

A strategy game that scales automatically on multiple  
platforms

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# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Executive summary</b>	<b>1</b>
<b>3</b>	<b>Structure of the game</b>	<b>2</b>
<b>4</b>	<b>High level concepts for this project</b>	<b>2</b>
4.1	Player's role . . . . .	2
4.2	Player's goal . . . . .	2
4.3	Player's motivation . . . . .	2
4.4	Genre . . . . .	3
4.5	Unique selling points . . . . .	3
4.6	Target player . . . . .	3
4.7	Inspiration . . . . .	3
4.7.1	Nobunaga's Ambition 13 [2] . . . . .	3
4.7.2	Romance of the Three Kingdoms series [3] . . . . .	4
4.7.3	Onmyoji [4] . . . . .	4
4.7.4	Fire Emblem Heroes [5] . . . . .	4
4.8	Design goals . . . . .	4
4.8.1	Automatic scaling on multiple platforms . . . . .	4
4.8.2	Winning condition . . . . .	4
4.8.3	Terminating condition . . . . .	4
4.8.4	The primary gameplay mode . . . . .	4
4.8.5	The secondary gameplay mode . . . . .	4
<b>5</b>	<b>Requirements behind visual scaling</b>	<b>5</b>
5.1	Scaling goals . . . . .	5
5.2	Scaling principles . . . . .	5
5.3	Inspiration by consistent requirements . . . . .	5
5.3.1	Keep the player experience constant . . . . .	5
5.3.2	Sacrifice . . . . .	5
5.3.3	Visual elements . . . . .	6
5.3.4	Camera model . . . . .	6
5.3.5	Interaction model . . . . .	6
5.3.6	Map . . . . .	7
5.3.7	Resources and entities . . . . .	7
5.3.8	Global mechanics . . . . .	7
5.4	Adapting for automatic scaling . . . . .	7
5.4.1	Essential game content and ineffective background . . . . .	7
5.4.2	Camera initialization . . . . .	8

<b>6</b>	<b>Primary gameplay mode</b>	<b>10</b>
6.1	Challenges . . . . .	10
6.2	Actions . . . . .	10
6.3	Visual elements . . . . .	10
6.3.1	Military scroll . . . . .	12
6.3.2	Summary bar . . . . .	12
6.4	Camera model . . . . .	12
6.5	Interaction model . . . . .	12
<b>7</b>	<b>Secondary gameplay mode</b>	<b>13</b>
7.1	Challenges . . . . .	13
7.2	Actions . . . . .	13
7.3	Visual elements . . . . .	13
7.4	Camera model . . . . .	13
7.5	Interaction model . . . . .	14
<b>8</b>	<b>Core Mechanics</b>	<b>14</b>
8.1	Resources . . . . .	14
8.2	Entities . . . . .	14
8.2.1	Officers . . . . .	14
8.2.2	Soldiers . . . . .	15
8.2.3	Buff and debuff by terrains and strategies . . . . .	15
8.2.4	Strategies . . . . .	15
8.2.5	Terrains . . . . .	15
8.3	Mechanics . . . . .	16
8.3.1	Global mechanics . . . . .	16
8.3.2	Damage computing formulas . . . . .	16
<b>9</b>	<b>Test</b>	<b>16</b>
9.1	Automatic scaling . . . . .	16
9.1.1	On a 18:9 screen . . . . .	17
9.1.2	On a 16:9 screen . . . . .	18
9.1.3	On a 16:10 screen . . . . .	19
9.1.4	On a 3:2 screen . . . . .	20
9.1.5	On a 4:3 screen . . . . .	21
9.1.6	On a portrait screen . . . . .	21
9.2	Consistent experience . . . . .	22
9.2.1	Conduct the survey . . . . .	22
9.2.2	Analysis of results . . . . .	23
<b>10</b>	<b>Conclusion</b>	<b>25</b>
<b>11</b>	<b>Reference</b>	<b>25</b>

<b>12 Appendix</b>	<b>26</b>
12.1 Value and skill settings for officers . . . . .	26
12.2 Settings for soldiers . . . . .	27

# 1 Introduction

With the popularity of mobile gaming, we are seeing more strategy games available on mobile devices. This means we need to consider the player experience for this genre as it moves from more traditional gaming devices to smaller portable devices. The player can have a more consistent experience if the game can be played on PC, Android and IOS devices without any loss on user experience. Preserving the user experience does not only mean that the game can automatically scale according to different screen sizes and aspect ratios, but also that the UI and mechanics should complement the new environment.

In this project, we try to implement automatic scaling in a strategic game “Strategy Three Kingdoms” (STK) built in Unity3D, which prioritizes the effect of strategy and terrain factors in the Three Kingdoms background. Our goal is to ensure players have the same user experience among different platforms. Meanwhile, more and more strategy games merge RPG elements and emphasize the role of powerful characters with tactics and strategy have been superseded by heroes. We believe that this should not be the case that strategy games should focus on simulating real world battle scenarios for the player to apply tactics, logistics, and strategy to complete. So STK returns the focus to strategy and tactics over individual character power.

This document is organized in seven sections in addition to this introduction. Section 2 is the high concept document of the game that presents key ideas of the game in a broad outline. Section 3 addresses scaling and consistency requirements, including a discussion of how the mechanics are inspired by the constraints as well as the implementation of consistent user experience and automatic scaling. Section 4 and 5 document the primary and secondary gameplay modes respectively, including challenges, actions and UI elements. Section 6 explores the core mechanics of the game. Section 7 illustrates test results of the game running on several devices with different screen sizes. We follow this paper with an appendix listing some design details of officers and soldiers as they appear in the game.

## 2 Executive summary

Strategy Three Kingdoms is a strategy game with the topic on battle in ancient China. In the game you are supposed to win the battle as a commander. You can play the game on PC and mobile devices. Don’t worry about the performance on small screens. Dedicated UI, layouts and gameplay ensure the game can scale automatically according to different screen sizes and make you emerge in the same game even if you change to another device.

Actions from the player are very simple so you don’t need to care about RPG elements such as unit training, resource management, building, complex magics or social communication. The player can just focus on the art of leading, because Strategy Three Kingdoms offers pure strategy and tactics game experience. However, the game is still challenging. It is not easy to complete a level without thinking hard about how to deploy your units. Remember to use ambush to strike enemies and take use of terrains even direction factors to get the upper hand. Strategy and tactics are the keys to victory. The following sections

will explain the secret behind the consistent experience in details.

### **3 Structure of the game**

Just like other Unity projects, which are composed of scenes, this project consists of three scenes, “MainMenu”, “LevelSelect” and several “Level” scenes.

