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Didactics

The Story of Science

Abstract. *The Story of Science* is a book series by Joy Hakim of which the first three volumes are now available – *Aristotle Leads the Way* (2004), *Newton at the Center* (2005) and *Einstein Adds a New Dimension* (2007) – and three more are planned. The books represent an on-going project aimed at teaching science in a way that is both specific and interdisciplinary. Kim Williams discussed the project and its goals with author Joy Hakim and art scholar Sabine Russ, who chose the illustrations for the books.

Keywords: History of science, art and mathematics, didactics

Introduction

Three volumes of a planned six volumes of the book series entitled *The Story of Science* have been published to date. These are *Aristotle Leads the Way* (2004), *Newton at the Center* (2005) and *Einstein Adds a New Dimension* (2007). This rich compendium covers a time range of some 7,000 years, from the Sumerians to the present day of the quark and quantum, and encompasses developments in astronomy, mathematics, physics, mechanics, chemistry and more. The main text is interspersed with feature sections that offer insights into concepts or applications that complement the story. The nature of the feature sections is marked in the main index, according to whether they deal with science, math, technology, geography, philosophy/religion, art or music. Thus those interested in following one thread of many can use this as a guide. The books are aimed at a young audience, but this shouldn't deter an older reader. Given the range of this ambitious project, the lively and engaging tone and true wealth of illustrations will be welcomed by all who are new to the history of science. In fact, given our specialized world, there will be few readers lay or professional who are familiar with the whole history of the sciences. These volumes provide a broad but not superficial overview.

KW: Given such a broad and complex subject, how did you decide to write for young people?

JH: I'm often asked what age reader I had in mind when I wrote these books. And I usually answer with a question, "And how old are you?" The real answer: My books are for anyone who wants an introduction to science, or for anyone who doesn't know its tales. Smithsonian Books, the publisher, says "for readers from 9 to 99." I got an email from an

engineer with a degree in physics. He read all three books. “I knew the science,” he said, “but I’d never heard the stories.”

KW: There are noteworthy cases of scientists who were also architects: Leonardo da Vinci, Desargues, Guarini, Wren, Hooke; even Newton was led by his theological studies to consideration of the architecture of Solomon’s Temple. Do you think that there is a fundamental connection between the sciences and architecture?

JH: I see science and architecture as compatriots. Each is a form of art with its own version of beauty. Architecture and science have a mathematical base in common, so there is a natural connection. In past ages the best thinkers on every level of society have always been aware of the breadth of thought in their time. That is less so today, and the fierce anti-intellectualism around us is one result.

KW: *The Story of Science* books present a kind of inside/outside view of the world of science, that is, we are shown at once what science is like from the inside and what it looks like from the outside. The vehicle for doing this is culture, both the culture of science itself and the broader culture in which scientists live. C.P. Snow famously discussed the “two cultures”, that is, the divide between the sciences and the humanities. Do you see your books as a bridge between the two?

JH: Kim, I’m glad you cited C.P. Snow. His argument in *The Two Cultures* is as pertinent today as it was when he gave the Rede Lecture in 1959 and said, “Literary intellectuals at one pole – at the other scientists. . . .Between the two a gulf of mutual incomprehension – sometimes (particularly among the young) hostility and dislike, but most of all lack of understanding.”

That lack of understanding impacts mightily on us all in today’s world—especially in the field of education (consider the evolution brouhaha). We have become two cultures with increasing polarization and even contempt between those who understand the ideas that underlie our times (i.e., modern physics and biology) and those who don’t have a clue.

So, if I’ve written books that can do anything to bridge that gap, I’ll feel very good about it. I’m with E.O. Wilson in his endeavor to resurrect William Whewell’s nineteenth-century word “consilience,” which means the “jumping together” of disciplines. His idea was that all fields of knowledge are streams of a big river. That makes sense to me. It also seems to make sense to my young readers. The walls that exist between subjects in schools aren’t out there in the real world. Every ten-year-old understands that.

