



SPACE
MESSENGERS
STEMarts Quick Guide

Overview

STEMarts Lab designs sci-art experiences that develop artistic, scientific and humanistic literacy empowering youth with essential 21st century skills.

Space Messengers is an immersive mixed reality (MR) installation with VR experiences and a youth exchange program whose mission is to develop our artistic, scientific and humanistic literacy and our identity as planetary citizens. *Space Messengers* is a [multi-artist collaboration](#) created in 2020/21 during the pandemic and is now touring to festivals around the world, evolving with new interactive experiences as it travels.

Our new and evolving STEMarts Metaverse is a private virtual reality platform that will host STEMarts Mixed Reality (MR) installations with interactive VR experiences designed especially for youth. The first Mixed Reality installation hosted on the STEMarts Metaverse is [Space Messengers](#). We create a 3D model from each festival venue allowing the audience to experience current and past MR installations through the custom designed VR platform. Our first VR event was the Global VR Youth Day which launched as a [pilot program](#) at the Harwood Art Museum in 2021. We will be expanding the program in 2022 to include 5 schools/ community spaces throughout Northern New Mexico serving as VR Station Hosts. Students can visit those stations during the event to join a private VR space to meet with students from around the world, interact with the *Space Messengers* installation and socialize with each other, in conjunction with the live festival event. We will also have a VR station installed at festivals.

Students explore the universe through the *Space Messengers* curriculum to participate in the Global VR Youth Day as the installation travels to festivals around the world. The [curriculum tool](#) designed for middle and high school students allows the teacher to integrate the event into their curriculum to enhance the learning. Throughout the year and as part of the [STEMarts International](#) youth exchange program, we bring the STEMarts VR Stations to schools in rural and under-served communities where access to the festival site is not possible, as well as to urban city centers, to form social VR bridges to the sci-art experience.

For more information visit:

<http://www.stemarts.com/projects/spacemessengers>





SPACE MESSENGERS QUICK GUIDE

Space Messengers

Get Started

The Quick Guide provides condensed lesson plans for educators participating in Global VR Youth Day. Students create questions, statements and images to be included in this years Space Messengers installation. Full Activity Guides can be found in the Teacher Tools at Stemarts.com.

Subjects

Art, science, technology, philosophy, humanities

Estimated Time

One or more 45 minute class period, or several class periods throughout the week.

Grade Level

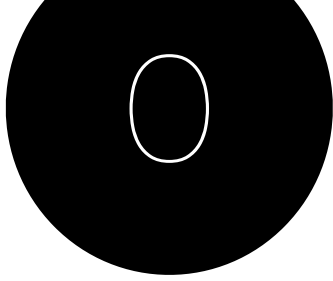
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Objectives

Participation in the Space Board as part of the STEMart Global Youth Day Space Messengers Installation and VR experience. Students participate with global youth to develop inquiry skills around complex science topics and interpersonal exchange.

Students will be able to:

- Explore 'Who am I?' through creative writing and art making.
- Develop curiosity and empathy towards individuals from other cultures, and practice cross cultural communication skills.
- See themselves as ambassadors representing their city and country in creative and positive ways.
- Start to explore and see themselves as planetary citizens and future imagineers.



SPACE MESSENGERS QUICK GUIDE

Space Messengers



Objectives

Students will be able to:

- Draw connections between the diverse ways that we connect with nature; Through direct relationship and through measurement and instrumentation.
- Realize the importance of ‘responsibility’ in protecting the environment for future generations, and in the pursuit of truth in the scientific method.
- Recognize the cultural role of symbology in science and art to understand our place in the universe in both western and native science (imaging science + native symbology)
- Understand the space policies that are currently in place through the Outer Space Treaty

Space Board Profile: Who am I?

Use this Avatar activity with students to answer basic questions about themselves to share with global peers on the Space Board.

1. **Avatar: Who am I?**

av·a·tar is the embodiment of a person or idea, often depicted as a character, cartoon or artistic rendering for an online user. Students will create an Avatar to represent themselves on the profile page of the Space Board. Students will create an Avatar using one of the apps below, create their own handmade art to act as a self portrait, or use a real photo of themselves.

