



A photograph of three young women in a classroom setting, focused on a laptop screen. The woman on the left wears a white sweatshirt and has her hair pulled back. The woman in the middle wears a yellow ribbed sweater. The woman on the right wears a grey hijab and a blue t-shirt, looking directly at the camera. They are all looking at a laptop screen which is partially visible in the foreground.

# Stereotyping in Computer Science



# Gender & Computer Science



## The Computer Girls

BY LOIS MANDEL

A trainee gets \$8,000 a year  
...a girl "senior systems analyst"  
gets \$20,000—and up!  
Maybe it's time to investigate....

Ann Richardson, IBM systems engineer,  
designs a bridge via computer. Above (left)

Twenty years ago, a girl could be a secretary, a school teacher . . . maybe a librarian, a social worker or a nurse. If she was really ambitious, she could go into the professions and compete with men . . . usually working harder and longer to earn less pay for the same job.

Now have come the big, dazzling computers—and a whole new kind of work for women: programming. Telling the miracle machines what to do and how to do it. Anything from predicting the weather to sending out billing notices from the local department store.

And if it doesn't sound like woman's

computer can solve a problem, and then instruct the machine to do it."

"It's just like planning a dinner," explains Dr. Grace Hopper, now a staff scientist in systems programming for Univac. (She helped develop the first electronic digital computer, the Eniac, in 1946.) "You have to plan ahead and schedule everything so it's ready when you need it. Programming requires patience and the ability to handle detail. Women are 'naturals' at computer programming."

What she's talking about is *aptitude*—the one most important quality a girl needs to become a programmer. She also

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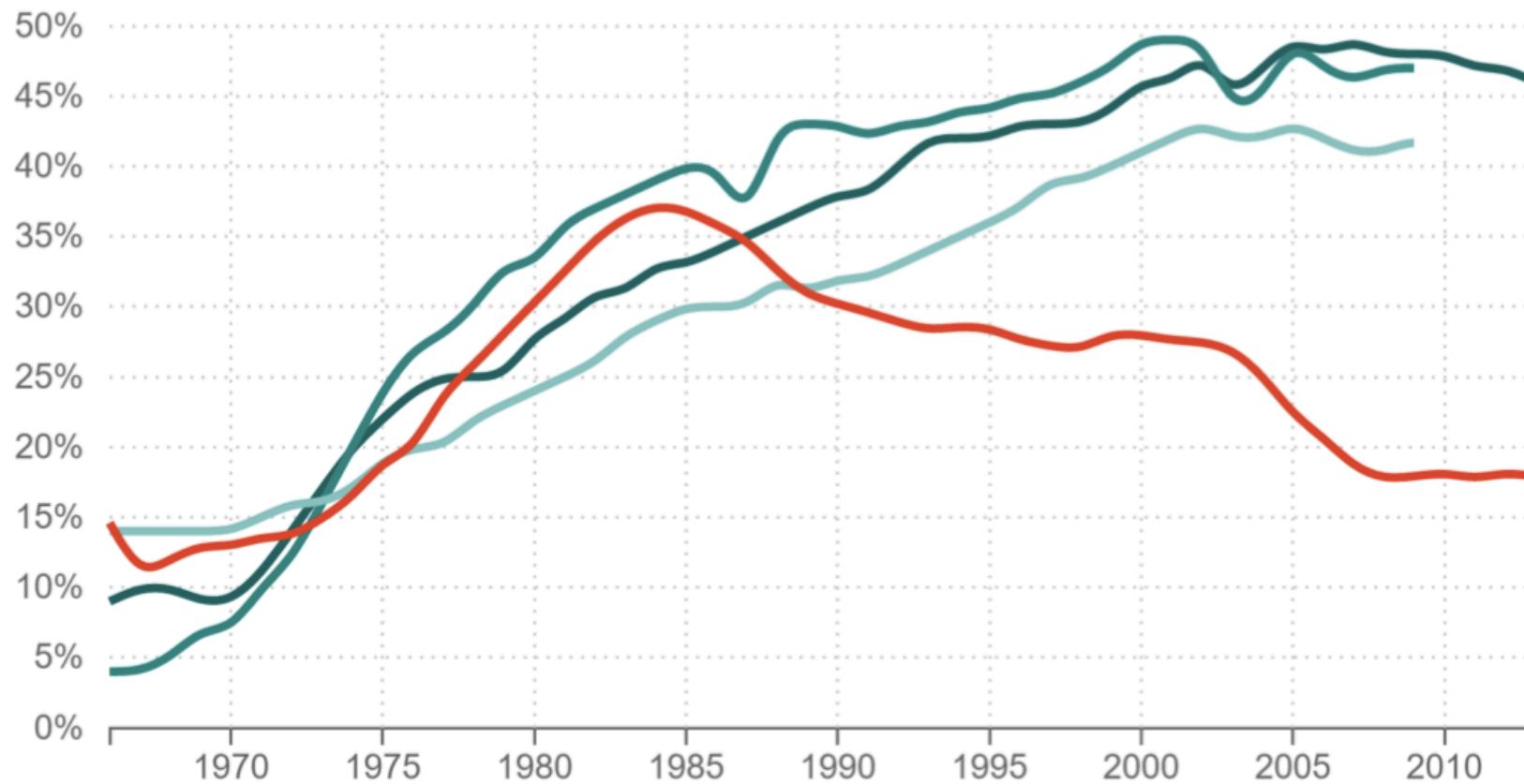
1967

