

MCA101 : COMPUTER GRAPHICS

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1 HISTORY

2 CONSTRAINT OF THE REAL-TIME

3 SOME TERMINOLOGY

4 THE GRAPHICS PIPELINE

1 HISTORY

- Applications
- Display
- Print

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SKETCHPAD 1960



Image Courtesy: Youtube
(Youtube)

FLATLAND 1999

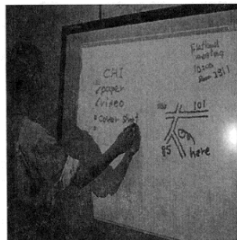


FIGURE 1. Using Flatland

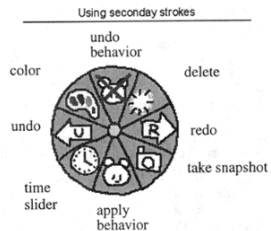


FIGURE 2. Gestures and Pie Menus

FIGURE: Flatland [MIEL99]

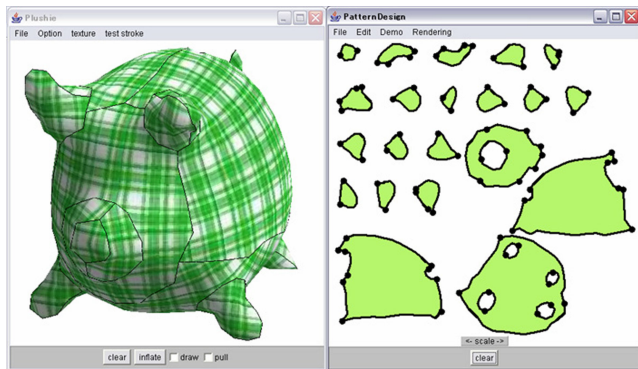


FIGURE: Plushie [MI07]

(Youtube)



Image Courtesy: Youtube
(Youtube), Peter Wonka @3DGV

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CATHODE RAY TUBE

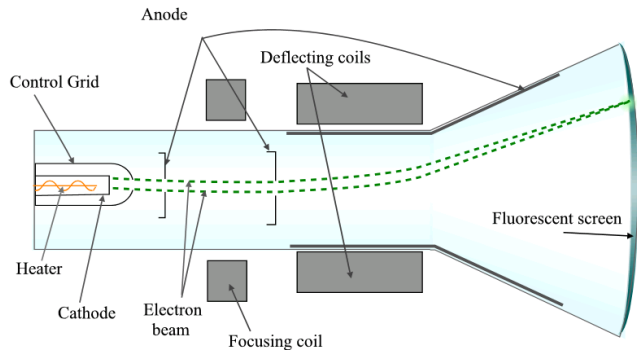


Image Courtesy: [Wikipedia](#)

Monochrome (Raster), Colour (Raster), Direct-View Bistable Storage (Vector)

NIXIE TUBE

(Variant of a Neon Lamp)

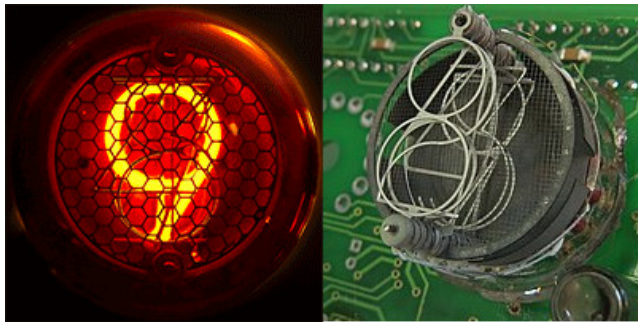


Image Courtesy: *Wikipedia*

FLIP-DISC DISPLAY

17:30	SIA	JAKARTA	SQ182	
18:00	SIA	BANGKOK	SQ68	
18:10	SIA	JAKARTA	LH778	
18:35	SILK AIR	PHUKET	MI758	SQ5058
18:45	SIA	JAKARTA	SQ168	
18:45	SIA	PENANG	SQ198	MH9028
18:50	SIA	DHAKA	SQ436	
18:50	SILK AIR	KUCHING	MI378	MH9032
			SQ5078	
18:55	malaysia	KUALA LUMPUR	MH616	
19:00	SIA	BALI	SQ148	
19:00	SIA	HONG KONG	SQ868	
19:00	SIA	K4LSRTZ	1R5*#	1S2911
			SQ5078	
19:55	malaysia	KUALA LUMPUR	MH616	
20:00	SIA	BALI	SQ148	
20:00	SIA	HONG KONG	SQ868	

Image Courtesy: *Web*

- LCD
- Plasma (1995)
- LED
- OLED
- AMOLED
- E-Ink (Kindle)

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Prehistoric, Ancient & Medieval

- Clay Tablets
- Wood Block Printing
- Stencils/ Masks
- Seals and Stamps
- Lithography
- Flat-bed Printing Press

