Gamification in architecture

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“Gamification is design that places the most emphasis on the human in the process. In essence, it is human-focused design.” - Yu-Kai Chou, Gamification Pioneer
WORLD 1
ABSTRACT
User-centered design is all about the needs, wants and experiences of end users. These experiences matter greatly as they influence the judgment of the end user. Architecture is a field where the design is not always user-centered even though the high desirability of it. Gamification focuses on the experiences of the end users. The use of gamification in the field of architecture can transform our contemporary architectural design methods to create different architectural concepts that are more focused on the experience of the end user of the architecture.

This thesis has two major purposes: Firstly it is an explorative design research that aims towards gamification as a potential concept in architectural design by creating a gamification framework for gamifying architecture. Secondly the thesis focuses on the actual application of this framework by designing a gamification concept leaded by a use-case. This concept then translates into the architectural design for the use-case.

On the basis of the results of this research, it can be concluded that gamification has the potential to create interesting and innovative concepts for application in architectural design. By focusing on user-centered architectural design the crafted experience will be tailor-made and suitable for many use-cases and situations.
WORLD 3

INTRODUCTION
As the name itself implies, the main focus of the Digital Architecture graduation studio lies in the digital part of Architecture: the development and use of new computer tools and computer aided design to generate and create a new kind of architecture. Students are challenged to explore the possibilities that these new techniques and methods have to offer in the context of a design assignment. The graduation pre-study as well as the graduation project itself focus for a great part on research and development including prototype research varying broadly for example from 3D printing to scripting.

The objective of the graduation studio is to research, explore and apply new digital technologies and techniques to the field of architecture. Questions such as “How can we improve our designs using modern digital tools?”, “To what extent can we benefit from the digital technological advancements in the built environment?” and “How can digital tools assist in the creative process of designing?” are the kind of questions that are raised in this graduation studio.

Our contemporary world is becoming more digitized day by day. Everything around us becomes digital to a certain extent. Most people have a smartphone nowadays and the amount of available information to everyone is almost countless. This expanding digitizing of the world brings a lot of benefits to our societies which revolve around experiences.

Architecture plays a big role in our environment and daily life. Every day we experience architecture when doing our daily activities and events. However, the architecture itself is rather traditional and lacks the integration of the modern evolution of digital technologies like the rest of the world is undergoing. This ensures that the benefits and the experiences of this digitizing world also does not reach its full potential in relation to the field of architecture.
This research is an explorative design research in a specific field that is relatively young. The focus of this research is to explore the extents of applying gamification in architecture (gamifying architecture). The aim or goal of this in the end is to improve the user experience(s) of architecture through gamification because gamification provides ways to enhance the experience and motivation of people in different kind of fields. Therefore the main research question of this research is as follows:

“How can gamification serve architecture with the purpose to enhance, improve or create a new kind of architectural experience?”

Since the main research question is still broad and the domain of gamification covers a lot of different aspects, the following sub-questions have been defined to narrow down the scope and to structure the essentials of gamification in architecture in relation to this research:

**Technical Sub-questions**

Some people think of gamification as a hype, gimmick or simple marketing tool that does not always succeed or guarantees predefined goals. In some occasions this is true and therefore the technical sub-question aims at this potential weakness:

“How can you preserve the quality of a gamification concept/gamified system in architecture to prevent ending up with a gimmick?”

This sub-question is further divided into:

“What are the requirements to make a gamification concept/gamified environment viable throughout the lifetime of the architecture?”

**Architectural Sub-questions**

Because gamification is a young and quite fresh field of research (and pioneering in relation to architecture), one can wonder how gamification contributes towards the architectural concept.

“In what way can and does gamification work as an architectural concept?”

Gamification is often applied in virtual spaces. Applying these concepts in real spaces is therefore challenging;

“What does gamified architecture look like and what are its components/building blocks?”

Also, what are the spatial requirements for applying gamification;

“What kind of spatial impact does gamified architecture have in contrast to non-gamified architecture?”
Social Sub-questions

The social sub-questions focus more on the experience, motivation, behavior and social aspects of gamification in architecture;

“To what extent can gamification drive and motivate people to adapt or change their behavior in relation to the use/function of the architecture?”

Gamification proved itself over time as an excellent tool to function as a social catalyst;

“How can gamification be used as a concept or tool to generate social activity in architecture?”

Gamified systems only work and succeed if users actually use and keep using the system;

“How can you lower or possibly remove/integrate the threshold for people to interact with gamified systems in architecture?”

“How can gamification serve architecture with the purpose to enhance, improve or create a new kind of architectural experience?”

Image 1: The Research Question
The aim or goal of this project is to improve the user experience(s) of architecture through gamification. The experience of architecture is very personal and thus different for everyone, but certain aspects of architecture are the same for everyone. For example, think about the general routing through a building, the spatial properties and qualities of a room, the amount of light illuminating a space, or the capacity of the amount of people in a room. These examples show a lot of parameters that influence people's experience on architecture. This is also where the overlap between gamification and architecture becomes visible; the notion of the experience, see Image 2. The main focus of gamification is all about improving or enhancing the experience of the user in order to tackle certain objectives that have a predefined goal as purpose. Architecture is a very suitable field for applying a gamification concept since one of the main purposes of architecture is to offer solutions to a certain demand or spatial question. Designing architecture through the scope of gamification offers a different perspective on architecture. This perspective holds the key to potentially create new, better or improved experiences in architecture.

"Gamification is a way to improve user's engagement of a service, however, it only provides secondary support to the main system functionality. It is impossible to magically shift user's behavior via gamification when the main services of the system cannot attract user's interests at all." - Yefeng Liu [13]
Scientific relevance
The scientific relevance of this thesis focusses on the development and usage of gamification in the field of Architecture. Further development of gamification concepts for architectures can lead to new and different ways of deploying architecture. The way we experience architecture is most of the times rather traditional in contrast to gamification. Gamification can in that sense create different kind of architecture with its own experiences and limits. Scientifically it is interesting to develop new and different methods of experiencing architecture through the use of a gamification concept.

Social relevance
The social relevance of this thesis focusses on the experience of architecture. In most cases buildings are rather static structures built for one certain purpose. Therefore the architectural experience that people experience is often the same, dull, predictable and less original and inventive. This is not a problem at all since these buildings have proven to be effective over time. However, for some buildings with certain functions it is interesting to develop different ways of experiencing architecture, especially if this enforces the purpose of the building. Luckily there are enough architects who understand this and who develop beautiful, original and great functioning buildings. To keep on innovating and developing these new experiences it is vital to explore new emerging fields like gamification to discover and apply the potentials in architecture. In the end it all comes down to the experience of the user and therefore the development of a new kind of experience for the user through the use of a gamification concept in architecture is the social relevance of this project.

Summarized this comes down to:
Scientifically it is interesting to develop new and different methods of experiencing architecture through a gamification concept. Socially it is interesting to apply these methods and concepts to create new and/or different experiences for the users of the architecture.
WORLD 4
GAMIFICATION
Since the explosive growth of the video game industry around the start of the 21st century it is clear that gaming is an emerging and compelling way of entertainment. The video game industry is currently one of the biggest, if not the biggest entertainment industry out there. It are those successful games like Grand Theft Auto V (with a revenue of $1 billion in just 3 days) that makes you wonder why this form of entertainment is so successful. Besides the success of the gaming industry itself it is interesting to see what we can learn from that. What is it that we can learn from this massive success and in particular: what is interesting for the field of architecture?

To continue down this path and to capitalize on the success of the gaming industry a new term sprouted over the last years: “Gamification”. Gamification is the highest rated emerging technology in terms of expectations in “Gartner’s 2013 Hype Cycle for Emerging Technologies” [1]. Understanding these successful core game design principles and thinking like a game designer potentially holds the key to developing new and innovative architectural concepts with their own unique spatial experiences. It is for that reason that gamification and its relation to architecture is the main field of focus for this report.

Besides the sufficient available amount of gamification, behavior and motivational theory there is a lack of gamification research in context to the field of architecture. Therefore this research is rather a pioneering, experimental research in order to unite gamification with architecture.

The hereafter presented information and theory on gamification is the result of research ranging from books, papers, online articles and two MOOC’s (Massive Open Online Courses). The basic and more advanced knowledge about gamification in this report will serve as a solid foundation and guide to understand the approach of gamification throughout this project.

Image 3: Gartner’s 2013 Hype Cycle for Emerging Technologies
Gamification as a term originates from the digital media industry and the first documented use dates back to 2008. The widespread adoption of the term however came after the second half of 2010. Gamification is thus a relatively new concept/way of thinking and therefore there is not a clear universally accepted definition. There are however multiple explanations that come close to defining what gamification is in order to understand the general concept. The definition that suits best towards understanding the concept in relation to this project is defined as follows:

“Gamification is the use of game elements and game thinking/design techniques in non-game contexts (to engage users in solving problems).”

This definition consists of three elements that combined give meaning to and explain the term gamification. These three elements are broken down into:

**Game Elements:**
See game elements as a toolbox. A toolbox consists of pieces you have to work with in order to establish a gamification concept. Classical examples of game elements are: Levels, points, avatars, quests, rewards, achievements, progress bars, resources, badges, social interaction, leaderboards etc. These elements are just examples and as the game design progresses elements like these are constantly under development and like architecture there are tons of variations and options of these elements. Combined together, these game elements form a basis of game elements that will be present in a gamified environment.

**Game Design Techniques:**
Architecture is (mostly) not defined by a collection of architectural elements/components, there is more to it. Likewise games are not just game elements combined into a game but are properly designed and thought through on deeper levels. Games are designed thoughtfully, artistically, systematically for its individual purpose. This conceptual way of thinking/designing like a game designer is something that can also be applied outside the world of gaming and therefore is an important aspect of gamification. See it as a way to approach the challenges that you have.

To further elaborate on the relation and synergy between the game elements and game design techniques the following table has been developed to show that game design elements are identified on multiple levels of abstraction. These levels of abstraction should be included and understood to comprehend the definition of gamification. The levels are ordered from concrete to abstract in five levels, see Image 4.

**Non-Game Contexts:**
A non-game context can be anything outside the game itself. It is some objective other than success in the game. If you play a game this is mostly for entertainment and thus a gaming context. Examples of non-gaming contexts are gaming to learn, or gaming to work. The actions/proceedings may be very game like but the purpose, the rational for the experience is something outside of the game. It has validity, an intention outside of the game.

To conclude the definition there is also a bracketed part present. This part is often an important aspect of applying gamification because gamification is most of the time (not always, hence the brackets) oriented
towards problem solving. The users in this part are the users of the gamified environment or the so called “players”. These problems can be anything that the gamification concept tries to focus at. For example: low social employee engagement within a company. Gamification in this case then tries to focus the users to engage this problem. Therefore to successfully apply gamification it can be very beneficial to focus on a situation or problem that you’d like to solve and to continue from that point of view.

