Computer science and technology : historiography IV (7)

Camille Akmut

May 10, 2022

Social history of computer science (graphics, games, ...)

COMPUTER SCIENCE MANUALS

First warning - It is important to note, once again that these manuals – for those who put in the effort, and are not bound by pre-conceptions – contain information of both technical and historical importance.* A second warning : found in these books are regularly *significant* differences from edition to edition (the same of course applies to books of other disciplines, and in theory one should not expect things to be different for computer science, but it deserves to be emphasized here). Hence consult as many as possible.

[*Ratio of historical to technical indications varies greatly between computer scientists : e.g. some authors, either by mostly misguided principle ("we are technologists!"), or lack of knowledge, and often both, keep the history side slim... Evidently others, like Knuth or Hennessy/Patterson, feel that knowledge of past approaches enriches, advances the discipline.]

— Hennessy, Patterson. *Computer Architecture : A Quantitative Approach.*

Among information of both historical and technical nature, in the chapter on memory, the writers present this wonderful quote from 1946 (abridged further) : "*Ideally one would desire an indefinitely large memory capacity ... We are ... forced to recognize the possibility of constructing a hierarchy of memories, each of which has greater capacity than the preceding but which is less quickly accessible.*" by Burks, Goldstine, von Neumann – essentially describing the rules that continue to organize reflections around and constructions of computer memory (Level 1 memories, small and fast, L2 : relatively bigger and slower, ...).

In the 4th edition of this text – according to the authors "the most significant since the first" due to multicore inclusion – a section previously concerned with the treatment of a, really-existing, video games console seems to have disappeared entirely except for one brief little extent sentence ("*RDRAM was at its strongest in small memory systems that need high bandwidth, such as a Sony Playstation.*", p. 336).

Contrasting with this approach, (by that time perhaps the authors felt the particular console chosen was now outdated, or this was all too "practical" for computer scientists, whichever the case), are the older editions which contained an entire section dedicated to the PlayStation 2's design – which we personally still find fascinating.

In these older books Hennessy and Patterson still argued :

> "*but we will take detours to point out where the memory hierarchy of servers and embedded computers diverge from the desktop. Towards the end of the chapter we will pause for two views of the memory hierarchy in addition to the Alpha 21264: the Sony Playstation 2 and the Sun Fire 6800 server.*"
>
> p. 376

In our opinion, this approach i.e. explaining architecture based on different applications, still seems as valid then as now (beyond the particularities - if they prefer they can pick other consoles, servers, etc.). As they themselves wrote, then, it represents "another view" into what may otherwise appear as fairly abstract computer design and architecture (choices).

5th edition reviews an ARM processor (next to Intel), a very interesting case but not varied enough.

Social history of computer graphics and video games (continued)

HARDWARE SPECIFICATIONS AS PRIMARY SOURCE

— Hennessy, Patterson. "Another View : The Emotion Engine of the Sony Playstation 2" In: *Computer Architecture*, 3rd ed., section 5 14

Justification for the PlayStation 2 being a case for study in 'Computer Architecture Quantitative Approach' follows the idea that,

> "*Desktop computers and servers rely on the memory hierarchy to reduce average access time to relatively static data, but there are embedded applications where data is often a continuous stream. (...) this section examines the microprocessor at the heart of Sony Playstation 2. As we shall see, the steady stream of graphics and audio demanded by electronic games leads to a different approach to memory design. The style is high bandwidth via many dedicated independent memories.*"

By the time the third edition appeared, desktop computer had already been gaming platforms for quite some time (if the release of games like e.g. Doom is taken as reference point) it should probably be noted. (It may also explain why this section was remove, however this does not change the fact it retains historical value if not more). In any case,

In this development the notions of local and spatial locality are introduced which are explained at the beginning of this manual :

> "*Temporal locality* states that recently accessed items are likely to be accessed in the near future. *Spatial locality* says that items whose addresses are near one another tend to be referenced close together in time."

Another reason the PS2 was picked, and in general generated interest with researchers, is likely – fairly extraordinary fact – its Linux support. It is not impossible to do experiments on proprietary systems, obviously; on the other hand it is easier and likely to gain greater interest where free software is available. (The availability of the latter does not solve the issue of proprietary/"closed"/non-documented hardware, but is at least one less obstacle.)

