# Experience of Visually-Impaired Children in the Enjoyment of Cartoons

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**Abstract.** Accessing video media by people with visual impairments is still a challenge. Audio descriptions are used as a tool to describe images that cannot be perceived by those who cannot see and cannot be understood from dialogues. The creation of audio descriptions involves (1) modifying the videos in terms of additional audio tracks with the use of tools that require specific skills, and (2) the need to alter the original video, unless the same is directly inserted by the producers. In addition, the structure and language used for audio descriptions are often adult-oriented and less designed for children with visual impairments. In this paper, we propose a solution to provide audio descriptions without editing the original videos. A pilot test with 4 children with visual impairment allowed us to evaluate the audio descriptions prepared for a series of episodes of a cartoon popular among children, and the use of the proposed system.

**Keywords:** Cartoons, audio-descriptions, blind children, accessibility.

## 1   Introduction

The usage of videos is popular across a variety of disciplines and learning contexts (e.g. leisure time, school, higher education, and work). Videos can contribute to the promotion of an inclusive society through the multimodal presentation of information. However, it is important to note that the usage of videos can also exclude citizens if they are not designed to be accessible (Wilkens et al., 2021).

Cartoons are one of the most famous kinds of entertainment for children and adolescents. They can be very important for delivering educational content such as science, math, history, etc. since they are usually very attractive to children. Often younger children have far fewer accessible tools for entertainment unless they are specifically for education (Buzzi et al., 2015). For children with disabilities, cartoons may have a therapeutic value in terms of learning skills and behaviors (Anwar et al., 2020). Therefore it is very important that cartoons are accessible to all, including visually impaired children.

AudioCartoon (https://audiocartoon.com/) is a project that aims to fill this kind of gap by addressing accessibility in the enjoyment of cartoons which are usually available to sighted children. Thus, the multimedia content considered in this paper is related to cartoons for children with visual impairment.

Our solution for delivering accessible cartoons to children with visual impairments is based on audio descriptions (ADs), which are widely used to make videos usable by people with visual disabilities (Snyder, 2020). Our approach synchronizes audio descriptions with the audio cartoon while avoiding video editing usually applied to add ADs. Specifically, in our study we focus on:

a)      How to narrate images for visually-impaired children;

b)      How to associate narration with the videos and to enjoy them by the children.

The proposed solution was applied to 26 episodes of a popular cartoon. A preliminary study was carried out to obtain a first evaluation of the proposed accessibility features of the audio cartoons with the synchronized external ADs.

The paper is organized into 6 sections. Section 2 briefly discusses the relevant literature, and section 3 introduces the method. Section 4 presents the proposed solution. Section 5 describes the pilot test conducted with 2 visually-impaired and 2 totally blind children. Conclusions end the paper.

## 2      Related Work

Blind people can miss important information and communication when this is only or predominantly delivered in visual form. Audio description is a narrative technique which enables blind and visually impaired people to have full access to multimedia videos such as movies, talks, shows, theatre performances, museum and gallery exhibitions (Zabrocka, 2018). Audio descriptions are useful not only to overcome multimedia obstacles experienced by people due to their vision impairment but also as of integration tool for people with disabilities (Wilkens, 2021). Furthermore, The study in (Hättich and Schweizer, 2020) confirms that audio description is a useful tool for sightless people to immerse themselves and enjoy films as much as sighted people do.

Audio can affect or influence people's feeling and mood (Shadiqin Binti Firdus, 2012). Zabrocka (2021) analyzes the potential of ADs also in terms of psycho-social development, considering the importance of accessing videos, cartoons and movies by children and adolescents. Visual elements in fact can favor conversation, enabling the acquisition of communication skills and new knowledge. important opportunities in terms of child and adolescent social and personal development. This author also offers guidelines for AD creators to increase the effectiveness of their descriptions.

