

# Minecraft and Geodesign

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Ecocraft and geocraft created in cooperation with:

Willemijn Simon van Leeuwen (Geofort)

Sanne Hetting (VU)

Steven Fruijtier (Geodan)

Prof. dr. Henk Scholten (VU, Geodan)

Mark Opmeer (VU)

Maria Andrzejewska (UNEP-GRID Poland)

Brian de Vogel (VU, Geodan)

Among others...

# Minecraft (144 M copies)

## a short introduction



# What is Minecraft?

- Open world or sandbox game
- No goal, no rules, just the creativity of children




















# Building Blocks

















Scale: 1 block:1 meter



# Materials

Icon	Dec	Hex	Block type
	00	00	Air
	01	01	Stone
	02	02	Grass
	03	03	Dirt
	04	04	Cobblestone
	05	05	Wooden Plank
	06	06	Sapling
	07	07	Bedrock
	08	08	Water
	09	09	Stationary water
	10	0A	Lava
	11	0B	Stationary lava
	12	0C	Sand
	13	0D	Gravel
	14	0E	Gold Ore
	15	0F	Iron Ore
	16	10	Coal Ore

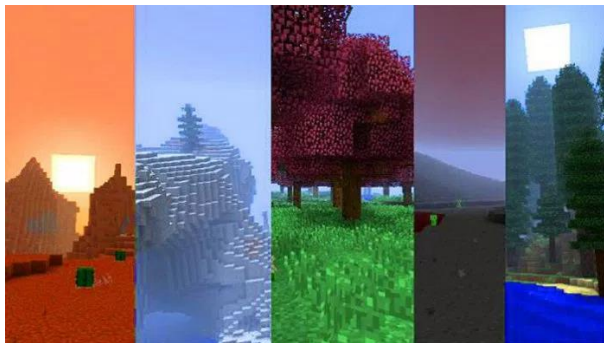
Icon	Dec	Hex	Block type
	17	11	Wood
	18	12	Leaves
	19	13	Sponge
	20	14	Glass
	21	15	Red Cloth
	22	16	Orange Cloth
	23	17	Yellow Cloth
	24	18	Lime Cloth
	25	19	Green Cloth
	26	1A	Aqua green Cloth
	27	1B	Cyan Cloth
	28	1C	Blue Cloth
	29	1D	Purple Cloth
	30	1E	Indigo Cloth
	31	1F	Violet Cloth
	32	20	Magenta Cloth
	33	21	Pink Cloth

Icon	Dec	Hex	Block type
	34	22	Black Cloth
	35	23	Gray Cloth
	36	24	White Cloth
	37	25	Dandelion
	38	26	Rose
	39	27	Brown Mushroom
	40	28	Red Mushroom
	41	29	Gold Block
	42	2A	Iron Block
	43	2B	Double Slab
	44	2C	Slab
	45	2D	Brick Block
	46	2E	TNT
	47	2F	Bookshelf
	48	30	Moss Stone
	49	31	Obsidian

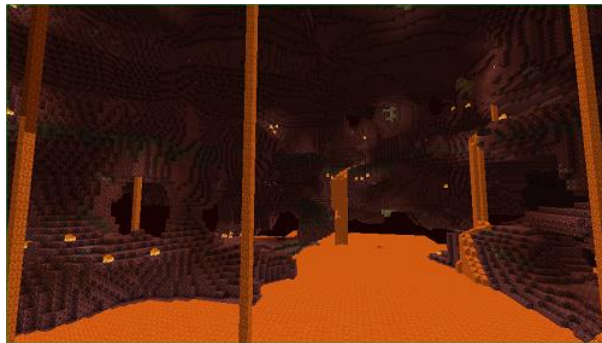
# Worlds

Normal world

Different Biomes



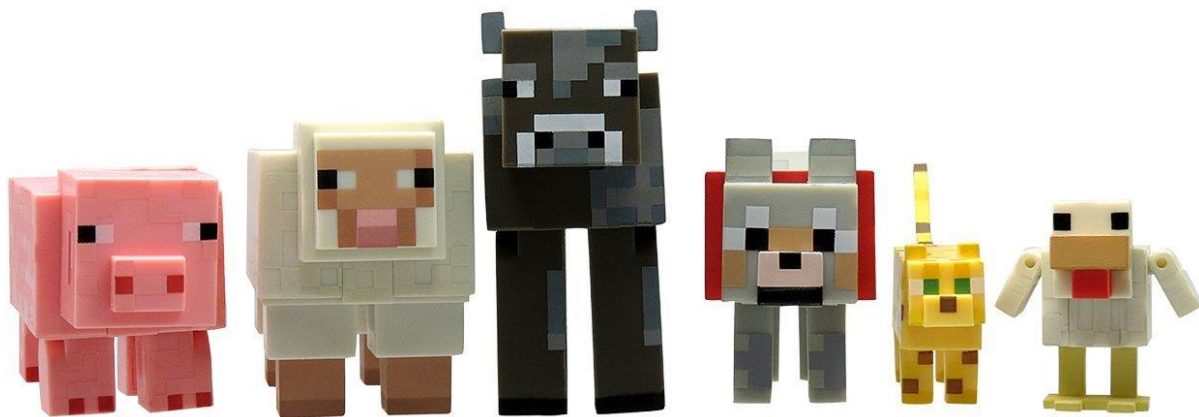
The Nether



The End



# Mobs



# Modes





# Commands

- Type “/” to enter command
- Overview: <https://minecraft.gamepedia.com/Commands>
- Examples (availability depends on rights)
  - /tp <player>: transport to player
  - /tp <x y z>: transport to a specific location (remember: y is height)
  - /say <message>: say something to the entire server
  - /tell <player> <message>: say something to specific player
  - /time set <time>: set time
  - /weather clear: remove rain and thunder
  - /weather rain: make it rain
  - /gamemode 1: set the mode to creative (0=survival)

# Versions of Minecraft (servers)

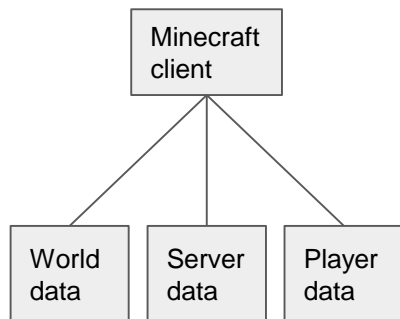
Two code bases:

- Java
  - Original: **Minecraft Vanilla** (stand-alone and server)
  - Educational version: **EduCraft**
  - Modded version: **SpigotMC [\*]** - most played Minecraft server software
- C++
  - Pocket Edition (a.o iPad), Windows 10, XBox One

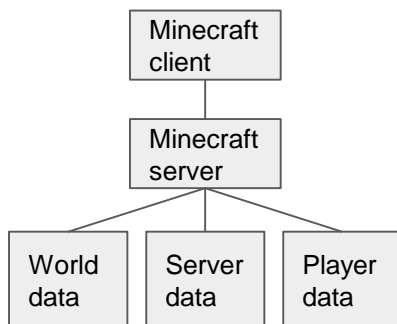
[\*] there are more: <https://www.spigotmc.org/wiki/what-is-spigot-craftbukkit-bukkit-vanilla-forg/>

# Minecraft Java servers

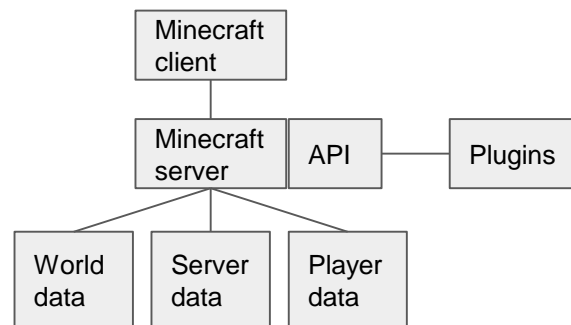
Single player



Multi player



Spigot MC



# Minecraft server examples

- Most played servers
  - Eggwars: [https://www.youtube.com/watch?v=\\_zxtMw4ITOs](https://www.youtube.com/watch?v=_zxtMw4ITOs)
  - Skywars: <https://www.youtube.com/watch?v=k2ZMqgMUgJw>
- Geocraft: Netherlands in Minecraft
  - Geofort: <https://www.youtube.com/watch?v=Bi1s4h12gBc>
- Happy Life: Making kids move



Geocraft



# *Inspiration*

UNHABITAT



**BLOCK BY BLOCK™**  
Reimagine your neighbourhood with Mojang and UN-Habitat



UNDUGU PLAYGROUND



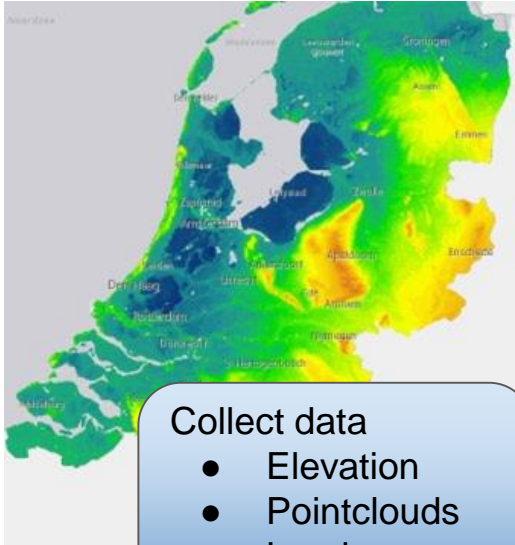
Hummmmmm... we could do it more effectively with geo data!