Other consoles are mentioned in Hennessy and Patterson's book, e.g. Nintendo 64,

> "*Vector instructions are particularly appealing for embedded processors because they support high degrees of parallelism at low cost and with low power dissipation, and have been used in several game machines such as the Nintendo-64 and the Sony Playstation 2 to boost graphics performance.*" [Appendix G Vector Processors]

In this book/edition, useful is also for instance 5 2 : 'ABCs of Caches'.

A few notes, lastly, of some sociological importance :

- Hennessy, president of Stanford, MIPS group, created a company "which developed one of the first commercial RISC microprocessors", sold to Silicon Graphics;
- Patterson, Berkeley, "led the design and implementation of RISC I, likely the first VLSI reduced instruction set computer", RAID project...,
based on author descriptions [a common source for social historians, in part. for prosopographies].
(Hennessy and Patterson were awarded the Turing Award 2017, both are now sun-setting at Google.)

— Stokes, Jon. 2000. "Sound and Vision: A Technical Overview of the Emotion Engine" *Ars Technica*

A multi-part article opening with the words, "*I'll cut right to the chase. The Emotion Engine is weird. (...) it took me quite a while*".
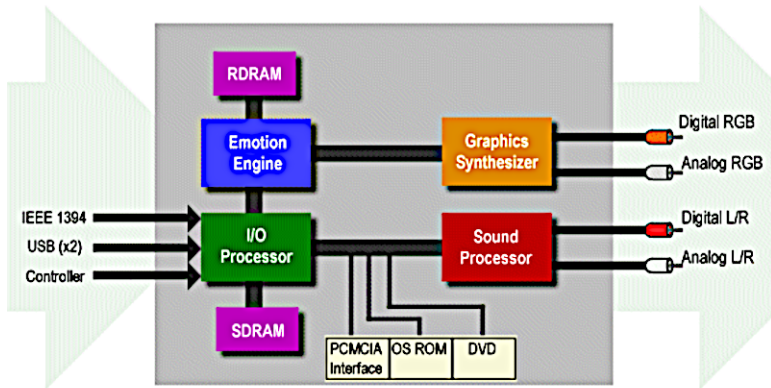
Il. a graphic of the "main parts of the PS2" (Stokes/Ars 2000)

Il. "*Emotion Engine: Basic Architecture*" (Stokes/Ars 2000)

NEWS

— "Alphabet Names John L. Hennessy As Executive Chairman" *Fortune*, Feb. 1 2018.

> "Hennessy, a long-time computer scientist who was Stanford University's tenth president before stepping down in 2016, takes over Alphabet's (GOOG) board after former Google CEO Eric Schmidt said in late December that he would step down as executive chairman.
>
> Schmidt, who was Alphabet's chairman for 17 years, is still a member of the company's board, which also includes Google CEO Sundar Pichai, Google's cloud computing chief Diane Greene, and Google co-founders Larry Page and Sergey Brin. (...)
>
> Hennessy has been on Alphabet's board since April 2004, and has been its lead independent director since April 2007, Google said. In 1984, he co-founded the semiconductor company Mips Computer Systems, which went public in 1989 and was eventually sold to computing company Silicon Graphics in 1992 for a little over $400 million."

A computer scientist with side-business and hustles galore.

