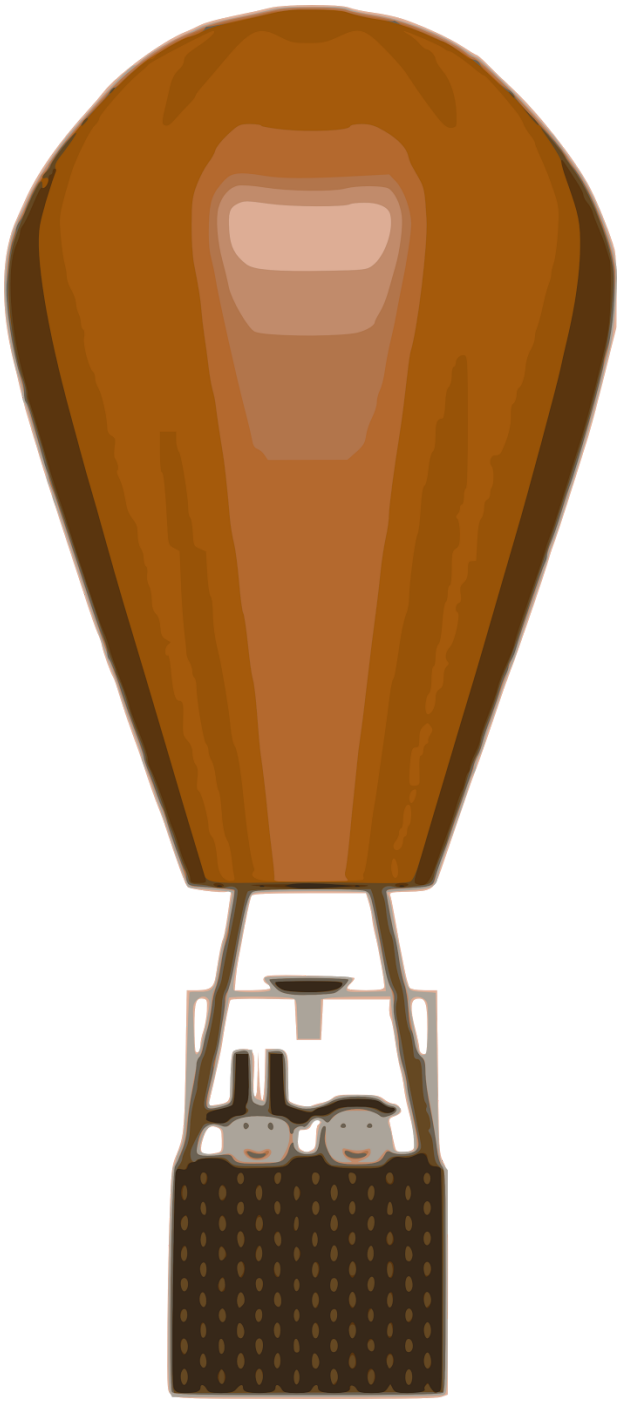

2D Unity game

Game design

Design and playtesting of Hot Air

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30 October 2016

1. Describing the game

Story

You are controlling Jacques and Joseph, two brothers who like to ride in a hot air balloon. One specialises as a pilot and the other is an accomplished gunner. They simply want to stay in the air, but evil birds find hot air balloons a threat and mountains keep passing under them and airplanes over them. On top of all that; their hot air balloon is rather old and has often engine problems. Can you help Jacques and Joseph to stay in the air as long as possible?

Mechanics

Hot Air is a 2D Unity game that can be played by one or two players on one computer. The game begins with a title screen, as can be seen in figure 1. The title screen is made up of five elements: (i) the title of the game 'Hot Air', (ii) the hot air balloon that will be controlled by the player during the game, (iii) the message that the player can choose single player or two player mode by pressing '1' or '2' respectively, (iv) the current best score achieved in the game and (v) a brief overview of the player controls.

Figure 1: The title screen of the game.

The game starts after a player has pressed the number '1' or '2' on the keyboard. There are three elements the player will see when the game starts: (i) the hot air balloon that the player can control, (ii) the current score of the player in the top left corner of the screen and (iii) the number of lives a player has left in the top right corner of the screen. These elements can be seen in figure 2.

Figure 2: The beginning of the game.

Three other elements can enter the game screen during the game. These elements are called obstacles and they are able to damage the hot air balloon. The three obstacles are (i) birds, (ii) mountains and (iii) airplanes, which can be seen in figure 3.

Figure 3: the three obstacles of the game; birds, mountains and airplanes.

Birds fly through the air towards the hot air balloon to defend their territory. When a bird touches the hot air balloon one game life will be lost. A player starts with three lives and goes game over when there are no lives left. When a bird touches the hot air balloon it will not yet be removed from the game and will therefore remain a threat to the player. To prevent a bird from reaching the hot air balloon a player can shoot bullets to hit the bird which will remove it from the game. The player will receive points for removing birds.

Mountains move from the right of the screen to the left and stay at the lower half of the screen. They can vary in height and if the hot air balloon touches a mountain all lives are lost and the player is immediately game over. Airplanes can only be found at the top half of the screen and they move from the left side of the screen to the right. The engine of the airplane can be heard before it appears in the game screen, giving the player the possibility to get out of the way before it is too late, since an airplane has a high speed and a collision with an airplane will also result in an immediate game over.

During the game a warning, see figure 4, can appear on the screen that there seems to be something wrong with the engine. A few moment later the hot air balloon will no longer be able to go up or to the sides, but will slowly drop towards the ground.