Audio descriptions are a practice now widely used to tell the images and scenes of videos to those who cannot see them (Schmeidler & Kirchner, 2001). Audio Description (AD) allows persons with visual impairments to hear what cannot be seen at theatre performances, on film and video, in museum exhibitions—in a wide range of human endeavors. Viewers through a secondary audio channel can hear the regular program audio accompanied by the descriptions, precisely timed to occur only during the lapses between dialogue (Snyder, 2020). To find videos that are accessible, or understandable

without additional description of the visual content, in Liu et al. (2021) people with vision impairments involved in the studies reported that they used a time-consuming trial-and-error approach: clicking on a video, watching a portion, leaving the video, and repeating the process. Unfortunately, ADs need to be prepared by a human and added to the video. Most audio descriptions have been proposed for films, documentaries and videos for adults (Holsanova, 2016; Fryer, 2016; Ramos, 2015). A wide range of examples – from film to multimedia events and touch tours in theatre, along with comments throughout from audio description users are discussed in (Fryer, 2016).

The AD audience is diverse in terms of sight experience and circumstances. Visually impaired children have needs different from the general public, as they are more likely to have delayed language than other children because of the gaps in their experience (López, 2010).

Generally speaking, a small number of existing studies indicate that cartoons are not fully accessible and suggest how to increase the effectiveness of audio descriptions. There are many studies in the literature on how to deal with audio descriptions in education, or how to generate them even automatically (Campos et al., 2020) or in real time through the use of the Text-To-Speak (TTS) (Kurihara et al., 2019). Other works investigate accessible tools to reproduce accessible multimedia contents, such as (González et al., 2015). However, these studies assume that the content is not for children and that the audio descriptions are embedded directly in the multimedia videos. Therefore, further studies are needed to investigate the issue of accessibility of cartoons and especially how to provide audio descriptions for children. For successfully accessing cartoons, it becomes crucial to understand how non visual content can be delivered with an equivalent expressive meaning and comprehensible for blind children. Our study tries to put a little step ahead in this direction.

## 3    METHOD

Our study aims to investigate audio descriptions suitable for children with visual impairments and then how to play them while watching videos. Specifically, we focus on (1) a system for playing audio descriptions synchronized with the original videos of the episodes of the cartoon 'Masha and Bear' and (2) the level of verbosity of the narration used to describe the images to children with visual impairment.

We propose a solution for playing ADs synchronized with the videos without having to alter the source video file. Three narrative verbosity levels have been evaluated with a pilot user test conducted with 4 children with visual impairment. One questionnaire - for children - was used to collect qualitative information.

A team of experts was set up to set up and conduct the user test. The team was composed of a typhlology educator, a psychologist (blind), an expert in assembling and editing videos, an expert in preparing audio descriptions, and two researchers with expertise in HCI and accessibility. The team meetings were focused on defining (1) the aspects to be evaluated, (2) the characteristics of the episodes to be included in the evaluation, and (3) the qualitative data to be collected with the questionnaire. After

analyzing the qualitative results collected with the questionnaire, a further meeting was held with the educators to better analyze and discuss some of the collected answers.

## 4      The proposed solution

Usually, audio descriptions are added to a second channel or track of the video being audio described. This procedure implies a modification of the source file, resulting in a new, modified video file as output. This requires specific digital skills to use the proper tools to process audio tracks of videos. This might limit the dissemination of audio descriptions that could otherwise be made by more people, even if specific skills in editing ADs are important (Fryer, 2016). An audio track has to be added so that such a track runs parallel to the audio of the video and such that it is played synchronously, i.e., at the right time and avoiding overlapping with the original dialogues of the video. As a result, Ad services may require skills, time and costs. So, the producers of movies, shows and other TV programs view AD as a costly service with no revenue potential (Plaza, 2017). Such a process implies that the original video needs to be modified by adding one or more audio tracks. This means that permissions need to be sought from the producers of the videos (movies, documentaries, cartoons, etc.), and there might be some copyright issues. This can take time and resources, and scalability is not assured.

The solution we propose is to run an audio track with ADs synchronized with the original video, avoiding overlapping of ADs with dialogues (as indicated for the generation of audio descriptions). To verify the feasibility of the proposed solution, audio descriptions have been produced for 26 episodes of the 'Masha and bear' cartoon, published on the official 'Audiocartoon' YouTube channel. Next, to evaluate its pros and cons, a pilot test has been carried out with four children.

