

How a fake Kepler portrait became iconic

Textbooks and popular writings introduce portraits of historical personalities to illustrate the human side of science. Usually they get it right. Albert Einstein did stick out his tongue to reporters, Marie Curie really did dress in black, and J. Robert Oppenheimer wore a porkpie hat. But for the past few decades, one of the founders of modern physics and astronomy has been routinely portrayed erroneously. Since this year marks the 450th anniversary of Johannes Kepler's birth, it is timely and necessary to point out an egregious example of unwittingly propagated misinformation.

As this issue of PHYSICS TODAY goes to press, the top left painting below is the first image returned in a Google search of "Kepler portrait," and it's accompanied by a striking array of variations and re-creations. Prior to 6 August, it was the lead image on Kepler's Wikipedia page. For users in select countries, Google replaced its logo on 27 December 2013, Kep-

ler's 442nd birthday, with a doodle that incorporated the portrait.

The portrait is in the possession of a Benedictine monastery in Kremsmünster, Austria. The earliest mention of the painting we have found is in the 1877 book *Geschichte der Astronomie* (*History of Astronomy*) by Rudolf Wolf. According to Wolf, the descendants of Kepler's siblings sold the painting to the abbot of the Kremsmünster monastery¹ in 1864. Ludwig Günther recounted a similar story in the introduction to his 1898 German translation of Kepler's *Somnium* (*The Dream*), stating that "according to the notes I received from Father Hugo Schmid, the monastery librarian there, the painting belonged to a notary [named] Gruner, who sold it in 1864 to the current abbot of the monastery, [Augustin] Reslhuber."² (All translations of German are ours.) Neither Wolf nor Günther identifies the artist who painted the portrait.

The painting is an oil on oak (35.5 cm × 44.5 cm) with no signature or attribution.

There is only the Latin phrase *Aetatis Suae* 39, 1610 (At the age of 39, 1610) in the upper right corner (which is usually omitted in reproductions). In a 1930 Festschrift published in honor of the 300th anniversary of Kepler's death, Ernst Zinner notes that the painting was sold to the abbey for 200 gulden and that

Gruner was from Weil der Stadt (Kepler's birthplace, in what is now southwestern Germany).³ Zinner summarizes Wolf's and Günther's descriptions, calls the painting an "alleged portrait," and notably includes the opinion of Seraphin Maurer, who examined the painting in the 1920s. Maurer, the curator and conservator at the Picture Gallery of the Vienna Academy of Fine Arts, stated the following:

The overall impression of the picture is good, namely, it corresponds with [that] of a picture from the 17th century. However, upon closer inspection, the technical treatment (brushwork) shows that the painter had no understanding of natural forms but could only mechanically reproduce someone else's [work], which is clearly evident to the specialist. Furthermore, the colors have not yet taken on a glaze-like appearance, which is always the case with pictures from that time. There are no visible signs of aging such as cracks, so I presume that the picture was probably created around 1800 (or a little earlier or later). Likewise, the oak panel used [by the artist] has a finish that does not conform with the usual type from around 1600. These are the main factors that enable me to state that the picture is a copy. (reference 3, page 339)

Even before reading Zinner's article, we had long suspected that the painting could not be from earlier than the 19th



A COMPARISON OF PORTRAITS. Fake Johannes Kepler portrait (top left). Allegedly from 1610, this painting by an unknown artist is more likely from the 19th century. If it is based on anything, it likely derived from a portrait of Michael Mästlin. **Michael Mästlin portrait** (top right). A black-and-white photograph of an original from 1619 sometimes attributed to Conrad Melberger. The portrait, at the University of Tübingen, was flagged by Ernst Zinner as a possible source for the fake.³ **Kepler portrait** (bottom left). An engraving based on a portrait of Kepler from 1620. The portrait was given to the Strasbourg University Library in 1627. (Courtesy of the Smithsonian Libraries and Archives.) **Presumed Kepler portrait** (bottom right). Attributed since 1973 to Hans von Aachen.^{4,5} It is from around the same year inscribed on the fake portrait, likely 1612. (All four images are in the public domain.)

century for stylistic reasons, and we were quite pleased to find that Zinner and his informants reached the same conclusions.

It's likely that the painting is not even a painting of Kepler but, as Zinner suggested in 1930, a 19th-century forgery based loosely on a portrait of Kepler's teacher and mentor Michael Mästlin (top right). That image depicts Mästlin in the ruffled collar and academic gown typically worn by professors of that period. The alleged Kepler portrait held by the Kremsmünster monastery shows Kepler in a similar academic outfit, but that does not accord with what Kepler wears in other portraits that incontrovertibly depict him: a commemorative medallion from his wedding in 1597 and an official portrait from 1620 (bottom left). In those, Kepler wears a lace collar, which is more appropriate as he was neither an academic at the time nor a nobleman. Moreover, the Latin inscription in the alleged portrait could have been added by anyone knowing Kepler's birth date.

