



MDDN 251

Physical Computing

Course Outline Trimester 1, 2015

GENERAL

Elective; Trimester One; 20 points

ASSESSMENT

100% internal by assignment

CLASS TIMES AND LOCATIONS

LECTURES / STUDIO	Tuesdays	15:40 – 18:30	Media Lab, WIG 401
	Thursdays	15:40 – 18:30	Media Lab, WIG 401

COORDINATOR

Coordinator

<i>Name:</i>	<i>Walter Langelaar</i>
<i>Room:</i>	<i>WIG 410</i>
<i>Office Hours:</i>	<i>Wednesdays 3-5pm or by appointment</i>
<i>Email:</i>	walter.langelaar@vuw.ac.nz
<i>Phone:</i>	<i>463 5512</i>

For Tutor details please visit the course blog via: blackboard.vuw.ac.nz

COMMUNICATION OF ADDITIONAL INFORMATION

Any changes or additions to this Course Outline will be discussed and agreed with the class, and conveyed via email or through the course blog on the School of Design Teaching and Learning website: blackboard.vuw.ac.nz

PRESCRIPTION

Electronics, circuit design, material fabrication and programming as design tools to build 'intelligent' objects and systems. Techniques using microcontrollers allow students to think beyond the mouse/keyboard/screen paradigm in exploring design solutions to real-world problems using physical computing.

COURSE CONTENT

This course is a practical hands-on exploration of physically interactive electronics, which analyses the ways that computational, biological, mechanical and electronic apparatus negotiate communication to and through one another, from a design perspective. Conceptually, we will be looking at topics such as emotion, sensing, instinct, signal processing, entropy and transduction. Technically we will be building designs that harness such topics through physical computing and electronic design automation.

The primary aim of this course is to explore cutting edge ways of designing digital interaction that moves beyond the screen/keyboard/mouse paradigm. You will learn how to interface objects and digital infrastructure with the viewer's body and ambient stimuli such as motion, light, sound, or intangible data, and how to document and share prototypes of interactive electronics, and incorporate them into your designs. The appropriate use of, and integration with traditional and experimental materials will be covered, alongside low-cost and environmentally progressive strategies, such as hacking existing technologies for re-use.

Additionally, we will be looking deeper into the phenomena of behaviour, motivation and emotion, better informing our sensibility for designing interaction. You will finish the course with a wide range of new skills and a greater appreciation for the communication between biological and electronic systems.

COURSE LEARNING OBJECTIVES

Students who pass this course will be able to:

- 1: Able to critically analyse complex situations to identify key design questions
- 2: Work with physical computing hardware and software
- 3: Engage digital media design-specific knowledge and vocabulary
- 4: Able to develop and execute an effective strategy towards creating an imaginative and innovative design solution
- 5: Integrate physical and virtual interaction systems
- 6: Convincingly communicate design concepts in a variety of ways with clarity and insight in written, oral and visual formats

TEACHING FORMAT

The course will be delivered through a series of lectures covering basic electronics, physical computing hard- and software, digital platforms for creative output and community building, and accompanying material on interactivity and usability principles in art and design. Demonstrations and tutorials of all project software, protocols and design related templates and systems will be held. There will be several guest lectures given by experts from different fields, each relating to one of the courses subtopics and/or projects, and there will be a series of quizzes for students to complete.

At the beginning of each project students will be given a full brief with specific hand-in requirements and marking criteria.

The two sessions per week will include lectures as well as practical tutorials, group critiques and individual mentoring. Students are expected to attend all weekly sessions. This is a tightly packed course, so any absences could potentially result in a large setback. Any potential absences should be communicated to the course coordinator via e-mail prior to the missed class. Additionally, students may seek assistance from the course coordinator and tutors during office hours or by making appointments.

All course materials, project descriptions, important dates, reference materials and required readings will be available on the course blog, located on the School of Design Teaching and Learning website, see: blackboard.vuw.ac.nz

MANDATORY COURSE REQUIREMENTS

None.

WORKLOAD

Attendance and participation is an important aspect of the learning process, and you are required to attend all lectures and tutorials.

If extraordinary circumstances arises that require you to be absent from some class sessions, you should discuss the situation with the Course Coordinator as soon as possible.

You should expect to spend a total of around 200 hours on this course, including both scheduled class time and independent study. Typically this involves around 12-14 hours per week during the twelve teaching weeks, with the balance during the mid trimester break, study week and examination period.