To properly understand what gamification is, it is important to also understand what gamification is not. A common misunderstanding is to think that gamification is all about turning everything into a game. Gamification is not making everything a game or an immersive virtual 3D world. It is also not any game at work that people play, usually this is done out of boredom. What gamification does is taking the parts that are not boring and enhance them using game design principles. Gamification says your still in the real world or you are still in a real building or you are still doing your job at work. Instead of turning the experiences into a game, gamification focusses on improving these experiences in different ways. In short the idea is to listen to what games can teach us, learn from a certain successful game design/concept and take the parts, elements and/or design techniques from that and find out why they are so successful. Then take the meaningful core of these experiences to create a better and improved experience applied to your own situation and problem(s). By generating greater motivation you will keep the users interested and active but it should not pull the users out of the real world (lose reality). And last but not least, gamification is about appreciating and having fun.

"IN EVERY JOB THAT MUST BE DONE, THERE IS AN ELEMENT OF FUN. YOU FIND THE FUN, AND SNAP! THE JOB'S A GAME!" - MARY POPPINS

Image 5 shows how gamification fits in with other concepts that are related to gamification but whom are very valuable to distinguish from gamification.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Game interface design patterns</td>
<td>Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations</td>
<td>Badge, leaderboard, level</td>
</tr>
<tr>
<td>Game design patterns and mechanics</td>
<td>Commonly reoccurring parts of the design of a game that concern gameplay</td>
<td>Time constraint, limited resources, turns</td>
</tr>
<tr>
<td>Game design principles and heuristics</td>
<td>Evaluative guidelines to approach a design problem or analyze a given design solution</td>
<td>Enduring play, clear goals, variety of game styles</td>
</tr>
<tr>
<td>Game models</td>
<td>Conceptual models of the components of games or game experience</td>
<td>MDA; challenge, fantasy, curiosity; game design atoms; CEGE</td>
</tr>
<tr>
<td>Game design methods</td>
<td>Game design-specific practices and processes</td>
<td>Playtesting, playcentric design, value conscious game design</td>
</tr>
</tbody>
</table>
To illustrate the power of gamification and the potential of gamifying architecture the following examples have been chosen to elaborate the relation between gamification and spatial solutions. These examples are inspiring and insightful concepts to show the potential of applying Gamification in the field of Architecture.

**Piano Staircase – Volkswagen Fun Theory**

“Taking the stairs instead of taking the escalator or elevator feels better.” With this motto in mind the creators of the piano staircase searched for a way to increase the amount of stair users. Their main question was: Can we get more people to use the stairs by making it fun to do? To reach their goal the designers came up with a creative solution: By installing sensors and speakers over night at a metro station exit in Stockholm they visually transformed the stairs into a piano staircase. When people step onto one of the stairs the sensors pick up the presence of the people and send out a signal for the speakers to play a piano sound linked to the stair they step on. The lower stairs produce a low tone and the further you go up the higher the tone gets. The first thing this generates is curiosity: people exit the metro and see a giant piano staircase instead of the usual stairs, what do they do? Is it art or is it even functional? After that people try to check out what it does by walking over it, people understand the concept and start to have fun by playing music by walking over the stairs. The result? 66% more people took the normal stairs over the escalator [14].

**Terra Poo WiFi**

Mexican internet provider Terra found a smart solution for a common urban problem: An overload of dog feces covering public areas. Getting people to clean up their dogs excrements in a public place is not an easy task. Instead of placing signs that indicate it’s prohibited to walk with a dog or that you have to clean up the provider looked at it from a different perspective. What is the problem? Dog feces are everywhere in public places like parks. What is the goal? To encourage dog owners to scoop up their dogs feces so the public places stay clean and excrement free. The solution they came up with is simple: create an incentive or reward that is highly desirable as a reward for cleaning up the feces. By placing a bag filled with dog feces in a container, the container weighs the package and rewards the user with corresponding WiFi access throughout the whole area. More weight means more minutes of free internet access. Exchanging feces for WiFi might be a bizarre concept, but at the same time it motivates people to keep their public spaces cleaner and thus to improve the urban quality of the area [15].

Both examples are clear examples in terms of how gamification is applied. In the first example with the staircase the focus lies on the unexpected to generate curiosity to encourage user engagement. The Poo WiFi example clearly elaborates on an action/reaction type of gamification where the incentive or reward drives people to clean up their dog’s poo.
Why should we want to apply gamification to architecture? To answer this question it is interesting to first answer the following question: Why are video games so successful? This question is very relevant because the emergence and success of gamification roots back to the explosive growth and success of the videogame industry. There has been an explosive growth in the market for video games because more and more people start to play games resulting in a growing amount of demands. So why is it that people love to collect coins, solve puzzles, shoot monsters or explore dungeons in the first place?

Gamers often answer with “having fun” or “escaping reality” but these are mere hollow explanations for what actually really motivates them to play video games. The real motivations for playing video games are far more complex than one of the latter explanations. The power of games lies in the fact that they actually fulfill several real-world human needs:

“We all have basic psychological needs, these needs operate all the time when we’re at work, or when we’re engaging in a softball league, or on weekends while we are playing a video game. These needs are always operating. Games perfectly target several of these needs.” – Scott Rigby, Ph.D. Research Psychologist in motivation

Rigby breaks this down into three basic categories [3]:

Competence: People love to feel successful and to feel like we’re growing and making progress in our accomplishments and knowledge. See competence as a desire to seek out control or to feel mastery over a situation.

Autonomy: The desire to feel independent or have a certain amount of control over our actions. The drive toward autonomy is why people instinctively dislike being manipulated; it’s why imprisonment is a punishment, and why we feel an innate urge to rebel against slavery.

Relatedness: We like to feel like we matter to others, and we like to feel like we are making a significant contribution to society.

Competence for example is really effective at creating a relation between effort and rewards. In real life situations we cannot always immediately see the result of actions that we consciously or subconsciously make. Games are in this way more consistent at rewarding the players for their choices they make due to their feedback systems. To express yourself in many ways with little to none impairment is something what autonomy should aim at. This is also one of the reasons why free roaming games like GTA or the Elder Scrolls Series are very successful. Relatedness cannot always easily be achieved in real life by everyone while it is easy to achieve in games. Studies have found that this need for relatedness can be met even if gamers are interacting with people who are not real [4].

“Over the centuries we’ve gravitated towards experiences that make us feel more competent, more autonomous, and more related because these experiences make us feel good and keep us mentally healthy. These needs can be fulfilled in any number of ways: through work, school, friends, sports, and hobbies. However, sociologists are
beginning to understand that video games are one of the most seductive of all of these activities because they fulfill our psychological needs more efficiently than almost any other activity.” – Ben Reeves, Associate Editor for Game Informer [5]

The core knowledge we can take from this is that people have certain psychological needs that drive them (or at least reduce the threshold) to participate in playing games. The start of gamification goes back to the success and growth of the game industry and thus to these fundamental aspects of video game design. By taking the core aspects of video game design, gamification aims towards applying this to non-game related fields to generate a better experience for the user of the gamified environment.

Going back to the initial question: Why should we want to apply gamification to architecture? For architecture this means that we can potentially create new, different, better, and/or improved experiences compared to our current architectural experiences by applying gamification in architectural design. By taking gamification elements, techniques and ideas to create interactive architectural spatial and environmental designs and concepts, gamification can transform experiences like video games did years ago and still do nowadays.
To understand the potential of gamification and in order to apply gamification it is important to comprehend the basics of gamification. This World is dedicated to explaining and teaching the basics of gamification theory [6].

"I am a game designer"
Jesse Schell [7] urges people who are interested in game design to understand the following five words: “I am a game designer.” As explained in previous chapters gamification is different from game design but these five words are nonetheless important to people that want to apply game design lessons through gamification as well. Schell’s statement points at the idea that game design is a state of mind, a way of thinking. It’s about resolving your problem(s) in a way you would think like a game designer, through a different set of lenses. Think about your problems as if it was a game. “Your problems are still real and important but if it was a game and you would be the designer of that game, what would you do?” [6] Werbach points out two caveats of what this means: First it doesn’t mean that thinking like a game designer makes you become a game designer. It’s different than being a game designer. The point is that you are going to approach things through the lens of game design, instead of the usual architectural lens in this case. The second caveat Werbach shows is that thinking like a game designer is different than thinking like a gamer. Gamers play the game, designers design the game. As a gamer you focus and care about the experience, as a designer you design and create frameworks and structures as opposed of the experience.

"THE GAME IS NOT THE EXPERIENCE, THE EXPERIENCE IS WHAT IT FEELS LIKE TO PLAY THE GAME (AND YES THAT IS ULTIMATELY THE OBJECTIVE) BUT THE GAME ITSELF INVOLVES ALL OF THE STRUCTURES THAT IT TAKES TO CREATE THAT EXPERIENCE." - KEVIN WERBACH

So how do you think like a game designer?
A solid starting point is to consider your participants as “players”. Regardless of your target participants (building users, community, customers) it makes sense to call them players instead of their original names as participants because those names have certain subtle implications for the nature of the relationship. In game design (and also in gamification) the relationship is between the designer and the player. Players are the center of the game, the game revolves around the player. Even if the purpose of the game (or gamified environment) serves a different goal or purpose, for the player it feels that the game resolves about the player. Make sure your players get their needs and desires from the game. This points back to the three basic categories explained earlier by Rigby [3]: competence, autonomy and relatedness. The goal as a game designer is to get your players playing and to genuinely engage them to keep them playing for an extended period of time.

The player’s journey
The player’s journey is the conceptual path that the player takes when playing the game, see Image 11. Like any story the player’s path consists of the beginning (start), the middle part and the end. The player start at the beginning and by continually progressing through the game he or she will eventually reach the end. This process should be as seamless as possible and contains at least the following three important phases:

**Onboarding:** Onboarding is all about getting the player into the game as quickly and easy as possible.
**Scaffolding:** Scaffolding focuses on providing the player training and learning to overcome problems/obstacles/complexities that otherwise would get the player stuck. By overcoming these complexities the player will realize how to use this knowledge in other situations that otherwise would get them stuck.
**Pathways to mastery:** The player conquered and achieved some real skill in context of the game. This criteria can be met on multiple levels and scales depending on the context of the game or the gamified environment.
The 4Keys 2Fun: Player Experience (PX) is how player interaction creates emotion. Best selling games use emotion from four types of interactions to capture attention and motivate play. Use the 4Keys 2Fun to paint attention onto any UI like Velcro and color it with emotions to match a brand or the task at hand.

Hard Fun
Provides the opportunity for challenge, mastery, and feelings of accomplishment. Hard Fun focuses attention with a goal, constraints, and strategy.

