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Accessibility in Practice: A Case Study on a Viennese Video Game Studio

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by

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to the Faculty of Informatics

at the TU Wien

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Matthias Vigele, BSc

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Wien, 26. Jänner 2024

Matthias Vigele

Danksagung

Danke an alle, die mich über die Jahre hinweg unterstützt haben. Ohne euch hätte ich das nicht geschafft.

Acknowledgements

Thank you to everyone who supported me over the years. I wouldn't have been able to achieve this without you.

Kurzfassung

Videospieler*innen mit Behinderungen müssen oft auf Videospiele zurückgreifen, die speziell für Menschen mit Einschränkungen designt worden sind, da Mainstream-Spiele oft keine Unterstützung für Barrierefreiheits-Features anbieten. Das Ziel dieser Arbeit ist es deswegen die Frage zu bearbeiten, warum Barrierefreiheits-Features bei der Videospielentwicklung anscheinend von geringer Priorität sind. Dazu wurden 272 Game-Design-Dokumente, die von einem Wiener Videopspielentwicklerstudio erstellt wurden, analysiert und teilstrukturierte Interviews mit neun Personen, die für dasselbe Studio arbeiten, durchgeführt. Durch die Anwendung qualitativer Inhaltsanalyse an Dokumenten und Interview-Transkripten wurden als Einflüsse auf die Priorisierung von Barrierefreiheits-Features Aspekte wie verfügbare Ressourcen, Design-Stabilität, Feature-Sichtbarkeit, Verantwortlichkeit und Team-Diversität identifiziert. Externe Berater heranzuziehen wurde als Strategie beschrieben um einen Mangel an Team-Diversität auszugleichen. Mit Ausnahme von Lokalisierung und Untertiteln, die von allen Interviewten als unverzichtbar angesehen wurden, gab es keinen Konsens was die Priorisierung von bestimmten Barrierefreiheits-Features betrifft. Manche Barrierefreiheits-Features wurden zwar als unverzichtbar beim Spielen, jedoch beim Entwickeln nur als optional angesehen, und umgekehrt. Die Interviewten betrachteten manche Barrierefreiheits-Features zwar auf niedrigem Qualitäts-Niveau als unverzichtbar, nicht jedoch auf höherem Niveau (z.B Untertitel, Lokalisation, Tutorials, Text-Größe/Schriftarten, Eingabebelegung). Features wie Screen-Reader-Unterstützung, Unterstützung für zusätzliche Eingabegeräte, Audio-Cues, oder eine Ausgabe in Gebärdensprache wurden als optional oder als bei der Videospielentwicklung überhaupt nicht bedacht beschrieben. Barrierefreiheit wurde nicht nur als das Implementieren mit gewissen Barrierefreiheit-beachtenden Voreinstellungen (z.B das vermeiden von rot und grün als Farbkombination) beschrieben, sondern auch als das zur Verfügung stellen von anpassbaren Einstellungen für Spieler*innen. Die meisten der Interviewten erlangten ihr Wissen über Barrierefreiheit nicht aus Schul- oder Universitätsbildung, sondern durch den Besuch von Konferenzen, den Konsum von Online-Medien, oder die Arbeit in der Videospielbranche.

Abstract

Video game players with disabilities often have to resort to playing video games which were particularly designed for people with impairments because mainstream games often lack accessibility features. This work therefore aims to address the question of why accessibility features seem to be of rather low priority during game development by analyzing 272 game design documents created by a Viennese video game studio and conducting semi-structured interviews with nine people working at the same local video game company. By applying qualitative content analysis on documents and interview transcripts, aspects like available resources, design stability, feature visibility, responsibility and team diversity were identified as having an influence on accessibility feature prioritization. Consulting external expertise was described as a strategy to make up for a lack of diversity among team members. Except for localization and subtitles, which were considered must-haves by all interviewees, there was no consensus on the prioritization of particular accessibility features. Some accessibility features were considered must-haves while playing but only nice-to-haves when developing, and vice-versa. Interviewees regarded some accessibility features as must-haves at more basic levels, but not at their most advanced levels (e.g. subtitles, localization, tutorials, text sizes/fonts, button mapping). Features like screen reader support, additional input device support, audio cues or sign language output were described as being considered nice-to-haves, or as not being considered during game development at all. Accessibility was not only described as implementing certain defaults with accessibility in mind (e.g. avoiding red and green as color combination) but also as providing players with customizable settings. Most of the interviewees did not acquire their knowledge about accessibility through school or university education, but by attending conferences, consuming online media, or learning about it while working in the games industry.

Contents

CHAPTER 1

Introduction

1.1 Problem statement

"*The WHO estimates that about 15% of the world population lives with a disability*" [JALM17, p. 2]. For the USA, this percentage amounts to 26% with about 33 million of domestic people with disabilities who regularly play video games [VOC21, p. 823] or in some cases also broadcast themselves while doing so by using streaming platforms like Twitch [AJ22]. Video games exclusively developed for people with certain disabilities (e.g. audio games without any graphics for visually impaired) provide a way to play to some extend, but do not meet the demand for access to popular mainstream games for broader inclusion [ARW+19, p. 6].

1.2 Aim of the work

There are several ways to make video games more accessible during their development. The game accessibility guidelines (GAG) [WKDH18] list methods and techniques to make games more accessible for people with motoric, cognitive, visual, hearing or speech disabilities [VOC21, p. 822-823] [Ham17b]. "The Last of Us Part 2" is an example for a mainstream video game which implemented so many accessibility features that its whole story mode can be finished by blind players [LIRHMG22, p. 53] [Gal20] [Sig20]. But this appears to be an exception as there are still many games released without universal access in mind [LIRHMG22, p. 53].

This master thesis therefore aims to explore why accessibility features seem to be of rather low priority during video game development by analyzing game design documents of titles aiming for a broad "mainstream" audience and conducting semi-structured interviews with people working in the games industry.

The analyzed game design documents are sourced from already finished and released first-party video game projects developed by a small (less than 50 employees) Viennese game studio. The interviewed people are employed by the same Viennese studio. Games previously released by the studied company indicate a higher focus on accessibility as a topic for story content in comparison to accessibility as an explicit topic for features to implement. I therefore hypothesized there might be a lack of awareness concerning certain accessibility features, or the benefits (i.e. more potential customers [JALM17, p.3]) they could bring with them. For first party projects, implementing accessibility features might be considered as too expensive for the available budgets. For work-for-hire projects, the responsibility to require accessibility features might be considered to be on the client's side. People working at the production department might think more accessibility means higher production costs, design and art department views might argue it would restrict their creativity, technology and quality assurance might argue it would require additional implementation work and testing effort. Some of the accessibility software (e.g. screen readers) or hardware (e.g. specialized controllers) which are used by people with disabilities can be quite expensive - Getting approval for extra budget to purchase this software or hardware in order to develop and test on them might be problematic for some game development studios.

In particular, I am aiming to answer the following research questions with this case study:

- RQ1: How are accessibility features prioritized during game development?
- RQ2: What accessibility features are considered *must-haves* (or only *nice-to-haves*) and why?
- RQ3: What does the term "accessibility" mean to people working in the games industry? What educational backgrounds shape their understanding of the term "accessibility"?

Porter and Kientz previously conducted interviews with people working in the games industry. According to participants of their study, factors impacting the level of accessibility of a finished game include decisions made by executive personal ("*internal positions of authority, such as executives*"), regulatory laws enforcing accessibility ("legislations"), middleware (e.g. video game engines like Unity or the Unreal Engine) supporting the implementation of accessibility features and having more diverse development teams, consisting at least partially of members with impairments [PK13, p.6]. As research by Andrade et al. indicates, such diverse teams require middleware not only to be able to produce accessible games, but to be accessible itself: "*Unity is not accessible though, otherwise people would probably use it... The only people who I know who code their audiogames in Unity are sighted people*" [ARW+20, p.7]

CHAPTER 2

Methodology

I currently work at the Quality Assurance department of a Vienna-based video game development studio and therefore have access to other persons who work at the same company as well as digital game development documents. To research the importance and prioritization of accessibility during game development, I therefore conducted a participatory ethnography based study at the company I work at: Document Analysis [Bow09] was applied on 272 game design documents and semi-structured interviews were conducted with nine people across five studio departments.

2.1 Literature Review

I conducted two literature review rounds. The first one included papers from the last five years, while the second round focused on more recent scientific works which were published within the last 12 months.

2.1.1 Round 1

I started my literature review on September 27th 2022 by entering the search string "*videogames accessibility screen reader*" into Google Scholar, with the restriction to only return results which were published during the last five years (between 2017 and 2022). With this, I was able to add 14 works about video game related approachability [LVFS18], accessibility evaluation [AFD+17] [JALM17] [SUAVLM20], accessibility toolkits [SPSA18], accessible development [KKM18], accessibility guidelines [NFJB+20] [WKDH18] [AFD+17] [JALM17] [SUAVLM20], accessible ports [NFJB+20] [LVFS18], video game accessibility in general [AS20] [BPCB18] [SUAVLM20] and accessibility particularly for people with visual impairments [KKM18] [NFJB+20] [ARW+20] [AFD+17] [JALM17] [ARW+19] [LVFS18] [SPSA18] to this thesis' body of research.

2.1.2 Round 2

For the second literature review round, I used the same search string as for the first round on October 16th 2022 on Google Scholar again, "*videogames accessibility screen reader*". This time, however, I wanted to focus on the latest developments in video game accessibility, so I restricted search results to works which were published between the years 2021 and 2022. This allowed me to add another 12 works about video game accessibility for people with dyslexia [JAVCCLM21], visual [LIRHMG22] [CSAMdLPAMFIHC21], hearing [Sci21] [Gra] or cognitive impairments [Gau21] to this thesis' body of research.

2.2 Document Analysis

A document analysis was conducted to partially answer RQ1 (*How are accessibility features prioritized during game development?*) and RQ2 (*What accessibility features are considered must-haves (or only nice-to-haves) and why?*). The studio I work at gave permission to review digital wiki documentations from two internal, first-party video game projects as a basis for the document analysis. Such documents include production plans, game designs, technical designs, art designs, test plans and meeting notes. The used wiki software also allows to view the edit history of documents, so even features which were only considered at one point in time during development but were dropped later were considered for the analysis.

The document analysis consisted of two phases [Bow09]: During the first phase, relevant documents were selected from all 272 documents the company gave permission to analyze, while also documenting why certain documents were excluded. The remaining documents then served as the data source for the second phase's qualitative content analysis ([May83, p.1]).

2.2.1 Phase 1

I reviewed the titles and paragraph headings inside the latest versions of all 272 documents to decide which documents should be included in the second phase's qualitative content analysis. 178 of 272 documents were excluded from the remaining analysis during the first document selection phase. A document was excluded if its content:

- consisted solely of links/references to other documents of this analysis
- was too short for any subsequent qualitative analysis
- consisted solely of a list of quantitative data (e.g. list of assets or display resolutions)
- consisted solely of instructions on how to reach the game's end (i.e. walkthrough)
- described the game project's story and characters
- described development workflows without any connection to accessibility

- consisted solely of post-release information (e.g. press coverage)
- did not include any accessibility related information

A document was included if its content:

- described the game project timeline (to assess what features were planned for when)
- described the game project's features (e.g. saving/loading, auto-save, achievement/trophies, tutorials, localization, audio, voice-over)
- described the game project's user interface (e.g. fonts, typography, colors, readability, contrast) and user interaction
- described the game project engine's features
- described the game design process
- described accessibility related development workflows (e.g. localization, platform support, debug features, testing)
- described platform features (e.g. DRM, localisation, Linux support)
- summarized a development team meeting
- summarized a play test session
- summarized a player survey or questionnaire
- described platform requirements (e.g. audio volume, physical button input support, languages, screen flicker, image descriptions, text legibility)
- suggested the documents version history or attached developer comments might include accessibility related information

2.2.2 Phase 2

The 94 documents which remained after phase one were further reduced to 46 after in-depth reading their current and past contents (document history) as well as attached developer comments. At this stage, documents were removed from further analysis if their content:

- consisted solely of links to the studio's issue management system
- and history and attached comments did not include any accessibility related information

After reviewing its privacy and data protection policy, the web based tool QCAmap by Mayring and Fenzl[1] was used to conduct a qualitative content analysis on the remaining 94 documents. [May83, p.111-117] Any explicit mentions of employee names, company names and project names in text documents and images were replaced with pseudonyms before adding the documents to QCAmap (See Figure 2.1 and Figure 2.2). Inductive category formation with the following parameters was chosen as the content analytical technique:

- **Selection Criterion:** Text section must refer to techniques to make games more accessible for people with motoric, cognitive, visual, hearing or speech disabilities.
- **Abstraction Level:** Specific for individual accessibility techniques (e.g. name of technique), but more general for project specific aspects.
- **Coding Unit:** Phrase or clause (word sequences).
- **Context Unit:** Other text sections within the same document, other documents from the research body, the implemented game as it was released to the public, additional literature research or the upcoming expert interviews.
- **Recording Unit:** All Documents. Ignore multiple codings per document.

2.3 Semi-structured Interviews

This section describes how nine semi-structured interviews with people working in the games industry were conducted and subsequently evaluated using qualitative content analysis during the course of this thesis.

2.3.1 Interview Phase

To gain insights from various viewpoints, interviews with persons working at different studio departments (production, game design, tech, art and quality assurance) were conducted. I initially aimed for two interviews per department, and this goal was reached for all but the art department where only one participant was available for the given time frame. The company gave permission to conduct five 45 minute long interviews during working-hours. The remaining interviews and conversations taking longer than 45 minutes were conducted during interviewees' free-time. All nine interviews were audio-recorded for a subsequent transcription and interviewees were provided with a consent form, informing about data protection and storage practices and the possibility to withdraw from participation at any time, before every interview (See Figure 2.3). German native-speakers were provided with German language consent forms and interviews with German native-speakers were conducted in German. International employees with native

[1] Available at `https://qcamap.org`

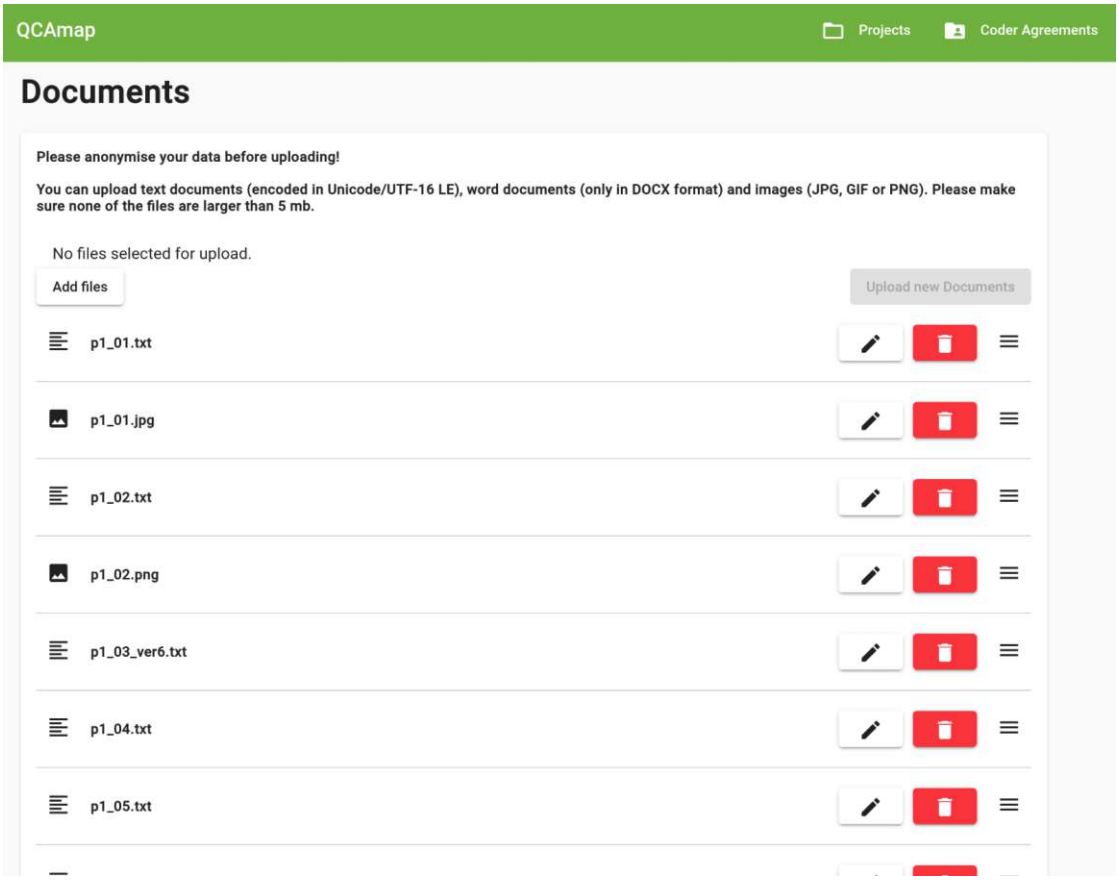


Figure 2.1: Screenshot of the list of documents inside QCAmap.

languages other than German received an English language version consent form and interviews with these persons were conducted in English. Four of the interviewees identified as female and five identified as male. The interview transcriptions were used as the basis for a subsequent qualitative content analysis [May83].

The results of the preceding Document Analysis and learnings from a test interview with a fellow student were incorporated into the interview guide shown in Table 2.1. The listed topics were planned to be addressed during each interview and guided questions were used in case the conversation did not naturally lead to a certain topic:

- What does the term accessibility mean to them? How does it differ from "usability", "affordability" or "User Experience" for them? Or do they make no difference between these terms?
- How did they learn about this? (Education)
- What kind of body is required to play their games?

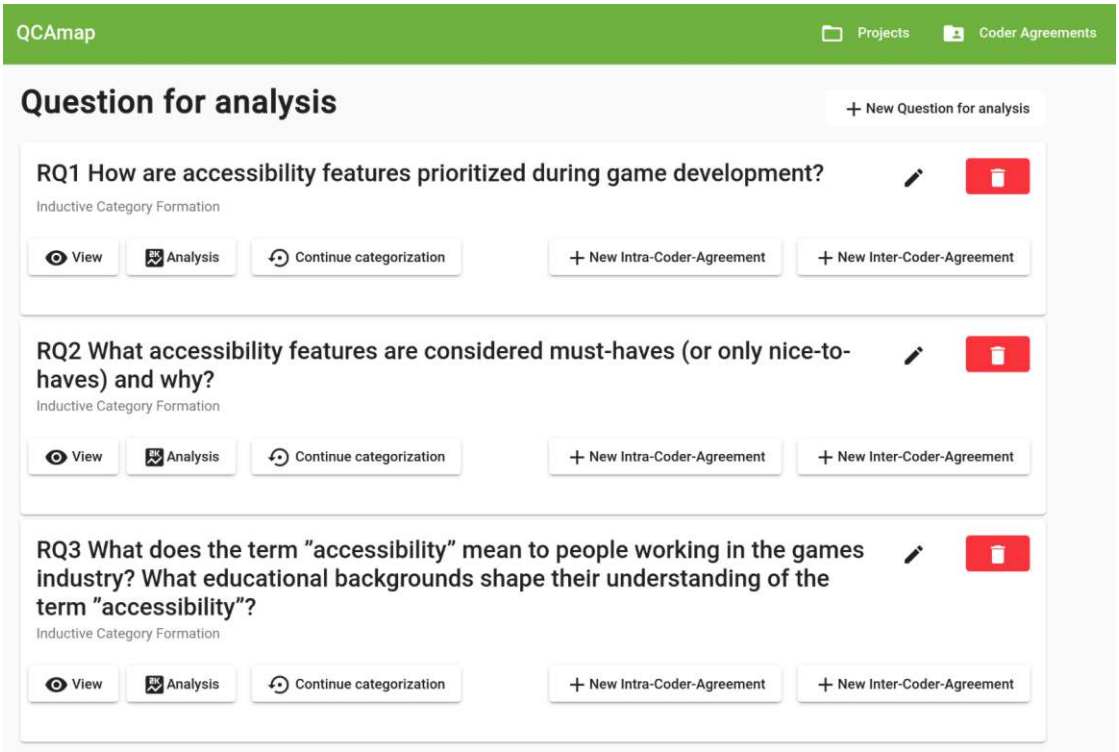


Figure 2.2: Screenshot of the research questions inside QCAmap.

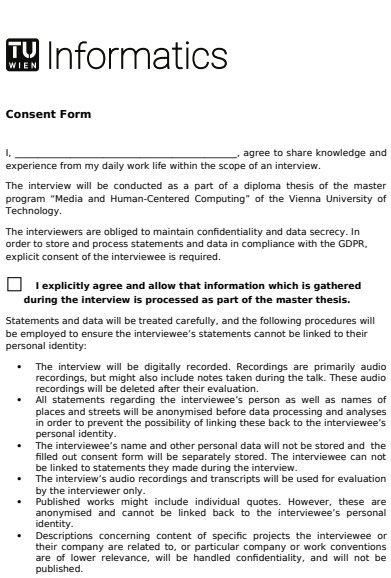
- How do they decide what features are *must-haves*? How do they decide what features are only *nice-to-haves* and can therefore be prioritized lower?
- Accessibility as a means to widen the target audience

2.3.2 Qualitative Content Analysis

After reviewing its privacy and data protection policy, the web based tool QCAmap by Mayring and Fenzl[2] was used to conduct a qualitative content analysis on the nine interview transcripts. [May83, p.111-117] Any explicit mentions of employee names, company names and project names in the documents were replaced with pseudonyms before adding the documents to QCAmap. Inductive category formation with the following general parameters was chosen as the content analytical technique:

- **Selection Criterion:** Text section must refer to techniques to make games more accessible for people with motoric, cognitive, visual, hearing or speech disabilities.
- **Abstraction Level:** Specific for individual accessibility techniques (e.g. name of technique), but more general for project specific aspects.

