Social and Technical Factors Contributing to Successful 3D Animation Authoring by Kids

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ABSTRACT
Creating 3D animations has traditionally been restricted to adult experts. With the advent of easy-to-use software packages like Alice [2], we can now imagine animations being created by end users with no formal training in this area. Does this work in practice? Supporting real people in the successful use of complex multimedia authoring environments requires not only quality software, but also a supportive social context. What might such a supportive social context look like? In this paper, we report on a workshop in which seventeen children ages 11-12, working in pairs, were asked to make their own animations using Alice. Students were part of a language arts class studying fables, and were asked to retell a fable of their choice in 3D animation. This assignment proved to be an appropriate size and scope for the time available, skills of the students, and affordances of the software. The students found the assignment motivating, and their teacher was pleased with learning outcomes. We discuss social and technical factors that helped students create successful animated fables.

Keywords
Children, Animation, Learning, Social Context

INTRODUCTION
New media increasingly surround our everyday lives. However, it remains an open question to what extent real people will have meaningful control over those media. Are non-professionals solely consumers of multimedia content, or can they also be creators? Creating original content can benefit those who view and interact with it, supporting a greater plurality of opinion. It can also benefit the author, who may learn through the process of multimedia creation.

The constructionist philosophy of education [12] advocates learning through design and construction activities. Early work in constructionist learning had children write their own computer programs in the Logo language [11]. Since then, a wealth of construction tools have been designed to support kids learning through creating something that is meaningful to them [13].

However, student motivation to finish projects can often fade. For example, Joseph and Nacu organized an after-school program where kids made their own web pages. They carefully documented that the students' initial interest was high, but faded over time, and many projects were not completed [8]. Creating a successful project-based learning environment requires not only well-designed, usable software tools, but also a supportive social context.

Animation, as seen in cartoons, videogames and movies, has strong cultural resonances for many children. Can children create their own animations? What are the technical and social ingredients to make this possible? What can kids learn through the process of creating their own animations?

In fall 2003, we introduced the Alice software [2] to a group of students at an after-school "computer clubhouse" where less advantaged kids come to use computing technology for free. While many kids and teens expressed interest in participating, few remembered to bring in signed parental consent forms. Of those who did join the workshop, none completed even a simple animation. Many factors contributed to the difficulties we encountered, and a full discussion of that workshop is beyond the scope of this paper. We mention it merely to note that, like Joseph and Nacu, we found that creating a supportive social context is harder than it might seem. In spring 2004, we redesigned the workshop and tried again--this time with success. In this paper, we report results of that second workshop, and highlight factors that helped make it succeed.

Alice
Alice is a 3D graphical environment originally designed to support the creation of both virtual reality and desktop animation. It was designed for undergraduates with no 3D graphics or programming experience. It allows users to construct 3D virtual worlds by dragging and dropping

graphical tiles that represent statements in a programming

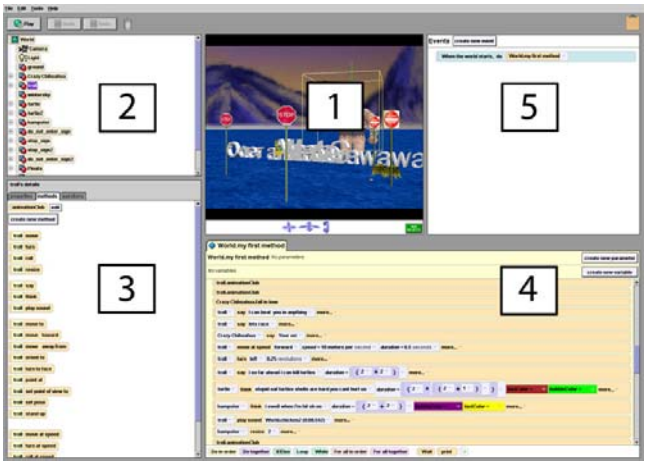

Figure 1. The Alice Interface: the scene window (1), object tree (2), object details area (3), animation area (4), behaviors area (5)

language [9].