'Women are naturals at computer programming'

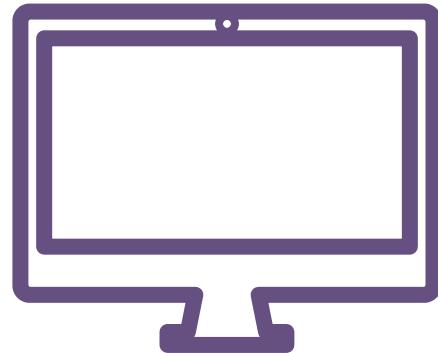
# What Happened To Women In Computer Science?

% Of Women Majors, By Field

Medical School Law School Physical Sciences Computer science

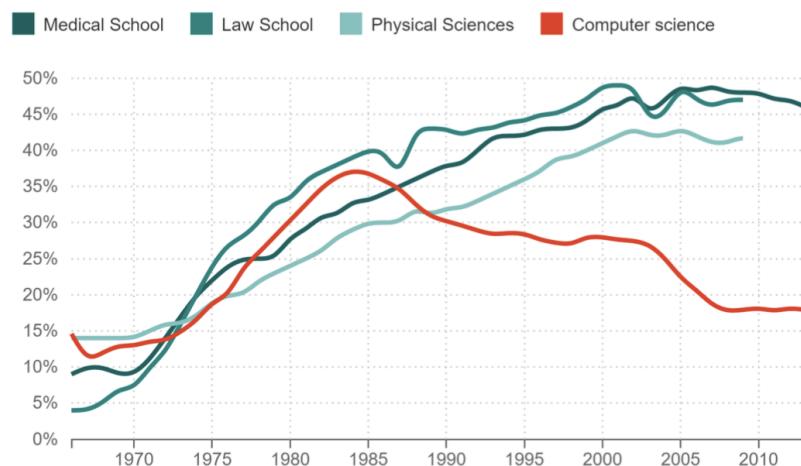


Source: National Science Foundation, American Bar Association, American Association of Medical Colleges  
Credit: Quoctrung Bui/NPR



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**What it is is beautiful.**

Have you ever seen anything like it? Not just what she's made, but how proud it's made. It's a look you'll see whenever children build something all by themselves. No matter what they've created.

Young children build for fun. LEGO Universal Building Sets for children ages 3 to 7 have colorful bricks, wheels, and friendly LEGO people for lots and lots of fun.

Older children build for realism. LEGO Universal Building Sets for children 7-12 have more detailed pieces, like gears, rotors, and treaded tires for more realistic building. One set even has a motor.

LEGO Universal Building Sets will help your children discover something very, very special.

