.g. caves and mining parks)
- Fashion Museums
- Sports Museums
- Virtual Museums
- Other

7. Can you recall a museum that left a strong impression on you and why?

.....

.....

.....

8. Is this your first time visiting the Museo Galileo?

- Yes
- No

9. What types of cultural activities are you interested in?

- Museums and Exhibitions
- Conferences
- Theatrical Performances
- Musical Performances
- Sports Events
- Cinema
- Other

Section 3 - Activities at the Galileo Museum

10. What do you expect from this activity?

- Consolidation of knowledge
- Enrichment of cultural background
- Stimulating experience
- Sharing and exchanging opinions
- Development of critical thinking
- Other

11. Which value do you associate with the concept of "journey"?

- Knowledge
- Dialogue
- Freedom of thought
- Multiplicity of perspectives
- Progress or Innovation
- Experimentation

12. Can an imaginary journey stimulate a real one?

- Yes
- No

If yes, in what ways do you think it can do so?

.....

.....

13. "As soon as somebody demonstrates the art of flying, settlers from our species of man will not be lacking.

Who would once have thought that the crossing of the wide ocean was calmer and safer than of the narrow Adriatic Sea, Baltic sea, or English Channel? Given ships or sails adapted to the breezes of heaven, there will be those who will not shrink from even that vast.

Therefore, for the sake of those who, as it were, will presently be on hand to attempt this voyage, let us establish the astronomy, Galileo, you of Jupiter, and me of the moon."

(J. Kepler, *Dissertatio cum Nuncio Sidereo*)

Which of these values do you think emerges from this text?

- Cooperation
- Experimentation
- Progress
- Science for the public good
- Other

14. Can you indicate the importance you attribute to these values?

	Irrelevant	Slightly Important	Important	Very Important	Essential
Freedom of thought and expression					
Dialogue					
Tolerance					
Progress					
Experimentation					
Cooperation					
Science for the public good					
Equality among peoples					

15. Which of these scientific instruments most strongly represents the idea of progress and the utility of science for the public good (choose only one)?

- Telescope
- Microscope
- Maps, cartography, and navigation instruments
- Other

APPENDIX - II

Pre-Visit Questionnaire for Teachers

Dear Teacher,

Thank you for the time you are dedicating to completing this survey. The questionnaire is anonymous, and your participation is entirely voluntary. The survey results will be evaluated and used for research purposes, and to enhance the educational offerings of the Museum. Should you have any questions regarding the survey, you can contact us.

Your contribution is greatly appreciated!

UNIQUE CODE*	
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** Choose a unique code (word or number) and remember it to use in the post-visit questionnaire.*

Section 1 – Personal Information

1. Age

- 22-30
- 31-40
- 41-50
- 51-60
- > 60

2. Gender

- M
- F
- Other
- I prefer not to answer

3. Where do you live?

- Large City/Capital (>100.000)
- Suburb near a large city
- Small City (<100.000)
- Town or Rural Area (<30.000)

4. Educational qualification
- Bachelor's Degree
 - Master's Degree
 - Ph.D.
 - Other

5. Years of work experience in the educational field
- < 5 years
 - 5-10
 - 11-20
 - 21-30
 - > 30

6. What type of school are you currently teaching at?
.....

7. What is the age of your students?
.....

8. What subject do you teach?
.....

Section 2 - Museum Experience

9. Which museums have you already taken your students to?
- Art Museums
 - Science and Technology Museums
 - Natural History Museums
 - Ethnographic, Anthropological, and Regional Museums
 - Archaeological Museums or Archaeological Parks
 - Historical Museums
 - House Museums
 - Military or War Museums
 - Maritime or Oceanographic Museums
 - Botanical Gardens
 - Outdoor Museums (e.g. caves and mining parks)
 - Fashion Museums
 - Sports Museums
 - Virtual Museums
 - Other

10. Do you recall a museum that left a particular impression on you? Could you explain why?

.....
.....

11. Is this the first time you are accompanying your students to our museum?

- Yes
- No

Section 3 - Museums and Values Communication

12. Have you ever participated with your students in an educational activity centered on values?

- Yes
- No

If yes, which ones?

.....

13. Do you believe that a museum can serve as a medium for promoting certain values and consequently contribute to societal change and the expression of values?

- Yes
- No
- I'm not sure

If you wish, please explain why

.....

14. If your answer is positive, on which values would you like a museum to focus its attention?

.....
.....

15. Considering the current socio-political reality, do you think museums should contribute to reflecting on these events?

- Yes
- No
- I'm not sure

If you wish, please explain why

.....

Section 4 - Activities at the Museum

16. What benefits do you expect for your students from this activity?

- Consolidation of knowledge
- Enrichment of cultural background
- Stimulating experience
- Sharing and exchanging opinions
- Development of critical thinking
- Other

17. Do you think an activity focused on the dissemination of the history of science is suitable for stimulating a discussion on values?

- Yes
 - Somewhat
 - No
- Why?
-

18. Do you believe there are inherent risks in this operation?

- Yes
 - No
 - I'm not sure
- If yes, what are they?.....
-

APPENDIX - III

Post-Visit Questionnaire for Students

UNIQUE CODE*	
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** Please provide the unique code you used to fill out the pre-visit questionnaire.*

1. In light of the activity carried out, can you once again indicate the importance you attribute to these values?

	Irrelevant	Slightly Important	Important	Very Important	Essential
Freedom of thought and expression					
Dialogue					
Tolerance					
Progress					
Experimentation					
Cooperation					
Science for the public good					
Equality among peoples					

2. *"I am aware how great a difference there is between theoretical speculation and visual experience; between Ptolemy's discussion of the antipodes and Columbus' discovery of the New World, and likewise between the widely distributed tubes with two lenses and the apparatus with which you, Galileo, have pierced the heavens. But here I am trying to induce the skeptical to have faith in your instrument".*

(J. Kepler, *Dissertatio cum Nuncio Sidereo*)

From the text just read, one can deduce the value of observations against purely theoretical speculations. Do you agree?

Yes

No

What other values do you think emerge from the text, in your opinion?

.....
.....

3. Select the value that comes to your mind first when you read this passage:

"When the king had forbidden to all his people navigation into any part that was not under his crown, he made nevertheless this ordinance; that every twelve years there should be set forth, out of this kingdom two ships, appointed to several voyages; That in either of these ships there should be a mission of three of the Fellows or Brethren of Salomon's House; whose errand was only to give us knowledge of the affairs and state of those countries to which they were designed, and especially of the sciences, arts, manufactures, and inventions of all the world; and withal to bring unto us books, instruments, and patterns in every kind."

(F. Bacon, *New Atlantis*)

Knowledge

Science for the public good

Equality among peoples

Other

4. *"Therefore, I think that in disputes about natural phenomena one must begin not with the authority of scriptural passages, but with sense experiences and necessary demonstrations".*

(G. Galilei, *Letter to the Grand Duchess Christina of Lorraine*)

Highlight the words that, in your opinion, showcase the value of evidence against the principle of authority.

5. *“Against the obstinate critics of innovation, for whom anything unfamiliar is unbelievable, for whom anything outside the traditional boundaries of Aristotelian narrowmindedness is wicked and abominable, you may advance reinforced by one partisan.”*
(J. Kepler, *Dissertatio cum Nuncio Sidereo*)

Which of these values do you think emerges from this passage?

