When Puppets Dream

(An Exercisebook for understanding the Digital Age)

The activities in this document play in the so-called Pinocchioverse, a fictional universe, which was created for teaching computer science dynamically through different forms of media. The adaptation for stories is only one possibility of this. More information and the documentation can be found here: https://pinocchioverse.org/documentation/. February 2023, this text as well as all images original by the author are licensed under CC BY-SA 4.0 (Attribution, ShareAlike). The rights of the other images belong to their authors respectively.

or: How I became a real boy

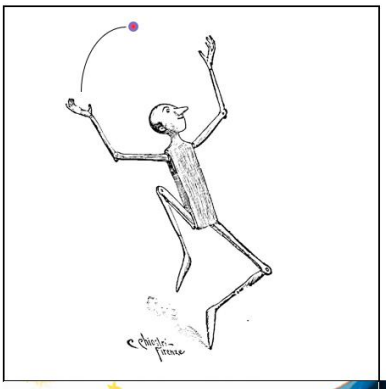
What if Gepetto wouldn't have created Pinocchio based on magic, but with magic marbles, with which he could automate any technical device and even do simple calculations with them? What would that have meant for the time the story played in, and what for Pinocchio?

In this book, you will follow Pinocchio through the Marble Revolution and Beyond and discover, how he became a real boy in the process.

From where it began, to Today and the near Future, in Exercises

You will follow Pinocchio through different ages of the marble revolution. Because he does not age, he lived through them all. He can tell you how it all went up, and how it all went down. In the so-called four ages of marbles: early marble ages, or marble dark ages, mechanical marble ages, digital marble ages and cybermarble ages. And while he is at it, he will tell you how he became a real boy in the process (TODO: maybe he should say this? Makes it more personal).

Marbles are being discovered



Mechanical Marble Age

Digital Marble Age

… and then?

TODO: Eventuell entferne letztes Bild

The When Puppets Dream exercisebook lets children witness the marble revolution at first hand. From the discovery of marbles, over the age of mechanical marbles and finally, to the digital age, in which we live today.

Fictional worlds like Harry Potter already teach people important lessons about the digital world. What didactics of computer science need to provide, is showing people what really lies behind the

devices they are using daily and giving them insight into the inner workings of the digital works, by this empowering them to become more mature and confident actors in the digital world.

The Pinocchioverse was the idea to provide such a thing by combining it with the first point: through a fictional universe.

This document contains actual applications of the Pinocchioverse for the classroom through group activities. Each group station shows computer science concepts through different media and different aspects of it. The material for controlling devices is in this activity sheet always the same: through marble track pieces, which can be put together like puzzle pieces. But the things, which these tracks control, vary with each group station. How the functionality executed is again always the same: through human marbles, that means, children are playing the marbles and then doing the actions right away, or with the help of an augmented-reality app. That means, the execution is done manually. These, devices, which the children control, however, always get more complex and by this, showing them how the concept of abstracting complex functionality in simple operations works and how devices in their daily life are developed.

Approach: Physical Marble Track Pieces and Manual Checking with Human Marbles (potentially with help of augmented reality applications)

Idea: Marble track pieces are available as puzzle pieces, which can be sticked together. Then the running of the marble track is done manually by the children/the teacher, or with the help of an augmented reality app.

Marble tracks can be used to control all kinds of devices. In the following, it starts with easy exercises with very simple actions, which shows how simple applications can be crafted, then going to the creation of more complex devices, the hiding of their functionality in abstract operations and by the successive application of this, to the creation of more complex devices.

The journey will be accompanied by Pinocchio, who because he doesn’t die, lived through all revolutions and can serve as a narrator.

For that I must tell you about a thing, a development I must say, that changed everything in the last 200 years. Its called the marble revolution and it was the reason why I am a real boy today. You want to know the story? Then listen closely and I will tell you everything from start to finish.

Introduction

Ask children how a very complex device works. Then tell them that after today's group exercise, they will be able to understand, how it works in principle.

But when Geppetto died, Pinocchio became very lonely. And so began to wander around and help the people with the apparatuses that he and Geppetto had brought among them. But as approached the people, he was treated just like another apparatus and he became very sad.

That was when Pinocchio had a dream. He wanted to become a real boy.

Age 1: Discovery of Marbles. Group Station 1: Simple, plain operations without any hidden functionality

And that wooden boy had a dream: he wanted to become a boy, a real one, like all the other boys, too. But in him was no live on its own. There were only marbles moving. But what we wanted, was a soul.