# Data (World)

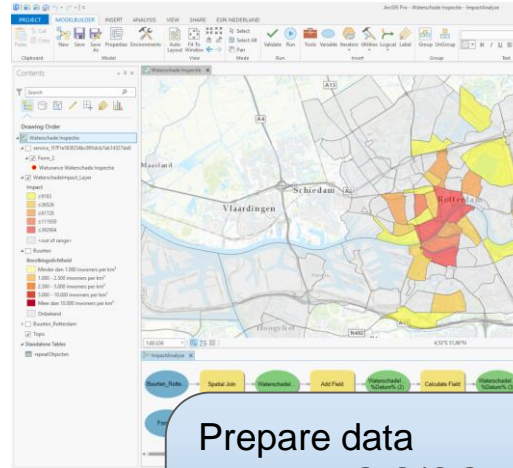
Minecraft structure  
Creation from GIS data

# GIS: Converting the world into Minecraft



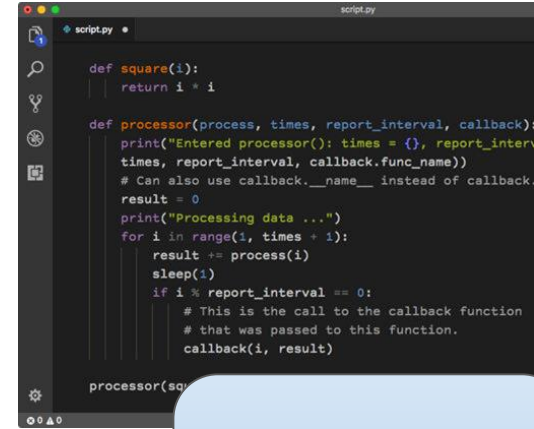
## Collect data

- Elevation
- Pointclouds
- Land use
- Buildings



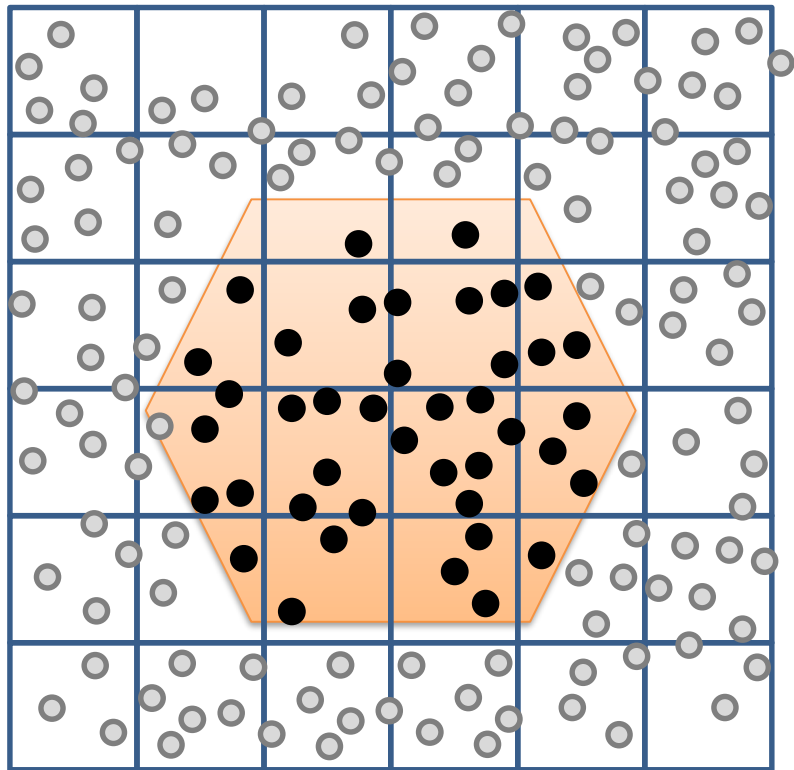
## Prepare data

- ArcGIS/QGIS
- FME
- PostGIS
- Geoserver

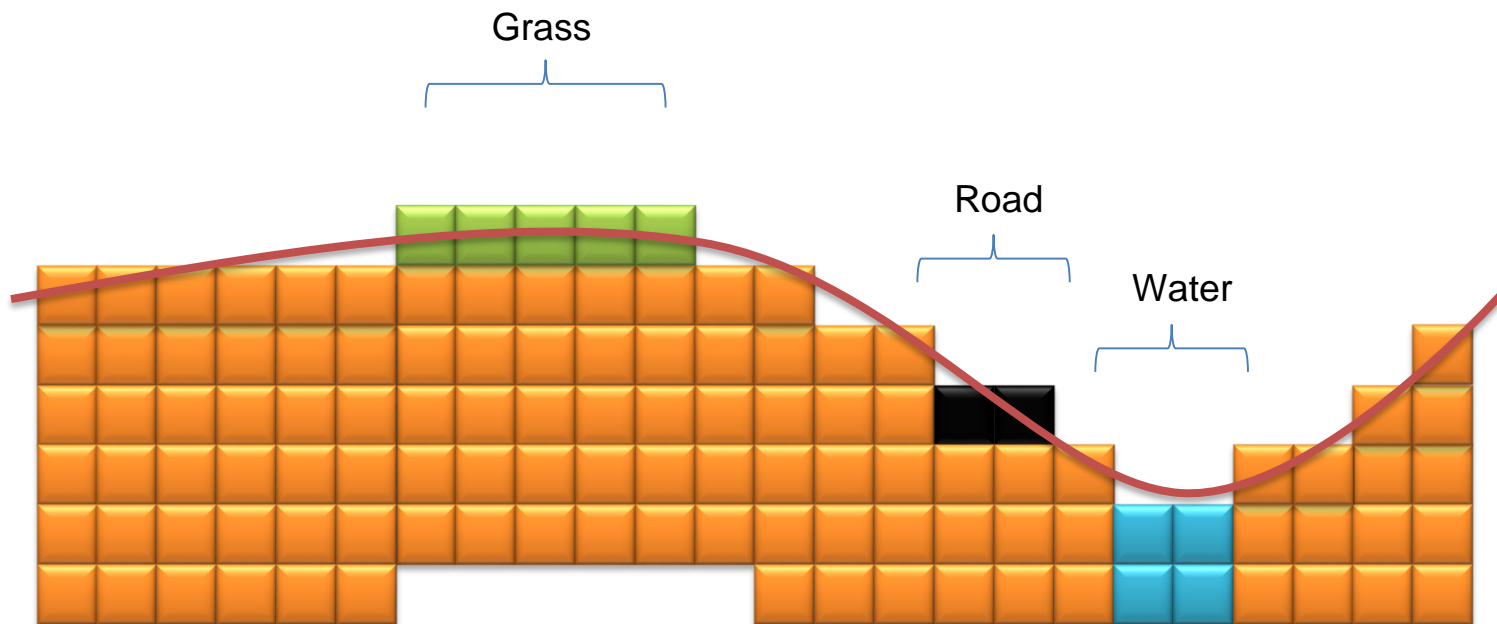


## Convert data

- Python
- pymclevel

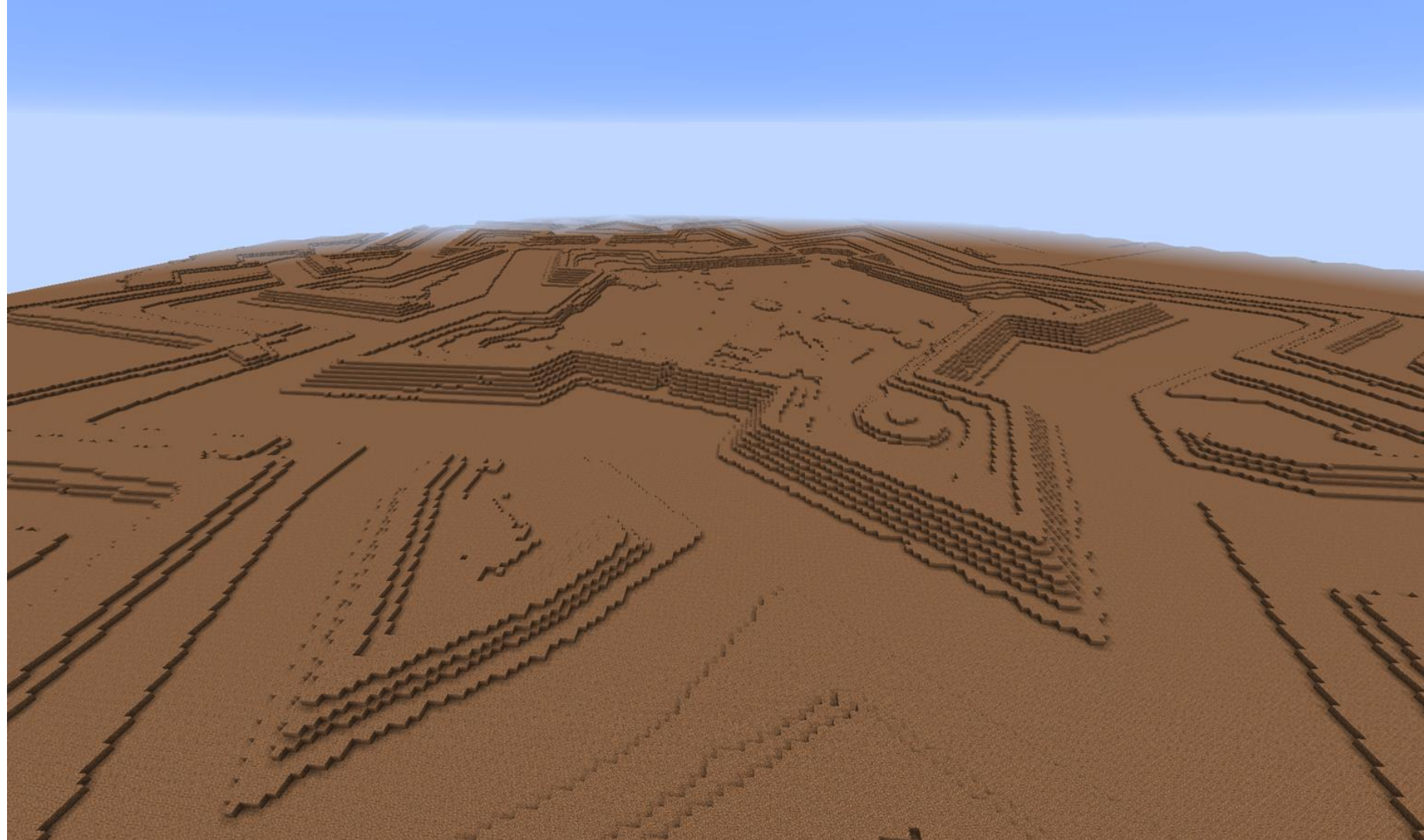






















For those who are interested!

Email me for a hands on GIS-2-Minecraft tutorial.

