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Nicholas Hellmuth, Project Editor, FLAAR+BGSU

Brent Cavanaugh, Technical Lab Manager, Large Format Digital Imaging Lab, BGSU

Roshita Mukhia, Graduate Student, Computer Sciences, BGSU+FLAAR

## Comparison of the Performance of Adobe Applications Between the Apple G4 and Three Dell Pentium 4 Systems

With follow-up Notes on Comparison of Performance of Adobe CS  
Between Apple G5 and Dell Pentium 3.2 Ghz Systems



**Abstract**

The purpose of this study is to determine which platform performs the best for general graphics work by comparing the performance of three current Dell computers to a current Apple Macintosh computer using application software available for both platforms. The programs are all produced by Adobe Systems, Inc. and are primarily related to the graphics industry. The systems are all designed with components suited to the graphics industry.

Productivity is a driving factor of the choice of a personal computer for the home or office. The study will help individuals or companies determine which platform they should choose for their application. The results from the various applications will allow an individual to better determine the most suitable platform.

The study determined the Dell 650, 450 and 360 computers outperformed the Apple G4 1.42 GHz computer when compared using various functions of Adobe Photoshop 7.0, Illustrator 10 and Acrobat 6.

**Preface by Editor**

This project began before the Apple G5 was announced. After we finished comparing the Apple G4 with the three Dells we acquired an Apple G5 dual-processor, fully loaded with 8 GB of RAM. Since by then the 3.0x MHz Dell machines were a past generation we updated to two 3.2 MHz Dell computers.

Much to our surprise the Mac G5 was nowhere near as fast as we expected, and in many tests using Adobe Photoshop the 32-bit Dell computers were still more agile than the Apple G5 with 64-bit processing. This goes to show that when an independent entity (a university) does the tests, with no intent to hobble one platform and no attempt to enhance the other platform, that the truth comes out.



BGSU and FLAAR use Macintosh and Dell computers; FLAAR uses both platforms at Universidad Francisco Marroquin also. **Left:** FLAAR at BGSU with Adobe software at work on a Dell. **Right:** FLAAR at UFM using Adobe Illustrator to design our corporate logo on a 22" Apple Cinema Display.

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Mac G5 and Dell dual processor workstations at BGSU during the 2-months of benchmarking.

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Caption for front cover photograph: Benchmarking Dell Precision Workstations in the facility at BGSU shared by C.A.T. and FLAAR

## Introduction

Bowling Green State University uses both Apple Macintosh and Microsoft Windows based personal computers for the students, faculty and staff. The Large Format Digital Imaging Lab uses both platforms as well. Each platform has its strengths and weakness. This study will demonstrate the strengths and weaknesses of each platform specifically for the graphics and large format inkjet printing industry.

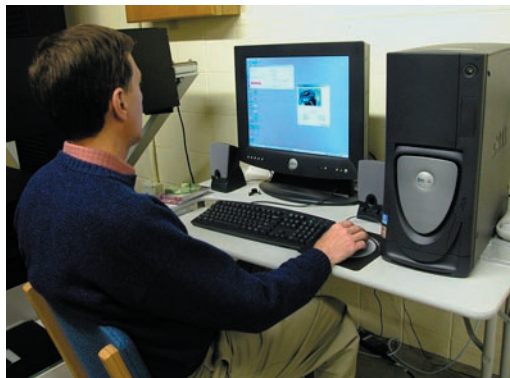
It is difficult at best to compare two completely different platforms that have unique system architecture and operating systems. In order for the comparison to be fair we will use only applications that are available for both systems.

Adobe is the leading provider of software tools for the graphics industry. Photoshop, Illustrator and Acrobat are software packages frequently used on campus for design and production. They also have a strong place in the graphic design and printing industry. The study will compare the amount of time it takes to perform specific software functions commonly used by professionals in the graphics industry.

Benchmarking has been performed since the earliest personal computers were released. As Apple and Microsoft operating systems have developed many comparisons have been performed between both platforms as well as between different computer manufacturers. Early graphics program could take several minutes or even hours to perform some of the functions used every day in general production. Speed was an important factor in improving productivity.

Computers of today are many times faster than those of five years ago. The increase in speed has allowed graphic artists and others to perform more and more complicated processor and memory intensive functions using the graphics programs. The quest for speed still continues because of these time consuming functions.

This study will not determine why the systems perform differently. It is to define a basic user evaluation of the performance of these applications on the four systems listed.



BGSU and FLAAR use Macintosh and Dell computers; FLAAR uses both platforms at Universidad Francisco

## Review of Literature

Current benchmarking of personal computers takes many forms. Manufacturers have compared windows based systems for many years to demonstrate the capabilities of their own designs. Benchmarks are generally based on the following aspects:

- **Application based** tests, which run current applications and time them.
- **Playback** tests, which use logs of system calls made during specific application activities (e.g. graphics calls or disk usage) and play them back.
- **Synthetic** tests, which approximate application activity in specific subsystems.
- **Inspection** tests, which directly exercise specific subsystems.

Some benchmark programs are not based on user applications but are based on integer and floating point calculations, video graphics capability in 2D and 3D, read, write and seek speed from the hard drive, memory read-and-write speed. WinBench<sup>1</sup> by PC Magazine has been the most widely used benchmark software for PC's. At one point a Macintosh version was developed for use on Apple computers. It is no longer available from the manufacturer and has not been updated in several years.<sup>2</sup>

Further information on the architecture of the PowerPC can be located at [http://www-1.ibm.com/servers/eserver/pseries/hardware/whitepapers/power/ppc\\_arch.html](http://www-1.ibm.com/servers/eserver/pseries/hardware/whitepapers/power/ppc_arch.html)

Apple has used the Standard Performance Evaluation Corporation (<http://www.spec.org/>) to conduct benchmarking (Glossary of terms at <http://www.spec.org/spec/glossary/>). Their testing specifically addresses the speed and throughput of the processor and operating system. These tests do not measure the typical user's application experience.

Comparisons have been performed by Gene Steinberg who speaks of his own comparison of a G4 Mac and the Pentium 4.<sup>3</sup> His testing determined a dual 3.06 GHz Pentium computer outperformed the 1.42 GHz G4.

The website [www.barefeats.com](http://www.barefeats.com) contains a comparison made by ROB-ART Morgan.<sup>4</sup> In his test he compared the Mac G4 1.42 Ghz computer with a Pentium 4 3.06 Ghz processor PC built by ACCS. His tests were composed of applications such as Photoshop 7.0, and Bryce 5. Cinebench, a graphics benchmark program, was also used as well as 3D rendering software and graphic intensive games.

The PS7Bench from [http://www.geocities.com/sw\\_perf/PSBench.html](http://www.geocities.com/sw_perf/PSBench.html) provides an action file for Photoshop 7 to use for system comparisons. Their results are posted here.

## Data Collection and Analysis

This evaluation will record the amount of time each computer takes to complete each task. Each will be performed 3 times and averaged. The four computers will have the following applications installed following the guidelines given by the manufacturer. Pricing has not been included because of the volatility of prices. For more information please visit each manufacturer's web site.

Table 1 through 4 lists the specifications of the hardware for the four computers to be used in the evaluation. The specifications were given by Dell Computers and Apple Computers.

<sup>1</sup>Veritest.com website, <http://www.etestinglabs.com/benchmarks/benchmk.asp?visitor=>

<sup>2</sup> PC Magazine website, <http://www.veritest.com/benchmarks/default.asp?visitor=>

<sup>3</sup> Gene Steinberg, <http://www.usatoday.com/tech/columnist/2002/07/12/steinberg.htm>

<sup>4</sup> <http://www.barefeats.com/pentium4.html>

Table 1

<b>Dell Precision™ Workstation 650:</b>	Intel® Xeon™ Processor, 3.06GHz, 512K Cache
<b>2nd Processor (Must match speed selection above):</b>	Intel® Xeon™ Processor, 3.06GHz, 512K Cache
<b>Memory:</b>	2GB, DDR266 SDRAM Memory, NECC (4 DIMMS)
<b>Keyboard:</b>	Enhanced Performance, USB (8 Hot Keys)
<b>Monitor:</b>	Dell UltraSharp™ 2000FP 20 inch Flat Panel Monitor (20.0 inch vis)
<b>Graphics Cards:</b>	nVidia, QuadroFX 500, 128MB, dual monitor VGA or DVI/ VGA capable
<b>First Hard Drive:</b>	36GB Ultra 320 SCSI, 1 inch (15,000 rpm) for PERC3
<b>Floppy Drive:</b>	3.5 inch 1.44MB Floppy Drive
<b>Operating System:</b>	Microsoft® Windows® XP Professional, SP1 with Media using NTFS
<b>Mouse:</b>	USB, Logitech, 2 button OPTICAL w/ scroll
<b>CD-ROM, DVD, and Read-Write Devices:</b>	4X DVD+RW/+R with Roxio® Easy CD Creator and DVD decode
<b>Speakers:</b>	Internal Chassis Speaker, Dell
<b>Productivity Software:</b>	Dell Precision Workstation
<b>2nd Hard Drive:</b>	36GB Ultra 320 SCSI, 1 inch (15,000 rpm)
<b>Optional SCSI/RAID:</b>	Integrated U320 SCSI controller with RAID-0, 64b PCIx
<b>4th Hard Drive Bracket:</b>	4th Hard Drive Bracket, SCSI, Gray
<b>Hardware Support Services:</b>	3Yr Parts + Onsite Labor (Next Business Day)
<b>Optional Support Services:</b>	Gold Technical Support, Precision, 3 Years
<b>Installation Services:</b>	No Installation
<b>4th Hard Drive:</b>	36GB Ultra 320 SCSI, 1 inch (15,000 rpm)
<b>3rd Hard Drive:</b>	36GB Ultra 320 SCSI, 1 inch (15,000 rpm)

**Table 2**

<b>Dell Precision™ Workstation 360 Minitower</b>	Intel® Pentium® 4 Processor, 3.00GHz, 512K / 800 Front Side Bus
Memory:	2GB,DDR333 SDRAM Memory,NECC (4 DIMMS)
Keyboard:	Enhanced Performance, USB (8 Hot Keys)
Monitors:	Dell UltraSharp™ 2000FP 20 inch Flat Panel Monitor (20.0 inch vis)
Graphics Card:	nVidia, QuadroFX 500, 128MB, dual monitor VGA or DVI/ VGA capable
Boot Hard Drive:	146GB Ultra 320 SCSI, 1 inch (10,000 rpm)
Floppy Drive:	3.5 inch 1.44MB Floppy Drive
Operating System:	Microsoft® Windows® XP Professional, SP1 with Media using NTFS
Mouse:	Logitech® , USB, Optical (2-button, w/scroll)
CD ROM/DVD ROM:	4X DVD+RW/+R AND 48X CDROM with Roxio® Easy CD Creator and DVD Decode
Speakers:	No Speaker
Productivity Software:	Dell Precision Workstation
Controller Card:	U320 SCSI Adapter with RAID 0 at No extra charge
Hardware Support Services:	3Yr Parts + Onsite Labor (Next Business Day)
Optional Support Services:	Gold Technical Support, Precision, 3 Years

**Table 3**

<b>Dell Precision™ Workstation 450 Desktop</b>	Intel® Xeon™ Processor, 3.06GHz, 512K Cache
2ND PROCESSOR:	Intel® Xeon™ Processor, 3.06GHz, 512K Cache
Memory:	2GB,DDR266 SDRAM Memory,NECC (4 DIMMS)
Keyboard:	Enhanced Performance, USB (8 Hot Keys)
Monitor:	Dell UltraSharp™ 2000FP 20 inch Flat Panel Monitor (20.0 inch vis)
Graphics Cards:	nVidia, QuadroFX 500, 128MB, dual monitor VGA or DVI/ VGA capable
First Hard Drive:	146GB Ultra 320 SCSI, 1 inch (10,000 rpm) for PERC3
Floppy Drive:	1.44MB FDD,Full-size,no-bezel,F3 bay-1ST SOURCE
Operating System:	Microsoft® Windows® XP Professional, SP1 with Media using NTFS



Mouse:	USB,Logitech,2 button OPTICAL w/ scroll
CD-ROM, DVD, and Read-Write Devices:	4X DVD+RW/+R with Roxio® Easy CD Creator and DVD decode
Productivity Software:	Dell Precision Workstation
2nd Hard Drive:	146GB Ultra 320 SCSI, 1 inch (10,000 rpm)
SCSI/RAID:	U320 SCSI Adapter with RAID 0 at No extra charge
Hardware Support Services:	3Yr Parts + Onsite Labor (Next Business Day)
Optional Support Services:	Gold Technical Support, Precision, 3 Years
Installation Services:	No Installation
Other Options:	1394 Controller Card
2nd Monitor:	Dell UltraSharp™ 2000FP 20 inch Flat Panel Monitor (20.0 inch vis)

**Table 4**

<b>PowerMac 1.42Ghz Dual Processor with Super-Drive</b>	1.42GHz w/ 2MB L3 Cache
2ND PROCESSOR:	1.42GHz w/ 2MB L3 Cache
Memory:	512 mb ram
Keyboard:	Apple Keyboard
Monitor:	Apple 23" Cinema HD Display
Graphics Cards:	NVIDIA GeForce4 Titanium dual-display w/128MB DDR
First Hard Drive:	160GB Ultra ATA drive 7,200 RPM
Floppy Drive:	none
Operating System:	OS X v.10.2 Jaguar
Mouse:	Apple
CD-ROM, DVD, and Read-Write Devices:	Apple Superdrive
Productivity Software:	Stock
2nd Hard Drive:	160GB Ultra ATA drive 7,200 RPM
SCSI/RAID:	None

Adobe Photoshop 7.0 will be the primary application examined. Adobe Illustrator 10.0, Adobe Acrobat 6.0 will have only specific tasks tested.



