ISSUE 1 SEPTEMBER 2016

Careers with Code

Game-changing jobs of tomorrow

Develop apps, gear, games and more!

Meet today's code ninjas

Make an impact on the world

CREATIVE COMPUTER SCIENCE CAREERS

Google

[Virtual reality] [Sports tech] [Music & film] [Social change] [Business skills] [Wearables]


@research
Computer science gives you the tools to change the future
@CareerswithCode
CareerswithCode.com
REFRACTION MEDIA
Google

YVONNE MELTON

Creating change

Computer science skills have never been more relevant

What would you do if you could change the world, perhaps starting with the community you live in today? Computer science is a set of tools that empowers individuals to change the world using creative problem solving across all industries. There are even folks like Robert Nelson who use computer science to create an entirely new 3D virtual reality world! (Read more about Rob on page 15.)

There will be an estimated one million open careers in computer science in the United States by 2020. *Careers with Code* aims to inspire students and provide educators, counselors and librarians with stories and ideas of how computer science can amplify student interests, and how it relates to many different study areas.

Computer science is much more than just writing code. It's the study of computers and algorithms – including their principles, their hardware and software design – and their impact on society. Computer science drives innovation, not just in tech, but also in fields as diverse as music (page 24) and medicine (page 35).

Your world is changing faster than ever before, and you have the potential to create solutions and re-imagine a future powered through technology. To accomplish this, we need more students pursuing an education in computer science to bring bold new perspectives to – and to invest in – solving everyday problems. It's just the beginning of a life-long journey into learning, where you'll be able to choose from careers that may not have even been invented yet.

Come with us on this journey, and read on to see how you can use computer science to follow your passion and be an agent of change!

Mo-Yun Lei Fong
Director of Google K–12 Education Outreach

> **"YOU'LL BE ABLE TO CHOOSE FROM CAREERS THAT MAY NOT HAVE EVEN BEEN INVENTED YET."**

DISCOVER NEW IDEAS, CAREERS AND STUDY OPTIONS

What is *Careers with Code*?

Computer science provides important foundational skills for fast-growing careers. These skills can also be combined with subjects in the arts, science, law, design, business, sports and more. In a future characterized by rapid technological change, it is people with tech skills and the ability to move rapidly across different areas who will take on and make the jobs of the future. *Careers with Code* is your guide to the tools you can use to change the world around you.

Median earnings, 2015
Computing jobs:
$39/HR
All other jobs:
$21/HR

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$3.1M

Computer science graduates earn half a million more over their working lifetime than other college majors earn ($2.4 million).

> 3 out of 4 (71%) new science or engineering jobs in the United States will be in computing by 2018.

CS+ART

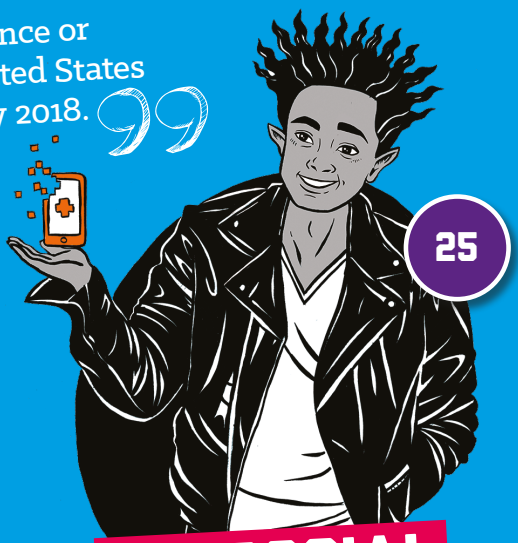
22

Crafting the future
If you're into music, film, fashion or gaming, tech skills can open doors to hot careers. Just ask Ann Mincieli of Jungle Studios or Maddy Maxey from The Crated.

28

CS+BUSINESS

Make your mark
Start a start-up to solve a local or global issue, like Perry Ogwuche's excellent shipping business or Jonathan Graham's coding school for unemployed people.



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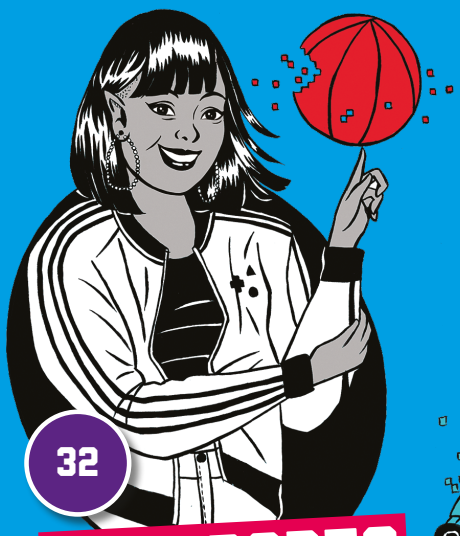
CS+SOCIAL JUSTICE

Coding for good
Apps to empower women experiencing domestic violence from genius programmer Alicia Carr, plus the most amazing ways computer science is making the world a better place.



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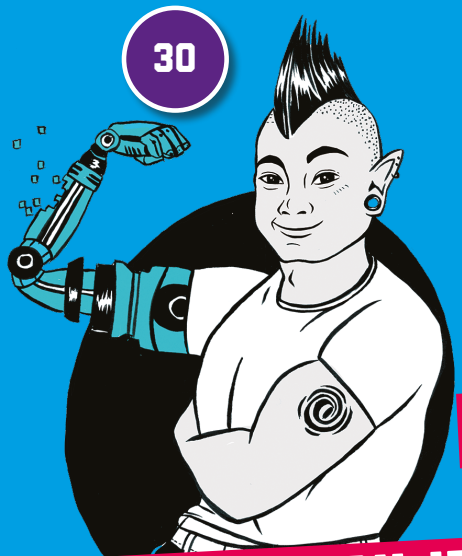
CS+SPORTS

Bring your A game
Under Armour bring us their top wearable tech that helps atheletes acheive their best performance with the help of a device that tracks their sweat chemistry.



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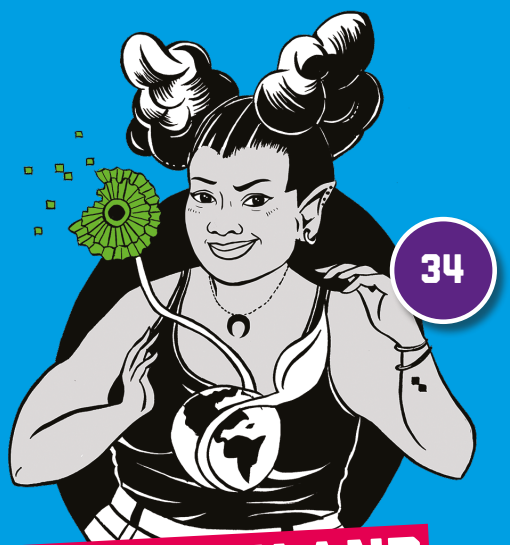
CS+ACCESSIBILITY

Access for all
Transforming the way we use the Web and some high school students helping to take code to people with learning challenges.



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CS+HEALTH AND SUSTAINABILITY

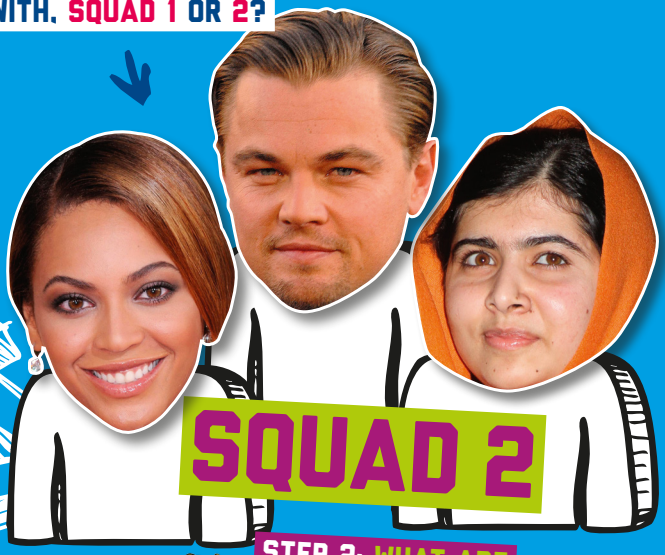
Code the planet!
Saving the world one line of code at a time, and meet Brittany Hayes, whose Twitter analysis shows how the media responded to the Ebola crisis.

REFERENCES: US CENSUS BUREAU: BIT.LY/1INWXFB / CHANGETHEEQUATION.ORG / USA TODAY: USAT.LY/1WO7L9G

WHAT CODER TYPE ARE YOU?

YOU MIGHT NOT THINK YOU'RE A CODER, BUT YOU'RE ONLY TWO QUESTIONS AWAY FROM FINDING OUT HOW COMPUTER SCIENCE FITS IN WITH YOUR DREAM GOALS

STEP 1: THESE CELEBS HAVE A REP IN THE WAY THEY ARE TRYING TO CHANGE THE WORLD. WHICH DO YOU MOST IDENTIFY WITH, SQUAD 1 OR 2?



STEP 2: WHAT'S ON THE HOME SCREEN OF YOUR DEVICE...

ESPN

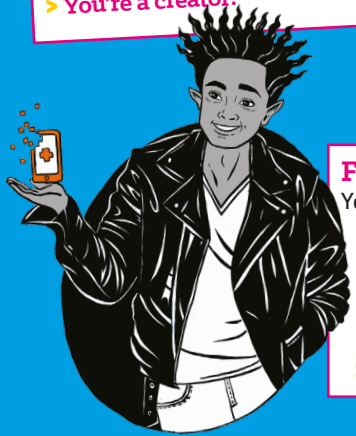
A future in sports awaits. From talent scouting to building computer models of how athletes' bodies move, computers and sports go hand in hand. Check out **page 32** to start yourself off on the road to sporting success.

> You're a game-changer!

music.ly

You have a strong creative streak. Film, art, music – coding helps you get ahead in whatever direction your creativity takes you. Flick to **page 22** to find out how.

> You're a creator!



Feedie / TED Talks

You're flying the flag for social change. Head straight over to **page 25** to find out how you can make positive changes in your neighborhood and beyond.

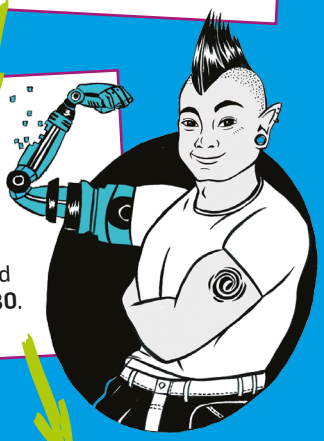
> You're a trailblazer!

STEP 2: WHAT ARE YOU WATCHING...

Shark Tank

You could be a natural business leader. Coding skills might just help you launch Silicon Valley's next big company. Your journey begins on **page 28**.

> You're an innovator!



Daredevil

You're interested in justice and fair access to the future. Let's build a better Web that's inclusive of all people, regardless of background or ability. Stop by **page 30**.

> You're a helper!

Last Week Tonight

Ever wanted to save the planet? The world needs people like you to make big changes. Computer science can help solve Earth's greatest challenges – see for yourself on **page 34**.

> You're a planet-shaper!

Design your career

Whatever your passion, with computer science you can create your future

Computer science goes by many names: technology, artificial intelligence, mechanization and robotics – the universal favorite. Behind the name, though, computer science is all about using tech to solve problems. People are now using computers for everything – from finding cures for diseases and tracking climate change, to finding new ways to communicate, preventing crime and empowering disadvantaged social groups.

These are some of the reasons why jobs in computer science are growing at twice the rate of jobs in any other employment market in the United States. By 2020, there will be one million jobs in computer science-related fields that will need to be filled by graduates – and that's just going to keep on growing. For real!

"Technology has become the cornerstone of modern civilization," says Andreas Stefik, assistant professor of computer science at the University of Nevada. "Even those not in the technology field are influenced by it one way or another." Andreas helps develop technology for people with disabilities to write computer software, including a programming language that lets people with visual disabilities create their own 3D games. He says computer science affects the most important parts of our lives, connecting us to people we love and letting us enjoy parts of the world we may never visit – and it also plays a big part in imagining our future, which is really cool.

"Computer science is a key language of creation," says Cordell Carter, founder and CEO of TechTown, a technology learning center in Tennessee. "Early exposure to computer science education positions students to be active participants in the culture of creation." Cordell has seen a ton of transformations at TechTown. This includes one awesome moment when a young summer camp student who, when explaining how he'd learned to modify Minecraft using Java, kept stopping, mid-sentence, to repeat to the group, "I coded that; I'm a coder now!" – full of amazement.

