Value-based redesign in gamified learning environments

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VALUES-BASED REDESIGN IN GAMIFIED LEARNING ENVIRONMENTS

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ABSTRACT

Architectural redesign risks damaging or destroying built heritage, especially when designers are unaware of its cultural significance. This needs to be prevented, as built heritage is a human right, as coined by the 2005 Faro Convention. As a result, architects are now encouraged to conduct values-based redesigns with a broader range of stakeholders in order to uncover the cultural relevance of built heritage and co-create their redesigns. This shift in perspective, from one that was formerly expert-based and individualistic, aims to better preserve built heritage and its cultural relevance. Students, the architects of tomorrow, must acquire the knowledge, skills, and attitude to master this shift in perspective. This chapter reports on the lessons learned when teaching values-based redesign in gamified learning environments (GLEs) in two courses offered to architecture students by the Heritage and Architecture Section of the TUDelft, in the Netherlands. GLEs were chosen because of their known efficacy in enhancing stakeholder involvement and contributing to decision-making processes in other contexts. Results revealed that even if students are more aware of heritage value, their redesign decisions are more often guided by their personal values, rather than collective values (i.e. cultural significance). Values-based design and co-creation are not relevant for the redesign of built heritage only. The lessons learned in this research can help develop learning objectives across bachelor and master programs so that students learn to engage with different stakeholders in different contexts. Elsewhere, this new approach is being applied in practice, often without training. In this situation, training new architects on the use of GLEs as engagement tools contributes to their professional development, fostering a culture of greater participation and co-creation in urban planning, architecture and built heritage.

GAMIFIED LEARNING ENVIRONMENT (GLE), GEOGAMES, VALUES-BASED REDESIGN, HERITAGE VALUES AND ATTRIBUTES, HUMAN RIGHTS.

PROLOGUE

'The game is a typical case of behaviours neglected by the traditional school, given the fact that they seem devoid of functional meaning. For current pedagogy, it is just a rest or a drain on a surplus of energy. But this simplistic view does not even explain the importance that children attach to their games, much less the constant way in which children's games are taken, symbolism or fiction, for example (...) the child who plays develops his perceptions, his intelligence, their tendencies to experimentation, their social instincts' (Piaget, 1985, p. 158).

1. INTRODUCTION

Higher education students and stakeholders involved in design are positioned as active and emancipated spectators (Rancière, 2007). From passive observers, stakeholders need to assume the roles of students and researchers, who observe phenomena and look for their causes (Lefebvre, 1991). Interpreting the world is already a way of transforming or reconfiguring it. This notion of the active spectator is aligned with the growing interest in international conventions and recommendations in the heritage field for citizen participation (Council of Europe, 2005; UNESCO, 2011). Unfortunately, who should be involved (social groups), how (methods) and by what means (tools) is yet to be further investigated.

Gamified (or Gamification of) Learning Environments (GLEs) have been broadly recognised as part of technological innovations that educational institutions are to adopt (Alexander et al., 2019; European Commission, 2020; Northern Dimension Partnership on Culture (NDPC), 2021) (ref, date; ref, date; ref, date). GLEs provide flexible and user-friendly learning methods to meet educational needs and the current challenges of the digital era. The gaming industry grew exponentially, as did the development of scholarship on teaching with games and the awareness that students today are immersed in computer games. However, such a trend has faced challenges sustaining its development (Alexander et al., 2019). Falling IT budgets, the difficulty of creating games that work for a large audience in academia, and the fact that some academics consider games better suited to primary schools are among the most referenced challenges.

Still, the application of serious games has been expanding, and they have already been used to address urban redevelopment in relation to heritage conservation, such as building degradation, densification and climate change (Anderson et al., 2010; Bampatzia et al., 2016; Mortara et al., 2014). Such games concern real-time computer graphics, virtual worlds, augmented and mixed reality, and artificial intel-

ligence to document built heritage. However, there is still a gap in research for tools to support heritage planning, e.g. interaction and collaboration, user-friendly visualisation, real-time response, indoor-outdoor connection, and, in the societal aspect, redesign, learning and awareness raising about values and attributes.

There is a wealth of digital entertainment-oriented games to support urban planning and management, such as SimCity (launched in 1989), PlastiCity (tested between 2004 and 2006), Urban Plans, City Creator (launched in 2002), and Super City (released in 2011) (Poplin, 2011). The first serious games aimed at urban themes were elaborated on and described by (Abt, 1987). Abt also developed serious games such as 'Corridor', 'Politica', and 'Simpolis' to explore transportation infrastructure, pre-revolutionary crisis, and decision-making facing an urban crisis, respectively. He defined games as '[...] a context with rules among adversaries trying to win objectives' and serious games as '[...] an explicit and carefully though-out educational purpose, [...] not intended to be played primarily for amusement.' However, 'this does not mean that serious games are not, or should not be, entertaining' (Abt, 1987, p. 6).

Serious games matched the need in urban planning to seek alternative methods and tools to deal with the complexity of citizen participation (Gordon et al., 2011). In traditional processes, prompted by a verbal description or even a set of images, spatial and urban concepts can be unknown to the lay public and can lower their interest and participation. Therefore, schools have created most digital serious games for urban planning with a focus on education, such as 'Londoner', 'SCAPE', and 'Urban Science' (Poplin, 2014). In particular, such 'games for change' should be able to represent, incorporate and express values (Flanagan & Nissenbaum, 2014), whist researchers can reflect on 1) how games can communicate values; 2) how to analyse the values that a specific game express.

Public participation is growing in urban planning, architecture and cultural heritage (Council of Europe, 2005; UNESCO, 2011). The future generation of architects, now students, is to gain knowledge, skills and attitude to successfully reveal the cultural significance and co-create the redesign of built heritage. Architectural redesign risks destroying built heritage, especially when designers and stakeholders are unaware of the cultural significance of the built environment. While design means adding new structures, redesign means adapting existing structures (Kuipers & De Jonge, 2017). Values-based redesign concerns a redesign where decisions are informed by the cultural significance (values and attributes) of built heritage. Cultural significance can be depicted conceptually in values (*what* is significant) and attributes (*why* it is significant). This is to ensure that the redesign decisions to add, keep and remove tangible and intangible attributes from a building capitalise on, and where needed, restore and enhance the existing cultural significance rather than destroying it.

Given the general lack of statements of significance detailing the cultural significance (values and attributes) of built heritage, and when existent, given their partial and

temporal nature, architecture students are challenged to identify cultural significance (values and attributes) as a baseline for their redesign (Clarke et al., 2020). Hence, this chapter explores two tools to support values-based redesign (Meurs, 2016; Pereira Roders, 2007) in an architectural and urban redesign approach in higher education. In the educational activities discussed in this chapter, the theoretical framework of values includes eight primary values: social, economic, political, historic, aesthetical, scientific, age and ecological values; and varied secondary values (Tarrafa & Pereira Roders, 2012). The theoretical framework of attributes includes both tangible (landscape, area, asset) and intangible (process, societal, relation) attributes (Veldpaus, 2015). The methodology and results sections further explain these frameworks and how they were integrated into the redesign.

