Game concept

seminar Design and Implementation of Business Games – winter semeseter 2017/18

This Game Design Document describes a general overview and structure of the video game which is developed by students of the Technical University Munich in collaboration with the Online Experimentation Research Group at the Faculty of Engineering of the University of Porto. The project aims to create a game to aid in the rehabilitation of medical patients with disabilities in their hands incorporating the SHaRe device created by the Online Experimentation Research Group.

Keywords—game development; video games; therapy; medicine; rehabilitation;

I. THE SHARE DEVICE

SHaRe, or the System for Hand Rehabilitation in Dexterous Manipulation of Daily Objects, was developed in order to help individuals regain hand dexterity. It is capable of displaying the force applied to a device as deformation of a virtual model, providing visual feedback of the applied force. Furthermore, it is also capable of applying the device's orientation to the virtual model.[1]

Fig. 1. The SHaRe device, Online Experiments

II. GENRE

The game developed can be categorized as a "serious game" as its primary usage will be to aid medical therapy, not solely entertainment. It will focus on mastering interaction with the SHaRe device and thus can also be categorized as a "skill based game".

III. THEME AND SETTING

The player will be put into the role of a coffee shop owner in an urban environment, as the shape of the SHaRe device visually resembles a cup and thus makes for a more diegetic gameplay. It will be a simulator of daily tasks as well as finance and management as not only will be player be able to create their own beverages (which includes mundane activities such as gripping objects, moving them around and applying appropriate force onto them) but also to manage their salary and buy enhancements as needed and/or desired.

This game, however, will focus more on the completion of these mundane tasks, rather than the financial aspect as it serves more as a feedback to the user. The game's function as an aid to medical therapy will be the game's primary focus.

IV. TARGETED PLATFORMS

The game will be available for the PC and used as an aid to a medical rehabilitation therapy carried out by medical professionals.

V. STORY

The player starts out as the owner of a cafe. He or she will have to learn the basics of beverage-making and earn a specific sum of in-game credits each working day. A working day typically consists of customers visiting the cafe and ordering a beverage from the menu. The player than has to create the beverage via manipulations of the SHaRe device - further explained in the section "Core Gameplay Mechanics" - and gets a fixed sum of credits after completion of said beverage and bonuses for accuracy of motion/force applied and time of completion. After a workday is done the player will receive their payment and will be able to buy upgrades and tools if sufficient account balance is available.

VI. INFLUENCES

Our game will be set in a coffee shop in a European urban area. The player will take the role of the coffee shop owner, the barista. The player takes orders from customers and prepares different beverages. In this setting it is possible incorporate a lot of different hand movements and gestures in a closed and coherent player experience. We want to emphasize on hand movements as they are encountered by patients in their everyday life.

A. Cooking Mama, video game, 505 Games, Nintendo DS, Nintendo Wii, iOS

In Cooking Mama, the player is tasked with performing a series of simple tasks that include movements and gestures in order to complete a meal and is rated based on the precision and timing of the movements.

Fig. 2. Cooking Mama, Nintendo

[1] © https://remotelab.fe.up.pt/instrumented_devices/share.php

B. *Papa's Freezeria, video game, Flipline Studios, web browsers, Android, iOS*

In this game the player takes the role of an owner of an ice cream shop. The player takes order from customers, picks ingredients based on the order and prepares the ice cream at different stations. The player is rated by customers based on speed and accuracy. With earned tips the player can buy decorations for the shop and for the avatar as well as upgrades for equipment.

Fig. 3. Papa's Freezeria, Flipline Studios

VII. GAMEPLAY

The game will be separable into these broad features:

- Taking orders from incoming customers with clear audio-visual cues.
- Preparing beverages by completing a series of clearly indicated hand movement with the SHaRe device.
- Reward System: players will be rewarded for accuracy and speed when preparing beverages with in-game currency.
- Penalty System: very mildly implemented. Less accuracy and decreased speed result in less in-game pay. Clear focus is giving the player feedback and not to discourage them from playing.
- Progress tracking, possibly new levels and new customers, new locations for one's coffee shop and new recipes.
- Unlockable features such as cosmetic accessories and new tools and mechanics.

VIII. CORE GAMEPLAY MECHANICS

A. *Receiving an order*

Customers enter the shop and order a beverage. Unambiguous visual and auditory cues are given for how to complete each order. The player will be able to review said order at any given time after the customer it has been posted. The orders themselves will be known recipes from a reviewable, pre-presented list. A 'special order' (i.e. an order that is not on the menu list) is possible in advanced levels.

