Accessible Play: Towards Designing a Framework for Customizable Accessibility in Games

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ABSTRACT

Video games are an important form of entertainment and have become an increasingly popular pastime in the 21st Century. However, many people with disabilities are still excluded from gaming due to accessibility barriers. While some progress has been made in recognizing accessibility as a design value, there is still a significant need for further advancements in game accessibility. Our research analyzes accessibility features in games across genres and platforms (PC, Console, Mobile, VR). Using Interactive Process Modelling (IPM), we map customizable accessibility options available in different games. We present our methodology for conducting interviews with game designers and gamers with disabilities to provide insights into existing options. The research project will result in the development of an accessibility-focused framework for game designers that will enable them to effectively design new customizable accessibility options for their players. Through this research, we aim to contribute to the broader discourse on accessibility and inclusivity in gaming for individuals with disabilities. This work-in-progress paper presents the ongoing progress of our research and invites feedback from the community.

CCS CONCEPTS

• **Human-centered computing** → **Accessibility design and evaluation methods**; *Interaction design process and methods*; • **Applied computing** → Computer games.

KEYWORDS

Accessibility, Video Games, Accessible Games, Game Design, Interactive Process Modelling

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1 INTRODUCTION

Video games have gained immense popularity as a form of entertainment, captivating a wide range of individuals. Over 3.2 billion people in the world participate in digital gaming [7], and according to a survey by Information Solutions Group for PopCap Games, there are more than one in five (20.5%) casual gamers who have some sort of disability [11]. However, despite people with disabilities comprising a substantial portion of the gaming population, a significant barrier to inclusivity in gaming persists. Many individuals with disabilities encounter accessibility barriers that hinder their ability to fully engage in and enjoy gaming experiences [23].

Although the recognition of accessibility as a core design value among gaming studios and developers is increasing, there remains substantial work to accomplish. According to the State of the Game Industry 2023 survey, 38% of game developers reported that they have implemented accessibility measures in their games [6]. Conversely, the percentage of developers who reported not implementing such measures was 32%, down from 36% in 2022 [6]. While the affirmative responses outweigh the negative, this statistic underscores the ongoing need for continued efforts and improvements in this domain. Unfortunately, a substantial number of games continue to lack even the most basic accessibility features, indicating the necessity to enhance game developers' awareness of various aspects pertaining to game accessibility [2]. In a recent survey focusing on gamers with disabilities, 49% of participants concurred that existing games are currently inaccessible to them [1]. Moreover, an overwhelming 71% expressed agreement that they would engage in gaming more frequently if games were designed with greater accessibility considerations [1]. These findings highlight the pressing need for further advancements in game accessibility.

Previous research on game accessibility has primarily focused on only PC and Console games or specific game genres, often overlooking the broader landscape that exists across different genres and platforms [8, 9, 18]. Additionally, many existing accessibility frameworks or guidelines for games are either based only on studying literature or focus on specific

types of disabilities, not capturing the full range of experiences and needs across different disability groups [10, 17, 22].

Our research endeavors to address these gaps by developing an accessibility-focused framework for game designers, to empower them to effectively design new, customizable accessibility options that cater to players' diverse needs. To create this framework, we will analyze accessibility features in games spanning a diverse range of genres and platforms, including PC, Console, Mobile, and Virtual Reality. Through our analysis analysis, we will build insights into existing accessibility features by mapping them using Interactive Process Modelling (IPM) [19], which models how different aspects of a game can change as a result of player interaction. To supplement our mapping of accessibility features, we will conduct interviews with both gamers with disabilities and game designers who have worked on accessibility features, to gather first-hand data from their perspectives about their gaming experiences. Our research will combine theoretical knowledge with practical insights, enabling us to build a well-rounded framework in game accessibility.

In this work in progress paper, we showcase the preliminary stages of our ongoing project: we outline how we use IPM to map a game's accessibility features and then explain the methodology of our planned study, with the goal of inviting feedback from the community as we progress with this work.

