



THE IMPACT OF NEW FORMS OF MEDIA ON PRODUCTION TOOLS AND PRACTICES

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ABSTRACT

This paper presents a new survey of production teams' perceptions of personalisable media and its integration into their current workflows. It examines whether production teams are happy working with new media forms where the audience can personalise their media experience. These results, combined with the outcomes of the 2-Immerse Project, are formed into key principles for the design of new media tools. These key principles are then compared with the experiences of three separate production trials of new media. These teams had supporting tools which were at various stages of development. The limitations of these tools and the impact they had on completing the projects in terms of time and complexity is discussed along with the additional tools that the teams used and the roles these played, most noticeably at the planning stage. Finally, we use the experiences of these teams to validate the developed principles for creating production tools and workflows for new media experiences.

INTRODUCTION

Creating new tools for media production is always a challenge - these tools must have the desired functionality, integrate well into existing workflows and their value must be demonstrable to prospective users. An even greater challenge exists when the form of media the tool is developed for is still in its infancy and has not yet established its own creative potential. So how can effective production tools be developed in parallel with new and developing forms of media?

Much of the research to address this question has been conducted as a small part of larger trials whose primary aim was to get the new media in front of the largest audience possible. As a result, these studies only involved a narrow production cohort and cannot inform us how widely their opinions are held. This paper endeavours to deliver a broader understanding of the perceptions and challenges new media tools present in the production community. To achieve this, it first reports a broad survey of the perceptions of technical audio production staff. This is analysed along with large scale iterative consultations with production staff undertaken as part of the 2-Immerse project [1]. From these a set of principles is developed and then compared with in-depth case studies of Object-Based Media (OBM) productions. These case studies cover three end-to-end productions created by experienced production teams. Two of the productions were interactive versions of their existing programme series and the other was a specially commissioned documentary with an established independent television production company. The case studies, and the type of OBM functionality used, are:

- **Click1000** which trialled in-content narrative choices.
- **Instagramification** which trialled personalisation based on pre-selected decisions.
- **Casualty Accessible and Enhanced (A&E) Audio** which trialled personalisable audio layers for accessibility of dramatic content.

These trials offer a view into an often painful process, as production teams discover the limits of the tools available for creating new media. By comparing with the results of the large-scale studies, the design principles are validated and extended. This offers a rubric for tool developers and developers of new media to help enable their workflows to become viable as ‘business as usual’.

PERCEPTIONS OF AUDIO PRODUCTION TEAMS

This first study set out to gather the perceptions those working in audio production on new forms of media and how new media tools might integrate into their current workflows. It used examples from the Narrative Importance approach to personalisable audio [2, 3]. In this approach, all audio objects in the mix are assigned to one of four audio layers during production, based on their importance to conveying the narrative. The end user can then control the effective complexity of the mix with a single slider.

An online survey was conducted with 33 participants experienced in audio production, with an average of 21.8 years’ experience in the industry. They worked in a range of media, the majority in television production (42%) followed by radio (36%) and film (26%). Most identified their main role as sound mixer (39%) or dubbing mixer (18%). The most common genres covered were documentary, drama, and music. 73% of respondents were familiar with the object-based audio and 42% had worked on an object-based production before.

The main part of the study consisted of six questions and a narrative importance metadata assignment task. All the questions can be seen in Table 1. Participants were also given free text boxes to elaborate on their answers. The metadata assignment task used an excerpt from the Turning Forest Radio Drama [4] with an interface designed to mimic a Digital Audio Workstation (DAW). This was developed based on workshops with two experienced producers assigning narrative importance to a piece of their own content.

Results

Figure 1 shows the responses to Q1. The free text responses ranged from ‘*could be implemented almost immediately, with no real time, or cost implications*’ to ‘*it would be a lot more work involved*’. The variety of ratings probably stem from the vast differences in existing workflows. Respondents also commented on integration into particular genres with drama, where post-production times are longer, seen as more suitable whereas significant challenges were identified for live production.

