

Refereed Digital Publication of Computer Graphics Educational Materials

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ABSTRACT

Computer Graphics as a discipline has undergone drastic modifications over the past decades. Indeed the phenomenal progress in both the technical and digital art domains requires educators to master new content and achieve deeper understandings of computers and imagery if they are to keep up with the pace of change. Moreover, as the core field matures, educators in all areas experience a greater need for high quality curricular resources. Thus, offering excellent educational materials online is an important service to the community. Such support will empower both young and seasoned educators alike to benefit from and contribute to the work of others.

The purpose of the work described here is to provide tools to foster such a community of Computer Graphics educators. We present a system that will allow for original work to be appraised, assessed and made available to others through an online source for refereed educational content in Computer Graphics. The present paper highlights some of the user requirements and describes the current status of CGEMS, the online Computer Graphics Educational Materials Source. This is organized around a web-based groupware application that supports the all phases of submission, reviewing, acquisition, and archiving of curricular resources.

KEYWORDS

Administration; Education; Multimedia document processing; Electronic publishing; Online information service; Computer uses in education; Digital libraries

1. Introduction

The fast pace of change in the Computer Graphics (CG) field makes it difficult for educators to continually design up to date, meaningful and robust curricula that address the full potential of new technology. As CG as a whole matures, much of the emphasis shifts away from teaching the minutiae and foundations of the discipline to the interrelations of latest developments and their applications. Still, the changing hardware and software influence, and in some cases transform, the way these are used and what creative expressions can be borne out of them. Whether in arts or science, new technology does not change creativity. Rather, it changes our understanding of art or science problems and enables us to observe things that we did not see before [1]. Because of this, and for pedagogical reasons, Computer Graphics educators need to stay current with new CG trends and incorporate them in their curricula.

Although small systems and groups of people exist who are trying to address this issue, there is currently no centralized worldwide-refereed repository for Computer Graphics educational materials. This paper presents a system that supports a way for educators to easily access

quality course materials and for contributors to share and get recognition for their curricular innovations.

The Computer Graphics Educational Materials Source (CGEMS) is an online system that provides curricular materials for Computer Graphics educators. CGEMS is available through the URL

<http://cgems.inesc.pt>. The system includes a method both for contributors to submit and editors to jury and control the quality of published content. The initial shape and components of CGEMS arose from fruitful discussions around, during, and after the Workshop on Computer Graphics Education [2] held in Bristol, UK in July 2002, from an idea that originated in Graphics and Visualization Education Workshop (GVE99) [3] in Coimbra, Portugal.

The CGEMS project aims at serving the Computer Graphics educators' community on a number of levels. First, by making timely and quality materials available to educators, those teaching in the rapidly changing CG field will be able to tap into resources that will aid in their efforts to keep pace. Often it is not enough to know how the technology works, rather it is most important to

understand its implications and how best to apply it. Only at this point can an educator design materials for students that fully reveal the potential of the technology. The collective contributions of the Computer Graphics community will add to a network of knowledge and understanding that educators may use to provide content rich courses.

Curricular development in a technically complex and rapidly changing landscape is not trivial. Rather, a successful curriculum is creative and innovative and deserves research recognition. The CGEMS project seeks to support these efforts by providing an opportunity to have curricular materials peer reviewed, thus making them worthy of recognition. In order to facilitate content availability, peer recognition and quality materials, CGEMS implements a thorough refereeing process similar to that of a journal, policies for submission and the subsequent editorial review of materials.

In what follows we explain the server submission and editorial policies and workflows. The last section discusses results, conclusions and future work.

2. Related Work

In recent years many systems have been developed to support electronic submissions and peer-review of scholastic work, most notably for conferences as well as journals. These usually take the form of on-line web sites, which provide some degree of support for many editorial tasks traditionally done using paper and conventional communication media.

Among the systems commonly available, many are devoted to managing conference submissions, although many systems support journal publication. The main differences between conference and journal management lie in workflow and deadlines. Conferences typically have submission deadlines and a shallow review pipeline due to rigorous timing constraints. These limit review and acceptance cycles to one or two at most. Moreover, conferences tend to set limits on the number of accepted technical contributions due to a limited number of presentation slots. As a result, selective conferences may reject technically sound, quality papers. On the other hand, journals tend not to operate on pre-set deadlines (save for special issues), but rather on absolute technical merit of submissions. Resource limits arise from publication and distribution schedules on paper journals, which constrain the maximum and minimum number of printed pages per issue. An on-line journal, on the other hand, is free of such limits. Because consumers pay for distribution costs when downloading, the fixed charges are just the space occupied on physical disks. Given the ever-shrinking cost per megabyte of storage these tend to be marginal. In this manner, journals tend not to set rigid deadlines, but can afford long review cycles and “deep” pipelines, where a given submission may be refereed several times before being accepted for publication.

