Inside AI

An Algorithmic Adventure

unesco

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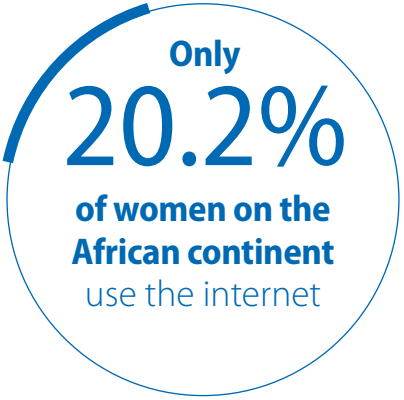
SHORT SUMMARY

What is AI's impact on humankind?

Across the world and particularly in the Global South, people are at risk of being excluded from the benefits of the digital transformation - and most of them are girls and women. **On the African continent, only 20.2% of women and 37.1% of men use the internet**[a], even though being online is one of today's key requirements for social and economic participation.

- In the framework of UNESCO's work to harness emerging technology for sustainable development, this graphic novel for young adults explores the impact of Artificial Intelligence on humankind.

- By following characters in four different corners of the globe as they grapple with the limits of AI technology, a young audience jointly embarks on a mission in an algorithmic galaxy called Plethor.A.I. There, they have but one option: travel across this hidden world behind our screens to learn about the social, technical, ethical and human rights impacts of Artificial Intelligence, and help the characters find a way back to reality.



[a] p.17 from UNESCO report *The Effects of AI on the Working Lives of Women*

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"Since wars begin in the minds of men and women it is in the minds of men and women that the defences of peace must be constructed"

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Contents

Foreword

Today, Artificial Intelligence (AI) and its applications are no longer limited to science fiction movies. You have likely interacted with AI yourself, through voice assistants or facial recognition filters, or by receiving social media content mediated by algorithms. As a tool, AI has enabled unprecedented achievements, from personalizing recommendations to billions of people, to predicting diseases before they occur.

It is precisely because AI is such a powerful tool that we must also look at its risks and potential negative impacts. Why is AI sometimes biased when it comes to important decisions such as whom to hire? How come it excludes certain groups of people? How can we avoid discrimination, ensure inclusion and diversity, protect our privacy, and overcome complex AI black box challenges?

These are just some questions that UNESCO tries to answer across our fields of competence in education, science, social and human sciences, culture, communication and information. For example, in 2021, UNESCO launched a free online microcourse on AI and Human Rights that made complex AI concepts easy to understand for youth around the world. With this and other initiatives, such as the 2021 Recommendation on the Ethics of Artificial Intelligence adopted by UNESCO's General Conference at its 41st session, we aim to ensure that AI is used in a way that aligns with international standards and protects human rights, such as the rights to equality, education, privacy, access to information, and freedom of expression.

I invite you to join us in exploring both the opportunities and challenges that AI presents. We hope this graphic novel will not only make AI concepts accessible to everyone regardless of age, but also empower each individual to be aware of and protect their fundamental rights in the digital age.

We invite you to share your thoughts on #ArtificialIntelligence and interact with us by commenting, retweeting and sharing this graphic novel in your social media networks, and tagging @UNESCO. Under my account @TawfikJelassi, I will be posting more tweets on UNESCO's first graphic novel on AI! ▪

Dr. Tawfik Jelassi
Assistant Director-General of UNESCO
Communication and Information Sector

Episode I

Ari and the Parallel University

Conception and script: Dr. Katherine Evans

Illustration: Isobel Joy Te Aho-White

Māori Cultural Creative Consultant: Cian Elyse White

Introduction

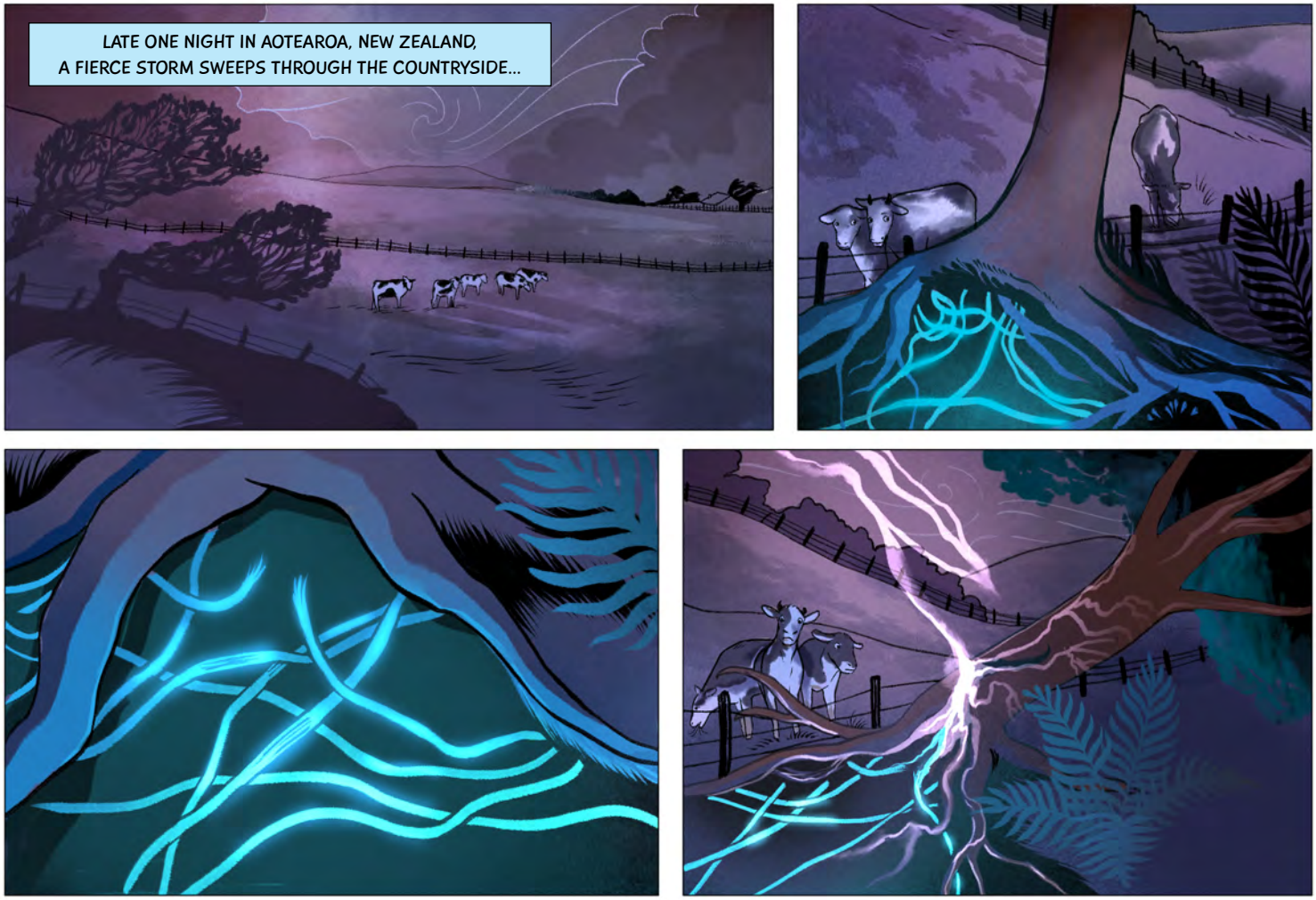
Though difficult to perceive, a hidden world lies behind the many screens which fill our lives. Surprisingly perhaps, we interact with this world every day: each time we open an app on our computers and smartphones, or access a web page, we open a door to it. Each time we ask a voice assistant a question, or use our faces for identification, we teach it to recognize us. And each time we like a post, watch a video, or buy something online, we let it learn something about us. In many ways, this world exists both everywhere and nowhere, and is governed by both everyone and no one. Many of us have heard of it, some of us fear it, but few of us understand exactly how it works.