Easy Fun
Inspires exploration and role play. Fun failure states, fantasies, or simply enjoying the controls enchants and captures the imagination. Easy Fun is the bubble wrap of game design.

People Fun
Provides the excuse to hang out with friends. People are addictive, and these mechanics over time build social bonds and teamwork. Everyone wants to spend more time with their friends.

Serious Fun
Purposeful play changes how players think, feel, behave, or make a difference in the real world. The excitement of games enlivens otherwise boring tasks. Serious Fun is play as therapy.

Provide Meaning & Value

**Four types of fun**

What is fun? Fun is the means to an emotion. The emotion triggered by fun can vary but generally speaking the emotion to fun is happiness, where fun is the way to achieve happiness. Fun itself is often described by gamers as the main reason why they play games. Lazzaro specializes in emotion in games (Player Experience Design). She published “The 4 Keys 2 Fun”[8] which focuses on the different kinds of fun and the relation with the corresponding actions and emotions to that fun.

“In looking at how games create emotion without story we created 4 Keys to emotion without story that met these requirements:

Criteria for 4 Keys:
1. What Players Like Most About Playing
2. Creates Unique Emotion Without Story
3. Already Present in Ultra Popular Games
4. Supported by Psychology Theory and Other Larger Studies

The 4 Keys unlock emotion with:

1. **Hard Fun**: Players like the opportunities for challenge, strategy, and problem solving. Their comments focus on the game’s challenge and strategic thinking and problem solving. This “Hard Fun” frequently generates emotions and experiences of Frustration, and Fiero.

2. **Easy Fun**: Players enjoy intrigue and curiosity. Players become immersed in games when it absorbs their complete attention, or when it takes them on an exciting adventure. These Immersive game aspects are “Easy Fun” and generate emotions and experiences of Wonder, Awe, and Mystery.

3. **Altered States**: Players treasure the enjoyment from their internal experiences in reaction to the visceral, behavior, cognitive, and social properties. These players play for internal sensations such as Excitement or Relief from their thoughts and feelings.

4. **The People Factor**: Players use games as mechanisms for social experiences. These players enjoy the emotions of Amusement, Schadenfreude, and Naches coming from the social experiences of competition, teamwork, as well as opportunity for social bonding and personal recognition that comes from playing with others.”

This results into four types of fun with its corresponding actions and emotions, see Image 12. What we can conclude from this (for the sake of gamification) is that we should not limit ourselves to thinking of fun as one aspect or another. By thinking that fun is only casual and for the pure sake of joy we miss the opportunity to engage other people and make things fun using these other categories of fun defined by Lazzaro’s XEODesign. Furthermore fun can and should be designed. Fun also can be very challenging and hard, it can appeal to people on different kind of levels and scales if properly designed.
Dynamics
Big-picture aspects; “grammar”

Mechanics
Processes that drive action forward; “verbs”

Components
Specific instantiations of mechanics and dynamics; “nouns”

1. Constraints
2. Emotions
3. Narrative
4. Progression
5. Relationships

1. Challenges
2. Chance
3. Competition
4. Cooperation
5. Feedback
6. Resource Acquisition
7. Rewards
8. Transactions
9. Turns
10. Win States

1. Achievements
2. Avatars
3. Badges
4. Boss Fights
5. Collections
6. Combat
7. Content Unlocking
8. Gifting
9. Leaderboards
10. Levels
11. Points
12. Quests
13. Social Graph
14. Teams
15. Virtual Goods

Images 13, 14: The “Pyramid of elements” by Werbach and Hunter, Manrique’s “35 Gamification Toolkit”
Balance
Another important aspect of games is balance. A good game is designed to be balanced: not too easy, not too hard. Balance can be met on multiple levels during a game. It should be balanced from the start but also during the end. If a game doesn't feel balanced to the players of the game, people will stop playing. This is a tricky part since the sense and meaning of balance can be different from person to person. For example take the game of roulette in a casino. Chances are statistically evenly distributed. You have 33 spaces where the ball can end up: 0 to 32. This means that the chance of the ball ending at number 17 is just as high as it is at 28. If the space where the ball can land on a particular number is 4 times as big as the other spaces then you will end up with an unbalanced game if the rest of the roulette rules stay the same. People will be less motivated to play a game where they have the feeling that the game is not balanced if the result of this imbalance has a negative influence on their chances.

Gamification frameworks
The pyramid of elements is a gamification framework designed by Werbach and Hunter [9] consisting of different game and gamification elements. It is designed to give a sense of the different kind of elements or pieces from games that can be applied in various ways. The pyramid consists out of three levels: Dynamics, Mechanics and Components. Important to note is that it’s just a framework for the game elements, the aspect of the game as a whole and thus the experience of the game is outside of this pyramid since the collection of game elements does not cover the whole game or its experience. It’s the whole that is greater than the sum of the parts. Things to consider that are also very important parts of the game as a whole are for example the aesthetics and the sound of the game. All that is above and beyond the elements and this pyramid focusses on recurring patterns that are often present in games and gamification concepts [10].

A different but useful framework for gamification is designed by Manrique [11]. He developed the so called “35 Gamification Mechanics Toolkit” which consist of 35 cards that resemble gamification mechanics sorted on 6 different levels. Every level means a step in the design process:

Level 1 (Pink Card): Onboarding
Level 2 (Yellow Card): Late Onboarding
Level 3 (Orange Card): Midgame
Level 4 (Blue Card): Late Midgame
Level 5 (Green Card): Endgame
Level 6 (Purple/Epic Card): Everlasting experience

By combining different mechanics on different levels these cards can be used as brainstorm tool but also as a development tool for gamification concepts.

It is important to understand that the game frameworks described by Werbach and Manrique are in no way complete gamification solutions. These elements (or as Manrique describes them as the 35 mechanics) are not the game. They are mere toolkits and serve as an aid or guide in the design process. It is important to understand for example that not all rewards are fun and not all fun is rewarding.
For comprehending the concept of gamification it is interesting to understand the basics of behavior and motivational theory to comprehend why people take certain decisions and to learn what you can do as a designer to change or improve things to get a certain desired result or outcome. Behaviorism focuses more on the behavior of people and the external influence on the behavior while cognitivism talks about mental states and what internally is going on in people’s heads.

**Behaviorism**

Behaviorists focus on the external influence on people, therefore they do not take internal states into account. This means that they do not look at what people actually think (inside the “black box”) but they do look at what kind of external stimuli does (outside the “black box”) the human receive and how does it respond to that. So what can we learn from behaviorism in relation to gamification?

Look at what people actually do, observing is knowledge. Do people react to a certain stimulus? Why do they do that? Instead of focusing on possible theories, learn from the specific outcome of an example. Secondly feedback loops are powerful tools to teach and motivate people. If someone takes an action and also receives feedback about that action/behavior then this tends to produce a response. A more detailed explanation of this can be found in the chapter “Guidelines for applying Gamification: “The 6 D’s”” but this loop tends to be a motivational stimulus. Another important aspect is that learning occurs by the reinforcement of stimuli. The more you see that a certain action produces a certain result the faster your brain will make associations to that. Through consequences of taken actions people will get conditioned. Examples of this can be found in a lot of games, especially social videogames that work on a time basis. If for example you don’t check out the building status of your new ship in a game there is a possibility that something goes wrong after a while and that you have to invest more time and/or resources to keep the building going on. Through learning from the consequences you then tend to check the building status more often because you want to complete the building of your ship as soon as possible without further delay. The last aspect worth pointing out is the notion of reinforcement through rewards. By offering rewards that are valuable in any kind of way to the user, users are more likely to return and keep active in the environment that offers them these rewards. For example if there is a small reward/incentive for checking out a website every 5 hours then people tend to check the website more often because they expect a small reward/incentive after doing so. This example also shows that rewards can be used as feedback loops to create a form of classical conditioning which makes rewards potentially powerful.

**Cognitivism**

Cognitivists focus on the inside of the “black box” in contrast to what behaviorism does. It’s all about what actually is going on inside of our head that motivates people to do things. A very important aspect related to gamification is the type of motivation that is used to engage in a gamified system. We have two kinds of types: Intrinsic motivation and extrinsic motivation.

Intrinsic motivation is what we ultimately search to create and have in gamification; you do things for its own sake just because you want to do it. This is without any influence of external stimuli. It’s all because you think it’s rewarding on itself, or engaging or fun just by doing the thing without thinking about the consequences and/or benefits to it. The other type of motivation is extrinsic motivation.
Extrinsic motivation is the exact opposite of intrinsic motivation; doing thinks for any reason other than the thing itself. The reward can be anything like help, support, money, reputation, status, self-esteem. The point here is that the motivation is driven by the reward and not for its own sake.

As stated before it is ultimately desirable if the users of a gamified system use the gamified system out of intrinsic motivation. It is however questionable if a system should be gamified in the first place if there is already a huge supply of users with intrinsic motivation. Therefore gamified systems are often based on extrinsic motivation to improve or enhance the experience so that it ultimately becomes intrinsic motivation.

Self-determination theory is a macro theory of human motivation and personality. One of the aspects that it covers is the psychological needs of humans. It focusses on the motivation behind the choices that people make without any external influence and interference. Self-determination theory states three characteristics of intrinsic motivation (which we already know from the studies of Rigby [4]): competence, autonomy and relatedness. Self-determination theory suggests that if these three factors are present in a certain sufficient amount that an activity will be worthwhile to people in and out itself.

**Behavior Change**

The last aspect that will be covered is what causes behavior change. As stated before there are a certain amount of aspects that are important to what motivates people and what types of motivation we have. Fogg [12] states that in order to cause behavior change there must be three elements present that converge at the same moment: Motivation, Ability and Trigger. “When a behavior does not occur, at least one of those three elements is missing. Using my Behavior Model as a guide, designers can identify what stops people from performing behaviors that designers seek. For example, if users are not performing a target behavior, the model helps designers see what psychological element is lacking.”
When setting up guidelines or a gamification design framework it is important to understand the basics of design thinking. Design thinking holds several key principles that are valuable to gamification and therefore worthy to point out. The first principle of design thinking is that it is purposive, it has a goal. By setting up a goal the gamification concept should constantly refer and aim towards reaching that specific goal. The second principle is that design thinking is human centered, based on and around human beings. The solutions that will be provided by the gamification concept are made and will be used by humans; Think about the desired experience. Design thinking is about positively pushing the experience further; notice that the player experience is different from the designer experience! The third principle is about the balance of the analytical and the creative. A well designed balanced gamification concept blends in the analytical and creative part of the concept just right. It’s not just about numbers, formal structures and logic but also about the creative aspects; for example innovation, elegance and beauty. The last principle worth pointing out is that design thinking is iterative. Design thinking is an iterative process that will not be perfect from the start; there will be a lot of prototyping and playtesting.

