

IL907-15 Habitability in the Universe

23/24

Department

Institute for Advanced Teaching and Learning

Level

Taught Postgraduate Level

Module leader

David Brown

Credit value

15

Module duration

10 weeks

Assessment

100% coursework

Study location

University of Warwick main campus, Coventry

Description

Introductory description

This module will draw together concepts of habitability from across the university, exploring both the realities of habitability and our own reactions to it.

We will look at habitable conditions both on- and off-Earth, discuss the possibilities for habitable environments in our own Solar system, and study how we find and understand habitable planets in the wider galaxy using modern telescopes. We will also investigate life at the extremes, considering extremophiles on Earth and what they might tell us about habitable conditions elsewhere, as well as examining the sustainability and long-term habitability of our own planet. We will look at how these concepts are woven throughout popular culture, assessing the representations of habitability and 'the other' in literature and film. Finally, we will try to place a historical context on "the new Space Age" with its growing stream of talk about other planets, colonisation, and off-world activity.

[Module web page](#)

Module aims

The principal aim of the module will be to draw together concepts of habitability from across the university, introducing concepts and ideas from different departmental perspectives and synthesising them into a complete understanding of habitability throughout the Universe.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

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- Introduction
- How the World Works
- Redefining Habitability - Life at the Extremes
- Habitability in the Solar System
- Habitability in Film: The Martian
- Humans, Chickens and Tardigrades - Multicellular life at the extremes
- Discovery of Deep Space
- Exoplanets and environments off-Earth
- The (Un)Inhabitable Worlds of Science Fiction
- Neocatastrophism

Learning outcomes

By the end of the module, students should be able to:

- Critically discuss habitability in different academic contexts, examining and evaluating primary and secondary sources
- Evaluate what is necessary to make an environment habitable, and assess different ways of investigating the required properties.
- Interpret the history of planetary habitability, both in and out of the Solar system.
- Demonstrate an original understanding of the diversity and capabilities of life on Earth and interpret the implications of this diversity for external life.
- Develop critical responses to existing theoretical discourses and formulate hypotheses of the influence of habitability on different institutions.
- Connect knowledge from multiple, diverse research areas and disciplines to synthesise their ideas and form a unique conception of habitation and habitability.

Indicative reading list

General:

- Benner, Steven A. (2010). "Defining Life". *Astrobiology* 10:10, pp. 1021-1030
- Roosth, Sophia (2018). "The shape of life". *Aeon*
- Kovic, Marko (2018). "Rules in space". *Aeon*
- Thirsk, Robert et al. (2009). "The space-flight environment: the International Space Station and beyond". *CMAJ* 180:12, pp. 1216-1220
- Marriner, Nick et al. (2010). "Geoscience meets the four horsemen? Tracking the rise of neocatastrophism". *Global and Planetary Change* 74, pp. 43-48
- Blastland, Michael et al. (2020). "Five rules for evidence communication". *Nature* 587, PP.

Astrophysics:

- Habitability of other planets and satellites / Jean-Pierre de Vera and Joseph Seckbach (editors). Dordrecht : Springer, 2013.
- Exoplanets: detection, formation, properties, habitability / John W. Mason (editor). Berlin ; New York : Springer, in association with Praxis Pub., Chichester, UK, 2008.
- The Habitability of Planets Orbiting M-dwarf Stars, A. Shields et. al., Physics Reports 2016
- Meadows, Victoria S. & Barnes, Rory K. "Factors Affecting Exoplanet Habitability" in "The Handbook of Exoplanets", Deeg & Belmonte (eds.), Springer International Publishing AG (2018), pp. 2771-2794
- Stanway, E. R. et al. (2018). "Exploring the cosmic evolution of habitability with galaxy merger trees". MNRAS 475, pp. 1829-1842

Life sciences:

- Merino, Nancy et al. (2019). "Living at the Extremes: Extremophiles and the Limits of Life in a Planetary Context". *Frontiers in Microbiology* 10:780
- Jönsson, K. Ingemar et al. (2008). "Tardigrades survive exposure to space in low Earth orbit". *Current Biology* 18:17, pp. R729-R731
- Shapiro, Robert (2017). "A Simpler Origin for Life". *Scientific American*
- Petit, G. et al. (2019). "Local sleep-like events during wakefulness and their relationship to decreased alertness in astronauts on ISS". *npj Microgravity* 5, 10
- Voorhies, A. A. et al. (2019). "Study of the impact of long-duration space missions at the International Space Station on the astronaut microbiome". *Scientific Reports* 9, pp. 9911
- McKay, Christopher P. et al. (1991). "Making Mars Habitable". *Nature* 352, pp. 489-496
- Lovett, Richard (2014). "Will space colonisation cripple our astronauts?". *Cosmos* 59, pp. 1-5
- Demontis, Gian C. et al. (2017). "Human Pathophysiological Adaptations to the Space Environment". *Frontiers in Physiology* 8, article 547

History

- Herschel, William (1785). "On the Construction of the Heavens". *Phil. Trans.*

Sustainability:

- Nixon, R. "Slow Violence and the Environmentalism of the Poor". Harvard University Press (2011)
- Costanza, R. et al. "Building a Sustainable and Desirable Economy in Society in Nature". Report to the United Nations on Sustainable Development in the 21st Century, Rio (2012)
- "Welcome to the Anthropocene". *The Economist* (2011)

Literature:

- Cixin, Liu. "The Wandering Earth". *Head of Zeus* (2017)
- Chambers, Becky. "To Be Taught If Fortunate". *Hodder & Stoughton* (2019)
- Stanley Robinson, Kim. "Red Mars".
- Traviss, Karen. "City of Pearl".

