COURSE CONTENT

Course Code	DM3009
Course Title	Audio-Visual Creative Coding
Pre-requisites	DM2008
No of AUs	3
Contact Hours	39 hours studio contact

Course Aims
This intermediate level course will introduce you to real-time interactive audio-visual performance and environments. You will explore a range of hardware and software systems where audio and video are piloted in real-time by audience, performer and /or operator. Your current basic understanding of programming, which is required for this course, will be extended and developed into expressive creative coding, and applied to the development of an original audio-visual work. This learning informs further studies in experimental practices, interactive media, interaction design, exhibit design and experience design.

Intended Learning Outcomes (ILO)
By the end of the course, you should be able to: 1. Describe different methods and techniques of creative coding. 2. Develop audio-visual performative strategies to communicate with audiences. 3. Apply the concept of creative coding to an original audio-visual work. 4. Present, evaluate and reflect on the effectiveness of an audio-visual performance piece in regard to creative coding. 5. Constructively discuss and critique performance concepts, formats, techniques and media employed by peers in creative coding for audio-visual performance.

Course Content
Contemporary technologies and software programming permeate digital media. Since the 1960's, artists and designers have been developing bespoke real-time systems, controller devices, parameter mapping, media synthesis, generative systems, sound diffusion and light projection. The proliferation of low-cost audio-visual equipment and devices with sensing, networking and computing capabilities, combined with the abundance of accessible software solutions, generate unique possibilities in the creative exploration of audio-visual systems. The course focuses on the development of a hardware-software system for a designed audio-visual performance using elements such as controllers, real-time software, loudspeakers and projectors. These environments are are rooted in 'sensory cinema', interactive computer music and related experimental art forms. By developing your own project, you will push the boundaries of your imagination to achieve some degree of novelty of expression. You will be exposed to many different ways that artists can perform, juxtapose and manipulate audio-visual media during live events. You will become aware of the strengths and limits of the creative coding. In this course you will engage in all the phases of developing an original performance, including research, ideation, design, implementation, execution, evaluation, documentation and analytical reflection. You will be exposed to key terminology and processes of creative coding and encouraged to explore these processes to create dynamic and unique interactive digital content.

You will explore audio-visual generative techniques, real-time control, novel performer's instrument design and operator interfaces. An overview of both the historical and contemporary leaders in audio-visual performances will contextualise the significance of creative coding in this field.

Creative Coding, Audio-Visual, Hardware-Software Systems.

In this course you will develop computational thinking skills to assemble bespoke solutions that supports the creative vision of audio-visual artworks including integrated development environments (IDE) found in a variety of popular arts-engineering toolkits. You will explore areas such as generative techniques, media synthesis, 3D graphics, visualization, projection mapping, virtual reality, sound spatialization, kinetic lights, kinetic objects, networking, and machine learning. You will receive a basic introduction on how to design a digital object that reacts to analogue and real-world settings through human physicality.

Class assignments and Projects.

Classes will include mini-lectures, demonstrations, and activities that may be included in the assessment. You will work individually and in groups combining studio practice, research and analysis to develop skills and knowledge that relate to creating situated interactions using analogue and digital media. Through a process of practical studio exercises and workshops you will explore how code and software development can enable innovative ways of translating concepts into unique visual and auditory form.

Assessment (includes both continuous and summative assessment)

Component	ILO Tested	Programme LO	Weighting	Team/ Individual
Continuous Assessment 1 Analogue Performance	1,2,3,4	N.A.	15	Individual
Continuous Assessment 2 Participation and Media	1,2,3,4	N.A.	15	Individual
Final Assignment: Concept development, presentation and documentation of an original performance project. Individual 50% —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. Alessandro Cipriani, Maurizio Giri (2010) Electronic music and sound design: theory and practice with MaxMSP.

2. Bohnacker, Hartmut, et al. Generative design: visualize, program, and create with processing. Princeton Architectural Press, 2012.

3. Center for Visual Music (CVM). http://www.centerforvisualmusic.org/

4. Chion, Michel (1994). Audio-Vision. New York: Columbia University Press

5. Collins, Nick, and Julio d'Escrriván, eds. The Cambridge companion to electronic music. Cambridge University Press, 2017.

6. Creative Applications Network http://www.creativeapplications.net/

7. Farnell, Andy (2007) An Introduction to Procedural Audio and Its Application in Computer Games, http://citeseerx.ist.psu.edu/viewdoc/versions? doi=10.1.1.531.2707.

8. Klanten, Robert, Sven Ehmann, and Lukas Feireiss, eds. A touch of code: interactive installations and experiences. Die Gestalten Verlag, 2011.

9. Lechner, Patrik. Multimedia Programming Using Max/MSP and TouchDesigner. Packt Publishing Ltd, 2014.

10. McDirmid, Sean. "Usable live programming." Proceedings of the 2013 ACM international symposium on New ideas, new paradigms, and reflections on programming & software. 2013.