Werbach and Hunter [9] created a six steps how-to guide on implementation of gamification, namely the “6 D’s”:

1. DEFINE business objectives
2. DELINEATE target behaviors
3. DESCRIBE your players
4. DEVISE activity cycles
5. DON’T forget the fun!
6. DEPLOY the appropriate tools
**Define business objectives**
For successful and effective gamification it is essential to have a well-developed understanding of your business objectives and goals, see Image 15. These goals are the specific performance goals of the gamified system/environment. Examples of this could be improving customer loyalty, or increasing productivity or in the case of architecture; improving the (spatial) experience of a museum visitor.

**Delineate target behaviors**
After defining your goals, focus on what you want the players to do and how to measure and evaluate them. Try to be as specific as possible with the target behaviors, for example:
- Visit your building
- Explore the tiger area in the zoo for at least 15 minutes
- Sign up for a newsletter of a club
- Use and share social status’ on a certain medium

The defined behaviors should reinforce or promote the previous defined ultimate business objectives. The more and concrete behaviors there are, the wider the range of possibilities and options there are for the players to explore. Be careful though to not make the behavioral options to complex or confusing for the player. Clean, simple and concrete are potential keys to success. The second aspect of delineating target behaviors is to develop the metrics of success. When is a gamification project successful? Define the win states for the gamified system and make them quantifiable, for example; The project is successful if the average visitor of the museum spends 30 minutes more in the museum. The last aspect of target behaviors is analytics. After defining win states the results of the project have to be analyzed in order to evaluate the performance and effectiveness of the independent parts of the gamified system. Examples of analytics are daily active users before and after the implementation of gamification or the amount of points given by the system (in case of a points/score based gamification system).

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*Image 15: Define your business objectives step by step*
Image 16: Bartle’s four type of players
Describe your players
Who are the players? Who will take part in the gamified system/environment and what will they do? What motivates your players? These questions are crucial elements of your gamified system. Try to think like the players of your gamified system and find out what motivates them to do and especially what they don’t want to do. Arrange your system and player tasks and objectives in such a way that it fits most to preferably the intrinsic motivation of the players. This can be very tricky since not every player will be the same and there will be multiple types of players. Therefore its very practical to segment the type of players. Bartle [16] invented a system to distinguish type of players as a research on text-based multiplayer online games. He distinguishes four type of players: explorers, killers, achievers and socializers. The following summary by Kyatric [17] is insightful to Bartle’s four types of players, see Image 16:

1. Explorers like to explore the world - not just its geography but also the finer details of the game mechanics. These players may end up knowing how the game works and behave better than the game creators themselves. They know all the mechanics, short-cuts, tricks, and glitches that there are to know in the game and thrive on discovering more.

2. Killers like to provoke and cause drama and/or impose them over other players in the scope provided by the virtual world. Trolls, hackers, cheaters, and attention farmers belong in this category, along with the most ferocious and skillful PvP (player versus player) opponents.

3. Achievers are competitive and enjoy beating difficult challenges whether they are set by the game or by themselves. The more challenging the goal, the most rewarded they tend to feel.

4. Socializers are often more interested in having relations with the other players than playing the game itself. They help to spread knowledge and a human feel, and are often involved in the community aspect of the game (by means of managing guilds or role-playing, for instance).

Even though Bartle invented and designed this theory in relation to MUD’s (Multi-User Dungeon), the concept of segmenting your players or audience in these player types is a good example and point of view for describing the players in a gamified system.
Motivation

Action

Feedback

Engagement Loop

Start (Onboarding Phase)

Progression Stairs

Images 17, 18: Engagement Loop, Progression Stairs
Devise activity cycles
Games are not simple linear processes. Games start with a start and usually end with an end but along the way games operate through a series of options and activity cycles/loops. An activity cycle is a series of events that are triggered by each other, for example sending an e-mail will give the receiver a notification of a new e-mail and after replying to that the new receiver will get a notification of that. Werbach and Hunter describe two kinds of cycles: engagement loops and progression stairs. “Engagement loops describe, at a micro level, what your players do, why they do it, and what the system does in response. Progression stairs give a macro perspective on the player’s journey.”

Engagement Loops: Engagement loops work with 3 elements: motivation, action and feedback, see Image 17. There is some kind of motivation that triggers a player to take an action. This action will produce feedback towards the player. This feedback will then again be a motivator to trigger new actions. In this way the cycle is complete and can be repeated over and over.

Progression Stairs: During the game experience fluctuates over time playing the game because a game is not a linear process with a directly reachable end goal. Players have to overcome obstacles and challenges in order to progress like described in the section of The player’s journey. The most commonly used model in games is the increasing progression and difficulty in order to reach the end goal. This end goal can already be clear from the beginning but is often too far to reach and in order to make this goal reachable games often introduce smaller or sub-objectives to gradually scale towards the end goal. You usually start with the onboarding phase to learn and get the basics until you mastered or achieved a certain problem, for example finishing one level or defeating a boss. After that you get a small moment of rest to then further continue your journey. These ups and downs in activity are what form the progression stairs, see Image 18. It is important however to make this progression stair as non-linear as possible as this introduces surprises and moments the player would not expect and thus a potential motivator for fun and playing.

Don’t forget the fun!
“The last thing to do before you start implementing a gamified system is to take a step back and ask a simple question: Is it fun?” What Werbach and Hunter state here is that while designing a gamified system it’s easy to lose track of the fun aspect. Like mentioned earlier in the “Four types of fun” section fun can mean a lot of different things for different people. However, if users experience the gamification project as fun they are likely to reuse it/come back more often because the project triggers something in their motivation or behavioral environment. Testing and prototyping can mean a lot in this sense because fun is a hard to pin down aspect and the best way to find out if people think it is fun is to actually test it out.

Deploy the appropriate tools
Using the appropriate tools for the right situation is crucial in achieving a well-designed gamification concept/gamified system. In the section “Gamification frameworks” two sets of tools have been presented and what they actually illustrate is the amount of possibilities and flexibility a gamification designer can and has to work with. Not every gamification project is the same and what works in one project can make another project fail. Also these sets are mere examples of what is possible, in the end it comes down to the creativity and the puzzle solving capability of the designer to properly applying gamification in a project.
Image 19: The four scenario’s, from top to bottom: 1, 2, 3, 4
Gamification can be applied in an almost endless amount of ways. In order to narrow down the scope in relation towards architecture the following 4 categories or so called scenarios have been developed. Note that these scenarios are developed to work on a spatial, architectural and/or urban scale.

**Scenario 1 - Gamification as an architectural concept for buildings:**
In this scenario gamification fulfills the role as a concept started up from the bottom in the design process; a new situation or location with a new project or building that is being designed and developed from scratch. Since this approach starts from scratch it only applies to new buildings.
Example: A new shopping mall.

**Scenario 2 - Gamification as an extension/expansion of an architectural situation:**
The second scenario focusses on expanding or extending an existing architectural situation; there is an existing situation or location with an already present building. The existing program of the building demands more space and therefore architectural intervention and injection is required. The new architecture takes gamification as a concept from the ground up and is applied in such a way that it integrates with the older existing architecture.
Example: An expansion to a library.

**Scenario 3 - Gamification as a concept for reuse/allocation of a building:**
In the third scenario gamification as a concept is applied and integrated in the adaptive reuse of an existing building that doesn’t meet the contemporary demands anymore. This is based on an existing situation with a building that (partially) needs to be redesigned and build.
Example: Old industrial silos that are empty and need adaptive reuse in order to be functional again.

**Scenario 4 - Gamification as an architectural problem solver:**
The last developed scenario aims at gamifying architecture in order to create solutions for existing spatial/architectural/urban or even social problems. These solutions are mostly applied to existing situations with existing buildings but one could argue that certain spatial, urban or social problems can be solved in an existing situation but with a new building. If this is the case then the fourth scenario is more or less an addition to the first scenario.
Example: Solving peak pressure at a public transport station through gamification.

For the further development of this research scenario 1 is the scenario of choice to continue with. Although gamification suits perfectly as a problem solving tool on different kind of scales (scenario 4), use-cases are rather limited and tend to go towards architectural installations rather than full scale architectural designs (building/project). Scenario 2 and 3 can also be interesting to develop but when you are designing an extension/expansion/reuse to an existing architectural situation the concept tends to be integrated in just these parts rather than the full architectural project. The potential of showing a case of gamification in architecture becomes more integrated when starting from the ground up with a full scale new project (scenario 1).
WORLD 5
PROGRAM
In order to apply a gamification concept in architecture a program is required. This chapter is dedicated towards the program of the project. For this project the program is shaped in the form of a suitable use-case to apply a gamification concept to. The use-case used for this project will be a use-case matching the previously explained scenario: Gamification as an architectural concept for buildings.

The Netherlands does not have a Museum of National History, or as the dutch would say, a “Nationaal Historisch Museum” (abbreviated as NHM). In 2006 a political debate started with the idea and initiative to build such a museum for the country in order to properly publicly display the rich and cultural history of the Netherlands. After a lot of debating and discussions the whole project got cancelled in 2010. Because of the political, social and cultural relevance the NHM lends perfectly as a use-case for applying gamification in an architectural design. Museums are buildings with a unique design made for a specific reason or use. Each museum has its own ways of navigating through the building, showcasing their collection and using spatial quality to create a unique and compelling visit for its public. The fact that there is already a rich history to build the NHM means that there are also defined requirements to a certain extent. These requirements (formulated by the government) will serve as a basis for the requirements for this project.
Image 21: René van Zuuk Architekten’s design for the NHM

Image 22: Mecanoo’s design for the NHM
Even though there is no tangible NHM today, the museum already has a long history. Political and content related debates, decisions and revisions all rapidly followed each other in succession. Dating back to 2006 it all started with a letter sent by the politicians Jan Marijnissen and Maxime Verhagen. This letter was a call for the importance of the (national) historical notion of the Netherlands because of the lack of it in our contemporary society. This letter raised a lot of attention and started to keep the discussion and possibility of a NHM going.

Why do we need the NHM? First of all because of the preservation and characterization of the Dutch history. Another important reason why this letter emerged is the substandard historical notion in the Dutch education system. There is no sufficient knowledge clustered and showcased of our own history and even Dutch citizens lack certain common knowledge of their own history. There is currently no place where people can get properly informed in a coherent way of the background and history of the Netherlands. Lastly the Dutch common rituals, traditions and heroes feel lost and need a way to feel connected again. This is the so called cultural citizenship.

The following summary [18] will go through important moments and events related to the development of the NHM in a chronological order:

On May 15th 2006 the previously mentioned letter was submitted starting the development of the NHM. A couple of months later on September 8th the government decided that the NHM should be located at the “Malieveld” in The Hague because of the good accessibility and the fact that the Dutch government is seated there. Four days after this decision the municipality of The Hague said that it is prohibited to build the NHM there because of the Act of Redemption from 1576 which is signed by Willem van Oranje himself. This act states that no tree ever may be chopped down nor may the forest ever be sold. On September 20th Dutch Queen Beatrix announced the following during the Queen’s speech from the throne: “The government is committed to the cultural resources available in our country, to preserve them and to make them accessible. The Rijksmuseum will be renovated and the decision is made to create a Museum of National History. Culture connects and enriches.”

