Integrating Art, Science, and Technology: The Art of Lásló Moholy-Nagy
Learning Physics and Chemistry through Art
A Lesson Plan for High School Science Teachers

This lesson plan connects the 2015 SBMA exhibition The Paintings of Moholy-Nagy: The Shape of Things to Come with Next Generation Science Standards for California Public Schools for grades 9-12.

Lásló Moholy-Nagy
*Untitiled (Space Modulator)*, 1946
Oil on Plexiglas
Lásló Moholy-Nagy (1895 – 1946) was a Hungarian abstract artist, active in Europe and the USA. After his experience on the front in the first world war (in 1915), he dedicated his life’s work to making art that would bring about a new revolutionary future without warfare. This improved humanity, Moholy-Nagy believed, would be possible thanks to advances in science, technology...and art. The role of the artist was to create artworks that would attune people to more sophisticated thought about society, history, and politics. This “modernization of the viewer” could be achieved through a new geometric visual language that referenced industrial manufacture. Abstract geometry, Moholy-Nagy believed, forced viewers to look at art carefully, which in turn would make them more perceptive of the world around them. Moholy-Nagy advocated that art should not function as décor, but that every household should own a “library” of artworks that, like books, would be taken out, studied, and contemplated.

Fully embracing scientific and technological advances, Moholy-Nagy always experimented with new industrial materials and techniques in his art, and regretted that “traditional” and static oil painting seemed to remain the most feasible and manageable means of production for the individual artist, including himself. As a faculty member of the Bauhaus in Berlin (1922–1928) and later as director of the New Bauhaus in Chicago (1937), he hoped that engaging in practical industrial design projects would help his students become active participants in shaping a rational and beautiful future.

The above is a very brief distillation of the discussion of Moholy-Nagy’s life and ideas in Joyce Tsai’s Essay “The Shape of Things to Come” in the exhibition catalogue. If you would like to read more about the artist, please ask the SBMA education department for a copy of the exhibition catalogue.

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1 He enthusiastically used new plastics and alloys as grounds for paintings, experimented extensively with emerging photographic techniques, and for a while stopped painting to instead dedicate himself wholly to constructions in artificial light. An articulate advocate for the integration of art, science, and technology, he was remarkably successful in soliciting industry funding and collaboration for many of his technically ambitious projects.

2 Joyce Tsai is the guest curator of the SBMA exhibition The Paintings of Moholy-Nagy: The Shape of Things to Come
LESSON WARM-UP: ART & SCIENCE

Moholy-Nagy was passionate about art that articulated and shaped a future of scientific and technological revolution. While all paintings included in the exhibition *The Shape of Things to Come* are evocative of scientific imagery, many of them are even prescient of scientific discoveries that were made only in the second half of the twentieth century, well after the artist’s death.

What follows are a series of images from scientific discoveries juxtaposed with paintings by Moholy-Nagy. Physics and Chemistry teachers can use these sets of images as concrete and visual catalysts for discussions in the classroom about the history of science, and the nature of scientific research and discovery. The sets of images also represent an opportunity to broach the cross-disciplinary nature of research, situating scientific thought in a larger (pop)cultural context that may feel more tangible to High School students.

The scientific images have been selected and curated by Dr. Sean Hartnoll, a theoretical physics professor at Stanford University.

- Engage students who are less confident in science by approaching science via art
- Get students excited about the cross-disciplinary potential of research and innovation
- Talk about the history of scientific innovation; help students see their own potential for impact on this evolving field
Solar panel powered satellite

Lázló Moholy-Nagy
*Untitled*, 1924
Linoleum Cut
Lázló Moholy-Nagy
Architektur 1, 1922
Oil on canvas
Plaque sent into space on the pioneer satellite, meant to communicate who we are to potential extraterrestrial intelligence.

László Moholy-Nagy
G. SMIRG, 1923
Watercolor and collage on sandpaper
Light reflection from a concave mirror

Lásló Moholy-Nagy

*Untitled*, 1922-23

Gouache, watercolor, pencil, charcoal, and pasted paper
Elementary particles in a bubble chamber

Lázló Moholy-Nagy
*Untitled (Space Modulator), 1946*
Oil on Plexiglas
Telescope for radio astronomy

László Moholy-Nagy
Composition, 1922-23
Paper collage
Model of the solar system

Lásló Moholy-Nagy
*Space Modulator Experiment, AL 5*, 1931-35
Aluminum and Rhodoid
LESSON: SEEING SCIENCE

Moholy-Nagy’s paintings shown in the SBMA’s exhibition *The Shape of Things to Come* are explicitly evocative of many scientific principles that students study in grades 9-12. His art provides an opportunity to approach science learning from a new and engaging angle. Physics and Chemistry teachers can use a selection of Moholy-Nagy’s paintings to review scientific principles with their students.