On-line submission systems for conferences tend to be available more or less free of charges to the academic community, while most on-line journal management systems require some form of licensing and payment of fees. This is due to the different uses and needs of the different communities. While conferences tend to be organized by academicians and scientists on a voluntary basis, journals are traditionally run by publishers who, naturally expect to run a profitable venture.

After considerable discussion, we decided to adopt the journal model for CGEMS, including possible special issues. Indeed, while there are a few “natural deadlines” affecting educators in the field (end of academic year, semesters, professional conferences such as Eurographics and SIGGRAPH, etc), forcing the conference model on submissions could result in lesser opportunities for interaction between authors and reviewers with a negative impact on the quality of final submissions.

Among the many systems available [4], CyberChair [5] is among the best known and used. One interesting feature is that it offers support for most of the editorial/administrative tasks that we intended to support from the start. Further, the source code is freely available for academic use. However, many of the tasks are hard-coded into modules and the system proved difficult to adapt to our needs. Another excellent reference is Conference Review [6], which provides an excellent user interface but is not available as open source. Journal refereeing systems [7] in principle would be available as a basis to support our development. However as we mentioned above, these tend to charge fees, even for academic purposes, let alone providing access to their source code for modification.

For a fee, systems such as Bench>Press [8] claim to be customizable although this may take several months and can only be done in-house by the original developers. Other systems such as AllenTrack [9] are only accessible via remote login to a corporate server, which does not make them particularly useful for our purposes. Systems such as EditKit [10] and BioMed Central [11] seem to have been custom-developed for special applications and the support for editorial workflow is not clearly developed. Other systems such as Rapid Review [12] do not offer on-line support for many editorial tasks. The systems that seem to offer more complete support for the editorial and review process such as Bench>Press and Editorial Manager [13] (EM) do not make it clear how submissions are circulated to reviewers. Nor are details provided concerning workflow management and how to handle conflicting reviews. Another important criterion is browser and platform independence, which are usually glossed over by most systems.

In sum, most systems reviewed exhibit different shortcomings. We could find no general-purpose freely available system that we could readily adapt to our purposes. Therefore we decided to implement our own review and publication system. In the next section we describe the reviewing system and workflow.

3. Editorial Policies and Structure

Many debates took place during and after CGE02 to shape the structure and policies of CGEMS. While many of the ideas emerged during a debate spanning several years, editorial and reviewing policies are bound to change and evolve as the community uses the service. To serve CG educators worldwide, we wanted to ensure (a) timely submission, (b) regular updates, (c) rigorous quality control, and (d) peer recognition. This led to establishing a journal-like system with several review cycles without a fixed deadline. This enables flexible review workflow and encourages timely updates of content. However, there will be regular calls for submissions possibly at the end of each academic semester in fall and spring. In this way, we hope to get notes, assignments, and examples from successful courses.

Authors can update their materials in subsequent editions. These get assigned a new version number to differentiate from older versions. The new versions will also be refereed and do not replace older versions. Users will be able to make comments and rate modules, which will help authors with newer versions and other users to identify useful materials.

Authors will submit work only after they have registered in the system, which will issue a password via email that the author will use to submit and modify submissions. Although this is not fully secure, it will discourage would-be hackers. Authors will also be required to ensure that all materials are free from copyright and can be used and downloaded by users.

While most if not all the materials currently assembled are written in English, we envisage and encourage both localizations and submissions in different languages, including Portuguese, Spanish, French, German, etc.

The general editorial structure of CGEMS includes one or more editors-in-chief (EIC) and an editorial board. The editorial board will both review submissions in their given expertise and solicit outside reviewers in specific disciplines for input. Additionally, a volunteer reviewer can register through the CGEMS system and members from the editorial board will deny or accept and place her or his application.

The editorial board will also be responsible for soliciting content submissions as well as advising the EICs on quality control of the server and identifying needs for under-covered curricula.

