# Conceptual design and development of a serious game for learning topographical maps

## (Developing a digital learning game – from the idea to a prototype)

# Abstract

# Introduction

# Theoretical background

# Methodology

Checkpoints:

1. Idea – Ilya’s idea, that there shuld be a dlg which teaches topographical maps. My own interest and connection to this topic. This lead me to make the project as my master thesis project.
2. Research
   1. Putting down how the game should work, what are its benefits, on which academy theories it relies on.
   2. Searching for similar programs (games and simulations) that have been made – in Estonian and English. Outcome: there were no game or simulation that uses drawing method to teach a map; drag-n-drop method exists (<http://www.teacherled.com/2008/06/01/map-maker/>), and also orienteering ([VirtualO](http://store.steampowered.com/app/529020/VirtualO/), [Suunnistussimulaattori](https://www.youtube.com/watch?v=uvBOFBvUZs4), [Skiddaw](https://vimeo.com/78057630)). Only map-maker practices creativity – the learner can make the map on his/her own
   3. Gathering feedback. From geology and military defense teachers – they would not use this kind of program in their lectures. (Probably because there was no usability scenario for them to get acquainted with; and “never tell teacher if they wanted to use a product, but instead tell them if the product was mandatory, what would make the product more pleasant to use”) This put the project to a halt – needed to find if the program could satisfy all the teachers. Final decision – to target the students directly, taking away the responsibility from the teachers -> added tutorial function to the idea.
3. Start of production: Rethinking the time scale – map converter idea. Map converter positive side – that would interest companies (potentially reliable target group); **reverse engineering method** to build the drawing game (saves time to use existing **authentic** data instead of creating entirely new data(-system)). Negative about it - A whole new product with no research information.
   1. Gathering authentic, widely-used data – to see if it would be too difficult to make a converter or a drawing game. Visit to Regio: interest in both (game and converter), suggestions to look up the data in maaamet.ee website.
   2. Examining the authentic topographical data – found out that the data can be read by 3D programs, Unity cannot read it before converting it to readable data. Planned to build the converter in Unity anyway (provide reasons: need to learn the game engine; the engine has prefabricated functions that save time to accomplish anything). Did not seem reasonable to convert data in order to convert the data. Decided to start building prototype
4. Building the prototype
   1. Goal to achieve the most difficult function (also the core functionality of the game) – the drawing mechanism. Because aesthetics should be the last thing (https://medium.com/ux-power-tools/heres-everything-i-ve-learned-from-designing-10-000-ui-screens-as-a-lead-product-designer-7d2810bee810). Start by searching drawing tutorials -> did not get too far with experimenting, because there was no need to actually alter the code -> therefore no progression. **Realized that there is** **no connection watching tutorials, if I cannot apply the knowledge to practice.** Decided to start with manipulating the terrain ASAP.
   2. Searching tutorials, manuals and instructions on how to manipulate Unity terrain data. When got the knowledge, it could be applied to the line drawing code in order to manipulate the terrain. The steps of terrain manipulation: manipulate a point; manipulate a squared area; manipulate an area in a circle; manipulate the area according to mouse movement; manipulating according to drawn line (bringing together line code and terrain code) – makes available amoeba-shaped outlines; manipulating terrain points inside the custom-shape outline.
   3. When finishing the most important function, there was already found theoretical solutions on: how to fill areas (forests, swamps, fields, water); how to drag-drop custom symbols on the map (houses, towers, churches); how to apply line-shaped objects on the map (roads, railways, ditches). Decided to concentrate on GUI.
   4. Creating exploration mode and making it switchable between the drawing mode (adding player controls, functions to stop drawing). Applying texture to the terrain and grass color to the map-drawing-canvas. Creating grid in order to get the idea of the scaling when drawing lines-of-the-same-height. **Thus the prototype is ready** for the writing part.