B. *Creating a beverage*

After an order has been released, the player will be able to create the beverage. A regular beverage involves the following steps:

1. Choose a cup
2. Mix the beverage
3. Apply toppings

For each of those stages various steps have to be made to complete them, they are realized via movements and appliance of force to the SHaRe device which will translate to in-game actions

- Pouring: The simplest as well as the most diegetic motion will be Pouring which will be accomplished as changing the orientation of the upright SHaRe device and recline it into a horizontal position, as if pouring a beverage or powder into another container.
- Cutting: For some recipes it will be necessarily to grip a knife and cut the ingredients into smaller pieces (i.e. cutting fruits to decorate the cup. The player will have to squeeze the cup, hold it in a diagonal position and commence vertical up-and-down motions as if wielding a knife.
- Squeezing: On occasion, ingredients such as fruit juices will be needed and the player will get the option to apply a lot of force to the SHaRE device to squeeze the fruit while maintaining a certain orientation to not spill the freshly pressed juice. Analogous operations will be needed for squeezing bottles.
- Shaking: Some beverages will need to be shaken and as such the player has to provide the corresponding fast paced side-to-side motion with a certain amount of force for a certain period of time.
- Pressing: The pressing motion - appliance of force over a short period of time - will be mainly used for pressing buttons, closing lids, etc.
- General movement: General movement (up-down, left-right, forward-backwards) will be an important part of completing a beverage, as well. The unfinished beverage may need to be moved to a different tool, held under some in-game device or presented to the customer, all the while making sure that the ingredients inside of the cup do not spill.

C. *Serving and customer rating*

After a beverage has been completed, the player will present it to the customer. The player will receive a fixed sum of in-game currency for completion and additional tip for accuracy and speed, thus serving as a feedback for the user. Additional feedback will be saved as medical data for later review by medical professionals and made available in desired format through either the game directly or its file system.

IX. Additional gameplay mechanics

A. Upgrading the equipment

The earned currency may be redeemed in an in-game shop in which additional content can be purchased. This content ranges from cosmetic accessories, which serve no function other than decoration, to new tools which unlock new recipes and mechanics to handy devices to make the gameplay easier such as an automated blender etc.
The prices of the various items will be according to the player's level. Fancier looking cosmetics will be more expensive but, more importantly, the various tools, especially those that introduce new movements and thus potentially make the overall gameplay harder, will be much more expensive and only unlockable if the player has the skillset to earn a specific sum of money. The same goes for automated machines (i.e. blender) which are only unlockable if the player does not 'need' the functionality anymore.

B. Decorating

There will be a separate mode to apply the cosmetics bought in the shop on the player's workspace. The purchased decorations can be moved and rotated, in case of stickers duplicated and glued to a surface.

X. Game progress

The game should take into consideration the different conditions medical patients are in. A short tutorial will explain the concepts and the rules of the game. During early stages, only the simplest movements have to be completed. Based on medical records, the movements necessary to complete each step will be adjusted. Factors like the applied force or the time a certain force needs to be applied to the device can be changed.
The function to include upgradeable features, enables the player to continually increase the challenge. Motivated by the fact, that the player has earned the in-game currency increases the psychological benefit of the game. Upgrades and new recipes will change the parameters of the movements, introducing more complex and demanding movements in later stages of the game. The force to apply and the durations of the movements will be increased. Timing thresholds for movements will be introduced, urging the player to react quicker.

XI. Data tracking

To ensure the medical benefit of the game, user specific data will be tracked during gameplay. This data will then be stored in a database. Reporting systems for medical personal will be able to analyze the data and create reports with important progression indicators. These include user specific data and a representation of the user's medical profile for the game. Furthermore session data like game duration and start and end time will be tracked for analyzing the player habits. For a detailed overview over the database layout, refer to the data scheme following the game concept.

XII. Project scope

The following includes important gameplay functions sorted by priority for the intended project.

A. Must haves

- Receiving an order from a customer
- Recognition of movements such as shaking, cutting, pouring, etc.
- Tracking and saving of progression data as well and medical relevant data

B. Should haves

- Feedback and rating from customer
- Equipment upgrades
- Difficulty levels
- High score value for motivation