The discussion of the location continued on October 24th when Jan Marijnissen debated for the NHM to be built in Amsterdam. Between this discussion for the location of the NHM it was also uncertain at one point (April 20th, 2007) if the museum would ever be built because the government forgot to reserve money to build it. On May 9th 2007 three cities offered a potential location for the NHM: Amsterdam, The Hague and Arnhem. Quickly followed by Utrecht and Nijmegen two days after. Almere popped up as a serious candidate for the NHM on May 30th with two designs by René van Zuuk and Perspekt Studio’s. Minister Ronald Plasterk decided on June 29th that the final location of the NHM will be Arnhem next to the “Nederlands Openluchtmuseum”. The content of the museum has to match the “Canon” that has been set up in 2006. The opening of the museum was estimated at March 30th 2011 with the costs of 50 million euro. The Dutch politicians were not all satisfied by Plasterk’s choice of location but nevertheless this remained the final choice. A design was made by Mecanoo Architects. On October 1st 2008 two curriculum directors were appointed to the museum and on December 11th the discussion about the content of the NHM arises: Should we continue with the Canon or the so called “5 Worlds” theme: “Me and We”, “Land and Water”, “Rich and Poor”, “War and Peace” and “Body and Mind”? After a lot of further discussion, debating and deliberation the final decision to cancel the building of the NHM is made on October 29th 2010: the costs are simply too high. Instead, decided on November 2nd, The NHM will go to Amsterdam as an exhibition and as a digital museum opening January 1st 2011. This last effort to have the NHM unfortunately only lasted one year as it closed its doors in December 2011, the costs were too high. In total it is estimated that the government spent 15 million euros for the development of the NHM.
The Canon of Dutch History (“Canon van Nederland”) [19] is a list of topics which is prepared by the Committee for the Development of the Dutch Canon and commissioned by the Minister of Education, Culture and Science. This list consists of fifty topics and aims to provide a chronological summary of the Dutch History divided into fourteen themes. It is mainly made as material to be taught in primary schools and the first two years of the secondary school in the Netherlands. The scope of the Canon aims to provide an overview of the basic and general things people are ought to know about Dutch culture and history. This is also why the government first issued the Canon to be part of the NHM: It is a solid foundation for everyone that likes to learn, know and understand the Dutch history and culture and therefore serves as a great guide for the NHM.

The Canon of Dutch History consists of the following 14 themes:

1. The Low Countries by the Sea
2. On the outer edges of Europe
3. Conversion to Christianity
4. The Dutch language
5. An urban conglomeration and trading centre at the confluence of the Rhine, the Meuse and the Scheldt rivers
6. The Dutch Republic emerges from an uprising
7. The flowering of the Golden Age
8. A trading nation and colonial power
9. A nation-state under a constitutional monarchy
10. The rise of modern society
11. The Netherlands during the time of the world wars from 1914 to 1945
12. The welfare state, democratisation and secularisation
13. The diversification of the Netherlands
14. The Netherlands in Europe

On the next two pages the full list of 50 topics of the Dutch Canon are listed in a table with their corresponding theme, date and description.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Theme</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
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<td>Dolmens</td>
<td>3</td>
<td>c. 3000 BCE</td>
<td>Early farmers</td>
</tr>
<tr>
<td>The Roman Limes</td>
<td>2, 3</td>
<td>47 - c. 400</td>
<td>On the borders of the Roman empire</td>
</tr>
<tr>
<td>Willibrord</td>
<td>3</td>
<td>658 - 739</td>
<td>Spread of Christianity</td>
</tr>
<tr>
<td>Charlemagne</td>
<td>2</td>
<td>742 - 814</td>
<td>Emperor of the Western world</td>
</tr>
<tr>
<td>Willibrord (Hebban olla vogala)</td>
<td>4</td>
<td>c. 1100</td>
<td>Earliest fragment of Old Dutch script</td>
</tr>
<tr>
<td>Floris V, Count of Holland</td>
<td>6</td>
<td>1254 - 1296</td>
<td>A Dutch Graf and a discontented nobility</td>
</tr>
<tr>
<td>The Hanseatic League</td>
<td>5</td>
<td>1356 - c. 1450</td>
<td>Trading cities in the Low Countries</td>
</tr>
<tr>
<td>Erasmus</td>
<td>3</td>
<td>1466? - 1536</td>
<td>An international humanist</td>
</tr>
<tr>
<td>Charles V</td>
<td>2, 6</td>
<td>1500 - 1558</td>
<td>The Low Countries as an administrative unit</td>
</tr>
<tr>
<td>The Beeldenstorm</td>
<td>3, 6</td>
<td>1566</td>
<td>Religious conflict</td>
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<tr>
<td>William the Silent</td>
<td>6</td>
<td>1533 - 1584</td>
<td>From rebellious nobleman to 'Father of the Nation'</td>
</tr>
<tr>
<td>The Dutch Republic</td>
<td>6</td>
<td>1588 - 1795</td>
<td>An exceptional federal republic</td>
</tr>
<tr>
<td>The Dutch East India Company</td>
<td>8</td>
<td>1602 - 1799</td>
<td>Expansion overseas</td>
</tr>
<tr>
<td>The Beemster polder</td>
<td>1, 6</td>
<td>1612</td>
<td>The Netherlands and water</td>
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<tr>
<td>The Grachtengordel</td>
<td>5, 6</td>
<td>1613 - 1662</td>
<td>Urban expansion in the seventeenth century</td>
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<tr>
<td>Hugo Grotius</td>
<td>6, 7</td>
<td>1583 - 1645</td>
<td>A pioneer of modern international law</td>
</tr>
<tr>
<td>The Statenbijbel</td>
<td>3, 4</td>
<td>1637</td>
<td>The Book of Books</td>
</tr>
<tr>
<td>Rembrandt</td>
<td>7</td>
<td>1606? - 1669</td>
<td>The great painters</td>
</tr>
<tr>
<td>The Atlas Maior of Joan Blaeu</td>
<td>7, 8</td>
<td>1662</td>
<td>Mapping the world</td>
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<tr>
<td>Michiel de Ruyter</td>
<td>7</td>
<td>1607 - 1676</td>
<td>Naval heroes and Dutch naval power</td>
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<tr>
<td>Christiaan Huygens</td>
<td>7</td>
<td>1629-1695</td>
<td>Science in the Dutch Golden Age</td>
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<tr>
<td>Spinoza</td>
<td>7</td>
<td>1632 - 1677</td>
<td>Seeking the truth</td>
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<tr>
<td>Slavery</td>
<td>8</td>
<td>c. 1637 - 1863</td>
<td>Trafficking and forced labour in the New World</td>
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<tr>
<td>Buitenplaatsen</td>
<td>7, 9</td>
<td>17th and 18th century</td>
<td>Summer residences in the country</td>
</tr>
<tr>
<td>Eise Eisinga</td>
<td>9</td>
<td>1744 - 1828</td>
<td>The Enlightenment in the Netherlands</td>
</tr>
</tbody>
</table>

Table 1: The 50 topics of the Dutch canon
<table>
<thead>
<tr>
<th>Topic</th>
<th>Theme</th>
<th>Date</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>The Patriots</td>
<td>9</td>
<td>1780 - 1795</td>
<td>Crisis in the Republic</td>
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<tr>
<td>Napoleon Bonaparte</td>
<td>9</td>
<td>1769 - 1821</td>
<td>The Kingdom of Holland</td>
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<tr>
<td>William I</td>
<td>9</td>
<td>1772 - 1843</td>
<td>The United Kingdom of the Netherlands</td>
</tr>
<tr>
<td>The first railway</td>
<td>10</td>
<td>1839</td>
<td>The Industrial Revolution</td>
</tr>
<tr>
<td>The Dutch constitution</td>
<td>9</td>
<td>1848</td>
<td>A state's most important law</td>
</tr>
<tr>
<td>Max Havelaar</td>
<td>4, 8</td>
<td>1860</td>
<td>Protest against colonial abuse in the Dutch East Indies</td>
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<tr>
<td>Opposition to child labour</td>
<td>10</td>
<td>19th century</td>
<td>Out of factories and into schools</td>
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<tr>
<td>Vincent van Gogh</td>
<td>10</td>
<td>1853 - 1890</td>
<td>Modern art</td>
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<td>Aletta Jacobs</td>
<td>10, 12</td>
<td>1854 - 1929</td>
<td>Emancipation of women</td>
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<tr>
<td>The First World War</td>
<td>10, 11</td>
<td>1914 - 1918</td>
<td>War and neutrality</td>
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<tr>
<td>De Stijl</td>
<td>11</td>
<td>1917 - 1931</td>
<td>Revolution in Design</td>
</tr>
<tr>
<td>Crisis years</td>
<td>11</td>
<td>1929 - 1940</td>
<td>Society in the Great Depression</td>
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<tr>
<td>The Second World War</td>
<td>11</td>
<td>1940 - 1945</td>
<td>Occupation, resistance and liberation</td>
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<tr>
<td>Anne Frank</td>
<td>11</td>
<td>1929 - 1945</td>
<td>The Holocaust in the Netherlands</td>
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<tr>
<td>Indonesia</td>
<td>11, 13</td>
<td>1945 - 1949</td>
<td>A colony wrests itself free</td>
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<tr>
<td>Willem Drees</td>
<td>12</td>
<td>1886 - 1988</td>
<td>The welfare state</td>
</tr>
<tr>
<td>The watersnood</td>
<td>1, 12</td>
<td>1 February 1953</td>
<td>The perils of a low-lying country</td>
</tr>
<tr>
<td>Television</td>
<td>12</td>
<td>from 1948</td>
<td>A breakthrough in media technologies</td>
</tr>
<tr>
<td>Port of Rotterdam</td>
<td>12</td>
<td>from c. 1880</td>
<td>Gateway to the world</td>
</tr>
<tr>
<td>Annie M.G. Schmidt</td>
<td>4, 12</td>
<td>1911 - 1995</td>
<td>Going against the grain in a bourgeois society</td>
</tr>
<tr>
<td>Suriname and the Netherlands Antilles</td>
<td>13</td>
<td>from 1945</td>
<td>The West decolonises</td>
</tr>
<tr>
<td>Srebrenica</td>
<td>14</td>
<td>1995</td>
<td>The dilemmas of peacekeeping</td>
</tr>
<tr>
<td>Veelkleurig Nederland</td>
<td>13</td>
<td>from 1945</td>
<td>A multicultural society</td>
</tr>
<tr>
<td>Natural gas</td>
<td>12</td>
<td>1959 - 2030?</td>
<td>A dwindling resource</td>
</tr>
<tr>
<td>Europe</td>
<td>14</td>
<td>from 1945</td>
<td>Netherlands and the European Union</td>
</tr>
</tbody>
</table>
The location is an important aspect of a museum of this national importance. Such a location has a desired amount of requirements which the museum would benefit greatly from if met. The location for this use-case has to meet the following requirements:

- The building has a certain national importance and status
- Size of the plot needs to meet the requirements of the design requirements
- High accessibility and approachability for everyone (transportation wise)
- Exposure to its surroundings (the city)
- Publicly accessible area

Therefore the location of the NHM will be in Amsterdam. As already seen in the everlasting discussion of the museums history, there are different proponents and adversaries to the different locations, each with their pro’s and con’s. The capital of a country is a solid choice for a building of this cultural and historical magnitude which should be accessible for everyone. Besides the good accessibility the status of the museum is also something that is often displayed in the capital of the country. Contemporary Amsterdam is a metropolis and the amount of visitors, both natives and tourists, suits the needs for a museum like this.