**Table 5:** List of Tests, includes each of the tasks to be performed with each program.

Photoshop	Test	Specifications
1	RGB to CMYK	AdobeRGB to SWOP
	Unsharp Mask/ Sharpen	
2		Default
3		50,1,0
4		100,10,5
5		50,3,7
	Rotate/Arbitrary	
6		0.9
7		44
8		90
	Gaussian Blur	
9		.5
10		5
	Image Resize from 300 PPI,	
11		25%
12		50 %
13		200 %
	Render/Lighting Effects	
14		Spotlight Default
	Noise/Despeckle	
15		default
	Artistic/Watercolor	
16		7,5,1
17	Pixellate/Pointillize	
18	Image/Mode/Convert to profile	sRGB to Adobe RGB, ACE, Perceptual, Black Point and Dither on
19	Dust and Scratches	1 pixel, Threshold 20 Levels
<b>Illustrator</b>		
20	Export Photoshop File	
		150 PPI
		300 PPI
		600 PPI
21	Save as PDF	
22	Export as TIFF	
		300 PPI
		600 PPI
23	Save as EPS	
<b>Acrobat</b>		
	Save PDF	
	Save Postscript	

### Factors that May Affect the Results

The differences between the two platforms and manufacturers' systems cause many variables that may affect the outcome of the tests. Our evaluations are intended to be comparable to the results a user would receive from a computer purchased directly from the manufacturer with the operating system preloaded, then directly loaded the applications on the startup drive.

Beyond the variations in processors and architecture, hardware variables that may affect the results include the amount of memory and the hard drives installed in each machine. The three Dells have 2 gigabytes of memory installed while the Apple originally supplied to the lab for these tests had 512 megabytes. Performance on both systems can be affected by the amount of memory installed.

Tests were performed with the full memory installed on the Dell computers as well as at 512 Mb to better compare to the Apple.

Working with smaller file sizes and testing each item from a freshly opened file or using the undo function to keep history images out of memory and scratch disk will keep memory free and keep from saving and accessing the cache on the hard drive. Larger file sizes may cause some of the information to be written to scratch disk in some of the applications. The percentage of memory available was set to 80% in Photoshop on each computer.

The hard drives in the four computers vary both in interface as well as spindle speed. These differences could affect the results of some of the tests. These factors can be examined more closely to determine if there is any relationship to the final results.

### Procedures

The tests will be performed on freshly booted computers. The computers were not networked or allowed to connect to the internet. While this did not allow us to check for updates to the operating system or applications, it prevented any variation in the installation of software.

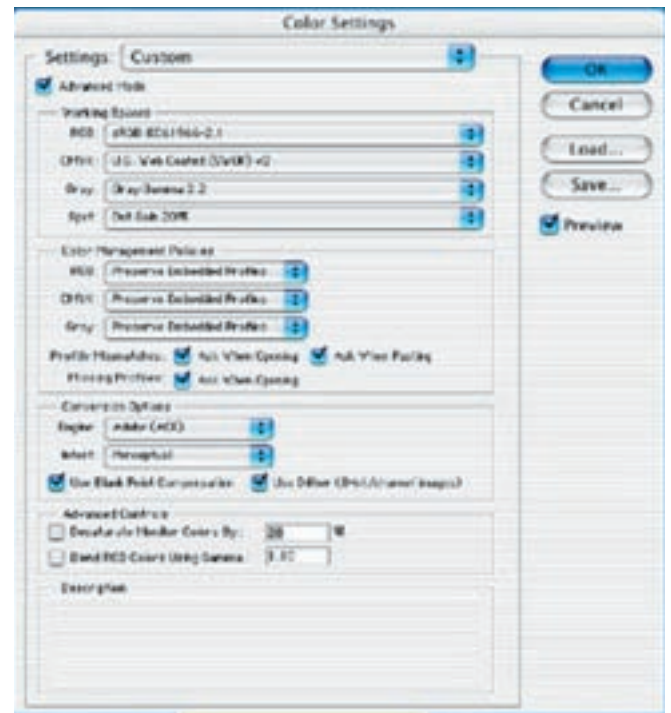
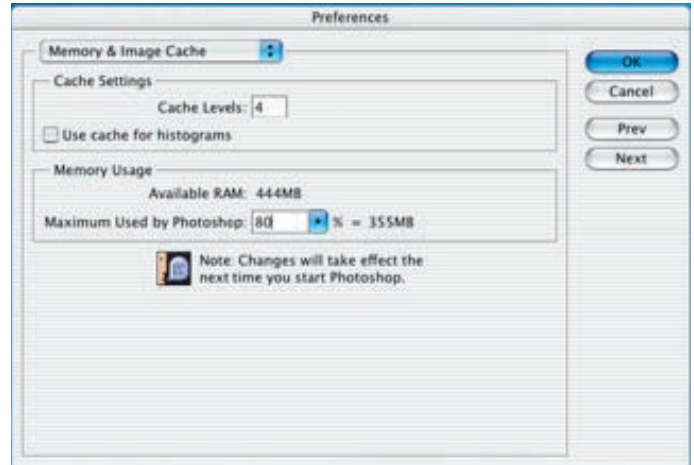
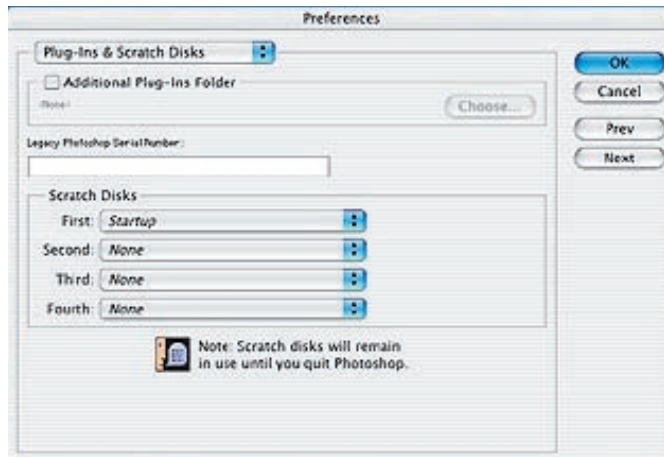
The programs were installed using the typical installation process recommended by the manufacturer.

After installation some application settings were checked and adjusted for consistency among the four computers.

### Photoshop

Two series of tests were performed with Photoshop using different memory settings. The first series used the 2 Gb memory installed on the three Dells and 512 Mb on the G4. The second series was performed with just 512 Mb enabled on all computers.

In Photoshop, the scratch disk for each of the systems was pointed to the startup disk for consistency, since not all of the PCs had two hard drives. Additional testing using the second hard drive for scratch disk can be performed later. In the preferences window under Plug-ins and Scratch Disk the Scratch disk was set to Startup. The Memory and Image Cache setting was set to 80%.



The Color Settings were changed to reflect more of a true color management environment. The policies were set to preserve the file's profile and to ask when handling mismatched profiles. The CMM was set to Adobe Color Engine with Perceptual intent. These settings reflect more of a photographic workflow.

Four test image files (Figure 2) were created from a photographic digital image for the Photoshop test. The files were transferred to the desktop of each system. The files were 14"x14" at 150 pixels per inch, 300 PPI, 450 PPI and 600 PPI. Table 6 shows the megabyte sizes of each of the files.

Table 6: Size of Test Files

File size PPI	HxW	Size in Mb
150	14"x14"	12.7
300	14"x14"	50.5
450	14"x14"	113.6
600	14"x14"	201.9

An action was created to step through each of the tests, stopping between each function so the time can be recorded. After the function was performed the file was reverted back to its original state to prevent a buildup of memory or scratch disk usage in the History. In Photoshop the timing display was used to determine the time Photoshop took to complete each test. Three runs were recorded and averaged for the final results.

A problem was discovered in running the action of resizing the image to a smaller size on the Mac. The window on the screen became too small to display the time. In this case the action was paused to resize the window so the time could be seen. The action was then restarted.

Another issue arose with the timing function displaying two times when performing an action. The first time was the completion of the task and the second was after the screen refreshed. In all cases, the first time was used in the results.

After recording the data from the two memory settings the times for each function was averaged and the total time to perform all the functions was determined. This data was used to evaluate the performance of each computer.



Figure 2: Test Image File, courtesy N. Hellmuth

### Illustrator

The memory was left at the shipped memory configuration for this evaluation. The color settings for Illustrator were configured similar to those of Photoshop.

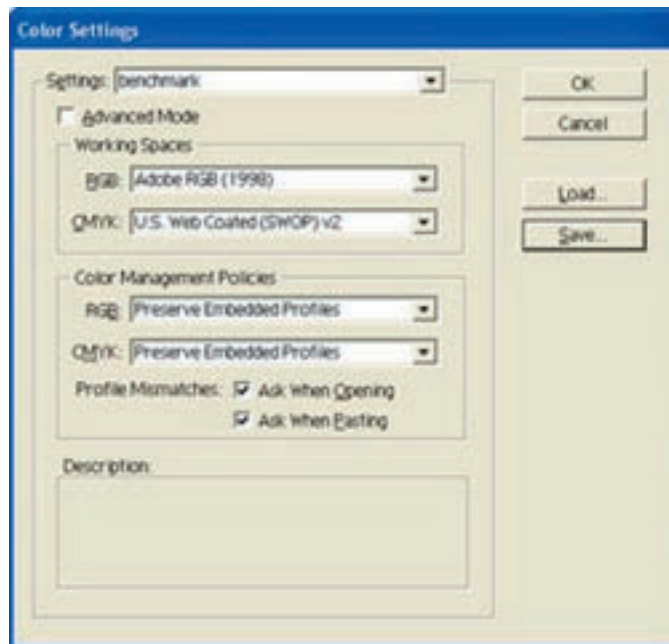
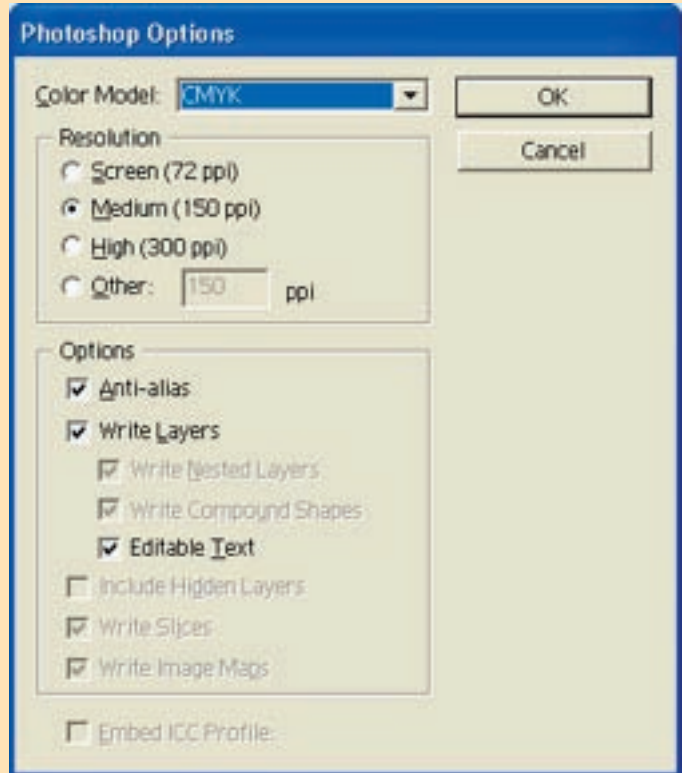


Figure 3: Illustrator Color Settings

To perform the tests for Illustrator, a file was created using text, raster and vector components.



**Left;** Figure 4: Illustrator Test File, **Right;** Figure 5: PSD export configuration. **Below;** Figure 6: TIFF export settings

The file was set to a size of 8"x10". The raster photographs were imported at 600 PPI. The file was saved to embed the font and images so the file would be portable to each computer. The file was copied to the desktop of each system.

### Photoshop Format Export

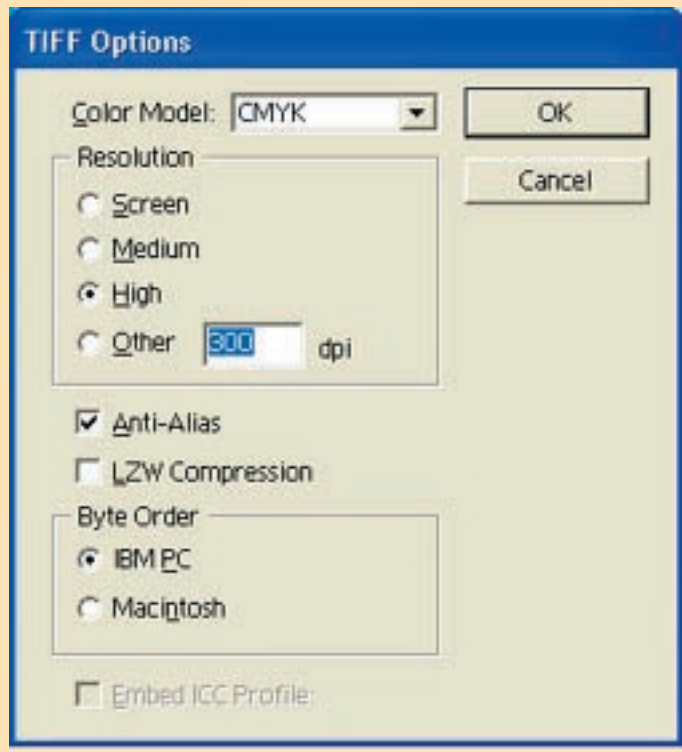
The file was exported as a Photoshop PSD file at 150 PPI, 300 PPI and 600 PPI. Figure 4 shows the configuration window for the export. The durations of the three trials were timed with a stopwatch and recorded.

### TIFF Format Export

The file was also exported and recorded as a TIFF file in a similar manner. Figure 5 shows the configuration window for the export.

### C. Save as Acrobat Format

The last test to be performed with Illustrator was to save it as an Acrobat PDF file. Figure 7 shows the settings used for the export. A stopwatch was used to measure three trials of each test.





## Acrobat

Comparisons of the performance using Acrobat were based on how quickly a reference file could be saved as a PDF or a postscript file. The memory configuration was left at the shipped computer configuration. The Illustrator test file was opened in Acrobat and then saved as a PDF file. The processing time was measured with a stopwatch. This process was repeated for three samples each as a PDF and as a postscript file.

