CHILDREN AS DIGITAL MOTION PICTURE AUTHORS

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1. INTRODUCTION

When left to themselves, most children engage in make-believe fantasies, transport themselves to imaginary worlds through television and movies, play games and sports, chat and gossip, and just hang out. When guided by adults, as in school, they read and write, listen to lectures, do research, answer questions, solve mathematics problems, and engage in artistic pursuits. Unfortunately, only in ideal circumstances do they engage in and carry out projects that are meaningful to them.

The personal computer revolution of the last two decades has enhanced the speed and flexibility with which children can write and edit papers and with which they can do research and structure the knowledge developed in group projects [Scardamalia and Bereiter 1993]. Yet many students in many schools are not motivated by the activities that adults and teachers think are valuable. Is there a way to harness the passions of youth so that they can engage in projects that have clear educational benefits and that are also engaging to them?

The premise of this paper is that authoring and creating motion pictures is compelling to children *and* educationally valuable in a wide variety of ways. Until recently, the process and technology of motion picture creation was too difficult and too expensive to allow access to any but the most dedicated, such as the young Steven Spielberg. Yet recent advances in computer-based multimedia have allowed for the possibility that many children could have physical, cognitive, and economic access to filmmaking.

The paper begins with a brief account of filmmaking and digital media creation by children. It then summarizes our user-centred, iterative design and development over the past six years of the novel Movie Authoring and Design (MAD) system. We report on MAD's use in two multimedia summer camps in which groups of seventh graders made movies with the support of high school counselors and our research staff. Impacts on the campers are described in the children's own voices. We conclude by extrapolating from these experiences to a vision of significant, educationally valuable, project-based digital filmmaking activities by children working individually in homes and schools and working collaboratively with others located throughout the world.

2. HISTORY AND THEORY

Children today spend significantly more time watching TV and movies than they do reading. Yet students are not learning to express themselves in the dominant media:

> "The essential medium of expression in the classrooms is no longer print. It's a hybrid of print, video, audio and video games, but unless we provide access to the tools to compose in this medium, we will be training students to be readers but not writers. And if all they do is read these multimedia texts, not only will they have sore eyes, they will be missing out on an important part of what it means to be literate."
> [Reilly 96]

There is very little literature (but see [Buckingham 90; Paley 95]) describing studies of children creating media. An exception is Reilly [Reilly 94, 96], who documents innovative uses of multimedia authoring at several California high schools as a part of the Apple Classrooms of Tomorrow program. The students create video essays, music videos, and public service announcements, using conventional text editing software and video editing equipment.

The conventional filmmaking process is very complex. It is typically a linear flow from pre-production — idea development, script writing, and location and set design — to production — shooting the film or video material — through to post-production — editing and the addition of music, special effects, titles, and credits. It involves a variety of technologies and specialized techniques that deal with disparate media — text, still images, sound, and moving images. It is

expensive and difficult for a single individual to master and control. It is hard for those who are not Spielbergs to envision the result until they are near the end of the long process.

Filmmaking has therefore been a boutique item in the school system, expensive, rarely available, and rarely used. We set out to change this, because, as we shall illustrate in this paper, we believe that filmmaking can satisfy our goals of engagement and educational value.

Our Movie Authoring and Design system (MAD) was designed to assist hierarchical development and organization of movie ideas and components such as scripts, pictures, audio, and video; to support their manipulation in a unified manner that is easy to learn and use; and to aid visualization of the ultimate result [Baecker et al. 96; Cohen et al. 96, Friedlander et al. 96; Posner, Baecker, and Homer 97; Rosenthal and Baecker 94; Rosenthal 95]. It is therefore useful for both experienced and novice filmmakers, including, in our experience, children as young as 7 years old.

We assert, as does Reilly, that children benefit by being able to express their ideas in movies, and that digital media can provide rapid learning opportunities and access to filmmaking tools previously reserved for experts. We assert that the idea development, organizational structuring, and visualization capabilities of MAD provide benefits above and beyond those present in conventional consumer digital video editing. We assert that MAD is a tool that fits Papert's description of constructionism:

> "ConstructioNism—the N word as opposed to the V word—shares constructiVism's connotation of learning as `building knowledge structures' irrespective of the circumstances of the learning. It then adds the idea that this happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it's a sand castle on the beach or a theory of the universe" [Papert 91].

We wanted to study and test these hypotheses in a controlled but realistic setting. Before presenting the results of our study of the use of MAD in two multimedia summer camps, we shall describe the technology and our design process in more detail.

3. TECHNOLOGY AND DESIGN PROCESS

MAD introduces a paradigm shift in the making of motion pictures. It allows the easy intermingling of pre-production, production, and post-production. It allows film concepts to be

made tangible, demonstrable, and accessible in a way not possible with traditional technologies. It encourages tight artistic control by an "author" over all aspects of a production — words, images, and music. It also encourages the interaction by members of a creative team through an artifact representing the planned production in a way not possible with traditional technologies, in which words, music, still images, and moving pictures appear in separate media.

3.1. Technology

In short, MAD is the first system that allows the design and management of words, images, sounds, and video for visualization during the pre-production, production, and post-production phases of motion picture development. Key design goals were:

- *Ease of learning and ease of use* — the ability to start working productively within a few minutes and to be proficient without the need for a manual or ongoing help from an expert
- *Hierarchic idea structuring* — the ability to develop movie ideas both top-down and bottom-up, to modify the structure with ease as new ideas arise, and to work at various levels of detail.
- *Multimedia support* — the integrated handling of scripts [Figure 1], dialogue or narration, music, sound effects, storyboards [Figure 2], and video, and of commentaries on these elements, all accessible through appropriate representations and specialized editors (for example, script and storyboard editors), and all linked to the underlying hierarchic film structure and to a common multimedia database.
- *Visualization* — the inclusion of aids to visualizing the film, for example, being able to request a real-time preview of the movie [Figure 3] or the best approximation to it at any stage in the film development process.
- *Interchange representations* — the provision of mechanisms for importing, exporting, and sharing movies and parts of movies, to allow individuals to communicate to others about their work and to collaborate with others on projects.