1.1. GAMIFIED (OR GAMIFICATION OF) LEARNING ENVIRONMENTS (GLE)

When addressing urban issues, serious games are now known as geo games (Ahlqvist and Schlieder, 2018; Poplin et al., 2017). Such geo-location games for public engagement are based on collaborative planning (Innes and Booher, 1999) and playful public participation (Poplin, 2012). Recent geogames designed in higher education differ in concept and representation of space, approach to civic engagement, users, implementation, and the gradient of seriousness and fun (Poplin et al., 2017). For example, 'River Bend' focused on solving urban problems, with a realistic map to create a revitalisation plan for the city and collect players' opinions and perceptions. 'Fun Trippers' and 'Eggroll' focused on the learning functions of acquiring knowledge and new skills. 'Vacant Spaces' proposed interactions and tensions between players with bonus cards and some level of learning about urban planning decisions related to land use change. Figure 1 illustrates the evolution of the concepts: games - serious games - geogames, according to Poplin (2011, 2012, 2014 and 2018).

When geogames are used to support learning, they can be considered a Gamified (or Gamification of) Learning Environment (GLE). GLEs are pedagogical tools (Gee, 2003) which support the rhetoric of humanistic design (Deterding, 2019), aligned with positive psychology, design, and virtue ethics, which understand humans as inherently social, emotional, growth-oriented, meaning-making beings (Deterding, 2014). In GLEs, the learner is immersed in a virtual environment and has to undertake a learning journey and achieve specific targets. These targets are the learning goals (LOs) of the course. They can be more or less explicit. In addition, geogame mechanics such as the rewards (performance points, level badges, constructive feedback, and outdoor exploration) can help enrich the learning experience, embedding aspects of fun, challenge, autonomy and social network.

An excellent example of a GLE is the block-building game Minecraft. Released in 2011 by Mojang, it is the most-played and best-selling game in the world, with over 238 million copies sold in 2021 and a cultural phenomenon due to being a plat-

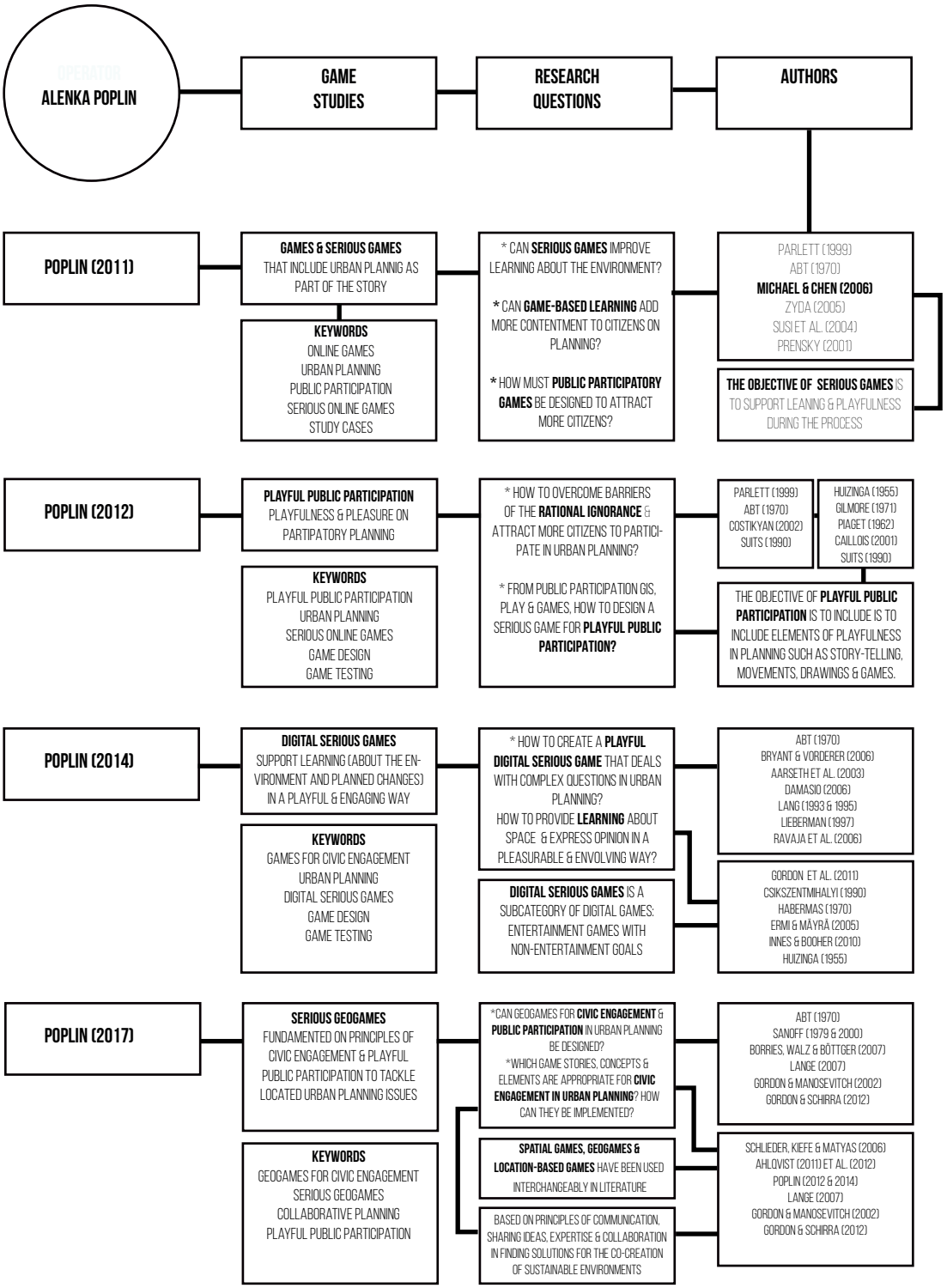

Figure 1: Diagram showing the evolution of the concept the concept of games to serious games to geogames. Diagram by authors, based on Poplin (2011; 2012; 2014; 2018).

form for creativity, education, and inclusivity (de Andrade et al., 2020). In Minecraft, the players use resources available in a fictional or real context to convert them into building materials. From 2013 onwards, the game was used to address urban issues, such as the 'Block by block' initiative (Delaney, 2022), a partnership between Mojang, Microsoft and UN-Habitat. For example, in Nairobi, young residents redesigned a public space together with the help of Minecraft. It can also been used to create a GLE such as exploring a university campus, and creating virtual teaching classrooms using Virtual Reality (VR) (Rospigliosi, 2022). Moreover, the Geocraft project (Scholten et al., 2017), proposed a methodology to engage young people to detail their own streets and houses to reconstruct virtually the whole Netherlands.