Converting GIS data into a minecraft world through ArcMap and Python

- Building footprints (BAG)
- Land use (Top10NL)
- Elevation (AHN3)

# Madrid

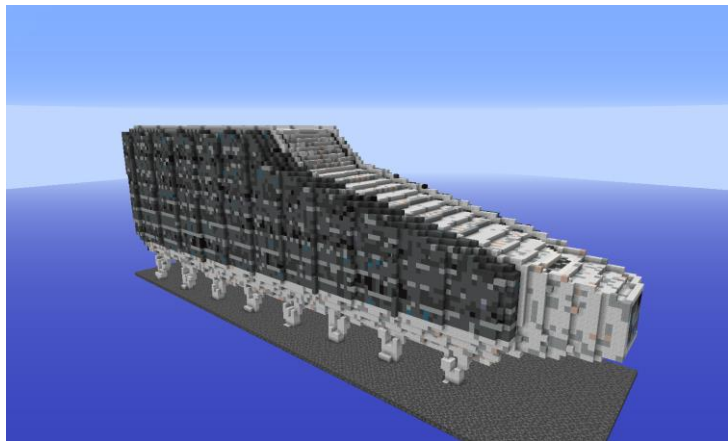


# Converting data to minecraft

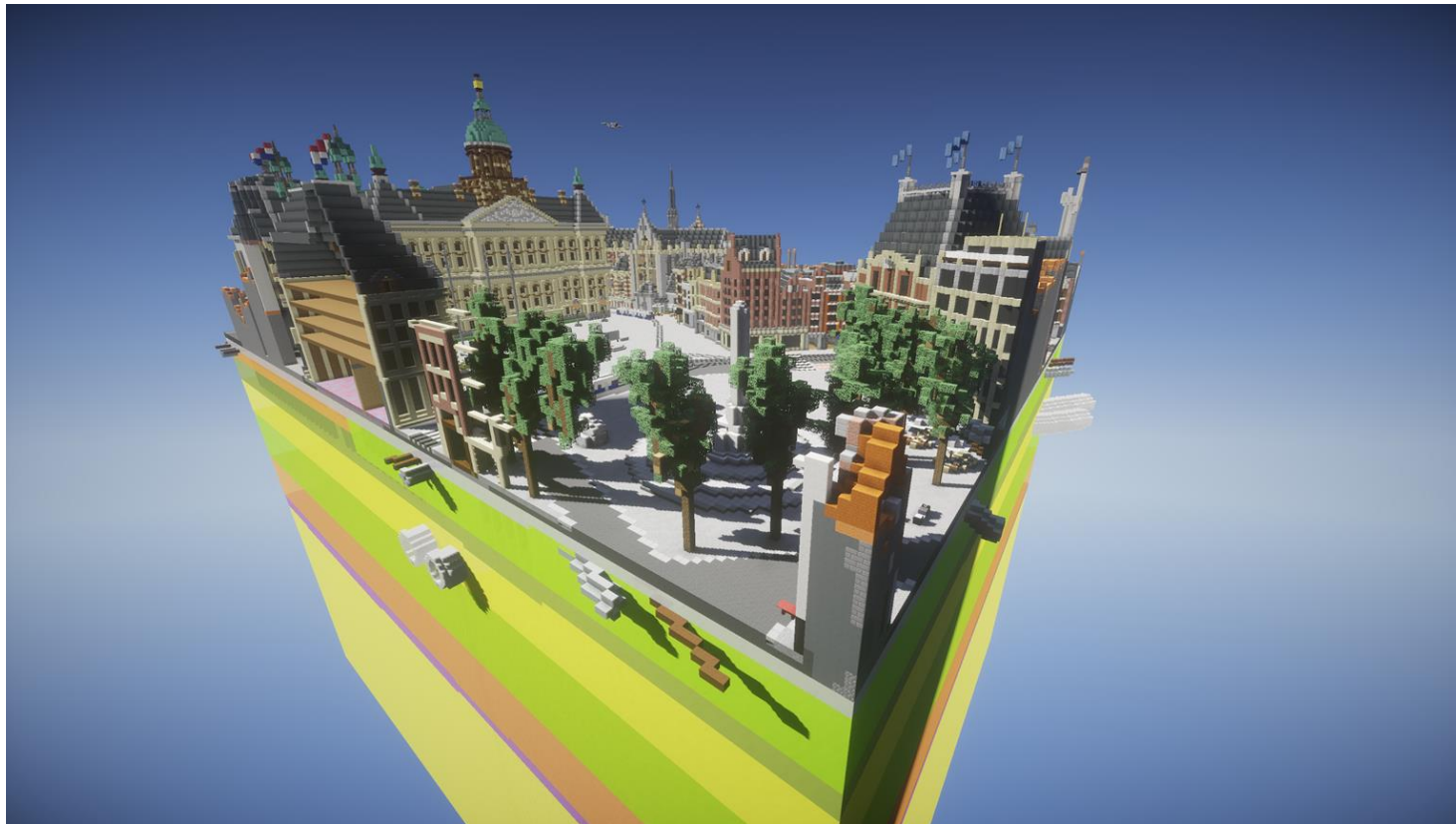
- GIS
  - Using GIS data to create minecraft worlds
- KMZ
  - Adding 3D georeferenced collada models
- Subsurface
  - Using coloured glass to 'see' the subsurface
- Matching colours to minecraft material



