STEAM
PROCESS

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STEAM PROCESS

SCIENCE   TECHNOLOGY   ENGINEERING   MATHEMATICS

STEAM
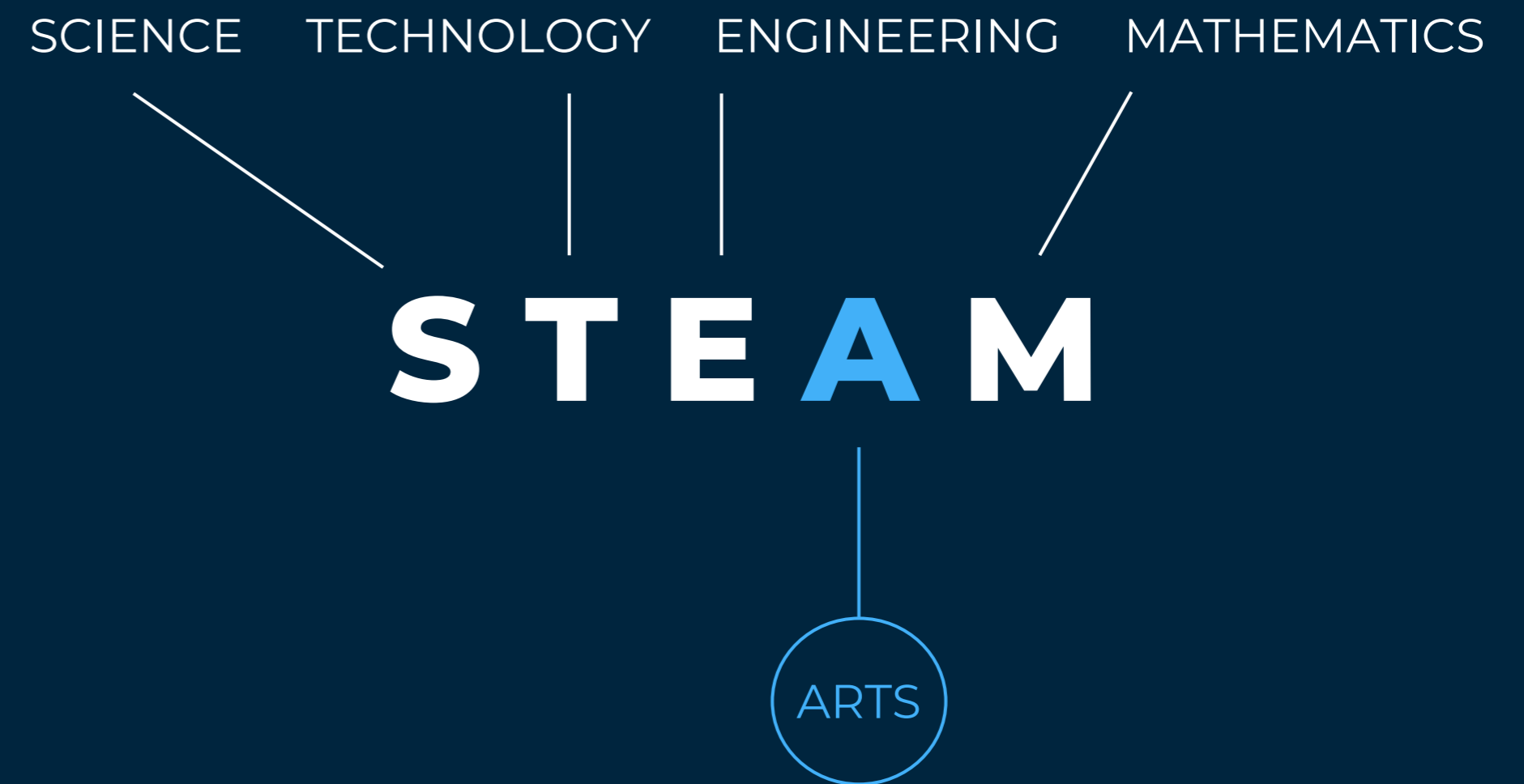
ARTS

What is the role of art in STEM education?

What can we learn from arts for science, and vice versa?

What is, or could be, the role of arts in education?

How can we bring practices and processes from arts and science to examine and understand the world?

How can arts and science feed innovations and discoveries of the other?

WHAT IS **STEAM?**

Arts and Science both "aim to understand the world"

In the past, art and science were considered as complementary ways of understanding and describing the world around us.

Art was considered to reflect the same universal laws as the nature around us. Understanding and mastering these principles was the biggest achievement of humankind, that enabled us to rise as a species above many other.

Art communicates directly to our senses enabling bodily experiences, through which we begin to become aware. Becoming aware enables us to analyze and find commonalities and hence draw theories from single phenomenon to underlying universal principles.

"Experience never errs; it is only your judgments that err by promising themselves effects such as are not caused by your experiments."

"Although nature commences with reason and ends in experience, it is necessary for us to do the opposite, that is to commence with experience and from this to proceed to investigate the reason."

—Leonardo Da Vinci

Henna Suortti 2021

TO MAKE THIS IDEA ACCESSIBLE

HERE ARE MULTIPLE WAYS TO APPROACH STEAM CONTENT

ART IS AS OLD AS HUMANITY

- **Communicating with the unknown:** Gods, spirits and "the other side".

- **Creating symbols and images** to portray and communicate meanings, values and beliefs.

- Acknowledging something is important and meaningful and should be paid special attention.

- **Gathering information** through our all senses.

- **Seeing the forest through the trees,** understanding what is meaningful in the whole.
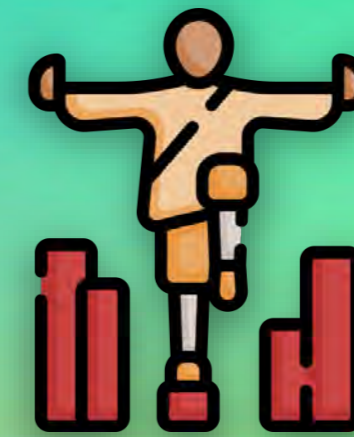
WHAT DOES IT MEAN **TODAY**

Acknolwedging through reflecting.
Using bodily and sensory, intuitive knowledge,
that we know through being human.

_____

Understanding and learning through doing,
experiencing, attempting to do it (practicing)
in order to understand.

