

Exploring ways of meeting a wider range of access needs through object-based media - workshop

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Abstract

BBC R&D has been carrying out research into what an IP (internet protocol) broadcasting system could offer in the way of new and improved audience experiences and more efficient production workflows and tools. A key concept is object-based media where media assets and post-production functions are all kept as separate components, along with metadata describing how they might come together. By delaying media composition till as late as possible in the broadcast value chain (preferably all the way to the audience devices) experiences can respond to audience needs and the situation as the media is consumed. Audio, visual and other content can be assembled and presented in a way that is customised for the device, the person and the device limitations, enabling accessibility to be customized to the needs of the moment. In contrast to the way subtitles and audio-description are added after TV programmes have been completed, an object-based approach builds a capability for responsive personalisation into the production process. It also can enable the use of textural and semantic representations of audio and visual media (c.f. subtitles and audio description) to streamline some of the production processes and provide new production interfaces. This workshop will be an interactive session where participants are encouraged to bring along accessibility scenarios and needs to stimulate discussion around the ways in which object-based media could be shaped to provide assistance for a wider range of access needs than are currently supported by access services on television.

This workshop will be an interactive session where participants can explore the potential of OBM for access needs and help influence future work in this area.

1 Introduction

Current access services for television, subtitles and audio description are additional channels of information which can be added to the video and audio to provide cross modal information to assist people who have difficulties with hearing and vision. Object-Based Media (OBM) encompasses the idea that media could be produced in component form with guiding semantic data which allows the media to be compiled and viewed in a form that better suits the viewer's needs. This opens up new possibilities for tailoring media in ways which can help make it more accessible to people with cognitive and sensory needs. These could include adding information about mood or emotion, altering the style or pace of a programme. It can also include the addition of alternative pathways through the content, making it interactive and even linking into information about the viewer to make it more engaging.

2 Object-Based Media

In an IP based broadcasting system media can be provided in ways that can be tailored to the needs of the audience in a more fine grained manner than for traditional radio and television. By using production methods that capture and retain the structure of the programme and its semantic content alongside information about the user and their device (TV, tablet, phone etc) it is possible to provide different forms of personalisation, even down to the editorial level [1]. We use the term object-based media to describe content that can behave in this way and BBC R&D has been exploring the potential of personalisation in a number of different contexts. The following examples illustrate the potential of OBM and the ways in which media can be personalised to an individual's requirements.

One of the most straightforward uses for object-based techniques is to provide alternative audio mixes or alternative soundtracks. An early experiment was in the style of a radio football broadcast, streamed via the web, which gave the audience the option to personalise their experience varying both the level of crowd noise and the mix between the different supporters. Feedback from participants was very positive with some appreciating the ability to reduce the crowd noise so they could hear the commentators whilst others could enjoy more atmosphere [2]. More recently as part of the Orpheus project BBC R&D created an object-based play that could be followed through the perspective of different characters.

Another potential use of alternative sound mixes is to enhance the audibility of speech in TV programmes. Early proposals were for separate speech-only “clean audio” mixes. However, because TV narrative can be driven by sound effects and music as well as the speech content the challenges are more complex and require an object based approach [3]. Work is ongoing at the University of Salford into examining the needs of people with hearing impairments for audio mixes [4].

Object-based audio can also be used to build complex surround sound experiences, including height which can be replayed on loudspeaker arrays or rendered to binaural versions for headphone listening [5]. This approach is ideal for creating sound for VR experiences and was used to create *The Turning Forest*, a sound-led VR fairy-tale, premiered at the 2016 Tribeca Film Festival [6].

Object-based techniques have also been used to deliver companion screen experiences, where one or more additional screens deliver visual content which complements the main television or theatre screen. As part of the 2-IMMERSE project a prototype experience was built to present a synchronised transcript of Richard II whilst the main screen showed production of the play. This had 3 modes of operation, passive - where the screen presented the synchronised script, exploratory - where the viewer can call up additional information about the characters and actors and Call-to-action - which asked the viewer to answer questions about the play [7].

In a move away from the linear time-line of conventional media, BBC R&D created a variable length radio documentary where the listener can choose the programme duration yet still enjoy an editorially complete programme. This involved a detailed analysis of the narrative to ensure that each of the individual sub-themes within the programme remained coherent along with the overall story [8]. A similar approach could be used to enable the listener to hear different topics in a programme at varying levels of detail. This could alter the length of the programme or keep it constant by

expanding the time given to some themes whilst reducing the time given to others.

BBC R&D has also created examples of OBM which adjust implicitly in reaction to information about the audience to alter the content. These introduce additional elements to the media based on information such as their location or their music collection [9]. Other experiences have enabled the audience to explore a long running complex narrative to help catch up or explore parts of the story again as well as simply listening for hours on end [10].

