Survey of Industry Perspectives on 3D Computer Animation Education

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Abstract

The paper summarizes the results of an online survey of 43 professionals working in the animation industry, including modelers, animators, technical directors, conceptual artists and lighting and texture artists. Respondents were asked to rate the appropriate level of emphasis of 14 topics commonly addressed in academic computer animation programs, ranging from fine arts skills to computer programming. Three relatively non-technical topics were top rated: fundamentals, preproduction and design/layout. There was substantial agreement in rankings among participants, even those with widely varying areas of professional interest. When asked about their own personal educational experiences 25% felt that they had been well prepared, 38% satisfactorily prepared and 37% underprepared.

Keywords: 3D Computer Animation, Education, Survey.

1 Introduction

The opinions of working professionals form an important measure of the state of 3D computer animation education. In assessing the strengths and weaknesses of current academic programs and curricula, it is useful to consider industry perspectives on which areas are being well covered, and which may require more attention. This is particularly difficult to assess in a fast-moving profession such as 3D animation, where technical changes may affect both theory and methods. Many schools are struggling to find or maintain an appropriate balance among general education goals and technical and artistic skills. Although this is a lively topic of discussion among students and educators, to date there has been very little published empirical research on this topic.

In 1997, the City of Los Angeles Private Industry Council commissioned a study of the entertainment industry workforce issues [The Public Affairs Coalition of the Alliance of Motion Picture and Television Producers and the PMR Group 1997]. This research used focus group interviews to identify a set of job skills required for various positions within the film and animation industries. This study had one job category for "Computer Artist – Technical" with subcategories for matchmover, motion, lighting, shader writers and effects animator. Required skills were divided into artistic, technical and organizational areas. This is a sensible overall approach. However the results were expressed in such highly general terms that they provide very little guidance to 3D computer animation instructors. For example, the artistic skills listed for "motion" jobs were "3D motion, 3D structure, human form."

Morie [1999], at the time director of education for the Los Angeles studio Rhythm and Hues, examined similar curriculum and skills issues. She provided a list of "skill sets beyond those of traditional computer science programs drawn from the most common requests and observations received from supervisors during production." These include "communication", "social and management", as well as "artistic" skills. While clearly reflecting a useful expert opinion, this research, provided only a generalized characterization of industry perspectives.

In 1997, the consulting firm Regan and Associates developed "A Labor Market Analysis of the Interactive Digital Media Industry: Opportunities in Multimedia." [Regan and Associate, 1997]. Their report was based on a mail survey of approximately 300 members of two Southern California professional societies. The report presents analyses of "geographic profile, employment by sector, age and racial/ethnic, education and training and occupation" of the respondents. The purpose of the report was to profile people working in the Multimedia and Digital Visual Effects industry and not to provide insight on the skills required by these two industries. In the "Education and Training" section, they report but do not quantify the observation that although the respondents were highly educated, their education was not "focused on the artistic, business, or technical skills most in demand by employers."

The intent of this study was twofold. First, to use survey methods to begin to collect more systematic data, and second to focus much more specifically on 3D computer animation, a field which has seen significant growth in recent years.

2 Methods

2.1 Survey Administration

The survey was conducted online in April through December 2005. Responses were requested only from industry professionals – not from academics or students. Invitations to participate were sent by email to the professional list servers Maya-L and XSI-L. Although precise characterizations of list membership are not available, these lists are the major forums for users of the two most popular professional-level 3D animation packages, and reach several thousand people worldwide. The survey was also publicized at a panel on the topic of Computer Animation Education at the SIGGRAPH 2003 conference. The survey was designed, administered and summarized using the Rochester Institute of Technology's "Clipboard" survey system.

2.2 Scoring, Ranking and Measures of Agreement

The main survey question asked about the level of emphasis which should be given to each of 14 topic areas. Answers were provided along a bipolar Likert-type scale, with five categories: "much more", "more", "about right", "less" and "much less".

In order to summarize these responses, we used a weighted average measure of the central tendency of responses to each topic. "Much less" and "Much More" responses were weighted twice as heavily as "Less" and "More" categories. Scores were normalized to the range -100 to 100. A score of -100 would

indicate that all respondents agreed that a topic should receive much less emphasis. Conversely, a score of +100 would indicate uniform agreement that a topic should get much more emphasis. A score of 0 would indicate that – on average – participants thought the current level of emphasis was appropriate.