The game starts from “MainMenu” scene which offers options for the player, including “Single game”, “Multiple game” and “Exit”. Then click “Single game” button (Multiple game has the same process), and the game will jump to “LevelSelect” scene where the player could choose which level and force to play. After selecting a level and force, the player will enter into that level scene starting with the planning stage. By finishing the preliminary deployment of units, the player should click the drum to proceed the game to the battle stage. For the player who plays the game the first time, a tutorial level is mandatory to guide him how to play the game step by step. When the player defeat a level, the game will return to “LevelSelect” scene and he could choose to play another level or go back to “MainMenu”.

## **4 High level concepts for this project**

### **4.1 Player’s role**

The player’s role is a commander to lead units to win a battle. At planning stage, the player is assumed to deploy units on a map to finish preparation before the battle begins. The player need to generate a combination of tactical and strategic considerations.

At battle stage, the player need to adjust strategies through observing intelligence on map in real-time as well as make quick decisions to command units at the most appropriate opportunities.

### **4.2 Player’s goal**

The main emphasis of this game is the player’s ability to outthink the opponent. The main goal of the player is to slay all enemies that are more than the player’s total strength.

### **4.3 Player’s motivation**

The player’s motivation is strategy and terrain based combat required for passing levels. The player need to think about how to make use of strategies and advantage terrains to overcome the strong opponent. For the player who knows the Three Kingdoms story, he can also experience some classic plots and battle described in the novel.

## 4.4 Genre

The main genre of this game is strategy that the player's autonomous decision-making, planning and deployment skills are significant to pass each level. The game requires very high situational awareness and substantial brainstorm to generate appropriate deployment plan and correct action orders before the combat actually happens. The player is supposed to command the battle through an overlook view on top of the map. There is no resource or building system in this game while no micro-management is required, which distinguish it from an RTS game. STK tries to reproduce the strategic situations in ancient Chinese battles.

The game has two gameplay modes corresponding to planning stage and battle stage. The planning stage has some normal strategic elements because the player cannot move units or perform any strategies/skills. Levels are designed to follow plots narrated in The Three Kingdoms [1]. Each level is designed based on a major battle happens in the novel.

## 4.5 Unique selling points

The game emphasizes strategy and use of terrain factors instead of paying most attention on officers' skills or weapon advantage in traditional strategy games about the Three Kingdoms. Sufficient time for planning is required before the battle stage while frequent actions are not required during the battle.

## 4.6 Target player

The target players for this game are hardcore gamers who are interested in the Three Kingdoms or strategy games about cold weapon battle. Especially for players who are looking for a strategy game that emphasizes terrain and strategic factors instead of skills and values.

## 4.7 Inspiration

### 4.7.1 Nobunaga's Ambition 13 [2]

- Automatic combat by internal round.
- Meld RTS-similar combat elements into a strategy game. The player and opponent act in the same time instead of by turn.
- Buff/debuff system.
- A menu bar containing officers' skills and unit information.
- Damage calculation formulas.

#### **4.7.2 Romance of the Three Kingdoms series [3]**

- Terrain factors including land, forest and hills.
- Strategies including fire attack and ambush.

#### **4.7.3 Onmyoji [4]**

- UI elements including layout and the menu bar shown in scroll.

#### **4.7.4 Fire Emblem Heroes [5]**

- Level design.
- Winning and termination conditions.

### **4.8 Design goals**

#### **4.8.1 Automatic scaling on multiple platforms**

This game is supposed to be played on PC, smart phone and pad with Windows or Mac OS. The game should automatically scale on various screens and ensures the same player experience.

#### **4.8.2 Winning condition**

Slay all enemies on the map that total strength of opponent is zero.

#### **4.8.3 Terminating condition**

The player loses all units that total strength of the player is zero.

#### **4.8.4 The primary gameplay mode**

The gameplay mode for battle stage that combat actually happens. The player can deploy new units only through fortresses or command existing units to move, attack and perform strategies.

#### **4.8.5 The secondary gameplay mode**

The gameplay mode for planning stage. The player can deploy and ambush new units in a larger area around fortresses but cannot move or command them. Combat will not happen in this stage.



## 5 Requirements behind visual scaling

### 5.1 Scaling goals

The scaling goal is to implement automatic scaling in order to ensure the same player experience on various devices.

### 5.2 Scaling principles

Some scaling principles need to be followed to achieve the scaling goal.

- Challenges, actions and core mechanics relevant with strategy should be completely scale-independent.
- Players' actions should be limited and don't need to be performed frequently to make it easier for players to play on mobile devices.
- UI elements and interaction model should not disturb player experience among all platforms, especially for making quick decisions and observing intelligence on map in real-time.

### 5.3 Inspiration by consistent requirements

#### 5.3.1 Keep the player experience constant

Players should never concern about what is the current platform. They should just feel they are playing this certain game. For example players don't need to consider a question like "Now I am playing on smart phone which I need to control my view in smart phone way that is different from the PC version". Another example is that keyboard shortcuts on PC are abandoned to ensure the player doesn't rely on shortcuts managements that do not exist on other devices. If the player used to use shortcuts on PC but cannot use shortcuts on mobiles without keyboard, that leads to a different game experience impacted by fluctuating controlling difficulties.

UI and interaction model should keep the same style that players don't feel they need to have different actions to adapt on a new platform. The only difference might be input method due to different input devices such as mouse clicking on PC and touching on mobile phone that can be almost adapted unconsciously.

#### 5.3.2 Sacrifice

Consider advantages and disadvantages for different platforms with various screen sizes. A large screen can always show more elements in appropriate layouts. However, it is hard to contain the same content in the same layout on a smaller screen. In order to keep the same player experience, it is meaningful to keep essential game content constant on screens and balance other content by sacrificing some conveniences on large screen.

If this game is a PC-only game, the map can be shown entirely in full screen so that players don't have view controlling issue at all. But this game is supposed to be run on multiple platforms, some considerations might be sacrificed in PC version to ensure the same user experience on all platforms. For example, PC has a large screen while smart phone has a small one. It is not a good design if maps can be entirely showed on a big screen while on smart phone maps are partially showed. Players do not need to move camera on PC but always need to move camera on smart phone that causes much more operations when play the game. There will be a serious impact on game experience via different platforms if maps are showed in different ways.

So it is a good idea to make maps can be zoomed in and out on all platforms. That is, the map can be zoomed out to a global map that can give an overview and be zoomed in to a local view to be interacted with when many units concentrate. In details, the map in the most zoom in view (local map) can be inspected by limited dragging extent and it can be zoomed out to fix screens' height or width as a global view. Keep these map design considerations on all supported platforms to make sure players have very similar view controlling actions.