Another example of GLE, is Pokémon GO, an augmented reality (AR) mobile game launched in 2016 by Niantic, which uses GPS to locate, capture, train and battle virtual creatures called Pokémon. The game attracted over 65 million users worldwide within one week of its launch and is especially popular among young people (Ekonomou & Vosinakis, 2018). It allows players, as Pokémon trainers, to explore real locations differently, suitable to experience historic cities, since its mechanics help an immersion into their cultural content. The game has been adapted and curated by researchers and the Pokémon GO company to attract people to get to know the built heritage of their city, such as the 'Lure Party – Pokémon Go' organised by the municipality of Braga in Portugal, and 'Pokémon GO at Big Heritage Festival', organised by Big Heritage, a UK heritage organisation, in Chester, the UK (Atari, 2018).

This chapter reports on the lessons learned when teaching values-based redesign in gamified learning environments (GLEs) in two courses offered to Architecture students, by the Heritage and Architecture section, in TUDelft, the Netherlands. The GLEs used were, respectively, Minecraft and Pokémon GO. They were used to support learning activities of fieldwork, 3D reconstruction, design and decision-making. In addition, both geogames supported students in gaining knowledge, skills and attitude to master a change in approach, formerly expert-based and individualist. The new approach involves a broader range of stakeholders to reveal the cultural significance of built heritage and co-create their redesign.

The GLE set-up addressed three inter-connected challenges: a) hybrid education due to Covid-19, b) students learning and engagement (Kapp, 2013; Nacke and Deterding, 2017) about the values-based redesign, and c) the right of the public to built heritage. Between 2020 and 2022, a pandemic made higher education institutions implement hybrid education to keep functioning and tackle students' learning curve and lack of motivation. Also, such restriction brought up an issue of accessibility (and right) to built heritage and stakeholders' participation in built heritage redesign and decision-making.

2. TEACHING METHODOLOGY

Two courses were adapted to apply GLEs in support of a values-based redesign (see table 1) in the Architecture track, offered by the Heritage and Architecture section, TUDelft, the Netherlands, in two editions each, 2020 and 2021. Two geogames were implemented - Pokémon GO and Minecraft – for the GLE setting in order to analyse the cultural significance of a building and its urban context as well as to redesign with the outcomes.

Below, the methodology of the two chosen games as learning activities - Pokémon GO and Minecraft - are explained to explore the potential of the notions of values and attributes, defining the cultural significance of built heritage (Pereira Roders, 2007). These explore the concept of heritage more broadly, aiming to better capture their diversity and evolution over time and place. The case study is the city of Delft, South Netherlands, chosen due to being where TUDelft is located, accessible during the Covid-19 pandemic, for students to self-organise and explore it, with minimum risk, in a blended learning environment.

Students at the master level were asked to combine the outcomes of personal observation and perception with the outcomes of a systematic analysis of the (available) statements of significance, decoding in both the cultural significance on values and attributes of built heritage. They used the in-game textual descriptions of the tangible attributes in the built environment (e.g., short description of a church representing a Pokémon Stadium) to identify and code values.

COURSE	LEARNIBG GOAL (LO)	GAME
Bachelor's: Minor in Heritage and Design. Modules: BK7555 City and Transformation	LO1: Experiment cultural significance methods and tools concerning the appreciation, analysis and redesign of built heritage.	LO1: Pokémon GO LO1: Minecraft
Master's: Heritage and Architecture Lab. AR3AH115 Graduation Studio Revitalising Heritage. (55 credits)	LO1: Produce a cultural significance report based on the analysis of the values and attributes of a historic building. LO2: Produce an architectural project based on the cultural significance (values and attributes) of a historic building.	LO1: Pokémon GO LO2: Minecraft

Table 1: Learning goals and activities of the two courses, offered to Architecture students by the Heritage and Architecture section, TU Delft, the Netherlands.

2.1. POKÉMON GO

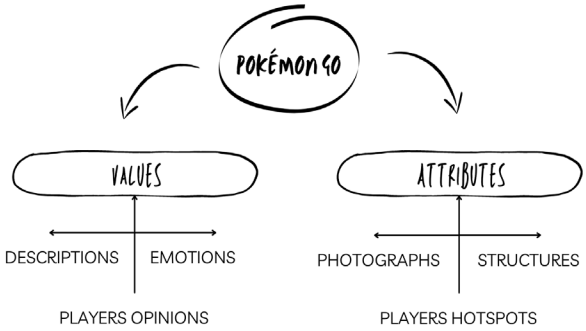

Figure 2. Cultural significance identification in Pokémon GO. Diagram by authors.

Pokémon GO was used to research the cultural significance of the historic city of Delft (Figure 2). The geogame visualisation shows the city augmented with digital structures such as Pokémon creatures, Pokéstops and Pokégyms. These last two are usually hosted in the real world by historic buildings and urban structures (bridges, courtyards, fountains, statues, and street art). Moreover, they usually show a photograph and a description of such tangible attributes. Therefore, Pokémon GO was used mainly to identify tangible attributes and, when available, values from the textual descriptions of these attributes.

There is an increase in complexity in this exercise, in which for the Bachelor level, students focused in their own opinions about the cultural significance of Delft. They undertook the technique of the *derive* (Debord, 1958) to explore and drift in the city. They were also asked to use a list of emotions (Plutchik, 1984) (eight primary emotions: anger, anticipation, joy, trust, fear, surprise, sadness and disgust), to help them produce the cultural mapping and to overlap positive and negative emotions with values (Figure 3). For the master's level, students needed also to identify and code values and attributes based on in-game text descriptions, using the categories of Pereira Roders (2007) and Veldpaus (2015).

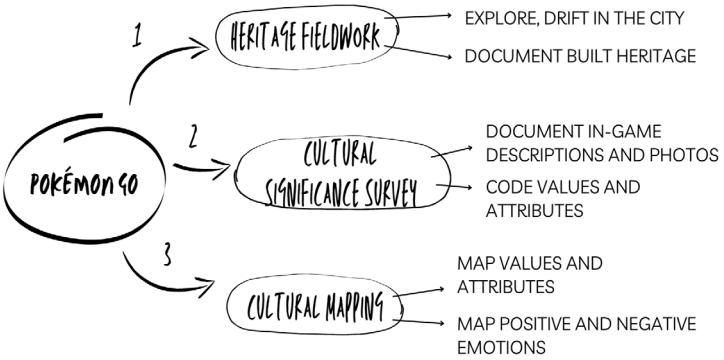

Figure 3: Pokémon GO implementation process. Diagram by authors.

2.2. MINECRAFT

The 3D block-building geogame Minecraft has been used for (re)designing buildings, cities and landscapes (de Andrade & Loddo, 2021; McNally & de Andrade, 2022; Poplin et al., 2020). Still there is a gap in research and education related to the accuracy and precision of the model, participation of older age groups, and its capacity to convey intangible attributes and values. It is a popular game that has a huge online community of players creating and adapting worlds, fostering autonomy, three-dimensional and spatial awareness, creativity and social interactions.