4. Submission Policies

We are encouraging members of the Computer Graphics community to submit course innovations for consideration in CGEMS. In order to submit, authors must first register through the online server. Once complete, they will have a personal web page that they will be able to use to submit modules, change their login password, change their personal details, and check their submission status and information, resubmit modules, or interact

with the editorial board concerning their submissions. The details of this process were covered as part of a presentation at the SIGGRAPH 2003 educators program. The submission policy includes the content authors may submit, information that authors need to provide, categories or focus areas, and fair use policies.

Ideally, we would like to have content organized in modules, or a complete group of materials including notes, assignments, and examples that cover a specific subject. For example, a module could be about shading networks for 3D modeling and the materials might include course notes, interactive demonstrations, assignments, and example student work.

There are many quality-teaching materials that do not fall neatly into the module format, so the CGEMS server will also accept portions of modules, such as individual assignments or course notes. We are specifically looking for the following materials:

Complete Modules – These are the preferred type of submission. A module is a self-contained, single-topic teaching unit. This includes all course materials required (images, notes, problem sets, etc.)

Lessons / Teaching Gems – These are similar to modules but more narrowly focused bits of teaching material that highlight an approach to teaching a particular problem in either introductory or advanced settings.

We will accept the material in most common formats (PDF, Java, VRML, JPEG, GIF, MPEG, etc...). The main rationale for accepting a given format will be the existence of free, publicly-available viewers for that format. While the subject of proprietary formats has been thoroughly debated, we want to strive for maximum availability and usefulness of published materials.

When submitting their work, authors will be asked to provide information about themselves and their submission. In addition to name (s), content, and actual submission, the authors must prepare keywords, an abstract, system and software requirements, instructions, the type of submission (assignment, module, etc), prerequisites, the intended audience, and subject categories. These keywords will help educators search for and identify appropriate materials available on the CGEMS server. The requirements include not only hardware or system specifications, but could also specify a list of software. In the case of the shading networks example, the course notes might not be conceptual and specifically cover how to create them using Maya software. In this case, Maya software would be listed as a requirement. Other notes on shaders, for example, might be more general and only require any 3D modeling software.

Finally, it is important that authors include specific instructions about how to work with their submission. Because most courses assume some level of expertise in a given discipline, authors will be asked to list prerequisite courses or knowledge level. This will help other educators identify the appropriateness of a module or material. Although this sort of classification is not universal, a

general list of skills necessary for the course material should be sufficient.

Another issue related to the prerequisite experience is the intended audience. Is the module designed for elementary school art classes or college level graphics programming? In a similar manner to the prerequisites, this will help other educators identify appropriate courseware. Additionally, because we accept educational material associated with Computer Graphics from any discipline, it is important for authors to correctly identify their submissions in categories, or what we refer to as focus areas. These are specializations within a discipline that the materials cover. For example, focus areas within the arts include digital imaging, 3D modeling, and digital video. Finally, any educator may use all submitted work for educational purposes. Fair use does not include applications of the materials for any purpose other than academic teaching. Indeed, educators who download materials from the server may not distribute them outside of class or publish them in any other way. To this end, they will be asked to accept a fair use agreement before accessing such materials. Our intent in having a fair use policy is to encourage educators to submit and reuse materials freely from the server with due credit being assigned.

We intend for the submission policies to help in organizing available content for CGEMS users. Although still under development, the categories or focus areas will help educators to quickly identify the proper content. Modules will also aid in streamlining the process because they will contain a complete set of materials for a subject.

5. Managing Workflow

This section describes the overall workflow for the process of submitting, reviewing and publishing educational content in the CGEMS server. We explain the interchange of information between the authors, reviewers and editor-in-chief, which are the three major roles in this procedure.

In general, the reviewing process starts when registered authors submit their work for possible publication in the refereed server. The editor-in-chief (EIC) starts by checking these new submissions against a set of minimum requirements related to the subject, scope, consistency and style. Submissions that satisfy the criteria are accepted by the EIC for review, while those that do not are rejected. Independent of the EIC decision, the system notifies the contact authors via an email message about the new status of their submission. The system enables all approved volunteering Reviewers and all who have accepted an EIC invitation, to check for accepted contributions so that they can express interest in reviewing submissions. Later, the EIC assigns accepted works to at least three reviewers, according to their preferences and expertise. A notification is sent via an email message to all assigned reviewers, who can decide whether or not to review assigned contributions.

