1 THE CARD DECK MANUAL

WHO?

This card deck is intended to be used by science storytellers, which may be researchers, students, and intermediaries such as media professionals, museum and cultural heritage professionals, and mental, social welfare and community-based practitioners who want to translate their scientific story to the public.

WHAT?

This card deck is a reflection tool and contains guidelines for the design and evaluation of science stories. It is not a prescriptive checklist, but a **reflection** support. The guidelines on the cards are posed in the form of **questions** to stimulate thinking and spark discussion.

The cards are characterized by three properties, including dimensions, layers, and themes.

- There are **four science story dimensions** in the card deck. The dimensions correspond with four different facets of science storytelling. These dimensions are clustered by the colour of the front cards and label shown in the upper left corner, namely: "**science"** (colour red), "**communication**" (colour green), "**technological tool**" (colour orange), and "**impact**" (colour blue).
- Within each dimension, we distinguish three layers that are ordered according to their complexity. The layers are clustered by colour saturation of the front cards and label shown in the upper left corner, ranging from the basic layer "**layer 1**" (least saturated colours), the intermediate layer "layer 2", to the most advanced layer "**layer 3**" (most saturated colours).
- Within each dimension and at each layer, there can be one or more theme-specific content cards. The specific theme is shown on the titles and subtitles on each of the front cards.

WHY?

The motivation behind this self-reflective card approach is to give science storytellers agency in the development and evaluation process of their science stories. In doing so, the card approach can support people to look at (the creation of) their science stories from different perspectives.

WHEN?

The cards can be used to **develop and design** a science story (beginning), to **iterate** a science story (during the process), or to **evaluate** a science story (final phase).

HOW?

STEP 1. PREPARATORY STEP: INDIVIDUALLY OR COLLECTIVELY?

The cards can either be used individually or collectively as a team. There are **many specializations and expertise** within the field of science storytelling. Collective use is recommended when the users of the cards do not have the necessary expertise in all four science story dimensions, for instance when a background in science or curation is lacking.

By joining forces and using the card deck collectively, people can **exchange experiences and reflections,** and where possible also engage in **dialogues and discussions** at an advanced multi-dimensional level.

STEP 2. STARTING WITH THE CARD DECK STACK

The cards are grouped into **four coloured stacks** with a paper clip. These four groups represent the four basic science story dimensions, with the colour red for the dimension science, the colour green for the dimension communication, the colour orange for the dimension technology, and the colour blue for the dimension impact.

When starting with the card deck stack, it is recommended to keep these cards divided into **four piles** and not yet remove the paper clips.

STEP 3. THE FOUR BASIC SCIENCE STORY DIMENSIONS

Dimensions are to be explored in a meaningful order, namely starting from **science** (the story content) to → **communication** (translation and presentation of the story), and optionally also → **technological**

tools (to present or support the story), to then eventually ending with considering → the **impact** (on society).

The four basic science storytelling dimensions include science, communication, technology, and impact.

The **technological tool** dimension is **optional** since not all science storytellers will make use of a supportive, technology-driven tool to present their science story.

Regardless of the expertise and specialization of the science storyteller, the first layer of the card deck with the basic science storytelling dimensions is important for **everyone**. When the cards are used collectively, we recommend that each team member first **individually reflects** upon the four different dimensions as represented on the first-level cards. These reflections should be hereafter discussed with the team.

The **questions** at the bottom of the cards are **prompts** for individual reflections and group discussions.

The card deck should be seen and used as **an integrated whole**. Therefore, all science story dimensions should be taken into consideration and there should not be a cherry-picking of the engagement components. For example, if one would solemnly focus on creating an engaging or impactful story at the expense of the scientific grounding of the story, there is a risk that the card desk is used for conscious or unconscious misinformation by distortion or propaganda. Alternatively, if the information is disseminated with an academic approach, it may have a low reach or response from the public.

STEP 4. THE GUIDING QUESTIONS ON THE CARDS

Being critical about own work can be a challenge. Therefore, the guiding questions on the cards can help to think about the **potentialities and limitations** of your science story.

It is recommended to **read all** the questions on the cards since they might reveal aspects or issues that are overlooked. However, it is possible that not all questions apply to the science story. Therefore, **not all questions require an answer**.

STEP 5. UNFOLDING THE CARD DECK STACK

The card deck consists of **three layers**. The first layer introduces the four different science story dimensions (science, communication, technology, impact) at an introductory, relatively basic level. The **second and third** layers are **more in-depth** and require more expertise.

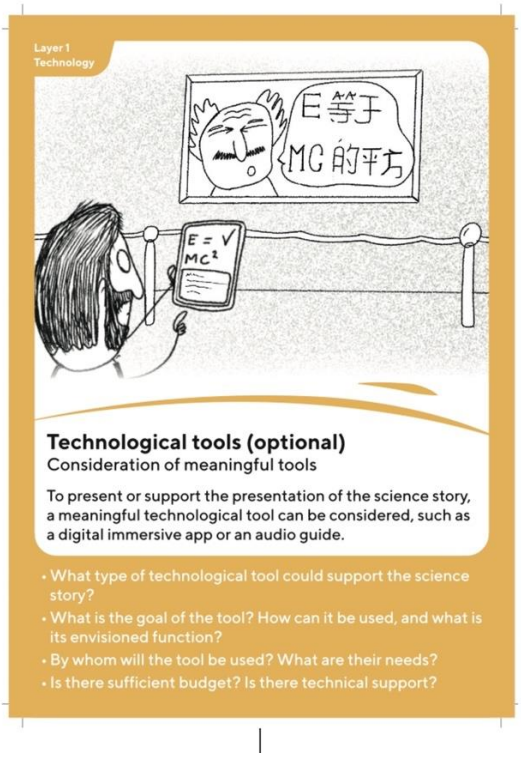
In this step, the different dimension piles can be **unclipped**.

When removing the paper clips, we recommend you to keep the cards **grouped**. Cards that belong to the same dimension are characterized by the same dimension label in the upper left corner and by the same **dimension colour** for the front card.

Within a single-dimension pile, there is a subtle colour gradient. The more in-depth the content of the card, the more **saturated** its dimension colour.

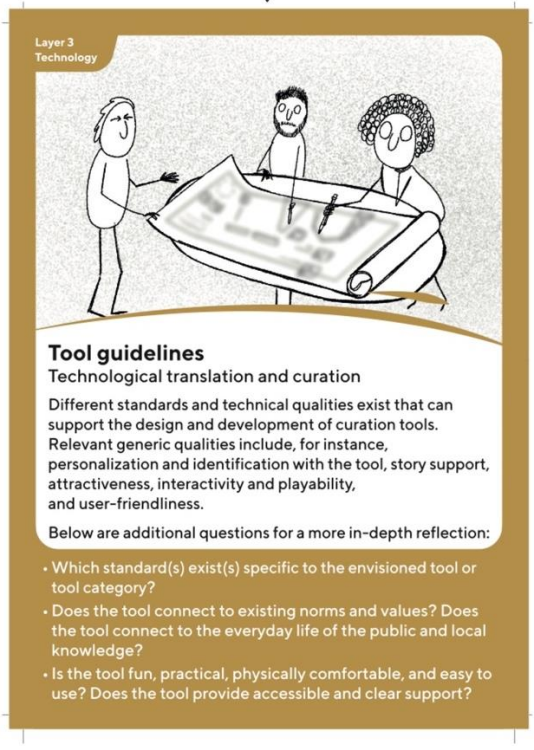
It works well if you can **organize** the different cards **vertically** from light to dark, with layer 1 on top and layer 3 at the bottom.