Topics were ranked in descending order by score. In order to determine which differences in scores were statistically significant, paired students T tests were applied in rank order. Tests for differences between groups of respondents were conducted using standard analysis of variance (ANOVA) as implemented in the statistical software MiniTab. The null hypothesis was that topic response or group response patterns were similar. This was tested against a probability threshold 0.05.

3 Results

3.1 Characteristics of Survey Respondents

The vast majority of respondents were male (95%) (Fig. 3.1.1). This may not reflect the exact gender balance of this portion of the industry. However, available employment statistics from state and national level agencies aggregate the film and video industry as a whole and do not provide gender breakdowns (U.S. Census 2002, California Employment Board 2005). Most respondents had a bachelor's degree (60%), with much lower numbers having graduate (23%) or high school (18%) degrees (Fig. 3.1.2). None of the respondents reported having a PhD. Participants were largely in their twenties (56%) or thirties (34%) (Fig. 3.1.3).

Figure 3.1.1: Gender

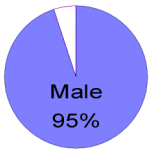


Figure 3.1.2: Education

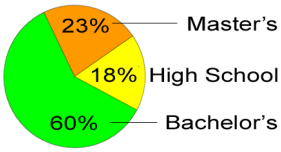


Figure 3.1.3: Age

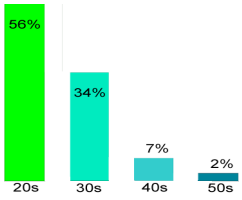
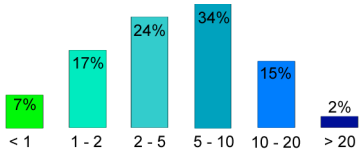


Figure 3.1.4: Years of Experience



Respondents demonstrated a relatively wide variety of professional expertise. While the plurality were animators (22%), technical directors (20%). modelers (17%), conceptual artists, special effects and texture and lighting professionals were also well represented (12% each) (Fig. 3.1.5). Respondents were relatively experienced, with a median time working in the industry of 5-10 years (Fig. 3.1.4). The largest share of respondents was employed by large studios (23%), however there was also good representation of all other size companies (Fig. 3.1.6).

Figure 3.1.5: Area of Expertise

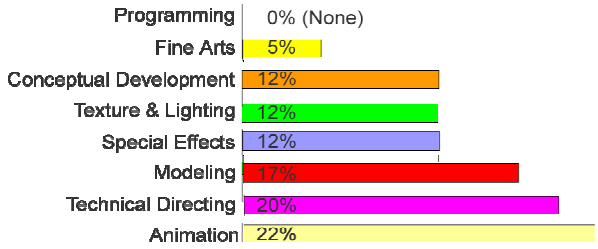
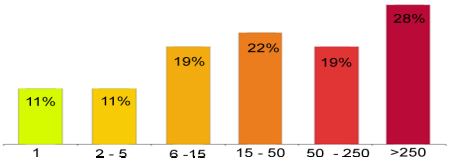


Figure 3.1.6: Company Size (Total Employees)



3.2 Personal Experience

Although all of our respondents currently work in the 3D animation industry, only 59% are graduated from an animation program (Fig. 3.2.1). When asked their overall level of preparation upon graduation, one quarter of graduates of animation programs thought that they were well prepared, 38% reported satisfactory preparation, and 37% reported that they were under-prepared (Fig.3.2.2).

Figure 3.2.1: Graduated from Animation Program?

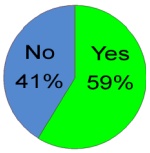
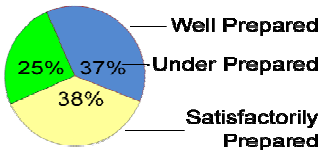
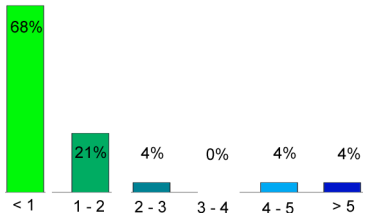


Figure 3.2.2: Self-Evaluation of Educational Preparation by Animation Grads



The amount of time after graduation required to find a professional job is a major concern of students. About 68% of our respondents were employed in the profession within a year of graduation, and another 21% within two years (Fig. 3.2.3). However, it should be noted that our survey population by definition only included those who had been successful in finding employment, and thus is not likely to be representative of all 3D computer animation program graduates.