In the media, textbooks and online, we usually call this world 'Artificial Intelligence', or 'AI' for short. Technically, it is comprised of *data*—information or facts about us and the world we live in—*algorithms*—sets of rules or procedures that can be followed to achieve a certain goal—and *connectivity*—hardware that links it all together, sending data both all over the globe, and directly to the devices of people, or *users* like us. Although we may not recognize it, this little trio of data, algorithms, and connectivity has, and will continue to have, a profound impact on nearly every aspect of our lives, and even life on Earth itself.

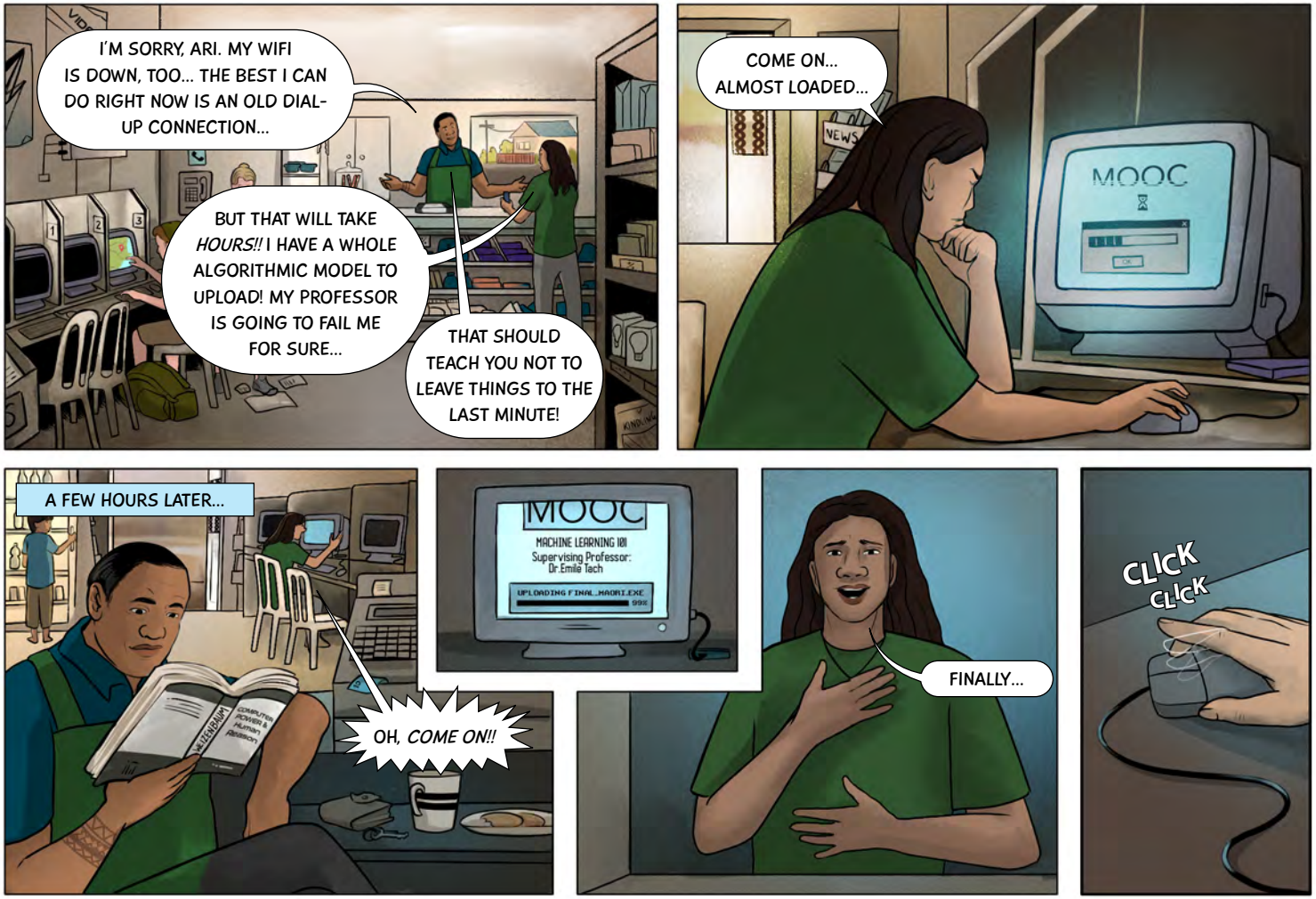
In part, this is because AI is designed to help people: it can perform tasks humans once had to tackle on their own, or provide services many of us cannot live without. It can give us valuable insights into complex problems too big for any one mind to decipher, and it can even be creative, finding new solutions that none of us expect. In some ways, it is the most useful tool humanity has ever created, and its applications are limited only by our human imagination.

Yet, like any tool, Artificial Intelligence is only useful if it's used in the right way. If we want AI to help us, then we must be careful not to lose ourselves in its promise and potential, and in so doing, lose track of what matters most: humans and their rights and dignity, the environment, and the value of living in harmony. AI might be virtual, but its true impact on humankind and the planet is very real.

