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| Game Design Document |
| Project Hephaestus |
| Ian Barrow, Lizzie Briggs, Clement Smith, Alexander South, Jack Denne |

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# 1.0 Game Overview

## 1.1 Concept

Project Hephaestus is an interactive serious game centred around the history of Smiths. It will explore the different types of Smiths through the ages; travelling through different geological locations, it will teach the user about the unique history of a trade that has helped develop human civilisation.

Virtual Reality will be used to create an in-depth interaction with the world, which will allow the player a first-hand experience as a Smith whilst they forge unique items. This will include refuelling and maintaining the forge, hammering their materials at the anvil, cleaning and polishing, and be able to unlock other tools as they progress and expand their abilities as a Smith. Items will also be graded on quality, offering higher rewards when made correctly, but also can be recycled to save costs on buying new resources.

## 1.2 Focus & Aims

As this product is a serious game, two of the key goals for this project is to create a serious game that is: educational and entertaining to play. Historical accuracy will be important to represent what was available and create progression through development of new technologies and techniques. Unique techniques will therefore be aimed to be recreated to teach users how different areas developed these trade skills and contributed to their civilisations.

The use of game mechanics such as internal economies and progression will also be a key focus in order to ensure the game is entertaining and engaging to play by giving the user a motivation to keep on playing.

## 1.3 Target Audience

The primary target audience for this game will be teenagers aged 13-19 who are in education, and are interested or being taught about smithing, however possible consumers could also be VR users with historical interests, or interactive museum experiences.

# 2.0 Feature Set & Mechanics

## 2.1 General Features

* Developed for Virtual Reality
* Immersive gameplay
* Cell-shaded visual style
* Educational

## 2.2 Gameplay Features

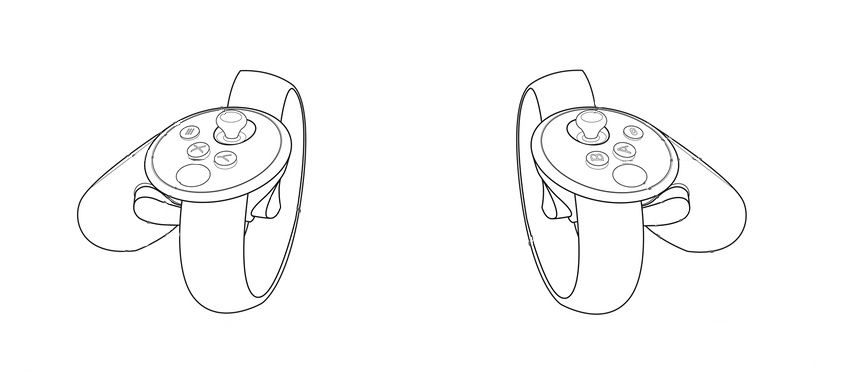
* Interact and move around the play area freely
* Heat and maintain the furnace
* Hammer materials
* Clean and polish materials
* Store/Reuse crafted items
* Progress/Replay levels

## 2.3 Mechanics

* Item interaction
* Anvil hammering
* Furnace heating
* Job board display
* Gauge displays
* Inventory belt
* Level changing
* Difficulty setting
* Opening menus

## 2.4 Control Scheme

The control scheme is defined using the following diagram of a generic VR headset controller.



# 3. Concept Requirements

Below is a table of the functional and non-functional requirements for the artefact. These have been prioritised using the MoSCoW technique to ascertain what requirements will need to be focused on.

|  |  |
| --- | --- |
| REQUIREMENTS | Priority (MoSCoW) |
| FUNCTIONAL |  |
| UI REQUIREMENTS |  |
| 1. Home screen | M |
| 1. Inventory system | S |
| 1. Pause menu | C |
| 1. Job/Task board | M |
| 1. Item grading | M |
| 1. Sound controls | W |
| 1. Crafting gauges | M |
|  |  |
| USER FUNCTIONS |  |
| 1. Interact with objects | M |
| 1. Move around the play area | M |
| 1. Traverse through levels | M |
| 1. Craft items | M |
| 1. Purchase crafting materials | S |
| 1. Deposit/Withdraw items | S |
| 1. Testing area | W |
| 1. Save/Load game | C |
| 1. Exit game | M |
|  |  |
| NON-FUNCTIONAL |  |
| 1. The game must be made in Unity | M |
| 1. The game must be developed for VR | M |
| 1. Compatible with all PC powered VR | M |
| 1. Accessibility (controller accessibility, colour blindness etc.) | C |
| 1. PC requirements | S |
| 1. Publisher requirements | S |