First: Introduction of basic marble track pieces through stories (for resources see www.pinocchioverse.org/teach)

Lesson 1: Help Little Red Riding Hood (Move operations in a coordinate system; simple actions)

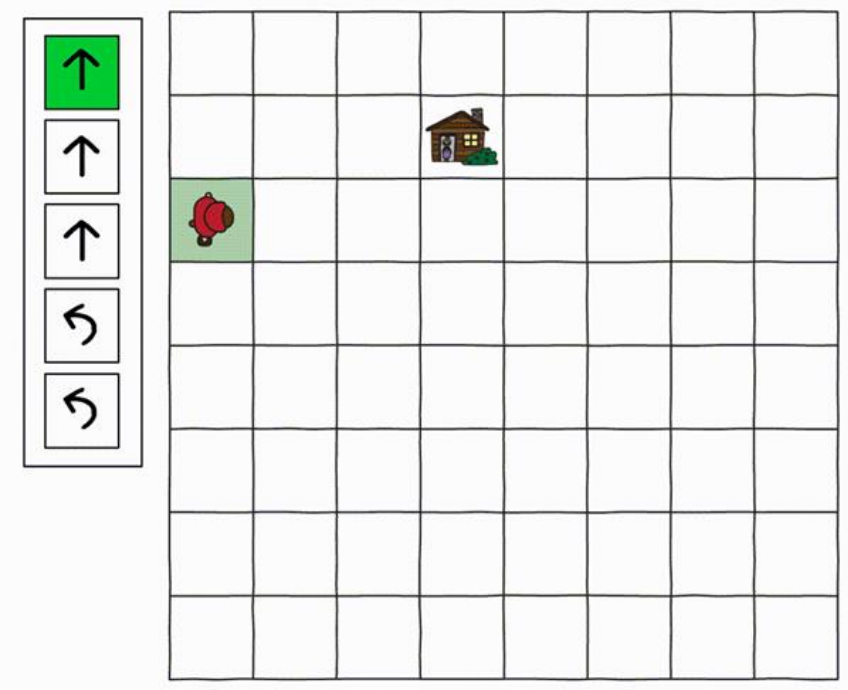
Introductory Concepts: Kid Bot-Exercises from CS Unplugged

Kid Bots from cs-unplugged.org can be used as introduction. The exercises do not even need to be adjusted. The idea is that the left actions are pasted on a single marble track piece, over which the marble roles then beginning from the top, triggering the actions one by one (actually, if you look at the image on the left side of the image, it already looks like a marble track piece). The task of the children is then to add actions on the marble track piece in a way that the person is guided to the house.

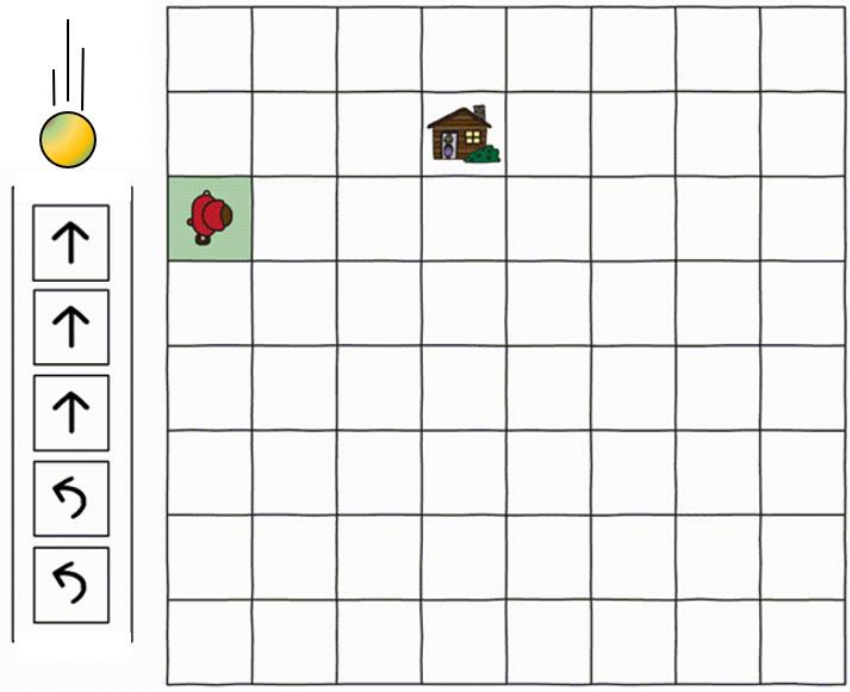
TODO: Replace with Pinocchio-Example – is too complex -> make it simpler. Would be something for next Age

- ➔ Button maybe?