Music lovers can use computer science to compose songs or collaborate with other musicians. Those with medical ambitions can use computer science to develop life-saving medical technology. If you love sports, it can help you train, participate or work with your favorite athletes. There is no end to how computer science can help you realize your dreams.

"IN THE COMING YEARS, WE SHOULD BUILD ON THAT PROGRESS BY OFFERING EVERY STUDENT THE HANDS-ON COMPUTER SCIENCE AND MATH CLASSES THAT MAKE THEM JOB-READY ON DAY ONE."
– BARACK OBAMA IN HIS 2016 STATE OF THE UNION ADDRESS

HELGA ESTEB / ANDREA RAFFIN / S_BUKLEY / JSTONE / SHUTTERSTOCK / FREDA CHIU

Code ninjas

Meet the women building amazing careers in computer science

CODE IN MOTION

SUE PERROTTO BRINGS ANIMATION TO LIFE AT DISNEY JUNIOR

When I was young, I wanted to be an astronaut, actor, artist, you name it. But I always loved animation. It's an art form where I get to do it all – even work with NASA! After my degree in film/TV production at New York University, I started my career in animation. I've always been fascinated by coding and computer programming, and now animation has evolved into the digital realm, I can use the computer as part of my artist's toolbox.

I bring scripts to life visually, drawing directly on Cintiq monitors and using software to create the images on a panel – I sync them to the dialogue, then add music and sound effects. Sometimes the coolest results are different from what you imagined at the start.

I really feel like I'm making a difference through the art of animation. Keeping material entertaining makes learning more accessible and more fun! I've always been astounded by the possibilities presented by computer science. My mind gets blown every day!

STARTED DOING PROGRAMMING AND FILM COURSES. BISHOP EUSTACE PREPARATORY SCHOOL. >> ATTENDED AN INTRO TO FILM PRODUCTION COURSE. UCLA >> STUDIED FILM/TV. NEW YORK UNIVERSITY >> BECAME AN ANIMATOR. MICHAEL SPORN ANIMATION >> WORKING AS A DIRECTOR ON MILES FROM TOMORROWLAND

A BRIGHTER MIND

CLENNITA JUSTICE DOESN'T DO BOREDOM

As a kid, I wanted to be a dancer, then a lawyer and then a poet. I also remember math being my favorite subject. As a senior in high school, I took a computer programming class. I did well and really liked it.

When I took my first programming class as a freshman, I was hooked. I remember standing in front of an ATM on UC Berkeley's campus and wanting to know how it worked. That has stayed consistent in my career — I want to know how things work.

I now help researchers study large groups of users to inform them on how to build better products, like Google Maps and Google Search. My friends and family didn't have any understanding of what I did when I was writing code every day. Now, they come to me to help expose others to computer science careers. The best advice I've been given lately is to be curious before being certain. I think that applies to all areas of life and especially my career.

STUDIED FOR A BACHELOR IN COMPUTER SCIENCE. UNIVERSITY OF DENVER THEN UC BERKELEY >> TAUGHT HERSELF TO USE HTML, CSS AND JAVASCRIPT >> COMPLETED A MASTERS IN COMPUTER SCIENCE. HOWARD UNIVERSITY >> RECEIVED A PROJECT MANAGEMENT PROFESSIONAL CERTIFICATION. PMI >> BECAME A SENIOR ENGINEERING PROGRAM MANAGER. GOOGLE

LOVE TO LEARN

DAISY GALVAN CREATED HER OWN TECH PATHWAY AND NOW WORKS AT FACEBOOK

To me, computer science is more than just coding all day; it's a creative outlet that can turn ideas into something real.

My family is from a rural town in Mexico, so none of them had the opportunity to go to college. I love to learn, to discover the unknown and to be constantly challenged. I was selected for the McNair Scholars Program in college. One of my peers was researching mechanical engineering. I was fascinated and switched from arts to engineering.

I studied electrical engineering in college, and at a summer program – the Intel Ultimate Engineering Experience – I was introduced to the world of tech and engineering. It wasn't until my first role at Facebook that I really discovered how software combines two of my favorite things – building and problem-solving. I was hooked!

I taught myself to code using free online resources and attending a coding boot camp while holding a full-time business operations role at Facebook. I invested lots of time and energy into something I wasn't sure would materialize. I now design and develop solutions for Facebook's internal support tools.

Computer science lets you design a solution for just about anything. If I could change the world with computer science, it would be to make education more accessible, especially for women.

LOVED MATH IN HIGH SCHOOL. CLOVIS EAST HIGH SCHOOL >> COMPLETED A BA. CALIFORNIA STATE UNIVERSITY, SACRAMENTO >> INTERNED AT INTEL >> WENT TO AUSTIN CODING ACADEMY >> WORKS AS A SYSTEMS DEVELOPER, FACEBOOK

TOM KUBIK

Life in code

Computer science is part of your daily life – even if you can't see it

GAME OF HOMES

Robotic vacuum cleaners, such as Dyson's 360 Eye, clean your home by tracking the floor plan and memorizing their path so they don't cover the same area twice. You can also program them by smartphone.

CS USED: ALGORITHMS, ARTIFICIAL INTELLIGENCE, SOFTWARE DESIGN

THRASH IT OUT

Lifelike video games, such as *Call of Duty* and *Fallout 4*, feature "intelligent" enemies that can respond to, and learn from, your behavior and act unpredictably. Some games, such as the widely anticipated *No Man's Sky*, generate unique environments for each player using an algorithm-based method called procedural generation. A recent report from the Entertainment Software Association found that more than 150 million Americans regularly play video games.

CS USED: PROGRAMMING GRAPHICS SOFTWARE, ARTIFICIAL INTELLIGENCE, CLIENT-SERVER INTERACTION

ANYWHERE, ANYTIME

Online grocery stores, such as Amazon Prime and Netgrocer, can do same-day deliveries to your door and predict which products you like based on what you've put in your cart in the past.

CS USED: DATABASES, WEB PROGRAMMING, ARTIFICIAL INTELLIGENCE, MACHINE LEARNING, NETWORK SECURITY, ENCRYPTION

CREATING ANIME

Anime, such as the awesome new series *Kabaneri of the Iron Fortress*, has a distinct visual style and innovative production methods. Computer animation became more prominent in the 1990s, with films such as *Ghost in the Shell* and *Princess Mononoke* combining celluloid (or cel) animation with digital processes. Coding and digital media are essential skills in anime. You can even create your own anime through a wide range of software, such as Smith Micro's Anime Studio Pro 11.

CS USED: PROGRAMMING GRAPHICS SOFTWARE, ANIMATION, RENDERING, SCATTERING, SOFTWARE DESIGN

FOLLOW ME

According to the not-for-profit advocacy site Common Sense Media, American teens spend an average of one hour and 11 minutes a day on social platforms, creating, sharing and exchanging info.

CS USED: DATABASES, USER INTERFACE, SEARCH, VISUALIZATION, SECURITY MODELS

follow TWEET

DIABLUSES / TTATTY / LAUREN ELISABETH / SHUTTERSTOCK

FITNESS FRIENDS

Fitness apps, such as Fitbit and Digifit iCardio, count calories, record your heartrate and track your daily activity via your smartphone. Some fitness apps, such as JEFIT, also have exercise databases that help you design and log your workouts at the gym.

CS USED: DATABASES, USER INTERFACE

ON THE MONEY

ATMs and apps give you fingertip access to cash and account balances without having to stand in line to see a bank teller.

CS USED: EMBEDDED SYSTEM PROGRAMMING, DATABASES, SECURITY, ENCRYPTION

BINGE WATCH

Streaming media, such as Netflix, allow you to watch a large catalogue of films and TV shows on demand. According to a report from the commercial broadband company Sandvine, Netflix accounts for more than 37% of North American Internet traffic.

CS USED: DATABASES, USER INTERFACE, COMPRESSION ALGORITHMS

MIDDLE SCHOOL >> GO ONLINE TO GET SOME BASIC SKILLS >> JOIN UP WITH LIKE-MINDED FRIENDS OR FORM YOUR OWN GROUPS >> FIND OUT WHAT YOUR SCHOOL OFFERS

GO YOUR OWN WAY

THERE ARE PLENTY OF WAYS TO GET INTO COMPUTER SCIENCE AND MAKE A DIFFERENCE IN ANY FIELD

Think getting into a computer science career means you have to be obsessed with computers from like, birth? Nope. There are tons of ways you can explore this amazing new world. Really!

It's never too late to check out what computer science is about. The first step? Find out what's already available at your school. "Look for a class that allows you to be creative," says Jane Margolis, author of *Stuck in the Shallow End*. "Not a course where you just cut and paste code. Students need courses that teach them how to create and invent."

For example, as part of the course Exploring Computer Science, which Jane helped design, students in drought-stricken Los Angeles built an app to monitor the water consumption of their families. Others combined sensors with fashion design to create clothing that lights up. So cool! "Computer science is about using the power of technology to create meaningful things for your community," says Jane.

ASK AROUND

Find a mentor, such as a parent or your fave teacher, to help you out, and if there's nothing you're keen to try at school, talk to your teachers about starting a class or club using free programs, such as Google's CS-First or lesson plans from Code.org. "Our mission is to get computer science into schools," says Baker Franke, the curriculum developer for Code.org. "The best learning happens with teachers in classrooms, so we've developed materials for teachers with literally no experience so they can get their students into the world of computer science."

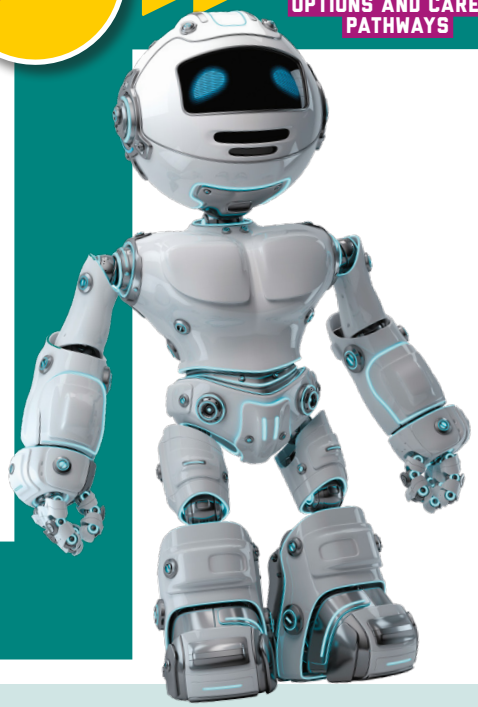
Once you've got the hang of it, you'll find a bunch of creative ways to apply computer science. Go with those ideas! Work with friends, or make new ones. Team up with others – you'll find the process easier and learn more.

Computer science isn't just about learning to code, either. It helps with skills, such as solving complex problems by breaking them down into simple parts, and gets you thinking logically and methodically about stuff.

The best bit? After high school, you can totally stay involved in computer science in whatever you decide to do. Universities, community colleges and technical schools are adding to their computer science course offerings – fast. Plus, there's always free online tutorials available to give computer science a go at home.

So, whatever you want to do, or be, computer science can help you get there.

HIGH SCHOOL >> TALK TO YOUR SCHOOL COUNSELOR ABOUT COURSE OPTIONS AND CAREER PATHWAYS >



COLLEGE >> EXPLORE ALL YOUR OPTIONS: TECHNICAL COLLEGE, COMMUNITY COLLEGE OR 4-YEAR UNIVERSITY >> HIT A SPEED BUMP? DON'T STRESS – YOU CAN LEARN THE MOST FROM YOUR BIGGEST MISTAKES >> FIND AND WORK WITH ROLE MODELS, MENTORS AND SPONSORS (SEE PAGE 42 FOR IDEAS)

"COMPUTER SCIENCE IS ABOUT USING THE POWER OF TECHNOLOGY TO CREATE THINGS THAT ARE MEANINGFUL TO YOUR COMMUNITY."

SHUTTERSHOCK/LAUREN KEYES/HANDS-ON TECHNOLOGY EDUCATION

START A CODE CLUB IF THERE ISN'T ONE AVAILABLE AT YOUR SCHOOL

TAKE STEM (SCIENCE, TECHNOLOGY, ENGINEERING AND MATH) CLASSES. CHECK WITH YOUR TEACHER ABOUT STUDY OPTIONS

DISCOVER WHAT YOU LOVE TO DO, AND HOW TO APPLY COMPUTER SCIENCE TO IT

GET INVOLVED WITH THE CODING COMMUNITY – SEE PAGE 38 FOR IDEAS

GO FURTHER

- Get more ideas for building your computer science pathway (page 40)
- Find out what's available near you and what you need to get started (page 42)
- Check out other great resources such as Facebook's TechPrep (techprep.fb.com/) and NCWIT's Aspirations in Computing (bit.ly/29Y6opn)

Heads up!