# 4.0 Research

## 4.1 Overview

As the artefact will be a serious game, it is important that the game is historically accurate, ensuring factually correct information is being taught to the user. The development of a serious game requires a person with expertise in the field of which the game is being centred around to ensure to the pedagogical aspect of the serious game is fulfilled, however due to the lack of having a member with extensive knowledge in smithing, research must be undertaken to ensure factually correct content will be implemented into the game.

Therefore each team member has conducted their own research on specific periods, locations and types of Smiths which will contribute to the level design of the artefact.

## 4.2 Smithing

A Smith is a craftsman who fashions useful items out of metal with the application of heat and force generated by a hammer. The history of Smithing methods has remained consistent throughout but has generated different types of Smiths. These are:

* A Blacksmith is what is usually referred to as “Smith”, working mainly with iron and steel materials. They usually specialise in the forging of horseshoes, but also work in other tools and weapons. Their essential equipment consisted of a forge or furnace as well as an Anvil, Tongs, Hammers, Chisels, and other equipment to cut and shape, flatten or weld into the desired object.
* A Bladesmith mainly specialised in the creation of blades such as knives, swords, daggers, and bladed cutlery.
* A Brownsmith or Coppersmith mainly specialised in using Copper and Brass to create items and was the earliest form of Smithing as Copper and Brass are soft and easy to manipulate.
* Coinsmiths are specialised in the creation or manipulation of coins, with modern day Coinsmiths recreating vintage and modern-day coin jewellery. A Moneyer is a Coinsmith who is officially permitted to mint money.
* A Goldsmith specialises in manipulating Gold in the creation of various Gold items.
* A Gunsmith specialises in the repairs, modifications, designs and building of firearm weaponry. This requires a high level of skill in machinery, woodwork and engineering.
* A Locksmith works in the creation and repair of locks, keys, and other security systems (in modern day)
* A Silversmith works with Silver in the creation of various Silver items.
* A Swordsmith is a Bladesmith specialised further in the creation of different swords.
* A Tinsmith, Tinner or Tinker works with light metals such as tinware.
* A Weapon-smith forges various weapons.
* An Armourer specialises in the creation of plate armour and may also repair weapons.

By covering these different styles of Smiths, levels can have an additional layer of depth in teaching about different artisans of the trade along with the different eras and locations. Personality can be crafted to create immersion as well as narrowing down the experience across levels for diversity.

Smith techniques follow the process lined out by the Blacksmith category. They differ not only on the items that they create or materials that they use, but also in the ways that they utilise these methods. Different heat applications, timing, and hammering techniques all come together to create this. It will be the Tech Leads responsibility to design and create these mechanics in an adaptable way to be used in various and unique ways.

## 4.3.0 Level Structure

Levels throughout the project will follow through 5 categories, each containing individual levels. The main aim is to take the player through multiple levels in each era, exploring how different areas were developing in a linear fashion. The player will complete each level, advancing through the era. On completion of all available levels in the era, the player will be able to move through to the next era. UI will have the levels organized into individual categories to reflect progression and ease of navigation on level selection.

### 4.3.1 Bronze Age – Mesopotamia

The choice was made to create a level focused in the Bronze Era. As none of the pre-researched eras fit into the Bronze Era, new research was conducted to determine a suitable setting for a Bronze Era level. Mesopotamia was an ancient region that spanned across the Eastern Mediterranean, corresponding to today’s Iraq, Iran, Syria and Turkey. Considered to be the cradle of civilisation, Mesopotamia is credited for many firsts in History, such as the invention of the wheel, and has a very long rich history as it prospered from the Pre-Pottery Neolithic Age (10,000 BCE) until the Classical Antiquity age (7th Century CE).