➔ Should be an example that is easy in the beginning and then becomes more complex and abstract through the ages. At the end all marbles disappeared, it can be controlled with wand movements and underlying functionality is completely hidden (digital age)



Left line could be interpreted as linear marble track:



This will give the children a better understanding of how the actions work. After these concepts have been understood, the exercises from the following sections can be used to introduce advanced topics of marble tracks.

TODO: explain kid bots

Material:

Marble-Pieces like puzzle pieces. Coordinate system.

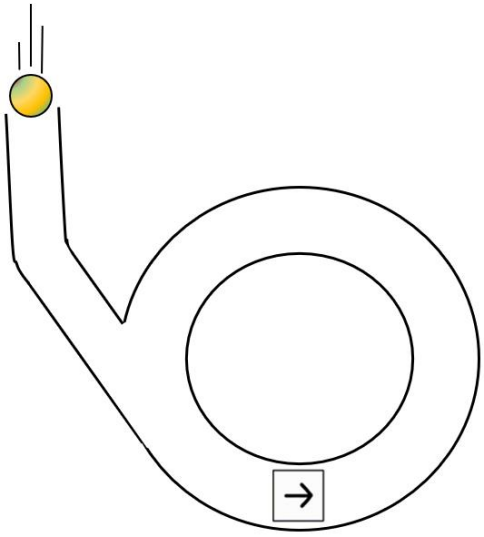
Advanced Concepts: Kid Marble Exercises from Pinocchioverse.org

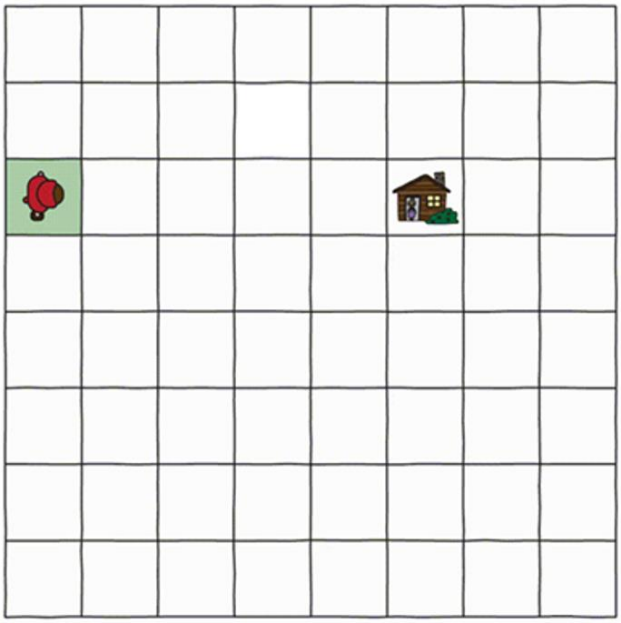
For this, the concept of kid marbles is introduced, based on the kid bots from last section.

Lesson 1: Bring the person home with only two pieces!

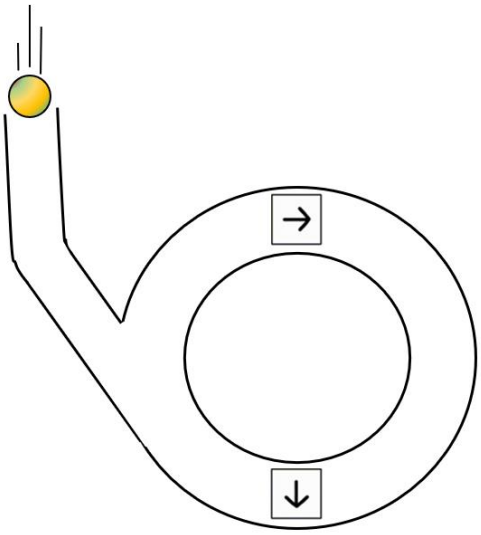
Solution: Loop piece and move forward action