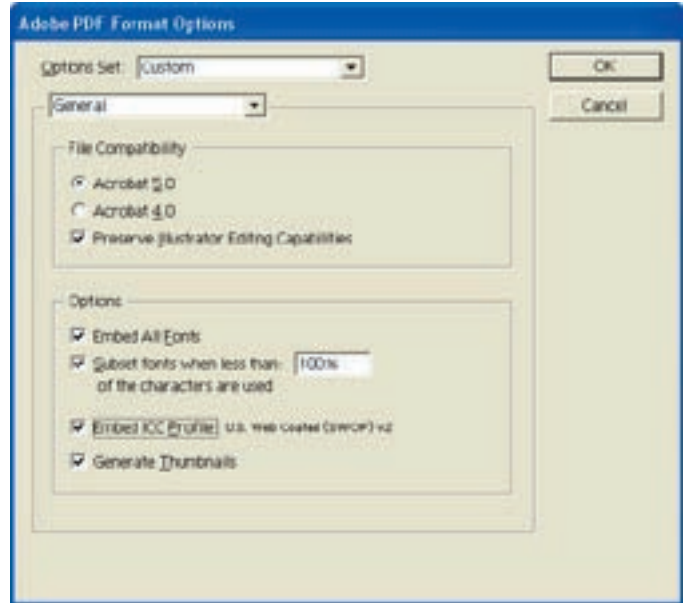


Figure 7: Acrobat Saving Settings

## Results Photoshop

The following graphs display the total test times on each computer using the installed memory.

In both series the three Dell computers all outperformed the Apple in the total time to perform the listed tests. Further analysis shows that the times for test 13, resizing the file to 600 ppi, were significantly higher for the Mac G4. This may have been due to the lower amount of memory on board which may have caused writing to the hard drive cache. Another set of graphs were created removing this test. Figure 9 illustrates these results.

This series of tests show the Apple G4 to be slower in performance than the three Dells. The Dell 360 performed fastest in the 300 and 450 PPI file tests.

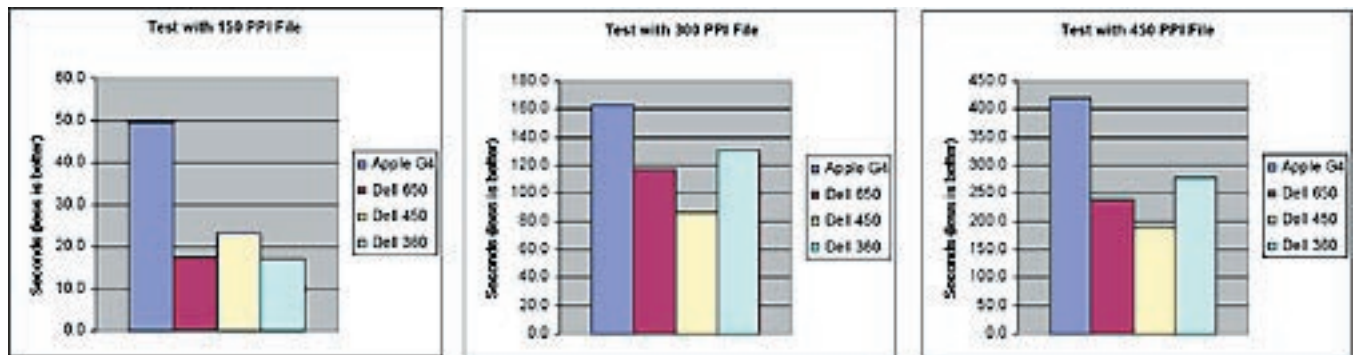


Figure 8: Photoshop Test Results

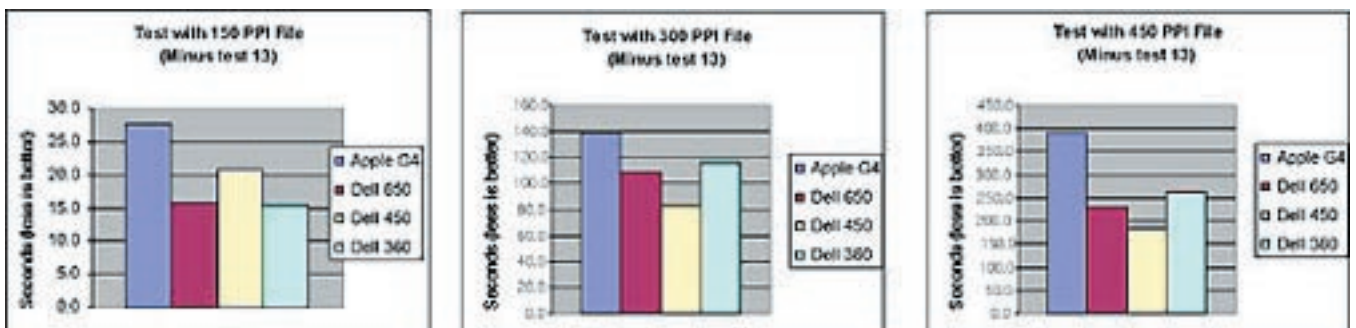


Figure 9: Photoshop Results Without Test 13

Additional testing was performed with the memory of the Dell computers restricted to 512 Mb by editing the boot.ini file and adding `/maxmem:512` to the following line:

The Photoshop tests were performed again and the times recorded. Graphs were created illustrating the performance times.

The test with the 300 PPI file (50 Mb size) shows very similar results to the first test. The 450 PPI file test shows similar results with the 650 and 360 model Dells. However, the 450 Dell's time increased to the same speed as the Apple.

The 150 PPI file (12 Mb size) test results show the most variation from the previous tests. The Dell 650's time is much higher than before and is equal to the Apple G4. An examination of the individual results for each series shows the particular tests with the most

These results illustrate the variation in how each computer performs each test within the suite. The watercolor filter and the image resize of 200% tests have the greatest affect on the average performance times.

### Illustrator

The averaged results from the tests were added together for each computer. The results are shown below in figure 10.

The graph shows the Apple G4 took twice as long to perform these tasks than the Dell 360. While there are differences in the hard drives and memory of the Dells these factors appear to have had little effect on the results. It could be inferred that the differences in memory and hard drive on the Apple would have only minimally skewed the results. Further testing could be done to examine this issue.

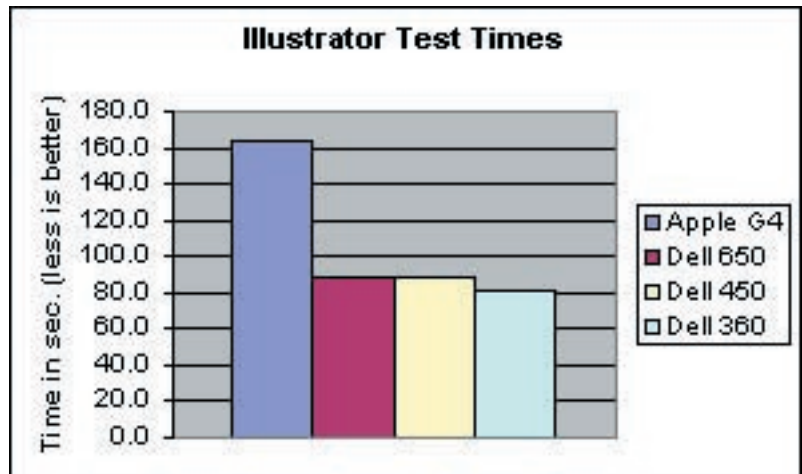


Figure 10: Illustrator Test Results

### Acrobat

The sum of the average times of saving the PDF and postscript file formats again show the Apple G4 to be slower than any of the Dells although it is very close to the Dell 650.

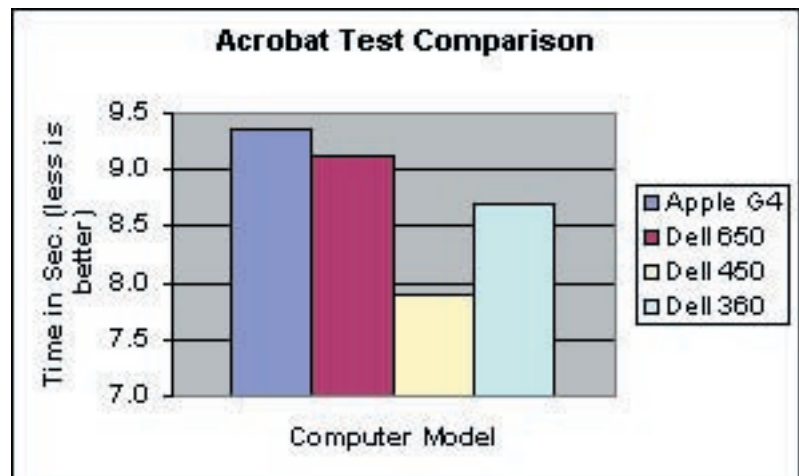


Figure 11: Acrobat Test Results

## Conclusions

With each application the Dell Precision 650, 450 and 360 computers proved to be quicker in performing the tests using the Adobe applications than the Apple G4. The tests that were performed are only a sample of the capabilities of each of the software packages. Some functions within Photoshop are performed more quickly by the Apple G4. However, for the purposes of this study the results show a significant difference in performance.

The Dells do overall perform more quickly. The Dell 360 performed the best overall. This is probably due to the faster front side bus speed. Other researchers have had similar results when comparing the Pentium 4 3.06 Ghz processor to the Apple G4 1.42 Ghz processor. The tests would indicate that if performance was the deciding factor for purchasing a computer for digital graphics the Dell computers would be best choice.

The research would have been more thorough if the Apple G4 could have been available for evaluation for a greater period of time. Also, the difference in memory between computers played a roll in obtaining accurate results with larger file sizes. These tests should be repeated with an Apple with the equivalent amount of memory as the Dells. More trials could have been performed to have a more accurate measure of performance.



Helen Golden, gilcéé printing with an HP DesignJet 5500 at SIGGRAPH '03.

Other topics that could be researched include:

- Effect of memory on software performance
- Effect of hard drive speed on software performance
- Utilization of dual processor by the software
- Comparison of Apple G5 processor to the Dell Precision computer line
- Video card performance with the Adobe applications
- Performance of the Adobe InDesign program

The information gained on this study should help graphic professionals in their decision making process when deciding on what system to purchase. It also demonstrates how the Adobe products operate very similarly in both operating systems.



**Appendix A**

The following is the data recorded from the Photoshop tests performed with 2 Gb Dell memory and 512 Mb Apple G4 memory, including test 13.

	150.0	150.0	150.0	150.0		300.0	300.0	300.0	300.0
	Mac 1.42					Mac 1.42			
Test	Gh	Dell 650	Dell 360	Dell 450		Gh	Dell 650	Dell 360	Dell 450
	Average	Average	Average	Average		Average	Average	Average	Average
	0.0		0.0	0.0				0	0.0
1	0.7	1.2	1.8	0.9		4.2	4.4	7.0	3.7
2	0.3	0.1	0.1	0.1		3.4	0.5	0.4	0.3
3	0.8	0.2	0.3	0.2		4.2	2.4	0.9	0.7
4	1.2	0.4	0.5	0.4		7.9	9.6	2.0	10.2
5	0.9	0.3	0.4	0.3		4.9	5.7	1.5	4.7
6	1.5	0.5	0.7	0.5		7.1	6.5	2.9	8.1
7	0.9	0.6	0.9	0.6		11.0	7.2	3.5	9.6
8	0.1	0.1	0.1	0.1		6.9	3.2	0.2	3.9
9	0.3	0.2	0.2	0.2		4.9	2.3	0.6	3.4
10	1.8	0.3	0.4	0.3		6.6	5.3	1.6	7.0
11	0.4	0.1	0.2	0.1		0.7	0.7	0.7	0.8
12	0.0	0.0	0.0	0.0		2.0	0.5	0.8	0.5
13	21.9	1.6	2.3	1.7		24.2	8.3	2.9	14.9
14	2.0	0.4	0.5	0.3		6.2	3.4	1.7	3.8
15	0.9	0.5	0.9	0.5		3.4	3.2	3.4	4.4
16	9.2	7.2	7.0	7.0		39.2	32.0	27.2	31.6
17	4.7	2.4	4.4	2.4		19.6	14.6	19.3	14.5
18	1.0	0.5	0.9	0.5		2.9	3.3	3.7	4.6
19	1.0	0.8	1.5	0.8		3.6	4.4	5.9	4.5
<b>Total</b>	<b>49.7</b>	<b>17.3</b>	<b>23.2</b>	<b>17.0</b>		<b>163.0</b>	<b>117.4</b>	<b>86.2</b>	<b>131.1</b>

	450.0	450.0	450.0	450.0		600.0
	Mac 1.42 Gh	Dell 650	Dell 360	Dell 450		Mac 1.42 Gh
	Average	Average	Average	Average		Average
			0.0	0.0		
	12.1	9.7	15.6	8.3		34.0
	9.4	4.7	0.6	10.4		39.5
	9.8	11.7	2.2	11.6		44.6
	39.5	17.2	4.8	19.8		121.5
	11.4	8.8	3.5	11.9		47.1
	17.2	9.3	6.5	13.7		54.0
	27.9	12.6	7.9	17.7		61.0
	14.1	7.4	0.4	9.4		61.2
	10.7	4.6	1.3	7.5		52.0
	42.0	12.4	3.8	14.4		123.9
	1.7	1.2	1.3	1.5		1.9
	3.0	2.0	2.2	2.7		3.0
	29.6	10.0	3.6	15.4		84.9
	14.3	7.5	3.9	8.3		85.7
	10.3	6.7	7.5	7.9		52.1
	93.0	62.7	60.2	64.2		178.1
	56.9	33.9	39.7	36.5		301.6
	8.9	7.3	8.2	6.9		35.6
	7.8	9.8	12.6	10.0		91.6
	<b>419.6</b>	<b>239.4</b>	<b>186.0</b>	<b>278.1</b>		<b>1473.5</b>

**Appendix B**

The following is the data recorded from the Photoshop tests performed with 512 Mb Dell memory and 512 Mb Apple G4 memory, including test 13.