The Bronze Age of Mesopotamia can be broken into 4 eras. The Copper Age (5,900 BCE – 3,200 BCE), was the era in which Mesopotamia transitioned from stone to Copper. During this period areas of Mesopotamia saw advancement, gaining the first Temples and unwalled Villages away from their sporadic settlements of single dwellings. From there, the Early Bronze Age (3,000 BCE – 2,119 BCE) saw Bronze supplant Copper and the rapid growth of City-states to establish economic and political stability, leading to rise of Akkadian Empire. The Middle Bronze Age (2,119 BCE – 1,700 BCE) saw the expansion of Assyrian Kingdoms and the rise of the Babylonian Dynasty. With this came increased warfare. Finally, the Late Bronze Age (1,700 BCE – 1,100 BCE) gained more shifts on power and the expansion of culture, which further lead to the discovery of mining ore and crafting Iron. Throughout these eras, the most interesting is the 200-year space between the Copper Age and Early Bronze Age.

As the first area of the game, utilising Copper to craft a personal seal would give an identity for the player. At the time, seals were considered the equivalent of modern-day identification cards and would be an important item for the player. Given the ability, this could give a small function of customisation for the player and can be used as a way to stamp and authenticate their favourite work (giving a favourites category). Starting here could be a small tutorial of the most basic functional mechanics of the game. Then, as the tutorial progresses to introduce the Job Board system, as well as giving the player the chance to try the mechanics for themselves, Bronze can be used to introduce the economy system for upgrading and purchasing new materials. The first bronze crafting item could be “The Shadow Stick”, a Mesopotamian Sundial. This could be done with a wooden version given to the player, with the request of crafting a Bronze version, and introduce the timer mechanics.

### 4.3.2 Iron Age – Egypt

Egyptians valued their jewelry very highly, therefore I goldsmithing is the best fit for the Egyptian level, as it can be tied to history and culture of the Egyptians, they adorned their jewelry with valued stones, the most valuable stones were Lapis Lazuli Obsidian, garnet, rock crystal and carnelian, pearls and emeralds were the more common stones

**Iron Meteor necklace**

The Egyptians found iron from meteorites, an example of this are 9 beads, these 9 beads were strung together into a necklace, this was done by hammering the iron into thin sheets, then rolled into tubes, this is one of the few examples of jewelry making using iron.

**The Death mask of Tutankhamun** is a world famous symbol of ancient Egypt, it is created with layers of gold, Egypt could have some gold-smithing mechanics as they have a lot of popular gold artefacts such as this, the mask also has various gems around it that the player could put in place such as Lapis Lazuli around the eyebrows, Quartz for the eyes, Obsidian for the pupils, and rows of carnelian, Feldspar, turquoise, amazonite, faience around the collar

**Protective Amulets**

Used by the Egyptians as charms to give them protection or power. Made of gold and jewels infused in, came in various shapes such as humans, rams, falcons, Scarabs, etc.

**Heart Scarabs**

These were funeral amulets in the form of scarabs, they were shaped like hearts, ovals, and beetles. They were made of stone typically. Heart scarabs were important, as they believed that once placed over the heart of someone that had died, their heart would not separate from the body, and the heart would then be judged by Anubis in the afterlife to determine the life they led

### 4.3.3 Medieval Age – Japan

Materials: Traditionally used tamahagane which is produced from Iron sand. Mainly used to make samurai swords such as the Katana.

Steel production.

Smelting process: A clay vessel about 1.1m tall and 3m long and 1.1m wide is constructed (Known as a tatara). After the clay is set, it is fired until dry. Then a charcoal fire is started from soft pine charcoal until the smelter reaches the correct temperature (???)

Forging:

Three types of steel are chosen for the blade, a very low carbon steel called hocho-tetsu is used for the core of the blade (called a shingane). The high carbon steel(tamahagane) and the remelted pig iron (cast iron/nabe-gane) are then combned to form the outer skin of the blade (kawagane)

The making of the swords is done by a process called folding the steel. This is a process where the swords are made by repeatedly heating, hammering and folding the metal. The high carbon steel and higher carbon cast iron are then forged into alternating layers. The cast-iron is heated, quenched in water and then is broken into smaller pieces to help free it from the slag. The steel is then forged into a single plate, and the pieces of cast iron are piled on top, and the whole thing is forge-welded into a single billet, which is called the age-kitae process. The billet is then elongated, cut, folded and forge welded again. This process (called shitae-kitae) is repeated from 8-16 times.