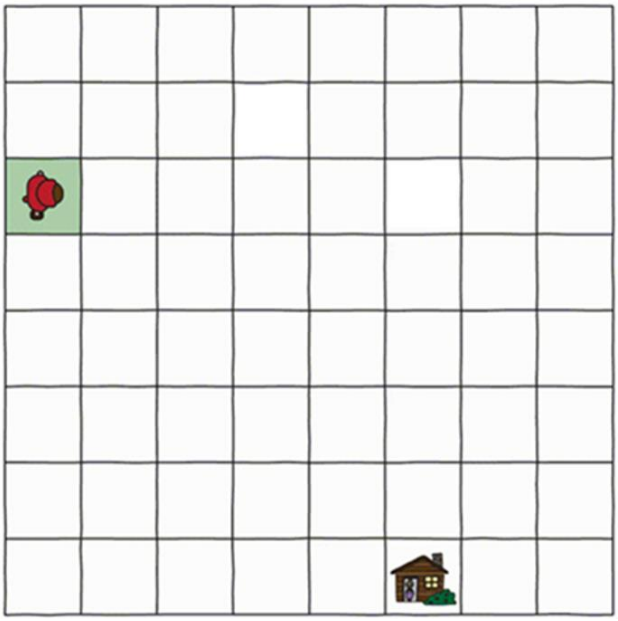
Exercise: How to reach the house with only two pieces?

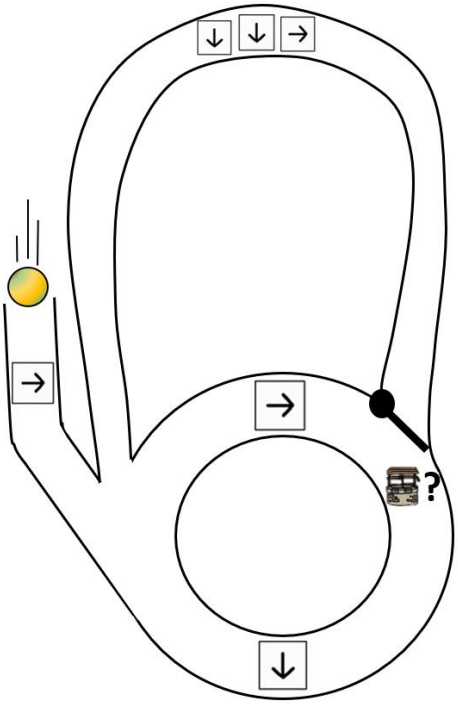


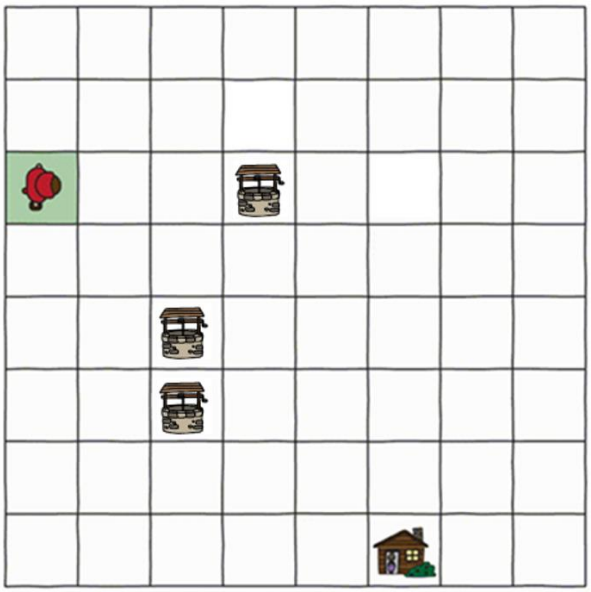


Other Labyrinth-Exercises:





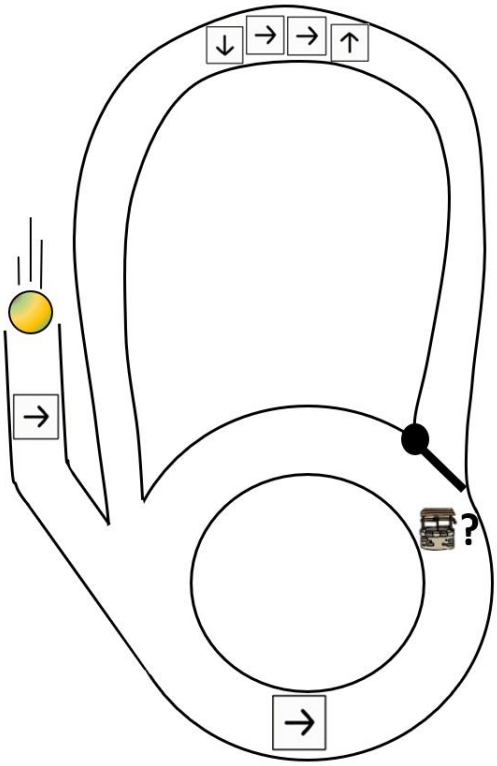


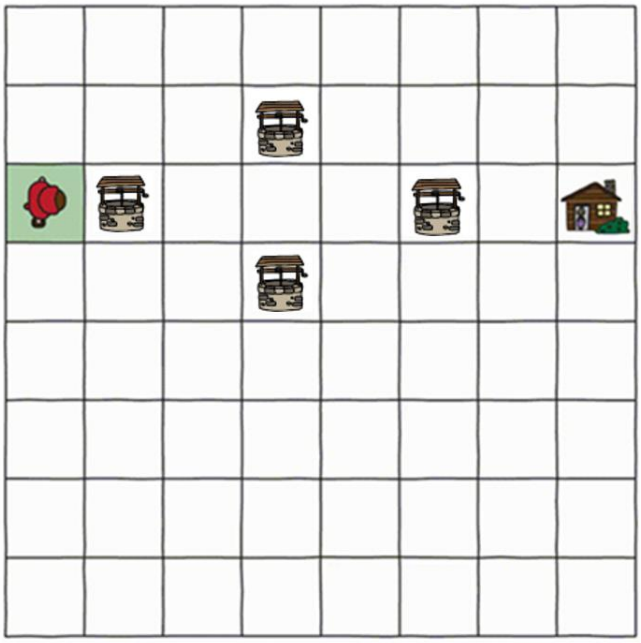


How to reach the house with only the following pieces:

…

Solution:





Age 2: Age of Mechanical Marbles. Group Station 2: Controlling of more complex devices (some level of abstraction; some hidden functionality)

First: Creating more complex devices

TODO: Maybe use human bots to represent the concept of hiding functionality and abstraction (human uses operations, but can be directly controlled through other commands).

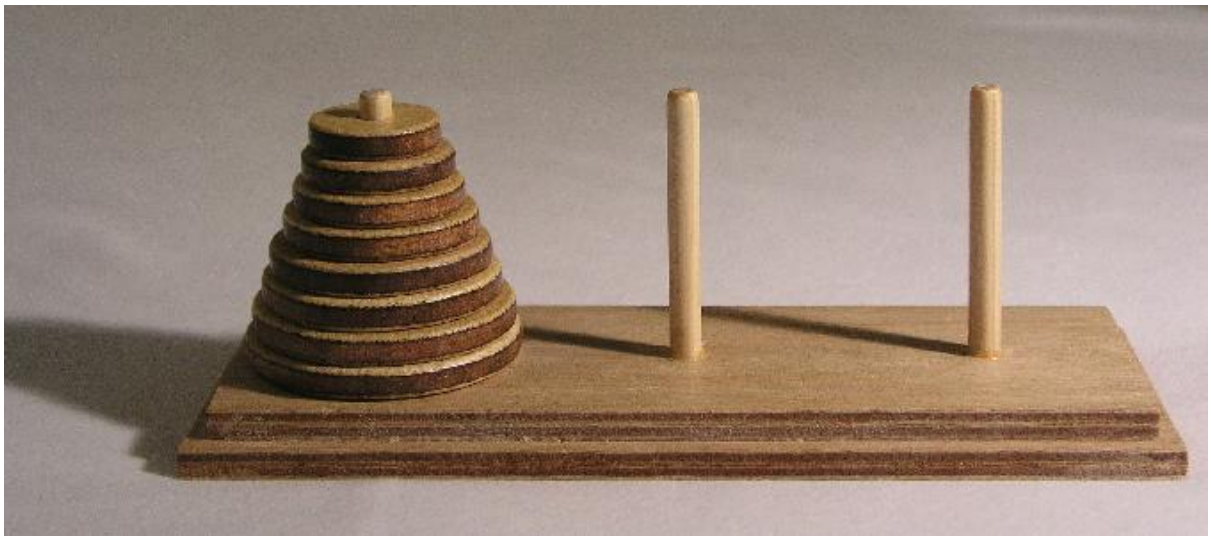
➔ No, in this case, first, some simpler devices would need to be crafted, right?