MAD differs from other pre-production filmmaking tools such as script writing software by including multimedia support and visualization capabilities. It differs from multimedia authoring tools in providing strong support for film narrative and dialogue structure [Baecker et al. 96].

3.2. Design process

Because MAD enables fundamental changes in the ways films can be made, we had to build and refine a working and functional (not "smoke and mirrors") prototype in order to convey the concept before we could make good use of domain expertise and user feedback. We therefore adopted a user testing methodology (McGrath, 1995) that eschewed the internal validity of standardized designed tasks in favour of the external validity of mostly qualitative observations of free form exploration by users working on real films. We have employed a variety of interview and observational techniques to study and learn from our users' experiences. Adults, university students, and children have used MAD in over 60 one- to twenty-minute filmmaking projects; most of our work has been done with 12-14 year-old children.

Our development has gone through three major stages:

- Design and construction in the C programming language of a working bare-bones prototype of the concept. Carried out as a M.Sc. thesis project [Rosenthal and Baecker, 1994; Rosenthal, 1995], MAD 1 allowed us to create a few short movies and to understand both the strengths and weaknesses of our initial approach [Baecker, et al., 1996].

- Design and construction in the C++ programming language of a more elaborate, production prototype. Carried out by part-time professional programmers and students, MAD 2 was robust enough to enable the creation of several dozen short movies in our lab and in two multimedia camps that we ran at the University of Toronto Schools in the summers of 1996 and 1997 [Baecker, et al., 1996; Posner, Baecker, and Homer, 1997]. Careful observation of work in these projects brought significant new understandings in key areas of the design.

- Design and construction in the Java programming language of a production version of the concept. Carried out by professional programmers and students, MAD 3 is currently undergoing alpha testing pursuant to its becoming a commercial product.

In carrying out these developments, we have constructed dozens of screen prototypes with Adobe Photoshop, Macromedia Director, and other prototyping media. We have given hundreds of demonstrations to educators, film and video professionals, and individuals interested in media, and then listened carefully to their reactions. We have administered questionnaires to most of our users, interviewed them, watched them work, videotaped them, and worked closely with them. We have transcribed and analyzed hours of interview and video data about product and process. (Further details about our methods of data collection and analysis appear later in this chapter.)

The two multimedia summer camps were therefore particularly suggestive sources of insight about the potential of digital video authoring in the classroom. In this chapter we shall focus primarily on qualitative results from both camps.

4. USE OF TECHNOLOGY

In the summers of 1996 and 1997, grade seven students from Scarborough, a Toronto suburb, were selected by lottery to come to the multimedia summer camp for one week [Figure 4]. At the camp they learned about computers and filmmaking and produced short movies.

The students came from different schools and had diverse educational and cultural backgrounds. Their computer experience ranged from none at all to having grown up using computers. The counselors were high school students from the host school who learned the software and the technology just prior to the camp. Three counselors were present both summers.

4.1. Camp process

Each summer camp ran for two weeks. Twelve campers aged 13 years old attended each week — 5.5 hours per day. Campers were divided into four groups. We controlled for computer experience and gender and tried to ensure that group members were from different schools.

The first summer we conducted a controlled experiment to evaluate the effect of multimedia tools on the filmmaking process. Groups used two different systems — MAD and a "conventional" digital video editing software — to create two movies, each one using a different

system. Following the completion of their first movie, the campers previewed the movies for their peers and listened to a lecture by a professional filmmaker addressing some of the problems encountered in their moviemaking. Midweek they switched software and created a second movie.

Analysis of the quantitative and qualitative data (see below) yielded interesting results [Posner, Baecker and Homer, 1997]. For example, we learned that children quickly learned moviemaking, regardless of their technical skills and computer background, and brought great imagination and creativity to the task. Their skill and the quality of their creations improved markedly from their first to their second films and were significantly impacted by the work of their counselors. Additional work done in the idea generation and script writing phase resulted in films of higher quality. MAD proved to be both useful and usable and was preferred by the children over the "conventional" digital video editing solution.

After examining these results we decided to modify our approach. Carrying out the controlled experiment had forced us to give only minimal feedback to the students, with an attendant cost to the quality of the students' experience and the movies they produced. In the second camp, therefore, we gave the campers more time and more in-depth feedback during their work, and we did qualitative, ethnographic, observations only. Each group made one movie during the week. We gave constructive criticism to the groups at numerous stages of their work.

4.2. Data collection and analysis

More specifically, we collected in both camps large amounts of qualitative data using questionnaires, audio and video journals, digital records, paper artifacts, and group discussions:

- *Background questionnaires:* We asked about campers' experience with technology (e.g., video games, VCRs, video cameras), computers, moviemaking, other interests, and group work experience. Knowledge about filmmaking was assessed before, during, and after the camp.

- *Daily questionnaires:* At the end of each day the students filled out questionnaires describing the day's activities, what they learned that day, and the activities they enjoyed most and least.

- *Interactive feedback sessions*: A teacher and a researcher met with each group several times during the week to discuss movie topics, review the groups' progress, stimulate critical thinking and discussion, and suggest possible improvements.

- *Final questionnaires and group debriefings* : At the end of the week all campers filled out a questionnaire describing their experience, evaluating the software, and providing feedback. A group discussion and debriefing session has also held with each group at the end of camp.