- Have students download an AVATAR app from one of these selections: [Avatars](#).
- Save Avatar on desktop as a JPG so it is easy to access during the workshop.
- Collect photos of students. Have them save it to their desktop. They will be asked to upload to their Space Board profile.

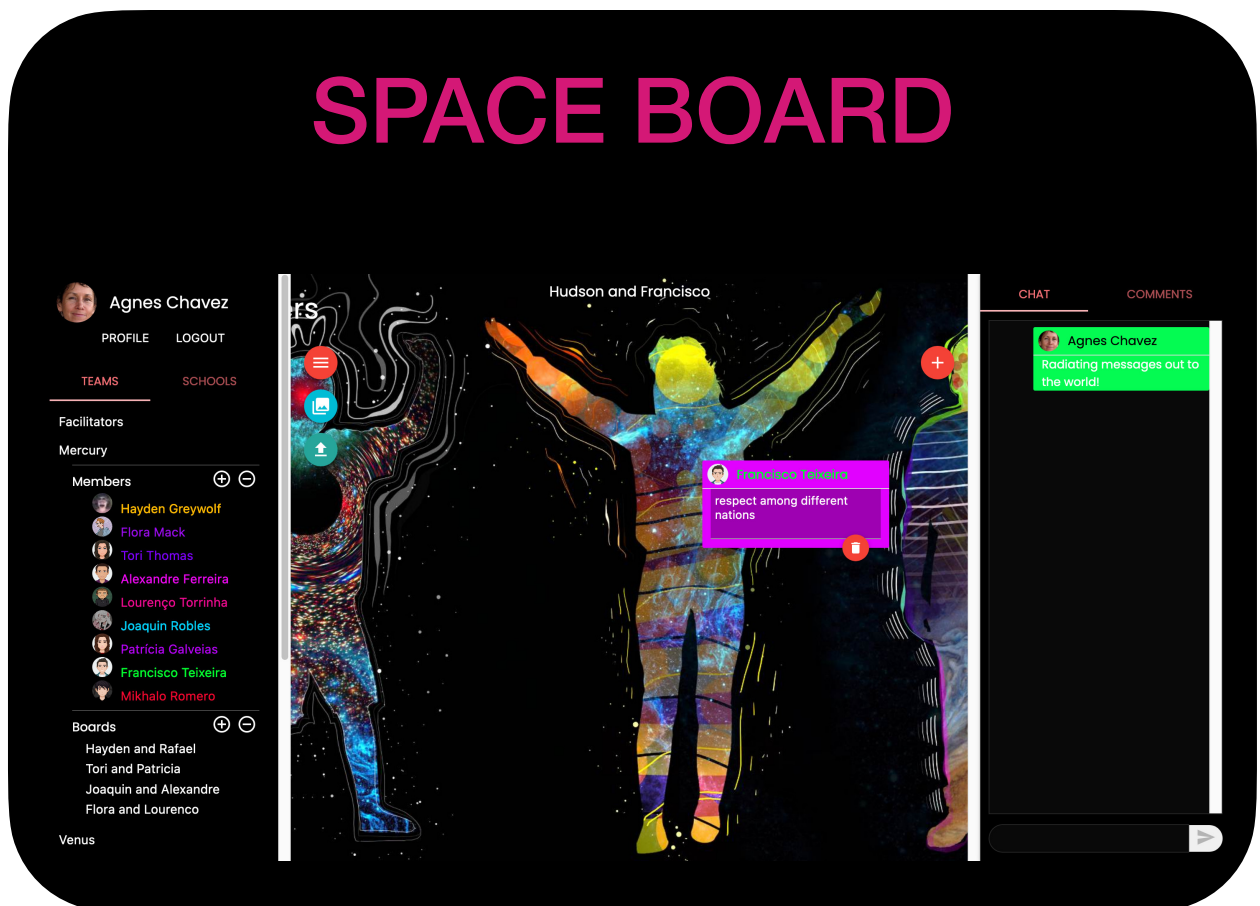
2. **Bio: Who am I?**

bi·o comes from the Greek bios meaning 'life', and in this context is a concise biographical profile of someone. Have students use the 'Who Am I?' Question Guideline below to write their personal bios which they will share on their profile on the Space Board. Their profile bio should be no more than 100 words.