Practically, a single audio track containing the whole episode narration is started together with the original episode. The audio track only shows a static black window with the details of the episode (Fig.1). It is automatically synchronized using a link on the page which activates the video of the original episode in a new tab that receives the system focus (Fig. 2).
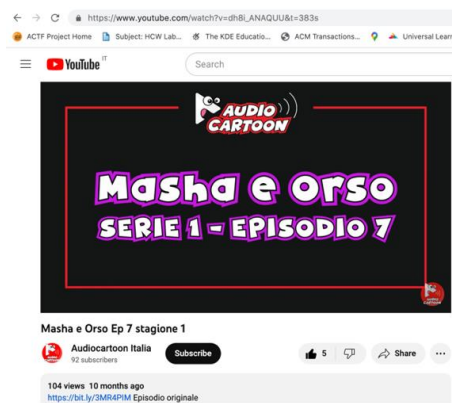


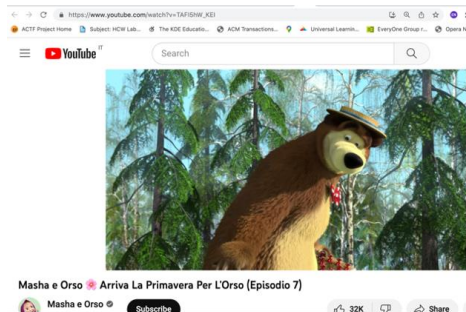**Figure 1:** Episode 7: Playing the audio track.

**Figure 2:** Episode 7: Playing the original video.

### 4.1 The Procedure

The solution we propose does not require any manipulation of the original videos, simplifying and facilitating the whole process. Specifically, it is based on:

   a) Prepare a single audio track with the audio descriptions;
   b) Upload the audio track to an online server;
   c) Play the two files (original video and AD audio track) simultaneously so that the audio contents are synchronized with the original video.

Point a) can be developed in different ways and tools. The solution we propose is independent of how the audio descriptions are produced. In the 'Audio cartoon' project, for example, experts and volunteers use software called 'ADauthor' (http://www.audiodescription.info) designed specifically to support the audio descriptor in preparing narrative content. However, this does not directly impact the solution we propose. Therefore, we take into account the audio track coming out from step a).

### 4.2 How to use the audio descriptions

The user can listen to the audio descriptions synchronized to the original 'Masha and Bear' video thanks to two YouTube pages opened simultaneously.

The user, after accessing the YouTube channel 'Audiocartoon', chooses and clicks on the desired episode. The first tab opens the track related to the audio description of the chosen episode. The link to the original episode is also available on the page. When the link to the original episode is clicked, a second tab opens and the video is played. To ensure synchronization, it is important to click on the link to the original video at a specific time. The time at which to open the link is provided by the instructions given verbally at the beginning of the audio description giving a countdown to the actual click. Accordingly, a second tab opens and the original video is played. A specific tutorial is available that explains in more detail how to listen to the audio descriptions in a way that is synchronized with the playback of the original video. The tutorial also describes how to proceed in case of loss of synchronization between the audio description and the original episode.

In our study we started to evaluate three different levels of verbosity. Three audio descriptions delivering three different levels of detail of information to the user were

associated with three different episodes: from having more details, such as character descriptions, to minimal information to describe the bare minimum. A more in-depth study needs to be conducted, but in the meantime in this study we started to analyze the acceptance of different levels of narration by the visually impaired child.

## 5 The pilot test

In this section, we describe the user experiences of blind and visually-impaired children when playing audio cartoons through the proposed solution (i.e. with synchronized external ADs). A pilot test has been carried out to have a preliminary assessment of the proposed solution, specifically to collect an early feedback about the verbosity of ADs. For this purpose, we used episodes with different verbosity.

A laptop equipped with Windows 10, Google Chrome and the Jaws for Windows screen reader was used to listen to the episodes. External audio speakers were connected to the computer to play the videos with clearer audio.

Three audio cartoons episodes with different verbosity levels have been used for the pilot test:

    a) Detailed ADs with character descriptions (verbose ADs)
    b) Detailed ADs without character descriptions (intermediate ADs)
    c) Small ADs without charactes descriptions (small ADs)

The test was included among a set of activities planned as part of a summer boot camp for blind and visually impaired children organized by the I.Ri.Fo.R. Two educators supported the children during the test: an expert in typhlo-didactics (special education for the blind) and a psychologist (also blind) with experience on visual impairment.