Figure 3.2.3: Job Search Time (Years)



Many 3D computer animation programs encourage their students to seek internships. This survey asked animation professionals if they did internships, and if so whether they found them useful. Overall, only about one third of respondents had done internships (Fig. 3.2.4). Those who had were positive about the experience, with about three quarters of them rating agreeing that the internship was useful (Fig. 3.2.5).

Figure 3.2.4: Did Internship?

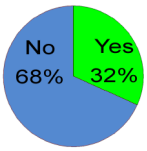
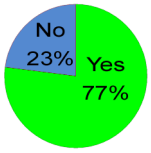


Figure 3.2.5: Internship Useful?



3.3 Areas of Emphasis in 3D Animation Education

The results of this portion of the study are shown in Figure 3.3.1 sorted in rank order of preference. The top rated topics were "fundamentals" – defined to include Principles of Animation, Motion Studies, Drawing, Anatomy, and Acting for Animation. About three quarters of respondents felt that this area should receive "more" or "much more" emphasis, with nearly half suggesting "much more." There was also strong agreement (70%) on this point, with only one participant dissenting. The second and third ranked topics (Preproduction and Design) showed a similar response pattern.

The next two items were somewhat of a surprise. In contrast to the topics above, Compositing and Texturing & Lighting traditionally receive little emphasis within academic curricula. Yet more than half of the respondents suggested that they require more or much more emphasis, again with little dissent. The next item was Scripting / Programming. Some have contended that the rise of graphical users interfaces has reduced the use of these skills. However our survey results show that a majority of respondents (56%) still wish to see more emphasis on this area.

3D Character Animation and Dynamics are statistically second-ranked overall with about one third of respondents stating that they currently receive sufficient emphasis, but nearly half wanting increased emphasis in these areas.

Nearly equal proportions of respondents were satisfied or wanted more attention given to hand drawn animation.

3D Modeling and Computer Graphics are the first topics in which the majority of our respondents are satisfied with the current level of emphasis. For 2D Animation, our respondents were largely satisfied (47%), but this question showed the lowest level of agreement of all topics. Twenty-three percent of respondents wanted less emphasis in this area, but twenty one percent wanted more.

Finally, Sound Design was our bottom-ranked topic, the only one in which the plurality of respondents suggested less emphasis.

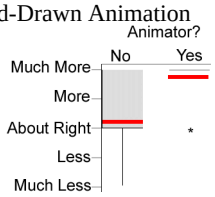
3.4 Differences in Opinion by Expertise

At the outset of this survey, it was not known if respondents would agree or disagree about the appropriate levels of emphasis in animation education. To some extent, we would expect people with different professional interests to be more critical of the educational system within their area of expertise. However, our finding was the opposite – that there was relatively strong agreement on which areas should be emphasized, regardless of professional specialization. For example, topics 1 (Fundamentals) 2 (Preproduction), 3 (Design/Layout) and 4 (Compositing) were consistently top ranked by all specialties. An analysis of variance (ANOVA) found no significant overall differences.

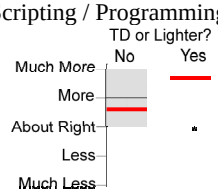
There were four specific exceptions. First, animators want significantly more emphasis on hand drawn animation than any other group ($p = 0.007$). Second, while most specialties want increased emphasis on dynamics, conceptual artists argue for less to much less ($p = 0.001$). Third, special effects artists unanimously declare that there should be much more emphasis on compositing. However because all other groups also support more emphasis in this area the difference is not statistically significant ($p = 0.099$). Fourth, lighting artists and technical directors advocate much more emphasis in scripting and programming than other groups ($P = 0.026$).

3.4.1 Statistically Significant Differences in Opinion by Expertise

Animators and Others on Hand-Drawn Animation



TD/Lighters and Others on Scripting / Programming



Gray bars = 95% confidence intervals, red bars = mean

4. Discussion and Conclusions

In the ACM SIGGRAPH 2003 Panel "The Future of Animation Education" panelist Steve Weiss (Executive Editor, New Riders Publishing) made the point that 3D computer animation education is a balance among art, technology and craft. This survey took a neutral stance in this regard, asking participants to rate a broad range of topics, some inherently technical and others not. Given that nearly 40% of our respondents considered themselves "underprepared" and only 25% "well prepared" by their educational experiences, there is clearly considerable room for improvement in many areas.

