



# Game Accessibility Guidelines and WCAG 2.0 – A Gap Analysis

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**Abstract.** Game accessibility is to remove unnecessary barriers for people with disabilities (PwD), within the limitation of game rules. Canvas in HTML5 and WebGL means that virtually every web browser is a game runtime environment. The problem is that web-based games can only be optimised to follow WCAG within limits of game rules and WCAG may not include what is needed for accessible games. The W3C Silver Taskforce is at the time of this writing preparing the next version of WCAG. This paper compares WCAG 2.0 and a set of current game accessibility guidelines (GAG), to answer: (1) Which similarities and differences can be found between WCAG 2.0 and GAG?; (2) How may these differences inform the W3C Silver Taskforce in the ongoing work to prepare the next version of WCAG?; and (3) How could the optimisation for accessibility in web-based games be performed? 107 GAGs were compared with WCAG 2.0, resulting in 61 survey questions plus comments and demographics, sent to experts and other users of WCAG. Semi-structured interviews were also conducted. Conclusions are that there is a clear gap but WCAG 2.1 bridges a few parts. Furthermore, the study seems relevant for the Silver Taskforce in understanding the demarcation line between apps in general and games and possibly for how extended reality applications could be made more accessible.

**Keywords:** Games · Accessibility · Web · Canvas · WebGL · Guidelines

## 1 Introduction

Games are defined by strict rules, differentiating from other types of computer applications by adding such deliberate obstacles: “playing a game is the voluntary attempt to overcome unnecessary obstacles.” [1] Accessibility is to make a product or service (e.g.

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a game) usable to as many as possible, which means improved design for all. Thus, game accessibility can be defined as to remove unnecessary barriers for people with disabilities (PwD), within the limitation of game rules. Game accessibility has been researched since the early days of the digital game industry [2]. However, it was not until 2010 that it was legislated, under the 21<sup>st</sup> Century Communications and Video Accessibility Act 2010 (CVAA) in the USA. CVAA compliance requires Advanced Communications Systems (ACS) e.g. voice and text chat in games to be accessible. A detailed discussion of the CVAA and its impact on games is presented by Brooks [3].

Since the introduction of the Canvas tag in HTML5 and WebGL (support for hardware rendered real-time graphics without plugins), virtually every web browser is a game runtime environment. This means that web accessibility has to consider game accessibility within limits of game rules. The World Wide Web Consortium (W3C) has defined a set of Web Content Accessibility Guidelines 2.0 (here referred to as WCAG). A W3C working group called the Silver Taskforce<sup>1</sup> (TF) is currently preparing the next version of WCAG, i.e. after the interim version 2.1<sup>2</sup> (to be released). Following the WCAG requires that content is accessible, to different levels (A/AA/AAA) with Success Criteria, which poses several challenges in practice.

## 1.1 Problem and Research Questions

The problem is that web based games can only be optimised to follow WCAG within limits of game rules and WCAG may not include what is needed for accessible games. This paper presents and compares WCAG 2.0 and a set of current game accessibility guidelines (GAG), to try and answer these research questions (RQ): (1) Which similarities and differences can be found between WCAG and GAG?; (2) How may these differences inform the Silver TF in the ongoing work to prepare the next version of WCAG?; and (3) How could the optimisation for accessibility in web-based games be performed? Answering these questions is a prerequisite for further work in improving the WCAG with regards to Canvas and WebGL-based games.

## 2 W3C WCAG and the Silver Taskforce

As part of Accessibility Guidelines Working Group, Silver TF aims to include as many perspectives as possible by engaging with diverse stakeholders. Furthermore, Silver TF broadly communicates its efforts to keep the community informed and improve WCAG so that it can be inclusive of more disability and technologies<sup>3</sup>. The objective of the Silver TF is “to perform preliminary research and development for a successor to the Web Content Accessibility Guidelines (WCAG)”<sup>4</sup>. To achieve these goals, Silver TF has collaborated with researchers to compile the academic researches on WCAG. Also, Silver TF hosted a two-full day Design Sprint in March 2018 prior to CSUN Assistive

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<sup>1</sup> [https://www.w3.org/WAI/GL/task-forces/silver/wiki/Main\\_Page](https://www.w3.org/WAI/GL/task-forces/silver/wiki/Main_Page).

<sup>2</sup> <https://www.w3.org/TR/WCAG21/#new-features-in-wcag-2-1>.

<sup>3</sup> [https://www.w3.org/WAI/GL/wiki/Goals\\_for\\_Designing\\_the\\_Silver\\_Process](https://www.w3.org/WAI/GL/wiki/Goals_for_Designing_the_Silver_Process).