Computational thinking... big title, sure, but it's a pretty basic skill that you're probably already using and could rocket you forward

"IN THE NEW ECONOMY, COMPUTER SCIENCE ISN'T AN OPTIONAL SKILL – IT'S A BASIC SKILL."

What is computational thinking?

Computational thinking is a way of chopping big problems into bite-sized pieces. If this sounds complex, don't be scared. You're almost certainly using these skills every day already!

"If you're asked to cook a meal for 1000 people and you've never cooked before, how do you break down that problem? You just don't do it, or you start thinking, 'OK, a meal, that's maybe three courses: starter, main course, dessert'," says Jonathan Graham of Mined Minds. (See page 29.)

That's "problem decomposition" because you're breaking down the larger problem of a meal into three smaller problems: the three courses.

Then you think about friends who can help out. That's "abstraction" because you know that Alexis likes to bake and Perry usually makes salads for potlucks, and you've applied that pattern to help solve your problem.

The next step is "data collection". Alexis can look up cake recipes. Then maybe one of her friends will make a whole bunch of crusts from crushed cookies, while Alexis whips up a big batch of cheesecake filling.

You make the process efficient by using "parallelization", that is, having multiple people work on different processes at the same time. And, just like that, you've done some computational thinking!

Find paths into code careers

PATHWAY #1

ROB NELSON
TRANSFORMING REALITY

Growing up, I wanted to be a Transformer. When that didn't work out, I opted for the next best thing – transforming reality. I want to make a world for people to be able to experience in 3D – a virtual reality world that can operate from a smartphone.

I work on Google's Project Daydream, a high-quality virtual reality platform. Imagine seeing all your favorite programs in 3D. Or traveling anywhere you want, anytime – but instead, places come to you. Rome is right in your living room or you're in the Bahamas on your lunch break.

When I started out in computer science, smartphones didn't even exist, and now we have these amazing devices in our hands. I'm excited about how technology is unfolding at work, and I want to help make the world a better place.

I grew up in a rough area in Southern California, and neither of my parents finished high school. I figured out coding when, with a friend, I worked out how to reverse-engineer a game called *Warcraft II* by inserting our own code.

I went to Orange Coast College in Costa Mesa, CA, then I got into UC Berkeley and from there, graduate school at UCLA. I love computer science because all you need is an Internet connection and a cheap laptop. Whatever you're interested in, there's a project you can work on. For my next career move, I'd like to be a rock star. That'd be awesome!

ATTENDED COMMUNITY COLLEGE >> FINISHED UNDERGRAD, UC BERKELEY >> WENT TO GRAD SCHOOL, UCLA >> WORKING AS A SOFTWARE ENGINEER, GOOGLE'S PROJECT DAYDREAM

BOYCATALYST / SHUTTERSTOCK/ GOOGLE

Find paths into code careers

PATHWAY #2
DR KOREY SEWELL
EMPOWERING YOUTH

Working as a computer engineer is a dream come true. At Apple, I get to work on products that millions of people will use every day. My focus is on CPUs (central processing units), which are often called the "brains" of things like smartphones and tablets. It's a blast.

I'm also a Summer Tech Camp Director where I teach kids how to code and build electronics. Teaching is crazy fun. What makes it even better is I get to try out camp projects with my kids.

My parents always encouraged me to not just play games but figure out how to build them myself. This mindset led me to learn how to code.

I believe empowering youth through technology will inspire changes that will help communities thrive in ways we've never seen before. My advice to kids is to start with coding! It's fun, easy to start up and learn, and there's plenty of online support.

DID A BACHELOR'S IN COMPUTER SCIENCE. UNIVERSITY OF CALIFORNIA. RIVERSIDE

COMPLETED HIS PHD IN COMPUTER SCIENCE. UNIVERSITY OF MICHIGAN. ANN ARBOR

WORKS AS A COMPUTER ENGINEER. APPLE + SUMMER TECH CAMP DIRECTOR

Why's it important?

That process – of removing complexity to get to the bottom of a problem – is super important in every career, not just coding. Let's face it, computers are part of everyday life. So one of the most useful skills around is knowing the best problems to tackle with a computer and how to shape those problems the right way so a computer can understand them. Makes sense, right?!

"Computational thinking is a way humans solve problems; it's not trying to get humans to think like computers," says Jeannette Wing, corporate vice president of Microsoft Research. "Computers are dull; humans are clever and imaginative."

Using computational thinking

Take Netflix. Its business is getting you to watch a bunch of TV, so it recommends movies and shows that you might like, using data about your previous viewing history. But if you only ever watch romantic comedies, then based on that data, you'd only ever get suggestions for films exactly the same.

Netflix held a million-dollar competition to find clever ways to solve this problem. Its algorithm (or the set of rules it uses to figure this out) is always evolving, but currently one answer is to occasionally suggest something out of your comfort zone – say, a drama or documentary – and then see which ones you watch. It's an imaginative solution to a tricky problem and one part of computational thinking (algorithms).

The people who can harness computational thinking will be the ones who drive and shape the new economy. "In the new economy, computer science isn't an optional skill – it's a basic skill, right along with 'the three Rs'," said President Obama in a weekly address. "This means not just being able to work with computers, but developing the analytical and coding skills to power our innovation economy."

Whether your career is in music, medicine, engineering, the arts or data mining, you can apply useful knowledge in new, creative solutions using computer science. Find your passion, figure out how to use the tools of computer science with your passion and you'll always find work.

"MY ADVICE IS TO MAKE CONNECTIONS, ESPECIALLY WITH PEOPLE YOU FEEL A LINK TO."

GRETCHEN MATHISON / LAUREN KEYES, HANDS-ON TECHNOLOGY EDUCATION / ELITE / HEATHER CATCHPOLE / SHUTTERSTOCK

Think it out:

- The rate of car accidents on the street corner near you is high. How could you solve this, save lives and prove it works?
- At the grocery store, there are three lines. How do you decide which line to choose? Could you make lines move faster? How?
- You need to stop at the drugstore, return a book and pick up your lil sis. How do get it all done? (Hint: bit.ly/2aueHI7)

Robo-brain

You use elements of computational thinking every day. No kidding!

- Before school you take a look at your history homework: How did the Civil War start? Thanks Google! (**data collection and analysis**)
- In math, you learn to solve problems like long division. (**algorithms**)
- You need to get across school to the bus stop, avoiding the gym because basketball tryouts are on. (**problem decomposition and simulation**)
- You and your dad are doing the laundry. Once his clothes are washed, yours go in while his dry. (**parallel processing**)

Find out more about **computational thinking** @ Google: bit.ly/1FML2Pl

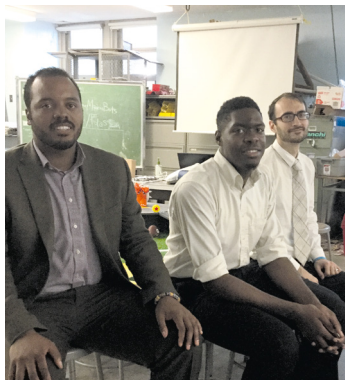
MAKERS TO MENTORS

Creating something new is so powerful – just ask the students who work with Emerging Leaders in Technology and Engineering (ELiTE) and New York City Department of Education teacher, Joel Bianchi, at the Frederick Douglass Academy in New York's Harlem neighborhood.

Joel's team of kids dedicate after-hours time to creating amazing things, from robots that play sports to fashion accessories powered by computer chips. Ex-students like Charlton Smith are now coming back to mentor younger kids. "No one in my family knows how to program. I fell into it messing with Windows environments," Charlton says.

Joel also works with Chelsey Roebuck from ELiTE, a STEM-education-focused youth organization based in New York City, which started out as a program teaching kids in Ghana. Through ELiTE, the group has met some amazing mentors. "Hundreds of students like Charlton go through the global programs, then return as volunteers and instructors to give back," Chelsey says.

Being a mentor isn't all one way – the college students also get to learn and gain exposure to the content themselves. "I learn so much more and so much better when I have to explain a concept to someone else," Chelsey says.



> "I LEARN SO MUCH MORE AND SO MUCH BETTER WHEN I HAVE TO EXPLAIN A CONCEPT."

Find paths into code careers

PATHWAY #3

VICTORIA C NNEJI
DESIGNING THOUGHTFUL ROBOTS

During my fellowship at Stanford, my team and I designed a companion robot to tutor young students through mechatronics. Our experiments found they were more likely to bond with the robot when it was more vulnerable or expressive. I could've used such a robot when I moved to the United States and started school in rural South Carolina at age five! Being an immigrant was challenging but ultimately rewarding in the strengths I've built with the social and educational opportunities afforded to me.

I am blessed to have a courageous mother who reminds me that we're not given the spirit of fear, but of power, love and a sound mind to reach our life's purpose. She encouraged me to reach for the highest, which propelled me to earn numerous scholarships. My advice is to recognize these people in your life – family and others – who inspire you to be creative. We design our future, so let's be thoughtful about it!

WENT TO NORTH CAROLINA SCHOOL OF SCIENCE + MATHEMATICS HIGH SCHOOL >> SPENT A SUMMER AT GOOGLE >> COMPLETED A BACHELOR OF SCIENCE IN APPLIED MATH. COLUMBIA UNIVERSITY >> EARNING A PHD IN MECHANICAL ENGINEERING-ROBOTICS. DUKE UNIVERSITY

Find paths into code careers

PATHWAY #4

AURA BARRERA CODE GIRL

If you asked me what I wanted to do four years ago, I doubt I would've told you computer science! My dream job has changed often. I wanted to be an artist/journalist/business owner/civil rights leader/scientist.

Although I started to create websites and blogs at age 10, I thought it was just a hobby. Then I found Girls Who Code, and it became this hub where all my interests converged: my love of education, my community and technology. I did online computer science courses with Codecademy and Treehouse, and last year I took AP computer science at school.

Growing up in six cities all over the Bay Area helped me realize how the opportunities kids get are really inconsistent. Some kids don't get the same access to technology, resources and programs to help them explore different opportunities.

In my last formal internship, I was at a local start-up incubator. There, I learned new skills, including how to work in a professional environment and contribute to the workplace. I realized how social computer science is – you have to communicate and work in teams to build software.

My aspirations are to continue learning computer science, to educate others in my community and to build tools that level the playing field.

- STUDIED AP COMPUTER SCIENCE AND PHYSICS, OAKLAND TECHNICAL HIGH SCHOOL
- WAS PART OF THE GIRLS WHO CODE SUMMER IMMERSION PROGRAM
- DID A FELLOWSHIP WITH SHE++ AND #INCLUDE
- COFOUNDED AND ORGANIZED THE FIRST HIGH SCHOOL HACKATHON IN OAKLAND, CA

Team teach

Anyone can learn to code

Whether it's navigating a game of Pokémon Go, communicating through Snapchat or posting Facebook or Instagram updates, students today spend lots of downtime with their noses firmly on a screen. But the idea of someday pursuing a tech-related career is often overlooked, partly because only one in four US high schools offer computer science classes.

TEALS (Technology Education and Literacy in Schools), a Microsoft Philanthropies program, is on a mission to change that. TEALS helps to build sustainable computer science programs in US high schools by pairing trained computer science pros across all tech industries, with

TOM KUBIK

classroom teachers to team teach. (It was founded by Microsoft engineer Kevin Wang in 2009 and later embraced and adopted by Microsoft.) The program has quickly grown from teaching 12 students in one school in 2009, to teaching an estimated 9000 students in 230 schools in the 2016-17 school year.

It's an amazing time to get into computer science. There will be an estimated 1.4 million new computer science-related jobs by 2020, with only 400,000 computer science students to fill them. There's also a surprisingly low percentage of female professionals in the field. Between 1990 and 2013, the percentage of female computer scientists decreased from 35% to 26%, according to an American Association of University Women report.

TEALS wants to engage *all* students and introduce them to career possibilities through courses like Introduction to Computer Science and AP computer science. Eunice Wong, a program manager at RootMetric and a TEALS volunteer, was drawn to the program after discovering how tough it was to find young talent with computer science training and skill sets. "I had to interview people from other countries with more computer science technology training," she says.

Eunice was also discouraged by how few women were involved in computer science and wanted to help change the perception that coding is hard. "Anyone can learn it," she explains. So, she signed up for TEALS and volunteered to teach computer science classes at Holy Names Academy in Seattle, WA.

Anthony Papini, the volunteer manager for TEALS, says volunteers benefit greatly from the program. Many of them enjoy taking on a mentor role and giving back to their industry, while also helping their local high schools build a computer science program and teaching the next generation of computer scientists.

The students have even more to gain. Three of Eunice's former TEALS students from Holy Names Academy – Megan Fu, Laura DeBoldt and Phebe Hinman (pictured below from L to R) – are now studying computer science in college thanks to the exposure they received through the TEALS class in high school. The girls also participated in internships at Microsoft's main campus this past summer, and all three plan to pursue a computer science career.

