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TryFilm: Situated Support for Interactive Media Productions

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ABSTRACT

The emergence of participatory, on-demand and interactive media is changing the media production landscape. Producing interactive media is often more complex than creating traditional linear films, resulting in increased pressure for production teams. In this paper we explore what implications this has for cast and crew who participate in the production of such new media. We explore how collaborative technologies can support creative practitioners, within these challenging settings. We present TryFilm, a collaborative editing system, designed by the authors and deployed during an interactive film shoot by a small film company featuring a cast of early career actors.
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Author Keywords

Editing; Video; Production; Participation; Actors; Complex Environments; Pro-am; Tangible; Tabletop; Collaborative

ACM Classification Keywords

H.5.1 Video (e.g., tape, disk, DVI)

INTRODUCTION

The convergence of broadcast TV and film, Web 2.0 generally and social media in particular [10] have together reconfigured the landscape of film and TV production for amateur and professional makers alike. The rise of a participatory culture of media production through online and user-generated content services such as YouTube, has begun to democratize the process of media production and distribution: an industry previously dominated by large well-funded production houses and broadcast corporations.

Developments in digital video technology are empowering a new generation of independent film companies who are producing high quality media within the constraints of low budgets, limited timeframes and limited technical infrastructure. Freed from the prohibitive costs of chemical film stock, cameras and processing, these companies can take advantage of 'all-digital' production workflows: in which footage is shot, edited and distributed entirely through digital means.

Although digital technology is increasingly used in the production and distribution of video, the workflows used by production teams have remained largely unchanged. Planning often takes place on paper, with a single document - the only record of an intricate set of tasks that need to be performed. The organizational structure of the production team is crucial to the success of the project and crews often rely on a standardized set of working practices in which each member has a strictly specialized role within a complex hierarchy.

Small independent film companies, besides using highly-trained but relatively inexperienced crews - fresh from film schools, often use new (unknown) acting talent. By definition, Early Career Actors (referred to here as ECAs) often do not have a body of skills and experience to perform at their best in complex new media film shoots.

In a number of previous research projects, including StoryCrate [1], we have explored how collaborative digital systems can support media production workflows. On the basis of this research we were approached by a small independent film company who were interested in technologies to support their small film crews and ECAs in facing the challenges typical of low-budget film shoots for interactive media. In particular, they wished to explore how

technology could help them better manage complex branching narrative productions by promoting better communication and coordination between cast and crew.

To achieve this we developed 'TryFilm' (see Figure 1) - a situated collaborative editing and playback tool, which uses a hybrid interaction modality combining a multi-touch surface and tangibles. Regularly updated with new footage from the shoot, the system not only allows instant playback of the 'rushes' (unedited footage, straight from the camera), but also offers the ability to trial edits within a branching narrative. Most significantly for the production team, TryFilm was designed to be accessible to all members of the cast and crew, enabling them to maintain a shared awareness of the state of the production as it progressed. The research aim of the project was to ascertain whether facilitating group communication, reflection and learning through technology could enable a reconfiguring of traditional production roles and allow cast and crew to better manage the production while developing actors' skills.

THE CASE STUDY

Trylife are an independent film company who produce high quality, branching-narrative fiction films that are delivered to audiences via an interactive website. These films approximate the format of a 'choose-your-own-adventure' novel. At key points in the narrative, viewers can make decisions for the protagonists, the results of which have an effect on the outcome of the drama. Each ~22 minute episode presents approximately 15 different choices to the viewer. Funded and supported by charities and social organizations, Trylife's films are intended to engage young audiences with social issues relevant to them (e.g. sexual health, drugs and knife-crime) and to discuss the consequences of personal decisions relating to these issues.

Trylife are a typical example of the recent generation of film companies empowered through low-cost digital technology. Their use of an all-digital workflow and early career production teams has enabled them to build a reputation for producing innovative, high-quality interactive films despite having very limited budgets. Trylife's Executive Producer approached us during the distribution phase of the company's first interactive film, as a second episode was being planned. Reflecting on this first production, the company had identified a number of areas in which the production team had struggled, which they speculated might be solved through improving communication, reflection and engagement within the production team. We saw this partnership as providing an ideal case study through which to explore how digital technologies, which facilitate and promote collaboration and learning might be used to support complex media productions.

To thoroughly understand the company's situation, we began by undertaking interviews and in-depth discussions with a cross-section of the Trylife production team and ECAs involved in the production of previous Trylife episodes. The Executive Producer, Director, lead actor and Social Engagement Manager were involved in five group discussions in which they guided us through the production process of their previous episode chronologically; here we supported the group envisioning not only a perfect workflow, but also an ideal experience for the cast and crew, which would ensure that the cast were kept informed, engaged and mentored while at the same time, a high quality episode was produced. After each session, we discussed and fed back our interpretation of their experiences, verifying that we had understood the specifics of their practice.