<sup>4</sup> [https://www.w3.org/WAI/GL/task-forces/silver/wiki/Main\\_Page](https://www.w3.org/WAI/GL/task-forces/silver/wiki/Main_Page).

Technology conference. This was a brainstorming session with invited accessibility experts for the next version of WCAG. To prepare this, Silver TF looked at existing WCAG with three lenses: (1) Conformance; (2) Usability; and (3) Maintenance, which may also be useful to understand the gap in this study.

### 3 Game Accessibility Guidelines

Game Accessibility Guidelines<sup>5</sup> came about as a response to developer demand for game-specific accessibility resources, evolving from BBC's internal game accessibility standards and guidelines [4], which in turn were adapted from WCAG 2.0. Key goals for the project were to communicate information relevant to game developers in language that game developers understood and striking an effective balance between being detailed enough to be useful, while not too verbose that they become intimidating.

On the surface they appear similar in structure to WCAG, particularly the split between basic/intermediate/advanced, but these are in fact fundamentally different to A/AA/AAA in WCAG. In particular that they cannot be used as benchmarks to audit/comply against, as what is appropriate to consider varies between games and genres. The categorization is based on a balance of how many people benefit, the level of impact on them, and developer cost/effort. They are further split by type of impairment<sup>6</sup>; vision, hearing etc., as these are easy for developers to relate to the kind of challenges present in their games. This pragmatism required for games is reflected in how the guidelines are implemented. The first action is to disregard guidelines that are not applicable to you; guidelines that would break your game if implemented. This varies significantly from game to game, e.g. avoiding all timing is an entirely reasonable accommodation in a turn-based strategy game such as *Civilization*, but it is not in a real-time game such as *Call of Duty*. This then leaves you with a tailored set of guidelines, based on what constitutes reasonable accommodations for your specific game design. The guidelines have formed the basis for academic marking criteria, government funding criteria, and a number of corporate internal guideline projects.

### 4 Related Research About Guidelines for Accessible Games

In the past many people have put a lot of effort into the topic of game accessibility guidelines and a selection are outlined below. While some guidelines focus on disabilities among seniors [5], others focus on a specific type of disability such as visual with audio games [6] and mobility and orientation [7] as well as hearing [8]. In addition to these guidelines found in research papers, BBC and the GAG, there are also well-defined guidelines developed by organisations such as AbleGamers [9], CEAPAT [10], and the IGDA Game Accessibility SIG [11]. A more generic set of guidelines of how to write about people with disabilities is also important to mention [12]. One reason to focus on GAG in this paper was that GAG has been continuously updated since 2012 (here Sep.

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<sup>5</sup> <http://gameaccessibilityguidelines.com/>.

<sup>6</sup> <https://www.w3.org/WAI/intro/people-use-web/diversity>.

2017 update), while the other game accessibility related guidelines were published once (related to the quickly evolving game industry) and some focus on only one impairment. Another reason was that three of the authors were very familiar with or creators of GAG, which made it easier to identify the gap.

## 5 Methods

An exploratory survey approach was chosen combined with a comparative gap analysis to identify and confirm the gap between WCAG and GAG (RQ1, RQ2). RQ3 was answered by discussing the analysis and survey results with related research. The authors are more or less experienced users of WCAG; one is a WCAG expert with accessibility testing certificate from US government.

### 5.1 Gap Analysis

The gap analysis was made in three steps: (1) Both sets of guidelines were inserted side-by-side in a spreadsheet, with hyperlinks to each guideline to make it easy to look up a detailed description of each. A column to identify whether each guideline in GAG (Sep. 2017 update, available as a spreadsheet online<sup>7</sup>) could be related to guidelines in WCAG 2.0 was added, as well as a column to write a brief reason. There were 121 GAGs in total, of which 13 occur one or more times (total 27 instances). By removing the 14 extra instances there were 107 unique GAGs. (2) The second step in the gap analysis was to fill in the table, by evaluating whether each GAG was represented in WCAG. For this, the names of guidelines were used. If there was any uncertainty, a question mark (?) was added. (3) One author who was familiar with both GAG and WCAG followed up those with a question mark, by using the hyperlinks to read and compare the guidelines in detail. The evaluation and motivation were updated accordingly. If there was still uncertainty (“Y?”) then it was included in the survey questions, along with those coded with ‘N’. Of the 107 unique GAGs, 61 was found not (or were still uncertain) to be in WCAG. For these, feedback from other WCAG users was needed to validate the gap analysis through the online, exploratory survey.