_____

Mastering, identifying and communicating
meanings, values, beliefs and ethics & aesthetics
of what is important now.
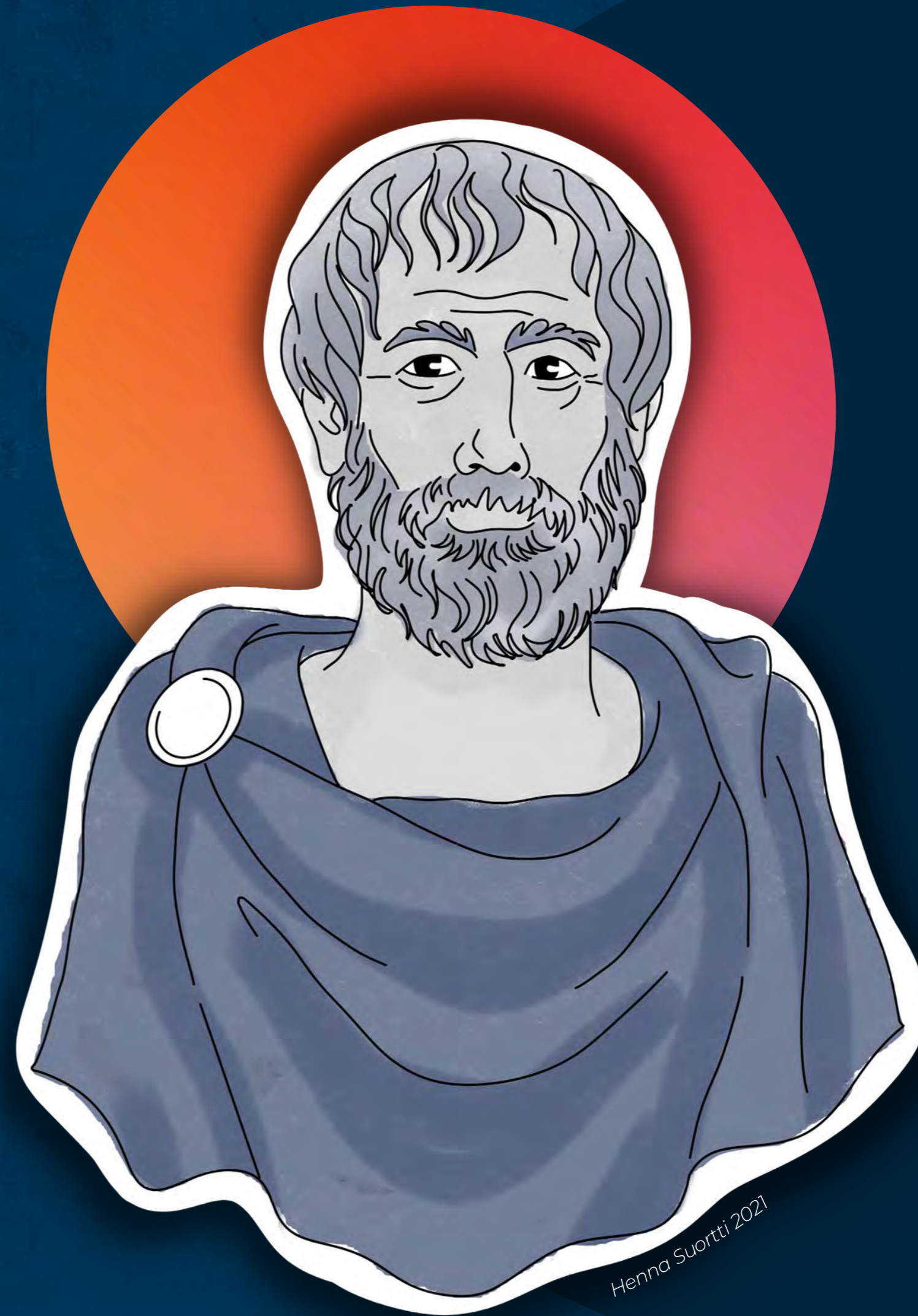
*"The soul never thinks
without a picture."*

—Aristotle

*"All our knowledge has its
origins in our perceptions."*

—Leonardo da Vinci

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CREATIVE SOFT SKILLS

Soft skills are our needed personal attributes at work.

They are a combination of people skills, social skills, communication skills, character or personality traits, attitudes, career attributes, social intelligence, and emotional intelligence quotients.

These skills enable employees to:

- navigate their environment
- work well with others
- perform well
- achieve their goals

EXAMPLES OF SOFT SKILLS

- Cognitive flexibility
- Communication
- Complex Problem Solving
- Coordinating with others
- Emotional intelligence
- Ethics
- Integrity
- Judgement and decision-making
- Motivation to development
- Negotiation

- Networking
- Passion and self-motivation
- People management
- Personality
- Persuasion
- Respect
- Self-awareness
- Service orientation
- Trustworthiness

It's important to recognize soft skills and facilitate the connection between people and the labor market. Soft skills concern everyone at the early stage of their careers. Regarding art and science this phenomenon is very relevant.

CREATIVITY AND THE BRAIN

L

R

B

Can you think of a reason NOT to **use both sides of our brain** more consciously? It is about **balance and coordination** of the two hemispheres.

The theory is that people are either left-brained or right-brained, meaning that one side of their brain is dominant. If you're mostly analytical and methodical in your thinking, you're said to be left-brained. If you tend to be more creative or artistic, you're thought to be right-brained.

This theory is based on the fact that the brain's two hemispheres function differently. This first came to light in the 1960s, thanks to the research of psychobiologist and Nobel Prize winner Roger W. Sperry.

Logical
Language
Analythical
Grammar
Punctuation
Sequential
Detail
Letters/Numbers
Decoding
Short term
(Auditory) memory
Thinks accordingly
To rules & patterns
Fine motor
Sense of time
Planned
Controls R-side
of body

Creative
Pictures
Intuitive
Tonality
Illustrations
Simultaneous
Big picture
Symbols/Spatial
Encoding
Long term
(Visual) memory
Thinks outside of
the square
Gross motor
No sense of time
Spontaneous
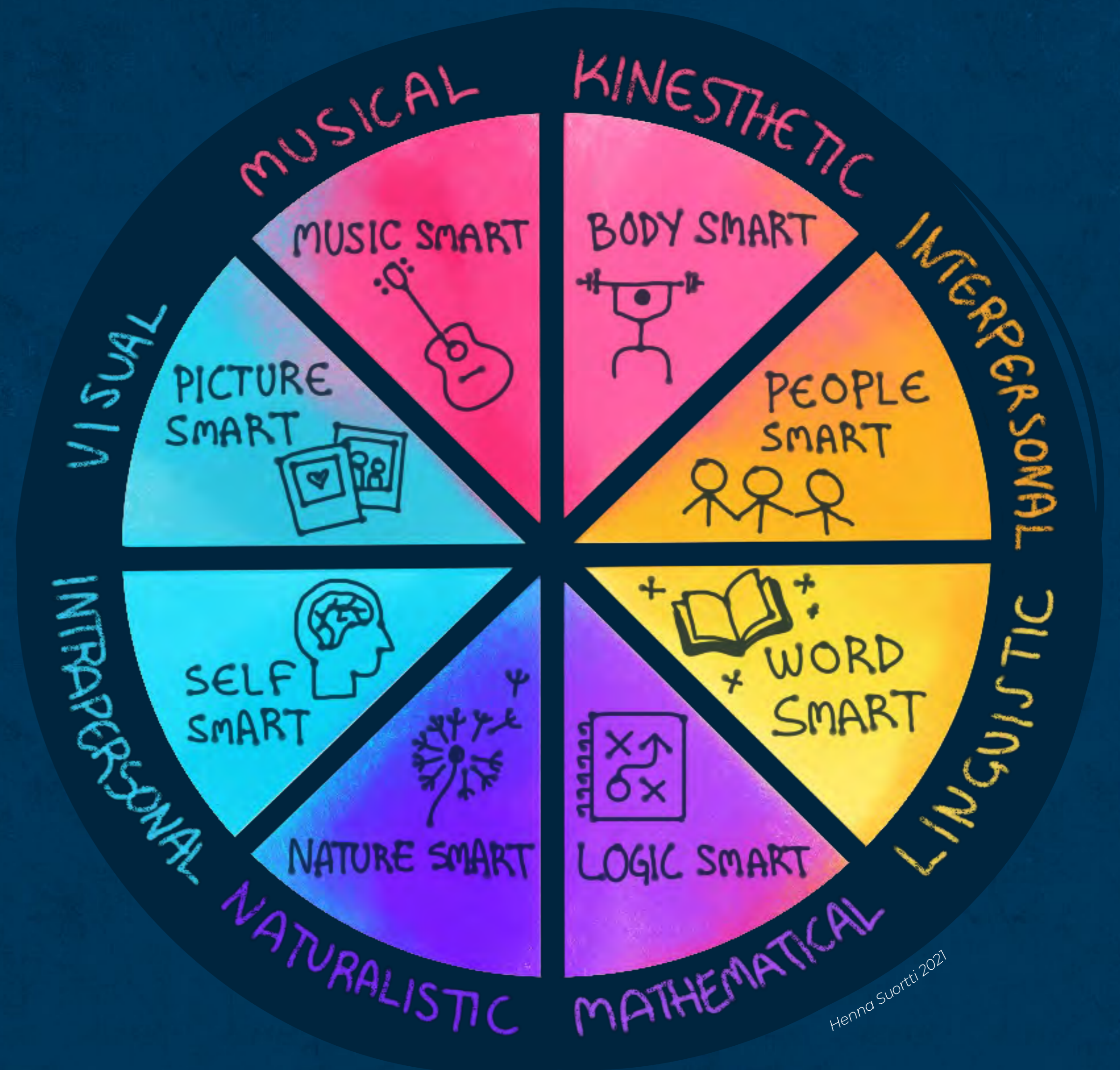**Controls the L-side**
of body