Recent work has focused on creating learning experiences that adapt to the abilities of the user. A pilot experience has been built around the concept of a cookery programme that keeps pace with your progress through preparing a meal. The Cook-Along Kitchen Experience (CAKE) adjusts itself to your choice of menu options, your hob capacity and other facilities and the number of people you are catering for. The experience schedules the cooking instructions and you follow the programme in a step by step manner, providing instructions as either video clips or cue cards. It waits for you to complete each step and can adjust the schedule according to your progress [11].

3 A Model for Media Access Needs

There are many models used to categorise accessibility issues that affect media users. The model that we use in this work creates a separation between sensory (i.e. perception) and cognitive (i.e. understanding) issues. These are described in more detail below.

3.1 Sensory Accessibility Challenges

Sensory accessibility challenges are areas that can have a direct impact on individuals’ ability to perceive what is happening within a media broadcast. In this case, issues such as visual, auditory, and physical challenges are all included.

Visual challenges relate to individuals’ visual interaction with media, and the ability to fully comprehend any information that is being presented visually. Auditory challenges are related to users’ ability to interpret sound information that is attached to media. Historically, subtitles and audio description have been used to map the information from audio to video and from video to audio. However, with a shift in media habits towards smaller and more personalised displays along with alternative ways of presenting audio such as binaural comes an opportunity to revisit this and develop new interaction techniques.

Physical challenges are related to individuals' interaction with media, including the positioning and setup of media items, along with any gestures or physical inputs that are required. Whilst physical challenges are not an overly large concern within traditional media, the focus on user interaction and the possible use of haptic devices within OBM means that this is now an area of concern regarding media accessibility. For example, haptic feedback is commonplace in games controllers and the latest braille display to be launched is both multiline and far less expensive than previous displays [12].

When describing sensory challenges, it is important to think broadly about the different issues that users may face and to not only consider permanent sensory issues. Media consumption is no longer tied to specific environments where viewers are gathered round a television in an optimum viewing environment, and our view of designing for this, therefore, needs to adapt. Potential sensory challenges outside of a standard format may include:

- Designing for an interactive cooking show with hands free interaction
- Learning experiences for teaching skills such as bicycle maintenance where users are concentrating on many tasks at once
- Providing accessibility for media presented using virtual or augmented reality displays
- Accessible media on portable devices where display area is limited.

3.2 Cognitive Accessibility Challenges

Cognitive accessibility challenges can have a direct impact on users' ability to engage with and enjoy the programme that is being presented. These can come at various stages of the process of watching and listening to a piece of content such as a news broadcast, documentary, drama or educational programme.

The initial issue is engagement and concentration. If the viewer isn't sufficiently engaged by the programme then their attention will drift elsewhere and the content is simply lost to them. Engagement is dependent on many factors including the interests and lifestyle of the viewer.

If the person is sufficiently engaged with the programme and any sensory problems have been overcome, then the next step is the initial processing of the information. Visual processing disorders such as dyslexia and dyscalculia make it difficult to comprehend information presented as text and maths [13], whilst prosopagnosia makes it difficult to

recognise faces and facial expressions [14]. Similarly, auditory processing disorder can affect the ability to understand speech, distinguish similar sounds, concentrate when there is background noise and enjoy music [15]. Also any difficulty with motor skills, such as dyspraxia [16] will impact on the person's ability to interact with OBM.

People on the autistic spectrum can find busy content difficult to take in and may also have difficulty with metaphors, exaggeration and ambiguous language, preferring consistency. Particular elements of the auditory and visual content can have heightened and unpleasant impact for some people. Particular sounds or images can badly affect people with phobias or those experiencing stress, for example images of certain animals or violent scenes. There can also be problems with the content being inappropriate for the age of the viewer.

Comprehension of the content relies on shared understanding of the world and the way it works between the programme maker and the audience. This includes the use of mutually comprehensible language as well as shared knowledge of the subject and context of the programme. Differing educational backgrounds and cultural norms can make content difficult to understand as will the ability to process information and understand emotions.

Finally, the role of memory is crucial in all of these steps. Difficulties with short term memory can impair processing and comprehension whilst loss of long term memory impacts on the ability to bring context and meaning to the understanding and enjoyment of a programme.

Many of these challenges are also faced, albeit temporarily, by people coping with short term illnesses or with stressful events and issues such as attention and processing difficulties arise for people carrying out other tasks whilst consuming media. New forms of media also create new challenges in this area:

- Motion sickness induced by immersive visual media, particularly when viewed through head mounted displays [17]
- The enhanced emotional impact of immersive experiences can be overwhelming
- Multi-screen media where attention is split between devices
- Voice interfaces which create issues both in comprehending the artificial voice and being understood by the device.

