Interaction and Participation in Radio Plays: A Novel Approach to an Old Medium

André Melzer, Michael Herczeg, and Oliver Jeskulke

University of Luebeck, Institute for Multimedia and Interactive Systems
Ratzeburger Allee 160, D-23538 Luebeck, Germany
`melzer|herczeg|jeskulke@imis.uni-luebeck.de`

Abstract. Radio plays have recently regained both popular interest and commercial success. Yet, listeners are not provided with either feedback channels or the ability to actively participate in this medium. The TAPE-Player concept described in the present paper extends the radio play medium by adding interactivity as well as participation to the production process. The user takes the roles of both actor and director, which includes verbal interpretation, recording, and editing the dialogues for the selected role(s) as the play's script evolves. The creative freedom is supported by TAPE-Player's underlying hypermedia architecture: audio clips are managed separately and combined dynamically to produce a personalised radio play. The applicability of the concept was corroborated in an empirical study. Specifically, the users welcomed the interaction via TAPE-Player's easy-to-use interface, the creative freedom, and the substantial influence they had in producing radio plays in a personalised entertainment medium.

1 Introduction

The concept of radio plays dates back to the early 1920s. Its popularity, as an entertainment medium, is inextricably connected to the triumphant success of the radio medium. The term *radio drama* reflects the pronounced historical tendency to involve literary writers in the making of radio plays. Hence, narrative radio plays may be defined *"…as the acoustical art form that emerged from the development of the radio medium and in which stories are told or presented by means of electro-acoustically recorded and distributed sound material."* [7, p. 46].

Over the last years, radio plays regained popularity and commercial success. This success is surprising, for it contrasts much of the theories and findings of current human-computer interaction literature. While radio plays are confined to a single (i.e., acoustic) modality, current trends in entertainment media try to address multiple sensory channels to provide the user with multimodal experiences. Secondly, "traditional" radio plays do not provide interactivity: the recipient listens without having any adequate form of feedback channel. Thirdly, the listening audience is excluded from the production process. Each feature of a radio play (e.g., script, dialogues, music, and sound effects) is already tightly embedded in the final product that is sold commercially or broadcast.

In the present paper, we argue that radio plays still bear great potential as an entertainment medium. In particular, we believe that some of the medium's apparent shortcomings are in fact its major strengths. These strengths refer to triggering the processes of role-taking, imagination, and immersion. We believe that to tap its full potentials, radio plays —like other well-established media— benefit from careful adaptation to changes in technology [4, 5, 11].

Following the analysis of theoretical concepts that are related to the topic of this paper, we will describe the TAPE-Player[1] concept that seeks to advance radio plays by enabling users to interact with and participate in the medium. We will then introduce the hypertext architecture as the basis of the concept. The detailed description of the implementation will be followed by a description of the evaluation and an analysis of the results. Finally, we will conclude this study with an outlook on future developments of the interactive and participative TAPE-Player concept.

2.   Imagination and Immersion

Due to their historical background in radio-broadcasting, radio plays are confined to a single (i.e., acoustic) modality and, thus, address only the auditory sensory system of the recipients. Current trends in entertainment multimedia, however, provide the audience with a broad range of multimodal experiences by addressing multiple sensory channels (e.g., vision, haptics) [e.g., 19]. The employment of advanced multimodal elements is most prominent in computer and video games: spatial sound, 3D-animation, and haptic feedback, are thought to create the best possible realistic experience [e.g., 22]. However, rendering photorealistic impressions should not be equated *a priori* with joyful experiences. Rather, the high level of intended realism may also backfire on the medium causing a sense of general distrust to the visually displayed information. In particular, it may establish some form of cognitive set that the displayed picture is "not real", which may then induce confirmatory visual search. Any noticed leaks or glitches will be perceived as particularly disturbing [23]. This notion has already been acknowledged by the game industry. Hence, Satoru Iwata, Nintendo's CEO, stated at the Game Developers Conference 2005 that „*making games look more photorealistic is not the only means of improving the game experience*"[8]. As a consequence, games begin to incorporate more and more narrative content, thus blurring the boundaries between games and stories [e.g., 12].

Likewise, the confinement to a single human receptor system may not at all be disadvantageous for joyfully experiencing the medium. Rather, listening to radio plays challenges the recipient because it requires active participation and creative imagination. This is achieved by the medium's innate necessity for the listener to process cognitively the complexity of the incoming audio data stream. While listening, different acoustic signs (e.g., sound of different voices) have to be actively related to specific narrative functions (e.g., to indicate subjectivity). Radio plays thus follow the broadened approach to narration of media studies [7], which has been applied particularly to film, but also to digital media [13]. In radio plays, the

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[1] The term TAPE-Player was chosen as a mark of respect to the historic standard carrier medium of radio plays.

recipient's imaginative processing integrates the different auditory perceptions into a coherent and meaningful whole. The resulting perception of the radio play represents the listener's inferred narrative meaning [7], which is based on knowledge, expectations, and preferences and is experienced as highly entertaining.

Imagination is closely related to the concept of immersion, which denotes the various degrees of mental involvement due to the user's focused attention [21]. When computer gamers are totally immersed, they report being cut off from reality and detachment to such an extent that the game is all that mattered [3]. In terms of radio plays, total involvement or the sense of "being there" was most prominent in the audience's reaction to Orson Welles' famous *War of the Worlds* in 1938. The quality of his work and the tendency at that time to believe anything presented on the radio in a realistic way [12] led to the tremendous success, though admittedly, with unexpected effects: Welles' basically far-fetched idea of Martians landing in New Jersey caused literal panic in the streets. Of course, media illiteracy (here: taking the media content for real) is not an indispensable prerequisite to feeling immersed and enjoying entertainment media. Even if people know that they are witnessing staged creations or that they are consuming fiction (e.g., in movies or books), they may nevertheless experience a high level of involvement and immersion [12]. When listening to radio plays, immersion will benefit to the extent people engage in what S. T. Coleridge called *"willing suspension of disbelief"*.

In sum, though radio plays are confined to a single (i.e., acoustic) modality, they challenge the recipients' active participation and creative imagination. The continuous and complex data stream of acoustical features has to be actively integrated to infer narrative meaning. The inherent immersive effect based on narrative storytelling in radio plays is an important source for joyful experiences. In the next section, we will argue that radio plays bear yet another potential: the different roles and voices that offer different character perspectives to the story. Multiple points-of-view serve as a further source for experiencing the story as novel, challenging, and entertaining.

3.   Interaction and Multiple Points-of-View

People have a general interest in entertainment that provides immediate experiences of personal relevance and individual meaningfulness [e.g., 20]. This interest has its origin in the natural and intrinsic ambition of people to broaden their knowledge and to enhance their abilities [24]. However, this motivation is not solely confined to the individual level. Rather, actively gathering information is also functional behaviour in social interaction. Exploring other peoples' points-of-view reduces the likelihood of misinterpreting behaviour because it grants access to their way of thinking and feeling [6]. Perspective taking through interaction thus fosters essential human skills on a cognitive and emotional individual level, as well as on a socio-cultural level [4]. This is also reflected in theories that suggest storytelling may have originated from a human need to explain and understand their surrounding physical world [cf. 9]. Likewise, the intrinsic motivation to perspective taking is also an important aspect of performing as an active and expressive form of role taking in dramatics.

In human-computer research, however, the term *interaction* is commonly used in a sense to denote the degrees of freedom in controlling form and content of computer-mediated communication. Interaction includes both system input and system output (i.e., system feedback) as a result of user actions. Interaction has emerged as a core variable for the user's mental model or understanding of the system's functions [16]. In addition, the degree of interactivity provided by a system or medium was shown to be crucial for rich and meaningful experiences [20].

Various computer-mediated forms of entertainment have been presented that support perspective taking based on user interaction, while still providing immersive and joyful experiences [9]. Current extensions of experience design have been proposed on this issue [20]. In addition, various forms of interactive or participatory narrative concepts have been conceived to attract and maintain the attention of users, enabling them to switch between different perspectives or roles [13].

More specifically, Mazalek and colleagues [9, 10] suggested computer-mediated storytelling systems based on interactive multiple points-of-view narrative. The authors reasoned that interactive narratives offer the potential to tell more complex and personally meaningful stories than those delivered to a mass audience. By viewing different character perspectives to a given event, different insights may be revealed [9]. Tangible interfaces (i.e., computer-mediated physical objects) served as different points-of-view and provided an atmosphere for immersion in the story.

In accordance with the notion of multiple points-of-view narrative, Melzer et al. [11] proposed a DVD-based hyperfilm called *Deine Wahrheit/Your Truth* that enabled viewers to switch between different character perspectives and, thus, to gain insight into different subjective realities or perceptions. Perspective taking resulted in a comprehensive and coherent interactive, yet entertaining, story experience.

Cassell and Ryokai [4] introduced *StoryMat,* a tangible interface for children that supported perspective taking by recording and recalling children's narrating voices and the movements they make with stuffed toys on a story-evoking quilt. In contrast to the visually dominated DVD hyperfilm [11], the narrating voices in *StoryMat* primarily addressed children's hearing sense. In addition, a moving shadow of the toy was projected that accompanied the narrating voices.

As has already been mentioned, traditional forms of entertainment media, like radio plays or novels, are exclusively confined to non-interactive processes. This lack of interactivity may also have contributed to the little importance of radio plays in entertainment media research. Instead, the predominant focus of media research is on computer and video games and their high degrees of interactivity and participation in the stream of ongoing events [22].

There are only few attempts to bring interactivity into the radio play genre, one being Nick Fisher's *The Wheel of Fortune* for the BBC, which was aired in September 2001. *Wheel of Fortune* is a collection of three plays simultaneously broadcast on three different channels. Each of the three plays focused on the story of a different character. By switching between the channels at fixed key points, listeners actively created their own plays [5]. *Wheel of Fortune* thus resembles *Deine Wahrheit/Your Truth* [11] except for the different (i.e., auditory) sensory channel.

In conclusion, interaction is an important factor both for the user's mental model of the system functions and as a source for personal experiences. Interacting via multiple character viewpoints has proven fruitful in different entertainment media. Multiple

points-of-view support perspective taking, which represents an important individual and socio-cultural human skill. This point is still missing in the radio play genre: the user/listener is actually *receiving*, not participating actively and creatively in the sense of speaking or interpreting dialogues like an actor, for example. To our knowledge, this attempt has not as yet been made; this medium is still lacking adequate forms of computer-mediated active user participation. In the next section, we will introduce TAPE-Player, a novel concept that was designed to address this particular issue.

4. The Concept of the Interactive Radio Play Environment

Based on the analysis in the previous sections we designed TAPE-Player, a computer-mediated interactive concept, which aims at supporting active and creative participation in radio plays. At the same time, TAPE-Player should perpetuate the entertaining and immersing effects that occur while listening to the medium. Due to the medium's origin as *radio drama*, user participation in our radio play concept was designed to match expressive performing in dramatics as closely as possible. This refers to the creative verbal interpretation of dialogues specified in a visually displayed script. Hence, after having selected a certain character or role, the user should play a significant part in the recording process without limitation to their creative freedom (e.g., time allotted for speaking the dialogue). The final play should thus become the result of creative idiosyncratic work, thereby reflecting the user's own personality. In addition, other functions, which usually require additional software tools (e.g., audio editing), should also be integrated in a single application.

As will be discussed in the next section, the TAPE-Player concept requires a flexible underlying architecture to manage separately stored tracks (e.g., voice recordings). This architecture supports the dynamic and seamless combination of information into a single and unique data file, the final radio play. Following the description of the form of interaction, we will present the modular structure of TAPE-Player as well as the application's actual use.

4.1 The Hypermedia Structure

Despite the tendency towards verbally dominated storytelling, a multiplicity of acoustical features (e.g., voice, music, sound effects, fading in/out, cutting, mixing) usually play an important role in radio drama production [7]. In traditional radio plays, these features form an interconnected system stored in a single continuous data stream. Interactive radio plays, however, inevitably require flexibility in terms of handling separate and interchangeable information or data files. In the TAPE-Player concept this refers to selecting and replacing speakers for different characters or roles. This issue has been addressed by hyperaudio [2], a concept that denotes an audio-based hypermedia system. Hypermedia systems like the *WorldWideWeb* allow authors to create hyperlinks between pieces of content (i.e., hypernodes or frames), thereby forming a non-linear graph structure or web that users may actively navigate [25]. According to their actions at each hypernode, single components will be combined at run time.

For the film medium, Naimark [14] presented the hyperfilms *Aspen Moviemap* and *3D Moviemap*. A related approach was suggested by Melzer et al. [11]. Viewers of their DVD-hyperfilm *Deine Wahrheit/Your Truth* were asked to select one of the different characters' points-of-view. The story then moved forward in a linear fashion from one chapter to the next. At each chapter, however, viewers either switched between different narrative perspectives or stayed with the current point-of-view.

The non-linear hypermedia structure was adopted for the TAPE-Player concept. Selecting and replacing individual speakers required a specific audio clip structure. Particularly, the system should not impose any restrictions on voice recordings for the selected character/role (i.e., time allotted for speaking a given dialogue, pronunciation, or accentuation). The system should also be able to insert seamlessly recordings into the story to result in a coherent, but entirely new radio play. Since it is common that more than one character will be speaking at the same time, it is impossible to reconstruct the play on the basis of simple relations between frames.
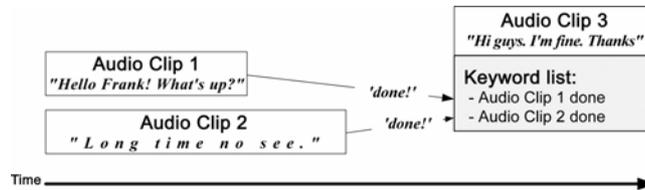

Fig. 1. Audio Clip 3 (*right*) may start because the keywords occurred

Rather, multiple relations need to be logically interconnected, as was suggested in the interval script concept [18]. Hence, the abstract audio clips in TAPE-Player were linked by keywords similar to token and transitions in a Petri net. Only when keywords occur, the preconditions of an audio clip for play-back are met (figure 1).

4.2   Combining Interaction and Immersion

Interactive entertainment media have to acknowledge the inherent conflict that exists between interaction and immersion [9]. Users, who are immersed in a story, are, for example, less inclined to interrupt the experience through complex interaction. Hence, any form of obstruction of immersion induced by the interface has to be minimized.

For the TAPE-Player concept, we speculated that, once the voice recording process starts, users will mainly direct their focal attention to the dialogues that are visually displayed. To avoid disruptive attention shifts, any form of necessary interaction should therefore be indicated and occur within the displayed script. Hence, indispensable events that require user actions are included as stage directions and indicated by embedded hyperlinks within the script. These hyperlinks follow Web design conventions (i.e., blue underlined letters) and are therefore likely to be coupled with the triggering of events in users' memory (i.e., established part of their mental model). Thus, they do not require unnecessary mental resources. Hyperlinks in TAPE-Player denote, for example, events like starting/stopping of additional sounds, or sending keywords to other roles. Simply moving the mouse across hyperlinks triggers the corresponding sound clip, thereby further reducing the mental effort

associated with the interaction. In addition, this "mouse-over effect" helps to avoid clicking noises. More importantly, however, it supports natural interaction in form of a hand-like gesture that reduces the unwanted visibility of the computer interface [15]. Hence, during voice recording, users are totally free to interpret creatively their selected role by changing or adding words or noises (e.g., whistling, wheezing).

In conclusion, the TAPE-Player interface is designed to warrant an immersive experience by supporting the focalisation of attention to the evolving story, rather than to the handling of the interface: TAPE-Player lets the user interpret creatively her selected role with all the freedom of an actor [cf. 17]. Yet, whatever the user does will affect the radio play as a result of her work, thereby reflecting her own personality.

4.3   Using the TAPE-Player Application

The TAPE-Player uses audio files in the wave file format. Any other information (e.g., story content, user actions) is stored in XML. TAPE-Player was implemented in JAVA using the Java Media Framework (JMF).

In the application architecture (figure 2), the system input and output are provided via microphone, headphones, and TAPE-Player's graphical user interface (GUI). A dedicated module serves as a production manager and coordinates both processing of incoming signals and regulation of workflow. The knowledge and communication module synchronises the radio play. It directs the communication between different modules and stores keywords into a repository. Any part of the software that may send keywords also receives information of incoming keywords. Finally, a mixing module provides the export of the radio play into a single wave file.
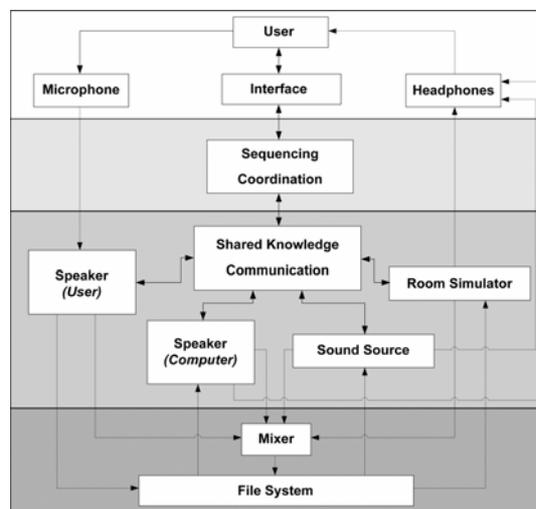

Fig. 2. The architecture of the TAPE-Player application

Pressing the record button causes TAPE-Player to run the radio play (figure 3). Stored sound clips play according to the course of the script. To guide the user visually, any current dialogue is highlighted in a grey-shaded frame in the application's GUI. Once

a dialogue for the selected role(s) starts, the frame colour changes to red. This indicates that the user may now start interpreting and recording their dialogue.
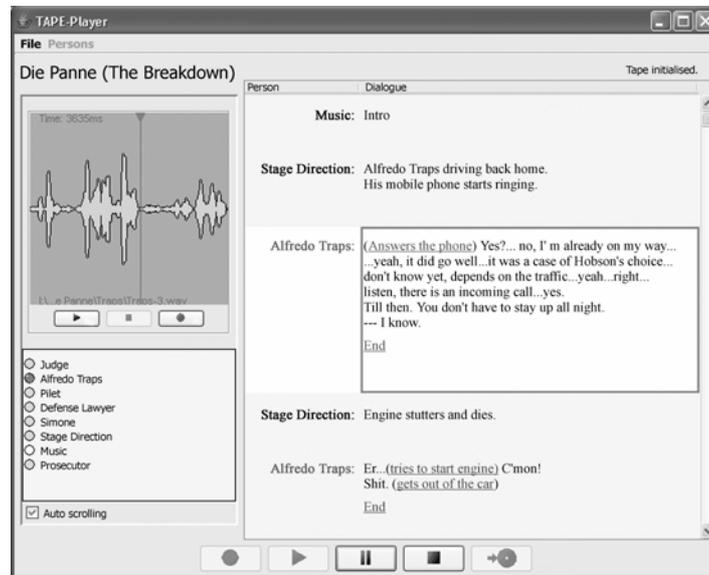
Fig. 3. Main control window in TAPE-Player with audio editor (*top left*) and script (*right*)

For stage directions, and if the cast is incomplete such that some roles are missing their audio sound files, a karaoke-like function will automatically and progressively colour the text red (figure 4). This visualisation (i.e., the visual anchor) provides the user with additional orientation in the course of the script. Please note that the karaoke function is not displayed for the selected role(s) because this would force the user to keep up with the letter colouring and, thus, interfere with their creative interpretation of the dialogues.

Fig. 4. Karaoke-like progressive letter colouring for stage directions and to compensate for absent speakers (Please note that letters turn red in the original application)

Sound effects specified in the script (e.g., starting a car's engine, closing doors) will be unobtrusively initiated by the user (see previous section) and played instantly during the recording process. Following the script's run-through, TAPE-Player automatically adds atmospheric background sound clips according to the script (e.g., reverberation). Users may then edit their audio recordings or listen to the resulting radio play by pressing the play button. Alternatively, pressing the export button will cause TAPE-Player to save the entire play as a single wave file that can be played with any other audio applications. Hence, TAPE-Player does not only support the

joyful experience of acoustic play acting in the recording process, but also provides the rewarding experience of listening to a personalised version of the radio play, which may be shared with others.

5.   Evaluation

TAPE-Player was empirically tested as an online tutorial that comprised 12 HTML pages. A total of 16 students and scientific researchers participated (11 male, 5 female). Their mean age was 25.6 ranging from 18-40 years (*SD*=5.18).

   Participants were initially requested to download and install the required components. This included the JAVA and JMF environment, the TAPE-Player application, and the first ten minutes of a pre-produced version of F. Dürrenmatts 1961 radio play *Die Panne/The Breakdown* (German version only)[2]. For comparability reasons, participants selected the role of Alfredo Traps, one of the main characters. After the main menu and hyperlink functions had been introduced, participants were given an interactive example and practised the triggering of events (e.g., start/stop recording). They were particularly encouraged to bring their own individual interpretation into the voice recording of the dialogues for the selected character. Then, the audio editing functions were introduced and used with an interactive example. After participants had exported the final wave file, they listened to their radio play version. A novel thirty-one item questionnaire concluded the tutorial. The questionnaire determined demographics, the participants' interest in different forms of media, and the actual media use (e.g., radio plays, film). In addition, participants rated the quality of the tutorial and the complexity of the task. Similarly, they assessed the tangibility and the usability of the application, the interaction possibilities, and the overall TAPE-Player concept. Finally, participants gave future prospects to upcoming developments of the interactive radio play concept.

5.1   Results and Discussion

The following section presents the main results based on the questionnaire ratings. For each item, participants' ratings were recorded on a four-point scale, ranging from 1 (positive, e.g., *"I fully agree"*) to 4 (negative, e.g., *"I don't agree at all"*). The following details represent mean scores (*M*) and standard deviations (*SD*). Pearson's correlation coefficient (*r*) was used to denote correlations between items. For the statistical analysis, alpha was set at .05. An asterisk (*) indicates a significant result.

   Mean ratings showed that participants thoroughly liked the TAPE-Player concept (*M*=1.06, *SD*=0.25). The concept also satisfied participants' expectations concerning the medium's performance (*M*=1.44, *SD*=0.51) and the overall usability of the system (*M*=1.50, *SD*=0.52). Participants reported that they were well aware of what to do in the course of the script (*M*=1.31, *SD*=0.48). Handling the interface (*M*=1.38, *SD*=0.50) and triggering the events by moving the mouse across hyperlinks (*M*=1.56,

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[2] The use of *Die Panne* was kindly permitted by the publisher Diogenes Verlag, Zurich, Switzerland.

SD=0.63) was rated "easy". Specifically, controllability of the TAPE-Player interface was "rather good" to "very good" (*M*=1.38, *SD*=0.50).

In line with our hypotheses, participants strongly appreciated both their creative freedom in interpreting the selected role (*M*=1.25, *SD*=0.45), and their influence on the entire radio play (*M*=1.63, *SD*=0.50). Moreover, a majority of the participants (.69) reported that they had felt like having been part of a vivid story. Their sense of immersion substantially benefited from being allowed to using their own voices to "interact" with the system, which strongly supported their own creativity (*r*=.55*).

Although the overall use of radio plays did not influence their ratings of the TAPE-Player concept (*r*=-.02), participants' prognosis concerning the further success of the concept was mediated by their overall interest in the radio play medium (*M*=2.06, *SD*=0.93). This is illustrated by the critical estimation of the applicability of the concept for visual media, like video and film (*M*=2.31, *SD*=1.14): though participants reported liking movies (*M*=1.69, *SD*=0.60), fans of radio plays were less interested in this medium (*r*=-.56*). However, it was the fans of radio plays that reported looking very much forward to more plays for the TAPE-Player (*r*=.65*). Similarly, they had a positive attitude towards social interaction and engagement in future communities (*r*=.71*) and also wished to use the TAPE-Player concept on the Internet (*r*=.59*).

To sum up, the evaluation data from the pilot study substantiated TAPE-Player as a successful interactive and participative concept. Though most participants came from the target group of radio play users, which might have positively biased their ratings, we conclude from the data that TAPE-Player satisfied even the high expectations in this group. The concept meets the requirements for the system functions. In addition, the interface also required only standard levels of computer literacy. Most importantly, participants thoroughly liked both the basic concept and the experience of creative freedom. The interactive and participative radio play concept was considered a promising supplement to traditional forms of the radio play medium.

6.   Concluding Remarks

The TAPE-Player concept addresses the basic human motivation to exploring actively others' points-of-view. Perspective taking is provided by enabling the user to select a character or role, which may then be creatively verbally interpreted. In the voice recording process, the user may, in a sense, *become* the selected person. In addition, TAPE-Player lowers the organisational threshold for active participation in some form of dramatics: users become actors in the privacy of their home. Yet, they are a fully integrated part of the final radio play.

We believe that using TAPE-Player is not only entertaining, but also highly rewarding. On both cognitive and emotional levels, the outcome (i.e., the final radio play) may lead to experiencing *self-efficacy*, a term coined by Bandura [1], which denotes the individual belief that one has the capabilities to execute the courses of actions required to manage future situations. In current media research, self-efficacy is primarily associated with the rewarding effects of gaming [22]. This behaviour-influencing effect of productive creativity is not present in traditional radio plays that are confined to processes of imagination. TAPE-Player, however, directly supports

the intrinsic motivation of people to broaden their knowledge and to enhance their abilities [24] by means of creative expression. We are currently developing a complementary authoring tool, *TAPE-Maker,* which will even further extend user participation such that writing scripts and composing interactive radio plays will be supported.

How can current state-of-the-art technology address the universal interest in stories and entertainment that provide experiences of personal relevance and individual meaningfulness? It has been suggested that the best and newest technology may well resemble the oldest forms of culture [4]. Likewise, Nick Fisher, writer of the interactive radio play *The Wheel of Fortune,* argued that *"… there can be a creative tension where interactivity and traditional narrative and character blend together"* [5]. In the present paper, we have presented a concept that follows this notion by offering creative participation in a popular entertainment medium. Based on its flexible hypermedia structure, TAPE-Player actively supports perspective and role-taking and triggers processes of imagination and immersion. Most importantly, then, the underlying technology supports the oldest-of-all human cultural behaviour, telling stories.

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