# KMZ/Collada

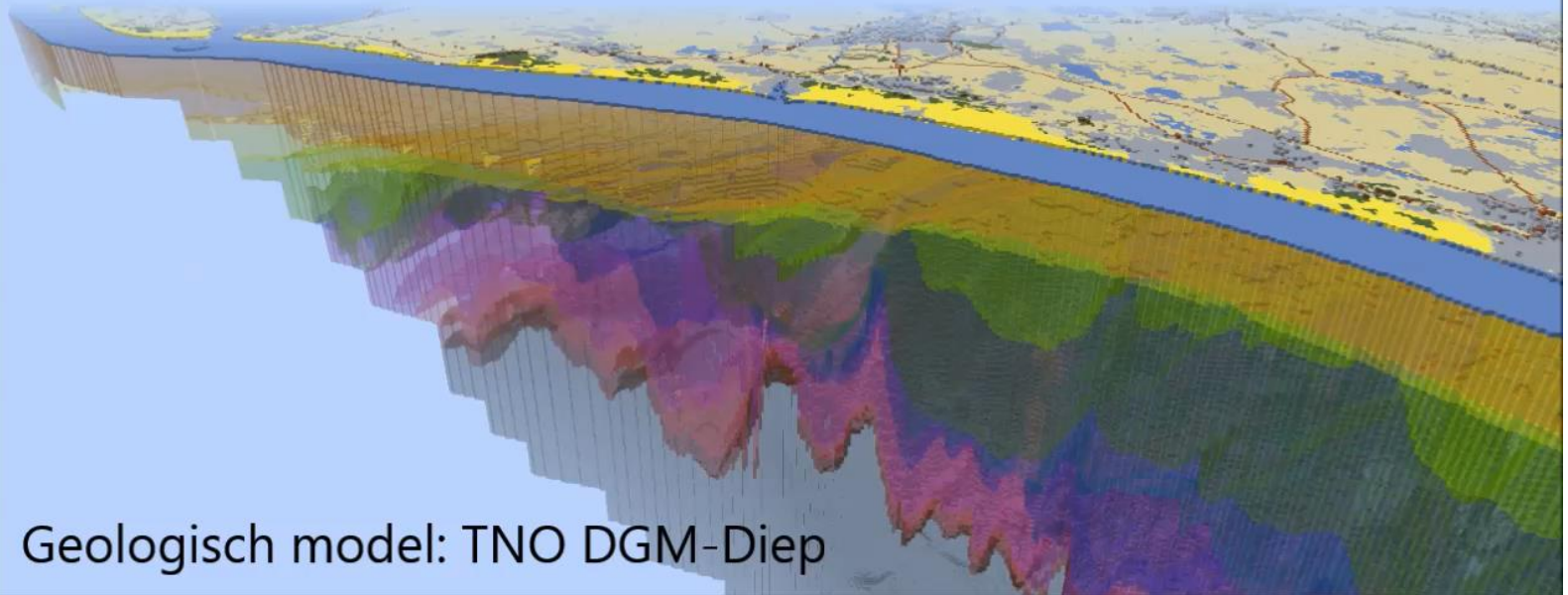


# Subsurface





## West-Nederlands Bekken



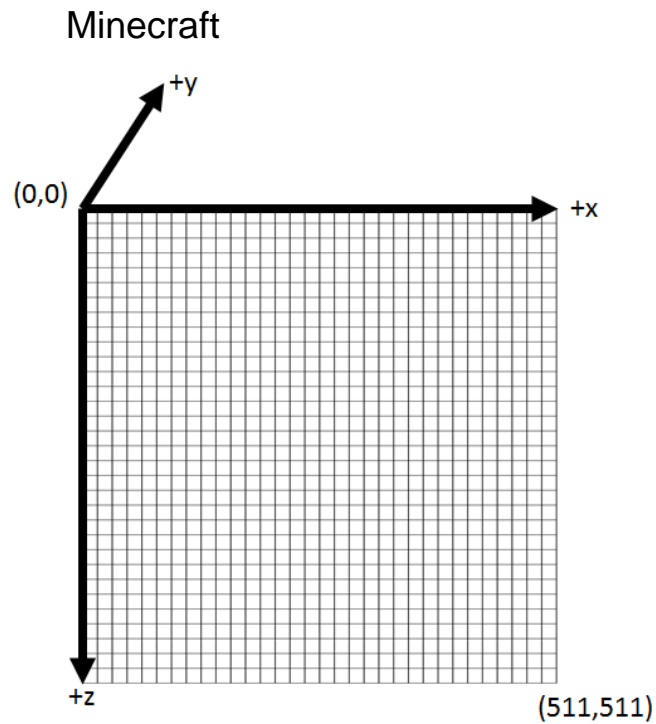
Geologisch model: TNO DGM-Diep

Colour matching

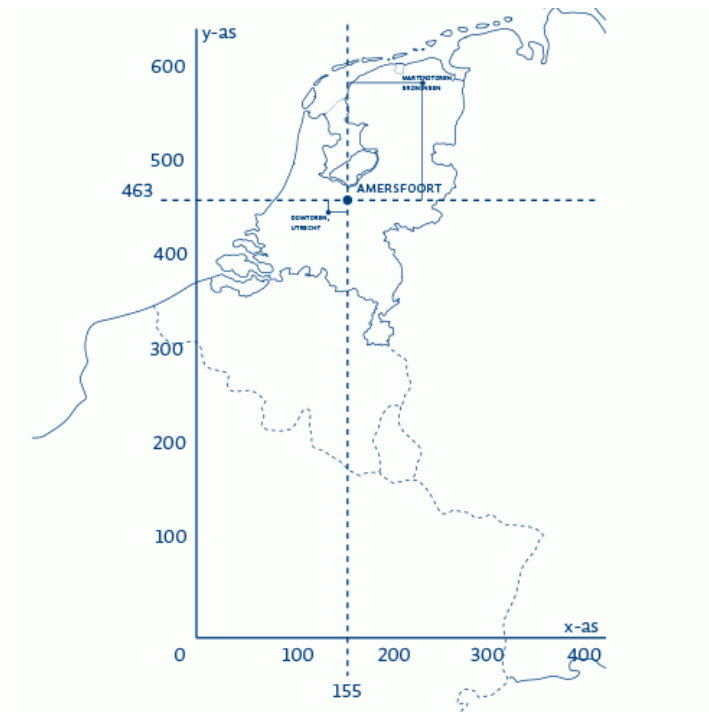


Scaling up: Netherlands in Minecraft

# Coordinate system

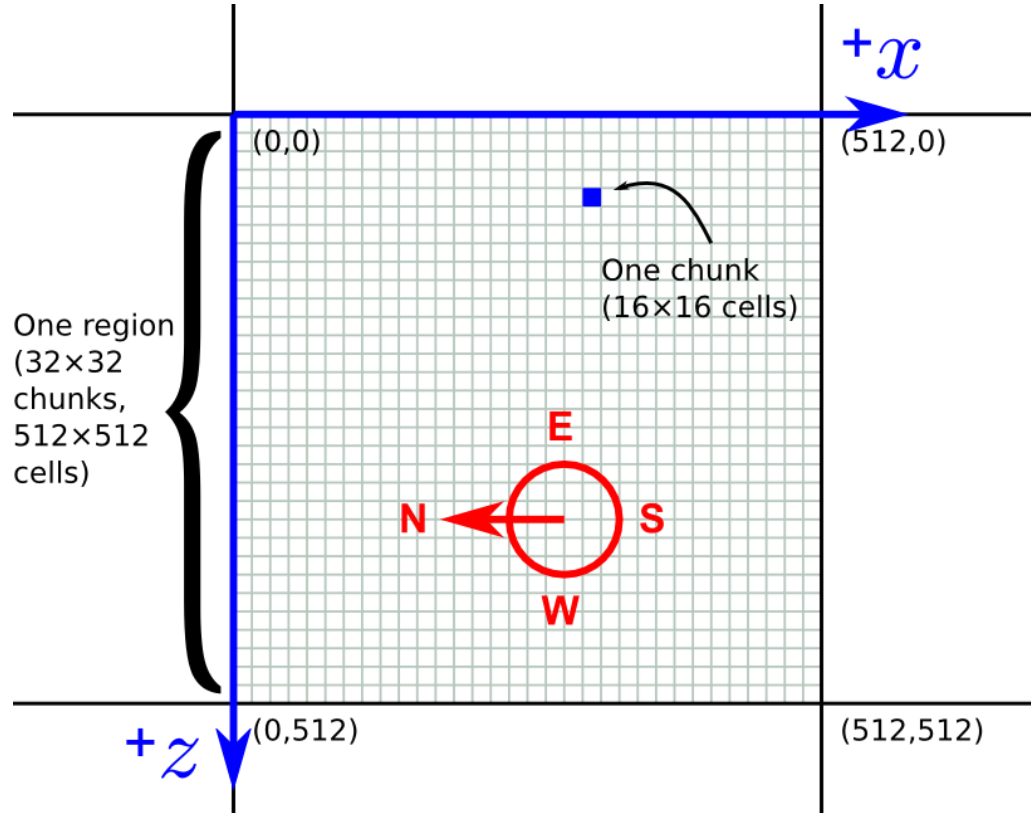


Dutch coordinate system (rijksdriehoekstelsel)





# Minecraft cells (blocks), chunks and regions



# Minecraft: Region files

	<u>-512</u>	<u>-1</u>	<u>0</u>	<u>511</u>	<u>512</u>	<u>1023</u>
-512	r.-1.-1	r.0.-1	r.1.-1			
-1						
0						
511	r.-1.0	r.0.0	r.1.0			
512						
1023						

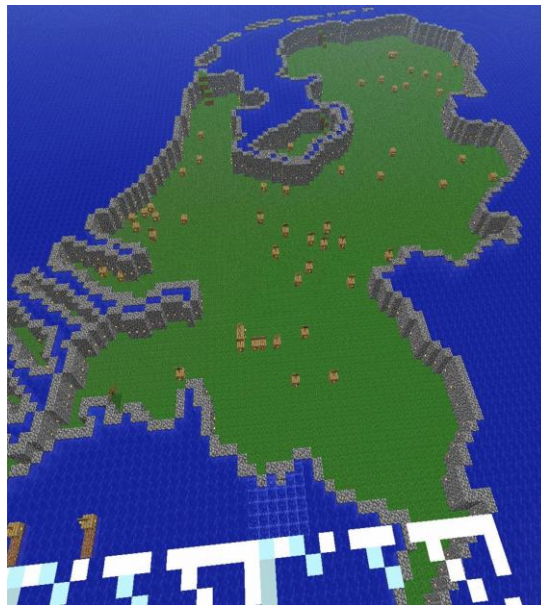
file: r.[regionX].[regionZ].mca



# NL in Minecraft

## 200,000 meters

300,000 meters



*Some numbers:*

**150 million blocks**

**286 502 MC Tiles = 1,7 Terabytes**

143 672 empty

142 830 with data

**12.18 sec** for 1 MC tile on one core (high performance)

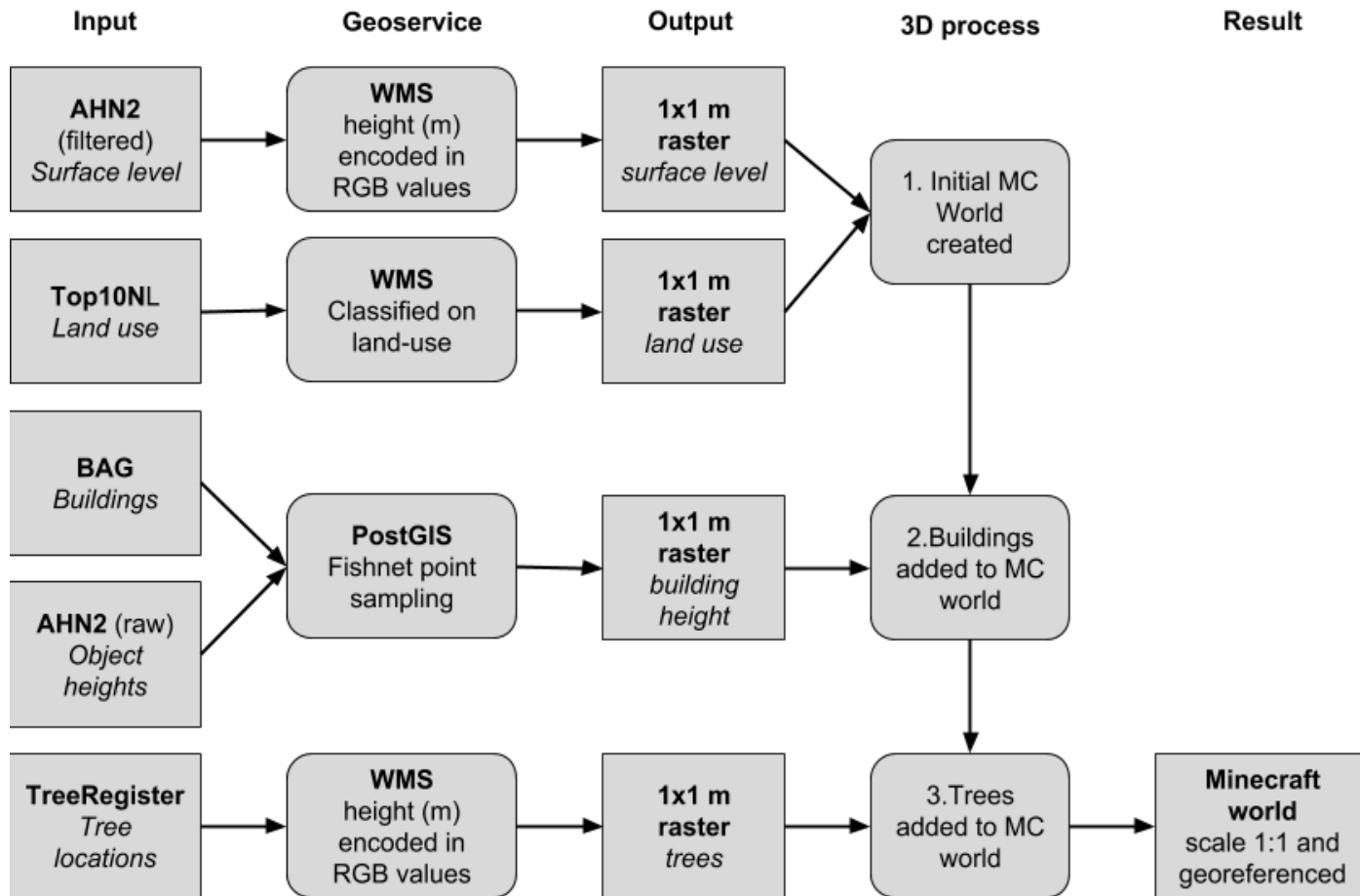
**1 year and 11 months** using one core.

Using **240 cores** (Azure Batch) = **2 days and 21 hours**

**The whole of the Netherlands available in MC!**



# Process



# Optimilisation: MapProxy

minecraft:

tile\_size: [512, 512]

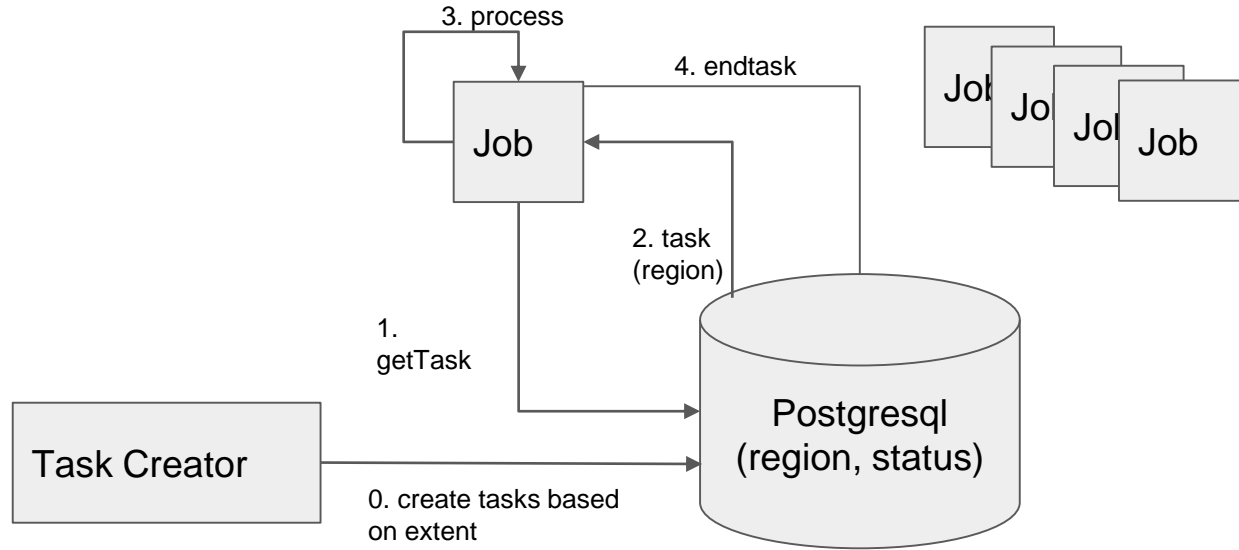
srs: 'EPSG:28992'

bbox: [0, 299520, 280062, 620032]

bbox\_srs: 'EPSG:28992'

res: [1,2]