In the first camp we also collected quantitative product and process data [Posner, et al., 1997]:

- *Analysis of movies and artifacts produced during movie creation*: We kept the campers' paper artifacts including rough notes of brainstorming ideas, storyboards, and scripts, as well as original film footage and copies of all final films. All digital records and files were saved (approximately 600Mb/movie), including scripts, digitized video segments, and versions of the movies. We analyzed movie and script structure using a detailed quantitative evaluation form. Movie quality was rated by three "experts" — one filmmaker and two avid movie viewers.

- *Process data:* The counselors kept records of their groups' work using paper activity calendars and audio journals. We collected video journals of the first two hours of work on each movie, six of which were analyzed [Posner, et al., 1997]. We visualized the process information by combining data from calendars, audio journal transcripts, observers' notes, and digital time stamps on files to produce activity plots with categories such as brainstorming, script writing, filming, digitizing and compressing, editing, and Internet searching.

4.3. Campers' accomplishments

The majority of the campers had never made a movie before and had little computer experience. After a short time and with modest support they were able to produce creative and interesting films that they were very proud to show. They quickly learned about scripts, storyboards, locations, sound, camera angles, directing, editing, and getting video from the Internet [Figure 4].

They used these new skills to create interesting and in some cases even insightful and educational movies [Figure 5]. These included:

- a variety of fiction thrillers about man-haunting monsters, robots taking over the earth, and kids getting sucked into video games

- a music-video-count-down show

- a magazine format show about Toronto [Figure 5a]

- a public service announcement about treating and preventing choking

- a talkshow debating cars versus public transit

- a parody of the television show, the "X files" [Figure 5b]

- an advertisement

- a film introducing the school in which the camp was being held [Figure 5c]

- a movie about a bomb blowing up in a school and the value of freedom.

5. IMPACT OF TECHNOLOGY

The children were engaged and exhibited lots of creativity. They learned many new computer, filmmaking, and group skills.. They provided evidence of the educational value of filmmaking and evidence that MAD's basic concepts are powerful and appropriate.

5.1. Engagement and creativity

For example, the movie entitled "UTS a Journey" [Figures 1-3, 5a] described the history of the host school. The campers visited the school web pages and gathered background information. They then interviewed the school principal and asked him pointed questions about his job and "about why girls were introduced so late at this school?"

Another camper whose parents were refugees from Sri Lanka drew on his family's experience to create a movie dealing with the "Value of Freedom." He described his parents reaction:

> Ragif: "Well, I just told them [parents] it was about freedom and they said it was a good topic to pick. It is a good movie to make because it is showing you some qualities and telling you how the other world is true. People here don't take freedom seriously and it is a shame to see that people here don't take it seriously here in Canada because there is no war. They don't think about the other side of life."

(Please note that the students' names have been changed to preserve anonymity; however, gender differences were preserved.)

No matter what the theme was, the campers showed great creativity in its execution. They interviewed people in the school and people in the street. They brought reference material, props, and costumes from home. They drew maps and figures. Although the software provided did not support any special effects such as wipes or dissolves, the campers' movies included special visual effects such as an earthquake, many kids coming out of one locker, and people disappearing off the screen. Their movie titles include spoken on camera, filmed chalk drawing on the board, typeset video-recorded text, and scrolling hand-drawn titles set to music.

Writing in film authoring

The majority of our seventh graders admitted that they dislike writing essays.

Instructor: "Does anyone dislike writing papers here?" (All three raise their hands.)

Tony: "Yes. …Writing essays is boring."

Ragif: "Yeah. Because it [moviemaking] is more interesting. When the teachers tell us to write an essay, the kids are bored. When they introduce something new, it makes them want to do more stuff."

Yet all the campers' movies included a script component. The students did not complain when they had to write these scripts.

Motivation and dedication

Despite the fact that the students spent an entire week working on their movies, they all felt that the time went quickly and that moviemaking was fun:

David: "It went by faster here [compared to school]. … It was more fun. It wasn't 'sit down, here is this work, do it.' It was 'go out and have fun.'"

Campers were very enthusiastic about their projects. One group worked on their script at camp, then without prompting went home and further refined it. They were very dedicated to their work and tried very hard even without the threat of marks.

Chris: "I think we tried really hard on this one, just as if we were getting marked, but I think if we had more time we would have done better.… It was hard work, but it was hard work in a fun way."

Groups were extremely motivated to succeed in their projects. Their daily work was very focused and task driven:

> **A counselor:** "They focused quite well. We didn't even have breaks sometimes. This guy stayed until five one day doing clips. On the whole they were interested, because it was new to them. Except for the digitizing and the compressing [when the computer is unusable], sometimes they would go play with the camera, but besides that, they were focused 99% of the time."

Novelty

Children like playing with new technology "toys" and if they can create something to show their family and friends, then they are even more motivated. When asked if they had access to this technology would they use it? They replied,

> **David:** "I would be using it every day.… Anything [any project] that I had the chance to do."

> **Victor:** "You would feel like doing it more. If you were home, and you had this stuff, you wouldn't be sitting around doing nothing.… Instead of watching TV for two hours."

Although we may be observing a Hawthorne effect — anything new is exciting for a while — there is some evidence that, given the opportunity, children would be active moviemakers instead of passive viewers and television consumers.

Movies as school projects

Several students were under the impression that they would receive higher marks if they submitted a movie project for school than if they used some other presentation method.

> **Chris:** "I think that if I did a movie, my teacher would give me a higher mark, because anybody can write an essay, and how many students do a movie for their project?"

According to the campers, marks were not the only motivation for contemplating a movie project for school. Several campers felt that viewers would learn more from a movie than from another presentation,

> **Ahmed:** "It might take longer, but when you think about it, you are going to get marks for it. It takes longer but it is worth it for the marks."

> Instructor: "So you think you would get more marks for doing it?"

> **Ahmed:** "Yeah."

> **Instructor:** "But if you really couldn't get extra marks, would you still want to do it?"

Ahmed: "Yeah, I think it is fun. And the audience could learn more about it than just the essay."