[2]Available at `https://qcamap.org`



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Consent Form

I, _____, agree to share knowledge and experience from my daily work life within the scope of an interview.

The interview will be conducted as a part of a diploma thesis of the master program "Media and Human-Centered Computing" of the Vienna University of Technology.

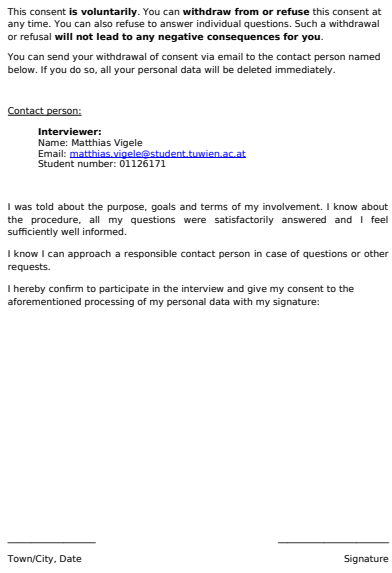
The interviewers are obliged to maintain confidentiality and data secrecy. In order to store and process statements and data in compliance with the GDPR, explicit consent of the interviewee is required.

☐ **I explicitly agree and allow that information which is gathered during the interview is processed as part of the master thesis.**

Statements and data will be treated carefully, and the following procedures will be employed to ensure the interviewee's statements cannot be linked to their personal identity:

- The interview will be digitally recorded. Recordings are primarily audio recordings, but might also include notes taken during the talk. These audio recordings will be deleted after their evaluation.
- All statements regarding the interviewee's person as well as names of places and streets will be anonymised before data processing and analyses in order to prevent the possibility of linking these back to the interviewee's personal identity.
- The interviewee's name and other personal data will not be stored and the filled out consent form will be separately stored. The interviewee can not be linked to statements they made during the interview.
- The interview's audio recordings and transcripts will be used for evaluation by the interviewer only.
- Published works might include individual quotes. However, these are anonymised and cannot be linked back to the interviewee's personal identity.
- Descriptions concerning content of specific projects the interviewee or their company are related to, or particular company or work conventions are of lower relevance, will be handled confidentiality, and will not be published.

(a) The consent form's first page describing interview and anonymization procedures.



This consent **is voluntarily**. You can **withdraw from or refuse** this consent at any time. You can also refuse to answer individual questions. Such a withdrawal or refusal **will not lead to any negative consequences for you**.

You can send your withdrawal of consent via email to the contact person named below. If you do so, all your personal data will be deleted immediately.

Contact person:

Interviewer:
Name: Matthias Vigele
Email: matthias.vigele@student.tuwien.ac.at
Student number: 01126171

I was told about the purpose, goals and terms of my involvement. I know about the procedure, all my questions were satisfactorily answered and I feel sufficiently well informed.

I know I can approach a responsible contact person in case of questions or other requests.

I hereby confirm to participate in the interview and give my consent to the aforementioned processing of my personal data with my signature:

_____ _____

Town/City, Date Signature

(b) The consent form's second page with contact information to ask questions or withdraw consent.

Figure 2.3: Interviewees were asked to sign this consent form.

- **Coding Unit:** Phrase or clause (word sequences).
- **Context Unit:** Other text sections within the same document, other documents from the research body, the implemented game as it was released to the public, additional literature research or the upcoming expert interviews.
- **Recording Unit:** All Documents. Ignore multiple codings per document.

Additionally, the following parameters were used while analyzing RQ1 (*How are accessibility features prioritized during game development?*):

- **Selection Criterion:** Text section must refer to the process of deciding on features (which are suitable to make games more accessible for people with motoric, cognitive, visual, hearing or speech disabilities). It can either reference the process for a specific feature or for accessibility features in general.
- **Abstraction Level:** Specific for individual accessibility techniques (e.g. name of technique), but project specific aspects and procedures need to be abstracted.

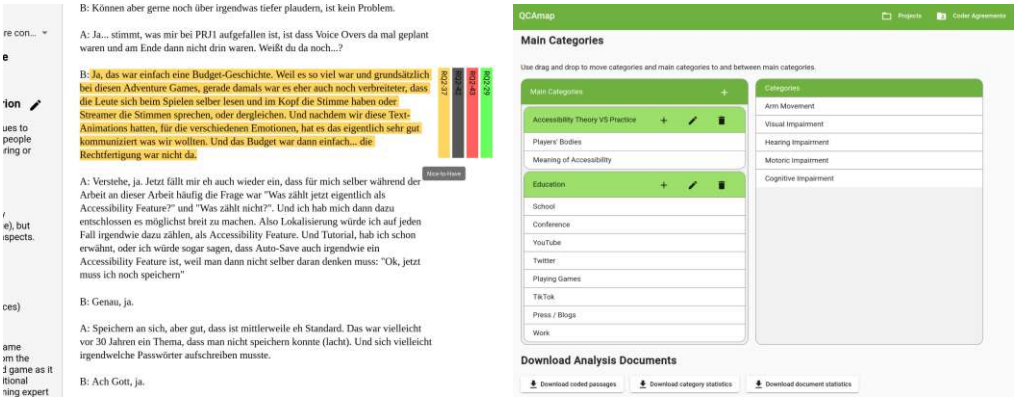
For RQ2 (*What accessibility features are considered must-haves (or only nice-to-haves) and why?*):

- **Selection Criterion:** Text section must refer to specific techniques to make games more accessible for people with motoric, cognitive, visual, hearing or speech disabilities. It must also refer to the importance of the technique and why this importance is assigned during game development.
- **Abstraction Level:** Specific for individual accessibility techniques (e.g. name of technique), but project specific aspects and procedures need to be abstracted.

For RQ3 (*What does the term "accessibility" mean to people working in the games industry? What educational backgrounds shape their understanding of the term "accessibility"?*):

- **Selection Criterion:** Text section must refer to the term accessibility or educational resources about the term accessibility.
- **Abstraction Level:** Types of accessibility techniques/settings and impairments or schools (high-school, university, etc.), media (books, web sites, etc.) and conferences which teach about accessibility.

Codes were assigned to individual interview transcript passages by applying these procedure rules (See Figure 2.4a). The codes were then combined to form overarching main categories (See Figure 2.4b). After multiple intra-code stability tests, the resulting category system was interpreted in the direction of its respective research question.



(a) Text segments which are assigned to a category are color-coded.

(b) Categories were assigned to Main Categories via drag and drop for RQ3.

Figure 2.4: Coding process and main category assignment inside QCAmap.

Topic	Guiding Questions
Term Accessibility	What does the term accessibility mean to you with regards to video games?
	How does it differ from ”usability”, ”affordability” or ”User Experience” for you?
	Or do you make no difference between these terms?
Education	How did you learn about this?
	Where did you learn about accessibility?
	How did your school/university teach about accessibility?
	How do video game conferences cover accessibility?
Expectations of players	What kind of body is required to play your games?
	What kind of players cognitive abilities are required to play your games?
	Why do you have these expectations of your players?
Personal Needs	What kind of accessibility options/settings do you personally use while playing video games?
	What kind of accessibility options/settings do you personally use inside development tools while working on video games?
	What kind of accessibility options/settings do you miss inside games and game development tools?
Feature Prioritization	How do you decide what features are must-haves?
	How do you decide what features are only nice-to-haves and can therefore be prioritized lower?
Target Audience	What kind of effect do you expect accessibility features to have on the target audience?
	Do you think the adoption of more accessibility features would widen the target audience (include more people) or make it more narrow (shift from one larger group of people to another smaller one)?
	Why do you expect this?

Table 2.1: The interview guide I used while conducting the semi-structured interviews.

CHAPTER 3

State of the art

This chapter reviews strategies and techniques to make video games more accessible for people with certain impairments and discusses the relevance of this thesis.

3.1 "Out-of-Loop" and "In-Loop" Failures

As a means to achieve more Universal Design, Aytemiz and Smith define six classes for failures which can occur while playing video games (Encoding Input, Decoding Output, Discovering Mechanics, Setting Goals, Planning, Execution) and further distinguish between "in-loop" failures, which were explicitly designed during the game's development, and the opposite, "out-of-loop" failures, which prevent players from executing certain intended gameplay mechanics. [AS20, p.9] Examples for such "out-of-loop" failures belonging to the decoding output class are "*If the player can not differentiate enemies from allies due to their colorblindness [...] not being able to read text on screen because of it being too small [...] or not being able to understand the natural language that conveys crucial information about the game.*" [AS20, p.4] But decoding output failures can also be "in-loop": "*consider the flashbangs in many first-person shooters or the screen obscuring attacks in Super Smash Bros [...]. Suddenly, if a player fails as they could not decode the screen because it was visually washed out, it is once again acceptable.*" [AS20, p.9] Aytemiz and Smith argue the explicit classification of failures "*can allow the designers to be more precise in deciding which failures act as barriers to enjoyment (and so should be removed) and which failures are essential for the game experiences (and so should be preserved).*" [AS20, p.3]

Being aware of this concept proved to be especially valuable while talking about the difference between highlighted and deliberately obscured game elements with interviewees from art and design for this thesis.

3.2 Accessibility Features for Players with Visual Impairments

Andrade et al. name several techniques to make video games more accessible to people with visual impairments. One such technique which employs abstraction is the use of "*earcons, abstract artificial sounds or sound patterns with varying metaphors and levels of articulatory directness*" [ARW+20, p.2], which can be used to represent arbitrary objects as audible sounds. However, as earcons often lack natural representations, their meaning has to be learned before they can be of any use for players [ARW+19, p.3]. Therefore "*sound-based metaphors constructed around auditory icons [...] may be easier for PVI* [1] *to associate with real-world phenomena than earcons*" [ARW+20, p.8]. Radar, sonar ("*for example, beeping more rapidly as the player walks towards a building*" [AS20, p.8]) and "white cane-like approaches" [ARW+20, p.2] as well as spatialised 3D sound in combination with head-tracking [ARW+20, p.6] can be used to communicate positions of objects and other entities to players, allowing navigation through virtual 3D space. Despite "*the skill required to master*" it [ARW+20, p.5], echolocation, "*a technique that combines production of sounds with an understanding of how those reverberate over surfaces and the time delays of the echoes produced to create a mental image of the physical surroundings*" [ARW+20, p.2], is considered to provide "*valuable information about the game world as it does in the physical world*" [ARW+20, p.5]. Text can be made accessible by representing it as sound via voice-actor-based audio recordings, speech synthesis or supporting screen-reader-software [ARW+20, p.6]. As people with visual impairments would use screen-readers to control their PC or mobile device anyway, games with screen-reader support offer improved user experience [ARW+20, p.5] and more streamlined event flows in case of game crashes. [ARW+20, p.8] Video game accessibility would also benefit from screen-reader support for development engines, like Unity [AS20, p.9], because it would allow people with visual impairments to build state-of-the-art games themselves [ARW+20, p.7]. To "*reduce overload on the auditory channel*", separate volume settings for music, sound effects and other audio tracks [ARW+20, p.9] or alternative output, like haptic or olfactory feedback [ARW+20, p.7], could be used. Voice-input as alternative input might be considered as well [ARW+20, p.8].

Accordingly, voice-overs, head-tracking-based spatial 3D audio and screen-reader-support were considered as relevant topics for this thesis' document analysis and semi-structured interviews.

3.2.1 Responsive Spatial Audio Cloud (ReSAC)

Swaminathan et al. propose with the *Responsive Spatial Audio Cloud* (ReSAC) a framework for creating video games which are accessible for people with visual impairments. [SPSA18, p.465] ReSAC includes a screen-reader, audio descriptions, defining objects as audible anchors to help orientation and "BodyScan", which allows players to iterate through all currently visible objects in spatial order. [SPSA18, p.466] Although

[1] PVI refers to "People with visual impairments"

Swaminathan et al. did manage to build a functional ReSAC game prototype in Unity, they had to use a self-written metadata container script to achieve this and acknowledge "*the evolution of game engines like Unity and 3D modeling platforms like Blender and Maya to provide support for accessibility metadata creation [...] is essential to minimize the load on game developers so that all mainstream games are eventually built to be accessible.*" [SPSA18, p.466]

It is one of the goals of this thesis to assess how well video game engines assist game developers while implementing accessibility features now, four years after Swaminathan et al. conducted their work. Statements by interviewees for this thesis' suggest game engine support for accessibility features, like screen-readers, to still be limited.

3.3 Accessibility Features for Players with Hearing Impairments

Sciberras' work highlights the importance of subtitles as a feature to make spoken words, sound effects and music in games accessible for people with hearing impairments, while also showing players' customization options on how these subtitles are displayed (font size, duration, text and background colour, etc.) can differ significantly between games. [Sci21]

This thesis aims to find out what reasons game developers might have for choosing to implement subtitles with less customization options.

3.4 Accessibility Features for Players with Dyslexia

Jaramillo-Alcázar et al. list the following techniques and features to make games more accessible for people with dyslexia: Use of simple language, subtitles, simple to difficult progression, training levels, reminders of objectives during gameplay, explicit visual rewards, repeatable voice-messages and texts, ability to pause the game while reading text, high color contrast between text and its background, large font sizes, avoidance of justified formatted text blocks, recommended font styles, low space between characters and lines, sentences between 15-20 words and use of groups to keep related information spatially together in one area. [JAVCCLM21, p.4-5]

As many of these techniques are often absent from games, this theses aims to answer the question of why game developers might decide against implementing them.

3.5 Relevance of this Work

This chapter provided several examples for techniques to make video games more accessible for people with visual impairments, hearing impairments or dyslexia. However, these techniques are often not put into practice by mainstream game developers. This thesis

therefore aims to analyze how accessibility features like these are prioritized during game development and why they are apparently often considered as negligible.

CHAPTER 4

Document Analysis Results

The document analysis was only able to answer a few quantitative aspects of RQ1 (*How are accessibility features prioritized during game development?*) and RQ2 (*What accessibility features are considered must-haves (or only nice-to-haves) and why?*). Based on the available documents, it was impossible to answer how they were prioritized, but the following features were part of the development planning:

- Support for multiple platforms (including DRM-free)
- Support for multiple hardware profiles (lower and higher performance end)
- Support for multiple input modalities (physical button or touch screen)
- Saving/loading/auto-saving/cloud-save progress
- Multiple Save Files
- Adjustable Options/Settings (Audio Volumes)
- Achievements/trophies
- Tutorials
- Localization in multiple languages
- Audio Cues
- Spatial Audio
- Visual Cues
- Subtitles/Closed Captions

- Voice-Over
- Text legibility/readability
- Debug Features (to display otherwise hidden information)

Project timeline documents were too abstract to provide information about the chronological prioritization of individual features. The version history of timeline documents showed some project milestones were delayed compared to initial project planning, but because there were no developer comments attached to this documents, the reasons for this shift as well as the impacted features could not be derived from this data.

Achievement/trophies related documents and the corresponding developer sections did not contain any information about accessibility considerations. This might have been the case because some games, like "The Last of Us Part 2", deliberately refrain from including difficulty-related trophies. [ste21, p. 10]

Summary documents of development team meetings only included decisions but did not describe how or why they were reached.

Testing related documents did not include any explicitly accessibility related test cases.

Although including questions related to controls and difficulty, documents including player surveys or questionnaires only included the blank surveys or questionnaires themselves, but no filled out forms with player feedback or information about how this feedback was incorporated into development.

The version history of one document showed that voice-overs were considered for one of the projects: "*We will do a voice over test case as soon as we have first dialogues and story ready.*" [1]. However, the finished game was ultimately released without any voice-overs. The answer to the question why this particular feature was prioritized lower was answered later during the semi-structured developer interviews (See Section 5.1.1).

During the analysis, documents describing development workflows for development team members were identified as essentially being tutorials for developers. As an example, the following is an excerpt of such a document: "*Excel-files holding text translations to be used in [this project] can be imported automatically using batch scripts found in [...]. Our loca toolchain consists of a custom-written tool for converting text assets & XLSX files between Excel and the engine, a Visual Basic script that automates the XLSX → XML process, and a few Windows batch scripts that drive the import/export process as a whole. [...] Before starting any of the scripts, make sure that both the Localization folder [...] and the asset folder [...] are up-to-date.*" [2]. The aspect of tutorials being an accessibility feature and these developer tutorials thus making game development work more accessible was later discussed during the semi-structured developer interviews.

[1] Document 3 from Project 1
[2] Document 17 from Project 1

CHAPTER 5

Qualitative Content Analysis Results

This chapter describes the results of performing qualitative content analysis on the nine interview transcripts.

5.1 RQ1 Results

The following main categories were identified while conducting qualitative content analysis based on research question 1: *How are accessibility features prioritized during game development?*

5.1.1 Available Resources

Budget was mentioned several times as being a factor when prioritizing features. Not just monetary budget, but also the available time budget in relation to the implementation effort for a given feature. Available resources (budget, time, readily available employees) were described as being dependent on company size and publisher decisions, which in turn might depend on features and requirements of digital game store platforms.

Time Constraints

Available time was mentioned several times as having an impact on feature prioritization: "*Thinking back to development, we were usually focusing on getting at least the basic features done within the available time. For ports, 100% was the minimum, and for other games, core features. There was pressure from producing [...] If we cannot finish certain things, they need to be cut.*" [1]

[1] Transcript of Interview 1, line 82 (Translated from German)

"*It went like this: "Do we want [this feature]? Oh, we would need five more days for this. Well, we only have a budget of two days. We don't do it. Let's kick it out."*" [2]

"*How much time do you invest into it? There are a lot of things you can potentially do for accessibility, but the game itself would not directly benefit from them. Then you have to ask yourself the question: What helps more? Investing three weeks of programming time to add new gameplay to the game, or two weeks for accessibility?*" [3]

"*I suspect this is usually done under time pressure. So you don't get certain things done [in time]. This is nothing you implement first, but later. And then it's the part that simply gets cut. I would suspect this is usually due to time pressure. If I want to implement an easy-mode, for example, things need to be balanced first to make it work properly. So it might cost extra time to implement. Designers are involved in everything, especially towards the end of a project. So it might not be possible for them to take care of this [extra balancing] as well.*" [4]

"*It might be a problem with budget related things, so you might say: "Yes, we would like to do this. And we are aware and think it would be cool, but we just don't have the time and the budget. Other things are more important right now. And with those, so many people are covered already. We will deliver it later."*" [5]

The available resources might depend on publisher decisions, which in turn might be influenced by the availability of certain platform features: "*I do think platform developers or platform holders hold a lot of power to create change in this sector. As soon as this would be there, publishers would be interested and would say: "Ok, we invest one month more budget, three person months, so accessibility features A, B, C and D for four different types of impairments are accessible. Because this would make us so-and-so more present for a specific market size." I would say that would be a good starting point which would make a difference.*" [6]

Indeed, some digital apps and games stores, like Google Play[7] or the Apple App Store[8], list accessibility as a criteria for "getting featured", i.e. getting better store presence, additional promotion and better visibility.

Available Employees

It was mentioned how the decision to implement certain features might depend on who is available at what time: "*I think the accessibility things which are cheapest to implement*

[2] Transcript of Interview 1, line 124 (Translated from German)
[3] Transcript of Interview 2, line 134 (Translated from German)
[4] Transcript of Interview 2, line 181+182 (Translated from German)
[5] Transcript of Interview 6, line 39 (Translated from German)
[6] Transcript of Interview 2, line 94 (Translated from German)
[7] "*High-quality apps and games also embrace Google Play's reach and scale, localizing for different regions and providing accessibility options for a diverse user base.*" - `https://play.google.com/console/about/guides/featuring/`
[8] "*Accessibility. Well-integrated features that provide a great experience for a broad range of users.*" - `https://developer.apple.com/app-store/getting-featured/`

are the ones where somebody is currently available for. Color blind mode for red/green blindness, for example. Telling an artist to change the color palette might be feasible, because they might not have much on their plate. Or the programmers might have less on their plate. So the area where somebody is available is the one where something can be done." [9]

"*Localization is easier for us to add. Also because we have many people who can easily translate if they are good at writing and if there is not too much text. Because it is their native language or they have very good language skills. [...] I think some things are added because they are easy wins. That's what localizations are for us. They are an easy win because the employees can do it. We don't need an external company, we can do it ourselves.*" [10]

Company Size

Bigger companies are described as having access to more resources, but smaller companies could benefit from the experience of bigger games and could implement accessibility on a more basic level because of lower expectations on feature quality.

