

# The Shoulders We Stand On

Furkan Uzumcu

Senior Software Engineer | Autodesk

Quinn Hou

Engineering Manager | DapperLabs

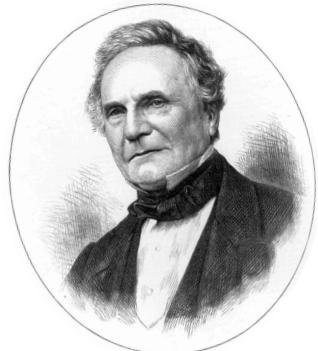
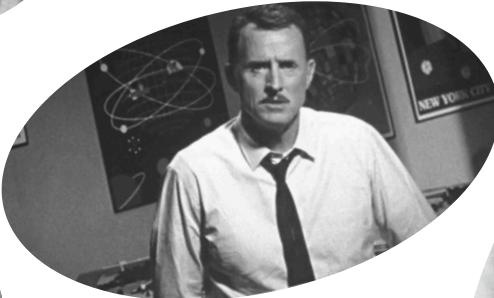




Would you just take, along with me, 10 seconds to think of the people who have helped you become who you are, those who cared about you and wanted what was best for you in life.

■ Fred Rogers





## Graph overview

372 nodes

474 edges

Download dataset

Clear all filters

Color nodes by...

act

Degree

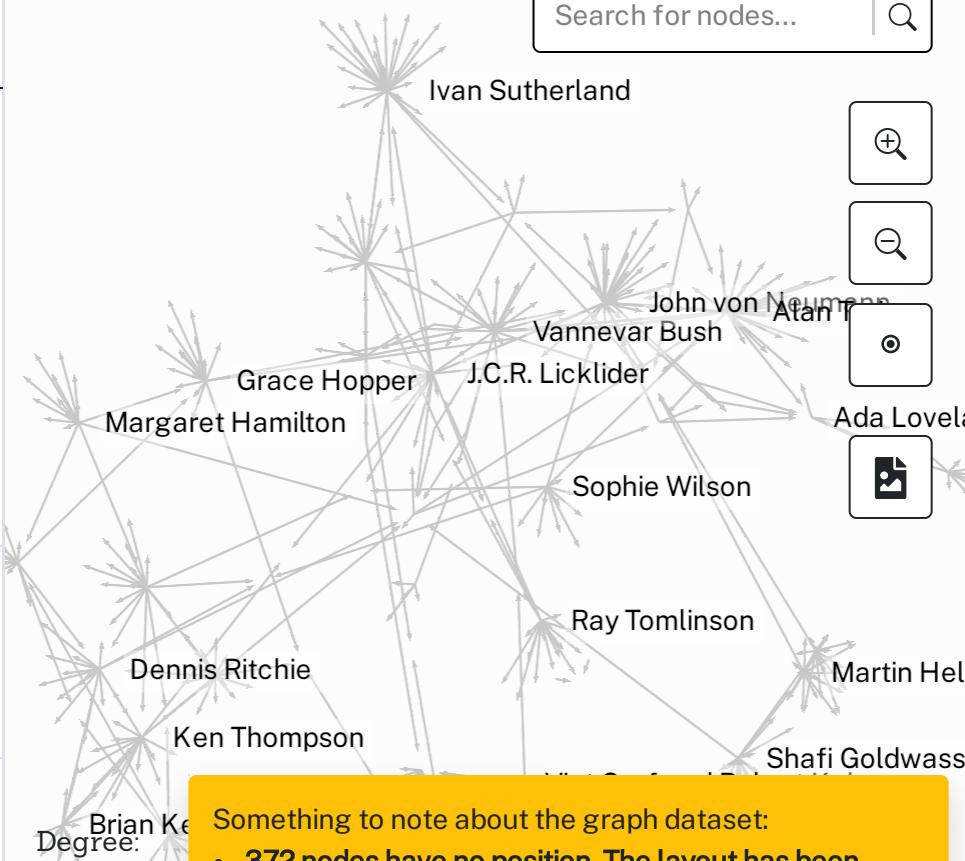
Size nodes by...

act

Sort alphabetically

Act\_1 (125 nodes)

Act\_3 (114 nodes)



Degree:  
Brian Kernighan

1

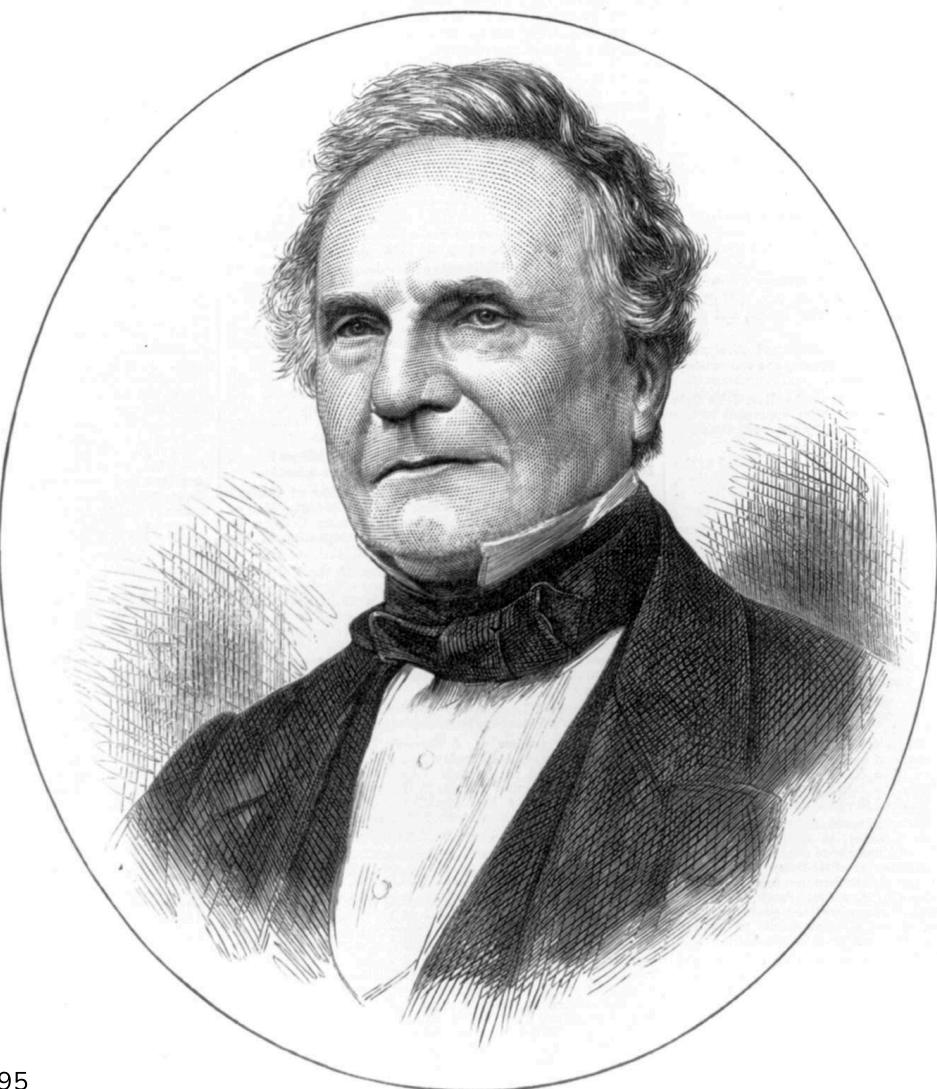
37

Something to note about the graph dataset:

- 372 nodes have no position. The layout has been determined using [ForceAtlas2](#). However, it would be better to load a file with the layout already computed.