Minecraft was used as a tool to research the cultural significance of the Orsanmichele church and museum in Florence, Italy, and the Prinsenhof museum, Cable Factory, and Yellow Chemistry building complexes, in Delft, the Netherlands (Figure 4). The geogame visualisation shows the buildings with blocky and pixelated graphics, which can be removed/destroyed or added. Therefore, Minecraft was used mainly to explore the 3D reconstruction and decision-making aspects of the values-based redesign exercise focusing mainly on tangible attributes (asset: built element, building, urban element, natural element).

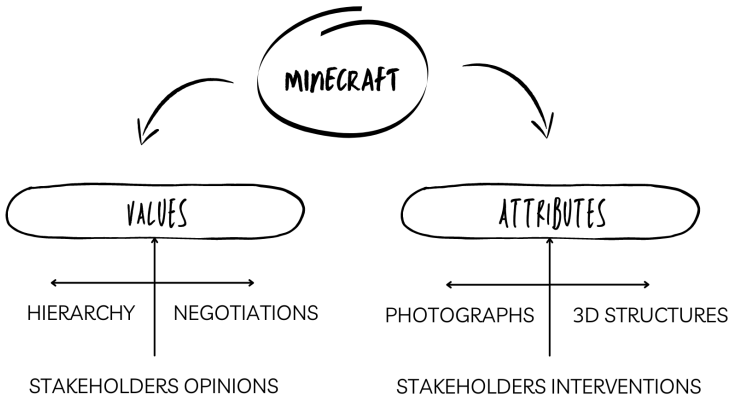

Figure 4. Cultural significance identification in Pokémon GO. Diagram by authors.

For the Bachelor level, 38 students, grouped mostly in five people, joined an online Minecraft co-creation workshop for 2:45 hours. They used a simplified version of the categories of values (ecological, social and economic) and attributes (skin/exterior and surroundings) to engage with their peers on a role-playing mode. In another exercise, three master students engaged with a group of real stakeholders in their own Minecraft workshops (4 hrs average) for their specific cases. This was accompanied with a values and attributes survey, where participants were asked to make a hierarchy of values (high, average, low) about specific attributes identified in archival research, projects reports, and expert interviews about ongoing redesign projects

related to their case studies. Such hierarchy aimed to keep track over decisions about what to keep, to adapt and to remove in the redesign. Students used participant observation methods for data collection (Kawulich, 2005) to position themselves as facilitators, helping stakeholders in the decision-making and negotiation process to reach one final values-based redesign representing consensus amongst the group involved (Figure 5).

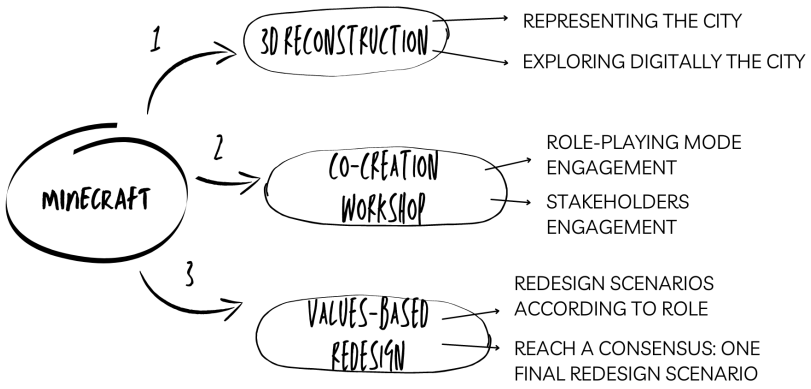

Figure 5. Minecraft implementation process. Diagram by authors.

3. RESULTS

3.1 POKÉMON GO

Pokémon GO provoked effectively provoked students to explore and analyse the city in a playful way, rather than the usual pin-point map-oriented or historic-led routing. It also contributed to kicking off the courses and raising the motivation and interest in the topic. Though it was their first contact with concepts such as cultural significance, students were able to identify and apply them reasonably. Bachelor students coded their opinions on values and attributes while combining positive and negative emotions. Master students took one step further and coded values and attributes present in-game. However, the lack of information on description texts, or imprecise ones, as well as the photos available, some outdated or misleading, limited the experience of better understanding what the community of players values.

BACHELOR LEVEL

In 2020, as part of the Minor in Heritage and Design course at the Bachelor level, a group of 3 students self-organised fieldwork to the city of Delft, in the Netherlands, to playtest, document, and evaluate Pokémon GO (Haahr, 2017). Students mapped

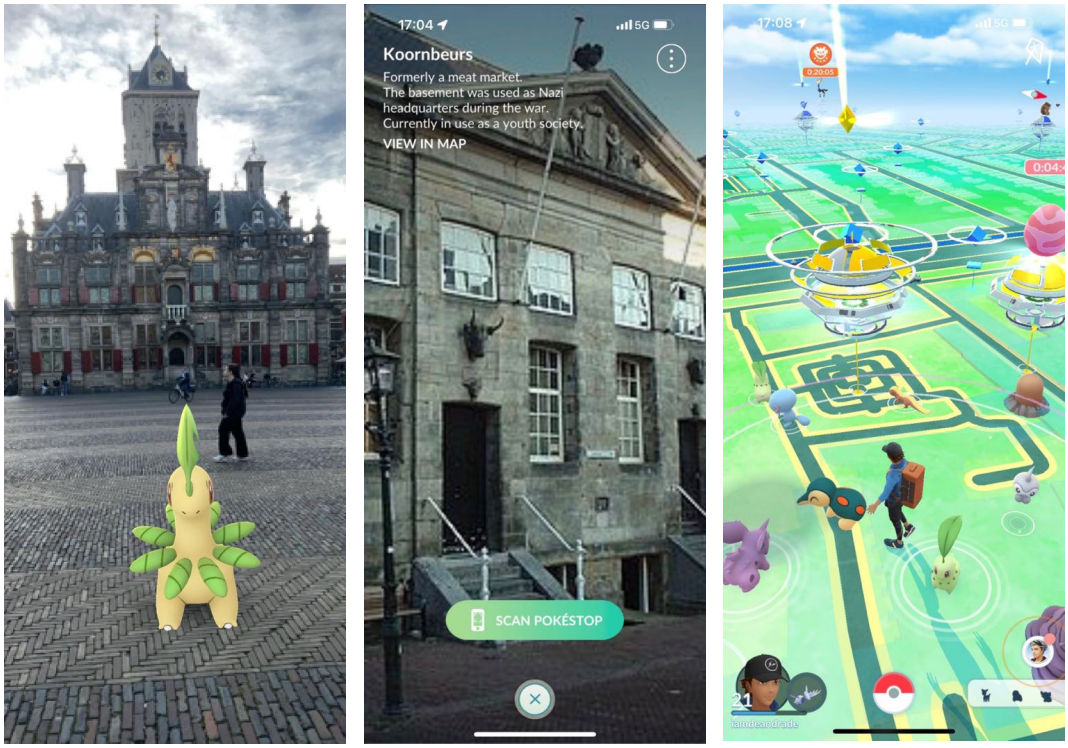

Figure 6: Pokémon GO images: left) catching a Pokémon in front of the City Hall; center) De Centrale building, former meat market; right) Prinsenhof urban block and related gaming elements. Screenshots by authors.