"*Games which feature a real accessibility menu worth being called as such are usually very big titles. I think smaller titles have on average a higher number of or more frequently accessibility options, although small in scope. So it's either prioritized higher because it is personally important to you to implement it. Or you have a big studio with the money, time and person number to just do it on the side, so it doesn't have to be cut.*" [11]

When asked about the high budget numbers, like the 220 million dollar budget of *The Last of Us Part 2* [Car23], one of the interviewees answered: "*The big companies do big games. They'll need more money to put the accessibility options in it. Smaller companies do smaller games, so probably the cost of the accessibility options is also smaller. So it might be more resource heavy for the smaller teams, but at the same time they can use the experience from other people. And I think the accessibility right now is at such a state that people want it to grow and want more games to be accessible, so you don't need to invent the wheel from the start. You can turn to already working tools or schematics or ideas. [...] the bigger companies also make it for the bigger games for sure, but also the quality needs to be very high, that's why the budgets grow very high. All the options need to be perfect, because the expectations are much higher than for smaller or medium size games.*" [12]

"*Of course it's also useful when platform operators can provide things. So you don't have to do everything by yourself. [...] Naturally, this also makes it affordable for small*

[9] Transcript of Interview 2, line 182 (Translated from German)
[10] Transcript of Interview 3, line 193-211 (Translated from German)
[11] Transcript of Interview 6, line 45 (Translated from German)
[12] Transcript of Interview 8, line 101

studios to have any kind of support for something, because not everyone can invest the time needed to implement lots of accessibility features." [13]

"*Color blind is something that just doesn't really happen like consciously in the sense of like "we don't plan this", it is just part of the process, which I think is a really good way of making a game more accessible. Because with a lot of other things: If you plan them in as a feature, then it gets tough if you're in a relatively small developer or have a small scope. So, honestly, I would love it, if our games have difficulty options, if they have options for controller mapping, basically so that people can tweak the experience so they are able to enjoy it. But it depends largely on the effort required to implement these features."* [14]

Two interviewees described how accessibility features might only have a big impact for big studios or big publishers: "*I think opening the market for this target audience is a marketing concern. When they say "That costs so much, we won't be able to return it in revenue" then shareholders will be against it. It doesn't matter if you want it or not in this case. Most [companies] are stock corporations after all. I'm thinking about studio sizes where this really has an impact. I mean, if we would be the leader in [accessible games], it might be mentioned in the tech section of [a local newspaper] or we would receive another [...] award. But there'll never be a 30 metres high poster of us reading "[We] are accessible!" hanging on the Times Square."* [15]

"*There were color blindness checks already built into the games. You could activate these anytime to be able to see the game in the three respective modes. We also had lots of UI requirements concerning scaleability and such, so [this publisher] puts a lot of emphasis on this. I think the bigger publishers also have the money to do so. For them, it also makes a real difference."* [16]

Monetary constraints

Available monetary resources were mentioned several times as having an impact on feature prioritization:

"*I think I can at least encourage people to think about adding a feature. But I don't know how much I can influence this, because it also depends on the budget. I don't now how important this is for the publisher. Probably not so much. I would say this is a money matter."* [17]

"*[The situation] improved recently because of popular Triple-A titles with the corresponding budget, like Last of Us or God of War. [...] I didn't check myself yet what they did and how they did it. To make it accessible for blind, physically or motoric impaired people. A lot was invested, a lot was done, a lot of research was conducted. I think this fails most*

[13] Transcript of Interview 2, line 166-170 (Translated from German)
[14] Transcript of Interview 5, line 65
[15] Transcript of Interview 1, line 114 (Translated from German)
[16] Transcript of Interview 9, line 193
[17] Transcript of Interview 3, line 47 (Translated from German)

of the time because the budget simply doesn't exist, because this target group might not be suitable for marketing a game for them. It seems to me that most of the time, it's really popular IPs who pick this up and say: "Hey, we are accessible and can make the game easier and communicate the story to people with impairments." [18]

One of the interviewees argued how independent hobbyist developers might have it easier to implement accessibility features, because they do not depend on a publishers budget: "*I think it can be easier if you are an indy developer, like somebody who develops alone inside their garage. That is because as soon as you have a publisher who is not too keen about [accessibility], budget becomes important again. So not only platform holders and developers, but also publishers play a role. And when you say during budget calculation: "We might want to calculate one additional month to implement accessibility features, because we don't want to cheap out on these too much." If you don't use your own budget to finance it independently during your free-time, it'll probably often depend on the availability of the budget. Sadly.*" [19]

Not enough monetary budget is also named as the reason why voice overs were ultimately not implemented for one of the projects which were part of Chapter 4's document analysis: "*It was simply about budget. Because there was so much [dialog], and with adventure games in general and especially back then, it was still more common for people to read for themselves and hear the voices inside their heads, or let streamers do the voices. As we had text animations for different emotions, it did communicate what we intended very well. There simply was no budget, no justification.*" [20]

"*I think this was solely due to budgetary reasons. During [the next project], there was a budget for it. And for that one we did at least English voice overs.*" [21]

5.1.2 Effort

The effort to test and implement a feature was named as having an impact on feature prioritization.

Test Effort

Especially for people with motoric impairments, Microsoft offers the Xbox Adaptive Controller[22] for its Xbox platform, and Sony likewise recently launched its Access controller[23] for the PlayStation platform. Both feature buttons which are designed in a more accessible way compared to default controllers, AMPS compatibility to mount it in a stable way, as well as several standardized 3.5mm ports to connect external accessible inputs, like switches or joysticks.

[18] Transcript of Interview 4, line 23 (Translated from German)
[19] Transcript of Interview 4, line 66 (Translated from German)
[20] Transcript of Interview 6, line 123 (Translated from German)
[21] Transcript of Interview 10, line 163-165 (Translated from German)
[22] https://www.xbox.com/en-US/accessories/controllers/xbox-adaptive-controller
[23] https://www.playstation.com/en-us/accessories/access-controller

(a) Xbox Adaptive Controller. (b) Access controller.

Figure 5.1: Accessible controllers for Xbox and PlayStation. They also serve as adapters for conventional buttons, switches and other accessible inputs.

Test effort was mentioned several times as having an impact on feature prioritization: "*One has to mention Xbox as pioneers with their freely configurable controller, although I have never seen it in the wild yet. And now Steam or Sony are following suit with such a controller. That's going to make the whole thing interesting again. [...] As a developer, you would have to obtain the device for testing, to see how it works, and if it works the way you imagine it. [...] Especially on PC for people who are blind, with a braille display which you cannot use as a non-blind person. You cannot confirm if it really works. You would need appropriate play testers and would need to decide to conduct play tests with appropriate target groups. So people with visual or hearing impairments can try if it really works that way. But this probably only works very rarely.*" [24]

"*I think [the required budget] grows relatively fast. The scale for good accessibility. Because you have to start thinking about it very early during design. You need the tools for it, and there is of course also more effort for testing. It has to work after all. That's also the reason why we are trying to do this [template] thing. So we have certain accessibility essentials automatically in every new project.*" [25]

"*I often think the following is a pity in video game development: I know lots of settings, cheats and similar things are already there during production. Many things are experimented with, so you can do things one way or the other. These are then not put into the public options for various reasons. Maybe because the implementation wasn't pretty enough. Or because it wasn't tested, as it was just a debug feature. But I think that's a pity. You could make so much more out of it.*" [26]

Implementation Effort

Implementation effort was mentioned several times as having an impact on feature prioritization:

[24] Transcript of Interview 4, line 70-78 (Translated from German)
[25] Transcript of Interview 9, line 167-173 (Translated from German)
[26] Transcript of Interview 6, line 85 (Translated from German)

"*Things which are super easy to implement are simply [done], for example font size, subtitle background, increased contrast, transparent or opaque backgrounds. Those would be the easiest things. They don't cost much.*" [27]

"*But also depending on how difficult the thing would be to implement. Color blindness, it's easy to catch and implement early on. But, for example, completely changing the controls after you learn some people might not be able to play it either on the phone or VR, then it gets tricky how much resources you can focus on that, and depending on the state of the project.*" [28]

"*The workflows are like this: You don't really commit to [values] but add colors later, and then tweak it again. Actually, you would have to permanently test it again, but that's often not done. It is considered more, if there is a requirement for it. I think not enough emphasize is put on this.*" [29]

"*I had a game idea about sign language once. I took a look at a few things and it's extremely difficult, because you need custom animations for everything. If you synchronize mouth movement animations [with voice over], you only approximate. [For sign language] you need custom things, probably motion capture, for everything spoken. So it is a huge effort, although it would be super awesome.*" [30]

"*Because you mentioned cognitive, that's also difficult. In general, I haven't seen difficulty levels being implemented at large scale, because doing them is certainly an effort. And I also didn't see that adding different modes was considered anywhere. Instead of just making certain [game sections] more difficult or easier.*" [31]

"*I think it's easier with Mario Kart, for example: There you have settings to prevent you from falling off the track, or you don't have to accelerate yourself [...], controls customization, so you can either change directions via the joystick or by tilting the controller. [...] Racing games are more suitable for this. To make it easier. But puzzles [...] I find them more difficult [to adapt].*" [32]

"*Even for the cheapest projects, with almost no UI text, you would have to localize the UI. Those are only ten texts, but even those would have to be localized. And the more text you have, the more necessary it becomes to do it. The less you have, the easier it gets. That's why developers don't have the option not to do [localization], because it gets so easy anyway.*" [33]

Using simple language was also described as requiring additional effort: "*Even if it's a language you know, it can be of varying difficulty. [...] If you use certain jargon. [...] It's not just localization, but also about how difficult you write. How difficult you localize. [...]*

[27] Transcript of Interview 4, line 104 (Translated from German)
[28] Transcript of Interview 8, line 67
[29] Transcript of Interview 7, line 31 (Translated from German)
[30] Transcript of Interview 6, line 205 (Translated from German)
[31] Transcript of Interview 3, line 41 (Translated from German)
[32] Transcript of Interview 3, line 137-161 (Translated from German)
[33] Transcript of Interview 2, line 74 (Translated from German)

Also if you have terms which you do not translate. [...] I tried to translate it to German. [...] I would say that's not good. That one was in English. You should definitely translate it, even if it's a proper name. Because if you don't know English at all, then it's just a bunch of letters to you. That's super-weird." [34]

"*Ideally, PlayStation, Xbox, and whoever else would have all kinds of features, which would be easy to implement and use. [...] I don't think many things are easy to implement yet. At least I haven't seen any."* [35]

One interviewee described how a standardization of game user interfaces could reduce the effort to implement more accessible UIs. However, they also raised concerns about how feasible such generic UIs are, if UIs tailored to the game are desired: "*Having general tools for certain things which are pretty easy to add. Let's take subtitles as an example. If I look at the VLC video player, I can turn subtitles on at any time. And they always look the same. Independently of the video in the background. With games, I assume, designers and artists have more influence on how subtitles are supposed to look like. And that's why every project can have its own, and that's difficult to implement. It would be easier, if you could rely on the assumption [the subtitles] just need to be there. But it gets more difficult as soon as people have an influence on how it should look like. [...] Even if you show text surrounded by a box which fits the game. [...] What I mean is this: The more you want to adapt it to the game, the more effort it becomes and the more likely it becomes to get cut. It is easy to find a solution which works for many or all games if it is generic and not-so-pretty. But people might complain then: "It's not looking so pretty. I want it to look prettier.""* [36]

Such standardized UIs could access and use fonts from the operation system or platform the game is played on to display text. There would be no need to explicitly add dyslexia-friendly fonts to a game, for example, because these would be readily available: "*Ideally, platforms like Unity, PlayStation etc. would offer things per default so you can add them if you want to. So platforms would principally provide these features. Then they could offer arbitrary fonts. Everyone could configure it the way they want to. If a player is satisfied with this standardized design, it will be applied instead of the game-specific one. So players are provided with the choice between the game's solution or the external one. And even if a developer would not implement, for example subtitles, the standardized solution might still work."* [37]

Native platform support for accessibility features in general is described as reducing the effort needed to implement them for games: "*The screen reader on the PS5, for example. I don't know about the linking, but if it is easy to integrate then people don't have much of an excuse. "Why didn't you do it? It is so easy after all!" If you have to do everything by yourself and it's a lot of work: "Well, let's just cut it." These excuses disappear and*

[34] Transcript of Interview 3, line 193-211 (Translated from German)
[35] Transcript of Interview 2, line 208 (Translated from German)
[36] Transcript of Interview 2, line 210-226 (Translated from German)
[37] Transcript of Interview 2, line 210-226 (Translated from German)

pressure not to cut it builds up, because there is so little there [to do]." [38]

"*So console platform operators root this system-wide so deeply, so you, as a game developer, simply have interfaces. So you access this interface and fonts, for example, are enlarged or contrasts enhanced, system-wide. Or the operating system adds a color-blind filter on top of everything. [...] The more such features are offered by the system, the less I, the developer, have to think about it. I just forward the information to the API so I can implement it.*" [39]

"*Implementing languages into a game is much easier. The most default tools like Unity and Unreal have built-in tools for language. So, if you don't oversleep and realize late in production that it would be good to localize your game, then it's much easier to put it in and you just hire a localization company to translate all the text and you just copy and paste it. So, there is very little overhead on that. And for the other customization or accessibility options, that depends on the game. So, that's where the part comes: Is there something that's already on the market that somebody did and we can copy it? But then we need to do it. For the localization part it's something you do once for all the languages. So, the potential outcome is much more profitable, because you just do one thing and you can have 100 languages, if you need. And for the accessibility options one option is one option, and you cannot copy it for the next few. At least not in all cases.*" [40]

Code reusability was often mentioned as having an impact on accessibility feature prioritization. If code could be reused from another project to implement a feature into a new game, this would reduce the required effort significantly: "*About color blindness, to have different configurable modes. That was implemented for our [template]. I think that's cool. The settings are already part of [the template] and have a UI. They don't look pretty, but they work. I like how it's already there, because you cannot cut it that way. They are already there and I like that. [...] Also because it is treated as a fundamental pillar, so the game is build on top of it instead of the other way around. Like: "Let's do the settings!" At the end, saying: "Let's see if we have time left for this." I like that time is spent on things like that. [...] It means I don't have to do it and can do other things instead. Things which are not that easy to generalize, like difficulty levels. For these you have to hook into the game to see "What can I make easier?" or "What can I make more difficult?*"" [41]

"*And we had instances when people said "I'd love to be able to play the game, but I'm having this condition..." And if we saw that it was easy to do and just beneficial for the game and other people would also do that and it would save time for another project, then we added those. The additional positive thing was: Once you do it once for the first time, it's easy to do it for the next project, and the next, and the library of those options grows. So, the earlier you start, the easier it is to add more options.*" [42]

[38] Transcript of Interview 2, line 232-234 (Translated from German)
[39] Transcript of Interview 4, line 100 (Translated from German)
[40] Transcript of Interview 8, line 107
[41] Transcript of Interview 3, line 215-223 (Translated from German)
[42] Transcript of Interview 8, line 31

"*I think it's fundamental to already consider this during planning. You need certain processes during planning, then create tasks for it. It's kind of automatically considered by design if there is a task for it. But I also think that, of course, you don't need to think up things which are already there. You just need to configure them correctly.*" [43]

The required effort to implement a feature was described as depending on how early the feature was considered for implementation: "*I think it's the wrong way to say: "We have this game which is pretty successful and we have a budget. We want to expand the target group a bit and want to retroactively implement additional accessibility features." I think it's similar with a port, when you say: "We have been focusing on PC, and now we will port this to consoles." But no work has been spend on readability or controller input at all, so you need to deep dive into details to retroactively hack this in. I think it's the wrong approach to just add it on top. You have to consider it right from the beginning. It's half-hearted otherwise.*" [44]

"*It seems to me that accessibility is something which is added late to design and planning processes in general. This is actually a problem because you should think about it already during the design process. What elements can be depicted differently, and for which ones is it critical to be done this way? I think it's still prioritized as very low.*" [45]

"*If the property to be accessible is not a USP or pillar of the game already, then it's actually considered very late during planning. Or often rather relatively. You look at test groups, especially if it is an online game. Then you have to address it. But not much is changed as long as there are no people complaining about something not being alright.*" [46]

5.1.3 Core Features

Whether a feature is considered to be a core feature or not was named as influencing its prioritization.

"*Thinking back to development, we were usually focusing on getting at least the basic features done within the available time frame. For ports, 100% was the minimum, and for other games, core features. There was pressure from producing [...] If we cannot finish certain things, they need to be cut. We talk about cutting a lot. [...] If I consider a car racing game and say "Ok, we've got the car now" and then we start saying "We don't need the rear mirrors" and "We are also not going to do the custom aerodynamic body work" until we reach "Fine, we'll afford the steering wheel, but can we [let the car drive on] three wheels instead?" I think that's where we are instead of "Yes, we'll add a spoiler, stickers and little flags, and also a backup driver and a net for the door". So we basically didn't manage to do anything related to polish or anything extra most of the time.*" [47]

[43] Transcript of Interview 8, line 175-181 (Translated from German)
[44] Transcript of Interview 4, line 49 (Translated from German)
[45] Transcript of Interview 9, line 115 (Translated from German)
[46] Transcript of Interview 9, line 183-185 (Translated from German)
[47] Transcript of Interview 1, line 82 (Translated from German)

"*How much time do you invest into it? There are a lot of things you can potentially do for accessibility, but the game itself would not directly benefit from them. Then you have to ask yourself the question: What helps more? Investing three weeks of programming time to add new gameplay to the game, or two weeks for accessibility?*" [48]

"*Yeah, so it all relays to the core gameplay experience. So, what is part of the core mechanic gets prioritized, anything outside of that is essentially a nice-to-have. So we determine of course the scope before we start the production, we make a budget for that. Usually we include some accessibility options in there, such as language, such as subtitles. Those things just make sense, I feel, from a marketing perspective as well. I think that's widely accepted within the industry to be like regarded as a good idea.*" [49]

"*I often think the following is a pity in video game development: I know lots of settings, cheats and similar things are already there during production. Many things are experimented with, so you can do things one way or the other. These are then not put into the public options for various reasons. Maybe because the implementation wasn't pretty enough. Or because it wasn't tested, as it was just a debug feature. But I think that's a pity. You could make so much more out of it.*" [50]

Marketability

Interviewees described how a feature is usually considered a core feature, if it is believed to be both suitable for promotion and to increase the number of sold units: "*Marketing [decides what's supposed to be part of the product]. [...] It's becoming more and more mainstream in the video game industry. [...] Especially people with physical impairments who are not super mobile are certainly looking for alternative forms of entertainment. Reading books, playing video games, watching TV. If we manage to reverse it, to achieve that society considers [missing] accessibility as bullying against other people. [...] If we change it, from one side being responsible for complaining, to the other side being responsible for delivering. Instead of saying "You in your wheel chair need to make sure a ramp is built so you can get up there" it should be "We are sorry for building wheel chair incompatible houses". When society reached this stage, people will say "Games without these measurements are unattractive". And marketing will recognize this. They will say "We need these features to sell our games." They will talk about what features are necessary. There will be huge surveys to find out what impairments people really have, and then things get deliberately tailored. Making sure it works, then market it accordingly. And then it will be established. But as long as people can avoid it and can keep selling their games without any financial drawbacks, without getting condemned, this probably will not be put into action.*" [51]

[48] Transcript of Interview 2, line 134 (Translated from German)
[49] Transcript of Interview 5, line 65
[50] Transcript of Interview 6, line 85 (Translated from German)
[51] Transcript of Interview 1, line 104-110 (Translated from German)

"*I don't think this is a question about good-will and that people will say they do it because they just realized they want to make it available to people out of generosity. But if it sells and there is no other way, it will be done.*" [52]

"*It adds more value, as all of these features are added on top of existing ones. And this value will be accepted by people. We are eight or nine billion humans, and if I think about how 150 million are in Russia, 300 million in America and 700 million in Europe... Asia is a separate market. Africa is a separate market. So if we look at this as a thing for customers, then I don't know how many of this billion of Europeans and Americans are actually affected by color blindness, input issues or similar. But I think opening the market for this target audience is a marketing concern. When they say "That costs so much, we won't be able to return it in revenue" then shareholders will be against it.*" [53]

"*Localization is kind of a must-have. Inevitably. There are many people you do not reach if you do it in English only.*" [54]

"*[The situation] improved recently because of popular Triple-A titles with the corresponding budget, like Last of Us or God of War. [...] I didn't check myself yet what they did and how they did it. To make it accessible for blind, physically or motoric impaired people. A lot was invested, a lot was done, a lot of research was conducted. I think this fails most of the time because the budget simply doesn't exist, because this target group might not be suitable for marketing a game for them.*" [55]

"*I think it can be easier if you are an indy developer, like somebody who develops alone inside their garage. That is because as soon as you have a publisher who is not too keen about [accessibility], budget becomes important again. So not only platform holders and developers, but also publishers play a role. And when you say during budget calculation: "We might want to calculate one additional month to implement accessibility features, because we don't want to cheap out on these too much." If you don't use your own budget to finance it independently during your free-time, it'll probably often depend on the availability of the budget. Sadly.*" [56]

"*As soon as [such a store feature] exists, publishers will be interested and say: "Ok, we'll invest three more person months to have accessibility features A, B, C and D for four different types of impairments. Because that will make us so-and-so more visible for this market size.*"" [57]

"*But if you don't know anybody then you just don't think about it. So I think it's that, and I think also, even if people think about it, they gonna think that the market is much smaller than it is for speakers of a different language, for example. So in this sense, it*

[52] Transcript of Interview 1, line 110 (Translated from German)
[53] Transcript of Interview 1, line 114 (Translated from German)
[54] Transcript of Interview 2, line 70 (Translated from German)
[55] Transcript of Interview 4, line 23 (Translated from German)
[56] Transcript of Interview 4, line 66 (Translated from German)
[57] Transcript of Interview 4, line 94 (Translated from German)

can also be kind of a business decision to make the choice of "Ok, we are gonna add more languages, but we are not gonna add accessibility features"." [58]

"*And I think recently it was also a big topic by the very big companies, like Santa Monica from the God of War, to have a big accessibility team working on the games, and I think Ubisoft has also lots on that plate. So the bigger players are also looking into that, because: More options, more players. I mean, someone plays the game and sees the options are in there, and someone else says: "Oh, I wish I could play this, because I don't like this...", then they say "But you actually can, turn off the spiders!" or "make it that there is no combat" and stuff like that, and "Ok, I can try it" and then it goes and more and more people can play.*" [59]

"*If the property to be accessible is not a USP or pillar of the game already, then it's actually considered very late during planning. Or often rather relatively. You look at test groups, especially if it is an online game. Then you have to address it. But not much is changed as long as there are no people complaining about something not being alright.*" [60]

"*If I imagine them realizing "Ok, implementing this would mean an effort of 2 million more" while there are maybe 100 people who would buy it, then it wouldn't be worth the effort. Companies utilize surveys after all. They do marketing surveys all the time to find groups of customers.*" [61]

Number of affected players

The number of how many players are affected by a certain impairment who would benefit from implementing an accessibility feature was also mentioned as influencing what is considered a core feature: "*I suspect that's one of those features which get cut first. Because "We can live without it." If somebody is color blind and the game is not fundamentally required to use red and green everywhere, then it's also playable like that. It's not ideal, but there is also the fact that many things are already automatically offered by the consoles on PlayStation and Xbox. That means if you would implement something like that, you would implement it for PC only and not for the other platforms. So an even smaller group would benefit from it.*" [62]