	150.0	150.0	150.0	150.0		300.0	300.0	300.0	300.0
	Mac 1.42 Gh	Dell 650	Dell 360	Dell 450		Mac 1.42 Gh	Dell 650	Dell 360	Dell 450
Test	Average	Average	Average	Average		Average	Average	Average	Average
1	0.7	1.2	1.8	0.9		4.2	4.4	7.0	3.7
2	0.3	0.1	0.1	0.1		3.4	0.5	0.4	0.3
3	0.8	0.2	0.3	0.2		4.2	2.4	0.9	0.7
4	1.2	0.4	0.5	0.4		7.9	9.6	2.0	10.2
5	0.9	0.3	0.4	0.3		4.9	5.7	1.5	4.7
6	1.5	0.5	0.7	0.5		7.1	6.5	2.9	8.1
7	0.9	0.6	0.9	0.6		11.0	7.2	3.5	9.6
8	0.1	0.1	0.1	0.1		6.9	3.2	0.2	3.9
9	0.3	0.2	0.2	0.2		4.9	2.3	0.6	3.4
10	1.8	0.3	0.4	0.3		6.6	5.3	1.6	7.0
11	0.4	0.1	0.2	0.1		0.7	0.7	0.7	0.8
12	0.0	0.0	0.0	0.0		2.0	0.5	0.8	0.5
13	21.9	1.6	2.3	1.7		24.2	8.3	2.9	14.9
14	2.0	0.4	0.5	0.3		6.2	3.4	1.7	3.8
15	0.9	0.5	0.9	0.5		3.4	3.2	3.4	4.4
16	9.2	7.2	7.0	7.0		39.2	32.0	27.2	31.6
17	4.7	2.4	4.4	2.4		19.6	14.6	19.3	14.5
18	1.0	0.5	0.9	0.5		2.9	3.3	3.7	4.6
19	1.0	0.8	1.5	0.8		3.6	4.4	5.9	4.5
<b>Total</b>	<b>49.7</b>	<b>17.3</b>	<b>23.2</b>	<b>17.0</b>		<b>163.0</b>	<b>117.4</b>	<b>86.2</b>	<b>131.1</b>

450.0	450.0	450.0	450.0		600.0
Mac 1.42 Gh	Dell 650	Dell 360	Dell 450		Mac 1.42 Gh
Average	Average	Average	Average		Average
		0.0	0.0		
12.1	9.7	15.6	8.3		34.0
9.4	4.7	0.6	10.4		39.5
9.8	11.7	2.2	11.6		44.6
39.5	17.2	4.8	19.8		121.5
11.4	8.8	3.5	11.9		47.1
17.2	9.3	6.5	13.7		54.0
27.9	12.6	7.9	17.7		61.0
14.1	7.4	0.4	9.4		61.2
10.7	4.6	1.3	7.5		52.0
42.0	12.4	3.8	14.4		123.9
1.7	1.2	1.3	1.5		1.9
3.0	2.0	2.2	2.7		3.0
29.6	10.0	3.6	15.4		84.9
14.3	7.5	3.9	8.3		85.7
10.3	6.7	7.5	7.9		52.1
93.0	62.7	60.2	64.2		178.1
56.9	33.9	39.7	36.5		301.6
8.9	7.3	8.2	6.9		35.6
7.8	9.8	12.6	10.0		91.6
<b>419.6</b>	<b>239.4</b>	<b>186.0</b>	<b>278.1</b>		<b>1473.5</b>

**Appendix C**

The following is the data from the Illustrator and Acrobat tests.

		Mac 1.42			Mac 1.42	Dell 650			Dell 650
					150 Avg				Average
<b>Illustrator</b>	<b>Export PSD 150</b>	17	16.0	16.0	16.3	9.8	9.7	9.7	9.7
	<b>Export PSD 300</b>	79.0	74.0	74.0	75.7	37.4	37.7	37.2	37.4
	<b>Export PSD 600</b>	7 min 46 sec				180.5			
	<b>Save as PDF</b>	13.5	13.5	13.2	13.4	8	8.2	8.2	8.1
	<b>Export TIFF 300</b>	19.1	19.1	18.9	19.0	10.4	10.4	10.1	10.3
	<b>Export TIFF 600</b>	25.9	24.5	23.6	24.7	15.2	14.3	14.4	14.6
	<b>Save as EPS file</b>	14.7	14.3	14.4	14.5	8.4	9.1	8.2	8.6
	<b>Sum of Times</b>				<b>163.6</b>				<b>88.8</b>
<b>Acrobat</b>	<b>Save as PDF</b>	5.4	5.4	5.2	5.3	5.5	5.8	6.3	5.9
	<b>Save as Postscript</b>	4.2	4.0	3.9	4.0	3.4	3.2	3.2	3.3
	<b>Sum of times</b>				9.4				9.1

Dell 450			Dell 450	Dell 360			Dell 360
			Average				Average
10	9.8	9.8	9.9	9.3	9.2	9.2	9.2
37	37.3	37.2	37.2	35.4	34.9	35.1	35.1
181				172			
8.6	8.2	7.9	8.2	7	7.1	7.2	7.1
10.6	10.4	10.1	10.4	9.5	9.6	9.6	9.6
14.8	14.5	14.3	14.5	13.3	13	13.1	13.1
8.5	8.5	8.3	8.4	7.7	7.7	7.3	7.5
			<b>88.6</b>				<b>81.7</b>
6.3	3.9	4.1	4.8	5.4	5.1	4.9	5.1
3.1	3.2	3.1	3.1	4.2	3.3	3.2	3.6
			7.9				8.7

## Appendix D

### Editor's Comments

Nicholas M. Hellmuth

Most comparative tests of Macs and PCs that I have seen in popular magazines seem to go to great effort to use computers with identical specifications. The philosophy appears to be that testing equals is the only way to evaluate.

But what if the two computer platforms are inherently unequal? Indeed, this was one purpose of our evaluation, to determine the degree of similarity, or lack thereof.

This was not a test to determine if one brand is best for your lifestyle, or looks best on your desktop.

This evaluation was designed to take the absolute top-end machine of one brand, and compare it with the absolute top-end machine of the other brand. To debilitate one brand by using a less-than-optimum configuration just because the other brand had limits did not make any sense to us.

In late July 2003, FLAAR + BGSU was invited to participate in the Guerilla Studio hands-on demonstration area at SIGGRAPH '03, an important national conference for digital artists.

We asked for both Mac and PC computers to showcase along with our wide format printers and professional imaging equipment in this demonstration area. The concept for the benchmarking project came during our preliminary planning for this conference.

The Apple web site during May 2003 had a claim that their G4 is faster than a PC. As late as August 6, 2003, Apple web site had a claim touting "The dual 1.42GHz Power Mac G4 is 32 percent faster than the fastest PC on the market with a 3 GHz Pentium 4 processor..." ([www.apple.com/powermac/processor.html](http://www.apple.com/powermac/processor.html))

The independent tests by Brent Cavanaugh in the lab of the Center for Applied Technology, College of Technology, organized by the FLAAR evaluation center, all at Bowling Green State University, document a completely different reality. The BGSU-FLAAR benchmarking project was a real-world evaluation, not just a test of those limited aspects where one platform might appear to be superior if you don't look at the wider perspective.

We would ask why these claims are no longer on the Apple web site. Of course we have full copies. Also worth pointing out is that Apple targets the Dell Dimension 8250, which is a mid-range computer. Apple seems to have avoided the Dell Precision, which is Dell's workhorse. Interesting that Apple shied away from the more powerful workstation until the G5 became available. Now that G5's are available, it is also noteworthy to see the Macintosh magazines pointing out all the weak features of the G4. Curious that these deficiencies were not mentioned during 2001, 2002 and 2003.



**Above:** SIGGRAPH '03, showing both Mac and PC platforms. **Below:** Nicholas arranging a scan for the Cruse reprographic digital camera in the FLAAR area of SIGGRAPH '03. In the background, Dell and Macintosh computers (the Cruse produces a 450 MB photograph. it requires a PC; it won't run on a Mac)

We thank Dell for providing the three computers; we thank Adobe for providing the complete suite of content creation software; we thank ProVar LLC for arranging the loan of the first Mac G4; we thank HP San Diego for the loan of an HP DesignJet 5500 wide format inkjet printer for SIGGRAPH. We also appreciate the Cruse reprographic scanner company of Germany for loaning one of their digital cameras for SIGGRAPH, and BetterLight for providing one of their digital panorama-rollout scanning back systems for FLAAR.

The first Mac G4 which arrived (for SIGGRAPH) had only 512MB memory, and in any event was on loan for such a short period we had to send it back before we could do additional benchmarks. So we had to obtain a second loan, this time through the Apple student rep on campus, who contacted Jeffrey D. Feeman, who provided a replacement G4. This time FLAAR purchased the RAM since Apple itself did not provide a full 2 GB. We needed to test a fully-loaded Mac since the Dell's came already fully loaded with 2GB. There will be an update of these benchmarks with the full 2 GB RAM in the Mac.

No monetary payment was made by either computer company, or the software company. Dell provided the three computers that were used in the tests to FLAAR at BGSU, where they will continue to be used for comparative research in fields such as large format printing workflow, color management, and as RIP servers. For example, people ask how color management is on a PC, since Apple's ColorSync is so well known. However Windows software has caught up and besides, most RIPs only operate on a PC and color management software such as Monaco Profiler work just fine on a PC.

Our labs are open, and any representative of Dell or Apple is welcome to visit and time the benchmarks as they are run.

Check back for Brent Cavanaugh's benchmarking of the G5 compared with PC platforms. FLAAR is currently arranging to bring in the corresponding workstations.



Mac G4 and Dell platforms at BGSU-FLAAR

Dell Precision Workstation 650



FLAAR, Dell Precision Workstation 650 at UFM



Right: Case and top front door. Left: Case back Dell Precision Workstation 650

**Appendix E**

Specifications of the two Dell workstations and Mac G5 as outfitted for the FLAAR+BGSU benchmarking evaluation test.

<b>Dell Precision™ Workstation 650</b>	Intel® Xeon™ Processors, 3.2GHz, 2MB L3 Cache
2nd Processor (must match speed selection above)	Intel® Xeon™ Processors, 3.2GHz, 2MB L3 Cache
Memory:	3GB, DDR266 SDRAM Memory, ECC (4 DIMMS)
Keyboard:	Entry Level, PS/2 No Hot Keys
Monitor:	Dell UltraSharp™ 2001FP, Flat Panel, 20"
Graphics Cards:	nVidia™ Quadro® FX 500, 128MB, dual monitor VGA or DVI/VGA capable
First Hard Drive:	36GB Ultra 320 SCSI, 1 inch (10,000 rpm)
Floppy Drive:	1.44MB, 3.5 inch
Internal Zip Drive:	Iomega ZIP, 250MB, IDE, bezel, F5 bay
Operating System:	Microsoft® Windows® XP Professional, SP1 with Media and NTFS
Mouse:	PS/2, Dell, 2-button w/no scroll
CD-ROM/DVD, and Read-Write Devices:	48/32X CD-RW/DVD Combo, Data Only
Speakers:	No Speaker
Productivity Software:	Dell Precision Workstation
Hardware Support Services:	3 year limited warranty plus 3 year NBD-Site Service
2nd Hard Drive:	36GB Ultra 320 SCSI, 1 inch (15,000 rpm)
3rd Hard Drive:	36GB Ultra 320 SCSI, 1 inch (15,000 rpm)
Optional SCSI/RAID	Integrated U320 SCSI controller with RAID-0, 64b PCIx
Hardware Support Services:	3 Yr Parts+ Onsite Labor (Next Business Day)
Installation Services:	No installation

<b>Dell Precision™ Workstation 650</b>	Intel® Xeon™ Processors, 3.2GHz, 2MB L3 Cache
2nd Processor (must match speed selection above)	Intel® Xeon™ Processors, 3.2GHz, 2MB L3 Cache
Memory:	3GB, DDR266 SDRAM Memory, ECC (4 DIMMS)
Keyboard:	Entry Level, PS/2 No Hot Keys
Monitor:	Dell UltraSharp™ 2001FP, Flat Panel, 20"
Graphics Cards:	nVidia™ Quadro® FX 500, 128MB, dual monitor VGA or DVI/VGA capable
First Hard Drive:	36GB Ultra 320 SCSI, 1 inch (10,000 rpm)
Floppy Drive:	1.44MB, 3.5 inch
Internal Zip Drive:	Iomega ZIP, 250MB, IDE, bezel, F5 bay
Operating System:	Microsoft® Windows® XP Professional, SP1 with Media and NTFS

Mouse:	PS/2, Dell, 2-button with scroll
CD-ROM/DVD, and Read-Write Devices:	48X MAX CD-RW/DVD Combo Drive
Speakers:	No Speaker
Productivity Software:	Dell Precision Workstation
Hardware Support Services:	3 year limited warranty plus 3 year NBD-Site Service
2nd Hard Drive:	36GB Ultra 320 SCSI, 1 inch (15,000 rpm)
Optional SCSI/RAID	Integrated U320 SCSI controller with RAID-0, 64b PCIx
Hardware Support Services:	3 Yr Parts+ Onsite Labor (Next Business Day)
Installation Services:	No installation

<b>PowerMac G5</b>	Dual 2 GHz SuperDrive
Memory:	2GB DDR400 SDRAMM PC3200 6GB DDR400 RAM PC 3200 from Orange Coast Micro for total of 8 GB RAM
Hard Drive:	Two 250 GB Serial ATA 7200rpm
Optical Drive:	SuperDrive DVD-R/CD-RW
Graphics Support:	ATI Radeon 9800 Pro with 128MB of DDR SDRAM frame buffer
System software:	Mac OS X version 10.3 "Panther"



**Appendix F**  
**Report of 679 and 920 MB file using Photoshop CS**

**Opening file**

Memory Files	Dell 3GB		Mac 8GB		Mac 2GB	
	679	920	679	920	679	920
	10.2	16.8	7.5	11.3	18.4	24.9
	6.6	16.2	5.5	13.5	6.4	24.5
	6.5	16.5	5.5	11.2	17.2	25
	6.6	16.3	5.6	11.4	7.6	24.8
	6.5	20.3	5.6	11.5	17.4	24.2
	6.4	16.4	5.7	11.5	17.3	24.7
	6.5	16.3	5.6	11.8	17.5	24.7
	6.4	16.4	5.6	11.4	17.4	24.6
<b>Average</b>	<b>6.9625</b>	<b>16.9</b>	<b>5.825</b>	<b>11.7</b>	<b>14.9</b>	<b>24.675</b>

For just opening the file, Dell is faster in overall. Mac 8 GB is little faster than Dell 3GB but it has more memory too. If we take the Mac of Memory size almost equal to Dell 3GB (for example 2 GB), then we can clearly see the result that Dell is faster in opening the large files such as 679 and 920MB.