2 RELATED WORK

According to the International Game Developers Association, game accessibility can be defined as the "ability to play a game even when functioning under limiting conditions", where "limiting conditions can be functional limitations, or disabilities such as blindness, deafness, or mobility limitation." [4]. The importance of accessibility in games cannot be overstated as it allows games to be inclusive to everyone. It should be possible for all individuals to enjoy and fully participate in the gaming experience, regardless of their abilities or disabilities. A PopCap Games survey found that there is a considerable portion of casual game players who have some form of disability [11]. In the USA alone, of the 61 million people who have a disability, 33 million play video games [21]. The number of individuals affected by accessibility barriers in gaming is even higher when considering additional groups who were not included in the PopCap Games survey, such as those with colorblindness, low reading age, and individuals with temporary situational impairments [14]. This further emphasizes the need for comprehensive accessibility features in games to ensure the inclusion of these individuals.

Furthermore, the same PopCap Games survey revealed that people with impairment not only play more frequently, for longer amounts of time, and for more hours per week, but also derive more substantial advantages from playing when compared to non-disabled users [11]. In line with the general population of casual gamers, individuals with disabilities also obtain physical and mental benefits from gaming, such as stress relief, mood elevation, and improved concentration [11]. However, many disabled gamers have also indicated that they experienced additional benefits beyond what non-disabled players typically experience (77%), including deeper sensations of achievement and belonging, as well as finding distraction from feelings of loneliness and chronic pain [11]. From these findings, it is evident that gaming serves as a valuable medium for disabled players, which reinforces the importance of creating accessible games that address the unique needs of gamers with disabilities. By ensuring that gaming experiences are accessible to individuals with disabilities, game developers have the opportunity to not only provide entertainment but also contribute to the overall well-being and quality of life of this group.

2.1 Existing Frameworks and Guidelines

Frameworks and guidelines are essential tools in supporting accessibility in games. They can be valuable resources for game designers and developers to help realize their projects, through addressing accessibility considerations that they might not have thought about themselves. In the past few years, various guidelines have been developed and adopted by developers and researchers to evaluate and ensure the effective accessibility of games. These guidelines are often derived from reputable institutions and organizations, including the World Wide Web Consortium (W3C), the Nielsen Norman Group, the AbleGamers Charity, the Game Accessibility Guidelines, and the International Game Developers Association (IGDA) [17]. However, it is important to note that the field still faces significant challenges. Unlike other domains such as web applications, which have established standards like the Web Content Accessibility Guidelines (WCAG), the gaming industry lacks a universally recognized and widely adopted set of guidelines for accessibility [5, 25]. This gap in the literature and absence of an official standard can limit the progress towards creating fully accessible games.

Additionally, as mentioned previously, while valuable contributions have been made in relation to accessibility in PC and Console games, there is a notable lack of research that specifically addresses accessibility in Mobile and Virtual Reality (VR) games. There are a few papers that have attempted to address this gap by proposing guidelines for accessibility in VR and Mobile games [10, 17]. However, while these papers advance the research on Mobile and VR games accessibility, it is important to note that these guidelines are primarily derived from literature reviews, which indicates a reliance on existing knowledge and resources rather than empirical research that involves users with diverse accessibility needs. The scope of these research studies is thus constrained due to the fact that they could have overlooked particular accessibility challenges or user perspectives that may not be adequately covered by existing guidelines.

3 INTERACTIVE PROCESS MODELLING

As a part of our project, we will be using the Interactive Process Modelling (IPM) framework [19] to map accessibility features that players can customize in games. The IPM

framework is designed to represent how different elements of an interactive system can change through the actions of one or more agents; it calls these elements *target objects*. Within the context of games, IPM specifically illustrates how various aspects of a game are perceived, reasoned about, and ultimately changed as a result of player interaction [20]. This model represents each step of reasoning, change, and feedback as a distinct abstract function, namely an *action function*, a *transition function*, and an *observation function*, respectively. In addition to these three functions, the IPM incorporates elements such as an initial state, potential observations, actors, potential actions, and potential states.

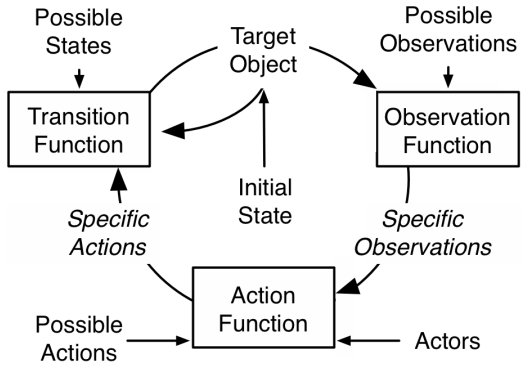

Figure 1: An interactive process with boxes representing functions and labeled arrows representing data. Italicized text represents the data that only arises while the process executes (comes from [20]).