3. Bonus: Create a Word Cloud from the collected bios to observe similarities and differences of the students.
4. Upload Avatar picture and Bio to Space Board to create a profile.

Bio Questions

- What is your name?
- What are your interests, hobbies, pets, siblings, favorite things to do at home?
- Where are you from? Tell us about the language or languages you speak at home, foods that you eat that are unique to your family or culture.
- Tell us about your school, what is it like, what are your favorite subjects?
- Tell us about your town, community or country. What would you show them if they came to visit such as local attractions?
- What are your favorite things to do in your town?
- What fields of study or global topics are you interested in pursuing?



Asking the Big Universe Questions

Science and art develop tools and technologies to try and answer the big universe questions: *Where do we come from? How are we connected to the universe? How do we know? What is our responsibility to our world and future? What makes us us?*

Diverse worldviews such as those found in Western and Indigenous Sciences offer unique perspectives in which humans filter the knowledge they have gleaned about our universe. One of the defining talents of the human brain is the ability to recognize and organize patterns. It is no surprise then that this would lead to diverse symbolic languages representing unique perspectives and meanings. These messages of understanding move with us through time as living cultural expressions of self and our connection to the universe. Symbols are the words, sounds, gestures or images that create the descriptive language of human experience.

1. Watch the [Neil Degrasse Tyson](#) video as a class to start the conversation about our connection to the universe through astrophysics.
2. Choose one or more activities centered around Space Messengers speaker videos to generate questions and other expressions to add to the Space Board and that will be featured in the Space Messengers Installation and in the metaverse.



"The cosmos is within us. We are made of star stuff. We are a way for the universe to know itself" - Carl Sagan



1. EXPLORING THE MULTI-MESSENGER UNIVERSE

The past decade has been called the Golden Age of Astronomy because incredible new instrumentation has shown us previously invisible realms in space. In this workshop we will learn from astrophysicist, **Dr. Nicole Lloyd-Ronning** that ripples in space-time from two black holes colliding can be felt here on earth revealing how interconnected we are to what is called 'outer' space. We will learn about multi-messenger particles which inspired the title of this project - Space Messengers - and how different particles from space send us messages that reveal different dimensions of our universe.

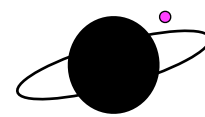
1. Watch Nicole's [video](#), *Wrinkles in spacetime: A multi-messenger view of our universe*, as a class and discuss key take-aways:

- ◆ Light and the other messages (neutrinos, gravitational waves, cosmic rays) we receive carry information about the physical processes going on in the objects in space (stars, planets, galaxies).
- ◆ Light (and the other space messages) look differently from different objects.
- ◆ The color of light tells you how much energy the system has and/or how hot it is.
- ◆ The strength and "shape" of the signal of any of the space messages (that is, how strong the signal is and what it looks like spread across different energies and through time) tell us about what type of physical process produced it (e.g. nuclear fusion, black holes colliding, particles spinning in magnetic fields, etc)

2. Illustrate one or more of the above takeaways. Compare drawings. Post best images to Space Board.

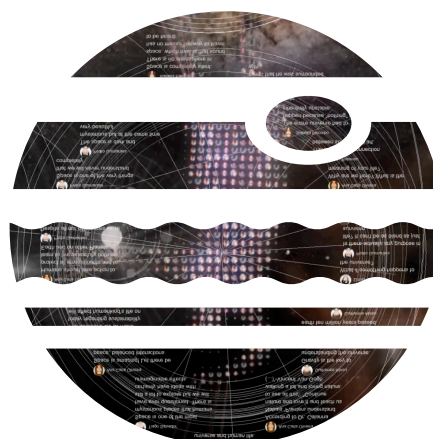
3. Read Nicole's statement on the next page. How might our perspective and the tools we are using to "see" the universe impact the way we understand messages? Write a short response on the Space Board.