Creating an animation in Alice largely consists of two steps. First, users must select objects from a library containing hundreds of low-polygon models with hand-painted texture maps. The library is organized by types (animals, vehicles, etc.) as well as by theme (old west, amusement park, etc.) Selecting a model places it in the scene where, amongst other things, it can be moved, rotated, and resized. [5]

The second step is scripting the animation. Throughout the interface, elements that might be used in an animation (commands, programming constructs, 3D objects, objects' properties, and variables) are tiles that used can drag and drop into animations they are creating.

For example, if the user had added a chicken to her scene and wanted it to turn to face the camera, she would first select it from the object tree. Then, in the object details area she would select a method called "Chicken turn to face". This tile would then be dragged into the animation area and the user would be prompted for valid parameter

Figure 2. Closeup of animation area

choices. In this case, she would select "Camera".

Tiles in the animation area can be reorganized, edited and even combined with programming structures such as "If/Else", "While" and "Do Together". Figure 2 shows an example animation in which a chicken turns its head to the camera while simultaneously saying "Hi There!".

Alice has been in development since the mid-1990s at University of Virginia and later at Carnegie Mellon University. Its design has seen numerous iterations and improvements. Most of the recent changes have been to improve ease-of-use and accessibility. For example, Caitlin Kelleher has developed special Stencils-based tutorials and SotryKits designed to introduce users to Alice and provide them with ideas to get started on their projects. Alice's creators hope the tool will be used to teach programming to non-science/engineering audiences, and are focusing in particular on undergraduates and middle school girls. [4-6, 9] The Alice software is available for free from

Figure 3. Children working on their animation

http://www.alice.org/

ANIMATION WORKSHOP

In our workshop, children worked in pairs to create an adaptation of a fable of their choice using Alice. The workshop was voluntary, non-graded and took place in the context of a 6th grade language arts class at a suburban private school in Georgia.

A total of seventeen children participated (11 boys and 6 girls). Their ages were between eleven and twelve years old. Attendance was high, with no dropouts. Four kids missed one session each due to illness.

The workshop lasted six weeks with regular scheduled meetings once a week for approximately one hour (see

Table 1). During the 5th week an extra session was held at the teacher and students' request. The workshop was carried out in the school's computer laboratory with the computers arranged in a horseshoe with the children facing outwards (see Figure 3). During the sessions there were at least two researchers present to provide instruction as well as assistance. The teacher and her assistant were also present most of the time.

Table 1. Summary of activities for each workshop session

Session	Main Activity
1	Introduction: Kids are introduced to the Alice software and its first tutorial. They also decide on a fable to animate.
2	Storyboarding: Kids sketch out storyboards on paper. They also look at the objects/characters available in Alice.
3	Text and Camera: Kids are shown how to add cartoon text bubbles as well as basic camera movement.
4	Work on Animations
5	Titles and Credits: Kids are taught how to add 3D-text to serve as titles and credits for the animations.
5b	Extra Session: Kids fine-tune their animations.
6	Premiere – Kids ate popcorn, drank lemonade and presented their animations to the rest of the class.

Data Collection

Before the start of the workshop, the children were surveyed on their prior experience with computers as well as their affective relationship with computers in general. The workshop sessions were videotaped using two cameras. The first camera was in a fixed location surveying the entire computer laboratory while the second camera was held by one of the researchers. The second camera was used to capture close-up footage of each of the groups while they were working. Once the workshop had ended, follow-up interviews were carried out with seven of the participants as well as the classroom teacher and her assistant. The interviewees were selected using a purposeful sampling strategy on the basis of their accomplishments during the workshop (good/not so good) and their answers on the initial survey [7]. Finally, the animations created by the participants were analyzed for superficial characteristics such as number of objects used and time duration.

Fables

During the week prior to the workshop, the children had been introduced to fables as the starting point of a unit titled "Legends and Myth." During this time they read fables, talked about them in class and individually wrote a summary of a particular fable they had enjoyed.