### 5.2 Exploratory Survey Design and Selection

The population of WCAG experts is unknown to the best of the author’s knowledge. Thus, an explorative survey approach was chosen to validate the gap analysis. Four different approaches to survey design were tried; (1) all GAGs coded with ‘Y?’ or ‘N’ were included as they were, with only minor edits such as adding “WCAG considers...”. From the authors’ internal discussion and one pilot test with a colleague, it was necessary to ease the work for respondents, while keeping as close to the origin as possible; (2) thematically grouped GAGs to 19 questions; (3) a mix of 1 and 2; and (4) as 1 but with rephrasing of GAG names, to lower the cognitive load for WCAG experts who could

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<sup>7</sup> <http://gameaccessibilityguidelines.com/excel-checklist-download/>.

not be expected to also be game experts. The fourth approach was selected as it was judged by the authors as the best compromise of being close to the original GAG names and understandable by the survey respondents of WCAG users.

Demographic questions were (1) self-identification of disability; (2) years of WCAG use; (3) self-reported WCAG expertise; (4) role(s) when using WCAG; (5) industry; and (6) work title. Questions 1–4 were control questions to better interpret the results. 61 questions (one per GAG from gap analysis) were divided into Visual, Hearing, Motor, Speech, Cognitive, and General questions. The questions were designed as hypotheses with a 5-point Likert scale: “WCAG considers <GAG name>: 1 (Disagree) to 5 (Agree)”. At the end of each section there was a comment field, and a final feedback field. There were 74 questions in total (including six demographics, six comments and one final question). The survey questions are available online<sup>8</sup>. The survey was submitted with permissions to W3C lists public-silver, wai-gl, wai-ig and aria. A one-time email was sent to 70 email opt-ins members of Silver researchers group. The survey was also spread via various social media channels, and introduced at the CSUN 2018 Silver TF Design Sprint with invited WCAG experts and others. The survey closed after 18 days.

### 5.3 Interviews

Before conducting the semi-structured interview, an online pilot interview was done with one of the survey respondents. Then we narrowed down and identified interview questions to ask. Three semi-structured interviews were conducted during the biggest Assistive Technology conference. The goal of the interview was to follow up survey answers which were hard to interpret; i.e. why some thought that WCAG considers certain GAG, while authors did not (in our gap analysis). Interviewees were two WCAG experts with more than 10–15 years of W3C WCAG involvement and a product manager overseeing accessibility testing for the company. The interview template was defined with four questions based upon preliminary survey results and a conceptual explanation of each GAG rule (see Results section). The interviews were conducted by: (1) asking four questions first; then (2) explain GAG concepts and ask to add comments for each question. Interviews were between 6–12 min long, recorded with audio, transcribed and coded with the MaxQDA<sup>TM</sup> software tool.

### 5.4 Ethical Considerations

The participation for the survey and interview was voluntary and could be withdrawn at any time. The informed consent forms for the interviews were collected and those for the online survey were waived because online survey poses no more than minimal risk nor has any personal identifiers. Before sending out online survey, permissions by relevant W3C working group chairs were obtained in writing. This research is also approved by University of Illinois Institutional Review board.

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<sup>8</sup> <https://tinyurl.com/y8bkdurm>.

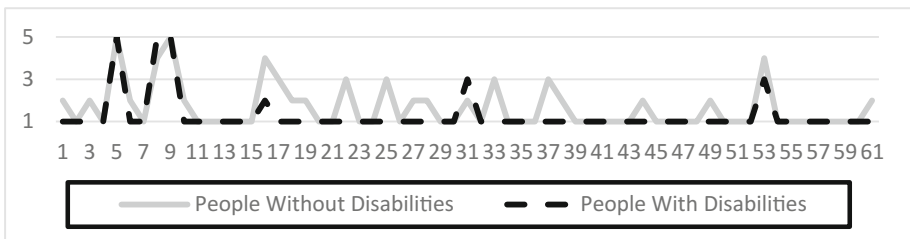
## 6 Results and Analysis

### 6.1 Preliminary Survey Results and Survey Redesign

In the 14 first survey responses to questions, a majority (>50%) respondents agreed (to a level of 4 or 5) in 5/61 questions. However, it was hard to understand why based on Likert scale data alone. Hence, we found a need to add one comment text field at the end of each section (Vision, Hearing...): “If you agreed (level 4 or 5) to any of the above, please explain”. In addition, following text was added to increase the clarity based on preliminary survey feedback: “Do you think any of these are already covered by existing WCAG guidelines?”.