4 Current Access Services

In the UK subtitles and audio description (AD) are provided as part of the broadcast signal which can be added to the video and audio in the TV receiver. This can be seen as the most basic form of object based media in that the final mixing of the signals takes place in the receiver. They provide cross modal information to provide assistance for sensory loss and do not directly address cognitive needs, though some users on the autism spectrum use access services to help understand emotional content [18]. Recent research has also uncovered the problem that the one size fits all approach for AD and subtitles does not serve all users equally with AD users wanting more personalisation [19] and subtitle users having contrasting requirements. In the case of subtitles the viewer's experience can be a tri-modal intake of language through the sound, lip-reading and subtitles [20]. Where subtitles are provided ahead of the speech they can act as priming information, enabling the viewer to hear the words more easily, whilst for others they act as a safety net, only viewed when they fail to hear a particular word [21]. Both access services can suffer from being created without directorial input sometimes leading to errors in the interpretation of words or the meaning of images. Some theatre production companies have moved beyond AD to make productions inclusive through script changes and production changes [22].

4.1 The roles of sound & vision

The audio and visual content of a TV programme carry more information content than can be conveyed by subtitles and AD. Foreground sound effects usually have a narrative role, such as a door bell ringing, and these are usually often included by subtitlers. However, the role of background sound and/or music in TV is wide ranging, from attracting the viewer's attention to maintaining continuity across cuts, providing a sense of location or mood, manipulating the viewer's understanding of the image and sometimes just to mask unwanted noises [23, 3].

Similarly, the visual images used in TV can have quite varied roles. Unlike cinema, TV grew out of radio so the narrative is carried mostly by the sound leaving the pictures free to take on a more flexible role. For example, in a news item the journalist will often write a script that is equally suitable for use on TV or radio and then edit video footage behind their speech to illustrate the story and provide context. Furthermore, the transitions between shots, e.g. from wide to close-up will move the narrative along with the expectation they

hold together with the logic of the narrative [24]. In combination, the sound and video may work together or may deliberately conflict to create a range of feelings in the viewer's mind.

5 Potential OBM Access Services

The development of OBM is an opportunity to consider accessibility needs for audio and visual media beyond just those of sensory loss. If media is being rendered locally in the device it is possible to provide enhancements to the presentation along with interaction to provide support for cognitive requirements as well.

Access requirements like these are also likely to appear in combination with each other. For these needs, there are ways in which it may be possible to provide additional content or modalities that enable the viewer to enhance their viewing experience and engage better with the stories and characters. These enhancements could be part of the audio or video, but could also be presented as text or even on haptic devices such as a braille display or games controller.

The pace and presentation style of the media could also be altered to better suit the viewer. Additional steps could be included in an explanation to provide a gentler pace or additional background information, such as information about the emotions experienced by characters in a story. The content might be sub-divided into shorter segments to allow it to be digested a little bit at a time with more frequent recaps or more background information. There is also scope for making the content more interactive, enabling the viewer to explore a story at their own pace, calling up more information about characters or locations for drama, or more in-depth information for documentaries.

Enhancements to the media could be in the form of replacement content or as re-presentations of parts of a story or as clear signposting of narrative events. However, this content could also act as priming, in the way that music is often used to set the mood of a scene additional items could be used to prepare the viewer for the upcoming narrative events.

6 Workshop Plan

This workshop will build on an approach used by Michael Crabb and Dr Michael Heron to examine how accessibility is viewed in the gaming industry and investigate what changes need to take place both to cater for new media and devices. It will start with brief introductions from participants, who will include people currently carrying out work on accessibility using object based media. As the workshop will only last for an hour these will be an informal, quick-fire paper and pen activities lasting only 10 minutes, each designed to start conversations and stimulate ideas rather than arrive at concrete conclusions.

6.1 Activity 1 – Access Needs

The first activity in the workshop will allow participants to freely explore accessibility challenges beyond those of hearing and vision. These can include temporary and situational access needs along with permanent ones. Participants are encouraged to bring their own experience of and expertise in areas of access needs not currently met by subtitles and audio description. They will also be encouraged to explore the challenges that people will face with new types of experience that may be interactive, responsive and delivered through new devices such as headsets and glasses.

6.2 Activity 2 – Meeting Access Needs

The second activity will encourage participants to explore what methods could be used to meet the access needs identified in activity 1. Participants will be encouraged to collaborate and consult with others to pool and share knowledge. Accessibility is a profoundly embodied and contextual topic, and the life experience of one person may offer a lens on the challenges discussed that another may find useful. We will encourage participants to draw on the different perspectives that others may have on how to best meet accessibility challenges.

6.3 Activity 3 – Towards Solutions

The third activity participants will be asked to pick an of the access need identified in activity 2 and develop scenarios for meeting this access need. Participants will be encouraged to base these scenarios around the concepts of OBM. However, solutions which challenge the concepts of OBM will be equally useful in terms of framing future research work.

6.4 Wrap Up

To conclude the workshop participants will be asked to briefly report back on their discussions and to suggest ways in which future research could move towards meeting new access needs. We will capture the ideas from the workshop through the use of the paper materials and photographs with the aim of sharing them in the form of a blog post.

7 Next Steps

Workshop participants who are interested in the potential of object-based media will be encouraged to share contact details. BBC R&D is in the process of building a community of practice around object-based media and input from people with expertise in accessibility issues will be very welcome. BBC R&D are also currently developing tools for building object-based media which we hope to be able to share in the future [25].

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