Layer #1 Technology
Different science dimensions of the science story / basic layer



Layer #2 Technology
Digging deeper / pillars

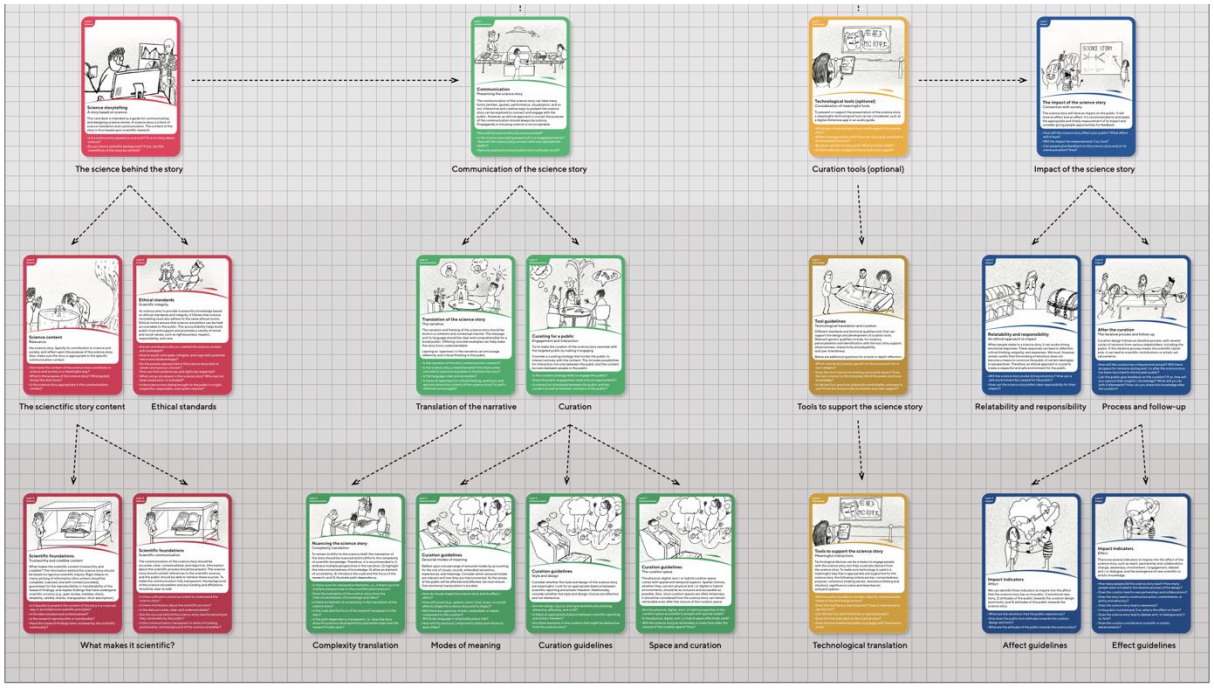
Layer #3 Technology
Specialization / expansion



Example of the three different layers within the technology dimension, organised from the basic layer at the top (orange colour) to the specialisation layer at the bottom (dark orange colour).

STEP 6. THE FULL PICTURE

When the card deck is completely unfolded, the **overview** of the cards looks like the structural overview depicted below.



For the large version of this schematic overview, we refer to the Appendix in chapter 4.

After the consideration of each of the dimensions separately, it is important to **connect the cards again** and reflect on how they form a meaningful whole. When working individually, try to make as many connections across the different dimensions and between the different cards as possible. When working in a team, let first each member present their thoughts and reflections on the dimension they have explored. Next, establish synergies by discussing connections between the different dimensions.

STEP 7. ADDITIONAL SUPPORT

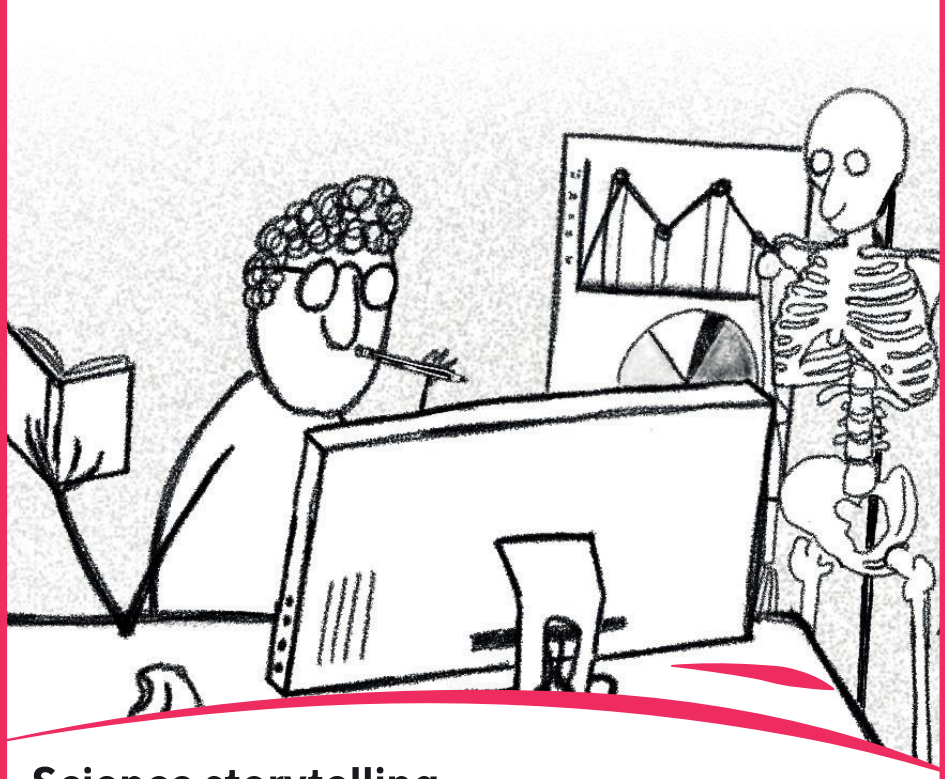
More **information** and explanation about the **individual cards** can be found in the following chapter as a means of support.

2 THE TRAINER CARDS

2.1 DIMENSION: SCIENCE (THE STORY CONTENT)

LAYER 1
THEME Science storytelling

Layer 1
Science



Science storytelling

A story based on science

This card deck is intended as a guide for communicating and designing science stories. A science story is a form of scence translation and communication. The content of the story is thus based upon scientific research.

- Is it a science story (based on science)? Or is it a story about science?
- Do you have a scientific background? If not, can the scientificity of the story be verified?