**Hue and Saturation**

Memory Files	Dell 3GB		Mac 8GB		Mac 2 GB	
	679	920	679	920	679	920
	10.4	16.7	7.5	12.1	18.7	25.2
	6.7	17.4	5.4	11.3	17.3	25
	6.5	16.8	5.5	11.4	641.5	25.5
	6.6	16.7	5.5	13.4	7.7	17.2
	6.4	16.8	5.4	11.4	17.2	25.2
<b>Average</b>	<b>7.32</b>	<b>16.88</b>	<b>5.86</b>	<b>11.92</b>	<b>140.48</b>	<b>23.62</b>

In this test, Mac 2 GB was little unpredictable because while working with the 679 MB file, once it took 641.5 and I repeated the test again then it was normal again give 17 or 18 something. However, it again gave 7 which was very low than the rest.

### Selective Color

Memory Files	Dell 3GB		Mac 8GB		Mac 2 GB	
	679	920	679	920	679	920
	6.4	16.5	7.4	11.2	17.5	28.1
	6.5	16.5	5.4	11.2	17.6	25.4
	6.4	16.6	5.5	11.1	17.6	24.8
	6.5	16.6	5.5	13.3	9.1	25
	6.4	16.5	5.4	11.1	7.5	25.1
<b>Average</b>	<b>6.44</b>	<b>16.54</b>	<b>5.84</b>	<b>11.58</b>	<b>13.86</b>	<b>25.68</b>

The result of this test shows that the Dell 3GB might be equivalent to Mac 6 or 7GB because of the difference between the result of Dell 3GB and Mac 8GB. I am not sure about all 2GB memory of Mac but I think in 2GB memory of Mac that we have has something wrong because of the large difference in time taken.

### Channel Mixer

Memory Files	Dell 3GB		Mac 8GB		Mac 2 GB	
	679	920	679	920	679	920
	6.5	16.7	5.4	11.1	19.1	24.9
	6.6	16.6	5.4	13.5	17.4	24.7
	6.4	16.3	5.5	11.7	7.5	27
	6.5	16.5	5.6	11.6	17.3	24
	6.5	16.5	7.2	13.3	7.6	24.9
<b>Average</b>	<b>6.5</b>	<b>16.52</b>	<b>5.82</b>	<b>12.24</b>	<b>13.78</b>	<b>25.1</b>

In this test, Dell has almost the constant time whereas Mac seems to have a lot of variable in 679MB file but in case of 920 MB file, it is almost constant too.

### RGB to Lab

Memory Files	Dell 3GB		Mac 8GB		Mac 2 GB	
	679	920	679	920	679	920
	39.9	43.3	84.2	88.7	79.9	113.5
	55.6	39.2	77.3	84.7	81.6	128.7
	26.2	37.1	79.2	80.6	84.1	111.2
	26.8	37.5	90.9	87.4	74.7	136.2
	26.5	37.6	90.5	87.1	69.8	111.6
<b>Average</b>	<b>35</b>	<b>38.94</b>	<b>84.42</b>	<b>85.7</b>	<b>78.02</b>	<b>120.24</b>

In this test, the time taken by Mac is almost twice the time taken by Dell.

**Lab to CMYK**

Memory Files	Dell 3GB		Mac 8GB		Mac 2 GB	
	679	920	679	920	679	920
	39	57.2	38	37.8	91.1	132.3
	37.4	50.2	40.6	40.5	87	134.2
	34.2	49.3	39.8	39.5	90.1	142.8
	33.9	46.8	44.5	46.2	86.6	145
	35.3	48.5	40	39.9	89.6	147.4
<b>Average</b>	<b>35.96</b>	<b>50.4</b>	<b>40.58</b>	<b>40.78</b>	<b>88.88</b>	<b>140.34</b>

As compared to the other tests, in this test the average time taken by Mac 8GB to open the 920 MB file is less than the time taken by the Dell 3 GB to open the same file.

**RGB to Grayscale**

Memory Files	Dell 3GB		Mac 8GB		Mac 2 GB	
	679	920	679	920	679	920
	23.2	22.9	19.3	37.8	36.5	27.7
	22	27	18.7	18.7	30.8	16.7
	22.1	27.4	18.7	18.4	30.6	16.8
	22.1	27.5	18.4	18.4	30.2	17
	22.1	27.7	18.8	18.4	30	16.6
<b>Average</b>	<b>22.3</b>	<b>26.5</b>	<b>18.78</b>	<b>22.34</b>	<b>31.62</b>	<b>18.96</b>

The difference between the average time taken by Dell 3 GB and Mac 8GB is becoming less in this test.

**8bits to 16 bits**

Memory Files	Dell 3GB		Mac 8GB		Mac 2 GB	
	679	920	679	920	679	920
	25.6	34.1	151.6	189.6	36.5	27.7
	29.4	37.7	130.2	191.2	30.8	16.7
	30.4	43.9	178.5	151.9	30.6	16.8
	25.8	35.1	183.3	263.8	30.2	17
	26.1	36	177.9	252.6	30	16.6
<b>Average</b>	<b>27.46</b>	<b>37.36</b>	<b>164.3</b>	<b>209.82</b>	<b>31.62</b>	<b>18.96</b>

Suprisingly, Mac 8 GB is taking even longer time than Mac 2 GB to do the s ame work.

**Appendix G**  
**Photoshop**

	150					150			
	512	Mac (GB Memory)				512	Dell (GB Memory)		
	2	4	6	8	2	2	2	3	
	0.9	0.8	0.4	0.4	0.4	0.4	0.2	0.3	0.2
	0.7	0.7	0.3	0.3	0.3	0.1	0.1	0.2	0.1
	0.6	0.7	0.3	0.3	0.3	0.1	0.1	0.2	0.1
	0.7	0.7	0.3	0.3	0.3	0.1	0.1	0.2	0.1
	0.6	0.7	0.3	0.3	0.3	0.1	0.1	0.2	0.1
	0.7	0.7	0.3	0.3	0.3	0.1	0.1	0.2	0.2
	0.7	0.7	0.3	0.3	0.3	0.1	0.1	0.2	0.2
	0.7	0.7	0.3	0.3	0.3	0.1	0.1	0.1	0.1
	0.6	0.7	0.3	0.3	0.3	0.1	0.1	0.1	0.1
<b>Average</b>	<b>0.69</b>	<b>0.71</b>	<b>0.31</b>	<b>0.31</b>	<b>0.31</b>	<b>0.13</b>	<b>0.11</b>	<b>0.19</b>	<b>0.13</b>

As memory increases the average opening time is less. The same case applies to Mac. However when memory is 4,6 and 8 GB in Mac the average opening time remains constant. Comparing Mac and Dell, the Dell computer with 3 GB memory is faster than the Mac with 4,6 or 8 GB.

	300					300			
	512	Mac (GB Memory)				512	Dell (GB Memory)		
	2	4	6	8	2	2	2	3	
	2.2	2	1	1	1	1	0.4	0.7	0.4
	1.8	1.7	1	1	1	1	0.3	0.5	0.4
	1.8	1.7	1	1	1	0.4	0.3	0.5	0.4
	1.8	1.7	1	1	1	0.4	0.3	0.5	0.4
	1.7	1.7	1	1.2	1	0.4	0.3	0.5	0.4
	1.7	1.7	1	1	1.2	0.4	0.3	0.8	0.4
	1.8	1.7	1	1	1	0.7	0.3	0.5	0.4
	1.7	1.7	1	1	1	0.4	0.3	0.5	0.4
	1.7	1.7	1	1	1	0.7	0.3	0.5	0.4
	1.7	1.7	1	1	1	0.4	0.3	0.5	0.4
<b>Average</b>	<b>1.79</b>	<b>1.73</b>	<b>1</b>	<b>1.02</b>	<b>1.02</b>	<b>0.58</b>	<b>0.31</b>	<b>0.55</b>	<b>0.4</b>

While opening the test file 300 the average time of all Dell computer seems to be better.

	450					450			
	512	Mac (GB Memory)				512	Dell (GB Memory)		
	2	4	6	8	2	2	2	3	
	4.8	4.6	2.6	2.6	2.6	2.34	0.7	1	0.9
	3.9	3.8	2.1	2.1	2.1	0.9	0.7	1	0.8
	3.9	3.8	2.1	2.1	2.1	0.9	0.7	1	0.8
	3.9	3.8	2.1	2.1	2.5	0.9	0.7	1	0.8
	3.9	3.8	2.1	2.7	2.7	0.9	0.7	1.4	0.9
	3.9	3.8	2.1	2.1	2.1	1.3	0.7	1	0.8
	3.9	3.8	2.6	2.1	2.7	0.9	0.7	1.6	0.9
	3.9	3.8	2.1	2.1	2.1	0.9	0.7	1	2.3
	3.9	3.6	2.1	2.1	2.1	1.3	0.7	1	0.8
	3.9	3.9	2.1	2.1	2.1	0.9	0.7	1	0.8
<b>Average</b>	<b>3.99</b>	<b>3.87</b>	<b>2.20</b>	<b>2.21</b>	<b>2.31</b>	<b>1.12</b>	<b>0.70</b>	<b>1.10</b>	<b>0.98</b>

In case of Mac the least time taken to open the 450 test file is by the one with 4GB memory. However the Dell computer took relatively very less time to open the same file. The one with 2 GB memory took the least time which is 0.70 sec. The two Dell computers with the same memory (2GB) surprisingly took different time to open the file.



512	600 Mac (GB Memory)				8	512	600 Dell (GB Memory)		
	2	4	6	8			2	2	3
9.7	8.5	4.3	4.3	4.3	3.9	1.3	2.6	1.5	
9.2	7.6	3.8	3.8	3.8	1.7	1.2	1.6	1.4	
8	7.3	3.8	3.8	3.8	1.8	1.2	2.9	1.5	
7.6	7.4	3.8	3.8	3.8	1.6	1.2	1.6	1.5	
7.5	7.6	3.8	4.6	4.3	1.6	1.2	2.2	1.6	
7.5	7.5	5	3.8	3.8	1.7	1.2	1.6	1.5	
7.4	7.4	3.8	4.3	4.3	1.6	1.2	2.2	1.5	
7.4	7.5	3.8	3.8	3.8	1.6	1.2	1.6	3.9	
7.7	7.5	3.8	4.9	4.8	1.7	1.2	2.9	1.4	
7.5	7.5	3.8	3.8	3.8	1.6	1.2	1.6	1.5	
<b>Average</b>	<b>7.95</b>	<b>7.58</b>	<b>3.97</b>	<b>4.09</b>	<b>4.05</b>	<b>1.88</b>	<b>1.21</b>	<b>2.08</b>	<b>1.73</b>

While opening the test file 600 Dell computer with even 2 GB did better performance than the Mac computer with 8 GB

**Illustrator**

2	150 Mac (GB Memory)			512	150 Dell (GB Memory)		
	4	6	8		2	2	3
2	2	1	2	1.41	2	1	
1	1	1	2	2	2	1	
1	1	1	1	1	1	1	
1	1	1	1	2	1	1	
1	1	1	1	2	1	1	
<b>Average</b>	<b>1.20</b>	<b>1.20</b>	<b>1.00</b>	<b>1.40</b>	<b>1.68</b>	<b>1.40</b>	<b>1.00</b>

Here, Mac with 6GB and Dell with 3 GB had the same performance. Mac with 8 GB had even worse performance than the Mac with 6 GB.

2	300 Mac (GB Memory)			512	300 Dell (GB Memory)		
	4	6	8		2	2	3
5	5	5	4	3	4	2	
4	4	4	4	3	4	2	
4	4	4	4	3	4	2	
4	4	3	3	2	3	2	
3.5	3	4	3	3	3	2	
<b>Average</b>	<b>4.1</b>	<b>4</b>	<b>4</b>	<b>3.6</b>	<b>2.8</b>	<b>3.6</b>	<b>2</b>

Here the performance of Mac with 8 GB was same as the performance of Dell with only 2 GB. However, Dell with 2 GB had the best performance.



		450			
		Mac (GB Memory)			
		2	4	6	8
		8	11	11	8
		8	7	8	8
		7	8	9	7
		8	8	9	7
		8	8	9	8
Average		7.80	8.40	9.20	7.60

		450		
		Dell (GB Memory)		
		2	2	3
512		5	8	4
		5.31	8	4.5
		5	7	4
		5	7	4
		5	8	6
Average		5.06	7.60	4.50

Dell with 3 GB had best performance than the Mac with relatively higher memory such as 4,6 and 8 GB

		600			
		Mac (GB Memory)			
		2	4	6	8
		15	18	19	14
		15	15	15	13
		14	14	14	13
		14	14	16	13
		14	14	14	13
		15	15	16	14
Average		14.50	15.00	15.67	13.33

		600		
		Dell (GB Memory)		
		2	2	3
512		9	14	7
		9	13	7
		10	13	7
		8	13	10
		9	13	8
		9	13	7
Average		9.00	13.17	7.67

Here, Dell with 2 GB had better performance than any others.