Please check out the link below with information on Studio Courses:

www.victoria.ac.nz/fad/faculty-administration/current-students#studioculturepolicy

ASSESSMENT

MDDN251 is internally assessed.

Assessment items and workload per item		Due	%	CLO(s)
1	Session Preparation Assignments	Throughout trimester	25%	3, 6
2	Project 1: Found Interfaces	2 April	25%	2, 4, 5
3	Project 2: Feedback and Signal Routing	12 May	25%	1, 2, 4, 5
4	Project 3: Final Project	4 June	25%	1, 2, 3, 6

The School has a long tradition of providing *critical review* of student work as it progresses especially in design projects. For further information please refer to the Website below:

All grades posted during this course are only provisional results until confirmed by the School Examiners Committee, which meets after the examination period.

Note: Victoria's grading system is changed for Trimester 1, 2014 with the introduction of a new C- grade.
<http://www.victoria.ac.nz/students/study/progress/grades>

All work submitted for this course must be original and developed for this course only, unless prior approval is gained from the course coordinator to further develop existing work from previous or concurrent courses.

Project descriptions:

Session Preparation Assignments (SPAs) | throughout trimester | Assessment: 25%

Throughout the trimester there will be 10 SPAs, at 2,5% each, on the assigned lectures or technical tutorials.

In order to be able to create physical computing projects, it is essential to learn some basics of electronics, circuit design and Arduino microcontroller coding. To ensure this, there will be a number of in-class technical tutorials. Students are required to revisit these tutorials outside of class time, and to practise and master the tasks set out in these basic tutorials. Should there be any unclarities, students can always contact the coordinator and tutors by email, or discuss their questions in the office hours.

Students will complete Session Preparation Assignments before each session about the technical aspects that were taught in the tutorials. The SPAs will occur throughout the trimester, and the specifics for each will be relayed via Blackboard. Students can score 2.5% of their final grade per SPA, with a maximum of 25%.

PROJECT 1

Found Interfaces | 4 weeks | Assessment: 25%

The goal of this project is to introduce you to physical computing.

Developing momentum over the past few decades, physical computing is *the* design domain defined by questioning and extending the screen/keyboard/mouse paradigm. At the heart of this discipline, physical computing takes digital design and interaction towards a more organic and human form, freeing us from the inflexible authority of standardised hardware and interfaces. Further informing our work here will be an analysis on how contemporary consumer grade hardware interfaces are constructed and what types of mechanical or sensory hardware can be found inside. To do this we adopt and deploy strategies borrowed from circuit bending and/or hardware hacking, alongside tactics of collaging or modification of found (interface) objects - or '*objet trouvé*'.

As mentioned above, physical computing aims to question and extend on already existing human-computer interfaces. Your main objective in this project will be to re-imagine an interface of your choosing, open it up for analysis and repurpose its hardware using your own Arduino and electronics kit. During this 4-week project there will be regular in-class technical tutorials that will guide and assist you in completing your design. Several combinations of hardware and software will be discussed, and part of your design should incorporate a (possible) functional application of the interface. The main production focus in this project will be basic electronic circuit design with Arduino, and extending on this design with hardware of your choosing.

Schedule:

- Choose three different interface models or modes of interaction
- Research your topics and production focus.
- Create a proposal based on your research. It should include:

- Your topic of focus (interface and/or mode of interaction)
- Your production focus
- Hardware and components that will be used

- Ideation: sketches, timeline, flowchart
- Timeline with milestones

- Select one topic and execute your design
- Present your design, a functional prototype and hand-in required material

Hand-in format:

- Submit to hand-ins drive: finalised proposal based on your research.
- Present finalised design and functional prototype in class (details of presentation to be discussed in class)

Due dates:

Initial Research Document review: 12 March

Research Document due on Blackboard: 17 March

Presentation of functional prototype in class: 2 April

PROJECT 2

Feedback and signal routing | 4 weeks | Assessment: 25%

This project departs from experience and skills gained earlier in the trimester, and builds upon the designs and prototypes of Project 1: 'Found Interfaces'. You will propose two new iterations of your initial design and expand on its context and environment. Research topics move into more elaborate modes of interaction and feedback including haptics, feedback loops, modularity, repetition and recursion.