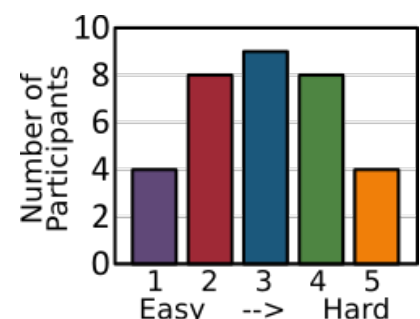


Figure 1 – Q1, Ease of integration

Participants did not find the metadata assignment task particularly easy, or particularly hard, Q2. The free text responses show that much of the difficulty stemmed from their lack of familiarity with the content. For this reason, they felt it was important that ‘*the person to categorise the content is the producer/mixer rather than a third party*’. Some also found it challenging because it involved balancing more audio objects than they were used to.

	Question	Modal Response
Q1	Rate the difficulty of the following scenario: <i>You work for a broadcaster and they have implemented the [narrative importance] personalisation control allowing the end-user to switch between high, medium and low complexity mixes in their home. To allow for the necessary metadata to be collected, you have been asked to create four narrative importance buses in all the mixes you deliver and ensure all objects are routed to one of these buses. (1 = Easy → 5 = Hard)</i>	
Q2	How easy or hard did you find it to assign an importance category to each sound object? (1 = Easy → 5 = Hard)	4 (36%) (mean = 2.8)
Q3	Do you think the number of [narrative importance metadata] categories was appropriate? (Yes/No/Unsure)	Yes (79%)
Q4	Would you change how you categorised the sounds if there was an accompanying video or a visual display? (With reference to the metadata assignment task). (Yes/No/Unsure)	Yes (56%)
Q5	Rate how you would feel about the audience being able to control the volume balance of objects in the mix based on their listening needs? (1 = Comfortable → 5 = Uncomfortable)	1 – Comfortable (56%) (mean = 1.7)
Q6	Is the importance of a sound to the narrative something you consider when you mix? (Yes/No/Unsure)	Yes (100%)

Table 1: Study Questions and responses

Responding to Q3, the majority of those surveyed felt that the number of categories of narrative importance was appropriate. More than half of those remaining (4 participants) wanted fewer categories: *‘essential, not, and middle of the road’*. Participants were split in their responses to Q4 with just over half of respondents (n=19) indicated that visuals would affect how they rate the importance of audio objects. A further 9 were unsure and the final 5 participants said No.

The responses to Q5 can be seen in Figure 2. The majority of production staff surveyed are happy for users to have greater control over the content they consume. More than half of the respondents gave a rating of ‘1 – Comfortable’ and no respondents gave a rating of ‘5 – Uncomfortable’. The free text responses demonstrated that there are four key considerations which influenced respondents’ ratings:

- Improving audience experience
- Content is already altered when reproduced
- Improving producer experience
- Concerns the audience might not know the best mix or use the function

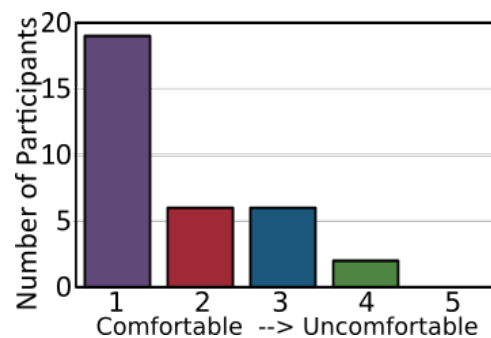


Figure 2 – Q5, Giving the user control

The response to Q6 is overwhelmingly positive. This indicates that even accounting for possible biases in the study, the concept behind the Narrative Importance approach is widely understood in the production community.

Preliminary Discussion

The results of this survey highlight the appetite which exists in the production community for new forms of personalisable media. Many production staff see giving the audience agency over the media as a creative opportunity. However, there is concern over how new



media tools may disrupt their workflows and whether the new media forms will deliver the proposed benefit. These present a valid challenge for tool development and deployment.