### 6.2 Final Survey Results

34 responses were collected in this exploratory survey. The median ordinal data from Likert scale questions (range 1–5) in the survey are presented in Fig. 1, visualising the gap between WCAG 2.0 and GAG. Lower values confirm the gap analysis. As seen in Fig. 1, most of the gap analysis was confirmed. Notable exceptions were the five questions mentioned in the previous section. The groups of people with or without disabilities had some different opinions, where PwD tended to confirm the gap more clearly (dashed line in Fig. 1).



**Fig. 1.** Median values of 1 or 2 (Y-axis) confirm gap in each question (X-axis).

### 6.3 Semi-structured Interviews

Feedback from three interview participants (IP#) can further validate the gap analysis. Quotes and comments are added under each interview question.

**Interview Question 1.** Does WCAG require giving a clear indication that interactive elements are interactive? Conceptual explanation: Ensure clear distinction between elements that are interactive and elements that are not, for example ensuring that a white label on a red rectangular button is clearly distinguishable from a white title on a red rectangular background. This refers to visual affordances; being able to discern the function of an object through its appearance. IP1 said that “I don’t think there are any design requirements about visual design indicating interactivity” and further, “this would be at a programmatic level, your assistive technology knows that this is interactive

and can tell you.” This refers to e.g. screen readers that is still not possible to use in games as the common game engines and platforms do not support these. IP2 said “I don’t think there are specifics about what interactive means” in WCAG and further that a game “is very different on how you might just interact with content or search on a browser”. IP3 said “I actually don’t believe WCAG 2.0 covers this anyway, but 2.1 might.”. Thus, this GAG is not considered by WCAG 2.0 (according to the IPs).

**Interview Question 2.** If a printed manual is provided on how to use a website, does WCAG require the printed manual to be duplicated online in a screen-reader accessible format? Conceptual explanation: This relates to information that is required for the use of the product but is not provided within the product itself; instead it is provided externally through an entirely different type of media. IP1 said “No, because printed material is out of the scope of WCAG, it only addresses web content.” and IP3 confirmed: “No because WCAG does not cover stuff that is not web”. However, IP2 said: “they need to have access to it in an alternate form. And that to me is covered by WCAG.” but IP3 explained that with “WCAG for ICT, it is Section 508 that requires us to do that and not WCAG itself”. Thus, this GAG is not considered by WCAG 2.0 according to IP1 and IP3.

**Interview Question 3.** Does WCAG require that subtitles/captions are or can be turned on before any sound is played? Conceptual explanation: Ensure that if a single option to enable/disable the display of captions for all videos throughout a product is provided, either the menu containing that option can be accessed before the first item of video content starts to play, or the option is enabled by default. As opposed to an introductory video for an application being captioned, but captions turned off by default, and having to wait until the video finishes to gain access to the application’s general settings. IP1 said “I don’t think it specifically requires that one way or the other.” The ‘before’ is the keyword here, which IP2 noted: “Whether that happens at the beginning, I don’t think there is any specific WCAG that requires that.”. IP3 said “No it doesn’t require that but you must be able to repeat it with them on”. Thus, this GAG is not considered by WCAG 2.0 (according to the IPs).

**Interview Question 4.** Does WCAG require an option for non-essential elements to be bypassed, either by making a choice upfront or through a contextual skip option? Conceptual explanation: If part of a test or process is too challenging, offer the option to skip that part of it, on the basis that if it is removed what is left still has value. IP1 said that “I would say definitely WCAG 2 does not address that at all”. However, IP2 said that “to me the intent of the WCAG is to enable users to skip pass redundant information in the same way that any other user can do that.”. Furthermore, IP3 seems to agree: “I don’t think it is covered by WCAG” and also adds that: “to enable people with different skill level to still manage to do the game that is absolutely awesome, and it’s not just disabilities, it’s like different skill levels so a kid might still be able to play it”. Thus, this GAG is not considered by WCAG 2.0 (according to IP1 and IP3).

## 7 Discussion

Below the research questions are answered by discussing the results and analysis.

### 7.1 Similarities and Differences Between WCAG 2.0 and GAG

GAG was built upon BBC guidelines, which was built upon WCAG 2.0. While at some abstract level, there are some similarities, there are many differences. Some of the main (D)ifferences are: (D1) WCAG focus on web only, GAG focus on games as a whole product (including printed manuals); (D2) WCAG relies on User Agents, AT and programmatic determined; from the survey comments: “WCAG throws a lot of these things to a user’s assistive technology, and doesn’t expect the owner/developer of the content to provide accessibility functions”. GAG is more explicit and specific. (D3) WCAG levels A/AA/AAA vs GAG Basic/Intermediate/Advanced; e.g. GAG level basic which is applicable to most games (but not all due to game rules); (D4) WCAG aims for universal access, games cannot be universally accessible within limits of game rules; and (D5) GAG is best practices oriented, WCAG is conformance oriented.