As the location itself in Amsterdam it is very desirable to be in a central public place where people can easily reach the museum. For this reason the plot for the building is located in the Amsterdam Central area. The museum will be located on “Oosterdokseiland” at the head of the plot. The plot is where the old mail sorting centre was located before it got demolished. The museum on this location also confirms to its surroundings in terms of function: It is surrounded by other cultural buildings like the Public Library and the Conservatory. Also by choosing this plot for the NHM a formation/cluster of museums starts to form: The Museum of National History, Science Center Nemo and the National Maritime Museum.

Transportation wise it is a suitable location because it is easy to reach by public transport (train, busses and trams), bike and car. Also as the first/last building on the Oosterdokseiland block the plot has the desired exposure on multiple sides towards the city.
Images 26, 27: The location for the NHM use-case
Image 28: The four ESAA factors
During the initial development phase of the NHM the government came up with several requirements that the museum has to meet. The essentials of these requirements can roughly be simplified to two essential conditions:

1. A chronological overview of history: the notion of time.
2. The placement of events (Canon) in a proper way.

These conditions have a more empirical than a formal nature and therefore are subjective to personal experience. When do we experience the notion of time? What is “the proper way” of placing and showcasing the events of the Canon in a museum? These empirical conditions are taken as primary guidelines for the following formal requirements for this use-case:

- Gamification framework used to develop and design a gamification concept for the NHM.
- The routing should follow the chronology of the Dutch history as much as possible.
- The placement of events (Canon) in such a way that it is clear for the visitor in what time period they are and perceive the notion of time of that period.
- A fully programmatically working museum design (see World 5.7).

Also the following more empirical conditions are key aspects for the use-case:

- The emphasis of the experience lies in a unique and personalized visit instead of the general startpoint-endpoint visit that most museums use.
- The visitor perceives the visit as a mix of “the four ESAA factors”: Experience, Study, Authenticity, Amusement.
- The perception of the visitor is focused on reliving the moments and experience of the culture and history of the Netherlands. This perception and experience should be enhanced or amplified by the gamification concept.
The museum has the following design and program requirements in order to fulfill the use-case requirement of being a fully programmatically working museum:

**Logistics:**
Logistics Street  
Goods supply  
Loading and unloading bays

**Facilities:**
Reception (including information desk and counter)  
Wardrobe & Lockers  
Restaurant  
Kitchen  
Giftshop

**Program:**
Museum spaces that accommodate proper display of the Canon  
Exhibition spaces  
Archives  
Offices  
Meeting rooms  
Art depots

**Utilities:**
Toilets (multiple per floor)  
Tool Cabinets (1 per floor)  
Elevators  
Technical area  
Building management and security  
Staff spaces (toilets, repro, entrance)  
Registration and numbering
WORLD 6
DESIGN
The concept that is developed for the NHM is a combination of the multiple gamification frameworks and guides explained in the gamification world earlier. The main part of the concept consists out of Werbach and Hunter’s six steps guide named the “6 D’s”:
1. DEFINE business objectives
2. DELINEATE target behaviors
3. DESCRIBE your players
4. DEVISE activity cycles
5. DON’T forget the fun!
6. DEPLOY the appropriate tools

For step 4 a simplified version of the gamification framework by Manrique is used: onboarding, scaffolding and mastery. Step 6 uses the elements from Werbach and Hunter’s pyramid of elements.

1. DEFINE business objectives:
The core objective of the gamification concept is to create a museum visit experience that is focused on the enhancement and enrichment of the personal experience by linking personal preferences and interests to the contents of the museum. By achieving this objective each visitor will have an own unique and personal visit for the museum that matches their interests. By matching the interests and preferences of an individual to the contents of the museum it is likely that the visitor will be less bored and more enthusiastic about the content that is presented to him or her and therefore enjoy the museum more.

2. DELINEATE target behaviors
Certain behavior is very desirable in terms of the concept, examples for this use-case are:
• Visit a zone for at least 30 minutes.
• Spending a certain amount of time at a specific part of the collection.
• Usage of the interactive parts of the museum.
• Participating in zone events.

To translate behaviors into quantifiable results, metrics of success are desired. These metrics generate results that give feedback to the gamification system. Examples for the previous examples are:
• For staying at least 30 minutes in a zone a zone-specific reward is unlocked and added to your profile.
• By spending time you accumulate points that are added to your profile.
• By using the interactive parts of the museum bonus points are awarded upon completion.
• By participating in zone events a special event reward will be added to your profile by participating in the event.
Image 34: The NHM gamification framework
3. DESCRIBE your players
The players of the gamification system are the visitors of the museum. Each player receives a personal media device (PMD) once an entry ticket is bought. This PMD is then used throughout the building for several purposes. The main purpose is as a profile carrier: Each visitor is assigned a profile to their PMD after completing a personal interests and preferences test.

4. DEVISE activity cycles
Onboarding: This is the initial phase. After the visitor obtained a PMD the visitor goes through a profile assignment process to complete a personal interests and preferences test. This test can be done on the PMD itself or guided by the museum staff on the terminals in the lobby. After the profile has been established the PMD will calculate the most suitable routing through the building according to the results of the test. The zone with the highest interest rate will be assigned as the first zone to start at. The elevators will then bring the visitors to the according zone to start their journey.

Scaffolding: The second phase is the scaffolding phase, after exploring the first zone and accumulating your first points, badges and achievements the visitor gets the hang of the gamified environment. The architecture is designed in such a way that the visitor can flow into the next zone (that matches his profile the most) without passing through zones or areas that don’t meet his preferences or interest. By spending enough time in a certain zone points will be accumulated and added to the profile on the PMD. After reaching a certain threshold of points (which can be personal or the total of all the visitors present in a zone) you will level up and your profile gets updated (see Image 35). If you accumulated enough points and meet the level threshold, a “bonus room” is unlocked and accessible for those who earned the reward by actively participating in that zone’s activities. This ultimate reward is the climax of a museum zone. These rooms have special activities and exclusive content that is only available for those who earned access to it.

Mastery: The true museum enthusiasts will try to access and unlock all content in all zones, both digital on their PMD (badges, points, achievements) and physical in the museum (bonus rooms). This profile can also be managed and stored through the museums website so people can view and share their rank on the leaderboard with their own social networks. Visitors can also retrieve their profile and continue where they left after their first visit when the museum updates zones and content to display including temporary exhibitions etc.

5. DON’T forget the fun!
To make the activities in the different zones fun for the visitors they have to appeal to a broad kind of audience from young to old. Therefore a mix of all kinds of media will be used to showcase the collection. From classical static displays to interactive statues and mini-games, all activities require the use of the PMD. Passive use (presence detection) or active (login/check-in), all activities will be tracked and used to constantly update your profile while maintaining fun by visiting the museum.
Profile creation based on personal interests

Entrance

Level 0: Explorer

Level 1: Farmer

Level 1: Soldier

Level 18: Fisherman

Level 14: Freedom Fighter

Zone: Agriculture

Zone: Fishing Culture

Zone: First World War

Zone: Second World War

Zone: Slavery

Zone: Dutch Law

Level 1: Slave Trader

Level 17: Attorney

Image 35: The NHM leveling concept
6. DEPLOY the appropriate tools
The following elements from the pyramid of game elements are the tools that play a primary role and are deployed for this museum concept:

**Dynamics:**
- Narrative (a consistent, ongoing storyline)
- Progression (the player’s growth and development)
- Emotions (curiosity, competitiveness, frustration, happiness)

**Mechanics:**
- Feedback (information about how the player is doing)
- Rewards (benefits of some action or achievement)
- Cooperation (players must work together to achieve a shared goal)
- Challenges (certain task that require effort to solve)

**Components:**
- Avatars (visual representations of a player’s character)
- Quests (predefined challenges with objectives and rewards)
- Points (numerical representations of game progression)
- Levels (defined steps in player progression)
- Badges (visual representations of achievements)
- Achievements (defined objectives)
- Collections (sets of items or badges to accumulate)
- Content Unlocking (aspects available only when players reach objectives)
- Gifting (opportunities to share resources with others)
- Leaderboards (visual displays of player progression and achievement)
By utilizing the NHM Use-Case gamification concept, the design of the museum has to meet certain criteria. The criteria with the most spatial impact in this use-case is the routing that has to match the concept. The concept primarily revolves around the aspect of personal experience by linking personal preferences and interests to the contents of the museum. To achieve this personal experience, the routing through the museum has to match every individual visitor. The idea is that the visitor can skip content that is less interesting to him or her and dive directly into the content that they like. Spatially, this is a challenge if you don’t want to end up with a labyrinth of paths and stairs.

To address the design issue of the routing, the routing concept matches the use of the PMD (that is received upon buying a ticket to the museum). The profile on the PMD assigns the highest matching museum zone to the visitor. The visitor gets in the elevator and the PMD guides the visitor to the first zone (starting zone). After the visitor is done in the first zone, the PMD calculates the zone with the highest match based on the current position of the visitor.

To get the best match possible, it would theoretically be ideal if every zone is directly accessible from every starting zone. Practically, this is not viable with the amount of zones that the NHM hosts. To achieve a high amount of flexibility, crossroads are designed in-between zones. Most crossroads have six zones connected to it: two above, two beneath, and two next to it. Since there are two crossroads next to each zone, there are multiple combinations of follow-up zones. Since the PDM knows where the visitor is, it also knows which crossroads are near and can thus which zones are directly accessible. From the accessible zones, the highest matching zones are used as follow-up zones. After a visitor is finished visiting the museum, he or she can exit the museum through the ramp on the first floor that leads to the gift shop and exit.