(Bonus video: <https://www.youtube.com/watch?v=S8qMpohp23k>)



“In the same way multi messenger astronomy shows us we can learn different things from the universe and see it in different ways depending on the lens through which we observe it, we too see the same objects from our own eyes, our own filters, and cultural perspectives. Exploring what it means to live sustainably on planet earth and on other worlds will need the different lenses and perspectives of all humanity, just like astronomers need to look at various different kinds of light and energy to fully understand a cosmic object. *How can what we learn from space help us improve or create a more sustainable life on earth and in space? With that in mind, imagine, how would your community on earth be different in an interplanetary future? What kind of life would you like to live in space? What are the different ways you could imagine communities on other planets? How would people make decisions with this new understanding of our interplanetary place in the universe? How might your relationship with the environment be different? How would you conduct science and produce knowledge differently?”*

Dr. Nicole Lloyd-Ronning, LANL Astrophysicist
Frank Tavares, NASA Communication Specialist



2. UNDERSTANDING THE UNIVERSE THROUGH PARTICLE PHYSICS

From CERN physicist Dr. Steven Goldfarb we will learn how international scientists worked together to build a machine that would produce and visualize particles that existed only fleetingly at the birth of our universe. Their discoveries have revealed how elementary particles acquire their mass and continue to explore our most fundamental components, many of which originated in exploding stars. From this research in particle physics we also developed new technologies that change our future such as MRIs, PET scans, proton therapy and the World-wide Web.

When scientists say the universe is in us, they are not just speaking metaphorically. The fundamental elements that make up our universe, make up our bodies as well. We are star stuff- literally.

1. Watch Steven Goldfarb's [video](#), *Understanding the Universe Through Particle Physics*.
2. Develop questions or answers to some of the Big Universe questions that came up for students. Have each student add question to the Space Board. These questions will join an international community in the Meta verse that will be shown during Global VR Day.

- ◆ *How do we measure what we can't see? What can we learn from "looking out" and "looking in"? How big is the universe compared to you and how old is it compared to you? How can we communicate this?*
- ◆ *What are we made of? Where did the elementary particles that make up your body come from? How do physicists use experiments and models (such as the standard model) to explain what the universe is made of?*
- ◆ *Why is it important that we do fundamental scientific research, even if we do not know what exactly we will get from it (other than knowledge)?*
- ◆ *What is the advantage of having people from different parts of the world, who speak different languages and have different backgrounds, work together on an experiment?*

Below are some extensions to deepen the understanding.

[CERN and the Rise of the Standard Model](#)
[CERN: Standard Model of the Universe](#)
[Power of Ten](#)

UNDERSTANDING THE UNIVERSE THROUGH INDIGENOUS SCIENCE

Lakota artist and cultural specialist Steve Tamayo will take us on a journey back in time to explore where we come from through the lens of Lakota cosmology. We will learn how his people use observation and storytelling to study the stars, the weather patterns and their relationship to land and each other. In this way they developed a way to live in balance with the earth and all the species as an interdependent whole. How can this worldview be applied to imagine and create a peaceful and sustainable interplanetary future?



Cultural knowledge is a deeply local expression of human experience. Tied to seasonal change and cycles, traditions are intimately connected to the systems that support life, and are preserved through tools of cultural memory like story, symbology, movement and song to help answer “Why, why why, why why?”.

Watch Steve Tamayo speaker video (15 mins)

1. Watch Steve Tamayo video, *Living in Balance*, as a class and discuss the symbols observed in Lakota Cosmology and Steve’s key take-aways.

- ◆ It’s our responsibility to stand up and come together to save our lands, water, and air. How can we carry out this mission? Post your questions, answers and musing on the Space Board.
- ◆ How can we communicate something we know in symbolic language? How do we communicate something we don’t know? Are there universal symbols or gestures we all understand? Post images to Space board.

