L: STUDIOCANAL; R: UNIVERSAL PICTURES

Left, Benedict Cumberbatch as Alan Turing in *The Imitation Game*; right, Eddie Redmayne as Stephen Hawking in *The Theory of Everything*.

FILM

Enigma variations

Robert P. Crease ponders a brace of biopics on Alan Turing and Stephen Hawking.

Early in *The Imitation Game*, a constable says, "I think Alan Turing's hiding something." The implication is that it is his sexuality. But as well as being gay, Turing was a master code-breaker, spy and recluse. Secrets drive this thrilling, fast-paced film — as gripping as it is tragic — about one of history's most brilliant mathematicians and computer engineers. Meanwhile, a movie about physicist Stephen Hawking turns his life into a feel-good saga.

Morten Tyldum's *The Imitation Game* makes it clear that Turing's passion was finding solutions to abstract logical problems. But how to animate a character (played by Benedict Cumberbatch) whose life is all in his head? The answer is provided by the Enigma machine, used by Nazi Germany to encipher military messages. In trying to crack the secret, Turing's otherworldly interests in 'impossible' logical challenges intersected with urgent worldly ones — the challenges of the British government, at one of the darkest junctures of the Second World War.

An early scene, in which we are first shown Enigma, dramatizes that intersection. Turing pronounces the device beautiful; a government official declares it "the crooked hand of the devil". As Turing and his colleagues at Bletchley Park, the British code-breaking centre, work on deciphering Enigma, every tick of the clock means more warfare, more death. The film cross-cuts scenes of bombs raining on cities with scenes of prospective code-breakers solving crossword puzzles, and you get the connection.

The Imitation Game
DIRECTED BY: MORTEN TYLDUM
Black Bear Pictures: 2014.

The Theory of Everything
DIRECTED BY: JAMES MARSH
Working Title Films: 2014.

When the Bletchley gang finally solve the code, they have to hide their triumph or risk tipping the enemy off. Turing is asked to determine which secret — such as news of impending attacks on convoys or cities — can be acted on without arousing suspicion. Meanwhile, the Soviets are spying on Bletchley, kept at bay with a drip-feed of minor information. The UK government blackmails Turing (gay in an era when that was illegal) to force him to spy on the Soviet ring.

NATURE.COM
For *Nature*'s Alan Turing special, see:
nature.com/turing

The film takes its title from the Turing test, an imitation game that he devised in which a human has to judge whether a concealed interlocutor is a machine or a human. The idea is invoked in a scene, played powerfully by Cumberbatch, in which Turing is about to reveal the full details of his life story, including the code-breaking and homosexuality. He challenges the (baffled) constable to judge him: "What am I? Am I a criminal? Am I a war hero?"

The movie neither sensationalizes nor ignores Turing's sexuality. It tells us little about his work in maths or cryptography, but it allows us to glimpse something deeper: how the ordinary world is shaped by mathematicians and scientists in ways that many people hardly suspect. A final scene shows ecstatic celebrations in the street at war's end. We are left feeling that, if such events fail to give the Turings of the world their due, the revelry is hollow. Turing, of course, was not just unheralded: like most Bletchley employees, his accomplishments were classified and his war records expunged. Later, he was arrested for 'gross indecency' and forced to undergo chemical castration. He killed himself in 1954. ▶

The Theory of Everything is, like *The Imitation Game*, about a scientist. There the similarities end. The film tells us that Hawking has refused a knighthood, but it thoroughly canonizes him. There have been other depictions of Hawking's life, including *Hawking* (2013), a documentary by Stephen Finnigan, and *Hawking* (2004, a BBC television film starring Cumberbatch). This turn, with Eddie Redmayne in the lead role and directed by James Marsh, is loosely organized around Hawking's relationship with his first wife, Jane Wilde, and based on her memoir *Travelling to Infinity* (Alma, 2008). Despite Redmayne's fine performance, it unfolds with such plodding, reverential linearity, and with so much melodrama and uplift, that it is the least compelling of the treatments.