This first dimension “science” deals with the story content, and thus focuses on science as the fundament for the story. With the first layer card, the card user is invited to reflect on whether their story is based on science and what exactly makes their story science-based.

The reflection on the scientific foundations of the story might benefit from the input from a card user that has a background in scientific research and is familiar with how science works.

The word ‘science’ is etymologically derived from the Latin word *scientia,* which is commonly translated as ‘knowledge’. Scientific knowledge denotes a wide range of activities and covers both natural and social worlds. This knowledge can be in *any* field of inquiry. Scientific knowledge is, however, at the same time a very specific kind of knowledge. This type of knowledge is acquired using the scientific method. Science-based knowledge follows a systematic and logical methodology based on evidence.

To evaluate the scientific soundness behind the science story, one needs to be able to understand the scientific method(ology) that generated the ‘data’ or ‘findings’ that underly the content of the story.

LAYER 2
THEME Science content

Layer 2
Science

Science content

Relevance

the science story. Specify its contribution to science and society, and reflect upon the purpose of the science story. Also, make sure the story is appropriate in the specific communication context.

- How does the content of the science story contribute to science and society in a meaningful way?
- What is the purpose of the science story? What goal(s) do(es) the story have?
- Is the science story appropriate in the communication context?

At intermediate layer 2 of the “science” dimension, there is a card that invites the user to reflect on the relevance of the science content. The content of the science story should contribute something valuable to society and/or science. Keeping the purpose and relevance of the science story in mind is very helpful when developing the narrative, designing the presentation, and evaluating the possible impact of the science story.

When reflecting on the relevance of the content, the card user is also invited to gauge whether the content is appropriate in the context within which it is being communicated. For example, it would be inappropriate to communicate a science story on fertility issues in an elderly care setting.

A relevant science story should have solid scientific foundations. We refer to the theme cards on layer 3 to get more guidance and inspiration on how to make the content trustworthy and credible and elaborate on how to communicate in a scientific manner.

LAYER 2
THEME Ethical standards

Layer 2
Science

Ethical standards

Scientific integrity

As science aims to provide trustworthy knowledge based on ethical standards and integrity, it follows that science storytelling must also adhere to the same ethical norms. Ethical norms ensure that science storytellers can be held accountable to the public. This accountability helps build public trust and support and promotes a variety of moral and social values, such as righteousness, respect, responsibility, and care.

- Are all contributors who co-created the science content acknowledged?
- How to avoid, anticipate, mitigate, and cope with potential harms and disadvantages?
- Do the people represented in the science story wish to remain anonymous / known?
  How can their preferences and rights be respected?
- What voices are absent in the science story? Who has not been heard and / or included?
- Is the science story being brought to the public in a right, respectful, responsible, and careful manner?

At the intermediate layer 2 of the “science” dimension, there is a card that invites the user to reflect on the ethical standards of the science story, including its scientific integrity. A good science story should always adhere to ethical standards and scientific integrity. These standards not only lead to proper content and a better representation of what the story is about, but they also ensure to keep the scientific basis trustworthy and rightfully credible.

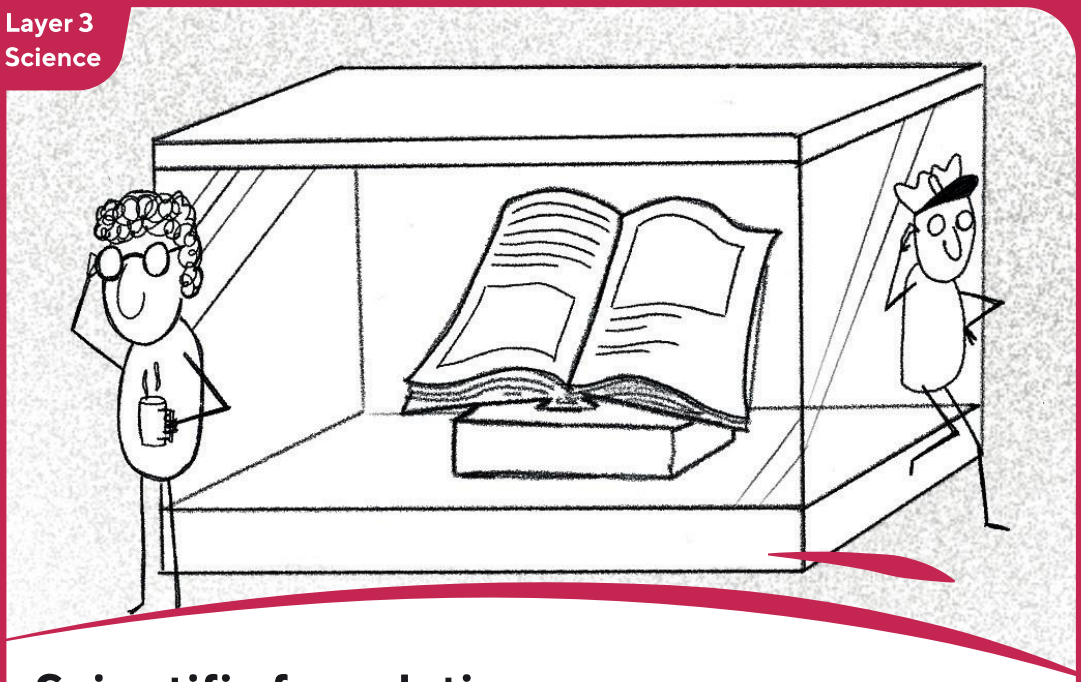
The ethical standards / scientific integrity theme has its own card in the scientific foundation dimension, but a reflection on ethics and scientific integrity is needed in all the dimensions. Thinking about the fine line between an engaging science story and propaganda, or how technology can be used in a meaningful and supportive way, or about the possible effect or affect a science story can have on people, are also ethical reflections and considerations.

A science story communicates scientific knowledge. This knowledge may be co-created by different contributors. If so, these co-creators should be acknowledged. Another ethical issue relating to knowledge translation is that of representation and inclusion. Is the voice of the people who are talked about included? Is there a plurality of voices or perspectives represented? Are their voices absent in the science story? Who is not represented or included? Also, make sure that you know whether these represented voices wish to be known or remain anonymous and inquire how their preferences and rights can be protected. Acknowledgements are important, but so is confidentiality.

As mentioned before, a science story needs to be relevant and thus valuable to science and/or society. Reflecting on the public benefit from the science story is crucial, but equally so reflecting on whether the science story contains potential disadvantages or harms to certain individuals or groups in the population. Make sure that the science story is always brought up in a responsible, careful, and respectful manner.

LAYER 3
THEME Scientific foundations

Layer 3
Science



Scientific foundations

Trustworthy and credible content

What makes the scientific content trustworthy and credible? The information behind the science story should be based on rigorous scientific inquiry. Rigor means no cherry picking of information (the content should be complete, nuanced, and with context provided), guarantees for the reproducibility or transferability of the research findings, and implies findings that have undergone scientific scrutiny (e.g., peer review, member check, reliability, validity checks, triangulation, thick description).

- Is it feasible to present the content of the story in a nuanced way, in accordance to scientific principles?
- Is the data situated and contextualized?
- Is the research reproducible or transferable?
- Have the research findings been reviewed by the scientific community?