### **5.3.3 Visual elements**

- Information bar was originally separated to two lines. If the game is hard coded in a certain size, we can set meaningless borders to "hide" the bars so that it won't block any elements in essential game area. However, in automatic scaling versions, there may not any extra space for the bars. As a result, the information bars may block parts of map or units on some screens. Finally, the bars are merged into one and all texts can be contained in the "border terrain" in map where is meaningless for unit to access.
- A menu bar containing all officers' accesses is designed as a scroll that can be switched between deployed and not in battle officers.
- When multiple units are very close to each other on a small area on map, menus and texts may block each other to make the battlefield looks very disordered.
- The player can select the hoped unit via distinct icons instead of clicking the unit in the chaotic battlefield. The scroll saves room needed for UI that can be folded and dragged to prevent UI elements blocking map or units.

### **5.3.4 Camera model**

This game takes 2-D view by considering various terrains may block each other in 3-d view that leads to more complex view controlling actions especially on small screens.

### **5.3.5 Interaction model**

- Units cannot share the same tile. Units cannot move through a map tile that another unit is on. If some units belong to the same tile, extra UI elements are needed to handle selection issue. That may cause blocking issues and more actions from players.

- Borrow some interaction methods from RTS game. Move and select actions are straightforward that don't rely on any button. This improves interaction efficiency and simplifies controlling management compared with normal strategy games.
- No action relies on right click on PC since there is no way to migrate right click on touching screen device. The player needs time to adapt different controlling methods with or without right click. This contributes to the same player experience among platforms.

### 5.3.6 Map

In original plan, the map is designed to consist of hex or diamond tiles. However, in this way the side of map would be uneven. It is very difficult to handle automatic scaling due to the inclined borders of hex or diamond. This is one of reasons why finally we choose square tiles to build maps. Also, comparing with hex maps, tile maps can reduce blocking influence among elements on mobile devices. It is easier for the player to acknowledge distance. The player doesn't need to micro-change moving path of armies in order to reduce controlling difficulty on mobile devices.

### 5.3.7 Resources and entities

- Targets of officer skills are all units within some ranges so that players don't need to select target when perform skills. Also, skills don't require energy accumulation that means players don't need to keep an eye on energy progress of each officer.
- When select target of strategies, only available units are highlighted with hover icons or distinct colors(for example only forest and hills will be highlighted for fire attack). This helps the player select the hoped one accurately on touching screen.
- Each tile of a map contains one terrain type. Hills and forest are shown by plat icons to avoid view blocking on map.

### 5.3.8 Global mechanics

By considering many people have limited time and probably uncomfortable environment when play games on mobile devices, average time to pass a level should be short. This leads to a limited initial (total) number of soldiers. Automatic combat ensures the player doesn't need to care about combat details. Formation switch is abandoned for the same reason.

## 5.4 Adapting for automatic scaling

### 5.4.1 Essential game content and ineffective background

To ensure the same player experience on multiple platforms, it is meaningful to keep the essential game content having a constant ratio (16:9 in this game). Appropriate ineffective background is added around the essential area to fill the screen by height or width.

- Keep the essential (effective) game content in 16:9 ratio on all devices.
- For screens that have a W/H aspect ratio smaller than 16:9 (such as 16:10 screens), add background on top and bottom to fix the screen by height. The background consists of inaccessible map tiles covered by dark war fog.
- For screens that have a W/H greater than 16:9 (such as 18:9 screens), add background on sides to fix the screen by width.

#### 5.4.2 Camera initialization

For all size screens, the maximum zoom out orthographic size (that is also the initial orthographic size) of camera is the size that the screen has the same width ( $W/H > 16:9$ ) or height ( $W/H < 16:9$ ) with essential game content area. That is, the essential area is just entirely included to ensure it occupies the most proportion of screen. The minimum size is set to a constant number that players have a good local view of map to interact. The maximum size can be easily calculated through the formula  $orthographicSize = screenHeight/pixelPerUnit/2$  in Unity3D. Figure 1 shows how this method works.



On 16:10 screen. Add background on top and bottom.



On 18:9 screen. Add background on sides.

Figure 1: Background on screens of different ratios

## 6 Primary gameplay mode

The gameplay mode for battle stage.

### 6.1 Challenges

- Slay all enemies.
- Have a foresight to opponent's strategy and take advantage solutions. For example, attacking from ambush causes extra damage to the target while ambush can be resolved by fire attack.
- Take terrains into account when plan strategies. Each map has unique features and distinctive terrains. Players can't always win by using the same strategies on all maps.
- Notice opponent's real-time actions. Player should take corresponding actions to handle incidents in time.
- Perform officer skills at the most opportune time.

### 6.2 Actions

- Deploy not in battle units on map from fortresses.
- On/Off automatic attack toggle.
- Perform officer skills.
- Ambush.
- Fire attack.
- Select unit.
- Move unit.
- Select attack target.
- Stop moving.
- Camera controlling.

### 6.3 Visual elements

Visual elements are in opaque overlay (simplified diagram is shown Figure 2). Map is full-screen in landscape view for maximizing its proportion on screen.