Modern

- Rotary Printing Press
- Offset Press
- Screenprinting
- Dot matrix printing (DMP)
- Thermal Printing (Thermochromic)
- Laser Printing

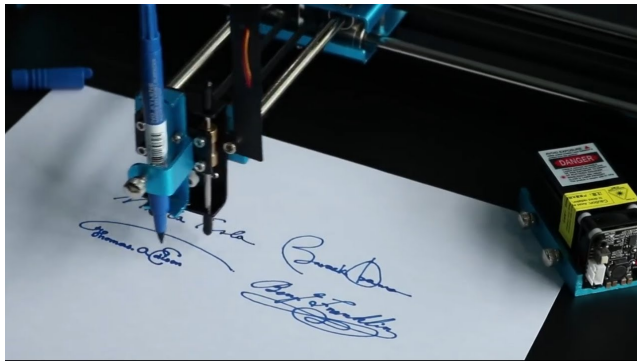


Image Courtesy: Youtube

Can I teach a robot to replicate a line art? [VKN20]

OUTLINE

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- **THROUGHPUT** ≥ 17 frames per second (FPS);
- **REFRESH RATE** ≥ 24 Hz;

A target of 24 FPS, will leave per pixel computation time of,

- $320 \times 240 \approx 77000 \text{ px} \rightarrow 543 \text{ ns}$
- $640 \times 480 \approx 0.3 \text{ MP} \rightarrow 135 \text{ ns}$
- $1024 \times 768 \approx 0.8 \text{ MP} \rightarrow 53 \text{ ns}$
- $1366 \times 768 \approx 1 \text{ MP} \rightarrow 40 \text{ ns}$

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With a 384 core GPU

- $1440 \times 900 \approx 1.3 \text{ MP} \rightarrow 12.3 \mu\text{s}$
- $1920 \times 1280 \approx 2.5 \text{ MP} \rightarrow 6.5 \mu\text{s}$
- $3072 \times 1920 \approx 6 \text{ MP} \rightarrow 2.7 \mu\text{s}$
- $8192 \times 4320 \approx 35 \text{ MP} \rightarrow 0.45 \mu\text{s}$

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The way a concept/ entity is represented in machine code. *e.g.*

- Colour as **RGB**; is just a mem block of 24-bits;
- Geometry as **Polygonal Faces**; Array of Vertex Data and Face Relations;
- Illumination as a physical model;
- Textures as 2D images;
- and so forth...

TRANSFORMATION

Changing the view-point

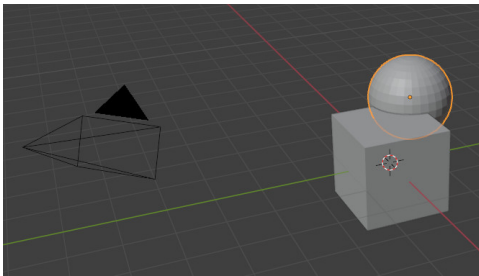


FIGURE: User View

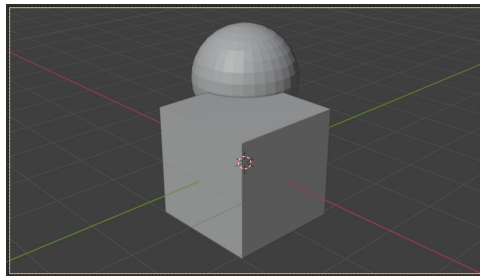


FIGURE: Camera View

Estimating/ Computing the values in between two states.

e.g.

Points on a line segment are intermediate/ interpolated states between its two end points.

To create a visible artefact
corresponding to a concept.

OUTLINE

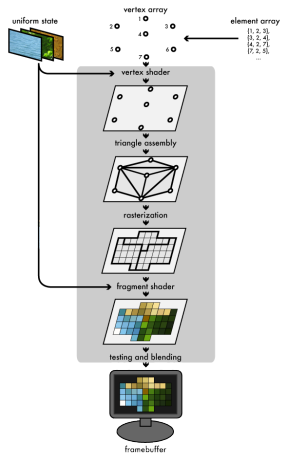
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THE GRAPHICS PIPELINE



Vertex Shader
Fragment Shader

- [MI07] Yuki Mori and Takeo Igarashi. “Plushie: An Interactive Design System for Plush Toys”. In: *ACM Trans. Graph.* 26.3 (2007) (see p. 6).
- [MIEL99] Elizabeth D. Mynatt, Takeo Igarashi, W. Keith Edwards, and Anthony LaMarca. “Flatland: New Dimensions in Office Whiteboards”. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. CHI '99. New York, NY, USA: Association for Computing Machinery, 1999, pp. 346–353 (see p. 5).
- [VKN20] R. B. Venkataramaiyer, S. Kumar, and V. P. Namboodiri. “Can I Teach a Robot to Replicate a Line Art”. In: *WACV. 2020 IEEE Winter Conference on Applications of Computer Vision (WACV)*. Aspen, CA, USA: IEEE, 2020, pp. 1922–1930 (see p. 15).