Specific functionality of tools is dependent on the new media itself. However, the results show a balance that must be attained between sufficient functionality for the majority of users and simplicity to minimise the barrier to uptake and scale-up time required. Functionality which builds on the established language and concepts of production is also vital. The response to Q6 shows that the narrative importance of a sound is already part of how these production staff mix and they have found the common language necessary to connect with this concept with these tools.

The tool must also be straightforward to integrate into production workflows with the right person completing the task at the right time. With narrative importance, the right person is the producer or mixer who is already working on the content. This ensures content familiarity and understanding of the narrative and audio mix. The right time is during production with any visual content available and it should be integrated with similar tasks.

The responses also highlight the importance of having time to adjust. For many participants integration of a narrative importance approach to their workflow was not seen as particularly challenging, if given time to develop new rules or templates and acclimate to the procedures. It is impossible to develop new media without some alteration to existing processes. So these changes, the content creators and programme team must be seen to increased value to compensate for the disruption and potential costs.

CONSULTATIONS WITH VIDEO PRODUCTION TEAMS

This section looks at the requirements gathering and iterative development carried out by the EU-funded, 2-Immerse project. Through its 3-year collaboration between numerous broadcasters and technical partners, the project assembled the experience and opinions of a wide range of industry practitioners. The project's aim was to develop a new open-source platform for live and on-demand object-based multi-screen entertainment that could adapt to the client device, bandwidth and personal preferences of the audience.

Requirement Gathering

The 2-Immerse project undertook the following activities to scope the needs of production teams and understand the production systems tools would need to integrate with. Those invited to participate were either already involved in the creation of object-based media or identified as in a role well-suited to adopting object-based technologies.

- Semi-structure interviews were undertaken with a technical cohort with substantial industry experience and specific experience of creating multi-screen experiences (n=7) and with a cohort of Creative Directors from the BBC (n=5). These drew out relevant requirements for object-based authoring tools to be identified.
- Review of currently used production tools, identifying common features and new features which new media would require.
- An observational study to better understand production workflows and staff roles in live broadcast was undertaken with BBC's 'Breakfast' programme.

From this the key functions were identified that tools must provide: testability, an ability to quickly react to live events, editable templates and components on demand along with an



ability to capture the priority of components relative to each other. To work well, this functionality must be offered as an extension of the current tools. This process also identified the need for a new role, that of the OBM director, using the new tools, coordinating all content that is shown aside from the main broadcast stream.

Iterative development process

From these results, a wireframe of the 2-Immerse toolset for producing object-based multi-screen experiences was developed for both live and pre-production tools. The following studies were then undertaken to evaluate and iteratively refine the tool prototypes.

Study 1. Evaluating the four different tool wireframes (n= 11, mostly comprised of participants from the requirements gathering phase). From this a single concept for the live and pre-production tools were distilled and additional functionality suggested.

Study 2. An observational field study of Outside Broadcast trucks was conducted at an international sporting event, to provide a wider understanding of the roles, editorial decisions, automated and dynamic processes, and the technical content specifications.

Study 3. A new workflow based on Study 1 and 2 was validated with participants (n=10, with some of the same participants as Study 1 with additional production staff).

Study 4. Project team undertook three in-situ live trials of the tools. Successful use of the live tool meant no further evaluation was undertaken, however the pre-production tool required further refined so the remainder of the studies focus on this tool only.

Study 5. Further evaluation of the Pre-Production Tool was conducted with participants (n=10) were presented with a new wireframe. Participants were asked to describe how they would utilise the tool to author an OBM experience.

Study 6. Participants evaluated a prototype of the Pre-Production Tool to author an OBM experience based on provided stimulus (n=7, a subset of Study 5 participants).

Results

From this iterative process, key themes emerged around crucial functions the tools needed and how they could integrate into existing workflows. Study 1 indicated that features which were similar to existing professional tools were appreciated, and emphasised that simple, intuitive features are crucial for the usability of the tool. The 2-Immerse platform was, as a result, designed with easy-to-use, graphical interfaces, of a style familiar to media producers. The observational study results built on this, surfacing a clear message about the unpredictability of live broadcasting and the increased effort that is needed in the preparation of a broadcast compared to post-produced content. The pre-production tool was significantly refined, to the point where it helped to digitise many aspects of pre-production which are currently a paper-based process. It also highlighted that the process is predicated on the playback device being a TV and that the new media would be changing some production teams' fundamental assumptions.

