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Opinion

Our Partners and Guides for Working in Extreme Environments - Humanoid Robots: How Comfortable Do We Feel?

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Opinion

The development and deployment of robotics to assist humans working in, or at distance from extreme environments, such as the nuclear industry, high and low temperature environments, in offshore maintenance, the mega-construction industry and deep mining has rapidly progressed may now be considered standard practice in many projects [1]. In all instances, robots are required to reduce or eliminate the risks associated with human presence, usually by reducing or removing the requirement for people to enter hazardous environments thus reducing or removing exposure to the hazard. In many manufacturing industries and often in confined spaces, robot-generated productivity far exceeds that which could be provided by humans, for example the food and automotive manufacturing industries, the tourist and on-line supply chain industry.

One area which has received much recent attention very recently is the successful deployment of the Martian rovers Perseverance and Zhurong from NASA's Mars 2020 and the China National Space Agency's Tianwen-1 missions respectively. For technical, human safety and likely profitability requirements, the initial phases of space colonisation will be likely fully automated [2], with the assembly of pre-fabricated habitats including bio-regenerative life support systems conducted by robots utilising additive manufacturing methodology with minimal human intervention [3,4]. Negating the extreme environment in such an off-world situation will be guided by robotics. The recent discovery of water-ice and lava tubes on the Moon and Mars along with the development of in situ resource utilization technology has focused rover-based surface missions towards terrain exploration with the goal of siting a habitat location. To date, construction of three-dimensional terrain maps derived from a planetary or lunar orbiter has insufficient resolution and the recent development of visual simultaneous localization and robotic mapping employing a stereo camera system on a rover offers a potential solution [5].

Advances in terrestrial biotechnology, electrical engineering and robotics science, machine-based learning artificial intelligence (MBL-AI) and the likely requirement for MBL-AI in the automated construction of extra-terrestrial habitats leads to a future-world potential of human-robot hybrids (humanoids) as deep space voyagers. Though we appear many years away from the development of general AI, simple responses in chatbots, and services such as Amazon's Alexa are in mass use today and our ability to generate life-like representations of human beings has existed for a number of years. The creation of the humanoid robot Sophia in 2016 [6], subsequently given citizenship of Saudi Arabia in 2017, demonstrates the principle. Now fast forward into a future where human beings are chipped with Radio-Frequency IDentification (RFID) transponders, made available originally in 2005 to monitor

cardiac function and now able to monitor 'total human vital signs'. Space explorers, lunar and Martian colonists have successfully utilized smart clothing to inform on their environment [7]. The new science of bio-robotics is emerging where integration of biology, biotechnology and robotics will permit robots to feel, smell, hear and see in order to react to changing environments. When partnered with human beings, biorobots will be able to act as sentinels alerting humans physically or digitally via RFIDs to take evasive action, for example, to predicted sudden increases in temperature or rise in radiation exposure.

Some examples include the development of an electronic skin by researchers in Germany which comprises hexagonal sensing modules, which can be attached to a variety of surfaces [8]. In Australia, researchers have developed an artificial skin that responds to pain mimicking the body's ability to provide immediate feedback when pressure, heat, or cold reach a certain threshold [9]. Towards a future where robots are provided with warning signals, researchers at the Chinese University of Hong Kong have created an artificial skin which can change colour to simulate bruising [10], using spiropyran, a molecule that changes colour from pale yellow to bluish-purple when exposed to mechanical stress. Scientists in France have developed an artificial nose and incorporated the device into a robot that can detect survivors in rescue operations [11]. Finally a team in Israel has created an optical nose that can sense smells using carbon nanotubes [12]. The device uses MBL-AI to detect odour signatures and can distinguish the aromas of red wine, beer, and vodka. Such olfactory systems have many applications in the food and perfume industry and may warn manufacturers of food spoiling and decay of active chemical and biological ingredient.

This exceptional advance in progress shows no sign of slowing down. However, how comfortable are we as human beings to be guided by humanoid robots that look like and may be indistinguishable from ourselves in the future? In the 1970s, Japanese roboticist Mori M [13] coined the term 'bukimi no tani genshō' which translates into the 'uncanny valley' [13], and describes a concept that as robots appear more human-like, they acquire a persona which makes them appealing to humans but up to a limit. At the boundary of entering the uncanny valley, human acceptance decreases and humans develop a sense of unease and mistrust.