- Cooperation/Collaboration
- Tradition vs. Innovation
- Freedom of Research

6. Do you think the values we discussed have the same significance nowadays?

- Yes
- No

Explain why and indicate the value you consider most relevant today

.....

.....

.....

7. Which values would you like to be predominant in your ideal society? (Please indicate at least three values, not necessarily among those discussed)

.....

.....

8. In light of the activity carried out, which values among those listed do you think Galileo's telescope might have represented for that era?

- Tradition vs. Innovation
- Freedom of Research
- Progress
- Knowledge
- Other

9. What value do you associate with Galileo's telescope today?

- Tradition vs. Innovation
- Freedom of Research
- Progress
- Knowledge
- Other

10. How much did you enjoy participating in this activity?

- Not at all
- A little
- Moderately
- Very
- Extremely

11. What did you like the most?

.....

.....

.....

12. Do you believe that the language used by the facilitator during the activity adequately conveyed the connection between the museum collection and the discussed values?

- Yes
- Moderately
- No
- If no, why?

.....

13. Do you want to add a comment?

.....

.....

APPENDIX - IV

Post-Visit Questionnaire for Teachers

UNIQUE CODE*	
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** Please, provide the unique code you used to complete the pre-visit questionnaire.*

1. How would you rate the activity?

- It was a pleasant surprise
- It was as I expected
- It was not very effective

If you wish, please explain why

.....

.....

2. Do you believe the activity successfully stimulated a discussion on values?

- Yes
- Somewhat
- No

If you wish, please explain why

.....

.....

3. Do you think the activity highlighted the connection between the displayed scientific instruments and the expressed values?

- Yes
 - No
 - Other
-

4. Do you believe the activity managed to provide a broader perspective on scientific instruments to your students?

- Yes
- No
- I'm not sure

Do you have any comments on this?

.....

.....

.....

5. What did you like the most about the visit?

.....

.....

.....

6. Which part of the laboratory activity do you think most stimulated your students?

.....

.....

.....

7. The foundations upon which a value originates and develops lie within the social, cultural, and institutional context, as well as within the personality of individuals who are part of that context.

Considering the activity conducted, do you believe that a museum, as a cultural institution, can be a place of interaction, where discussions about the transformation of values across different eras can take place?

- Yes
- No
- Other

.....

8. Values form the foundation of our intangible cultural heritage. Do you think that the digitalization of experiences carried out within the scope of the VAST Project could contribute to the study of values and their emergence in modern society?

- Yes
- No
- I'm not sure

If you wish, please explain why

.....

.....