To streamline integration, the preparation of the media assets and the templates in the 2-Immerse tools were used existing production tools such as Adobe Photoshop. Where new functionality was required, it was implemented with style and function that mirrored existing tools e.g. preview capabilities. The tools also mimicked the workflows themselves ensuring the existing style of collaboration was retained.

The order and priority of elements were identified as fundamental concepts in the production of live content. The tools built on these concepts and ensured the new tools captured and displayed these spatial and temporal relationships between objects. This used timelines, division of the content into chapters and visualisations of content layout with place-holders for the live inserts.

Key principles

Though varied in its approach, the results of 2-Immerse echo many conclusions from the audio production study. From their combined results, key principles can be identified for the development of new media production tools. These are summarised in Table 2. In particular, 2-Immerse builds on the results by demonstrating the importance of the development process. Designing tools requires an understanding of what the desired functionality is, what workflows the tool will be integrated into and what value production staff see in the tool.

Effectively establishing the creative potential of new media whilst concurrently evaluating tool functionality and integration requires an iterative process. Only by speaking to staff, observing how they worked and learning about their existing tools, did 2-Immerse develop an understanding of the required functionality for tools and how they might integrate into, and complement, existing workflows. This emphasises the need for a mixed method approach to tool development. The frenetic pace and urgency of live production could not have been understood and designed for if the project team had not observed existing live production processes. Surveys of existing tools were also vital to ensure that the new tools did not replicate functionality and that the look and feel were as familiar as possible.

Finally, 2-Immerse also highlights that whilst integration of the tool into the right person’s workflow at the right time is important, the ‘right person’ may not yet exist and new roles may need to be created.

Functionality	Simplicity vs. Function	Tools must be powerful enough to achieve the desired creative outputs whilst being intuitive and easy to learn.
	Reflect existing concepts	Tools should endeavour to build on existing production tool functionality and the fundamental concepts of story-telling.
	Utilise a Common Language	The concepts and the tools should use language that reflects underlying production concepts and is interpretable to the target production staff.
Integration	Right person at the right time	Integration must be targeted at the right stage of production and at the role best suited for the task, if it is to naturally extend current workflows. If no role is best suited, a new role may be required.
	Scale-up time	Extra adjustment time will be required as staff must not only adapt to new tools but also adjust to the underlying concepts of the new media.
Development Process	Iterative	An iterative development process allows for integration of the new tool functionality in parallel with the realisation of the new media’s capabilities.
	Mixed methods	Varied approaches are needed to capture the broad range of functionality and integration challenges the tools and new media face.
Value Proposition	Cost vs. Benefit	Does the benefit of the new media (in creative ability or audience experience) outweigh any increase in production time and resources?

Table 2: Key Principles for New Media Tools

CASE STUDIES

Table 2's key principles give an insight into the perceptions of production staff on new media workflows. To evaluate the robustness of these principles, this section examines three case studies where new media tools were trialled with varying levels of success. The following section discusses the validity of these principles and the need for any extensions.

Case Studies 1 & 2: StoryFormer and Variable Narrative Structure

The first two case studies, Click1000 and Instagramification, utilised the BBC R&D StoryFormer tool, a cloud-based tool for editing the narrative structure of OBM stories. It introduces two new core concepts to traditional storytelling: multiple representations, that allow one section of the story to be represented by different pieces and/or types of media; and conditional logic that determines what path through the story is taken or which representation will be played. In order for the logic to respond to the user, the system has to hold information input by the user in the form of variables.

Tool Development

User-centred design sessions were held to steer the design of this application through several iterations. A workshop was conducted with a mix of content producers and developers. The aim was to identify what types of variables would be most useful to integrate into the tool and how the logic for each of these types would be handled. A second workshop was conducted to ensure that the language used in the tool was user friendly, as the original terms used were found to be confusing to users. The tool was also demonstrated to industry professionals in a series of lab-based studies. The sessions lasted 45-60mins and included the following tasks: introduction to the tool concepts; exploring a pre-loaded story; editing the story while thinking aloud and creating a story from scratch using a set of media assets.