Figure 1 provides a visual representation of a simple IPM model (with only one target object), and Figure 2 shows an example with two target objects. A brief description of each function and element is presented below.

- `Target Object (S)`: Any part of an interactive system that can be changed as a result of one or more agents' actions. For example, the state of a game's world, or the current value of an accessibility setting. We use `S` because the target object is always "state-like" [19], even if a function is being changed (e.g., see Figure 2).
- `Observation Function` (Ω): The observation function is responsible for processing the present state of the target object and generating an observation of that target for each participating agent, such as a player, that is involved in the interactive process. This observation is how a player obtains feedback from the game system about the results of their actions.
- `Action Function` (α): The action function receives and processes the observation provided by the observation function and generates an action. It represents how a player determines their course of action based on the information they have observed.
- `Transition Function` (τ): As time proceeds forward, the transition function regularly examines all recent actions by agents as well as the current state of the target object. It produces a potentially different state for the target object, which then becomes the new current state. In a video game, this represents how the game's code, when executed, modifies some aspect(s) of the game in response to the player's actions.
- `Initial State (IS)`: The initial state refers to the configuration that the target object has at the start of the process execution. When the target object is a game's world, the initial state would describe the properties (e.g., position, appearance, behaviour) of everything in the game world in the first moment of gameplay. When the target object is a game's difficulty settings, the initial state would describe which of the available alternatives was selected when the game was launched for the first time (e.g., as the "default" setting).
- `Possible Observations (PO)`: The set of possible observations includes all potential observations of the target object that an actor participating in the process may receive. This encompasses all forms of feedback that the system can generate to communicate aspects of the target object's state (e.g., visual, auditory, haptic).
- `Actors (A)`: Actors are the agents that are capable of engaging in the interactive process by either observing or attempting to change the target object. For this paper, the actors are the players of the game.
- `Possible Actions (PA)`: Possible actions encompass the complete range of actions that an actor within the interactive process can undertake in their endeavor to modify the target object.
- `Possible States (PS)`: The set of possible states includes all configurations of the target object that can occur while the process is running. For instance, when the target object refers to the state of a game world, the possible states encompass (i) all possible properties for entities within the world, as well as (ii) all records of gameplay progress that could be recorded (e.g., completed missions). When the target object is the settings of an accessibility feature, the possible states would include the possible configurations of those settings.

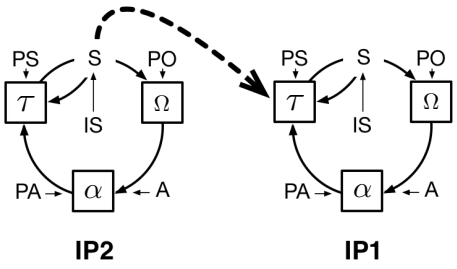

Figure 2: Minified versions of two interactive processes, IP1 and IP2, where IP2 has its target object (S) set as the transition function (τ) of IP1 (adapted from [20]). Such a link can be used to represent how a game's difficulty (controlled by τ in IP1) is changed via actions in another process (α in IP2).