Laura, a freshman at the University of Washington, recently applied her skills from TEALS to build a website to get young girls involved in computer science. Phebe, a sophomore at Brown University, says thanks to TEALS she knew she wanted to pursue computer science beyond school. And Megan, now a sophomore at MIT, is already planning to give back. "I'm looking to get involved with a TEALS program at a school near my college," she says.

Global coder

Tsion Behailu dreams of making computer science accessible to everyone

Computer science is in every aspect of my job – not just in the code that I write. Computer science teaches you how to look at a problem, approach the issues and find a solution. You learn how to think, and that's more empowering to me than simply learning what to do.

I'm really passionate about education and providing opportunities to students who don't have them. I believe that computer science can definitely play a role in this. My siblings are already motivated to explore it as a potential major in college. If I could do anything with computer science, it'd be to bring it to every corner of the world.

I have lots of mentors and I'm always learning from the people around me. It took a lot of hard work, support and luck to get where I am today. But I'd like to take luck out of that equation because it shouldn't be a requirement to overcome your circumstances.

My advice would be to only listen to those who believe in you because passion is a bigger part of accomplishing your dreams than you think!

"LISTEN TO THOSE WHO BELIEVE IN YOU BECAUSE PASSION IS A BIGGER PART OF ACCOMPLISHING YOUR DREAMS THAN YOU THINK!"

COMPLETED A BACHELOR OF COMPUTER SCIENCE, UC BERKELEY >> INTERNED AS A SOFTWARE ENGINEER, GROUPON >> WORKS AS A SOFTWARE ENGINEER, GOOGLE

TOM KUBIK

Creating success

Angelica Inguanzo helps others experience film through her passion for computer science

I had no exposure to computer science before college, but I loved math. Math was my favorite subject, and in my senior year of high school I took AP calculus and AP statistics at the same time. When I first discovered computer science at college, it seemed intangible to me. I felt like I was miles behind my classmates. There are so many roadblocks, millions of bugs and a ton of things that'll break before they work out. But there is something beautiful about being able to create whatever you can think of.

My mom is the biggest mentor I've ever had. She did all of the things my college mentors did without ever being an undergrad herself. She passed away during my last year of college, but Mom is still at the heart of my aspirations.

My family and friends used to think that having a career in computer science meant I could hack into systems or fix their computers. Since I've been working at Google, they've become more exposed to what it's really all about.

I've had a passion for film my entire life and would love to combine that with computer science by providing mass access to both mediums.

My dream is to create a film studio that focuses on social injustices regarding race, poverty, immigration, discrimination and education in the United States. I'd utilize computer science in all my films and create characters and stories through the perspectives and voices of marginalized communities.

ATTENDED PROSPECT HIGH SCHOOL >> WENT TO COLLEGE, UC BERKELEY >> COMPLETED FILM EDITING INTERNSHIPS >> INTERNED AT GOOGLE >> BECAME A PRODUCT QUALITY ANALYST, GOOGLE >> WORKS AS A FRONTEND SOFTWARE ENGINEER, YOUTUBE

CS + ART

Crafting the future

Torn between a love of art *and* computer science? It's a no-brainer, you can do both!

Getting creative with tech is a massively fun area. Tools like virtual reality are changing the way we collaborate and create, and kits like Raspberry Pi and Arduinos are making it totally accessible and way easier to design with code.

Some digital artists are combining silicon with stitches, like Maddy Maxey from The Crated. (See profile opposite.) Levi's and Google have teamed up to make a smart jacket where you can use your phone by swiping, tapping and touching the sleeve. What?! The "Commuter" looks like any regular denim jacket, but the fabric is interwoven with cool extras that detect movement. The built-in chip transmits signals to the phone, so people can adjust stuff like the volume on their music or voice directions from Google Maps.

"Technology is way more than what we can do with it; it's why we want to do something with technology, and you want both pieces," says assistant professor Ge Wang, from Stanford University's Center for Computer Research in Music and Acoustics. "We need engineers who revel in the beauty of doing things in a certain way."

Ge's passion is computer music – he heads the Stanford Laptop Orchestra, where performing students use laptops, hand-built speakers and a custom programming language written by Ge, for live compositions. As co-founder of the start-up Smule, he's developed toys and apps for iPhone like Ocarina, which turns your phone into an ancient flute. (You blow into the mic to play.) Ge believes that if artists let their projects have a life of their own, they will grow in tons of different directions. "Creativity is messy; it's inefficient. And that's OK! Even after you've coded for 20 years, some things still surprise you, and hopefully some things still delight you."

"CREATIVITY IS MESSY; IT'S INEFFICIENT. AND THAT'S OK!"

SHUTTERSTOCK / FREDAOHIU

GET INTO COMPUTER SCIENCE + ARTS!

Your options are huge...

CAREERS...

USER EXPERIENCE DESIGNER $88,000

3D ARTIST $57,000

FASHION DESIGNER $60,000

INTERN...

Pixar, MoMA, PVH (Calvin Klein/Tommy Hilfiger)

LEARN...

Computer Science plus Arts degrees at Illinois or Stanford, iD Tech Summer Camp, or teach yourself (see page 42)

FOLLOW...

FB: @99Designs

T: @Polycount

Insta: @DeviantArt

yt: RocketJump Film School

G+: Pitchfork

SEE MORE OF MADDY'S JOURNEY
MADEWITHCODE.COM

SILICON SEAMSTRESS

MADDY MAXEY IS REIMAGINING FASHION DESIGN

Curiosity drives my career. I was curious about clothing, so I started making apparel in my living room. I got curious about code and hardware, so started reading books and making prototypes. I work at the intersection of fashion and tech – linking old-world knitting, spinning, weaving and sewing with new-gen hacking, prototyping and open-source "making".

Smart apparel and intelligent textiles are on their way to replacing the "dumb" clothing we wear today – I want to help shape that. I'll use code to make things; other times I'll work with fabric. Sometimes it's 3D printers and electronics, and then some days it's pencils and pens.

Clothing should be responsive to our bodies. Just imagine if we had clothing that regulated our temperature! What if we had tracking devices on our clothing? What if we had garments that could change color? That's the future we want to design at The Crated, the New York fashion company I founded in 2013.

We recently finished a prototype of an industrial wearable we call Armor, which is designed to monitor bodily stress. It includes custom-printed textile circuits that use Arduino logic, as well as biometric and touch sensors, so that Armor can help to identify worker fatigue on industrial sites.

Making the piece only took a few weeks because I could do everything from programming the microcontroller to designing the laser-cutting files for the acrylic outer shell. When you can drive the machines, you can be so much more creative!

The building blocks of all of our innovations at The Crated require an understanding of code. I really believe if you get involved with code now, you'll build the future of fashion.

COMPLETED A SCHOLARSHIP, TEEN VOGUE >> INTERNED AT TOMMY HILFIGER + NYLON MAGAZINE >> STUDIED AT CREATIVE TECH RESIDENCES: AUTODESK, THE SCHOOL OF VISUAL ARTS AND UNDERCURRENT >> ATTENDED PARSONS SCHOOL OF DESIGN >> FOUNDED HER BUSINESS, THE CRATED

THE CRATED

RETROTECHNO

ANN MINCIELI IS AN AUDIO ENGINEER WHO CREATES YOUR FAVORITE TUNES BY ARTISTS SUCH AS ALICIA KEYS AND JAY Z

My passion is discovering and creating solutions for the new music industry. These days, music is put together like a puzzle using music workstations, apps and tech. Computer science is totally replacing some of the more human-centered aspects of creating a song.

I started out as an assistant engineer while interning for a record label. I wanted to learn absolutely everything about the music industry. I studied software, music programs and computers as technology was gradually replacing tape machines. In audio school, I learned a lot about how music, math and computer science are interrelated. There are so many types of equipment and software that are like a bunch of crayons in a box — with different colors and sounds.

If I could do anything in the world with computer science, it'd be to further develop the relationship between people and computers. While music software has opened up greater creative possibilities, people often forget there's an art to recording. I'd like to see software that isn't so robotic.

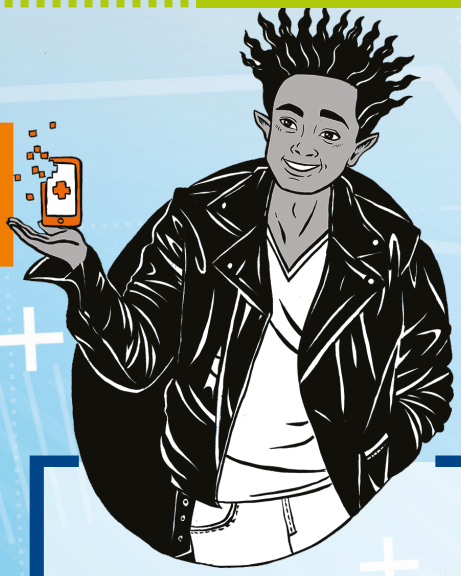
> "I LEARNED A LOT ABOUT HOW MUSIC, MATH AND COMPUTER SCIENCE ARE INTERRELATED."

WENT TO NEW DORP HIGH SCHOOL, NY >> INTERNED AS AN ASSISTANT ENGINEER FOR A RECORD LABEL >> COMPLETED MATH, MUSIC AND SCIENCE COURSES, AUDIO SCHOOL >> STARTED HER OWN BUSINESS, JUNGLE CITY STUDIOS, NY

CS + SOCIAL JUSTICE

Coding for good

Digital tech is driving social change and making a difference



Computer scientists are closing the "digital divide" — the gap between those who have access to technology and those who don't. Mostly, being hooked up to technology comes down to where people live, education levels and their socioeconomic status.

Founded by software engineer Sam King at Stanford University in 2009, Code the Change is a community of computer scientists and students from colleges around the world. They develop new digital tools to help different communities improve everything from medical aid to their local agricultural productivity.

The organization provides the tools for free and the coding is done by volunteers — often students who can benefit by honing their skills in computer science. "All nonprofits can benefit from computer scientists in some way," says Sam. "It's about asking them what they need and how digital technologies can empower them."

Code the Change has partnered with researchers from Makerere University in Uganda to help detect agricultural disease in the cassava plant, the source of a staple food for locals. In the past, researchers manually counted flies on the plants to determine the extent of the disease. The process was time-consuming. Throw in poor infrastructure and not enough trained pros on the job, and it was hard work.

"Now, thanks to the computer scientists at Makerere University, there's a smartphone app that can tell with just one photo whether a plant is diseased or healthy," explains Sam. Farmers can now better detect the disease before crops die, which helps give production a boost.

Sam's super passionate about healthcare and also works as a software engineer for Nuna, helping to build analytical platforms for healthcare data. One of Nuna's projects is consolidating data from Medicaid, the largest funding program for health-related services among low-income earners in the United States. "Policy makers in Medicaid need one central place to look at their data, see its quality and make decisions to improve the country's healthcare," he says.

"I thought if you wanted to change the world, you needed to study political science or medicine, but I took an introductory class in computer science and have never looked back," says Sam.

GET INTO COMPUTER SCIENCE + SOCIAL JUSTICE!

Check out just a few work and study options...

CAREERS...

DATA ARCHITECT $132,000

PRODUCT MANAGER $118,000

BUSINESS CONTINUITY ANALYST $106,000

INTERN...
Google, Ashoka, Cisco

LEARN...
WynCode, SEO Career, Coursera, Udacity, Code.org

FOLLOW...
FB: @NunaInc

T: @CodetheChange @EraofEngineer

yt: InSTEDD

SHUTTERSTOCK/FREDA CHIU

FRESH START

ALICIA CARR'S APP, PEVO, HELPS VICTIMS OF DOMESTIC VIOLENCE DEVELOP A SAFE EXIT PLAN

When I was 18, I wanted to be a programmer, but I didn't know how to get started. I'm 51 now and was inspired to learn computer science after speaking to a young millionaire who learned to code through YouTube. I took online courses, joined meet-up groups and went to a three-month boot camp called Bitfountain. With the skills I learned, I built PEVO in 2014.

The idea behind PEVO came from seeing domestic violence firsthand, after my best friend lost her life. My app provides information to victims on their rights, the laws around domestic violence and where they can find shelters. The app also helps those in need to communicate through a discrete, untraceable platform.

Right now, I'm trying to find ways to grow my app and get funding. My plan is to include coupons in the app and provide clothing, food and bank accounts for victims.

WORKED AT ATLANTA IOS DEVELOPERS GROUP >> COMPLETED ONLINE COURSES SUCH AS BITFOUNTAIN >> DEVELOPED HER APP, PEVO >> WORKS AS CEO, PURPLE EVOLUTION >> BECAME A CERTIFIED LIFE COACH

Mission Possible

Nine ways computer science can make the world a better place...

