

COURSE CONTENT

Course Code	DM5000 (DM3002)
Course Title	Creative Robotics
Pre-requisites	NIL
No of AUs	3
Contact Hours	39 hours studio contact

Course Aims

This intermediate level course will introduce you to the history, genres, aesthetics, practice and relevance of creative robotics. This course discusses the deep historical and contemporary issues surrounding the artificial double that is the robot, its epistemological role and its repercussions on society. You will gain exposure to basic technical skills of physics and mechatronics, making robotic bodies from simple physical assemblages, sensors and effectors. You will then apply your knowledge in the creation, development, presentation and documentation of an original creative robotics work. This learning forms a deeper understanding of embodied approaches for further studies in animation, performing arts, interactive media, interaction design and product design.

Intended Learning Outcomes (ILO)

By the end of the course, you should be able to:

1. Describe different methods and techniques required for creative robotics.
2. Develop embodied and creative robotic strategies to communicate with an audience.
3. Apply the concept of creative robotics to an original work.
4. Present, evaluate and reflect on the effectiveness of a robotic creative piece in regard to engagement, interaction and perception.
5. Constructively discuss and critique creative robotics concepts, formats, techniques and media employed by peers.

Course Content

Robotics in the Arts is more than two millennium old and its development has responded to contemporary understandings of the body, technology and society. This course examines the theoretical and practical aspects of creative robotics.

You will explore concepts surrounding the fundamental roles of a body, how it shapes our view of the world and how it interacts with its environment. This leads to a deeper understanding of animated objects, its apparent intentions and its observed behaviours. This course introduces perceptual mechanisms of movements and body morphologies that facilitate engagement and interaction with creative robotics which in turn, can be further extended to embodied media at large. The class will develop critical and artistic skills to frame creative robotics as a reference for their own practice.

Exercises and projects will introduce you to various ways in which embodied art can be realized. You will have a practice-based experience of creative robotics and become aware of the strengths and limits of the medium. You will have a familiarity with the many and different ways that an artist have contributed to the field of creative robotics.

You will work individually and in groups combining studio practice, research and analysis to

develop skills and knowledge that relate to develop creative animated embodied objects.

Robot as an epistemological double.

You will be exposed to the cultural and historical presence of machine throughout history. You will receive an overview of the key concepts of creative robotics while you will be exposed to different genres of kinetic art, robotic artworks, installation and performances, real artificial life and generative systems.

You will become aware of the animate object and its role in engagement, communication and visualisation, and gain familiarity with a wide spectrum of artistic endeavours including social robotics, man-machine cooperation, activism and contemporary issues of machine ethics.

Embodiment: from ecological niches to psychology of perception.

You will become familiar with the various levels of embodiment. An ecological body that can operate within the physical world as much as a conceptual body operating under the codes of societies. The embodiment addresses the perceptual aspects of movement and behaviours in relation to neurobiology, psychology and anthropomorphism. The study looks at the role of body morphologies at both physical level and perceptual levels. The study of perception further looks into intentionality, animacy, the uncanny and non-verbal communication. The embodiment will also explore alternate anatomies and their applications in various domains such as performances, workplace and game design.

Making Bodies: Mechatronics and DIY/Makers' approaches.

You will receive a basic introduction on how to design animated physical objects. The class will introduce and survey mechatronics systems and basic mechanics to help you sculpt an animate body for your creative project. You will examine the basic concepts and techniques of mechanical systems, transfer of energy and motion, study of materials, artificial intelligence and animatronics. You will get familiar with the contemporary cultural and artistic trends of the citizen science, "Do it Yourself" , "Makers" and open source and design approaches, their impact on the growth of experimental creative robotics.

Assessment (includes both continuous and summative assessment)

Component	ILO Tested	Programme LO	Weighting	Team/ Individual
Continuous Assessment Themed Presentation	1,2,3,4	N.A.	15%	Individual
Continuous Assessment Assignments	1,2,3,4	N.A.	15%	Individual

Final Assignment: Concept development, presentation and documentation of an original performance project. –Ideation 20% –Execution 20 % –Documentation 10%	1,2,3,4	N.A.	50%	Individual
Participation	5	N.A.	20%	Individual
Total			100%	

Reading and References

1. Breazeal, Cynthia, et al. "Interactive robot theatre." Intelligent Robots and Systems, 2003.(IROS 2003). Proceedings. 2003 IEEE/RSJ International Conference on. Vol. 4. IEEE, 2003.
2. Brooks, Rodney A. "Intelligence without representation." Artificial intelligence 47.1-3 (1991): 139-159.
3. Herath, Damith, and Christian Kroos, eds. Robots and art: Exploring an unlikely symbiosis. Springer, 2016.
4. Pfeifer, Rolf, and Josh Bongard. How the body shapes the way we think: a new view of intelligence. MIT press, 2006.
5. Riskin, Jessica. "The defecating duck, or, the ambiguous origins of artificial life." Critical Inquiry 29.4 (2003): 599-633.
6. Riskin, Jessica. "Eighteenth-century wetware." Representations 83.1 (2003): 97-125.
7. Riskin, Jessica, ed. Genesis redux: Essays in the history and philosophy of artificial life. University of Chicago Press, 2010.
8. Roberts, Dustyn. Making Things Move DIY Mechanisms for Inventors, Hobbyists, and Artists. McGraw Hill Professional, 2010.
9. Vogel, Steven. Cats' paws and catapults: Mechanical worlds of nature and people. WW Norton & Company, 2000.
10. Waldron, Rick, et al. Make: JavaScript Robotics Building NodeBots with Johnny-Five, Raspberry Pi, Arduino, and BeagleBone. Maker Media, Inc, 2015.