For the design of the routing, a script is written that generates the floor slabs and routing ramps through various parameters. The resulting parametric model is used to match the parameters to requirements of the use-case. The parametric model is scripted in Rhinoceros with the Grasshopper plugin. The routing concept is inspired by knot theory (mathematical knots) [20] and UNStudio’s Mercedes Benz Museum.

The following parameters can be adjusted in the script:
• Radius of the Inner Circle, Middle Circle and Outer Circle: used to define the overall dimensions
• Rotation of the Inner Circle, Middle Circle and Outer Circle: used for rotations to create shape variations
• Amount of Segments: amount of routing ramp segments (in this use-case five)
• Height: clear height between floors
• Control Points: the amount of control points on the curve of the ramps
• Storeys: total amount of floorslabs
• Floor Thickness: the thickness of the floorslabs
• Ramp Width: total width of the ramps
• Ramp Thickness: thickness (height) of the ramps
• Ramp Void Height: the desired clear height between the ramps and the floorslab above (voids will be created)
SCRIPT: PARAMETRIC MODEL FOR THE ROUTING CONCEPT
VISITOR: MICK HEIJKENS
ZONE: WORLD WAR II
ACTIVITY: WATCHING TANKS

EXPLORER

EARN POINTS TO LEVEL UP!

POINTS: 17/30
CURRENT: LEVEL 2 EXPLORER

SOLDIER

CURRENT QUESTS:
- FINISH THE WORLD WAR II ZONE
- MEET FOR THE DAILY EVENT AT 16.00 HOURS
- WEEKLY EVENT IN ZONE THE PATRIOTS

NEXT ZONES:
80% MATCH: THE ROMAN LIMES
72% MATCH: THE DUTCH REPUBLIC
67% MATCH: THE PATRIOTS

EARNED BADGES:

WAR EVENT 2014
Lucky
Sweepstake Winner
First Visitor of the Day
December 12th
Profile Created 2014
ROUTING CONCEPT
Image 39: Two transportation concepts from left to right:
Vertical transport in the centre and museum content concentrated in the periphery,
Vertical transport in the periphery and museum content concentrated in the centre
Image 40: Three route transportation concepts from top to bottom:
“Traditional” vertical transport,
Split-level hopping,
Flowing ramps with access from elevators
Image 41: Visitors enter through one big main entrance and follow their own individual routing
Due to the routing concept the spatial sequence is different for every visitor. Because of the flexible routing the clustering (or zoning) of the museum is important. The content of the museum has to cover the Canon of Dutch History. The content of the museum is displayed on floors 1, 2, 3 and 4. Since chronology has always been an important aspect of the design of the NHM the chronology of the 14 themes of the Canon are leading as spatial sequences for the museum zones.

The 14 Canon themes plus 1 extra theme (The Netherlands in the future) form the main exhibition of the museum on floor 1, 2 and 3:
1. The Low Countries by the Sea
2. On the outer edges of Europe
3. Conversion to Christianity
4. The Dutch language
5. An urban conglomeration and trading centre at the confluence of the Rhine, the Meuse and the Scheldt rivers
6. The Dutch Republic emerges from an uprising
7. The flowering of the Golden Age
8. A trading nation and colonial power
9. A nation-state under a constitutional monarchy
10. The rise of modern society
11. The Netherlands during the time of the world wars from 1914 to 1945
12. The welfare state, democratisation and secularisation
13. The diversification of the Netherlands
14. The Netherlands in Europe
15. The Netherlands in the future

The fourth floor offers space for temporary exhibitions and special events.

All in all the spatial sequence flow of a visitor can be summarized as follows:

Ground Floor: Entrance, buying a ticket and acquiring a PMD, profile creation, elevator to main exhibition.
Floor 1, 2, 3, 4: Main exhibition, temporary exhibition(s), special events.
Floor 1 to Ground Floor: Exit through the gift shop.

The activity organization is rather straightforward and is designed on the activity cycle of the visitor. On the ground floor you have a public function in the front of the building and a closed private part in the back. The public part consists covers the visitors entrance from the main street with a big lobby, wardrobe and lockers, two meeting rooms and the gift shop. The closed private part has a staff entrance with staff space, offices, buffer zone for the supplies with an exhibition street and a space for goods supply. In between these two parts lies the core that goes through all floors which consists of 4 elevators, 1 supplies elevator, toilets and space for technical installations. First, second and third floor are all occupied by the main exhibition of the museum. Fourth floor has a restaurant and spaces for temporary exhibitions and special events. The -1 floor supplies space for archives, art depots, registration and numbering and technical installations.
Image 42: The 15 best visited Dutch museums in 2013
The design and specifically the dimensions of a building are related to the capacity of the building. Logically this means that bigger buildings can hold more visitors (more capacity) and smaller buildings can host less visitors (smaller capacity). The same logic goes the other way around: buildings with a small amount of visitors don’t need to be big and suffice with a small building. In this use-case the overall dimensions of the building are primarily determined by the capacity (amount of visitors) of the museum. The capacity of the museum is mainly determined by two factors: the concept and reference projects.

Since the concept aims for a unique and personal visitor experience that works through a personalized profile, it is theoretically possible that a lot of people have the same preference for an area or zone to visit. For this reason it is not desirable to have overcrowded and under crowded areas. Assuming the maximum amount of people in a zone is 150 with 15 zones to visit, a safe margin of maximum 1000 people present in the building is used in this use-case.

The openings hours from the museum will be from 09.00 till 18.00 every day of the year. Assuming that the average visitor spends around 3 hours in a museum, 3 time blocks can be made to visit the museum: 09.00-12.00, 12.00-15.00 and 15.00-18.00.

This means that you can have a maximum amount of daily visitors that is equal to the maximum amount of people in the building times 3. In this use-case it comes down to 3 x 1000 = 3000 people. On a yearly basis this means a theoretical maximum of 3000 x 365 = 1.095.000 visitors. However during weekdays museums are visited less often compared to weekends and not every day will have the full capacity of visitors. Therefore a correction of 30% is assumed resulting in 328.500 yearly visitors.
Existing Boundary Situation

Shape by boundary

Field of Interest

Resulting Final Shape

Shape by concept
Volume and Mass

Existing Boundary Situation

Field of Interest

Final Shape 3D
LOGISTICS & BORDER BETWEEN PUBLIC AND PRIVATE
Zone 1: The Low Countries by the Sea
Zone 2: On the outer edges of Europe
Zone 3: Conversion to Christianity
Zone 4: The Dutch language
Zone 5: An urban conglomeration and trading centre at the confluence of the Rhine, the Meuse and the Scheldt rivers
Zone 6: The Dutch Republic emerges from an uprising
Zone 7: The flowering of the Golden Age
Zone 8: A trading nation and colonial power
Zone 9: A nation-state under a constitutional monarchy
Zone 10: The rise of modern society
Zone 11: The Netherlands during the time of the world wars from 1914 to 1945
Zone 12: The welfare state, democratisation and secularisation
Zone 13: The diversification of the Netherlands
Zone 14: The Netherlands in Europe
Zone 15: The Netherlands in the future

Image 43: “Traditional Routing”
In World 5.4 - Canon of Dutch History the 14 themes from the Dutch Canon were summarized.
In World 5.6 - Requirements Use-Case the two requirements that the government set up were:

1. A chronological overview of history: the notion of time.
2. The placement of events (Canon) in a proper way.

The chronological overview of history is distorted by the gamification concept: It is possible that someone has the highest interest in a time period that is more recent than the other zones he will visit resulting in a twisted chronology. However the personal interests and experience of the visitor play a bigger role in this use-case. To still meet these requirements it is possible for the traditional, “non-gamified”, visitor to follow a default route that follows the chronological order of history. For the placement of the zones the 15 themes that are defined in World 6.1.3 are used. The “default” routing starts with Zone 1 and ends with Zone 15. The visitor goes clockwise across every floor to visit each zone in chronological order.
Zone 1: The Low Countries by the Sea

Zone 2: On the outer edges of Europe

Zone 3: Conversion to Christianity

Zone 4: The Dutch language

Zone 5: An urban conglomeration and trading centre at the confluence of the Rhine, the Meuse and the Scheldt rivers

Zone 6: The Dutch Republic emerges from an uprising

Zone 7: The flowering of the Golden Age

Zone 8: A trading nation and colonial power

Zone 9: A nation-state under a constitutional monarchy

Zone 10: The rise of modern society

Zone 11: The Netherlands during the time of the world wars from 1914 to 1945

Zone 12: The welfare state, democratisation and secularisation

Zone 13: The diversification of the Netherlands

Zone 14: The Netherlands in Europe

Zone 15: The Netherlands in the future
Zone 1: The Low Countries by the Sea

Zone 2: On the outer edges of Europe

Zone 3: Conversion to Christianity

Zone 4: The Dutch language

Zone 5: An urban conglomeration and trading centre at the confluence of the Rhine, the Meuse and the Scheldt rivers

Zone 6: The Dutch Republic emerges from an uprising

Zone 7: The flowering of the Golden Age

Zone 8: A trading nation and colonial power

Zone 9: A nation-state under a constitutional monarchy

Zone 10: The rise of modern society

Zone 11: The Netherlands during the time of the world wars from 1914 to 1945

Zone 12: The welfare state, democratisation and secularisation

Zone 13: The diversification of the Netherlands

Zone 14: The Netherlands in Europe

Zone 15: The Netherlands in the future
Zone 13: The diversification of the Netherlands

Zone 14: The Netherlands in Europe

Zone 12: The welfare state, democratisation and secularisation

Zone 11: The Netherlands during the time of the world wars from 1914 to 1945

Zone 15: The Netherlands in the future

Transport Core
An important element of the gamification concept for this use-case is rewarding the visitors. In step six of the gamification framework concept it is also listed as a mechanic for the concept. Rewards are incentives for the visitors by completing certain tasks or activities. For this use-case of the NHM the rewards are zone specific. This means that each zone has its own reward, namely the so called “Bonus Levels”. These bonus levels are special rooms, areas or spaces that are only accessible after completing certain tasks. These tasks involve user engagement with the zone that the visitor is visiting. This engagement can be different for each zone but some examples are: visiting a traditional display with artifacts from the past, participating in an interactive history game, watching a video of a historical event or listening to original audio tapes from the past. After completing such tasks the PMD registers the activity and points are awarded to the profile of the visitor. If enough points are accumulated the visitor will “level up”. After reaching a certain threshold of points the visitor is then able to visit the bonus level of that zone.

Since each floor of the museum has the same basic layout (the basic layout is a circle divided into 5 zones) the design of each zones bonus are concepts that can be applied in multiple zones. In this way a catalog of bonus level typologies has been developed and the museum’s board of directors can then decide which bonus level typology fits best to which zone in relation to the content that zone has to offer. This way of designing also offers the museum input and flexibility into the design of each individual zone. Content from the “The Dutch Language” zone can greatly differ from “The flowering of the Golden Age” zone. It is imaginable and desirable that different spatial concepts for bonus levels are applicable as rewards.