their values with positive and negative emotions. According to their final report, they found the geogame to be educational because it showed historic facts and locations in the city (Figure 6). Some of the findings reveal two bridges close by, one has an important crossover function, whilst the other, Ursulabrug, was kept after the demolition of a monastery in the 16th century, and it leads to nowhere, connecting two buildings with no relation to each other. Another finding revealed that underground the current restaurant 'De Centrale', formerly a meat market in the 17th century, was an undercover Nazi basis during World War II.

The road infrastructure is shown by the width of the roads. The map is limited to a flat two-dimensional surface, which means that by not visualising bridges, slopes, and crossroads, players can be misled. Students produced a cultural mapping of their routing in the city (Figure 7) highlighting in green and red lines the positive and negative emotions, respectively, which they related to their personal values. Buildings and places hosting Pokéstops and Pokégyms were marked with various icons resembling tangible attributes (e.g., old church, new church, Prinsenhof museum, city hall). Students identified tangible attributes with aesthetical values (artistic), political and social values (symbolic), and age and historic values (architectural).

For example, students conveyed historic and political values to the Prinsenhof museum, due to its rich history which impacted Delft and the Netherlands, i.e.

Figure 7: Cultural mapping produced by students (Fabian Schwegman, Florian Holtbernd, and Rens van Poppel) with a focus on values and emotions. Printed with permission.

being the house of Willem the Silent, leader of the Dutch Revolt against the Spanish Habsburgs that resulted in the formal independence of the United Provinces in 1648, and the place where he was killed. The building conveyed social values due to its different uses over time (e.g., convent, school, military). For them, its current function of a museum conveys aesthetical values. Regarding negative emotions and values, students warned against a dangerous area near the Sint-Sebastiaansbrug, south of city, where a Pokégym is located. The exact location is a small sculpture of Sint-Sebastiaan at a crosswalk of a busy road.

In 2021, another group made a fieldwork in the southern part of Delft, near the university campus. Students mentioned negative emotions and values due to bad smells such as horse excrement (which indicated they left the inner city), unpleasant smokes from the industries, and from scooters and cars. They also mentioned positive ones related to fragrant smell of freshly cut grass, lavender and of thyme. They identified different state of conservation of roads in front of the Science Centre (good), Royal Delft museum (bumpy and narrow) and Hortus Oculus garden (gravel). The most present soundscape was of bikes and their squeaking wheels and ringing bells, and of the wind. They conveyed the following values in the Science Centre (aesthetical, economic, historic, and age), Royal Delft (age, historic, social), and Hortus Oculus (aesthetical, ecological).

MASTER LEVEL

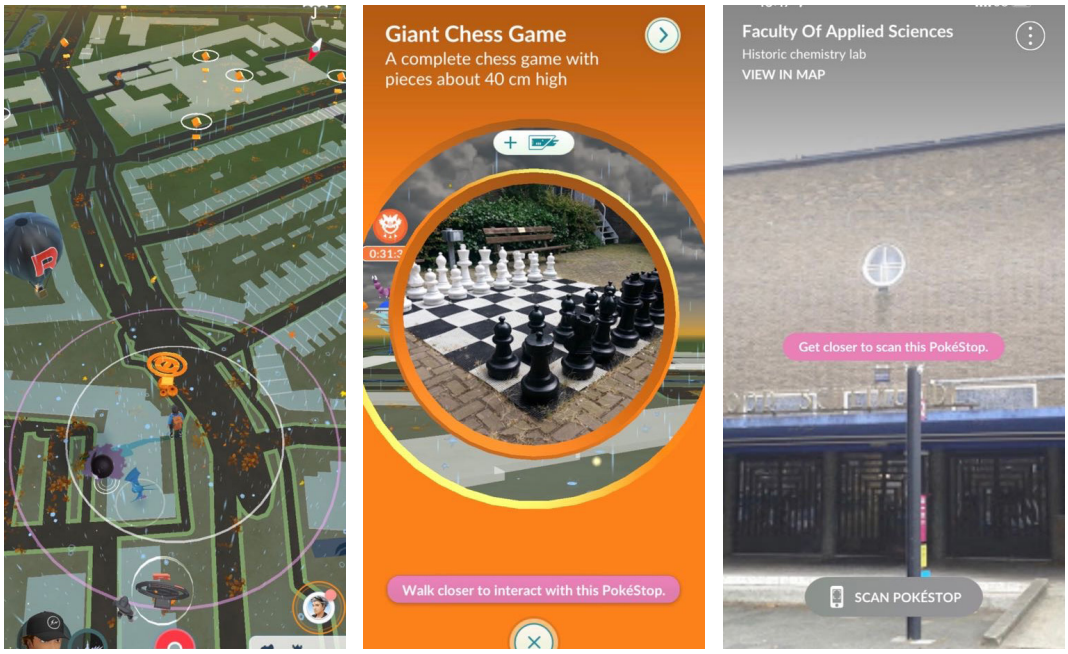

Figure 8: Pokémon GO images: left) Yellow Chemistry complex on the top right side; centre) the giant chess game; right) historic chemistry lab. Screenshots by authors.

Pokémon GO was used as a tool for fieldwork and context analysis. Three master students chose one building complex, Gele Scheikunde (Yellow Chemistry) and Kabelfabriek (Cable Factory) in Delft. In Gele Scheikunde, there were five Pokéstops; two entrances 'Kramers Laboratorium' and 'Faculty of Applied Sciences', which she conveyed historic and aesthetic values due to being an exemplar of a modernist educational campus; one garden with a 'Giant Chess Game', a former popular place for students and neighbours, conveyed social and economic value; two indoor functions 'Tiny Library', which used to promote book exchanges, conveyed social, emotional value.; lastly, a 'Knooppunt 28', formerly a point of a walking network, conveyed use and entertainment sub-categories of economic value (Ugnat, 2021) (Figure 8).

Concerning the Cable Factory, a former industrial building, a Pokéstop showed the façade of the building, the in-game map showed the main entrance to the building, a courtyard, and, next to it, another Pokéstop 'Hidden Artwork', conveyed historic and aesthetical values (Tol, 2021). The use of Pokémon GO in the fieldwork was defined as 'getting lost consciously', as well as safe and friendly due to in-game messages 'Remember to be alert at all times. Stay aware of your surroundings', and 'Be courteous to members of real-world communities as you play'. Tangible attributes such as materials, textures, and colours conveyed historic value, whilst the factory function itself or the new companies working inside it temporarily as with economic value (Figure 9).