# Optimilisation: Tasking using Postgresql



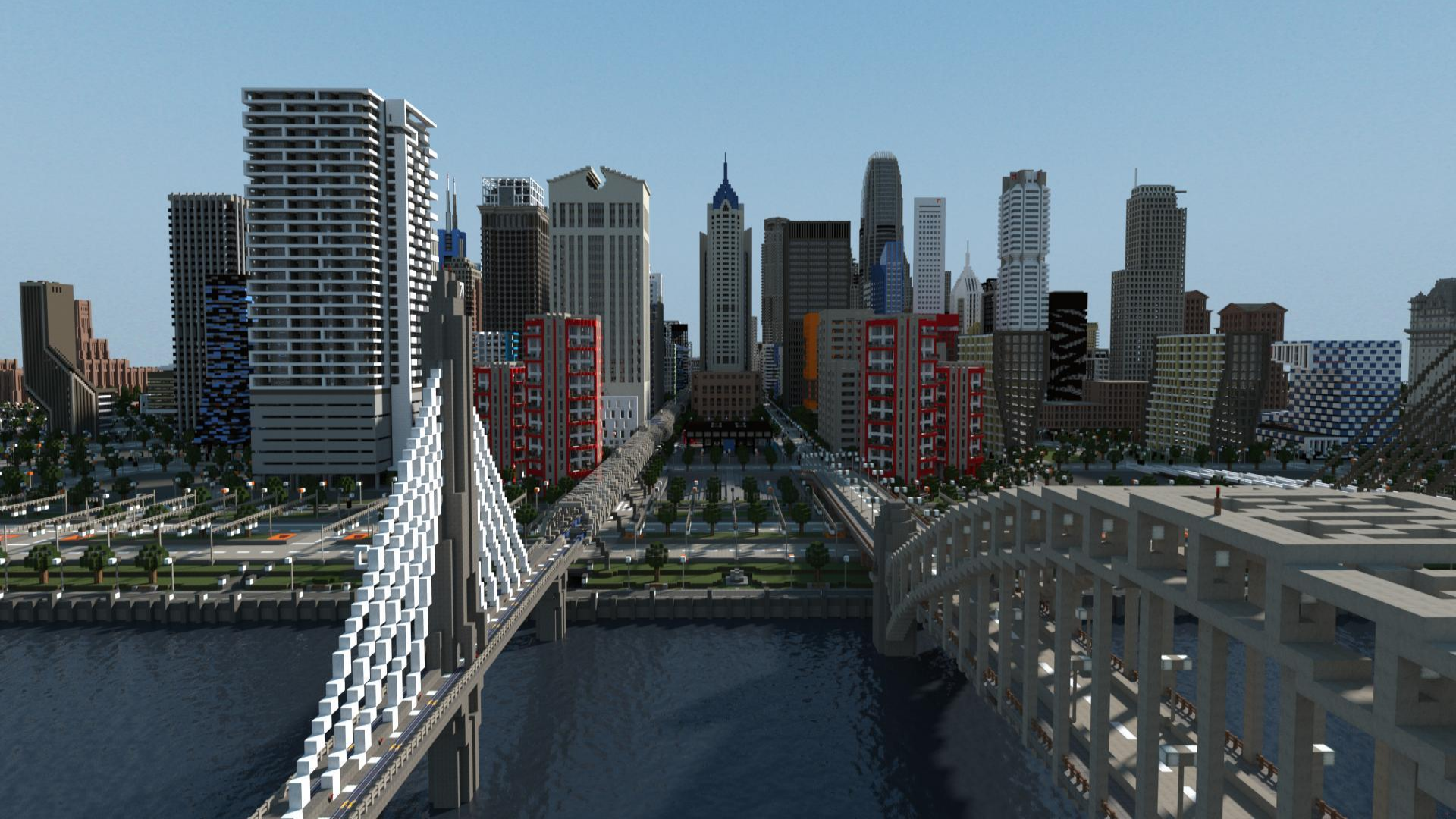








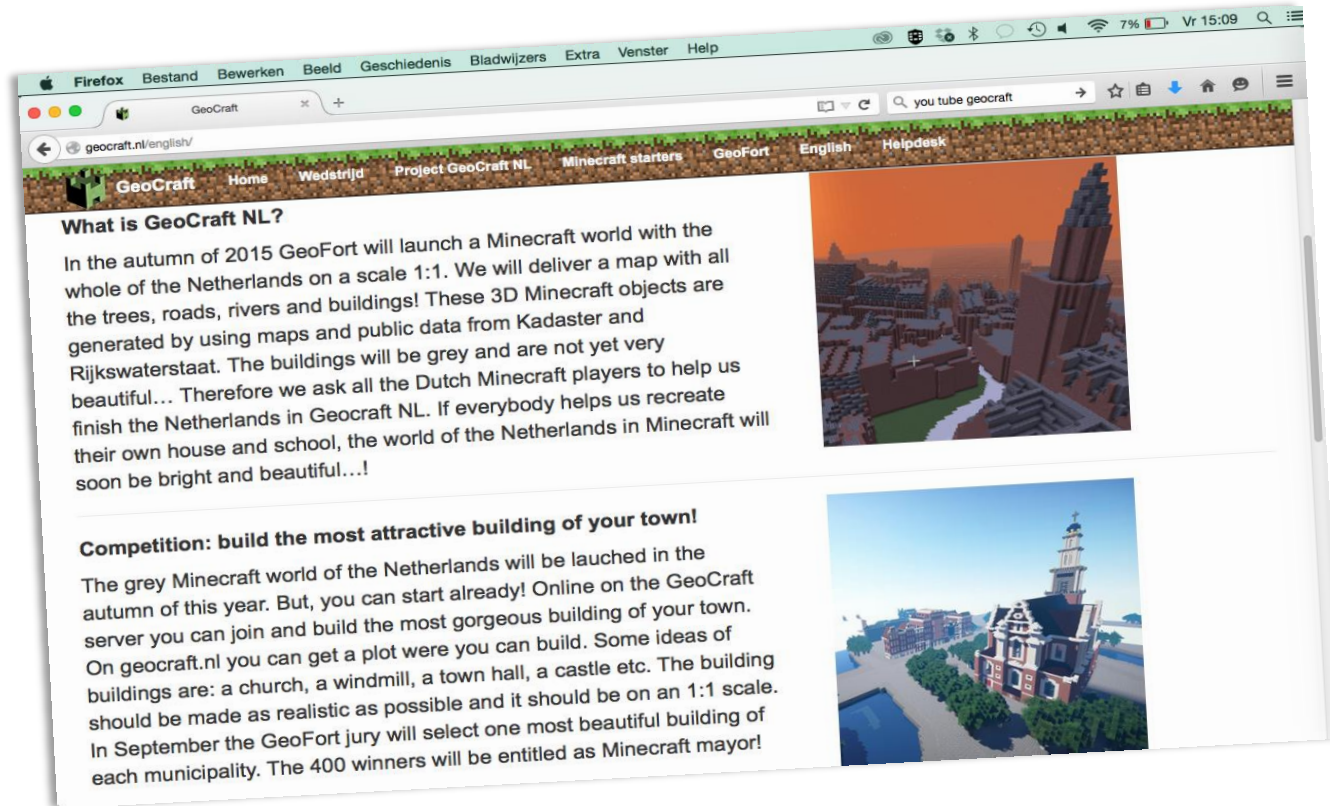




*www.GeoCraft.nl*

since

*3 October 2015*





*Management:*

## **Minecraft King at the GeoFort**

**12 Province Commissaries**



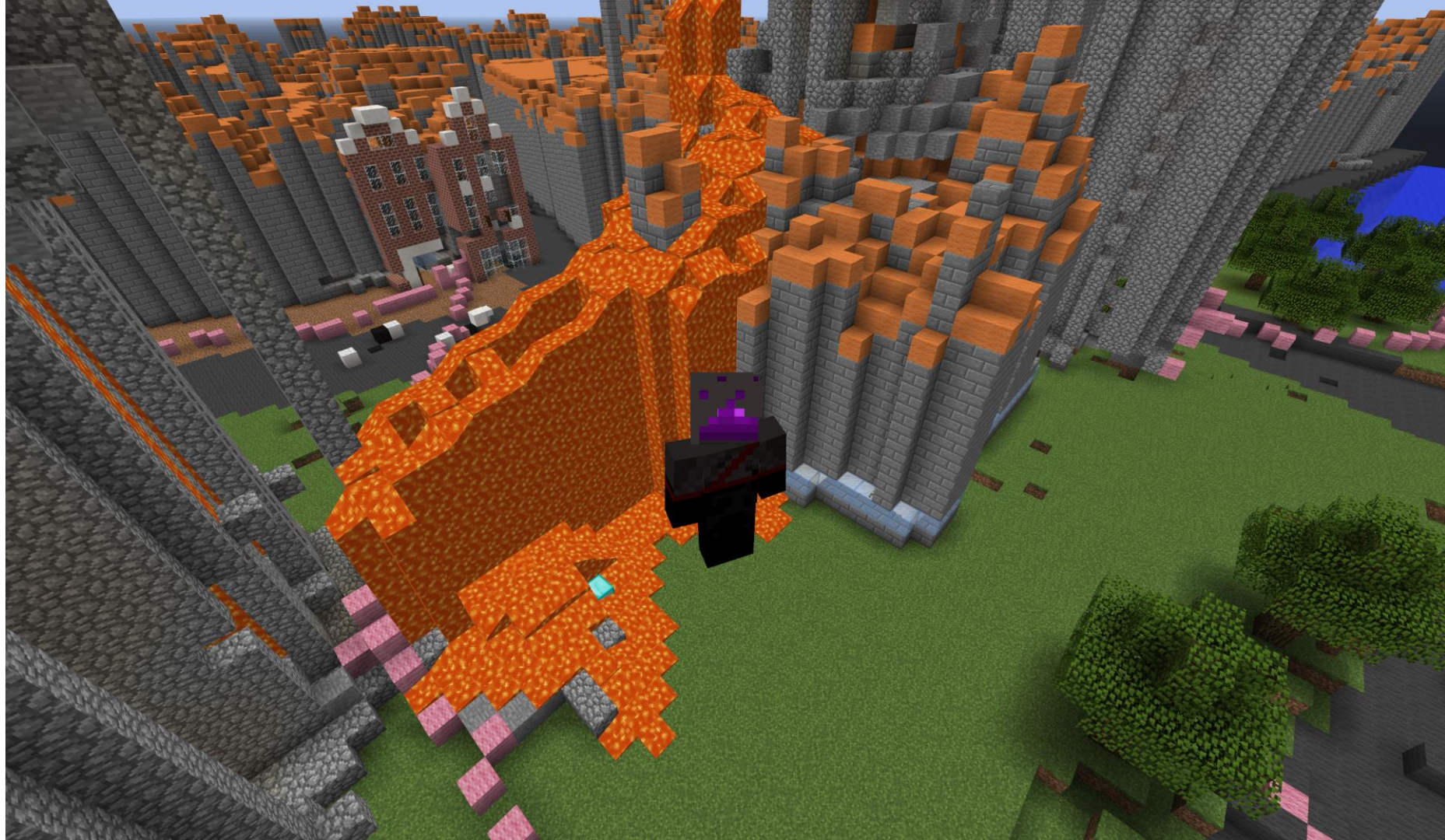
**400 City Mayors**





***But...***

















# Geocraft: second version - Virtual Community

- Virtual king, mayors, civilians etc
- Virtual Cadastral Agency
- Virtual Jail
- Virtual Currency