Who Are We?

★ Exploring Sustainable Interplanetary Futures

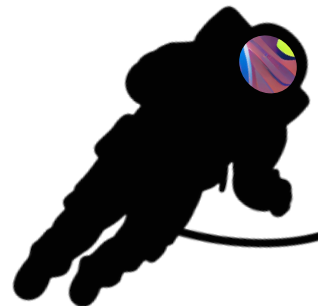
One of the most important questions humans ask themselves is ‘Who Am I?’ Some say it is what makes us human. It’s one of the questions we ask ourselves when discovering our place in the vast universe and when connecting or distinguishing ourselves from others. It is a query that will be explored in the Space Messengers project through the lens of art, science and technology. Through this international collaboration with youth, educators and artists we also explore and share who we are in relation to our community and country, from the perspective of planetary citizens. Watch the [Overview Effect](#) with students and discuss student reflections and questions to frame the question of who I am as an earthling. What values, perceptions and blind spots do I carry with me into my problem solving, exploration and use of other planets?

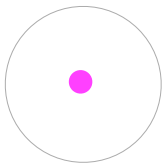
Answers to questions like these frame the way we might shape global/interplanetary citizenship, fostering:

...citizens capable of understanding that as well as belonging to a country, a nation, they are also members of the wider human family, that they have the same rights and depend on the same environment as the other 6 billion humans; that our various different micro-realities – in school, at home, in the city – are connected to the rest of the world ; that the lives of the men and women on this planet can be affected by events and processes taking place thousands of miles away, and that local micro-decisions and micro-actions affect the macro-reality. ([source](#))

- Other resources to explore with students:
 - <https://blogs.oregonstate.edu/technosphere/2021/03/07/planetary-citizenship/>
 - <https://www.bighistoryproject.com/home>
 - <https://www.planetary.org>

★





CONNECTING PERSPECTIVE TO POLICY

Frank Tavares, Affiliated Researcher, Space Enabled Research Group at the MIT Media Lab, shares with us how space exploration today is accelerating and offering amazing possibilities for our future. Yet at the same time we are often repeating the ways of thinking from our past that created the environmental and social problems of the present. We will learn about bio-spills on Mars, satellite pollution and moon advertising and mining. He shows how using science fiction is a powerful tool to imagine alternative futures for space exploration that are more sustainable and equitable.

Students will also meet and hear from Michelle Hanlon, Co-Director, Center for Air and Space Law and Frank Tavares, Affiliated Researcher, Space Enabled Research Group at the MIT Media Lab to learn about the latest international space regulations and what is still needed to achieve a peaceful and sustainable exploration of space.

Subjects: Art, space policy, technology, science fiction

1. Watch Frank's [video](#). Discuss the current ethical, social and biological challenges that Frank outlined in his presentation. As a class, introduce each of these real world examples.

[Bio Spills in Space](#)
[Moon/Astroid Mining](#)
[Space Advertising](#)
[Space Cemeteries](#)

Storytelling is a power tool for human visions of the future. Science fiction is a whole genre of storytelling dedicated to these speculative visions and has predicted some of the innovations and complexities of our modern world. Watch these videos and discuss the power of storytelling in Futures Thinking:

[How can science fiction predict the future?](#)

[Re-Imagine the future](#)

2. Watch Michele Hanlon's [video](#). Discuss the current policies in place such as the Outer Space Treaty of 1967. What are the challenges and how could we improve the policies to assure a peaceful and sustainable use of outer space.