The testing sessions resulted in a number of changes to the UI, for both the addition of media assets as well as the editing of the narrative logic. These included:

- Ability to drag and drop media items into a story node.
- A dialogue box for adding media to a node with a list of available media assets.
- Conditional Logic: The ability to apply conditions to determine which link is followed.
- Functionality to add, edit and view available variables from a drop down box.
- Change of language for variables: Boolean became 'Yes/No', Enum became 'list', and a number variable was called a 'range'.
- The added ability to preview the story with selected combinations of user inputs (variables).

Click1000 & Instagramification

Click1000 is the interactive version of the 1000th edition of television technology magazine Click, produced by a BBC in-house team, which was published in July 2019. Click1000 set out to make a "choose your own path" lean-forward version of their linear programme offering audiences active and informed choices to navigate through layered content. Instagramification is a personalised documentary produced by independent Spirit Media, published in August 2019 [5]. Spirit was commissioned by the BBC to make a largely lean-back personalised documentary about Instagram which varied according to the answers



given by users to a preceding questionnaire. A BBC staff member spent several days with both teams as an observant participant before, during and after the programmes were made. The common themes from these are outlined below.

Communication and collaboration: Linear media has developed the use of tools like storyboards, location call sheets, and scripts to communicate a vision for the content. Outlining the layers, choices and paths that characterise new forms of media proved more challenging. StoryFormer's graph aimed to visualise these layers and paths but teams found this of limited use. Instead both teams chose to plan and write within external cloud-based software such as Google Docs/Slides and Draw.io. They also used whiteboards and post-it notes to communicate creative ideas and last-minute changes.

Vocabulary: Television producers have a shared vocabulary to communicate well-understood concepts. Confusion arose with these with StoryFormer and the new form of media. Teams fed back that in future producers should develop an agreed set of terms at the start of the process.

Flow: Both production teams set out to make content that "felt like TV" and flowed between elements. Both used on-screen presenters to aid this sense of flow and found the use of music problematic since in StoryFormer sound cannot overlap the node boundaries.

Workload: Click1000 contained approximately seven times more content than a typical episode. One factor was the "combinatorial explosion" of any branching narrative [6, 7] made worse by allowing the user to choose whether or not the presenter should wear a wizard's hat. Further sequences then had to be shot twice, both with and without the hat! The personalised documentary Instagramification set out to discover whether it was possible to tell the same story customised for different audiences. Again, a decision to offer a binary choice between 'entertained' and 'informed', which used different presenters, restricted later changes and resulted in the need to film every presenter-led section twice.

Preview and review: Previewing every user journey and reviewing the content in finished form was challenging. Team members from Click and BBC R&D spent several days before publication attempting to test user journeys and uncover broken links but the task proved impossible and some revisions had to be made after audience feedback. For Instagramification reviews were completed with linear versions of proposed content but once that content was published new issues became apparent. Being able to review and verify content in its native form is a requirement for these new forms of media.

Case Study 3: Narrative Importance and Audio Personalisation

The third case study was the 'Casualty Accessible and Enhanced (A&E) Audio' trial; an episode of BBC Studios' 'Casualty' programme with personalisable audio. This used the Narrative Importance approach, which requires all audio objects in the mix to be assigned to one of four audio layers during post-production [3].

Tool Development

The first steps in tool development were two in-depth workshops with experienced sound mixers, where they were asked to assign Narrative Importance metadata to objects in a finished piece of content they had produced. They used a metadata authoring plug-in co-opted from another experimental object-based audio toolset, called VISR [8]. To audition



the mix, the metadata had to be sent to the prototype end-user control which required two additional bespoke toolsets. This process was observed by a researcher.