# Sparks of Innovation and Inspiration



# Charles Babbage (1791 - 1871)

Father of Computers

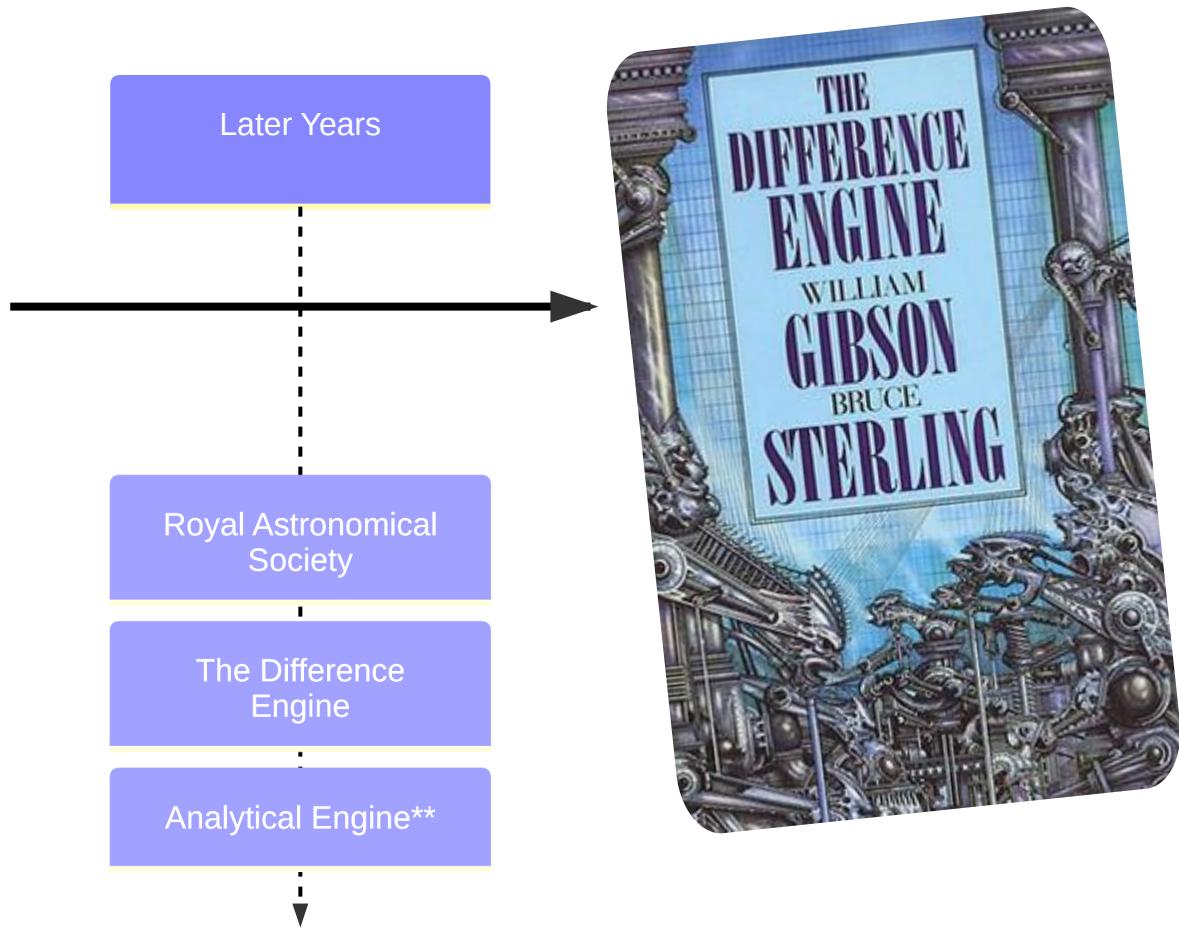
University Years

University of  
Cambridge

The Ghost Club\*\*

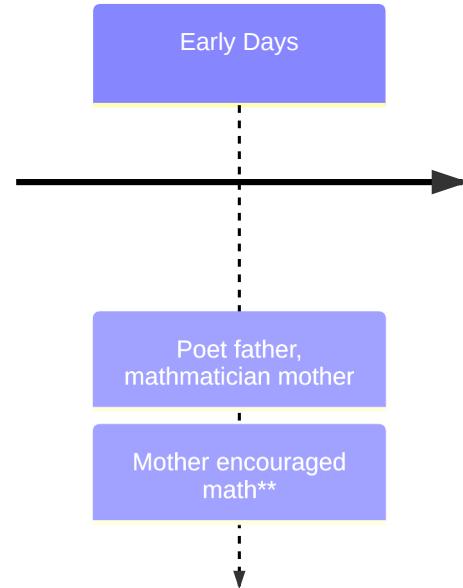
Analytical Society

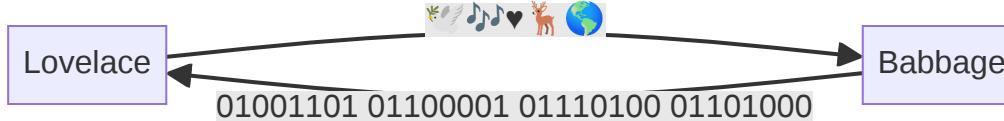




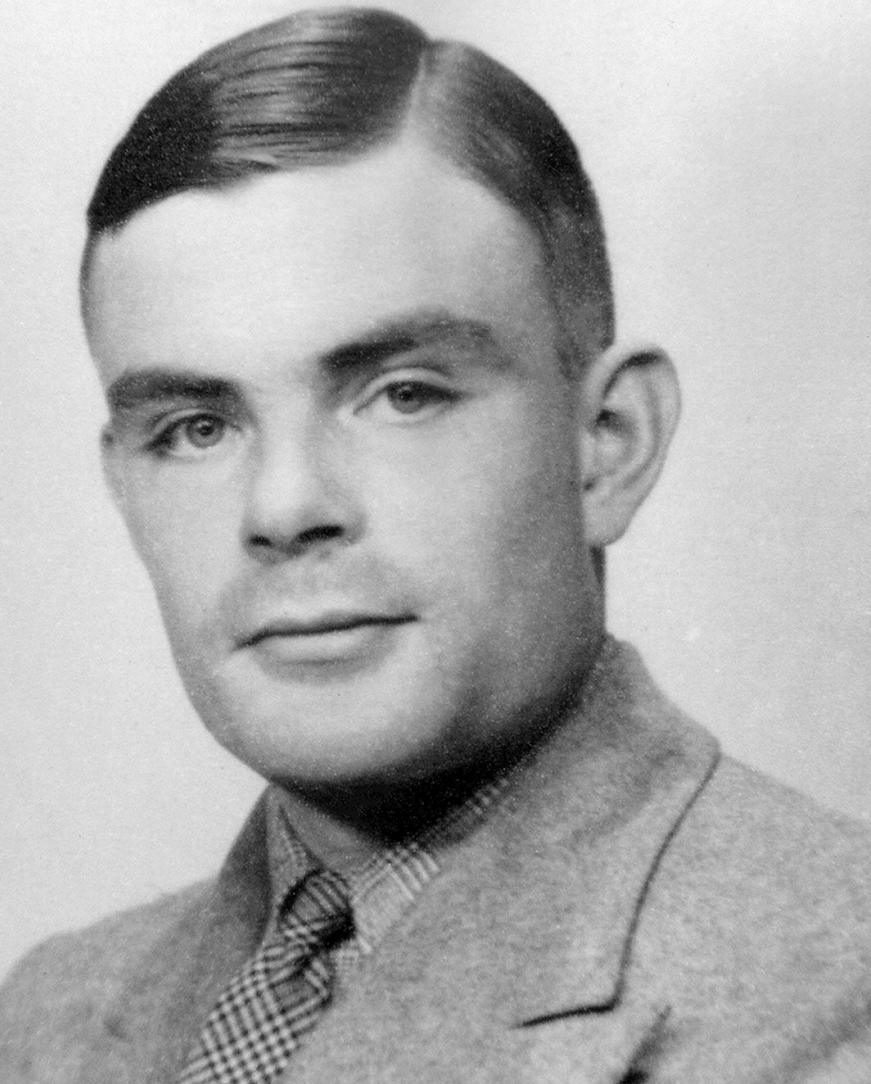
# Lady Ada Lovelace



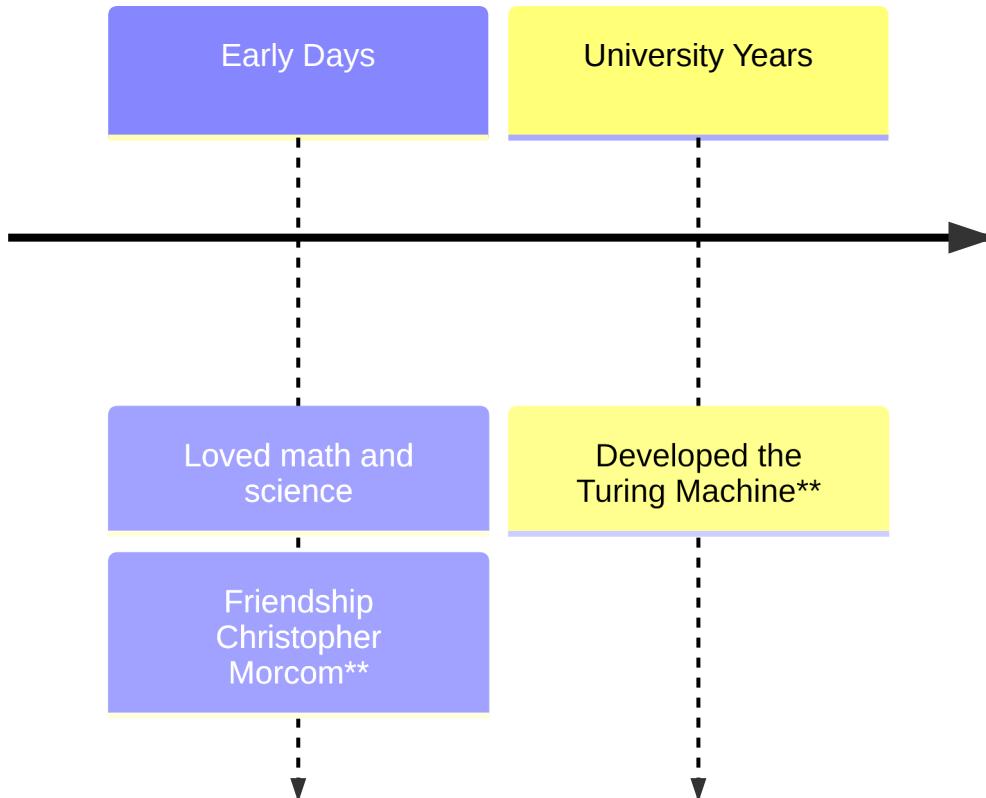


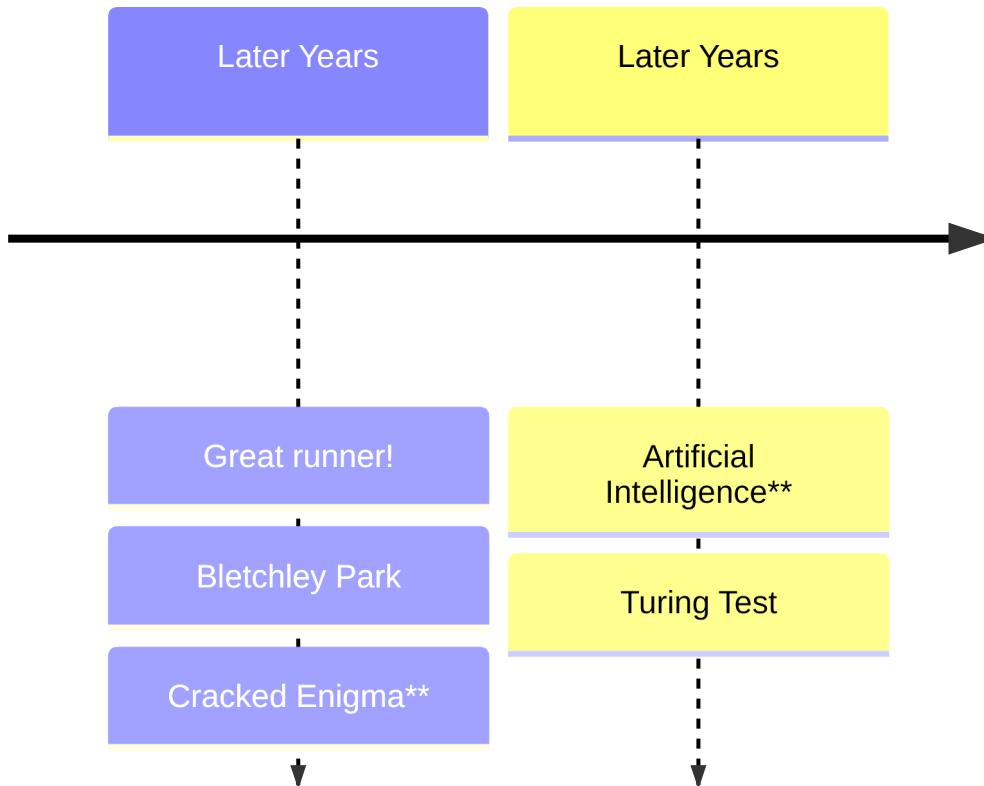


Supposing, for instance, that the fundamental relations of pitched sounds in the science of harmony and of musical composition were susceptible of such expression and adaptations, the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent.



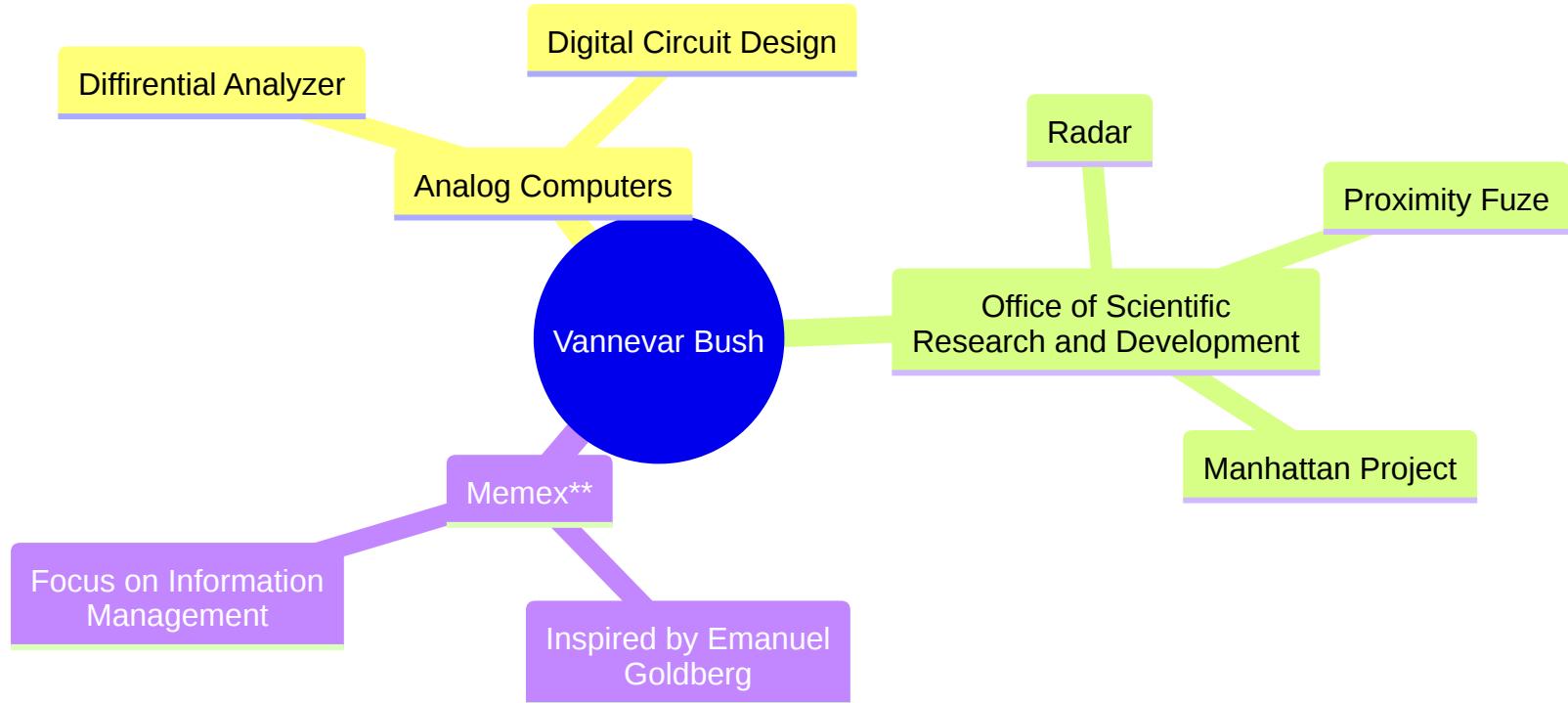
Alan Turing







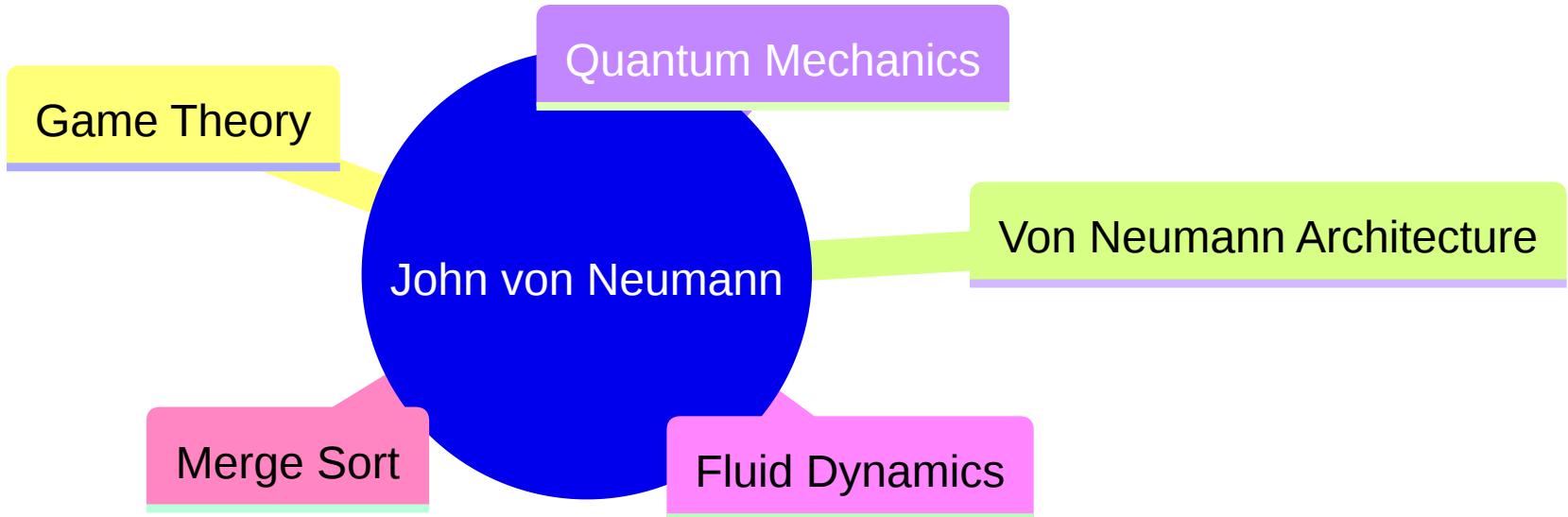
# Vannevar Bush





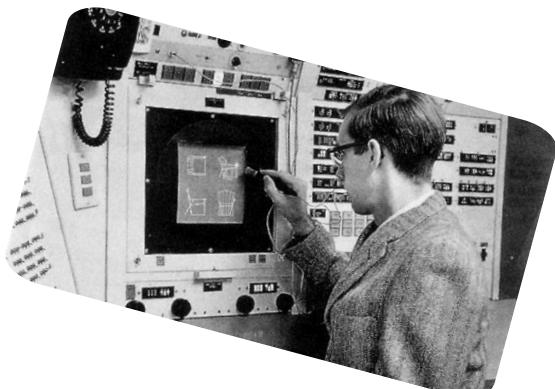
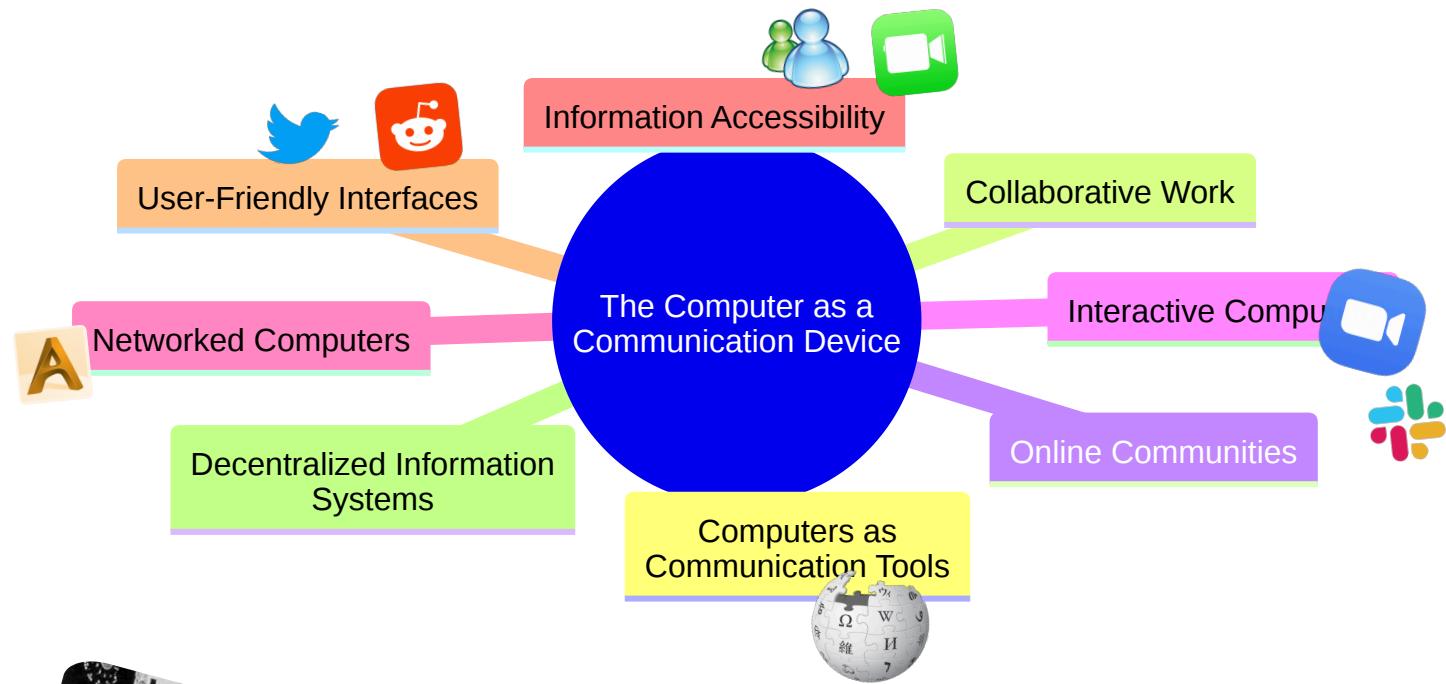
# John von Neumann

