

## SCIENCE FICTION, SCIENCE FACT

## Robot pack mules remain science fiction for now

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The plot of the 2014 science-fiction movie *Young Ones* revolves around a robot pack mule based on the real-world BigDog.

Would a robot be better for traversing desert mountains than a pack mule? The 2014 science-fiction movie *Young Ones* indirectly raises that question when a subsistence farmer replaces his dead mule with a legged robot patterned on Boston Dynamics' BigDog (1). The farmer and his family live in a near future where drought has obliterated their wheat fields, and their only source of income is bootlegging liquor to crews installing an aqueduct high in the mountains. Although water is scarce, energy and technology are cheap, and so, in addition to robot mules, the rural landscape is populated with delivery drones and exoskeletons for amputees and paraplegics. The robot mule, simply called by its model name "Simulit Shadow," "machine" or "sim" for short, is more than a prop; it plays a large role in unsavory events that drive the plot and anchors the shifting points of view of the three main characters.

The idea of a legged robot pack animal, versus a roboticized wheeled wagon, has been experimented with for more than 1700 years but is relatively new in science fiction. The

first legged pack robot may be Zhu-Ge Liang's wooden ox constructed ~230 CE (2). Interest in legged robots was sporadic over the intervening centuries, gaining momentum in the late 1800s with the rapid onset of inventions associated with, or inspired by, Thomas Edison. Edison himself speculated on the use of legged robots on Mars (3), prescient given that the current momentum in legged locomotion can be traced back to the space program and the proposed Moonwalker lunar rover vehicle in 1961 (4). After Moonwalker, a steady stream of legged robots with the intent to transport materials or people began to appear, leading to the BigDog and its follow-on, the Legged Squad Support System (LS3). In contrast, science fiction has ignored the potential for robots as pack animals, instead concentrating on legged robots for personal transportation. The earliest fictional legged robot may be a fanciful mechanical ostrich from an 1892 Tom Swift-like inventor series of novels (5).

Science and science fiction share the same motivations for legged transport robots over mules. A robot can carry a greater pack

weight for longer distances without rest, water, or food; LS3 carried 180 kg for 24 hours without refueling and covered 30 km (6). As illustrated in *Young Ones*, the machine could be stored in a shed for long periods with no need for food or mucking excrement and then loaded into the back of the truck (or a cargo plane) without a mule's famously temperamental resistance. A severely damaged robot may be repairable in the field or continue its mission in a degraded state, especially if it had a robust form of intelligence that learned to adapt in real time. In *Young Ones*, the robot mule was abandoned after a heavily armed ambush but managed to execute an autonomous return-to-home function by spontaneously creating a limping gait to compensate for broken joints; the struggling robot was piteous to watch because of the inevitable anthropomorphism.

However, as the U.S. military and the producers of *Young Ones* discovered, a robot mule has considerable disadvantages. One is the large capital costs of a robot compared with a \$2000 mule (6) that can be locally sourced from noncombatants presumably delighted to bolster their local economy with high markups. The more subtle problem that neither the Marines nor the movie

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could work around was the excessive noise of LS3 motors (6). Although the noise problem might be corrected in the future, the Marines discontinued further development. For a movie, the noise could be edited out, but it distracted the actors. Further accentuating the differences between a trainable mule and a robot, the LS3 user interface and level of autonomy did not provide the movie director with sufficient flexibility. Eventually, the producers of *Young Ones* constructed an LS3 puppet around two parkour athletes who emulated the distinctive robot walking patterns (1).

Ultimately, a comparison of biological and mechanical mules is a reminder of the substitution myth (7) that automation will seamlessly replace humans or, in this case, animals. A legged robot may offer substantial benefits, but it will also introduce hidden costs, such as changes to workflows, more training, and maintenance and logistics

expenses. Indeed, the plot of *Young Ones* revolves around one such unanticipated consequence: loss of privacy because the machine made a black box recording of everything it sensed. However, unanticipated effects are not necessarily unmanageable or unacceptable. For the youngest farmer, the surprising loss of privacy led to the discovery of the real cause of the death of his father. For the audience, the surprise is that a mundane robot can become the unspoken hero of the story.

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