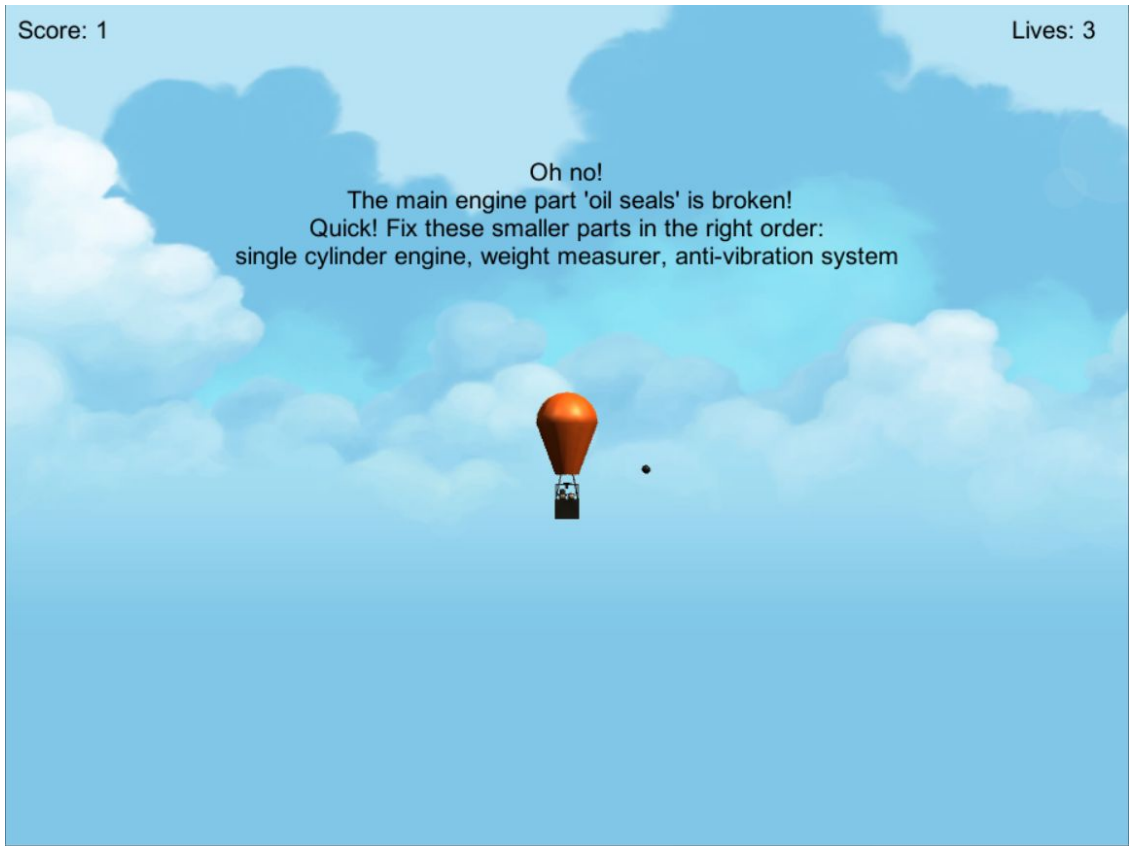


Figure 4: The game during an engine breakdown.

During this time no mountains or airplanes will appear. There will be no birds during single player mode, however, birds will continue to attack the hot air balloon when playing with two players, to keep the game balanced for both player modes. A PDF with an engine parts manual, see appendix A, is provided with the game and players can consult this manual to solve the engine breakdown. The quicker an engine breakdown is solved, the more points players can get. If the problem is solved, the player(s) can continue flying and all obstacles will start appearing again.

There are four possibilities to get a 'game over' which will end the game: (i) if the three game lives are depleted to zero (ii) if the hot air balloon hits a mountain, (iii) if the hot air balloon hits an airplane or (iv) if the hot air balloon reaches the bottom of the screen. A 'game over' screen, see figure 5, will be shown when this happens which contains the words 'deflated' and the options to restart the game or go back to the main screen. The goal of the game is to stay in the air as long as possible and by doing so to set a high score. The challenge lies in breaking the current high score or personal best.

