Resit Assignment: A Game to Create Mass-production Machines

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1 INTRODUCTION

We live in a world which relies on mass production. The far majority of products we use and consume are mass produced, yet we don't seem to think about how they were made. We just take their existence for granted, realizing that anything we use surely has a logistic history but unaware of the impressive machines and techniques used to create some of our items. This will all change with the launch of a new, never-before-seen game, where the player will design and create incredible machines and production lines capable of taking simple resources and making mass-produced goods.

This report will describe the game concept, the player and give an MDA model of the game. Next, the level design will be explained using a drawing. After this, the Self-Determination Theory will be used to argue what makes the game fun, including some other theories like cognitive flow and game feel. Finally, some alternatives of this game will be given based on those same theories which would be more interesting for other kinds of players.

2 GAME DESCRIPTION

The game concept is designing and creating 3D machines that are used to mass-produce goods (could be any kind of product, from paper cups to kitchen timers). The game will contain multiple products, which can be seen as chapters or missions, which all consist of multiple machines, which can be seen as levels. Every step in the production process of the item will be one level, where the player needs to create one machine. So, one level might be to create a machine which can cut out a shape out of a big sheet of material to form a paper cup, then moving these pieces in such a way that they will end up being stacked on top of each other. In a later level, the player will create a machine which takes a stack of cutouts, and bends and seals it to create the side of a paper cup. [2]

In each level, the input (material the player needs to work with) and desired output are given, the player can achieve this output in any way they want. When the output of the machine is acceptable, the player can start the next level, which presents the output of the previous level as an input for the player to work with. After finishing a complete production line for a product, the player will see the actual product being created by their machines, along with some statistics about the product and process. The player can go back to individual levels to improve scores like speed, efficiency, wasted / unused material, etc. Additionally, the player might have to fix a certain level if they notice some physical flaw in the final product.

This game concept of designing and creating individual machines does not exist yet. The closest matching concept which can be found is a game called "Opus Magnum" by the developer Zachtronics [9], which is a 2D game to create machines to produce molecule-like shapes. This is different from the game concept of creating machines to produce lifelike products, already because this would be in 3D rather than 2D. It is also different from games such as "The Incredible Machine", "Factorio" or "Satisfactory", because these are more focused on production processes rather than individual machines. In this game concept, the production process is already laid out in different steps, the objective of the levels is to complete every step one at a time.

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2.1 Player Type

Looking at Bartle's taxonomy, we learn that there are four types of gamers, also called the Bartle types. These are socializers, explorers, achievers and killers [6]. *Socializers*, by far the most common player type, mostly care about forming relationships with other players and therefor prefer to play games together with others. *Explorers* like to learn everything about the game and virtual world, including any resources, easter-eggs and more. *Achievers* are willing to put in a lot of effort in order to beat the whole game, preferably completing every level the best way possible. *Killers* like to cause chaos and influence the functioning of the game world or the experience of other players. It should be noted that most gamers have multiple player types: One main type with characteristics from other player types as well [5]. It is therefor important to make a game fun and interesting for all player types, rather than focusing on just one. Of course, it is still possible to select the main targeted player type, but the others should be kept in consideration when designing a game.

That being said, the player type of *Achievers* can be highlighted as the main player type for this game. Since the game will be level-based, Achievers would have high intrinsic motivation to successfully complete each level, even when it is getting a little difficult. When completing all machines for one product, they get to see some stats about how their machines combined perform. This allows them to go back and make some changes in some levels to improve the stats and have the best result possible. To this gamer-type, rewards should be proportional to amount of effort invested [6], meaning that completing a full production line at a 100% score should grant the player a major reward. This reward could be something that is helpful in later levels, though for the Achievers it is enough if this reward is purely status-related.

To keep the three remaining player types into consideration, some other gameplay elements can be added to the game that align with these player types. First of all, for the *Socializers* type, a potential addition would be a multiplayer-mode where players can work on (more complex) machines together. Some players might prefer to tackle challenging levels together with one or more friends, having a possible multiplayer mode would make this possible. An addition for the *Killers* type is also relatively straight-forward: Giving machines the ability to break or destroy input materials. This would mean that players should be careful not to use too powerful components, but if players want to mess around and try making machines that break in epic ways, nothing would prevent them from doing this.