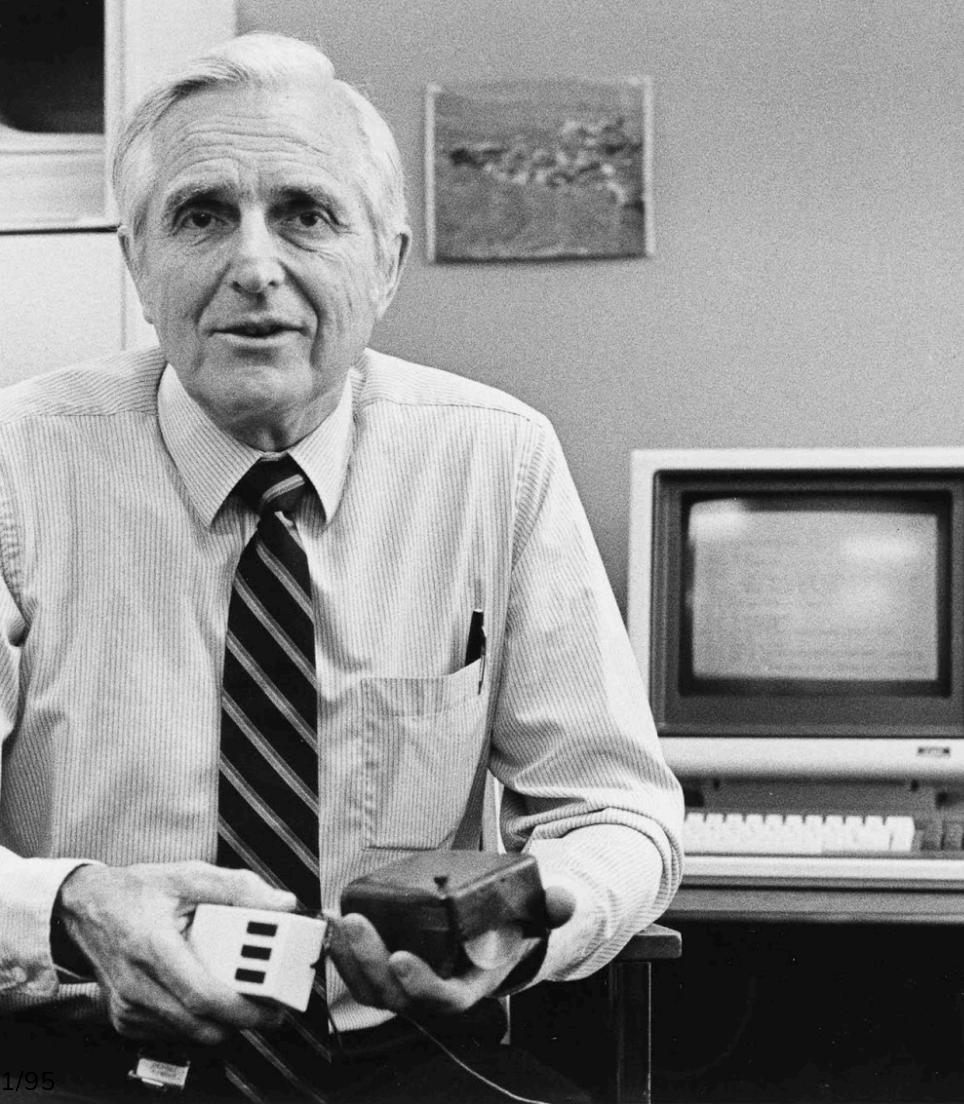
Most mathematicians prove what they can, von Neumann proves what he wants





Joseph Carl Robnett  
Licklider





# Douglas Engelbart



COMMAND RESET  
1  
  
HALT  
  
22

USAGE  
APPLICATION EXAMPLES  
TWO-PERSON COLLABORATION  
INFORMATION RETRIEVAL (BILL)



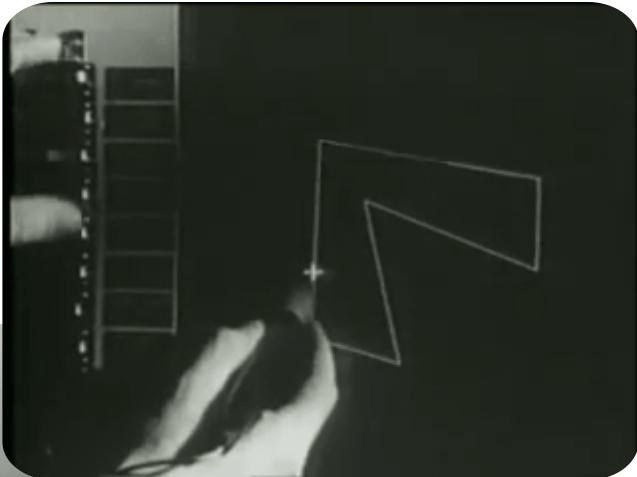
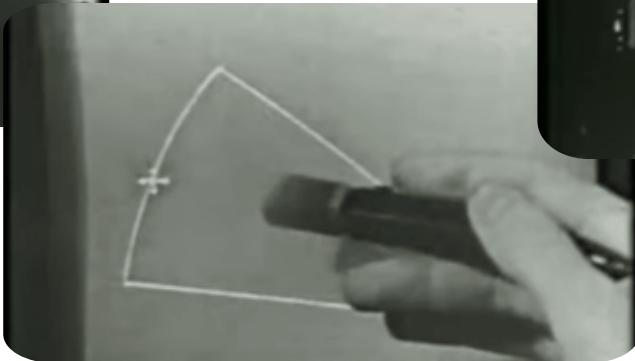
12/09/68 1709:00  
  
HALT ALL  
COMMAND RESET  
  
"HOT" RETRIEVAL -- KNOWN DESTINATION  
"COLD" RETRIEVAL -- UNKNOWN DESTINATION

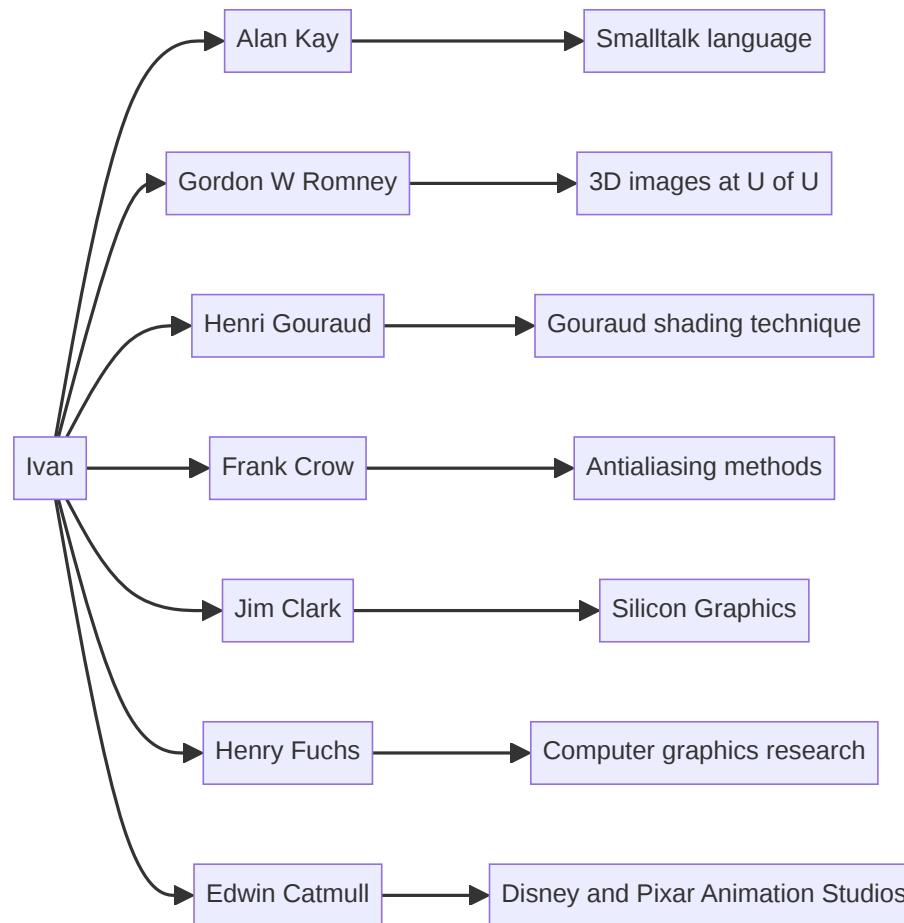
75CMR0  
  
INTRODUCTION  
----  
OVERALL ABOUT PROGRAM  
NCS AS AN "INSTRUMENT"  
CONTROL TECHNIQUES  
NCS IMPLEMENTATION  
USAGE  
ACTIVITIES  
CREDITS

A black and white head-and-shoulders portrait of Ivan Sutherland. He is a middle-aged man with a receding hairline, wearing dark-rimmed glasses and a dark suit jacket over a white collared shirt and a dark tie. He has a neutral expression and is looking slightly to his left.

Ivan Sutherland

# Sketchpad

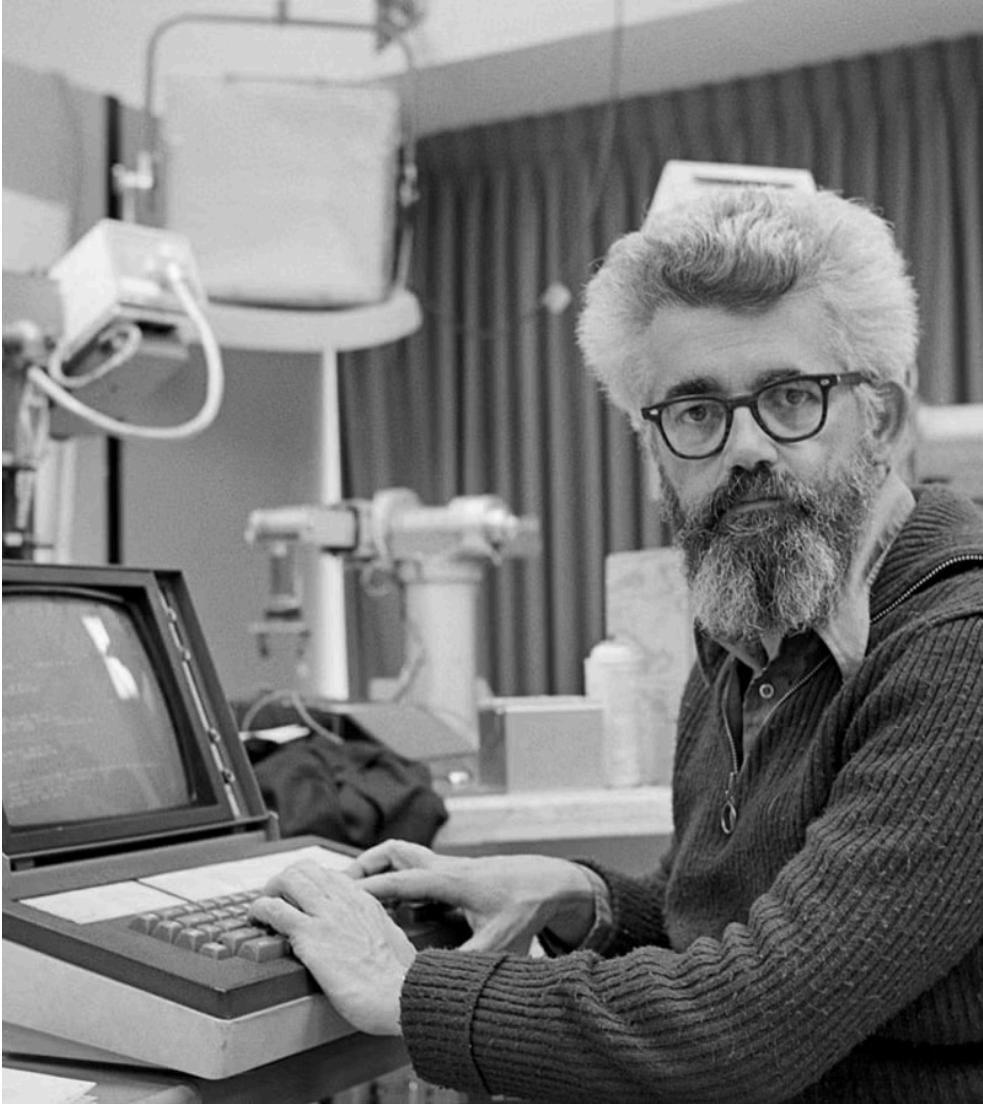




# The Theoretical Foundations

# John McCarthy (1927-2011)

- Artificial Intelligence: Coined the term "AI" in 1955
- Lisp (1958): One of the earliest high-level programming languages, influencing modern languages and AI research.
- Time-sharing: Innovated the concept of sharing computing resources among multiple users.



# Organizing the First AI Conference

Dartmouth Summer Research Project (1956)

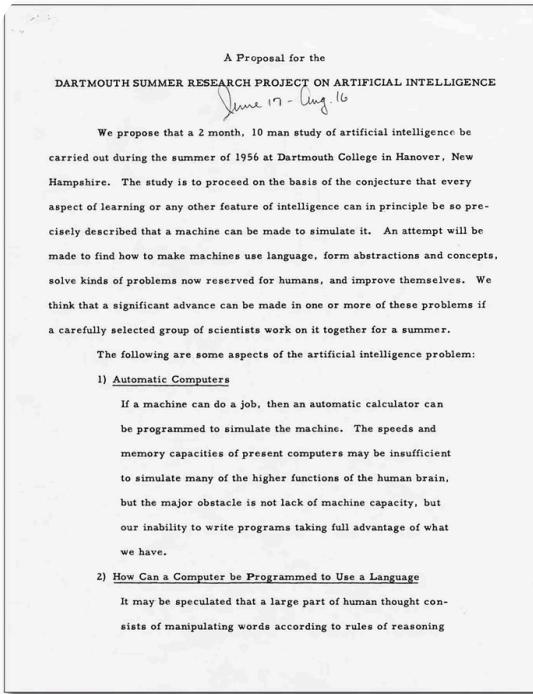
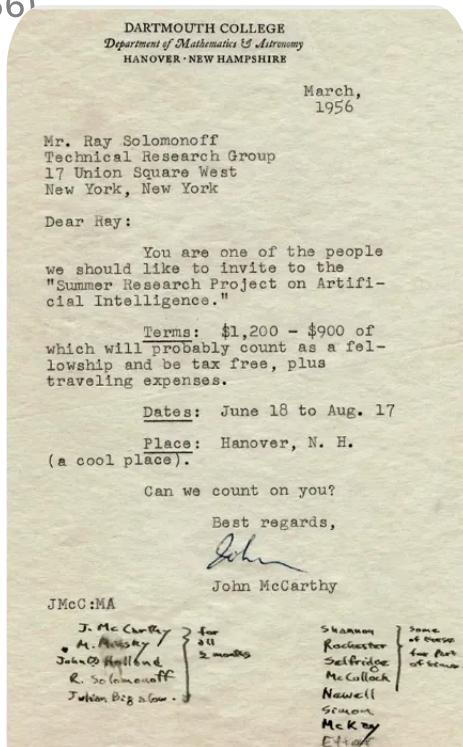


Photo courtesy Dartmouth College.

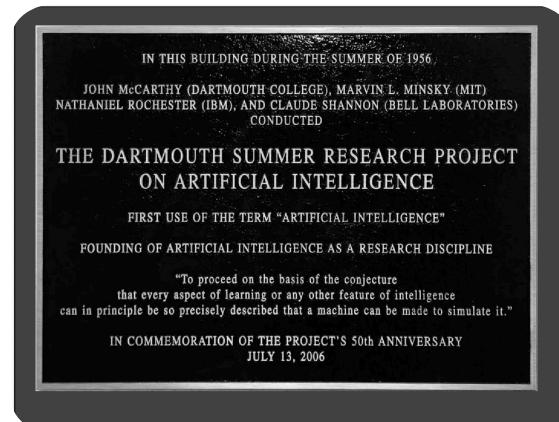
Page 1 of the Original Proposal.