One of the first things students did in the workshop was pick, together with their partner, a fable that they wanted to animate. The choice as to which fable to animate was completely open and, in general, the groups chose either fables they were familiar with, one of the ones they had summarized, or a fable that they felt would make for a good animation. For example, Tess and her partner Sue chose "The Tortoise and the Hare" because "it's like a race that isn't too long and the hare is fast while the turtle is slow. It would look good."

Due to the limitations of the availability of 3D objects like characters and props, most groups opted to make original adaptations of the fable they had chosen (see Table 2). For example, since there wasn't a "Hare" available for "The Tortoise and the Hare", the children opted to create "The Hummer and the Tank" or "The Ogre and the Chihuahua" while maintaining the basic story elements. Others presented a less-known fable such as "The Ox and the Frog" under a new title and characters (see Figure 4). In this case, the moral of self conceit leading to self destruction became a story of a helicopter and a plane that challenge each other to fly as high as possible. Additionally, one of the groups decided to animate a scene from a myth they had read and turn it into a fable.

Figure 4. Title shot for "Flyin' High in the Sky"

Results

At the end of the workshop, and after a combined total of less than six hours of hands-on time, all the groups presented an animation for their chosen fable. The animations created were, on average, 50 seconds long with the shortest one lasting 30 seconds (a typical TV ad has a duration of 30 seconds). The animations varied in their

complexity with some using up to 44 different 3D objects and 85 actions. On average, the animations used 18 different objects and had 49 actions. The example in Figure 2 requires one object and four actions. Finally, three projects used sound clips included in the Alice software to supplement their animations.

Table 2. Original Fables and alternate characters used

Original Fable	Main Characters Used
The Ox and the Frog	Tank and humvee
The Ox and the Frog	Frog, horse and death
Belling the Cat	Lion and monkeys
The Old Man and Death	Man and death
The Dog and the Hare	Persephone and centaur
The Ox and the Frog	Helicopter and airplane
The Hare and the Tortoise	Two girls
The Hare and the Tortoise	Ogre and Chihuahua dog
The Raven and the Swan	Tortoise and pterodactyl

Interview answers showed that the children were proud of their final animation product. For example, Tim stated "I'm most proud of the way it turned out. It was funny and the class seemed to like it" while Joe commented that "Animation was fun. I'm proud of the fact that I actually did one."

The children exhibited a high degree of motivation and excitement during the workshop. They even went so far as to request an additional workshop session to prepare their animations for the screening day. In the words of Beth, the teacher, "I saw a lot of excitement. [The kids] were really eager. It was really exciting for me to see how well it was working in terms of the kids." Jane, Beth's assistant, said that "it was something they looked forward to in the week, you could tell they were anticipating it and would talk about it with their friends."

The workshop was deemed a success by the teacher, who is interested in using it at a later date with more classes. Her assistant Jane explained: "the children are at an age where they are still in love with animation, so being able to use a program where they have power and control to be able to create that was really exciting for them. It challenged them to learn something new pretty quickly because they had to come up with a product. They also had to work together."

Beth noted that the kids "learned how animation works and how incredibly complicated it is by being able to revisit [their animation] every week for six weeks and really illustrate and think about the moral. Also, they really had to think longer creating this new story around [their fable]. I think it really drove home what a moral and a fable are."

The particular reasons that we believe explain the success of this workshop will be discussed in the next section.

DISCUSSION

3D-authoring environments for novice audiences without strong mathematical or programming backgrounds are rare. Most are designed for experts and/or professionals [1, 3, 10]. As we've seen, Alice is an environment that has been purposefully designed to be used by novices [5]. As part of this study, we wanted to explore non-software factors that contribute towards successful use of a multimedia authoring tool by non-expert children. In particular, what might a supportive social context involve and what kind of task would be appropriate?

As mentioned in our introduction, our initial attempt at teaching the workshop was a failure. A reasonable explanation for this failure lies in the fact that the kids had a less-advantaged background in terms of educational background and socioeconomic status. However, we believe that these differences alone are insufficient explanation for our initial failure. In both cases, we have no reason to believe that the task was beyond the capabilities of the participants and both groups of participants had plenty of prior experience with technology. Additionally, the less-advantaged kids had significant prior experience in the use of sophisticated software tools such as Adobe Photoshop and Macromedia Director. In all, we believe that the reasons for our initial failure do not explain our later success. The main differences in both experiences lie not in the participants, but in the supportive social context and proper nature and size of task.