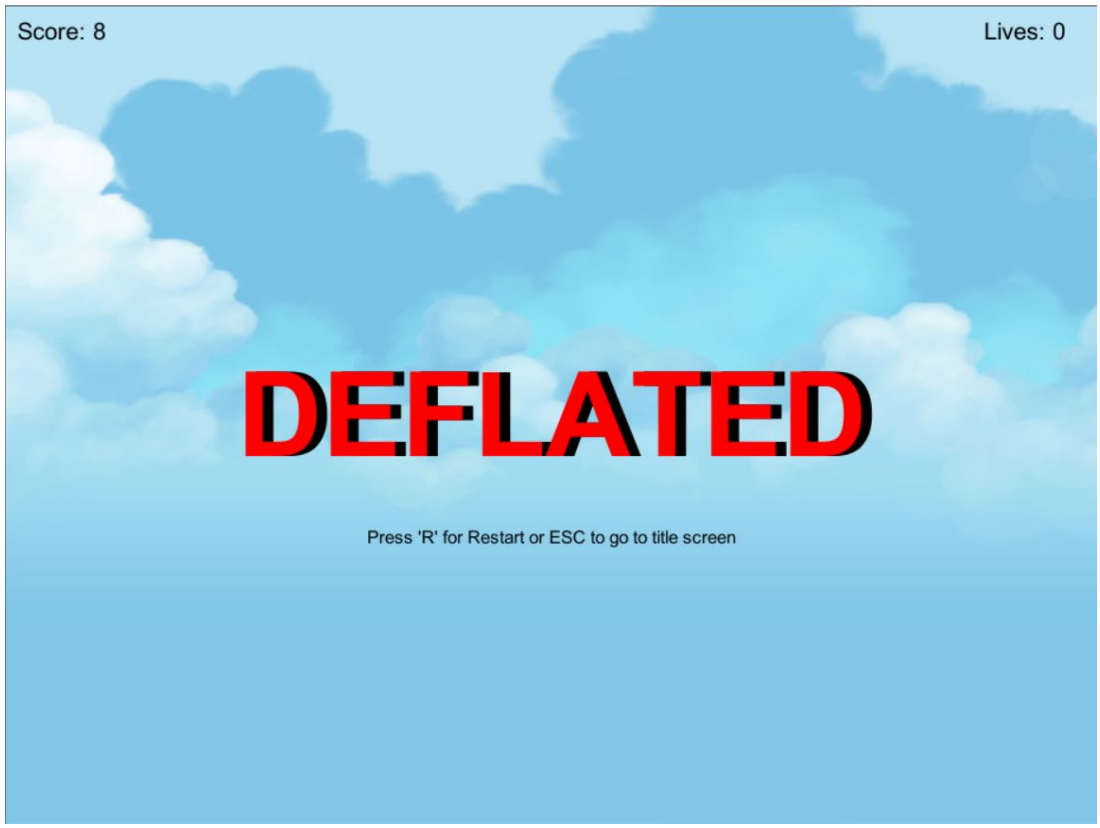


Figure 5: The game over screen.

Inside the hot air balloon there are two persons. One person can be seen as the pilot and the other person as the gunner. When playing with two players it has to be decided who the pilot is and who takes on the role as gunner. The pilot moves the hot air balloon around with the WASD keys to avoid obstacles and the gunner shoots a bullet with a left mouse click to get rid of birds. The shooting angle is restrained in such a way that the gunner cannot shoot through the balloon or the basket. This will require the pilot and the gunner to work together, since the gunner cannot otherwise reach every spot on the screen, stimulating conversation and cooperation in the case of two players.

Aesthetics

The air feels spacious due to the hot air balloon being small. However, the hot air balloon is still the most detailed object of the game, see figure 6, since it needs to be the most important object to the player. The balloon is coloured orange, the complementary colour of blue, to make the balloon pop against the blue background, asking for the player's attention. Music is also important for the atmosphere of the game. The background music during normal gameplay has been chosen for its mix of excitement and enhancing the feeling of spaciousness. The music during the engine breakdown emphasises the time constraint during those moments. Each event in the game , like shooting a bullet, killing a bird, flying against a mountain, etc., is also accompanied by a sound, to immerse players further into the game.

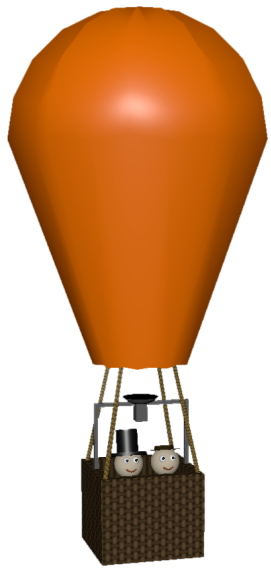


Figure 6: The hot air balloon.

Technology

A 2D computer game made in Unity (v5.4.1f1), a cross-platform game engine, with the possibility for co-op play. Game objects made in Maya (2017 edition), a 3D computer graphics software.

Existing game and hook

This game builds on the idea of a space shooter game, where obstacles are coming towards the player and the player either has to dodge or destroy them. However, due to the change from a rocket to a hot air balloon, the movements of the player object have changed with it. Players are now limited in their dodge capacities and the bird obstacles are able to fly around and come back when they miss the player. This will require a different strategy for steering and the gunner is forced to hit every bird obstacle, upping the difficulty in regards with the space shooter game.

The 'hook' of this game is the engine parts manual in combination with the game. It lets the user not only play the game behind a computer, but there is also the possibility, by printing the manual, to have a part of the game in their hands. Also; the combination of an action-based game and mental challenges in the form of puzzles, can add significant variety to a game. Hopefully this will also trigger the urge to play for different player types, like the achiever (defeating the high score), the explorer (solving puzzles) and the socialiser (playing together towards a common goal).

Balance

The height of the mountains and airplanes and the spawn points of the birds will be random, to ensure that players are playing a different game each time, but this will have no changes on the difficulty level. The difficulty of the game will, however, slowly build up by slightly increasing the number of obstacles after each engine breakdown. By doing this the game will 'search' for the point were the player will no longer be able to beat the game. Players can try to keep this point longer at bay by getting better acquinted with the manual, by mastering the shooting and flying controls and by finding, in case of two players, a better working strategy together. Different strategies could be to let the person who reads the manual also type in the key combination, so the other can keep its focus on the birds. Or to let the pilot read the manual instead of the gunner. Or to circulate the roles to give both players the chance to get a rest from the action part of the game.

2. Discussing the game

Lens #44: the lens of cooperation

We, the developers, like games were you play towards a common goal better than when you compete against each other. Therefore it was decided to create a game were cooperation would be important. The lens of cooperation helped to figure out what shape this cooperation should take.

Settings

The players have enough opportunity to communicate. Since they are required to use the same computer and screen, they will always be within talking range of each other when playing the game. The game will probably be played with people who know each other already, because the game is played on a single computer. The game separates essential roles that require communication between them to ensure success. The game can be played without any communication at all, however, the game should inspire players to communicate with each other, strangers or not.

Synergy and anergy

When players play together they get a separate role in the game on which they can focus. The focus on a single role can create synergy and antergy between the players. When all roles are played correctly the game will be easier, because all persons combine their skills creating synergy. However, when a role is played incorrectly this will also have a negative impact on the other players resulting in antergy.

Necessity of cooperation

During the engine breakdown birds will keep coming at the hot air balloon. Someone has to keep shooting to prevent the birds from reaching the hot air balloon and the birds keep attacking at a steady pace, making it impossible to take break from shooting. However, someone also has to be busy with figuring out how to fix the engine. If one of these two tasks then a game over will follow. It is therefore not possible to get past an engine breakdown as a single player in two player mode.