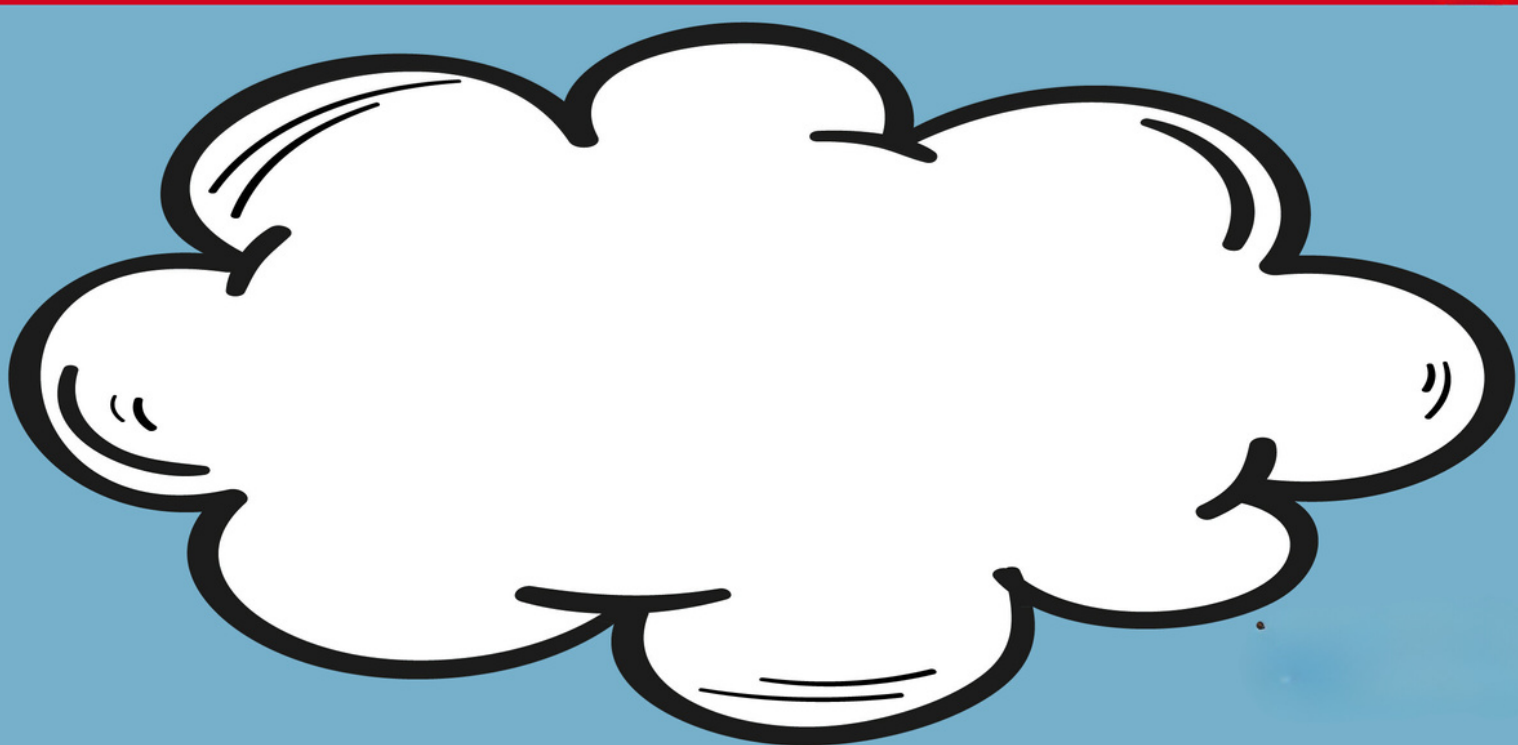
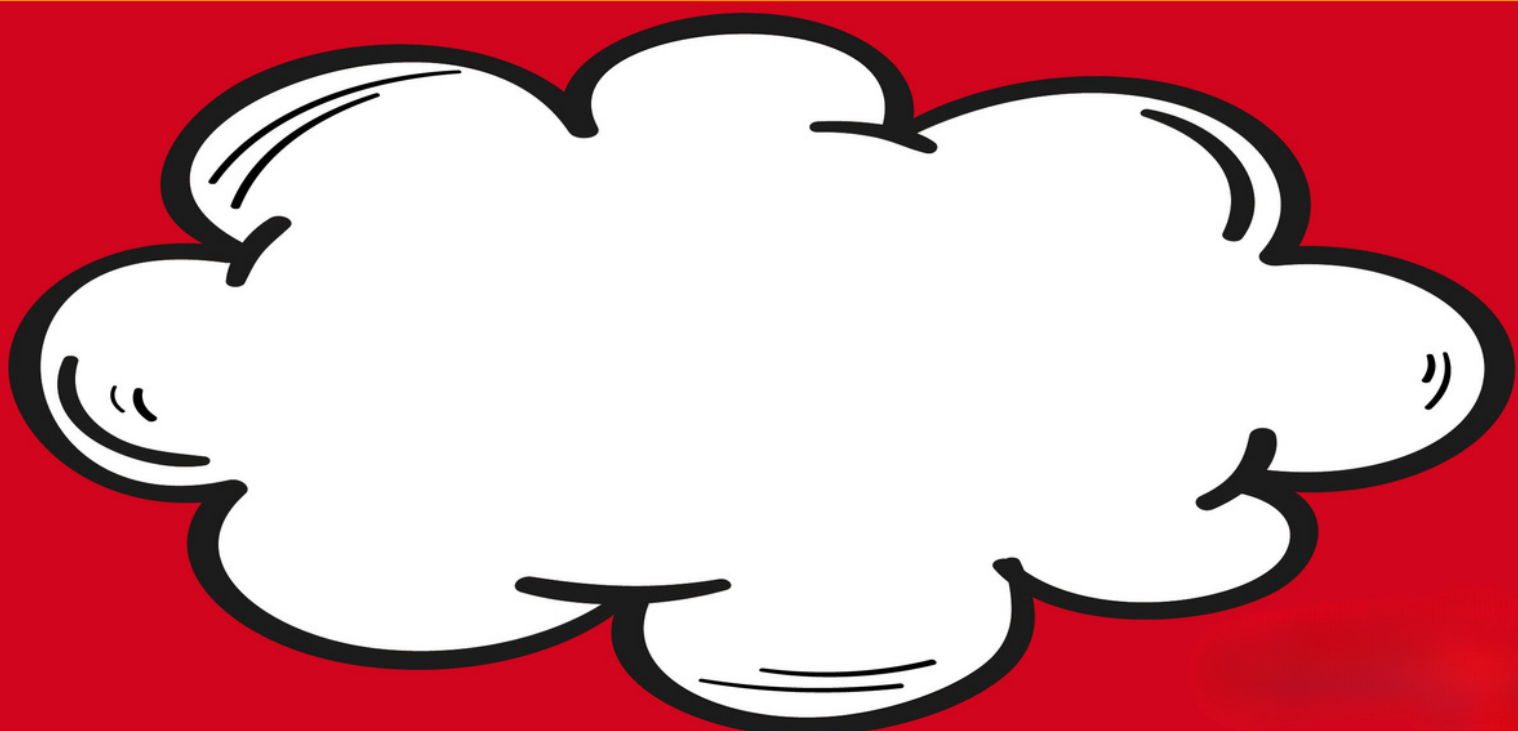
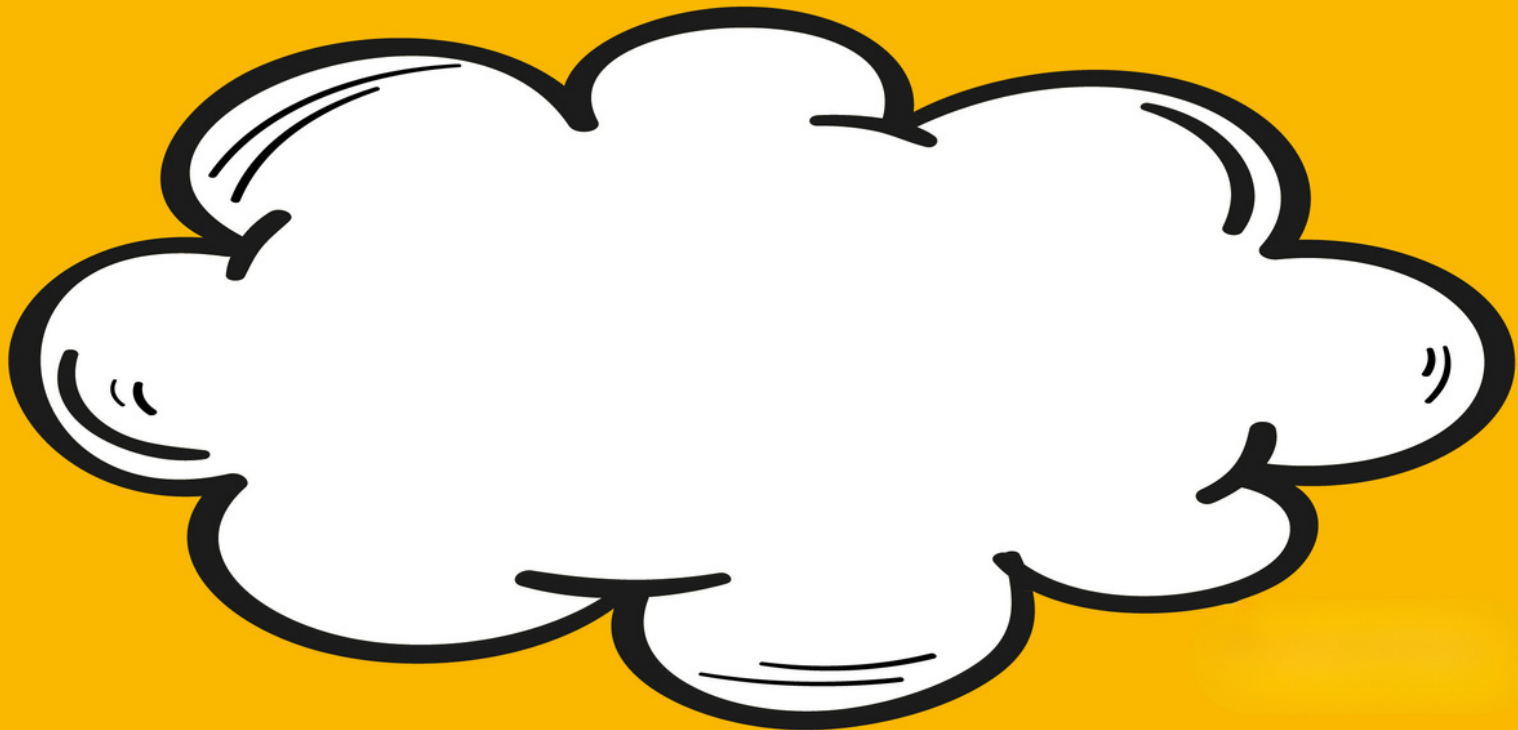