The *Explorers* type is a little more difficult to please with this game, since there is not really an open world to explore with secrets to find. Perhaps it could be possible to add a story to the game, making a sort of career-mode, but that feels as if it would not fit very well with the current idea. However, there is a lot to learn about the various parts and components that are unlocked throughout the game. Each technique has advantages and disadvantages, which could be explained using a tooltip. For example, a linear motion could be achieved using either a rack and pinion system or hydraulics. The rack and pinion could move faster and further, but hydraulics is stronger and has more force. To allow for some exploring, it would be a nice option to allow for trying out components in a separate setting. For example a sandbox mode or testing range, where players can access any of their (unlocked) components and run some tests to find out the differences themselves. This way, *Explorers* can explore and learn the qualities and features of every components without having to rely on written text and visual scoring / statistics. It might even be a good idea to not show any written information at all, or only a small amount, to really motivate the player to actually try things out.

2.2 MDA Model

An MDA model is a game broken down into its distinct components, the Rules, System and "Fun", after which their design counterparts are established. Respectively, these are Mechanics, Dynamics and Aesthetics - also known as MDA. This can be used to add the correct Dynamics and Mechanics to a game in order to achieve the desired Aesthetics to make it fun. So, first the Aesthetics have to be described, after which this can be used to define the dynamic and mechanic models [4].

2.2.1 Aesthetics. First, some aesthetic goals need to be defined. The game should be a *challenge* at times, especially in a later level where a complex machine is to be created. Furthermore, the game should allow for *discovery*, because there are a lot of ways to reach the goal in the level. *Expression* should also be possible in this game, by allowing the player to change how their machines look. Additionally, as mentioned in Section 2.1, the game should allow for some level of *fellowship* and *sensation* (to include the four Bartle player types).

These aesthetic goals can be used to determine the aesthetic models needed by the game to achieve these goals. To create *challenge*, the levels need to be increasing in difficulty. To allow for *discovery*, there should be plenty of configurations possible, each with different qualities and properties. Room for *expression* can be achieved by allowing personal customization. Finally, the *fellowship* can be achieved through the option of playing together, and *sensation* through the ability to create chaos (spectacularly breaking machines).

2.2.2 Dynamics. To create *challenge* through an increase in difficulty, new components need to be introduced in each level. There will be more and more to choose from when making a machine, with more properties to keep in mind. *Discovery* can come from dynamics that encourage the player to keep trying out things. The game will allow for *expression* by adding the possibility to change visual properties of the created machines, for instance changing colors or adding visual elements like side panels or graphics. The player should be encouraged to change the looks of their machines into something they like.

Finally, to allow for *fellowship* it should be easy for the player to invite a friend into their current session to help them out, as well as *sensation* by giving clear feedback about the state of the machine, like its structural integrity. Things like sounds or irregular movements could indicate an issue with a machine, after which a player will either try to fix it, or intentionally make it worse.

2.2.3 Mechanics. Determining the mechanics of the game would involve a long process of testing and adjusting, but it is possible to mention some of the most obvious and important mechanics. For instance, the increase in difficulty can be achieved by introducing new components regularly and the properties becoming more and more important. For instance, where both hydraulics and a rack and pinion would be able to complete a task in an earlier level, at some point one of the components should not be suitable (for example: Hydraulics would be too slow and imprecise, so the player has to identify this and choose to use a rack and pinion system).

To achieve the dynamics of *discovery*, perhaps the player can safely enter a testing area whenever a new component is unlocked, so they can try out anything they want. Furthermore, small changes like the thickness of a pipe or choice of construction material should have realistic and noticeable effects, especially later in the game when machines are becoming more complex. Players will have to discover the right dimensions and materials in order to create a perfect machine.