The story begins in Cambridge, UK, in 1963. Stephen and Jane flirt. He is diagnosed with motor neuron disease and told that he has two years to live. She remains selflessly devoted and they marry. Stephen works despite his disability. "He has done it!" we are told at one point, but we haven't a clue as to what 'it' is. Caring for Stephen and their three children gives Jane moments of doubt and insecurity. The ins and outs of the couple's relationships with each other and with their eventual second spouses — choir director Jonathan Hellyer Jones and Stephen's nurse Elaine Mason — are rolled out with surprisingly little conflict. Everyone is presented as well intentioned and concerned only for Stephen's welfare.

Key moments in Hawking's life are handled simplistically. He announces, "I will write a book," and knocks off *A Brief History of Time* (Bantam, 1988) without strain or editorial conflict; it is an instant best-seller. A final scene shows Hawking, now a venerated celebrity, delivering a talk to an entranced audience. One questioner asks how it is possible for him to live without believing in God. The question seems pointless: in the world of this film, so full of saints and sacrifice, who needs God? But cloaked in the ethereal strains of his electronically synthesized voice, Hawking's response — "Where there is life, there is hope" — brings the audience cheering to its feet. The scene invites us to regard Hawking himself as a miracle.

Dramatizing the lives of scientists, so much of whose work is mentation, is demanding. These two films demonstrate the promise and the perils. ■

Robert P. Crease *is professor of philosophy at Stony Brook University in New York, and co-author, with Alfred Scharff Goldhaber, of* The Quantum Moment.
e-mail: robert.crease@stonybrook.edu

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Matthew McConaughey, Anne Hathaway and David Gyasi in *Interstellar*.

Q&A Kip Thorne

Space-time visionary

Thanks to theoretical physicist Kip Thorne, real science is embedded in Christopher Nolan's film Interstellar, *in which explorers seek a new home for humankind. Thorne talks about what he learned from the film's unprecedented visualizations of black holes and wormholes, what it and his accompanying book can teach, and the likelihood of humans escaping the Solar System.*

ILLUSTRATION BY JIM SPENCER

How did *Interstellar* come about?
I have long worked on black holes and, since the 1980s, wormholes — hypothetical tunnels in space that link distant regions of the Universe. About eight years ago, I and my friend Lynda Obst, a film producer, came up with a movie set on the 'warped side of the Universe' — black holes, wormholes, higher dimensions and beyond. It interested director Steven Spielberg, who brought in Jonathan 'Jonah' Nolan to write the screenplay. Steven dropped out and later Jonah's brother Christopher Nolan took over as director and final screenwriter. Chris and Jonah changed our story almost completely, but preserved the warped space-time and splendidly fulfilled our vision of a science-fiction movie with real science woven deeply in its fabric. In it, nothing violates well-established physical laws and all the wild speculations spring from science, not just the fertile mind of a screenwriter.

How hands-on were you during development?
I met with Jonah and Chris every few weeks as they crafted the screenplay, brainstorming about the science. I worked on the visualization of black holes and wormholes with Oscar-winner Paul Franklin and his team at Double Negative Visual Effects in London.

Interstellar
DIRECTED BY CHRISTOPHER NOLAN
Warner Brothers: 2014.

The Science of Interstellar
KIP THORNE
W. W. Norton: 2014.

Black holes do not emit light, so you visualize them through gravitational lensing — how they bend light from other objects. I took equations based on Einstein's general theory of relativity and created a description of a wormhole with three parameters: diameter, interior length and the degree of flare where the wormhole joins the external Universe. Paul's team used my equations to compute what a camera would see through the wormhole; Chris, perusing the images, chose the parameter values for *Interstellar*'s wormhole.

Did you learn anything new?
With computing power beyond what is normally used by physicists, and software designed to give rapidly changing images at IMAX resolution, we were able to see something never seen before. We simulated a fast-spinning black hole and a field of stars, and what we discovered is an amazingly complex,