A high-quality science story with relevant content has solid scientific foundations based on rigorous scientific inquiry. The trustworthiness and credibility of the content is a crucial part of the establishment of solid foundations. Some important scientific principles are:

- No (un)intentional cherry picking
    - Cherry-picking means: directing attention to particular data or cases that fit the story and ignoring a significant portion of related data or cases that reveal something different.
    - Translating this within the picking fruit analogy means that when somebody goes to the grocery store and sees perfect cherries, one might wrongly conclude that all the fruit on these cherry trees is in perfect condition. In reality, however, a cherry picker only selected the cherries that meet the (perfect) standards of the grocery store.
- Reproducibility or transferability of findings
    - Reproducibility: when a researcher collects new data, that researcher will arrive at the same scientific findings. The results can be regenerated.
    - Transferability: there is evidence that the research findings can be transferred, and thus are applicable to other situations and contexts.
- Scientific scrutiny
    - Scientific scrutiny: the research findings are reviewed by the scientific community by means of a peer review, member check, or validity check.
    - Reliability: the findings were generated by consistently measuring under the same circumstances and are therefore considered to be reliable.
    - Triangulation: the findings were analysed by different methods of data collection.
    - Thick description: there is contextual detail in the observing and interpreting of the findings.

LAYER 3
THEME Scientific foundations

Layer 3
Science

Scientific foundations

Scientific communication

The communication of the science story should be accurate, clear, contextualized, and objective. Information about the scientific process should be present. The science story should contain references to the scientific sources, and the public should be able to retrieve these sources. To make the communication fully transparent, the background of the science storytellers and any funding and affiliations should be clear as well.

- Is there sufficient context provided to understand the science story?
- Is there information about the scientific process?
- Is the data accurate, clear, and understandable?
- Are the sources behind the science story mentioned and are they retrievable by the public?
- Is the communication transparent in terms of funding, positionality, and background of the science storyteller?

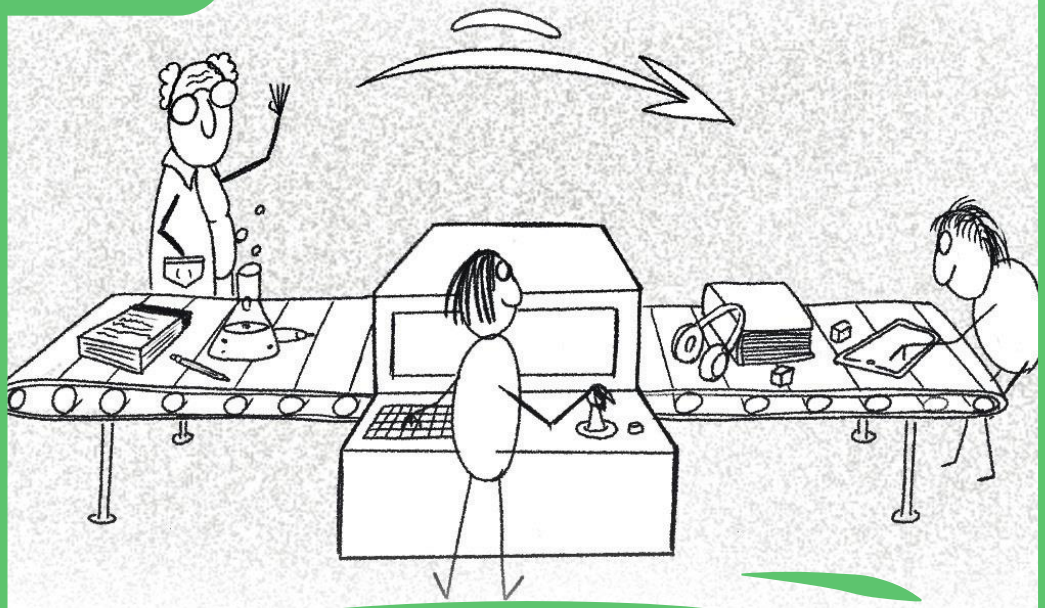
Even though communication has its own separate dimension pile, the different science story dimensions are interwoven. Thinking about the scientificity of the story requires thinking about communication and translation as well. The scientific foundations need to be safeguarded in the communication of the science story, otherwise the science story could lead to conscious or unconscious propaganda or misinformation by distortion.

To maintain this scientific character, the communication of the research findings should be objective, clear, accurate, and contextualized. Information concerning the scientific processes that led to the findings is an added value. Transparency is another important characteristic of qualitative science communication. The sources underlying the science story should be retrievable. Possible influences that have an impact on the content of the science story such as funding, affiliations, background, and positionality of the science storytellers, are also a part of being transparent. Characteristic of a 'story' is that there is a 'storyteller', which means that the meaning of the story depends on the storyteller(s) even though the story has scientific roots.

2.2 Dimension: Communication (translation and presentation)

LAYER 1
THEME Communication

Layer 1
Communication



Communication

Presenting the science story

The communication of the science story can take many forms (written, spoken, performance, visualization, and so on). Interactive and creative ways to present the science story can be explored to connect and engage with the public. However, an ethical approach is crucial: the purpose of the communication should always be science. Propaganda or misusing science is not acceptable.

- How will the science story be communicated?
- Is the science story being presented in an engaging manner? How will the science story connect with and captivate the public?
- Have you pursued communication that is ethically sound?

There are many forms by which the science story can be communicated. The story can be presented in a visual, audio, literary, performance, or new media format or a mixture of these forms. Every format will have its advantages and limitations, so it is recommended to consider these in advance.

Creative and interactive ways of communication are an important part of building a bridge between the scientific and public realms. With creative, we refer to sensorially and / or artistically inspired ways to present scientific findings. With interactive, we refer to the involvement of people in the science story. By using creative and interactive ways, the science story can become more inclusive and engaging.

A good science story Is engaging and captivating. At the same time, It Is Important to keep In mind that the goal of the story is to communicate science and that an ethical approach is crucial.

The communication dimension is separated into two strands, namely translation (the narrative of the story) and curation (the public display of the story). The narrative translation line is closely intertwined with the cards in the science dimension pile and requires affinity with and expertise in scientific research.

LAYER 2
THEME Translation of the science story

Layer 2
Communication

Translation of the science story

The narrative

The narration and framing of the science story should be done in a coherent and contextual manner. The message and its language should be clear and comprehensible for a broad public. Offering concrete examples can help make the story more understandable.

Leaving an 'openness' in the narrative can encourage reflexivity and critical thinking in the public.

- Is the narration of the story contextual and coherent?
- Is the science story comprehensible? Are there some concrete or practical examples to illustrate the story?
- Is the language clear and accessible?
- Is there an openness for critical thinking, questions, and opinions about the content of the science story? Is (self-) reflection encouraged?

The science story needs to be comprehensible for a broad public and the message and language should therefore be formulated in a clear and accessible way. Adding concrete examples in the science story, can help to make the story more understandable. The narrative should be framed in not only a coherent way but also in a contextual manner. The art of good science storytelling is translating it into something simple while maintaining the situatedness, complexity, and nuance of the science. More information on 'nuancing the science story' by translating the complexity of science, can be found in layer 3.