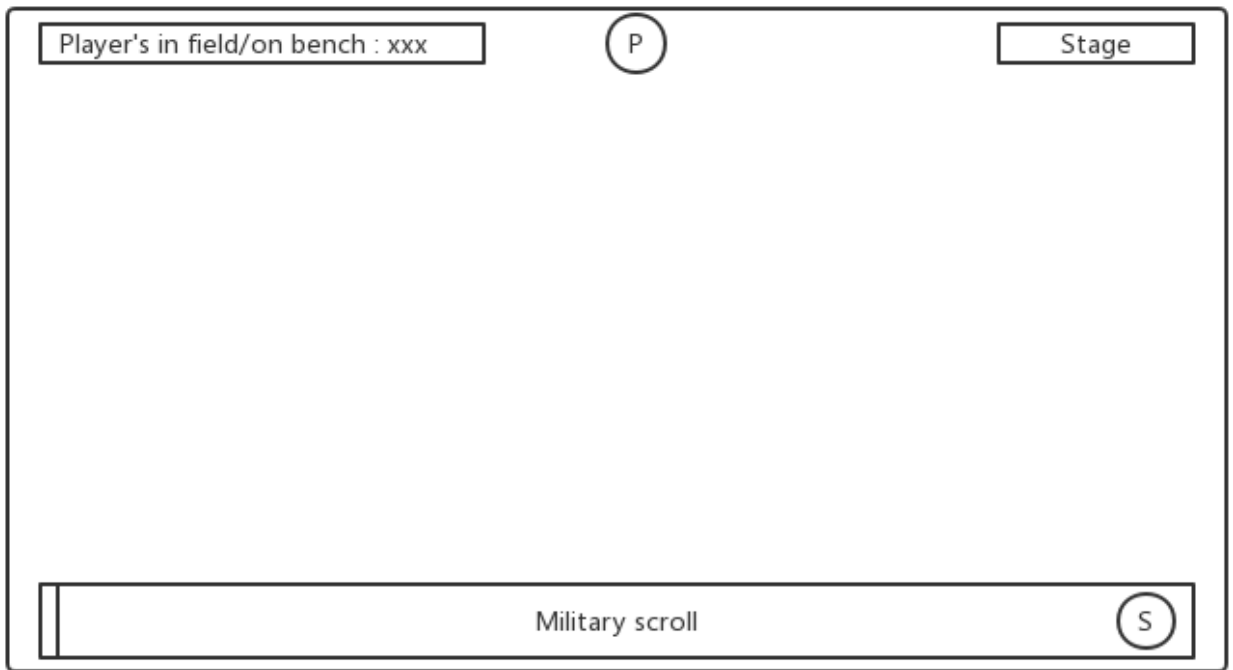


Figure 2: User Interface

### 6.3.1 Military scroll

Most actions are taken through the military scroll. This bar contains interactive buttons of all officers.

- Scroll button: Hide or show items in the scroll. The scroll can be dragged to anywhere on screen to avoid blocking any element on screen.
- Switch button: Shown on bottom right in figure 2 as “S” button. Switch between in battle officers and not in battle officers.

### 6.3.2 Summary bar

Show information about current stage, total strength and number of soldiers left that can be deployed.

## 6.4 Camera model

The camera model is side-scrolling landscape view.

## 6.5 Interaction model

This game takes omnipresence interaction model.

- Switch items in military scroll: Click the switch button at the end of military scroll.
- Hide or show items in military scroll: Click the scroll button.
- Drag the military scroll: Drag the scroll button to hoped location on screen.
- Deploy new units: Switch military scroll to not in battle officers list. Call deployment panel by clicking the icon of hoped officer. Select type and adjust number. Click decide button and select entry on map. New units can only be deployed on fortresses in the battle stage.
- Select unit: Select an army in battle by clicking/touching the unit on the map. Players can change selected unit by clicking another unit straightforward. Number of selected unit are shown in green color to be distinct. Enemy units can't be selected.
- Move unit: When a unit is selected, players can move it by clicking an empty tile on map.
- Select attack target: When a unit is selected, players can set attack target for it by clicking any visible enemy unit on map.
- Hold army: Players can stop and hold a moving unit by clicking it again.



- Unselect unit: Unselect a unit by clicking it again when it is holding.
- On/off automatic attack: Switch the military scroll to deployed officers. Click the hoped officer to open the strategy panel. On/Off the automatic toggle.
- Perform officer skills: Open the strategy panel and click skill button.
- Ambush: Open the strategy panel and click ambush button. A unit can only ambush on hill or forest terrain type.
- Fire attack: Open the strategy panel and click fire attack button. Players need to select target tile then. Available targets will be highlighted by hover icons.

## 7 Secondary gameplay mode

The gameplay mode for planning stage.

### 7.1 Challenges

- Plan how to offense/defense according to visible intelligence on current map.
- Have a foresight to opponent's strategy and plan advantage solutions.
- Make sure to combine appropriate officers, units and terrain factors.
- Allocate units appropriately (number, location etc.).

### 7.2 Actions

- Deploy new units on available fields.
- On/Off automatic attack toggle for deployed units.
- Proceed to battle stage.

### 7.3 Visual elements

- Proceed button: Shown on top center in figure 2 as “P” button.

Other elements are same as the primary gameplay mode.

### 7.4 Camera model

It is the same as the primary gameplay mode.

## 7.5 Interaction model

- Deploy new units: Switch military scroll to not in battle officers list. Call deployment panel by clicking the icon of hoped officer. Select type and adjust number. Click decide button and select an available tile on map. The new deployed units will be in ambush on hills or forest terrain by default.
- Proceed to battle stage: Proceed to battle stage by clicking the drum button on top center.

# 8 Core Mechanics

## 8.1 Resources

- Energy: The player has 100 energy for each officer that cost when perform skills or strategies.
- Unit: A unit consists of an officer and some amount of soldiers. Units can move by tiles on map. Available actions of units include attacking, moving and performing strategies.
- Officers: Each officer has an individual skill and two attributes that are martial art and leading. Martial art decides attack value of the unit. Leading decides defense value of the unit.
- Soldiers: There are two types of soldiers, one is archer, the other is Spearman. The only difference between them are attack range. Archer has attack range of two while spearman can only attack enemies in adjacent tiles in range one.
- Strategies Include ambush, fire attack and officer skills. Performing strategy cost corresponding energy.
- Map: Maps consists of 20x11 square tiles. The map of each level is unique.
- Fog of war: Partial transparent fog of war is used. Players can see all terrains on map but can only see enemies within range two of a friendly unit.

## 8.2 Entities

### 8.2.1 Officers

Detail value settings of officers and soldiers are listed in appendix section.

### 8.2.2 Soldiers

Attack range, attack value and defense value are represented by  $Range$ ,  $soldierAtt$ ,  $soldierDef$  in damage formulas.

- Archer Archer is a range unit that can attack enemies within range two.
- Spearman Spearman is a melee unit that can attack enemies in adjacent tiles.

### 8.2.3 Buff and debuff by terrains and strategies

Each buff/debuff exists on units for six seconds.

- Status buff Add to units because of being attacked by ambush or fire attack. Represented by  $coeStatusAtt/coeStatusDef$  in damage formulas.
- Terrain buff Add to units because of attacking or being attacked from archers on hills. Represented by  $coeTerrainAtt/coeTerrainDef$  in damage formulas.
- Direction buff Add to units when suffer attacking from behind or side. Represented by  $coeDirAtt/coeDirDef$  in damage formulas. Attacking from behind causes extra damage that  $coeDir = 0.4$ . Attacking from side causes extra damage that  $coeDir = 0.2$ .

### 8.2.4 Strategies

- Ambush: Costs 20 energy points. Ambush can be only performed on forest and hill terrain. Player need to decide if the unit automatically attack enemies inside attack scope by on/off automatic attack toggle in the strategy panel. Units in ambush status are invisible for enemies. Units break ambush status when move or attack. Units suffer a debuff that  $coeStatus = -0.25$  in six seconds when attacked by ambush.
- Fire attack: Costs 20 energy points. Fire attack can be only performed towards forest or hill terrain in range of three. Fire attack can break ambushed enemies and cause a debuff that  $coeStatus = -0.2$  in six seconds.