Before the test, the educators described the scope and activities to be performed to the children's parents and asked them to sign the consent form. Next, demographic data were collected for the users participating in the test. Data about the participants and the evaluation was collected via digital questionnaires completed by the educator.

### 5.1 Tasks

Three episodes of the 'Masha and Bear' audio cartoons were proposed to participants in the following order:

    1) episode N. 1 - "First Meeting", with verbose ADs;
    2) episode N. 7 "Spring Comes for the Bear" intermediate ADs;
    3) episode N. 18 - "laundry day" with small ADs.

The episodes were activated by the educators. All participants in a semi-circle were able to see and/or listen the selected cartoon.

### 5.2 Questionnaire

An online questionnaire was drawn up to investigate preferences and feedback with regard to the experience in playing audio cartoons by both blind and visually impaired children. The questionnaire is composed of 21 questions grouped into three sections:

  I. user demographic data (five questions);

  II. Information on audio descriptions (six questions);

  III. System Usability Scale (SUS) simplified for the child (10 questions). Simplified SUS has been successfully applied to children in recent studies (Putnam et al., 2020, Ahmetovic et al. 2022).

In the 'Information on audio descriptions' section, two questions were asked for each episode:

- Were the audio descriptions understandable by the child?
- Did the child like the audio descriptions?

  The audio descriptions had a different level of verbosity for each episode proposed, in order to understand the participants' appreciation and enjoyment related to different kinds of ADs. A 5-based Likert scale (1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, and 5 = strongly disagree) was used to collect preferences about comprehension and enjoyment.

  The questionnaire for each child was filled out by the educator after watching the episode, interviewing the child. The language of the questions was adapted to the participant age. A simple language was used and the questions were formulated to make them easy to remember in association with the Likert scale. The questionnaire was made available in Italian language as a web-based form using the Google Docs suite.

## 5.3 Participants

Four children: 2 totally blind and 2 visually impaired were recruited by the Institute for Research, Training and Rehabilitation (I.Ri.Fo.R.), which is a body managed by the Italian Association for the Blind and Visually Impaired People (UICI). The children were recruited to play the audio cartoons as part of a recreative time. Table 1 shows the Participants' demographic data. The participants' group is gender-balanced: 2 females and 2 males, 2 visually impaired and 2 totally blind.

  Participants' ages ranged from 8 to 13 years as shown in Fig. 3. One is adolescent since it is difficult to recruit totally blind children. However, this participant could evaluate the audio descriptions from the point of view of a sightless person and provide useful feedback. The two visually impaired participants (50%) previously have never enjoyed cartoons or other videos with audio descriptions, while 2 (totally blind) have occasionally played this kind of audio enriched videos. Overall, 3 users usually exploit a smartphone (iPhone/Android) while 1 participant prefers a Tablet - (iPad/Android).

**Table 1.** Participants' demographic data.

| PID | SEX | AGE | Visual Condition | Playing videos with ADs | Preferred Device |
|-----|-----|-----|------------------|-------------------------|------------------|
| P1 | F | 8 | Low vision | Never | Smartphone |
| P2 | M | 8 | Low vision | Never | Smartphone |
| P3 | M | 10 | Blind | Sometimes | Smartphone |
| P4 | F | 13 | Blind | Sometimes | Tablet |

## 5.4 Results

As mentioned before, three episodes with different levels of verbosity have been proposed to participants. All questions of the child questionnaire propose a 5-item Likert scale, thus in all graphs the X-axis reflects this scale (1..5, i.e. from strongly disagree to strongly agree).

As shown in Figure 3 episodes 7 and 18 were very comprehensible for all participants and episode 1 was very comprehensible by 3 participants, and comprehensible by 1 participant. All episodes were very liked by 3 out 4 participants and liked by 1 out 4 (Figure 4). However, the comprehension and liking of episodes could depend on many factors: including ADs verbosity, the content of the episode, and knowledge of the characters.
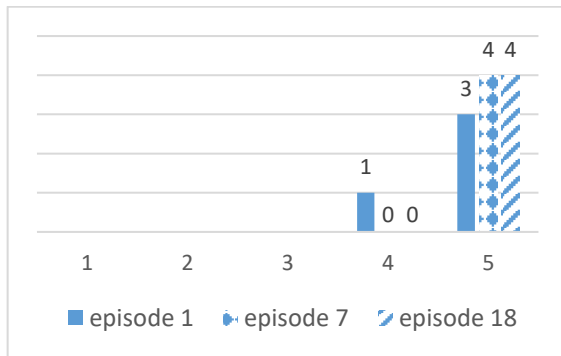