Course Policies and Student Responsibilities

(1) General

You are expected to complete all assigned readings, activities, assignments, attend all classes punctually and complete all scheduled assignments by due dates. You are expected to take responsibility to follow up with assignments and course related announcements. You are expected to participate in all project critiques, class discussions and activities.

(2) Punctuality

You are expected to be punctual for all classes. If you are more than 30 minutes late, you will be deemed as absent and will not be able to sign on the attendance register.

(3) Absenteeism

In-class activities make up a significant portion of your course grade. Absence from class without a valid reason will affect your participation grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for in-class activities.

Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the [academic integrity website](#) for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Planned Weekly Schedule*

*Subject to adjustment by instructor according to the teaching situation, students' progress, public holidays and unforeseeable circumstances. A revised schedule will be issued to students at the start of the semester.

Week	Topic	Course LO	Readings/ Activities
1	Creative Robotics	1,2,3	Lecture: Overview of the key concepts behind creative Robotics. In-class discussion on the definition of robot, types of intelligence and the artificial.
2	Creative Robotics: History and Genres.	1,2,3,4,5	Lecture: The lineage of robots throughout history. Epistemology, the western body, animism, artificial doubles. The lineage of robots in the collective imaginary, utopia and

			<p>dystopia, Hollywoodian narratives, famous plays and writing.</p> <p>The reality of robotics nowadays from the dumb, dull and dangerous tasks of industrial robots to the autonomous agents.</p> <p>Assigned Project 1: Making a simple robot (two articulated joints).</p>
3	Survey of Robotics.	1,2,3,4,5	<p>Lecture: Exploration of robotics from the scientific perspective with the reflex of re-appropriating solutions and concepts onto creative practices. Robot architectures, biologically inspired robots, metamorphing structures</p> <p>Assigned Project 1: Presentation of the project1. Analysis of the challenges of incarnating a moving structure in the physical world.</p>
4	The Body. Perception of.	1,2,3,4,5	<p>Lecture: Anthropomorphism, Zoomorphism, Mechanomorphism, Anthropocentrism. The Uncanny. Biological perception of movement. Animacy, Intentionality, Classifications of body: biological, ecological, social</p> <p>Semester Project: Initial Ideas and brainstorming.</p>
5	Making Bodies	1,2,3,4,5	<p>Lecture: Anatomies and morphologies and their resonance onto behaviour. Bottom-Up Artificial Intelligence and embodied cognition. Bio mimicry. Morphological computing. Beam robotics.</p> <p>In class exercises.</p>

			<p>Assigned Project 2: Making an object that emanates an apparent set of behaviours. Ongoing exploration of mechatronics and mechanical structures for creative expressions.</p> <p>Final assignment: Early discussion and feedback to deliver a pitch presentation.</p>
6	Artificial Life, Artificial Environments and Ecosystems	1,2,3,4,5	<p>Lecture: Real Artificial Life is robotics. Notions of the living and the quasi-living. Invented universe. Inspirations from kinetic arts.</p> <p>In class exercises.</p> <p>Assigned Project 2: Presentation of the project2. Analysis of the perception of behaviours and intention.</p>
7	Final assignment Project Presentations:	1,2,3,4,5	<p>Pitch and proof-of-concepts presentations from all groups for Final Assignment.</p> <p>Class Feedback and reflective discussion.</p>
8	Themed Presentations	1,2,3,4,5	<p>Lecture:</p> <p>Themed Presentations by Students: Student selected issues in creative robotics such as the Uncanny Valley, Ethics, Prosthesis, Robot Companions, Robot Musicians, Utopia, Dystopia, Future of Work, Future of Learning.</p>
9	Themed Presentations	1, 2, 3, 4, 5	<p>Lecture:</p> <p>Themed Presentations by Students: Student selected issues in creative robotics such as the Uncanny Valley, Ethics, Prosthesis, Robot</p>

			Companions, Robot Musicians, Utopia, Dystopia, Future of Work, Future of Learning.
10	Project workshop Continuous review and feedback of final assignment through various stages of completion	2, 3, 4, 5	Lecture: Project 3: Final assignment: First round of try-outs (low fidelity prototype) within the classroom. Feedback on engagement. Students in studio work. Continuous assessment and feedback throughout production.
11	Project workshop Continuous review and feedback of final assignment through various stages of completion	2, 3, 4, 5	Assigned Projects Project 3: Final assignment: Second round of try-outs within the classroom. Feedback on engagement. Students in studio work. Continuous assessment and feedback throughout production.
12	Project workshop Continuous review and feedback of final assignment through various stages of completion	2, 3, 4, 5	Project 3: Final assignment: Students in studio work. Continuous assessment and feedback throughout production.
13	Final Presentation	2, 3, 4, 5	Project 3: Final assignment student Presentations on final assignment with critique and feedback