"*It might be a problem with budget related things, so you might say: "Yes, we would like to do this. And we are aware and think it would be cool, but we just don't have the time and the budget. Other things are more important right now. And with those, so many people are covered already. We will deliver it later.*"" [63]

"*So I think from the project management point of view and being pragmatic, I think the more people have a certain condition that we could remedy, that's the priority. So, if we*

[58] Transcript of Interview 5, line 89-91
[59] Transcript of Interview 8, line 97
[60] Transcript of Interview 9, line 183-185 (Translated from German)
[61] Transcript of Interview 1, line 124 (Translated from German)
[62] Transcript of Interview 2, line 142 (Translated from German)
[63] Transcript of Interview 6, line 39 (Translated from German)

know there's a lot of people that have color blindness that's definitely a higher priority than something that would affect a less bigger group." [64]

"*This was, for example, the small group that I don't think would like to play those games. So, we never heard that someone would like to play the game, because they heard it's nice, but they are blind so they cannot. [...] But I didn't have the chance to work with that. We had people with motoric impairments. So they were either stuck in a wheelchair, could play with just one hand, and even played our games on conferences and fairs like that. So, we already saw if it's working and they were always happy, if it was covered. But for the blind people, unfortunately no."* [65]

"*I can imagine the group of players with more serious issues, like audio visual impairments or controller issues, as still being very small. That's probably not having much of an impact. But soon, the group of players who are still playing and already older will be much bigger in comparison. As those usually have both feed on the ground and money to spend on games, they are certainly a paying target group which shouldn't be neglected."* [66]

Development Conventions

Orienting on games from other developers, competitors and conventions was named as a possible strategy when deciding on core features: "*I think they are selected by asking "What is common?" By looking at indy games or smaller games. What is really included in the settings? What can be adjusted? What might appeal to the masses? Like: "People really like adjusting the difficulty. We have to add this, because it increases the range [of people] who will play our game for a longer time." And that's why it is included. I think that's the selection process."* [67]

"*Usually we include some accessibility options in there, such as language, such as subtitles. Those things just make sense, I feel, from a marketing perspective as well. I think that's widely accepted within the industry to be like regarded as a good idea."* [68]

"*I don't use super-fancy fonts in general. There are standard fonts which are also used in magazines and such. I believe these are made to be well readable. I don't know it for sure, but I assume the established ones are well-tested."* [69]

"*And we had instances when people said "I'd love to be able to play the game, but I'm having this condition..." And if we saw that it was easy to do and just beneficial for the game and other people would also do that and it would save time for another project, then we added those."* [70]

[64] Transcript of Interview 8, line 67
[65] Transcript of Interview 8, line 77-79
[66] Transcript of Interview 9, line 149
[67] Transcript of Interview 32, line 97 (Translated from German)
[68] Transcript of Interview 5, line 65
[69] Transcript of Interview 7, line 123 (Translated from German)
[70] Transcript of Interview 8, line 31

"*We could call it research, as we checked other games and saw what people talked and thought about them. So usually there was, when a new game got out and it was a big contender for the biggest games in VR, then we checked: How did they do this? And: How they did they do that? And what were the comments on YouTube and on Reddit and stuff like that. So, the community was very vocal about those changes and needs, so it was very easy to get those and then see: Who would like what?*" [71]

"*The big companies do big games. They'll need more money to put the accessibility options in it. Smaller companies do smaller games, so probably the cost of the accessibility options is also smaller. So it might be more resource heavy for the smaller teams, but at the same time they can use the experience from other people. And I think the accessibility right now is at such a state that people want it to grow and want more games to be accessible, so you don't need to invent the wheel from the start. You can turn to already working tools or schematics or ideas and you see "Can we implement that into our game?" - "Yes. No. Maybe. Or later" and that's the flexibility of the smaller teams.*" [72]

"*It feels to me like it is perceived like the history of features. The longer it has been around, the more you think it is important. Subtitles exist for a long time, that's why you do them first.*" [73]

Age Rating

Age rating was mentioned once as influencing the decision of classifying a feature as a core feature: "*That was also a topic. Are we going to show blood? But that was not because of accessibility but because of age rating.*" [74]

5.1.4 Design Stability

Design changes during development were mentioned several times as having an impact on feature prioritization.

One interviewee argued how it might be beneficial to include accessibility in the game's design early on: "*I think it can make sense to include [accessibility] sooner. With a color palette, defining which simple colors should be used for which characters, for example. If this is implemented early on by the artists, it's already part of the design, automatically. So nobody needs to take care of it afterwards. Retroactively changing the design might be difficult, you can do less at [a later] stage, so you might get better results if you include it sooner.*" [75]

But they also explained how this might not be done because the game's design might be expected to change during production: "*Realistically, there are certain things you*

[71] Transcript of Interview 8, line 69-75
[72] Transcript of Interview 8, line 101
[73] Transcript of Interview 9, line 115 (Translated from German)
[74] Transcript of Interview 3, line 283-293 (Translated from German)
[75] Transcript of Interview 2, line 190-192 (Translated from German)

wouldn't implement per default because you might not need them later on. [...] In essence, if you plan things too soon you already need to know what the game will be capable of exactly. A platformer, for example, will require certain motoric reflexes from players. Maybe the idea in the beginning was to have platform precision, but then it gets cut later on. Suddenly, motoric accessibility settings are not necessary any more. If you already implemented them, you did it without necessity. So some accessibility things can only be implemented when you are sure about them: "Ok, this will be part of the game." [...] Accessibility things often depend on other things. And that's why it's sometimes reasonable to do them later." [76]

The implementation of some accessibility features was described as requiring a design change or the addition of a separate game mode: "*Maybe you would need to completely redesign some parts of the game. I don't know what you would focus on, that highly depends on the game. Puzzle games come to my mind. I'm not sure if puzzle games would still work, if it's possible to redesign them this way. If the challenge would be the same, or if you would need to completely change the challenge so it's not the same anymore. The question is if this is even possible for some games.*" [77]

"*To be honest, no, because almost all of the games we did were adventure/action games, so the theme for those would be much more fast paced. This was, for example, the small group that I don't think would like to play those games. So, we never heard that someone would like to play the game, because they heard it's nice, but they are blind so they cannot. But I can imagine some less action-y games could definitely work with that, especially some adventures, but more like in the walking-sim direction. That uses walk around, listen to people and explore the world. [...] I can definitely imagine that. It wouldn't even be that difficult to implement, but how would the rest of the gameplay work with that?*" [78]

Notably, people working in the tech and production departments were the people who were concerned about impacts on game design the most, while game designers mostly welcomed and argued in favor of more accessibility features.

One interviewee argued how accessibility features can enrich a game's design, even for people without any impairments: "*I think even players without any accessibility related issues benefit, because they will face more interesting games. Because the challenge lies somewhere else. I think, these days, players without accessibility issues as well, don't want to play a game anymore which is all about pressing the dodge button at the right moment. Because it is just too silly. Players can feel the improvements caused by lifting the challenge to a higher level, even if they don't realize why that is. [...] An example for this would be when first-person-shooters found their way onto consoles. The main argument of PC gamers to call this move insane was the fact you could aim way better using a mouse. So the developers said: "Alright then, our challenge will not consist of aiming very precisely anymore, but we'll add enemies who behave in a more clever*

[76] Transcript of Interview 2, line 192-200 (Translated from German)
[77] Transcript of Interview 3, line 137-161 (Translated from German)
[78] Transcript of Interview 8, line 77-87

way and do things which you must solve by choosing your weapon and positioning your player avatar correctly." Halo was one of the first games using this dedicated game design approach. They didn't want rotational gameplay to be relevant anymore, they wanted positional gameplay instead. Where are you compared to the enemies, to make it interesting. And you actually don't need a mouse for that. And that's why it was one of the games that made people say: "This is so interesting and it plays completely different compared to other games" because they removed this skill component. This will also happen in other sectors. I think these timing windows will slowly disappear or become less relevant. Instead, you will have to ask yourself "What do I really want?" instead of "How do I aim to hit?" [...] I think [accessibility] supports creativity, if you are aware about how you think in conventions. You need to question all that. " [79]

5.1.5 Feature Visibility

Making players aware of the existence of accessibility features before purchasing a game was mentioned several times as an important factor. Features might be prioritized higher, if platforms provide means to promote accessibility features.

"*I think the problem is: How are people informed about which games have what features in terms of adjustable settings? [...] I mean, yes, if you watch [let's play videos], in case there are any from this game, which depends on how small or big it is. [...] Or screenshots. I don't think that's something which gets mentioned somewhere in a description, like: "We have these settings...". That's why I think that it will widen the target audience, if people find out about it. I think people for whom this is important or who need it are looking out for it. Because why should I buy a game I cannot play?*" [80]

"*I think the problem is that it's communicated as a minority issue. If journalists or other groups talk about accessibility on the internet, they do it to focus on it because it is important to them, or they put the emphasis on it. And then it feels to other people like it concerns only this bubble. If able-bodied go: "Oh, there are accessibility options. Nice, I'll adjust a few things" they don't communicate how it is helpful for them as well. It's just not mentioned and the review is about gameplay instead. That's also fine, but it would have been nice to mention it, if they take a look at it anyway.*" [81]

"*I think that's because it's not advertised a lot. Except for AAA titles, where a lot has been invested into accessibility, after all. But I think it does widen the target audience correspondingly. Especially trough word-of-mouth recommendations or influencers, like: "Hey, this game has a lot of accessibility settings. It's super-playable by deaf people and can also be played by people with motoric impairments."*" [82]

Good accessibility feature visibility appears to be still the exception in digital video game stores. The Xbox games store features a total of 20 different accessibility tags in four

[79] Transcript of Interview 9, line 153-161 (Translated from German)
[80] Transcript of Interview 3, line 105-109 (Translated from German)
[81] Transcript of Interview 6, line 85 (Translated from German)
[82] Transcript of Interview 4, line 45 (Translated from German)

categories ("Gameplay", "Audio", "Visual", and "Input" - See Figure 5.2a). Players can use these filters inside the store on Xbox consoles, inside a dedicated mobile app or inside a web browser[83] to only display games which support accessibility features fitting their needs. Likewise, games on the PlayStation store can be tagged with over 50 different accessibility tags in six categories ("Visuals", "Audio", "Subtitles and Captions", "Controls", "Gameplay" and "Online Communication")[Nis23]. However, these tags are currently displayed on store pages of individual games on PlayStation 5 consoles only (See Figure 5.2b) and absent from the web browser or dedicated app store versions. Additionally, it is so far not possible to search or filter by these tags.[84] The GooglePlay store supports 6 different "A11y tags" ("Screen reader-friendly", "Visual assistance", "Hearing assistance", "Learning disability", "Motor assistance" and "Accessible communication")[85], but also no easily usable way to search or filter apps and games by using these tags. Apple's App Store, Nintendo's eShop[86], Valve's Steam[87], CD Projekt's GOG[88] and the Epic games store[89] do not appear to support any accessibility tags, filtering, or search support.

5.1.6 Responsibility

Several entities were described as having an influence on feature prioritization: The individual developers, clients, publishers, engine developers and platform holders.

Individual Team Members

Personal initiative by individual developers was described several times as having an impact on feature adoption: "*I can remember how one of the first things [one of our designers] came up with was about color blindness and dyslexia. To use special fonts and adjust letter spacing. [...] We did some testing and then [our designer] implemented this alternative font and we switched to it.*" [90]

"*I kept hearing about people who can also use it on PC despite not using a controller. It's explicitly "either or", it only works after switching to controller input inside the game, and then you can't do anything with mouse and keyboard anymore. Because that would be too much of an advantage. But to be honest, I'm more interested in the technical aspects than gameplay here.*" [91]

"*The only thing I worked on is our [template] here in the [company]. This color blind mode, but that's not really a project. At least not one which actively uses it. [...] One [of*

[83] https://support.xbox.com/en-US/help/account-profile/accessibility/search-games-with-accessibility-features

[84] https://store.playstation.com/en-us/pages/browse

[85] https://support.google.com/googleplay/thread/164221330/accessibility-tags-make-it-easy-to-find-accessible-apps-in-the-play-store-app

[86] https://www.nintendo.co.uk/Nintendo-eShop/Nintendo-eShop-1806894.html

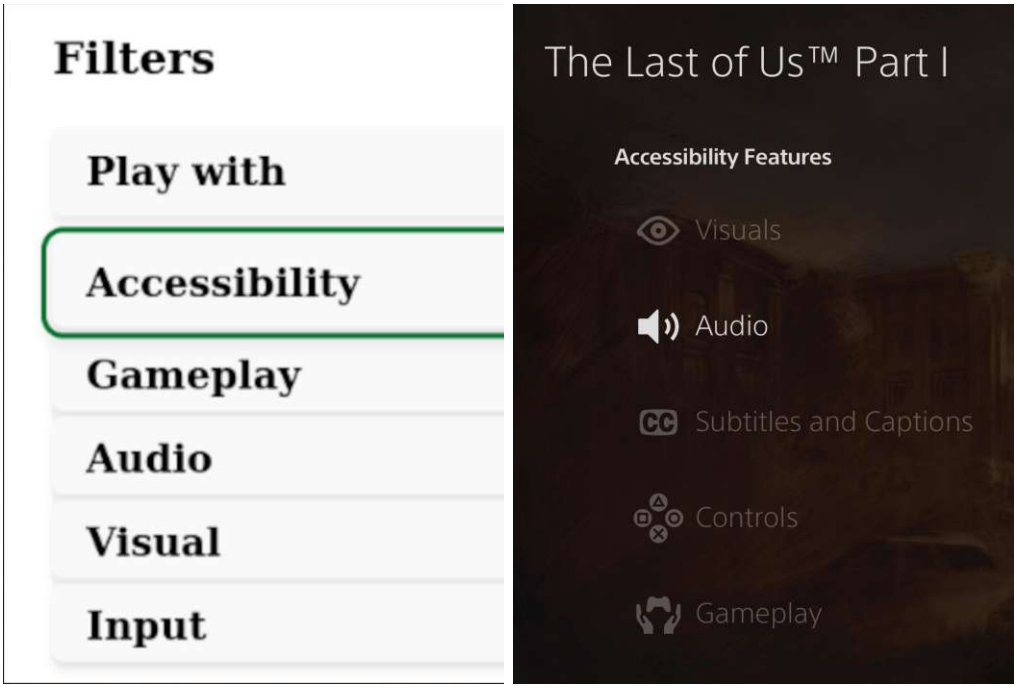
[87] https://a11yup.com/articles/steam-an-accessibility-nightmare

[88] https://www.gog.com/en/games

[89] https://store.epicgames.com/en-US/browse

[90] Transcript of Interview 1, line 50-58 (Translated from German)

[91] Transcript of Interview 1, line 78 (Translated from German)



(a) Tags to filter inside the web browser based Xbox store.

(b) Tags for "The Last of Us Part 1" as listed inside the PlayStation Store.

Figure 5.2: Accessibility tags on Xbox and PlayStation.

our programmers] initially created the project. I think they saw something interesting for PS5 one day and thought: "Yeah, let's create it." But I don't know exactly how it came to be. I just saw that the project exists and thought: "Yes, that's interesting, I'd like to do that." "[92]

"*I think I can influence this. I don't know if I could decide if it should exist at all, but if it's planned to implement a feature, like difficulty levels, I think I can influence this. Especially if I'm the person who's supposed to implement it. I could say "I'll add different modes" which make certain things easier or certain things different. Yes, I think I could influence it this way. I think I can at least encourage people to think about adding a feature.*" [93]

"*But I have to admit this probably wouldn't feel like a tragedy to me. To me personally. I would have to think more about different people and the audience. If I think about "Does it cause me pain if it gets removed?" it's for me more about "Do I enjoy implementing this?". Then I think more along the lines of: "Ok, well, I didn't want to do this anyway. This doesn't bother me." I should probably think more like: "What would be interesting for the audience and the players?" And feel empathy or sorry for them. But that's not*

[92]Transcript of Interview 2, line 60-64 (Translated from German)
[93]Transcript of Interview 3, line 47 (Translated from German)

how I'm thinking." [94]

"*It's also about testing effort and testers, who are "standardized" in a way and don't consider this much themselves. This means you should try to overcome your bias in general, during design, implementation, and testing. And should ask yourself: "Where could there be issues in this area?" Some of them might be dictated by hardware, but think about how to bridge them or tweak them a little.*" [95]

"*I mean, it depends on the project of course. But, even if we are working with a publisher, it doesn't mean you don't have a responsibility as a developer or any ownership or so. You can always suggest things. You can always make a case for things. So, yeah, even if the publisher is super unaware of it, you can make a case of like "Hey, actually we would like this game to have re-mapable controls". Not just because this allows anyone with like an alternative/accessible controller to map them according to their preferences, but also normal players, you know. It makes sense. A lot of players want to decide themselves how to... which button to do what. So I think that could be one of the examples where you're making a clear case towards your publisher or client about why this is beneficial. So I think the decision is made together. [...] I'd like to add though that QA can of course also flag these points. After all it's Quality Assurance and you always have the player in the back of your mind and looking through their eyes to the game. Like what's unclear? What's missing? What's not functioning as it should? And, yeah, QA can flag those things and maybe is not the end decider, but can at least... How do you say that? Like "start this little flame"*" [96]

"*Games which feature a real accessibility menu worth being called as such are usually very big titles. I think smaller titles have on average a higher number of or more frequently accessibility options, although small in scope. So it's either prioritized higher because it is personally important to you to implement it. Or you have a big studio with the money, time and person number to just do it on the side, so it doesn't have to be cut. [...] This is definitely something where I can take advantage of my position and say: "This is important. It should get prioritized and shouldn't get cut." However, this would depend on the project. If I work on a project for a client I'm often the first one who says: "It's important to address at least color blindness or text sizes." But if this actually gets done is not my call. And for our own [in-house] projects as well: I can talk it up, but the final decision doesn't lie with me. A "this is the hill I die on" scenario might be possible with me repeatedly saying "this needs to be in" until production says "alright then, we'll do it". But there is also always the question for me: "Yes, it is important to me, but maybe something else regarding the game is currently more important to me."*" [97]

"*There are multiple game development online accessibility pages collecting guidelines. And I saw how this was neglected on the current project and I thought: "It's commonplace design knowledge these days to do it this way to make it pleasant." It wasn't done, so I*

[94] Transcript of Interview 3, line 97 (Translated from German)
[95] Transcript of Interview 4, line 35 (Translated from German)
[96] Transcript of Interview 5, line 93-101
[97] Transcript of Interview 6, line 45-49 (Translated from German)

summarized these pages and gave it to the designer there, saying: "Here are these hints. Maybe something can be done?" [98]

"*Also because font size is often way too small. If you compare between the platform holders' recommendations and the currently implemented things, things are always way smaller than the recommended minimum size. This is an interesting detail I suspect to be caused by developers sitting too close to the screen while developing screen designs. Instead of simulating players' actual environment, who sit in front of their television at home. I think that's the main reason.*" [99]

Other Departments

Sometimes the responsibility for prioritizing accessibility features is described as lying somewhere else: "*It's rather somebody else in the team. At least for our project, with the UI being very separated from the actual programming team. I think this could also be the case with bigger projects and bigger companies, that it's a separate team. I think with us, in-house, everything is more likely to be together. Here it would probably be also on the programmers' plate.*" [100]

"*We did work on the input system, but more along the lines of having support for everything. To come up with what needs to be done or what keyboard shortcuts [to support] was also always a thing for design. That's the problem you have as a programmer. You miss a lot things if you are too far away from the user side. Or I don't even know what's included, in this regard.*" [101]

"*I was working on a ticket about color filters once, which was more about scenic day/night filters. Those are maybe also used for color blind filters and the like, but I don't know. We support a variety of things, and those are used for various things. So there are probably also things which are not used exclusively for this one topic, but for different ones. And you don't see for what exactly. [...] This is fine as long as there are people on the project who keep an eye on this and collect [information about] it. I'm an engine programmer after all, and far away. That's what I'm doing and that's the way it is. I don't need [to know]. It would be out of curiosity and not necessity. I'm not blocked because I don't know it. [...] It wouldn't be a problem for me to work on something like that. The question when working on certain things is always: How much time do you invest into it? There are a lot of things you can potentially do for accessibility, but the game itself would not directly benefit from them. Then you have to ask yourself the question: What helps more? Investing three weeks of programming time to add new gameplay to the game, or two weeks for accessibility? I'd like to leave this decision to somebody else. But I still find implementing it interesting.*" [102]

[98] Transcript of Interview 6, line 139 (Translated from German)
[99] Transcript of Interview 9, line 47 (Translated from German)
[100] Transcript of Interview 2, line 90 (Translated from German)
[101] Transcript of Interview 2, line 112 (Translated from German)
[102] Transcript of Interview 2, line 124-134 (Translated from German)

Platform Holders

Several interviewees described how the responsibility to prioritize accessibility features might also lie with platform holders: "*I suspect that's one of those features which get cut first. Because "We can live without it." If somebody is color blind and the game is not fundamentally required to use red and green everywhere, then it's also playable like that. It's not ideal, but there is also the fact that many things are already automatically offered by the consoles on PlayStation and Xbox. That means if you would implement something like that, you would implement it for PC only and not for the other platforms. So an even smaller group would benefit from it. [...] The color filters, for example. They are explicitly offering ones like this. Those served as an example for our implementation, how we want to have it for our [template]. There is a [menu] on the PlayStation where you can configure color filters. [...] It's for the players, so a color blind player can enable this and all games on PlayStation automatically feature it. [...] Additionally, the PlayStation approach has some advantages. The filter is applied for you, but if you stream [your gameplay], it is not applied for the ones who receive your stream. That means your audience sees the game "the normal way", while it is kind of "manipulated" for you. That's something our [template] would not be capable of. [...] That might make it less interesting for us to implement more things, because we can do inevitably less than PlayStation, for example, and they build their system in a different way. Maybe many developers expect: "The console or platform operator should do something, please." So we don't need to do anything anymore.*" [103]

Figure 5.3 shows the PlayStation 5 console's accessibility system menu which allows to enable color filters intended to address three different kinds of color blindness.