### 8.2.5 Terrains

- Plain: Normal terrain.  $coeTerrain = 0$  if attack is from plain to plain.
- Hill: For archers,  $coeTerrain = 0.2$  when attack is from hill to other terrains. Ambush is available on this terrain.
- Forest: Ambush is available on this terrain.

## 8.3 Mechanics

### 8.3.1 Global mechanics

- Initial state: Players have a certain number of soldiers that can be deployed in each level. It is less than enemy strength so that players should think hard about how to make use of strategies and advantage terrains to pass the level.
- Automatic combat: When enemies are in attack scope and be set as attack target, automatic combat is triggered. Damage is computed by formulas shown in next section.

### 8.3.2 Damage computing formulas

- $damage = (1 + coeDir) * (1 + coeTerrain) * attackNum / 25 * attackValue / defenseValue$
- $attackValue = [maxMartial^2 * 0.005 + 30] * 100 * 0.005 * soldierAtt * 0.1 * (1 + buffAtt)$
- $buffAtt = coeSkillAtt + coeStatus$
- $defenseValue = [maxLeading^2 * 0.005 + 30] * 100 * 0.005 * soldierDef * 0.05 * (1 + buffDef)$
- $buffDef = coeSkillDef + coeStatus$

## 9 Test

### 9.1 Automatic scaling

We test the game on five devices that have different screen size to see how the automatic scaling works. The results are ordered by width/height ratio from high to low.