[UNOOSA](#) (United Nations Office for Outer Space Affairs)

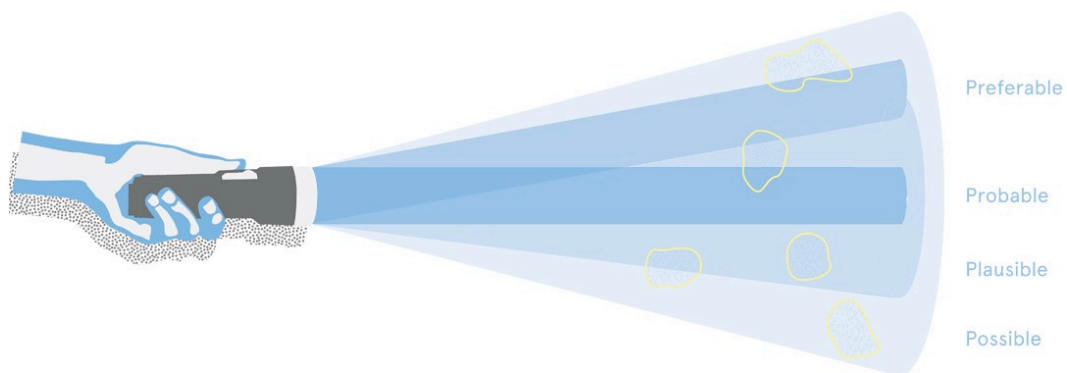
3. Ask students to think of a story or drawing that imagines how effective space policies can create a peaceful and sustainable solution to space exploration. What would it look like? How would it affect or change our lives?

Futures Thinking

Becoming Future Imagineers

We live in a time of extraordinary scientific and technological advancements that are expanding our understanding of the universe and our potential to create a future that is sustainable and equitable for all. And yet, as a civilization we continue to imagine and build a future where science denialism and the misuse of technology threatens our survival with climate change, species extinction and pandemic diseases. Many warnings from climate change scientists say that it is already too late and that the planet will be destroyed. Is this future possible? Plausible? Probable? Preferable? Luckily there are people and organizations from all disciplines around the world that are coming together to imagine other possibilities, other futures. Futures thinking and foresight is a systematic process to anticipate and shape the future by imagining other possibilities and exploring what it might take to bring them about and creating plans to get there. Futures Thinking tells us that the future is not something that will happen to you tomorrow but is being created by everyone today. It is a mindset and we are all Future Imagineers!

Futures thinking reflects a set of skills for anticipating and shaping the future – from scanning the horizon for signals of change, to imagining alternative futures, exploring the implications of potential futures, and designing mechanisms (technology, art, policy etc.) to shape the future. Futures thinking and foresight methodologies can enable individuals and organizations to anticipate, prepare for, adapt to, and recover from changing dynamics.



BASED ON A WELL-KNOWN TAXONOMY OF FUTURES, FIRST VISUALIZED BY JOSEPH VOROS, THE 'FUTURES CONE' IS A VISUAL TOOL THAT HELPS TO CATEGORIZE DIFFERENT FUTURE SCENARIOS ACCORDING TO LIKELIHOOD AND PREFERABILITY. (<https://medium.com/touchpoint/futures-thinking-a-mind-set-not-a-method-64c9b5f9da37>)



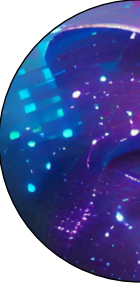
1. Watch these videos on Speculative Design that were created in partnership with the United Nations. Have them explore others on their own. In these videos youth leaders share their winning proposals on 'Futuring peace'. The videos and the project links show some real world examples of futures modeling that might help to inspire their drawings and writing for this week.

Speculative Design: Futuring Peace

Futuring Peace Projects

2. In this activity students will create a drawing that imagines an alternative future. They should be encouraged to think about what they have learned and let their imaginations run wild. Then ask them to write a statement that describes what they created. If they prefer they can start with the statement and then do the drawing. Provide prompts to give them possible ideas to work with:

- ◆ Explore the collected space board messages or choose/write one of your own messages from the Space Board to inspire your future. For example, a message asking about the nature of the wormhole could lead to a drawing showing what a community might look like if wormholes existed.
- ◆ Let your imagination lead you deeper into a question or idea posed by your peers.
- ◆ Use your unique cultural voice to imagine an interplanetary future.
- ◆ Create a drawing that shows your vision for a sustainable interplanetary planetary future. i.e. Transform your community into a fantastic future city.
- ◆ Ask a family member or elder to answer the question: What are your thoughts and wishes for an interplanetary future? Write their answers on the Space Board. How might different generations answer this question?
- ◆ Choose one of the 17 SDG like ocean pollution, species extinction, poverty and one of the science facts/theories you learned and combine to imagine a solution- as wild as it may seem. i.e. gravitational waves- ocean pollution, multi-messenger particles - species extinction, Space exploration -climate change
- ◆ Imagine it is 2040 and you are now the teacher in a high school class shaping our interplanetary future? What's your classroom like? What are you learning and doing





EXPERIMENT IN LIGHT AND MOTION



- ◆ Experiment with light and shadow: Find a blank wall and shine a light on it. Stand in front of the light to see your shadow. Try out different body poses and gestures that capture the ideas we have been learning about. Get creative and use objects around the house to create extensions or just use your hands, fingers and motions to express an idea of transformation and connectivity. Trace or photograph your shadow figure or take a short video of your movement. You could also prop your phone on a table to get the shot with a photo timer. If there is someone there to help, have them take a photo or video of your shadows. Upload your photo or video to the Space Board with a caption to share with your team.
- ◆ Draw and imagine creative silhouettes: Draw interpretive silhouettes with pencil or pen on paper that capture the idea of the human experience. Have fun imagining the body as it moves through space or how the body would look if traveling at the speed of light or teleporting through a worm hole! Recall the inspirational examples where the silhouettes were interpretive in proportions like the cut outs by Matisse. Get creative! If you like, fill in the silhouette with colors and textures inspired from the earth/space/technology images collected in the Space Board. Photograph your drawing and upload to the Space Board gallery with a caption to share with your team. Use one of the free scanning apps to assure you get good quality photos.

INSPIRATION RESOURCES

Artists have been expressing themselves in silhouette for many years. There is a fundamental nature to its simplicity. Check out some of the ways silhouette and shadow has been used in the inspiration links below:

Henri Matisse's cut-outs:

<http://www.matissepaintings.org/cut-outs/>

Lotte Reiniger's pioneering silhouette animations:

https://youtu.be/G_9L7r8NIBc

Iconic Apple iPod adverts from 2003:

<https://youtu.be/BTTglOeHdeY>

Hiwa Matreyek's shadow performance and installation:

<https://www.redcat.org/video/miwa-matreyek-myth-and-infrastructure-excerpts>





DISCOVER UNIVERSAL GESTURES

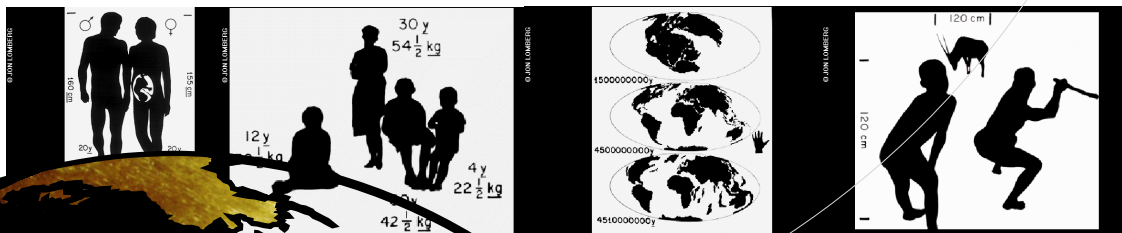
How might we express science concepts through gesture and shapes that can be “universally” understood?

In 1977, the Space Ships Voyager 1 and 2 contained golden disks that intended to communicate a story of Earth to intelligent life not of this world. This golden record included images, music, sounds and greetings of the diversity on Earth. Some of the images included silhouettes of humans. Why do you think scientists and artists picked these silhouettes? Imagine extraterrestrial life interpreting these signals. What meanings do they communicate? Are there universal gestures among humans? Can these gestures really be *universal*?