These workshops showed that the underlying idea of the Narrative Importance approach is already a part of how these staff mix; hierarchical gain structuring based on the importance of different sounds. To integrate the tools into existing workflows it was clear that auditioning the mix needed to be much simpler, and possibly within the Digital Audio Workstation (DAW). Participants also felt the narrative importance approach would need to be considered throughout the production process, not in the post hoc manner of the workshops. One participant suggested the process could be made simpler by using the existing routing in the DAW to assign the object to a layer (bus) corresponding with the importance, remarking; *'instead of selecting L/R on the channel I just press 0, 1, 2 or 3'*.

A new plug-in was developed based on this feedback. A wide variety of production staff was also surveyed about how they felt this approach would integrate into their current workflows. Allocation of objects to an importance level was achieved by routing to the corresponding importance level stem, which was then routed to the plug-in. When engaged, the plugin allowed auditioning of the personalisable mix, mimicking the end-user control from within the DAW. This plug-in was trialled again with one of the production staff from the original workshops. Feedback indicated this version was much more intuitive and easier to use. As a single tool, this new plug-in was also significantly easier to install.

Casualty A&E Audio

The personalisable audio mix was produced after the episode's standard mix had been completed and reviewed. The Casualty's dubbing mixer completed the mix, assisted by a researcher and with editorial input from the Producer and Post-Production Supervisor.

Despite a tool having been developed and tested, it was not approved by the DAW developer in time to be installed in the mixer's preferred DAW. Given the complexity of the session and set up of the dubbing suite, the use of an alternate DAW was not feasible. Some of these challenges were only identified on the day of the mix, necessitating the development of a new workflow on the fly. The routing in the DAW was still used and to audition the personalised mix, the gain on the four importance level stems had to be manually altered by the researcher. This presented numerous challenges:

- Introducing the mixer to the new media form whilst concurrently designing a workflow for authoring that media. Having a demo of the end-user system assisted with this.
- Use of the DAW's routing meant altering the mixer's standard workflow, using a mixing desk, to an 'inside the box' workflow.
- The process was slow as the DAW template had to be restructured (so each group of sounds e.g. sync dialogue or Foley had extra tracks to facilitate routing to the importance stems). This also made the template bloated and unwieldy.
- Multiple routing mistakes were made due the inability to easily audition the mix at varying levels.
- The sync dialogue, usually only tidied up by the track-layer, had to be edited again to split speech and non-speech sounds so they could be routed to different stems.
- Group processing (compression and EQ) had to be restructured as the narrative importance stems groups sounds by importance not similar spectro-temporal qualities. Even with a functional tool, this challenge would remain.



The process of designing the workflow, completing and reviewing the mix and rendering it took 13 hrs. Despite these challenges, the majority of decisions about the narrative importance of sounds were made easily. It was evident that knowledge of the over-arching series plots were vital to recognising the importance of some seemingly innocuous sounds. The conclusion was that the process could be made significantly simpler by not being post-hoc. Instead it was recommended that it be primarily completed in the track-lay with refinements and auditioning completed by the dubbing mixer. Development of a suitable template for this in the teams' preferred DAW would also facilitate this.

Approximately 4 months after the Casualty A&E Trial was broadcast, the Series Producer of Casualty invited the researchers back to work on a new episode. The Producer wanted to ensure that the new episode, whose plot focussed on issues around hearing loss, was as accessible as possible through the use of personalisable audio. This time, the researcher worked with the track-layer, introducing the procedure for assigning audio objects to importance levels and helping them to set up a new template. After completing approximately a third of the episode together, the track-layer felt confident to do the remainder themselves. The dubbing mixer finalised the mix independently with some remote support from the researcher. Despite the fact that it was still not possible to use the plug-in, due to the COVID pandemic disrupting the production timeline, this approach was still much quicker and involved less effort.

DISCUSSION

Development Process

The StoryFormer case studies demonstrated the importance of developing a common and intuitive language, particularly for a concept as novel as narrative logic. Crucially this language was developed early on in the process before either production began, ensuring communication between teams and between production staff and software engineers was possible, though not without difficulty, particularly for production staff. Importantly, this extended to the visual language too. By integrating the visual aspects of existing software into its tools, StoryFormer aimed for a common visual as well as spoken language.