Assembly:

The most basic assembly type, commonly used for katanas use the **Maru** assembly type, where the entire sword is composed of a single steel. However, due to the only using one steel, the sword can be quite fragile.

A different assembly type known as the **Kobuse** assembly type, which is made using two steels, Hagane (edge steel) and shingane (core steel). Honsanmai and Shihozume types add a third steel, called kawagane (skin steel).

There are different ways that a sword can be assembled, varying from smith to smith. One method is “drawing out” the edge steel (hammered into a bar), bent into a “U” shaped trough, and the very soft core steel is inserted into the harder piece. They are then forge welded together and hammered into the basic shape of the sword. By the time this process is finished, the two pieces of steel have been fused together, but retain their differences in hardenability.

A second way to assemble the blades is by assembling the different pieces into a block, forge weld them together and then draw out the steel (hammer into a bar) so that the correct steel ends up in the desired place.

### 4.3.4 Industrial Age France

The Industrial Age was a key era in the advancement of civilisation, being the time of innovation in new manufacturing processes through the introduction of machinery into factories, beginning notably in Great Britain around the 18th century. This development was a major toll on vocations such as smithing, as they relied mostly on the handiwork of trained humans, who could now be replaced by machines which can work with greater power and speed. Although the profession of smithing did begin to lose prominence due to this advancement, some types of smiths still retained their profession.

Most notable is silversmithing in France – due to silver having more than just utilitarian purposes, such as jewellery and household ornaments, the ownership of silver was viewed as a sign of wealth and status. Training to become a master silversmith took rigorous training, taking up to eleven years: eight years spent as an apprentice, 2-3 years as a journey, followed by a final trial (“masterpiece”), that if passed meant the obtainment of master status. The French are known also to have the highest standard of silver, using 958 parts of out 1000.

At this stage of the game, silver could be offered to the player as a new material to craft, creating items such as cutlery (e.g. teaspoons, forks), necklaces/bracelets or teapots, as these were common items in wealthy French households. Silver is also a recyclable material, meaning silversmiths can melt down old/unused silver items and reform into ingots to create new silver products. This gives the possible complexity to the internal economy of allowing the player to either use old items they may have made out of silver or spend money on buying new silver ingots. Hallmarking is also a very important process in creating silver or gold items, being the process of making a mark on metal items to certify its quality, acting as an indication of the content of noble metals (e.g. silver, gold, platinum) in the metal. This could mean the requirement for the player of creating a good quality product would include ensuring their item is appropriately hallmarked.

### 4.3.5 Modern Age – America

There is an estimation of which the Chinese was the first people to find out the explosive nature off gunpowder back as far as 850 A.D.. Canons and grenades were some of the first weapons that was incorporated with gunpowder, this was shortly followed by the guns such as primitive handheld firearms.

The tommy gun also known as the Thompson submachine gun, which was made after a long series of guns. This weapon was one of the first portable machine guns (fully automatic). The famous submachine gun was developed too late to be effective in world war 1, the inventor John Thompson put his creation via his company too law enforcement, this didn’t stop criminals also getting their hands on the weapon.

The raw materials used to create the Thompson machine gun is majority steel with some lighter alloys for the petite flexible parts, such as the springs within the weapon. For the handle it was made using wood more specifically walnut.

The traditional way too make a Thompson was long, but this involved multiple drawings and prototyping, for the use of world war 2 it was made more simpler and smaller for mass production purposes. <http://www.madehow.com/Volume-6/Thompson-Submachine-Gun.html>

There are five main steps too manufacturing a Thompson submachine:

1. Cutting the steel, this is where they receive the raw materials such as steel. The steel is then cut by several machines, the machines read blueprints too be cut exact. The gun has been designed so that it can be produced within one or two operations. A few of the parts are formed from solid steel such as the frame, barrel, receiver and the bolt.
2. Other material parts, the smaller parts must be stamped this is normally done by a sub-contractor who specializes in stamping. The way they use the stamping machines is like the way a cookie cutter works, the springs are also sub contracted out to someone who specializes in spring manufacturing.
3. The stock, the stock is made from a sub-contractor who works with wood and he will shape the stock from walnut board and then ship them to the manufacturer.
4. Subassembly, the Thompson submachine gun has a total of 60 and 70 parts. This is broken down to a team of 5 stations who have their own parts of the guns and this is how the gun is mass produced.
5. Final assembly, just five workers put the gun together after the subassembly. The parts just snap into place at this stage and everything is screwed together leaving the handle too last just before the gun is polished and this is completed before the quality check.