3

Il. Google Patterson page, *research.google/people/105290/* (2022)
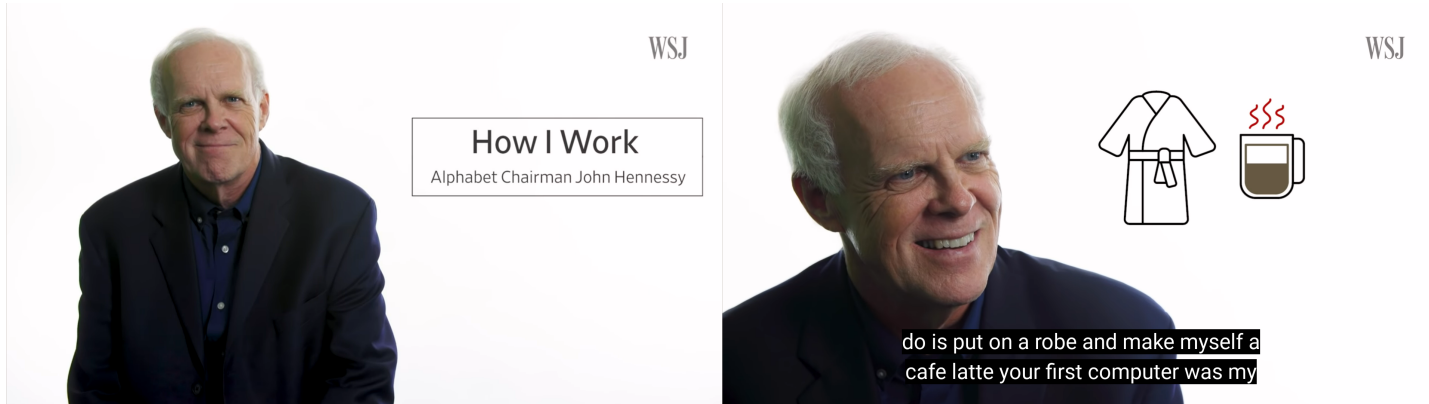
Il. *Wall Street Journal* 'Alphabet Chairman John Hennessy: How I Work' (2018) *HlZ0h0EaGBM*
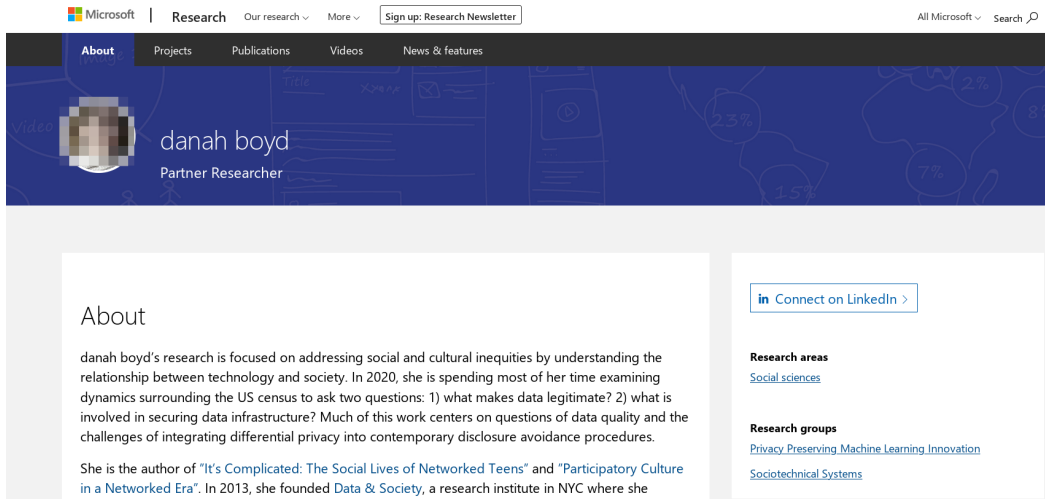
Il. Microsoft Danah Boyd page, *microsoft.com/en-us/research/people/dmb/* (2022)
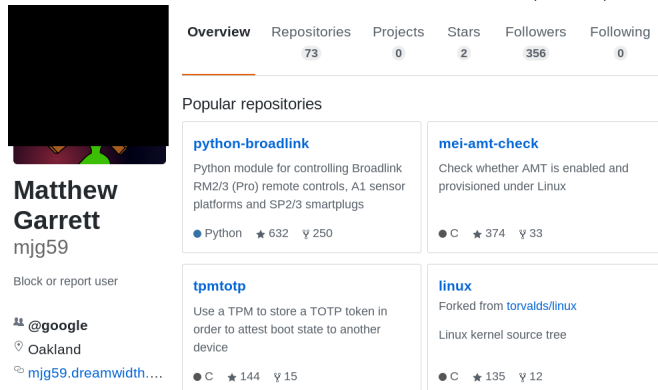
Il. "@google" Matthew Garrett, *github.com/mjg59/* (2019 Internet Archive)

GENERAL SOCIAL SCIENCE

— Panofsky, Erwin. *Gothic Architecture and Scholasticism.*
Erwin Panofsky – bless his soul a thousand, thousand times – was so far advanced when compared with his contemporaries and colleagues, that even today they still try to take him down ("ehm, I'd like to interject, Panofsky was act-shually wrong on p. 1517 of Early Netherlandish Painting, he meant *of course* Van Eyks pupil so-and-so..."). So complete was his overview of available knowledge, and materials, and techniques that even his mistakes were beautiful, and more valuable than other academics' entire career - whose meager results were formally correct as only safe, meaningless research can be.