Lens #34: the lens of skill

The lens of skill was used after the idea had surfaced to combine all three different skills, namely: (i) physical skills, (ii) mental skills and (iii) social skills. This lens gave us to possibility to explore the balance between these skills to determine the player's experience of the game.

Dominant skills

There are two skills needed for single player mode: (i) the physical skill and (ii) the mental skill. However, for two player mode the social skill is also necessary. The social skill can then even be seen as the dominant skill, sinc teamwork is required to stay alive together. Since the players have separate tasks, physical and mental, to keep the player character alive together, the player character cannot survive when one task is not done properly. Thus, the social skill should be excessively used when playing with multiple players to even stand a chance of getting through the first minute of the game.

Skills and experience

The concept was to create an arcade-like experience combined with mental challenges which can be done by one or (at least) two players and in the case of two players requiring them to communicate with each other. When looking at the playtests these skills created the experience that were wanted.

Balance and skill improvement

Players can differ in skill level by having knowledge of the workings of the manual and by training their shooting and manouvre abilities. New players will not have this advantage, which will result in a lower highscore than experienced player, but practice and experience will bring them eventually to a similar level.

The possibility of players having large differences in their high scores seems unlikely, but playtesting has to answer that more accurately.

Lens #38: the lens of challenge

The lens of challenge was used after the first playtest when the game was deemed too hard. New parameter combinations were thought up and held against this lens for further inspection, hopefully leading to a better resulting playtest.

Identifying challenges

The idea was to create two main challenges in the game, with an additional challenge when playing with two players. The first main challenge lies in controlling the player character in such a way that it stays alive. This is done by moving the player character around and shooting enemies. The second main challenge lies in solving a puzzle which is tied to a time limit. The additional challenge is communication between players. When doing a task together, good communication between players can provide quite a challenge.

Increasing the challenges

An increased challenge should not come unexpected. Since this game is played in the same level continuously we needed an event which separates the different levels of difficulty. The puzzle challenge makes a nice bridge between difficulties in our setting. Increasing the difficulty of the game is done by increasing the amount of enemies the player character has to face or evade. Additionally the player will face a wider variety of enemies as the game progresses. The puzzles will become harder as well. The challenge of communication can, in our case, not be altered by the game.

Variety

Repeating the same challenge over and over again will make it boring. By creating variety in the challenges, they remain fun to do. When progressing through the game a greater variety of enemies will be encountered, thus creating variety in the physical challenge. The mental challenge will take the same approach with different ways to solve the puzzles provided by the game, although the amount of ways to solve puzzles will remain constant. Unfortunately due to time limitations, only one additional enemy (the airplane) will spawn and there will be limited ways to solve puzzles when progressing through the game. Therefore it would be a nice improvement to extend the variety of physical and mental challenges.

Maximum challenge

There is no maximum level of challenge that the player can face (except for human limitations, disregarding hardware limitations). With the arcade-style gameplay in mind we thought that there should be no limit on the difficulty. The score should represent the skill of the player. The opposite of this are games were a player is able to master the maximum difficulty of a game. This would enable the player to continue the game without reaching a game over. As long as the player keeps playing, their high score would increase. However, this high scrore would at this point represent more the endurance of the gamer than their actual skill level. With a continuously increasing difficulty the score will represent the current skill of the player better.

Balance of the challenge

After playtesting this lens was revisited to estimate the balance of the game better. Playtesting made clear that initially the physical challenge (controlling the player character and shooting enemies) was too hard, frustrating most players by constant failure. These were tuned down and appeared pleasant at later playtests. The mental challenge (solving the puzzle) seemed to be too hard when initially playing the game. However, when players got grasp of the manual, the challenge was just right. The time given for the challenge was good initially, but became too long after getting to know the manual better (and therefore become too easy). This might be solved by adding a more difficult mode with a shorter time frame.

3. Evaluating the game

The game started as a simple idea of a hot air balloon that should navigate past mountains while keeping birds at bay by shooting at them. Playtesting was needed to discover if this concept would work as a game. However, since the first playtest(s) would only limit the tests to the mechanics and not the aesthetics of the game, the first playable version of the game was designed with the usage of basic shapes only, as can be seen in figure 7. The hot air balloon was represented by a capsule, the birds by blocks, the mountains by triangles and the bullets by circles. This version of the game was played during the first playtest.