# 5.0 Art style

## 5.1 Items

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Hammer and Tongs Design

Furnace Design



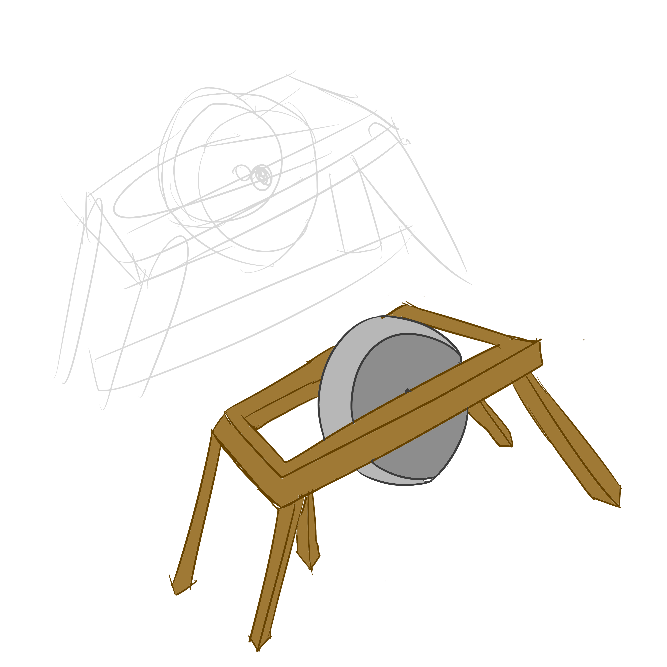
Anvil Design



Storage Box Design



Item Shop Design



Grindstone Polishing station design

## 5.2 Mesopotamia

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Mesopotamia level concept



Mesopotamia seal



Mesopotamia Key

## 5.3 Japan



Concept art for the Japan stage.

## 5.4 France

## 5.5 Egypt



Developmental concept for the Egypt level



Designs for items made in Egypt, heart scarab, Amulet and Tutankhamun death mask.



Design for the key used in Egypt, to unlock the next stage

## 5.6 America

# 6.0 Mood boards

## 6.1 Art style

## 6.2 Levels

## 6.3 Colour Pallett

# 7.0 Design Layouts

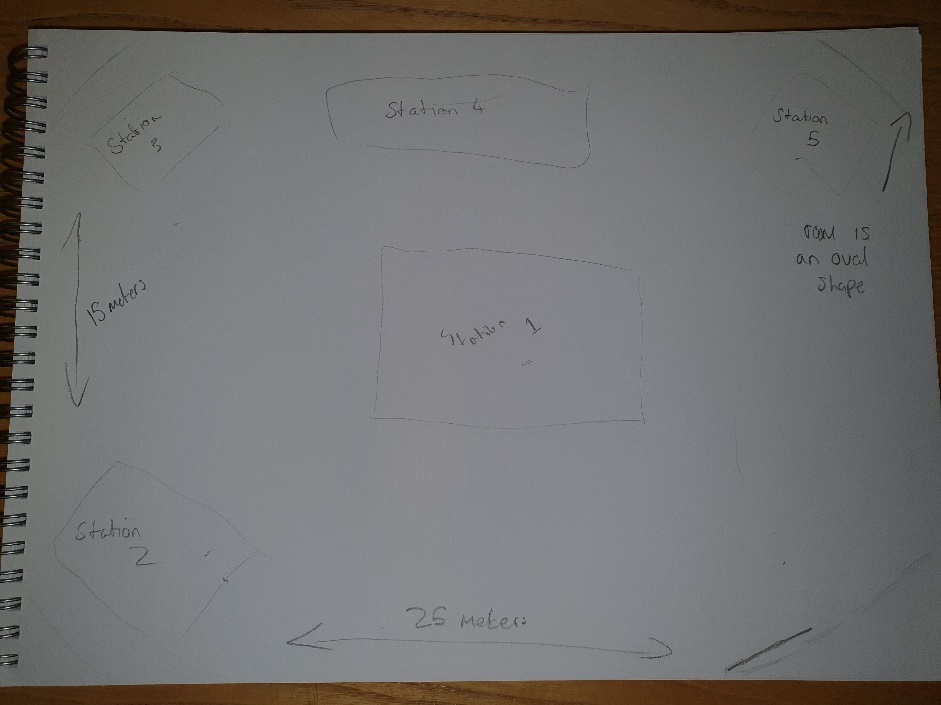
This is the first concept drawing of what the game with the UI elements will look like.