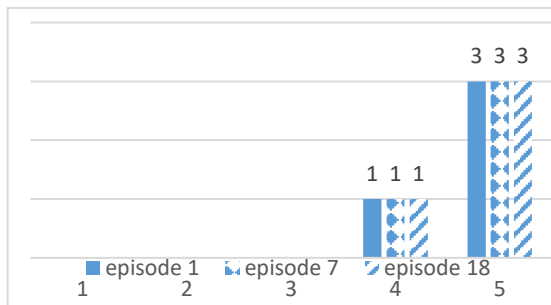**Fig. 3.** Comprehension of episode 1, 7 and 18. X axis: : 5-item Likert scale.



**Figure 4:** Liking of episodes 1, 7 and 18. X axis: : 5-item Likert scale

In the SUS section, the focus was on usability and detected issues. The SUS scale alternates between positive and negative phrases to account for biases due to a lack of attention while filling it (Peres, 2013). Overall, ten questions (shown in Table 2) were proposed for cross-validation. On the right side of Table 2 sum and average for each question are reported.

**Table 2 -** Participants' survey questions and answers rating.

| QID | Questions | Sum | Average |
|-----|-----------|-----|---------|
| Q1 | I would like to watch cartoons like this again | 17 | 4,25 |
| Q2 | It was complicated to watch cartoons like this | 7 | 1,75 |
| Q3 | It was easy to follow the cartoons | 18 | 4,5 |
| Q4 | I could use some help to be able to watch audio cartoons | 11 | 2,75 |
| Q5 | I understood the cartoon descriptions well | 19 | 4,75 |
| Q6 | Some things in the cartoon didn't make sense | 9 | 2,25 |
| Q7 | I think my friends would like these cartoons | 17 | 4,25 |
| Q8 | Some things that were said in the cartoon were strange | 7 | 1,75 |
| Q9 | I enjoyed watching the cartoon | 19 | 4,75 |
| Q10 | Descriptions should be improved | 6 | 1,5 |

To make the comparison easy, related questions were grouped in the discussion to make easier their comparison. Figure 5 shows the SUS results, aggregated by Likert values (from 1 strongly disagree to 5 strongly agree). It can be observed that the consistency of the answers: positive evaluation (Q1, Q3, Q5, Q7, Q9) varies from 4.25 to 4.75, confirming the effectiveness and usability of the proposed approach.
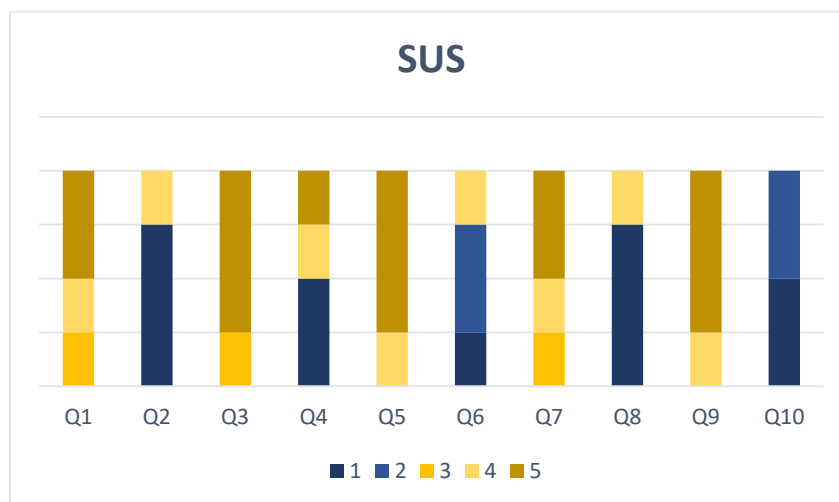


**Figure 5:** Child SUS

Concerning ease of watching/following the cartoon (Q3), three participants (75%) strongly agree it was easy and 1 (25%) believe that it is neutral (neither easy nor complicated). However, in the opposite question (Q2 - It was complicated to watch cartoons like this), one participant believe that this is a little bit complicated while more than

half of the participants (3, i.e. 75%) believe that It was not at all complicated to watch cartoons of this kind. Concerning the need to have some help to be able to watch cartoons of this type (Q4), 2 participants (50%) strongly disagree (believe they do not need help), while 1 (25) agree (need some help) and 1 (14.3%) strongly agree (absolutely need support).