The school where the successful workshop took place regularly integrates collaborative work as part of its curriculum. Children at this school routinely participate in collaborative group projects and other activities. We believe that this prior experience paid off by allowing the children to make the most of their time on task as well as helping them benefit from working with a partner. In the words of Mary, "working alone is not as good 'cause you

Figure 5. Closeup shot of "Belling the Lion"

don't have two heads. Two minds are better than one and you come up with better ideas."

The Alice environment provides a wide variety of ready-made objects that can be selected and included in the 3D environment that is being created. These objects include props and characters for different scenarios. For example, users can include a samurai, a castle and a revolver from the Japanese, medieval and old west scenarios respectively. The existence of these ready-made objects, many with pre-programmed methods (animations), allowed the children to quickly engage in the creation of their animated fables. Not only that, but many times the objects themselves suggested ways in which they could be used as well as directions their stories could take.

Mary and her partner chose to illustrate a scene where a centaur was supposed to kidnap a young girl. They were both unsure of how to animate this particular action until they noticed that the centaur had a method called "punch." They observed the animation carefully and realized that they could adapt it so that the centaur grabbed the little girl and threw her onto its back. This particular solution would probably not have occurred to them if they had not had access to a pre-made object and animation. In this case, ready-made and easily integratable objects and scenarios helped guide and suggest the creative process.

The nature of the assigned task, and how it related to the tool we used, also played a significant role. In our unsuccessful workshop we allowed the participants to choose whatever they wanted do. Invariably, they chose projects that were both too long and complex to be carried out effectively in the time-frame of the workshop or lost a great deal of time selecting characters and coming up with an idea for an animation. In other cases, students used too many 3D objects, stretching the hardware and software past their practical limitations. By the end of the workshop, none of the kids had finished an animation. For the second workshop, the choice of a fable as a narrative unit to be animated proved to be an excellent choice for the amount of time available. Fables are short, have a clear narrative goal (tell the moral) and have few characters. The choice of task was well-suited to the duration of the activity.

Additionally, since the purpose of a fable is to teach a moral (as opposed to tell a specific story), the children were able to easily adapt and modify the fable to suit their own needs (or the availability of objects). Tim explains his use of a chihuahua and an ogre for his rendition of "The Tortoise and the Hare" because "they were funny. [My partner and I] kind of both wanted it to be that way. We changed some things 'cause we found it was better. We added stuff that we thought would make it funny." The assigned task had the right balance between structure and flexibility. The kids had enough flexibility so as to enjoy creative expression without feeling at a loss of where to begin. The structured nature of the task provided them with a context, clear goals and an idea of what the finished product should look like.

FUTURE WORK

The success of our second workshop highlights the fact that it is possible for children to become authors of complex multimedia projects such as animations. We are interested in pursuing further questions related to the particular supports that children require as well as the best moments to provide these supports. We plan on implementing an online-community called "Anival" where children and adults can collaborate on the production of animated short films. In particular, we hope to explore issues pertaining to the communication of the processes that are involved in the production and creation of multimedia artifacts. We hope to answer questions such as how can visual storytelling techniques be learned? What kind of feedback on a partially finished artifact is most important, and when is it best to receive it? We plan to sponsor online competitions to help motivate people to create animations. What tasks are appropriate in size and motivating for both youth and adult audiences? Our broader agenda is to understand how multimedia creation can provide a rich context for learning in a variety of subject areas.

CONCLUSIONS

Our experience has shown that if we expect children to become authors of multimedia in an educational context, a supportive social context can be just as important as software ease-of-use. This experience has highlighted that:

- Collaborative skills are necessary
- Pre-made objects and scenarios suggest ideas and serve to guide the process of creation
- The nature and size of the task should meet the affordances of the tool
- It is important for the task to have a balance between structure and flexibility.

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