**Appendix H  
 Action Files**

Action No:		150 Mac (GB Memory)				150 Dell (GB Memory)				
		512	2	4	6	8	512	2	2	3
1	RGB to CMM		0.6	0.5	0.5	1.6	1.1	1.9	1.6	1.5
	SRGB working	not								
	space	done	1.2	0.5	0.5	0.7	1.1	1.9	0.7	1.4
			1.4	0.6	0.5	0.7	1	1.9	0.7	1.5
<b>Average</b>			<b>1.07</b>	<b>0.53</b>	<b>0.5</b>	<b>1</b>	<b>1.07</b>	<b>1.9</b>	<b>1</b>	<b>1.47</b>
<b>Note</b>		The performance of Dell with only 2 GB is equivalent to the Mac with 8 GB.								
2	Sharpen/Sharpen		0.4	0.1	0.3	0.5	0.1	0.2	0.5	0.1
			0.4	0.1	0.3	0.5	0.2	0.1	0.5	0.1
			0.2	0.1	0.3	0.5	0.2	0.1	0.5	0.1
	<b>Average</b>		<b>0.33</b>	<b>0.10</b>	<b>0.30</b>	<b>0.50</b>	<b>0.17</b>	<b>0.13</b>	<b>0.50</b>	<b>0.10</b>
<b>Note</b>		Mac with 4 GB did better than the Mac with 6 or 8 GB and the performance is equivalent to Dell with only 3 GB								
3	Sharpen/Unsharp		0.3	0.4	0.4	0.8	0.3	0.4	0.8	0.2
	Mask 50-1-0		0.3	0.4	0.4	0.9	0.3	0.3	0.9	0.2
			0.3	0.4	0.4	0.9	0.3	0.3	0.9	0.2
	<b>Average</b>		<b>0.3</b>	<b>0.4</b>	<b>0.4</b>	<b>0.87</b>	<b>0.3</b>	<b>0.33</b>	<b>0.87</b>	<b>0.2</b>
<b>Note</b>		Here the performance of Mac with 2 GB was equivalent to Dell with 512 MB								
4	Sharpen/Unsharp		0.7	0.7	0.7	1.5	0.5	0.6	1.5	0.4
	Mask 100,10,5		0.7	0.7	0.6	1.4	0.5	0.6	1.4	0.4
			0.7	0.6	0.5	1.3	0.4	0.6	1.3	0.4
	<b>Average</b>		<b>0.70</b>	<b>0.67</b>	<b>0.60</b>	<b>1.40</b>	<b>0.47</b>	<b>0.60</b>	<b>1.40</b>	<b>0.40</b>
<b>Note</b>		Dell with 3 GB did better performance than the Mac with 8 GB which did even worse then Mac with relatively less memory.								
5	Sharpen/Unsharp		0.5	0.4	0.4	0.8	0.3	0.5	0.8	0.3
	Mask 50,3,7		0.5	0.4	0.4	0.9	0.4	0.5	0.9	0.3
			0.5	0.4	0.3	0.9	0.3	0.5	0.9	0.2
	<b>Average</b>		<b>0.50</b>	<b>0.40</b>	<b>0.37</b>	<b>0.87</b>	<b>0.33</b>	<b>0.50</b>	<b>0.87</b>	<b>0.27</b>
<b>Note</b>		Dell with 3 GB had better performance.								
6	Image/Rotate/ Arbitrary 9 degrees		0.7	0.5	0.5	1.1	0.6	0.7	1.1	0.5
			0.6	0.5	0.5	1	0.6	0.7	1	0.5
			0.6	0.5	0.5	1.1	0.5	0.7	1.1	0.4
	<b>Average</b>		<b>0.63</b>	<b>0.5</b>	<b>0.5</b>	<b>1.07</b>	<b>0.57</b>	<b>0.70</b>	<b>1.07</b>	<b>0.47</b>
<b>Note</b>		Here, 512MB Dell was almost equivalent to 4GB Mac. 3GB Dell had the better performance in this case.								
7	Rotate Arbitrary 44 degrees		1	0.7	0.7	1.3	0.7	0.9	1.3	0.6
			0.1	0.6	0.6	1.3	0.7	0.8	1.3	0.6
			0.1	0.6	0.7	1.3	0.7	0.9	1.3	0.6
	<b>Average</b>		<b>0.40</b>	<b>0.63</b>	<b>0.67</b>	<b>1.30</b>	<b>0.70</b>	<b>0.87</b>	<b>1.30</b>	<b>0.60</b>
<b>Note</b>		Here Mac with 2 GB had the better performance than the Dell and the Mac with higher memory.								
8	Image/Rotate/ Arbitrary/90degrees		0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.1
			0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.1
			0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	<b>Average</b>		<b>0.10</b>	<b>0.10</b>	<b>0.10</b>	<b>0.17</b>	<b>0.10</b>	<b>0.10</b>	<b>0.17</b>	<b>0.10</b>
<b>Note</b>		Mac with 2,4, 6 GB 1and Dell with 512MB, 2, 3 GB all had the same performance								



9	Filter/Blur/Gaussian	0.2	0.2	0.2	0.6		0.2	0.3	0.6	0.2
	Blur/0.5	0.2	0.2	0.2	0.6	0.2	0.2	0.2	0.6	0.2
		0.2	0.2	0.2	0.6	0.2	0.2	0.2	0.6	0.2
	<b>Average</b>	<b>0.20</b>	<b>0.20</b>	<b>0.20</b>	<b>0.60</b>	<b>0.20</b>	<b>0.23</b>	<b>0.60</b>	<b>0.20</b>	<b>0.20</b>

**Note** Dell with 512MB and 3 GB did equal performance as the Mac with 2,3 and 4 GB.

10	Filter/Blur/Gaussian	0.6	0.5	0.50	1.1		0.4	0.5	1.1	0.3
	Blur/5	0.6	0.5	0.5	1.2	0.4	0.5	0.5	1.2	0.3
		0.6	0.5	0.5	1.1	0.4	0.5	0.5	1.1	0.3
	<b>Average</b>	<b>0.60</b>	<b>0.50</b>	<b>0.50</b>	<b>1.13</b>	<b>0.40</b>	<b>0.50</b>	<b>1.13</b>	<b>0.30</b>	<b>0.30</b>

**Note** Dell with 3GB had the best performance in this case

11	Image/Image		0.3	0.3	0.6	0.2	0.2	0.6	0.1
	Size/75PPI		0.3	0.3	0.6	0.2	0.2	0.6	0.1
			0.3	0.2	0.6	0.2	0.2	0.6	0.1
	<b>Average</b>		<b>0.30</b>	<b>0.27</b>	<b>0.60</b>	<b>0.20</b>	<b>0.20</b>	<b>0.60</b>	<b>0.10</b>

**Note** Dell with 512MB and 2 GB had the same performance. Dell 3GB had the best performance among all of the Mac and Dell.

Action No:		150 Mac (GB Memory)				150 Dell (GB Memory)				
		512	2	4	6	8	512	2	2	3
12	Image/Image	not	0.9	0.4	0.4	0.3	0.2	0.1	0.3	0.1
	Size/150PPI	done	0.7	0.3	0.3	0.2	0.2	0.1	0.2	0.1
			0.7	0.3	0.3	0.2	0.2	0.2	0.2	0.1
	<b>Average</b>		<b>0.77</b>	<b>0.33</b>	<b>0.33</b>	<b>0.23</b>	<b>0.20</b>	<b>0.13</b>	<b>0.23</b>	<b>0.10</b>

**Note** Dell with 3 GB is better among all of them

13	Image/Image	5.9	2.7	2.8	5.9	1.8	2.4	5.9	1.7
	Resize/600PPI	8.5	3.7	3.7	6.3	1.8	2.4	6.3	8.3
		10	4.2	4.1	7.6	1.8	2.3	7.6	11.2
	<b>Average</b>	<b>8.13</b>	<b>3.53</b>	<b>3.53</b>	<b>6.60</b>	<b>1.80</b>	<b>2.37</b>	<b>6.60</b>	<b>7.07</b>

**Note** Amazingly Dell with only 512MB did better than the Dell and Mac with higher memory.

14	Filter/Render/Lighting	1	0.8	0.9		0.4	0.6		2.1
	Effects/Spotlight	0.9	0.7	0.7		0.4	0.5		1.6
	Default	0.9	0.6	0.7		0.4	0.5		0.7
	<b>Average</b>	<b>0.93</b>	<b>0.70</b>	<b>0.77</b>		<b>0.40</b>	<b>0.53</b>		<b>1.47</b>

**Note** In this case, Dell with 512 MB did better than the Mac and the Dell with higher memory

15	Filter Noise/	0.3	0.2	0.2	1.1	0.6	1	1.1	0.6
	Despeckle/Default	0.5	0.4	0.4	1	0.6	1	1	0.7
		0.7	0.4	0.4	1.1	0.6	0.9	1.1	0.6
	<b>Average</b>	<b>0.50</b>	<b>0.33</b>	<b>0.33</b>	<b>1.07</b>	<b>0.60</b>	<b>0.97</b>	<b>1.07</b>	<b>0.63</b>

**Note** In this case, Mac with 4, 6 GB memory had better performance than the Dell

16	Filter/Artistic/	9.1	6.5	6.4		7.1	7		7.1
	Watercolor/7,5,1	9.1	6.2	6.4		7.2	7		8.1
		9.1	6.3	6.2		7.1	7		7
	<b>Average</b>	<b>9.10</b>	<b>6.33</b>	<b>6.33</b>		<b>7.13</b>	<b>7.00</b>		<b>7.40</b>

**Note** Here, Mac with 4 and 6 GB did better than the Dell with 512, 2, 3 GB

17	Filter/Pixellate/	3.6	3	3		2.5	4.4		1.7
	Pointellize/5	3.6	3	2.9		2.5	4.6		1.7
		3.6	2.9	3		2.5	4.5		1.7
	<b>Average</b>	<b>3.60</b>	<b>2.97</b>	<b>2.97</b>		<b>2.50</b>	<b>4.50</b>		<b>1.70</b>

**Note**





18	Image/Mode/Convert to Profile/ SRGB to Adobe RGB	0.3	0.3	0.2	0.4	0.6	1	0.4	0.6
		0.3	0.2	0.2	0.4	0.5	1	0.4	0.6
		0.3	0.2	0.3	0.3	0.6	1	0.3	0.6
	<b>Average</b>	<b>0.3</b>	<b>0.23</b>	<b>0.23</b>	<b>0.37</b>	<b>0.57</b>	<b>1</b>	<b>0.37</b>	<b>0.6</b>

**Note** Mac with 4,6 GB did better than the Dell

19	Filter/Noise/Dust & Scratches/1,20	0.7	0.8	0.8	1.9	0.9	1.6	1.9	0.5
		0.7	0.8	0.9	1.9	0.9	1.6	1.9	0.5
		0.7	0.8	0.9	1.9	0.9	1.6	1.9	0.5
	<b>Average</b>	<b>0.70</b>	<b>0.80</b>	<b>0.87</b>	<b>1.90</b>	<b>0.90</b>	<b>1.60</b>	<b>1.90</b>	<b>0.50</b>

**Note** Dell with 3 GB did better. In case of Mac the one with lower memory is better than the one with the higher memory in this case.

Action No:		300 Mac (GB Memory)				300 Dell (GB Memory)				
		512	2	4	6	8	512	2	2	3
1	RGB to CMM SRGB working space	not done	2.4	1.8	1.9	2	4	7.2	2	5.6
		done	2.5	1.9	1.9	1.9	3.9	7.2	1.9	5.6
			2.5	1.8	1.8	1.9	3.8	7	1.9	5.6
	<b>Average</b>		<b>2.47</b>	<b>1.83</b>	<b>1.87</b>	<b>1.93</b>	<b>3.90</b>	<b>7.13</b>	<b>1.93</b>	<b>5.60</b>
2	Sharpen/Sharpen		0.5	0.4	0.4	1.1	0.4	0.4	1.1	0.3
			0.5	0.4	0.4	1.1	0.4	0.4	1.1	0.3
			0.5	0.4	0.4	1.1	0.4	0.4	1.1	2.7
	<b>Average</b>		<b>0.50</b>	<b>0.40</b>	<b>0.40</b>	<b>1.10</b>	<b>0.40</b>	<b>0.40</b>	<b>1.10</b>	<b>1.10</b>
3	Sharpen/Unsharp Mask 50-1-0		0.9	0.6	0.7	2.6	4.8	1.1	2.6	2.4
			1.7	1.3	1.3	2.8	5.3	1.1	2.8	3.2
			3.2	1.2	0.9	2.8	5.8	1.1	2.8	3.3
	<b>Average</b>		<b>1.93</b>	<b>1.03</b>	<b>0.97</b>	<b>2.73</b>	<b>5.30</b>	<b>1.10</b>	<b>2.73</b>	<b>2.97</b>
4	Sharpen/Unsharp Mask 100,10,5		4.1	2.8	2.8	5.5	8.1	2.2	5.5	5.2
			4.5	3	2.9	5.6	9.8	2.2	5.6	5.1
			5.6	2.8	2.8	3.4	7.4	2.2	3.4	5.3
	<b>Average</b>		<b>4.73</b>	<b>2.87</b>	<b>2.83</b>	<b>4.83</b>	<b>8.43</b>	<b>2.20</b>	<b>4.83</b>	<b>5.20</b>
5	Sharpen/Unsharp Mask 50,3,7		4.2	2.2	1.9	3.4	5.8	1.5	3.4	4.1
			3.9	2.2	1.9	3.4	5.8	1.7	3.4	4
			4.2	2.2	1.9	3.3	6	1.7	3.3	4.1
	<b>Average</b>		<b>4.10</b>	<b>2.20</b>	<b>1.90</b>	<b>3.37</b>	<b>5.87</b>	<b>1.63</b>	<b>3.37</b>	<b>4.07</b>
6	Image/Rotate/Arbitrary 9 degrees		5.8	2.9	2.4	4.2	7.4	2.9	4.2	5.2
			5.4	3	2.5	4.4	7.1	2.9	4.4	3.8
			6	3	2.5	5	5.7	2.9	5	3.7
	<b>Average</b>		<b>5.73</b>	<b>2.97</b>	<b>2.47</b>	<b>4.53</b>	<b>6.73</b>	<b>2.90</b>	<b>4.53</b>	<b>4.23</b>
7	Rotate Arbitrary 44 degrees		8.8	4.1	3.7	6.9	7	3.6	6.9	4.9
			7.3	3.9	4.7	6.8	6.7	3.7	6.8	4.8
			7.4	5.4	6.1	7.2	7.1	3.6	7.2	4.9
	<b>Average</b>		<b>7.83</b>	<b>4.47</b>	<b>4.83</b>	<b>6.97</b>	<b>6.93</b>	<b>3.63</b>	<b>6.97</b>	<b>4.87</b>
8	Image/Rotate/Arbitrary/90degrees		7.3	2.8	3.8	3.8	3	0.2	3.8	1.8
			7.3	2.6	3.7	3.4	2.8	0.2	3.4	1.7
			7.4	2.8	3.8	3.5	2.7	0.3	3.5	1.7
	<b>Average</b>		<b>7.33</b>	<b>2.73</b>	<b>3.77</b>	<b>3.57</b>	<b>2.83</b>	<b>0.23</b>	<b>3.57</b>	<b>1.73</b>
9	Filter/Blur/Gaussian Blur/0.5		5.3	2.8	3.1	2.8	4.1	0.7	2.8	2.2
			5	2.6	3	3.2	4.1	0.7	3.2	2.2