As to artists and science: The great writers and artists of the past have always been aware and responded to the latest scientific knowledge. The word “science” wasn’t coined until Whewell came up with it in 1840. Before that, the term was “natural philosopher” and natural philosophy was widely enjoyed. Yes, today there is less comprehension of science by artists and the general public; I believe that is a tragedy of our time. The math behind

quantum theory and relativity is daunting, but the basic concepts can be understood. Without that knowledge, artists and others are out of touch with today's big ideas.

KW: The two cultures present one contrast, but also the disciplines of history and science themselves present another. David Speiser, who worked both as a physicist and a historian of the sciences, also recognized the difference, but delighted in the contrast:

...science and history are two radically different endeavors of the human spirit.

The essence of science lies in its property of being systematic since science ultimately always wishes to grasp the laws of nature, which it strives to uncover and to formulate in the simplest and most transparent form. But human history, and thus also the history of science, is the complete opposite of this: it is totally unsystematic, always complex and never simple or transparent. So, for writing the history of science two different, indeed totally opposite, endeavors must simultaneously be at work... This confrontation, one might say 'clash', of the endeavor to systematize and to extract the universally valid from the documents which the historian finds before him, with the aim to determine the conditions under which this, always unique, discovery was made, under very special circumstances and by one distinct individual different from all others, and then to interpret its significance for the development of science, is the character of the history of science. It is its very essence, even its unique prerogative and also its characteristic charm [Speiser 2003: 39-40].

world of ideas will appreciate it too. Can you explain the didactic philosophy behind your approach?

JH: I have strong feelings about this. I believe we have done our children a real disservice with today's fact-driven dreary textbooks. Despite what you hear, I find that children today still love to read (consider Harry Potter) and they like nonfiction. They seem to intuit that in the information age nonfiction is the important literary form. But nonfiction needs to have a story to hold attention. Today's children see very little narrative nonfiction in

school. Most textbook writing is committee driven and horrendously dull. We're losing a generation of potential thinkers with this drivel. I'm trying to do my bit to change things. It's not easy, the schoolbook market is controlled by three behemoth publishers who last year split four and a half billion dollars. Education today is a big business. I see myself as a mosquito in a land of elephants.

KW: Your books are richly illustrated and abound in asides. Still, as accessible as the constant references to human culture made the science for this reviewer, I found the books' layout a bit dizzying. There are diversions and discussion throughout – works of art, definitions of words, fun facts, examples of applications – but these often caused me to lose the thread of the main story. This I attribute to an old-fashioned brain. Do you think it's true that young people today learn in a different way than we did a couple of generations ago?

JH: Yes, this is a time of visual culture and perhaps an overabundance of information. We are flooded with images on TV and, on the Internet, what seems like limitless information delivered in bits and pieces. Today's young generation does seem to navigate and process visuals and text in different ways than their older siblings did just a decade ago. My books attempt to respond to that by providing a strong, informed, energetic narrative along with many, many bits of extra information in illustrations and sidebars. Readers have a choice: they can stick with the main narrative or venture from there into the sidebar material. It works both ways. I find that my young readers have no problem with that; some adults get confused.

Here's a quote I like. You'll see why. It's Max Born writing in *My Life & My Views*. Born was a physicist, a Nobel winner, one of Einstein's lifelong friends, and Olivia Newton-John's grandfather. This is what he wrote in 1968:

To present a scientific subject in an attractive and stimulating manner is an artistic task, similar to that of a novelist or even a dramatic writer. The same holds for writing textbooks.

KW: The story of science is accompanied rather than illustrated by works of art, in that, yes, there are figures that explain concepts, but the works of art shown also serve to take the reader on an excursion, using the subject at hand as a point of departure. For example, in vol. 2, *Newton at the Center*, a discussion on probability is accompanied by a painting of workers crafting playing cards; in the section about Émilie du Châtelet is a painting of a seventeenth-century soirée with a group at the card table. This might seem frivolous, but the fact that card games and lotteries were popular in the seventeenth and eighteenth centuries was a big spur to the science of probabilities. The capacity of the illustrations to enrich by showing the cultural context adds much to the book.