- Woods, Derek (2019). "Terraforming Earth – Climate and Recursivity". *Diacritics* 47.3, pp. 6-29
- Pak, Chris (2016). "Terraforming: ecopolitical transformations and environmentalism in science fiction". *Liverpool science fiction texts and studies*,
- Clarke, Arthur C. "The Star". New York: Signet/NAL (1974)

Film:

- Suggested screenings: *Forbidden Planet* (Fred Wilcox, 1956), *2001: A Space Odyssey* (Stanley Kubrick, 1968), *Alien* (Ridley Scott, 1979), *Avatar* (James Cameron, 2009), *Interstellar* (Christopher Nolan, 2014).
- Bould, Mark. "SF Colonialism and Globalisation". *Routledge Film Guidebooks: Science Fiction*. London: Routledge (2012). Chapter 3
- Palmer, Lorrie & Purse, Lisa (2019). "When the Astronaut is a Woman: Beyond the Frontier in Film and Television". *Science Fiction in Film and Television* 12:1, pp. 1-7
- Carroll, Siobhan (2019). "Lost in Space: Surviving Globalisation in Gravity and The Martian". *Science Fiction Studies* 46:1, pp. 127-134 & pp. 138-140

Interdisciplinary

Sessions will consist of a mix of lectures, seminars, guided discussions, and/or group activities, as appropriate for the topic and content of the session. During each session we will introduce new concepts from different academic perspectives, with each session being led by an academic from an appropriate department. We will cover the main concepts of habitability and how we understand it, before expanding progressively to cover more detailed ideas of habitability in both the sciences and the arts. Through this module, students will be able to connect knowledge from multiple, diverse research fields and form a new conception of their subject specialism from the perspective of other disciplines and standpoints.

Subject specific skills

- Appreciate multi-disciplinary approaches to conceptual and aesthetic questions.
- Form a new conception of their subject specialism from the perspective of other disciplines and standpoints.
- Use technical language from a range of disciplines.
- Develop argumentation and analysis skills relevant to a range of disciplines.
- Utilise the connections the concept of habitability forms across multiple disciplines.

Transferable skills

- Work collaboratively to combine multiple perspectives into original interpretations.
 - Articulate advanced arguments orally and in written form.
 - Manage time to meet deadlines, both in relation to presentations and written assignments.
 - Learn to give constructive critiques outside of usual disciplinary boundaries.
 - Independent and collaborative problem solving.
 - Understand the use of specialization and technical language across disciplines.
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Study

Teaching split

Provider	Weighting
Physics	54%
History	15%
Life Sciences	15%
Global Sustainable Development	8%
SCAPVC - Film & Television Studies	8%

Study time

Type	Required
Lectures	10 sessions of 1 hour (7%)
Seminars	10 sessions of 1 hour (7%)
Private study	50 hours (33%)
Assessment	80 hours (53%)
Total	150 hours

Private study description

- Directed reading
- Private study
- Independent research and reflection
- Feedback on activities
- Preparation for seminars and follow up reading

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group A

	Weighting	Study time
Presentation & viva	40%	30 hours

Weighting

Study time

15 minute pre-recorded group presentation (collective mark, 20%) + 15 minute in-person group viva (individual mark, 20%).

After the teaching is complete, students will work in small groups (2-3 people) to write and record a 15-minute presentation on a topic arising from the course. The recorded presentation will be submitted for assessment. Approximately one week after submission, each group will sit a 15-minute in-person group viva voce. During the viva, each student in the group will answer questions about the content of their presentation and their contribution to the group, and will be given the opportunity to discuss the topic further.

The presentation will be marked collectively, accounting for the quality of the presentation and accuracy of the content. The viva, though sat as a group, will be marked individually accounting for each student's ability to respond to questions and demonstrate their knowledge through discussion. The overall mark for this component will be equally weighted between the presentation and the viva.

2500 word Essay/Report/Literature Review 60%

50 hours

A written piece focusing on a subject or question raised during the course, comprising either an essay, scientific report, or literature review. The topic and format will be chosen by the student. Students will be encouraged to utilise the interdisciplinary nature of the teaching, and to apply lessons learnt from disciplines outside their usual experience to their chosen topic.

Feedback on assessment

Detailed written and oral feedback will be provided on both assessment components. Sessions throughout the module will give the opportunity for formative feedback contributing to the students' eventual written submissions, with written feedback provided alongside their mark. For the presentation & viva, students will receive oral feedback during the viva in the form of discussion with their peers and assessors, while written feedback will be provided alongside their mark.

Availability

Courses

This module is Optional for:

- TCHA-F764 Postgraduate Taught Global Decarbonisation and Climate Change
 - Year 1 of F764 Global Decarbonisation and Climate Change
 - Year 1 of F76B Global Decarbonisation and Climate Change (Policy)
 - Year 1 of F76A Global Decarbonisation and Climate Change (Science)