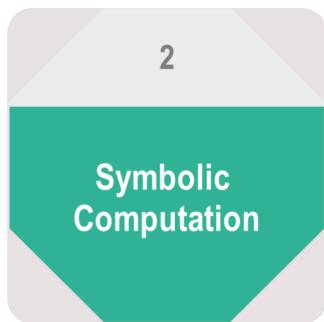
In March 1956, John McCarthy, one of the Dartmouth AI workshop's organizers, invited Ray Solomonoff to the summer workshop in Hanover, N.H. GRACE LOMONOFF

# Coining AI and Beyond

Dartmouth Summer Research Project (1956)



# Lisp (List Processing Language)



# Lisp Macros in Action

```
;; Define a macro to create a knock-knock joke
(defmacro knock-knock (who &rest response)
  `(progn
    (format t "Knock, knock.~%")
    (format t "Who's there?~%")
    (format t ,(format nil "~a." who) ~%)
    (format t ,(format nil "~a who?" who) ~%)
    (format t ,@response)))

;; Use the macro to create an AI-themed joke
(knock-knock "AI"
  "AI who?"
  "AI think, therefore AI am!")

;; Run the jokes
(format t "~%AI-themed knock-knock joke examples:~%")
(knock-knock "Bot"
  "Bot who?"
  "Botter not forget to laugh at my jokes!")
```



# Edsger W. Dijkstra (1930-2002)

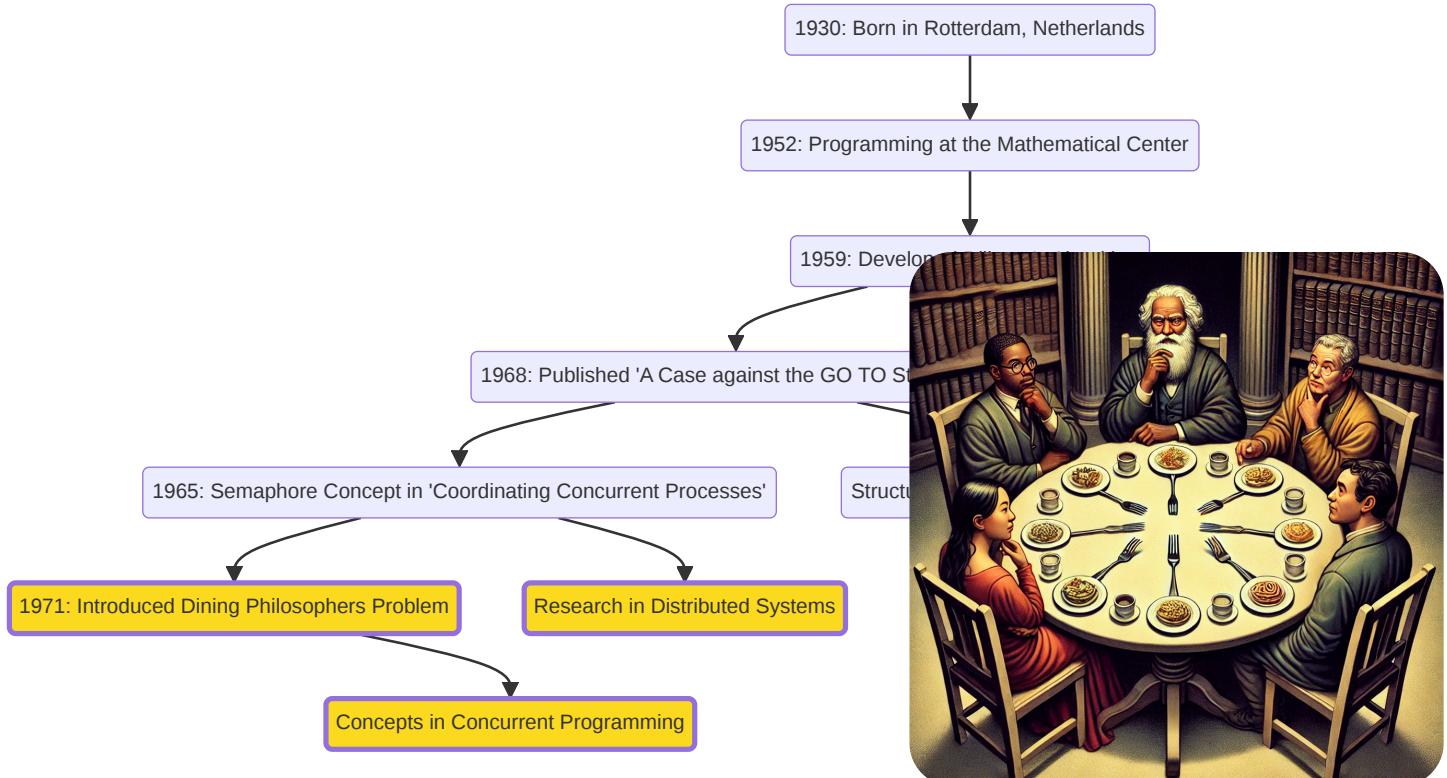
## Notable Influences

- Dijkstra's Algorithm (Shortest Path)
- Structured Programming
- Distributed Programming

# Dijkstra's Formative Influences

# A Case for Structured Programming

# Dining with Philosophers



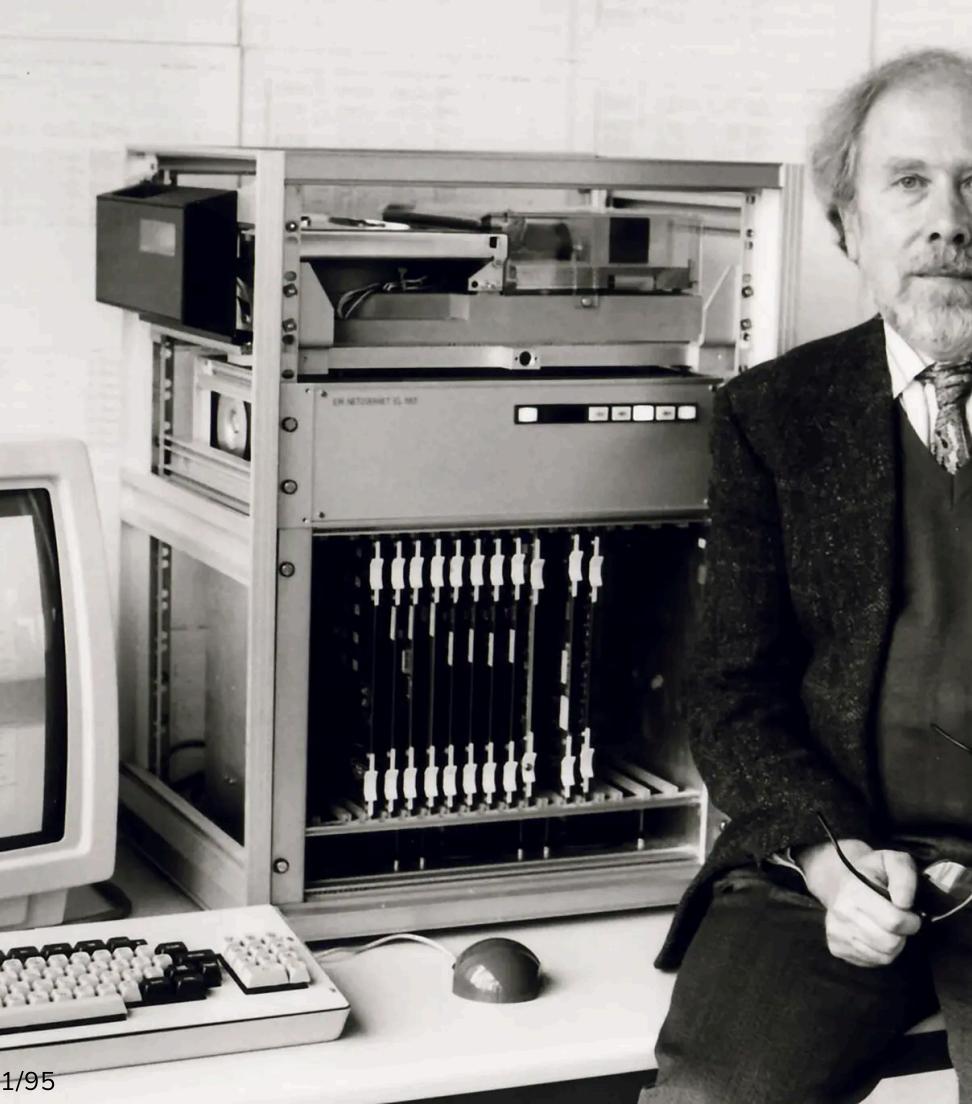
Teaching to unsuspecting youngsters the effective use of formal methods is one of the joys of life because it is so extremely rewarding. Within a few months, they find their way in a new world with a justified degree of confidence that is radically novel for them; within a few months, their concept of intellectual culture has acquired a radically novel dimension. To my taste and style, that is what education is about. Universities should not be afraid of teaching radical novelties; on the contrary, it is their calling to welcome the opportunity to do so. Their willingness to do so is our main safeguard against dictatorships, be they of the proletariat, of the scientific establishment, or of the corporate elite.

Austin, 2 December 1988

prof. dr. Edsger W. Dijkstra  
Department of Computer Sciences  
The University of Texas at Austin  
Austin, TX 78712-1188

## Eloquence and Elegance

- Known for elegant writing and handwriting
- Inspired the creation of Dijkstra Regular font



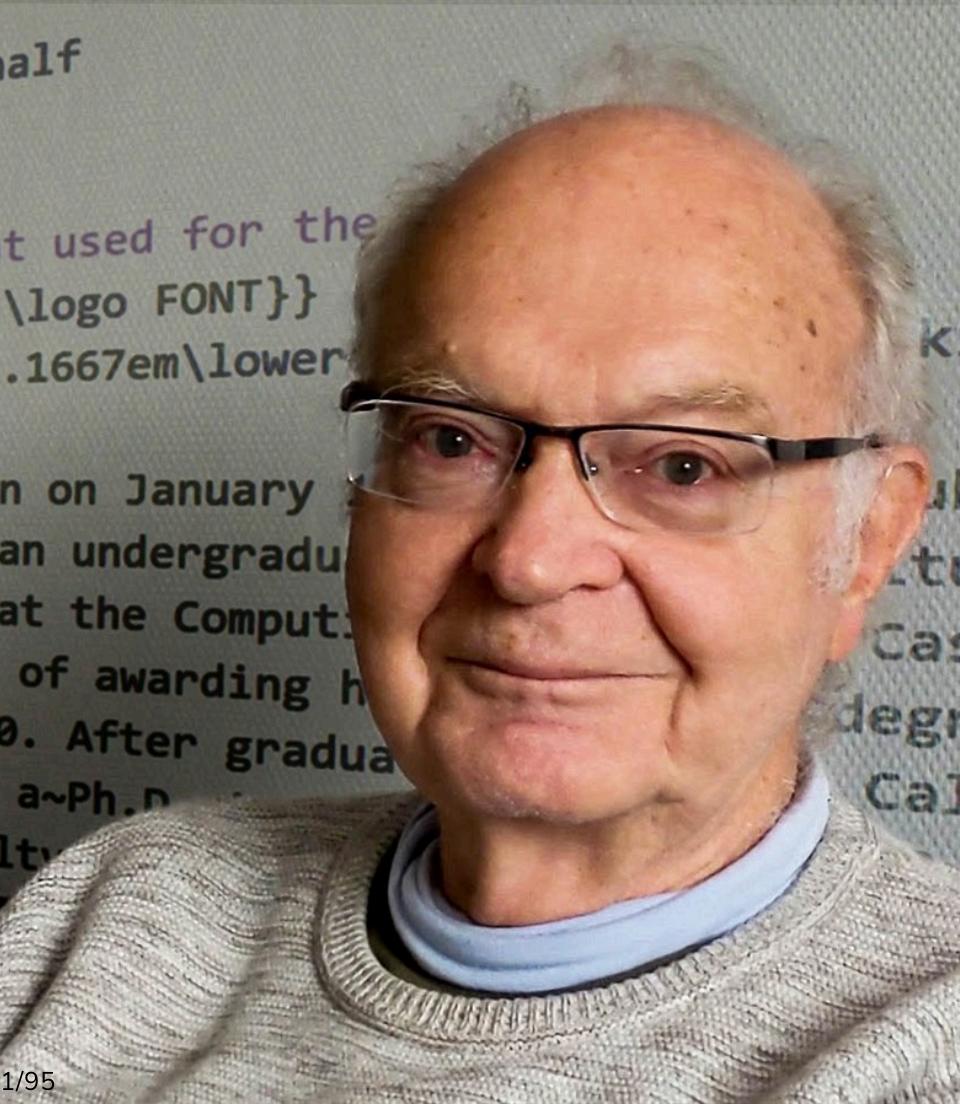
# Niklaus Wirth

Developed programming languages: Pascal (1970, Modula-2 (1979), and Oberon (1988)

# Pascal's Influence

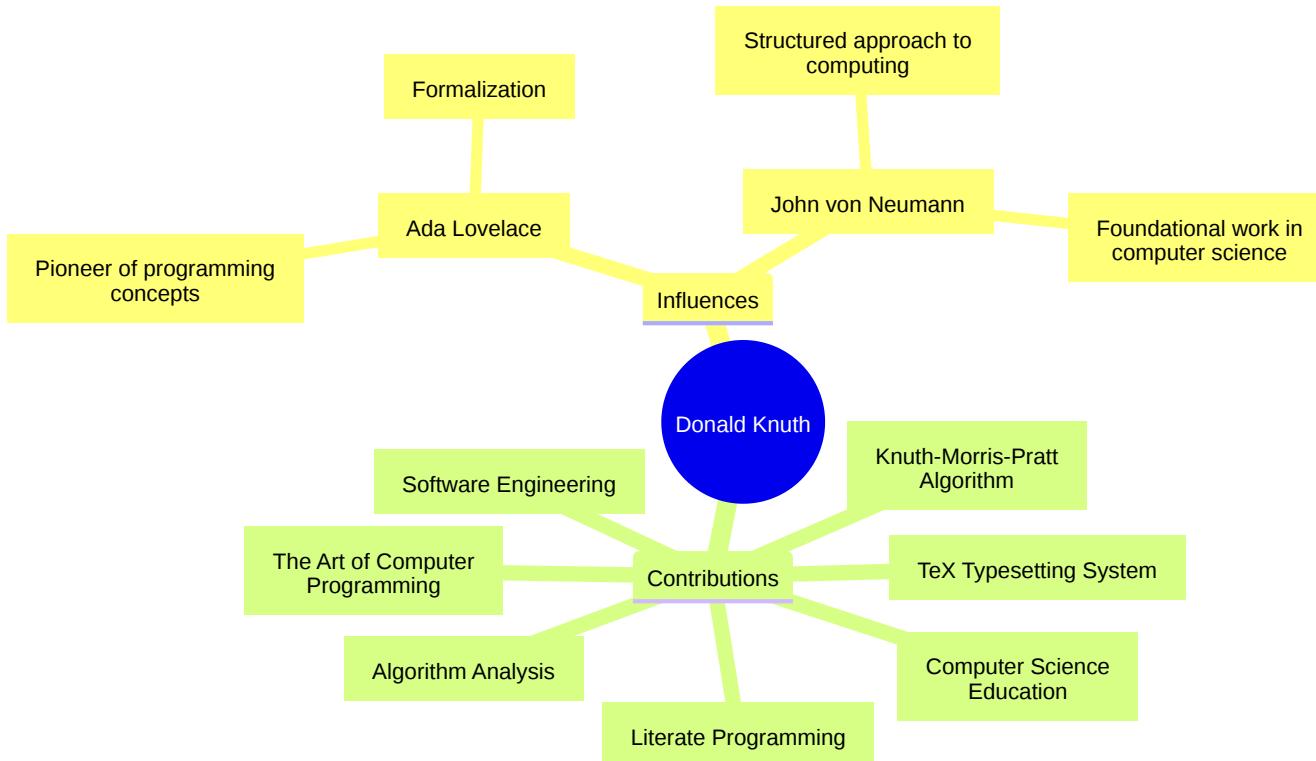
- Pascal Programming Language:
  - Emphasized structured programming and data structuring
  - Released freely as a "public good" aiding educators and tech companies
- Educational Impact:
  - Pascal became essential for teaching programming
  - Fostered good programming practices and efficient code