		4.9	2.8	3	3.5	3.9	0.7	3.5	2.3
	<b>Average</b>	<b>5.07</b>	<b>2.73</b>	<b>3.03</b>	<b>3.17</b>	<b>4.03</b>	<b>0.70</b>	<b>3.17</b>	<b>2.23</b>
10	Filter/Blur/Gaussian	7.8	3.7	3.8	6.3	9.1	1.8	6.3	3.4
	Blur/5	6.2	3.6	3.7	6.1	6.4	1.8	6.1	3.5
		6.1	4	4	6.4	6.5	1.8	6.4	3.6
	<b>Average</b>	<b>6.70</b>	<b>3.77</b>	<b>3.83</b>	<b>6.27</b>	<b>7.33</b>	<b>1.80</b>	<b>6.27</b>	<b>3.50</b>
11	Image/Image		0.6	0.6	1.3	1	0.7	1.3	0.6
	Size/75PPI		0.6	0.5	1.2	1	0.7	1.2	0.6
				0.6				1.3	
	<b>Average</b>		<b>0.60</b>	<b>0.57</b>	<b>1.25</b>	<b>1.00</b>	<b>0.70</b>	<b>1.27</b>	<b>0.60</b>
12				1.1				1.9	
	Size/150PPI		0.5	0.7	1.9	0.5	0.8	1.9	0.9
	not done		0.5	0.5	1.8	0.5	0.8	1.8	1
	<b>Average</b>		<b>0.50</b>	<b>0.77</b>	<b>1.85</b>	<b>0.50</b>	<b>0.80</b>	<b>1.85</b>	<b>0.95</b>
13	Image/Image	3.8	14.8	7.7	13.3	12.5	3	13.3	7.8
	Resize/600PPI	20.9	12.3	13	16.3	12.1	3	16.3	8
		27.7	14.6	15.5	15.1	13.8	3	15.1	9.1
	<b>Average</b>	<b>17.47</b>	<b>13.90</b>	<b>12.07</b>	<b>14.90</b>	<b>12.80</b>	<b>3.00</b>	<b>14.90</b>	<b>8.30</b>

Action No:	300 Mac (GB Memory)					300 Dell (GB Memory)			
	2	4	6	8	512	2	2	3	
14	Filter/Render/Lighting	9.2	4.6	4.8		4.8	1.9		8.8
	Effects/Spotlight	9.2	5	5		5	1.9		8.7
	Default	9.2	3.9	4		5	1.9		2.7
	<b>Average</b>	<b>9.20</b>	<b>4.50</b>	<b>4.60</b>		<b>4.93</b>	<b>1.90</b>		<b>6.73</b>
15	Filter Noise/	5.7	2.6	2.6	3.7	5.5	3.6	3.7	2.4
	Despeckle/Default	4.5	3	2.4	3.8	5	3.6	3.8	2.9
		4.1	2.7	2.7	3.8	5.7	3.6	3.8	2.8
	<b>Average</b>	<b>4.77</b>	<b>2.77</b>	<b>2.57</b>	<b>3.77</b>	<b>5.40</b>	<b>3.60</b>	<b>3.77</b>	<b>2.70</b>
16	Filter/Artistic/	39.9	26.9	27.3		30.7	27.4		26.7
	Watercolor/7,5,1	40.3	27.1	27.2		35.6	27.4		26.7
		39.9	27.3	27.4		31	27.4		27.9
	<b>Average</b>	<b>40.03</b>	<b>27.10</b>	<b>27.30</b>		<b>32.43</b>	<b>27.40</b>		<b>27.10</b>
17	Filter/Pixellate/	20.8	13.8	14.9		13.7	17.9		11.1
	Pointellize/5	21.5	13.7	15.2		13.6	17.9		10.6
		20.6	14	14.5		15.5	17.9		10
	<b>Average</b>	<b>20.97</b>	<b>13.83</b>	<b>14.87</b>		<b>14.27</b>	<b>7.90</b>		<b>10.57</b>
18	Image/Mode/Convert	4.8	1.9	2.4	2	5	3.8	2	4.9
	to Profile/ SRGB to	4.7	1.8	2.3	1.5	5.1	3.7	1.5	3.7
	Adobe RGB	4.1	2.2	2.3	1.4	5.1	3.8	1.4	3.8
	<b>Average</b>	<b>4.53</b>	<b>1.97</b>	<b>2.33</b>	<b>1.63</b>	<b>5.07</b>	<b>3.77</b>	<b>1.63</b>	<b>4.13</b>
19	Filter/Noise/Dust	5.5	3.9	5.1	7.3	4.2	6	7.3	3.3
	& Scratches/1,20	7.5	3.9	5.8	7.5	4.8	6	7.5	3.4
		7	4.2	5.7	7.3	4.8	5.9	7.3	3.4
	<b>Average</b>	<b>6.67</b>	<b>4.00</b>	<b>5.53</b>	<b>7.37</b>	<b>4.60</b>	<b>5.97</b>	<b>7.37</b>	<b>3.37</b>



Action No:		450 Mac (GB Memory)				450 Dell (GB Memory)				
		512	2	4	6	8	512	2	2	3
1	RGB to CMM		5.3	3.9		4.2	8.7	16	4.2	12.4
	SRGB working space	not done	5.3	3.9		4.2	8.7	16	4.2	12.4
			5.3	3.9		4.5	8.9	16	4.5	17.6
	<b>Average</b>		<b>5.30</b>	<b>3.90</b>		<b>4.30</b>	<b>8.77</b>	<b>16.00</b>	<b>4.30</b>	<b>14.13</b>
2	Sharpen/Sharpen		6.2	1.7		3.9	7	0.8	3.9	5.3
			6.9	4.6		3.4	8.4	0.6	3.4	3.5
			5.8	4.9		5.6	14.8	0.6	5.6	6.8
	<b>Average</b>		<b>6.30</b>	<b>3.73</b>		<b>4.30</b>	<b>10.07</b>	<b>0.67</b>	<b>4.30</b>	<b>5.20</b>
3	Sharpen/Unsharp		6.4	4.7		6.5	13.3	2.3	6.5	8.1
	Mask 50-1-0		9.3	5.6		6.6	14.3	2.5	6.6	8
			10.9	5.8		6.3	11.3	2.4	6.3	8
	<b>Average</b>		<b>8.87</b>	<b>5.37</b>		<b>6.47</b>	<b>12.97</b>	<b>2.40</b>	<b>6.47</b>	<b>8.03</b>
4	Sharpen/Unsharp		15.7	8.7		12.9	15.7	4.9	12.9	13.6
	Mask 100,10,5		16	8.8		13	20.4	4.9	13	14
			15.8	8.5		12.8	20.2	5.1	12.8	13.9
	<b>Average</b>		<b>15.83</b>	<b>8.67</b>		<b>12.90</b>	<b>18.77</b>	<b>4.97</b>	<b>12.90</b>	<b>13.83</b>
5	Sharpen/Unsharp		8.7	5.6		7.7	13	3.6	7.7	8.8
	Mask 50,3,7		8.7	5.7		8.4	13	3.6	8.4	6
			8.8	5.8		9.2	15.1	3.8	9.2	5.7
	<b>Average</b>		<b>8.73</b>	<b>5.70</b>		<b>8.43</b>	<b>13.70</b>	<b>3.67</b>	<b>8.43</b>	<b>6.83</b>
6	Image/Rotate/		17.3	8.7		11.7	14	6.6	11.7	8.3
	Arbitrary 9 degrees		17.2	8.5		11.6	14	6.6	11.6	8.1
			17.3	8.4		11.5	14.1	6.6	11.5	8.1
	<b>Average</b>		<b>17.27</b>	<b>8.53</b>		<b>11.60</b>	<b>14.03</b>	<b>6.60</b>	<b>11.60</b>	<b>8.17</b>
7	Rotate Arbitrary		22.8	12.4		16.1	18.3	8.1	16.1	10.9
	44 degrees		14.8	12.5		15.9	18	8.1	15.9	10.7
			15.1	12.5		16.4	18	8.1	16.4	13.8
	<b>Average</b>		<b>17.57</b>	<b>12.47</b>		<b>16.13</b>	<b>18.10</b>	<b>8.10</b>	<b>16.13</b>	<b>11.80</b>
8	Image/Rotate/		13.7	7.3		8.5	8.4	0.4	8.5	4.3
	Arbitrary/90degrees		14.8	7.3		9.1	12.5	0.4	9.1	4
			15.1	7.8		9.4	8.9	0.5	9.4	4.2
	<b>Average</b>		<b>14.53</b>	<b>7.47</b>		<b>9.00</b>	<b>9.93</b>	<b>0.43</b>	<b>9.00</b>	<b>4.17</b>
9	Filter/Blur/Gaussian		11.2	7.5		8.2	9.5	1.3	8.2	4.9
	Blur/0.5		12	7.9		8.4	9.7	1.4	8.4	4.9
			11.9	7.6		8.4	9.7	1.5	8.4	4.5
	<b>Average</b>		<b>11.70</b>	<b>7.67</b>		<b>8.33</b>	<b>9.63</b>	<b>1.40</b>	<b>8.33</b>	<b>4.77</b>
10	Filter/Blur/Gaussian		19.4	8.5		14.1	15.5	3.9	14.1	7.9
	Blur/5		18.5	9.2		13.9	15	4	13.9	7.9
			18.1	9.3		13.5	14.8	4.1	13.5	7.9
	<b>Average</b>		<b>18.67</b>	<b>9.00</b>		<b>13.83</b>	<b>15.10</b>	<b>4.00</b>	<b>13.83</b>	<b>7.90</b>
11	Image/Image			0.8		2.1	1.5	1.3	2.1	1.1
	Size/75PPI			0.9		2	1.6	1.3	2	1
			0.8						2.1	



Action No:		450 Mac (GB Memory)					450 Dell (GB Memory)			
		512	2	4	6	8	512	2	2	3
12	RGB to CMM	not done	2.3	3.9		4.2	8.7	16	3.2	12.4
	Size/150PPI		3.9	1.4		3.2	2.8	2.2	3.2	1.8
			2.4	1.4		3.1	2.7	2.2	3.1	1.9
	<b>Average</b>		<b>2.87</b>	<b>2.23</b>		<b>3.50</b>	<b>4.73</b>	<b>6.80</b>	<b>3.17</b>	<b>5.37</b>
13	Image/Image		22.9	13.2		16.1	16.2	3.7	16.1	8.7
	Resize/600PPI		25.8	15		16.1	15.7	3.8	16.1	8.5
			27.9	14.8		14.2	15.4	3.7	14.2	8.6
	<b>Average</b>		<b>25.53</b>	<b>14.33</b>		<b>15.47</b>	<b>15.77</b>	<b>3.73</b>	<b>15.47</b>	<b>8.60</b>
14	Filter/Render/Lighting		18.2	9.6			10.9	4.1		6.2
	Effects/Spotlight		18.8	10.3			10.7	4.1		6.1
	Default		18.4	9.6			10.8	4.1		5.1
	<b>Average</b>		<b>18.47</b>	<b>9.83</b>			<b>10.80</b>	<b>4.10</b>		<b>5.80</b>
15	Filter Noise/		10.4	6.8		8.6	10.1	7.7	8.6	5.2
	Despeckle/Default		8	4.4		8.9	7.4	7.7	8.9	5.2
			7.9	4.4		9.3	6.8	7.5	9.3	7.8
	<b>Average</b>		<b>8.77</b>	<b>5.20</b>		<b>8.93</b>	<b>8.10</b>	<b>7.63</b>	<b>8.93</b>	<b>6.07</b>
16	Filter/Artistic/		90.2	58.6			65.1	60.4		62.8
	Watercolor/7,5,1		91.7	59.4			68.1	60.2		61.8
			90.8	58.2			67.9	60.3		60.8
	<b>Average</b>		<b>90.90</b>	<b>58.73</b>			<b>67.03</b>	<b>60.30</b>		<b>61.80</b>
17	Filter/Pixelate/		45.9	32.8			41.1	40.1		22.5
	Pointellize/5		41.5	35.1			37.6	40.1		19.7
			41.7	35.1			33.1	40.3		19.9
	<b>Average</b>		<b>43.03</b>	<b>34.33</b>			<b>37.27</b>	<b>40.17</b>		<b>20.70</b>
18	Image/Mode/Convert		8.3	5.7		5.7	7.3	8.5	5.7	8.1
	to Profile/ SRGB to		7.4	3.5		5.7	7.3	8.5	5.7	8.2
	Adobe RGB		7.1	3.4		5.2	6.6	8.5	5.2	8.1
	<b>Average</b>		<b>7.60</b>	<b>4.20</b>		<b>5.53</b>	<b>7.07</b>	<b>8.50</b>	<b>5.53</b>	<b>8.13</b>
19	Filter/Noise/Dust		9.8	7.6		16.6	11.1	12.8	16.6	7
	& Scratches/1,20		11	7.6		16.9	10.5	12.8	16.9	7
			11.1	7.7		17.1	10.2	12.6	17.1	6.9
	<b>Average</b>		<b>10.63</b>	<b>7.63</b>		<b>16.87</b>	<b>10.60</b>	<b>12.73</b>	<b>16.87</b>	<b>6.97</b>