While the previous project focused on creating a functional prototype consisting of a well designed and correctly implemented basic electronic circuit, this project will focus on 'making things talk': creating a design that lets a custom built interface route signals to a host device or program, and from there back to either your own hardware or someone else's via a network protocol.

Schedule:

- Create two proposals for designs. Each should include:

- One paragraph description of your interface or interactive environment
- Visuals (sketches, diagrams, etc.) of your concept
- Hardware and software to be used
- Theoretical outline of technical concepts used in your design
- Visuals of any related previous work related to your proposal

- Each proposal will be assessed for its creative and artistic merit weighted against its achievable potential
- Proposals are reworked to accommodate set milestones
- Progress checks
- Present your design and hand-in required material

Hand-in format:

- Submit to hand-ins drive: two new design iterations based on your previous project and research.
- Presentation of finalised design and functional prototype in class (details of presentation to be discussed in class)

Due dates:

Interim Proposal review: 23 April

Project Proposal due on Blackboard: 28 May

Group presentation of functional prototype in class: 12 May

PROJECT 3

Final Project | 4 weeks | Assessment: 25%

In this Final Project you will combine the tools and techniques picked up in the first two assignments, and combine them into a new project. You can propose an entirely new concept, unrelated to previous iterations of your work made in the first two assignments, or you can choose to continue the progress made from projects 1 & 2. In any case you will treat this final project as if it's a new proposal, and create the appropriate documents including your research, ideation, topic of focus and production outlines. Additionally, throughout this assignment you will create and assemble documentation of your theoretical and technical work of this trimester, in written and audio-visual form – for which the details are outlined below.

Schedule:

• *Create your final project contextualisation document. It should include:*

- One paragraph description of your interface or interactive environment*
- One paragraph description explaining how this project departs from earlier work in this course*
- Visuals (sketches, diagrams, etc.) of your concept*
- Hardware and software to be used*
- Theoretical outline of technical concepts used in your design*
- Visuals of any related previous work related to your proposal*
- Your topic of focus (interface and/or mode of interaction)*
- Your production focus*
- Ideation: sketches, timeline, flowchart*
- Timeline with milestones*

- *Each proposal will be assessed for its creative and artistic merit weighted against its achievable potential*
- *Proposals are reworked to accommodate set milestones*
- *Progress checks*
- *Present your design, a functional prototype and hand-in required material*

Hand-in format:

- *Submit to hand-ins drive: finalised proposal based on your research.*
- *Present finalised design and functional prototype in class (details of presentation to be discussed in class)*
- *Submit to hand-ins drive (to be discussed in more detail in class): finalised presentation materials of course work including properly documented electronic circuits (format to be discussed in class), at least three high-quality, high-resolution images (min. 250dpi) per iteration of your work, text with original title of the final project, concept description and production outlines (min. 500 words as .pdf or .txt), and short video following the guidelines listed in the 'SUBMISSION AND RETURN OF WORK' section below.*

Due dates:

Finalised Project Contextualisation document: 26 May

Presentation of final project in class: 4 June

SUBMISSION AND RETURN OF WORK

The general Media Design video specifications for submissions are:

1. Resolution of the video is to be 1920x1080 px ([1080p](#)), compressed using the H.264 codec, and exported in the QuickTime file (.mov) or MPEG-4 (.mp4) format.
2. If you did not create the audio yourself, the music/audio has to be either appropriately accredited through Creative Commons or Public Domain audio, or you have acquired rights for educational/commercial reproduction.
3. Credits should be added at the end of the video, and include:

- Name of student
- Name of Project
- Year of work
- Victoria University of Wellington, School of Design
- Appropriate audio accreditation
- Anyone who has helped in any way

Alternative video formats need to be discussed with the course coordinator before submission.

Each student is responsible for ensuring their work is submitted to their course tutor or Course Coordinator on time and in the required format.

Work submitted late must be submitted to the Course Coordinator. Late submissions will be penalised as set out below, unless an extension is approved by the Course Coordinator.

EXTENSIONS

In the event of illness or other extraordinary circumstances that prevent you from submitting and/or presenting a piece of work on time, or that you feel adversely affect the quality of the work you submit, it is important that you discuss your circumstances with the Course Coordinator as soon as possible so that appropriate arrangements may be made. You should complete an Application for Extension form (available from the Faculty Office) for the Course Coordinator to approve. You must provide suitable evidence of your illness or other circumstances. In an emergency, or if you are unable to contact the Course Coordinator, you should advise the Faculty Office of your situation.