# Donald Knuth

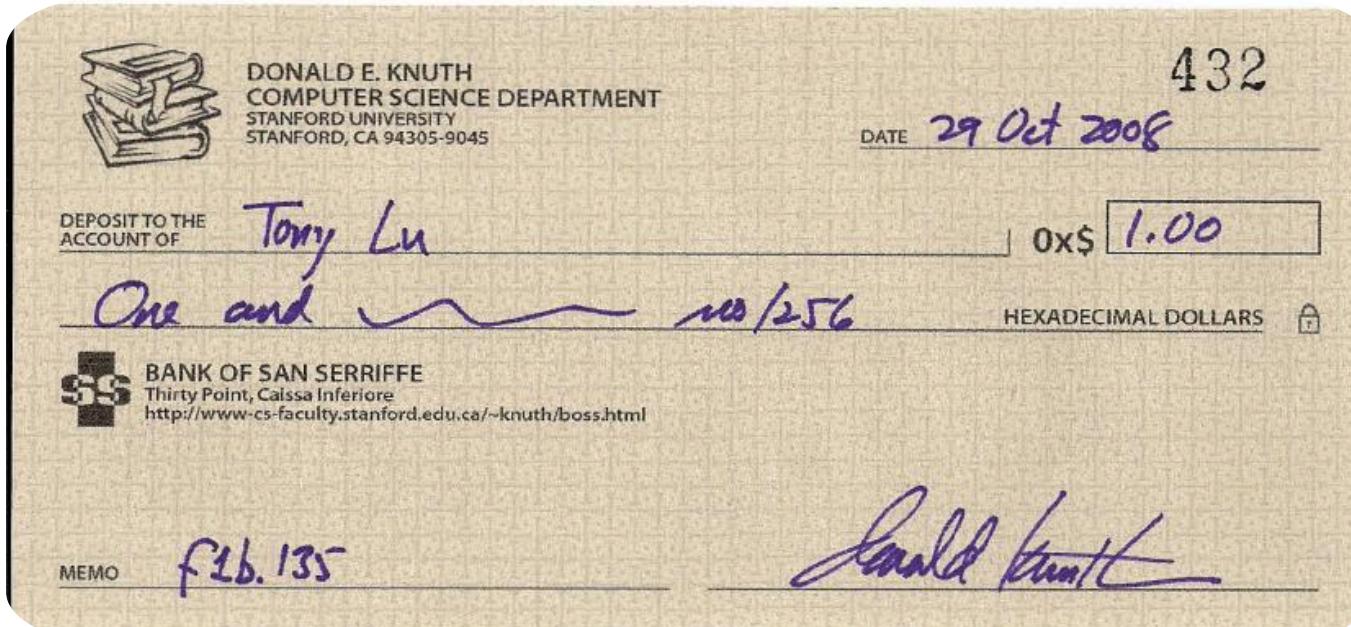
# Knuth's Influences and Contributions



'I certainly felt like an imposter for many years. There were so many other people who seemed so much more capable than I was. I just kept working hard and doing what I loved, hoping that someday I would belong.' - Donald Knuth

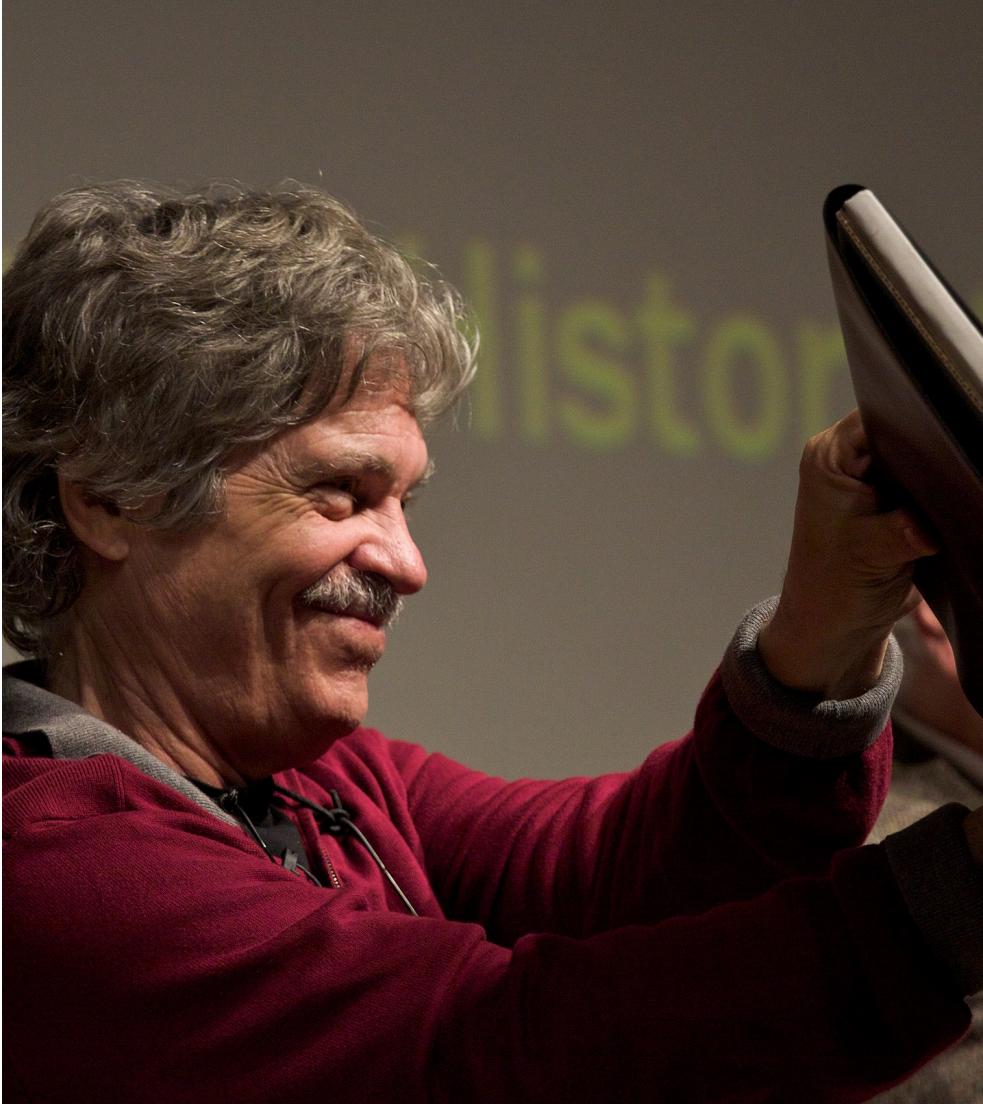
# Welcoming (and Rewarding) Feedback

- Error Rewards:
  - Mails you \$2.56 (1 hexadecimal dollar) for every mistake found in his book (stopped in 2008)
  - Now sends a cheque-like certificate (and real money if requested)

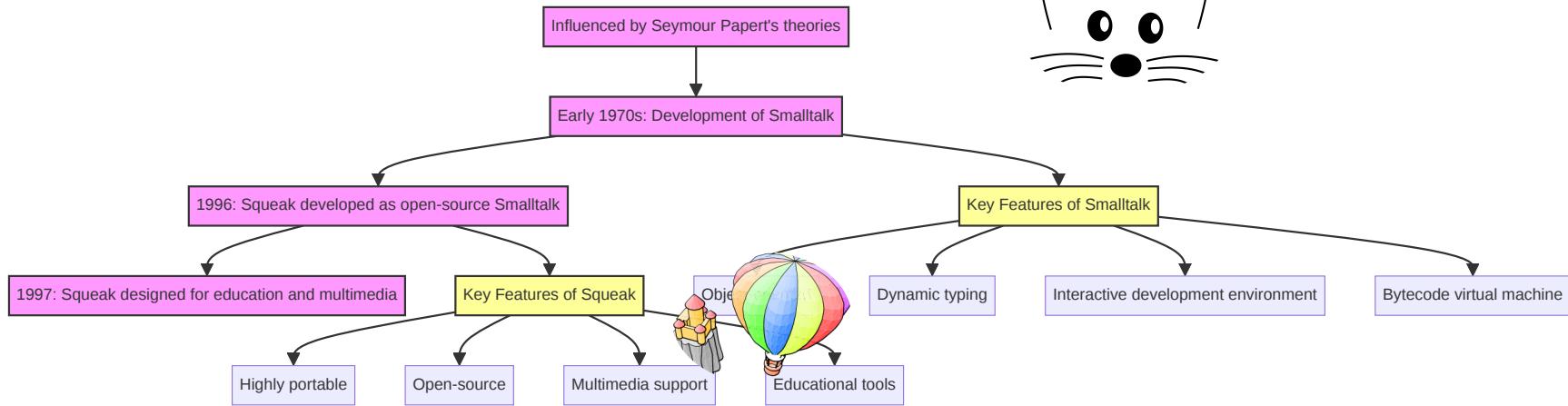


# Alan Kay

- One of the Fathers of Object-Oriented Programming
- Imagined a portable user-friendly computer - Dynabook



# Smalltalk to Squeak



# Xerox PARC and Robert Taylor



What was working at Xerox PARC in the early 1970s like?

Answer

Follow · 14

Request

i ⬤ ⬇ ...

All related (33) ▾

Sort Recommended ▾



Alan Kay · Follow



Worked at Xerox PARC · Upvoted by Mike Laursen, worked at Xerox · 7y

Best time ever! A truly wonderful combination of great people with great aspirations, abilities, and determination.

And great (and needed) protection for the critical years by the "impressario" (as he liked to call himself) Bob Taylor.

Upvote · 28



...

# A Gold Mine of Wise Words



**Alan Kay**

22,982 followers · 2 following

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Notify me

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...

Still trying to learn how to think better

[Profile](#) 670 Answers 0 Questions 0 Posts 23K Followers Following More ▾



**Alan Kay** · Follow

I am the Alan Kay in question. · Upvoted by Bryan Oswald, Pursuing a B.S. in Computer Science and Marcelo De Zen, 15+ years as a software developer. · 1y

Related **Do you agree with Alan Kay's comment that a computer science degree teaches students how to write bad code?**

I never said that — we should at least pose an accurate question.

One of the (many) things I have pointed out is that a computer science degree is no guarantee of "the kind of perspectives that are needed for (good) computing" — this has parallels with the larger idea that a university degree is no guarantee that the recipient is now at a "what is actually needed" level of learning and understanding.

I've also said that I nonetheless advocate going to university if possible, because there are generally more chances to encounter ideas that will trigger real thinking and real desires to learn.



## How can I get in contact with Alan Kay for an interview for my high school project? I want to interview him about the history behind the development of the GUI and his work at PARC

[Answer](#)[Follow](#)[Request](#)

All related (32) ▾

Sort

Recommended ▾

[Alan Kay · Follow](#)

I am the Alan Kay in question. · Apr 5

Please tell me more about your high school project ...

In any case, a good place to start is to read enough of what is available to gather enough context to ask good questions and to see how the answers fit with history.

Here's a relatively short tribute I wrote about the larger research community I was involved with. It has a fairly extensive bibliography. [The Power of the Context](#)

Some of the work I and my group did at Parc is in a history requested by the ACM "[The Early History Of Smalltalk](#)"

A longer white paper I wrote for the MacArthur Foundation in the UK is about "[How?](#)" really big efforts have been set up and succeeded.

A book about the larger context that is pretty good is "The Dream Machine" by Mitchel Waldrop.

——— I'm still hoping for a comment from the student who asked the question ...

3.4K views · View 117 upvotes · View 2 shares · Answer requested by Calvin Lei

[Upvote · 117](#)[0 9](#)

Calvin Lei · Apr 6

Would it be better if I emailed you a list of questions?



2



Reply



Alan Kay · Apr 7

I like email the most, but we could do a Zoom or Skype to get started. I have done a few talks (available on YouTube) that featured some of the historical examples that could be part of your project. A really early one — back in the days of acetate overhead "foils" and 3/4" video tapes — was for University Microfilms, and this would allow you to see how we tried to explain personal computing and GUIs back in the 80s.



14



Reply



Alan Kay · Apr 9

Give me a Skype handle or a Zoom link and we can find a time to chat.

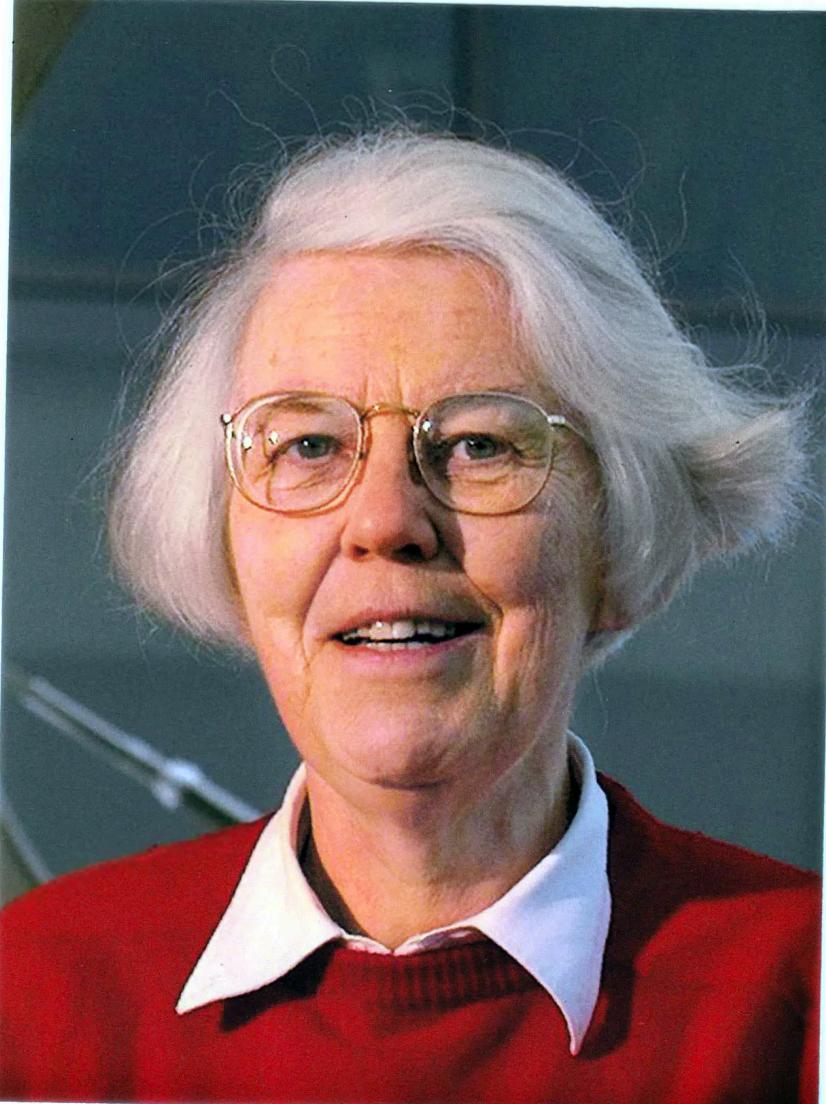


6



Reply





# Karen Spärck Jones

- Developed the concept of Inverse Document Frequency (IDF)
- Revolutionized information retrieval and search engine algorithms

"Computing is too important to be left to men" - Karen Spärck Jones

# Pioneers of Practice



# Grace Hopper

AKA "Amazing Grace" AKA "Grandma COBOL"

She was:

A Computer Scientist



A United States Navy  
Rear Admiral



And she retired twice...

A Pioneer of Programming



Effortlessly Funny!



Letterman: What interested you to go into the navy?

Hopper: Well, World War 2 to begin with...

Letterman: How did you know so much about the computers back then?

Hopper: I didn't, it was the first one!

Hopper: When an admiral asks you why it takes damn long to send a message via satellite? You point out to him that between here and the satellite there are a very large number of nanoseconds.

## Source Video

---



Letterman: How did you know so much about the computers back then?  
Hopper: I didn't, it was the first one!

