Scene-Driver: Reusing Broadcast Animation Content for Engaging, Narratively Coherent Games

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ABSTRACT

Scene-Driver is a software toolkit for the reuse of broadcast animation content to provide new engaging experiences for children. It has been developed and tested using content from the children's television series "Tiny Planets". Scene-Driver can be used to produce variations on a domino-like game. When playing, the child selects from a set of tiles that depict, for example, characters from the series. The child manipulates the direction of a story in the Tiny Planet world by their choice of tile. The successful selection of a tile will result in a scene from the show being played. A scene is defined as a section from an episode which has certain self-contained narrative elements such as conflict introduction, conflict resolution or comedic event. A scene-supervisor uses these descriptions to ensure that as well as having all the properties prescribed by the child's choice of tile, the scenes are presented in a coherent order according to certain plot and directorial principles. Inter-scene continuity is provided in the form of transition scenes which depict the departure and arrival of relevant characters between one scene and the next. Preliminary evaluations have demonstrated the potential of Scene-Driver to produce engaging and usable games based on broadcast content for young children.

Categories and Subject Descriptors

I.2.8 [**Artificial Intelligence**]: Problem Solving, Control Methods, and Search – *plan execution, formation, and generation*

General Terms

Algorithms, Design, Human Factors.

Keywords

Interactive narrative, child directed interface, visual interaction, animated interfaces, AI planning algorithms, interface evaluation.

1. INTRODUCTION

Tiny Planets is a computer animated cartoon series which is broadcast on British television and syndicated worldwide. The series follows the adventures of two space aliens, Bing and Bong, as they travel amongst a group of "tiny planets" on a large white sofa, encountering the inhabitants and solving problems along the way. In total, 65 episodes have been made of the Tiny Planet series, each consisting of about 3 minutes of novel content.

Due to the high costs involved with producing high-quality computer animation, it is often difficult to recoup production costs through sales of the series alone. It is therefore desirable to create additional programme related merchandise. Pepper's Ghost Production Company, the creators of the Tiny Planet's series, were therefore keen to explore the possibility of developing some kind of game which could be implemented without the need for creating additional content at extra cost to themselves. One possibility for achieving this is to reuse the existing broadcast content of the television series to create novel digital interactive narrative: the automatic, interactive creation of coherent stories using the Tiny Planet content. To be successful in achieving this aim, the experience of interacting with the new Tiny Planets story must be coherent, engaging and entertaining for the child. A further requirement, since the system is primarily aimed at children, is to ensure that the implemented interface is usable by children interacting with the system either by themselves or accompanied by an adult.

The composition and organisation of existing broadcast content within a game, to form a coherent and engaging experience, can be supported by theories as to the structure of narratives and stories. Predominantly, theories adopt the viewpoint that a story exists at an abstract level independent of the narrative, whilst the narrative relates to how the story is told [2, 3]. In other words, the story is a collection of related events that can potentially be narrated from a number of different viewpoints and also via different media. An important function of narrative is to present the story facts in a coherent manner so as to be easily understood [2]. Research has shown that coherence aids not only understanding but also memory of the events contained within a story [4]. There are certain types of event which are common to all stories, such that they form the basis of a plot. A story is centred around some conflict or series of conflicts which must be resolved within the context of the story. So a further requirement of narrative is that it should reflect these plot elements in a coherent way.

2. INTERACTIVE NARRATIVE AND TINY PLANETS

We are interested in using the pre-existing story-fragments (the scenes from the television show) and allowing a child to manipulate the order in which the scenes are viewed within a game, whilst maintaining narrative coherence. There are 65 existing stories in the Tiny Planets series, based around a particular set of characters - the two main characters Bing and Bong plus a variety of other characters (known as flockers, locals and robots), a set of props, a group of different planets and even particular stylistic qualities which must all be reflected in the resulting model. We devised a plot description based on narrative theory and analysis of the 65 Tiny Planets episodes. We believe that this form of description would be applicable for describing a broad range of animation series, for the purpose of implementing them within Scene-Driver. The results of the analysis are as follows.

2.1 Plot Level

The plot level contains elements that are commonly thought of as being integral to a narrative. A basic plot structure is shown in Figure 1.

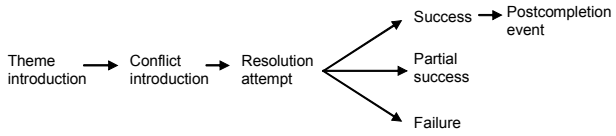

Figure 1. **Plot level analysis of Tiny Planets episodes**

Each Tiny Planets episode has a theme which tells the viewer the general purpose of the story, by way of a voice-over at the start of each episode. The theme of one episode is, for example, "a flocker is having trouble pushing a giant ball up a steep ramp on the Tiny Planet of Stuff. Bing and Bong figure out an easier way to move it". The theme introduction element of the plot-level is the introduction of the characters and props of the theme, so at some point in this episode (though not necessarily right at the beginning) the following constituents will be introduced into the story: a flocker, a giant ball, a ramp, Bing and Bong. Within each episode there is at least one conflict which must be resolved, through a successful resolution attempt, before the story can end. However, rather than ending the episode immediately a conflict has been resolved, there are one or more "postcompletion" events. In the episode mentioned, the postcompletion event takes the form of Bing pushing the large ball down the steep slope of the ramp and into the midst of some giant skittles, scoring a perfect "strike" (all the skittles fall down).

2.2 Directorial Level

The directorial level is the level at which events occur to provide dramatic effect, such as increasing anticipation or to provide entertainment value (such as the comedic events mentioned previously). The success of the directorial level, such that the enhancement of the enjoyment value of an episode is achieved, depends on the creative choices made in the edit and written into the storyboard. For this reason, the directorial level is more difficult to formalise.

The analysis of the episodes informed the design of planning algorithms to support engagement and coherence.

3. THE SCENE-DRIVER GAME RULES

Scene-Driver is a clip-based system using scenes from the Tiny Planets television series. The concept is based around the idea of dominoes. Unlike ordinary dominoes (which have patterns of dots to represent the numbers 1 to 6) the "domino-like" tiles used in Scene-Driver have, for example, characters from television series. The child interacts with the system by placing a tile that has a left-hand side which matches the scene they have just seen. The right-hand side of the tile specifies what will appear in the next scene. In this way, the child is able to manipulate the direction of the narrative, whilst a "scene-supervisor" module ensures that the narrative adheres to the narrative and principles of conflict introduction, resolution, comedic moments etc. The scene-supervisor also ensures coherent transition from one scene to the next by way of "transitional scenes", such that if a character that was not in a previous scene is to be in the next scene, that character is seen to "arrive". Conversely, if a character was in the previous scene and is not to be in the next, then the character must be seen to "leave". At present, these transition scenes are pre-constructed on a blank background. The aim is to move towards dynamically generated transition scenes.

Certain options can be selected prior to starting the game. It is possible to choose from three different tile sets. In a character-set, characters from the series are depicted on the tiles and can therefore be manipulated within the narrative. Other possibilities are props, actions or a combination of these. A further option is to select a theme. A theme may be simply comedic (show only funny clips) or educational. For example, a theme may be to show only scenes based on physical principles - such as levers and springs. The difficulty level refers to the matching type, of which there are three possible options. These are described below, assuming that a character tile set has been chosen.

3.1 Complete Matching Games

In a complete match game, the left-hand-side of a tile matches a scene if the characters shown on the tile were present in the scene. The right-hand-side then determines which characters are present in the next scene. In this scenario, a question arises as to whether the matching should be based on the characters that are physically present on screen in the final shot of the scene or on all characters that have appeared at some point in the scene. For example, a scene may end with a close-up of a character which was involved in some activity within the scene. Other characters may have been seen to be present, for example watching the activity throughout that scene, right up until the final close-up. We refer to these two distinct methods of matching as either implicit (matching to all characters present throughout) or explicit (matching only to characters that are present at the start and end of scenes).

3.2 Rewrite Rules

In a rewrite rule game, the left and right-hand sides of the tile have a different meaning to that of the complete match game. In the rewrite rule game, whichever character or characters are depicted on the left-hand side of the tile are to be "removed" and then "replaced" – in the next scene - with the character or characters on the right-hand side of the tile. So, for example, take a scene involving Bing, Bong and a "triangle local" (a "local" is a

geometrically shaped character with eyes). If a tile depicting a "triangle local" on the left-hand side and a "round local" on the right-hand side is placed against that scene, this has the meaning "in the next scene, replace the triangle local with a round local". So instead of a scene involving Bing, Bong and a triangle local, there will be a scene involving Bing, Bong and a round local.

4. SCENARIO: PLAYING THE GAME

When starting the game, a scene is played on a "television" in the centre of the screen. In figure 2 this scene involves Bing and 3 flockers trying to push a ball up a ramp.

Figure 2. Starting the game (taken from complete-explicit)

Figure 3. A completed game (taken from complete-explicit)

In the top-left of the screen is an "inter" tile that are used in both the complete explicit and rewrite games for continuity and to aid the child in matching tiles to scenes. In a complete-explicit game the "inter" takes the form of a different coloured tile, that matches the start and end state of the scene which has been played. In a rewrite game, the inter takes the form of a "cast-tile", which shows the cast that had been present within the previous scene and which characters are therefore available to be "replaced" in the next scene. At the bottom of the screen is a set of 8 available tiles. The icons to the left of the television say "try again" and "go". The "try again" icon lights up red if a wrong tile is chosen, otherwise the green "go" light is lit.

A screen shot of a completed game can be seen in Figure 3. The row of tiles represents the collaborative narrative created by the child and Scene-Driver.

5. SCENE MANAGEMENT AND TILE-SET CREATION

The two main components of Scene-Driver are the selection of a sub-set of scenes (or clips) from an available scene-library, according to a theme chosen by the user and also the creation of a "tile-set" for linking these clips together in a narratively coherent way.

Each scene in the library is described according to the ontology. This description is used to firstly select scenes of the appropriate theme, then to construct tiles that can be used with the selected scenes according to the chosen game rules and finally to organise the selected scenes according to narrative structure. Examples of attributes used to describe the scenes include "has-characters", "has-start-state", "has-themes" etc.

The first stage in tile-set construction is to create a sub-set of scenes which are consistent with the chosen theme. The theme may be intrinsic to the clip or may further reflect the theme of an episode or the theme of the particular planet the episode was set on. For example, a clip involving pushing a ball could be described by the themes "moving heavy objects", "shapes" and possibly "comedic".

The second stage is to ensure plot coherence. The simplest plot structure must have the plot elements "theme introduction" "conflict introduction" and "conflict resolution" in this order, to maintain plot coherence. More complex plot structures must still maintain this ordering, but could have additional plot elements such as "comedic events" to provide directorial consistency. Therefore, in this stage, the sub-set of selected scenes are classified as being one of the above four plot element types. The scenes that fall into the categories "theme introduction" and "conflict introduction" are part of a "theme phase" (TP) and "conflict phase" (CP), respectively.

From the set of conflict resolutions matching the theme, one is selected to be used within this particular game (CR). This will be the successful solving of the task by the character(s) displayed if the child succeeds in creating a chain of dominoes. The rest of the set of potential conflict resolutions are discarded.

From the set of scenes in the conflict phase, the one which is the corresponding introduction of the conflict resolution chosen in the previous step (i.e. from that same episode of Tiny Planets) is selected. This will be the first scene shown in the conflict phase during any playing of the game. We refer to this scene as the conflict anchor (CA).

Of the scenes in the theme phase, one is selected as the scene to be shown before the child plays the first domino. This scene is called the theme anchor (TA). Once these have been selected all possible legal pathways between the scenes can be generated (see figure 4). Arrows show possible paths between the scenes. Some arrows are uni-directional to maintain the appropriate order in which scenes are shown, such that a child progresses from TP, through CP before reaching CR. Comedic scenes can be associated with both phases.

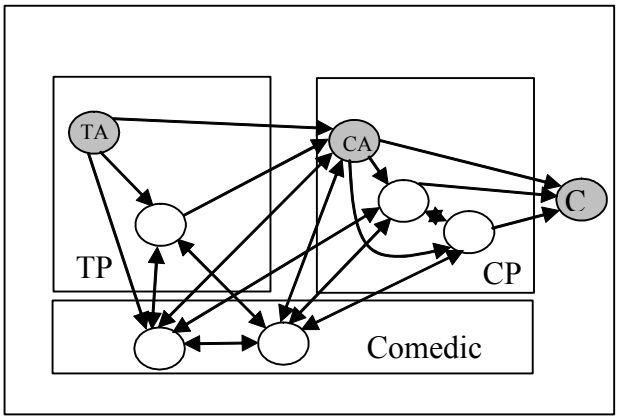

Figure 4. Overview of the architecture

The final stage of tile-set generation is to prune this search space to eliminate tiles which would enable illegal moves during a game. Examples of illegal moves include:

- the possibility that a tile can be placed which necessitates playing the conflict resolution before the conflict introduction has been played.
- A tile is available that can be placed after the conflict resolution has been played.

6. PRELIMINARY FINDINGS

Two evaluation studies have been conducted. In the first study, children directed the course of a narrative by placing cardboard mock-up dominoes, whilst an experimenter played the matching scene on a laptop screen. Development of the Scene-driver prototype meant that in the second study children could directly control the game without the need for intervention from an experimenter to play scenes. A further benefit of automating the game was the ability to record data, such as number of errors and the choices made when there was more than one possible match.

33 children from year 2 at Oldfield Park Infant school in Bath were tested across the two studies children, in 3 conditions: complete-explicit, complete-implicit and rewrite game. The children were aged between 6 and 7.

In the second study children's enjoyment of the task was also assessed using a "sticky-ladder" [9]. This is a ladder that is made of a material to which discs backed with Velcro may be attached. Rather than pointing to pictures on a scale, children can express their views by physically sticking items onto the ladder to rate them in terms of preference.

The overall impression in both studies was that the children enjoyed playing all versions of the game. In the second study it was possible to make a comparison between the recorded errors that a child made and their subsequent rating on the sticky ladder. This analysis showed that the ability to correctly match tiles was reflected in the enjoyment rating they subsequently gave on the sticky ladder, such that the fewer errors a child made, the higher the rating they gave the game on the sticky ladder.

7. CONCLUSIONS AND FUTURE WORK

A functional implementation of Scene-Driver has been developed in which tile-selection drives the creation of new narratives. It would seem that the Scene-Driver approach to interactive narrative effectively combines the concepts of narrative and interactivity, with the benefit that it is not necessary to capture the full extent of directorial knowledge that would be required to create a continuous story. The "domino-like" tile interface has been tested in two evaluation studies and found to be intuitively used by children in the target age range.

Whilst the system has been implemented with content from the Tiny Planets television series, it is anticipated that the same principles and software infrastructure could be easily applied to a wider range of children's animation content. The Scene-Driver approach would be particularly appropriate for animation series of an educational or problem solving nature, where characters have to overcome various challenges introduced during the narrative.

A second version of Scene-Driver will be developed. The main difference between the current version and the later version will be at the point of interaction. Whilst in the current version the interaction occurs at the end of a scene, the interaction for version two will occur within dynamically generated scenes.

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