Five of Moholy-Nagy’s paintings follow. Below each is a list of science principles from the NGSS\(^3\) that it evokes. What more can your classroom find?

- Engaging way to revisit and discuss principles and concepts from physics and chemistry studied in class
- A fun and student-driven way to review material
- Helps teacher assess where students lack (re)cognition of studied material
- Open-ended discoveries allow all students to experience themselves as competent
- Builds cross-curricular critical thinking skills for students as they explain their reasoning
- Orthogonal approach to science encourages creative thinking, open-mindedness and curiosity —important skills for research and innovation in science, and all academic fields

When art teachers and museum educators talk about artworks with students, they often use something called Visual Thinking Strategies (VTS) to help start and shape a thoughtful and inclusive conversation. For this lesson, science teachers are encouraged to use a slight variation of VTS to engage their students. A description of VTS and how to use it follows.

**A Quick Introduction to Visual Thinking Strategies (VTS)**

VTS is a specific set of questions that art educators use to get students (of *any* age) thinking and discovering when looking at a work of art (*any* work of art). The questions are designed to:

- Welcome multiple “readings” of an artwork
- Encourage exploration, creativity and imagination
- Teach reasoning and logical thinking
- Give every student an opportunity to participate and be heard
- Make students recognize ownership of their ideas
- Be a fun, collaborative way of “unpacking” a work of art

**There are three VTS questions that an educator asks in the following sequence:**

1) **What’s going on in this picture?**

   *Any student can volunteer to suggest what she thinks is happening. This narrative approach is engaging to students of all ages. Students always surprise each other (and the teacher) with how wildly different their ideas are.*

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\(^3\) Next Generation Science Standards for California Public Schools, Revised March 2015
2) What do you see that makes you say that?

The student is then asked to back up her hypothesis of what is going on by explaining her observations and conclusions. This helps the student clarify her position, and other participants to “see where she is coming from”. As the student explains, the educator points to the parts of the picture she is describing and neutrally paraphrases what she is saying, so that everyone can follow the student’s thoughts.

3) What more can we find?

This question opens the conversation back up for the next idea. It sets the tone for a learning experience in which multiple view-points are possible and, suggests that they are, in fact, fun to collectively analyze and compare.

For more information on VTS and to see films of VTS “in action” with students of various ages, go to www.vtshome.org.

Use the following VTS variation to analyze Moholy-Nagy’s paintings in the science classroom:

1) What scientific laws or principles do you see in this picture?

In this lesson plan, each image is presented with a collection of possible “discoveries” taken from the NGSS for High School science. This selection does by no means represent the only science themes that a student might find. Add your own and also let them surprise you.

2) What do you see that makes you say that?

Ask students to explain why the image made them think of a certain scientific law or principle. Have them explain what the law/principle is so that everyone can understand why they saw what they saw. Paraphrase and summarize what the student says, possibly writing applicable equations on the blackboard as the student speaks. You, as the teacher, help and guide the student in reviewing material for everyone’s benefit.

3) What more can we find?

Ask this question to open the conversation back up for other students’ discoveries. Set the tone for a learning experience in which multiple view-points are possible and, suggests that they are, in fact, fun to collectively analyze and compare.
Students may find and explain these NGSS scientific concepts:

- Chemical reactions; rearrangement of atoms into new molecules
- Optimizing the design solution; break down criteria into simpler ones
- Gravitational, electric, and magnetic fields; field lines
- Excited states; gas, liquids, non-solids

What more can your classroom find?
Students may find and explain these NGSS scientific concepts:

- Kepler’s laws (motion of orbiting objects)
- Newton’s second law of motion; mass and acceleration
- Gravitational, electric, and magnetic fields; field lines
- Newton’s law of universal gravitation and Coulomb’s law
- Earth and Solar Systems
- Structure of an atom

*What more can your classroom find?*
Students may find and explain these NGSS scientific concepts:

- Electromagnetic radiation; reflection of waves
- Detection of cosmic microwave background with radio telescopes
- Planets and solar system; eclipse
- Balanced forces; equilibrium

What more can your classroom find?
Students may find and explain these NGSS scientific concepts:

- Structure of an atom
- Organize and predict properties of elements based on patterns of electrons
- Periodic Table as model to organize and predict elements
- Stable forms of matter and stable states
- Solar cells

What more can your classroom find?
Lásló Moholy-Nagy

*CH Space 6*, 1941

Oil paint on canvas

Students may find and explain these NGSS scientific concepts:

- Kepler’s Law (elliptical orbit paths of planets around the sun)
- Wave properties
- Electromagnetic radiation
- Magnetic fields and currents

*What more can your classroom find?*