PENALTIES

If no extension has been approved, the following penalties will be applied:

- Failure to personally present work at any scheduled graded review will result in an automatic failing grade of E (maximum mark of 39%) for the work being reviewed;
- Work submitted late will receive a failing grade of E (maximum mark of 39%);
- Any work not submitted within 5 working days of the due date will be recorded as a non-submission (0%).

REQUIRED MATERIALS AND EQUIPMENT

Students will need to provide all materials and equipment as necessary for the completion of required work.

Please check the website link below for the standard requirements:

www.victoria.ac.nz/fad/faculty-administration/current-students/faqs#materialsandequipment

Required: electronic components kit for approx. \$110,- , a digital storage medium for backing up your work, pen and sketchpad, headphones.

Additional Costs: Variable.

SET TEXTS

Tom Igoe & Dan O'Sullivan, *Physical Computing: Sensing and Controlling the Physical World with Computers* (2005), of which the following chapters will be provided in class (required reading):

Introduction
Chapter 1 - Electricity

RECOMMENDED READING

TECHNICAL & DESIGN READING

www.arduino.cc

www.processing.org

Charles Platt, *Make: Electronics* (2009)

Tom Igoe & Dan O'Sullivan, *Physical Computing: Sensing and Controlling the Physical World with Computers* (2005)

Tom Igoe, *Making Things Talk: Practical Methods for Connecting Physical Objects* (2007)

Brian Evans, *Arduino Programming Notebook, 2nd Ed.* (2008)

Simon Monk, [*Hacking Electronics: An Illustrated DIY Guide for Makers and Hobbyists*](#) (2013)

Forest M. Mims III, *Getting Started In Electronics* (2003)
 Pages 1, 7, 13-17, 20-21, 28-31

Forest M. Mims III, *Electronic Sensor Circuits & Projects* (2004)

Thomas Petruzzellis, *Electronic Sensors for the Evil Genius* (2006)

Vilém Flusser, *The Shape Of Things: A Philosophy of Design* (1999)

Donald Norman, *The Design of Everyday Things* (2002)

Nathaniel Stern, *Interactive Art and Embodiment: The Implicit Body as Performance* (2013)

SCHEDULE OF SESSIONS

Week month	day	date	item	location	time	Comments
Week 9 February	M	23				Orientation Week
	TU	24				
	W	25				
	TH	26				
	F	27				
Week 10 March	M	2				Trimester 1 Begins
	TU	3	Class session	WG401	15:40-18:30	THROUGHOUT TRIMESTER: SESSION PREPARATION ASSIGNMENTS, TOTAL: 25%
	W	4				
	TH	5	Class session	WG401	15:40-18:30	
	F	6				
Week 11 March	M	9				
	TU	10	Class session	WG401	15:40-18:30	

	W	11				
	TH	12	Class session	WG401	15:40-18:30	P1 initial Research Document review 5%
	F	13				<i>This is the last date that you can withdraw with a full fees refund</i>
Week 12 March	M	16				
	TU	17	Class session	WG401	15:40-18:30	P1 Research Document due on Blackboard 5%
	W	18				
	TH	19	Class session	WG401	15:40-18:30	
	F	20				
Week 13 March	M	23				
	TU	24	Class session	WG401	15:40-18:30	
	W	25				
	TH	26	Class session	WG401	15:40-18:30	
Week 14 March/ April	F	27				
	M	30				
	TU	31	Class session	WG401	15:40-18:30	
	W	1				
	TH	2	Class session	WG401	15:40-18:30	P1 presentations in class 15%
Week 15 April	F	3				Good Friday – Public Holiday
	M	6				Easter Monday – Public Holiday Mid Trimester Break starts
	TU	7				University Holiday
	W	8				
	TH	9				
Week 16 April	F	10				
	M	13				
	TU	14				
	W	15				
	TH	16				
Week 17 April	F	17				Mid Trimester Break ends
	M	20				Trimester 1 resumes
	TU	21	Class session	WG401	15:40-18:30	
	W	22				
	TH	23	Class session	WG401	15:40-18:30	P2 interim Proposal review 5%
Week 18 April/ May	F	24				
	M	27				Anzac Day Observed – Public holiday
	TU	28	Class session	WG401	15:40-18:30	P2 Project Proposal due on Blackboard 5%
	W	29				
	TH	30	Class session	WG401	15:40-18:30	
Week 19 May	F	1				
	M	4				
	TU	5	Class session	WG401	15:40-18:30	
	W	6				
	TH	7	Class session	WG401	15:40-18:30	
Week 20 May	F	8				
	M	11				
	TU	12	Class session	WG401	15:40-18:30	P2 presentations in class 15%
	W	13				
	TH	14	Class session	WG401	15:40-18:30	
	F	15				<i>After this date the Associate Dean's approval is required for withdrawals</i>

