

Game Design Document

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Contents

1. Introduction	4
2. Backstory	4
3. Towers	5
3.1. Slingshot Tower	5
3.2. Hammer Tower	6
3.3. Bug Spray Tower	6
3.4. Magnifying Glass Tower	7
3.5. Cannon Tower	7
3.6. Honey Tower	8
4. Ants	8
4.1. Abilities	8
4.1.1. Armour	8
4.1.2. Cloaking	8
4.2. Regular	9
4.3. Regenerative	9
4.4. Strong	9
4.5. Shielded	10
5. Gameplay	10
5.1. The Windmill	11
5.2. Controls and Display	11
5.3. Elements	12
5.3.1. Gold	12

GAME DESIGN DOCUMENT	3
5.3.2. XP	13
5.3.3. Building	13
5.3.4. Upgrading	13
5.3.5. Selling	13
5.3.6. Wave Difficulty Number	14
5.4. Flow	15
5.4.1. Main Menu	15
5.4.1.1. Windmill Screen	15
5.4.1.2. Towers Screen	15
5.4.1.3. Career Screen	16
5.4.1.4. Scoreboard Screen	16
5.4.1.5. Play Screen	16
5.4.2. In Game	16
5.4.3. Winning	17
5.4.4. Losing	17

1. Introduction

Ants is a tower defence game. Your windmill is under attack from ants and you must defend it. Ants of various strengths and abilities will make their way through a path towards your windmill and you can lay various types of towers along the way to defeat them before they reach your windmill. When an ant dies, you gain gold. You can spend this gold on new towers and tower upgrades. The ants will come in waves composed of different types and amounts. You may build and upgrade your towers at any time as long as you have the gold to do so. Each tower type will gain XP with each ant it defeats; this XP will be used to unlock upgrade options. Each tower has 2 upgrade paths with 4 tiers each. You may upgrade 2 tiers in each path but only go above tier 3 in one path. Once all upgrades have been unlocked they are permanently unlocked. Your windmill has 100 health and each ant that reaches it will lower it by a certain amount depending on the type of ant.

2. Backstory

You are known far and wide for the wondrous pies that you bake at your windmill. It is rumoured that you might even use advanced forms of science, or even magic, to create such delicacies. Until now, you've been able to bake your pies without much interruption. However, a colony of ants has found the location of your windmill and they will do anything they can to storm your windmill and eat all of your pies! You must defend your windmill from the onslaught of clever ants or your life's work will be ruined!

3. Towers

Each tower is unique with its own strengths and weaknesses. When each tower is upgraded, the sprite reflects this upgrade. The towers may be placed anywhere along the sides of the path that the ants must take to get to the windmill. The tower cannot overlap one another and they have a set range. Each tower has 2 paths of upgrades, which have 4 tiers of upgrades each. The player may upgrade up to tier 2 on both paths but can only go past tier 3 on one upgrade path (denoted in tables with darker cells). All towers except the bug spray and honey tower can aim at specific ants. These towers can be set to aim at the front ant, closest ant, toughest ant, or back ant.

3.1. Slingshot Tower

The slingshot tower slings rocks at the ants. It fires 1 shot every second that deals 1 damage. Projectile can hit 1 ant. It cannot affect the beetle. Cost: 200 gold.

Upgrades	1	2	3	4
Path 1	Range +1	Range +2 and can hurt cloaked ants	Flaming ball (10 damage)	Can hurt armoured ants
Path 2	Projectile can hit 2 ants	Projectile can hit 3 ants	3 projectiles at once	2 damage per projectile

3.2. Hammer Tower

The hammer tower hammers the ants with a hammer. It hits once every second that deals 1 damage. Can hit 1 ant. Can hurt armoured ants. Cost: 500 gold.

Upgrades	1	2	3	4
Path 1	Hit/.0.75 sec	Hit/0.5 sec	Can hit 3 ants	Can hit 6 ants
Path 2	Bigger hammer 2 damage	Stone hammer 3 damage	Metal hammer 6 damage	Metal spike 12 damage

3.3. Bug Spray Tower

The bug spray tower sprays bug spray to defeat the ants. It sprays in 8 directions once every second that deals 1 damage. Can hit 1 ant. Cost: 400 gold.