5.2. Learning

The campers learned about multimedia and MAD; Internet searching and downloading; moviemaking skills such as camera operation, choice of camera angles, and use of sound; digitizing and editing digital video footage; and project management and organization techniques:

> **David:** "Everything was new. How to film and put it on the computer. I never made a movie before or use a video camera or the Internet. I learned how to do research on the Internet. "
>
> **Deborah:** "I learned the importance of organization."

How they learned

The campers learned from their counselors, the camp staff, and especially from one another. In most schools the computer to student ratio often compels sharing, which in many cases allows students to learn from each other and gain comfort to venture out on their own. There are however situations where dominant individuals deny access to technology.

> **Tammy** [in response to question, "Have you ever surfed the Internet before?"]: "Not really. Not by myself. I would usually have a friend with me and she would use it. I would sit there and watch."

The counselors encouraged equal participation by all group members, enabling Tammy to get hands on experience.

> **Tammy:** "It [the Internet] is fun. You can learn a lot from it!"

By grouping together students from different schools we tried to avoid biases that students have towards their classmates and to allow everyone equal opportunity to interact with the technology.

Learning about filmmaking

In the span of one week, working on one or two short movies, the campers learned much about filmmaking, filming and editing, and became more discriminating movie viewers.

Most campers had never made a video and many of them had never used a video camera before the camp. At the end of the week they were comfortable with using a camera:

> **Mark:** "Things I learned were how to use a camcorder; I never knew. I thought they were high tech and crazy things and I didn't know how to use them. Now I know how to use them. I always wondered how in

the movie they always did the graphics and all the different overhead shots and camera angles, and I learned them this week."

The campers started out as average movie viewers, who seldom notice technical aspects of movies such as shot compositions, camera angles, lighting changes, and background sounds. In the second camp, after initial work on the movies we conducted an in-depth analysis of one short segment of a popular movie . The campers were then able to work more professionally and view their own movies more critically.

> **Chris:** "Well, you know how you showed us the Batman movie. I never looked at it like that. I watched the movie and I didn't really look how they had so many cameras. I went home, I was watching movies, and I noticed them now."

> **Tommy:** "We started breaking the filming up into different segments.… We filmed the guy coming out of the subway station, we didn't watch him cross the road and put the camera down. We stopped and did each thing a couple of times to get it right. We mixed a couple of parts. If the first part of one segment was good, and the last part of the second, we'd mix the two."

After making their movie the campers gained a profound appreciation of moviemaking. They learned how long it takes to make a movie; how many takes are required to perfect a shot; and how to recognize problems with camera work, lighting, sets, and sound.

> **Andrew:** "Usually when you go out for a movie, you just go, but you don't know how many times they have to take that little thing over again. It may just be a cat walking by, but then they have to take it so many times because they want the cat to walk the right way. … Usually you just sit down and watch the movie."

> **Ahmed:** "I used to think movies were just camera shooting, but now I found out that you can put it on the computer and do special effects on it."

> Raymond: "[Moviemaking is] Hard. More than it is cracked up to be. [More] work."

5.3. Group work

Campers learned about both the advantages and disadvantages of group work and developed effective approaches to the distribution of the work. In general, they grew to appreciate the need for team effort in filmmaking, a complex task involving many different kinds of activities.

Advantages and disadvantages of group work

Campers encountered many advantages and some disadvantages of group work. They appreciated the ability to share the workload, to develop new friendships, and to increase the number of ideas:

Andrew: "There were three minds so it is better than one!"

Yet some students dislike group work because of the difficulty in reaching consensus.

Alfred: "It is easier to work alone than with other people because you can agree on everything."

Other minded not having their ideas used and arguments. However the main opposition to group work resulted from varied levels of commitment among participants.

Chris: "I don't usually like working in groups. I like to work by myself, unless there is somebody that I know who would work really hard with me. I have been in groups before and nobody would work, and I would be the only person. They would put everything on me and I would be so angry."

Work distribution

We observed several approaches to the distribution of group work. In most groups we witnessed campers taking turns on most activities. One group developed a rotating system:

David: "We all took rotations. We had three different chairs. Every time we edited one scene, we would switch."

In some cases the counselors would assign tasks trying to ensure equal division of labor. Individuals' expertise and preferences were also taken into account in dividing the work. For example, some campers who felt uncomfortable in front of the camera became camera operators.

Group work in filmmaking

The campers quickly came to appreciate the complexity of the moviemaking process and the varied roles that are required for a successful production. When asked if they would chose to work on another movie either alone or in a group, all but one said they'd prefer group work. This included those who earlier expressed a dislike of group work.

5.4. The educational value of moviemaking

Moviemaking is a generic tool for expression and communication. It can be used for school projects in English, drama, history, geography, and science. Campers expressed an interest in using this for their school work:

Paul: "An information project. If we had to tell a lower grade about something."

Victor: "If you are doing a book report, you can put in little movie clips to act out what you are saying; so people can see it."

Moviemaking has educational value, providing an alternative method for creative and informative expression. Students can become authors in the media they consume constantly.

More interesting and memorable presentations

Students felt that their peers would better attend to and take video presentations more seriously:

Samantha: "With this you just have to show it and people will learn more because it is visual and it is easier to learn than just reading. … Because it is more interesting to look at a video than hearing."

Victor: [Compared to writing] "If you are filming and editing, it would take longer to film but it would come out much better."

Campers were asked, who finds it interesting, the author or the audience?

Andrew: "Both of us [are more interested].… I think it is fun. And the audience could learn more about it than just the essay.… If you have it digitized, you can show you project, and it is even better because you can see and experience it."

Many campers felt that they would learn better from a video presentation than from an aural one.

Samantha: "You have to write it up on a science board and present it, but if you had this software at school, you could just do a video and then show it to the class, and people would listen better and learn better.