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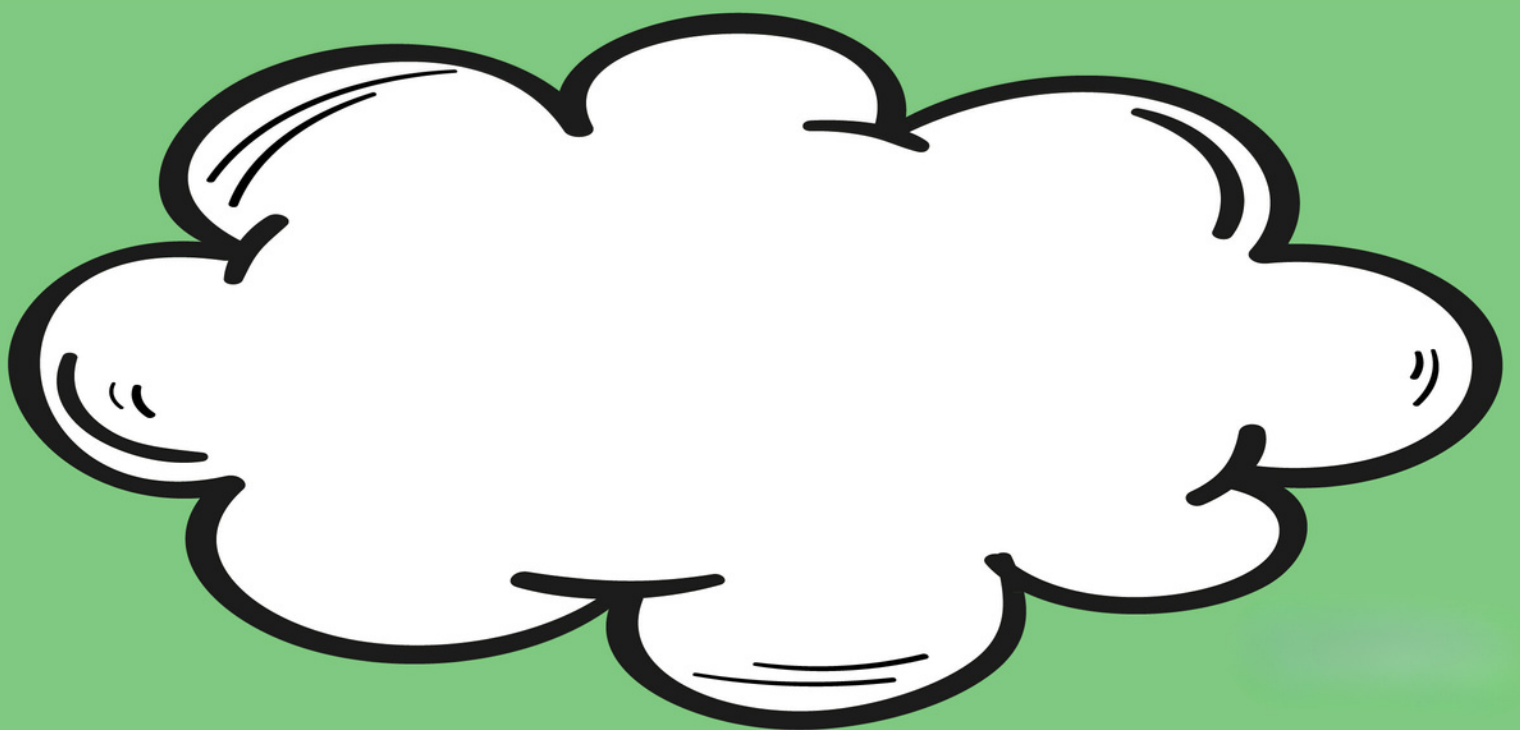
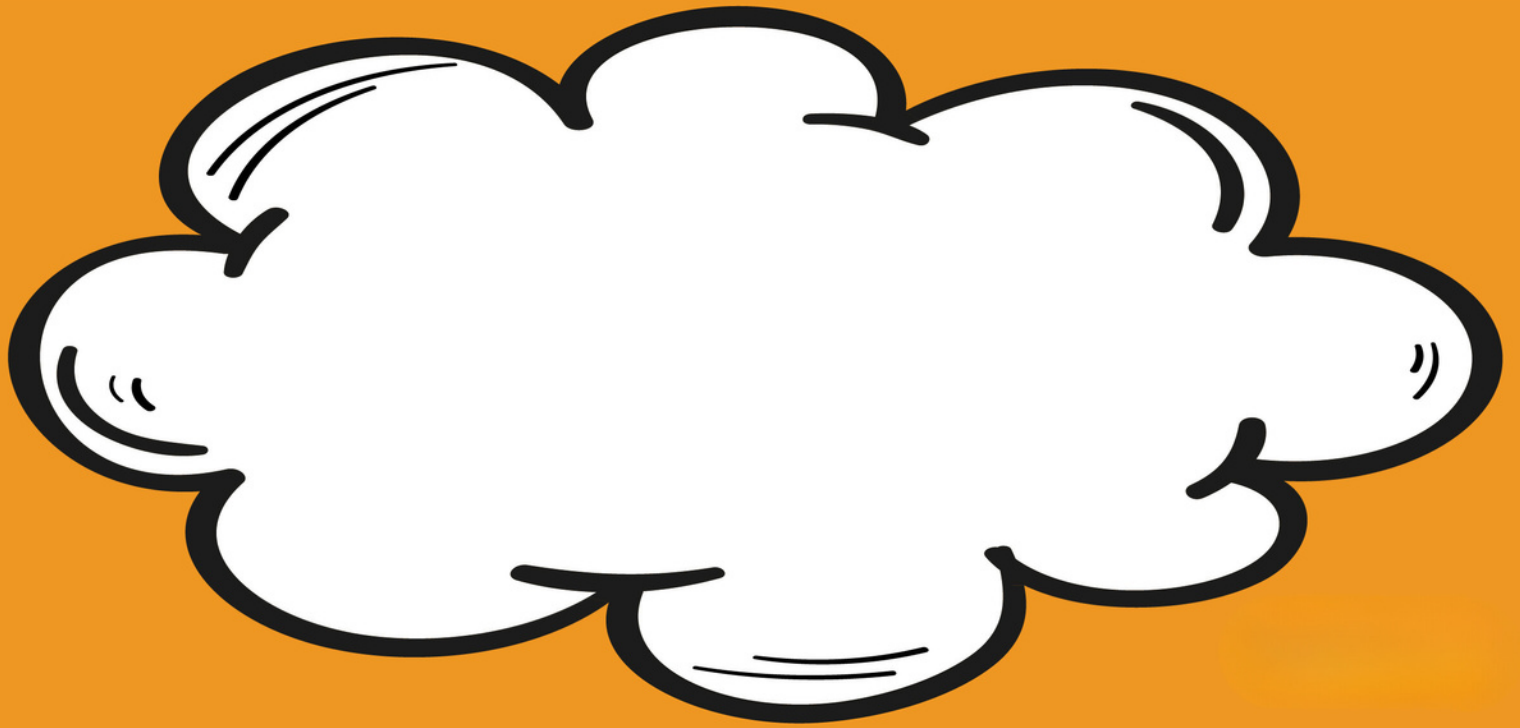