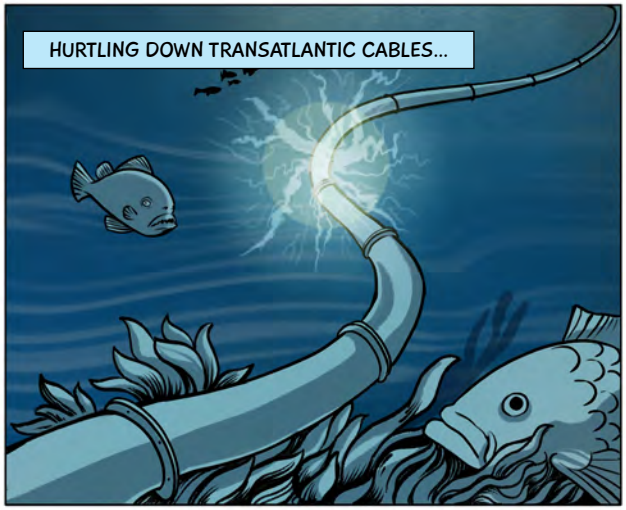
It all starts with AI explorers like you, those that are brave enough to face the hidden universe beyond our screens, and to investigate its mysterious connection with our own. ▪

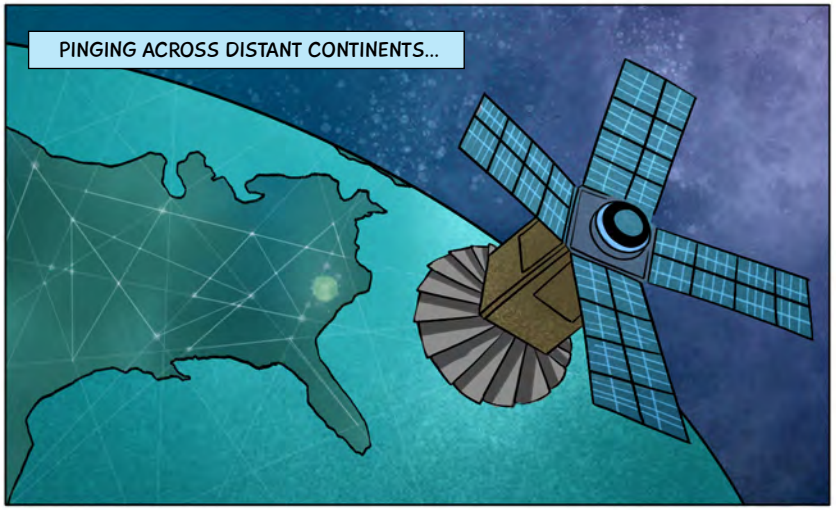

LATE ONE NIGHT IN AOTEAROA, NEW ZEALAND,
A FIERCE STORM SWEEPS THROUGH THE COUNTRYSIDE...

*GOOD MORNING **HELLO THERE, FRIEND!


I'M SORRY, ARI. MY WIFI IS DOWN, TOO... THE BEST I CAN DO RIGHT NOW IS AN OLD DIAL-UP CONNECTION...
BUT THAT WILL TAKE *HOURS!!* I HAVE A WHOLE ALGORITHMIC MODEL TO UPLOAD! MY PROFESSOR IS GOING TO FAIL ME FOR SURE...
THAT SHOULD TEACH YOU NOT TO LEAVE THINGS TO THE LAST MINUTE!
COME ON... ALMOST LOADED...
MOOC
A FEW HOURS LATER...
MOOC
MACHINE LEARNING 101
Supervising Professor:
Dr. Emile Tech
UPLOADING FINAL_MAORI.EXE
99%
OH, *COME ON!!*
FINALLY...
CLICK
CLICK


ARI'S HOMEWORK BEGINS ITS LONG JOURNEY TO ITS DIGITAL DESTINATION...
Island Time
NEWS
BIG STORM
ZIPPING THROUGH UNDERGROUND INFRASTRUCTURE...
CHOCOLATE FISH


HURTLING DOWN TRANSATLANTIC CABLES...


PINGING ACROSS DISTANT CONTINENTS...


...BEFORE LANDING IN A SERVER FARM SOMEWHERE IN RURAL VIRGINIA. SOMETHING, HOWEVER, SEEMS TO HAVE GONE WRONG...

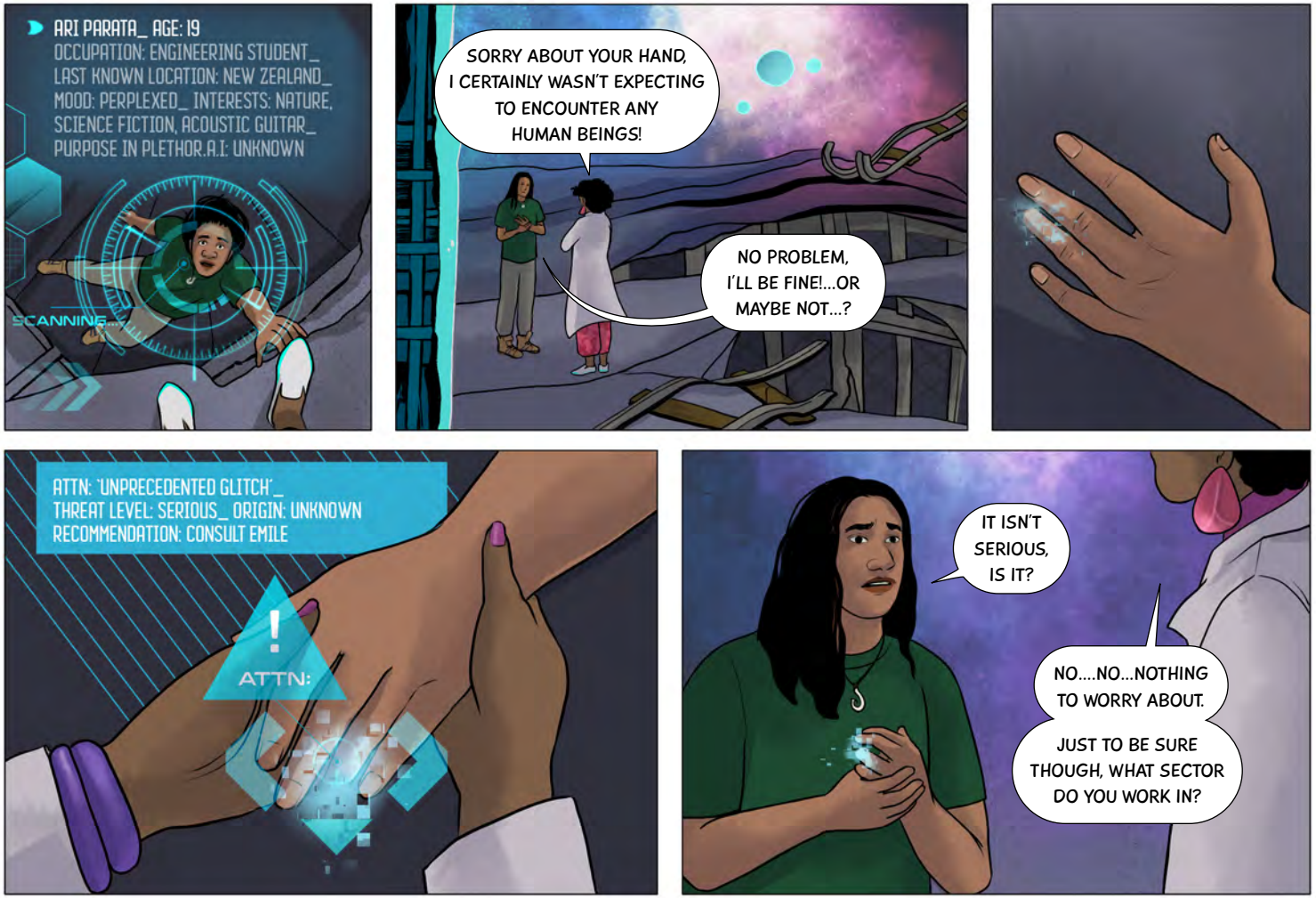

VERY WRONG...