1 STALKING BULLIES

From anonymous trolling to targeted abuse, the Net is a playground for bullies. But stopping to think before hitting "send" can change that. Trisha Prabhu is 15 and she's been coding since she was 10. Trish created ReThink, an app that recognizes common bullying words. These phrases trigger a pop-up window that prompts the writer: "Are you sure you want to do that?" Trisha's studies found that the prompt leads bullies to delete their message 93% of the time. **<RETHINK: bit.ly/2afDvkq>**

2 DITCHING GRAFFITI

Vanessa Tostado, Ashley Davis, Margarita Tenisi and Rosie Valencia, four students from East Palo Alto (EPA), are the EPA Chica Squad who proved that code can help clean up neighborhoods. "We started with issues in the community and then looked at what type of apps could help," says Rosie. The girls created an Android app called Tag It! that tracks pictures of trash, graffiti and other neighborhood vandalism, tags their location, and creates an event to clean it up. Sweet!

<EPA CHICA SQUAD: bit.ly/2avEU8y>

3 POWERING UP + MAKING FRESH WATER

Want technology that can charge your phone and provide fresh water? Watly can do just that. The 131-foot-long thermal solar-powered hub purifies water, generates electricity and provides Internet services. Watly 2.0 was super successful in the village of Abenta in Ghana, and an Indiegogo campaign is currently underway to roll out the 3.0 version in priority regions of Africa. The purification process can treat over 1300 gallons of water each day, and provide villagers with a wireless Internet connection up to 1640 feet away. Nice.

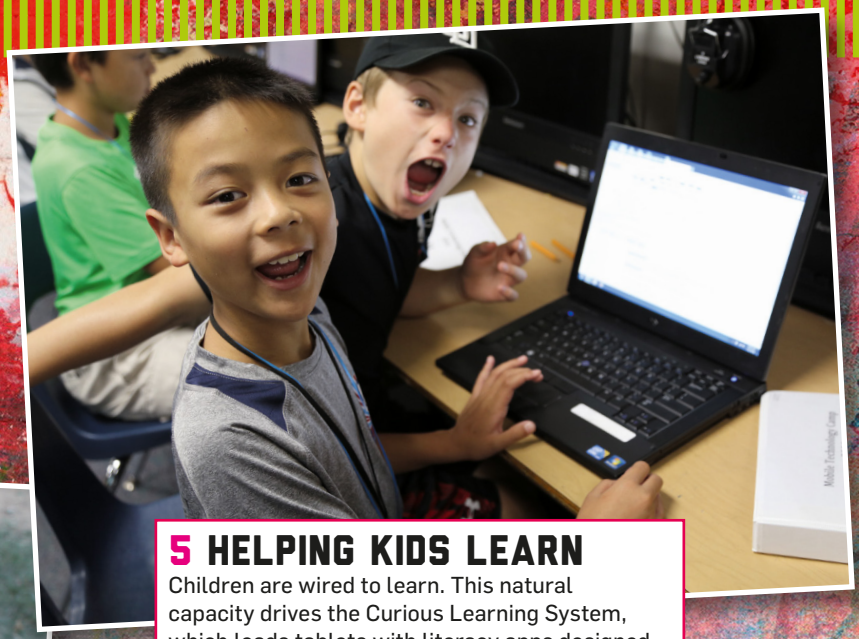
<WATLY: bit.ly/2asB9SK>

4 MAPPING DISASTERS

Getting aid to people after earthquakes and other natural disasters requires good maps, but many rural areas remain uncharted. Whenever a major disaster strikes, the Humanitarian OpenStreetMap Team rallies a network of volunteers to create online open-source maps that help responders reach those in need and provide useful local information for emergency services. So far, over 3500 Missing Maps volunteers have made 12 million edits to OpenStreetMap, putting 7.5 million people on, like, the map.

<HOT: bit.ly/2avEEX1>

SHUTTERSHOCK/WATLY/LAUREN KEYES, HANDS-ON TECHNOLOGY EDUCATION



5 HELPING KIDS LEARN

Children are wired to learn. This natural capacity drives the Curious Learning System, which loads tablets with literacy apps designed to get children to teach themselves to read. The fun activities draw on the latest developments in neuroscience and learning theory. The Curious Learning System was pioneered by the Global Literacy Project, a nonprofit founded to ensure that every child receives an education, regardless of resources or location.

<CURIOUS LEARNING SYSTEM: bit.ly/29YgYgb>

7 PINPOINTING ABUSE

Child abuse affects over 3 million children in the United States every year, yet individual cases can be difficult to identify as victims are rarely in a position to report offenses. Data is key to addressing the issue, so students at the University of Texas, Dallas, created a ZipRisk Map using US Census and other data to rank Texas zip codes based on frequency of social issues such as teen birth, substance abuse and child poverty. By identifying high-risk regions, state and local organizations can help peeps in the right place at the right time.

<ZIPRISK MAP: bit.ly/29Yh9rK>

8 GAMING FOR CHANGE

Global gamers are helping to fight major health threats. Foldit showed the power of video games to solve real-life problems after gamers took just 10 days to get to the bottom of a virus behind an AIDS-like disease in monkeys. Now, over a million gamers in 140 countries are helping the human race by playing Phylo, Eterna, Project Discovery and others, and making a difference with every challenge they get through.

<FOLDIT: bit.ly/2afMEMW>

6 MAKING RURAL HEALTHCARE BETTER

Medic Mobile is a support platform for health workers operating in hard-to-reach communities. When founder Josh Nesbit noticed he had stronger cell reception in a rural African village than he did on Stanford's campus, he realized cell reception was key to digital communication in Africa. The platform now arms more than 13,000 community health workers with an app that can register pregnancies, track disease outbreaks, communicate emergencies and keep an inventory of critical medicines.

<MEDIC MOBILE: bit.ly/2atQfcj>

9 STANDING UP FOR HUMAN RIGHTS

Big-time cruelty and awful events threaten global security and leave long-lasting scars on those affected. The Tech Challenge for Atrocity Prevention supports problem-solvers who develop innovative concepts and prototypes to help. People's Intelligence, cofounded by computer engineer Yilin Huang, gives victims and witnesses the tools to write down and verify their stories and produce useful info for official organizations to use.

<PEOPLE'S INTELLIGENCE: bit.ly/2aoRtmk>

CS + BUSINESS

Make your mark

The future of tech is relying on big ideas from all walks of life

Despite being underrepresented in today's tech workplace, women and minority groups often have insights the mainstream crowd doesn't. Now tech entrepreneurs of all backgrounds are creating awesome startups to fill the gaps. Take Richie Serna, a first-generation Mexican American from Santa Ana, CA. Richie cofounded Finix Payments, which helps businesses write apps where money changes hands. Then there's Estefania Ortiz, originally from Puerto Rico, who taught herself computer science in high school. She's about to graduate from Stanford, scoring internships at Microsoft and Facebook along the way.

Perry Ogwuche's career has taken him from Nigeria to New York. He was selected by the University of Maryland – Baltimore County (UMBC) to attend the CODE2040 program in 2013. Now Perry has cofounded Shypmate along with two other African friends, Tochukwu Okoro and fellow UMBC graduate, Chisom Ebinama. "Shypmate was inspired by the need to send items back to Nigeria," says Perry. Standard shipping can cost a ton, and some stores don't even ship to Nigeria. So, the Shypmate team came up with the "Uber" of shipping services. Overseas customers shop online and pay through Shypmate, which then takes delivery in the United States. A week or so later, the shopper meets a traveler who is paid to carry the goods to their nearest airport.

The team compared costs to send a pair of shoes to Nigeria: regular shipping costs $250, but Shypmate comes in at only $25. Early-stage investment group Y Combinator selected Shypmate for start-up funding in the winter of 2016. Perry's advice to potential entrepreneurs: "Work hard from a very young age. You can change the world with computer science."

GET INTO COMPUTER SCIENCE + BUSINESS!

There are tons of work and study options to choose from...

CAREERS...

BUSINESS INTELLIGENCE ANALYST $72,000

DATA ARCHITECT $107,000

SOFTWARE DEVELOPMENT MANAGER $124,000

INTERN...

Facebook, Google, Apple

LEARN...

Swift Playgrounds, SummerQAmp, Best Business Schools

FOLLOW...

FB: @Robert Scoble

T: @Polycount

Insta: @TechCrunch

yt: Code.org

G+: WIRED

> "YOU CAN CHANGE THE WORLD WITH COMPUTER SCIENCE."

SHUTTERSTOCK / FREDA.OHIU

SMART SOLUTIONS

A PRACTICAL PROBLEM LED PERRY OGWUCHE TO A NEW CAREER

My friends and family think computer science is essential and leads to a high-paying job. They also think I can fix every phone, computer and microwave because I'm a computer scientist!

Today, my company uses technology to solve a common problem of people not having access to things from other countries. Shypmate allows people all over the world to buy what they want online and get it delivered to their city.

I love talking to customers, discussing their issues and finding ways to use tech to help find a solution. My dream is to build software that solves one problem for millions of people every day.

WENT TO FEDERAL GOVERNMENT BOYS COLLEGE, ABUJA, NIGERIA >> STUDIED A BACHELOR OF COMPUTER SCIENCE AT UNIVERSITY OF MARYLAND – BALTIMORE COUNTY >> COMPLETED A CODE2040 FELLOWSHIP >> BECAME A SOFTWARE ENGINEER AT JAWBONE >> FOUNDED HIS COMPANY, SHYPMATE, APPOINTED CEO

NEW PATHS

JONATHAN GRAHAM HELPS OTHERS UNLOCK THEIR POTENTIAL

Science and music were what I liked as a teenager. I studied science at college and worked as an industrial chemist for nine years. Then my brother-in-law came to me with an idea about coding music live on stage, so I learned how to code while playing music.

Today, I'm the co-founder of Mined Minds. We teach unemployed people how to code. It started when we went to Pennsylvania for 4th of July with my wife's family. The local mines were closing and her brother was worried about what he'd do. For six months we drove eight hours each way, teaching coding to coal miners on weekends, then back to our day jobs in Chicago.

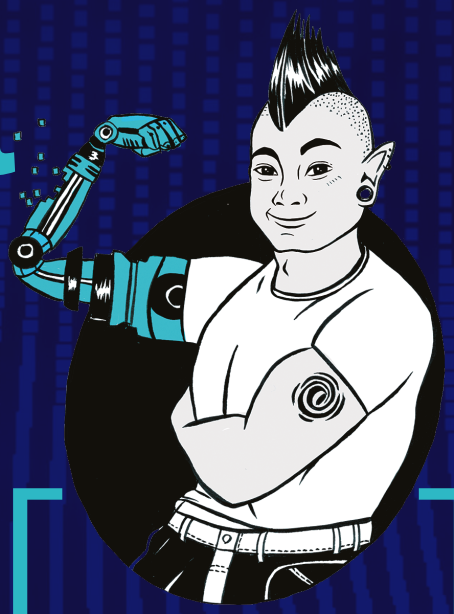
Now Mined Minds is our full-time job. We've taught a 17-year-old girl and a couple in their 50s. Having many interests is really valuable, but it doesn't matter what you're doing, as long as you carry on learning.

PROCESS CHEMIST, GLAXOSMITHKLINE, UK >> LIVE-CODING MUSICIAN, META-EX >> SOFTWARE DEVELOPER, 8TH LIGHT, CHICAGO, IL >> COFOUNDER, MINED MINDS

CS+ACCESSIBILITY

5 WAYS COMPUTER SCIENCE IS MAKING LIFE EASIER

Access for all



The Web should be a space where offline barriers disappear, yet visually impaired people struggle to access content via screen readers, while those with hearing, speech, or communication difficulties miss out on Web chats, conferences and audio content. Things like screen flicker can also endanger those with a seizure disorder. Accessibility means opening the Web to all and, over the past decade, serious progress has been made to enable everyone to get online.

Google senior software engineer Casey Burkhardt has oculocutaneous albinism. It's a condition that means his skin, hair and eyes have no melanin (a pigment-producing chemical), and his sight is impaired, making him legally blind so that he can't drive.

Since moving to Silicon Valley, technology has transformed his life. By using car services such as Uber and Lyft, Casey can travel at a moment's notice, while delivery services such as Google Express and AmazonFresh have replaced errands that used to be a hassle. At work, though, Casey's disability is an asset – it lets him understand some of the challenges many other users face daily.

Casey is part of Google's Accessibility Engineering Team, helping his colleagues across the company make their products and services work well for people with disabilities. It's no surprise that Casey has been so successful in his work. Strip away the tech and coding relies on one main skill: creative problem solving – something people with disabilities have to do a lot of.

Support is available if you have a disability and you want to work in computer science. "Lime and AAAS are two organizations leading the way in connecting students with disabilities to companies looking for exceptional talent," says Casey, who strongly recommends internships, coding projects and other real-world experiences to distinguish you from the competition when going for computer science jobs.