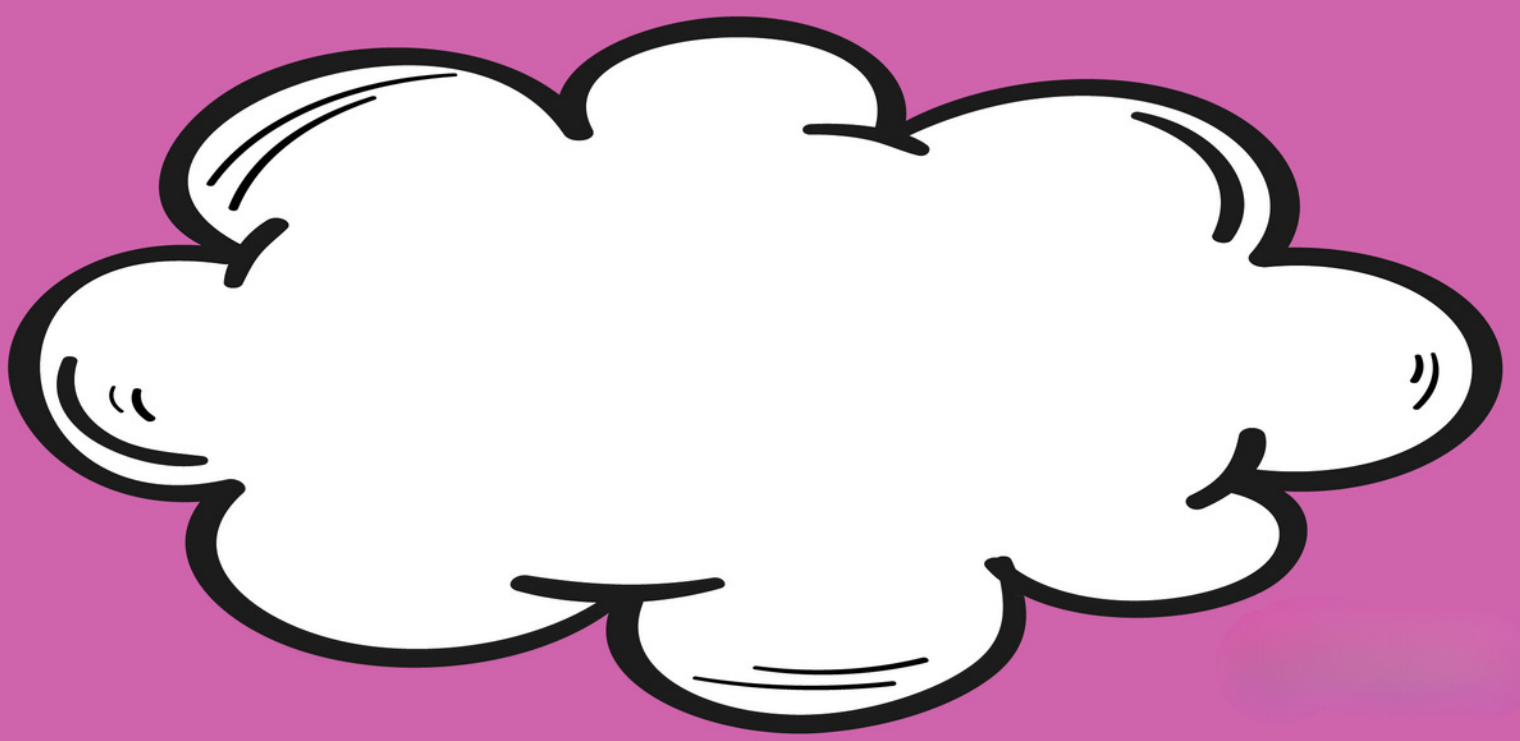
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APPENDIX - V