The Figure 1 shows hypothetical emotional responses against anthropomorphism of either a moving, animated object or a stationary, inanimate object. In 2021 the requirement for maintenance of personal space of both humans and human-like avatars has been modelled [14] and reported that discomfort-by-distance functions for both humans and avatars were closely aligned by a power relationship, that is don't get too close to me! This reinforces the notion that humans need personal space. This need for personal space may not just be from other humans, but may also reflect the need for space from human-like objects and this could become important for the future design of humanoid robots both on Earth and in space for sustaining an effective partnership [15,16]. The science of bio robotics is a wonderful opportunity for biotechnology and bioresearch and holds enormous promise for the benefit of humankind. It also has the potential to teach us more about ourselves and what it means to be human.

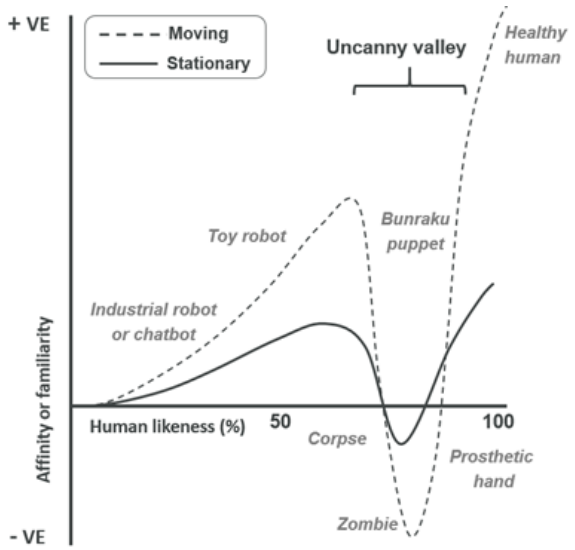

Figure 1

References

1. Wong C, Yang E, Yan XT, Dongbing G (2018) Autonomous robots for harsh environments: a holistic overview of current solutions and ongoing challenges. Systems Science & Control Engineering 6(1): 213-219.
2. Campa R, Szocik K, Braddock M (2019) Why space colonization will be fully automated. Technological Forecasting and Social Change 143: 162-171.
3. Bier H, Vermeer E, Hidding A, Jani K (2021) Design-to-robotic-production of underground habitats on Mars. SPOOL 8(2): 31-38.
4. Flinders L, Grainger J, Clark H, Rich BJ, Braddock M (2022) Design architecture for 3D printing a lunar habitat. Room The Space Journal of Asgardia 1(31): 90-97.
5. Hong S, Bangunharcana A, Park JM, Choi M, Shin HS (2021) Visual SLAM-based robotic mapping method for planetary construction. Sensors (Basel) 21(22): 7715.
6. Sophia M (2018) The robot that looks almost human, National Geographic, Washington DC, USA.
7. Lei S, Xiangfang R, Jianbin W, Han C, Jianyong O (2022) Study on body area network of smart clothing for physiological monitoring. Intl J Distrib Sensor Networks 18(2): 1-14.
8. Bergner F, Dean-Leon E, Cheng G (2020) Design and realization of an efficient large-area event-driven E-skin. Sensors 20(7): 1965.
9. Rahman MA, Walia S, Naznee S, Taha M, Nirantar S, et al. (2020) Artificial somatosensors: Feedback receptors for electronic skins. Artificial Intelligent Systems 2(11): 2000094.
10. Qiu W, Zhang C, Chen G, Zhu H, Zhang Q, et al. (2021) Colorimetric ionic organohydrogels mimicking human skin for mechanical stimuli sensing and injury visualization. ACS Appl Mater Interfaces 13(22): 26490-26497.

11. https://list.cea.fr/en/september-2-2021-miniature-robot-equipped-with-smart-chemical-sensor-sniffs-out-buried-survivors-during-urban-search-and-rescue-operations/

12. Shumeiko V, Paltiel Y, Bisker G, Hayouka Z, Shoseyov O (2021) A nanoscale paper-based near-infrared optical nose (NIRON). Biosens Bioelectron 172: 112763.

13. Mori M (2012) The uncanny valley. IEEE Robotics and Automation 19(2): 98-100.

14. Tootell RBH, Zapetis SL, Babadi B, Nasiriavanaki Z, Hughes DE, et al. (2021) Psychological and physiological evidence for an initial rough sketch calculation of personal space. Sci Rep 11(1): 20960.

15. Hambuchen K, Marquez J, Fong T (2021) A review of NASA human-robot interaction in space. Curr Robot Rep 2: 265-272.

16. Orzech G (2022) Intelligent systems division. NASA, Washington DC, USA.