Ability to perfect a presentation

Perfectionists with high quality standards expressed interest in creating movie presentations for school projects.

Tommy: "If we had the camera, we could fix all the stuff we did wrong and do it over again until we get it right."

Some students felt movie presentations would help them ensure that all group members, especially those with immature tendencies to be silly in class, could be allowed to perform properly,

> **Chris:** "It depends on who the people are. If they can't act appropriately in front of people, it is better to do it on camera because if they goof up or act stupid, we can just take it out and do it over again."

Improved self expression

Many individuals in society do not have an opportunity to present their best image because their behaviours are inhibited by having an audience. Removing the live audience at the time of the performance can reduce these inhibitions. Individuals can use the privacy of the electronic environment to prepare their presentations without embarrassment and to refine them until the desired result is reached. They have complete freedom and control to create the script, refine and rewrite it, act it out, and produce the final presentation.

> **Ragif:** "And the good thing about this, is that you can come up with your own ideas instead of someone thinking for you and then you just acting.…Because it is good to act what you believe in."

Many students shy of presenting in front of their peers said they preferred to use movies instead of live performances,

> **Alfred:** "I would try to use it [movies] on ones that I would have to present in front of people.…"
>
> Instructor: "So, even if it takes you more time to prepare, if you had a choice of presenting in front of your class or doing a movie, which would you do?"
>
> **Alfred:** "I would do a movie."

Exploiting and recognizing different talents

Filmmaking is a task generally done in groups. There are many roles in moviemaking; various talents, abilities, preferences, and technical expertise can contribute to a successful collaborative project. The campers utilized their talents during moviemaking:

> **David:** "We used her artistic abilities for the pop cans [creating movie props], and Marta was pretty fast at typing, so she did most of the typing."

Team building

The majority of the campers enjoyed working in groups. Creating a movie in a group was a rewarding experience.

> **David:** "I wouldn't like to make a movie by myself. It would be boring, because there would be only one character, and I would have to change my clothes every time."

Smooth moviemaking depends on good group work:

> **Gabriel:** "[I would work with a group] because when you are filming you have to work together."

Although our campers started out as strangers, working in groups helped develop friendships:

> **Kimberly:** "Yeah, it is too short. As you become friends with people, it is the last day, and as soon you get to know people, you have to leave."

Despite the different roles played by various campers, they typically felt that all group members had contributed equally to the movie.

> **Mark:** "I think everybody did the same, even though Christa wasn't in the movie, she was videotaping it all. That is just as important as acting."

In only one case, where one male camper dominated most of the group activity, two female members did not want to work on another movie with the same group.

Deglamourizing Hollywood

Campers left with a new appreciation of camera, sound, and editing techniques, work in and behind the scenes.. Their one week experience moved them somewhat from being passive consumers, absorbing media and its messages, towards becoming informed and discerning viewers.

5.5. Evaluation of MAD

The campers' impressions of the MAD software were mostly positive. They found the software easy to use and the script helpful for organizing their multimedia documents, despite some discouraging moments dealing with the technical difficulties inherent in experimental software.

MAD is easy to learn and use

The campers' feedback suggested that we succeeded in our goal of making MAD easy for novices to learn and use.

> **Chris:** "I don't have a computer at home and we don't use it much at our school that much. For my first time using it, I thought it was pretty cool and easy."

The script view is powerful

During moviemaking, the campers worked primarily in the script view. They wrote scripts, attached video segments, or shots, to elements of the script, previewed the result, and rearranged the elements. They found the layout of the script very helpful.

> **Samantha:** "It is easier to do the script rather than doing it in normal ClarisWorks. It is a lot easier to read off of..."
>
> **Raymond:** "Everything is there right in front of you..."
>
> **Ahmed:** "It is better with the pictures there, because the script goes with the pictures..."

MAD helps with organization and navigation

MAD's structured approach to movie authoring allows novices to get a grasp of all related media and to be able to organize various components into a whole:

> **Tammy:** "It was easier to organize things in MAD because there are places to put everything. Those places to write in, and the space to put the videos and pictures."
>
> **Gabriel:** "I think it is neat that you can do item by item instead of just going from one camera shot angle to the next one so it is not bunched together. You can do them one at a time."

This skill of breaking up large problems into smaller manageable ones is a skill that the campers can use in many other situations.

The structured organization also facilitates navigation through the movie and access to its segments.

> **Andrew:** "I like the fact that, if you make a movie, you have to look at the whole movie to check a little thing, but if you know the mistake is in MAD, you just go to that one and click on it, and it will preview it for you. You can know that is the one with the mistake and you can fast forward to that part and fix the mistake in it."

Samantha: "Rather than having to type everything up and figure out where your part is, it is a lot easier to go straight to where you are. It is easy to organize audio and video clips and to edit it."

MAD supports creativity

MAD aids users in manipulating all aspects of the movie, encouraging experimentation and refinement and thereby improving quality. One camper who had previous experience with video editing found the digital video much easier to work with.

Paul: "It was really easy to edit. All you had to do was find out where you wanted to cut out. Put the cursor there, hold shift, and drag it to the other part. … Compared to put it on the other screen [as in video tape editing]. Having two different screens and having to coordinate where it is."

The flexibility provided by the digital representation and the ease of changing the script at any time allowed the campers to evolve their movies and adjust to their audience feedback.

Mark: "We added a couple things. We didn't write them in the script, but when we watched the movie it looked kind of boring, so we added a couple musical numbers and some pictures. …You could write down your ideas, so you have the general idea, but you don't have to be limited."

Another group wrote a script but as they worked on the movie they "totally changed it around."

Victor: "It makes it more interesting and it brings out the real thing."