# Results

* Importance of research (puts down the path what to achieve) – when finding out in the middle of doing the prototype, that the thing has been made, the motivation drops drastically – the production could come to a complete halt. So during research it’s possible to foresee what could have a negative impact to the production phase.
* Stress from having few time might have a positive effect of showing creative solutions on how to reach the destiny (like the usefulness of the map converter in this project)
* On building prototype:
  + Start with tutorials which you can already use in your code.
  + To achieve a difficult task, start by the simplest (terrain dot, squared area, circled area, area based on mouse movement, etc.).
  + Leave the aesthetics to the last. The functionality is the most important part! (https://medium.com/ux-power-tools/heres-everything-i-ve-learned-from-designing-10-000-ui-screens-as-a-lead-product-designer-7d2810bee810)
* The usability scenario should be the first thing to introduce to the target group!
* “Never tell teacher if they wanted to use a product, but instead tell them if the product was mandatory, what would make the product more pleasant to use”

# Discussion

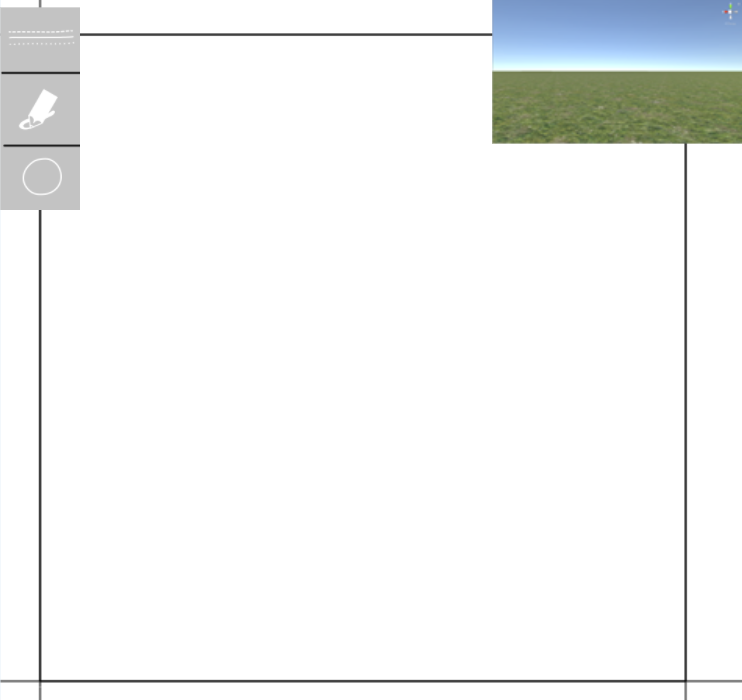
# Summary

# Extras

## Scenario of usage

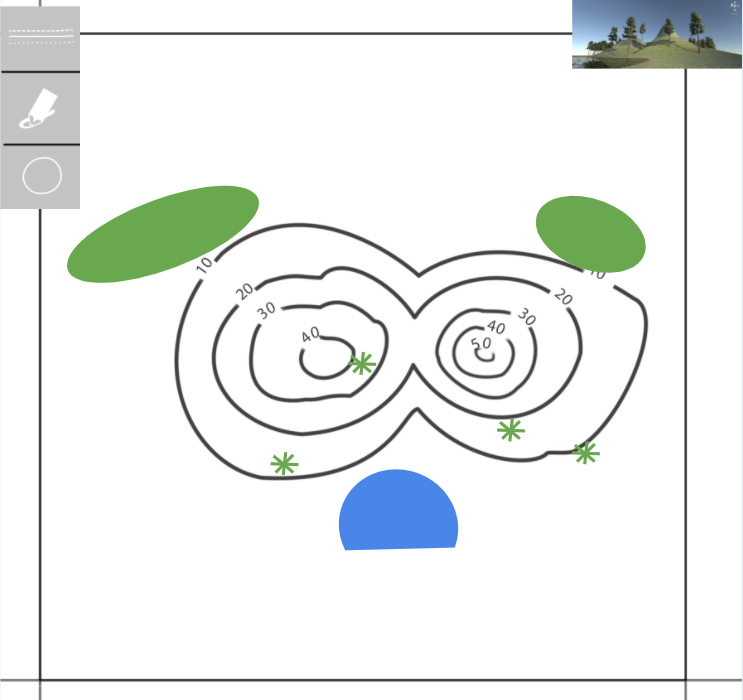
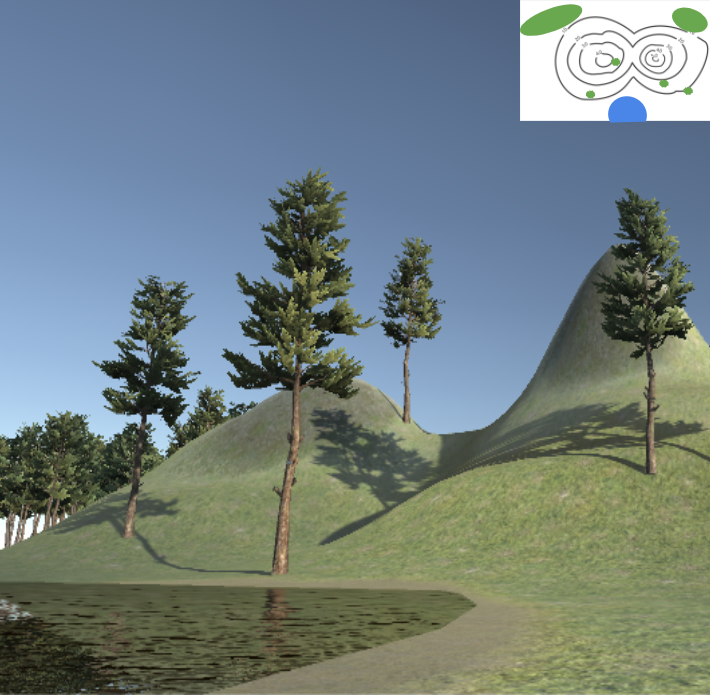
Nate has just started studying geography in 6th grade and the teacher has assigned the first homework for the pupils. The assignment is to download the digital learning game “Topographics” to their smartphones or tablets via Google Play; then start and complete the tutorial in the program, and post results to e-school, or send them via e-mail to the teacher. Unfortunately Nate does not own a smartphone, so the teacher suggests Nate to use the program in the computer class instead.