JH: As you noted, the books are gorgeous. We tried for a synergy between text and pictures. This was a team effort, and Sabine Russ, who is responsible for the illustrations, can tell more about how the books evolved visually.

SR: At the start we had to make a decision on how to illustrate these books. One could either appoint an illustrator to draw pictures to accompany the narrative or use existing imagery from historical archives and image collections. We opted for the latter (adding some diagrams drawn specifically for the text) because it allowed for a greater visual variety and for more creativity in terms of documentation.

If you illustrate history before photography (before 1850), you will naturally have to work with drawings, paintings, and sculptures which were, in one respect, the “cameras” of the time. If you need a portrait of Newton and Plato, you won’t find a photograph but a painted picture. When I had the choice I went for the best, such as *The School of Athens* by Raphael.

What we call art today was not necessarily art at the time of its making. A 1400 B.C.E. Egyptian tomb painting could function as a list, a calendar, or an astrological treatise. Artifacts, maps, statues, paintings, etc. often had a documentary purpose or religious meaning. In these books we use and value them as both – as art works and as mirrors/documents of their time.

My background is in art history and I’m involved with contemporary art as a critic and exhibition curator. In my role as picture editor and managing editor for these books I took my clues from the manuscripts but I was, of course, delighted to bring some of my “curatorial” background in. The narrative includes numerous excursions into fields that are not “straight” science. Every chapter starts with a group of quotes by scientists, novelists, poets, philosophers, or artists. This sets the tone for a choir of different voices and therefore different types of images. I tried to keep a balance between pictures that directly address the science discussed in each chapter and images illuminating the circumstances and culture of the time as well as the scientists’ biographies.

In chapter 44 of *Einstein Adds A New Dimension* I thought it appropriate to bring in a few works of contemporary art, knowing that astronomy and cosmology have a great resonance with artists today. The box titled “What’s Art Got to Do with It?” (p. 405) gives a few examples of contemporary visual artists tackling the scientific universe. Young readers might be encouraged to look and recognize science in places other than those they might normally expect.

As to the visuals, I have made an effort to stay on a high level in terms of selecting and combining pictures. Especially as we are flooded daily with thousands of images, the goal was to encourage an associative, creative reading of pictures. For instance, to illustrate the Second Law of Thermodynamics (*Newton at the Center*, page 404), I decided on a photograph of two rotten apples next to a beautiful picture of an old person’s wrinkled hands. Everybody will understand the message. But it’s important that the photographs are not your usual stock images, they are art works and there is a visual poetry in the juxtaposition of these two black and white pictures. They won’t divert from the text and the principles explained in the chapter but they might stop you in your tracks for a moment. And you might keep the images in the back of your mind.

KW: Three more volumes are planned for your series. What do they hold in store for us?

JH: I’m working on a new book titled, *In the First Place*. It starts with the formation of Earth, delves into some geology, and then life forms begin to appear. We get a Cambrian explosion, mass extinctions, dinosaurs, and (I’m not there yet) us humans. I have two other books in mind to complete the series, but sometimes I think I might take time off and do a book on education.

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About the authors

Joy Hakim earned a bachelor's degree at Smith College and a master's of education as well as an honorary doctorate at Goucher College. She is also the author of *A History of US*, a ten-volume, interdisciplinary U.S. history published by Oxford University Press that merges informative illustrations and narrative. A sixteen-part PBS TV series, "Freedom: A History of US," produced for WNET by Kunhardt Productions with Katie Couric as narrator, was based on her book of the same name. She lives in Virginia and Colorado. Her website is <http://www.joyhakim.com>.

Sabine Russ is Managing Editor at American Historical Publications, which produced *The Story of Science* for Smithsonian Books. She is also a freelance art critic and exhibition curator of contemporary art. A native German, she is based in New York City.

Kim Williams is editor-in-chief of the *Nexus Network Journal*.