6. SUMMARY, ISSUES, OPPORTUNITIES, AND FUTURE DIRECTIONS

6.1. Summary

Digital video authoring enables students to learn about research, writing, organization, computers, the Internet, moviemaking, filming techniques, and editing. Students develop group work skills, an appreciation for the amount of work involved, and an understanding that movies are not "real." MAD is easy to use for first film projects and helpful in organizing and managing the movie's structure and constituent media elements. The digital representation allows easy experimentation and manipulation of the elements and facilitates creative expression.

The students are able to produce meaningful and educational movies, and feel these would be taken more seriously by their peers than other types of presentations. Movies allow individuals to

perfect their presentations and to avoid live performances if they are shy. The accessibility and flexibility of this creative medium and the camaraderie of group work increases motivation for filmmaking and results in great dedication to the task despite technical difficulties that are encountered. Moviemaking and multimedia authoring can enhance self expression and seduce students who normally hate writing into writing scripts without complaints The students find these experiences extremely exciting and rewarding — "one week is not enough!"

6.2. Issues and problems to be solved

Yet digital video authoring will only achieve its potential in the classroom if a number of problems are solved — overcoming technical glitches with complex multimedia software, providing sufficient resources, enabling a movie to be authored in a very few hours, and developing the culture of criticism, patience, and hard work required to produce films of sufficient quality to reflect the students' potential to achieve quality.

Students must achieve proficiency and overcome technical problems

Campers with little technical knowledge found the experience challenging:

> **Experimenter:** "Did you find it easy to use, especially considering your [lack of] experience."
>
> **David:** "So so, because I don't use computers. At first it was really hard."

With time they became more comfortable and successfully completed their projects.

The MAD software used at the camps was a pre-alpha version which had many bugs. The campers were frustrated by system crashes and other technical difficulties. Some features that they wanted to use, such as special effects and transitions, were not yet available.

As the complexity of a task increases so does the number of possible problems. Moviemaking on the computer involves a lot of technology and there were times when some of it would not function properly. Counselors' inexperience also led to a couple of problems which could have been resolved with more extensive and focused training.

Adequate resources must be available

Access to technology can be a bottleneck; it is best if each group or movie has a separate machine. Disk space is a major concern especially if several groups share one machine. Students are painfully aware of the shortages of technology in their schools.

> **Paul** [when asked if he would use MAD in school]: "It would be full and I would never get to use it, because everyone else would use it."

Moviemaking is time-consuming

The campers spent a week to create 5 minute movie presentations.

> **Gabriel:** "If the teacher is only going to give you two days, I would write it out, because I wouldn't have enough time to put a presentation together. This one is only four minutes and it took us five days to do it. I wouldn't be able to do a ten minute presentation in two days."

Although we believe that work can go two or three times faster with software that is stable and that possesses more functionality (see discussion below), the time available for school projects does constrain how filmmaking can be used in school:

> **Tony:** "At school I am always begging the teachers for more time but they never gave us any. There is only a certain amount of time you can spend on a project, because there is much other stuff that we have to do."
>
> **Samantha:** " It is time consuming to do this."
>
> **Instructor:** "Would it still be worth it?"
>
> **Samantha:** "Yes, if the teacher gave us that much time."

Since multimedia projects often require extended amounts of time, it is hard to fit the work into short one period segments. Schools must be organized to allow project work to be completed. Some of our students expressed a willingness to work after school to finish their movies.

> **Richard:** "You would probably have to do it after hours at school."

Moviemaking is harder than essay writing

Moviemaking requires new skills that students don't normally have.

> **Ragif:** "The acting part is hard. If something that is funny, that is going on, you have to control yourself."

Marlene: "It would be easier to write an essay, [than to make a movie]."

One counselor explained why moviemaking is difficult:

"But I think that is because there has been so much emphasis on you have to write an essay, that people have got so much practice with it. They are so comfortable with it. And since very few people have made movies before, it is new, and it is harder."

Achieving quality requires skill and persistence

The time factor is especially critical when a group has high standards for the quality of their movie. At the camp we witnessed both extremes.

One group refused to refilm their video footage although they were unhappy with its quality.

Ahmed: "The thing is, I heard that you have to do every scene over and over again, but here, it is for fun, so you don't have to do it over again."

They also refused to discard any ideas. Instead of focusing their energy on one topic, the used all their original footage, combined the two topics that they had brainstormed, and edited the result to fit the desired maximum length of 5 minutes:

Ahmed: "There are actually two parts. One part is entertainment wise, and the other one gives knowledge wise. It gives you information. We took the two aspects of TV: entertainment and documentary, and we put it together to make our movie."

On the other extreme, another group created a short movie, only one minute long, and did iteratively revise and refine it. They wrote a detailed script and filmed multiple versions of each shot, including one shot which required eight takes. Following the discussion of moviemaking techniques, they chose to edit the video footage carefully:

David: "In one of the scenes, every time somebody else speaks, it [the camera] is changing back and forth, so there are four different times we change it in five seconds!"

When the lighting was imperfect, they reshot the video sequences. They listened to the instructors' feedback and incorporated a new shot using an overhead camera angle. These improvements required extra time, which they could only afford because the movie was short.

Tools like MAD that facilitate easy and rapid reworking and editing of digital video must be used so that students can create quality projects and show them with pride to media savvy peers.

Gabriel: "I was really surprised at how it came out, because I wasn't expecting it to come out that good. I was expecting it to look like a low budget one that someone spent two days doing, but it turned out really good for what I was expecting."

6.3. How work with children has informed our design

Clearly, the children have pushed and challenged the then current limits of our technology. By analyzing our data, but to a greater extent just by watching, listening, and thinking about what we have seen and heard, we have learned much that has led to better technology. Here are a few examples:

- The children requested new functionality, e.g., the ability to record to VCR, to add titles, and to sketch overlays, as well as many others still under development or consideration

- Watching our users work suggested simplifications to the conceptual structure and mental model associated with a MAD movie, namely, the use of a three-level hierarchy of acts, scenes, and shots in place of an arbitrarily deep nested hierarchy

- Watching our users work suggested the need for improved interfaces to existing functionality, e.g., to the film clip editor

- Watching where the campers and counselors had trouble and how they spent their time suggested pragmatic needs, e.g., easier and safer management of media resources.