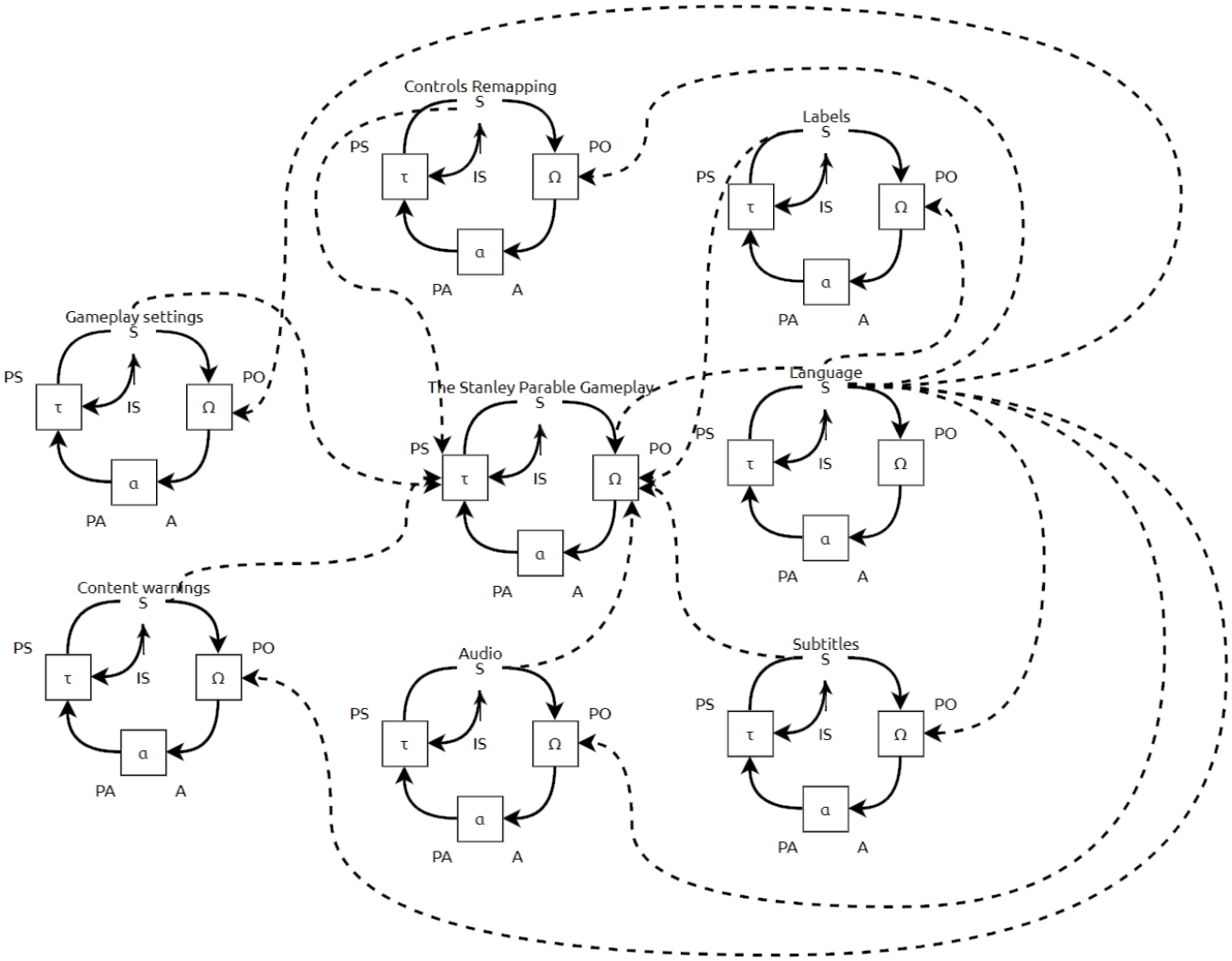

Figure 3: The Stanley Parable: Ultra Deluxe and its accessibility options in an Interactive Process Model.

IPM is useful for capturing how players can customize different aspects of a game [19]. Traditionally, game design frameworks have focused on defining player actions and the corresponding changes in a game's state. However, with the emergence of player-driven customization and accessibility-focused design, games now provide options for players to modify not only the game's state but also its observation and transition rules, such as changing a game's head-up display (HUD) or adjusting its difficulty levels [19]. IPM offers a way to model these kinds of actions in games and enables designers to reason about how different parts of a game can be altered, providing clarity over the design of different game-changing options. IPM has additionally been used to support design considerations in the field of Interactive Digital Narrative (IDN) [3, 12, 13].

In our study, we will use the IPM framework to map the accessibility features that players can customize in games across different platforms and genres. As an example, Figure 3 shows the accessibility options of the PC version of *The Stanley Parable: Ultra Deluxe* [24] mapped using IPM. *The Stanley Parable: Ultra Deluxe* (TSPUD) is a narrative-driven interactive game that serves as a pseudo-sequel to the initial instalment, The Stanley Parable. Throughout the game, players assume the role of a protagonist named Stanley, who navigates through the game world accompanied by a narrator [24]. As the storyline unfolds, players are presented with branching paths, and their choices dictate the course of the narrative, leading to multiple possible endings before the game resets back to its starting point.