DRINK
COMPUTER POWER &
J. WEIZENBAUM
TAIKA?? I THINK SOMETHING BAD IS HAPPENING!!
RELAX, ARI. IF YOU FAIL THE CLASS YOU CAN JUST TAKE IT AGAIN NEXT SEMESTER...
$1.99
SALE
HEY... WHERE'D HE GO?

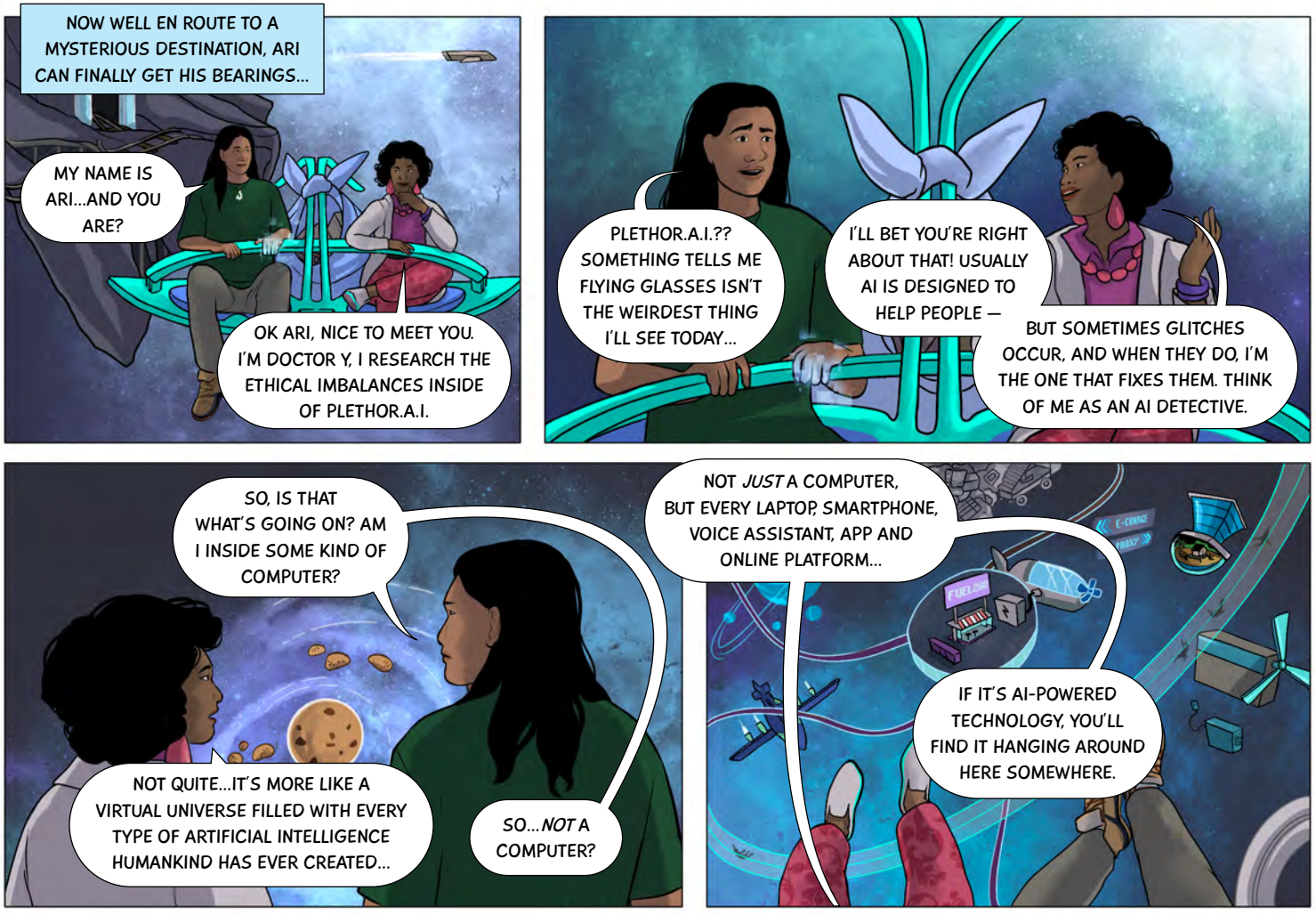

Tēnā koe, e hoa
Hello there, friend
?!?!?!
He aha tō ingoa?
What is your name?
Tō pātaki hoki!
You're handsome!
Tō koi hoki!
You're so smart!
He aha tō mahi?
What is your occupation?
He pātai āu?
Do you have any questions?


UPLOAD
DOWNLOAD
He pātai āu?
Do you have any questions?
Tō koi hoki!
You're so smart!
UH-OH...
LOOKS LIKE I
MIGHT NEED A
LITTLE PUSH...
THAT'S NOT
WHAT I HAD
IN MIND!
He aha tō ingoa?
What is your name?
FASTER,
FASTER,
FASTER!
KEPLER COURIERS
We go fast
AAHHHH!!!
CLANK!