Reviewers can reject assignments because of a conflict of interest, a submission is out of scope of their expertise, or just because reviewers have too much work to do. Should the reviewer reject the assignment, the EIC will reassign it to another reviewer. After all reviewers have produced and submitted their module reviews, the EIC decides whether a submission is accepted, whether it must be revised according to reviewers' comments, or whether the module is not accepted for publication. The EIC decision is sent to the contact authors through an email message. Authors of submissions accepted for publication can decide whether or not to submit a final version based on the EIC and reviewers' comments. The EIC then checks and prepares the final submissions for any idiosyncrasies such as checking if the documents contained in a module are printable or if they require additional formatting. Once these are considered ready to be published in the CGEMS server by the EIC, they are catalogued, classified as accepted contributions and made available for downloading. All subscribers of the CGEMS mailing list whose interests match the keywords associated to module being published receive an email message with detailed information on the new accepted contribution.

6. Discussion

From an earlier prototype developed in August 2002, CGEMS is currently available and hosted in an independent server installed at the National Portuguese Foundation for Scientific Computation (FCCN). CGEMS is fully accessible using most popular browsers on the market as of this writing, such as Internet Explorer 5.0 (or higher), Netscape 7.0 (or higher), Mozilla 1.1 (or higher), Opera 6.04 (or higher), and Netscape 4 browsers. We have made available a demo version parallel with the functional server to allow users to try and experiment all the functionality and workflows. The demo version can be found at <http://cgems.inesc.pt/demo>.

The design and implementation of the server has also been presented and thoroughly discussed in SIGGRAPH 2003 [14] and Eurographics'2003 [15] Educational programs.

At the time of this writing we are finalizing the server and performing integration, portability and usability tests. At the time of this writing we have issued the first call for Reviewers to be followed by the first call for contributions. The Editorial Advisory Board is in place, reviewers have started to submit volunteer applications and the first submissions have started to flow in. Last but not the least, we are currently working on proving multilingual support for the server in order to enhance and extend its reach throughout the CG Educator's community at large.

Among the main features the current CGEMS version supports online management of all reviewing and redactional workflow. This includes awareness management for all aspects and events that arise out of a journal op-

eration. Our system also provides automatic email notifications to CGEMS mailing list subscribers whenever new modules are published. To foster interactions within the community of CG educators, authors and reviewers alike are able to access the system with only one username and password for a given user. Subject to EIC approval, users can volunteer online to review submissions. The EIC is also able to assign modules based on stated preferences and interest in particular modules expressed by reviewers. Reviewers are able to decide whether or not they want to review their assigned modules.

The system has been tested for portability with a large number of different browsers, spanning more than 80% of current Internet users' configurations.

While the current implementation still falls short on several desirable services for community support such as user comments and ratings, discussion forums, advanced search mechanisms and other services that might provide added value. We plan to add these in the near future.

The most relevant core services of the CGEMS proposal arising out of the CGE02 workshop are already implemented and in good working order. Both the core submission and review system functions are implemented and tested. We are looking to extend the core systems functionality through enlisting the cooperation of additional members from the Computer Graphics education community at large.

7. Conclusions and Future work

While Computer Graphics has matured in regard to basic concepts, it is still experiencing rapid growth and phenomenal evolution in applications and research. This makes for an extremely dynamic environment and presents challenges to educators who have a need to keep abreast of latest developments while developing high-quality teaching materials. We have presented an overview and high-level description of CGEMS, a refereed content server for CG educational materials. CGEMS aims to provide basic services to the worldwide community of CG educators through refereed content. However this does not prevent using the server to also host non-refereed information.

We feel that the added value of such a server is directly related to the rigor of the refereeing process. Not only does a refereed system ensure premium materials, but it also supports recognition of those who publish on the server. To this end we have developed comprehensive support for online submissions and editorial workflow management. The prototype system has been online since July 2003.

In the future we plan to implement services that further support the community, such as user comments and ratings for specific modules, mailing lists and advanced search mechanisms. Along with these added features, we will continue to evaluate the success of the functions and processes and make changes when necessary.

We hope to mirror the site in a number of locations, including highly visible sites such as the Eurographics and SIGGRAPH servers. Our hope is for CGEMS to become the primary centralized resource server for Computer Graphics educational materials. While much work remains to be done, we feel confident that CGEMS can serve as a cornerstone in supporting educators in spreading the gospel of Computer Graphics in a world where both the field and teaching methods are rapidly evolving.

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