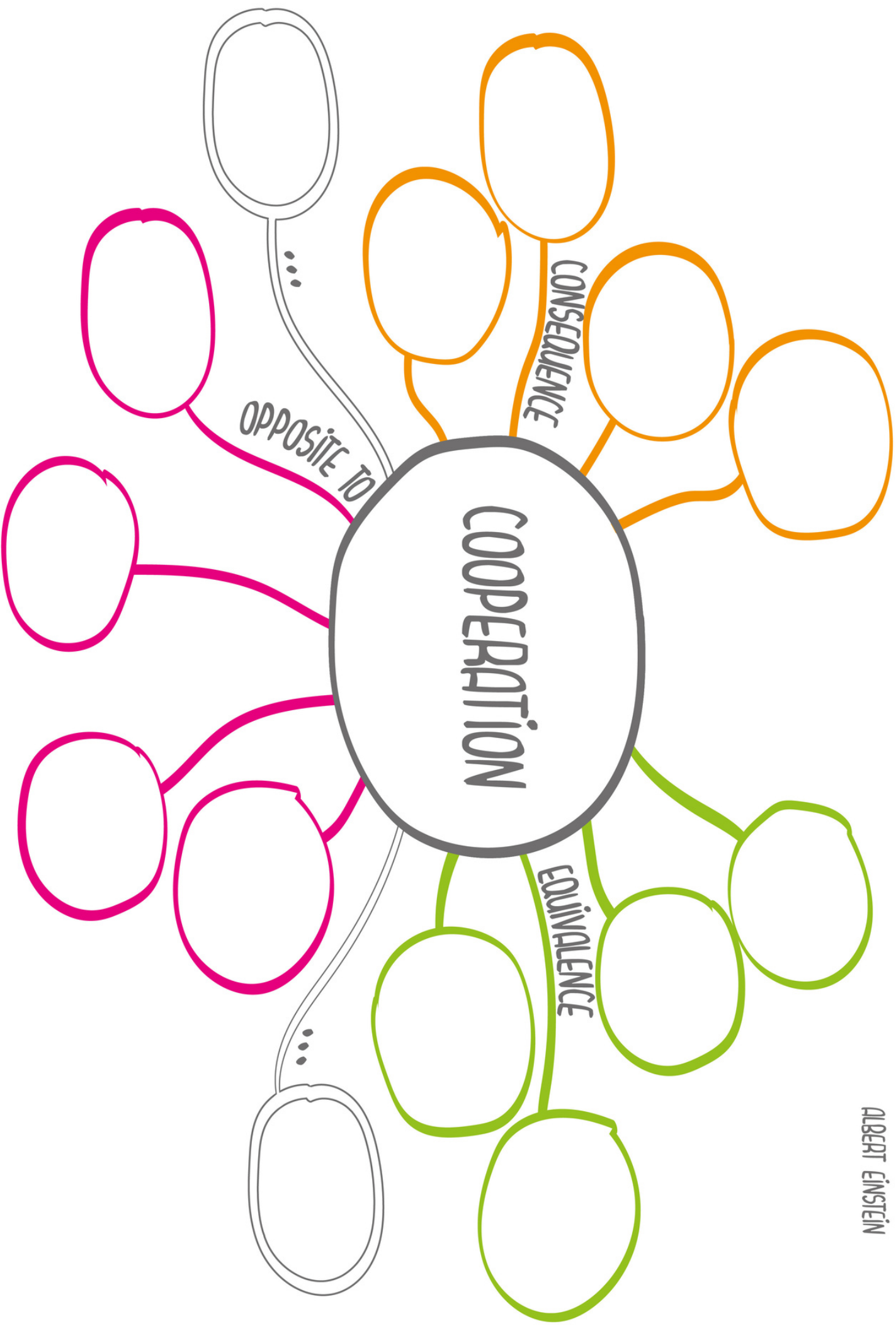




APPENDIX - VI

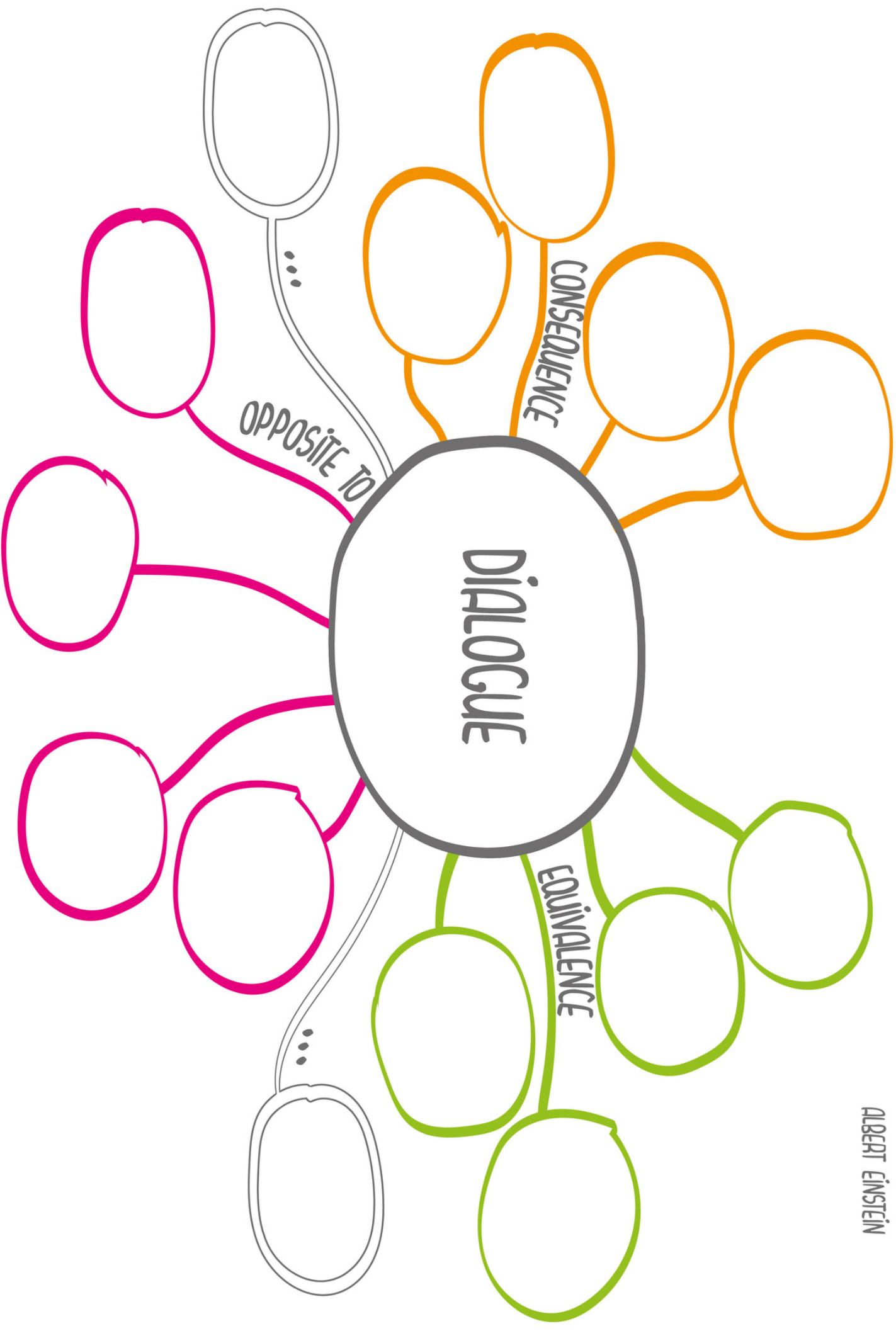
THE MIND THAT OPENS TO A NEW IDEA NEVER RETURNS TO ITS ORIGINAL SIZE

ALBERT EINSTEIN



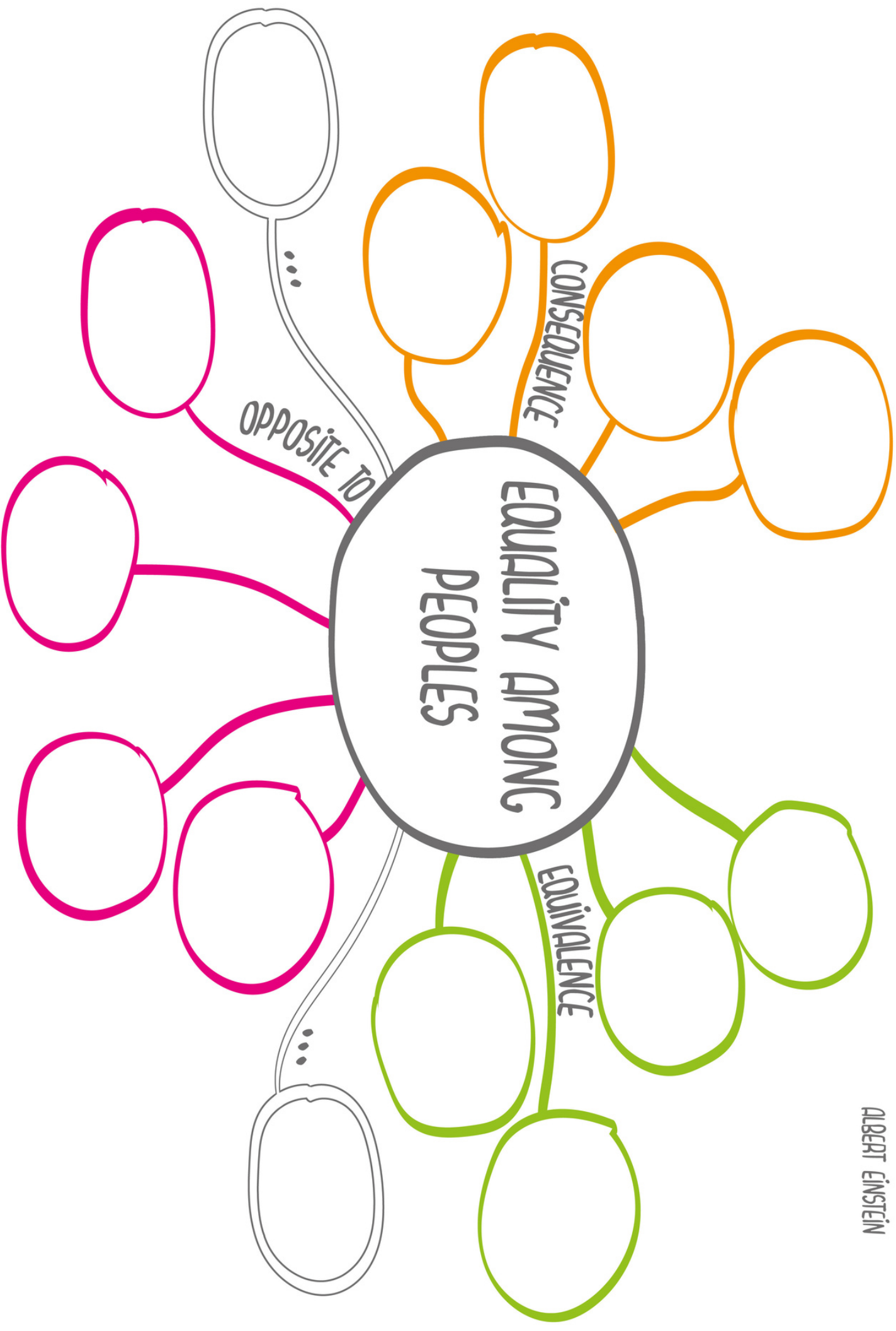