GET INTO COMPUTER SCIENCE + ACCESSIBILITY!

Check out some work and study options...

CAREERS...

USER INTERFACE DESIGNER
$92,000

MANAGEMENT CONSULTANT
$78,600

DISABILITY COMPUTER SPECIALIST
$88,000

INTERN...
Entry Point!, Emerging Leaders

LEARN...
Teach Access, DO-IT, CAST, EASI, STEMEd HUB

FOLLOW...
FB: @Matt King Paralympian
T: @AustinSeraphin
yt: Fix the web bit.ly/1cPLOPC

1 TECH FOR THE MIND

The latest VR gear from Oculus, HTC, or PlayStation lets you into the mind-blowing experience of fighting aliens or exploring the deep ocean. For a disabled person, VR offers an escape – and a chance to practice tough, real-world tasks in a safe virtual world.

2 DRIVERLESS TECH

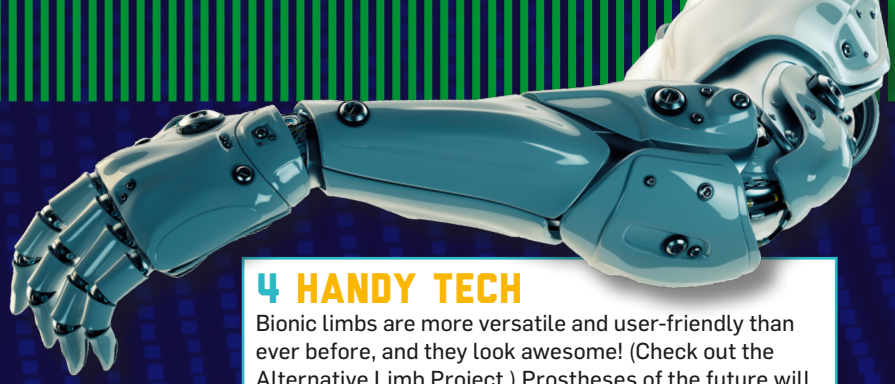
Self-driving cars are here, and, in time, they'll be everywhere. In 2012, Google released video footage of Steve Mahan, who is legally blind, at the wheel of an autonomous car. The cars, which use sensors that can detect objects up to two football fields away, are being tested in four cities across the US.

SIRI: HADRIAN / SHUTTERSTOCK / FREDA CHIU

> CODING RELIES ON ONE MAIN SKILL: CREATIVE PROBLEM SOLVING."

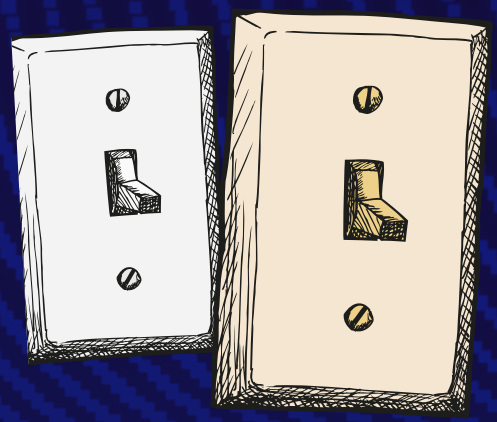
3 TALK TECH

Voice interfaces suit people lacking the fine typing skills needed for tiny smartphone keyboards. Voice tech like Siri, Google Now, Cortana and Amazon Echo already improve the way everyone accesses the Internet.



4 HANDY TECH

Bionic limbs are more versatile and user-friendly than ever before, and they look awesome! (Check out the Alternative Limb Project.) Prostheses of the future will move via their users' mind control, have near-perfect dexterity and even a sense of touch. So cool!



5 HOUSE TECH

Smart homes are the future. Imagine turning on and off lights, radiators and any other connected appliance with just a voice command or phone swipe. Disabled people will benefit greatly. Check out Alcove or Nest, two companies that provide smart home systems.

CODE CAPABILITIES

THESE REMARKABLE CHANGEMAKERS WANT THE WEB TO BE ACCESSIBLE FOR ALL. SO THEY'RE DOING IT

Kassidy McIntyre and Brittany Robinson, two high school students from Phoenix, AZ, won the Computer Science Teachers Association's 2015 Faces of Computing contest with a video about Kassidy's brother DJ, who was diagnosed with autism when he was two years old.

"Our entry was a story about a girl (Brittany) who teaches DJ how to code. He then passes his knowledge on to another girl (me) at the end of the video," says Kassidy. The video touches on a serious issue for many people with disabilities – isolation. "The message we really wanted to convey was the power of code and how it can connect people of different ages and genders and from all walks of life," Brittany adds.

Kassidy and Brittany first encountered computer science in their sophomore year. They enjoyed it so much that they both took AP courses in computer science, and are now considering it as their major when they go to college.

> CODE CAN CONNECT PEOPLE FROM ALL WALKS OF LIFE."

CS+SPORTS

Bringing your A game

Computer science is supercharging training regimes for top sports teams and athletes

Not so long ago, computer science and sports were worlds apart. But computer science is quickly changing the way we qualify, train and compete in every major sport. "Coaches, athletes and teams are using data and computation to help understand their problems and inform their decisions," says Jimmy Lyke, a senior software engineer at the sports clothing and equipment company, Under Armour.

Under Armour is a leader in such wearable technology as the smart shoe – a shoe that includes a chip to capture your running distance, time and even your route. There's also Under Armour's HealthBox, which is a wearable tech kit that links to an app tracking nutrition, activity, fitness and sleep.

The NBA team Golden State Warriors from Oakland, CA, uses wearable technology to track heart rate, movement and stamina, and cameras to record players during a game. "The Warriors used a few pieces of technology to help identify players' limiting factors and address these issues," says Jimmy. Data like this helped the team win 73 out of 82 games this year, breaking the NBA record. "Ultimately, the data needs to empower performance on the field, pitch, court, rink, track and pool."

It's not just the players benefiting from computer science. Yisong Yue, an assistant professor in the Computing and Mathematical Sciences Department at Caltech, developed an algorithm to predict where a ball will go during a fast-moving game, which allows cameras to pan more smoothly and keep the ball in shot. Yisong has also worked on software that searches through footage to bring up relevant plays in less than a second – an invaluable tool for coaches. "We live in a digital society," says Yisong. "Having a strong computer science background is almost like having a superpower. There are many sports companies looking for talented computer scientists."

FREDA CHIU / UNDER ARMOUR

GET INTO COMPUTER SCIENCE + SPORTS!

Captain the team *and* code? There are tons of ways to do it...

CAREERS...

DATA ARCHITECT $107,000

SOFTWARE DEVELOPER $81,000

DATA SECURITY ANALYST $74,000

INTERN...

Microsoft, NASA, Under Armour, Nike Research Lab

LEARN...

MIT OpenCourseWare, Code.org, tickleapp.com

FOLLOW...

FB: @Under Armour

T: @Work In Sports

Insta: @nike

yt: Jamie King

> "HAVING A STRONG COMPUTER SCIENCE BACKGROUND IS ALMOST LIKE HAVING A SUPERPOWER."

PUSHING THE THRESHOLD

PATRICK MERCIER IS DEVELOPING TECH TO PROPEL ATHLETES TO NEW HEIGHTS

People think that if you do computer science you spend all day in a lab, but I love getting out into the field. I like building things with my hands first and then building in the code. I like to see the things I make interact with the environment.

We're developing a wearable sports tracker to give athletes instant readings on their lactic acid levels in real time. I was working on wearable technology, and realized that lactic acid can easily be measured from sweat.

Athletes have a lactate threshold, which determines how far and fast they can run, row or bounce a ball. If they stay under it, they can go forever, but when the body produces too much they "hit the wall" and become exhausted. Athletes need to stay just under their lactate threshold to maximize performance.

Currently, a finger-prick blood reading shows lactic acid levels in athletes, but technology could revolutionize their training because they won't have to stop what they're doing to take a measurement. We're talking to lots of people who are waiting for this to be ready, such as the US Olympic Committee and the Tour de France, and we're almost there.

My advice to anyone interested in computer science is to get out there and play with gadgets. Take them out, take them apart – just go out and play.

WENT TO HIGH SCHOOL IN ALBERTA, CANADA >> COMPLETED AN UNDERGRADUATE IN ELECTRICAL AND COMPUTER ENGINEERING, THE UNIVERSITY OF ALBERTA >> DID A PHD IN ELECTRICAL AND COMPUTER ENGINEERING, MIT >> BECAME THE CO-DIRECTOR, CENTER FOR WEARABLE SENSORS, UCSD

LAURA KEYES, HANDS ON TECHNOLOGY EDUCATION

CS+HEALTH AND SUSTAINABILITY

Code the planet!

Computer scientists are down with *all* the global issues – from creating ways to protect our oceans, to making us more energy-efficient – they're on it!

Fish Facebook

"Tagging" a fish through facial recognition (just like on Facebook) lets scientists quickly know how fish populations are doing. It's a simple way to help create a better planet. "Fish recognition is challenging," says University of Washington electrical engineer Dr Jenq-Neng Hwang. Jenq-Neng spent six years developing signal and image processing technology for the National Oceanic and Atmospheric Administration. "Unlike human recognition cameras that rely on facial features, we develop algorithms to recognize facial and body features of fish, and in changing light situations."

See it, believe it

Global policy responses to the effect of climate change on our oceans have been poor. Professor Jeremy Bailenson, founding director of Stanford's Virtual Human Interaction Lab, believes virtual reality (VR) could help by letting people connect with the issue on an emotional level. Jeremy is developing software compatible with VR technologies such as Google Cardboard and Oculus Rift, to take people on a virtual field trip under the sea.

"In the simulation, users turn into a carbon dioxide molecule, fly into the reef and see the breaking apart of the molecules that happens in ocean acidification," Jeremy explains.

Sustainable space base

NASA scientists are also creating environmental solutions. The $25 million two-story Sustainability Base at the NASA Ames Research Center has been developed as a future building prototype. It uses 90% less water than comparable buildings, and has building controls that respond to sunlight, temperature and usage. Equipped with solar panels, the building generates more electricity than it consumes. There are even plans to cover the umbrellas on the patios with solar films and include phone-charging stations.

GET INTO COMPUTER SCIENCE + HEALTH AND SUSTAINABILITY!

Here are some amazing work and study options...

CAREERS...

DATA SCIENTIST $93,000

ENVIRONMENTAL ENGINEER $98,000

GEOGRAPHIC INFORMATION SYSTEM SPECIALIST $92,000

INTERN...

NOAA, YLCC, Oculus, Marine Careers

LEARN...

University Rankings, Summer Programs, CERN, Program Guides, Google

FOLLOW...

FB: @American Academy of Environmental Engineers and Scientists

T: @StandfordVR

Insta: @esdglobal

yt: NASA Education

G+: Juniper Networks

SHUTTERSTOCK / FREDA CHIU

HEALTH HACK

WHEN THE EBOLA OUTBREAK HAPPENED, BRITTANY HAYES WAS ANALYZING IT ON TWITTER

At Automated Insights, a company that uses data to generate stories, I work with software called Wordsmith. It helps companies such as Yahoo, the Associated Press and Allstate to create hundreds of stories in the time it would take for a person to write just one article.

I was totally a humanities and social sciences person before I took a text-mining course in grad school. I thought it was cool that you could take social media posts and use tools to make sense of them on a larger scale. I wrote a program to analyze the tweets from two public health organizations and the Twitter handles of major media outlets, to see who was covering the Ebola outbreak. I found that most American media outlets didn't pay much attention to it until the first cases involving American citizens showed up – four months after the outbreak.

I've come to realize how complementary computer science is to just about any domain. Everyone can explore aspects of computer science – through internships, volunteering and coursework. You never know what you might have a passion for, career-wise.

"I'VE COME TO REALIZE HOW COMPLEMENTARY COMPUTER SCIENCE IS TO JUST ABOUT ANY DOMAIN."

ATTENDED JH ROSE HIGH SCHOOL. GREENVILLE, NC >> STUDIED AT SCHOOL OF INFORMATION AND LIBRARY SCIENCE. UNIVERSITY OF NORTH CAROLINA >> COMPLETED A MASTERS IN INFORMATION SCIENCE. UNIVERSITY OF NORTH CAROLINA >> WORKS AS A DATA SCIENTIST. AUTOMATED INSIGHTS

GRETCHEN MATHISON

Be who you choose

Where can computer science take you? Anywhere you want!

1 THE TRAVELER

OLIVER TAN SOFTWARE ENGINEER, DROPBOX

I'm an adventurer – I love traveling and exploring. I grew up and studied in Australia, and recently started working at Dropbox in San Francisco. As a file storage company, we handle exabytes of data with huge amounts of traffic every second.