Leaving an openness in the narrative can encourage reflexivity and critical thinking in the public. An openness sparks the interest of people, stimulates them to raise questions, inspires them to do further inquiry, and draw their own conclusions and opinions.

LAYER 2
THEME Curating for a public

Layer 2
Communication

Curating for a public

Engagement and interaction

Try to make the curation of the science story resonate with the targeted public by making it engaging.

Consider a curating strategy that invites the public to interact actively with the content. This includes possibilities for interaction not only between the public and the content but also between people in the public.

- Is the curation strategy likely to engage the public?
- Does the public engagement meet ethical requirements?
- Is interaction stimulated between the public and the content as well as between members of the public?

By curating the science story, we refer to the formative presentation of the content of the science story. To resonate with the public, the curation of the science story needs to be engaging. Consequently, the story will have an effect and an affect. However, keep in mind that the goal is to present a scientific story and not just a story. Science storytellers are accountable for their curation and should avoid misusing storytelling for unethical purposes such as propaganda or purely entertainment. Make sure that the story meets ethical requirements. Such requirements can be found on the card 'Relatability and responsibility' in the dimension 'impact' layer 2.

A possible way of making the science story engaging is making it interactive. Interactivity means that people take up a more active role in the science story communication and knowledge translation process. This interaction can be situated on multiple levels and the active role can vary in degree. Interactivity can take place between people and the science content, between people and the curation format or tool, or between people. The curation can spark interest and reflection, stimulate conversations or debates, or even involve people in the exchange of information.

More detailed attention points related to curation can be found in layer 3 in the series on 'curation guidelines'.

LAYER 3
THEME Nuancing the science story

Layer 3
Communication

Nuancing the science story

Complexity translation

To remain truthful to the science itself, the translation of the story should be nuanced and truthful to the complexity of scientific knowledge. Therefore, it is recommended to 1) embrace multiple perspectives in the narration; 2) highlight the interconnectedness of knowledge; 3) allow an element of uncertainty; 4) introduce the scale and the focus of the research; and 5) illustrate path-dependency.

- Is there room for interpretive flexibility, i.e., is there room for multiple perspectives on the scientific phenomenon?
- Does the translation of the science story show the interconnectedness of knowledge and ideas?
- Is there an element of uncertainty in the translation of the science story?
- Is the scale and the focus of the research transparent in the story?
- Is the path-dependency transparent; i.e., does the story show the previous development(s) and earlier steps that the research builds upon?

A major challenge is to translate science into a broadly accessible narrative or story without losing its scientific core. The narrative design should be nuanced and truthful to the complexity of scientific knowledge.

The following five indicators are recommended guidelines:

1. Multiple perspectives in the narration / interpretive flexibility
    - It is important to embrace different perspectives, interpretations, and values of various stakeholders in the narrative design. This enables us to see the whole picture and to take various needs and understandings into consideration.
    - The notion of interpretive flexibility is originally used in the field of technology studies to illustrate and explain how technical artefacts and designs of technology are socially constructed. The word flexibility indicates that there is flexibility in how people interpret and think about the same design. Although this concept of interpretive flexibility is usually linked to technology–human interactions, the idea behind the concept can be applied more broadly. Interpretive flexibility refers to an openness to sustain divergent opinions or to present more than one interpretation by including various relevant social groups. The key takeaway for the narrative design is that the form and meaning of the science story should be seen as the result of how various groups perceive and interpret a scientific phenomenon in particular contexts.
2. Interconnectedness of knowledge and ideas
    - Knowledge and ideas are interconnected. Inquiring how you know what you know and what you don't know, reveals that knowledge is not fixed but develops and changes.
    - This interconnectedness of knowledge can be made visible by exploring multiple perspectives. For example, by looking at the science story through different sensorial perceptions (using one or more senses) or various disciplinary perspectives (learning across disciplines). Taking a different perceptual approach makes it easier to comprehend that there are much more meanings to something than we see. For instance, when you look at a cup of coffee standing on your desk you see a beverage. However, when you taste it, smell it, or touch it, you will have different sensorial experiences. These sensorial experiences will be influenced by the production, roasting, and brewing process that determine the quality and taste of the coffee blend. In turn, geographical and economic conditions have an impact on these production and consumption processes and, consequently, also on the sensorial experiences.

3. Element of uncertainty
    - Science is based on the principles of plausibility (determining how likely it is for something to be true) and falsification (eliminating false theories and hypotheses). This element of uncertainty should be incorporated into the science story as well.
4. Scale and focus of the research
    - The scale and the focus of the research have an impact on representation and should therefore be transparent in the story narrative.
5. Path-dependency in science
    - The science story should reveal which previous development(s) and outcomes, or earlier steps it builds. Science is a path-dependent process which means that it is not merely the result of current conditions: 'history' has an influence as well.

LAYER 3
THEME Curation guidelines

Layer 3
Communication

Curation guidelines

Sensorial modes of meaning

Reflect upon a broad range of sensorial modes by accounting for the role of visuals, sounds, embodied sensations, experiences, and meanings. Consider which sensorial modes are relevant and how they are interconnected. As the senses of the public will be affected and effected, we must ensure that emotional manipulation is avoided.

- How do visuals shape the science story and its effect / affect?
- How will sound (e.g., speech, voice, tone, music, or sound effects) shape the science story and its impact?
- Will there be a gestural, kinetic, embodied, or haptic component in the curation?
  Will body language or physicality play a role?
- How will the sensorial components relate and influence each other?

Consider which sensorial modes could be relevant for the curation of the science story. There is a broad range of sensorial experiences that could be accounted for and included. Visuals such as photos, drawings, animations, and its properties such as colors, shapes, symbols, and perspective. Sound such as speech, music, or sound effects.

Embodied or haptic sensations are also an interesting mode of meaning to explore. The word haptic derives from the Greek *haptós* and means palpable or able to be touched or felt. It denotes any sensation that we can perceive through touch with our body. Examples of haptic sensations include vibrating objects (devices, chairs, driving wheel, etc.), motion, pressure, and enclosure. Haptic technologies can also create virtual or illusory sensations through applied force.

When considering different sensorial modes of meaning, keep in mind that they are interconnected and dependent, and reflect upon how they may influence one another. Are the different components complementary, supplementary, or in competition? Are some redundant or distractive?

Incorporating sensorial experiences and meanings in the curation implies that the public will be affected and have emotional responses. Hence, ethical considerations must be considered to avoid emotional manipulation.

LAYER 3
THEME Curation guidelines

Layer 3
Communication

Curation guidelines

Style and design

Consider whether the style and design of the science story are meaningful. Look for an appropriate balance between scientific reporting and artistic freedom. Additionally, consider whether the style and design choices are effective and not distractive.

- Are the design, layout, and style aesthetically pleasing, attractive, effective, and vivid?
- Is there an appropriate balance between scientific reporting and artistic freedom?
- Are there elements in the curation that might be distractive from the science story?