/jail player1

All implemented using plugins for SpigotMC

**why**

**UBUAG COLLEGE 2**

**Participatory Spatial planning**



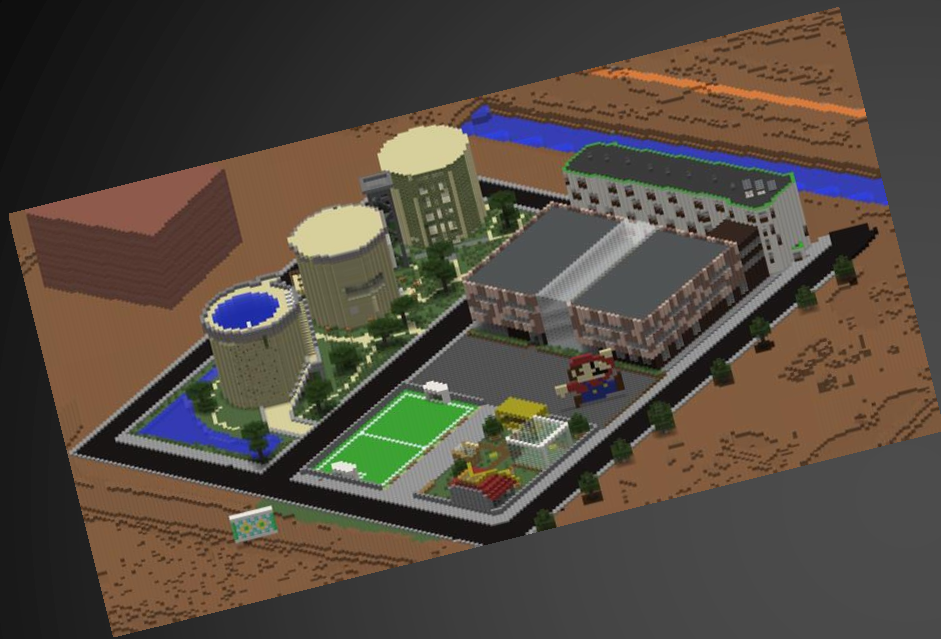
**LEBURG COLLEGE 2**

# **The dreams translated**

Ideas? How building went? Collaboration?



**Presenting the professional design  
back**



# THE design

Via a planning professional













# LEBURG COLLEGE 2

Jouw naam: \_\_\_\_\_

## 1. Sta je achter het ...

Bouwwerk van de	Ja, zeker!	Ja	Zo, zo	Niet echt	Absoluut niet
1 <sup>te</sup> groep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2 <sup>de</sup> groep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3 <sup>de</sup> groep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4 <sup>de</sup> groep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## 2. Heb je Minecraft goed kunnen gebruiken om je idee vorm te geven?

Ja, zeker!	Ja	Zo, zo	Niet echt	Absoluut niet
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## 3. Kon je Minecraft eenvoudig gebruiken?

Ja, zeker!	Ja	Zo, zo	Niet echt	Absoluut niet
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## 4. Wat vond je leuk aan het bouwen?

Wat vond je leuk aan het bouwen?	... en niet leuk? Noem 1-3 dingen.
1	1
2	2
3	3

## 5. Vind je het leuk om mee te doen als het een vervolg krijgt? b.v. andere ideeën of ideeën van andere mensen bouwen

☐ Ja  
☐ Nee

## 6. Andere opmerking:

In the end...

# Social research!

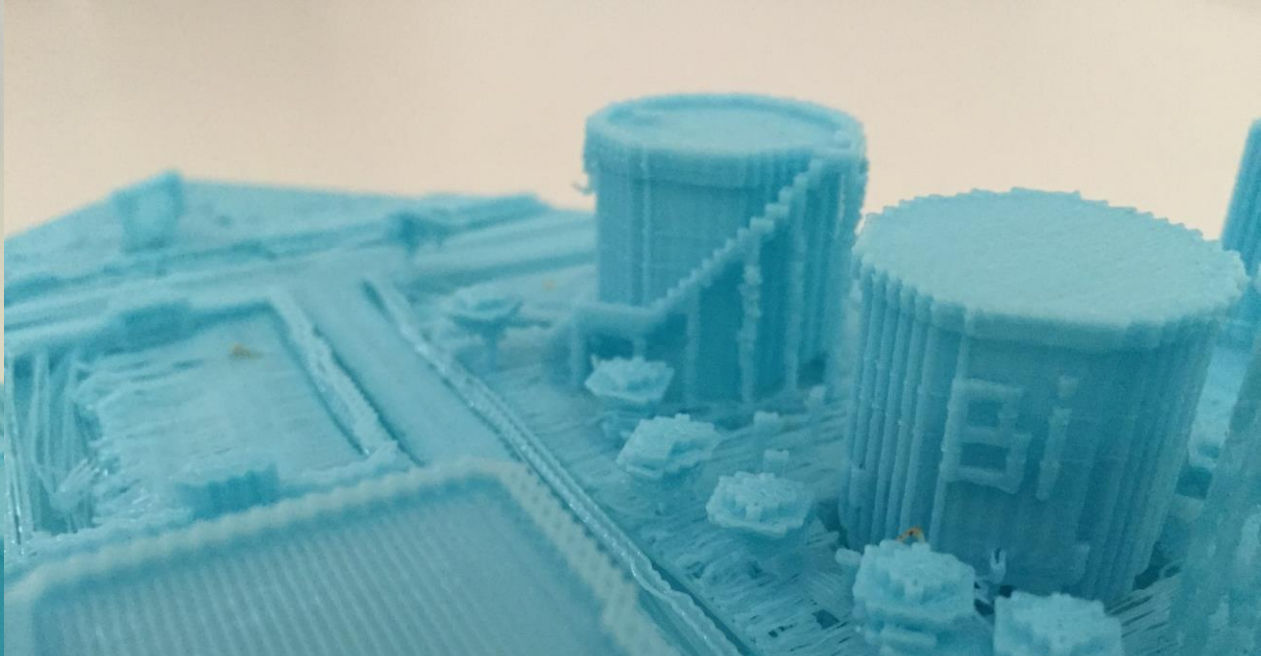
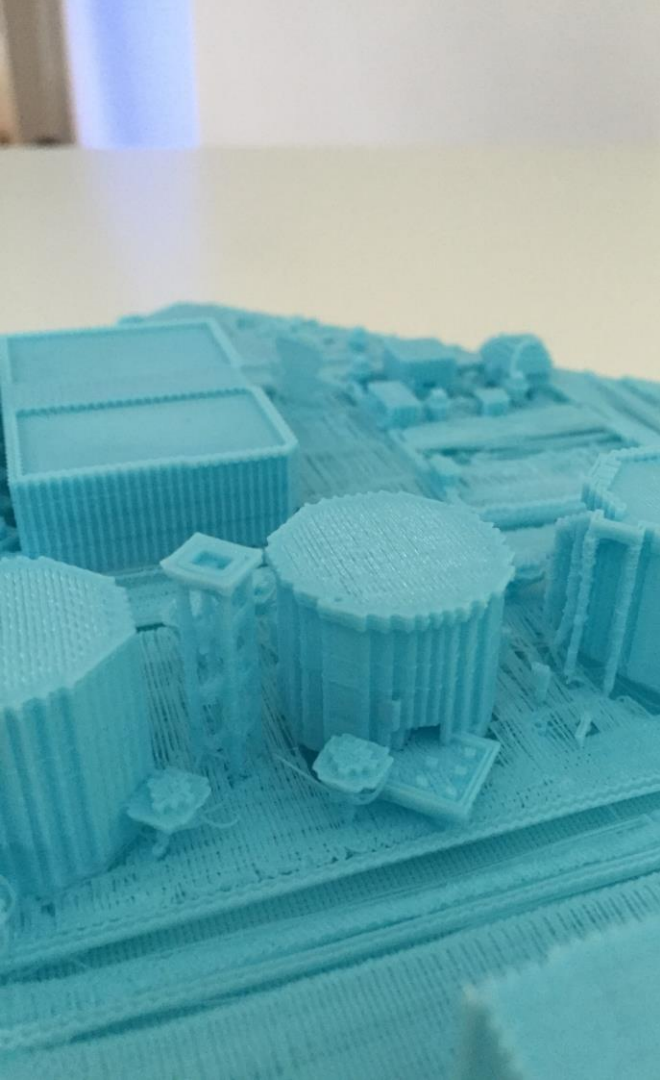
7. Welke ideeën vind je het meest leuk om te bouwen? (Noem 1-3 dingen.)

Ja, zeker!	Ja	Zo, zo	Niet echt	Absoluut niet
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## 8. Teken een ☐ waar je voor bent of een ☒ waar je tegen bent.