Action No:		600 Mac (GB Memory)					600 Dell (GB Memory)			
		512	2	4	6	8	512	2	2	3
1	RGB to CMM			6.8		7.6	15.1	28.1	7.6	21.5
	SRGB working space			9.3		10.6	15.2	28.1	10.6	30.1
		not done	not done	6.8		11.1	38.4	27.9	11.1	30.3
	<b>Average</b>			<b>7.63</b>		<b>9.77</b>	<b>22.90</b>	<b>28.03</b>	<b>9.77</b>	<b>27.30</b>
	<b>Note</b>	Among all of them Mac with 4 GB did better								
2	Sharpen/Sharpen			6.9		6.4	17.3	1.4	6.4	13
				5.6		10.2	19.7	1.4	10.2	18.9
				9.9		10	25.8	1.4	10	12.2
	<b>Average</b>			<b>7.47</b>		<b>8.87</b>	<b>20.93</b>	<b>1.40</b>	<b>8.87</b>	<b>14.70</b>



3	Sharpen/Unsharp Mask 50-1-0	10	11	21.1	4.2	11	13.6
		10	11.1	27	4.1	11.1	13.7
		9.9	10.9	27	4.2	10.9	13.8
	<b>Average</b>	<b>9.97</b>	<b>11.00</b>	<b>25.03</b>	<b>4.17</b>	<b>11.00</b>	<b>13.70</b>
4	Sharpen/Unsharp Mask 100,10,5	15.9	24.2	43.1	8.4	24.2	23.7
		15.8	24.3	40.8	8.7	24.3	23.7
		16	24.3	35.9	8.7	24.3	23.8
	<b>Average</b>	<b>15.90</b>	<b>24.27</b>	<b>39.93</b>	<b>8.60</b>	<b>24.27</b>	<b>23.73</b>
5	Sharpen/Unsharp Mask 50,3,7	10	13.9	15.7	6.4	13.9	10
		11.1	12.1	14.1	6.2	12.1	9.9
		11.1	14.1	13.9	6.3	14.1	9.8
	<b>Average</b>	<b>10.73</b>	<b>13.37</b>	<b>14.57</b>	<b>6.30</b>	<b>13.37</b>	<b>9.90</b>
<b>Note</b>	In these test 2,3,4,5 and 6 the Dell with 2 GB was better than the rest of them with higher memory						
6	Image/Rotate/ Arbitrary 9 degrees	15.3	18.6	23.9	11.6	18.6	14.9
		14.6	19.2	24.1	11.6	19.2	15
		16.2	19.6	24.4	11.6	19.6	15.1
	<b>Average</b>	<b>15.37</b>	<b>19.13</b>	<b>24.13</b>	<b>11.60</b>	<b>19.13</b>	<b>15.00</b>
<b>Note</b>	Dell with 3 GB did better than the others. However Mac with 4 GB almost had the same performance						
7	Rotate Arbitrary 44 degrees	20.2	28.3	31.5	14.3	28.3	19.5
		22.1	27.7	39.9	14.3	27.7	24.9
		22.4	28.1	39.1	14.2	28.1	19.6
	<b>Average</b>	<b>21.57</b>	<b>28.03</b>	<b>36.83</b>	<b>14.27</b>	<b>28.03</b>	<b>21.33</b>
8	Image/Rotate/ Arbitrary/90degrees	13.6	14.2	14.9	0.7	14.2	7.2
		13.7	14.2	14.9	0.7	14.2	7.4
		13.2	13.6	16.1	0.7	13.6	6.7
	<b>Average</b>	<b>13.5</b>	<b>14</b>	<b>15.3</b>	<b>0.7</b>	<b>14</b>	<b>7.1</b>
<b>Note</b>	In test 7, 8 the Dell with 2 GB had better performance than any other						
9	Filter/Blur/Gaussian Blur/0.5	11.5	12.7	12.5	2.4	12.7	8.3
		11.7	12.2	12.5	2.4	12.2	8.2
		11.2	12	11.9	2.4	12	8.2
	<b>Average</b>	<b>11.47</b>	<b>12.30</b>	<b>12.30</b>	<b>2.40</b>	<b>12.30</b>	<b>8.23</b>
<b>Note</b>	Dell with 2 GB took only 2.40 sec to perform this task which is very less as compared to others						
10	Filter/Blur/Gaussian Blur/5	15.8	23.6	25.2	6.9	23.6	14
		16	21.4	25.1	7.1	21.4	14
		16	23.5	25.4	6.9	23.5	14.2
	<b>Average</b>	<b>15.93</b>	<b>22.83</b>	<b>25.23</b>	<b>6.97</b>	<b>22.83</b>	<b>14.07</b>
<b>Note</b>	In this case the Dell with 2 GB did better than the others						
11	Image/Image Size/75PPI	1.1	2.9	1.9	1.8	2.9	1.5
		1.1	2.9	2.2	1.8	2.9	1.4
						2.9	
	<b>Average</b>	<b>11.1</b>	<b>2.9</b>	<b>2.05</b>	<b>1.8</b>	<b>2.9</b>	<b>1.45</b>
<b>Note</b>	Again the Dell with 2 GB had the better performance than the other Dell and Mac with higher memory						



Action No:		600 Mac (GB Memory)				600 Dell (GB Memory)				
		512	2	4	6	8	512	2	2	3
12	Image/Image			1.5		4.1	3.7	3.2	4.1	2.5
	Size/150PPI	not done	not done	1.9		4.1	3.4	3.2	4.1	2.5
				1.9		4.2	3.6	3.2	4.2	2.6
	<b>Average</b>			<b>1.77</b>		<b>4.13</b>	<b>3.57</b>	<b>3.20</b>	<b>4.13</b>	<b>2.53</b>
	<b>Note</b>	Here the Mac with 4 GB did better than the Mac with higher memory or the Dell with lower memory.								
13	Image/Image			24		12.9	14.5	1.2	12.9	7.4
	Resize/600PPI			23.7		13.7	15.5	1.3	13.7	7.8
				21.5		13.8	15.2	1.3	13.8	7.7
	<b>Average</b>			<b>23.07</b>		<b>13.47</b>	<b>15.07</b>	<b>1.27</b>	<b>13.47</b>	<b>7.63</b>
14	Filter/Render/Lighting			16.4			18.2	7.1		10.7
	Effects/Spotlight			16			18.1	7.1		8
	Default			12.1			11.7	7.3		8.2
	<b>Average</b>			<b>14.83</b>			<b>16.00</b>	<b>7.17</b>		<b>8.97</b>
15	Filter Noise/			7.3		12.4	13.8	13.3	12.4	8.2
	Despeckle/Default			7.4		12.7	13.8	13.3	12.7	10.7
				11		12.6	16.9	13.3	12.6	8.9
	<b>Average</b>			<b>8.57</b>		<b>12.57</b>	<b>14.83</b>	<b>13.30</b>	<b>12.57</b>	<b>9.27</b>
	<b>Note</b>	In test 14 and 15 the Dell with 2 GB did better than the others								
16	Filter/Artistic/			104.8			117.7	105		103.4
	Watercolor/7,5,1			104.6			117.5	105		100.7
				103.4			111.4	105		101.2
	<b>Average</b>			<b>104.27</b>			<b>115.53</b>	<b>105.00</b>		<b>101.77</b>
	<b>Note</b>	Here Dell with 3 GB did better than others. However, Mac with 4 GB almost had the same performance.								
17	Filter/Pixelate/			55.7			64.2	71.3		39
	Pointellize/5			55.8			64.3	87.8		35.5
				56.1			58.1	71.1		35.7
	<b>Average</b>			<b>55.87</b>			<b>62.20</b>	<b>76.73</b>		<b>36.73</b>
	<b>Note</b>	Dell with 3 GB had better performance than any others								
18	Image/Mode/Convert			6.4		11	14.6	15	11	13.4
	to Profile/ SRGB to			6.4		7.4	14.3	14.9	7.4	13.3
	Adobe RGB			6.4		7.8	13	15	7.8	13.3
	<b>Average</b>			<b>6.40</b>		<b>8.73</b>	<b>13.97</b>	<b>14.97</b>	<b>8.73</b>	<b>13.33</b>
	<b>Note</b>	Here, Mac with 4 GB had the best performance than any other								
19	Filter/Noise/Dust			12.7		27.2	19.5	21.9	27.2	11
	& Scratches/1,20			12.6		27.5	17.8	22	27.5	11
				12.8		27.4	18.6	21.9	27.4	11
	<b>Average</b>			<b>12.70</b>		<b>27.37</b>	<b>18.63</b>	<b>21.93</b>	<b>27.37</b>	<b>11.00</b>
	<b>Note</b>	Here the Dell with 3 GB had the best performance. However, Mac with 4 GB almost had the same performance.								

## Appendix I

### Editor's Comments on the G5 Benchmarking

Roshita Mukhia dedicated about two months to carefully benchmarking the Mac G5 and the two Dell computers. We now have reams of useful data on the performance of both PC and Mac platforms.

Roshita Mukhia said that she likes the Mac G5, and we all definitely feel it is by far the best design as a piece of furniture in the office.

But if you want to save your employees expensive time, and if you want to get digital imaging jobs done more quickly, now you know why more individuals and companies are switching to PC. FLAAR used to use both Mac and PC but as the Macs age and wear out we are replacing them with Dell computers at both the universities where we do digital imaging projects.

It will take a while before we can move all the benchmarking data into an appendix. So in this preliminary version I quote just the highlights. In essence the Mac does okay on some things, was a tad faster than the Dell on a few functions, but the Dell was faster on more than any of us expected. Keep in mind that Dell is not yet 64-bit.

Below are some of the comments by Ms Mukhia. This is based on a test using a panorama photograph of 679 MB and another of 920 MB file size. FLAAR has a digital camera capable of achieving these file sizes in rotating panoramic mode.

The time taken by Dell to open 920 MB file is less than the time taken by both the Mac to open even the smaller file 679.

The time taken by Dell to open 920 MB file is less than the time taken by both the Mac to open even the smaller file 679.

The most embarrassing result is "The time taken by Dell 3 GB to open large file 920 MB is less than the time taken by even 8 GB Mac to open the small file 679 MB." Ouch, and the Mac G5 is supposed to be the world's fastest computer?

As compared to the other tests, in this test the average time taken by Mac 8GB to open the 920 MB file is less than the time taken by the Dell 3 GB to open the same file.

### Potential Follow-up Projects

As a follow-up to this study, we would be interested in knowing if the new Mac G5 runs Adobe products faster, or is faster in video editing, than a PC using the Windows platform. We have a particular interest in this, because Bowling Green State University is a world center for professional training in Media 100 digital video editing software. The College of Technology also does every imaginable kind of video editing as part of its Visual Communications Technology programs. VCT is the "parent" of the Center for Applied Technology, which in turn is the overseer of the Large Format Digital Imaging Division, in whose lab the benchmarking took place. The majority of this video editing is Mac-centric, so this is ideal place for further benchmarking.

The other partner university where FLAAR has a digital imaging resource center, Universidad Francisco Marroquin, also has an active digital video editing center in the New Media building. This is the same building where FLAAR has its office in Guatemala (the test of the Dell and Mac G4 was accomplished in

the FLAAR facilities at BGSU in Ohio). However, Universidad Francisco Marroquin is primarily equipped with Dell computers. They have no Macintosh computers to test their video editing skills on. Thus, the two universities make an ideal future test platform since video editing is the last stronghold for Mac, and hence an immense market for PC-Windows.



New Media building on campus of Universidad Francisco Marroquin. Video editing is in front left; FLAAR occupies back right portion of building. Inside view shows staff of video editing suite (all with PC, namely Dell workstations)



**Left:** Professor Charles Spontelli doing evaluation of newly arrived Canon large format printer with Gretag Spectrolino on SpectroScan table.  
**Right:** BGSU graduate student Stephanie Madeya working with X-Rite DTP41UV and Dell Precision Workstation as she writes the new FLAAR publication "Color Management Step by Step."

Both FLAAR and BGSU also do color management evaluations. Indeed we are concurrently evaluating the two leading competing ICC color profile packages: GretagMacbeth EyeOne and X-Rite DPT41UV, both with Monaco Profiler software. We evaluate on Macintosh platforms and on PC-Windows platforms. FLAAR and the university continue to use both Mac and PC platforms in our daily work.

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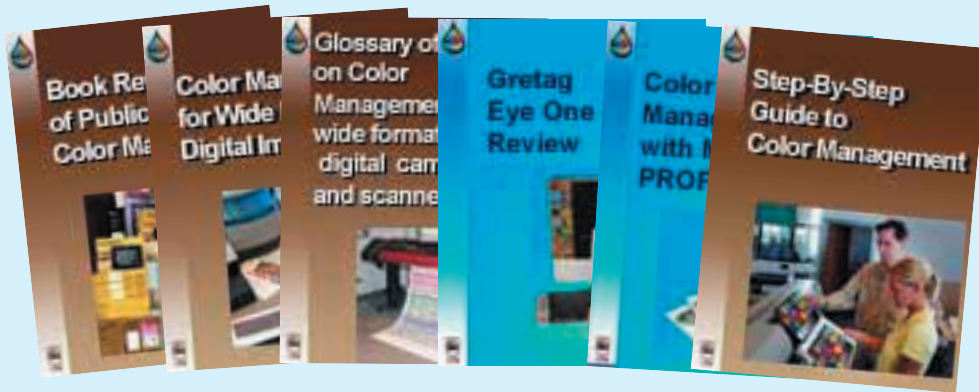
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