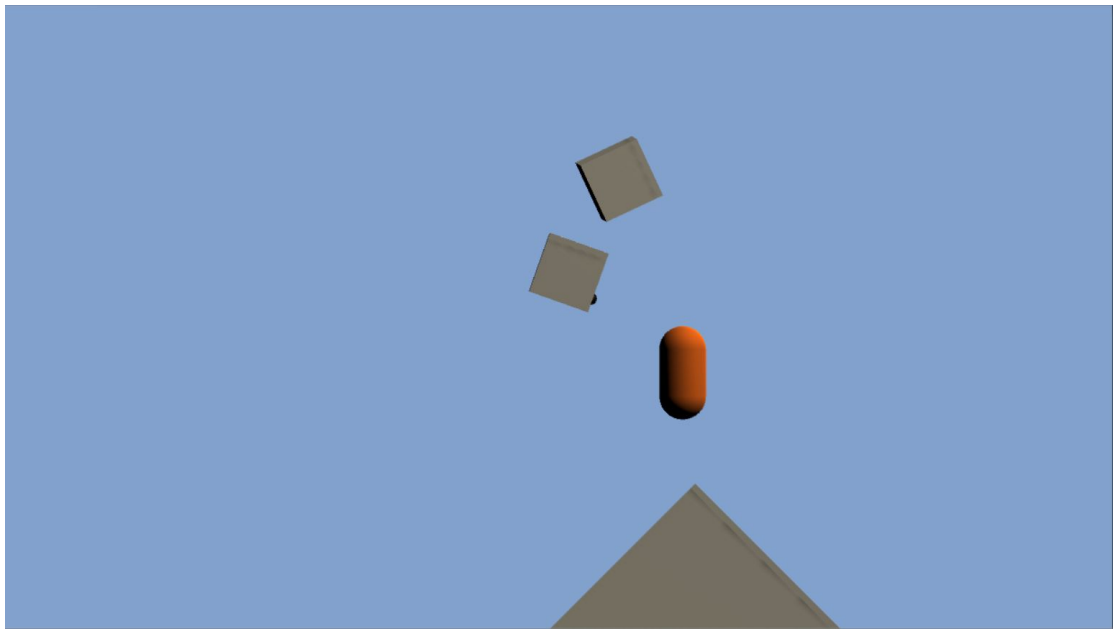


Figure 7: The game with basic shapes.

First playtest

The first playtest was used to try out the core gameplay of the game and had five defined goals: (i) to see if testers would enjoy the game, (ii) to look at the balance and difficulty of the game, (iii) to discover if playing with two people together would add to the experience, (iv) to ask if the game mechanics were understandable and (v) to inform after discovered problems and possible improvements. The first playtest was done by four testers. All testers received an explanation of what the different shapes represented and of the game mechanics. They played the game twice for roughly three minutes; once alone and once together with another tester which resulted in a total of six sessions. After each session a short interview was held.

The remark heard from all four testers was that the bird waves were too long and that the intervals between these waves were deemed too short. This made the game rather difficult which resulted in testers dying often and quick, diminishing the enjoyment of the game. However, they still assured that they saw potential in the game concept if these parameters would be adjusted.

After the session with two players, testers were asked to compare that experience with their single player session. It was observed by a tester that the overall time before going game over was longer when playing together in comparison with playing alone. The tester supposed this resulted from being able to better concentrate when there was only one task to focus on (steering or shooting) instead of having to do two tasks at the same time. Another tester emphasised that it was nice to play with someone else since you cannot predict what the other is going to do, which can lead to fun moments.

Second playtest

The second playtest was done by two groups of two persons and those four persons also playtested the game alone. Four aspects of the game were tested during the second playtest: (i) number of obstacles, (ii) speed of the obstacles, (iii) opinion on the realism of the movement of the hot air balloon, (iv) length of intervals between waves and (v) frequency of engine breakdowns. There were five different game versions to test, each with different parameters. At the end of the playtesting it was clear what the different parameters should be for the next playtesting session. In addition, it was named by three testers that they missed an extra obstacle. One tester came with the suggestion to add airplanes with warning signs.

Third playtest

The third playtest was done with new parameters based on the results of the second playtest and airplane obstacles were added that would make themselves known by way of sound. Version one of the engine parts manual, see appendix B, was also included for playtesting. This playtest can be divided into two parts: (i) a first part with three groups of two people and one person alone playing and (ii) a second part with close to fourty people playing both alone and together. During the first part we were able to get feedback by watching the testers play and by interviewing testers. Feedback of the second part was received in the form of written text. In total thirteen written comments were received.

During the first part of the playtest a printed engine parts manual was handed out to each group. It would still take some time before the actual game could be played, but it was observed that the given booklet roused the curiosity of testers regarding the game. Testers were also going through the manual beforehand, giving them something to do before the game had even started. At the start of the game it was observed that people had trouble with discovering that the mouse could be used for shooting bullets. We therefore had to tell a few testers that they could use the mouse for shooting. Since this game should be playable and clear on its own it was decided to add for the next playtest a control menu at the bottom of the title screen.

The manual concept was named a nice and creative addition by testers, however, the complaint made most often was that it was too difficult to go through. Three steps had to be taken in the manual to find the right combination of keys for fixing the engine breakdown and to continue with the game. It was suggested by testers to shorten these steps or to make the puzzles in the manual easier. However, they did stress that they would like to keep the manual in the game, since it provided variation to the gameplay. Testers also noted that they liked that both roles accommodated different player styles. They could choose to focus more on the action part of the game by dodging and shooting or to focus on the puzzle part of the game.

The feedback of the second part of the playtesting was made up of varied responses. Regarding the game itself it was liked for its many features, it was found to be original and interactive and the gameplay was found fun and unique. It was also noted that it was refreshing to play together instead of against each other. Regarding the manual a tester noted that there is a great learning curve and that there is a possibility that this would frustrate players. There indeed were other feedback responses that noted the difficulty of the manual, with some testers suggesting to remove the manual altogether and to replace it with a small arcade game or quick time events. However, other testers suggested to give a small introduction for the manual while not changing the manual too much, since they were of the opinion that figuring out the manual was a core element of the game.

Fourth playtest

After the third playtest it was made clear that the manual had to be replaced by something else or the manual had to be made easier to navigate through. It was decided to start with making the manual more comprehensible and to playtest again with the new manual. This new manual can be seen in appendix A. When an engine breakdown now occurred, the tester would look up in part I of the manual if they had to go to part II, part III or part IV. These parts used to be respectively part IIA, part IIB and part III in the previous manual, see appendix B. In the old manual one still had to go to part III after solving part II to link the engine small part

terms to the right keys. In the new manual this link is already made on each page. This means that a player is able to decipher the right order and the right keys on the same page, leading hopefully to a quicker run through the manual without the manual becoming too easy. In addition, part IIA of the old manual (in the new manual called part II) has been reduced to one page instead of two and more elaborate explanations of the puzzles are given in the manual. Also more time during the engine breakdown is given to the player to solve the puzzles.