ADVANTAGES	DISADVANTAGES
COGNITIVE DEVELOPMENT - Sparks location awareness, contact with nature and historic buildings, and social interaction. - Offers a hybrid space (real and digital), and countless Pokéstops and Pokégyms which are anchored in tangible attributes in the city. - Relatively simple controls (for mobile phones). **ACCESSIBILITY** - It can be played by all ages, though younger people were mostly seen playing it. - It is free, though it has in-game purchase options. - Players can interact with each other in the game e.g., battles and exchange items. **EXPLORATION** - Human perspective in the game. - Navigating through the city is a good way of interacting with built and natural heritage. - Includes an option to explore the city in Augmented Reality (AR). **REPRESENTATION** - The AR representation enriches the reality with Pokémons and other gaming elements, and makes it more fun to explore the environment. - The 2D map conventional representation allows players to better understand the area and get encouraged to explore it, e.g., finding 'hidden' public courtyards. **VALUES-BASED DESIGN** - Values conveyed to the fabric of built heritage by the community of players were partially identified by students, supported by prior knowledge. - Tangible attributes were identified and documented, and consequently also addressed in the cultural mapping. - Identification of most known values was successful e.g., historic and aesthetic.	**COGNITIVE DEVELOPMENT** - The wide range of gaming elements can be overwhelming, and distract students from their assignments. **ACCESSIBILITY** - Older generations are less likely to play the game, they were not seen by students playing it. **EXPLORATION** - Some students felt oblivious and at risk in a few routing if not aware of the environment. **REPRESENTATION** - Photos and texts are suggested by the most experienced players and approved by the managers. It is a bottom-up documentation provided by the community of players. Consequently, photos, and texts differed in accuracy, size and focus. - Some areas in the southern part of the city of Delft had less or no gaming elements. - The road infrastructure can be confusing when there is an overlap of streets at different height levels. The game also does not show topographic differences. **VALUES-BASED DESIGN** - Values that were not conveyed to the fabric of built heritage, or unknown were neglected. - Some relevant tangible attributes were not included in the game, and consequently also not addressed in their cultural mapping. - Intangible attributes were not identified in the game. - Identification of values and attributes failed when would not match the personal values.

Table 2: Advantages and Disadvantages of Pokémon GO.

Figure 9: Cultural mapping with Pokémon GO (Ugnat, 2021). Printed with permission.

On page 306. follows a set of advantages and disadvantages collected by the students and tutors while facilitating and observing participants during the workshops. The notes were grouped, categorised, and analysed accordingly (Table 2).

3.1 MINECRAFT BACHELOR LEVEL

Overall students (50%) rated the Minecraft workshop experience as a 4 out of 5. The level of engagement to fill out the evaluation survey via google form was average (26 out of 38 students). The Game design was assessed as 4 by 62%, Usability also a 4 by 54%, and both Learning Outcomes and Cognitive Behaviour a 3 and 4, respectively, equally rated by 46%. Students with previous experience (so-called Minecrafters) playing Minecraft were able to design rapidly and support their own groups, while others found it difficult in the beginning to learn it while thinking about their designs. The Minecrafters used the game as a design thinking tool, while others used traditional tools such as hand-drawing and/or brainstormed orally their design ideas.

Mostly, the final designs proposed greening Florentine streets around the building complex and making it a car-free zone. Some proposed bringing back old uses such as the marketplace. The Minecraft geogame was useful for initial design stages which do not require architectural detailing, though its blocky and rough appearance. One

Figure 10: One of the scenarios proposed during the Minecraft online co-creation workshop. Printed with permission.

group of students stated that the tool '(...) is visually engaging and easy to change things in, creating easy consensus between a designing and commissioning group'.

One of the scenarios (Figure 10) proposed a change in tangible attributes such as urban and natural elements, as well as intangible attributes such as societal use. However, this last one was not possible to be explicitly represented in-game. The new urban condition between buildings included a car-free zone with a green sidewalk, plants, flowers, and benches. For such change in attributes, the following values were conveyed historic, social and ecological, e.g., local meeting point referring to a previous function as well as the reduction of urban heat island effect.

MASTER LEVEL

Three architecture students organised and conducted three different Minecraft co-creation workshops, to engage stakeholders to redesign three buildings and their surroundings, in Delft, the Netherlands, i.e., Prinsenhof, Cabel Factory, and Yellow Chemistry building complexes (Figure 11). The co-creation methodology was structured following the consensus-building process of the Geodesign workshop methodology (Campagna et al., 2016; de Andrade, 2019), where different stakeholder groups make their proposals individually, then start to merge with other groups by the similarity of design ideas while negotiating and compromising their tolerance for change. This is done until there is one last big group and one final design proposal which represents consensus through all stakeholders present in the workshop.

Students prepared a survey pre-workshop (Figure 12) about a values hierarchy related to attributes, informed by previous research (archival research, projects report review, and expert interviews) and their personal observation (e.g., Pokémon GO). Participants filled out the survey by making a hierarchy of high, average, and low values among a given list of attributes. Students elaborated a graphic to visualise

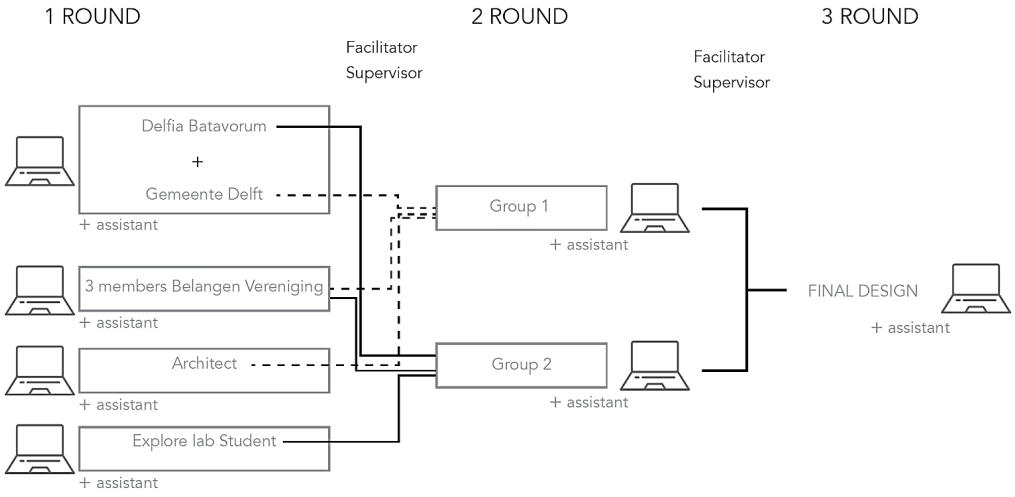

Figure 11: Minecraft co-creation workshop process (Ugnat, 2021). Printed with permission.

such hierarchy amongst different stakeholders to identify divergences and convergences in redesign decisions.