Upgrades	1	2	3	4
Path 1	Range +1	Range +2	“Extra strength” Spray can hit 2 ants	“Radioactive strength” deals 8 damage
Path 2	Spray once every 0.5 seconds	Spray once every 0.33 seconds	Spray in 16 directions	Gas bomb (full radius gas that hurts all ants within range)

3.4. Magnifying Glass Tower

The magnifying glass tower harnesses the light of the sun to vaporize ants. It is a constant beam that deals 5 damage per second. Can hit 1 ant. It cannot affect the red ant. Cost: 3,250 gold.

Upgrades	1	2	3	4
Path 1	Range +1	Range +2	"Bigger" deals 10 damager per second	"Yuuge" deals 20 damage per second
Path 2	Projectile can hit 2 ants	Projectile can hit 3 ants	3 projectiles at once	2 damage per projectile

3.5. Cannon Tower

The cannon tower fires cannons to blow up the ants. It fires 1 cannon ball every 10 seconds and deals 1 damager. It can hurt armoured ants. Cost: 700 gold.

Upgrades	1	2	3	4
Path 2	Range +1	Range +2	Fires 1 shot every 5 seconds	Fires 1 shot every 2 seconds
Path 1	2 damage	4 damage	8 damage	16 damage

3.6. Honey Tower

The honey tower sprays honey onto the path in order to stop and slow down ants. It sprays once every 10 seconds and traps all ants within range for 3 seconds. It cannot affect the white ant. Cost: 350 gold.

Upgrades	1	2	3	4
Path 1	Range +1 and stops ants for 4 seconds	Range +2 and stops ants for 5 seconds	Slows all ants within radius by 10%	Slows all ants within radius by 25%
Path 2	1 damage per spray	2 damage per spray	“Extra sticky” slows ants by 5% for 20 seconds	“Pure sugar” slows ants by 10% for 30 seconds

4. Ants

There are many types of ants; their colour and look represents different abilities and traits. As an ant is damaged, its colour and look will reflect how many HP it has left. For example, a black ant has 6 HP and each time it gets hit it will change colour to reflect its HP. It would go purple, yellow, green, blue, brown, and then die. Ants give gold depending on their difficulty number and type which can be found in the table in section 5.3.6.

4.1. Abilities

4.1.1. Armour

All ants have the ability to come armoured. Armour can only be destroyed by certain towers with specific upgrades. The armour absorbs all of the projectile's damage. So, if a projectile can do 20 damage, all of that damage will be used up by the armour leaving a full health ant to continue on. An armoured ant appears as shiny silver.

4.1.2. Cloaking

All ants have the ability to be cloaked. Cloaked ants can only be targeted by certain towers with specific upgrades. They will appear slightly transparent.

4.2. Regular

Regular ants have no special trait about them. Their speed matches their HP and their colour reflects the amount of HP they have left.

Colour	HP	Speed
Brown	1	1
Blue	2	2
Green	3	3
Yellow	4	4
Purple	5	5
Black	6	6

4.3. Regenerative

Regenerative ants regain 1HP every 2 seconds and can start as a green ant or higher. They have a rounder shaped body than regular ants.

4.4. Strong

Strong ants have higher HP and can move quickly. They have resistances to all attacks from specific towers. They are larger than regular ants.

Type	HP	Speed	Resistance
White	25	6	Honey
Red	25	6	Magnifying Glass
Beetle	50	6	Slingshot

4.5. Shielded

Ants can travel under shields. These shields have HP and act like armour mentioned in section 4.1.1.