**Universal Building Sets**

744 pieces 7-12 years old

1172 pieces 3-7 years old

**LEGO**

# Leaking pipeline

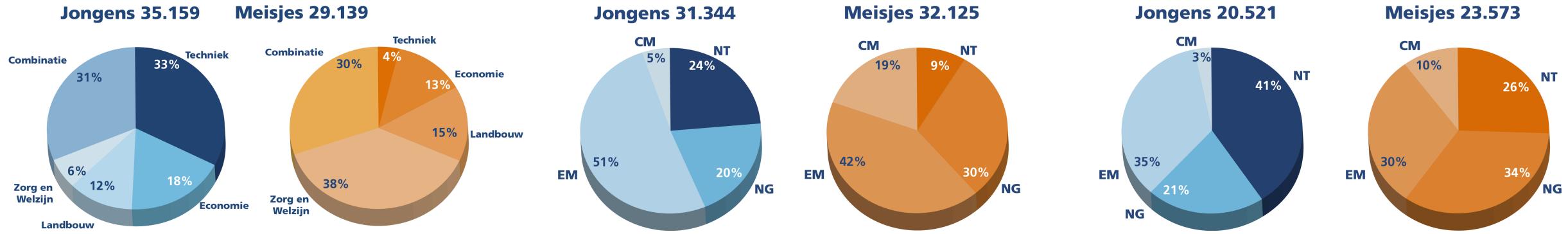


Every step of the way,  
girls fall out of the Computer Science pipe-line



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# In the Netherlands..



m: 9,1%  
f: 0,4%



m: 13,8%  
f: 3,1%



m: 12,8%  
f: 3,9%

# Why?

- Low self-efficacy
- Stereotypes
- Limited view
- Lack of role models

# What does VHTO?

Increase participation of girls and women in STEM

- DigiLeerKracht
- DigiVita
- Computer Science Certificate

A photograph of two young women working on a small robot. The woman on the left, with long dark hair, is smiling and holding the robot. The woman on the right, wearing a black hijab, is looking at the robot. They are in a classroom setting with other students in the background.

Stereotypes in Computer Science

# What is gender?

Gender =  
socio-cultural aspects of femininity and masculinity

Numbers often about sex

# Motivation

- Low gender diversity in CS
- Strong stereotypes → lower interest and self-efficacy  
(Master et al. 2017)
- Interest and self-efficacy → career orientation  
(Aivaloglou and Hermans 2019, Nugent et al. 2015)

# Stereotypes in CS

- Male
- Technological Oriented
- Asocial
- Intelligent
- Work alone
- Not helping others



# Stereotypes among children

**Aivaloglu and Hermans (2019)**

no stereotypes found

- singularly focused
- asocial
- competitive
- male

# Stereotypes among children

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## Hansen et al. (2017)

- Male
- Mean age of 25
- Work alone
- Predominantly use computers
- Perform a vague set of tasks
- Scientist who use computers



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# Draw-a-computer-scientist-test



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# Goals

1. Research stereotypes that children hold about computer scientists
2. Research whether stereotypes are affected by a virtual intervention with role models
3. Research whether visual and textual instruments yield similar results

# Data collection

- 300 - 1,000 children aged 6 - 18 years
- Science Live at NEMO Science Museum
- Stereotypical beliefs before and after an intervention

# Implicit Association Test

- Reaction time when clustering two subject together

Zitelny et al. (2017)

What Is the Implicit Gender-Science Stereotype? Exploring Correlations Between the Gender-Science IAT and Self-Report Measures.

Steffens et al. (2010)

On the Leaky Math Pipeline: Comparing Implicit Math-Gender Stereotypes and Math Withdrawal in Female and Male Children and Adolescents

Cvencek et al. (2011)

Math-Gender Stereotypes in Elementary School Children



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A group of children are sitting at wooden tables in a classroom, working on laptops. In the foreground, two girls are looking at a laptop screen together. One girl is holding a piece of paper. In the background, other children are also working on their laptops. A cup with the word "KOFFIE" is visible on one of the tables.

# Software project

# Expectations

- Reliable application for data collection
  - Target group: children 6 - 18 years
  - Informed consent on separate device
  - Implicit association test
  - Statements
  - Video intervention
  - A dashboard with intermediate results / analysis would be nice to have

# Expectations

- Dissemination
  - Making people aware of there own stereotypes
  - Available on different devices
  - Needs to be easy to use
  - Enjoyable
  - A follow-up action for the user
  - Be creative :-)

# Expectations

- Pilot: maybe (June 6 and 7)
- Well documented
- Don't be afraid to share/show things that are not perfect yet
  - Make clear what you envision to change
- Let me know when you run into problems

# Suggestions

- Make use of the references in this presentation
- Do an implicit association test yourself (Harvard)
- Existing applications:
  - Implicit association testing
  - Informed consent
  - Awareness applications
- Include software/hardware that you think is required
- Next meeting and feedback next week