The core process of the game targets the state of the game world itself, while the surrounding processes target the customizable accessibility options that are integrated into the game. Each dashed arrow signifies how the player's

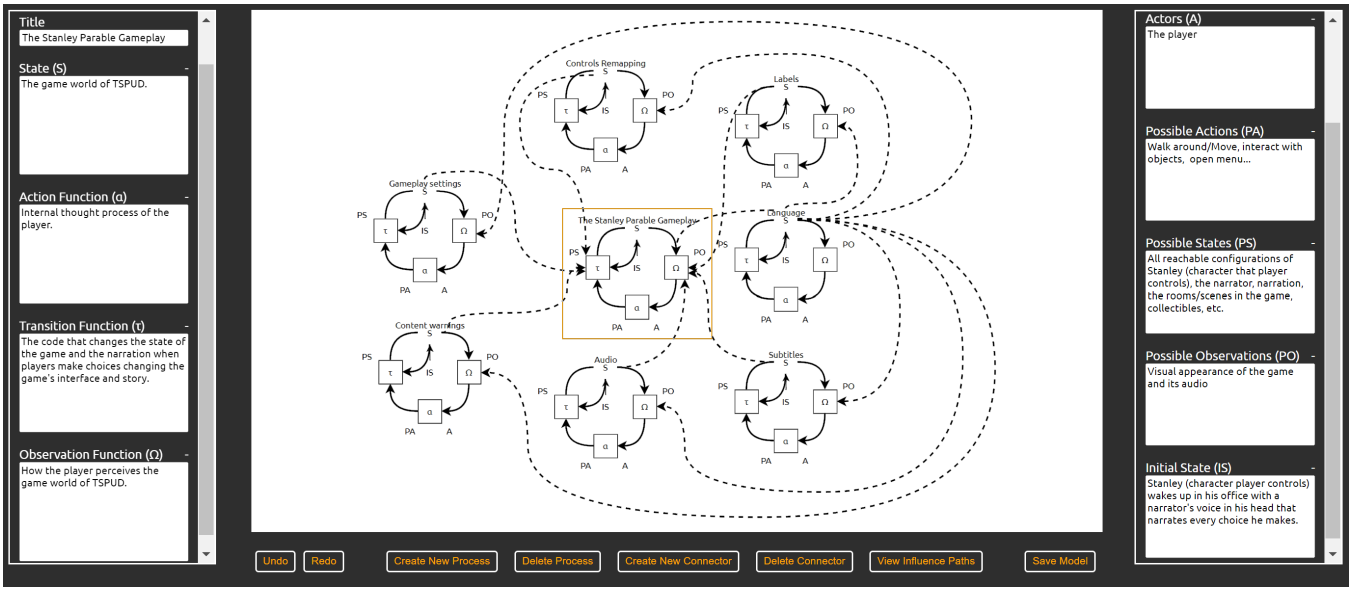

Figure 4: Our software for creating IPM models, with our model of *The Stanley Parable: Ultra Deluxe* [24] in the middle. The orange box shows that the game's core process has been selected, and data for its functions and elements are thus shown at either side.

interactions in one process can indirectly change some aspect of another process in the model. For example, the act of enabling or disabling subtitles directly impacts the core process's observation function, altering how players perceive the game world. In some instances, modifications to one accessibility option can also affect another accessibility setting. For instance, in the case of this game's model, changing the language settings in the game affects the language of the entire game interface, which also includes all of the settings menus. Hence, this relationship is depicted by dashed arrows connecting the state of the 'Language' process to the observation function of every other process.

The software that we created for modelling interactive systems using IPM contains dedicated sections for inputting data relevant to each target object within a given process. The data for the core process of *The Stanley Parable: Ultra Deluxe* (TSPUD) (which targets the game's world state and it outlined by an orange rectangle) can be observed in Figure 4. A description of the functions and elements of the highlighted process is provided below as well.