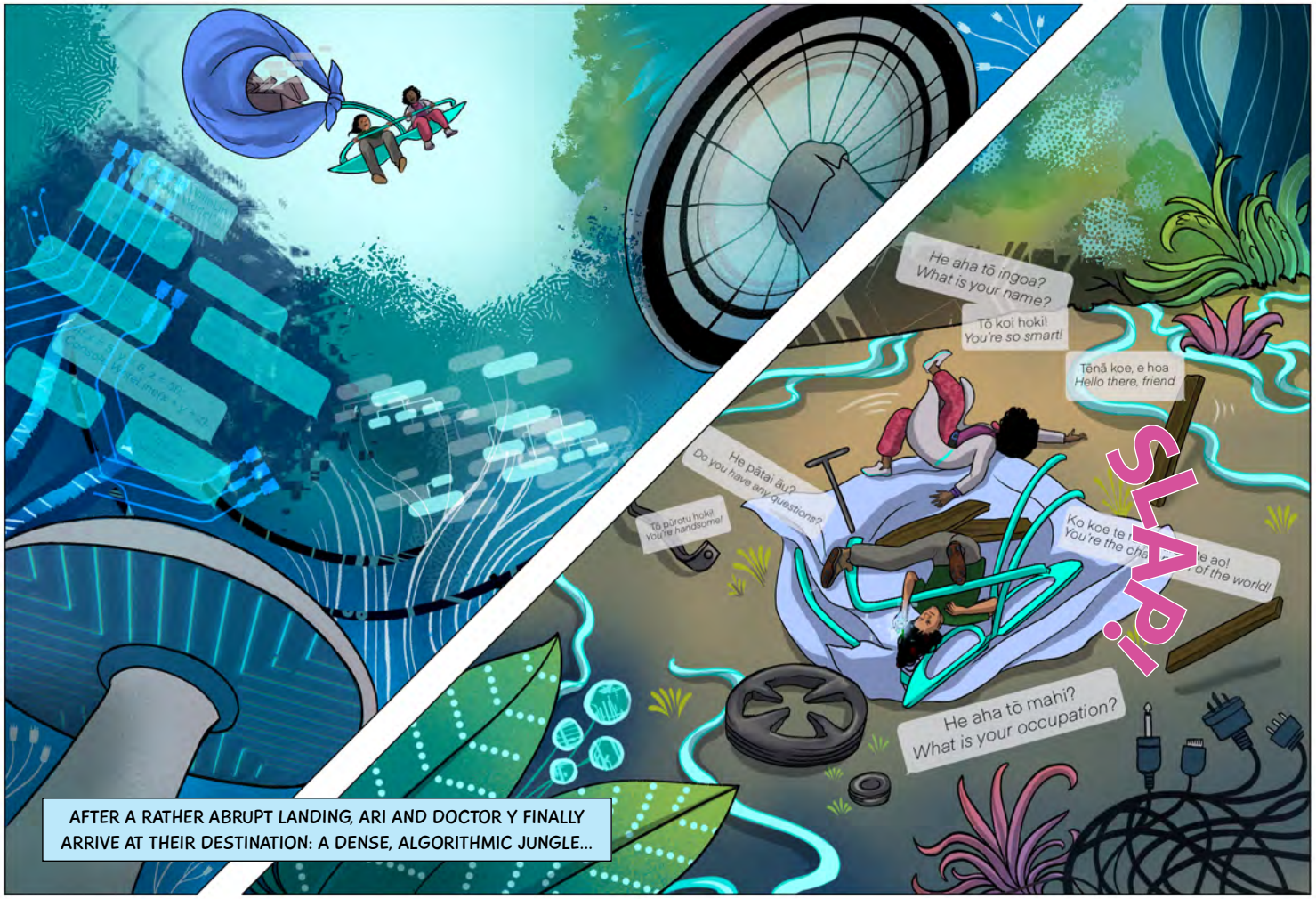

Tō pūrotu hoki! You're handsome!
AAAAAAAAAAHHHHHHHHHHHHHHHH!!!!!
Tēnā koe, e hoa Hello there, friend
Tō koi hoki! You're so smart!
He pātai āu? Do you have any questions?
502 BAD GATEWAY ERROR
A LITTLE WHILE LATER, A MYSTERIOUS FIGURE SWOOPS IN TO INVESTIGATE THE CRASH SITE...
OK, GLASSES, TAKE NOTE: SUSPECTED DDOS HACK IN THE OUTER LIMITS OF PLETHOR.A.I....
UNUSUAL CIRCUMSTANCES... NO OBVIOUS SIGNS OF TAMPERING...
GLASSES, IF THERE'S ONE THING I'VE LEARNED AFTER YEARS OF EXPLORING THIS ARTIFICIAL UNIVERSE, IT'S THAT EVERY PROBLEM HAS A SOLUTION.
ALL THAT IS NEEDED IS ONE SMALL STEP IN THE RIGHT DIRECTION...AND...
OW!!


ARI PARATA_ AGE: 19
OCCUPATION: ENGINEERING STUDENT_
LAST KNOWN LOCATION: NEW ZEALAND_
MOOD: PERPLEXED_ INTERESTS: NATURE, SCIENCE FICTION, ACOUSTIC GUITAR_
PURPOSE IN PLETHOR.A.I: UNKNOWN
SCANNING
SORRY ABOUT YOUR HAND, I CERTAINLY WASN'T EXPECTING TO ENCOUNTER ANY HUMAN BEINGS!
NO PROBLEM, I'LL BE FINE!...OR MAYBE NOT...?
ATTN: 'UNPRECEDENTED GLITCH'_
THREAT LEVEL: SERIOUS_ ORIGIN: UNKNOWN
RECOMMENDATION: CONSULT EMILE
!
ATTN:
IT ISN'T SERIOUS, IS IT?
NO....NO...NOTHING TO WORRY ABOUT.
JUST TO BE SURE THOUGH, WHAT SECTOR DO YOU WORK IN?


SECTOR? WAIT...I WAS JUST HANDING IN MY HOMEWORK?
STRANGE...WHAT WAS IN THE FILE?
A NATURAL LANGUAGE PROCESSING ALGORITHM...
NLP?!...ON A DIAL-UP CONNECTION??
THAT'S ALL I HAD TO WORK WITH... BUT ANYWAY...HOW DO YOU EVEN KNOW ALL OF THIS?
THIS GATEWAY IS RESERVED FOR DIAL-UP CONNECTIONS...
AS YOU CAN SEE, IT'S A LITTLE OUTDATED.
GATEWAY?! GATEWAY TO WHAT??
THAT'S A BIG QUESTION...WE SHOULD GET OUT OF HERE FIRST.
WHY? IS THERE ANOTHER TRAIN COMING??
OH, I DOUBT IT...I JUST WANT A SECOND OPINION ON WHAT'S HAPPENED.
I'LL JUST NEED TO COLLECT SOME EVIDENCE...
OK... BUT DO YOU THINK YOU CAN HELP ME GET BACK HOME?
I'M CONFIDENT WE CAN FIND A WAY, YES. BUT YOU'D BETTER BUCKLE UP, SINCE I'D SAY WE'RE GOING ON—
QUITE THE ALGORITHMIC ADVENTURE!!


NOW WELL EN ROUTE TO A MYSTERIOUS DESTINATION, ARI CAN FINALLY GET HIS BEARINGS...
MY NAME IS ARI...AND YOU ARE?
OK ARI, NICE TO MEET YOU. I'M DOCTOR Y, I RESEARCH THE ETHICAL IMBALANCES INSIDE OF PLETHOR.A.I.
PLETHOR.A.I.?? SOMETHING TELLS ME FLYING GLASSES ISN'T THE WEIRDEST THING I'LL SEE TODAY...
I'LL BET YOU'RE RIGHT ABOUT THAT! USUALLY AI IS DESIGNED TO HELP PEOPLE —
BUT SOMETIMES GLITCHES OCCUR, AND WHEN THEY DO, I'M THE ONE THAT FIXES THEM. THINK OF ME AS AN AI DETECTIVE.
SO, IS THAT WHAT'S GOING ON? AM I INSIDE SOME KIND OF COMPUTER?
NOT QUITE...IT'S MORE LIKE A VIRTUAL UNIVERSE FILLED WITH EVERY TYPE OF ARTIFICIAL INTELLIGENCE HUMANKIND HAS EVER CREATED...
SO...*NOT* A COMPUTER?
NOT *JUST* A COMPUTER, BUT EVERY LAPTOP, SMARTPHONE, VOICE ASSISTANT, APP AND ONLINE PLATFORM...
IF IT'S AI-POWERED TECHNOLOGY, YOU'LL FIND IT HANGING AROUND HERE SOMEWHERE.
FUELS