# Next steps

Meeting the neighbors  
Present to the  
Municipality

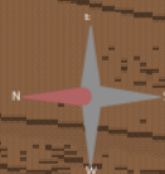




Location:

---

06:16

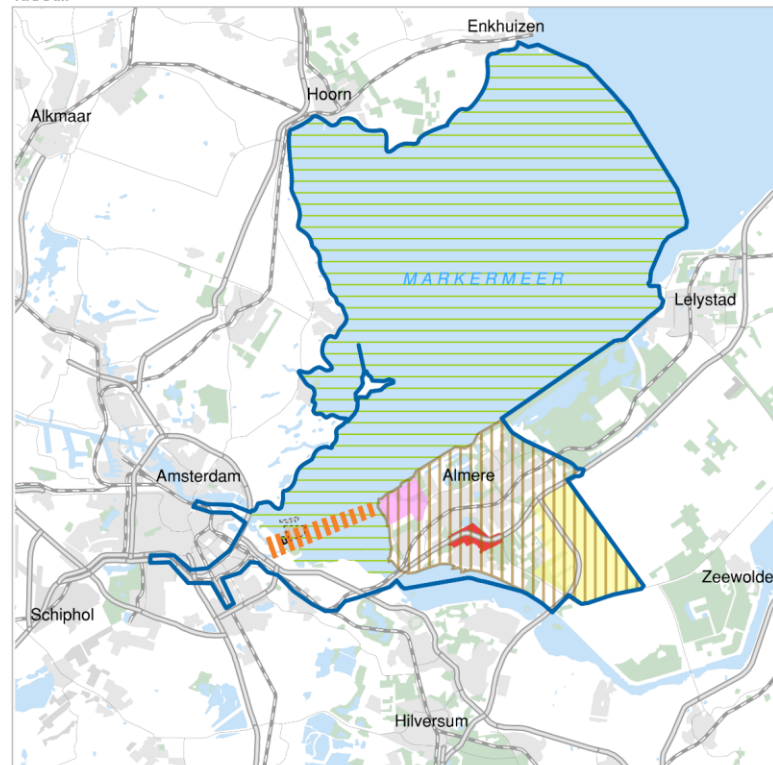


<http://www.buurtcraft.nl/ijburg/>



Education projects

**TITEL: TOEKOMSTPERSPECTIEF "AMSTERDAM - ALMERE - MARKERMEER"**  
**RRAAM**



- Plangebied RRAAM
- Almere Pampus
- Almere Centrum Weerwater
- Almere Oostenwold
- Sociaal-economische agenda Almere
- Tweede fase Amsterdam IJburg: Centrumeiland
- Tweede fase Amsterdam IJburg: overige eilanden

- IJmeervoorverbinding
- Toekomstbestendig Ecologisch Systeem (TBES)











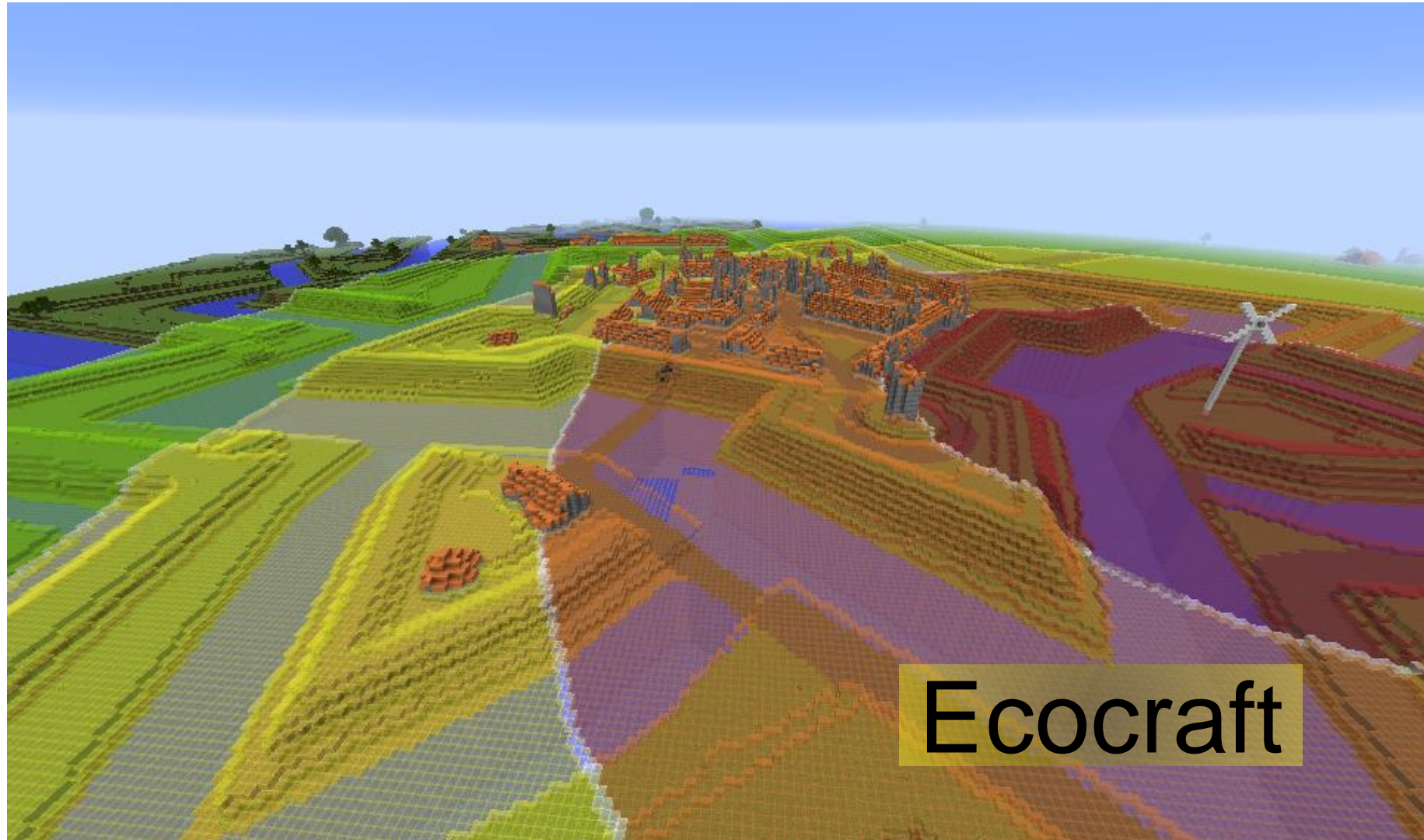












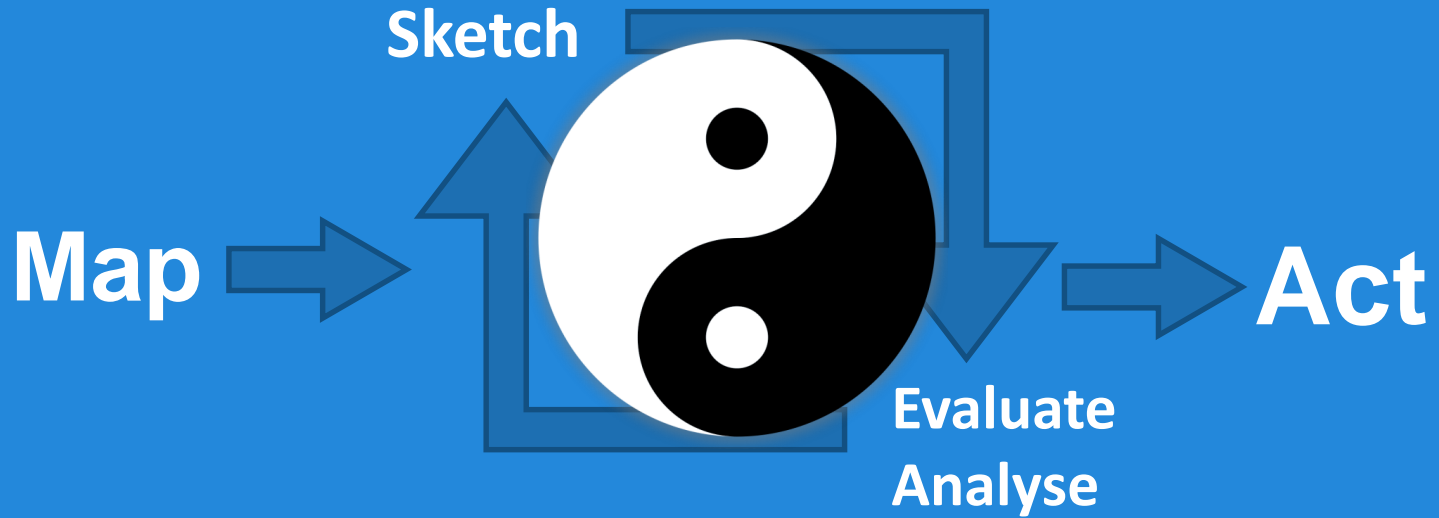
Ecocraft

**Geodesign** is an **iterative** and  
**collaborative** design and planning  
method whereby an emerging design is influenced  
by **(scientific) knowledge**  
derived from  
**geospatial technologies.**

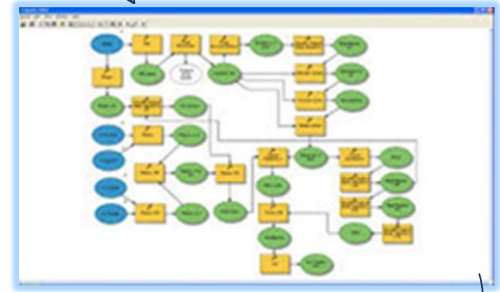
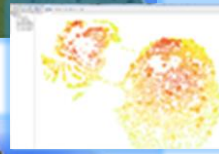
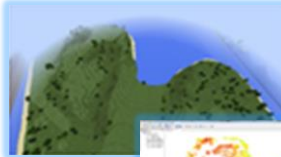
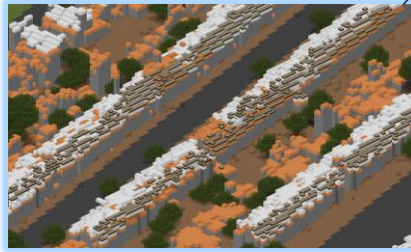
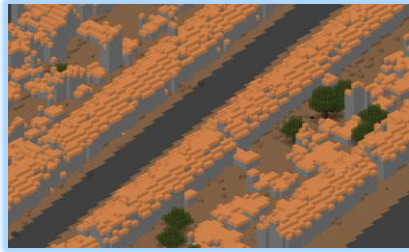
*(Lee, Dias & Scholten, 2014)*



*Yin - Yang*



# Game design & scoring

A screenshot of an Excel spreadsheet showing data.

Wordpress.com Example Spreadsheet	
Some Numbers	More Numbers
100	100
200	300

A screenshot of an Excel spreadsheet showing data.