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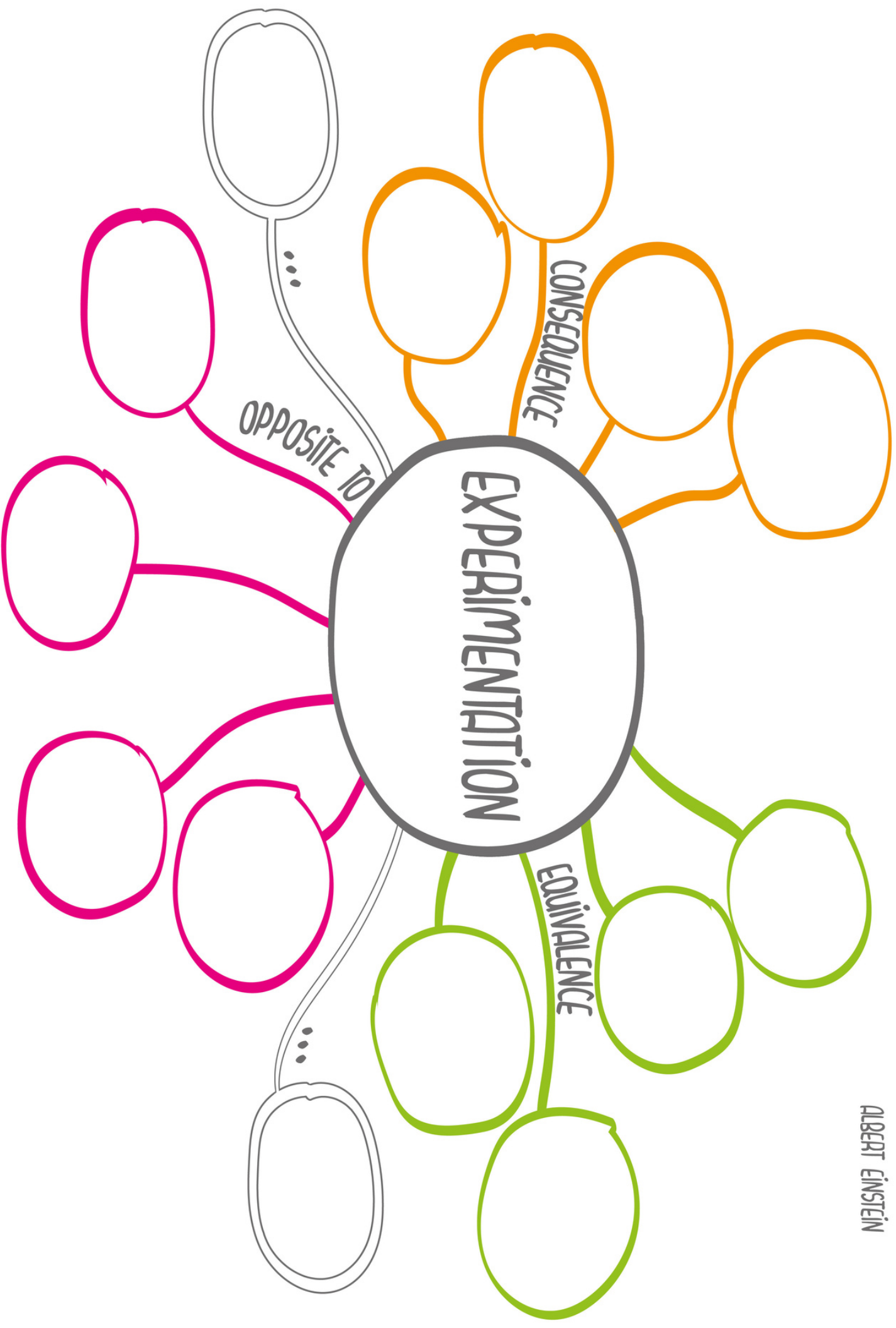
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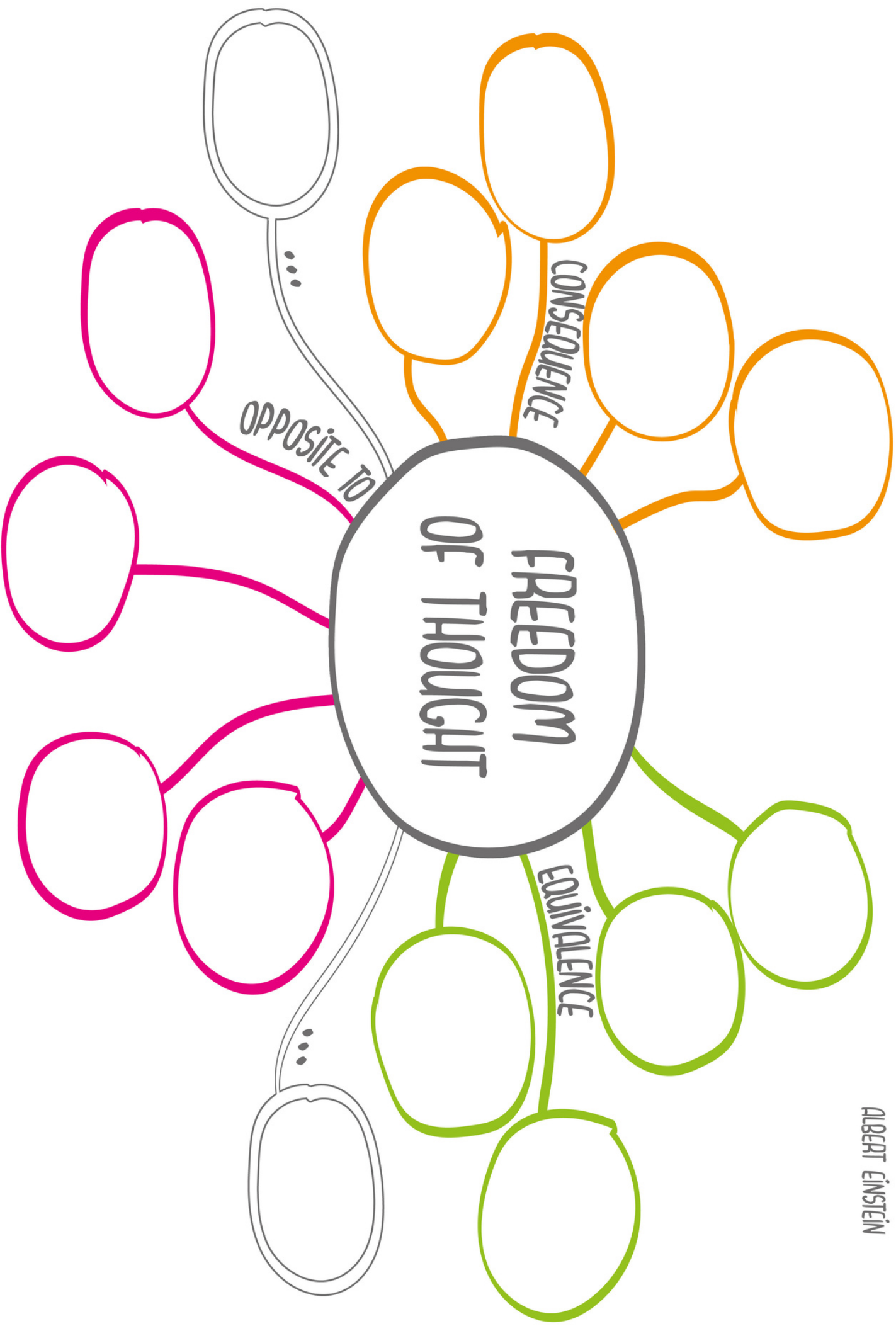