The concept of the bonus levels can be summarized as follows: By creating interesting zone specific content the visitor is more motivated to actively engage with the content. By doing so the visitor knows that he or she can visit the zones bonus level where the most interesting content of that zone is displayed. This works as an engagement loop: By completing activities more activities become accessible. The desired side effect of this is that visitors will participate in at first sight less interesting zones to still be able to visit the exciting content of the bonus level of that zone.
EARLY PHASE BONUS LEVEL CONCEPT SKETCHES
BONUS LEVEL CONCEPT 1: SPLIT-LEVEL
BONUS LEVEL CONCEPT 2: SELF-CONTAINED STANDING
BONUS LEVEL CONCEPT 3: SELF-CONTAINED SUSPENDED
BONUS LEVEL CONCEPT 4: RISING
BONUS LEVEL CONCEPT 5: PODIUM
To achieve the exciting and thrilling experience that a bonus level offers it is important to deploy the appropriate tools. These tools can be a variety of things and can be shaped in a lot of ways. To elaborate on this principle the following techniques are proposed as viable examples to create stunning bonus levels that visitors want to experience:

**Pepper’s Ghost:**
This is an illusion effect to make objects seem to appear and disappear. It is also used to make things appear transparent and to morph objects into each other. This is a great effect for creating experiences that involve spookiness or ghostlike effects. Zone example: The Flying Dutchman.

**Projection Mapping:**
Also known as spatial augmented reality. This is a projection technology which uses three-dimensional real life objects and uses them to project images or videos onto using projectors. This technique is a more general technique suitable to emphasize immersion next to video footage. Zone example: Burning castle.

**Holography:**
Holography is another technique which enables the creation of three-dimensional images. By creating images in three-dimensional space the perception of information is different and more appealing compared to traditional ways. Zone example: Facts, graphs and other data visualization.
FAÇADE TECHNICAL PRINCIPLE

OUTER LAYER
MEDIA SKIN

LED BACKLIT FACADE
MULTI-LED MEDIA FACADE

INNER LAYER
BUILDING PHYSICS SKIN

SKINS JUNCTION
ISOLATED CURTAIN WALL

Façade technical principle
The façade consists of an inner and an outer layer. The inner layer is the building physics skin that provides all the necessary components for a weather proof, safe closed-off environment for the building users. This layer mainly consists of glazing interlocked by the concrete floor slabs. For climate purposes the windows are able to open and close if desired. Attached to this inner layer is the outer layer: the media skin. This layer consists of three components: a metal frame grid, LED backlit panels and a multi-LED media façade (Mediamesh®) [21].

To elaborate on the media skin it is important to firstly explain the design of the façade pattern. The media skin layer consists of the LED backlit panels and the multi-LED media elements attached to a metal frame grid. The pattern for this design originates back to the topic of the museum: the national history of The Netherlands. The Netherlands consists of twelve provinces. Every province has its own background and history which can be explored inside the museum. By creating a pattern based on the geographical outlines of the provinces on the façade the museum has the opportunity to use the façade of the building to communicate towards its surroundings what the museum is all about: The multi-LED media façade works as a huge billboard for the museum by displaying parts of the history of that province to its environment. The idea behind this is that nearby pedestrians can catch a glimpse of the content of the museum by watching the media displayed on the façade (hopefully to trigger a visit to the museum).

The other parts of the media skin are the LED backlit panels that radiate visitor activity to the city to create a dynamic and constant changing façade image. By collecting data from visitor activities inside the museum through the PMD’s the façade at a certain zone can change in relation to the activity. For example: If a group completes or finishes a Bonus Level in a certain zone the façade can starts to briefly flash by changing the intensity of the LED’s on that part of the façade. A second example is a fluctuating color gradient of panels if people participate in a special event or activity.
The Netherlands
The 12 Dutch provinces
The 12 Dutch provinces mirrored
Panels generated by script based on outlines of the mirrored provinces
Building mass to wrap façade around
The final wrapped façade
FAÇADE PRINCIPLE
FAÇADE PRINCIPLE DETAIL

MATERIAL

TECHNIQUE

EFFECT

LED BACKLIT PANELS

MULTI-LED MEDIA FACADE

MEDIAMESH™
For the LED backlit panels hammered copper will be used as material. Together with the LED lighting hammered metal has a nice relief effect. The technique used to get the desired effect is by attaching multiple RGB-LED’s to the back of the metal. The wiring of the panels goes through the metal grid frame. The metal grid will be made of black aluminum. The idea is that the media façade stands out from the rest and therefore the rest of the shell both inner and outer layer will be colored dark gray to dark. The windows between the black colored mulligans are coated with a dark UV reflective film to both function as blinds and fit in with the interior style (see World 6.4.4).
Image 48: Archaeology Museum of Álava by Francisco Mangado

Image 49: Nanjing Art museum by KSP Jürgen Engel Architekten

Image 50: Ziggo Dome by Benthem Crouwel Architects
The structure of the building consists of concrete slabs with a load-bearing core in the centre of the building and columns arranged around it. The floors are concrete slabs casted in situ with the use of the BubbleDeck technology [22]. These so called “Biaxial Hollow Slabs” reduce weight by using plastic balls filled with air instead of concrete being poured all over the slab. This weight reduction makes it possible to achieve bigger spans. The columns are placed on a grid of 7.5 meters outwards starting from the core.

The cinquefoil-shaped ramps used for navigating through the museum are supported by splitting the load on both the upper and the lower floor: The floor above the ramp is supporting the top part of the ramp while the floor beneath supports the bottom part of the ramp.

Image 55: Ramps support structure
Image 56: MONA Museum of Old and New Art by Fender Katsalidis Architects

Image 57: Shanghai Museum of Glass by Logon Architecture

Image 58: Metropolitan Museum of Art, New York City

Image 59: Shanghai Film Museum by COORDINATION ASIA
For a museum it is essential to have a pleasant building climate. The core is designed to handle all of the technical requirements like pipes, canals, cables etc. for ventilation, electricity and water applications.

The idea behind the building climate is that the outside of the building with its media façade skin radiates the content of the museum and the visitors’ activity to the city while the inside of the building orients towards a closed off environment. This environment is oriented towards the visitors and less to none to outsiders. Therefore the inside climate is rather dark with little to no daylight to fully focus on the activities and to artificially (high)light the content of the museum zones itself. The following references represent the ambience and interiors that will be used inside the NHM.

For navigation purposes the zones are clearly and distinctively marked (both physical and digital) by using visual coding (the use of different colors, logos, emblems, heads up display elements) so the visitor understands in which time period they currently are.
WORLD 6.5
DRAWINGS & VISUALS

WORLD 6.5.1
PLANS

FLOOR -1 1:400

- Registration and Numbering (85 m²)
- Building Security and Management (45 m²)
- Bufferzone (48 m²)
- Technical Area (30 m²)
- Art Depots (475 m²)
- Archives (475 m²)

106
ZONE 1: THE LOW COUNTRIES
BY THE SEA  
(715 m²)

ZONE 2: ON THE OUTER EDGES OF EUROPE 
(1000 m²)

ZONE 3: CONVERSION TO CHRISTIANITY  
(1000 m²)

ZONE 4: THE DUTCH LANGUAGE  
(975 m²)

ZONE 5: AN URBAN CONGLOMeration 
AND TRADING CENTRE AT THE CONfluence OF THE RHINE, THE MUSE 
AND THE SCHELDÔT RIVERS  
(825 m²)
Zone 8: A Trading Nation and Colonial Power
1000 m²

Zone 7: The Flowering of the Golden Age
1000 m²

Zone 6: The Dutch Republic Emerges from an Uprising
775 m²

Zone 9: A Nation-State Under a Constitutional Monarchy
975 m²

Zone 10: The Rise of Modern Society
825 m²
TEMPORARY EXHIBITION A
(1000 m²)

TEMPORARY EXHIBITION B
(975 m²)

RESTAURANT & LOUNGE AREA
(1000 m²)

SPECIAL EVENTS
(825 m²)

OPEN KITCHEN
(775 m²)
3D PRINTED PROTOTYPE MODELS

CINQUEFOIL RAMPS SCALE 1:500 & 1:1000
WORLD 7
DISCUSSION & CONCLUSION
In this final World, the findings of this research and general conclusions regarding gamification in architecture are presented.

The following definition of gamification was stated in World 4.2: “Gamification is the use of game elements and game thinking/design techniques in non-game contexts (to engage users in solving problems).” The non-game contexts part of this definition already define that gamification is a concept that can be applied in almost any kind of field. It is therefore interesting to see how gamification relates to a field like architecture since this has not been explored extensively due to the rather short history of gamification.

By looking back at the research question it is clear that there is no single perspicuous answer to this question because there are a lot of factors involved in this question. Therefore the answer to this research questions is divided in three domains: technical, architectural and social.

It is essential to develop a gamification concept that matches a specific use-case with a clearly defined structure. To prevent ending up with a gimmick or a non-viable/short-term concept it is essential to design a concept with razor-sharp goals in mind. To help with developing such concepts the framework used in this thesis is a great starting point. The clearer a concept is the more effective it will be (provided that the further execution is done sufficient).

Since a developed gamification concept can consists of multiple goals in any field, the possibilities and outcomes are specific per use-case. This also means that gamification in architecture is not a predefined concept that always looks and works the same. In this thesis the use-case of a museum is explored with a specific goal in mind (the creation of a unique individual visitor experience). Even with the same use-case of a museum, but with a different goal in mind, the gamification concept and architectural design would be completely different. Therefore there is no universal “style” or “look” of gamified architecture. However there are gamification components that are universally applicable in all gamification concepts.

For architectural purposes gamification can improve or give a boost to certain predefined architectural design goals. Some examples of these goals could be: increasing the amount of visitors, regulating user activity, routing navigation through the building or prolonging visiting times.

Compared to non-gamified architecture, gamified architecture does not necessary look or work different. This is once again use-case specific and the possibilities are almost endless; the extent of gamification is up to the architect. However gamification can work as a great social catalyzer and if deployed properly, social interaction (both intended and not preconceived) can make a difference in contrast to non-gamified architecture. Gamification works as a motivator for certain activities when deployed properly. This makes it possible to stimulate and achieve a certain desired behavior from the end-users.

If the design of the gamification concept is centered on a specific target group, the likability of interaction of that target group is much higher than designing for a general audience. If end-user participation is an important aspect of the concept it is therefore important to focus on a specific target group to increase user participation in the gamified environment.

Gamification is still emerging in a lot of fields and most likely is not yet saturated in the near future. Especially in architecture the possibilities are yet to be discovered. This thesis only shows a tip of the iceberg of the possibilities and potential of gamified architecture.