In the computer class, Nate logs in on a PC, and opens the learning game “Topographics” by double-clicking the program’s icon on the desktop. The program opens and shows options to “start drawing a map”, or to “start the tutorial”. Nate chooses the option for the tutorial, and the screen changes to “the drawing view”. This view contains a drawing canvas, a toolbar on the left of the screen and to the top-right corner of the screen there is a small window showing a flat landscape.



A text “Click here” appears next to the toolbar, with an arrow pointing to a “line” icon in the toolbar. Nate clicks on the icon, and the text changes to “Click & drag to draw a shape”, and an arrow pointing to the canvas. Nate clicks and drags on the canvas and sees a line appearing where the mouse cursor is moving. When he releases the mouse button, he notices the landscape change in the landscape window on the top-right corner: the landscape has raised in the exact shape as Nate drew the line. Next to the landscape window appears a new text “Congratulations! Now you know how to raise the terrain! Click on the terrain window to have a closer look!”

After clicking on the terrain window, the canvas disappears and the “landscape view” is shown in full screen. Nate is introduced how to look and move around in the landscape and also how to switch back to the drawing view. Then the tutorial continues to introduce other tools, such as colors and symbols. After another minute, Nate has created two hills, a lake and some trees which he is eager to start exploring in the landscape view.

Now the tutorial introduces Nate the final task: the canvas zooms out, revealing the grid of the map on the canvas, and ordering Nate to fill all the 9 squares of the grid with any of the tools found in the toolbar.



After finishing the final task, the tutorial shows Nate how to save the work and share it online or by e-mail. Nate sends the work to his teacher, but also chooses to share images of the newly created world on social media, so others can see his creation too.