Another group of questions is composed of Q5, Q6, Q8 and Q10 which are related to the ADs and their overall comprehension. Three participants (75%) strongly agree and 1 agrees that they understood ADs very well. Concerning the opposite question, "some things in the cartoon didn't make sense" one participant agree (25%) while 2 disagree (50%) and 1 strongly disagree (25%) respectively. Some things that were said in the cartoon were a little bit strange for 1 (25%) of the participants while 3 of the participants (75%) strongly disagree. The descriptions should be improved 2 (50%) participants disagree and 2 strongly disagree (50%) respectively.

The last group of questions, concerning the pleasantness of the audio-cartoon episodes, and includes questions: Q7, Q9, Q1. Two participants (50%) strongly agree they would like to watch cartoons of this kind again, 1 (25%) agreed while 1 selected the neutral option (the older female blind participants). Three participants (75%) strongly agree they enjoyed a lot watching the cartoons and 1 (25%) agree.

Concerning the question "I think my friends would like these cartoons" 2 participants (50%) strongly agree and 1 agree while 1 (25%) expressed the neutral option. In the last two questions, we have to consider the episodes were more suitable for children while one of the participants is a totally blind adolescent.


## 6    Discussion

The preliminary evaluation of the system and the audio descriptions was positive, by both the children and the educators. All episodes were evaluated as very comprehensible (score 5), except for 1 user who evaluated episode 1 (the higher level of verbosity) as comprehensible (score 4). All episodes were liked by 1 participant and very liked by 3 out of 4 (score 5). The SUS confirmed these results showing a high degree of usability of the system. Children believe that is not necessary to improve ADs. However, some critical points emerged from the in-depth discussion with the educators who supported the children during the test.

Concerning educators, they can offer valuable feedback. What surprised the educators was how few children had experience with audio descriptions. This confirms how ADs are really few used in the community of young children. The children enjoyed the system and the audio descriptions but expressed comments that highlighted the difficulty of the system in actual use.

The educators noted how much the children enjoyed this activity, thanks to the audio cartoons described to discuss all together. Thus, the activity was considered very positive since it fosters group sociability. The educators also noted that audio descriptions - if appropriately narrated - could be a valuable aid in enriching the language of young children.

# 7    Conclusion

In this paper, we have presented a way to play audio descriptions synchronised with a video, without actually embedding them in the video itself. Usually, audio descriptions are included in the video requiring specific skills and the need to have the rights to add and edit the audio tracks. The proposed solution offers a general method for distributing audio descriptions without the need to use specific and possibly paid-for software for editing videos. The idea is based on the use of audio tracks prepared with commonly used tools and synchronised using the YouTube channel.

In our study, we targeted children with visual impairments, as the younger community is the one that suffers most from the lack of amusing and entertaining material, such as cartoons. The proposed solution was applied to 26 episodes of the first series of the 'Masha and Bear' cartoon, which is the result of the 'Audiocartoon Italia' project developed in collaboration with the Italian Association for the Blind and Visually Impaired.

We perform a preliminary test of three different levels of verbosity of the audio descriptions used in the different episodes. Although the ADs subject needs to be further investigated via a specific study, the preliminary test, conducted with 2 blind and 2 visually impaired children, allowed us to gain initial feedback on the type of audio descriptions and their usefulness in the educational field for visually-impaired children.

The proposed system was not practical for young children. The difficulty is related to opening two pages simultaneously so that the respective audios are synchronized. In addition, observations and comments of the educators leading the pilot test suggest the need to have at least two levels of verbosity and the ability of the user to activate the type of audio description to listen to, more or less verbose. These are the aspects we will consider in future work.

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