JUST A MINUTE... YOU MEAN MY PHONE IS FLYING AROUND HERE SOMEWHERE?
WELL, NO...BUT THE ALGORITHMS THAT POWER IT SURE ARE.
NOT TO MENTION ALL THE DATA THAT IT COLLECTS AND USES...
BUT WHY AM I HERE? IT SOUNDS LIKE YOU DON'T GET A LOT OF TOURISTS...
COME TO THINK OF IT, NO!
MOST OF THE HUMANS IN PLETHOR.A.I. ARE WHAT WE CALL AI PROFESSIONALS: ENGINEERS, PROGRAMMERS, C.E.O.'S, LEGISLATORS, DATA SCIENTISTS...
AND EVEN A FEW PHILOSOPHERS LIKE ME!
WELL, I LIKE COMPUTER SCIENCE, BUT I'D HARDLY CALL MYSELF A PRO...
PRO OR NOT, WE'RE GOING TO HAVE TO SORT OUT THIS GLITCH IF YOU WANT TO GET BACK HOME.
HOPEFULLY I KNOW JUST THE PERSON FOR THE JOB!
SPACE FOR LEASE
I HOPE SO...I HAVE TO MAKE SURE MY PAPER GOT IN ON TIME... MY PROFESSOR WILL FREAK OUT!
AH YES...THEY DO HATE SURPRISES, DON'T THEY...

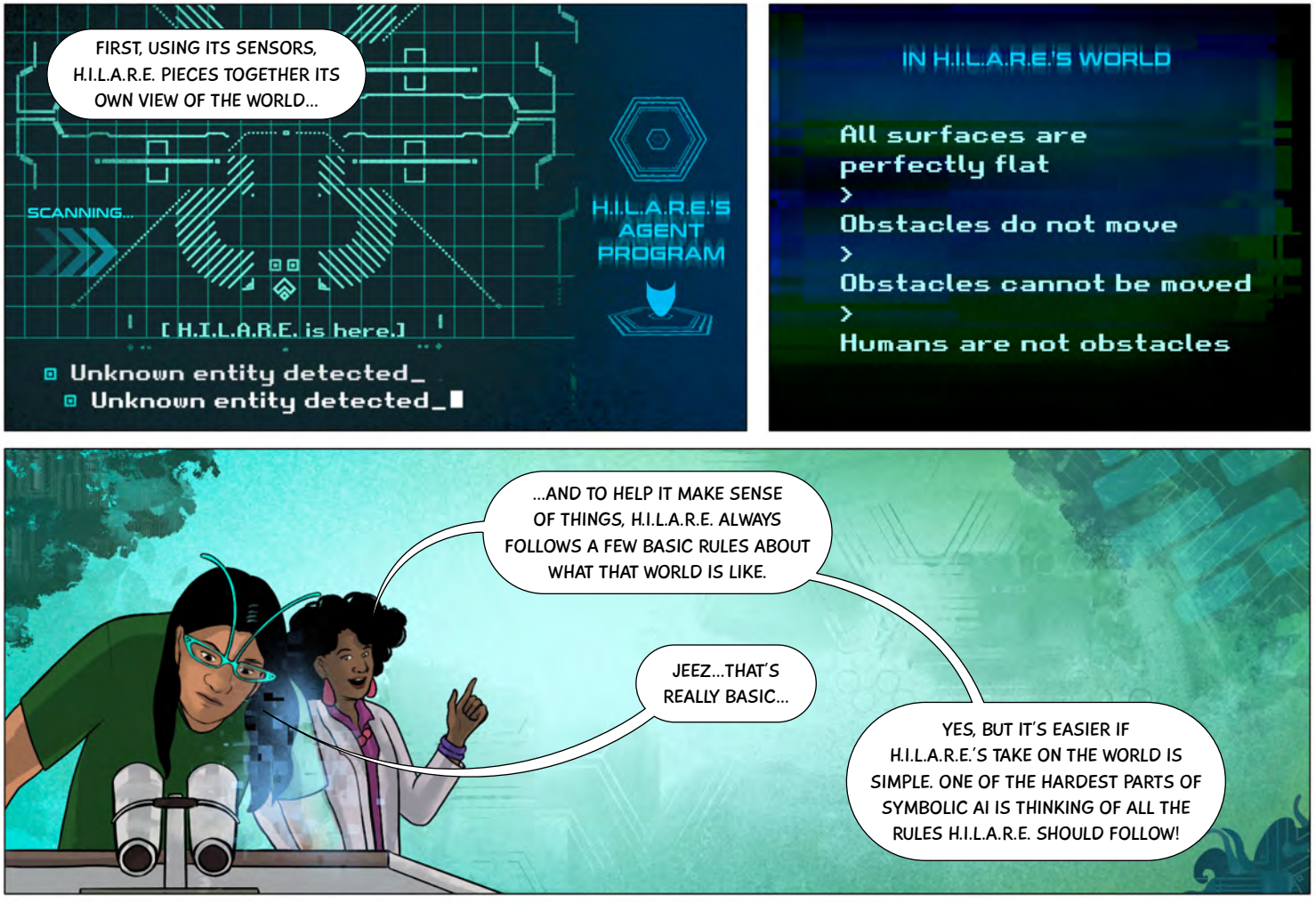

He aha tō ingoa?
What is your name?
Tō koi hoki!
You're so smart!
Tēnā koe, e hoa
Hello there, friend
He pātai āu?
Do you have any questions?
Tō pūrotu hoki!
You're handsome!
SLAP!
He aha tō mahi?
What is your occupation?
AFTER A RATHER ABRUPT LANDING, ARI AND DOCTOR Y FINALLY ARRIVE AT THEIR DESTINATION: A DENSE, ALGORITHMIC JUNGLE...


SORRY ARI, THE AUTOPILOT STILL NEEDS SOME TWEAKING...
TELL ME ABOUT IT!
ALL THE SAME, WE'VE MADE IT TO THE DATA COMMONS!
PEOPLE FROM ALL OVER THE EARTH CAN UPLOAD DATA SETS HERE, AND ANYONE IS FREE TO ACCESS AND USE THEM.
THE JUNGLE YOU SEE HERE IS...WELL... THE FRUITS OF THIS PROCESS...
YOU MEAN THIS FOREST IS MADE OF ALGORITHMS?
YES! A DATA COMMONS IS A BIT LIKE A COMMUNITY GARDEN,
EVERYONE IS FREE TO TAKE THIS DATA, AND GROW WHATEVER THEY WANT!
THAT WOULD'VE COME IN HANDY BACK HOME...
OH REALLY... WHY IS THAT?
WELL...THIS TECHNOLOGY IS NEW TO A LOT OF OUR KAUMĀTUA* BACK HOME.
SO, I WANTED TO DEVELOP A CHATBOT TO HELP THEM ACCESS PUBLIC SERVICES, KEEP INFORMED...THAT'S MY PROJECT.
THAT'S VERY NOBLE OF YOU, ARI...
IT WOULD'VE BEEN, EXCEPT I COULDN'T FIND A DATA SET OF MĀORI LANGUAGE EXAMPLES BIG ENOUGH TO GET IT TO WORK...