3 LEVEL DRAWING

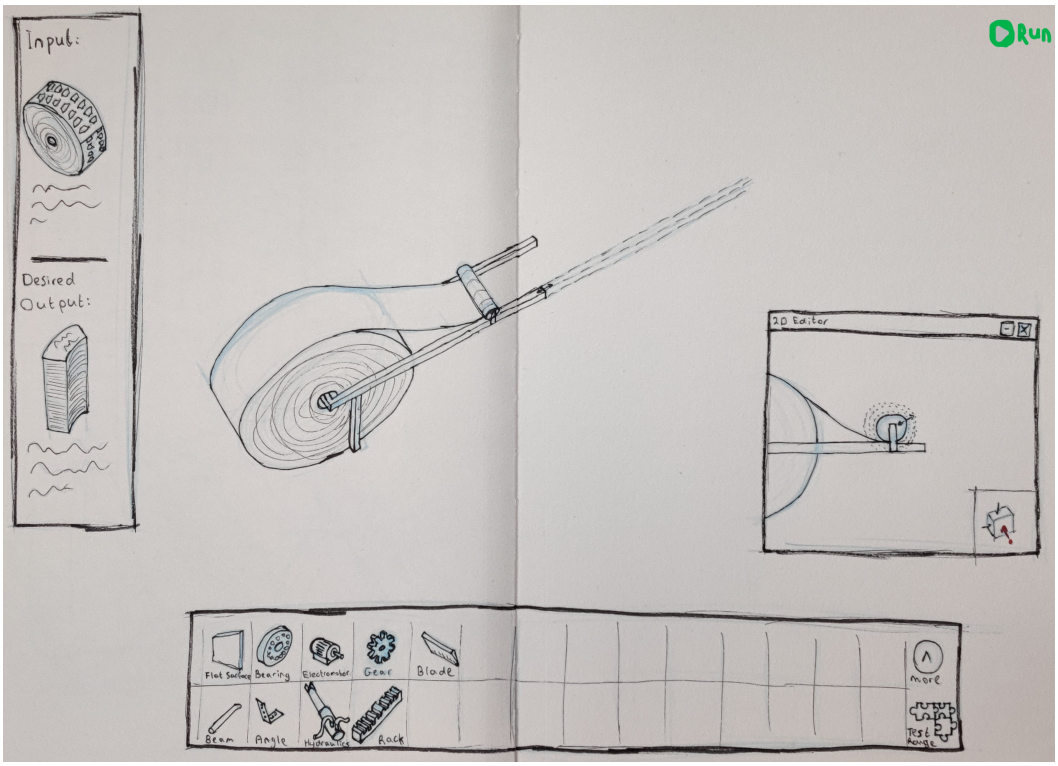

Fig. 1. Level drawing

The level drawing (Figure 1) shows the input and desired output on the left, they can be dragged into the scene to fit into the machine. The bottom menu shows the unlocked components which can be used to build machines, they too can be dragged into the scene. They will automatically attach to a surface on the machine upon being placed there. Hovering over these items will show a tooltip next to the cursor with a short explanation and some relevant statistics, like strength, speed, distance or weight. Of course, a player can also use the "Test Range" button at the bottom right to enter a test range where they can test any of the components and learn about their properties. When many components are unlocked, they can be accessed using the "More" button, which will open some sort of catalog.

The main scene is where the magic happens. The player has certain controls, like zooming in, rotating, etc. Some components, like beams or plates, can be changed in dimensions by grabbing the end with the cursor and dragging it to the right dimension, as is visible by the dashed lines extending from the bottom beam in Figure 1. More complex dimensions, like the radius of the roller used to guide the paper, can be changed in a similar way using the 2D Editor. This will only show one side of the machine, making it easier to manipulate some components in only one direction. At any time, the machine can be tested by pressing the "Run" button on the top right, which will activate any moving parts. If it works, and the desired output is created, they player will see an option to finish the level and move to the next one. If the machine is not working properly, the player might see it break as a result, or observe it not producing a suitable output.

4 FUN

4.1 Self-Determination Theory

According to the Self-Determination Theory (SDT), a game can use two sources of motivation: Intrinsic and Extrinsic motivation. Extrinsic motivation can be achieved using external rewards, in case of work this may be salary or evaluations, in case of games these can be rewards. Being intrinsically motivated means that people are motivated from within, which is more related to their personality. Intrinsic motivation does not need any external rewards. Despite being the opposite kind of motivation, extrinsic and intrinsic motives are very related to each other [3], especially when it comes to designing games.