Shield	HP	Speed	Contains
Green Leaf	25	3	2 black ants
Styrofoam Cup	150	3	2 Green Leafs (4 black ants)
Soda Can	300	2	2 Styrofoam Cups (8 black ants)
Rock	600	1	4 Soda Cans (32 black ants)

5. Gameplay

The game will be played from a top-down view. The windmill will be located in different locations depending on the map chosen. The ants will enter at one specific point on a map and follow a specific route to get to the windmill. The player will be able to place towers on the map, upgrade towers, or sell them for 60% of their value. Easier maps will have more bends and the ants will take longer to get to the windmill. The harder the map, the less bends in the path and it will be more direct to the windmill. The player will start on the beginner map and once they have beat it they will unlock the next map. Each map will become more difficult. Initially the game will have one map and the final iteration will have a minimum of 3 to choose from. The player gets gold for each ant they defeat; the harder the ant the more gold they get. The player may spend this gold to purchase towers and place them beside the path or upgrade their towers. The player must manage their spending, placement, and upgrade strategy if they hope to win. Once the player defeats all waves, which progressively become more difficult, they may continue playing in free-play mode to see how long they can last. The difficulty will

continue to ramp up until it becomes impossible to win. Their total XP will be saved to a high-score leaderboard.

5.1. The Windmill

The player can unlock new HP levels for their windmill, reflected by the windmill being constructed of different materials. This is done by the player reaching specific XP tiers.

Material	Cost (Total XP)	HP
Wood	0	100
Stone	50,000	150
Concrete	125,000	200
Steel	250,000	250

5.2. Controls and Display

The player will interact with the game with a mouse and keyboard. Across the top of the screen there will be a wave indicator, wave difficulty number, gold, and windmill health. Across the left of the screen will be the tower tray where towers can be clicked and then placed on the map. There will also be the continue button which turns into a fast forward button once the wave begins. Below that will be the menu button. Next to the menu button will be the sound effects button and music button which may be clicked to mute the respective sound channel. The player may also click on their towers to see information about them and their upgrade options. This information and the upgrade options will appear in a tray just under the top bar.

Screen Layout

Wave: #/# Difficulty: # Gold: ### Health: ###							
Towers	Tower Image	Sell	First Closest	Strongest	Last	First path image and price	Second path image and price
	Play area						
Play / Fast Forward							
Menu/Sound							

5.3. Elements

The game has various gameplay elements such as: gold, XP, building towers, upgrading towers, selling towers, and the wave difficulty number.

5.3.1. Gold

Gold is the currency used in the game. The player receives gold for each ant they defeat or by selling towers they have already built. They can spend this gold on purchasing or upgrading towers. Gold does not save from map to map, the player begins each map with just enough gold to buy a basic slingshot tower.

5.3.2. XP

XP is rewarded for each ant that is defeated. When an ant is defeated by a tower, that specific tower type gains XP towards unlocking the next upgrade tier which they can then purchase with gold. All XP gained by all towers counts towards the player's cumulative XP which is used to unlock new towers and higher HP for the windmill. The amount of XP that an ant gives is equal to its difficulty number. So, a brown ant gives 1 XP, while taking down a rock will net the player 3,592 XP.

5.3.3. Building

The player may select a tower they have unlocked and then click anywhere on the map that allows for placement of a tower. The tower will immediately begin attacking ants that come within range of it.

5.3.4. Upgrading

The player may select any tower that they have built on the map and click on whichever upgrade path they desire from within the tower tray near the top of the screen.

5.3.5. Selling

The player may sell any tower they wish for 60% of the gold they already invested into it. They can do this by selecting the tower on the map and then clicking the "sell" button located in the tower tray near the top of the screen.