- `State`: The game world of TSPUD.
- `Observation Function`: How the player perceives the game world of TSPUD.
- `Action Function`: Internal thought process of the player.
- `Transition Function`: The code that changes the state of the game and the narration when players make choices changing the game's interface and story.
- `Initial State`: Stanley (character player controls) wakes up in his office with a narrator's voice in his head that narrates every choice he makes.
- `Possible Observations`: Visual appearance of the game and its audio.
- `Actors`: The player.
- `Possible Actions`: Walk around/Move, interact with objects, open menu, etc.
- `Possible States`: All reachable configurations of Stanley (character that player controls), the narrator, narration, the rooms/scenes in the game, collectibles, etc.

The target objects for all the accessibility options in the game are explained in the model as well. For instance, the functions and elements pertaining to the 'Subtitles' process are specifically shown in Figure 5, where the "State (S)" field shows that the target object of this process is the collection of settings that control the game's subtitles.

- `State`: The current state of the settings for the game's subtitles.
- `Observation Function`: The method of displaying the values of the game's subtitle settings.
- `Action Function`: The internal thought processes of the player playing the game, as influenced by their primary language and their vision acuity.
- `Transition Function`: The code that changes the subtitles settings.
- `Initial State`: English subtitles enabled in a default size.
- `Possible Observations`: The display of subtitle settings in the menu and subtitles preview.
- `Actors`: The player.
- `Possible Actions`: Enable or disable subtitles, adjust their size, and adjust their background opacity.

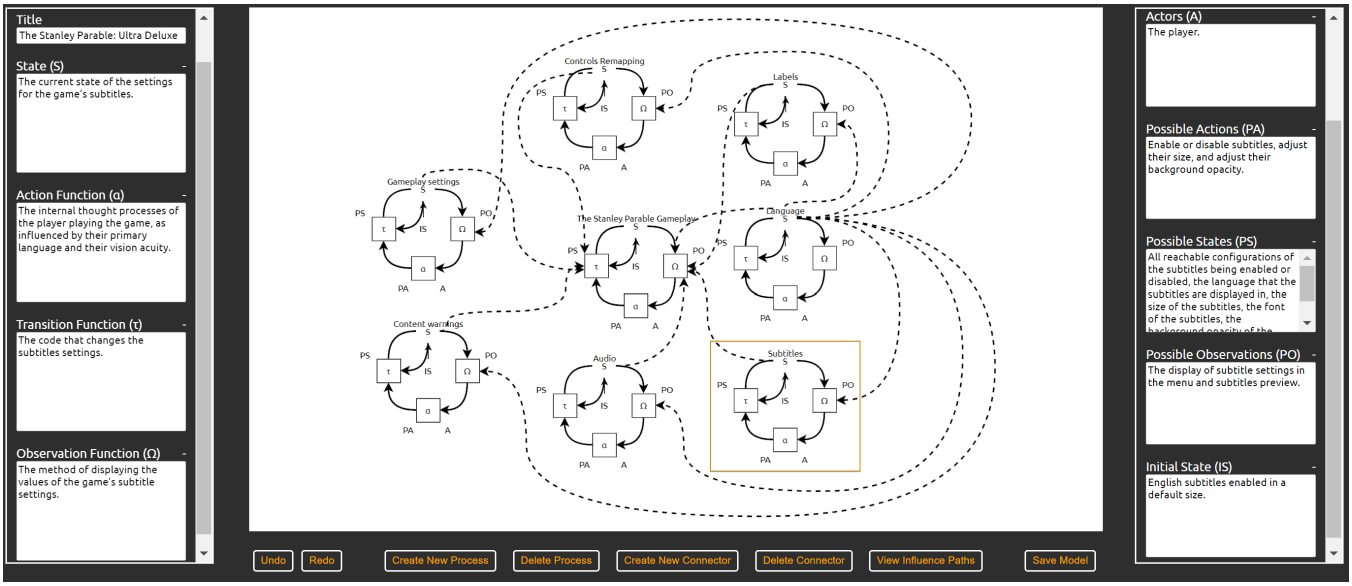

Figure 5: Another view of our model of *The Stanley Parable: Ultra Deluxe*, with the orange box now showing that the 'Subtitles' process has been selected. The data for its functions and elements appear to either side.