An iterative development process for the A&E audio tools conferred similar benefits to the production line: through developing a workflow primarily reliant on existing tools the production could continue even though the tool could not be installed, albeit more slowly. Without conducting this consultation with production staff and integrating their suggestions for building on existing tools, being unable to install the new media tool would have been a major bottle neck. Though successful in some facets, the development process for A&E failed to recognise the challenge of group processing. Despite surveying a large amount of production staff, the observational aspects of the development was comparatively limited. A more balanced focus on these methods would likely have highlighted this challenge.

Functionality

The development process of StoryFormer demonstrated the need for simple, graphical interfaces which felt and looked similar to existing tools. This was further reinforced by the A&E Audio trial which emphasised that new tools should only add functionality when required and rely as heavily as possible on existing familiar toolsets.



Reviewing content is a fundamental part of the production process, which must be incorporated into new tools. Given the many permutations of interactive or personalisable media, this can become a lengthy process, requiring tools which visualise progress and flag up errors such as branches that can never be reached or layers that can never be displayed. Other issues that need to be visualised include the order and priority of content - what comes first and which layer sits on top. Without this functionality, errors happen. For A&E Audio, not having the auditioning tool resulted in a lengthy and tedious process of rendering and re-rendering the content as errors were caught.

A key problem which surfaced in the StoryFormer case studies, was the lack of functionality in key respects. Teams had to improvise with additional tools to create graphs for planning and communicating aspects of interactivity. Also teams were hampered by the inability of StoryFormer to use sound to provide continuity across scene boundaries.

Integration

Integrating new tools into existing workflows and production processes presented big challenges for all the case studies, particularly underestimating scale-up time. For A&E Audio, not only was the approval time for the tool misjudged but so was the adaption time for the DAW template. As a result, what could have been an additional few hours of production time ballooned into a marathon 13 hour mixing session. This was further exacerbated by taking place at the wrong staff of the production process and with only some of the correct staff. When conducted primarily as part of the track-lay in the second Casualty episode, following refinements in the dubbing mix, the process was much smoother. Crucially, given COVID travel restrictions, the process could be conducted independently.

For the StoryFormer case studies scale-up time was also an issue. Because of the time required to learn the tool, only one or two members of each production team learnt how to use it. This meant teams opted for familiar tools for storyboarding and scripting the content and only utilised the tool for content generation. Not having time to scale-up knowledge and understanding of the media form also impacted the production. Both teams had significant workloads caused by having two versions of the presenter. Greater time to explore the new media form may have given the opportunity to experiment with this and to explore more efficient ways to achieve their narrative aims.

Value Proposition

The additional effort of learning and using these new production tools needs to be justified by the additional value to the audience and hence to the production team. Tools that build on and improve existing workflows in the process are likely to aid adoption. However, in the case of early pilot work, production teams can be forgiving of poor or even non-functional tools if they buy into the benefits for the user experience. A&E Audio demonstrates that, despite tools which could not be installed and a lengthy addition to the production, the researcher was invited back for another episode. The benefits of personalisable audio for making content accessible overcame the production challenges.



CONCLUSION

Tool development and deployment is never seamless. When it is coupled with a media format in its infancy, this is doubly true. However, whilst the challenges faced can feel totally idiosyncratic of the particular medium, many of the challenges are common across the different new media formats and so, to some extent, predictable.

This paper has conducted a comparative analysis of large-scale surveys of production staff developing and using new tools. The results of these studies have been distilled into key principles which can guide other developers. Three case studies of new media production tools and their use in content creation are reported and used to validate these principles. They show that principles are a reliable means to identify the points of success and failure in tool development and deployment. They highlight that iterative development in close consultation with production teams facilitates development of tools which have both the key functionality and simplistic and intuitive interfaces. They have workflows which slot naturally into the production process, building on fundamental ideas of storytelling and production. Most importantly though, the new media format must deliver a benefit to the producer's creative process, the end-user experience or both. And if that benefit is evident, it can overcome most production challenges.

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