The translation [low value = demolish] is reductionist because a designer can turn low values into high values with their redesign. Demolition should not be the only solution. The only reason there is a direct connection between them in the survey was to keep track of the tolerance for change in attributes by the stakeholders during the workshop. For example, some of the recent buildings in the Yellow Chemistry complex were demolished in the game to restore the original public-private relation and create more open and green spaces. It was a compromise of the group representing the local historic association group with a developer group, whose counterpart agreed to conserve the main façade of the main street as it is.

The first task was to explore the building complex in the Minecraft geogaming model to find as many attributes that were on the pre-workshop survey list. Stakeholders were also allowed to use analog tools to support their design thinking process e.g., hand-drawing and consulting maps. Each stakeholder group had to make a redesign intervention according to their expertise and professional background. The workshop sparked interesting conversations supported by the in-game navigation. To illustrate such conversation, some opinions can be read on page 310 (Ugnat, 2021) (Table 3).

The representatives from the historic association of Delft were key in the workshops. Their position to conserve the building complex in its existing condition as much as possible triggered interesting, contrasting, and fruitful discussions over what /why to keep, adapt and remove. After this step, the students reflected using the partial and final designs and surveys with stakeholders to further develop their values-based redesign model to be in the context of their master's graduation thesis.

Further are illustrations (Figures 13 and 14) of participants' designs which inspired the design concept related to the new entrance, underground parking, new bike path, rooftop urban farming, and added volume (Ugnat, 2021).

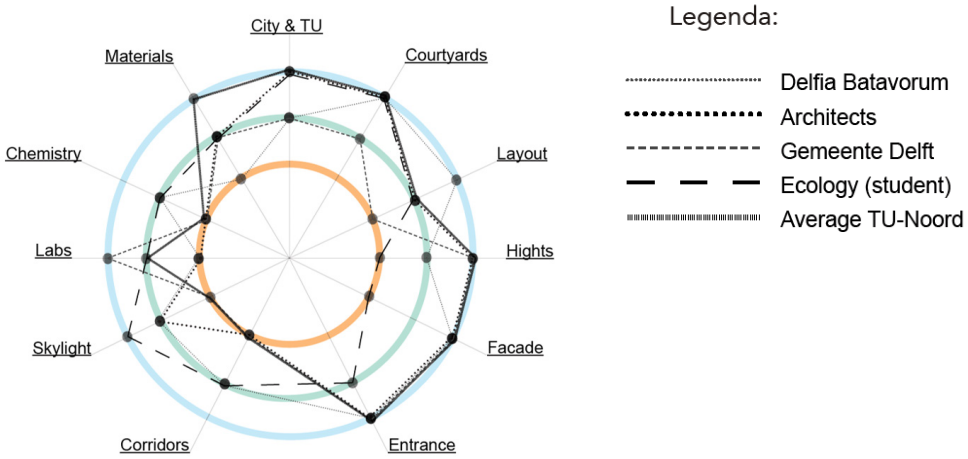

Figure 12: Values hierarchy survey of the Gele Scheikunde Building, Delft, The Netherlands (Ugnat, 2021). Printed with permission.

GEMEENTE DELFT	'Building ***conservation***, how can we keep the existing as much as possible, which is very important for the city and the government. (...) For the function, living and working can be combined. And concerning the living program, the target group are ***elderly*** 50+, with that comes the idea of what the elderly want, community services, caretaking which is in shortage in Delft. And another target group are ***young people***. So how to combine the mixed target groups, with living and working setting'.
DELFIA BATAVORUM	'It is very important to keep the outside so the ***skin*** as it is, that you can see how the buildings were built. Delfia Batavorum wouldn't agree on putting the extra levels and demolishing the buildings'.
ARCHITECT	'How can this enclave become a part of the city and still stay as an enclave as it is now. For that, the existing low perimeter can remain and be enhanced since it is very characteristic of the area. Another suggestion is to get rid of the added, residual blocks that don't contribute to the main ***typology*** of the site'.
BELANGEN VERENIGING TU-NOORD	'We live on the Julianalaan. We agree to conserve the outside of the complex. For us, the ***mobility*** is quite important'.

Table 3: Samples of redesign decisions per stakeholder (December, 2021)

Figure 13: One presentation and negotiation step of the Minecraft co-creation workshop (Ugnat, 2021). Printed with permission.

Upper Image 19: New entrance at Michel de Ruyterweg that connects courtyards by Group 1 (screenshot from the Minecraft model)
Lower Image 20: Underground parking entrance, new bike path (in red) and rooftop urban farming by Group 1 (screenshot from the Minecraft model)

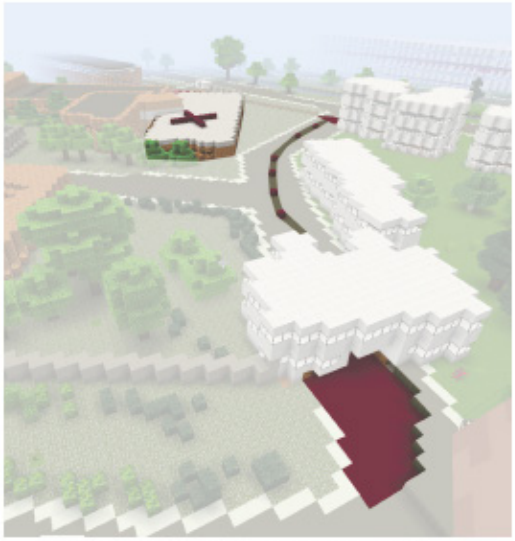

Image 21: New bike path in red. Autoclave lab (with a red cross on the roof) can facilitate bike storage by Group 1 (screenshot from the Minecraft model)

Image 22: Underground parking entrance (with greenery) and bike bridge (in grey color) by Group 2 (screenshot from the Minecraft model)

Image 23: Added volume on top of the buildings of Michel de Ruyterweg by Group 2 (screenshot from the Minecraft model)

Figure 14: Some of the stakeholders' redesign proposals (Ugnat, 2021). Printed with permission.