<center>***</center>

Here is another exercise for only the 1% graduating class computer scientists and technologists :

Create a path through Stanford buildings that does not include a place funded by, or named after a millionaire or billionaire, or some modern-day dynasty and their offspring, or a company, "philanthropy" [1]

A helper : it's either impossible or going to be hard, and definitely absurd : by that point one may have solved the particular problem, and by doing so proving the contrary...

Problem 2: create a path fulfilling the first problem exposition, from the Nvidia auditorium to Knuth.
Problem 3: as above, from the Knight building to Hennessy's (former) office.
Problem 4 : same, but this time from the Alcatel-Lucent chair holder's office to Huang Buildings.
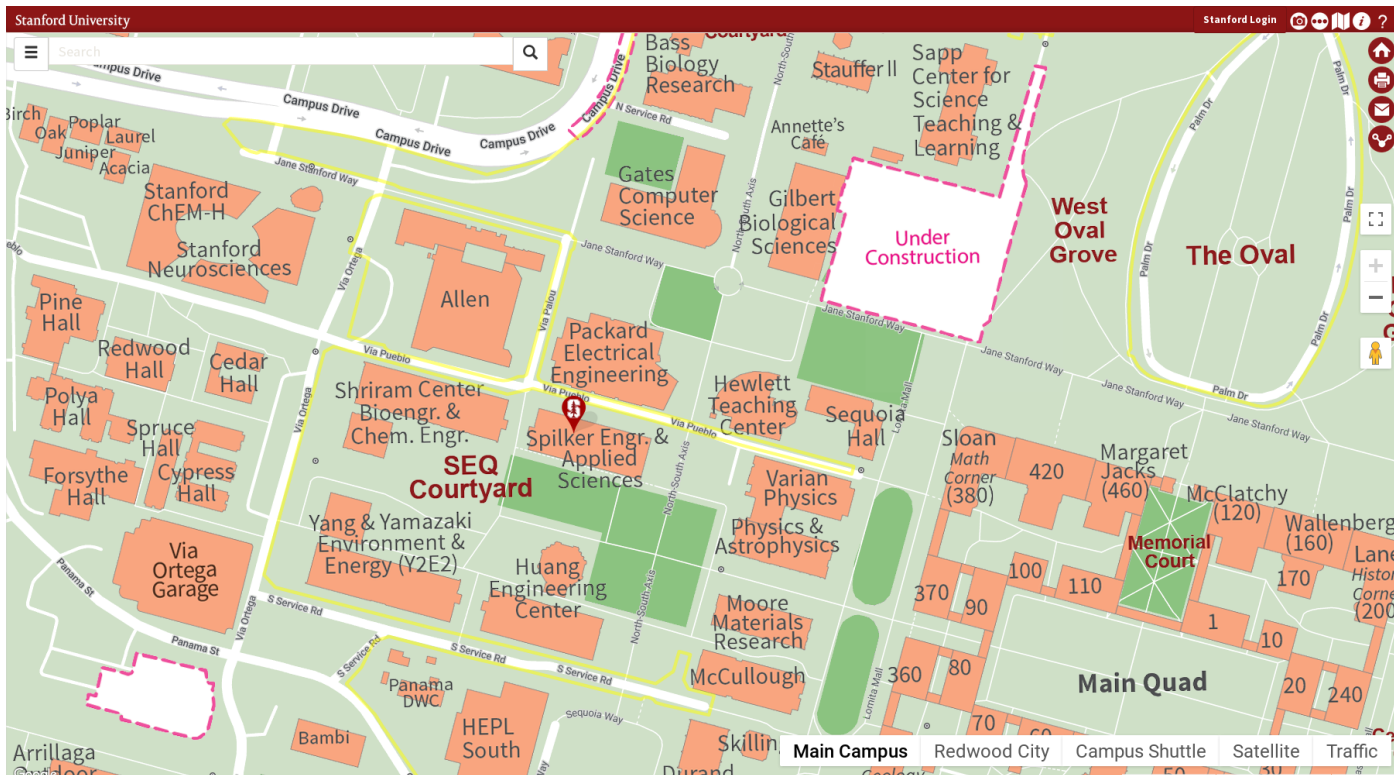
Bonus problem : find the shortest path from the Business school to Computer Science buildings. Here we can offer a hint : a path often traveled, a trip often made...