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MULTIPLE INTELIGENCES

In Frames of Mind: The Theory of Multiple Intelligences (1983) and its sequels, **Howard Gardner proposed eight abilities that manifest multiple intelligences.**

People do not have just an intellectual capacity, but have many kinds of intelligence, including musical, interpersonal, spatial-visual, and linguistic intelligences.

While a person might be particularly strong in a specific area, they most likely possesses a range of abilities. For example, an individual might be strong in verbal, musical, and naturalistic intelligence.

MUSICAL — MUSIC SMART
KINESTHETIC — BODY SMART
INTERPERSONAL — PEOPLE SMART
LINGUISTIC — WORD SMART
MATHEMATICAL — LOGIC SMART
NATURALISTIC — NATURE SMART
INTRAPERSONAL — SELF SMART
VISUAL — PICTURE SMART

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JUNGIAN ARCHETYPES

Stereotypes that portray characteristics and personas (moving clockwise)

Ruler, Creator, Sage, Innocent, Explorer, Rebel, Hero, Wizard, Jester, Seductress, Lover, Caregiver

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- These help us identify who we are, and what characters we carry with us in our lives.

- These help us understand common patterns of behaviors in ourselves and others.

- Awareness of a specific behavior and characteristics is the key to changing them (whether they work against us and what we are trying to do).

- Applications/tools: Disc, de Bono's 7 Thinking Hats.

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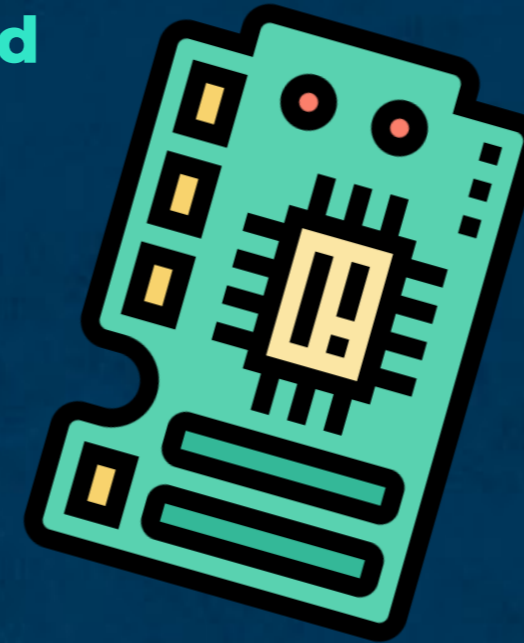Source: Neill, C., 2018. Understanding Personality: The 12 Jungian Archetypes. [online] Moving People to Action.
Available at: https://conorneill.com/2018/04/21/understanding-personality-the-12-jungian-archetypes/ [Accessed 28 March 2022].

A TYPOLOGY OF KNOWLEDGE BASES

ANALYTHICAL
*Science based

Know
WHAT

SYNTHETICAL
*Engineering based

Know
HOW

SYMBOLICAL
*Art based

Know
WHO

|		
Developing new knowledge by applying scientific laws	Applying or combining knowledge in new ways	Experimenting with experiences and thus gaining new knowledge and awareness
CIENTIFIC KNOWLEDGE, MODELS, DEDUCTIVE	**PROBLEM SOLVING, CUSTOM PRODUCTION, INDUCTIVE**	**CREATIVE PROCESS**
Cooperation with research units	Interactive learning with customers / partners	Experiments in studios and teams
Strongly codified knowledge, universal	Strong tactic component, partially codified knowledge, context specific	Importance of interpretation, values cultural knowledge
MEANING RELATIVELY THE SAME BETWEEN LOCATION	MEANING VARIABLE SUBSTANTIALLY BETWEEN LOCATION	MEANING VERY VARIABLE BETWEEN LOCATION, CLASS & GENDER

STEAM PROCESS / CASES

The "A" skills are identified through interviews with entities that, in different ways, have already experienced a STEAM process (research centers, training institutions, companies).

The first innovation element of the framework is, therefore, the shift of the point of view. Artistic skills are not defined through the self-assessment of artists but through the evaluation of those who have introduced Art in their study or research processes.

INSIGHT
Instinct

1

PROCESS
"Test drives"

2

OUTPUT
Social impact

3

Henna Suortti 2021
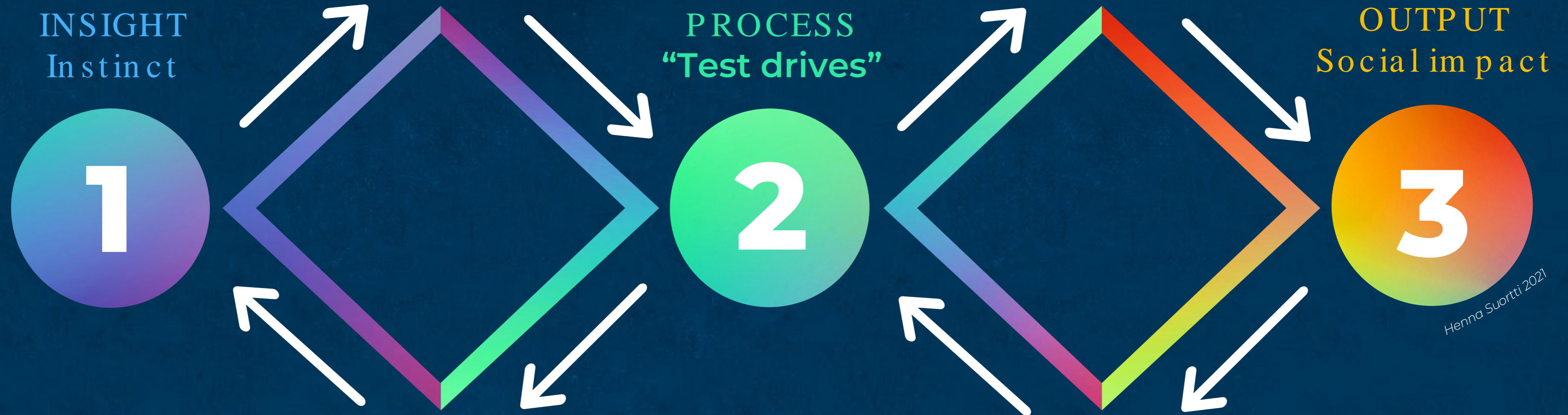
Personal skills and competences

- **Self-awareness** →Reflection and mindfulness, awareness of meanings and values through experience and thinking of ethics, aesthetics and philosophy.