						<i>from Trimester 1 courses.</i>
Week 21 May	M	18				
	TU	19	Class session	WG401	15:40-18:30	
	W	20				
	TH	21	Class session	WG401	15:40-18:30	
	F	22				
Week 22 May	M	25				
	TU	26	Class session	WG401	15:40-18:30	P3 Project Contextualization due on Blackboard 10%
	W	27				
	TH	28	Class session	WG401	15:40-18:30	
	F	29				
Week 23 June	M	1				Queen's Birthday – Public Holiday
	TU	2	Class session	WG401	15:40-18:30	
	W	3				
	TH	4	Class session	WG401	15:40-18:30	P3 presentations in class 15%
	F	5				
Week 24 June	M	8				Study/Examination Period
	TU	9				
	W	10				
	TH	11				
	F	12				Mid-year Examinations begin
Week 25 June	M	15				
	TU	16				
	W	17				
	TH	18				
	F	19				
Week 26 June	M	22				
	TU	23				
	W	24				
	TH	25				
	F	26				
Week 27 June/July	M	29				
	TU	30				
	W	1				Mid-year Examinations end
	TH	2				Mid-year break begins
	F	3				
Week 28 July	M	6				
	TU	7				
	W	8				
	TH	9				
	F	10				
Week 29 July	M	13				Trimester 2 begins
	TU	14				
	W	15				
	TH	16				
	F	17				

CLASS REPRESENTATIVES

The Faculty of Architecture and Design operates a system of Class Representatives in 100-level courses, and Year Representatives in each of the professional disciplines. Student Representatives are elected during a class

session in the first week of teaching. All Student Representatives will be listed on the STUDiO notice board in the Atrium, and the relevant Representatives are also listed on studio notice boards. Student Representatives have a role in liaising between staff and students to represent the interests of students to the academic staff, and also in providing students with a communication channel to STUDiO and the Student Representation organiser.

Class Rep name and contact details:

STUDENT FEEDBACK

No significant changes to this course have been made as the feedback from the last cohort indicated that students found the content and structure of the course supported their learning.

Student feedback on University courses may be found at www.cad.vuw.ac.nz/feedback/feedback_display.php.]

OTHER IMPORTANT INFORMATION

The information above is specific to this course. There is other important information that students must familiarise themselves with, including:

- Academic Integrity and Plagiarism: www.victoria.ac.nz/home/study/plagiarism
- Aegrotats: www.victoria.ac.nz/home/about/avcacademic/publications2#aegrotats
- Academic Progress: www.victoria.ac.nz/home/study/academic-progress (including restrictions and non-engagement)
- Dates and deadlines: www.victoria.ac.nz/home/study/dates
- Faculty Current Students site: www.victoria.ac.nz/fad/faculty-administration/current-students
- Grades: <http://www.victoria.ac.nz/students/study/progress/grades>
- Resolving academic issues: www.victoria.ac.nz/home/about/avcacademic/publications2#grievances
- Special passes: www.victoria.ac.nz/home/about/avcacademic/publications2#specialpass
- Statutes and policies including the Student Conduct Statute: www.victoria.ac.nz/home/about/policy
- Student support: www.victoria.ac.nz/home/viclife/student-service
- Students with disabilities: www.victoria.ac.nz/st_services/disability
- Student Charter: www.victoria.ac.nz/home/viclife/student-charter
- Student Contract: www.victoria.ac.nz/home/admisenrol/enrol/studentcontract
- Turnitin: www.cad.vuw.ac.nz/wiki/index.php/Turnitin
- University structure: www.victoria.ac.nz/home/about
- VUWSA: www.vuwsa.org.nz