Preferably, players are both extrinsically and intrinsically motivated to continue playing. However, relying too much on extrinsic motivation is not good either, as it can kill creativity and can undermine intrinsic motivation people have for an activity [8]. In this case, the main player type for the game is the *Achievers*. As mentioned in Section 2.1, they are very intrinsically motivated to finish the whole thing. They already have high motivation to keep trying until they succeed, so we should take care not to undermine this with forms of extrinsic motivation. This includes any kinds of rewards after completing a level, like earning money for a sold machine or showing a leaderboard with the best performing machines. The player can still receive a minor reward when completing a level, but only to complement their intrinsic motivation, which should remain the main reason for the player to continue. A key reason for this, is that creativity comes from intrinsic motivation, not extrinsic. This means that if a player is too extrinsically motivated, they would have a harder time coming up with creative solutions to finish the level, thus making the game less enjoyable [8]. A possible minor reward when completing a level, is seeing the machine actually work. Just seeing and hearing the machine work, perhaps in a cutscene with nice camera angles, could lead to a satisfying feeling, ultimately increasing the motivation the player feels to start the next level.

This feeling of satisfaction is related to the feeling of competence. Seeing this machine they just created gloriously working in a cutscene, makes the player feel competent in the game. It supports one of their tree basic psychological needs: **Competence**. The need of **relatedness** can also be supported using this cutscene, by making it easy to share it with others. By adding a share-button to easily share the video or some nice and industrial-looking renders with friends, the player can feel more connected with people around them, especially if they are also familiar with the game. The basic need of **autonomy** is already being supported by the game, because there are infinite ways to complete a level. Any kind of machine can be built using the available components, as long as the output is close enough to what is requested.

4.2 Gameplay

Since this game does not have a storyline, the game should be fun mostly because of its gameplay. The gameplay mostly consists of learning how different components work and figuring out what works together and what doesn't. This makes the game mostly knowledge-based. To prevent the player from feeling overwhelmed from all the components there are to learn, these will gradually be unlocked throughout the game. Additionally, the levels in the first production line will serve as an introduction to the game, requiring very simple machines to be created. This will give the player time to get more comfortable with the controls and learn about the various components in the game at a comfortable pace. This is to make sure the player stays within their cognitive flow, meaning the game does not become too difficult or too easy, preventing feelings like anxiety or boredom [1]. This should keep the game fun and engaging throughout.

The only thing that is constant when playing a game, is the interaction with it. Input and output. Production lines are only occasionally completed, even a level takes time to complete and feel rewarding. The actual interaction with the game should promote fun as well, it should *feel* good. There are multiple pieces of game feel, but in the case of this game it mostly comes down to **Polish**, also known as the aesthetics. As a video game is inherently something audiovisual and interactive, the interactions should feel good by enhancing both the visuals and the audio resulting from an interaction. Any interaction with or between objects in a game should introduce clues about the physical properties of these objects to the player [7]. These clues could be things like particles, screen shake, view shifts, deforming materials, and of course sounds. Anything to add more "juiciness" to the game.

This can also be added in this game. The materials and components do not even have to *look* very realistic, but they need to *feel* realistic. First and foremost, this could be achieved by adding sounds. Whenever a component is attached to or removed from the machine, or even so much as touched by the player, a fitting sound needs to be triggered. This sound should vary by properties such as material and weight: Attaching a heavy electrical engine to a thick metal beam should trigger a loud and deep resonant sound, where sticking a sticker with a graphic onto a wooden plank would sound much more quiet and a little sticky. Additionally, placing or moving something heavy can be accompanied by screen shake, the machine moving away from the impact, and a small cloud of dust appearing. Generally, heavy materials would trigger more visual feedback and a more base-heavy sound than something light. Adding interactions like this should make the game more fun and engaging from moment to moment.

5 ALTERNATIVES

In this report, some theories have been applied to a game concept in a certain way, throughout the design process decisions were made based on these theories. The same theories could also have lead to another kind of game, if different decisions were made. For instance, in Section 2.1, about the Explorers player type, it was mentioned that the game could also include a story line and a career mode. This would make for a very different game, moving away from the puzzling to create novel machines, and more towards a business kind of game. With a career mode, the player could be managing a company which creates machines like these, to sell to clients to use in their production facilities. This would involve mechanics like hiring engineers, time limits to create machines and a currency system as rewards.

Another alternative direction for this game, based on the theories, would be to focus less on creating machines for producing products, but more on creating the biggest and craziest machines possible. A game like this could include a sandbox-mode, where players have all components available to create anything they want and share their incredible creations with friends or the public. Perhaps, players would come up with their own challenges inside the game, like building machines to mass-destroy products instead of mass-producing them.

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