Computer science is awesome! The job prospects are endless and there are lots of opportunities to make a real difference. If you're keen, get involved. Start studying online or join camps and competitions. Google Code Jam is a cool way to start. Most importantly, don't be afraid to ask questions. There are forums and people out there who are eager to help you. I'd love to change the world with technology. Anything that helps people – health, lifestyle, transport – I would happily do!

2 THE TEACHER

BAKER FRANKE CODE.ORG

Learning computer science changed my life. For one thing, I never thought I was good at math. Back then, I loved to draw; I wanted to be an artist. In high school, a friend said, "There's this thing called the Internet. I can show you how to make a website."

I started drawing on a computer, then took a class in Photoshop at the Art Institute of Chicago. I got a job at a graphic design firm when I was just 15. I got a Bachelor's degree in computer science and started clubs to do websites and graphic design. Then I got a Master's degree in computer science.

Now I write curriculum for AP computer science courses. I try to be engaging and help kids to think using process and logic. And I still get to be an artist – all the graphics in the lessons are mine!

3 THE SCIENTIST

ALEXIS PENA RESEARCH STUDENT

I first understood the impact computer science could have on medicine when I was doing my honors thesis at Syracuse University under the guidance of Professor James Henderson. When I started, there wasn't an approach to reliably identify cell types that wasn't invasive, expensive or time-consuming. I worked on a computational approach and eventually, we developed an affordable program that could be used over and over again, to track and identify a range of different cells. Although my work has a biomedical application, much of the design and approach is made possible through computers.

I'm from North Carolina. Growing up, I was often the only person of color in my class. Being a minority female in STEM has made me appreciate what I can offer, because diversity doesn't just mean gender and race. Diversity is also about the thoughts and experiences you bring to help create solutions with other people.

I always make time to mentor students. I tell them, "You can do anything! Be curious – find friends to practice with, code and be life-long learners!"

SYRACUSE UNIVERSITY / TOM KUBIK / CODE.ORG

4 THE ENGINEER

JORGE PADILLA GOOGLE

I grew to love engineering as a child, working alongside my dad making mechanical repairs to our family cars. Every repair was a new learning experience. I now design hardware in Google's data centers. Our servers are giant buildings, with row upon row of machines to provide the services that make Google function. These machines can overheat, so engineers like me find solutions for efficient heat transfer.

I'm passionate about sharing information with people through technology and experiences through sound. I play the trumpet and perform with the UC Berkeley Symphony Orchestra about twice a month. One of my favorite musicians, Miles Davis, wrote that "knowledge is freedom and ignorance is slavery." I think this resonates with my role as an engineer and Google's mission, to organize the world's information and make it universally accessible and useful.

5 THE ENTREPRENEUR

SILVIA JARAMILLO-REGALADO
STUDENT + COFOUNDER, CULTURE TECH CADETS

When I was a sophomore, I landed a financial internship at First Round Capital in New York City. I had daily conversations with software engineers-turned-entrepreneurs, and I loved it! The entrepreneurs introduced me to computer science. I met so many people who offered their help and support. One lady, Latha, was as a phenomenal mentor at a key point in my journey. She taught me how to ignore anyone who tried to put me down. My passion for computer science has no barriers, no limits.

I started up Culture Tech Cadets knowing there weren't enough resources for computing in the area. I love helping those who are marginalized by using the power of technology. I find it amazing teaching a child basic computer science skills. I'd love to help build computer literacy in families who lack the knowledge.

6 THE SOUND GUY

MICHAEL HORGAN
SENIOR ENGINEER, DOLBY LABORATORIES

It was very late in college – the end of my junior year – when I began studying computer science. I switched majors three times in one year, but eventually I figured out that learning how to apply technology to create new musical and auditory possibilities excited me.

I was encouraged by a close friend and completed the core computer science classes over the next two years, while finishing my Bachelor's and Master's degrees in music, science and tech.

Now I'm a software developer, helping to build Dolby's object-based audio format at their labs in San Francisco. Audio is my wider passion. I'd like to continue to hone my craft as a developer in industries that are using data science in ways that will enrich human experiences.

Get a flying start

Friends, fun and creative freedom. The computer science community is full of support networks

Computer science is the key to opening up exciting new career paths, so the community around it is super important. For Aura Barrera, an 18-year-old from Oakland, CA (see page 18), it was during a Girls Who Code Summer Immersion Program that a community changed the course of her life.

From what she learned that summer, Aura found a way to tap into her passion for helping others, too. "My dream is to engage and empower my community by teaching them to code," she says.

Aura is now studying computer science at the University of California, Berkeley, but still finds time to teach high school students how to code through Girls Who Code at her old school. She also started Girls Go Tech, a workshop that introduces middle school girls to computer science by teaching them to build Android apps. "Children of immigrant parents like myself might not have the same access to technology, resources and opportunities," Aura says. "I want to bridge that gap."

CHECK OUT THESE ORGANIZATIONS THAT ARE CLOSING THE DIGITAL DIVIDE BY EMPOWERING UNDERREPRESENTED GROUPS TO BE THE NEXT WAVE OF INNOVATORS...

- Blacks in Technology
- Hack the Hood
- Black Girls CODE
- All Star Code
- Black Founders
- digitalundivided
- CodeNow
- Code.org
- Anita Borg Institute
- CODE2040
- Code for Progress
- National Center for Women & Information Technology
- Science Club for Girls
- TECHNOLOchicas
- Women Who Tech
- Women Who Code
- Girls Who Code

Jump over

The digital divide is what we call the lack of access and exposure to tech that women, African Americans and Hispanics experience across the country. The problem is complex, but with 65% of the US population underrepresented in tech, the untapped talent pool is huge.

Girls Who Code runs summer immersion programs for 10th and 11th grade girls, as well as free after-school coding clubs for 6th–12th graders. There are plenty of great coding, tech and STEM camps across the country, like Hands-On Technology Education (pictured here).

She++ is another amazing community that empowers women to make their mark on the tech industry. She++ aims to start conversations about the need for greater diversity in tech. "Girls don't realize they already have many of the building blocks required to learn how to program or work in robotics. They have the math background, the curiosity and interest in technology to go from being a game player to a game creator," says Kimberly Bryant, Founder of Black Girls CODE, a nonprofit focused on diversity learning, social entrepreneurship and technology training for girls.

HANDS-ON TECHNOLOGY EDUCATION

"MY DREAM IS TO ENGAGE AND EMPOWER MY COMMUNITY BY TEACHING THEM TO CODE."

Help is at hand

Being different from most of your peers – whether by race, gender, sexual orientation or another characteristic – can fuel a sense of disempowerment.

This is the motivation behind groups such as Black Girls CODE, TECHNOLOchicas and CODE2040. They engage young African-American and Hispanic students in technology early, and keep them engaged, so their interest in computer science turns into a career.

These groups offer internships, fellowship programs, mentors and community support. They prepare you for success, while you also meet new people and have fun along the way. If no computer science group is nearby, why not start by sharing your computer science experience with your peers and encouraging others to do the same.

Plot your own course

Hurdles to a career in computer science can come in many forms. "Latha, a computer engineer at the Department of Defense, served as my internship mentor," says Silvia Jaramillo-Regalado (see page 37), an undergrad student at Villanova University. "As resilient and determined as she is, Latha faced instances of sexism."

Like Aura, Silvia loves helping underprivileged communities through the power of tech. She cofounded Culture Tech Cadets – a one-week middle school summer web-development program held in Newark, NJ. "I find it amazing when I change the life of a child by teaching them basic computer science skills," she says. Silvia has learned a range of programming languages through internships, Girls Who Code, workshops, college coursework and massive open online courses (MOOCs).

"I may not be fully knowledgeable in one programming language," says Silvia. "But I sure am proficient in several!"

There is more than one way to succeed in computer science, and there are plenty of places that offer support and advice. All you need is the drive to get there.

Step-by-step

Whatever grade you're in, there's a path

1. STARTING OUT

Learn through play

You can learn code by playing around with robots like Sphero, Dash and Dot. Or try out coding platforms that allow you to create your own animation – these can be the ultimate go-to for coding fun.

Learn the basics

Math is a really important skill. You'll need to keep taking math and make steady progress in your classes so every computer science class is available to you, including Advanced Placement (AP) computer science. Check with your counselor for more info on what's involved.

Go online

Plenty of tools and techniques exist to get you started in code. Interactive coding games help you learn, and easy-to-use programming languages let you code your own interactive stories, games and animations. You can also share your creations with friends.

Find friends

The coding community welcomes everyone with an interest in programming, regardless of experience. Hackathons, online communities and coding camps are great places to get started. See page 42 for resources.

2. GET GOING

Solve problems

The human brain is geared to code – we all have a natural ability to solve problems. Computational thinking (CT) describes these problem-solving processes. Pump up your CT skills with puzzle games and coding. Watch how Google uses CT to do amazing things.

GOOGLE CT bit.ly/2amSfkg

Learn advanced science

Some of the most cutting-edge coding jobs involve science, so signing up to an advanced STEM course might lead you to a career that hasn't even been invented yet! AP courses are college-level classes in subjects like calculus, computer science, studio art and physics. See which courses your school offers on the AP Course Ledger and check with your school counselor early to make sure you're on track. Some schools teach AP STEM courses through summer assignments.

AP COURSE LEDGER bit.ly/2aHGRP5

Join a computing club

It's more fun to learn with friends, and coding clubs are a great way to meet new people, learn outside the classroom and build your skills. No club at your school? No problem. Girls Who Code, Hack Club and CoderDojo provide all the support you'll need to start your own club.

GIRLS WHO CODE bit.ly/2azNun8
HACK CLUB bit.ly/2aHHb0j
CODERDOJO bit.ly/2aHHaJQ

Take an online computer science course

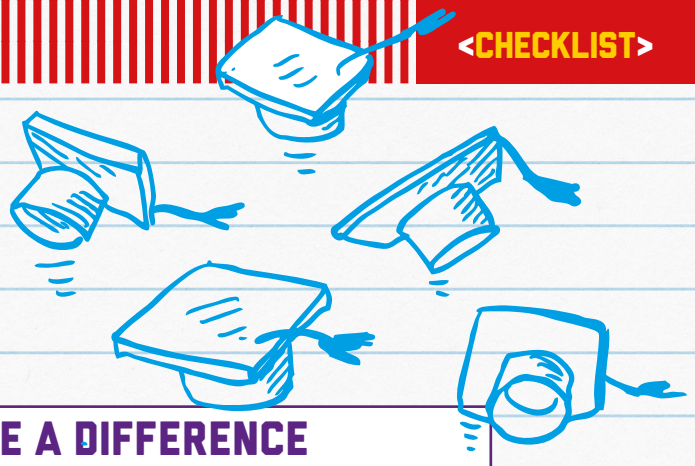
Whether you're a beginner or a coding ninja, you can always learn more. Udacity offers a range of courses, many of them free, including a CS101 course for beginners. Other free courses on coding topics are provided by Codecademy, Free Code Camp, Udemy, Khan Academy and Future Learn.

code.org
UDACITY CS101 bit.ly/2amRzeA
CODECADEMY bit.ly/2a8CiQa
FREE CODE CAMP bit.ly/2aFSid9
UDEMY bit.ly/2amRCXK
KHAN ACADEMY bit.ly/2azNpj4
FUTURE LEARN bit.ly/2aphJxJ

HANDS-ON TECHNOLOGY EDUCATION / GOOGLE / SHUTTERSTOCK.COM

checklist

to a computer science (CS) career for you!



4. MAKE A DIFFERENCE

If you can code, you will be in demand. Around one in every 20 open job postings in the US involves programming, with an average salary of $101,000. This demand is rising, and 17% more jobs for software developers is expected by 2024 than there were in 2014, fueled by the way CS is breaking into all aspects of life. "You might be working on an app to detect cancer, or maybe something to help in the political process, or something that makes work more open and connected," says David Garcia, a software engineering manager at Facebook. "You work on anything, because everything needs some amount of CS." Coding skills are your key to a future of bright possibilities, where you can not only match your career with your passions, but also invent the future. So what are you waiting for? Jump on board!

3. TAKE A BREAK

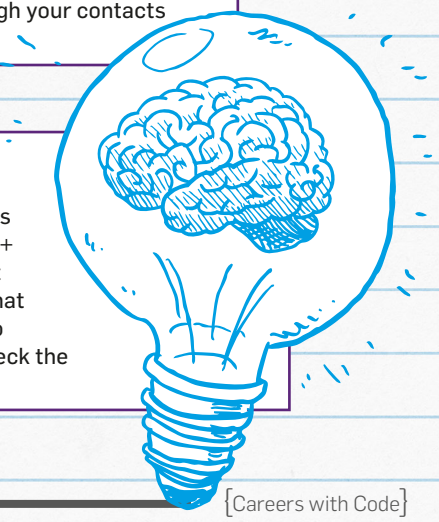
Unlike many subjects, there's no set way into computer science after high school. So if you are weighing your options, it might be an idea to take a gap year. This extra time will give you a chance to see if a career in coding is right for you, by exploring CS through short online introductory activities, gaining work experience, building a website, or joining the many hackathons, competitions, and communities supporting young people interested in coding (see 'Your Career Starts Here?' page 42). Another option is to take a community college course. Nearly 45% of Bachelor's grads first attended a community college. It's a quick way to get a head start and provides a strong foundation of general knowledge.