* ELDERS


...AND THEN THERE'S THE COMPUTING ISSUE.
EVEN IF I HAD ALL THE DATA, I DON'T HAVE ACCESS TO A COMPUTER POWERFUL ENOUGH TO TRAIN THE ALGORITHM...
IT'S HOPELESS.
HMMM....
...SOUNDS TO ME LIKE YOU'RE ON THE WRONG SIDE OF WHAT WE CALL THE 'DIGITAL DIVIDE'...
HUH?
IT'S AN ETHICAL IMBALANCE THAT PREVENTS SOME PEOPLE OR COMMUNITIES FROM DEVELOPING AI SOLUTIONS THAT EVERYONE WOULD BENEFIT FROM...
OR IN YOUR CASE, PREVENTS YOU FROM DEVELOPING AI APPLICATIONS THAT SERVE YOUR COMMUNITY.
YOU NEED ACCESS TO DATA, BUT YOU'RE WORKING WITH WHAT WE CALL A 'LOW-RESOURCE' LANGUAGE.
THERE'S A TERM FOR IT?
YES! COMBINE THAT WITH YOUR DIAL-UP CONNECTION, AND WHAT SOUNDS LIKE A VERY OUTDATED COMPUTER—
AND YOU'RE AT A SEVERE DISADVANTAGE COMPARED TO MOST YOUNG PROGRAMMERS LIKE YOURSELF.
THAT SURE SOUNDS LIKE THE SITUATION I WAS IN TODAY...
BUT YOU SAID DATA COMMONS LIKE THIS ONE ARE SUPPOSED TO HELP?
THEY CERTAINLY DO! BUT BRIDGING THE DIGITAL DIVIDE IS NOT JUST ABOUT MAKING DATA MORE OPEN.
WE NEED TO BUILD AI THAT IS ACCESSIBLE AND INCLUSIVE AT ALL LEVELS.
AHA! NOW YOU SOUND LIKE A PHILOSOPHER—
—ARI, WATCH OUT!!!


HA
H.I.L.A.R.E.???
WHAT DO YOU THINK, SHOULD WE PLAY DEAD?
OF COURSE NOT...H.I.L.A.R.E. IS HARMLESS!
BUT IT LOOKS LIKE IT'S ABOUT TO ATTACK?
TO THE CONTRARY, ARI...WE COULD BE HERE FOR A WHILE!
H.I.L.A.R.E. HAS TO BUILD AN ENTIRELY NEW INTERNAL MODEL OF ITS SURROUNDINGS BEFORE IT CAN DO ANYTHING!
UH... OK...?
H.I.L.A.R.E. IS WHAT WE LIKE TO CALL 'TOP-DOWN', MEANING IT'S DESIGNED WITH SOMETHING CALLED 'SYMBOLIC AI'.
HERE...HAVE A LOOK FOR YOURSELF...
BASICALLY, SYMBOLIC AI IS ALL ABOUT RULES, AND REASONING ABOUT HOW BEST TO FOLLOW THEM...

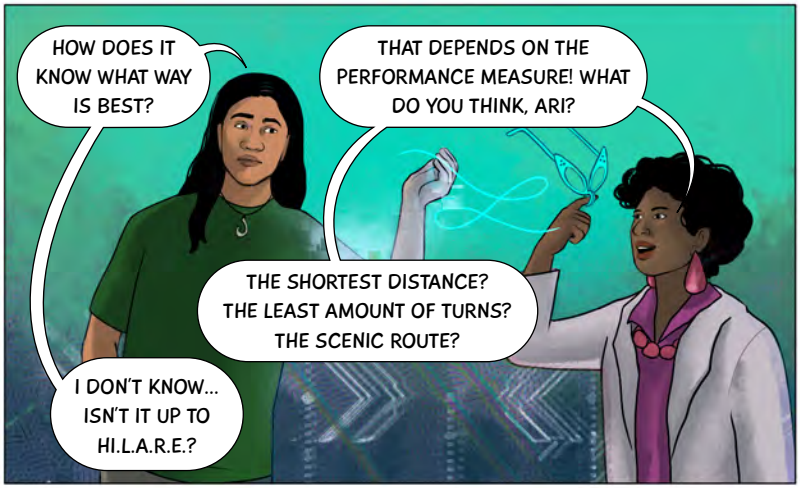

FIRST, USING ITS SENSORS, H.I.L.A.R.E. PIECES TOGETHER ITS OWN VIEW OF THE WORLD...
SCANNING...
[H.I.L.A.R.E. is here.]
Unknown entity detected_
Unknown entity detected_
H.I.L.A.R.E.'S AGENT PROGRAM
IN H.I.L.A.R.E.'S WORLD
All surfaces are perfectly flat
>
Obstacles do not move
>
Obstacles cannot be moved
>
Humans are not obstacles
...AND TO HELP IT MAKE SENSE OF THINGS, H.I.L.A.R.E. ALWAYS FOLLOWS A FEW BASIC RULES ABOUT WHAT THAT WORLD IS LIKE.
JEEZ...THAT'S REALLY BASIC...
YES, BUT IT'S EASIER IF H.I.L.A.R.E.'S TAKE ON THE WORLD IS SIMPLE. ONE OF THE HARDEST PARTS OF SYMBOLIC AI IS THINKING OF ALL THE RULES H.I.L.A.R.E. SHOULD FOLLOW!


Silly Rules
> H.I.L.A.R.E. CANNOT FLY
> H.I.L.A.R.E. CANNOT TELEPORT
Good Rules
> H.I.L.A.R.E. CAN MOVE IN 4 DIRECTIONS
> H.I.L.A.R.E. CANNOT MOVE THROUGH OBSTACLES
> H.I.L.A.R.E. CANNOT BE IN 2 PLACES AT ONCE
> H.I.L.A.R.E. CANNOT DESTROY OBSTACLES
> H.I.L.A.R.E. DOES NOT HAVE HANDS
> H.I.L.A.R.E. IS NOT A HUMAN
> H.I.L.A.R.E. IS NOT A FANCY SPORTS CAR


IT'S CALLED THE 'FRAME PROBLEM'...
...IT'S HARD TO WRITE RULES THAT WILL MAKE AN AI IGNORE WHAT'S SILLY—
—USELESS, OR IMPOSSIBLE, AND FOCUS INSTEAD ON WHAT'S IMPORTANT!

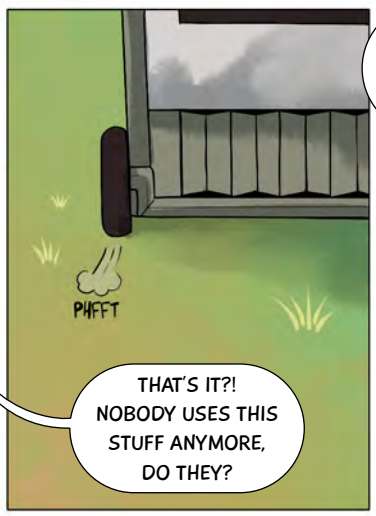

BUT WHAT'S SO HARD? ALL THAT'S JUST COMMON SENSE, ISN'T IT?
BELIEVE IT OR NOT, COMMON SENSE IS ONE OF THE HARDEST THINGS FOR AN AI TO HAVE...
SO! NOW THAT H.I.L.A.R.E. HAS BUILT ITS MAP OF THE WORLD, IT MOVES ON TO ITS GOAL: FIND A WAY THROUGH THE FOREST.