- **Learning-to-learn and think** →For example, E. Bono's Seven Thinking Hats, H. Gardner's Multiple Intelligences, personal traits and characteristics and Jungian Archetypes.

- **Novel and critical thinking** →Openness, dealing with uncertainty and critical disruption.

People/social skills

- **Communication →** Bodily and sensory, using symbols, storytelling, awareness of spatial issues and social intelligence.

- **Complex problem solving →** Multi-disciplinary contexts, mastering art and design-based methods, tools and facilitation, facilitative and people skills, and seeing the forest from the trees.

- **Leading creative people and processes →** Network-leadership, communication for purpose and meaning, and seeing the forest from the trees.

Raising awareness & social impact

- **Enable communicating the essence** of human emotions, experiences and revelations related to the meaningful dimensions of our lives.

- **The ability to produce scenarios,** "probable truths" based on incomplete data mixed with bodily or sensory knowledge and understanding of human behavior and the environment.

- **Raise interest** and aspire awe in phenome within and around us.

PHASE **1** EMPHASIZED

CASE YALE

INSIGHT
Instinct

1

Artwork Can Sharpen Medical Diagnostic Skills

Who / Yale University

What / Medical students observing 19th century British paintings. This case teaches not to automatically interpret but to really observe: physical diagnosis requires more than a glance.

Why / The point lies in how to prevent predefined patterns from influencing the way one observes. The following method helps us to see details and the bigger picture.

Results / This method improves students' abilities to pick up important details by almost 10%.

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*The course was offered in 1998 for the first time in Yale School of Medicine and now more than 26 medical school all over the world have established similar programs.

When asked what have they learned about themselves as observers, the students replied they had considered themselves to be adequate observers before the workshop, afterwards they realized they were looking at things superficially. The course had helped them learn to look at the world, and their patients, more in depth.
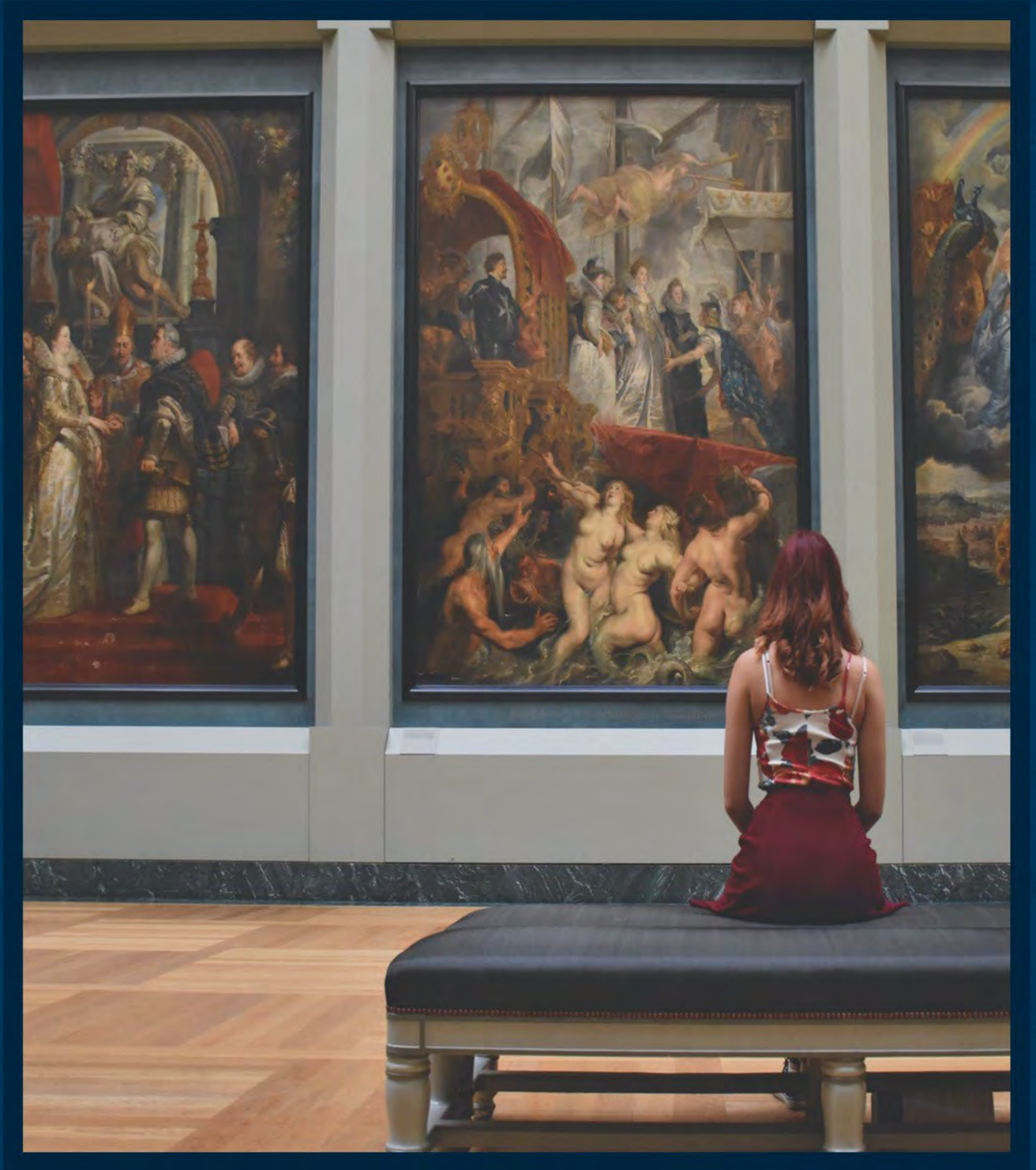
Photo by Una Laurencic, Pexels

CASE SCIENCE&MUSIC

Keywords: arts to STEM, music and science, arts as a way to communicate

1 INSIGHT — Instinct

2 PROCESS — "Test drives"

Arts to STEM learning

Who / Led by Herbie Hancock and the Herbie Hancock Institute of Jazz, supported by US Department of Education and UNESCO, designed by New York University Music Experience Design Lab; professionals from the academia and private sector specialised in scientific, technical, educational and musical disciplines.

What / This project brings response to the need of encouraging students to acquire skills and knowledge in STEM subjects by applying creative thinking. A digital repository that provides free and interactive tools for learning mainly science and mathematics concepts through music-based methods. The initiative has developed play-based games, apps and video interfaces and an engaging curricula. resources can be found for elementary and higher education students, as well as for teachers.

Why / The aim is to apply creative thinking to learning scientific and mathematical knowledge among students from elementary, middle and high schools. All concepts (arithmetic, geometry, logarithms, fractions, ratios, etc.) are approached engagingly using music-based methods (rhythm, scratches, grooves, beats, sound waves, etc.).

Results / Technology acts as an intermediary interface between musical, mathematical and scientific concepts through a set of interactive games, apps and video tutorials accessible for free and aimed both at students and teachers. All of them promote learning through play, experimentation, practical action and collaboration.