6.4. Opportunities

MAD allows video authoring to be used in schools in significant and educationally valuable ways:

- Bringing to life projects in traditional subject areas such as history, geography, English, and science by *creating video essays*

- *Learning and working with filmmaking* in classes and in dramatic productions

- *Film and video analysis* for courses such as science (e.g., recording and analyzing video data on force, mass, and motion), English (e.g., comparisons of versions of Hamlet), and media studies (analysis of television techniques and impacts)

- Teaching *planning, project management, communication skills, collaborative work, and problem solving* using filmmaking as a significant engaging activity

- *Combating technophobia* by introducing computers through filmmaking activities which are fun and non-threatening to both children and technophobic adults

- Creating *school video yearbooks and class reunion videos*

- Documenting school activities with *video-enhanced Web pages*

- *After-school activities* and *summer camps*

- *Enhancing the understanding of learning processes* by teachers and learners by videotaping, annotating, analyzing, and discussing classroom situations [Cohen et al. 96]

- Supporting the development of *student portfolios* in elementary and high schools and *student teacher portfolios* in teacher training colleges and universities.

Movie authoring as a vehicle for improving literacy

The level of literacy varies greatly among students, as evidenced by large differences in the responses to our questionnaires. Andrew, a very sociable and energetic grade seven student, turned in questionnaires riddled with spelling and grammatical errors far below the seventh grade level. If Andrew writes a story in class it will be full of errors and will receive a low grade. His reported daily activities indicated that he does little homework, *never* reads, watches a lot of television and videos, and plays sports. Yet multimedia is compelling to children even if they are not interested in reading and writing, and his extensive viewing habits make him an experienced media consumer. Thus, given the right tools, he may be able to prepare a higher quality story using a movie than by writing. Perhaps we can "trick" Andrew into writing if he needs to develop a script in order to create a movie. This is some evidence from our camp that this can happen.

Student excitement

The biggest complaint at the end of summer camp was that the students didn't like to climb three flights of stairs to get the lab. The campers' dedication, excitement and emotional involvement with the camp was intense. When due to some technical difficulties we were unable to make video

copies of two of their movies, we received repeated distressed and almost threatening phone calls from campers and their parents. Wouldn't it be nice to have students as excited about school as they were about the camp?

> **David:** "It's a lot of fun to work with MAD making movies. It's one of the best experience I've had. Peter is an amazing counselor and I had a lot of fun working with him. I think it's really good that you guys are doing something like this.… A lot of fun. Interesting. I learned a lot. I will come back next year."

> **Mark:** "IT WAS GREAT!!! … Like I said before, it was what I always wanted to do. Act, go to the computer, do editing and directing on the computer and stuff like that. … It had everything, all my hobbies, except for sports. … Because I always have said to my mom that I wanted to be an actor or someone to do with computer animation, and this week I got to do everything that I always wanted to do all in one: Using the computer, using the camcorder, directing, acting."

> **Deborah:** "My comment for this camp is please continue this next year so other kids could have the one in a life time experience that I had to learn every thing about computers."

6.5. Future directions

We are greatly encouraged by our work thus far. We are beginning to experiment with one- and two-day day multimedia workshops to see if students can learn and develop educationally valuable projects within a single day or two. We are beginning to work with teachers to create curriculum-based projects and to develop supporting materials for students and teachers. By turning our prototype software into a product our goal is that it be used widely in real classroom settings, and that we gather deeper evidence about the value of digital video authoring for providing meaningful and engaging projects to children, for documenting the products of their research and learning, and for acting as a Trojan horse to seduce them into writing despite their belief that they hate writing.

We are also planning experimental uses of MAD among distributed learning and filmmaking communities, and look forward to the day when children throughout the world will be able to create and interact in digital video as they now do with text. Imagine students in northern Ontario, Vancouver Island, Chile, and Russia jointly collaborating on a project dealing with issues of logging, clear cutting, and reforestation in their various environments. Imagine women in a variety of countries and cultures all interested in a career in a particular profession documenting and

sharing what it is like to enter that profession, incorporating and sharing interviews and video footage that bring to life experiences in those countries and cultures. Imagining these examples is easy. Our goal in the next year or two is to realize and prove the viability of the vision.