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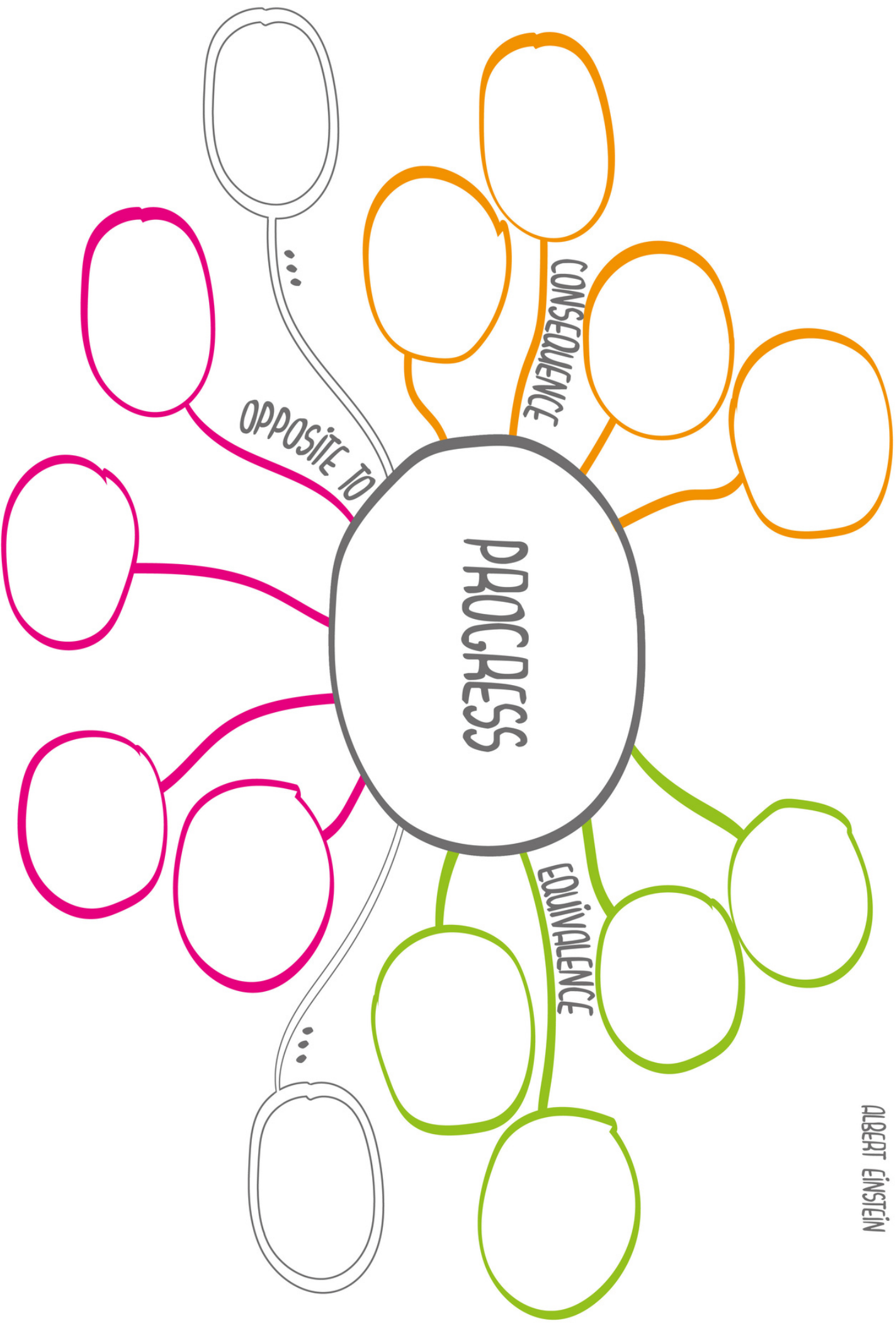
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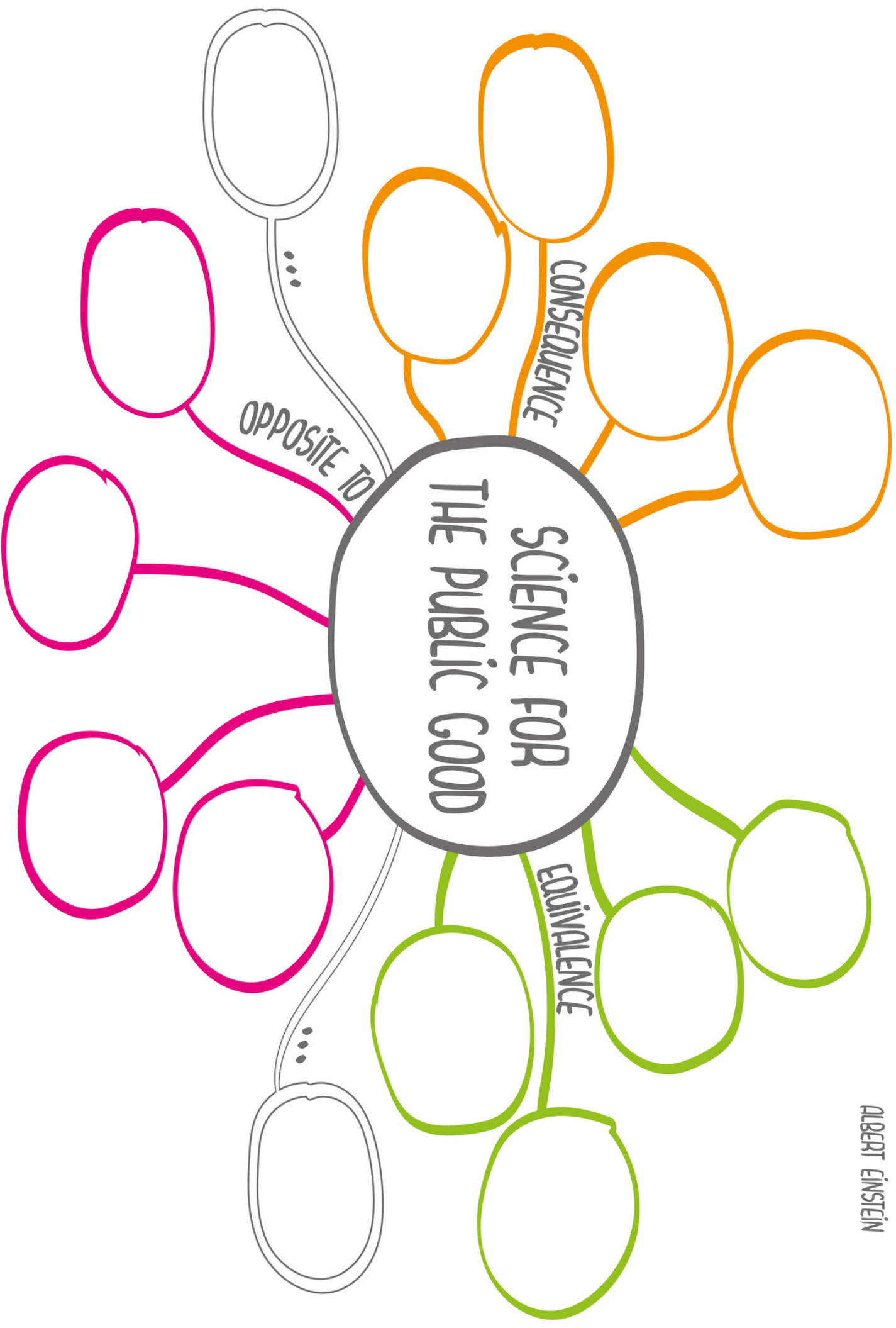
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