CASE FUTURE LAB

Keywords: future designs, social impact, Idea exchange

Event that brings curious minds together

Who / Ars Electronica Linz GmbH & Co KG - consists of the operational divisions Ars Electronica Festival-Prix-Exhibitions, Ars Electronica Center, Ars Electronica Futurelab, AE Solutions and Corporate Services.

What / The Ars Electronica Futurelab is a laboratory and atelier for future systems. It places humans at the centre of research, considering the social aspects of technological developments such as artificial intelligence, robotics, media architecture, interactive technologies, new aesthetic forms of expression or swarm intelligence and their effects on the future of society.

Why / The Futurelab networks and discusses the methods of creativity and technology to accompany this development, and shapes future trends and visions. It develops new concepts for an autonomous future society in an inspiring field of tension between disciplines (business, culture, research, and education) and transnational cooperation.

Results / With tangible future visions and artistic explorations it is humanizing technologies and novelizing cultural experiences, calling up to social participation and responsible creativity. All concepts and designs for the future are the result of many successful collaborations with art and culture, educational institutions, industries and businesses.

*The first international Ars Electronica was held in 1979. 20 international artists and scientists gathered at this new "Festival for Art, Technology and Society" to discuss the Digital Revolution and its consequences. Behind this whole idea was Hannes Leopoldseder. Together with musician Hubert Bognermayr, music producer Ulli A. Rützel and cyberneticist and physicist Herbert W. Franke , they founded a festival that has become globally the most important of its kind.

Photo by Guillaume Meurice, Pexels

Photo by Ramaz Buashvili, Pexels

CASE SIMETRIA

Keywords: creative process, idea exchange, arts to STEM

Exploring new ways of expression

Who / CERN in Geneva - Corporación Chilena de Video y Artes Electrónicas (CChV) in Chile. Artists: Chloé Delarue & Patricia Domínguez

What / This project connects one artist from each of the two countries for a dual residency, to research and explore new expressions in connection with fundamental science.

Why / During the residencies, the artists will explore the scientific sites, their extraordinary locations and scale – both laboratories and observatories – to explore new expressions in their artistic practices, and to further develop them into art productions. In this unique exploratory residency, the artists will collaborate with and receive support from scientists and engineers, as well as the staff of the host research facilities.

Results / The main results of the work of the two artists is to see multiple perspectives and explore the field of science and develop in co-creation an art production, the collaboration between the two countries helps to understand the origins and the evolution of the universe by the facilitation of scientists and researchers.

*Simetria is a new ambitious residential exchange programme, allows artists to carry out their artistic enquiry in relation to astronomy and particle physics at some of the world's most important scientific research centres.
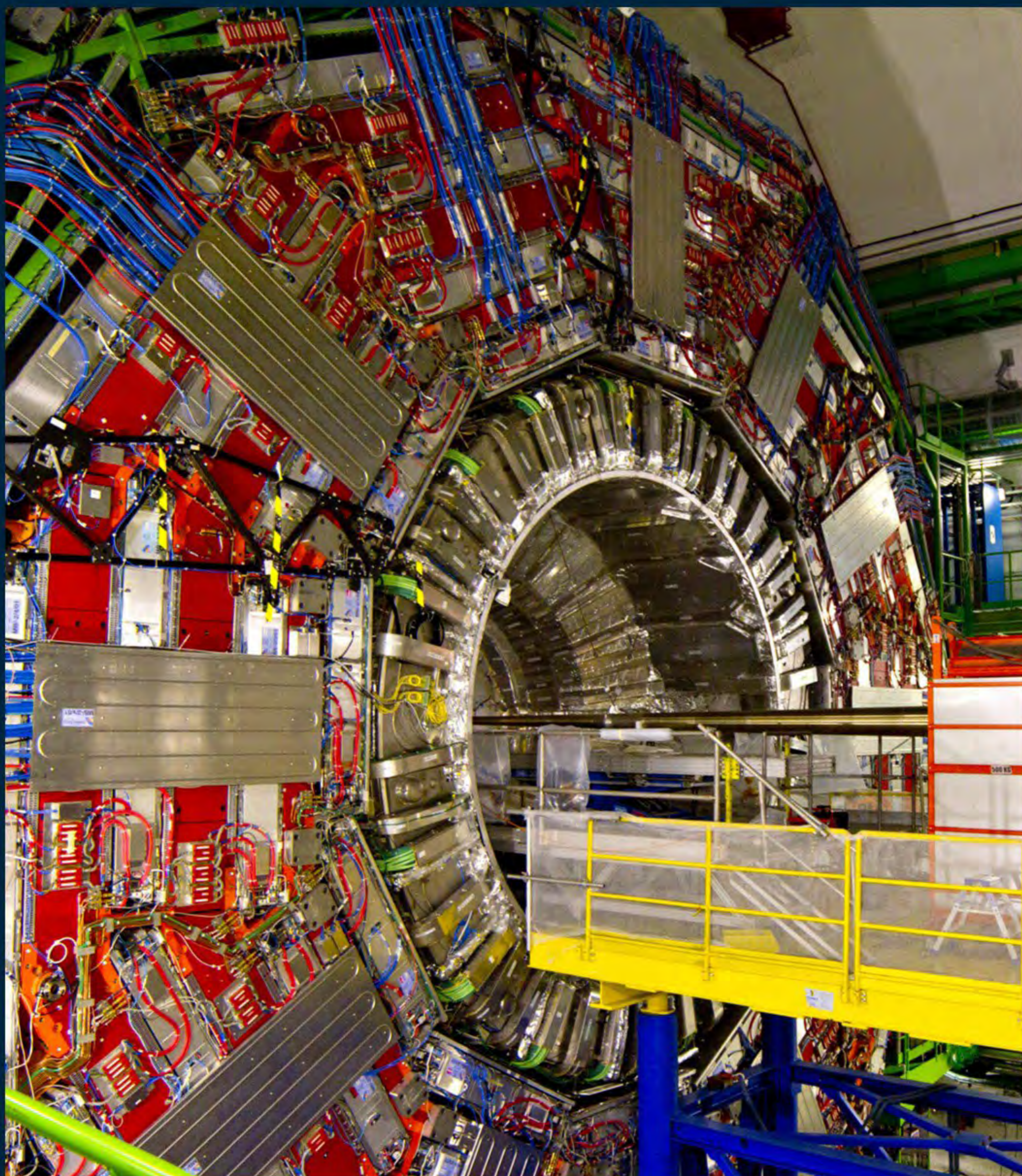
CASE DEFOREST

Keywords: social impact, technology, arts as a way to communicate

Arts as a tool to communicate larger meanings

Who / Joana Moll, artist and researcher who critically explores topics as techno-capitalist narratives, Internet materiality, surveillance, social profiling and interfaces.

What / Joana Moll uses art to show us how many trees are needed to absorb the amount of CO_2 generated by global visits to google.com every second. Through digital and technological means, the artist explores visual strategies that allow to make visible the invisible. To this end, she interprets complex data and translates it into a graphical visualization:
http://www.janavirgin.com/CO2/DEFOOOOOOOOOOOOOOOOOOOOOOOOREST.html

Why / The artist explores strategies that seek to activate critical reflections within the human mind. The visualizations aim to encourage critical thinking in an understandable and accessible way for all citizens.

Results / This artwork raises awareness of our actions, mainly about the environmental impact of our Internet browsing via Google.