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[Figures 1 to 5c]
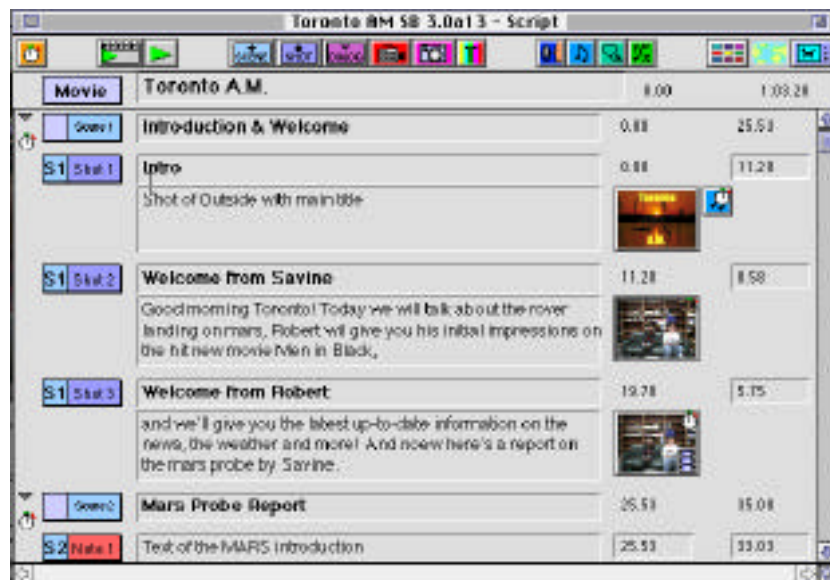
Figure 1. A MAD script view: The first scene of the "Toronto AM" movie is composed of 3 shots, an "Introduction" and two "Welcome" sections. The script text located in the centre column has a field for the title of each movie segment and a field for narration, dialogue, and director's notes. MAD supports a hierarchical structure in which movies can be composed of shots inside scenes inside acts. These are displayed in the left column. The right column contains the media elements: graphical images, poster frames depicting video sequences, and icons indicating the presence of narration, dialogue, music, and sound effects. This column also contains timing information — the start time and duration of each segment. Above the script a control bar provides easy access to commonly used commands.
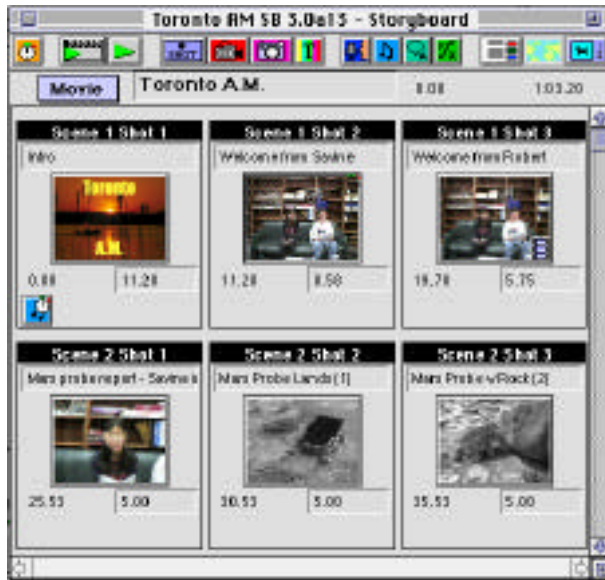
Figure 2. A MAD storyboard view: Successive shots from "Toronto AM" appear in this view. As with all MAD views, components of the movie can be added, removed, and rearranged, and the view can be tailored to suit the circumstances. For example, we can request smaller poster frames in order to see a larger number of shots.
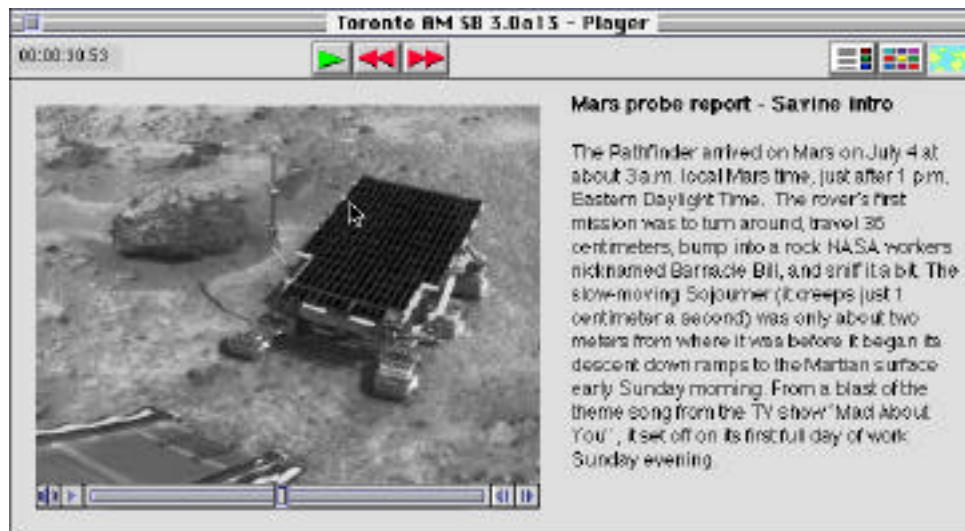

Figure 3. A MAD playback view: Visuals from "Toronto AM" appear on the left; narration, dialogue, and director's notes are shown on the right. In this picture we see one of the images downloaded from the Web by the students. We can play back the movie, scan forwards and

backwards in time, or jump from shot to shot much as one would flip through the chapters of a book. The controls at the top right provide users fast access to other views.

Figure 4. Kids at work: Several images of grade seven students working at the multimedia summer camp. The images depict students writing their scripts, digitizing video segments, and presenting their movies to their peers.

Figure 5. Examples of movies created with MAD: Film strips of several movies created with MAD at the multimedia summer camp.
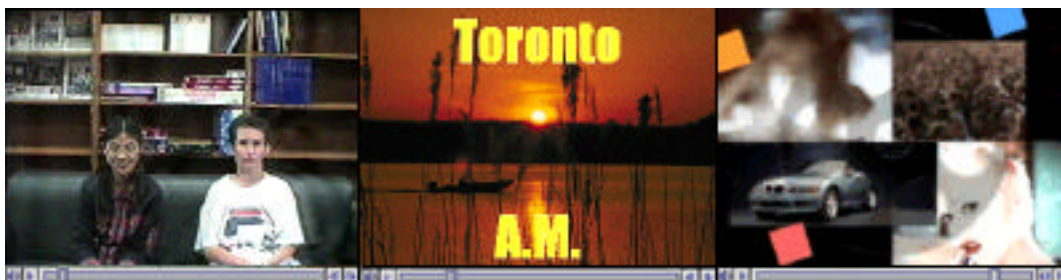
Figure 5a. Toronto AM: A magazine format program featuring news, weather, sports, entertainment, and advertising.

Figure 5b. The Z-Files: A Science Fiction spoof of the popular X-files series.

Figure 5c. UTS a Journey: A walking tour and historical look of the school.