1	2	3	4	5	6	7	8	9	10	11	12
1	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
2	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
3	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
4	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
5	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
6	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
7	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
8	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
9	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
10	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
11	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
12	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
13	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
14	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
15	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
16	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
17	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
18	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
19	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
20	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
21	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
22	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
23	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
24	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
25	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
26	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
27	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th

## Three technologies

- Solar panels
- Thermal insulation
- Urban wind turbines

# Model parameters

- Energy produced & saved
  - kWh and m3
  - Combined in GJ
- CO<sub>2</sub> emissions avoided
- Investment costs
- $Score = \left( \frac{E}{x} + \frac{EMIS}{y} + \frac{I}{z} \right) \times 1.000.000$



# Geocraft vs. Ecocraft



Environmental education  
in a real space, created  
within the Minecraft  
environment

[video](#)

# Plugins

- List: <https://www.spigotmc.org/resources/>  
~30000 plugins!
- Most used
  - WorldEdit: in-game map editor
  - PermissionEx: permission manager
  - WorldGuard: protecting minecraft worlds (logging and storing changes)
- Developed by Geodan
  - Geocoder: /gc <<address>>
  - Reverse Geocoder: /waarbenik (==WhereAmI)
  - Wind turbine builder
  - Solar Panel
  - Virtual Henk

# Plugins

- Building SpigotMC: <https://www.spigotmc.org/wiki/spigot-installation/>  
Due to DMCA no pre-compiled version
- Building a plug-in: <https://www.spigotmc.org/wiki/how-to-learn-the-spigot-api/>
- Developing: <https://www.spigotmc.org/wiki/spigot-plugin-development/>

# Plugin development

file: MyFirstPlugin.java

```
package eu.ecocraft.plugins;
import org.bukkit.plugin.java.JavaPlugin;

public class MyFirstPlugin extends JavaPlugin {
    // Fired when plugin is first enabled
    @Override
    public void onEnable() {
    }
    // Fired when plugin is disabled
    @Override
    public void onDisable() {
    }
}
```

file: config.yml: Code (YAML):

```
name: SpigotBlankPlugin
main: eu.ecocraft.plugins.MyFirstPlugin
version: 1.0

commands:
```



# API

- Javadoc: <https://hub.spigotmc.org/javadocs/spigot/overview-summary.html>
- org.bukkit.events: Event API
  - when something happens, e.g. a player joins, a block is placed, a block is destroyed, etc
  - e.g. org.bukkit.event.block.BlockPlaceEvent called when a player places a block
- org.bukkit.world: to manipulate the world
  - e.g. getBlockAt (x,y,z) or getBlockAt(x,y,z).setType();
- org.bukkit.entity: access to non-voxel objects like players and monsters.
  - e.g. teleport (x,y,z): teleport the player or monster to a specific location

Some extra's

# Minecraft on the Hololens (and in Unity)



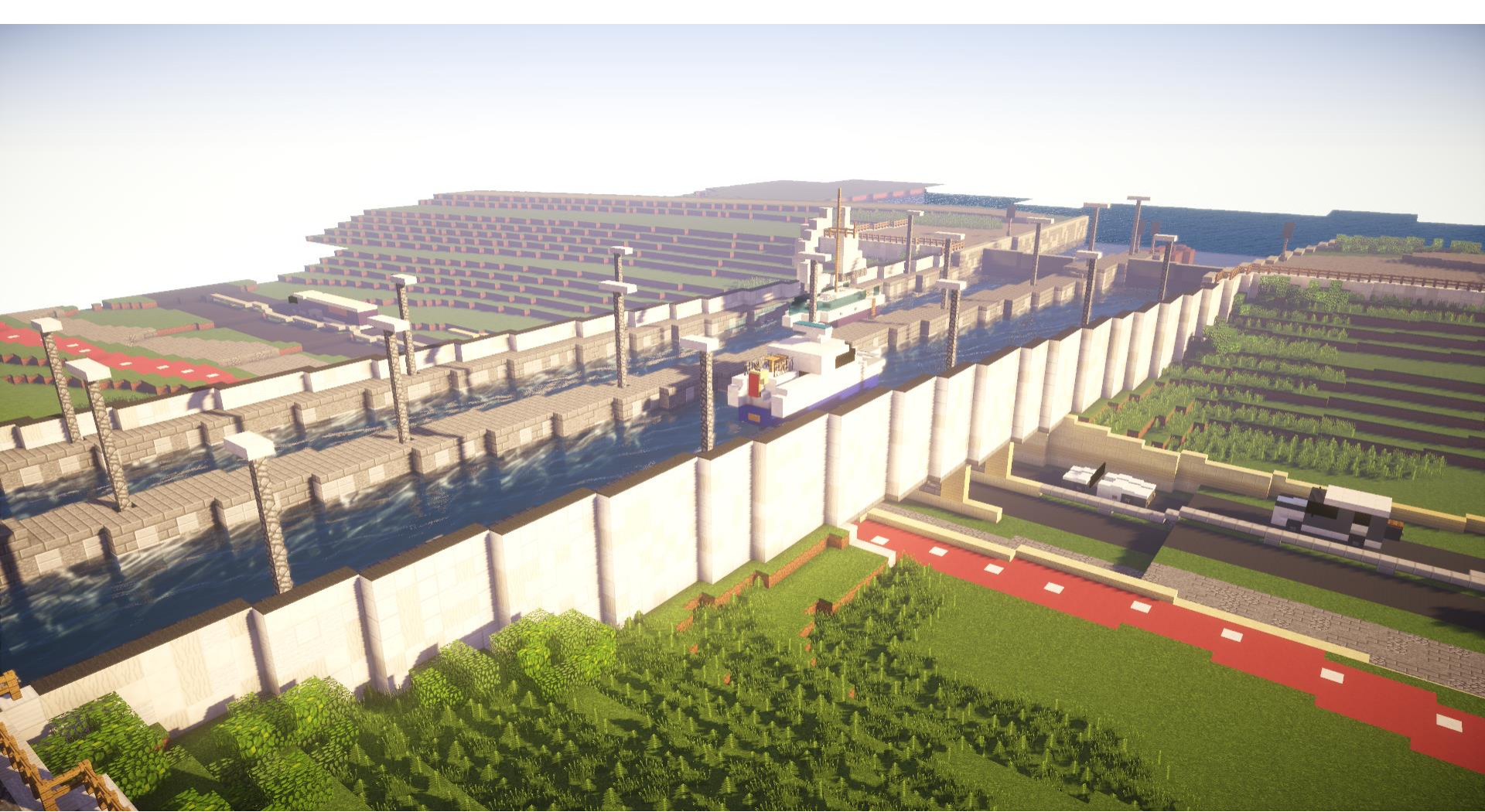
[video](#)

# Minecraft & touchtable











# UN Environment supports Ecocraft

- 23 June 2018 a MoU was signed between the UN Environment and EduGIS Foundation



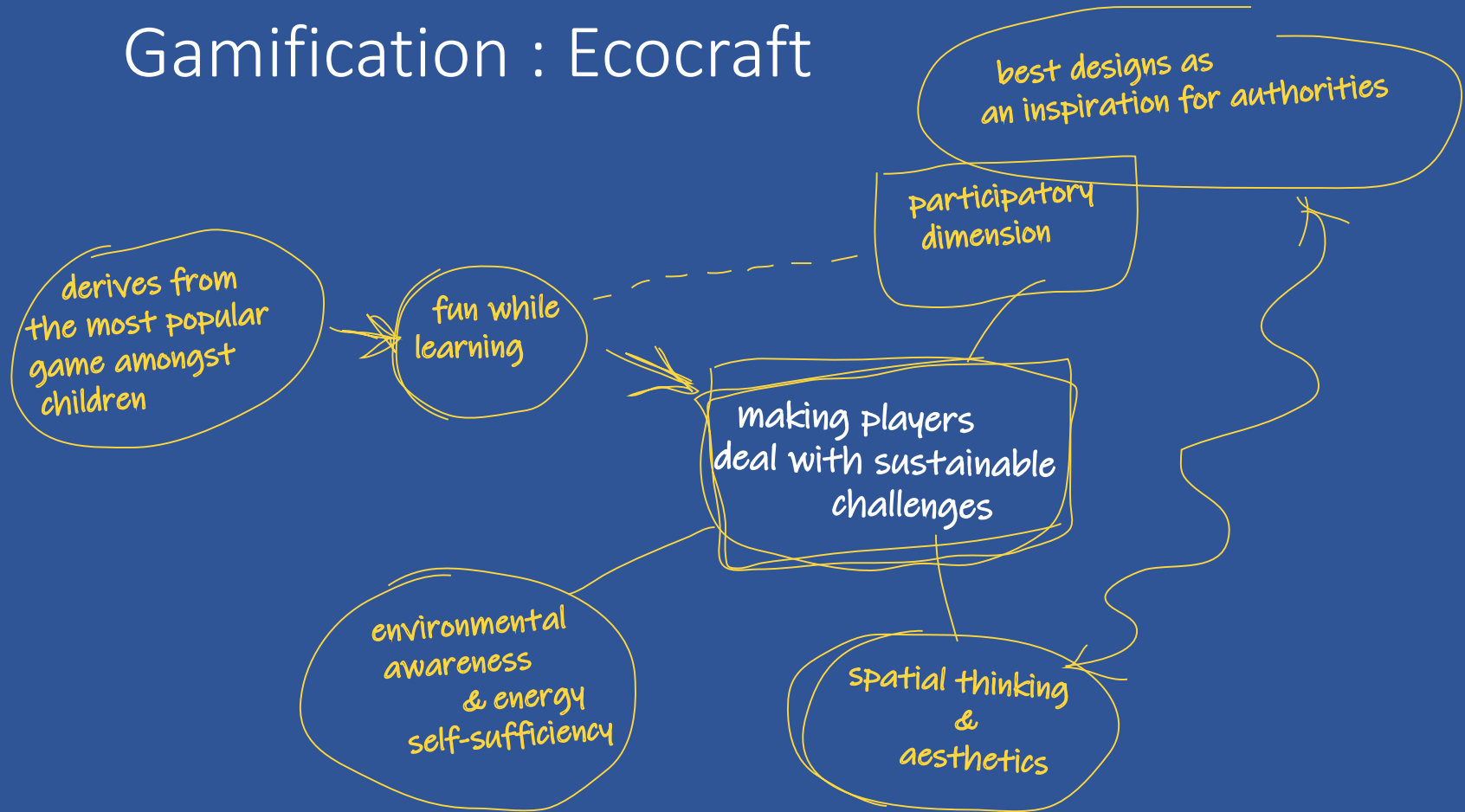
UN Photo/Ariel Alexovich

# Ecocraft – data collection





# Gamification : Ecocraft



# **The whole of Netherlands in Minecraft:**

- Education
- Spatial thinking
- Spatial planning workshops

## *Discussion points*

- Why are 70 million children (around the world) playing Minecraft?
- How can we leverage their motivation and creativity?
- Is this the new GIS for the new Generation?
- A new way of Teaching GIS and Spatial Thinking?
- The role of Gamification in Geodesign/spatial planning?

***Different tools***

**for**

***different phases***

**and**

***different audiences!***





Thank you!