The Game Accessibility Guidelines do not recommend using filters to accommodate color blindness: "*Filters that shift the entire palette can be tempting, and in some circumstances [...] can be the right option, but in general other solutions should be investigated first. They're more difficult to implement effectively than they appear, with bad reception from colorblind gamers being common. They are a blunt instrument, can change colors of elements that do not need to be changed, unnecessarily affect aesthetics, and introduce new clashes. And as they're based on fixed sets of colors, they only allow conditions specifically designed for to be catered for, without a way to reach edge cases.*" [Ham17a]

Several other platform features were mentioned by interviewees: "*It is true that it might be interesting for some people to swap the left and right mouse buttons or similar things. But I think it makes sense, of course, if platform operators can offer things. Naturally, this also makes it affordable for small studios to have any kind of support for something, because not everyone can invest the time needed to implement lots of accessibility features.*" [104]

"*Let's take the screen reader on PS5 as an example: After it has been built in once, every game can use it and it makes it a lot easier. Or the color filters: Every game has them,*

[103] Transcript of Interview 2, line 142-158 (Translated from German)
[104] Transcript of Interview 2, line 166-170 (Translated from German)

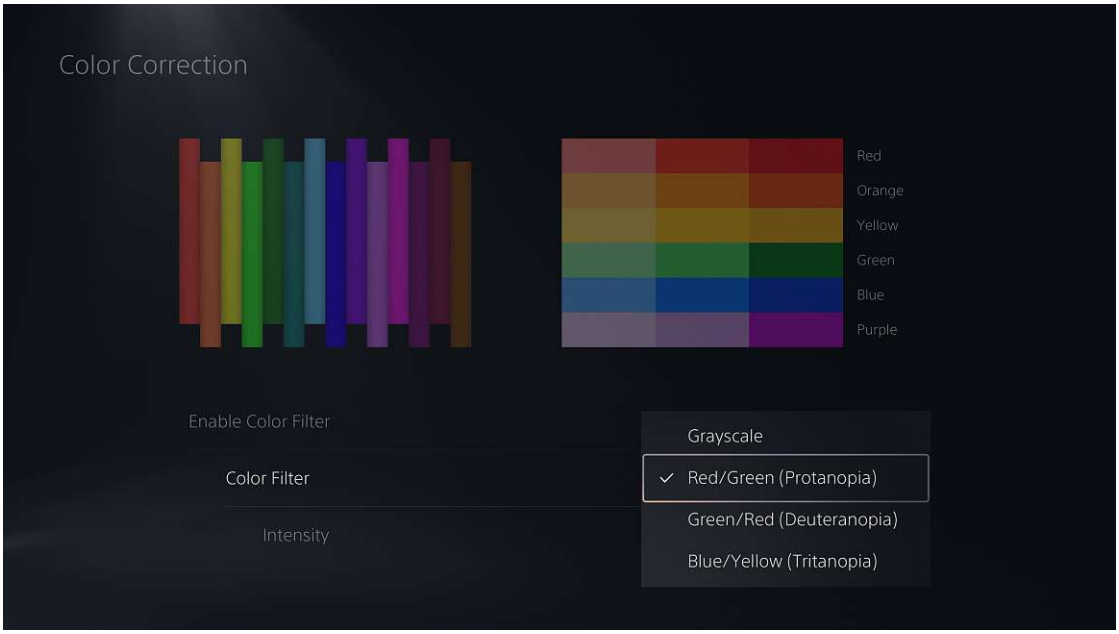


Figure 5.3: This system-wide color filter is automatically applied to all games.

there is no game without them. [Platforms] have a much greater influence. Yes, I think they are in possession of great influence and responsibility." [105]

"*Ideally, PlayStation, Xbox, and whoever else would have all kinds of features, which would be easy to implement and use. [...] I don't think many things are easy to implement yet. At least I haven't seen any.*" [106]

"*The screen reader on the PS5, for example. I don't know about the linking, but if it is easy to integrate then people don't have much of an excuse. "Why didn't you do it? It is so easy after all!" If you have to do everything by yourself and it's a lot of work: "Well, let's just cut it." These excuses disappear and pressure not to cut it builds up, because there is so little there [to do].*" [107]

"*Just like you already have things automatically in [your game], like always the same graphics engine, or support for audio output, which had to be custom programmed in the past. You don't even think about this today, because the operating system or console is taking care of it. Accessibility could be just like that. [...] You could also work with consoles in a way which only allows certain fonts, predefined by the manufacturer, to be used. So you can't choose [as a game developer] how big the font is, because this would be determined by the console. Those would be ways to shift this to a predefined domain.*" [108]

[105] Transcript of Interview 2, line 228-230 (Translated from German)
[106] Transcript of Interview 2, line 208 (Translated from German)
[107] Transcript of Interview 2, line 232-234 (Translated from German)
[108] Transcript of Interview 9, line 167-173 (Translated from German)

It was discussed how platforms could increase accessibility feature adaption via the search functionality inside their digital game stores. They could make games searchable by accessibility settings, or rank games higher which implement accessibility features: "*I do think platform developers or platform holders hold a lot of power to create change in this sector. As soon as this would be there, publishers would be interested and would say: "Ok, we invest one month more budget, three person months, so accessibility features A, B, C and D for four different types of impairments are accessible. Because this would make us so-and-so more present for a specific market size." I would say that would be a good starting point which would make a difference.*"" [109]

"*But I think every developer has to decide this for themselves. Although it could be viewed as a challenge, or extrinsic motivation for the developer, like: You can receive multiple checkmarks and seals of quality on platform store so-and-so for being compatible with things like that. That would certainly offer an incentive.*" [110]

Figure 5.4 shows an example for a game's store page which lists the number of supported accessibility features.

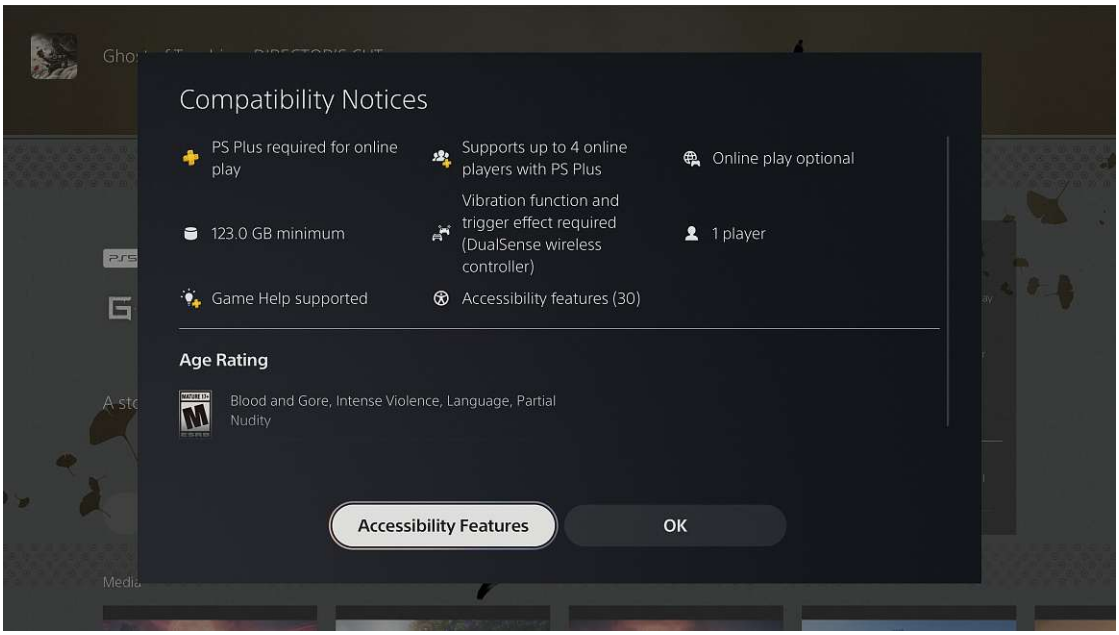


Figure 5.4: The PlayStation store listing for "Ghost of Tsushima" states the number of supported accessibility features. Pressing the "Accessibility Features" button provides further details for every single supported accessibility feature.

"*Like you can see it on iOS, because they have always put emphasis on accessibility. To have console platform operators root this system-wide so deeply, so you, as a game developer, simply have interfaces. So you access this interface, and fonts, for example, are*

[109] Transcript of Interview 2, line 94 (Translated from German)
[110] Transcript of Interview 4, line 116 (Translated from German)

enlarged or contrasts enhanced, system-wide. Or the operating system adds a color-blind filter on top of everything. These are just visions for the future: So it's not just about being present on the market, but also about the development of the next console generation or firmware patches to offer this system-wide. That would also be an option. So, they are not just relatively much in control of what they offer in the area of store-presence, but also of hardware development and operating system development. Because: The more such features are offered by the system, the less I, the developer, have to think about it. I just forward the information to the API so I can implement it." [111]

Platform Requirements

Additionally to the features they provide, platform holders might also influence accessibility feature adaption by defining what is required (and what is not) by game developers, if they want to release their games on their platforms: "*I think that's also a pity [...]. There is no "industry guideline" after all. Guidelines from platform operators, what Sony and the others are saying, are the maximum. But there are sometimes better guildlines, constrictions which are actually required, for smart TVs than for game development. Font sizes for Amazon-Fire-Whatever are required to be at least this big and must behave a certain way, otherwise you fail the submission. But for video games, it's more like "La La La [I can't hear you]""* [112]

"*I think Apple does it pretty well. If they receive an app for certification and the font is unreadable it won't get certified, no matter what. That's because they know usability is very important for their platform. There also has to be a certain amount of white space between things, and only a certain amount of interactable elements is allowed. The way feedback is designed is required to allow the audience to at least partially understand it. Of course, there are also things like supporting the screen reader. I think that one should be able to translate texts, but that's not reviewed as much."* [113]

Indeed, Apple's App Store Review Guidelines [114] and Google's Developer Program Policy[115] currently do not list accessibility features to be required for releasing apps and games on their digital stores.

Client & Publisher Requirements

Requirements by clients and publishers were mentioned as influencing accessibility feature prioritization: "*I think it can be easier if you are an indy developer, like somebody who develops alone inside their garage. That is because as soon as you have a publisher who is not too keen about [accessibility], budget becomes important again. So not only platform*

[111] Transcript of Interview 4, line 100 (Translated from German)
[112] Transcript of Interview 6, line 139-147 (Translated from German)
[113] Transcript of Interview 9, line 57-63 (Translated from German)
[114] https://developer.apple.com/app-store/review/guidelines/
[115] https://support.google.com/googleplay/android-developer/answer/13837496?visit_id=638373864901278896-1929013109&rd=1

holders and developers, but also publishers play a role. And when you say during budget calculation: "We might want to calculate one additional month to implement accessibility features, because we don't want to cheap out on these too much." If you don't use your own budget to finance it independently during your free-time, it'll probably often depend on the availability of the budget. Sadly." [116]

"*Yes, this was very important. These color blindness checks were always already built into the games [with this publisher]. You could activate them at any time to see instantly the game in the three respective modes. We also had a lot of UI requirements regarding scalability and such, so [the publisher] is very keen about this. Yes, I think bigger Publishers also have the money to do this. For them, it really makes a difference.*" [117]

"*No, that's not a standard. Those are web pages which describe details. You could say it's a document from [the publisher] with criteria inside which needs to be met. So you work through this list. It's about font sizes, font colors, contrasts, values in general and differences. How to make sure something is readable even with red-green-blindness. Things like that.*" [118]

"*Well, there are certain processes. You don't really commit to it, but add color before tweaking it again. You'd actually have to re-test repeatedly, but that's often not done. But of course, this would be considered a lot more, if it was a requirement. Yes, I think this receives way too little focus. [Without requirements], this is not acted upon most of the time. I've never done it at least.*" [119]

5.1.7 Team Diversity

Diversity among development team members was described several times as having an impact on accessibility feature prioritization: "*It's outside of the imagination of many developers, cause disabled people are vastly outnumbered or under-represented in developer teams. So people don't get in touch with people that have disabilities, then they are not gonna think about it. [...] if you don't know anybody then you just don't think about it.*" [120]

"*I think expectations [on players] are very high. The fact that the person who plays the game might not fulfill the same requirements as you do is often not considered. The reason for this might be that [the topic] is not close to you. That such a person is not close to you. There is nobody in the company who represents this group of people, who could say: "Hey! This group of people and that group of people cannot play the game!" I think that's a major aspect. I also often see that not even the simplest things get implemented. I think that's because it is so far away, because they might not even think about it.*" [121]

[116] Transcript of Interview 4, line 66 (Translated from German)
[117] Transcript of Interview 9, line 191-193 (Translated from German)
[118] Transcript of Interview 7, line 19-21 (Translated from German)
[119] Transcript of Interview 7, line 29-35 (Translated from German)
[120] Transcript of Interview 5, line 89-91
[121] Transcript of Interview 3, line 37 (Translated from German)

"*I think a lot of people make games from their own perspective. So they wouldn't be able to know what it is like to play if you have some sort of muscle disability or if you're visually impaired.*" [122]

"*I don't use super-fancy fonts in general. There are standard fonts which are also used in magazines and such. I believe these are made to be well readable. I don't know it for sure, but I assume the established ones are well-tested.*" [123]

"*I guess it's because you only actually consider these things if you're either affected yourself or know people who are affected by it. If you are more involved with it during your everyday life and you're therefore aware of it. Otherwise you just assume the ordinary, what affects yourself.*" [124]

"*This might sound stupid, but it already starts with primitive gender roles. Developers were mostly men in the past, and they didn't know how women look like. That's also the case with accessibility. You notice how you can only really do it once there are people in the team who are affected. Or you need to get a consultant who is able to inform about this topic.*" [125]

Diversity in Languages

One of the interviewees gave an example of an accessibility issue which might be caused by a lack of diversity of languages among team members: "*That's also the reason why many Asian games, Japanese games, are harder to read. Because the font for kanji symbols allows more information on the same space. People can read it better if it's in Japanese compared to writing it in romaji with our [latin] font. Because the same font size in the game leads to our font being presented smaller. I think developers don't notice this because it doesn't matter to them, and so it's presented to customers in America and Europe like this. [...] And they have to live with actually smaller texts. [...] You can see this, for example, by comparing screenshots from strategy games. If you take Fire Emblem: Three Houses and look at a Japanese and an English screenshot, you can see that the English text is much more fragile and smaller. This is especially noticeable while playing in handheld-mode, because then you suddenly really reach the 1.5 mm range. That's really very small. And that's because the screen space is the same as for the Japanese symbols, but those fill it differently. I think the developers are unaware of such details.*" [126]

Figure 5.5 shows "Final Fantasy 16" as an example for a game with very small UI text. In this example, the text is slightly bigger compared to English after switching the game's language to Japanese, but still barely readable.

Having multiple different native languages among studio employees was described as being beneficial: "*Because you asked about how settings are prioritized, and what is a*

[122] Transcript of Interview 5, line 31
[123] Transcript of Interview 7, line 123 (Translated from German)
[124] Transcript of Interview 6, line 39 (Translated from German)
[125] Transcript of Interview 9, line 91 (Translated from German)
[126] Transcript of Interview 9, line 123-129 (Translated from German)

nice-to-have or good-to-have: I think that some things are also added because they are an easy win. That's what localization is for us because it can be done by employees. We don't need an external company, we can do it ourselves. It doesn't take long and you can do it on [our monthly company] day. I think that's one of the reasons why this and other things happen." [127]

Accessibility of Workplaces & Development Tools

A prerequisite for including more diverse team members is accessibility for workplace and development tools. This was reflected by several interviewees: "*The impairment probably has an impact on the career. Being a programmer and being able to use Unity regardless of your impairment. I mean, you would already have the career goal beforehand, but that doesn't mean you have to be a programmer if you're blind. Maybe you're hired as a producer instead of - let's say, although it sounds stupid - "an active developer". The development tools probably depend more or less on the platform and how the person uses it. And if the company makes additional investments for the person, like a braille display."* [128]

"*I mean, if I was color blind and could give feedback somewhere. It would be good to have some sort of channel I could go to, like: "I'm color blind" or "I have motoric weaknesses and I have these problems when I try this game out." I think it would be enough to have this channel. I actually don't know, maybe they even have such a channel at [that company] I could turn to. I never noticed one so far, at least. [...] Not a dedicated one about this topic. We have general channels where you can just talk to everyone, like: "Who can I talk to if I want this to be communicated further?". There is no dedicated channel about this."* [129]

"*Of course, it's done within a realistic scope. I don't know about input devices, but I'm sure there are special keyboards for people who cannot write with both hands, or cannot write with hands at all. I recently tried using voice input for documentation tasks, but that didn't work. It should actually work, [provided by] the operating system. I think the operating system takes care of accessibility for the most part, and tools need to interface with it. [...] We had the case of not being able to get a consultant in a wheelchair into our office for [one project]. So accessibility doesn't solely start with the tools, but also with the facilities. It was impossible for us to get [them] into the office. That was quite a failure if you think about how the game was about dealing with this exact topic."* [130]

Consulting External Expertise

Several interviewees mentioned consulting external people as a way to bridge the knowledge gap caused by too little in-house diversity: "*You cannot [setup every studio to be*

[127] Transcript of Interview 3, line 211 (Translated from German)
[128] Transcript of Interview 4, line 124 (Translated from German)
[129] Transcript of Interview 2, line 112-120 (Translated from German)
[130] Transcript of Interview 9, line 71-75 (Translated from German)

as divers as possible]. There are not enough divers people for that. You would have to assume they are normally distributed for that. No, you have white people like us in Austria the most. And then everybody competes for the few [divers people]." [131]

"*Especially on PC for people who are blind, with a braille display which you cannot use as a non-blind person. You cannot confirm if it really works. You would need appropriate play testers and would need to decide to conduct play tests with appropriate target groups. So people with visual or hearing impairments can try if it really works that way. But this probably only works very rarely.*" [132]

"*And I think it was very inspirational for many people participating in the jam, because it was not just like "Oh, how can this person play games? What is the world like for this person?" But it's also like having a direct contact with someone, and that someone being able to kind of, you know, open your eyes, by saying: "Hey, this is what I'm facing". These problems. Yeah, I think that there is power in that human connection, so I just wanna stress: It can be hard to find people, if you're not well connected in local scenes. Like, I wouldn't know, where to find people, but you definitely need to put in some effort, but I do think that it is important that, if you want to widen your audience and add some features, to say: "Ok, we are gonna talk to people that actually have these kind of disabilities." And of course experts as well.*" [133]

"*So for all the things you are missing you can ask others, but the tricky part is to know about those needs and that's something that might take time. Because after you release a game or did them, then you learn what's missing. So, that's were the building libraries could be helpful for people to have a ready set of accessibility options and build on that.*" [134]

"*And I think also knowledge about it, cause I can imagine maybe there are Unity tools out there or so, that help you set this up in an easy way, but you need to be aware of it. And you also need to know what you're doing when it comes to accessibility, cause you don't... you know, you might have a lot of assumptions and might create something that the target audience then actually doesn't use [...] I mean, if you don't talk to people that are blind or disabled, then how are you gonna know?*" [135]

Assessing player feedback was mentioned several times: "*So we had that, and we put that in every other game. Then we had some mechanics that required two hands, so we got the feedback that some people would like to use it with one hand. So then we added the option to use it one-handed, with one hand. [...] So when we had, I don't know, climbing, we added this to the template. When we had a mechanic that you grab something from behind your back, there was the option to do it literally, by grabbing behind your back, or just pressing a button, because someone could not lift their hands so far.*" [136]

[131] Transcript of Interview 1, line 162-164 (Translated from German)
[132] Transcript of Interview 4, line 70-78 (Translated from German)
[133] Transcript of Interview 5, line 121
[134] Transcript of Interview 8, line 51
[135] Transcript of Interview 5, line 65-69 (Translated from German)
[136] Transcript of Interview 8, line 55-59 (Translated from German)

"*I think at the beginning, when we were starting out the VR games, one of our team members did a questionnaire through Reddit or another platform. And asked for "What is the most desired accessibility feature you'd like?" So, that was like the initial part and after that, with the library in this case, it grew so much we were able to add it. then we didn't do more like "official tests" [...] but we could call it research, as we checked other games and saw what people talked and thought about them. So usually there was, when a new game got out and it was a big contender for the biggest games in VR... then we checked: [...] what were the comments on YouTube and on Reddit and stuff like that. So, the community was very vocal about those changes and needs, so it was very easy to get those and then see: Who would like what?*" [137]

"*no, because almost all of the games we did were adventure/action games, so the theme for those would be much more fast paced. This was, for example, the small group that I don't think would like to play those games. We never heard that someone would like to play the game, because they heard it's nice, but they are blind so they cannot. [...] We had people with motoric impairments. So they were either stuck in a wheelchair, could play with just one hand, and even played our games on conferences and fairs like that. So, we already saw if it's working and they were always happy, if it was covered. So, yeah. But for the blind people, unfortunately no.*" [138]

"*If the property to be accessible is not a USP or pillar of the game already, then it's actually considered very late during planning. Or often rather relatively. You look at test groups, especially if it is an online game. Then you have to address it. But not much is changed as long as there are no people complaining about something not being alright.*" [139]

5.2 RQ2 Results

The following main categories were identified while conducting qualitative content analysis based on research question 2: *What accessibility features are considered must-haves (or only nice-to-haves) and why?*

5.2.1 Player's VS Developer's Perspective

Interviewees described different priorities when playing a game compared to developing a game. Some features were considered must-haves while playing but only nice-to-haves when developing, and vice-versa.