The game, now with added control instruction at the title screen, the new manual and the time prolongation to solve the manual, was playtested by three groups of two people and by two people playing alone. Each playtesting session lasted a quarter of an hour to see the difference between how the game was played when the manual was still new and when the manual was figured out.

Testers explained that the manual took a few moments to figure the puzzles out, but that they were solved before frustration kicked in and that once known they could be done more easily. However, because the skill of the manual reader increased, the time limit became less and less of a problem. Therefore, it was suggested by testers to give players the choice to choose between a beginner (the current game) and expert mode (with less time during the engine breakdowns) at the beginning of the game, to ensure that players who know the manual would still feel the pressure while solving the problem. It was also nice to see during informal observations that testers had fun with the game, but most importantly, had fun together. They kept talking to each other during the game and different combinations of roles were experimented with by testers to find out what worked for them. Testers confirmed afterwards that they had fun while playing the game and mentioned that they would like to play, a possibly more advanced, Hot Air again in the future.

Appendix A

The second version of the engine parts manual.

Engine Parts Manual

by Joseph & Jacques

Part I

[Is there something wrong with a *main* engine part? Find the name of that *main* engine part below and follow the path!]

Listen mate, things can go wrong when flying an air balloon! Especially when there is something wrong with your cylinder heads! Or even worse; with your piston liners! This would be even more dreadful if your air boxes would also decide to stop working. When that happens you´ll simply wish you had stayed in bed, so you could have dreamed peacefully about varlometers and sump pans, instead of actually trying to fix them. Of course these are not as hard to fix as distributor caps or ignition leads, but you get the point

You should also be aware to buy enough spark plugs before flying off to who-knows-where. Also; do not forget to buy a compass, or you´ll never get to who-knows-where. And when you are still in the store, please keep a lookout for some cheap boost pressure sensors, since you never know when you might need those.

Go to part II

There are a few parts that require lots of cleaning while flying with your balloon. For starters, there will be the piston engine valves who think it is their job to get dirty. They are wrong, but it is sadly your job to keep them clean. Next there is the intercooler to take care of, although it is a bit tricky to get to it. There will be a panel somewhere that you´ll have to remove, and you´ll then see it behind the turbocharger gaskets. Following that it might be time to check the pollen filters, since they will need a replacement when they are full.

Now, when you´re flying only to the right while you are steering to the left, it might be that your oil seals have burned away or that there is a really strong wind going towards the right. That, or your flywheel is broken. That is generally the point where you should start worrying. You could use the diagnostic system to detect the exact location of your problem, or you could connect the connecting rod to the battery. But never do this while your pyrometer is busy.

Go to part III

Now, listen very carefully, I shall say this only once: never use your booster more than once each day. If you do not listen to this advice, then the catalytic converter will heat up and then you can say bye-bye to your favorite radio channel. Also, when things heat up it will cause the exhaust sytem to hyperventilate which will likely confuse the oxygen sensor. And there is a good chance the emergency exit will open up, AKA the bottom of the basket, when things are confused. Which is why you always want to wear your parachute.

On a final note; if your altimeter gives weird readings that you do not understand then there can be multiple reasons for this weird behaviour. There is (i) something very wrong with the propane burner, (ii) your parachute valve cord just snapped or (iii) you are drunk. If (iii) is the case, I would suggest to give this manual to your fellow-air balloontist, before you make matters worse. Well, I will leave you to it then. Good luck!

Go to part VI

Ps: did you know you drop slower when pressing the sequence of w-d-s-a over and over again? Strange, but true.

Part II

[Find the three smaller parts you have to fix below and decide their order.
Then push the corresponding keys. Hint: The Roman numbers come first.]

ii

8 B C 6 9 7

forged crankshaft. mechanical governor. fuel filter. anti-vibration system. weight measurer. starting system

v

X T V Y U Z Q

fuel injection system, side valve, overhead valve, transportguard, cast iron camshaft, float feed carburetor, kool bore

五 二 四 六 三 七 一

vi

L K O P N M

gross torque, v-twin cylinder engine, ignition system, high oil fill tube, compression release, super lo-tone muffler

1 4 5 3 6 2

i

5 1 0 3 4 2

splash lubrication, oil bath air cleaner, debris management system, single cylinder engine, cartridge air cleaner, direct overhead valve

iii

E F H I J G

fuel tank cap, pressure lubrication, dura-bore, dual ball bearings, lo-tone muffler, foam air cleaner