11. Olsson, Fredrik & Collins, Nick (2006). klipp av: Live Algorithmic Splicing and Audio-visual Event Capture. Computer Music Journal Volume 30, Issue 2 (June 2006). ISSN:0148-9267

12. Levin, Golan & Lieberman, Zachary (2005). Sounds from Shapes: Audio-visual Performance with Hand Silhouette Contours in The Manual Input Sessions. http://www.flong.com/storage/pdf/articles/NIME_2005c_MIS.pdf

13. Maeda, John, and Red Burns. "Creative code." Education 7 (2005): 177

14. MaxMSPJitter. Cycling'74, http://cycling74.com/

15. McCarthy, James (2002). Rethinking the Computer Music Language: SuperCollider. Computer Music Journal. Volume 26 , Issue 4 (Winter 2002). ISSN:0148-9267

16. OpenFrameworks https://openframeworks.cc/

17. Perevalov, Denis. Mastering openFrameworks: Creative Coding Demystified. Packt Publishing Ltd, 2013.

18. Pure Data. http://puredata.info/

19. Reas, Casey, and Chandler McWilliams. Form+ Code: in design, art, and architecture. Princeton Architecturel Press, 2011.

20. Reas, Casey, and Ben Fry. Processing: a programming handbook for visual designers and artists. Mit Press, 2007.

21. Roads, Curtis, and John Strawn. The computer music tutorial. MIT press, 1996.

22. Schacher, Jan C., and Philippe Kocher. "Ambisonics spatialization tools for max/msp." Omni 500.1 (2006).

23. Shiffman, Daniel. Learning Processing: a beginner's guide to programming images, animation, and interaction. Morgan Kaufmann, 2009.

24. Shiffman, Daniel, Shannon Fry, and Zannah Marsh. The nature of code. D. Shiffman, 2012.

25. SuperCollider. http://supercollider.sourceforge.net//

26. Brain, Tega, and Levin, Golan. Code as Creative Medium: A Handbook for Computational Art and Design. N.p., MIT Press, 2021.

27. TouchDesigner https://derivative.ca/

28. Unity Unity Game Development Essentials Kindle Edition by Will Goldstone https://unity.com/

29. Vvvv, https://vvvv.org/

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*

Week	Topic	Course LO	Readings/ Activities
1	**Audio-visual Environments.**	1,2,3	**Introductory Lecture** Survey and history of audio-visual performances, environments and events. Digital and computational impact found in contemporary environments. The introduction presents human perception, synesthesia, engagement and participation in the arts.
2	**Creative Coding and IDEs**	1,2,3,4,5	**Lecture:** **Design of a hardware-software performance system** Survey of audio-visual real-time systems with characteristics, methodologies, target applications and programming styles. Scripting Languages and Graphical Programming Environment. Understanding data flow, data representation and asynchronous events. Sensors and Effectors for IDEs. **Assigned Project 1:** Revisit an artist work and emulate her/his audio-visual content within an IDE.
3	**Visual: synthesis, projections, immersions.**	1,2,3,4,5	**Lecture:** Visual representations and models: vectors, 3D geometries and pixel manipulators. Survey of visual systems: generative and parametric. Survey of immersive visual systems: displays, projection, artificial

			lighting, projection mapping, AR/VR/MXR. **Assigned Project 1 (Continued)** Revisit an artist work and emulate her/his audio-visual content with an IDE.
4	**Audio: synthesis, diffusion, immersion.**	1,2,3,4,5	**Lecture:** Survey of audio systems: generative and parametric. Survey of immersive systems: multi-channels, sound spatialisation, binaural. **Assigned Project 1 (Presentation)** Revisit an artist work and emulate her/his audio-visual content with an IDE. **Final assignment:** Initial Ideas and brainstorming.
5	**Interfaces and Instruments.**	1,2,3,4,5	**Lecture:** The performer instrument: gestures, audience tracking. The operator interface: Parameter visualisation, live manipulation In-class exercises. **Assigned Project 2:** Build an operator's interface for live manipulation of media. Build a sensing system that pilots live audio-visual media.
6	**Machine Learning Technique.**	1,2,3,4,5	**Lecture:** Generative and hybrid tools for audio and visual creation. Gesture recognition. **In class exercises:** Using Machine Learning to map gestures. **Final assignment:**

			Pitch and proof-of-concepts presentations from all groups.
7	**Managing complexities of IDEs.**	1,2,3,4,5	**Lecture:** Integrating solutions. Expanding the IDEs. Journals of experimentations. **Assigned Project 2 (Presentation):** Build an operartor's interface for live manipulation of media. Build a sensing system that pilots live audio-visual media.
8	**From concept to coding.**	1,2,3,4,5	**Lecture:** Production concerns: Incremental Development. Prototyping Cycle. Code reusability. Rehearsals/Production. Deployment. **Final assignment:** Low Fidelity Prototyping. Early try-outs within the classroom. Feedback on audience response.
9	**Project workshop -- IDE's challenges** Continuous review and feedback of final assignment through various stages of completion	1,2,3,4,5	**Themed Presentations by Students:** Student selected issues in creative coding for audio-visual performances. **Project Final assignment:** Students in studio work. Continuous assessment and feedback throughout production.
10	**Project workshop – Media manipulation and effectiveness** Continuous review and feedback of final assignment through various stages of completion	1,2,3,4,5	**Themed Presentations by Students:** Student selected issues in creative coding for audio-visual performances. **Final assignment:** Students in studio work. Continuous assessment and feedback throughout production.
11	**Project workshop – Integration to architecture, context or storyline..**	1,2,3,4,5	**Final assignment:** Second round of try-outs within the classroom. Feedback on

	Continuous review and feedback of final assignment through various stages of completion		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	1,2,3,4,5	**Final assignment:** Students in studio work. Continuous assessment and feedback throughout production.
13	**Final Presentation**	1,2,3,4,5	**Final assignment:** **Student Presentations** on final assignment with critique and feedback.