Text Size

A certain minimum or adjustable text size was both often described as a must have from a player's perspective but also as being frequently neglected by developers:

[137] Transcript of Interview 8, line 69-75
[138] Transcript of Interview 8, line 77-79
[139] Transcript of Interview 9, line 183-185 (Translated from German)

"*I noticed this with Last of Us and God of War in my circle of friends. All those accessibility features are well received among them now. They were not requested as much in the past, but now people are saying: "No, I want this easier" or "I switch to bigger fonts because I can't read it otherwise.*"" [140]

"*[I adjust] UI sizes to be bigger, if necessary. There are very few games that do have the setting with too small defaults. If there is an adjustable setting, the default setting is usually fine, because they spent time thinking about it.*" [141]

"*The font size [is what I adjust] most of the time, because I don't see as well anymore. Also because font size is often way too small. If you compare between the platform holders' recommendations and the currently implemented things, things are always way smaller than the recommended minimum size. This is an interesting detail I suspect to be caused by developers sitting too close to the screen while developing screen designs. Instead of simulating players' actual environment, who sit in front of their television at home. I think that's the main reason. Interestingly, I noticed while working with Apple mobile games how the recommended font size there is not stated in absolute [values] but relative to screen sizes. I like this approach, if you assume people always perceive the game with the same aperture angle. Saying fonts should be at least 8% of the screen height would significantly change the implementation. But nobody does this yet, and I think that's the main issue with readability in games. That's what I often miss.*" [142]

"*I think font size is something affecting many people. You definitely need very good eye sight, or well configured eyes (laughs).*" [143]

"*We do take the initiative, if we can influence it. To have at least things like adjustable font sizes. But often no budget or time is allocated for this during project planning.*" [144]

"*There is no "industry guideline" after all. Guidelines from platform operators, what Sony and the others are saying, are the maximum. But there are sometimes better guildlines, constrictions which are actually required, for smart TVs than for game development. Font sizes for Amazon-Fire-Whatever are required to be at least this big and must behave a certain way, otherwise you fail the submission. But for video games, it's more like "La La La [I can't hear you]*"" [145]

"*Sony, Microsoft and Nintendo have checklists. Certification requirements, TRC, or whatever they're called. If I remember correctly, [minimum sizes] are more phrased like recommendations, but they are not tested.*" [146]

[140] Transcript of Interview 9, line 145 (Translated from German)
[141] Transcript of Interview 6, line 53 (Translated from German)
[142] Transcript of Interview 9, line 47 (Translated from German)
[143] Transcript of Interview 4, line 27 (Translated from German)
[144] Transcript of Interview 6, line 35 (Translated from German)
[145] Transcript of Interview 6, line 139-147 (Translated from German)
[146] Transcript of Interview 9, line 53-55 (Translated from German)

Cheat Functionality

Passmore et al. describe "cheating" in video games as "*Secrets inserted by developers, developer consoles, cheat codes, third-party strategy guides, mods, walkthroughs, and game exploits*". [PML+20, p. 1]

Two of the interviewees described a decline in cheat functionality in more recent games compared to the past: "*I can remember being excited about how many games, especially strategy games, had cheats while I was younger. I was able to experience the game in many different ways without having to worry about "I'm going to lose" or "I need to watch out for my economy". I could just deploy lots of armies to see how they look like and enjoy. And this got completely lost. I think that's a pity.*" [147]

"*I sometimes use no-clip cheats if they are available, but they usually aren't anymore. To skip passages which are not interesting to me, or when I know: "Yes, I understood the puzzle, but right now I'm just too slow, stupid, lazy or just didn't get enough sleep." Then I help myself.*" [148]

It was also discussed how players could benefit from development features which are usually removed from games before release: "*I often think the following is a pity in video game development: I know lots of settings, cheats and similar things are already there during production. Many things are experimented with, so you can do things one way or the other. These are then not put into the public options for various reasons. Maybe because the implementation wasn't pretty enough. Or because it wasn't tested, as it was just a debug feature. But I think that's a pity. You could make so much more out of it.*" [149]

Difficulty Settings

"*Game difficulty choices that are presented in menus with typical labels such as "easy, medium, hard" can be found even in very early and simple games.*" [SMB+16, p. 5596] There are games offering additional difficulty levels called "story mode" or "explorer mode" which allow to play the game at your own pace, without having to worry about failing individual game sections. Figure 5.6 shows "Uncharted: Lost Legacy" as an example for a game offering "Explorer" difficulty.

Several of the interviewed developers mentioned using difficulty settings when playing themselves, but none of them called it a must-have feature when developing a game: "*I prefer starting games like Jedi Knight on story mode these days. Or all the other RPGs where you usually don't get better while playing, but your character gets stronger with more points, and you do the same things all the time. And if there is assistance, I use that too.*" [150]

[147] Transcript of Interview 6, line 101 (Translated from German)
[148] Transcript of Interview 1, line 26 (Translated from German)
[149] Transcript of Interview 6, line 85 (Translated from German)
[150] Transcript of Interview 1, line 14 (Translated from German)

"*Difficulty levels as well, I use them. If I realize that it's no fun anymore, because it's too difficult, I set it lower. Or the other way around, then I set it higher.*" [151]

"*Even though some action games are definitely stressful, I don't want to have extra stress, because I play it for other reasons than challenge. So I tend to play games on normal or easy difficulty, and I might tweak some settings.*" [152]

Making puzzle games accessible for players with cognitive impairments was described as difficult: "*Maybe you would need to completely redesign some parts of the game. I don't know what you would focus on, that highly depends on the game. Puzzle games come to my mind. I'm not sure if puzzle games would still work, if it's possible to redesign them this way. If the challenge would be the same, or if you would need to completely change the challenge so it's not the same anymore. The question is if this is even possible for some games.*" [153]

Adjustable Audio Volumes

Audio volumes were mentioned several times, but mostly from a player's perspective: "*Yes, that's what I like to adjust. Definitely audio volume. Especially on PC, the default setting is always so incredibly loud.*" [154]

"*Settings for audio volume are the norm anyways. So people who can't stand the noise level can turn off the music.*" [155]

"*I love audio sliders, if they are properly split. Because sometimes the music is sampled much louder than the dialogs when I listen via speakers, and especially with earphones. It's awesome when I can adjust this separately.*" [156]

"*Sometimes I turn off the music, make it quieter, or turn the effects down. [...] Regarding the balance between audio volumes, games are better balanced these days compared to the past. I think [developers] noticed how annoying this was.*" [157]

5.2.2 Dependency on Game

Some accessibility features were only regarded as must-haves depending on the kind of game or genre.

"*It was simply about budget. Because there was so much [dialog], and with Adventure Games in general and especially back then, it was still more common for people to read for themselves and hear the voices inside their heads, or let streamers do the voices. As*

[151] Transcript of Interview 3, line 63 (Translated from German)
[152] Transcript of Interview 5, line 43
[153] Transcript of Interview 3, line 137-161 (Translated from German)
[154] Transcript of Interview 3, line 63 (Translated from German)
[155] Transcript of Interview 4, line 104 (Translated from German)
[156] Transcript of Interview 6, line 53 (Translated from German)
[157] Transcript of Interview 6, line 85-93 (Translated from German)

we had text animations for different emotions, it did communicate what we intended very well. There simply was no budget, no justification, [for voice-over]." [158]

"*And in some cases it was deliberate part of gameplay, for example the dancing game. I think you could do it in a wheel chair, but it wouldn't really work if you can only be like horizontal or so. So, yeah, in this case, that's very much part of the mechanic to move around.*" [159]

"*But in many other games, where it's like more narrative-driven games or it's strategy games or so, there's a lot on the screen that you would need to be able to see, because the game doesn't support any other type of navigation through the world, through audio for example.*" [160]

"*I think it's easier with Mario Kart, for example: There you have settings to prevent you from falling off the track, or you don't have to accelerate yourself [...], controls customization, so you can either change directions via the joystick or by tilting the controller. [...] Racing games are more suitable for this. To make it easier.*" [161]

"*I had to learn the term [accessibility] very early anyway, because for my first job I was working on VR games. So the accessibility part was very important there, because different people reacted differently to the headset on the head. So, when we were designing the games, we had to make sure everything is covered*" [162]

"*For example, in my first company, when we did the VR games, from the very beginning we had two options for movement. So it was like smooth movement where the camerea moved as you moved the controller. Or teleportations where you would just spawn in the desired location. Cause this was the first thing people always noticed in the early days of VR. So we had that, and we put that in every other game. Then we had some mechanics that required two hands, so we got the feedback that some people would like to use it with one hand. So then we added the option to use it one-handed, with one hand. And then we thought of designing stuff both in this way. So: "Can it be one-handed? Then let's do it. If it could be two-handed, it's necessary.*"" [163]

"*To be honest, no, because almost all of the games we did were adventure/action games, so the theme for those would be much more fast paced. This was, for example, the small group that I don't think would like to play those games. So, we never heard that someone would like to play the game, because they heard it's nice, but they are blind so they cannot. But I can imagine some less action-y games could definitely work with that, especially some adventures, but more like in the walking-sim direction. That uses walk around, listen to people and explore the world. But I didn't have the chance to work with that.*" [164]

[158] Transcript of Interview 6, line 123 (Translated from German)
[159] Transcript of Interview 5, line 31
[160] Transcript of Interview 5, line 31
[161] Transcript of Interview 3, line 161 (Translated from German)
[162] Transcript of Interview 8, line 9
[163] Transcript of Interview 8, line 55
[164] Transcript of Interview 8, line 79

Visual Cues

Visual cues were named in context of action games: "*It has improved with acoustic or hearing abilities: You also have visual indicators if an enemy is approaching in an action game, so you also see from which direction they are coming. To have indicators in third-person or first-person games.*" [165]

"*There are also people who are almost blind who play all these action games. If you approach them and say: "We'll give you audio cues and tell you what's happening on the screen." Or the other way around: "We'll do visual cues wherever sound effects are happening in the game world, because you cannot hear." That's how you accommodate them without, for example, doing a whole game about a deaf person.*" [166]

Lower Timing Precision

Options to make gameplay less time critical and less dependent on fast reflexes was named in connection with action or shooter games: "*So there are certain action or shooter games that I like to play, and if they have accessibility options I always take a look at them and I check if there is anything I like. Usually I'd like to have more time with prompts or so*" [167]

"*An example for this would be when first-person-shooters found their way onto consoles. The main argument of PC gamers to call this move insane was the fact you could aim way better using a mouse. So the developers said: "Alright then, our challenge will not consist of aiming very precisely anymore, but we'll add enemies who behave in a more clever way and do things which you must solve by choosing your weapon and positioning your player avatar correctly." Halo was one of the first games using this dedicated game design approach. They didn't want rotational gameplay to be relevant anymore, they wanted positional gameplay instead. Where are you compared to the enemies, to make it interesting. And you actually don't need a mouse for that. And that's why it was one of the games that made people say: "This is so interesting and it plays completely different compared to other games" because they removed this skill component. This will also happen in other sectors. I think these timing windows will slowly disappear or become less relevant. Instead, you will have to ask yourself "What do I really want?" instead of "How do I aim to hit?"*" [168]

5.2.3 Must-Have

There was hardly any accessibility feature everyone could agree on being a must-have, but localization and subtitles were regarded the most important ones.

[165] Transcript of Interview 4, line 27 (Translated from German)
[166] Transcript of Interview 9, line 101 (Translated from German)
[167] Transcript of Interview 5, line 43
[168] Transcript of Interview 9, line 157 (Translated from German)

Localization

Localization was named a must-have feature by several interviewees: "*If accessibility also includes localization and subtitles, then I'm a little involved through UI. Especially localization and subtitles [are must-haves]. Subtitles even more, because they are text-only, because audio can be localized as well. Localization is kind of a must-have. Inevitably. There are many people you do not reach if you do it in English only. [...] I can barely imagine [a project without localization]. Even for the cheapest projects, with almost no UI text, you would have to localize the UI. Those are only ten texts, but even those would have to be localized. And the more text you have, the more necessary it becomes to do it. The less you have, the easier it gets. That's why developers don't have the option not to do [localization], because it gets so easy anyway.*" [169]

"*So we determine of course the scope before we start the production, we make a budget for that. Usually we include some accessibility options in there, such as language, such as subtitles. Those things just make sense, I feel, from a marketing perspective as well. I think that's widely accepted within the industry to be like regarded as a good idea.*" [170]

"*So I think it's that, and I think also, even if people think about it, they gonna think that the market is much smaller than it is for speakers of a different language, for example. So in this sense, it can also be kind of a business decision to make the choice of "Ok, we are gonna add more languages, but we are not gonna add accessibility features".*" [171]

Subtitles

Subtitles were named a must-have feature by several interviewees, both from a player's and a developer's perspective: "*[I] always turn on subtitles as well, because... I don't know, TV speakers are just not so good. And sometimes you cannot really understand the people, so then I rather just use the subtitles.*" [172]

"*I basically always use subtitles. Because I don't want to miss anything. And because you just misunderstand a certain percentage, even if you speak a language very well or even if it's you native language.*" [173]

"*It feels to me like it is perceived like the history of features. The longer it has been around, the more you think it is important. Subtitles exist for a long time, that's why you do them first.*" [174]

[169] Transcript of Interview 2, line 70-74 (Translated from German)
[170] Transcript of Interview 5, line 65
[171] Transcript of Interview 5, line 91
[172] Transcript of Interview 5, line 47
[173] Transcript of Interview 9, line 41 (Translated from German)
[174] Transcript of Interview 9, line 115 (Translated from German)

5.2.4 Accessibility Quality Levels

Comparable to the Game Accessibility Guidelines' "Basic", "Intermediate" and "Advanced" levels[175], interviewees regarded some accessibility features as must-haves at more basic levels, but not at their most advanced levels.

Subtitles

The minimum quality level for subtitles was described as covering spoken dialog and offering settings for enabling and disabling their display: "*I think you need to define it, so everybody knows what you are talking about. Because accessibility features are currently handled very differently. If you mean: "For accessibility features we have a subtitle on/off button and that's enough" or "accessibility features need to fulfill these criteria to be considered as such". That's quite important.*" [176]

More advanced implementations would also cover sound effects or music and allow players to customize the way subtitles are displayed: "*Regarding accessibility things [I use] always subtitles, always subtitle speaker, background, if available, and [adjust] UI sizes to be bigger, if it's necessary.*" [177]

"*We also started addressing things like noises in subtitles.*"[178]

"*Subtitles would basically be enough for hearing impaired people, but with an important addition: Audio descriptive subtitles, like you also have them for movies and series. So don't just have what is spoken, but also relative sound effects. Or the music, what kind of music, to get the mood across.* " [179]

Localization

Localization of all text of a game was described as a must-have. More advanced levels could be achieved by offering more languages or by offering not only localized text but also localized voice overs: "*If accessibility also includes localization and subtitles, then I'm a little involved through UI. Especially localization and subtitles [are must-haves]. Subtitles even more, because they are text-only, because audio can be localized as well.*" [180]

"*So I think it's that, and I think also, even if people think about it, they gonna think that the market is much smaller than it is for speakers of a different language, for example. So in this sense, it can also be kind of a business decision to make the choice of "Ok, we are gonna add more languages, but we are not gonna add accessibility features".*" [181]

[175] https://gameaccessibilityguidelines.com/full-list/
[176] Transcript of Interview 6, line 135 (Translated from German)
[177] Transcript of Interview 6, line 53 (Translated from German)
[178] Transcript of Interview 9, line 31 (Translated from German)
[179] Transcript of Interview 6, line 197 (Translated from German)
[180] Transcript of Interview 2, line 70-74 (Translated from German)
[181] Transcript of Interview 5, line 89-91

Tutorials

Tutorials were described as being offered in various quality levels by different games: "*I think the good tutorials are done earlier, but the bad ones are added later. Simple pop-up text, like: "You can do this and this.*""[182]

"*So, the accessibility options can go into very very small details. And the assumptions if something can be done goes a long way, because people will try stuff, just because they played this game or that game, or they didn't play any game at all. So they come to different conclusions of how something could work, so introducing them to that in an understandable way could also count as an accessibility option, because if something helps them play and it's easier for them to continue, it's an accessibility option. So, if they are not quitting after the tutorial, because they couldn't jump over or shoot something, then there could [not] be better work done. So it's all intertwined with many, many aspects of development.*" [183]

"*I think there's even like rules or good practices for tutorials, like: Show the thing the player's supposed to do, let the player do the thing, write the thing or... many steps on the way, because the player could miss any of this points, or all of them. So, the more... of course, it depends on the game, but the more ground you cover and make sure the player's aware of how things work, the more they will enjoy the game in the end. So, there is a lot of stuff that can be done in this regard.*"[184]

Text

Some interviewees described text presentation to be configurable by players as being of lower priority. However, the static default should be designed with accessibility in mind: "*You do make sure to fulfill certain requirements, and you also receive feedback, which is then incorporated. After all, it's sometimes also pretty difficult for people with normal vision if text is too small. Or if contrast is too low. Of course, you work against this in such cases.*" [185]

"*I don't use super-fancy fonts in general. There are standard fonts which are also used in magazines and such. I believe these are made to be well readable. I don't know it for sure, but I assume the established ones are well-tested.*" [186]

Others mentioned how fonts and text sizes could also be adjusted dynamically to provide a higher level of text accessibility: "*Ideally, platforms like Unity, PlayStation etc. would offer things per default so you can add them if you want to. So platforms would principally provide these features. Then they could offer arbitrary fonts. Everyone could configure it the way they want to. If a player is satisfied with this standardized design, it will be*

[182]Transcript of Interview 2, line 188 (Translated from German)
[183]Transcript of Interview 35, line 149
[184]Transcript of Interview 35, line 153
[185]Transcript of Interview 7, line 57 (Translated from German)
[186]Transcript of Interview 7, line 123 (Translated from German)

applied instead of the game-specific one. So players are provided with the choice between the game's solution or the external one. And even if a developer would not implement, for example subtitles, the standardized solution might still work." [187]

"*Like you can see it on iOS, because they have always put emphasis on accessibility. To have console platform operators root this system-wide so deeply, so you, as a game developer, simply have interfaces. So you access this interface, and fonts, for example, are enlarged or contrasts enhanced, system-wide.*" [188]

Figure 5.7 shows the PlayStation 5 console's accessibility system menu which allows players to choose between four different text sizes.

Button Mapping

Offering alternative predefined ways to support multiple input modalities for executing particular game play actions was considered a must-have: "*Yeah, the easiest one was for both PC and the VR games, were people had to hold a button. And sometimes that was difficult for people, so they could just press it once and it, for example, enabled sprint, or a different function. So this is the one that comes to my mind the fastest.*" [189]

"*In its simplest form it was just: "I can map my buttons differently." Which was a very important aspect already, in a way.*"[190]

In comparison, fully customizable controls were described as requiring more effort to convince stakeholders of their importance: "*Even if the publisher is super unaware of it, you can make a case of like "Hey, actually we would like this game to have re-mapable controls". Not just because this allows anyone with like an alternative/accessible controller to map them according to their preferences, but also normal players, you know. It makes sense. A lot of players want to decide themselves which button to do what.*" [191]

Figure 5.8 shows examples for games with static, predefined and fully customizable controls.

5.2.5 Accessibility Settings

One of the interviewees explained, how some games offer implicit accessibility settings which can be activated by executing certain in-game actions: "*From my perspective, the more accessibility options you have, the wider audience there is. There is one very prominent example contrary to this. That would be the FromSoftware games, where people... the accessibility options there is a completely different topic, I think. They have accessibility options, but they are just not presented as accessibility options. So you can*

[187] Transcript of Interview 2, line 210-226 (Translated from German)
[188] Transcript of Interview 4, line 100 (Translated from German)
[189] Transcript of Interview 35, line 97
[190] Transcript of Interview 9, line 17 (Translated from German)
[191] Transcript of Interview 5, line 93-101

play the game on easier difficulty, you just need to cater the builds or the stuff you use or how you play to "cheese" through bosses or make it a bit easier." [192]

Figure 5.9 shows "Kingdom Hearts" as an example for a game with implicit accessibility settings.