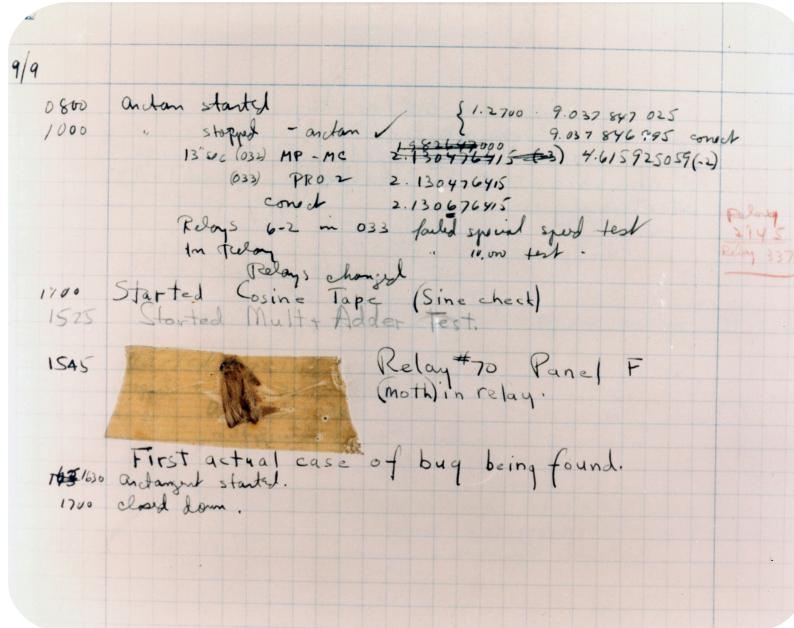
# FLOW-MATIC

```
1. OUTPUT 'HELLO, WORLD' TO CONSOLE.  
2. STOP.
```

# COBOL

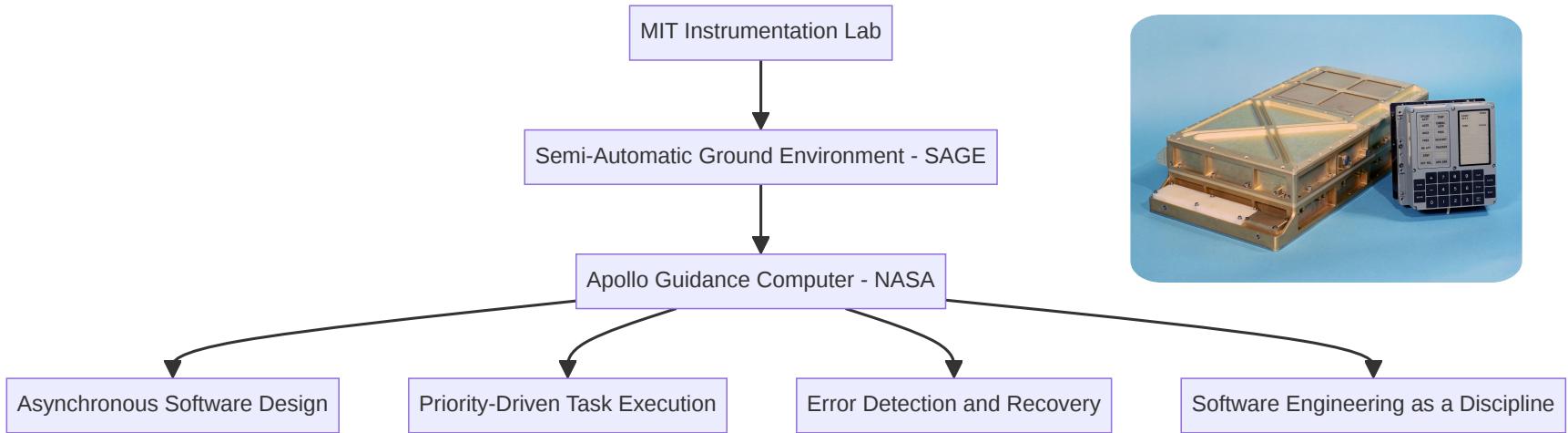
```
IDENTIFICATION DIVISION.  
PROGRAM-ID. HELLO-WORLD.  
PROCEDURE DIVISION.  
    DISPLAY 'HELLO, WORLD'.  
    STOP RUN.
```

An obviously, she found the first bug...



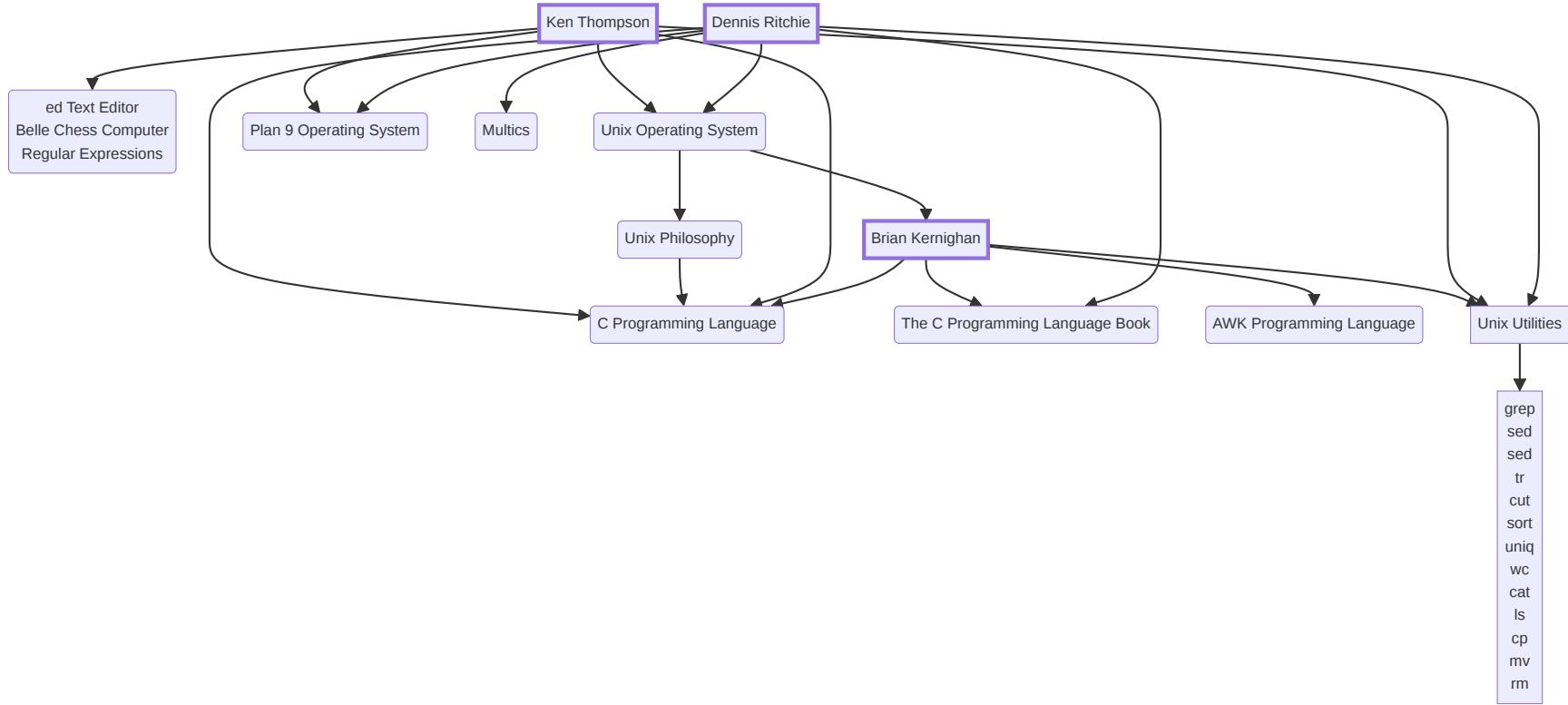


# Margaret Hamilton



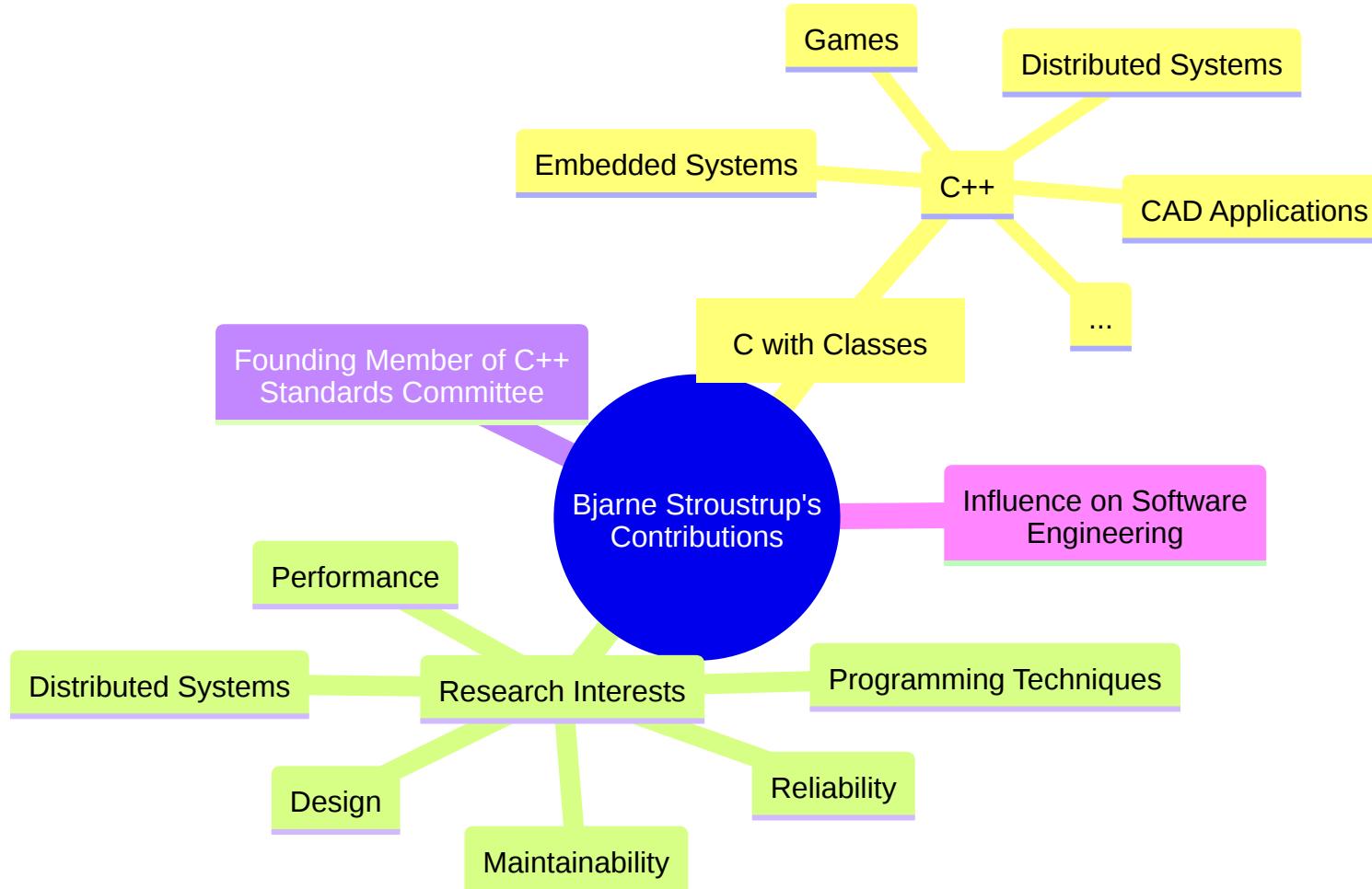
# Dennis Ritchie, Ken Thomson, and Brian Kernighan





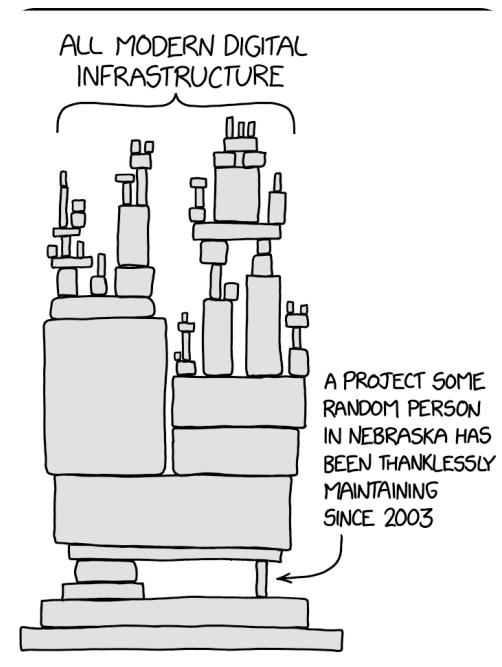
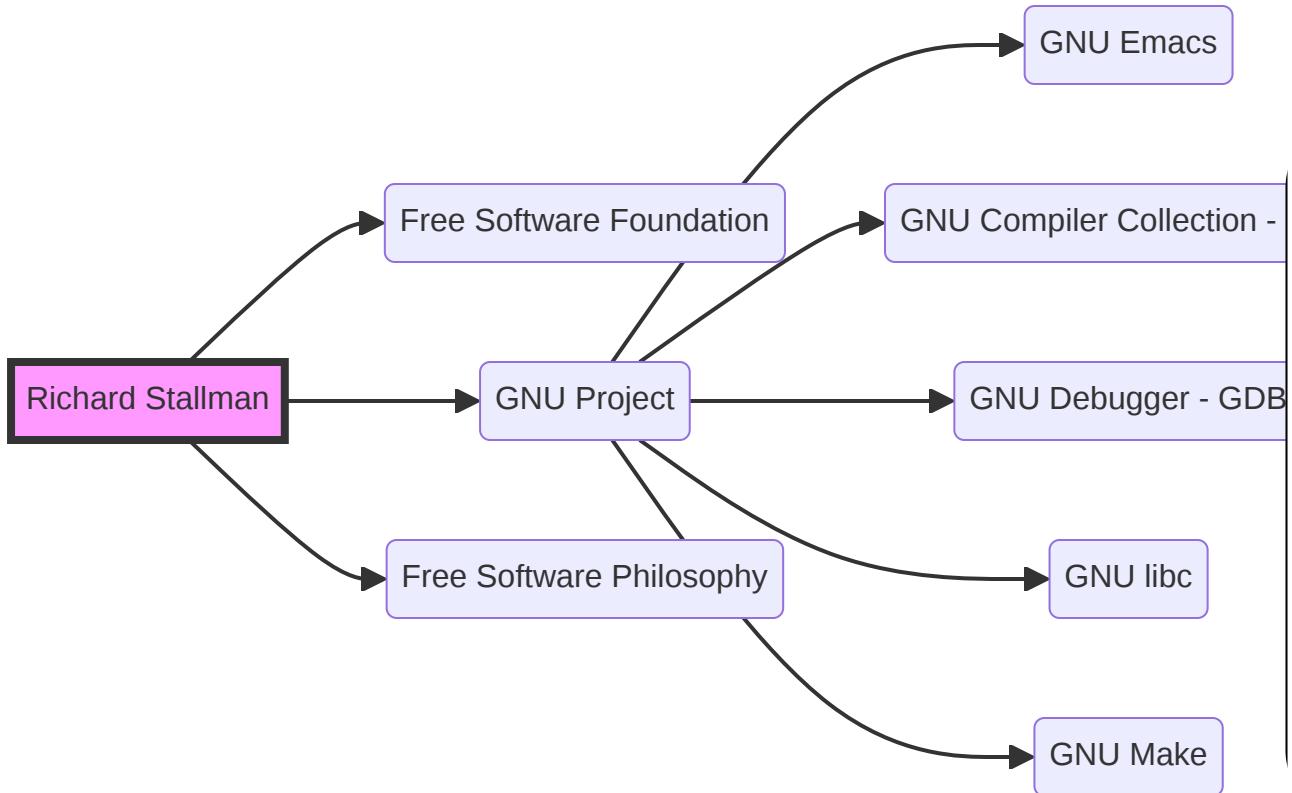