1st = — 4

2nd = 1 二

3rd = 三 2

4th = 6 四

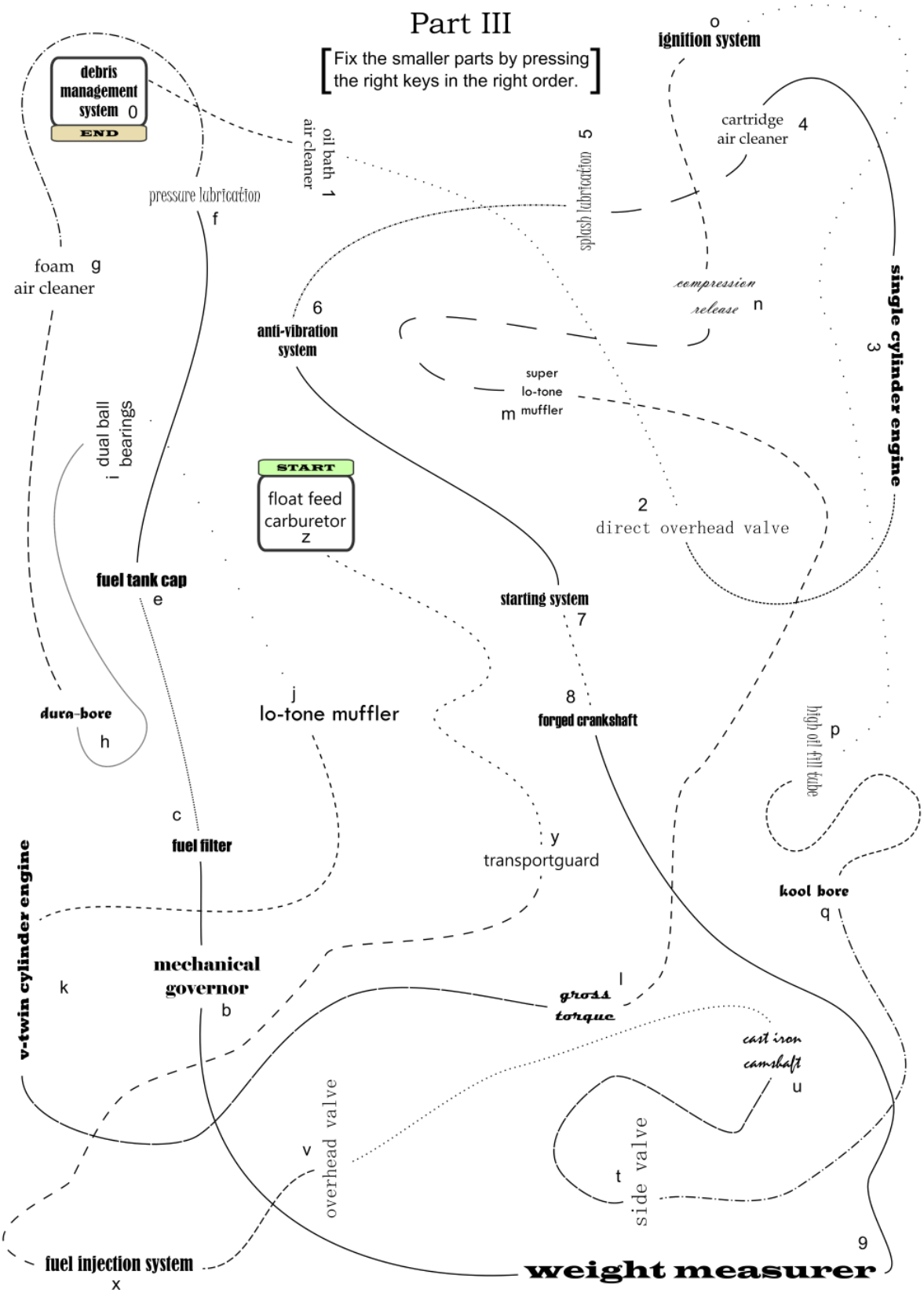
5th = 五 5

6th = 3 六

7th = 七

Part III

[Fix the smaller parts by pressing the right keys in the right order.]



Part IV

[The smaller parts of the broken main engine part can be fixed by pressing the right keys on your keyboard.
The mapping of the keys and smaller parts can be found here. Parts need to be fixed in order of appearance.]

anti-vibration system	6
cartridge air cleaner	4
cast iron camshaft	U
compression release	N
debris managment system	0
direct overhead valve	2
dual ball bearings	I
dura-bore	H
float feed carburetor	Z
foam air cleaner	G
forged crankshaft	8
fuel filter	C
fuel injection system	X
fuel tank cap	E
gross torque	L
high oil fill tube	P
ignition system	O
kool bore	Q
lo-tone muffler	J
mechanical governor	B
oil bath air cleaner	1
overhead valve	V
pressure lubrication	F
side valve	T
single cylinder engine	3
splash lubrication	5
starting system	7
super lo-tone muffler	M
transportguard	Y
v-twin cylinder engine	K
weight measurer	9

Appendix B

The first version of the engine parts manual.

Engine Parts Manual

by Joseph & Jacques

Part I

[Is there something wrong with a certain engine part? Find the name of that engine part below and follow the path!]

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You should also be aware to buy enough spark plugs before flying off to who-knows-where. Also; do not forget to buy a compass, or you´ll never get to who-knows-where. And when you are still in the store, please keep a lookout for some cheap boost pressure sensors, since you never know when you might need those.

Go to part IIA

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Go to part IIB

Now, listen very carefully, I shall say this only once: never use your booster more than once each day. If you do not listen to this advice, then the catalytic converter will heat up and then you can say bye-bye to your favorite radio channel. Also, when things heat up it will cause the exhaust sytem to hyperventilate which will likely confuse the oxygen sensor. And there is a good chance the emergency exit will open up, AKA the bottom of the basket, when things are confused. Which is why you always want to wear your parachute.

On a final note; if your altimeter gives weird readings that you do not understand then there can be multiple reasons for this weird behaviour. There is (i) something very wrong with the propane burner, (ii) your parachute valve cord just snapped or (iii) you are drunk. If (iii) is the case, I would suggest to give this manual to your fellow-air balloontist, before you make matters worse. Well, I will leave you to it then. Good luck!

Go straight to part III

Ps: did you know you drop slower when pressing the sequence of w-d-s-a over and over again? Strange, but true.

Part IIA

[Find the engine parts you have to fix in the five clustered word chunks below and determine their order. Do you have multiple engine parts in one cluster? Check that order on the next page.]

