Revenant Gun

Reviewed by Ursula Whitcher

There's an evil, star-spanning empire powered by torture and number theory, only two people can defeat it, and one of them is a ghost. This is the central premise of Yoon Ha Lee's *Machineries of Empire* trilogy. The third in the series, *Revenant Gun* (Solaris, 2018), came out this summer.
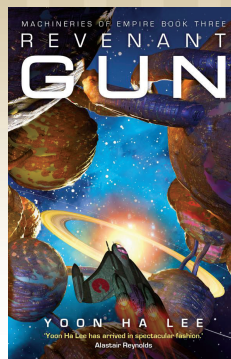
Lee has a bachelor's degree in mathematics from Cornell and a master's in math education from Stanford. His books are permeated by mathematics. In *Revenant Gun*, for example, the hero identifies a one-to-one correspondence between triangles on a screen and spaceships in his fleet, the villain draws lovingly rendered images of projective planes in his diary, a mysterious assassin uses the quantum computer in her backpack to factor large numbers, and a weapon kills by linearizing regions of space-time.

Lee's not pursuing scientific accuracy: There are many and deep connections between physics and number theory, but ritual sacrifice reminiscent of the Aztecs probably isn't the way to access them. Instead, Lee's telling a story about the ways that searches for knowledge and power intertwine, and the prices people pay along the way.

Revenant Gun begins with the ghost, Jedao, reborn into a body he doesn't recognize. Jedao thinks he's a college student; he has forgotten his history as a general, assassin, and tool of the undying ruler Kujen. Those memories now belong to Cheris, the protagonist of the first book in the series. She is somewhere in the far reaches of space, plotting revenge.

Kujen is very beautiful. Moreover, he likes to surround himself with beautiful things. In science fiction and fantasy, the villain often inhabits a lair decorated with black pillars, red hangings, bottomless pits, and smoke; in the edgier, more violent parts of the genre, where *Machineries of Empire* is often sorted, one might also expect grime, slime, and starving servants. Kujen, on the other hand, has an art collection. For example, his conference room is "appointed with fantastic models of buildings, all bird-curves and starry angles and tiny glittering windows."

Jedao and another character, the flying robot-snake Hemiola, spend much of the book trying to figure out how this genuine appreciation for lovely forms squares with the imperial architecture of torture. Part of the answer is that Kujen ruthlessly enforces stability: Within his sphere of influence, artists are protected, and people don't make pyres out of math and astronomy textbooks. This attention to the antagonist's values is mirrored by a clear-eyed assessment of the protagonists' faults. Lee never lets the reader forget that even "good" wars against evil empires have their costs; Kujen's not the only character in *Revenant Gun* who ends up destroying planets.

Imperialist projects supported by well-meaning people using interesting mathematics are hardly the stuff of fantasy. For recent real-world examples, one could consult Cathy O'Neil's *Weapons of Math Destruction*, about the ways that naive analyses of big data reinforce existing social inequalities, or any of the ongoing debates about the role of surveillance in Western society. One of the rewarding things about reading *Machineries of Empire* as a mathematician is that Lee doesn't attempt to flatten these complexities: Mathematics in his books is consistently beautiful, consistently useful, and exactly as moral as the person wielding it.

Another reward of the series is the sheer diversity of characters doing mathematics: humans of different races, genders, and orientations; intelligent robots (Hemiola's friend Sieve is suitably excited about factoring algorithms); and tentacled aliens. Fictional mathematicians are so often stuck in the antisocial male genius mold. There are improbable flashes of genius in these books, too. But we also get sign errors and computer algebra software and a character whose hobbies combine codebreaking and making fan art of lesbian kisses.

Revenant Gun is a weird, twisty, exhilarating ride. I ended with a list of questions about robots, aliens, improbable loyalties, and possible sequels. This isn't a good series for people who like tidy endings. If you like complicated adventures and complicated mathematics, though, those open questions hold their own appeal. ●

Ursula Whitcher is an associate editor at Mathematical Reviews. Her research involves the connections between string theory, geometry, and number theory. She has no particular calendrical expertise.