The bottom right painting is another presumed portrait of Kepler, from around 1610, that since 1973 has been attributed to Hans von Aachen, one of the favorite painters of Holy Roman Emperor Rudolf II and a contemporary of Kepler in Prague.^{4,5} The top left and bottom right portraits cannot be simultaneous representations of the same person. Although the identifications are still disputed, at least in the case of the von Aachen the artist is known and the painting is original. Finally, another painting identified as Kepler, known as the Linz portrait, is dated to 1620. The artist is unknown, but it does bear resemblance to the depiction on the frontispiece of Kepler's *Rudolphine Tables* (1627).⁶

So how did the fake Kepler portrait spread? Except for Wolf's and Günther's mentions, we cannot find any examples of the portrait attributed as being Kepler

before 2005. That's the year the portrait first appeared on Wikipedia, and thereafter it became ubiquitous. For example, it appears in a European Space Agency press release from 2011 (explicitly citing Wikipedia), the European Southern Observatory attached it to an article from 2016, and NASA used it in its Solar System Exploration educational materials in 2017. This past April the image appeared on the cover of *Giornale di Fisica*, an Italian magazine for secondary-school physics teachers.

Although this matter may just seem like a trivial byway, images fix in the mind. Kepler deserves better.

References

1. R. Wolf, *Geschichte der Astronomie (History of Astronomy)*, R. Oldenbourg (1877), p. 308, n. 4.
2. L. Günther, *Keplers Traum vom Mond (Kepler's Dream of the Moon)*, B. G. Teubner (1898), p. xx.
3. E. Zinner, *Ber. Naturwiss. Ver. Regensburg*, **19**, 337 (1928/1930).
4. O. Gingerich, *Trans. Int. Astron. Union* **15A**, 639 (1973), p. 642.
5. T. D. Kaufmann, *The School of Prague: Painting at the Court of Rudolf II*, U. Chicago Press (1988); D. Jansová, "Kapitoly z dějin sběratelství na Kolowratském zámku v Rychnově nad Kněžnou" ("Chapters from the history of collecting at Kolowrat Castle in Rychnov nad Kněžnou"), bachelor's thesis, Palacký University Olomouc (2014).
6. See H.-J. Albinus, D. Suckrau, *Math. Intell.* **43**(1), 64 (2021).

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Hydrogen as an aviation fuel

Powering airplanes by hydrogen, as reported on by David Kramer in the December 2020 issue of PHYSICS TODAY (page 27), is a nice theoretical idea that brings little practical benefit.

Apart from the difficulties of handling hydrogen as a cryogenic liquid or a gas at very high pressure, the most serious problem with hydrogen as an aviation fuel isn't the weight of the tanks containing it but rather its low density, even as a liquid. Consider the Toyota

Mirai, an electric car powered by a hydrogen fuel cell: The hydrogen is stored as a gas in polycarbonate tanks at 700 bar, twice the pressure proposed for the hydrogen-powered aircraft. The 2021 Mirai can hold 5.6 kg of hydrogen, but that's just 6% of the combined mass of the fuel and the fuel tanks. For tanks of conventional aviation fuel—kerosene or aviation gasoline (avgas)—the mass is mostly fuel, not tank structure.

The energy per unit volume of liquid hydrogen is 24% that of avgas or kerosene; that of hydrogen at 350 bar, only about 8%. Light aircraft use only a small part of the wing to store fuel. The combination of fuel cell and electric motor has approximately twice the efficiency of an internal combustion engine, though, so only half as much energy needs to be stored.

The situation is very different for long-range, turbine-powered aircraft used for intercontinental travel. The whole wing serves as a fuel tank, and fuel can account for 45% of a plane's allowed maximum takeoff mass. Even for the high-bypass-ratio turbofans found on a commercial aircraft, a substantial part of the high-altitude cruise thrust comes from the turbine core, not the fan, so driving the fan with a fuel-cell-powered electric motor effectively makes the aircraft more like a slower turboprop. The low density of hydrogen, even as a liquid, means that the aircraft doesn't have the space for the fuel needed for an intercontinental journey.

A flight of 500 nautical miles (900 km) takes about 1.25 hours. If the aim is to minimize carbon dioxide emissions from travel, then for flights of less than that distance—for which hydrogen is viable, though not necessarily practical—it would be better to just take the train!

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Correction

July 2021, page 24—Steel Made via Emissions-Less Technologies (SMELT) was incorrectly identified as a program of the Advanced Research Projects Agency–Energy. SMELT is in fact a “request for information,” seeking public input that could potentially lead to a future program. **PT**

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