Another interviewee said they appreciated an explicit settings menu: "*As a PC and console gamer, the first thing I do when starting a game is checking what is included in the options menu. So I get a feeling in the back of my head about the things I could adjust later, in case I don't like it.*" [193]

Making Accessibility Features Optional via Settings

Several interviewees highlighted the importance of making accessibility features optional for players. If an accessibility feature has been implemented, it is considered a must-have to give players the option to activate or deactivate it via settings: "*I don't think [it would narrow the target audience]. Because I think everything implemented towards [accessibility] is a "addition of more". Of course, if there ever was a game which, for example, featured a certain color-blind mode only, and therefore excluded everybody else, yes, that would shrink the market. But it adds more value, as all of these features are added on top of existing ones. And this value will be accepted by people.*" [194]

"*As long as it's optional, I would expect you to gain more people than you lose. [...] I think [if it wasn't optional] you were more likely [to lose people]. Especially with Dark Souls: It's a difficult game, that's kind of their reputation, and they would destroy this reputation [by making it easier in general]. There are enough other games, and you can create easy games, but that would be a different game. I think that would cause more damage.*" [195]

"*I think it definitely opens up more possibilities. It was no issue with God War. I didn't read about anyone complaining about: "Ah, my video games are getting more accessible, how dare they!". I guess people would usually just skip the [accessibility] tabs. That's the advantage of concentrating it in one tab. It allows them to ignore it and keep going, if they don't need it. I think it provides advantages only, because you benefit from it even if you're able-bodied or non neurodivergent. I only see advantages with certain settings to make the game easier or more fun.*" [196]

"*If you don't want to [use skip functionality]: It's just an option. If you do want to do it, there is a reason for it. There is nothing negative about it. Even if one would argue: "But then they don't see all of the game's content." Doesn't matter, they bought the game.*

[192] Transcript of Interview 8, line 97
[193] Transcript of Interview 6, line 53 (Translated from German)
[194] Transcript of Interview 1, line 114 (Translated from German)
[195] Transcript of Interview 2, line 44-52 (Translated from German)
[196] Transcript of Interview 6, line 81 (Translated from German)

They play it the way they want, for whatever reason. They use a different feature we implemented. And that's fine too, after all." [197]

"*I would say if [accessibility features] are optional, don't alter the original game too much, and aren't in the foreground of everything, then they attract more people. I don't think they would chase initial users away. But I also think it would depend on the particular game. About what happens there and how it is communicated. If it was its whole selling point it might primarily appeal to people who are, for example, color blind. But I don't think somebody who isn't color blind would be bothered or scared away if there is an option in a game to switch [to this mode].*" [198]

Accessible Accessibility Menus

When implementing accessibility settings, they should be designed in an accessible way: "*If it was implemented, I don't think it would be implemented in a way bothering people who don't need or don't want it. Because if I don't want to adjust settings, I don't go to the settings menu, so everything should be fine. If I do want to adjust something, I know what I want to adjust and don't need to alter anything else. I would expect a well-usable basic setup, or maybe a tutorial. For example, like you sometimes have them when playing on PlayStation, with these sliders to adjust "the game should get this dark at maximum" or "that's my screen cropping area". Those are also always presented as a "tutorial" or "intro" after all. I would expect to be able to adjust it there, like "Language: That's my language" and so on. So it's easy to use for everybody and not bothering. Not overcomplicated or annoying.*" [199]

"*However, the implementation is not so easy if you have this in the game. All the accessibility settings have to be appropriately presented by UX and UI design. I think just throwing accessibility settings in can scare some people away, because a huge number of settings can be overwhelming. Additionally, features are often not explained properly, color blindness for example. So you ask yourself: "What am I adjusting here?" One possible approach would be, like with different software types, to have "default menu settings" and "advanced features". Or you adapt a filter for all settings and have an "accessibility menu". So you can present and adjust accessibility settings there, in case one wants to delve into it. And of course, especially if you are impaired, this should be already presented per default, right at the beginning. "Do you want this?" - So you could say: "No, I'm normative, I don't use this." And then you won't get stressed or overwhelmed by the huge number. Or, if you are blind, to have "Do you want to activate this feature?" immediately per screen reader. "Yes" and you are guided through the rest, like in a tutorial. I think that would make more sense, but you have to fundamentally think about how to present this. [...] So [players] don't need somebody else to install,*

[197] Transcript of Interview 6, line 107 (Translated from German)
[198] Transcript of Interview 7, line 131 (Translated from German)
[199] Transcript of Interview 3, line 109 (Translated from German)

update, start the game, read aloud the menus because the screen reader is not activated per default or similar." [200]

Figure 5.10 shows examples for games with onboarding procedures to configure certain settings.

5.2.6 Nice-to-Have

Several accessibility features were described as being considered nice-to-haves, or were not considered at all during game development.

Screen Reader Support

"*If you go further and want to proactively do something for people with impairments, you make the menu readable for screen readers, so it's accompanied [by voice]. You implement every menu item plain and simple and allow the menu to be read aloud.*" [201]

"*Like, for example, I wouldn't really know how to make certain games accessible to blind players. I know that you can do a lot with contrast if it's only partial blind, but full blind is a mystery to me.*" [202]

"*Of course, there are also things like supporting the screen reader. I think that one should be able to translate texts, but that's not reviewed as much.*" [203]

Additional Input Device Support

"*I think input is more difficult, because we don't have access to alternative input devices other than the standard mouse, keyboard or controller here.*" [204]

"*And when it comes to controls, the games I worked on are not super-time-sensitive, so I haven't really worked on an action game before. But even then I wouldn't know if it supports special controllers with different setups. That's something that would be useful to know, but usually nobody really has time for thinking about that.*" [205]

Audio Cues

"*But in many other games, where it's like more narrative-driven games or it's strategy games or so, there's a lot on the screen that you would need to be able to see, because the game doesn't support any other type of navigation through the world, through audio for example.*" [206]

[200] Transcript of Interview 4, line 45-49 (Translated from German)
[201] Transcript of Interview 4, line 104 (Translated from German)
[202] Transcript of Interview 5, line 31 (Translated from German)
[203] Transcript of Interview 9, line 59-63 (Translated from German)
[204] Transcript of Interview 3, line 41 (Translated from German)
[205] Transcript of Interview 5, line 35
[206] Transcript of Interview 5, line 31

"*It feels to me like our projects are still primarily targeted at people who can use both hands, who can see and hear. We also started addressing things like noises in subtitles. But we don't have audio cues for visually impaired people yet.*"[207]

Sign Language Output

"*I had a game idea about sign language once. I took a look at a few things and it's extremely difficult, because you need custom animations for everything. If you synchronize mouth movement animations [with voice over], you only approximate. [For sign language] you need custom things, probably motion capture, for everything spoken. So it is a huge effort, although it would be super awesome.*" [208]

5.3 RQ3 Results

Qualitatively analyzing the interview transcripts with a focus on research question 3 (*What does the term "accessibility" mean to people working in the games industry? What educational backgrounds shape their understanding of the term "accessibility"?*) led to the following results.

5.3.1 Accessibility: Theory VS Practice

All of the participants described accessibility as the process of making video games playable for people with certain impairments: "*Accessibility is of lesser importance for me personally, because I'm not affected myself and therefore do not see all these barriers. [...] Accessibility is something you can see from the outside: How does the game work as such, so it can communicate with players. Because I can imagine that we have to deal with the situation in a different way, if they cannot hear or cannot see.*" [209]

"*I understand it as implementing things into the game, so people with certain handicaps can use it too. Color blindness, for example. Not using red and green as primary colors.*" [210]

"*Accessible means to me that as many people as possible can use it. [...] That this is addressed. That people with color blindness can play games. People, who might not have all limbs, or who cannot use them the way it is expected from controllers or whatever is used to control the game. That they can use it too, despite this. Or people who are blind, or deaf.*" [211]

"*It fundamentally means to me, that a game is accessible for every kind of impairment. Be it blindness, deafness, color blindness, to name the extremes. There is a lot of potential*

[207] Transcript of Interview 9, line 31 (Translated from German)
[208] Transcript of Interview 6, line 205 (Translated from German)
[209] Transcript of Interview 1, line 4 (Translated from German)
[210] Transcript of Interview 2, line 4 (Translated from German)
[211] Transcript of Interview 3, line 7 (Translated from German)

for improvement in this sector, but it got significantly better during the last few years." [212]

"*Those are probably games where I don't have to know a certain language. That are also accessible for people [...] For example, if somebody is blind, or is missing an arm, then they are motoric impaired. [...] And the language barrier. If somebody doesn't speak English, then they are restricted by many games. [...] You would probably call something accessible if it is very independently and openly accessible. Maybe it would even refrain from using any language, being so self-explanatory that the game concept can be understood without language."* [213]

"*For me, accessibility means in principle that all players should be able to play a game. That means if somebody's physical or mental ability to experience a game differs from the norm, accessibility should allow this person to play the game anyway."* [214]

Dynamic Accessibility

Accessibility is not only described as implementing certain defaults with accessibility in mind (e.g. avoiding red and green as color combination) but also as providing players with customizable settings: "*Accessibility in video games for me means adjustments or features in video games that allow a larger amount of people to enjoy the game. In particular I'm thinking of people that have disabilities, are hearing impaired, blind, motoric issues. [...] Basically those accessibility features would enable them to enjoy the game and being able to play. Because sometimes they wouldn't be able otherwise. But I'm also thinking of difficulty. Like having more time for certain events in the game. Having different types of interactions. For example, you don't need to press, like tap, a button very quickly, but you can just hold it down."* [215]

"*For me accessibility in games is the option to customize the experience to you, and it can be from different angles. It can be from controlling the game, to visual parts, or even difficulty. So, it can be very wide, and games can cover all of those, or just parts of those, but mainly it's options to customize the experience to your needs or desires."* [216]

"*Accessibility splits for me in two directions. The first are accessibility options that I can use to customize the game so it is more accessibility for me. The second are gamepads or controllers which were particularly designed to be accessible. [...] The hardware is either built by people themselves or by certain platforms or initiatives. As a game developer and designer, it is interesting for me to follow what is built there and why. But in the end, the customizable settings are what is super-relevant for my work."* [217]

[212] Transcript of Interview 4, line 5 (Translated from German)
[213] Transcript of Interview 7, line 9-13 (Translated from German)
[214] Transcript of Interview 9, line 5 (Translated from German)
[215] Transcript of Interview 5, line 9-13
[216] Transcript of Interview 8, line 5
[217] Transcript of Interview 6, line 5-25 (Translated from German)

Important, but still often neglected

One of the participants highlighted accessibility as important and necessary: "*"Disabled" really means "difficulty is at 100%". It is in fact impossible. [...] It is always about perception. If you can get rid of that feeling of exclusion - which inaccessible software creates - Nobody wants to feel that. So it is important to get rid of it.*" [218]

Despite this common understanding of accessibility, the needs of players with certain disabilities are described as still being often neglected during game development:

"*One of the first things were about color blindness and dyslexia. Using a special font and adjusting letter spacing. So dyslexia was taken into account, but I think people are still expected to be able to see, hear, and having fully operational limbs. [...] So I think that we are still designing with the assumption everything is "normal".*" [219]

"*I think I notice reflexes and speed the most. Certain games, like Dark Souls, require you to react fast. If that doesn't work, you might not be able to play the game at all. [...] With turn-based games, cognitive abilities are required: Can you keep an eye on everything, keep all the necessary things on your mind. I think those are the two points: You either need to be fast or kind of "smart". You cannot play certain games if you lack one of these.*" [220]

"*I think expectations [on players] are very high. The fact that the person who plays the game might not fullfill the same requirements as you do is often not considered. The reason for this might be that [the topic] is not close to you. That such a person is not close to you. There is nobody in the company who represents this group of people, who could say: "Hey! This group of people and that group of people cannot play the game!" I think that's a major aspect. I also often see that not even the simplest things get implemented. I think that's because it is so far away, because they might not even think about it.*" [221]

"*Many people are affected by text size. You definitely require very strong eyesight. [...] It has improved for hearing abilities. There are also visual cues now when an enemy is approaching in an action game. So you can see from which direction they are approaching in first or third person games. [...] Most of the games require fast reactions. A normative physical size, also for hands. A normative body in general, beginning with the hardware. I read, for example, about how older people are disadvantaged by smartphones' hardware design. Because skin hydration decreases with age, so touch inputs often do not work. [...] You can tweak the available hardware a bit, but testers are "normative" as well and don't consider this much themselves. This means you should try to overcome your bias in general, when implementing, designing, testing, and ask yourself: "What kind of issues could arise in this context?" They might be dictaded by hardware, but you should think about how they could be circumvented, adjusted or tweaked.*" [222]

[218] Transcript of Interview 1, line 200 (Translated from German)
[219] Transcript of Interview 1, line 50-54 (Translated from German)
[220] Transcript of Interview 2, line 32 (Translated from German)
[221] Transcript of Interview 3, line 37 (Translated from German)
[222] Transcript of Interview 3, line 27-35 (Translated from German)

"*I think in pretty much all of the games I've worked on up until now, you would need a body with developed motor skills or at least being able to press buttons. You need to be literate to read text. You would need to be able to hold on to a controller, or a mouse. I'm imagining if you have some sort of muscle disease you wouldn't even be able to lift it. You would need to know English or another supported language. You would need to be able to see. And in many cases also be able to hear, although that depends on the game. Some games are definitely playable without sound. In some cases you would need to be having a body that can stand and move. For example, dancing.*" [223]

"*The default settings is always completely able-bodied. Two hands, all fingers, good eyesight, sometimes even better eyesight than average. That sound is audible. A normative cognitive level. If something is considered during development or for settings, it is often one of the common things. Like red-green color blindness, or communicating information not via sound only, or visually only, but combining both. Or not via color only, but also via shapes. This is not only more pleasant for normative people, but also extremely important for accessibility. But this is the limit for what is planned most of the time.*" [224]

5.3.2 Education

Only one participant named school or university education as a contributing factor for their knowledge about video game accessibility: "*I came into contact with computer game [accessibility] when we were developing a university project with "Processing" ourselves. We were doing a game directly for blind people. It was very much focused on audio and making the button mapping as simple as possible, so it's also accessible for blind people.*" [225]

Others only encountered accessibility in general and not in a video game context during their time at school or university: "*No, [accessibility] has never been a topic. The only thing I encountered when I was at school around the year 2000 was the emerging: "It is kind of stupid how there are two or three doorsteps in front of the school to reach the main hall." Because inside, there were eight elevators with two-meter-wide entrances and space for four wheelchairs, but you had to pass these stairs to get there. There was talk about how stupid this was. But I wouldn't say accessibility as an attribute during design or taking it into account was part of the educational content.*" [226]

"*No [accessibility], not in connection with games, but only in general. [...] There was nothing in connection with games or media. [...] More architecturally, because that was my previous education. I did interior architecture. It was more of a topic there. [...] I think this helped, especially because I know about [the issue's] existence at all.*" [227]

[223] Transcript of Interview 5, line 23
[224] Transcript of Interview 6, line 35 (Translated from German)
[225] Transcript of Interview 4, line 9 (Translated from German)
[226] Transcript of Interview 1, line 30 (Translated from German)
[227] Transcript of Interview 3, line 11-27 (Translated from German)

"*To answer the previous question about school: Yes, you could notice during the mid-90s how accessible entrances were more widely adopted in public spaces. With wheelchair ramps and similar things.*" [228]

Conferences

While some of the interviewees stated to never attend conferences, others recalled listening to accessibility related talks:"*I think there was a talk about accessibility at the Reboot [conference] I attended. I remember how game designers and Robin Hunicke addressed it during their presentations. But I think that wasn't solely about physical but also psychological and emotional barriers. They also addressed typical fears. I think in this sense, a game where you are getting slaughtered by horror clowns is actually not accessible too.*" [229]

"*As far as I remember, there is very few [accessibility] at big conferences, it's rather underrepresented. The conference topics I memorized the most are monetization related (laughs). Smaller conferences are more likely. I was at the Gamescom GDC in Germany with a small indy conference in parallel once. I's more likely there were one or another accessibility related talks there, but they are rather weakly [represented].*" [230]

"*I definitely did not learn this at university, but I think I probably first heard it at Game Conferences. Where I was attending talks, which are advocating for more accessibility in games.*" [231]

"*There were definitely talks about [accessibility] at Reboot conference in Dubrovnik a few years ago. I can't remember if I attended them, but it was also mentioned multiple times during the design talks I attended. [...] It was mentioned why certain things should be designed in certain ways to have a positive impact on accessibility.*" [232]

"*I don't remember exactly, but [accessibility] was probably mentioned sometime during some kind of an art lecture. I can't say "It was during this exact event" though.*" [233]

"*I'm sure I encountered the [accessibility] topic during the Game Developers Conference at least once or twice. But it was mainly about partial aspects, because the term only just became a lot broader during the last few years. At first, they were solely talking about game controls, and in the meantime, neurodiverse topics were incorporated as well. Things like color blindness, people with audio or visual impairments, all these things are part of this scope today. This was not represented as much back then, and people also didn't know how to do it.*" [234]

[228] Transcript of Interview 7, line 47 (Translated from German)
[229] Transcript of Interview 1, line 34 (Translated from German)
[230] Transcript of Interview 4, line 17 (Translated from German)
[231] Transcript of Interview 5, line 17
[232] Transcript of Interview 6, line 17-21 (Translated from German)
[233] Transcript of Interview 7, line 43 (Translated from German)
[234] Transcript of Interview 9, line 13 (Translated from German)

Consuming Media

Self-teaching through websites, social media or by playing games was also mentioned as a used method to increase knowledge about accessibility: "*I personally watch YouTube channels about games frequently, and the topic often comes up there as well.*" [235]

"*I think I also got in touch through Twitter, because I follow a lot of activists on Twitter. And a lot of people in the industry that basically speak up about social issues. And accessibility is definitely one of them.*" [236]

"*I think I got it from industry press or blogs first.*" [237]

"*I wouldn't be able to say: "It was mentioned during this school subject" or similar. At the beginning, it was rather by playing games and realizing: "Oh, in addition to the gameplay tab the options menu now also has a accessibility tab." So, noticing it like this, or via online media. YouTube, or more recently, TikTok, where you can see people who show how they configured things for themselves. Especially these custom controllers.*" [238]

Learning by Doing

Two of the interviewees stated to have learned about the term through their work in the games industry: "*I had to learn the term very early anyway, because for my first job I was working on VR games. So accessibility part was very important there, because different people reacted differently to the headset on the head. So, when we were designing the games, we had to make sure everything is covered, so... I think I saw the term before I started working in the industry, but it was ever present, pretty much, ever since. Yeah, I'd say I've learned that pretty much from being in touch in the industry and learning about stuff.*" [239]

[235] Transcript of Interview 2, line 8 (Translated from German)
[236] Transcript of Interview 5, line 17
[237] Transcript of Interview 8, line 9
[238] Transcript of Interview 6, line 13 (Translated from German)
[239] Transcript of Interview 8, line 9

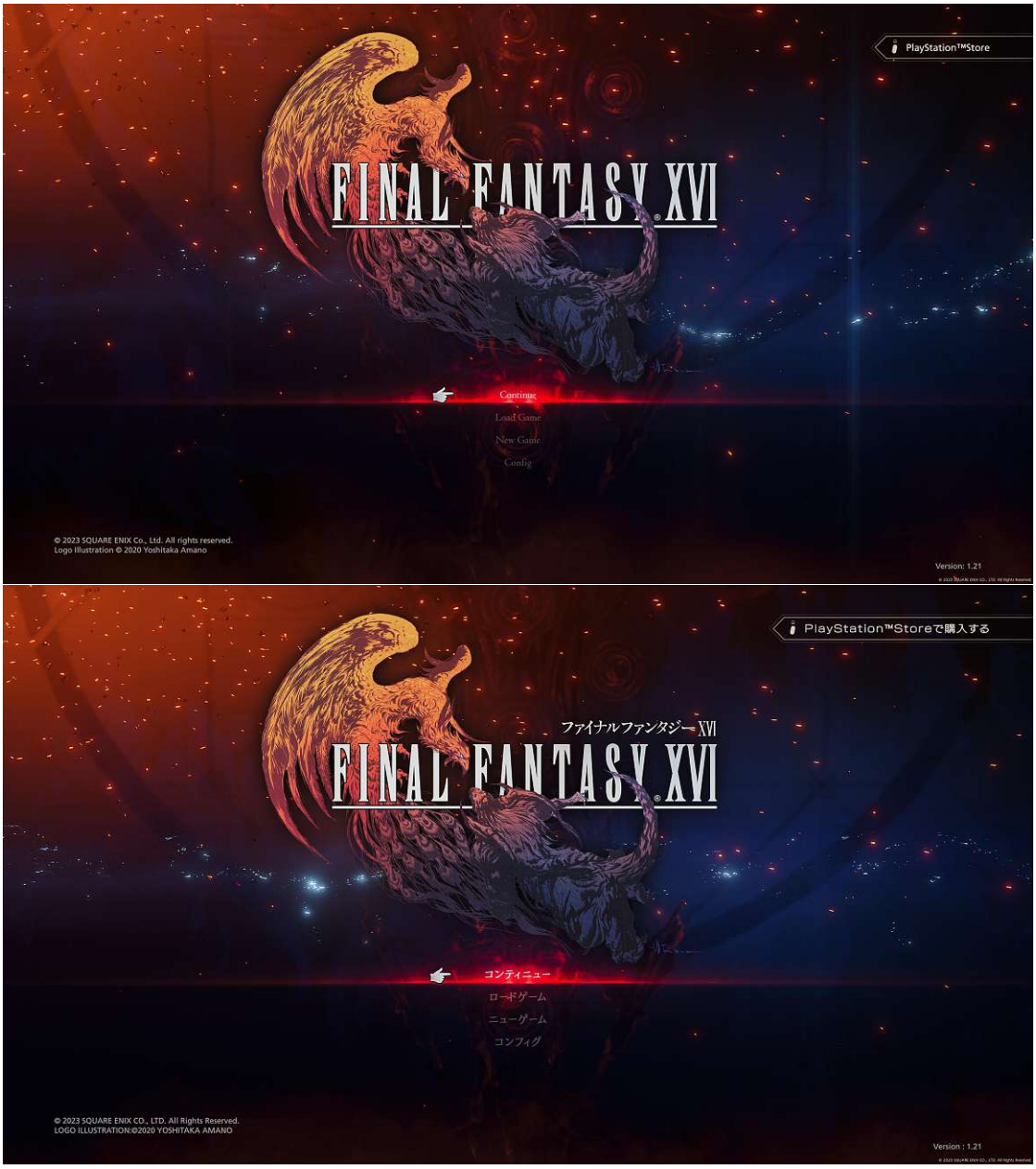


Figure 5.5: The UI text below the "Final Fantasy 16" logo is barely readable because of too small text size and a font with too thin stroke lines in both English (top) and Japanese (bottom).

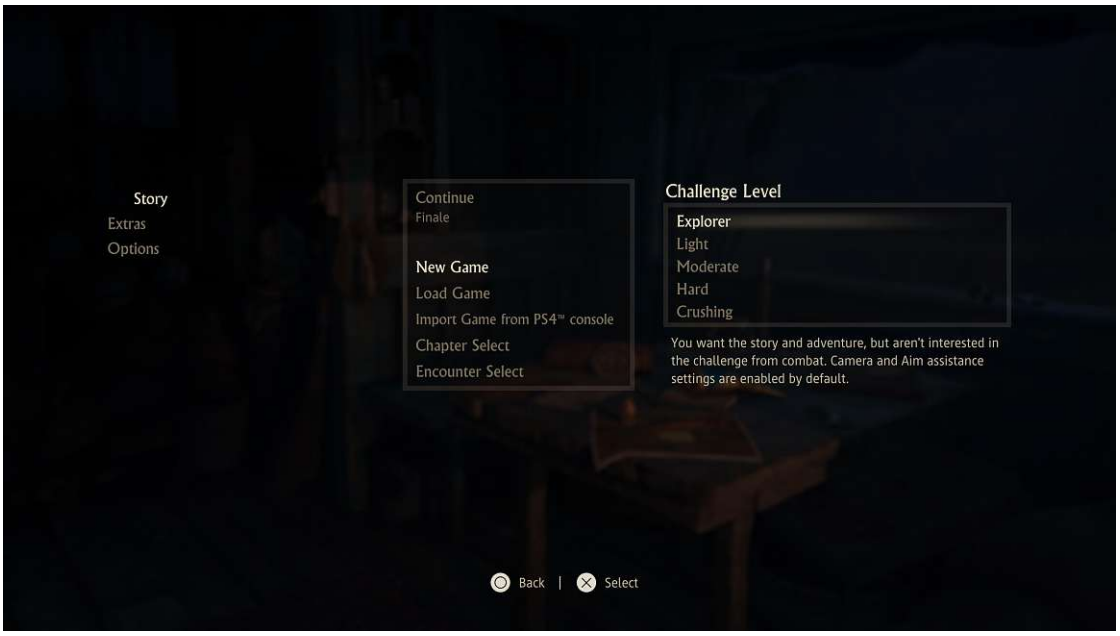


Figure 5.6: The "Explorer" difficulty in "Uncharted: Lost Legacy" .