CHALLENGES OF PARTICIPATORY NEW MEDIA PRODUCTIONS

A typical film production workflow, as used by most professional production companies consists of a number of phases occurring in strict sequence [20]. Usually commissioned on the basis of a script or treatment, an initial pre-production phase involves planning in great detail. Documents such as storyboards and lists of shots are drawn up, cast and crew are hired and equipment and locations are secured. In the production phase, the cast and crew are deployed and the film is shot. This latter phase is typically the most demanding in terms of logistics, as it involves a large number of people with different skill-sets (who may never have met before) working together to perform a huge number of specialized tasks. After the film is shot, the footage is processed, edited and prepared for distribution.

This rigid workflow has, over many years, become standard practice, largely due to the historical constraints of shooting on chemical film. The expense of film stock, necessity for powerful lighting, the number of crew required to operate each camera and the fact that footage cannot be played back until after processing has meant that film crews consist of many specialists who rarely share roles and rely on capturing footage in as few 'takes' as possible, avoiding reshooting at all costs.

Perhaps surprisingly given the youth of their cast and crew and their use of exclusively digital formats, Trylife's production workflow was based heavily on this traditional method and took little advantage of the affordances of digital technology, which might allow playback, continual checking and more flexible roles. Footage was occasionally reviewed on-set by the director and DoP (Director of Photography) and the producer, director and DoP would watch the rushes at the end of each day off-site, but other members of the cast and crew were excluded from these sessions.

Three main challenges emerged from our workshops with Trylife: increased production demands, the shoot as an opportunity for shared learning, and the problem of maintaining situational awareness for everyone on location.

Assisting with increased Production Demands

Digital video has freed many film crews such as Trylife from the expense of buying and processing chemical film stock, however this phenomenon has meant directors are able to shoot more takes, generating substantially more footage than

previously possible.

Web 2.0 is also providing a platform for new forms of storytelling; for example, the use of branching narratives actively engages viewers by allowing them to choose how a film plot evolves [4]. However these new formats present significant challenges for production crew and actors both in terms of the complexity of projects and the sheer amount of content required. Most of these difficulties arise from the necessity to shoot more footage (more scenes, more locations, and more possible combinations of content) than traditional productions, often within the same limited budgets and timeframes.

As an example, Trylife's second episode was 22 minutes long but required 172 pages of script in 75 scenes, requiring over 100 hours of footage to be shot. In real terms, this translates to more days shooting, more location changes, more takes of similar scenes and more time on set - factors that significantly impact both the ECA and crew experience on location.

The design challenge presented here was to develop a technology that supported cast and crew to better monitor the progress of the shoot, helping with continuity and management of the schedule for cast and crew.

Supporting Learning for Early Career Actors

As a socially engaged film company, Trylife were committed to maximizing the learning opportunities available to the young actors participating in the shoot. These learning opportunities not only concerned Trylife promoting discussion about the social issues depicted in the films but also involved helping the actors develop their acting skills and CVs. Supporting continued ECA learning was of particular importance as for many of the cast, this was their first experience of a real-world production.

Self-Reflection and Peer Support

Institutions that teach acting typically do so through a process that has been described as situated learning [14]. This process focuses on communities of practice in which people learn from one another through a complex balance of instruction, apprenticeship, and learning-through-doing. Within drama schools this involves promoting concepts such as self-reflection, visualization of action from the audience's perspective, and empathic understanding of characters [15]. Peer interaction [2] is used to motivate, teach and inform groups of actors as part of this situated learning process. Specific techniques such as recording and playing back monologues to perform micro-analysis and annotation on personal performances; real-time feedback during rehearsals; and performing group critique sessions with other actors, are used not just during training but throughout actors' careers.

The move from drama school to the film set can be a difficult transition, particularly when ECAs begin to work in independent film making contexts. Only recently, through digital video technology has it even been technically possible

to playback footage whilst still on location in order to review footage. On some crews, a Digital Imaging Technician (DIT) is employed to manage data storage and assist with camera settings and image integrity, necessitating that high-quality monitors and computers for playback (often using annotation tools such as Adobe OnLocation) are present on set. The organizational hierarchies present in traditional production teams however, usually prevent most of the cast and crew having access to content on location. It is therefore difficult for actors to receive feedback and to engage in the kinds of reflective practices - in particular visualization of action - which they have been taught to use in training.

The most common practice in these situations (although still rare) is daily group feedback sessions led by the director, in which feedback for each actor is given from the director's notes. This strategy only allows actors to adjust their practice for the following day's shoot rather than in response to their performance throughout the day. Similarly, the crew also lacks the tools to reflect on their approach and the influence of their own work on the generated footage.

On previous shoots Trylife observed that amongst the ECA cast, peer support was an important part of the learning process, increasing crew cohesion and supporting team building and personal improvement. This however was difficult to maintain in a high-pressure environment where many scenes are shot with a small subset of the actors, whilst others prepare or are at alternative locations.