### 9.1.1 On a 18:9 screen

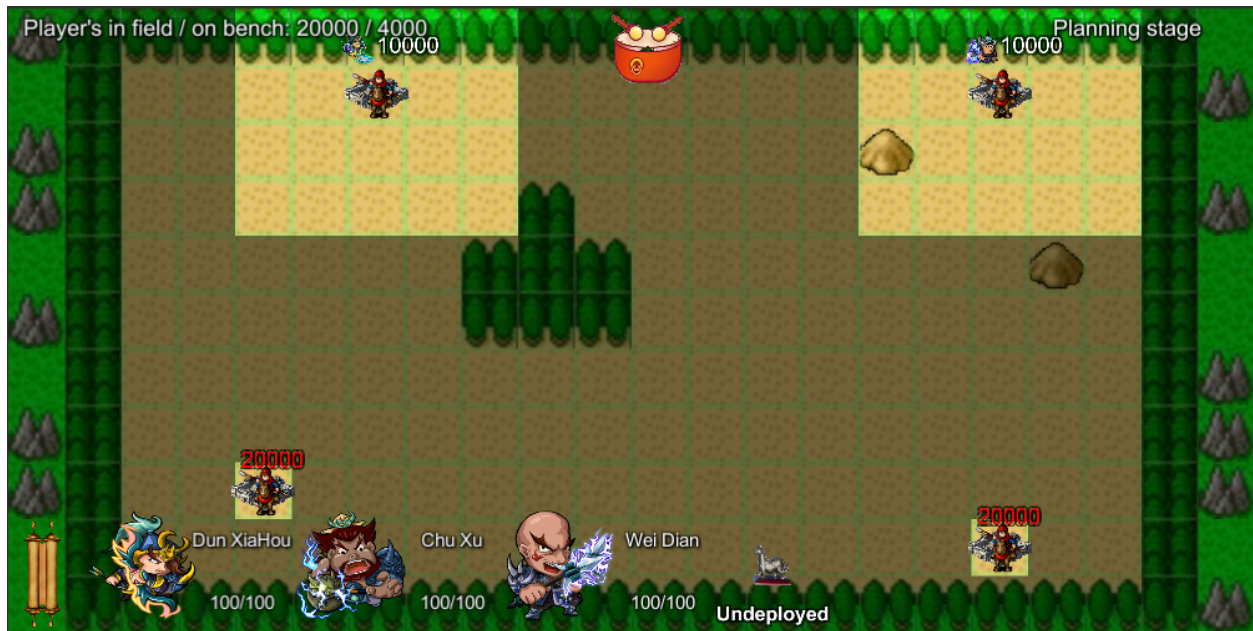


Figure 3: 18:9 screen

### 9.1.2 On a 16:9 screen

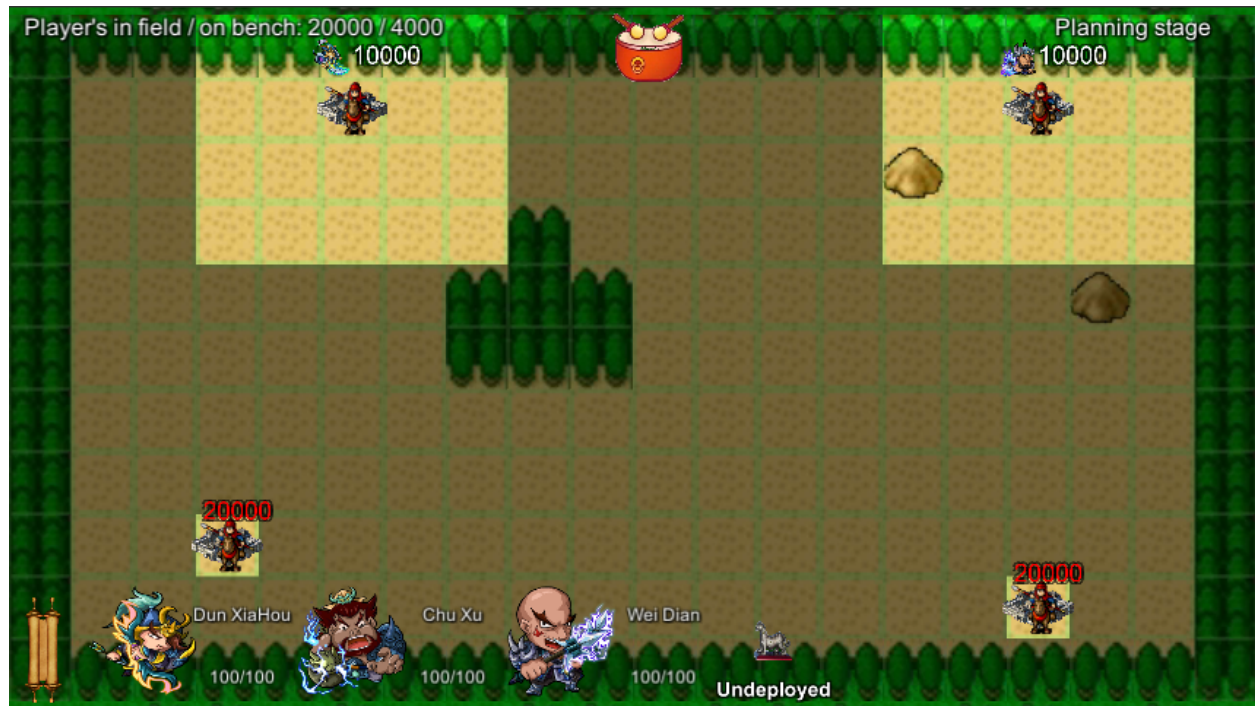


Figure 4: 16:9 screen

### 9.1.3 On a 16:10 screen

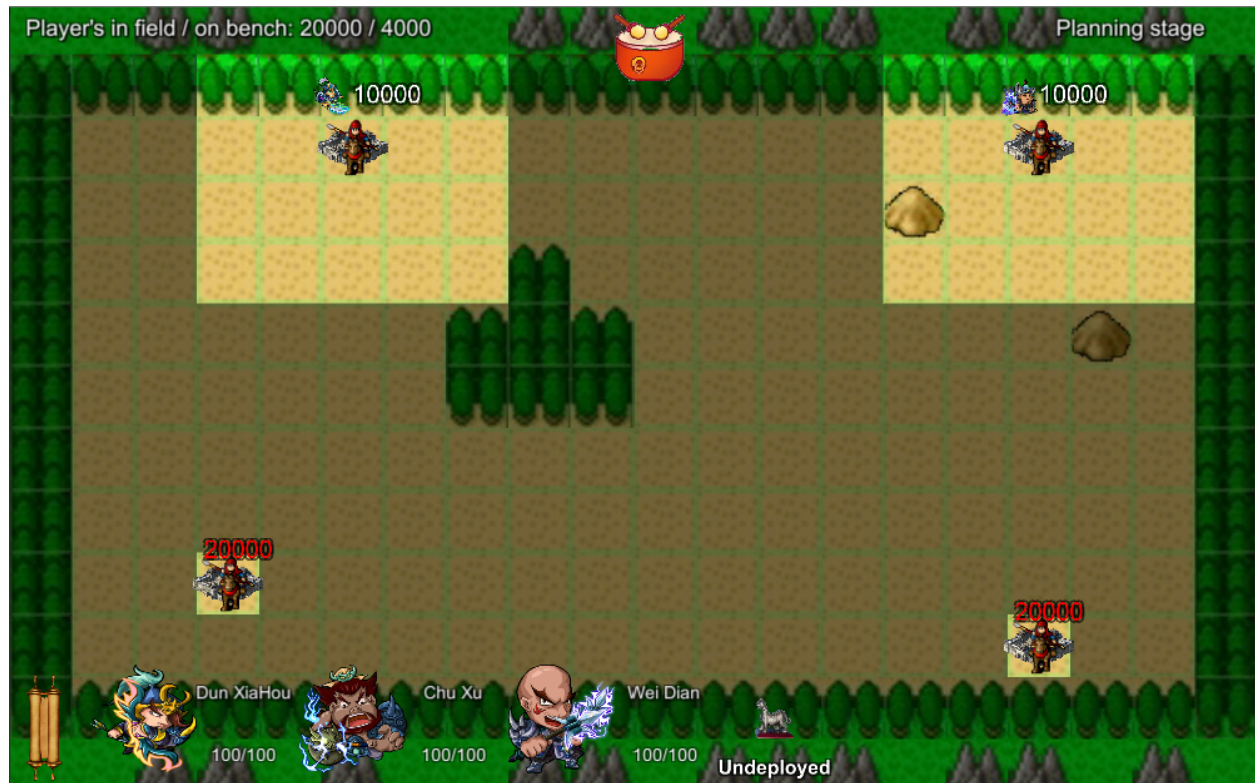


Figure 5: 16:10 screen



#### 9.1.4 On a 3:2 screen

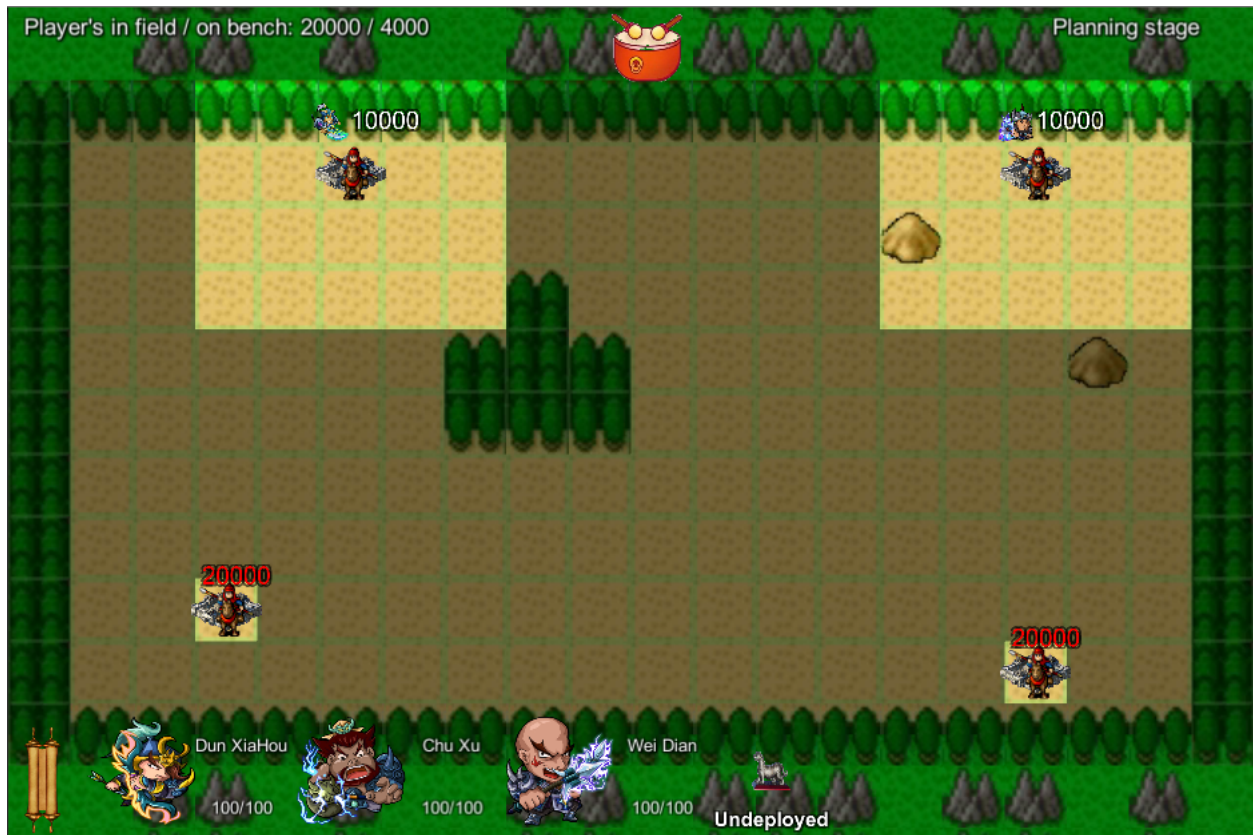


Figure 6: 3:2 screen



### 9.1.5 On a 4:3 screen



Figure 7: 4:3 screen

### 9.1.6 On a portrait screen

Automatic scaling cannot work on a screen that is portrait only or  $W/H < 4 : 3$  because there would be much more margin that can't be handled appropriately. The game is developed for landscape view only. Cases that  $W/H > 2$  are also out of scope because there are too few devices in such shape.