5.3.6. Wave Difficulty Number

The wave difficulty number is a number that represents how difficult the current wave is. This number is calculated by the total HP of all ants in the wave. Armoured ants can absorb the full damage of one attack even if it goes over the armour HP amount. This feature makes it a little difficult to approximate the difficulty of the ant because it depends upon the player's strategy and what towers they have built. Armour ants will be given a multiplier of 1.20 for their difficulty level. Cloaked ants also have the same difficulty in approximating their difficulty but will be given a multiplier of 1.20 as well. These multipliers combine when an ant is armoured and cloaked for a total multiplier of 1.50. Below is a chart representing this amount per ant:

Colour	HP	Difficulty Number (DN)	Armoured or Cloaked DN	Armoured and Cloaked DN	Comments	Gold Reg/AorC/A&C
Brown	1	1	1.2	1.5		1/1/2
Blue	2	2	2.4	3		1/2/3
Green	3	3	3.6	4.5		3/4/5
Yellow	4	4	4.8	6		4/5/6
Purple	5	5	6	7.5		5/6/8
Black	6	6	7.2	9		6/7/9
White	25	25	30	37.5		25/30/38
Red	25	25	30	37.5		25/0/38
Beetle	50	60	72	90		60/72/90
Green Leaf	25	37	44.4	55.5	Contains 2 black ants	25/30/38
Styrofoam Cup	150	224	268.8	336	Contains 2 Green Leafs	150/180/225
Soda Can	300	748	897.6	1122	Contains 2 Styrofoam Cups	300/360/450
Rock	600	3,592	4,310.4	5,388	Contains 4 Soda Cans	600/720/900

So, for example, a wave containing 10 brown ants, 2 black ants, and a green leaf will have a wave difficulty number of $(10 \times 1) + (2 \times 6) + (1 \times 37) = 59$.

5.4. Flow

5.4.1. Main Menu

The player will be greeted with the main menu and they will have a couple of options to choose from such as: windmill, towers, career, scoreboard, and play.

5.4.1.1. Windmill Screen

When the player clicks on the windmill button a window will pop up over the main menu and allow the player to see their windmill and its customization options. The player will see their total career XP, the next XP tier to unlock the next windmill material, as well as special skins they have unlocked by completing certain achievements.

5.4.1.2. Towers Screen

When the player clicks on the towers button a window will pop up over the main menu and allow the player to see the types of towers available to them. The towers, and upgrades, that they have yet to unlock will be greyed out so they cannot see them. They will see an outline of the tower and the amount of XP needed to unlock it. The tower, and upgrades, that they have unlocked will be visible in full colour and detail. They may click on the tower and see the upgrades they have unlocked.

5.4.1.3. Career Screen

When the player clicks on the career button a window will pop up over the main menu and allow the player to see how many games they have played, how many games they have won, how many games they have lost, their win rate (total games played/total games won), total ants defeated, total damage done, and average damage per game. The player will also see how much XP they have earned over their career.

5.4.1.4. Scoreboard Screen

When the player clicks on the scoreboard button a window will pop up over the main menu and allow the player to see the players with the highest XP.

5.4.1.5. Play Screen

When the player clicks on the play button a window will pop up over the main menu and allow the player to choose the level they wish to play. The levels will be shown visually and they'll be organized by difficulty. The player can click the level they'd like and then click continue. The window will then display four choices for difficulty such as: easy, medium, hard, and legendary. Once the user clicks on the difficulty level they may press continue and then the game will load.

5.4.2. In Game

Once the player is loaded into a level the screen will look like it does in section 5.2. The player will start with just enough gold to build one slingshot tower. The player then clicks the play button which will start the wave of ants. The play button will convert to a

fast forward button which they can click to double the speed of the game as some waves can take quite some time to accomplish. The first wave acts as a tutorial of how to place a tower and for the player to see how the ants come into the map and how they move around. After the wave is complete, the fast forward button converts back to the play button and it will continue in this fashion. The player may build, upgrade, and sell towers at any time.

5.4.3. Winning

Once the player has lasted the total number of waves of ants, which is denoted along the top of the screen, a window will display over the game stating that they have won. They will be given the option to return to the main menu or to continue playing in free-play mode to see how far they can go.

5.4.4. Losing

If the player lets too many ants through the path and they succeed in reaching the windmill, the windmill will take a damage equal to the ant's difficulty number. For example, if a brown ant reaches the windmill it will take 1 point of damage. If a rock reaches the tower it will take 3,592 damage which is certain defeat. When the player loses, a window will display over the game stating that they have lost. They will be given the option to try again or return to the main menu.