Similarly, mentoring relationships were important to the learning process for ECAs. However, since the cast of Trylife's productions consisted mainly of ECAs, the number of experienced cast members capable of providing mentoring was limited and their time was at a premium: they therefore were unable to offer personal attention to each cast member. Trylife noted that the few opportunities for professional mentoring were greatly valued by the ECAs, who were sometimes overwhelmed by the pressures and complex nature of the production.

Engagement with Social Issues

Trylife's branching narrative enables the viewer to try out a variety of different routes through the story depending on character choices. To support discussion about these choices with the ECAs, Trylife employed a number of youth workers to be on location. Film sets are often challenging, intimidating and confusing environments. Furthermore, the demands of film production scheduling mean that filming of scenes rarely takes place in the same order as the narrative. Trylife found that the ECAs were struggling to understand how their characters' roles and the decisions made in the narrative affected the different outcomes of each scene that they were asked to play.

The design challenge presented here was to consider ways in which ECAs could access the branching narrative format in a way that would support peer learning and self-reflection but would also help the cast engage with the

social issues raised in the film.

Facilitating Situational Awareness

Film shoots are complex situations in which each member of the production team works chiefly to fulfill his or her own role, and in the majority of cases, has little interaction with the cast. Cast members may be performing 20-30 scenes a day and are required to perform similar scenes repeatedly with only subtle changes in dialog or action, in addition to multiple takes of the same scene.

Continuity is a term used in the film industry to refer to the necessity for consistency in the characteristic of objects or actions in a scene: for example ensuring that the level of water in a glass does not change between consecutive shots. In Trylife's previous episode, continuity tracking became a major cause for concern due to the large volume of potential combinations in which each set of scenes could be viewed. This led to a constant state of uncertainty for both cast and crew, whereby the cast often lost track of where they were in the narrative, and the context in which their character was performing. The pressure and pace of the filming schedule also made it difficult for the cast to understand which scene was being shot, which location they were moving to next and where they were within the wider production cycle.

As discussed, cast and crew are active at different times throughout each day, often interspersed with long periods of waiting. Trylife had commented that during their previous shoot, it had been difficult to keep the cast to maintain their characters over the course of filming, leading to longer shooting times as actors re-entered roles and re-familiarized themselves with the context. In addition to the main characters, Trylife used a variety of non-speaking 'extras', employed day-to-day. It was found to be a difficult task to keep this group up-to-date with the shoot over long working hours and multiple days given their intermittent attendance. Given appropriate support, Trylife suggested that they might be able to use these 'down time' periods as opportunities for personal development or engagement of ECAs with the content.

The design challenge here was to develop a system that allowed cast members to review footage quickly and easily, annotate it and review how the viewer would see it, providing a context for their acting work, reinforcing the relationship between takes and helping to motivate cast not present when related footage was shot.

THE TRYFILM DESIGN

In designing for these requirements we considered available technologies and their limitations. To encourage collaboration we rejected single-user setups such as large screens connected to a single computer with mouse and keyboard as this might preclude multi-user and collaborative use. Likewise, simple off-the-shelf editing software such as iMovie and Windows Movie Maker lacked many of the features required (such as being able to quickly search and catalog complex scenes and annotate footage) while professional editing suites such as Premiere or Final Cut Pro were considered too unwieldy for cast and crew to use without training. Furthermore, none of these solutions allowed the exploration of branching narrative structures and individual scenes in a single environment.

Our response was to develop the TryFilm system (see Figure 1). Designed for deployment at a film shoot, TryFilm is a large (1.5m long) playback and editing system with a multi-modal touch and tangible interface (Samsung Pixelsense). The self-contained flight-cased unit contains a 40" interactive tabletop display and integrated computer, above which is mounted a 40" LCD display at right angles. It has removable legs and is easily transportable as a vertical unit on wheels, taking around 5 minutes to assemble by a pair of crew members.

Interaction

The design of TryFilm draws from a corpus of previous research that demonstrates the benefits of tangible, tabletop interfaces for use in collaborative settings. This work establishes the value of tabletop interfaces for supporting group learning and discussion around specific topics [13]. Large tabletops have been found to promote understanding and coherence of gestural actions amongst groups of users [6], and large, high-resolution displays are well suited to hosting complex data-sets and large amounts of media. Indeed, physical or tangible controls, or representations of data have been shown to offer advantage for group interaction over purely digital representation [21].

Tabletops and tangibles can be an easily-accessible way of supporting shared activities [8]. Physical control objects can be used to embody interface control structures, enforce group communication and control over functionality while fostering mutual awareness amongst the group [9]. To support group awareness of actions, Gutwin *et al.* [7] emphasize the need to design visual feedback cues into the system to balance the individual and group interaction paradigms present.

In other learning environments and in traditional (non-branching) media production there has already been work done to explore how new forms of situated technology can support peer learning. For example, the use of digital technologies (specifically tabletops and tangibles) in supporting direct engagement, self-directed learning, self-reflection and peer support is well documented [13, 17]. In particular this community has recognized the affordances of shared large-scale interfaces such as tabletops in supporting learning tasks, and in particular self-directed learning through reflection [12].