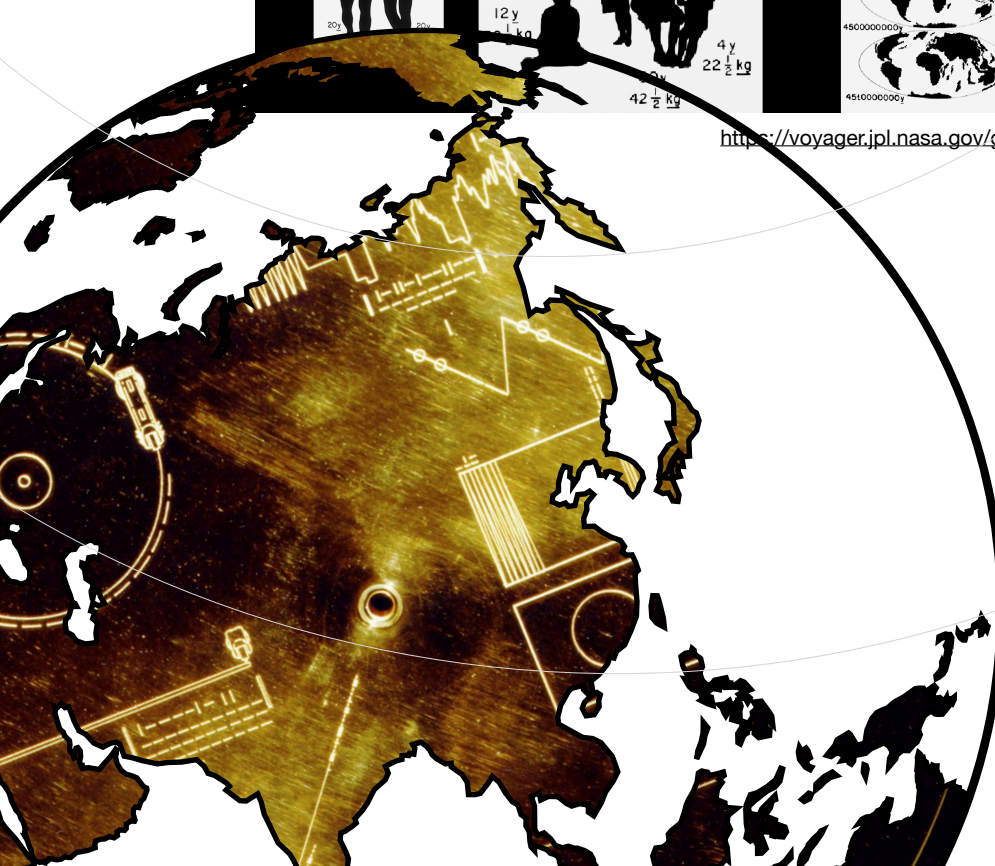
Silhouettes have been used for centuries to capture the essence of human forms in an outline. Silhouettes can be drawings, photos or video captured.

ACTIVITY

Experiment with silhouettes. Think of the messages you created on the Space Board for the Space Messengers Installation in the fall. Try out different body poses that communicate those messages. Get creative.



<https://voyager.jpl.nasa.gov/galleries/images-on-the-golden-record/>





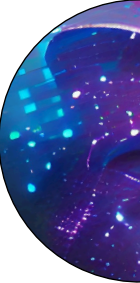
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- ◆ Imagine it is 2040 and you are now the teacher in a high school class shaping our interplanetary future? What's your classroom like? What are you learning and doing together?
- ◆ Imagine a specific person in a specific place who is experiencing a sustainable interplanetary future? What does their day-to-day routine look like? What role(s) do they play?
- ◆ How might the intersection of emerging trends shape our interplanetary future? What excites and concerns you about these potential futures? What actions and innovations might be needed to bring about a peaceful, sustainable interplanetary future?



“When people are supported to become creative and rigorous futures imaginers, they come to realize that the future is not something that will happen to them tomorrow but is being created by everyone today.”

Riel Miller (2003)