# Bjarne Stroustrup



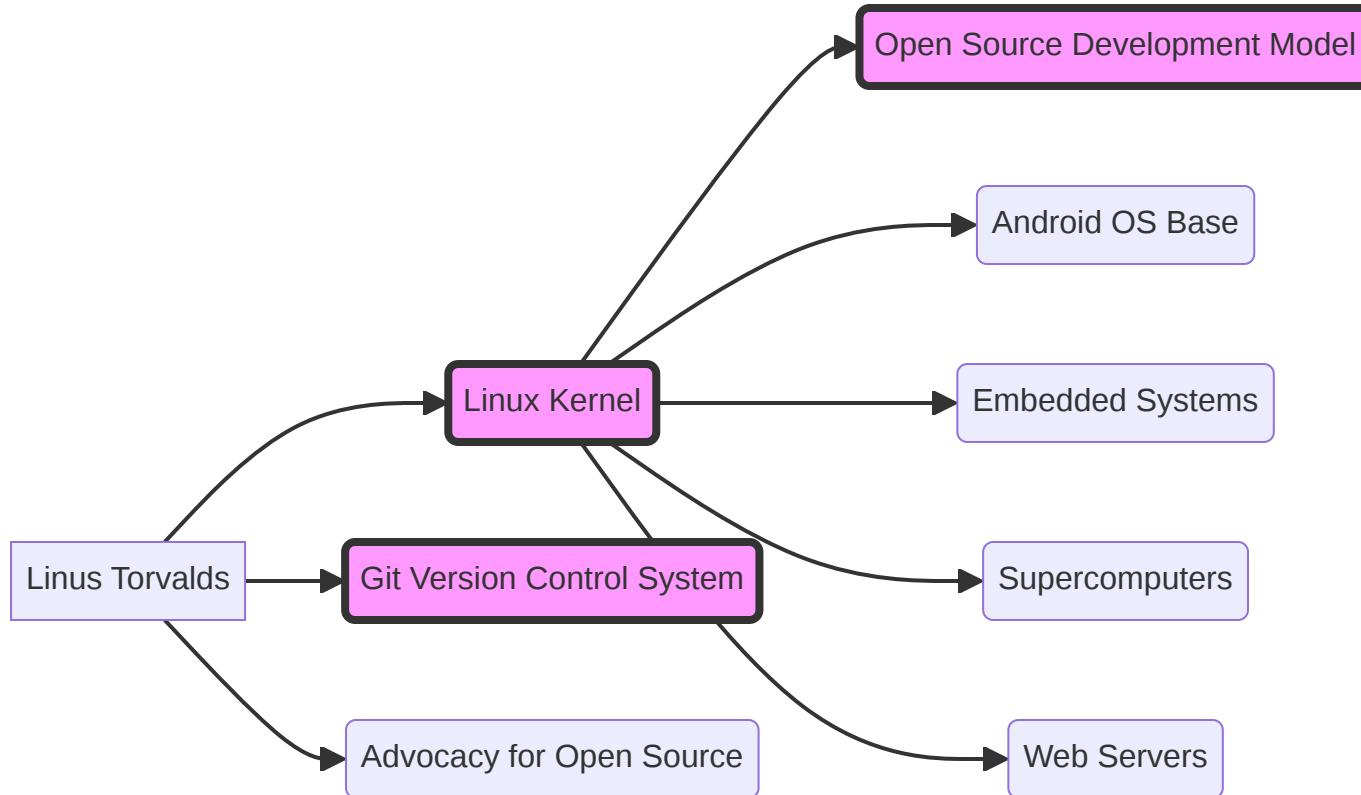


# Richard Stallman



A black and white close-up portrait of Linus Torvalds. He is wearing round-rimmed glasses and has his hands clasped together near his chin. He is looking directly at the camera with a slight smile.

Linus Torvalds

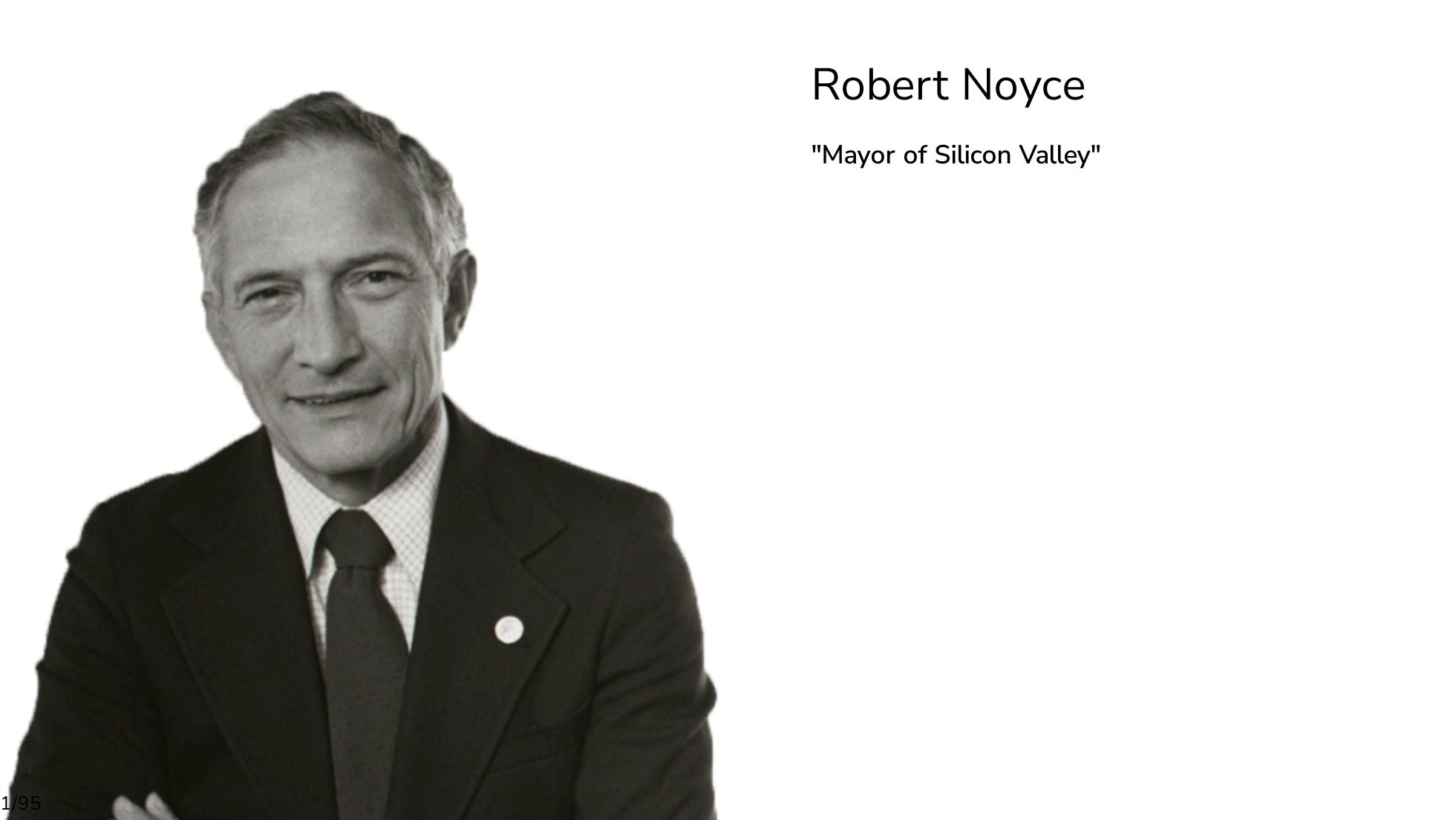


In my quest for a better patch, this made sense to me. I know now this was not OK and I am truly sorry. - Linus Torvalds

Source

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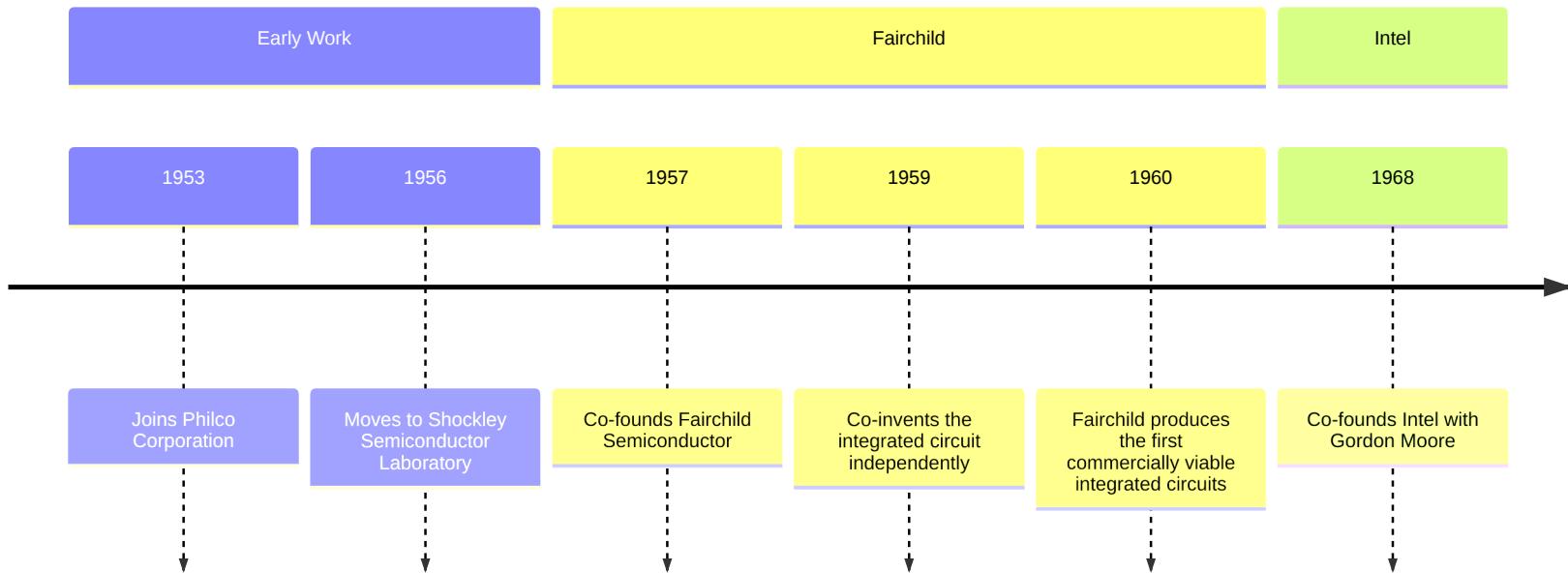
# Building the Infrastructure

A black and white portrait of Robert Noyce, an elderly man with grey hair, wearing a dark suit, white shirt, and dark tie. He is smiling slightly and looking towards the camera. A small white circular pin or badge is visible on his left lapel.

# Robert Noyce

"Mayor of Silicon Valley"

## Key Career Milestones



# Mark Dean

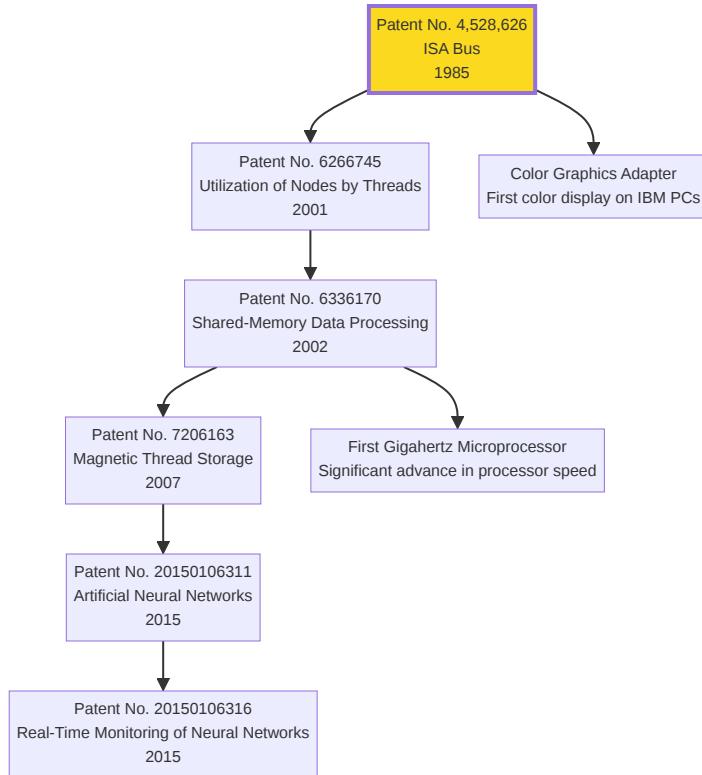
Co-creator of the IBM personal computer  
(1981)



# Mark Dean

- **Pioneering Innovations:** Co-inventor of the ISA Bus, foundational to the personal computer.
- **Multiple Patents:** Holds 44 U.S. patents, reflecting a prolific and impactful career.
- **Diverse Contributions:** From computer architecture to artificial intelligence, his work spans multiple critical areas in technology.
- **Educational Impact:** Professor Emeritus at the University of Tennessee, shaping the next generation of engineers.

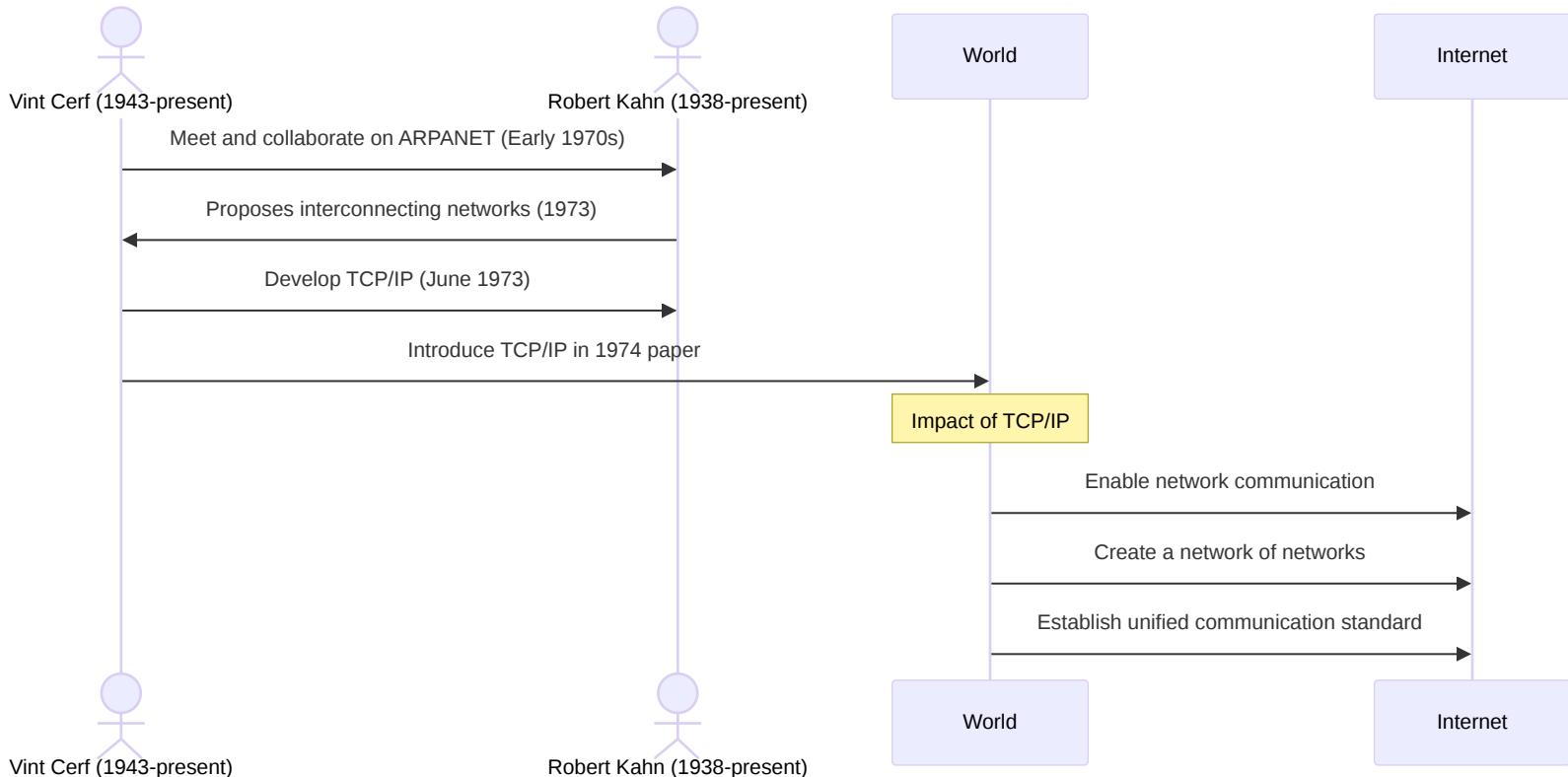
# Dean's Key Contributions



# Vint Cerf & Robert Kahn

## Fathers of the Internet

- Co-design of the TCP/IP protocols (1973)
- Enabled different networks to communicate, creating the "internet"
- Simplified data transmission and scalability