As discussed previously, TryFilm builds on previous research by the authors in which collaborative interfaces have been developed to explore alternative working models for media production. In particular it builds on the [1] *StoryCrate* project, in which a collaborative tabletop editing system was developed and deployed to support a linear

drama shoot. *StoryCrate* enabled crew members to upload and edit footage within minutes of shooting, allowing them to continually visualize the film as it developed.

Users interact with TryFilm through a hybrid scheme of tangibles and touch. Functions which change or manipulate content or switch between display modes are performed by manipulating tangible tiles (Figure 2). More subtle actions such as list-scrolling, drawing, and view-scrolling are performed using simple and intuitive single-touch gestures on the table surface. These interaction modes can be used in tandem and bi-manually to create a rich and intuitive interaction experience for the user.

Figure 2. Tangible Controls Used in TryFilm

Media is represented throughout the system as static thumbnails overlaid with icons representing the attached metadata and currently available media. The interface consists of three levels of detail: tree view, storyboard view and clip edit view representing the shoot wide status, specific scene status and individual performance status respectively. Prior to a shoot, TryFilm is loaded with a representation of the branching narrative by the crew including the script and some meta-data about shoot locations and a brief description of the scene content.

These clips can be viewed individually, or within the context of a scene by placing them in a timeline (see Figure 3). Alone however, the single scene visual representation is not rich enough to represent the complex branching narrative, so a tree-like visualization of the narrative is rendered where each 'leaf' is a scene, and 'branches' are routes viewers could take through the narrative (see Figure 3). Relationships between specific scenes are created in the open-source mind-mapping tool FreeMind and visualized as a color-coded tree on system startup.

Drawing from the design configuration of *StoryCrate* [1], a digitized pen and pad, wireless keyboard and a memory card reader border the tabletop for input of sketches, metadata and also video and images from camera memory cards. Leveraging the ECAs' and crew's familiarity with pictorial storyboards, the TryFilm interface is built around the visual representation of a film timeline.

As TryFilm was primarily targeted at users with little prior experience operating production equipment, it was important to design coherent and easy-to-learn interaction techniques that could be understood immediately. For example, as the preview and clip-edit functions influence playback on the same screen, the tangible controls initiating playback are physically attached to each other with a cord to enforce this constraint. Rather than enter freeform content using the inaccurate method of finger interaction, an Anoto pen is used for drawing new timeline content. This allows the user to work away from the interface and keep the paper copy for his or her reference.

Throughout the shoot, video content enters TryFilm without affecting the existing workflow: the crew inserts memory cards directly from each camera, usually when memory cards are changed for backup (2-3 times a day). Attached to TryFilm's interactive tabletop is a large non-interactive display. The use of such displays for supporting group learning tasks by focusing the group on a large centralized vertically mounted display is common practice, and often found in the form of electronic whiteboards [18] where simultaneous group interaction with content is undesirable.

Robustness

Emphasizing the importance of reliability, three levels of technology are described by Buxton; "standard spec., military spec., and artist spec" [5]. ECAs working in a situated environment within a highly constrained and pressured workflow clearly require the third level of robust design. As such, key design paradigms drawn from music and production technology were included in TryFilm both for practicality and to give credibility to the system on location. Auto-save, rollback and restore of the interface state were implemented alongside a startup system designed for rapid user feedback and background loading. TryFilm's editing is non-destructive, working on a copy of the raw footage, and clips can be reset at any time. A confirmation is required to 'delete' clips from the interface. The sensitive optical tracking technology and lack of weather proofing required us to provide a 1.5m x 1.5m black-out waterproof gazebo enabling use in all weather conditions, and deployment outside the immediate shoot location where space is at a premium. Deployment of the gazebo increases setup time of the system from five to fifteen minutes on average.

Supporting Self-Reflection, Discussion and Coaching

Supporting self-reflection for ECAs is facilitated primarily through playback of individual clips or edited sequences. Clips arrive and are collected onto a re-useable 'shelf' area at the top of the display. This shelf is a common storage area between all scenes, supporting easy copy, paste and move operations across multiple scenes. Clips can be moved between the timeline and the shelf to perform editing.

Although TryFilm supports complex editing tasks, we designed the action of playback to be as simple as placing the preview tangible onto a thumbnail of the clip. Once a specific clip is found, pinning it to the surface and lifting the tangible control adds this clip to the 'shelf' area of the interface for organization or further manipulation or placement on the

timeline. Once clips are associated with a scene storyboard, they can be recalled at any time by viewing the timeline for that scene.

TryFilm offers a random access model for playback. Rapid access of clips from any day of the shoot allows the comparison of shots filmed previously with recent ones, supporting comparison and analysis of acting over the length of the shoot. All clips that have been imported are stored in the *file-menu* control. Any clip from any day of the shoot can be recalled quickly by placing this tangible control, which displays clips in a paged, date-ordered list grouped by the relevant shoot day.

In *clip-edit* mode, a single time scale is displayed on the table surface, and the chosen clip is looped onto the preview output display. Placing and moving the *in* and *out* controls onto the display alters the start and end position of the clip, which is reflected in the playback. This view acts a 'focused' mode, easily supporting repeated playback of a single clip, and takes over the interaction space of the tabletop preventing other actions.

Each recording or 'take' of a scene may involve slight variations in an actor's performance which need reviewing in the context of the director's comments during shooting. TryFilm allows users to stack these multiple takes vertically on the timeline, and then switch between them by placing and rotating the *switch-take* control on a vertical stack of clips. This allows for the rapid review of footage of different performances of the same scene. By making possible for ECAs to scrutinize all of the footage that was shot (even those deemed un-usable by the crew), ECAs are able to engage with the crew decisions, roles and methods of judging success in moments of down-time.

Supporting Situational Awareness

Facilitating ECAs' awareness of the current shoot progress (which scene is being shot, how many are left remaining) is key to support them gaining an understanding of their own role within the production and preventing boredom. TryFilm is designed with a large vertically mounted display which can be seen from most places on location when others are playing back footage.

This breaks with the traditional compartmentalized model of production in which only the director and producer can view footage on location, and supports building of ownership of content by the rest of the cast and crew. Users can add key-value text notes as metadata to any media in the system by placing a tangible on the item and selecting from a pre-set list or adding custom terms using the keyboard. These notes can be viewed by any user of the system, allowing others to input into the notes made individually, and support users keeping notes and tagging clips with reminders relevant to their practice.

For more expressive creative input into TryFilm, two drawing interactions are supported. A digital Bluetooth pen mounted on the interface can be used to draw new content

frames on the supplied paper pad at any point during the shoot. These frames appear as still image tiles identical to video clips and can be used as in-place notes, placeholders for new or missing content, or visual descriptors. The Annotation control can place the tree-view into a 'drawing' mode, which allows users to draw onto the background of the tree with their fingers to annotate and markup the data for reference.

A progress bar on each node indicates how much of the scene footage has been shot, and nodes change color depending on the last shot added to them, helping to visualize shoot progress. In Scene Edit mode, TryFilm presents a multi-track linear timeline onto which video clips can be placed, edited and then played back. The clip editing window overlays the entire interface when editing single clips, allowing for accurate manipulation of tangible controls that change the in and out points of the clip, supporting instant scrubbing and accurate playback of individual performances. The ability to see each decisions made aims to drive each crew-members understanding of how the content will be used and how the rest of the crew is performing to produce the content, fostering an appreciation of other roles within the team.

Supporting Engagement

ECA's engagement in the film production environment is often overlooked, however it is important for ECAs to appreciate the value of their contribution and experience the sense of collective achievement that comes with contributing to a larger production.

TryFilm, besides providing access to footage shot throughout the production, also enabled cast and crew to try out different versions of the narrative. Clips can be assembled onto the timeline of any of the scenes, and played back by placing the
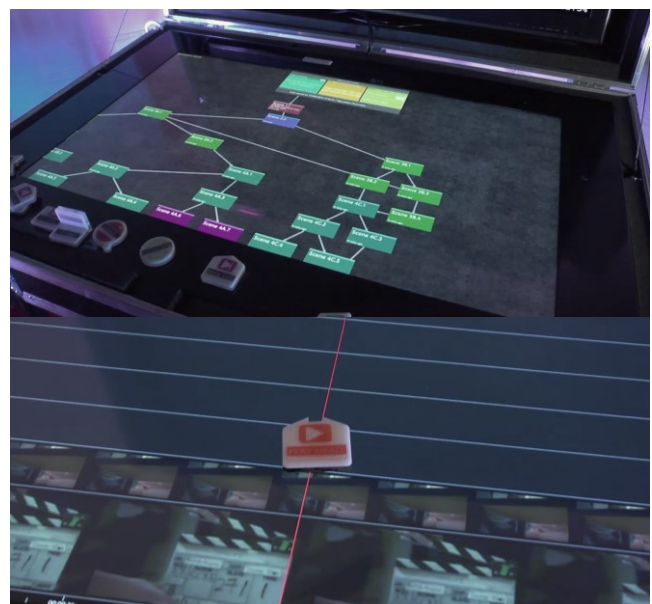

Figure 3. TryFilm's Tree view (top) and Scene Edit view (bottom)

play-head control on the timeline, creating quick edits. Moving this control or scrolling the timeline scrubs the video, allowing for rapid movement between cuts. In tree-view (see figure 3), these scenes can be previewed as complete edits and then reconfigured to check for issues between scenes. By drawing a line through the scenes in the desired playback order, ECAs can try out different edits of each scene, and even create their own alternative narratives, reinterpreting the script using available footage.

As all footage from the shoot is available to view, the playback of previous days' clips can help cast who were not present at those shoots to place their own performances in the context of their character's narrative journey and understand the current production schedule. The rapid turnaround of footage into TryFilm is intended to build ownership over the content, and facilitate discussion around the scenes that are fresh in the ECAs' mind.

DEPLOYMENT

The deployment of TryFilm took place during a twelve day film shoot planned by Trylife in a busy district of London. The film was shot over five locations ranging from a council-run youth center to private houses, a hospital and a police station. Trylife recruited a freelance film crew of twelve members, all of whom were recent film-school graduates. The crew was joined by fifteen ECAs recruited from the local area through workshops at youth organizations and acting groups, and through specialist talent recruitment agencies.

Three of the cast had previous experience performing in a professional environment, whilst for 12 this was their first professional role. In addition, a very experienced actor from the Trylife team was available as a mentor throughout the shoot. During the shoot, two teams of three researchers made observations, took notes and conducted multiple short interviews with each member of cast and crew. A video camera was set up above TryFilm to capture each interaction that took place (see Figure 4).

It was essential that the research team exercise timing and sensitivity in conducting their research so as not to hinder the production team. Key to this strategy was leveraging the film experience of our researchers (all of whom had worked in

Figure 4. Still from the camera above TryFilm on location

film previously) in offering their time and skills as additional crew members. To build trust with the crew and secure their role on set, the research team provided logistical and production support when required. While one member of the research team was to provide support, observe and answer questions about TryFilm, the rest took on formal crew roles, fulfilling the DIT (Digital Image Technician) role, copying and storing the footage for Trylife.

During the shoot, cast and crew were introduced to TryFilm by the research team and the Executive Producer. Crucially, they were shown its capabilities but not instructed in how it should be used or by whom; rather we followed a similar strategy as in the deployment of StoryCrate [1], in that we encouraged all the cast and crew to play and experiment with the system, rather than presenting it as a tool for one particular group or task.

We were open and responsive to new appropriations of TryFilm during the shoot, following up observations with targeted interviews when appropriate. A responsive and iterative research strategy was used where questions arising from the cast and crew's activity could be discussed immediately and responded to quickly with follow up questions. Daily meetings of the research team were held to reflect on the days' activity and build a coherent understanding of their observations. Through this process, interviews with cast and crew were guided by an increasing understanding of context. Questions could also be cross-referenced between interviewees to build a richer and more detailed picture and importantly, updates could be made to TryFilm in response to user feedback.

RESULTS

In each location, TryFilm was set up and deployed alongside the camera and lighting equipment store or 'green room' (waiting area for actors) – sites which were a focus for activity during the shoot – and was made available during the entire period of the shoot. The multi-modal design of the interface facilitated a simple learning process primarily through observation and repetition of peer viewed actions, but specifically through the use of iconographic tangibles, *"[…]it's so easy to use because we could just play with it ourselves – just read the little widgets and whatever its says it does.".* After a few brief introductions, the researchers were rarely asked for assistance in performing tasks, with users preferring to ask a peer and even teaching members of the crew.

By the end of production, TryFilm had been used by more than 20 members of the production team. Not surprisingly, given the amount of time spent waiting on set, the cast used the system far more than the crew. The male and female leads used the system most often (up to three hours per day over a number of sessions) reflecting the fact that they, of all the cast, spent most time on set. Other cast members used the system more sporadically, often in groups of 2-4 for up to 1 hour at a time.

The crew used the device far less often than the cast, indeed several never experimented with it at all. The lighting team for example checked their setups with the director and used neither TryFilm, nor the camera monitors, taking pride in the fact that they knew what needed to be done from experience. Makeup Artists and the Continuity Assistant, along with the Director and Producer used the device most often (up to 30 minutes per day), mainly to check for continuity errors.

Self-Reflection and Group Discussion

From the beginning of the production, the cast used TryFilm chiefly to access and play back footage of their scenes, most commonly to reflect on their own performances, "*I've been looking at mainly my body language and my facial expressions, just to help me see how I could change them. Looking to see if my performance was natural*". Typically, cast were recalling scenes from much earlier points in the shoot next to ones shot that day for comparison. Actors reflecting on their own practice reduced the pressure for the crew in recalling and making notes on specific points, using TryFilm as a reference for later discussion, "*…It really has helped me not to breathe down their neck and separately have a look at what's happening, then discuss it with them later."*

One cast member in particular described how the opportunity for analyzing a bad performance outweighed the emotional strain of watching it back, *"At least I've seen it before, even if I'm meant to look horrible or I do look horrible, let me see it before"*. Similarly, the male lead used TryFilm's ability to view shots in the order they might be edited to maintain consistency of his character and performance, "*… being able to do my scene and come back and watch it, make the cuts myself and improve it. You get more of an idea of what you could do to change it, to make it better…*" He added that he could see how performing this task on location could assist his development as an actor supplementing the minimal feedback he received from the director on set. Often these playback and editing sessions took place in small groups, where actors would critique and compare each other's performances. In particular, the male and female leads often viewed multiple takes of their performances together to observe their interactions with each other. The tangible controls were found to be useful here as the actors could pass controls to each other, enabling rapid turn-taking while both cast members were at the interface.

Due to changing weather TryFilm was confined to a waterproof blackout tent in some locations. This prevented observation of the content from a distance, but introduced a private viewing area, which was utilized by the cast, many of whom spent hours monitoring, evaluating and reflecting on their own performances without the pressure of judgment by others. Even the experienced actors took to using TryFilm in this way, "*I don't usually like to watch myself back on the camera, but when it's like that, I guess it can help you improve your performance, if you notice something on it as well.*" This scenario highlighted the unexpected tension between supporting in-depth individual playback and peripheral awareness of content by the wider team.

Coaching and Mentoring

Alongside casual playback of footage, members of the Trylife team were actively using TryFilm to engage ECAs in acting coaching sessions. On numerous occasions, a member of the team would take specific ECAs over to TryFilm, navigate to previous footage, and engage the actors in guided reflection, offering feedback on their performance using the large display to present footage back to the actors. Often the result of a session would entail the actor bringing others to TryFilm and presenting what they perceived as their best work, building self-confidence and morale amongst the cast.

The Executive Producer of Trylife (who had trained as a youth worker) saw a clear opportunity for using the tool to engage members of the cast and crew with each other, seeking out individuals and grouping them together around TryFilm where he would perform guided playback, selecting particularly interesting clips, *"[…] what I wanted to do was make sure that even right down to the runner would go and have a look and see what we were actually creating because […]they can't really see what the finished product's like […]It's great so it keeps people motivated."*

On other occasions, TryFilm was used by crew members to demonstrate to the actors the effect of certain performance techniques. During a fight scene, the Stunt Coordinator struggled initially to convince the cast members that punching a short distance to one side of an actor's head would create the illusion of an impact on screen. Playing back footage from earlier in the day using TryFilm, the cast were able to see the effect of the illusion and take up correct positions without help in subsequent scenes.

Engagement of Cast and Crew

As using TryFilm became everyday practice, the cast became adept at navigating and manipulating footage and through these skills started 'playing' with the film, trying out different playback sequences outside the official narrative. This playfulness was important in maintaining engagement of the cast with the project, particularly during periods of boredom on set; however, a negative consequence of this was identified by the Director, who expressed concern that within a production with more experienced actors, these opportunities would foster second-guessing of the director's actual decisions and increase dissent amongst the cast.

Allowing TryFilm to be operated by anyone on location was found to give the actors a greater stake in the production process. In comparison to the monitors sometimes used by directors, which are generally off-limits to the cast, TryFilm offered a shared space that the cast were genuinely encouraged to use. As one cast member stated, "*S***, that must be really expensive. Normally young people are told, 'Don't touch that, don't touch this, don't touch that' but with that it's like, 'Yes man, just go on it.'*"

In particular the crew valued how TryFilm motivated the

cast, *"So, it's really nice…if they have a few minutes, and have a look at what we're filming because it helps them, keeps them motivated because they see that it looks good. Then it gives them a boost, so they can go out and keep doing it."*

TryFilm became such a part of the actors' workflow that the crew often looked for missing cast members around it before checking elsewhere. Significantly, the Director valued the centralized and public nature of TryFilm as a method of drawing his team together over the shoot, *"But yes, all the young people coming in and standing around it and then being told that they can use it and actually start messing around with it, was great. It just created this buzz"*.

Situational Awareness

TryFilm's capacity to make footage available to view shortly after shooting played a large role in encouraging the cast to consider the production roles of the wider crew. They were able to see a direct correspondence between actions they saw the crew performing and their effect on the output of the film. This built appreciation of the crew's skills, furthered understanding of their roles and helped increase trust, bridging the traditional social divide between the cast and crew. Actors confirmed that seeing the result of the crew's input on location led to greater awareness of the craft involved in producing the film - something which they thought might be of use in their own professional development, *"I learned a lot these days, like if I wanted to do a short film. If I wanted to shoot something myself why not, you get the gist of it."*

The understanding of their place within the team and value of their decisions became central to peripheral crew members' interactions with TryFilm after observing actors use it, *"To see what was actually going on and how it all looked. How it all will come together eventually. Obviously there are all them angles and then how they they're just going to cut and then put it all - like it just flips between - it was good to see all - how it is done."*

The actors assembled clips into short edits to see how the viewer would experience their performance, *"it's so much more clear, you can really start playing with the editing and dragging it all together"*. In particular, the ability to see how scenes and narrative emerged incrementally through actors' performances in different scenes was valuable for understanding their characters' continuity. TryFilm was helpful in supporting cast members' day-to-day understanding of how the shoot was progressing, including on days when they were not present, *"What I'm really enjoying is the stuff that was on the night shoot went, what, the next day or it can be just straight away, just plug in"*. Cast members commented on the value of seeing their performance in the context of the wider narrative, *"I got to see other scenes that I wasn't in and it's just helpful to see the whole world of the story"*.

Interestingly, even during these sessions, few members of the cast and no members of the crew chose to use the branching narrative view to watch the entire production from start to finish. Instead, the attention of each member of the team was usually focused on fragments of scenes and their interactions with each other. Rather than use TryFilm for logging, the crew used traditional paper logs to keep track of how the shoot was progressing.

Increasing the visibility of content on location was an important role of TryFilm, and in particular the large display enabled cast and crew to analyze and compare specific footage for continuity. One of the makeup artists commented, *"it's good as a makeup artist on their* (the casts') *behalf because if they wanted to pick up anything, like detailing. Especially with us, we use HD makeup, we can see it clearly on the screen because it's quite wide. Yes, so we can pick up all the little details"*.

Emergent Behavior and Playful Interaction

Unexpectedly, we observed, on multiple occasions, that the novelty of the device, its availability and the access to content encouraged members of the cast to bring their peers from the local community to the shoot, use TryFilm to explain and engage them with the issues, the process of film making and show off their role, *"I've brought my friends along to come and see it, I've tweeted about it and I think it's really, really helpful"*. The Trylife team also saw an opportunity to use TryFilm to engage local residents in the filming process. Local residents were invited to visit the set and TryFilm was used to help quickly explain the project, ensuring the goodwill of the local community.

The Executive Producer realized the value of incrementally collecting the 'best clips' for when he needed to explain the vision and progress of Trylife to VIPs, stakeholders or visitors to the set. Initially, he presented individual clips, but once more footage was available, he set to editing his own trailer using TryFilm, effectively producing an on-site marketing tool, which demonstrated the progress of the shoot and the quality of the content. Towards the end of the shoot, this edit was exported to a professional format (Final Cut Pro) and was finished by a professional editor for release on the internet, becoming an official trailer for the production.

DISCUSSION AND CONCLUSIONS

In designing TryFilm, we took insights gained through working with established broadcast crews on linear film projects and applied them to a very different situation: early-career film companies working on low-budget, interactive media productions. As discussed, TryFilm was designed to support a range of activities, including rush-editing, construction of new branching narratives, guided reflection on acting practice.

In practice we found that cast and crew used the system in a limited number of ways for very different purposes. The vast majority of interactions with the system was by the cast and involved simple browsing, comparing and playback of clips to reflect on performances. Crew members used the system

rarely, mostly using it for error-checking and continuity, again relying on the device as a high-resolution playback system.

The tangible interaction scheme was helpful in making the system easy to access and also enabled cast members to rapidly switch control of the interface from one to another during discussions. However, far more important to how often TryFilm was used, was the way it functioned as a shared space for reflection, training and social interaction between cast and crew. TryFilm did not disrupt or reconfigure the crew hierarchy. It did however enable the Director and Producer to maintain a largely traditional production workflow, while promoting communication and discussion between team members, enabling the cast to feel more involved and the crew to maintain a better shared awareness of how the work was progressing.

Our analysis suggests that the technology supported ECAs to develop their own practice and to support the functioning of the production team as a whole. The cast valued having a shared space in which to reflect on their practice, gain peer support and learn more about the practice of film making, with the chance to apply these skills immediately. Their interactions with TryFilm had a positive effect on the production in general and enabled them to contribute to the work of the production team by assisting new actors and extras joining the production. Crucially, this benefit came at no extra cost to the production team in terms of time, as cast members could learn and experiment during their down time, without needing support from a dedicated crew member.

We found that many of Trylife's concerns were similar to their more established counterparts in previous projects. For example, some of the crew speculated that allowing the entire cast and crew access to the project footage could impact the hierarchical structure of the shoot. In particular, the Director suggested that giving more experienced actors access to footage during their time on location might cause them to be over-critical of their performances, undermining his authority on set, although no such problems were faced during the deployment.

Of particular interest was the emergent behavior, which developed around TryFilm. For example, the production team was able to use the interface to support engagement of both the local community and stakeholders in the production. We suggest that facilitating open collaborative working spaces in the design of interfaces for new media production has the potential not just to support existing workflows but to lend new capabilities to established production teams.

Despite the Production Team's request for features to support viewing of branching narratives, this feature was rarely used and the crew used paper documents to log and keep track of footage despite TryFilm's logging and annotation capabilities. This demonstrates how familiarity and skill with a simple device can outweigh the perceived benefits of a new system. We speculate that this might have been overcome with prior training of the crew-members, however a better solution may well have been to explore ways of better integrating TryFilm with pen and paper logging systems, possibly using systems like Anoto.

As the complexity of interactive film projects increases, TryFilm demonstrates how multipurpose tools that facilitate instant playback, on-site shot review and contextual awareness of a shoot can support actors' and crews' practice and development. Our deployment suggests that simple, inclusive interaction schemes that create shared and flexible social spaces can be useful in augmenting existing production environments, extending the work that can be done by capitalizing on long periods of cast downtime common to most film productions.

In particular, through working with, rather than against existing workflows and using systems that encourage greater collaboration and discussion between team members, film companies can work more efficiently, realize more complex projects and make more of their resources, especially in terms of their acting talents.

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