

## Machine Learning and Artificial Intelligence

Previous compulsory steps / Prior students' knowledge	Basic Programming Concepts, algorithmic logic
Learning objectives	<p>Learning about Alan Turing and the historical concept of Enigma's decoding machine (Nazi's message encoding machine)</p> <p>Knowing about Turing test (imitation game) and make an introduction to the concepts of machine learning and artificial intelligence</p> <p>Solving original IT problems (finite state machines)</p>
Subjects	Programming, Mathematics
Recommended Age	15-18
Material needed	Game: The Ultra Code
Sequence duration	70-90 minutes
Individual or group activity	Group Activity
Skills to be developed (after learning goals)	Critical thinking, problem solving, creativity, communication, collaboration and teamwork. presentation skills.

Game price range	<20 €
Extension / differentiation activities (at the end of the sequence)	<p>This pedagogical sequence as a spectator could later be used as one player's activity so students could explore more and more about problem solving and the concept of calculation machines (=computers). The website:</p> <p><a href="http://ivanzuzak.info/noam/webapps/fsm_simulator/">http://ivanzuzak.info/noam/webapps/fsm_simulator/</a> can be used for further experience with finite state machines, and the following video can be very helpful about enigma decoding:</p> <p><a href="#">The real story of how Enigma was broken - Sir Dermot Turing - YouTube</a> , <a href="#">Home   The Alan Turing Institute</a></p>
Similar games that you can use with the sequence	"while True: learn()"
Tips for inclusion	The videos are in English, but you can use the automatic translation (enhanced by AI) for other languages in YouTube (settings/subtitles/automatic translation). You can also provide a translated transcript to your students.
Tips for shortening the duration of the sequence	The sequence could be transformed into a "flipped classroom" alike procedure. For example, step 1 and step 2 can be made at home by students and steps 3 to 6 in the classroom.

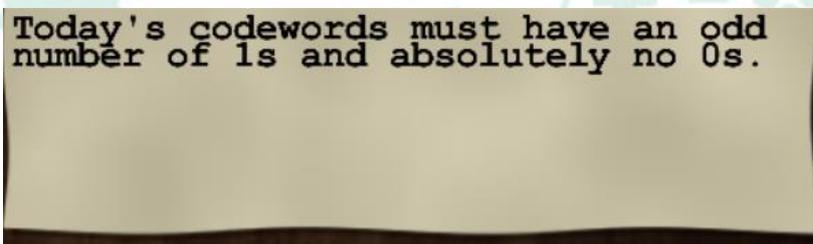
## Step by step: how to implement the sequence

In this pedagogical sequence, we will use a game through which students will get to know Turing ("father of computer science") and the Turing test (considered a historical basis of artificial intelligence). The game which will be used is "The Ultra Code".

The three videos used in this sequence present the historical figure of Alan Turing, the historical events of his time, and the description of the Turing test. After showing the videos, we will try to tackle the process of finite state machines through playing the game.

The procedure with the game could be as follows:

- The gameplay is presented, and the first problem given in the form of a note, chosen by the teacher:



Today's codewords must have an odd number of 1s and absolutely no 0s.

Snapshot 1 from the game: "The Ultra Code" (creator: Jack Gloyens)

- The solution to this problem is then presented by the teacher,
- The teacher discusses the solution with the students and proceeds to the next level with a new problem,
- Students discuss other the possible solution(s) and choose a person who will present the solution process verbally to the class,
- The teacher solves the problem at that level and the process continues.
- Each different level is a new problem to be solved (from step 3 onwards).

In more detail, the pedagogical sequence may include the following steps.

- **Step 1 – Watch videos as an introduction and discussion in class (25 minutes)**

View [video for Alan Turing](#) (*Alan Turing - Celebrating the Life of a Genius*, 2012b) as a scientist and personality: (video duration/v.d: 8:13). After the video, you can discuss Alan Turing's personality and contribution to computer science based on the video.

- **Step 2 – Watch two videos related to the Test Turing (imitation game) and discuss them at class in plenary (25 minutes)**

Through the following videos, students will get to know the Turing test.

- [What is a Turing Test? A Brief History of the Turing Test and its Impact - YouTube](#) (v.d: 2:09), (Eye on Tech, 2020),
- [The Turing test: Can a computer pass for a human? - Alex Gendler - YouTube](#) (v.d: 4:42), (TED-Ed, 2016).

After the video, students could read an article about Turing and Machine Learning (Gil Press, 2017) here: [Alan Turing Predicts Machine Learning And The Impact Of Artificial Intelligence On Jobs \(forbes.com\)](#) and an article about “Alan Turing influence on AI research and the resulting controversy” (Sharkey, 2012). here: [Alan Turing: The experiment that shaped artificial intelligence - BBC News](#).

After the reading you can discuss machine learning and Artificial intelligence with your students.

- **Step 3 – Discuss at class in plenary (15 minutes)**

At every level a small historical introduction with relative data is presented and the teacher (possibly in collaboration with the history teacher) makes a special reference to what is presented in the game.

- **Step 4 – Discuss at class in plenary (15 minutes)**

The teacher shows how to use the game and solves the first problem, then presents a way to resolve and control the solution with the help of "programming" of input and output lamps which is based on the theory of finite state machines.



Snapshot II from the game: "The Ultra Code" (creator: Jack Gloyens)

- **Step 5 – Small group discussion (20 minutes)**

The teacher presents a new problem to the class and divides the students into small groups (3-5 students). They students discuss with each other the appropriate solution, and one of them presents the appropriate proposed solution (as a representer of the team) to the plenary.

- **Step 6 – Class discussion (20 minutes)**

The teacher resolves the problem according to the suggestions of the students' groups. In case none of the suggestions are appropriate, the teacher will resolve the problem and explain it to the students.

The process starts again with a new problem.

Note: If the teacher has resolved a lot of problems, then they can use the "Free Game" option (which offers direct access to the problems).



## Resources

Getting the game

[https://store.steampowered.com/app/914950/The\\_Ultra\\_Code/](https://store.steampowered.com/app/914950/The_Ultra_Code/)

Cambridge University. (2012, June 21). *Alan Turing - Celebrating the life of a genius*. [Video]. YouTube.

[https://www.youtube.com/watch?v=gtRLmL70TH0&ab\\_channel=CambridgeUniversity](https://www.youtube.com/watch?v=gtRLmL70TH0&ab_channel=CambridgeUniversity)

Eye on Tech. (2020, April 2). *What is a Turing Test? A Brief History of the Turing Test and its Impact*. [Video]. YouTube. <https://www.youtube.com/watch?v=4VROUIAF2Do>

Gil Press. (2017, February 20). *Alan Turing Predicts Machine Learning And The Impact Of Artificial Intelligence On Jobs*. Forbes.

<https://www.forbes.com/sites/gilpress/2017/02/19/alan-turing-predicts-machine-learning-and-the-impact-of-artificial-intelligence-on-jobs/?sh=3e76a171c2b1>

Sharkey, N. (2012, June 21). *Alan Turing: The experiment that shaped artificial intelligence*. BBC News. <https://www.bbc.com/news/technology-18475646>

TED-Ed. (2016, April 14). *The Turing test: Can a computer pass for a human?* - Alex Gendler. [Video]. YouTube. [https://www.youtube.com/watch?v=3wLqsRLvV-c&ab\\_channel=TED-Ed](https://www.youtube.com/watch?v=3wLqsRLvV-c&ab_channel=TED-Ed)

## Information

All screenshots used in this lesson were taken from The Ultra Code, Flying Interactive (2019).