1 2 3 4 5

splash lubrication~oil bath air cleaner~debris management system

single cylinder engine~cartridge air cleaner~direct overhead valve

forged crankshaft~mechanical governor~fuel filter

anti-vibration system~weight measurer~starting system

fuel tank cap~pressure lubrication~dura-bore

dual ball bearings~lo-tone muffler~foam air cleaner

gross torque~v-twin cylinder engine~ignition system

high oil fill tube~compression release~super lo-tone muffler

fuel injection system~side valve~overhead valve~transportguard

cast iron camshaft~float feed carburetor~kool bore

continued ->

splash lubrication, oil bath air cleaner, debris management system, single cylinder engine, cartridge air cleaner, direct overhead valve

forged crankshaft, mechanical governor, fuel filter, anti-vibration system, weight measurer, starting system

fuel tank cap, pressure lubrication, dura-bore, dual ball bearings, lo-tone muffler, foam air cleaner

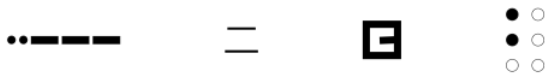
gross torque, v-twin cylinder engine, ignition system, high oil fill tube, compression release, super lo-tone muffler

1 4 5 3 6 2

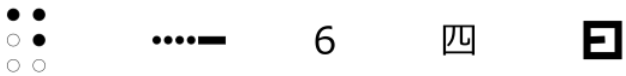
fuel injection system, side valve, overhead valve, transportguard, cast iron camshaft, float feed carburetor, kool bore

五 二 四 六 三 七 一

1st = 一 4

2nd = 1 

3rd = 三 2

4th = 

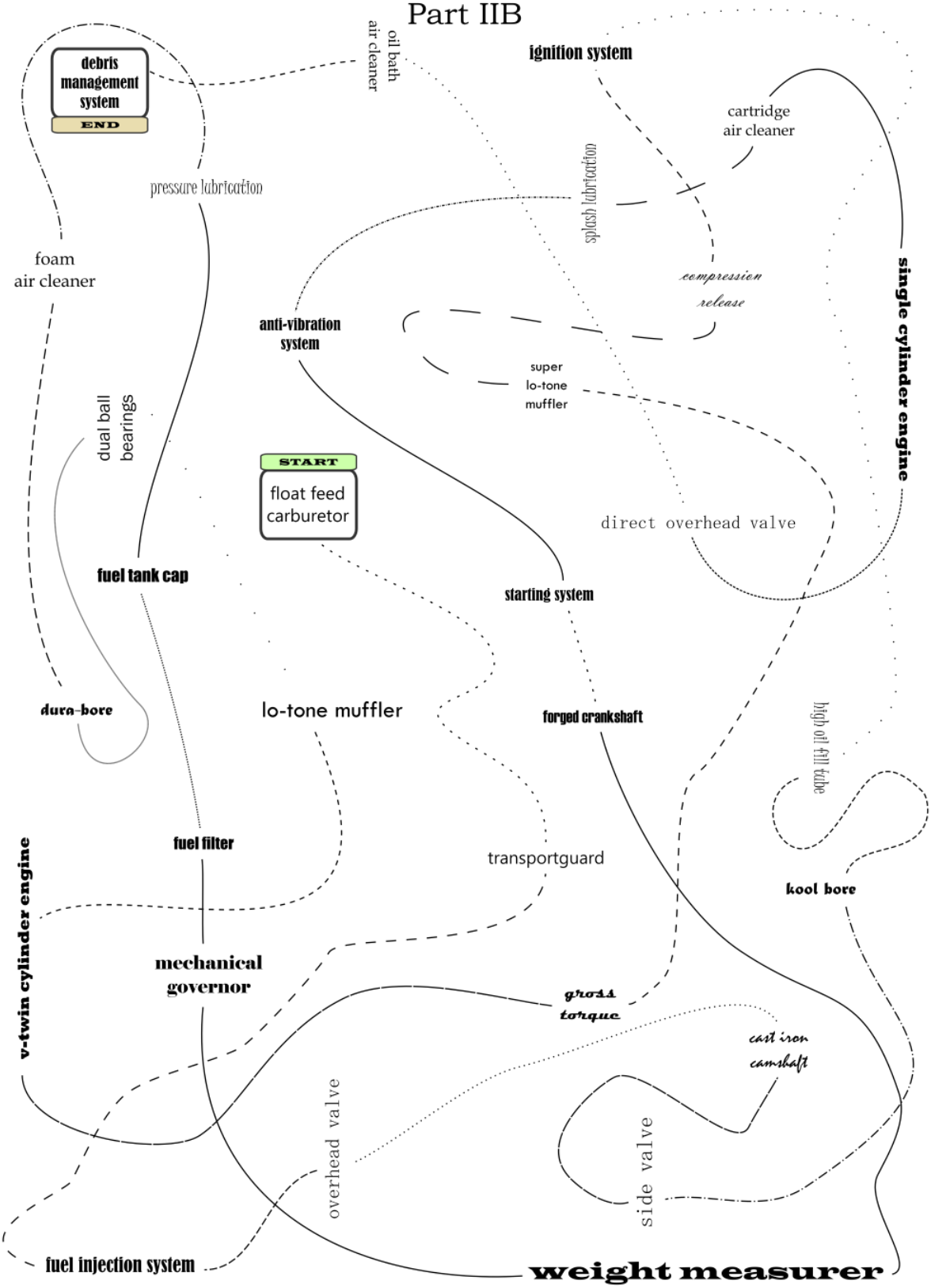
5th =

6th = 3

7th = 七

continue to part III ->

Part IIB



continue to part III ->

Part III

[Parts can be fixed by pressing the right key on your keyboard.]

anti-vibration system	6
cartridge air cleaner	4
cast iron camshaft	U
compression release	N
debris managment system	0
direct overhead valve	2
dual ball bearings	I
dura-bore	H
float feed carburetor	Z
foam air cleaner	G
forged crankshaft	8
fuel filter	C
fuel injection system	X
fuel tank cap	E
gross torque	L
high oil fill tube	P
ignition system	O
kool bore	Q
lo-tone muffler	J
mechanical governor	B
oil bath air cleaner	1
overhead valve	V
pressure lubrication	F
side valve	T
single cylinder engine	3
splash lubrication	5
starting system	7
super lo-tone muffler	M
transportguard	Y
v-twin cylinder engine	K
weight measurer	9