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*This project is closely related to CO2GLE: http://www.janavirgin.com/CO2 ,
another work by the artist in which she makes visible the amount of CO_2 generated every second in global visits to google.com.
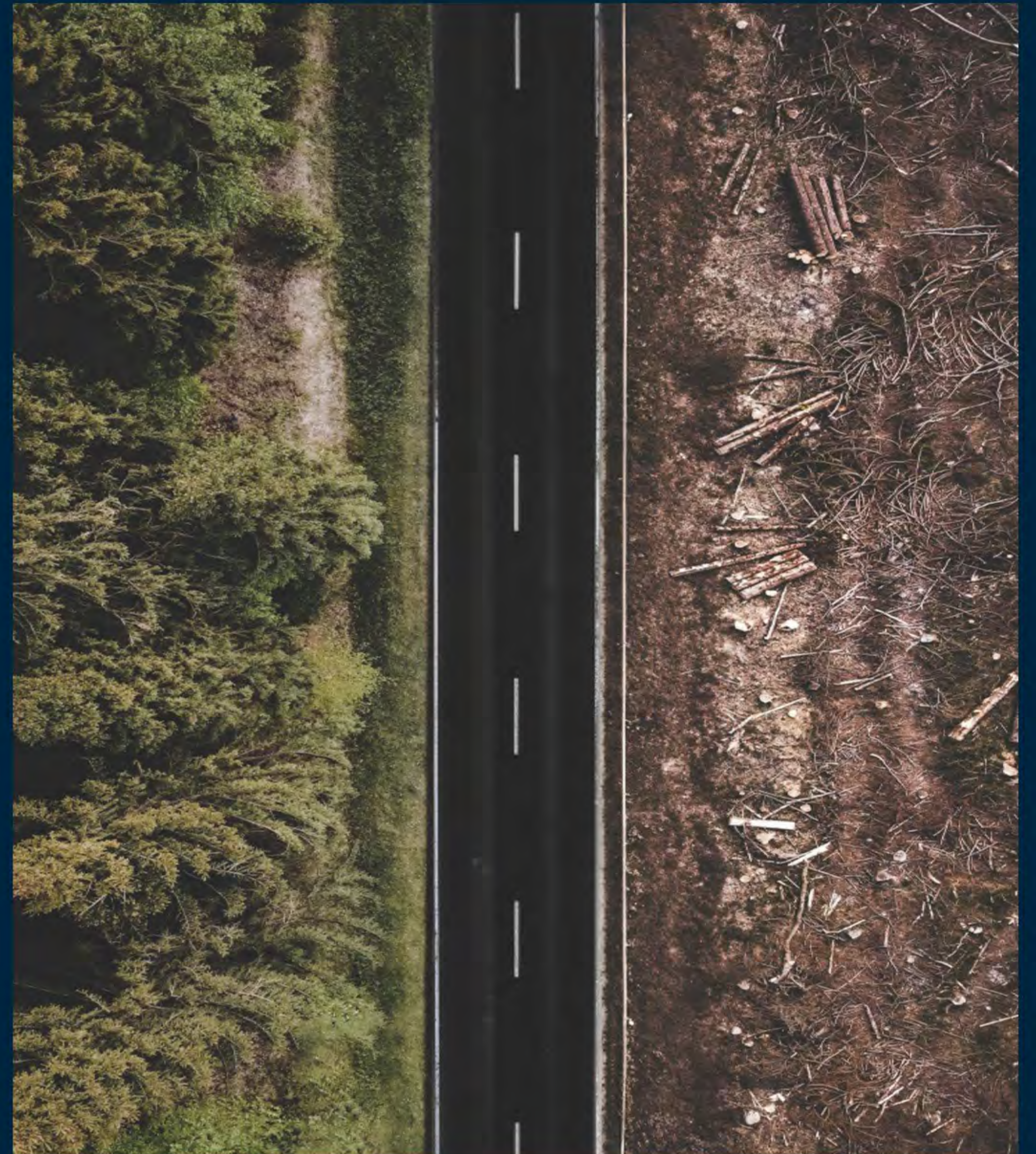

Photo by Guillaume Meurice, Pexels

PHASE **2** EMPHASIZED

CASE VÄRMLAND

Keywords: multidisciplinary teamwork, concept development, network utilization

How can digital game development benefit from the cultural sector

Who / The Great Journey-project started in 2015 but since 2020 they involved the Futuregames who offered an education program in the Indie Game Development.

What / Since 2020 in the Swedish region of Värmland, a project started, giving the possibility to game developers to work together with practitioners coming from other creative sectors. "The Great Journey" is a community-based project where game developers have the possibility to create new games in close cooperation with people coming from diverse creative sectors.

Why / The goal is to create synergies among the creative sector and the digital game developers. Nurturing a game concept is by no means a simple task. The ideation process can involve brainstorming ideas, creating sketches or prototypes to test those ideas, and evolving or streamlining an idea if needed.

Results / Typically, a full team of developers is involved in shepherding a gaming idea through to the next steps. The result is the creation of new digital games and new companies in the game development sectors, based on artistic and cultural skills.

*This project focuses to promote the video game industry in Värmland by creating the best environment for anyone who wants to develop games. The project offers pitching events and organizes game jams where people from different fields meet; Artists, graphic designers, storytellers, programmers and game developers participate all together in co-creation moments. The aim is to create a network, share ideas and develop new games.

Photo by Cottonbro, Pexels

CASE EARTH/WATER/SKY

Keywords: arts to STEM, creative process, arts as a way to communicate

An open call for artists from any art form

Who / Ca' Foscari University of Venice, the Science Museum of Venice. Artist: Haseeb Ahmed. https://wind-residency-venice.com

What / Haseeb's recently completed Wind Egg Trilogy blends art and aeronautics, myth and technology, to create new narratives for the present. He is currently an artist in residence at Science Gallery Venice. The focus of his research is the wind, one of the invisible forces which shapes the city of Venice and its maritime history.

Why / This case teaches individuals to observe the world by observing artwork and how the research can make the process visible by engaging emotions or questions.

Results / About the main results, the artist's research into the wonders of wind, including the dust-laden Sirocco which blows in from the Sahara, is to lead to the creation of an art piece to be showcased during the Venice Biennale in 2022. The final piece will combine sculpture, architecture, performance and the people of Venice in an artistic work which will also have a digital life.

* Earth Water Sky is Science Gallery Venice's 3-year residency programme for artists interested in the environment and the latest in cutting edge environmental knowledge. Every year there will be an open call for artists from any art form – digital arts, painting, sculpture, dance, performance, music, multimedia, video, film, photography, writing, drawing – to apply for a 2 month fully funded residency in Venice.

Photo by Dariua Kraus, Pexels

CASE RELIQUARY

Keywords: arts to STEM, concept development, bio art

2

Regenerative Reliquary

Who / Artist: Amy Karle supported by Autodesk, Autodesk's Pier 9 Artist in Residence (AiR) Program, Bio/Nano Research Team, the Ember 3D Printer Team, Within Medical, Autodesk Software and Evangelists, California Academy of Sciences, Exploratorium: The Museum of Science, Art and Human Perception, and The Bone Room

What / Leveraging the intelligence of human stem cells, Karle created "Regenerative Reliquary", a bioprinted scaffold in the shape of a human hand, 3D printed in a biodegradable pegda hydrogel that disintegrates over time. The sculpture is in a bioreactor, so that human Mesenchymal stem cells seeded onto the design will eventually grow into tissue and mineralize into bone along the scaffold.