Consider the aesthetic qualities of the science story and whether its style and design are meaningful, vivid, and attractive to the public. Look for an appropriate balance between scientific reporting and artistic freedom. Art and science both have interpretation and observation at their core and can work complementary to each other. Using an artistic approach to curate the science story can help to understand and communicate science. The curation of the science story should be attractive and inspiring, but the style and design choices should not be distractive. Make sure that the content stays the focus and that the style and design are effective. The style and design should support, emphasize, or add value to the science story.

LAYER 3
THEME Curation guidelines

Layer 3
Communication

Curation guidelines

The curation space

The physical, digital, and / or hybrid curation space comes with spatial and temporal aspects. Spatial choices, whether they concern physical and / or digital or hybrid environments, should be as inclusive and accessible as possible. Also, since curation spaces are often temporary, it should be considered how the science story can remain retrievable even after the closure of the curation space.

- Are the physical, digital, and / or hybrid properties of the curation space accessible to people with special needs?
- Is the physical, digital, and / or hybrid space effectively used?
- Will the science story be retrievable in some form after the closure of the curation space? How?

Space influences how we experience an event. A large auditorium that amplifies sounds offers a different experience than a small classroom with furniture. Large or small, high, or low ceilings, daylight or not, old or new, are but a few important factors that will characterize your space. Try to imagine yourself as a first-time visitor and analyze your experience. Ask yourself some basic questions such as: does this space make you feel welcome or not? Does it make you feel small or important? Does it invite you to be explored or not? In what sense could the architecture and the nature of your space be of an advantage or disadvantage to your curation story and how can you adapt yourself to get the most benefit out of it?

The space does not necessarily need to be a physical one. The science story can be presented in a digital or hybrid environment as well. The main concern should always be that the space is inclusive and accessible to a wide range of people. Furthermore, the space needs to be effectively used to achieve the desired interaction and knowledge transfer goals and effects.

When the curation space is only temporary, consider an option to make the science story retrievable afterward.

2.3 DIMENSION: TECHNOLOGICAL TOOLS (OPTIONAL)

LAYER 1
THEME Technological tools

Layer 1
Technology

Technological tools (optional)

Consideration of meaningful tools

To present or support the presentation of the science story, a meaningful technological tool can be considered, such as a digital immersive app or an audio guide.

- What type of technological tool could support the science story?
- What is the goal of the tool? How can it be used, and what is its envisioned function?
- By whom will the tool be used? What are their needs?
- Is there sufficient budget? Is there technical support?

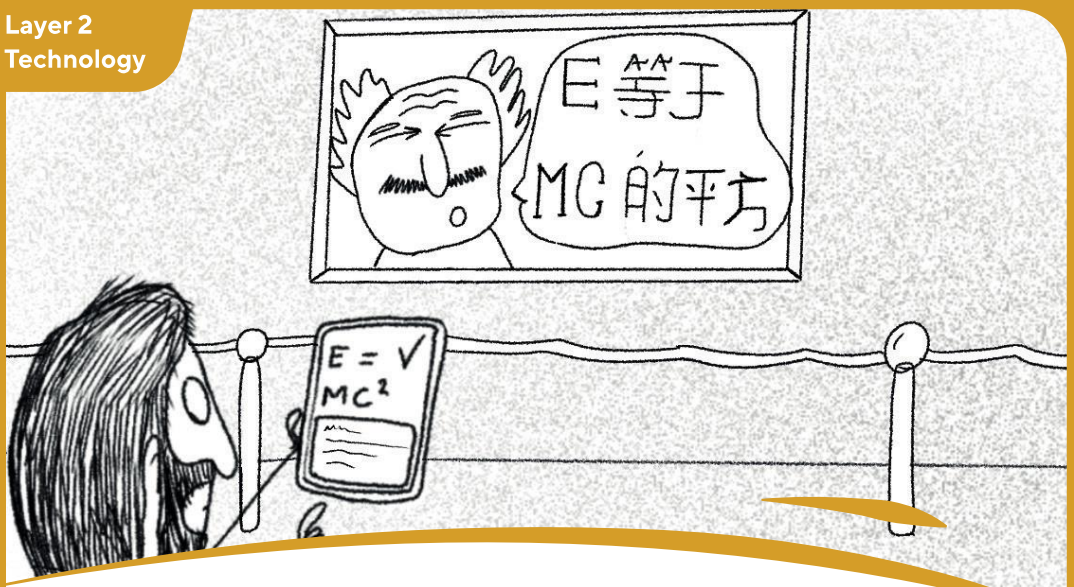
Since not all science storytellers will use technological tools to present or support their science stories, this dimension is optional.

When considering a technological tool to present or support a science story, such as a website or app, first consider these two fundamental questions: 1.) what is the purpose of this technological tool and what is its envisioned function?; and 2.) how would the tool enhance the science story or its curation format?. If it is difficult to answer these fundamental questions, a technological tool is probably not needed.

When it would be beneficial to use a technological tool to curate the science story, ask yourself by whom the tool will be used and what their specific needs may be. For example, children may have very different needs than adults. Furthermore, make sure that there is a sufficient budget to develop this tool and technical support. Not only will you need a budget for resources and staff to create and design the tool, but also for the maintenance and support of the tool. Otherwise, you could end up with old, broken and/or unsafe technology which should be avoided.

What the notion ‘meaningful’ depicts will be explained in the second layer of the technological tool dimension ‘Tools to support the science story’.

Layer 2
Technology



Tools to support the science story

Meaningful interactions

Technological devices can be a means to engage people with the science story, but they could also distract from the science story. To make sure technology is used in a meaningful way that is appropriate and supportive for the science story, the following criteria are key: connectedness, purpose, coherence (making sense), resonance (feeling and intuition), significance (value and importance), and participation.

- Will the public be able to connect, identify, and personally relate to the technological tool?
- Does the tool have a clear purpose? Does it make sense to use the tool?
- Can the tool be used intuitively or spontaneously?
- Does the tool add value to the science story?
- Does the tool enable the public to engage with the science story?

Implementing technological tools is popular in our times, but the science story curator must guard the line between pure entertainment and supportive engagement. Although technological devices can help to attract, engage, and even persuade people, they can also become an obstacle to the science story if they become the focus. After all, the goal of the curation is to find a successful way to get the science story message across.

To avoid this pitfall where technology steals the attention away from the science story, the following markers can help to establish a meaningful form of interaction with the tool:

- Connectedness: the public should be able to relate to the technological tool.
- Purpose: the technological tool has a clear purpose, and it makes sense to use it.
- Coherence: the tool is logical when you interact with it.
- Resonance: the public should be able to use the tool intuitively.
- Significance: the tool adds value to the science story.
- Participation: the tool engages the public with the science story. Or even better: the tool invites the public into the science story.

These different markers have an influence on each other. Without connectedness, it is difficult to perceive purpose, significance, coherence, or resonance. When people experience purpose, significance, coherence, and resonance, they will also be able to connect to the tool.

LAYER 3
THEME Tool guidelines

Layer 3
Technology

Tool guidelines

Technological translation and curation

Different standards and technical qualities exist that can support the design and development of curation tools. Relevant generic qualities include, for instance, personalization and identification with the tool, story support, attractiveness, interactivity and playability, and user-friendliness.