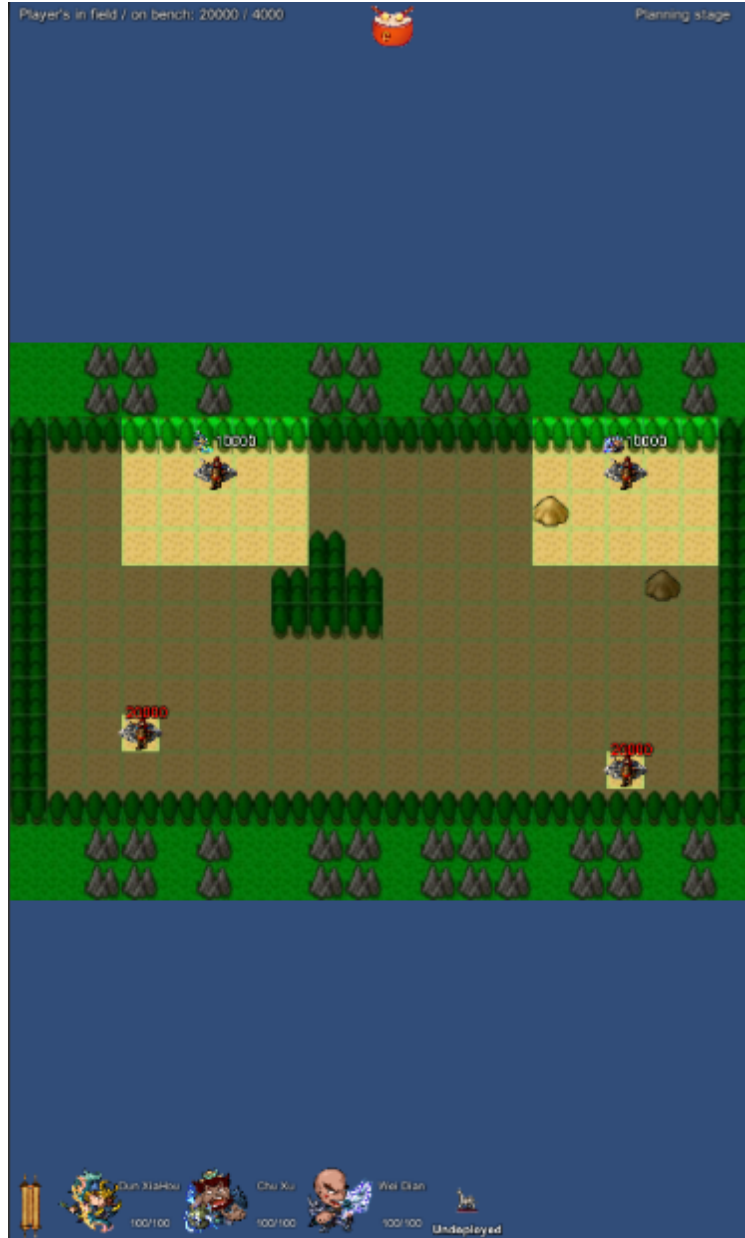


Figure 8: Portrait screen

## 9.2 Consistent experience

### 9.2.1 Conduct the survey

The main purpose of the survey is to elicit feedback about game experience from real players to verify if the methods introduced in this report actually helps keep a consistent player experience for STK. Six volunteers are invited to finish a questionnaire which consists of four questions after playing the game on both PC and Android device. The three required

questions emphasize on one topic that is consistent experience but respectively focus on the difference in controlling difficulty, visual scaling and general game experience. The last question is optional for the attendees to provide other comments. The questions are set as:

- To what extent you feel the game is more difficult in controlling from using mouse to touching screen? With the selections from rate 1 that is "Yes, much more difficult" to rate 5 that is "No, almost the same".
- To what extent you think visual scaling(UI, map, or other visual elements) causes obvious deviation in experience among different devices? With the selections from rate 1 that is "Totally different" to rate 5 that is "No deviation".
- Overall, do you have a consistent experience when play the game on PC and mobile device? With the selections from rate 1 that is "Not at all " to rate 5 that is "They are the same game".
- If you have any other comments, you are most welcome to tell me. (Optional)

The full questionnaire can be accessed through the link [https://docs.google.com/forms/d/e/1FAIpQLSeU0yM0n\\_plU827bjqAC1tvrr7c3rnC82xnaWPa8Am0sZXEMg/viewform?usp=sf\\_link](https://docs.google.com/forms/d/e/1FAIpQLSeU0yM0n_plU827bjqAC1tvrr7c3rnC82xnaWPa8Am0sZXEMg/viewform?usp=sf_link)

### 9.2.2 Analysis of results

Responses from attendees are listed as below column charts.

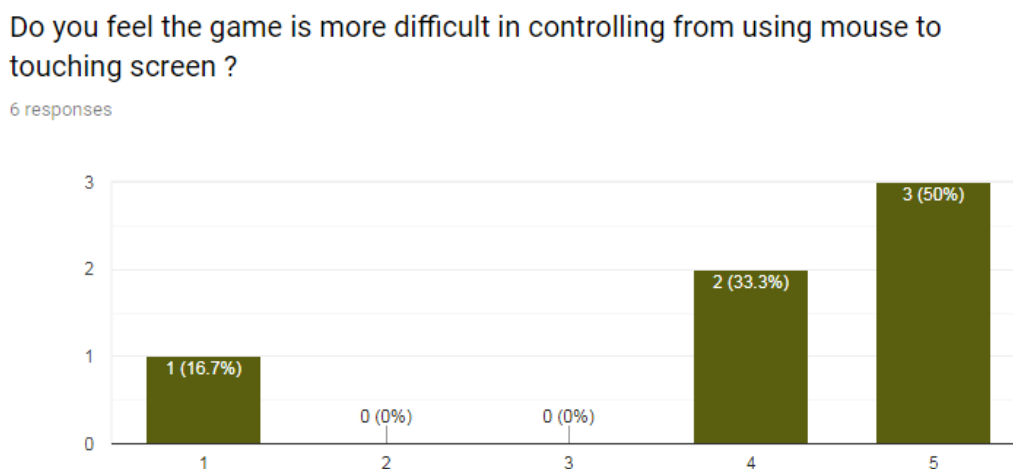



Figure 9: Feedback of question 1

From the result of question one we can see that the majority of attendees felt the controlling difficulty was almost the same on different devices with an average rate of 4.0. The

attendee who gave rate 1 complained about problems in unit and destination selecting when played the game on mobile device. According to the comments, we improve the unit models by adjusting sizes and positions of relevant UI elements to increase the accuracy of unit selection.