Why / This case may serve as a foundation for further exploration and research opening conversation about transhumanism, synthetic biology, the future of medicine and implants and speculative design.

Results / This bioart established a new art field, expanding opportunities for biomedical applications. This piece was intended as an artwork outside the body, but the potential healthcare benefit of this approach could be that a patient's own stem cells could be obtained and used for a personalized bone graft designed to be an exact fit and implanted with low risk of rejection since it is made of a person's own DNA avoiding complications of foreign implantation.

Photo by SpaceX, Pexels

CASE SUPRASPECTIVES

Keywords: social impact, space, arts as a way to communicate

Human universe colonization

Who / Artists Juliane Götz and Sebastian Neitsch, whose research focuses on data and physical experiments; In collaboration with Silvia Bonoli and Raul Angulo, astrophysicists from Donostia International Physics Center with the support of local science communities. Installation was developed in Tabakalera MediaLab, in collaboration with Ars Electronica.

What / An audiovisual installation, created through tracking and gathering the data generated by 590 former spy satellites. The installation was generated by remixing images from these satellites and from other ones passing close to the exhibition venue. A motorized antenna was built and placed on the roof to transform radio signals into sounds that were incorporated into the piece.

Why / The research is based on analyzing military space activity and how many of these former satellites can be considered space junk, even though they continue to "fly". Supraspectives raises awareness of phenomena that are hardly accessible and interpretable by most people.

Results / The audiovisual installation addresses questions related to the unexplored aspects of human life and the universe. It shows the contrast between stunning earth images taken from outer space and raises critical awareness about human universe colonization, often related to military and surveillance purposes.

*The creation process incorporated citizen science actions carried out together with the astronomy group of Tabakalera's MediaLab and the local amateur radio community.

CASE SIMPLIFICATION

Keywords: simplifying larger content, observation skills, advanced awareness

2

Communicating something with a few words or lines...

Who / Artist Al Hirschfeld

What / Simply visualizing even the most complicated of things. The case teaches how we can communicate ideas to one another.

Why / To make communication easier and simpler. The point lies in finding and simplifying the essence, sharpening the main point of an idea. The following method trains us to realize and communicate specific details in our surroundings.

Results / Despite the sharpness of his lines and the clarity of his work, Hirschfeld was also a master of camouflage. Each week, droves of his fans would spend their Sunday's searching for the word 'NINA' in his drawings. What started out as an innocent little gesture to celebrate the birth of his daughter turned into a weekend pastime for millions of readers.

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* Hisrchfeld's 'NINA's' became so popular that they were even adopted as a training exercise by the U.S. Army (much to Hisrchfeld's annoyance). Bomber pilots in training would use the illustrations as a means to improve their detection skills. If they were able to find the 'NINA's' in each illustration, then they were sure to be able to detect hidden targets.

Photo by Space X, Pexels

Photo by SpaceX, Pexels

CASE 8thPASSENGER

Keywords: arts to STEM, social impact, arts as a way to communicate

2 PROCESS "Test drives"

3 OUTPUT Social impact

How can complex data be represented?

Who / Mo Y, a collective comprising artists Katerina Chryssantopoulou and Benoît Durandin, who carry out cross-practices in the fields of art, architecture and science. A collaborative process with GTD System and Software Engineering, one of the most important European companies in sectors such as space, aeronautics, energy or science.

What / The Eighth Passenger aimed to develop a reliable source of knowledge to assist space crews. Experimental research was done, starting with the question: how can complex data be represented and at what scale? In response, a series of tools were devised to create alternatives or improvements to the graphical interface of decision support systems for users handling large amounts of complex data in a manned space mission control centre.

Why / The Eighth Passenger was an experimental research and prototyping process led by creatives and engineers working together to find a solution to support decision making and decision support systems, modelling of complex data, predictive diagnose and data, among others.

Results / In 2010 GTD presented the Eighth Passenger, conceived as an assistant based on artificial intelligence and augmented reality techniques capable of guiding astronauts on future manned planetary exploration missions. The ePartner helps interpreting complex data and material with which astronauts are not experts in, such as engineering, medicine or psychology, in the aim of aiding them in critical circumstances, and at the same time suggesting actions to be executed in specific situations.

PHASE **3** EMPHASIZED

CASE LIVING LIGHT

Keywords: prototyping, multisensory communication, sustainability

Fusing together "nature smart" & "logic smart" & a dash of creativity

Who / Nova Innova Netherlands

What / Microbial Fuel Cell (MFC) technology enables us to generate energy from organic waste: from compost to mud, from urine to plants. All organic waste streams are turned into sustainable energy sources thanks to this innovative technology.

Why / This case teaches individuals to be more sustainable from influencing the way one observes and become aware of how technology can help to generate energy and contribute to sustainability.

Results / The main result of the case is to make visible what happens in laboratories by developing sustainable applications which can be used in everyday life. This is an innovative approach where science and art can work together and contribute in a sustainable way.

*Nova Innova's aim is to inspire others by their collaboration with nature, and to develop important technologies that contribute to clean and sustainable water, air and energy systems with their practical applications. The Living Light project gives this promising technology the attention it deserves and is the living proof that this technology can already provide us with enough energy to design practical applications.

Photo by Singkham, Pexels

CASE FUNGI

3

Keywords: arts to STEM, network utilization, sustainability

Research regarding fungi becomes visible trough creative collaboration

Who / Departments of Applied and Molecular Microbiology and Bioprocess Engineering of the TU Berlin and the art and research platform Art Laboratory Berlin. Artists: Theresa Schubert & Fara Peluso. The Institute of Biotechnology works with Berlin citizens, artists and designers to develop new ideas and technologies for mushroom and lichen-based materials of the future.

What / Mind the Fungi is a biotechnological project which uses the interdisciplinary concept from STEM to STEAM to expand scientific research with artistic and design-based research. Both parties collaborate in organizing events and exhibitions promoting fungal biotechnology and the fundamental value of fungi.

Why / The project was intended to provide citizens the opportunity for scientific collaboration, to give the public an understanding of the importance of fungal biotechnology for a sustainable future and to establish a research network at the TU Berlin.

Results / The artistic and design related works are a result of a close and successfull collaboration with both departments of TU Berlin's Institute of Biotechnology. In addition to the work of Schubert and Peluso, the final exhibition also presented new results from the laboratories.

*One of the main goals working with the STEM/STEAM concept has been to inspire more young people to get exited about natural sciences as well as arts. The interest towards these fields have decreased when compared to how things used to be in the past.

Photo by Ravi Kant, Pexels

CASE SOURCEBOOK

3

Keywords: strategies, instructions, arts as a way to communicate

The Sourcebook for Teaching Science

Who / Authors Norman Herr and James Cunningham, and published by Jossey-Bass, John Wiley & Sons, Inc.

What / The Sourcebook for Teaching Science complements any secondary school science curriculum. Science teachers will find ready-to-use demonstrations, experiments, illustrations, games, puzzles, analogies, lessons, activities, and strategies, as well as explanations of how to adapt these for English learners and diverse student populations. All topics include extensive background material, providing scientific, organizational, and pedagogical principles necessary for successful classroom implementation.

Why / Science is usually seen as an abstract subject. Using games, analogies and illustrations give the pupils the possibility to touch and play with science.