Examples:

- Remotely controlled car
- Towers of Hanoi (this hard puzzle)
- Rubix-Cube
- Wooden automata
- Human bot: letting him/her draw something
- Sending messages

TODO: Wooden car, which can be driven around

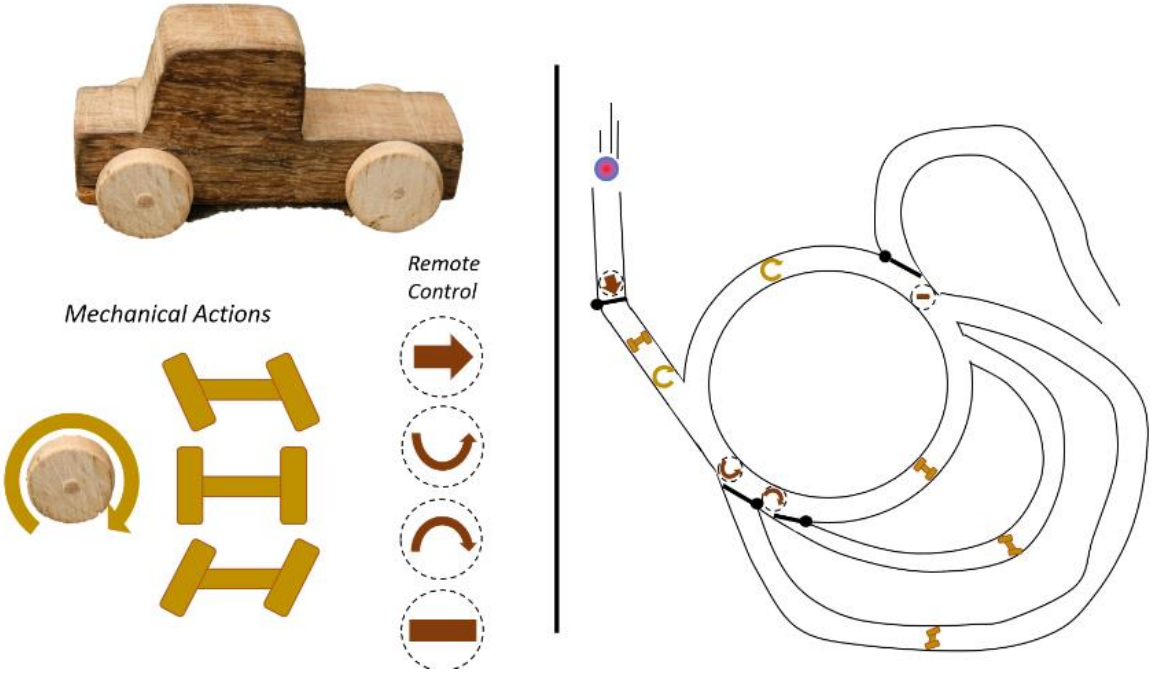
Lesson 1: Towers of Hanoi



(From https://en.wikipedia.org/wiki/Tower_of_Hanoi#/media/File:Tower_of_Hanoi.jpeg)

Lesson 2: Wooden Car

Or wooden car:



And as Pinocchio saw, how the people around him behaved more and more like machines, he wanted to become like them. And so he took mechanical devices and one by one, replaced his wooden parts with mechanical parts:

And just like this – he became a real boy, or so he though at the time. But as time passed, he thought, maybe the other people are just not behaving like humans anymore. It had nothing

to do with him. He was now not more real than at the time when he was out of wood. The humans were only more like him. But that wasn't, what he wanted.

And so, he waited and wandered the land.

And he even had to admit, that while he looked like a machine on the outside, he still felt like a human on the inside. And so, he realized:

Age 3: Digital Marble Age. Group Station 3: Controlling of very complex devices, e.g. smartphones (high level of abstraction; basically completely hidden functionality)

First: Imagine what devices could be create with the ones from last section, which operations could be provided for others to use → Big machines to draw images, etc.

And now we do human marbles on these devices and see: oh, we can already solve stuff with that. Examples for functionality could for example be: baking a cake. Baking a cookie.

And that would be as much as would be necessary for now.

TODO: Digital age is all about using magic with wands (marbles at the end), which can be used to activate stuff instantly through symbols.

➔ No need for smartphones. But functionality can be controlled much easier.

And then people discovered that with some magic wood, the marbles symbols could be triggered by moving them in the air as the symbol. This was the invention of the wand and made all our lives better. It was like magic.