Perhaps the most notable finding of this survey is strong and relatively widespread agreement among 3D animation professionals that more academic emphasis is needed on fundamental skills, such as the principles of animation and motion studies. Given that the survey focused on those who routinely use very high technology, it is interesting that the three top-ranked topics were a mix of largely non-technical skills. It is not that participants wanted less emphasis on technical areas, but rather that there was even stronger and more consistent support for teaching fundamentals.

Of the more technical topics, it is remarkable that compositing, texturing and lighting ranked much higher than, for example, 3D modeling. While texture and lighting are usually covered at least superficially in any animation curriculum, there is likely need to increase the depth at which they are addressed. The topics which

had neutral overall response were 3D modeling, basic computer graphics and 2D computer animation. Interestingly, hand-drawn animation skills ranked significantly higher the 2D computer animation.

One interpretation of the results on technical topics is that current programs do an adequate job at teaching more basic concepts such as computer graphics and 3D modeling, but less well at higher-level technical topics such as dynamics and 3D character animation. The relatively low ranking of 2D computer animation and sound design - and wide range of opinions on these topics - may also be a reflection of perceived disciplinary and professional boundaries.

In general, respondents wanted "more of everything." While understandable, this poses a challenge to educators, who typically must work within a fixed academic schedule. Within these constraints, the overall message of this survey may be to focus on the basics and/or to develop a core curriculum with specialization options at the upper division or graduate levels.

5. Future Work

As a first survey in this area, the questions asked were necessarily broad. Some topics aggregated for the sake of brevity turned out to be particularly important and should be examined in greater detail. For example, topic #1 was described as "Fundamentals: Principles of Animation, Motion Studies, Drawing, Anatomy, Acting for Animation." Since this was the top-rated topic, it would be worthwhile to consider which subtopics were most important within this broader area.

Future research in this area should explicitly consider the issue of specialization, a theme which was mentioned in several survey participants' comments:

> Participant #1: *"[the question] assumes that someone wants to become a generalist animator which there are fewer of these days."*
>
> Participant #2 *"It's hard to answer the above questions because it all depends on what sort of job you would like to have in the animation world, TD, Character Animation, effects, or compositing."*

Future efforts should also target other important stakeholders in the educational system, especially students and animation faculty.

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Figure 3.3.1: Areas of Emphasis in 3D Computer Animation Education

"Relative to your own personal education or experience with recent graduates, which areas do you think should be given more or less emphasis in animation education?"

Question Topic	Score	Rank Order	Statistical Rank	Much Less	Less	About Right	More	Much More	Less or Much Less	About Right	More or Much More	Percent Agreement
Fundamentals: Principles of Animation, Motion Studies, Drawing, Anatomy, Acting for Animation	60	1	1	1	0	8	12	19	2%	19%	72%	70%
Preproduction and Planning: Story development, Character Development, Storyboarding, Screenwriting	56	2	1	1	1	5	18	15	5%	12%	77%	72%
Design Skills: Visual Perception, Color Theory, Form and Space, Layout and Composition	50	3	1	1	0	9	17	12	2%	21%	67%	65%
Compositing	46	4	1	0	2	12	12	13	5%	28%	58%	53%
Texturing and Lighting	44	5	1	1	0	15	10	13	2%	35%	53%	51%
Scripting / Programming	38	6	1	1	4	10	12	12	12%	23%	56%	44%
3D Character Animation	28	7	2	1	3	16	13	7	9%	37%	47%	37%
Dynamics and Special Effects	25	8	2	4	2	14	10	10	14%	33%	47%	33%
Hand Drawn Animation	21	9	3	0	7	15	11	6	16%	35%	40%	23%
Editing	14	10	3	1	9	12	12	5	23%	28%	40%	16%
3D Modeling	13	11	3	1	4	22	8	4	12%	51%	28%	16%
Computer Graphics: Raster and Vector Representation, Color Representation	5	12	4	3	4	22	6	4	16%	51%	23%	7%
2D Computer Animation	3	13	4	0	10	20	6	3	23%	47%	21%	2%
Sound Design	-6	14	5	5	10	14	7	4	35%	33%	26%	9%