- `Possible States`: All reachable configurations of the subtitles being enabled or disabled, the language that the subtitles are displayed in, the size of the subtitles, the font of the subtitles, the background opacity of the subtitles, and the color of subtitles.

4 PLANNED METHODOLOGY

Our planned research methodology for this project consists of three key phases: 1) Mapping the accessibility features in current games using Interactive Process Modelling (IPM), 2) Conducting interviews with game designers and gamers with disabilities, and 3) Building and evaluating an accessibility-focused framework on its ability to help game designers during the design/development process.

To begin, we will conduct an extensive analysis of existing games with accessibility features. Games will be selected from various genres and gaming platforms from the website CanIPlayThat?, which provides accessibility-focused reviews of video games [16]. However, since this website focuses mainly on reviewing PC and Console games, the selection of Mobile and VR games will be based on the nominations for the 'Best Mobile Game' and 'Best VR/AR Game' categories at The Game Awards in 2022. The Game Awards is an annual awards ceremony that recognizes outstanding achievements in the video game industry, and its voting jury comprises more than 100 video game media and influencer outlets that have been carefully chosen for their expertise in critically evaluating video games [15]. Then, we will map the accessibility features that players can customize for each game using the IPM framework. Mapping existing games this way could potentially reveal insights such as differences across platforms or game genres related to what accessibility features are included, as well as how each feature is integrated into the game.

Following this, we will conduct semi-structured interviews with game designers who are responsible for including accessibility features in their games. Appropriate ethical clearance will be obtained prior to the interviews. These interviews will help us understand what tools and processes are currently being used in the industry to increase accessibility, as well as what the main challenges are in implementing accessibility features. Additionally, we will interview diverse group of gamers with one or more disabilities that adversely affect their ability to play video games on any platform (PC, Console, Mobile, VR). This will help us gain insights into the challenges that gamers with disabilities face when playing games, as well as what accessibility features would benefit the community. We aim to recruit 60 participants in total, with 30 participants in the Game Developers group and 30 participants in the Gamers with Disabilities group to ensure a balanced representation. These interviews are a crucial step in our research process, as they will allow us to capture a multitude of perspectives and experiences, emphasizing the importance of diversity in creating accessible games. We will use thematic analysis to identify any key themes and patterns in the interviews, and the results from the analysis will summarize the current landscape of accessibility options in games, including their design, benefits, and limitations.

Once the mapping process and interviews have been completed, we will synthesize the insights gained from both sources to create an accessibility-focused framework. Synthesizing the mapping results and interview insights will involve a triangulation process, where we seek to compare and connect

the similarities, differences, and important gaps between the two sets of data. By identifying patterns, recurring themes, and notable discrepancies, we will begin to formulate the core principles of the accessibility-focused framework. Thus, the fusion of mapping data and interview insights will guide the framework's development in a holistic manner, bringing together the practical possibilities we see in existing games and the real experiences of both game designers and gamers with disabilities. This framework will serve as a practical guide and resource for game designers, enabling them to incorporate and enhance customizable accessibility options in their games effectively. By building the framework from the insights we obtained from mapping and interviews, we aim to create a helpful guide that not only acknowledges the diverse challenges in gaming accessibility, but also helps to facilitate substantive improvements in the industry. Finally, to measure the effectiveness of the accessibility-focused framework, we will conduct focus group sessions with game designers and gamers with disabilities. Through collaborative discussions and feedback, we will evaluate and refine the framework based on its ability to aid in the game design/development process.

5 FUTURE WORK

The research project is currently underway in mapping the landscape of customizable accessibility options in video games using Interactive Process Modelling. Additionally, to gain deeper insights into the current landscape of accessibility options in games, ethical clearance is being sought to conduct interviews. Once ethical clearance is obtained, we will proceed with conducting interviews with game designers and gamers with disabilities, which will provide valuable firsthand information on the current state of accessibility options in games. The next steps will be to develop an accessibility-focused framework based on the insights gained from the mapping process and the interviews. Through presenting our work at this juncture, we seek to solicit feedback and insights from the community as we continue to advance this project.

In the future, one could use the framework to aid in the design of accessibility options within games in collaboration with game designers. Fostering a collaborative environment by involving game developers in the research process could encourage the creation of more accessible games. Furthermore, this approach would help test and enhance the practicality and applicability of the framework.

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