5. GO YOUR OWN WAY

Although more than 90% of Silicon Valley software engineers have a computer science degree, you don't have to have one to work in CS. Recruiters are looking for people who are passionate about the industry and take the initiative to teach themselves new skills. Maybe you want to explore a passion like law, arts or science. No problem. At Stanford, about 90% of undergraduates take at least one programming class, and many colleges offer CS + X combined degrees, minor options, or CS classes. Perhaps a set college program is just too slow (or fast) for you. Take massive open online courses (MOOCs) on websites such as Coursera and edX, sign up for online courses at Code School, W3Schools and CodeAcademy, or even go vintage and read CS technical books. If you learn better on the job, why not apply for an internship or a technical summer job? Thousands of internships are listed on LinkedIn, Looksharp and many other recruitment websites. Or you can ask to shadow or chat with industry professionals through your contacts or via hack.pledge().

6. CHOOSE YOUR PATH

Coding has been an important part of science for decades, with degrees such as computational physics (think computer science + physics), computational chemistry (CS + chemistry) and bioinformatics (CS + biology) offered at many colleges and universities. But what if you want to combine CS with a different passion, a different X, such as CS + English Literature or CS + Art? Colleges are beginning to realize that computer science is becoming necessary for many jobs, from marketing, advertising and journalism to gaming, medicine, and finance. You can combine CS with languages, art, music and many other Xs. Check the joint degree programs on the websites of colleges you are interested in for further information.



Your career starts here

There are so many ways to get into CS. Check out these ideas...

GET THE BIG PICTURE AND VISIT REGULARLY FOR IDEAS

Find a STEM opportunity near you > **The Connectory** > theconnectory.org

Discover events, ideas and opportunities at every level > **TechPrep** > techprep.fb.com

Find STEM summer programs and colleges > **Teenlife** > bit.ly/2aoZ9G3

Get all of the resources in this guide and more > **Careers with Code** > careerswithcode.com

All of Google's Education Resources > **Google for Education** > g.co/csedu

HAVE SOME FUN IN HACKATHONS, COMPETITIONS, CODING EVENTS

Enter a global online science and engineering competition > **Google Science Fair** > **Ages 13-18, worldwide** > bit.ly/2alATB3

Take part in a competition for college scholarships > **The Siemens Competition in Math, Science and Technology** > **High school students (grades 9-12), regional and national levels** > bit.ly/2aAFvI8

Get a one-hour introduction to computer science > **Hour of Code** > **Age 6+, worldwide** > code.org/learn

Take on other students around the world in a coding challenge > **Google Code Jam** > **Age 13+, worldwide** > code.google.com/codejam

Go for gold and the chance to represent the US > **USA Computing Olympiad** > **Pre-college students, nationwide** > usaco.org

Test yourself against other students around the world > **Microsoft's Imagine Cup** > **Age 16+, worldwide** > imaginecup.com

Find a computer science competition > **American Computer Science League** > **Pre-college students, worldwide** > acsl.org

GET SKILLS AND STUDY ONLINE

Spend 20 hours learning to code > **Code Studio** > **Ages 4-18, worldwide** > studio.code.org

Try games for tomorrow's programmers > **Blockly** > **All ages** > blockly-games.appspot.com

Create art, music, games and more as you learn to program > **Pencil Code** > **All ages** > pencilcode.net

Access tech courses on Python, 3D printing, Minecraft and more > **Tech Rocket** > **Ages 10-18** > www.techrocket.com

Make a website, learn SQL and more in eight different programming languages > **Codecademy** > **All ages** > www.codecademy.com

Watch YouTube videos on essential coding concepts > **CodeNow** > **All ages** > bit.ly/2aFmhlB

Learn to create animations, games and stories from Scratch > **Scratch** > **Ages 8-16** > scratch.mit.edu

Use your imagination making animated movies and simple video games > **Alice** > **Students** > www.alice.org

Build your own game or program with just a few lines of code > **Small Basic** > **Ages 10-16** > smallbasic.com

Take your pick of free tech topics – cryptography, algorithms, information theory... > **Khan Academy** > **All ages** > bit.ly/2al4Yqs

MEET UP WITH PEEPS THROUGH NETWORKS, CAMPS, SOCIAL MEDIA

Find role models > **Grace Hopper Celebration of Women in Computing** > ghc.anitaborg.org

Find mentors in other technical women > **Anita Borg Institute** > **Local events:** bit.ly/2aHkFVm > **The Systers community:** bit.ly/2aii83p

Learn to code with Microsoft > **DigiGirlz High Tech Camp** > **Girls, age 13+, locations around the US** > bit.ly/2ap0QmJ

Spend your summer at the hottest tech companies in the world > **Girls Who Code Immersion Program** > **Girls, ages 15-17, at leading tech companies around the US** > girlswhocode.com/programs

Choose from game design camps, web-design camps, robotics camps and more > **ID Tech Camps** > **Ages 6-18, locations around the US** > www.idtech.com

Become a technolochica, meet others and get info about opportunities > **NCWIT's TECHNOLOchicas** > **Latinas, nationwide** > technolochicas.org

Workshops for the new generation of coders > **Black Girls CODE** > **African-American girls, locations around the US** > www.blackgirlscode.com

Host a coding party at your house or school > **Made with Code** > **Female high school students, nationwide** > bit.ly/2aFA7E8

Become a coding ninja through community-based programming clubs > **CoderDojo** > **Ages 7-17, worldwide** > coderdojo.com

BOOST YOUR CAREER WITH INTERNSHIPS, SCHOLARSHIPS, TIPS

Scholarships, job opportunities and mentoring for girls and women > **NCWIT Aspirations in Computing** > **K-12 through to higher education, national** > bit.ly/2alCvKM

Enrichment programs, online learning, mentorships and more > **MIT MOSTEC** > **Free for high school seniors, nationwide** > bit.ly/2aoZwk1

Find success in tech > **#YesWeCode** > **For students from underrepresented backgrounds, nationwide** > yeswecode.org

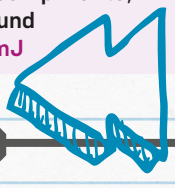
Prep for the tech industry > **All Star Code** > www.allstarcode.org

Map out your computing career path > **Anita Borg Institute** > bit.ly/2a8lIQ8

Explore internships in computer science around the nation > **internships.com** > www.internships.com

Apply for an internship at Google > **Google Careers** > bit.ly/2al5y7F

Check with your parents before going online



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You can also apply for computer scholarship through Google > **Google for Education** > bit.ly/2acGZ79

Find encouragement to pursue careers in STEM > **Microsoft Careers** > bit.ly/2aFAKxv

Microsoft has a 12-week summer internship program for college freshmen and sophomores > bit.ly/2aoYaDf

Read interview tips from Microsoft – they will help outside of computer science too! > bit.ly/2azvuZT

Work for the social company > **Facebook** > bit.ly/2aDzFoO

Discover opportunities for students and recent grads > **Ford** > ford.to/2aqlJuR

Get a high-tech career with a human touch > **Dolby** > http://bit.ly/2aHm6mM

Look out for fall, spring and summer internships for current students > **Under Armour** > bit.ly/2aSTFkU

Apply for an internship with Apple > **Jobs at Apple** > apple.co/2aqmcxi

Get equipped for a Bachelor's degree at a college or university > **Dell Scholars Program** > www.dellscholars.org

Cyber Corps: Get scholarships for service> **National Science Foundation** > www.sfs.opm.gov

HELP OTHERS THROUGH MENTORING, SOCIAL CHANGE, SCHOOL VISITS

Get a laptop, find a location and start a coding club at your school > **Google CS First** > **Ages 9-14, online resources** > csfirst.withgoogle.com

Help others learn to code > **Khan Academy** > **All ages, nationwide** > bit.ly/2ap00Uu

Get others involved in coding – start a hack club > **Hack Club** > **All students** > hackclub.com

Create and edit female-focused Wikipedia pages > **Girls Only Edit-a-Thon** > **Girls, all ages** > dsorg.us/2ap1fFI

Take part in a social media makeover and take on cyberbullying > **Social Media Makeover** > **All students, nationwide** > dsorg.us/2aijGu0

Sign up to be a coding mentor or find someone who can help you > **hack.pledge()** > **All ages, nationwide** > hackpledge.org

Sign up to support diversity in computing > **Code.org** > **All ages, nationwide** > code.org/promote

Make a difference in your local community > **IgniteCS** > **College students** > ignitecs.withgoogle.com

GET INSPIRATION FROM POSTERS, MOVIES AND MORE

Get a bunch of resources and information on standards > **Computer Science Teachers Association** > bit.ly/2aclpOS

Design a project, find a mentor and create cool code > **Made with Code** > madewithcode.com

Meet some inspiring Latina mentors > **TECHNOlochicas** > technolochicas.org

Visit NCWIT for plenty of resources for counselors > **NCWIT C4C** > bit.ly/2a8lMQ5

Watch inspiring speakers and get posters for your classroom > **Code.org** > bit.ly/2aHnvtC

Watch Code.org "What most schools don't teach" video > bit.ly/2aikfnF

Read interviews with women in IT – their advice and how they got there > **NCWIT Entrepreneurial Heroes** > bit.ly/2aHoU3f

Follow The Fosters' journey creating an app called Fost & Found for foster kids to find each other, resources and homes > **The Fosters** > twitter.com/fost_and_found

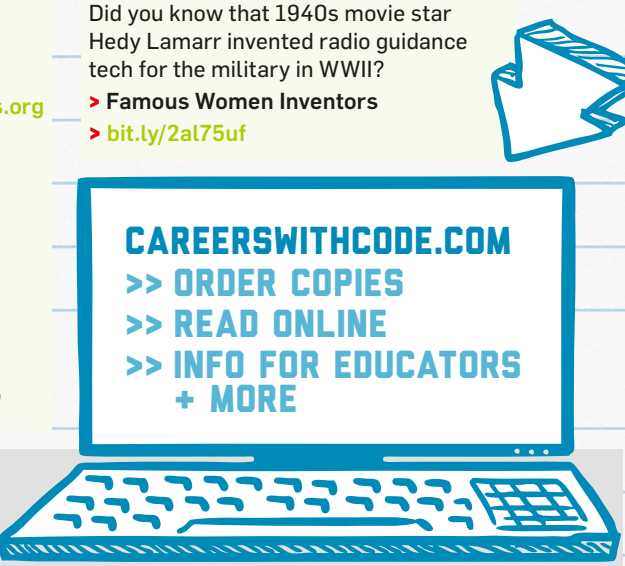
Watch Yara Shahidi, who teamed up with with DoSomething.org to create a fun, SMS text message game for girls > **Science Sleuth** > bit.ly/2aqndp7

Read about Katherine Johnson, who calculated the trajectory for Project Mercury and the 1969 Apollo 11 flight to the Moon > **Wikipedia** > en.wikipedia.org/wiki/Katherine_Johnson

And read about 16-year-old Victoria Pannell, whose app concept to stop sex trafficking won #YesWeCode's first-ever hackathon > **Victoria Pannell's real-life story** > bit.ly/2amA5ij

Also, check out the girls who invented the Tampon Run video game > **Girls Who Code** > bit.ly/2aSUTg1

Did you know that 1940s movie star Hedy Lamarr invented radio guidance tech for the military in WWII? > **Famous Women Inventors** > bit.ly/2al75uf



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Editor & Chief Wrangler: Heather Catchpole
Additional editing: Ben McCluskey, Fran Molloy, Ben Skuse, Vanessa Woods
Art Director: Kat Power
Production Manager: Heather Curry
Digital Editor: Elise Roberts
Publishing Coordinator: Laura Boness
Editorial Assistant: Gemma Conroy
Sub-editors: Pippa Duffy, Emily Lippincott
Illustrations: Freda Chiu
Photographers: Tom Kubik, Gretchen Mathison
Writers: Heather Catchpole, Gemma Conroy, Guy Fenton, Ben McCluskey, Renee Morad, Ben Skuse, Brett Szmajda, Vanessa Woods

EDITORIAL & ADVERTISING OFFICES:
Refraction Media
97 Rose St, Chippendale, Sydney, Australia
+61 2 9699 8999
PO Box 38, Strawberry Hills, NSW 2008
info@refractionmedia.com.au

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ADRIANA M ROISMAN

“The beauty of computer science is that you learn how to think, not what to do, and that is empowering to me.”

Tsion Behailu, Developer, Google

g.co/csedu