Results / It gives the pupils in secondary school the possibility to play with science. It is scientifically proof that Serious Games offer considerable potential for facilitating both formal and informal learning experiences. Games combine different aspects coming from the arts skills, such as graphic design and storytelling, and technological skills such as programming, logic, math.

*The contents of the book are now available on the Internet. At http://www.csun.edu/science/books/sourcebook/chapters/13-games/index.html a serie of games are presented, and there are many other resources simplifying scientific concepts using videos, visualisation, mind maps and so on. The Sourcebook was first published as a tool for teachers in secondary school, enabling them to present sciences in a more applied way, using serious games, puzzles, experiments, illustrations, and strategies.
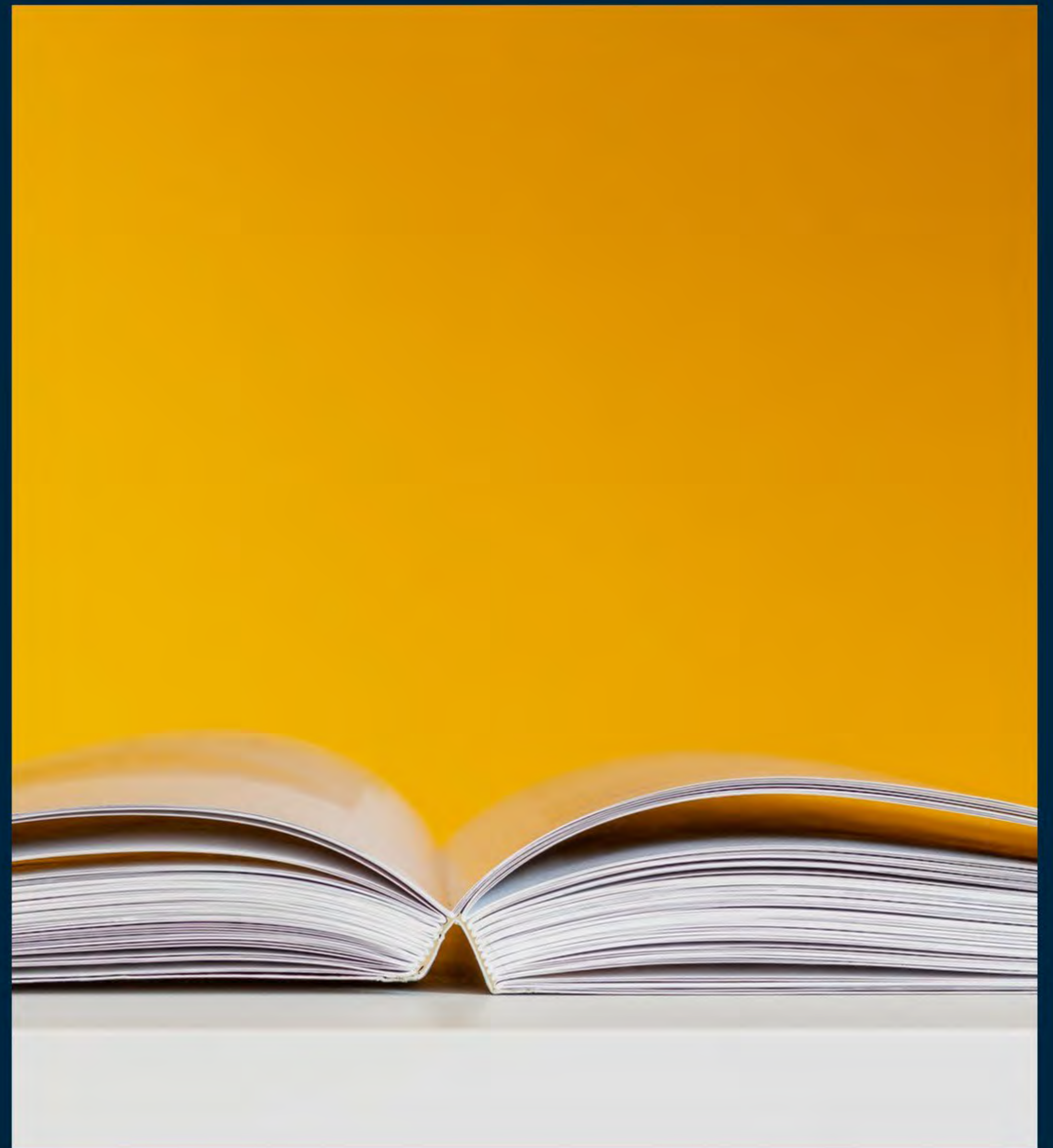

Photo by Stas Knop, Pexels

CASE ALMA

Keywords: prototyping, everyday life, future designs

3

When collaboration between art and science affects humans' everyday life

Who / STARTS Lighthouse Re-FREAM. Artist and designer: Giulia Tomasello. The co-creation process has been hosted by Fraunhofer IZM.

What / ALMA is a collaboration between a variety of professionals. The project team organized workshops and a survey for females to participate in the conversation and thus gaining permission to collect data on stigma and taboos regarding intimate health. The artistic identity of the project was refined through the co-creation with 11 international fashion designers.

Why / ALMA opened a space of innovation, where females can become aware of their own bodies by becoming empowered through technology. The aim is to provoke societal changes by rethinking fashion and technology together.

Results / The team developed four working prototypes of inclusive underwear that have an embedded, wearable biosensor for the non-invasive diagnosis of bacterial vaginosis. Alma will continue to build on the results demonstrated by its first pH sensing prototype and co-creation. The prototypes are also proof that collaboration has true value when designing wearable technology for female's healthcare.

*During the physical co-creation process in Berlin (Fraunhofer IZM), they successfully built a modular design where the technology is embedded in the gusset of the underwear- where the pH sensor is located- and the data is conducted through some conductive wires to a small case where the electronics are kept. The prototype even has wireless communication that can potentially allow a female to access her own information, to know better her body and feel encouraged to seek appropriate help when needed.

CASE ASTROPHOTO

Keywords: astrophotography, social impact, arts as a way to communicate

Aspire awe of what we don't yet understand

Who / Photographer Pekka Metsävainio. His photos have been published by National Geographic, the Smithsonian Institute and museum, NASA and Wired.

What / Metsävainio's panoramic photo of the Milky Way consists of hundreds of photos, shows over 20 million stars and covers 125 degrees of the sky cover. The photos were taken over 12 years. It is the most large-scale photo known of the Milky Way.

Why / Metsävainio's photos are a way of making people more aware of what it is like in space. The point lies in the ways we can raise interest in specific fields. The blind eye can't even imagine the true appearance of the milky way, but Metsävainio has been able to prove and capture this beauty with photographic skills.

Results / This case has awoken engaging questions about the unexplored sides of the universe. This case is one of the greatest examples of how much power visuality has on our comprehension especially on large scale phenomenon.

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*Metsävainio is a visual artist, not an astronomer. He didn't wait 12 years for this work to be finished. He published independent samples as their own work, and gradually filmed the gap between these samples. He had planned the final result beforehand; The angles and composition had to be considered well in advance because they can´t be changed afterwards. Technology is just an artist's tool. Taking long exposure times requires equipment that makes the camera follow the stars. Metsävainio has assembled his own equipment. "It's a terrible-looking tune-up," said Metsävainio. The axis of the German-made pedestal is parallel to the Earth's axis. Basically, it's a backward-rotating clock that keeps the camera pointing closely at the same spot in the constellation.

Photo by Jukka-Pekka Metsävainio

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