Level Design 1









# 8.0 UI Concepts

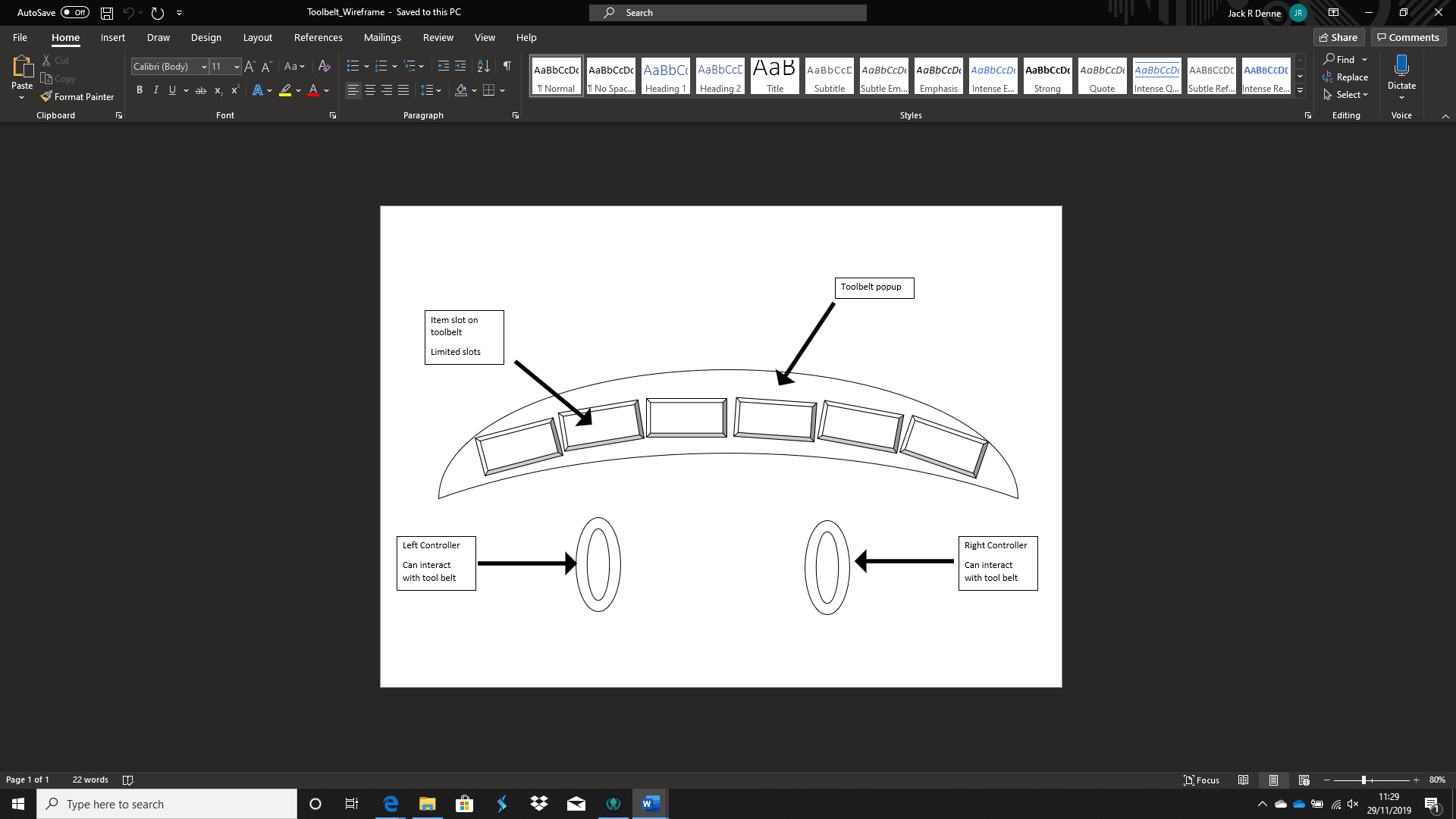












# 9.0 Storyboards



# 10.0 Colour Palette Design

## 10.1 Main Colour Palette

The main colour palette is for the design of the room and tools in the game. The general design of the room will stay the same, so the colours will stay the same as the colours of blacksmith workshops were generally the same.





## 10.2 Heated Steel/Metal Colours

Steel changes colour at different heats when being forged/melted. The different colours can indicate how close the player is to being finished with that item.