---

[1] ("philantropy", i.e. exploit with one hand and give back with the other and a smile...

(games, consoles so far)

Alone in the Dark	Frederick Raynal, RE influence...
Final Fight	Roxy (orange) not to be confused with Poison (pink)?
PlayStation 2	Emotion engine among other technical aspects e.g. Internet feature, Linux
Wipeout 2097 (XL, in other regions)	a 'cool' game turned into a giant Red Bull ad, "i'm 2 extreme 4 u bro" product
Ghost in the Shell	electronic music soundtrack e.g. 'Spook & Spell (Fast Version)' by Hardfloor [German], tracks by Derrick May [Detroit electro]
Ridge Racer 4	Gouraud shading, electronic music soundtrack
circa post-2000 games	Phong shading - transition to
so-called "unrealistic"/"unlicensed" tennis	alternatives to e.g. ATP Tour, Davis Cup Tennis
Top Skater	Jill, Kenji Kanno (Crazy Taxi), Tony Hawks influence

Il. *Alone in the Dark* : moving furniture to either access/show or obstruct/hide elements (cf. RE) [1-2] /
[3] difficult to illustrate here are the, fixed-point, camera transitions (e.g., in opening mansion scenes)

Il. Sega Saturn magazine #21: Jill "*decked out in the latest Tokyo streets clothes*"
[r.] Linux for PS2 1.0, detail EULA "NON COMMERCIAL USE ONLY"

(COMPUTER GRAPHICS) PAPERS

— Bui Tuong Phong. 1975. "Illumination for Computer Generated Pictures" *Communications of the ACM* 18(6)

" The quality of computer generated images of three-dimensional scenes depends on the shading technique used … The shading algorithm itself..."

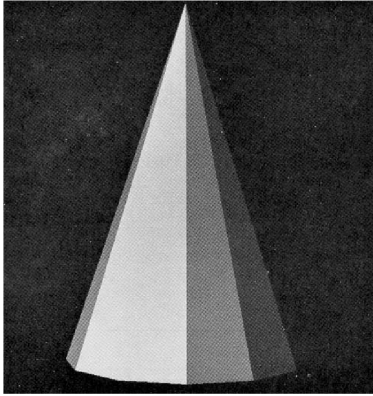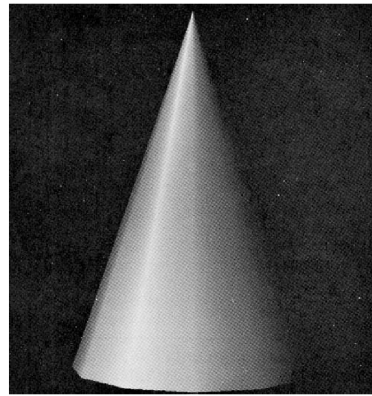Fig. 1. A cone represented by means of planar approximation.

Fig. 4. Gouraud shading, applied to approximated cone of Fig. 1.

Il. figures 1 and 4 from Phong's 1975 paper

Newell, Newell and Sancha's shading technique is also discussed (illustrated based on glass vase, in figure 2, not reproduced).

— Gouraud, Henri. 1971. "Continuous Shading of Curved Surfaces" *IEEE Transactions* 20(6)

"A procedure for computing shaded pictures of curved surfaces is presented."

[Both Phong and Gouraud are University of Utah affiliated - a major center for computer graphics, historically.]

(COMPUTER GAMES) MAGAZINES

Magazine	issue	example topic, content
Game Players	50	Rainforest rescue (p. 116), Mutant League Football ad (p. 52)
Intelligent Gamer (a ZD publication)	1(8)	PlayStation Expo
Newtype Gaming	2(2)	Gameboy color ad (double page, 89-90)
Maximum	1	Wipeout issue

What color is yours?

Introducing the Game Boy® Play It Loud™ Series. Five killer new colors and a cool, clear storage case with room for five of your favorite games. (Hair dye not included). Nintendo