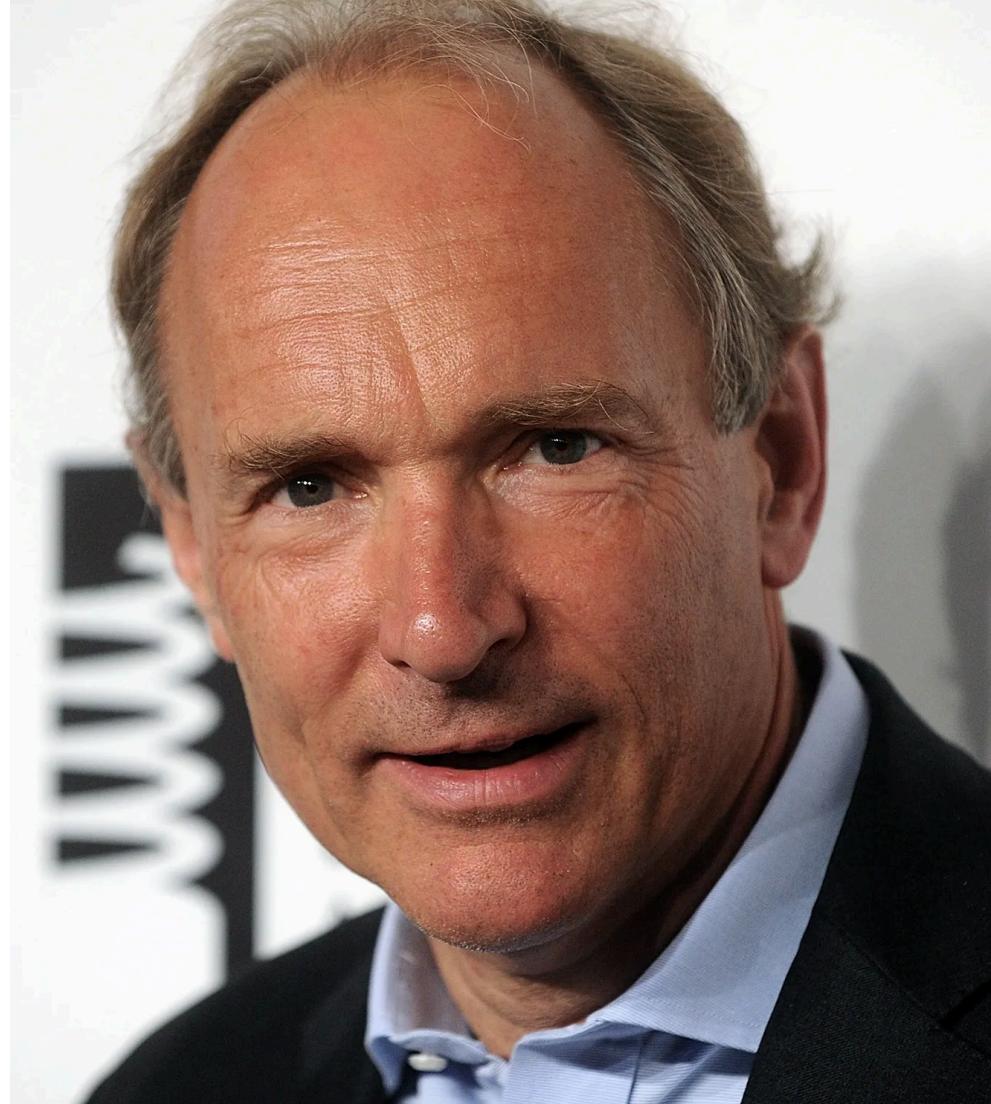


# Why TCP/IP Alone Wasn't Enough

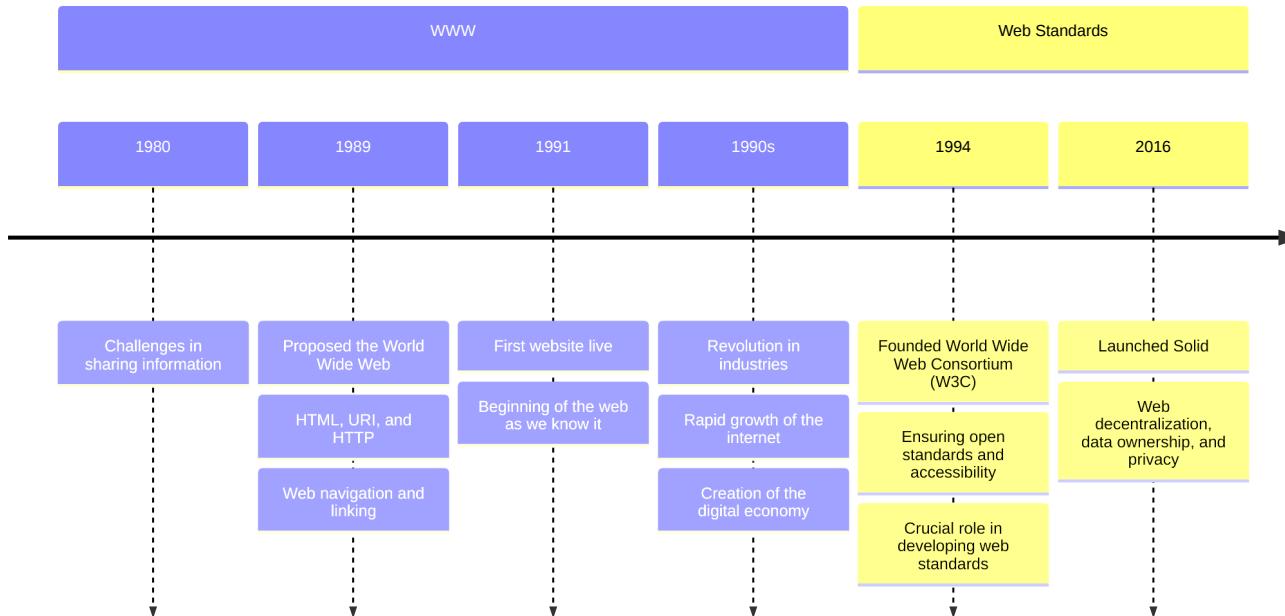
- TCP/IP Fundamentals
  - Reliable data transfer and addressing
- Missing Elements
  - User-friendly access
  - Information organization
  - Interoperability

# Tim Berners-Lee

Inventor the World Wide Web (1989)

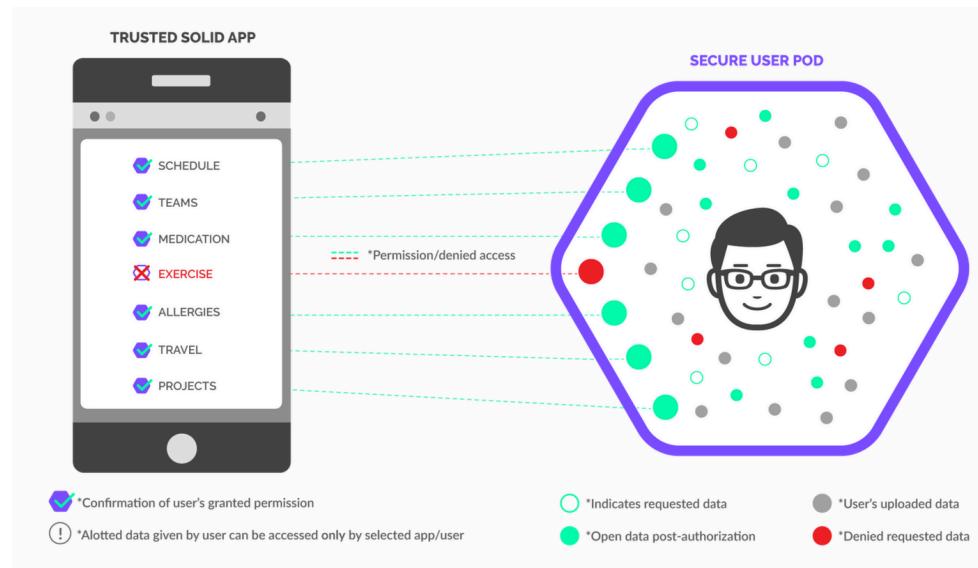
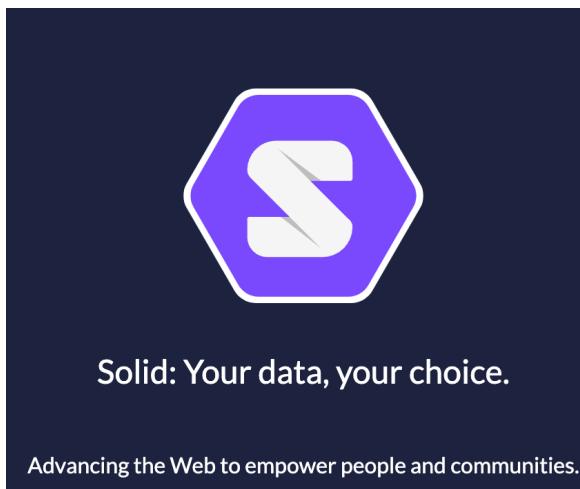


## Tim Berners-Lee's Achievements and Work



# Current and Future Work

- Advocates for a free and open web
- Current project: Solid (Social Linked Web) - decentralizing the web
- Vision for a universal and open platform



# Building on Top of Giants

# Ray Tomlinson

- Implemented the first email program on ARPANET in 1971



# Steve Wozniak

- Developed the Apple I (1976) and Apple II (1977) computers, along with Steve Jobs



# Daniel Bricklin and Bob Frankston

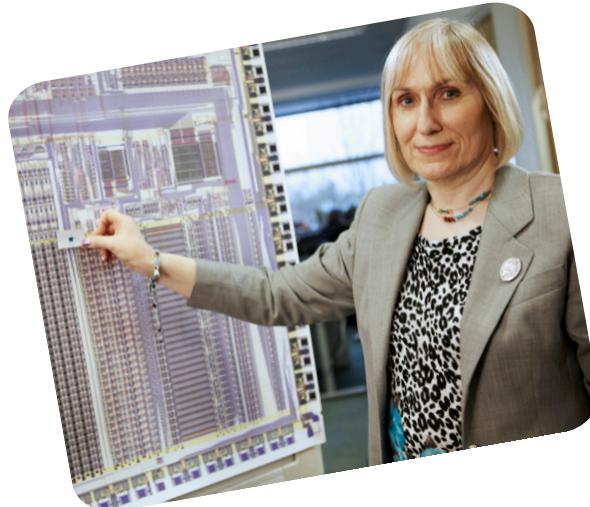
- Created VisiCalc in 1979



11 <L> TOTAL 25				
A	ITEM	B	NO.	C
				UNIT
1	MUCK RAKE	43	12	.95
2	BUZZ CUT	15	6	.95
3	TOE TONER	250	49	.95
4	EYE SNUFF	2	4	.95
5				-----
6				9.90
7				-----
8				SUBTOTAL 13155.50
9				9.75% TAX 1282.66
10				TOTAL 14438.16
11				
12				
13				
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16				
17				
18				
19				
20				

# Sophie Wilson

- Co-designed the ARM architecture in the 1980s along with Steve Furber



# Steve Wilhite

- Created the Graphics Interchange Format (GIF) in 1987

Nasir Ahmed - Invented Discrete  
Cosine Transform (DCT) in 1972



# Jarkko Oikarinen

- Created the first IRC client and server in 1988



# Phil Katz

- Created the ZIP file format in 1989



# Henning Schulzrinne

- Created the Session Initiation Protocol (SIP) in 1996



# Justin Frankel

- Created Winamp in 1997 and gnutella peer-to-peer network protocol in 2000



# Jan Koum and Brian Acton

- Created WhatsApp in 2009



# Ward Cunningham

- Developed the first wiki
- Then later federated wiki
- Co-authored the Manifesto for Agile Software Development
- "Cunningham's Law"

The best way to get the right answer on the Internet is not to ask a question; it's to post the wrong answer.



# Beyond Machines and Code

## Graph overview

372 nodes

474 edges

Download dataset

Clear all filters

Color nodes by...

act

Degree

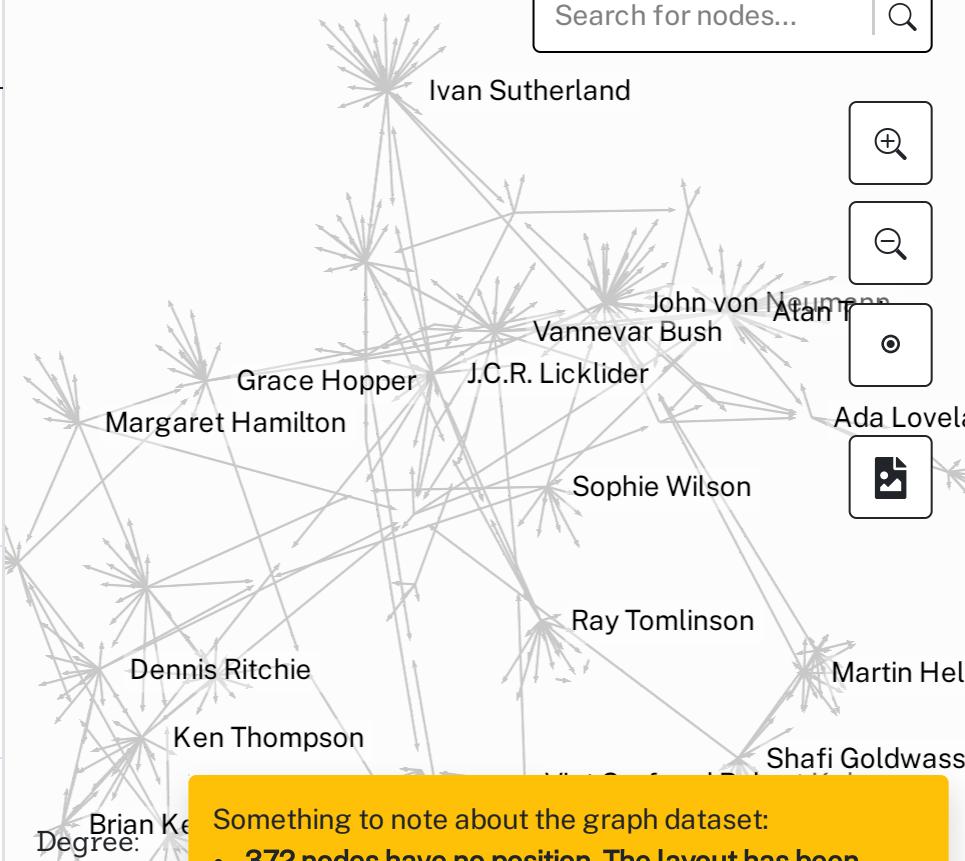
Size nodes by...

act

Sort alphabetically

Act\_1 (125 nodes)

Act\_3 (114 nodes)



Degree:  
Brian Kernighan

•

1 37

Something to note about the graph dataset:

- 372 nodes have no position. The layout has been determined using [ForceAtlas2](#). However, it would be better to load a file with the layout already computed.

A story of people, not just machines and code

# Thank You!

Slides at <https://github.com/Furkanzmc/cppnorth-2024-shoulders-we-stand-on>

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