Do you think visual scaling(UI, map, or other visual elements) causes obvious deviation in experience among different devices ? 

6 responses

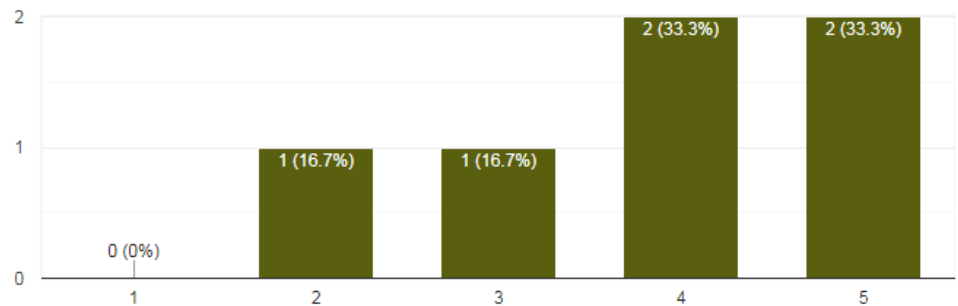


Figure 10: Feedback of question 2

The result of question two has an even distribution with an average rate equaling 3.83. The attendees who gave low rates thought the UI in the phone seemed a bit less evident and the graphic resolution was different. So we adjust sizes of buttons and menus to make it easier to be selected and change some icons with higher resolutions to avoid clearness deviation on different screens.

Overall, do you have a consistent experience when play the game on PC and mobile device?

6 responses

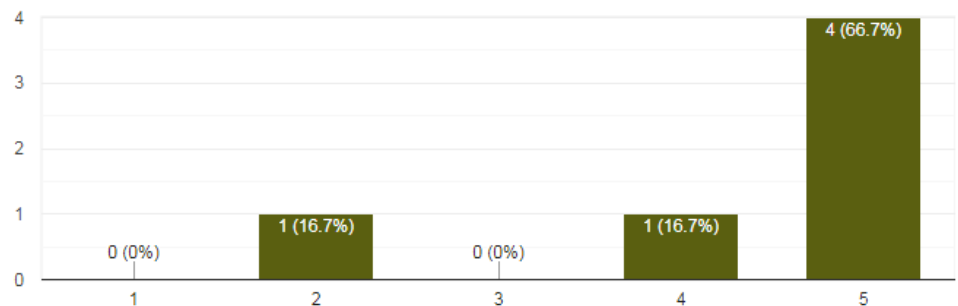


Figure 11: Feedback of question 3

We are glad to see the average rate of the third question is 4.3, which shows most players felt they played the same game on both PC and mobile device. The attendee who gave the lowest rate said he met several controlling issues with the touchscreen. By carefully reading his comments we found it was caused by frequent micro-managements. This issue exposed the tutorial level as well as the action limitation weren't designed very well. Micro-managements is not what we suppose the player to use because STK was not designed as an RTS game. We designed the levels in the game on purpose that can be easily passed by good planning, well organized action orders and pre-battle deployments that don't require any micro-management in battle stage. So after the survey we improve expressions and narrative methods as well as plot settings of the tutorials. We also plan to spend more time in refining the tutorial level in the future work so that it can express our ideas to the player more clearly.

## 10 Conclusion

Whether the game can scale well or not is essential to preserving the user experience across platforms. Our method of adding background and dynamic camera constraints is effective to implement automatic scaling. However, before scaling is possible the UI and mechanics must be designed to complement the new screen size. UI elements should efficiently use the screen space and be clear to prevent any mistaken inputs by the player and not obstruct the game information. Player actions should be simplified to account for differences in input methods (e.g. selecting a unit with a mouse vs. a finger on a touchscreen). In this way, game designers should keep consistency requirements in mind and adjust UI and game mechanics to reduce the influence of platform change to keep the same user experience.

## 11 Reference

All graphics, animations and icons used in this game come from free resource on Internet.

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11. Scroll icon: [http://weili.oopic.com/weili\\_16967275.html](http://weili.oopic.com/weili_16967275.html)
12. Seal icon: [https://tingsa.baidu.com/timg?image&quality=80&size=b9999\\_10000&sec=1541194604&di=135e83780d4b545358ea916fd55d4a39&imgtype=jpg&er=1&src=http%3A%2F%2Fi9.17173.itc.cn%2F2010%2Fweb%2F2010%2F10%2F25%2Fw1025110302s.jpg](https://tingsa.baidu.com/timg?image&quality=80&size=b9999_10000&sec=1541194604&di=135e83780d4b545358ea916fd55d4a39&imgtype=jpg&er=1&src=http%3A%2F%2Fi9.17173.itc.cn%2F2010%2Fweb%2F2010%2F10%2F25%2Fw1025110302s.jpg)

## 12 Appendix

### 12.1 Value and skill settings for officers

- Liao Zhang Martial art: 94; Leading: 99; Skill: All friendly units in range of three benefit a buff that  $coeSkillAtt = coeSkillDef = 0.25$  in six seconds.
- Huang Xu Martial art: 95; Leading: 95; Skill: All friendly units in range of three benefit a buff that  $coeSkillDef = 0.35$  in five seconds.
- Chu Xu Martial art: 97; Leading: 60; Skill: Chu Xu's unit benefits a buff that  $coeSkillAtt = 0.4$  in five seconds.
- Wei Dian Martial art: 97; Leading: 57; Skill: Wei Dian's unit benefits a buff that  $coeSkillAtt = 0.4$  in five seconds.
- Dun Xia Hou Martial art: 91; Leading: 93; Skill: All friendly units in range of three benefit a buff that  $coeSkillAtt = coeSkillDef = 0.20$  in five seconds.

## 12.2 Settings for soldiers

- Archer  $Range = 2, soldierAtt = 10, soldierDef = 5$ .
- Spearman  $Range = 1, soldierAtt = 10, soldierDef = 10$