### 7.2 Value of Gap Analysis to W3C Silver Taskforce

Clearly related to this, two comments were made by IP1 before the interview questions were asked: (1) “I believe a project like this will be an excellent first step to gather requirements.”; and (2) “One of the goals of Silver and the reason we have dropped web content from the name of Silver is that we want a broader scope”. The main differences above and the gap analysis with validations through interviews and survey may justify when to use GAGs for (web based) games instead of WCAG, or perhaps in combination. Using the problem statements by Silver TF<sup>9</sup>, maintenance problem relates to D1 and D2; conformance problem relates to D3, D4, and D5.

The scale of the gap (61 guidelines) presents several options for future Silver TF investigation. If this number of guidelines could reasonably be added to the work being considered by Silver TF. As a significant number them only apply to games, whether their inclusion may hinder developers not working on games, or if they would need to be split into a separate sub-section of guidelines. Whether separate or not, if spending time duplicating guidelines that already exist elsewhere is something that adds value. And as new mechanics and input methods arise more frequently in games than other media, a question around level of maintenance.

### 7.3 Optimising Accessibility for Web Based Games

WCAG evaluates the web page and perhaps also Canvas and WebGL content to some extent, but when that content is a game, i.e. an application with game rules, it seems better to use GAG or other sets of guidelines for accessible games. For instance, the CEAPAT guidelines [10] are written in Spanish with obvious benefits if English is a

<sup>9</sup> [https://www.w3.org/WAI/GL/task-forces/silver/wiki/Problem\\_Statements](https://www.w3.org/WAI/GL/task-forces/silver/wiki/Problem_Statements).



barrier. Also, if the game targets seniors [5], or is an audio game [6] or focusing on mobility and orientation [7] as well as hearing [8], the related research papers are also highly relevant to consider.

#### 7.4 WCAG 2.1, Virtual Reality and Beyond

This study has focused on the GAGs missing in WCAG 2.0. Comments from the survey on the still unreleased WCAG 2.1 and GAG are highly relevant: (1) “‘an option to adjust the sensitivity of controls’ is similar to WCAG 2.1’s 2.5.1 Pointer Cancellation.”; (2) “‘WCAG considers ensuring mobile content adjusts to fit users rotating their device between portrait and landscape’ is textbook WCAG 2.1’s 2.6.2 Orientation.”; (3) “‘WCAG considers avoid pressing inputs in quick succession in a limited period of time’ is helped by WCAG 2.1’s 2.5.1 Pointer Gestures”. Going further, extended reality (XR) is a concept including e.g. augmented and virtual reality, growing both in games and other application fields. IP1 commented on this: “The accessible platform architecture working group is looking at areas of work that need focus on, accessibility focus, and we have already identified web virtual reality as a major topic in gaming as I believe a subcategory of that.” As Silver TF aims to go beyond the web to apps, and GAG contains a small number of guidelines that are relevant to XR, those guidelines may be able to contribute to a starting point for XR accessibility.

#### 7.5 Limitations

34 survey responses are not enough to speak generally nor claim any statistical significance. More replies may have been possible with a longer time for the survey, but designing the survey took more time than expected. When interpreting results, years of work with WCAG did not matter much, self-evaluation of knowledge was more important. As the survey did not require login there was no control of duplicate answers, but the survey was followed up with expert interviews where the survey results seem reasonable in comparison. The survey questions were not mandatory to answer, but only two respondents missed one question each so this should not affect the results significantly.

## 8 Conclusions and Future Research

Within the limitations conclusions are that there is a clear gap but WCAG 2.1 bridges a few parts. More differences were related to the Silver TF lenses. Furthermore, the study seems to offer valuable information both for the Silver update and possibly for extended reality applications. GAG as well as other guidelines for games may be used in conjunction with WCAG for web-based games. The next step could be to evaluate more thoroughly which guidelines do not apply outside of games, or it could be to conduct several case studies or workshops, where the design of Canvas and WebGL based games are discussed in-depth involving PwD with experience of WCAG who preferably also have gaming experience. Nine persons identified as disabled in the survey. Although we did

not collect contact information, reaching out via the same channels could be a way to get in touch with them.

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