Hex Codes for each colour:

Faint Red – #700000

Dark Red – #B40000

Cherry Red – #F20000

Dull Orange – #FF6600

Orange – #FF9900

Lemon Yellow – #FEEC02

Yellow – #FFFF66

Bright Yellow – #FFFFCC

White – #FFFFFF

Glowing White – #FFFFFF

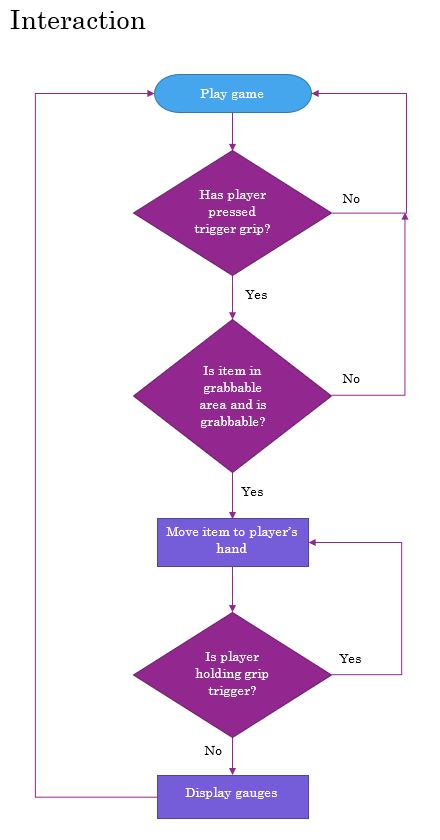
Image Sources:

sstought, (2018), Simplified Colour chart for forging steel [ONLINE]. Available at: https://www.reddit.com/r/Blacksmith/comments/8tjlgi/simplified\_colour\_chart\_for\_forging\_steel/ [Accessed 7 November 2019].