Below are additional questions for a more in-depth reflection:

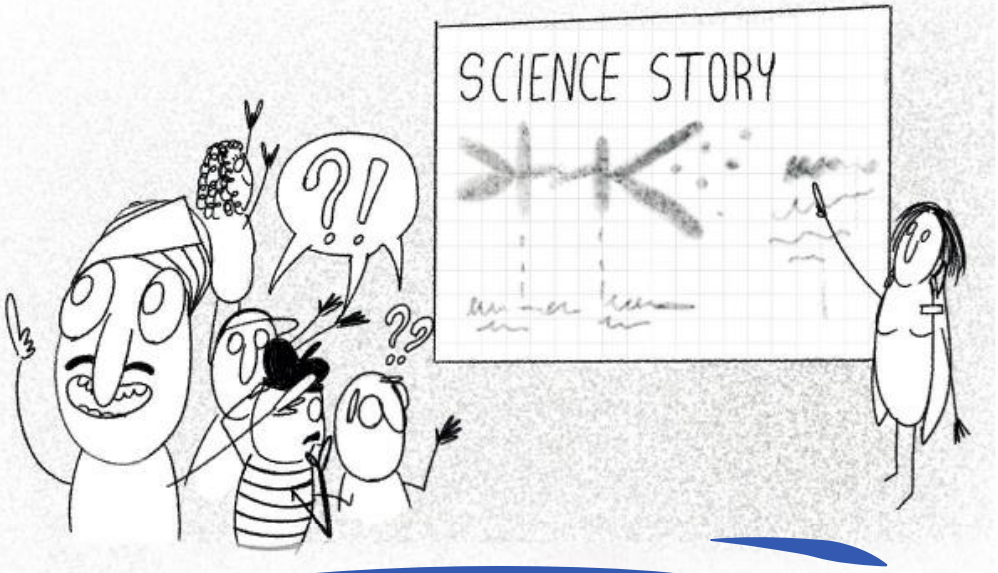
- Which standard(s) exist(s) specific to the envisioned tool or tool category?
- Does the tool connect to existing norms and values? Does the tool connect to the everyday life of the public and local knowledge?
- Is the tool fun, practical, physically comfortable, and easy to use? Does the tool provide accessible and clear support?

Once it is decided that a tool or tools will be used in the curation, it is worthwhile to explore the different aspects of its implementation. These can be divided into:

- Standards and technical qualities
    - Has this tool been used before and what are known problems, limitations, or possible pitfalls that can be avoided? What examples are there concerning best or familiar practices? Are there technological guidelines or patterns?
    - What are the technical possibilities, needs, and opportunities of the tool?
- Generic qualities
    - Think of how the tool can be adapted or personalized in function of the curation and the target public. How easy will it be to use the tool? Are there possible discomforts that can be eliminated or prevented (for instance by providing a clear and accessible manual or some sort of assistance in case of problems)?

LAYER 1
THEME The impact of the science story

Layer 1
Impact



The impact of the science story

Connection with society

The science story will have an impact on the public. It will have an effect and an affect. It is recommended to anticipate the appropriate and timely measurement of its impact and consider giving people opportunities for feedback.

- How will the science story affect your public? What effect will it have?
- Will the impact be measured and, if so, how?
- Can people give feedback on the science story and/or its communication? How?

The goal of a science story is to translate scientific insights for the public. Since science is generally viewed as the highest authority concerning knowledge, one must try to reflect upon the impact a science story could have on the public. The science story can have an impact on commonly held beliefs that are cultural or religious, or it can have an impact on older scientific stories, and so on.

As the saying goes, with great power comes great responsibility. How can you as a science storyteller create an impact that is not unilateral, and where the public is able to voice its own thoughts, concerns, or critics? For example, one could decide to try to measure the impact by using a short survey that is not just focused on satisfaction but also gives the opportunity for the public to voice its opinion(s).

LAYER 2
THEME Relatability and responsibility

Layer 2
Impact

Relatability and responsibility

An ethical approach to impact

When people relate to a science story, it can evoke strong emotional responses. These responses can lead to reflection, critical thinking, empathy, and awareness. We must, however, remain careful that the evoking of emotions does not become a means to convince the public of certain ideologies or perspectives. Therefore, an ethical approach is crucial to create a respectful and safe environment for the public.

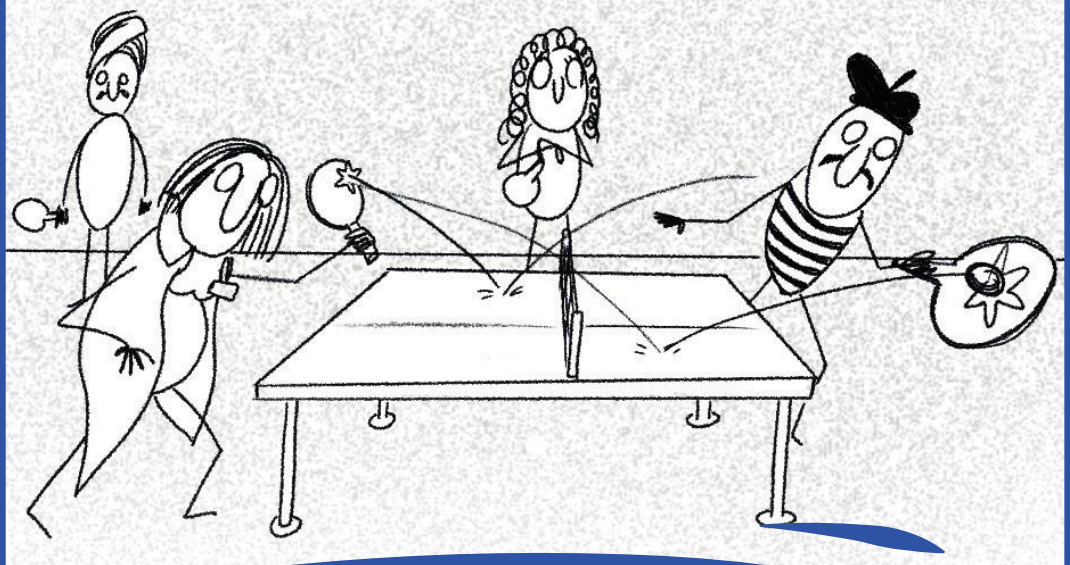
- Will the science story evoke strong emotions? How can a safe environment be created for the public?
- How can the science storytellers take responsibility for their impact?

The position of a science storyteller also entails responsibility. Responsibility goes hand in hand with transparency and visibility. For instance, if a science storyteller is reachable and visible to the public, it sends the message that dialogue is possible and that no one will be hiding in anonymity.

The science story will have an impact on both an individual and societal level. Since there is a fine line between emotionally captivating a public and manipulating their emotions, the curator must investigate this aspect of the curation and assess its integrity. When people relate to a science story, it can lead to strong emotional responses, so a respectful and safe environment is necessary.

LAYER 2
THEME After the curation

Layer 2
Impact



After the curation

The iterative process and follow-up

Curation design follows an iterative process, with several cycles of revisions from various stakeholders, including the public. If this iterative process meets the scientific standards, it can lead to scientific contributions or artistic advancements.