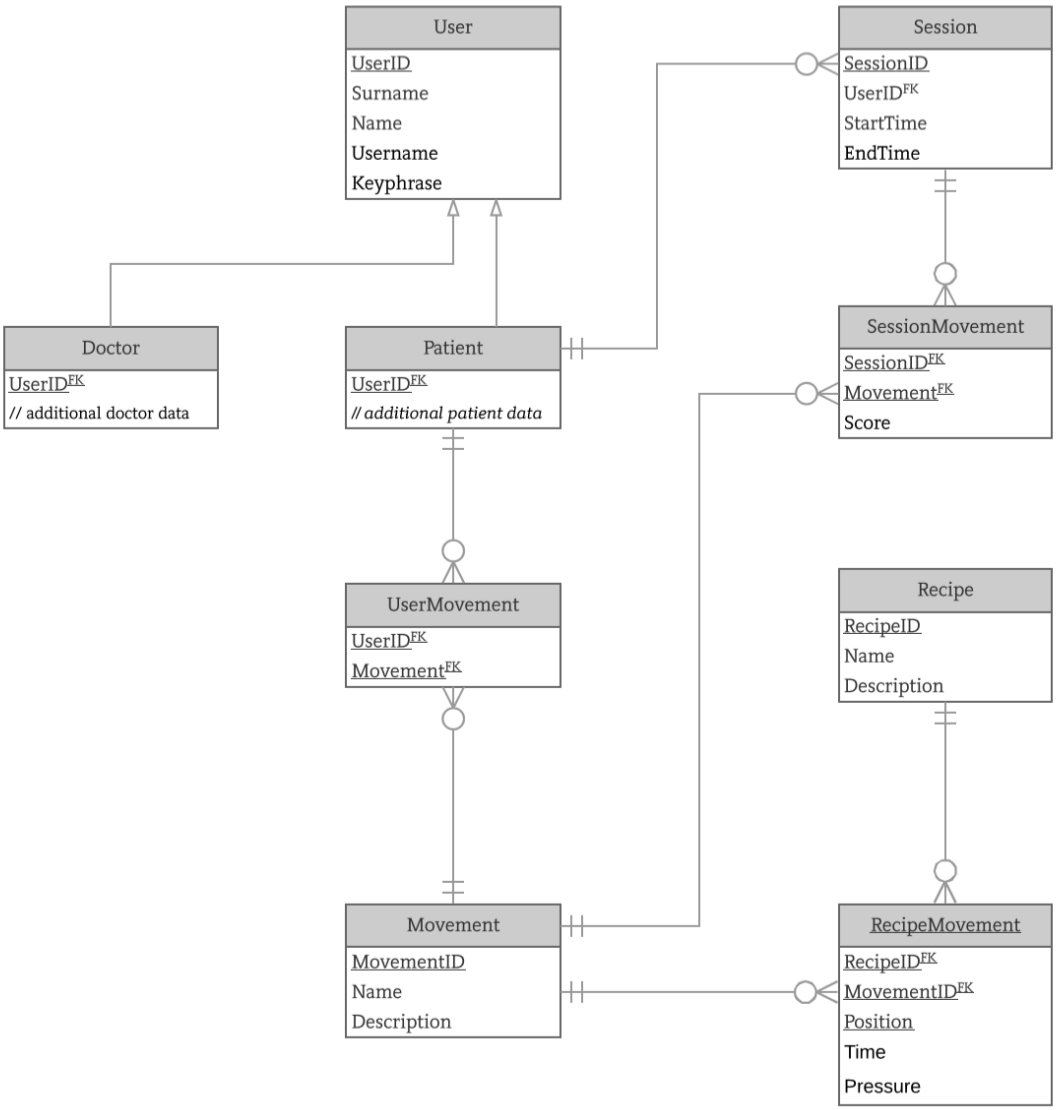
C. Nice to haves

- Customer characters from Portuguese folklore and myths
- Cosmetic customization
- Creation of an individual player avatar

XIII. Ease of access

For the medical benefit of the game a number of factors have to be considered. First of all is the need for continual motivation for the players. This will be accomplished by the feedback system, rewarding players with a score, a fixed amount of in-game money as well as a tip based on individual performance. A high score value will be tracked for movements, allowing player to compare to other players during their playtime.
The patients that make up the target group of this games have experienced hand traumata. Conditions that lead to hand traumata can include restrictions in other areas for the patient as well. For example, after experiencing an apoplectic stroke, patients might have difficulties with speaking or reading. The game will compensate for reading difficulties by relying on very clear iconographic instructions as well as auditory signals, to make it as easy as possible for patients to recognize the movement to be completed.
For patients that experience tremors in their hand following the trauma, the game needs to compensate for the additional movements caused by tremors for accurate movement recognition.

Data Scheme



-**User** (UserID: *Integer*, Surname: *String*, Name: *String*, Username: *String*, Keyphrase: *Password*)

-**Doctor** (UserID FK : *Integer*, *//additional doctor data*)

-**Patient** (UserID FK : *Integer*, *//additional patient data*)

-**Session** (SessionID: *Integer*, UserID FK : *Integer*, StartTime: *TimeStamp*, EndTime: *TimeStamp*)

-**Movement**(MovementID: Integer, Name: String, Description: String)

-**Recipe**(RecipeID: *Integer*, Name: *String*, Description: *String*)

-**UserMovement**(UserID FK: *Integer*, MovementID FK: *Integer*)

-**RecipeMovement**(RecipeID FK: *Integer*, MovementID FK: *Integer*, Position: *Integer,* Time: *Float,* Pressure: *Float*)

-**SessionMovement**(SessionID FK: Integer, MovementID FK: Integer, Score: Integer