On the next page, follows a set of advantages and disadvantages collected by the students and tutors while facilitating and observing participants during the workshops. The notes were grouped, categorised, and analysed accordingly (Table 4)

ADVANTAGES	DISADVANTAGES
COGNITIVE DEVELOPMENT - It sparks creativity, playfulness, visualisation, negotiation, and problem-solving skills. - It offers countless colors, materials, and textures to mine and use. - Relatively simple controls (for computer and videogame consoles). **ACCESSIBILITY** - It can be played by all ages. - The Minecraft Educational Edition is free for educational institutions in some countries. - It has the option to work in a server, meaning multiple players can work at the same time. - Minecraft Educational Edition has a repository with lessons on different subjects, such as the city of Florence, Italy. **INTERACTION** - It can be played in single and multiple players, on almost all computers. **EXPLORATION** - Human perspective in the game. - Navigating through the 3D model is a good way of visualising the environment, especially when compared to 2D maps. - Navigating through the model works well as a design presentation tool, one can easily show which part of the building they are referring to. - Latest editions can use RTX (real-time rendering) and VR (virtual reality). **REPRESENTATION** - Minecraft works like a physical model which players can infinitely adapt. - It can be modified using mods (modifications) to fit a specific purpose, with endless possibilities. **DESIGN** - Design ideas and interventions can be easily and instantly translated and created. - By making use of the 1mx1mx1m block mechanic, Minecraft is a good way of abstracting environments. **VALUES-BASED DESIGN** - Values conveyed to the fabric of built heritage were partially identified, supported by prior knowledge. - Tangible attributes larger than 1mx1mx1m were detailed and illustrated, and consequently also addressed in their redesign decisions. - Conservation of Values and Attributes in Redesign succeeded when matching the personal values.	**COGNITIVE DEVELOPMENT** - Some participants have a tendency not to take the workshop seriously at the beginning of the process. - The wide range of materials overwhelms participants, so they tend to pick simple and obvious ones, especially in a rapid design workshop setting. - 3-4 hours seemed to be a time-demanding slot, even with breaks, yet some of the design ideas were not complete by the end of each round. **ACCESSIBILITY** - Older generations have more difficulty learning the controls and playing the game, though some showed will invest in it during the workshops. - Younger people tended to think, negotiate and design directly in-game, while older ones made drawings and talked first. **INTERACTION** - The most experienced players tend to dominate the design decisions and choice of materials, due to their power to being the 'mouse' of the group. **EXPLORATION** - Moving in the game is slow due to the human scale, also the map only opens up when approaching, making it hard to see everything at once. **REPRESENTATION** - It needs improvements to work in a dynamic workshop setting such as it is too slow to make extensive interventions at once. - The lack of accuracy and abstraction can lead to misunderstandings and uncertainties about built heritage. - Modeling and detailing large areas such as the Prinsenhof ensemble is time-consuming. - The use of NPCs (Non-player characters) and signs / whiteboards can be explored for a more in-game learning mechanic in built heritage studies. **DESIGN** - The 1mx1mx1m block mechanic is a barrier when proposing a change in details, making it more useful early on in the design process, as a design thinking and negotiating tool. **VALUES-BASED DESIGN** - Values that were not conveyed to the fabric of built heritage, or unknown were neglected. - Tangible attributes smaller than 1mx1mx1m cannot be detailed and illustrated, and consequently are also not addressed in their redesign decisions. - Conservation of Values and Attributes in Redesign failed when would not match the personal values.

Table 4: Advantages and Disadvantages of Minecraft.

4. CONCLUSION

GLEs can support training future architects by enriching their knowledge, skills, and attitude to engage a broader range of stakeholders to reveal the cultural significance (values and attributes) of built heritage and co-create their redesign. Both Pokémon GO and Minecraft revealed advantages and disadvantages in conveying values and attributes in-game. On one hand, both geogames gave more freedom for students to explore and identify (personal) values and attributes beyond expert-based sources, on the other hand, they also gave room for students to neglect critical values and attributes, and consequently not address them in their redesign decisions. A few combinations of values and attributes were conserved in students' redesigns, while others were neglected and destroyed.

Overall, students remain prioritising values other than their research. The cultural significance is rapidly defined and sources are poorly taken into consideration in their final redesign project. Both geogaming tools favored more tangible attributes while students focused more on pre-defined personal values related to their own redesign goal, mostly historic, social and ecological. When pre-defined values matched stakeholders', students were consistent and included in their redesigns. The university proved to be a meeting point where behavioral change can be fostered, encouraging people to become more proactive in their right to heritage. The students' work with stakeholders supported creativity and motivation in their redesign thinking process. They got empowered with GLE's active learning method to facilitate and communicate with clients/stakeholders in co-creation workshops. When compared to the traditional approach of redesign without stakeholders, students were able to take one step further becoming more inclusive and aware of how to incorporate values and attributes. Still, the mindset is not there yet.

STAKEHOLDERS

If cultural built heritage is destroyed with ulterior motives, human rights are violated. GLEs can be used as catalysts to bridge academics and citizens in built heritage management engagement processes, shifting and collaboratively upscaling the debate. This will potentially allow stakeholders to move beyond being spectators, a condition of passivity (due to inherent societal conditioning and/or to the limitation/imposition of regulation). GLEs can have a societal impact by fostering a culture of participation and raising awareness to the access to and enjoyment of cultural heritage.

STUDENTS

The teaching approach with GLEs is a work in progress, which is already related to specific learning goals, activities, and tools in different educational levels and contexts. There is more room to gamify these courses and classes, using points, levels, role-playing, quests, and multi-player to better motivate and maximise learning, engagement, performance, and societal interaction. Nonetheless, such an approach is also related to the teaching style and the teacher's personality, which can and should influence the GLE setting.

POKÉMON GO

Students became flâneurs in the city of Delft, the ones who walk, explore, and observe buildings and life accompanied by Pokémon creatures. They were able to identify new attributes, such as bridges, hidden pathways and courtyards, and street art. In-game descriptions allowed them to reasonably code values and attributes. However, some attributes lacked descriptions, making it hard to identify values, whilst intangible attributes were mostly neglected. The game, when adapted and curated by researchers and the company, to a historic setting as in the cases of Braga in Portugal, and Chester in the UK, worked better.

MINECRAFT

Students became Minecrafters, gaining facilitator skills in a co-creation workshop either in a role-playing mode in the city of Florence, Italy or with stakeholders of the city of Delft, the Netherlands. There is still a mismatch in the distinction of personal and collective values, the latter varying from age groups and cultural background. The teaching method contributed to raising awareness about the value of built heritage for society and their right to heritage. Though students were challenged to incorporate values of others than their own, most of them were biased and tended to incorporate only the ones that relate to their own. This reveals what could be a big challenge in higher education in Architecture – students are not trained to think collectively, but rather individually.

WHAT'S NEXT?

More research is needed on the effectiveness of GLE for scientific impact in built heritage education, relating learning objectives with activities and assessment (constructive alignment), and linkages to the practice in built heritage planning and management. Also, the effectiveness of societal impact is related to attitudes and behavioral change. One possible future of redesign belongs to gamers. The Minecrafters are already in the universities, but are architecture education ready for this new profile of students? This is still an open question to be further explored not only due to a post-Covid-19 architecture practice but also to better accommodate their capabilities and needs in higher education.

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TU DELFT STUDENTS AT WORK. PHOTO BY R. ROCCO.