- How will the curation be critiqued and revised? Will there be space for revisions during and / or after the science story has been launched to the broader public?
- Can the public give feedback on the curation? If so, how will you capture their insights / knowledge? What will you do with it afterwards? How can you share this knowledge after the curation?

Since a science story and its curation is never complete or perfect, the importance of the iterative process of feedback should not be overlooked. Several stakeholders, including the public, ought to play their role in this follow-up, which gives the opportunity to advance science itself.

This iteration process could already be happening during the curation. Will there be a possibility for staff members to give feedback? Perhaps the public can provide feedback through some sort of survey or on-the-spot interviews or leave their comments on a wall or in a book? It is important to give thought to what will be done with the feedback once received: with whom will it be shared, in what format, and what will be done with it?

LAYER 3
THEME Impact indicators

Layer 3
Impact

Impact indicators

Affect

We can identify three indicators to inquire into the affect that the science story has on its public: 1) emotional reactions, 2) attitudes of the public towards the curation design (and tools), and 3) attitudes of the public towards the science story.

- What are the emotions that the public experiences?
- How does the public form attitudes towards the curation design and tools?
- What are the attitudes of the public towards the science story?

As mentioned earlier on, when people relate to a science story it can evoke strong emotional responses and it will affect them. There are three indicators of affect:

- People show emotional reactions when they experience the story.
- People show a certain attitude towards the curation design and technological tools.
- People show a certain attitude towards the science story.

There are different ways to captivate these emotional reactions and attitudes. Some examples that have been mentioned before are on-the-spot interviews or surveys with open questions. Depending on the type of science story curation, one could also decide to observe reactions and attitudes.

LAYER 3
THEME Impact indicators

Layer 3
Impact

Impact indicators

Effect

There are several indicators to inquire into the effect of the science story, such as reach, partnership and collaboration, change, awareness, involvement / engagement, debate and / or dialogue, and the emergence of new scientific or artistic knowledge.

- How many people did the science story reach? How many people were included in the iterative process of the design?
- Does the curation lead to new partnerships and collaborations?
- Does the story lead to constructive action, commitments, or policy and advocacy?
- Does the science story lead to awareness?
- Is the public involved and, if so, what is the effect on them?
- Does the science story lead to debate and / or dialogue and, if so, how?
- Does the curation contribute to scientific or artistic advancements?

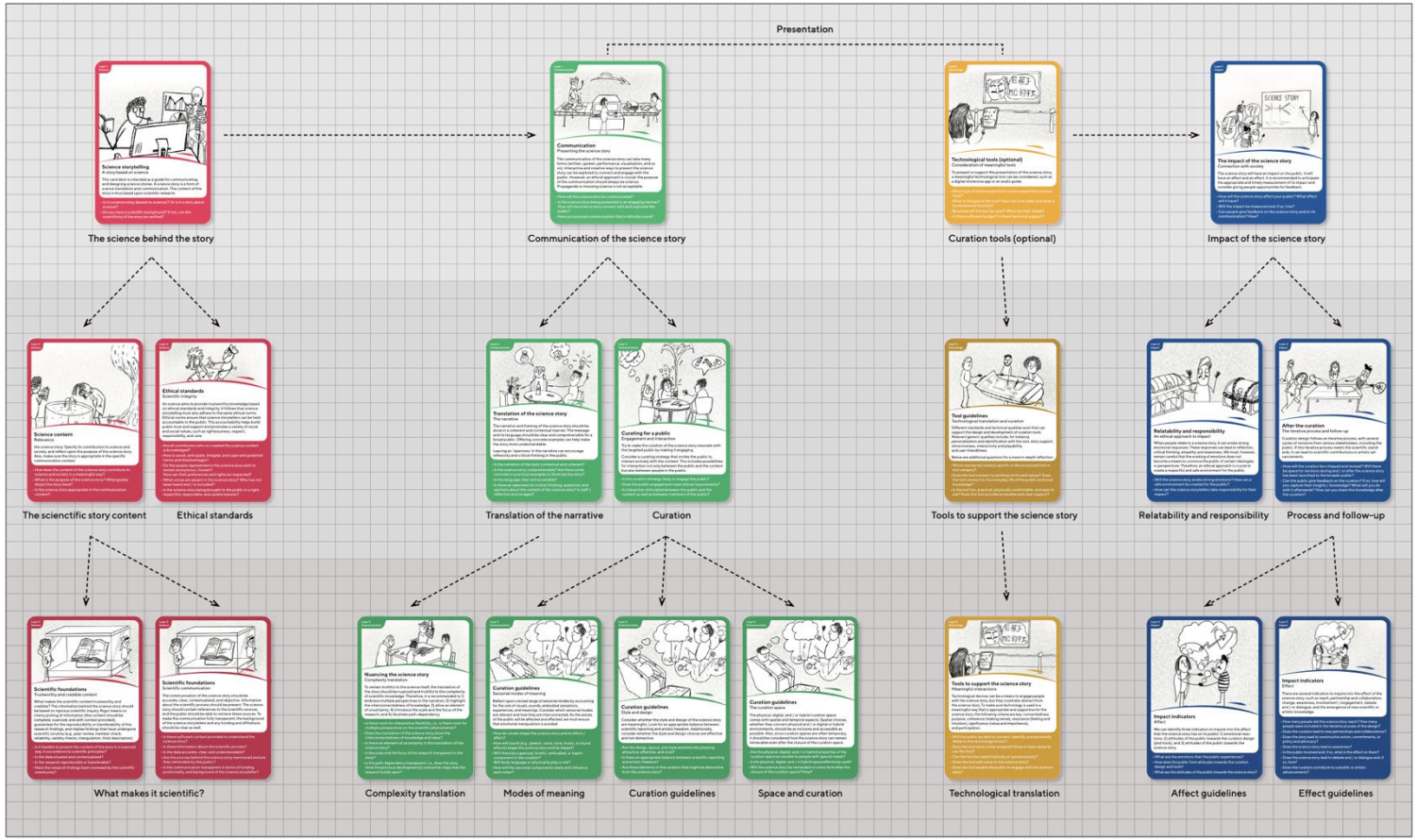
The effect of the science story can take various forms. Some indicators of effect are:

- The curation reaches various people. Some people may even be included in the iterative process and/or in the feedback loops of the curation design.
- The curation leads to new partnerships and future collaborations.
- The curation results in constructive action, commitment, policies, and advocacy.
- People gain useful knowledge that they can actively use.
- The curation causes public responses such as awareness, debate, or dialogue.
- The public is involved and engaged. For instance, they are captivated, fascinated, or interested.
- New scientific or artistic knowledge emerges from the curation.

3 Appendix

Showing the parts and interdependencies in participatory science storytelling

ParCos Trainer Cards



- The science behind the story
- Communication of the science story
- Curation tools (optional)
- Impact of the science story

- Layer #1 – Different basic components of the science story curation /ground layer
- Layer #2 – Digging deeper / pillars
- Layer #3 – Specialization / expansion deck

PARCOS
Participatory Communication of Science