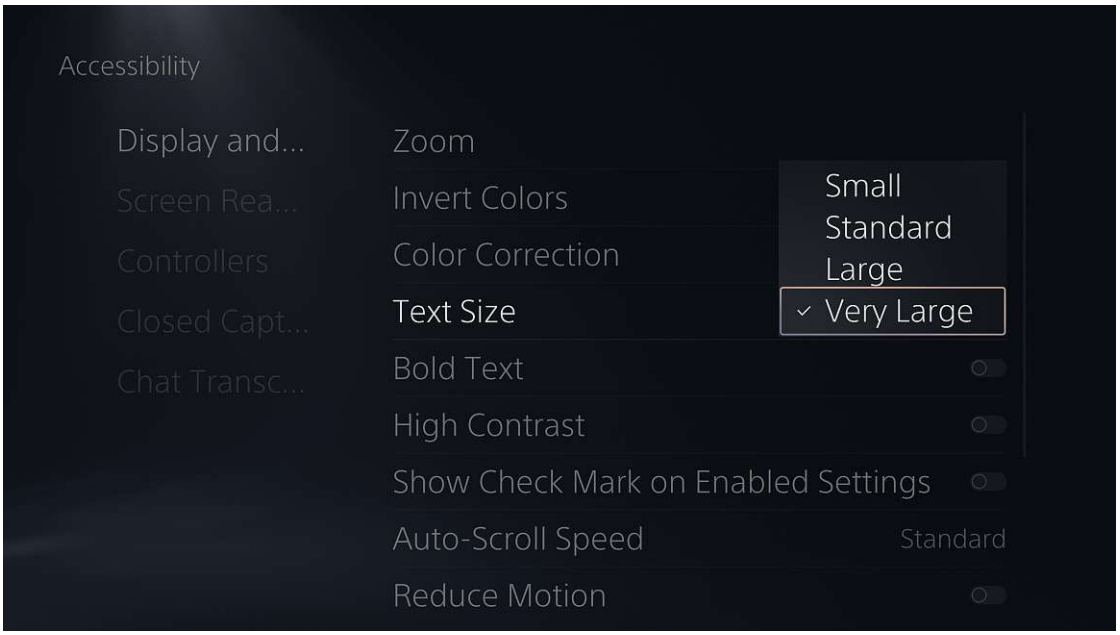
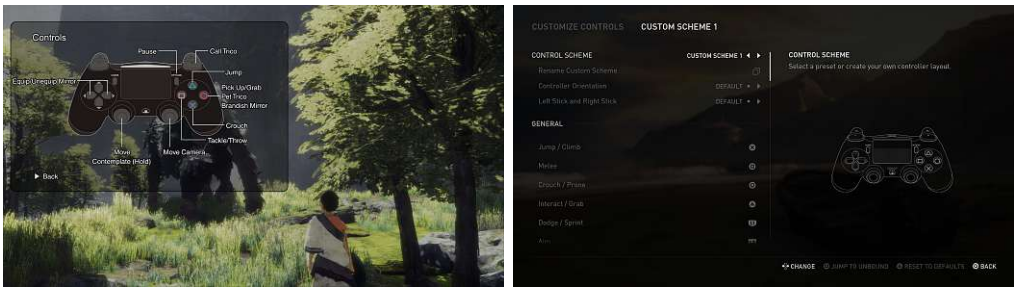


Figure 5.7: In this example, text size can be set to either "Small", "Standard", "Large" or "Very Large".



(a) Controls can be viewed only. (b) Controls can be altered by players.

Figure 5.8: "The Last Guardian" (a) offers static, predefined controls only. While "The Last of Us Part 2" (b) allows players to map controls however they want.

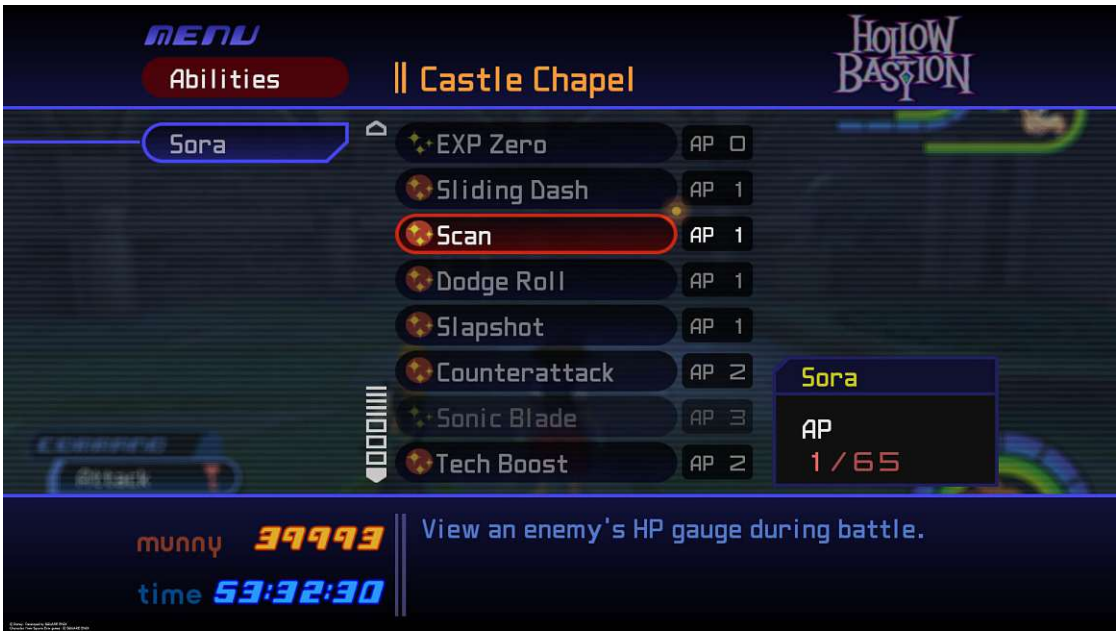
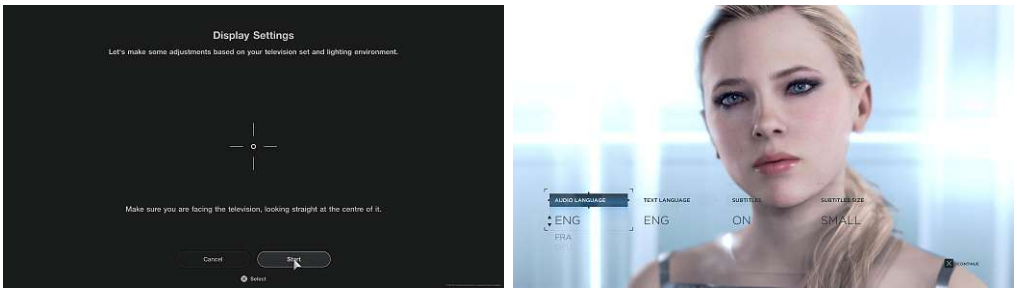


Figure 5.9: Enemy health bars can be enables in "Kingdom Hearts" by assigning "Ability Points".



(a) "Gran Turismo 7" asks for color contrast settings.

(b) "Detroit: Become Human" asks for audio and text languages.

Figure 5.10: Examples for games guiding through configuration steps during first startup.

CHAPTER 6

Critical Reflection

This chapter offers a critical reflection on the limitations of this thesis, compares it with related scientific works, and discusses open issues.

6.1 Limitations

This section discusses the following limitations of this thesis: No focus on particular impairments, document analysis sources, interview participants from a single company (without any impairments) and limited QCA verification.

6.1.1 Accessibility in General

This thesis covered video game accessibility in general. In-depth views of accessibility for people with particular impairments or addressing all kinds of different impairments was beyond the scope of this work. As such, the results of this thesis predominantly refer to video game accessibility practices in general.

6.1.2 Document Analysis Sources

The documents sourced from wiki documentation software which were used for the document analysis were ultimately not suitable for qualitative analysis. Presumably, transcripts of development team meetings would have led to richer and more qualitative results, but representatives from the studied video game studio did not agree to recording such meetings due to the invasiveness of such a procedure.

6.1.3 Interviewees from one single company - None of them with Impairments

All interviewees worked at the same company, so knowledge about the wider game development industry could only be acquired in limited capacity. Additionally, there are no employees with disabilities at the company, so interviewees were not able to provide insights about game development with disabilities.

6.1.4 Limited QCA Verification

I was able to perform intra-code stability tests only to verify the qualitative content analysis. [May83, p.105] Inter-code tests were not performed, because of the autonomous nature of this thesis and the confidential contents of both development documents and interview transcripts.

6.2 Comparison with related work

Porter and Kientz conducted semi-structured interviews with six individuals representing various roles in the game development industry (three of them worked for the same company and were interviewed as a group). The way participants of their study described many aspects matched this thesis' interview analysis results: Accessibility features were perceived as being more likely to be implemented if the implementation is considered to be easy to implement [PK13, p.5](See Section 5.1.2). Middleware was described has having a significant impact on the difficulty of implementing such features [PK13, p.6](See Section 5.1.6) and the value of in-house expertise was highlighted. [PK13, p.5](See Section 5.1.7) However, other aspects mentioned by Porter and Kientz' participants were not brought up by this theses' interviewees: The impact of ability variance within the relevant impaired population on accessibility feature prioritization [PK13, p.5], as well as the role of legislation and laws, and the difficulty implementing assistive technologies on consoles. [PK13, p.6] The later might be due to several accessibility improvements on consoles during the last decade.

Li et al. let two VR developers work with a Unity plugin to make games more accessible for people with hearing impairments. After the week-long study, the developers were interviewed. Matching this thesis' results, subtitles and captions were described as commonplace and being easy to implement [LSP23, p.4](See Section 5.1.2), lacking accessibility experts in the development team would make testing harder [LSP23, p.4] (See Section 5.1.7), accessibility features would usually be added late [LSP23, p.5] despite the benefits of a sooner implementation [LSP23, p.6] (See Section 5.1.4), and concerns about accessibility features impacts on the game's challenge were raised. [LSP23, p.5] (See Sections 5.2.1 and 5.1.4) In contrast to this thesis' interviewees, participants from Li et al. were not worried about missing knowledge about accessibility tools (See Section 5.1.7) but described the difficulty of finding appropriate development tools. [LSP23, p.4]

Kulik et al. conducted semi-structured interviews with 12 developers working in the video game industry. The way participants of their study described many aspects matched this thesis' interview analysis results: Accessibility features were considered to open games up to a wider audience of players [KBC21, p.5] and the importance of accessibility features existing as optional features was highlighted [KBC21, p.8] (See Section 5.2.5). Accessibility features' capacity to improve the player experience for everyone [KBC21, p.5], the importance of thinking about accessibility from very early stages in development and throughout the development lifecycle [KBC21, p.6], and concerns about possible harms to the game's design caused by accessibility features [KBC21, p.7](See Section 5.1.4) were mentioned. Playtests and feedback sessions with players with disabilities were described as valuable, because these would allow developers to better understand how their game was being experienced by this audience of players. [KBC21, p.5], but also as potentially difficult for various reasons such as recruitment and having an accessible building [KBC21, p.6](See Section 5.1.7). Accessibility options were more commonly applied if they were considered "low hanging fruit", meaning easier to implement [KBC21, p.5](See Section 5.1.2) or represented among staff already working at their studio [KBC21, p.5](See Section 5.1.7). Personal motivations of staff members [KBC21, p.7](See Section 5.1.6) was named as a key factor contributing to feature adoption, while not having enough time to focus on accessibility [KBC21, p.7](See Section 5.1.1) and the absence of tools and features in their work environment were described as making it more difficult to make accessible games [KBC21, p.7](See Section 5.1.6). Additional aspects which were not brought up by this thesis' interviewees were mentioned by participants of the interviews conducted by Kulik et al.: The value of having processes and an overall strategy that helps the studio to focus on accessibility issues [KBC21, p.6], the value in incorporating accessibility support at an organisational level and the benefit that this brings to sharing knowledge about accessibility within a studio [KBC21, p.5], the value of having staff who are designated as being responsible or advocating for accessibility at a studio [KBC21, p.6], the presence of accessibility reviews may allow members of staff with more knowledge about game accessibility to share that knowledge with less experienced team members. [KBC21, p.6] While interviewees of this thesis mentioned how platform requirements (See Section 5.1.6) which might be indirectly informed by current laws and regulations impact feature adoption, developers who were interviewed by Kulik et al. described how legislation directly helped convince stakeholders that accessibility was something that needed more of the studio's attention [KBC21, p.7].

6.3 Discussion of open issues

This section discusses open issues regarding static accessible defaults instead of dynamic accessibility settings, implicit and explicit accessibility settings, accessibility of development tools, debug features as accessibility features, communication of accessibility features, and competitive multiplayer and accessibility.

6.3.1 Static Accessible Defaults instead of Dynamic Accessibility Settings

Several statements by the interviewed developers imply that providing a certain default level of accessibility for certain elements is often being considered as a viable alternative to making them dynamically adjustable via settings. For example, offering only a static font size for all text within a game which is bigger than a certain minimum size and displaying it with a certain static minimum contrast against its background, using a certain static font which is considered to be well readable. While this certainly can make a game more accessible for people with certain visual impairments, other people might still need even bigger font sizes, higher (or lower) contrast, or alternative fonts to be able to read text within a game.

6.3.2 Implicit VS Explicit Accessibility Settings

This thesis covered mostly explicit accessibility settings. It needs to be discussed when something which might be called "implicit accessibility settings", i.e. making the game more accessible by performing certain game play actions within the game world itself, can actually be considered an accessibility feature. Certainly not if the action needs to be performed at a place within the game's world which cannot be reached in an accessible way in the first place. For example, enabling certain game play modifiers/cheats or easier difficulty levels only after the game has been completed on a higher difficulty level at least once. On the other hand, dynamically changing difficulty which automatically adapts to the player's needs might very well be regarded as "implicit accessibility settings".

6.3.3 Accessibility of Development Tools

Research by Andrade et al. suggests Unity to be inaccessible for blind video game developers. [ARW+20, p.7] Future studies might evaluate how accessible other video game engines (e.g. Unreal, Godot or in-house engines) are, and how development studios might need to customize and modify these development tools to make them more accessible for employees with impairments. How well these video game engines support the implementation of accessibility features for games is another possible topic for further research.

Many written tutorials and workflow manuals for development tools were reviewed during the course of this thesis' document analysis. Future research might investigate how important such documents are to make development tools more accessible for people working in the games industry.

6.3.4 Debug Features as Accessibility Features

One of the developers who were interviewed for this thesis mentioned how debug features, which are used during video game development, could be repurposed as accessibility

features for players with impairments. Future research could further examine the reasons why developers often do not expose these features to players.

6.3.5 Communication of Accessibility Features

It was beyond the scope of this thesis to evaluate how accessibility features are communicated to players before purchasing a game. Future studies might evaluate and compare how accessibility features are represented on digital video game stores, like the PlayStation store, Xbox store, Nintendo e-shop, Apple App store, Google Play, GOG, or the Epic games store. This might also include the accessibility of promotion material, like trailers, screenshots and video game websites.

6.3.6 Competitive Multiplayer and Accessibility

The development documents which were analyzed as part of this thesis did not stem from competitive multiplayer game projects. The information shared by interviewees likewise mostly related to singleplayer games. Future studies therefore might focus on video game accessibility in the context of competitive multiplayer games and e-sports.

6.4 Actionable Strategies for Small Studios

This section suggests actionable strategies for small video game studios to improve the accessibility of their games.

6.4.1 Consider Accessibility Early On

Interviewees of this thesis stated multiple times how late additions or late changes to design for more accessibility are difficult to implement. Instead of having to deal with such alterations at a time where stable design and requirements are mandatory, a much more promising approach for more accessible games appears to be embracing design changes early on, at the start of a project. If the game is set to support certain accessibility standards right from the beginning, nobody on the development team has to worry about the game "not being the same" after the planned accessibility features have been implemented at a later stage. A person on the team representing people with impairments or being dedicated to accessibility can help review the game's initial design from an accessibility perspective. They might also raise awareness about which features are well supported by the used video game engines or which accessibility features are available on the platforms the game is expected to be released on.

6.4.2 Give Players More Options

Many elements which are almost always added to games can be implemented in more accessible ways by making their properties adjustable for players. The accessibility of such elements can therefore be improved with relatively small effort. Text, for example,

can be made more accessible by providing settings for text size, text color, or text font. This might even reduce the workload on UI designers in some cases, because they could leave the decisions on sizes, colors, and fonts to players.

6.4.3 Explicitly Test Accessibility

Even if there are no internal development team members with impairments, personas incorporating one or multiple impairments can be utilized to think through or virtually test various accessibility aspects. External consultants could review designs or test gameplay in cases where in-house know-how and abilities do not suffice to evaluate the product's accessibility. Like "localization testing" often already is, "accessibility testing" could become an explicit part of the project plan.

6.4.4 Consider Simpler Inputs

Nowadays, accessibility focused controllers for video game consoles do not cost much more than their "standard" counterparts. Video game studios might acquire them to test how well their games work with alternative hardware and to gain a better understanding of how people with certain impairments play. However, as these controllers are designed to address a wide range of impairments and also serve as adapters for more specialized input devices, the use of this hardware alone does not guarantee accessibility for games which require too complex input actions from their players. Developers need to make sure there is a way to interact with their game without multiple simultaneous button presses or fast-paced, timing-dependent inputs. Ideally, games should feature a mode which never requires more than one button press at a time and always gives players as much time as they might need for this button press.

CHAPTER 7

Summary and future work

This chapter summarizes the results of the document analysis and qualitative content analysis which were conducted during the course of this thesis, and suggests topics for future scientific works.

7.1 Summary

Analyzing game development documents as part of this thesis' document analysis was only able to answer the question of *what* features were planned for the corresponding projects but not *how* they were prioritized. The document analysis did however provide valuable information for preparing the interview guide which was used during the subsequent semi-structured interviews with people working in the video game industry.

According to the interviewees, various aspects influence accessibility feature prioritization (RQ1: *How are accessibility features prioritized during game development?*): Available resources (time constraints, available employees, company size, monetary constraints), effort (test effort, implementation effort), if it is considered a "core feature" (which in turn depends on its marketability, number of affected players, development conventions, the desired age rating), design stability, feature visibility, responsibility (individual team members, other departments, platform holders, platform requirements, client & publisher requirements), and team diversity (which in turn depends on accessibility of workplaces & development tools). Consulting external expertise was described as a strategy to make up for a lack of diversity among team members.

Except for localization and subtitles, which were considered must-haves by all interviewees, there was no consensus on the prioritization of particular accessibility features (RQ2: *What accessibility features are considered must-haves (or only nice-to-haves) and why?*). Some accessibility features were considered must-haves while playing but only nice-to-haves when developing, and vice-versa. Examples for this include adjustable text sizes,

cheat functionality, difficulty settings and adjustable audio volumes. Some accessibility features were only regarded as must-haves depending on the kind of game or genre. For example, visual cues and the option to lower timing precision were described as being more important for action and shooter games. Interviewees regarded some accessibility features as must-haves at more basic levels, but not at their most advanced levels (e.g. subtitles, localization, tutorials, text sizes/fonts, button mapping). If accessibility features are implemented, it was considered a must-have to provide players with a settings menu to make these features optional. It was also named a must-have to implement such a settings menu in an accessible way for people with impairments who would use the included accessibility features. Features like screen reader support, additional input device support, audio cues or sign language output were described as being considered nice-to-haves, or as not being considered during game development at all.

All of the participants described accessibility as the process of making video games playable for people with certain impairments (RQ3: *What does the term "accessibility" mean to people working in the games industry? What educational backgrounds shape their understanding of the term "accessibility"?*). Accessibility was not only described as implementing certain defaults with accessibility in mind (e.g. avoiding red and green as color combination) but also as providing players with customizable settings. Despite this common understanding of accessibility, the needs of players with certain disabilities were described as still being often neglected during game development. Most of the interviewees did not acquire their knowledge about accessibility through school or university education, but by attending conferences, consuming online media, or learning about it while working in the games industry.

7.2 Future Work

None of the participants who were interviewed as part of this thesis identified themselves as being affected by motoric, cognitive, visual, hearing or speech disabilities. As a lack of accessibility of development tools was identified as a potential barrier preventing people with certain impairments from participating in video game development, future works might evaluate how accessible tools like Unity or Unreal are for affected people. Interviewees were often unaware if and how games can be made more accessible for players with certain impairments - Future studies might therefore evaluate how well development tools (e.g. Unity or Unreal) and platforms (e.g. PlayStation or Xbox) support accessibility feature implementation. As the majority of interviewees described accessibility as only playing a minor role during their education, a focus on how accessibility is taught during game development education is another possible topic for future works. One of the interviewees described how debug features which are available for developers only have the potential to make games also more accessible for players. Future works might investigate how this potential could be leveraged and why developers often choose to deny players access to these debug features.

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