TODO: Add exercises for this.

He wielded power in his hand.

Lesson 1: Control the wooden car with magic

TODO

Lesson 2: TODO

TODO

Pinocchio wusste nicht weiter. And so, just on the spot, he broke down and cried. And as he cried, a child stepped to him. And the child said: “Why are you crying Pinocchio?”

“I want to become a real boy, and it is just not working!”

The child looked irritated for a moment. “You look like a real boy to him”, she said and she pointed to someone else, who was walking by. “See his legs? They are out of wood. See that lady there? She is also out of wood, just like you. And me? I’m half out of wood, too, you know? And what about the spirits living among us but not among us? And the animals. Aren’t they living being too?”

“Oh”, said Pinocchio, and with that, Pinocchio felt a sensation rush through his body. He looked down on him and saw, that he had became not a real boy but something else, something much better. He had gotten a soul.

And just like that – he became a real boy! And he realized, it had been there all along. All it needed was someone else to see it. Like Geppetto. Or so he thought, until …

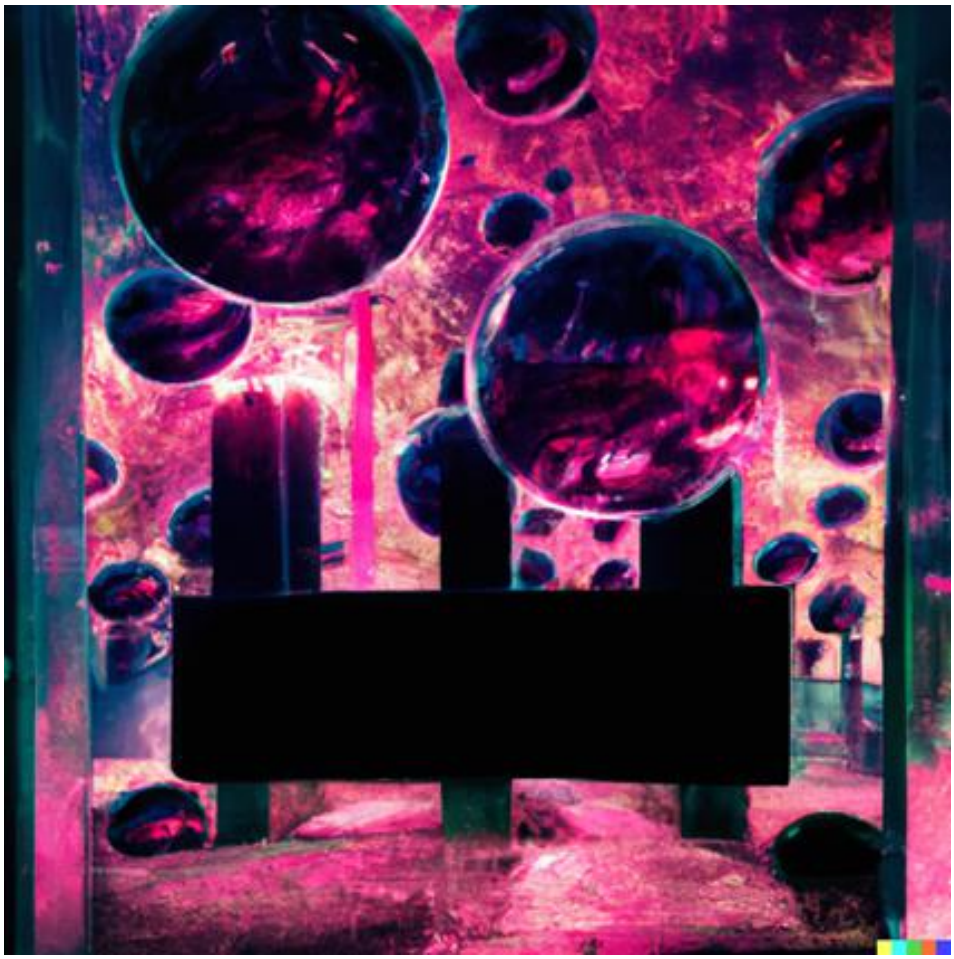
The Future TOOD: Muss das rein?

But what comes next?

And what role will I play in it? I don’t know, but maybe you can come up with ideas? And also: what will be *your* role in it?

Imagine what the future could or should look like

TODO

What will make us human in the future?

Draw a picture how the future could look like. For example: