Children's narrative development through computer game authoring

By Judy Robertson and Judith Good

(Editor's note: British spellings and usage preserved)

Playing computer games is an extremely popular leisure activity for children. In fact, the computer games market in the UK is now double that of the video rental market, and substantially larger than cinema box office sales (ELSPA, 2003), and under 18s make up 38% of these game players (Guterl, 2003). Young people are willing to devote considerable amounts of their time to playing games. For example, a recent UK survey reported that 53% of eleven to fourteen year olds play games four times a week or more, and that 44% play for more than one hour at a time (McFarlane, Sparrowhawk and Heald, 2002).

Although there has been moral panic in the media about the harmful effects on young people of playing computer games in terms of violence and anti-social behaviour, the hypothesised negative consequences have not been confirmed (Gunter, 1998; Surgeon General, 2001). In fact, the stereotypical image of lonely young people locking themselves in their bedrooms to play violent games is misleading, according to studies of children's social behaviour around computer games (McNamee, 1999; McFarlane, Sparrowhawk and Heald, 2002). These studies indicate that games are usually played in the company of friends or family members, and form the basis of various other sorts of social interaction such as peer tutoring, discussing tactics or sharing games-related magazines (Williamson and Facer, 2003).

Based on the popularity and strong motivational effect of computer games among young people, educators have started to consider how games can be used in educational settings. In a study conducted by the Teachers Evaluating Educational Multimedia organization (McFarlane, Sparrowhawk and Heald, 2002), parents, teachers and pupils were asked what they thought children could learn from playing computer games. 85% of parents interviewed said that they thought that their children learned something from playing computer games, identifying skill development in areas such as decision making, design, strategy, co-operation and problem solving. After integrating selected computer games into their normal classroom teaching, teachers were asked to evaluate the learning outcomes from using the games. They reported that the children rarely gained knowledge from the game content which was directly applicable to other areas of the curriculum. However, they did find some games useful as a stimulus to other creative activities, such as writing stories about popular game characters or scenarios. The teachers also valued the skills which the children developed directly from playing the game, or indirectly from working in a group on a game playing task. Problem solving, sequencing and deductive reasoning skills were used while playing the game; peer tutoring, co-operation and collaboration skills were developed as the children interacted with their peers around the computer. Teamwork was identified as a benefit by pupils who took part in the study.

As well as developing the problem solving, reasoning and team work skills described above, computer games can be integrated more tightly with specific domains within the curriculum, for example, literacy and narrative development, the subject of this paper. Literacy development, particularly the improvement of writing skills, is a high priority within the UK education system. In 2003, only 60% of 11-year-old pupils reached the government's expected levels for writing (DfES, 2003). As many pupils find writing a difficult chore, an important task in writing instruction is to increase motivation. A related problem is writing apprehension — some pupils dread writing assignments because they find them so difficult and have had negative feedback during writing experiences in the past (Robertson, 2001).

In classroom instruction, the written word is often the only medium in which children have an opportunity to create their own stories. Given the central importance of narrative as a mode of thought (Bruner, 1987), it is unfortunate that difficulty with writing often prevents children from expressing their thoughts and feelings in narrative form. We use narrative thinking to make sense of the world, and our place in it. Creating a story is an opportunity to exercise the imagination; to explore thoughts and feelings; to celebrate our memories and see into our futures. Experiences with facilitating oral storytelling by children suggests that children have a wealth of story ideas which they enjoy sharing with

other people. It is also clear that written language can act as a barrier for some children, preventing them from developing or enjoying ideas (Mulholland and Robertson, 2001). Enabling children to express their ideas in a non-textual medium gives them the opportunity to exercise their imaginations and produce an artefact which can be enjoyed by an audience. Successfully creating something which can be enjoyed by other people is rewarding, and has a positive effect on self esteem.

Creating stories in a non-textual medium can also act as a bridge to written literacy development. There has been some success in encouraging reluctant writers by introducing them to other forms of media literacy. For example, teaching children to appreciate film texts through analysis has a positive effect on their reading and writing, as shown in the increased variety of techniques used in writing after lessons in film analysis (Oldham, 1999). Taking part in a virtual drama session within a computer game has also been shown to have a positive impact on children's story writing (Robertson and Good, 2003).

This paper goes beyond the state of the art by considering the benefits which can be gained from enabling children to create stories in the medium of interactive 3D virtual reality computer games, with reference to previous research and currently available software packages. We provide some background on the development of interactive narrative in computer games and describe a study in which ten teenagers created their own stories using the computer game authoring tool available in a commercial role-play game, *NeverWinter Nights*. The games creation process, including preparation work away from the computer, is explained with emphasis on the narrative aspects of the games. In addition we report findings from analysis of the games produced by the young people, and interviews in which the workshop participants reflect on their experiences. Implications of these findings are explored and we conclude with some suggestions for future research directions.

Interactive narrative in computer games

There has been previous research into the benefits of enabling children to create interactive text based computer game adventures and non-interactive audio-visual stories. There has also been research into the benefits which children may gain from taking part in interactive 3D virtual reality stories. These research findings can be used to predict the advantages of enabling children to create their own interactive 3D virtual reality stories in the medium of computer games.

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Interactive narrative in textual form

Interactive fiction offers the reader a choice of paths through a story. For example, children's adventure books which ask the reader to decide what they think the characters should do next, and then to turn to different pages to read the next instalment, are examples of textual interactive fiction. Early computer adventure games were also a form of interactive fiction. Players/readers of these games traversed a world described in text by choosing where to go, what to do and who to speak to. Previous research has shown that creating interactive fiction has a positive effect on children's writing skills because children find it extremely motivating (Sharples, 1985; Bruckman 1997).

MOOSE Crossing (Bruckman, 1997; Bruckman and DeBonte, 1997) is a text-based virtual reality environment designed as a place for children to learn to program, and to practice reading and creative writing. It is a collaborative, constructionist online community populated by a few adults and many children in different geographical locations. The technology is based on MUDs (multi-user dungeons) and MOOs (MUDs object-oriented) but it has been specifically designed to make it easy for children to program. The children can build virtual rooms and objects and create new personas for themselves. This requires them to use a mixture of programming and creative writing skills. The examples in (Bruckman, 1997) demonstrate that the children's descriptions in *MOOSE Crossing* can be imaginative and well written.

Two main motivational factors which emerge from this work are that creating stories in this medium is ideal for collaboration between pupils, and that the pupils enjoy creating a story in which their peers can take part.

Audio-visual representations of narrative

In the classroom, children are encouraged to analyse films and television programmes and compare the presentation of stories in these media to stories in books. Research conducted by the British Film Institute (BFI) suggests that there are benefits in the creation as well as analysis of visual and auditory narratives. Reviewing recent work in this area, Parker (2002) supports the position that children's writing development can be fostered through working with narratives in moving image media. In the BFI supported "Animation for Storytelling" project, pupils were given the opportunity to work with a writer and animator in residence to create their own films which were shown at a film festival. A head teacher involved in the project found an improvement in the pupils' writing, but more importantly,

an increase in motivation towards writing and school work generally.

Story creation in audio-visual media is engaging and motivating, particularly for lower ability writers. In one of our recent studies, 6 pupils from a range of ability levels used software packages to create stories in different media and reflected on their experiences afterwards (Good and Robertson, 2003). The pupils with writing difficulties particularly enjoyed expressing their imaginative ideas in an audio-visual presentation using a software package called *Kar2ouche*. Using *Kar2ouche*, pupils can create a sequence of frames representing scenes from a story. Frames contain two-dimensional pictures of the story setting, props and characters, textual descriptions, speech bubbles, sound effects, spoken dialogue and music. The pupils particularly enjoyed collaborating with each other to record dialogue for their stories.

Williamson, Dillon and Owen (2003) describe two studies in which pupils create audiovisual stories using prototype software packages. In the first study, twenty-nine 9 year old children used software called *Virtual Puppeteer* to create puppets and enact scenarios with other puppets over the network. The puppet design tool allows users to mould virtual 3D characters out of virtual plasticine (clay). Pupils can then create performances collaboratively by moving puppets on a virtual stage and making them talk to each other. The performances and dialogue can be saved in order to view them later. This prototype was influenced by discussions with the target user group during the design process. The users suggested that they would find it easier to draw their ideas for characters rather than writing them down, and also expressed a desire to include dialogue, music and other storytelling elements in their puppet performances. During the study, the researchers observed that the participants employed storytelling conventions from different media, such as films and television as they improvised storylines in their puppet performances.

In the second study, the researchers observed fifteen 12-13 year olds using software called *Tableaux* to create a short news broadcast. Using *Tableaux*, pupils can put together a series of episodes using 3D scenes and characters with facial expressions and body language. The software also has an editing facility in which users can record dialogue, and review and sequence episodes in order to create a movie. The researchers observed that pupils were familiar with the form of television news broadcasts, and were able to create movies using techniques from that genre. They included humorous storylines by combining characters and props they discovered in the software libraries in novel ways. The

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process of creating and editing the news bulletin was highly collaborative as the pupils discussed and evaluated their scenes with each other. Williamson et al. (2003) note the value of software which enables children become producers rather than consumers of new media, and suggest that such software could be used to help children explore how messages are communicated in different media.

Interactive audio-visual narratives

Some computer games are examples of stories in interactive 3D virtual reality narratives. Users choose their own path through the virtual world by deciding how to respond to the situations they encounter. *Ghostwriter* is an example of such a computer game which was designed specifically to improve children's story writing skills.

Ghostwriter is a 3D graphical virtual environment implemented using the *Unreal Engine*, a commercial computer game engine. During a *Ghostwriter* role-play session, pairs of children engage in computer-mediated role-play, with each child taking on the role of a character in the story. A (human) role-play leader plays the part of the other story characters, and in character, encourages the children to become emotionally involved in the story and discuss difficult decisions with each other. After the role-play session, and a discussion about the experience, the children write stories based on their adventures in the virtual world. Results of field studies with ten-to-twelve-year-old children showed that children are highly motivated by *Ghostwriter* and form relationships with each other and the game characters (Robertson, 2001; Robertson and Oberlander, 2002). The stories they write afterwards contain more portrayals of characters' relationships, especially through dialogue (Robertson and Good, 2003; Robertson, 2001).

Ghostwriter was positively received by the teachers and head teachers who saw it used. The teachers could see the benefits of the activity on the children's motivation and self-esteem, and noted that this motivating experience seemed to have generally improved the behaviour of some of the children (Robertson, 2001). The study reported in this paper builds on the *Ghostwriter* research by examining the educational benefits of *creating*, rather than experiencing, stories in computer games.

Constructivism and computer games

In the sections above, the tension between *playing* a game and *making* a game are quite clear. To date, children have been able to construct textual representations of narrative, both

interactive and non-interactive. They are also able to create non-interactive audio-visual representations of narrative. However, they have been unable to create interactive 3D audio-visual representations of narrative because of the programming and advanced mathematical skills involved. The technology has only now reached the point where children could create stories in 3D virtual worlds, and we think this is an extremely important landmark from the point of view of research and education.

Firstly, these changes in technology allow children to realize fully their ideas for an interactive audio-visual story and to develop a final product. An endeavour such as the Game On exhibition website (http://www.gameonweb.co.uk/education/) provides a wealth of information to help teachers lead children in the activity of *designing* a game, but the implementation of the game remains out of reach of the children because of the technical sophistication required. We feel however that being able to create a product which is usable by others, and which can be critiqued and revised, is an important part of the game design process from an educational point of view.

From a motivational perspective, children have high expectations as to what constitutes a good computer game based on their experience with commercially developed games, many of which have taken hundreds of person years to develop. If we are to use games in education, and expect them to motivate children, they must be of high quality or their effect will be lost (Elliott, Adams and Bruckman, 2002).

Finally, while there is increasing research into the benefits of playing computer games (e.g. Gee, 2003; the Games to Teach Project (http://cms.mit.edu/games/education/), and the Education Arcade (http://www.educationarcade.org/), many in the educational field are still looking to computer games to provide extrinsic motivation for traditionally unpleasant subjects, and see children as game consumers, therefore adhering to an instructionist view of games in education.

There is much less research from a constructivist/constructionist perspective, where children create their own games, with the notable exception of Kafai (1996a, 1996b). However, in the relatively short time which has elapsed since Kafai's research on children and game design, the technology has evolved considerably. Previously, game design has required substantial amounts of programming. While this is a laudable goal in itself, and likely a very motivating way to learn programming, we are only just now at the point where we can look more fully at the other types of skills involved in computer game design, particularly at the development of narrative skills and literacy. By having environments in which interactive 3D audio-visual narrative can be created through user-friendly interfaces and minimal scripting, rather than having to learn a programming language, children can focus on literary concepts such as creating gripping plots, believable characters and compelling settings.

Figure 1. An interactive dialogue in Neverwinter Nights

Creating interactive 3D audio-visual narratives

As described above, creating audio-visual computer games has until recently been a task which required programming and 3D modelling expertise — skills the general public do not usually possess. There has been an increasing trend in the games industry towards selling games editing tools along with commercial games to encourage skilled members of their user communities to develop further (free) content for other players to use. Additional development by a user community keeps a game popular even after most players have played the original game content. In 2002, the role-playing game *Neverwinter Nights* released the *Neverwinter Nights* toolset. This toolset can be used by non-experts to create characters, settings, and interactive plots. No knowledge of 3D modelling is required and basic tasks can be completed without any programming skills. More advanced game features require the creator to learn some commands in a scripting language.

Figure 1 shows a story which includes interactive dialogue. The player character has encountered a young girl, who says, "Aha, you must have met up with that fairy who keeps telling everyone she's the innkeeper." The player has the choice of responding by saying, "I'm not telling you anything," or "Well, yes, what are you implying?" The player's choices will determine the course which the conversation takes, and ultimately, the structure of the plot.

Figure 2 (see following page) shows the use of the *Neverwinter Nights* toolset. In the middle of the screen, the area in which the story will take place is represented as a view from above, with a grid superimposed on it. The game designer can choose from a range of objects on the right hand side and place them in the area. In this case, a campfire has been placed, and is outlined in light green.

On the left hand side of the screen, the game designer can create conversations, such as the one illustrated above, and write scripts for more sophisticated behaviour.
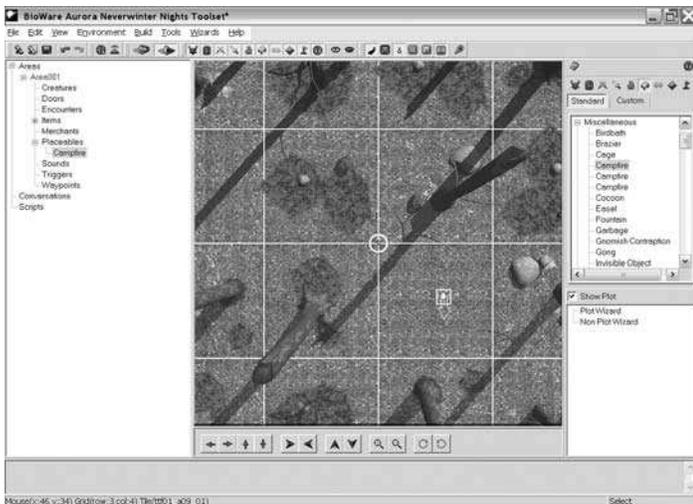
Figure 2. Inserting a campfire on an area using the Neverwinter Nights *toolset*

The *Neverwinter Nights toolset* is a valuable research tool for exploring the educational benefits of computer game authoring. Indeed it represents a very important landmark in the study of computer games in education because it allows researchers to look at the creative aspects of computer game design by young persons, a subject about which very little is known to date.

The following section describes an initial study into computer game design. The work was carried out during a four day workshop with a group of teenagers and represents, as far as we aware, the first research study which investigates the creation of 3D role-play games by young people. In doing so, we consider both the game design process and its outputs.

The Game Maker workshop

The Game Maker workshop was part of Edinburgh City Council's Go4it summer holidays programme 2003, and was advertised as being open to all secondary school pupils in communities around Edinburgh. The workshop took place over a period of four days in the computer lab of an Edinburgh secondary school.

The aims of the project were to:
- give young people an opportunity to tell their own stories in the medium of computer games;
- explore the possibilities of computer games creation as an approach to developing literacy skills;
- discover the strengths and weaknesses of the computer games authoring tool *Neverwinter Nights* toolset as an educational software package, with a view to developing a custom made educational games authoring tool as a software research project at Edinburgh University.

We chose to explore these research questions in a naturalistic setting in order to capture the process of game design while imposing as few artificial constraints on it as possible. We allowed young people time to develop their

ideas, and complete work on activities whenever possible. This provided a more realistic view of the activity of each workshop participant, rather than a normed situation which sacrifices the diversity of the group's experience.

The workshop participants were nine boys and one girl aged between twelve and fifteen years old. One boy was unable to attend the third and fourth days of the workshop since he went on holiday. Three of the young people attend the same school; two of them were good friends, but unfortunately did not get on well with the third pupil from that school, who has Asperger's syndrome. These pre-existing relationships occasionally resulted in verbal confrontations in which the other young people took sides. Two other participants are in the same computing class at school, and had a good working relationship.

The workshop leaders were the first author, a local visual artist, a professional storyteller, and an experienced amateur games designer with considerable experience using the games authoring software, *Neverwinter Nights* toolset.

Throughout the workshop, face to face story planning activities were interspersed with game creation tasks at the computer. The participants were given notebooks to record story ideas, plans and other ideas during the workshop and at home between sessions. The workshop culminated with an opportunity for the young people to play each other's games, and participants took home the games and other artwork they created during the workshop. One week after the end of the workshop, the games were showcased at the Museum of Scotland's public games exhibition as part of the Edinburgh International Games Festival. The workshop participants were invited to this event with their friends and families where they demonstrated their games to the general public.

Workshop activities

The workshop was organised around a series of activities as discussed below. In some of the activities, the young people worked by themselves; in others, the whole group, or a subset of it, worked together on tasks. An adult leader was always available to offer support and answer queries. The early workshop sessions aimed to assist the young people in developing storylines for their games using techniques which the authors have successfully used in other storytelling media.

Group discussion about games
On the first day of the workshop, the storyteller and researcher led a discussion about the sorts of games that the young people enjoyed playing at home, their favourite game characters and why they liked them. The researcher then explained what the workshop would involve. This discussion was a good ice-breaker, as the young people were keen to share their opinions about gaming. During the discussion it emerged that all of the participants enjoyed role-playing games (RPGs), which was fortunate as the *Neverwinter Nights* authoring kit supports the creation of role-playing games. One of the participants mentioned that he has a copy of the

Neverwinter Nights toolset at home, but had been unable to figure out how to use it by himself.

Initial trial of Neverwinter Nights *game*

Before planning the storyline or characters for their game, the young people were introduced to the technology they would use. They spent thirty minutes playing the tutorial level of the *Neverwinter Nights* game in order to familiarise themselves with the sort of game which the toolset would allow them to author. This led into a critique of the tutorial, and a spontaneous discussion of principles for good game design. It was clear that some of the young people, particularly the older boys, had spent some time thinking about these issues on previous occasions.

The participants felt that the tutorial could have been improved by making it a real game situation, by immediately placing the player in the midst of some action, by reducing the amount of dialogue and making it more exciting. They decided that it would be appropriate to give tutorial information only when necessary throughout the game, rather than telling the user everything at the beginning. It was suggested that a device like a magical book or journal could be used for this. More generally, it was discussed that games should keep their target audience in mind when designing the levels, that logical puzzles or riddles could be an alternative to violence and that actions in the game world should have realistic consequences.

Character design

The young people were then asked to design characters for their games. They drew pictures of the characters' physical appearance and wrote notes describing their motives, personalities, missions within the game, and other background information. This activity lasted for around thirty minutes. Figure 3 shows a character plan created by
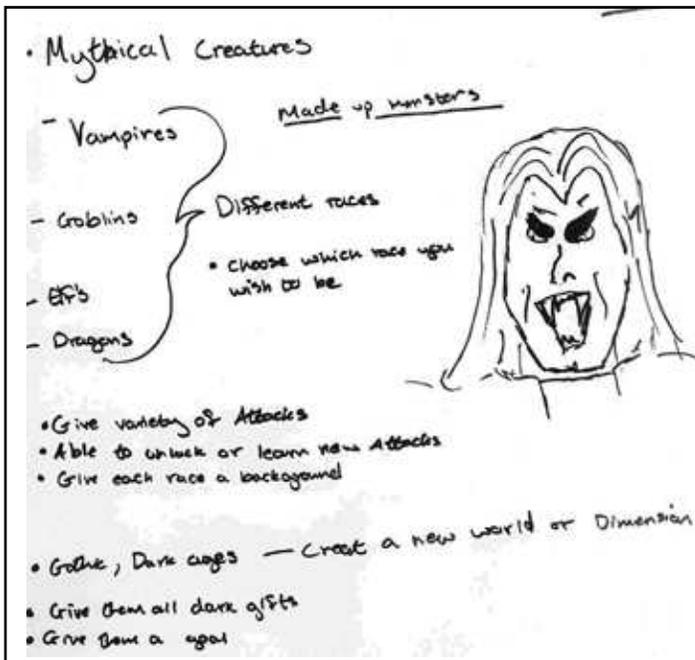
Figure 3. A character plan

a fifteen year old boy interested in vampires. His final game includes the character depicted here.

Character model making

Once the participants had decided on their characters, the artist explained how to make three-dimensional models of them. The artist prepared a selection of wire skeletons for the models based on the creatures available in the *Neverwinter Nights* toolset. The participants each selected a wire frame which was suitable for their character. The models were built up by layering plasticine on top of the wire frame to make heavy, solid bodies. A character in progress is shown in Figure 4, while the final product is shown in Figure 5. This model was created from the sketch shown in Figure 3.

Figure 4. Layering plasticine onto the wire frame

While the young people created their characters, they chatted to each other about what they would include in their games. They also thought up stories involving interactions between their own and other people's models. It was an opportunity for the participants to get to know each other better in a low-stress setting.

The artist demonstrated techniques to use to make the characters more life-like and then facilitated the creation of three sets for storyboarding: a river, castle and a graveyard. This session with the artist lasted for around four hours.

Plot planning

On the second day, the young people split into two groups. One group planned

Figure 5. The final character model

stories in the morning and created games in the afternoon, while the second group did the opposite. In the plot planning activity, each of five participants started with their model and a blank sheet of paper. They wrote down the first plot episode in the game which would include the character they had created. Each participant then moved one place to the right, where they read the plot episode and decided what should happen next. They wrote this new episode, in a different colour of pen, before moving on again. In this way, the young people helped each other to brainstorm ideas for a plot. Often this resulted in cross fertilisation between games, where characters or standing jokes from one pupil would become integrated into another pupil's adventure. This activity took around forty minutes.

Storyboarding with digital cameras

The next stage of story planning was to pose the character models in the stage sets to represent each plot episode. The young people split into pairs to help each other to pose the characters and take digital photos of the scenes. Participants who were not currently involved in the photography volunteered to make extra plasticine and cardboard props as the need arose. A sample scene is illustrated in Figure 6.

Figure 6. A fight scene in the castle

Once photos were taken for every scene in the story, the participants imported the photos into Microsoft Powerpoint. The photos were arranged into a storyboard with captions underneath to explain each scene (see Figure 7).

Half of the pupils completed the storyboarding exercise before using the *Neverwinter Nights* toolset. The other half had some experience using the toolset before planning their stories. As one participant pointed out, this meant that half of the pupils did not know whether it would be possible to create their storyboarded adventures within the constraints of the *Neverwinter Nights* toolset, while the other half did not have their story ideas fleshed out before beginning work with the toolset. However, it was necessary to split into two groups to make the plot planning exercise more manageable and because there were resource constraints on the digital photography exercise. The approaches of planning stories

Figure 7. An example storyboard

in other media before implementing them in the game, and allowing stories to emerge when using the toolset are compared in a subsequent section of this article. The time spent on this task varied from around twenty minutes to an hour.

Game authoring using the Neverwinter Nights *toolset*

The participants explored the *Neverwinter Nights* toolset at their own pace. The games expert was available to answer individual questions as they arose. Participants tended to start by exploring the facility for creating areas and for creating characters. Having mastered the basics, they wanted to learn more advanced tools, such as joining two areas together with portals or doors; how to make interactive conversations; how to make merchants sell items to a player; and how to use the plot wizard to make quest storylines. Once participants mastered a technique, they would often volunteer to teach it to others. The group adopted an informal testing strategy of playing each other's games after incremental changes. On the last afternoon of the workshop, the participants decided to play each others' games collaboratively using multiplayer mode which allows more than one player to participate in each game at the same time. The time spent on game authoring varied between participants from around ten to thirteen hours. Some of the young people were so keen to continue with their game development that they arrived early in the mornings, cut their lunch hours short, and arranged to stay late after the workshop finished in order to spend more time using the computers. The pupils were actively discouraged from cutting short their lunchtimes — on one occasion we took them to the park to remove the temptation to use the computers.

Reflecting and planning

On the third day of the workshop there was a group activity where individuals reported on their progress

and planned what to do for the rest of the workshop. The participants filled in a graph to estimate how much time they had spent using toolset features including: making areas; creating character; using the plot wizard and creating conversations between characters. The most time consuming activity for five of the young people was creating areas, while the other four had chosen to spend their time on different aspects of the game. One participant created a new column in his graph to represent his most frequent activity which was "planning and recovery," by which he meant trying out new features of the toolset and recovering from mistakes he made when learning these new features.

In addition to charting their progress with the toolset, the participants were asked to plan how to spend the rest of their time with the toolset. All of the participants indicated that the highest proportion of their total time would be spent creating areas although some considered creating conversations and characters almost as important. Some of the participants elected to spend more time on the activity which they had previously spent most time, emphasising the value they placed on that activity. Some people additionally decided to even out their efforts by spending more time on previously neglected activities, or beginning activities which they had not yet tackled.

A thirteen year old took the planning task so seriously that he prepared a very detailed work plan for the last day of the workshop so that he would be able to finish his game on time.

Workshop Analysis

The two main sources of data in this study are interviews with the young people and the games that they produced. Interviewing the workshop participants allowed us to gain insight into the experience of game design and the workshop activities from the point of view of the participant. Analysing the characteristics of the games that they produced provided a rich source of data. The structure of the games, and the storytelling techniques used in them, identify the potential educational benefits of the game and the areas of game development for which additional instruction would be helpful.

The participants' experience: Interview data

On the last day of the workshop, the participants were interviewed individually. The interviewer asked a series of questions relating to the young people's computing background, their opinions of the workshop activities and their experiences with the *Neverwinter Nights* toolset. The interviews lasted for 15 minutes on average. These interviews were videotaped, and later transcribed. This data gives insight into the workshop from the point of view of the learner, and is useful both for developing workshop activities for the future, and for evaluating the features of the *Neverwinter Nights* toolset.

Interview Questions

As one of the aims of enabling young people to create stories in games is to provide them with a motivating and rewarding experience, it is important to get their input about the workshop process and the games creation tool. Comments and feedback from this workshop can then be used to plan other workshops or classroom sessions in the future. Additionally, their feedback can form the basis for the development of an improved game design toolkit in the future.

On the last day of the GameMaker workshop, the participants were interviewed individually about their experiences during the workshop, and with using *Neverwinter Nights* in particular. An interview protocol was developed prior to the interviews, and included the following questions (grouped here by topic).

Prior Experience/Demographics
1. Do you have a computer at home?
2. Do you play games on it?
3. (If yes to Q2) What sorts of games?
4. Have you ever played *Neverwinter Nights*?
5. Have you ever used games authoring software?

Workshop issues:
1. [expectations] What did you think would be involved in the workshop?
2. [current] What do you think now?
3. [overall] What did you think of the workshop?
4. [enjoyment] Which part of the workshop did you enjoy most?
5. [future planning] If you were running the workshop, what would you do? Any activities which we did that you wouldn't have? Any extra ones which you would have done?

Workshop components:
1. [models] What did you think of model making?
2. [storyboard] What did you think of storyboarding?
3. [game design] What part of game design did you like most? What was your least favourite part/hardest to use?

Story Planning:
1. Did you use your storyboard in designing your game? Why/why not?
2. Did you use any ideas from others in your game? Why/why not?
3. Do you think it's better to plan the story in advance, or improvise while using the toolset? Why?

Use of the Toolset:
1. Was the toolset easy to use?
2. What was hardest part?
3. How would you improve the toolset?
4. Anything you can't do that you would like to?
5. Anything too difficult to do?
6. Any bugs?

Future *Neverwinter Nights* toolset use:
1. Would you buy /use *Neverwinter Nights* at home?
2. (If yes to Q1) What would you do with it?

"They became engrossed in the games design task, particularly when using the computers, and it was very difficult to persuade them to stop what they were doing to take lunch breaks."

3. Would you use it on your own or with friends?

Interview Findings

Findings are summarized here by topic.

Prior Experience/Demographics

All of the participants reported having a computer at home (with some having up to three). All had played games on the computer, and some participants also reported playing games on games consoles. The nature of the games varied, from the *Sims*, to *Warcraft 3*, *Age of Mythology*, *Harry Potter and the Philosopher's Stone*, *Theme Hospital*, the *Age of Empires*, a WW II flying game and solitaire.

Only two of the nine participants had used *Neverwinter Nights* prior to the workshop (one of these reported using it for "about a minute" and another for a year, although he had not used the toolset).

Finally, three of the participants had some experience in using software to design games (for example, making terrain, placing characters on a map, etc.).

Workshop issues

Expectations as to the content of the workshop were varied. Although all thought that the design and creation of games would be involved, they were unsure as to the actual activities which would take place. Some thought that they would be given a simple game and asked to improve on it, while another participant thought they would create simple games without using a toolset. At the other end of the spectrum, some thought that they would be required to do lots of programming. Two participants commented that they hadn't expected to use plasticine, although they quite enjoyed it in the end (and both later suggested that the plasticine models should remain a component of future workshops). When asked how they now felt about the workshop, all had positive responses. One felt that it was good that they hadn't spent all their time on the computer and had activities such as creating plasticine models. Three participants' comments concerned the ease with which games can be designed in *Neverwinter Nights*: participants were happy not to have had to program. They felt that the ability to select game components, rather than program everything from scratch, made designing the game easier. One participant also commented that his game would not have been as big or have had such good graphics if he had had to program it.

As one participant noted, with characteristic teenaged understatement, "I had quite high hopes and in the end it's turned out alright". Similarly, another participant stated, "I thought it was really good! If there was a second one I would definitely come back but not if it was exactly the same thing".

Two participants commented on the collaborative, hands-on nature of the workshop, with one happy not to have had to sit through lectures, and another commenting on the ways in which participants helped each other during the game design process.

In terms of improvements to future workshops, participants had the following suggestions:
- have a test run of the software early on, so that participants can see what the toolset offers before creating storyboards and models which can't later be implemented in the game;
- allow participants to choose the activities they want to do;
- conduct all the non-computer sessions (.e.g model making, story boarding) first, then have a day of game playing followed by two days of game making [note that this is difficult to implement for logistical reasons];
- have participants use more than one game, so as to foster more ideas;
- have people use the computer as soon as possible with more exploratory learning;
- provide additional guidance on using the toolset.

Note that the last two comments, which offer different views on the amount of instruction necessary, probably have more to do with individual learning styles and prior knowledge levels.

Workshop components — plasticine model making

One of the components of the workshop involved the use of wire frame models and plasticine to build characters for the game. Reactions to this activity were varied, although almost all were positive. It was evident that many of the participants enjoyed the experience itself, but not all found it of use in terms of game design.

Three of the participants did find the experience useful in terms of visualizing their characters and getting a better feel for what they would look like. On the other hand, six participants expressed clearly the idea that the *Neverwinter Nights* toolset imposes restrictions on the physical appearance of the characters, whereas the creation of plasticine models allows almost limitless possibilities. A certain number of character models had to be abandoned because corresponding characters could not be found in *Neverwinter Nights*.

One participant noted that although his plasticine model character didn't make it into the game per se, his mind and personality did. This suggests a pre-game design activity which focuses on the personality and motivations of a character in addition to physical characteristics.

In terms of the organization of the workshop, this also points to the need to have participants become familiar with toolset options (and restrictions) before going too far in the model making process. In terms of game design software,

more flexibility in terms of character creation would be a desirable feature.

Workshop components — storyboarding

The storyboarding phase involved two separate components. Firstly, participants contributed plot suggestions to their peers. Secondly, participants posed their plasticine characters in front of backdrops and took digital pictures of them in order to create scenes which could then be ordered into a story sequence.

Most participants felt that this first stage was a useful and helpful process, as it got people to think ahead "instead of being all sporadic and stuff." Another commented that this process was used frequently in movie making as a way of fostering ideas and finally, one participant felt that it helped his imagination work.

Opinions on the collaborative plot activity were more mixed. Some participants were not able to implement their original plot ideas in *Neverwinter Nights* in the first place, often because they could not recreate similar characters, so the addition of plot ideas from others was a moot point. From other comments, it appeared that suggested plot ideas were not incorporated if they took the story in a different direction from the one the author intended. Finally, some participants found that they either designed a new game from scratch or made up the game as they went along once they began to experiment with the *Neverwinter Nights* toolset.

One very interesting comment which emerged from this discussion concerned the ways in which plot can be conveyed. The participant suggested that when developing a game in *Neverwinter Nights*, plot can only be conveyed through dialogue, whereas in other games, plot is conveyed through films (typically, this takes the form of "cut scenes" which help advance the plot without direct player intervention). The participant stated that some of his plot ideas had to be abandoned once in the game design phase because the requirement to convey them through dialogue would have made the game boring.

Workshop components – game design

Although questions were asked specifically about the pros and cons of game design, many of the answers relate, quite understandably, to the toolset, given that it is used in the design of games. As such, some of the responses will be discussed in more detail in the section on the toolset.

When asked about the aspect of game design they enjoyed the most, "creating the characters" was most popular (6 responses). The second favourite design activity was creating the areas (5 responses). This is encouraging from an educational point of view, as it suggests that participants enjoyed those aspects of game design which share characteristics with the design of plays and other types of drama.

Of the things participants enjoyed the least, the plot wizard was mentioned most frequently (4 responses). The plot wizard is a feature of the *Neverwinter Nights* toolset which guides users through the process of creating a story within the game. The type of plot is very limited – most participants used a plot type where the player must collect an item for a character in order to earn a reward. Following the steps within the wizard requires the user to specify dialogue between the character and player. Most participants stated that it was not difficult per se, but that planning out the conversations was tedious, as was having to click through all the different screens in the wizard.

One participant also mentioned the difficulty of creating portals, a topic that came up frequently in the discussion of the toolset.

Story planning

An important issue which arose from the interviews involved the pros and cons of planning out a story in advance before using the game design toolset, or simply letting the story evolve while using the toolset. In traditional pen and paper based story writing, students are encouraged to plan out stories in advance, using text-based techniques such as outlines, or graphical methods, such as mind maps. On the other hand, game design imposes different constraints and a number of challenges. It is more akin to planning a play or a film, and requires thought about the visual aspects of characters and settings in addition to the narrative structure of the plot. Furthermore, interactive non-deterministic dialogue based games such as can be created in *Neverwinter Nights* compound the planning process, as game designers must think of a number of possible ways in which the plot could evolve, depending on the answers chosen in multiple choice conversations.

In considering the question of whether to plan out a story in advance, or let it evolve, opinion seemed to be more or less evenly divided.

Reasons given for planning out the plot in advance included:

- If the plot is already planned out, it frees the game designer up to spend time adding extras and improving the look of the game;
- It's better to plan in advance so that the game designer can concentrate on the toolset, rather than making lots of mistakes and having to delete things.
- Planning is helpful, otherwise the game design process takes longer.
- If the story has been planned in advance, "people get a sense that you know what you're talking about."
- Planning gives a clear structure to the game, with an obvious start and finish, rather than a series of multiple quests.

Reasons stated for letting the game evolve during the game design included:

- If the game is completely planned out, it may be overly rigid.
- Even if the plot was completely planned in advance, it probably would change during the game design anyway;

- Although there's more scope for "doing just anything," if you stick to a plan too rigidly, you may limit your creativity by not including good ideas as they occur.
- Letting the game evolve as you go along is easier if you are getting used to the interface (note that this is diametrically opposed to a comment made above on the benefits of planning).
- It's interesting to "go for it" and see what happens.

Use of the Toolset

Overall, feelings about the toolset were positive. As one participant pointed out, the toolset was a "good idea. You wouldn't get to make a decent game otherwise."

All of the participants found the toolset easy to use once they became familiar with it. Nonetheless, one participant was aware that there were obviously much more difficult things that could be accomplished with the toolset that he hadn't yet tried. Another participant stated that lateral thinking was required in order to use the toolset, as it was necessary to think several steps ahead and to anticipate consequences of actions.

The most difficult part of the toolset seemed to be the portals (5 responses). Portals can be placed within an area, and allow separate areas to be linked together. The difficulty with defining portals appears to stem from the requirement to have a unique identifier for each portal in order to specify which location should be reachable from which portal. Furthermore, this particular task requires scripting, and many participants needed help with this.

When asked if there was anything too hard to do in the toolset, the subject of portals arose again (2 responses), suggesting that these participants had not been able to master portals during the workshop. Finally, one participant wanted to have several characters follow the player around, but *Neverwinter Nights* only allows one character to do so. These comments reflect different issues: in the case of portals, the option to create them is available in the toolset, but it is difficult to do, whereas it is simply not possible to specify that multiple characters should follow the player using the *Neverwinter Nights* toolset.

Similarly, the plot wizard was seen as difficult and/or tedious to use. One participant commented that the plot wizard "gets confusing. If you click the wrong box it totally changes everything."

Finally, one participant suggested that "making merchants" was hard. *Neverwinter Nights* includes characters called merchants who can sell inventory items to the players in exchange for money, which is accumulated during the game. This participant needed to include merchants in his game to advance the plot, but felt that setting these characters up was not straightforward.

One of the biggest issues targeted for improvement concerned the characters. One participant pointed out that the appearance of characters could only be changed minimally. Many expressed a desire to be able to include the digital pictures of their plasticine models as portraits of the

characters in the game (i.e. include a digitized still picture in their character's description). Many other comments focused around character design, and included
- Ability to do full character design, e.g. to include oneself in the game;
- Increased ability to modify features of existing characters;
- Ability to choose different faces for characters, as well as more choices of clothing;

The creation of portals was also targeted for potential improvement, for example, by having *Neverwinter Nights* automatically generate unique identifiers, or by having a drag and drop interface for portal creation rather than a wizard.

Finally, other suggestions for improving the toolset were:
- Be able to include sound recordings, e.g. include key phrases for characters;
- Increase choice of objects;
- Provide more options for present day scenarios (as opposed to "medieval" ones);
- Include the toolset as part of the game itself (currently, it is necessary to quit out of the toolset and launch *Neverwinter Nights* in order to view one's game);
- Allow the use of icons within the plot structure, e.g. to represent a quest, or a conversation;
- Include instructions on getting started.

Participants were also asked whether they had identified any bugs. Apart from problems with computers crashing, only one participant reported bugs. These were: 1) that you had to save the game design and go back into *Neverwinter Nights* to view one's game (not a bug per se, rather an undesirable feature) and 2) portals (again, this comment probably doesn't relate to a bug so much as to the level of difficulty).

One bug did occur, although it was not mentioned as such: there appeared to be some difficulty in deleting certain areas. Kitchens however, could always be deleted. By superimposing a kitchen over the area to be deleted (which effectively replaced the area), it was possible to then delete the kitchen (and hence the original area). One participant discovered this workaround and named it "the kitchen strategy".

Future Neverwinter Nights toolset use

All of the participants reported that they would use *Neverwinter Nights* again if they had a copy, with some discussing plans to purchase it. All of the participants who were asked explicitly (4 in total), said they would use *Neverwinter Nights* to create their own games. Finally, most suggested that they would work on game design individually, and then play the game they created with friends. As one of the participants noted, in relation to game design, "I don't think it works as a group activity because you have arguments. There's a saying that a camel is a horse designed by committee." Only one participant felt that the game design itself would also work as a collaborative activity.

Further comments

One fascinating comment concerned the use of a workshop such as this in the conventional school curriculum:

> J: Imagine you were running this workshop - what other activities would you have chosen to do?
>
> S: I don't really know. I'd probably get them to bring in some of their English work because many of us have written many stories and some of them could be easily adapted to games. That would be good.
>
> J: In a secondary school what subject do you think this would be taught under?
>
> S: It would probably be taught under computing but I don't think my computing teacher would like that.
>
> J: Not English?
>
> S; I think it would be a crossover subject, like when business and home ec [home economics] go together to make a small business in our school, yeah, they sell muffins.

It is clear that this young person understands the integration of literacy and computer role-play game design, and yet also understands that this type of work is only beginning to be possible in schools, with their traditional separation of subject matter into discrete categories that fit within well-defined time periods.

Analysis of game features

As well as soliciting the young peoples' opinions of the workshop process in order to discover their attitudes towards making games, it is useful to analyse the products of the workshop, i.e. the games themselves.

By studying the features of the games created by the young people it is possible to see what aspects of games they consider to be important, and also identify game creation techniques around which these game authors would have benefited from extra support or instruction. From the point of view of studying literacy in new media, this work provides a first pass in analyzing the features of an interactive role-playing game and identifying their characteristics in a way that allows games to be compared.

General game features

Analysis of the young people's games confirm those features which they deemed to be important in producing a good game. Figure 8 illustrates the breakdown of features of the games in terms of setting, characterisation and dialogue. As one might expect, each game contains more characters than settings (or *areas* in the *Neverwinter Nights* toolset terminology). However many participants did create a number of different areas with different appearances and themes. Often an area was created as the scene for a particular plot episode. For example, in one game, the player

encounters a series of three siren characters in sequence. Each encounter takes place in a world created especially for that siren.
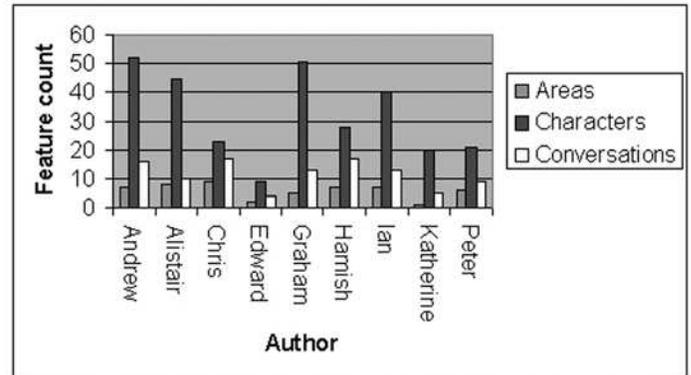

Figure 8. Features in the authors' games

It is also interesting to explore the function of the characters in the young people's games. Figure 9 shows the percentage of characters who can speak to the players in each game. This percentage ranges from 25 to 74 percent, suggesting that the authors took different approaches — for example, some authors' characters were mostly major characters with whom the player could interact, whereas others used characters almost as props to populate the areas.
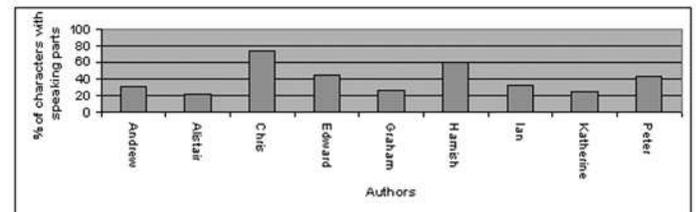

Figure 9. Percentage of characters with speaking parts

Dialogue complexity — structure

A major means for conveying the plot of a narrative game is through interactive dialogue. Through conversations with non-player characters, the player can learn information relating to the storyline, and receive instructions for how to proceed with the game. These dialogues can be interactive if the game author provides the user with a choice of responses to statements and/or questions made by the non-player characters.

Figure 10 (see following page) shows, for each game author, the percentage of conversations which are interactive. All authors included some interactive conversations. In all but one case, interactive conversations accounted for over half of all conversations, while four authors had interactivity in every conversation. This variety reflects different approaches to characterisation — some authors included minor characters with single lines, such as greetings or warnings; others preferred to give the player a chance to interact with the main characters over a number of conversational turns.

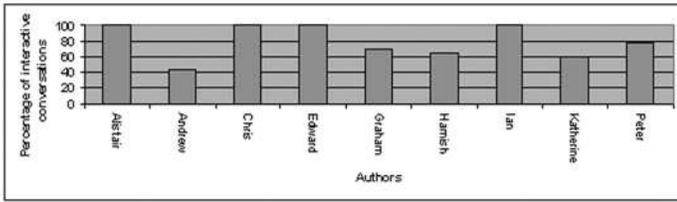An interactive dialogue has two main characteristics: 1)

Figure 10. Percentage of conversations which are interactive

Figure 11. Complexity of conversations

the number of conversational turns which take place between a user and a non-player character, and 2) the number of choices the player has in response to a statement or question by a non-player character. If the dialogue is represented as a tree structure, the *depth* of the tree will represent the number of conversational turns, and the *breadth* of the tree will indicate the extent of player choice. In Figure 11, the number of conversational turns (depth) is plotted against the extent of player choice (breadth) for each author.

It can be seen from Figure 11 (above right) that the game authors used a variety of different dialogue styles. For example, Author A chose to create long dialogues with little choice, while Author B chose shorter dialogues with greater choice. It is useful to characterise these dialogue structures with illustrative examples.

Long dialogues with little choice result from deep but "skinny" trees (see Figure 12 below). In the young people's games, dialogues of this type were mainly used for exposition. The non-player character would gradually reveal information of importance to the plot interjected by comments from the user. The user did not generally have a choice about what to say. Author A in Figure 11 used this form in all his conversations, possibly because he spent a good deal of time crafting the beginning of his game where establishing the plot was important. Author C in Figure 11 also occasionally created deep trees with little choice for exposition, but this was balanced by a series of shorter, more interactive conversations with minor characters.

Shorter dialogues with greater choice are characterised by short, "bushy" dialogue trees. In many of examples of this type, the alternatives offered to the user differed in politeness: the user could choose whether to insult the non-player character or not, resulting in different verbal
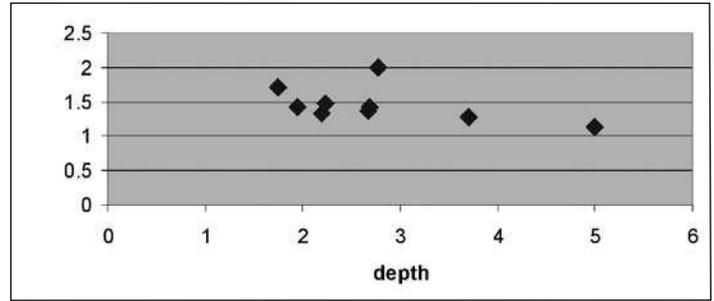
behaviour in response. In some cases, the dialogue choices resulted in different actions by the non-player characters, such as giving gold or attacking. In the example in Figure 13 (top, opposite page), if the player is foolish enough to agree to the non-player character's request and give her his dagger, she attacks him with it.

There were no examples of dialogues which exhibited both breadth and depth in the games created by the young people. The example dialogue in Figure 14 (bottom, opposite page) was created for a "whodunit" mystery game by an experienced *Neverwinter Nights* author. The player must discover who the killer is by questioning the witnesses. It is designed so that it is not too easy for the player to solve the mystery, therefore the branches in the tree cover a wide space of possibilities (i.e. it is bushy). The player can pursue a line of questioning at length, so the branches are also deep. This sort of dialogue is time-consuming to create. It also takes some skill to construct a tree in which the outcomes of the choice points are difficult to determine in advance, as is necessary to challenge the player in this mystery story.

Dialogue complexity — content

While it is useful to examine the structure of dialogues from the point of view of exploring the interactivity within the games, the content of the dialogues is interesting from a literacy perspective. A qualitative characterisation of the content of the dialogues gives some insights into the authors' assumptions about the genre, and suggests some educational interventions which could help the authors to improve their games.

The authors were not given any instruction on techniques for creating the interactive dialogue before they started. The
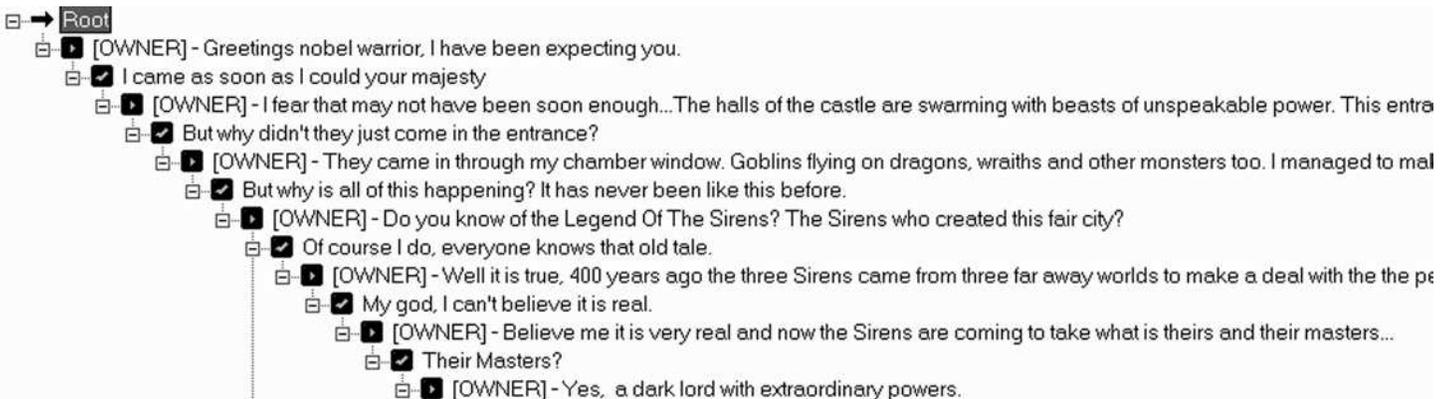

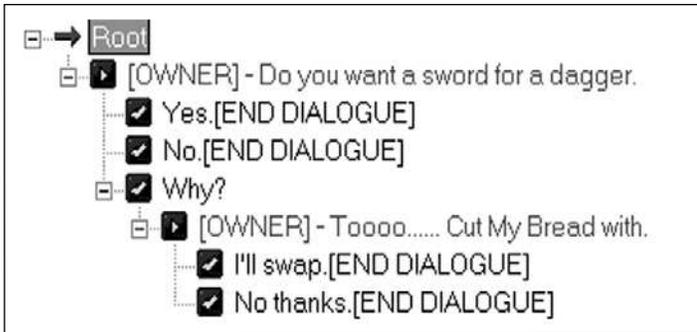Figure 12: A screen shot showing the structure of part of a deep tree with no player choice

Figure 13 : A screen shot showing a dialogue with low depth, but some interactivity

workshop leaders attempted to run a dialogue workshop during the third day but the pupils objected to this as they were so engrossed in the games creation task. Therefore the dialogues in the games reflect the authors' models of what kind of dialogue is appropriate in interactive games. These models appear to come from a variety of sources, including other computer games, books and oral stories, comics, pen and paper role-play and possibly films.

The influence from other computer games can be seen in the tutorial section of one author's game, which bears some resemblance to the tutorial dialogue in the first *Neverwinter Nights* level which the authors played before making their own levels. Another participant wrote a dialogue between merchant and player which he cheerfully admitted to borrowing from the game *Morrowwind*.

One of the older participants appeared to be inspired by literary sources such as Greek myths, and included Sirens in his game. He also mentioned that stories written in English lessons might be a useful source of ideas. The language used in his dialogues has a formal, literary flavour. Some examples of this genre of language are: "I fear that may not have been soon enough ... The halls of the castle are swarming with beasts of unspeakable power. This entrance hall is all of the castle that remains untouched." and "Do you know of the Legend Of The Sirens? The Sirens who created this fair city?"

Another source of inspiration was comic books and cartoons. One participant liked to write short humorous

dialogue in a minimalist style. This style is derived both from his verbal style, and comic books which he writes in his spare time. The lines:

> *Bob the Lion: Graaaaaaaar*
>
> *Player:Yep*

are characteristic of his sense of humour, as is the brevity of his storyboard narration: "Evil dragon goes on killing spree after failing his week long plan to diet." Two other participants were fond of sarcastic, ironic wit which relies on pretending to humour other people. This genre of humour appears in their games too. One boy mentioned (with pride) that his drama teacher told him that he was good at writing scripts, a skill which he used to good effect in his interactive dialogues. His dialogues were the only ones in which the style used by the player and the non-player characters were noticeably different, as the following example shows:

> *Servant: My lord, you are back! We your loyal servants knew this day would come!*
>
> *Player: Who the hell are you?*
>
> *Servant: Of course, The Guardian warned us you would not remember.*
>
> *Player: I'm still lost, who's the guardian? And you don't look so well [the servant is a zombie].*
>
> *Servant: We were condemned when you fell from power. You will free us, it was fortold [sic] and we will rain [sic] again.*

The young people also discussed pen and paper role-play games and films such as *Lord of the Rings* as they worked, although it is difficult to trace their influence on the dialogues directly.

All of the pupils had played role-play games before they started the workshop. As role-play games are not a
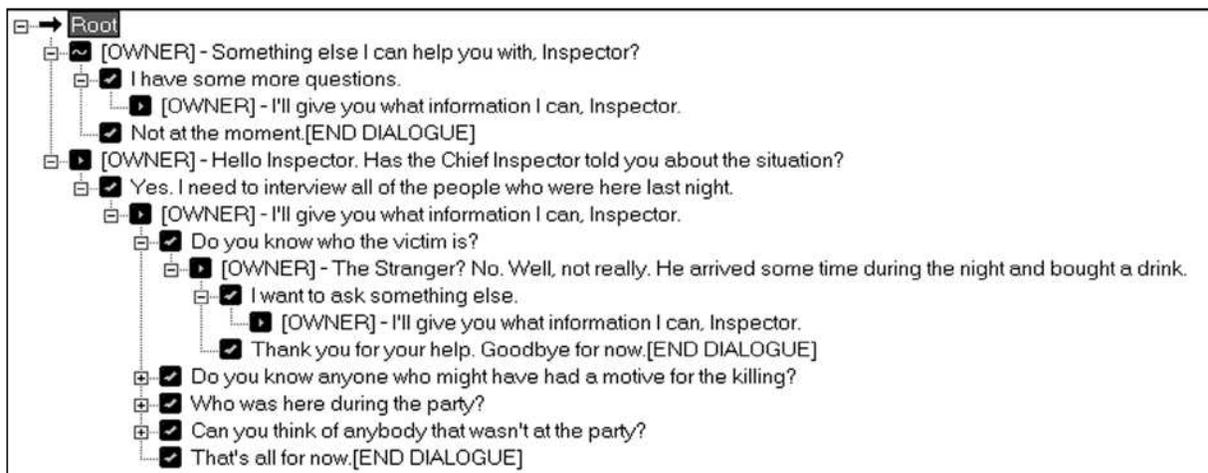

Figure 14: A screen shot showing part of a deep dialogue with high user choice

particularly popular genre of games for children, this was fortuitous. However, in future work we would like to work with pupils who have less background with related games. For this reason, uncovering sources of inspiration from other media is useful when considering how to approach teaching dialogue writing for games to general audiences of children.

Discussion

The Game Maker workshop was the first step towards understanding the educational benefits that can be gained from enabling young people to create stories in the computer game medium. The results reported in the previous section suggest that there is valuable educational potential in this approach.

The most important benefit was, as anticipated, the strong motivational effect this workshop had on the young people who took part. During the interviews, all the young people reported that they enjoyed the experience and would continue to use the *Neverwinter Nights* toolset if they had access to it. They became engrossed in the games design task, particularly when using the computers, and it was very difficult to persuade them to stop what they were doing to take lunch breaks. Some pupils were so keen to finish their games that they arrived early for the morning sessions, and stayed late after the afternoon sessions. This behaviour is particularly striking because this was a voluntary activity during the summer holidays when they could have been doing any activity of their choice.

A related benefit of the workshop was bolstering of the young people's self esteem. The participants were keen to have the other workshop participants play the games they had created because they valued the opinions of their friends. They were proud to show their games at the Edinburgh International Games festival to which they invited friends from school and members of their families. The younger participants seemed to enjoy particularly showing their parents their games in great detail, while the older participants spent some time helping general members of the public play their games. Some of the young people's parents took the opportunity to discuss their children's experiences of the workshop with the researcher. One mother was particularly pleased about her son's progress during the workshop because she said that he didn't like writing stories at school, yet he spoke with great pleasure about the game he was creating in *Neverwinter Nights*. She was keen for him to develop his interest in computer games design, perhaps with a view to studying it in further education.

Comments made by the young people during interviews and by parents at the exhibition confirm the expectation that computer games authoring could be used to bridge the gap between the sorts of literacy which are valued at home and at school. The participants of the Game Maker workshop indicated that they would like to use the *Neverwinter Nights* toolset at home and to share the games they created with their friends. In fact, some of them clubbed together to buy copies of the game to use at home. It would be interesting to further explore how classroom storytelling activities could be related to work using the game authoring toolset either at home or at after school clubs.

The Game Maker study also answered some open questions about the feasibility of the computer game authoring task for young people. Creating computer games is a complex task. Until the release of simplified toolsets such as the *Neverwinter Nights* toolset, it was not possible for non-experts to make their own games because of the programming skills required. The Neverwinter Nights toolset was the first authoring environment which did not require specific technical skills. Nevertheless, there are some difficult concepts and complicated procedures involved in creating an interactive narrative, such as: planning an interactive plot; understanding how interactive dialogue is represented in the interface and ensuring that objects such as portals have unique tags. In spite of the complexity of the games creation task, all the young people managed to create a game to their satisfaction. The games varied in sophistication, as would be expected when the authors have varied computing backgrounds and represent different age groups. All the participants but one were able to teach themselves how to use the basic features of the interface. The only girl in the group had more difficulty than her peers but she received extra help from a friend. Some participants mastered the more difficult features of the software, such as creating merchants and portals, after some tuition from the games expert.

Although the young people were able to use the *Neverwinter Nights* toolset to express their story ideas in game form, the software was not ideal for this purpose. The participants in the Game Maker workshop had difficulty using the plot wizard feature in the *Neverwinter Nights* toolset. The software has no facility for showing a representation of the multiple plot threads. As shown in the results, the conversations created using the *Neverwinter Nights* toolset did not take full advantage of the possibilities

Comments made by the young people during interviews and by parents at the exhibition confirm the expectation that computer games authoring could be used to bridge the gap between the sorts of literacy which are valued at home and at school.

offered by interactive dialogue. This probably results from a combination of the inadequacy of the software's user interface in supporting this task and lack of instruction on the skills required.

In addition, *Neverwinter Nights* contains a number of features which make sense in the context in which they were designed, but may not be desirable in the context of game design for educational purposes. For example, characters and settings are confined to the *Dungeons and Dragons* genre, and have a pseudo-medieval appearance. Allowing for a wider range of settings and characters would similarly expand the types of stories which young people could create. Similarly, the characters in the story possess a number of inherent features, such as skill and ability in different types of combat. Ideally, a game author should be able to create a character as a blank slate, and add personality features which go beyond the typical combat oriented scenario, for example, compassion or trustworthiness.

In a similar vein, the study also raises questions as to gender issues inherent in games environments of this type. Subrahmanyam and Greenfield (1998), in a survey of gender and games features, suggest that the violent, aggressive nature of computer games is often a barrier to female involvement, while Kafai (1996) notes that when creating game, girls often choose a realistic setting over the fantasy setting prevalent in computer-based role-play games. We are currently carrying out an analysis of the games designed as part of the Game Makers workshop, and have asked pairs of boys and girls to analyse and rate each game. Our analysis suggests that there are indeed gender differences in game preferences, and any work on story creation in 3D virtual environments will need to take this factor in account.

We are currently working on a prototype of a purpose built tool (*AdventureAuthor*) for creating stories in the games medium which has features to directly support story construction. The *AdventureAuthor* prototype will address these limitations of *Neverwinter Nights* by providing a visual representation to support plot planning and interactive dialogue as well as support features to guide the user through the game creation process (Good and Robertson, 2003). It will also allow for a broader range of settings, and characters with more fully developed personalities. More research is required to identify how the game making process could be integrated with the curriculum in a classroom context. Obviously the community education setting of the Game Maker workshop is very different from the formal educational setting of a classroom. In spite of this, there is some common ground. The approach of combining the non-computer story planning activities with the computer game creation task could be successfully adapted for a classroom, taking into account the participants' reservations about the extent to which their character plans could be used in the final game. Teachers might prefer to use more traditional story planning exercises as a preparation for making the game, such as class discussions, mind maps or short written descriptions of the characters.

A particularly interesting area for further research is the extent to which skills developed during story making in the games medium are relevant to textual story writing. For example, experiences from the Game Maker workshop suggest that games authoring might be a particularly motivating way to teach general dialogue writing. Classroom studies are required to explore whether computer games authoring can be used as a method of motivating reluctant writers.

In addition to the general storytelling skills which are common to all storytelling media, such as developing coherent plots, well motivated characters and convincing dialogue, game authors are likely to develop medium-specific storytelling skills. Learning how to express the emotional content of stories using sounds, music and lighting effects is a valuable part of becoming literate in the medium of computer games.

Conclusions

The strong motivational influence of computer games on children can be used positively within education. This paper looks beyond the educational benefits which children can gain as *consumers* of computer games to explore the additional benefits which could be gleaned from enabling children to *produce* their own computer games. In the domain of literacy and narrative development, creating an interactive audio-visual computer game to tell a story has many potential benefits. The Game Maker workshop described in the paper confirms that creating stories within computer games is a task which young people find highly enjoyable, engaging and rewarding. Additionally, the workshop experience suggests that sophisticated game design is well within reach of 12-15 year olds. These motivational advantages indicate that it is well worth exploring how computer game authoring can be used in the classroom to raise both literacy standards and children's enjoyment of story making activities.

Judy Robertson is a lecturer in computer games design at Glasgow Caledonian University. She is interested in using innovative technology to support children's literacy development. She has a doctorate in artificial intelligence from the University of Edinburgh, where she is an honorary fellow.

Judith Good is a lecturer in informatics at the University of Sussex. She is interested in novel uses of technology to foster both learning and excitement for learning. She teaches courses in interactive learning environments, educational simulations, artificial intelligence and education, and educational multimedia.

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