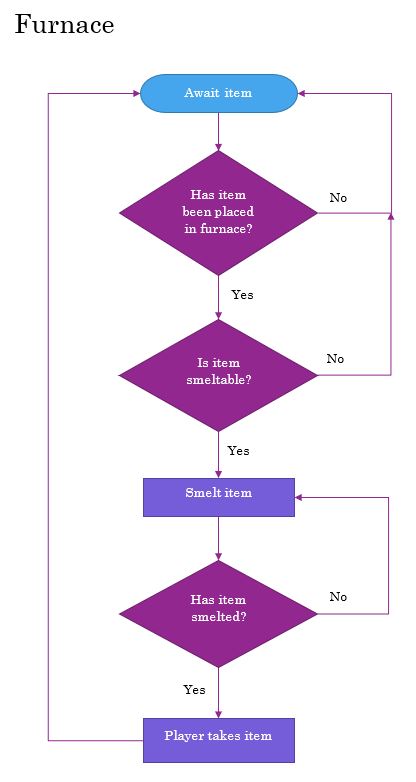
# 11.0 Mechanics Designs

## 11.1 Gameplay Loop

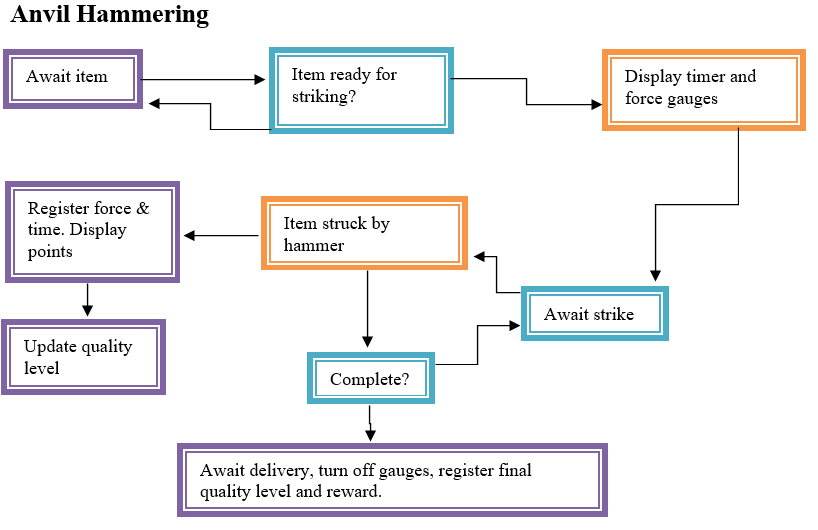
## 11.2 Interaction



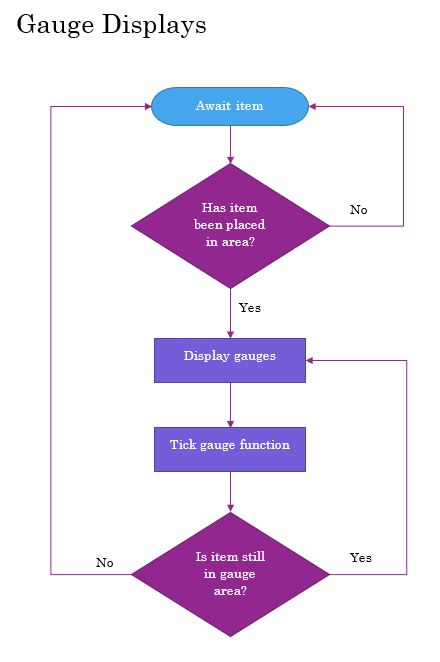
## 11.3 Furnace



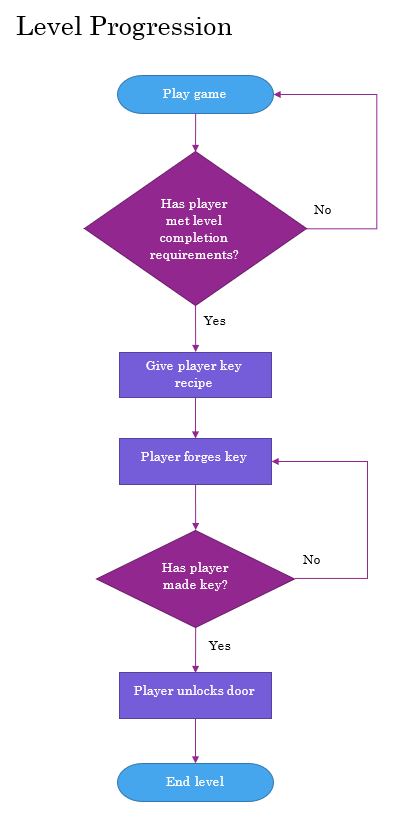
## 11.4 Anvil Hammering



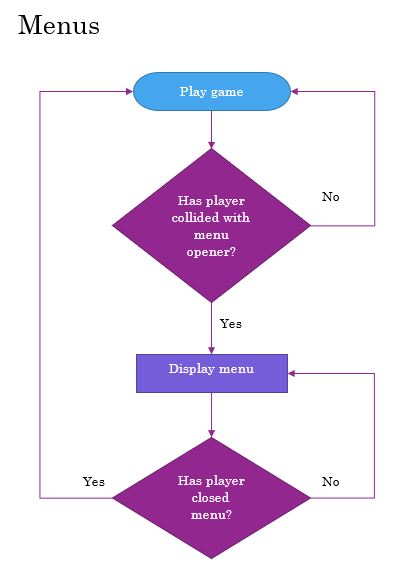
## 11.5 Gauge Displays



## 11.6 Level Progression

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## 11.7 Menus



## 11.8 Difficulty Setting