H.I.L.A.R.E. LOOKS FOR THE BEST WAY TO CROSS THROUGH THE FOREST, USING ALL OF THOSE RULES WE MENTIONED BEFORE...
OBSTRUCTION
UNKNOWN STRUCTURE
[H.I.L.A.R.E. is here.]
Mapping shortest route...


HOW DOES IT KNOW WHAT WAY IS BEST?
THAT DEPENDS ON THE PERFORMANCE MEASURE! WHAT DO YOU THINK, ARI?
THE SHORTEST DISTANCE? THE LEAST AMOUNT OF TURNS? THE SCENIC ROUTE?
I DON'T KNOW... ISN'T IT UP TO HI.L.A.R.E.?


NOPE! EVEN HERE, IT'S UP TO THE PROGRAMMER—
TO DECIDE WHAT 'BEST' MEANS FOR H.I.L.A.R.E..
BY WRITING MORE RULES...OK I CATCH YOUR DRIFT...


H.I.L.A.R.E. CALCULATES EVERY POSSIBILITY... OPTIMIZES FOR THE BEST SOLUTION... AND....
ACTS!!!

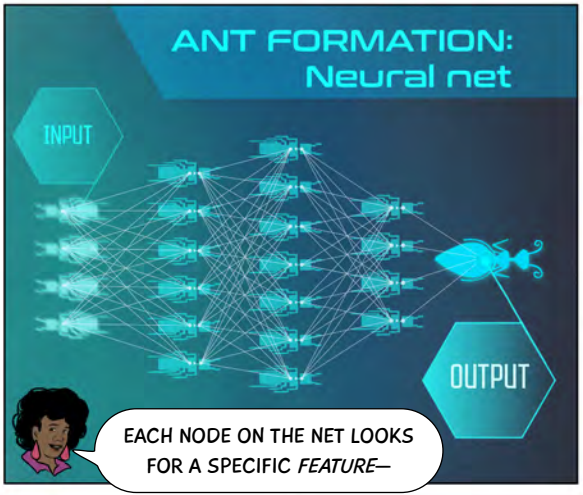

PHFFT
THAT'S IT?! NOBODY USES THIS STUFF ANYMORE, DO THEY?


OH, BUT THEY DO! SYMBOLIC AI IS WHAT LETS US DESIGN MACHINES THAT REASON LIKE EXPERTS! IT'S VERY USEFUL... ACTUALLY, IT MIGHT EVEN COME IN HANDY NOW...

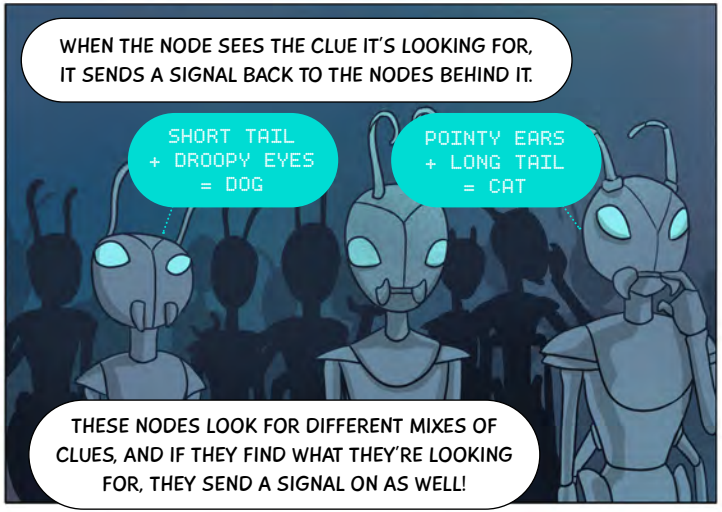

MEANWHILE, ON THE OTHER SIDE OF THE DATA JUNGLE, THE EXPERT DOCTOR Y SEEKS IS IN UNSUSPECTING CONCENTRATION...
I THINK WE'RE CLOSE! ONWARDS, H.I.L.A.R.E.!!
SURE SEEMS LIKE YOU'RE THE BETTER DRIVER, DOCTOR Y...
EMILE! THERE YOU ARE!!
GULP! I CAN ONLY GUESS WHAT AN EMILE IS....
PLEASE, KEEP QUIET! I'M RIGHT IN THE MIDDLE OF A TRAINING SESSION...
HE LOOKS STRANGELY FAMILIAR...

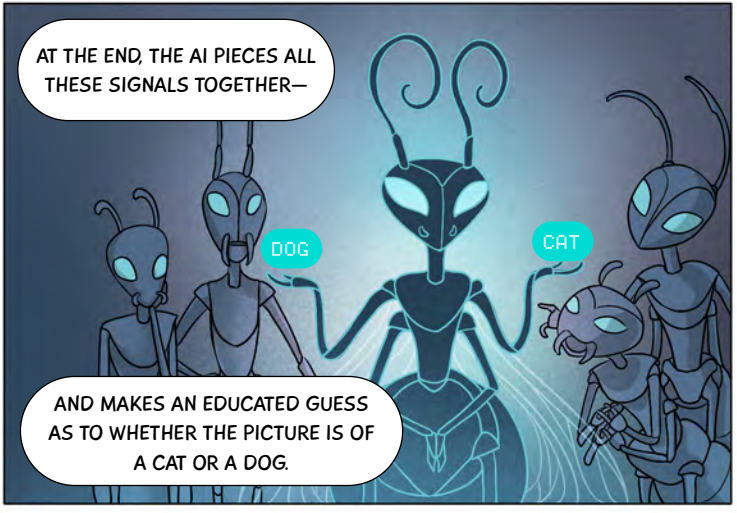

WHAT'S HE TRAINING ANYWAY?
AH! I ALMOST FORGOT ABOUT THE OTHER TYPE OF AI... 'BOTTOM-UP' OR WHAT WE LIKE TO CALL 'DATA-DRIVEN' AI...
HEY...THAT SOUNDS LIKE MACHINE LEARNING!
HA
YES!...WE JUST SAY 'BOTTOM-UP' BECAUSE THIS TIME, THE AI COMES UP WITH ITS *OWN* RULES, BASED ON WHAT WE SHOW IT!
HERE, FOR INSTANCE, I'D SAY HE'S TRYING TO TEACH IT HOW TO CORRECTLY IDENTIFY CATS AND DOGS.
I DON'T THINK THEY COVERED THIS STUFF IN MY ONLINE COURSE...
OH SURE THEY DID, REMEMBER? IT'S A LOT LIKE A GAME OF TELEPHONE...

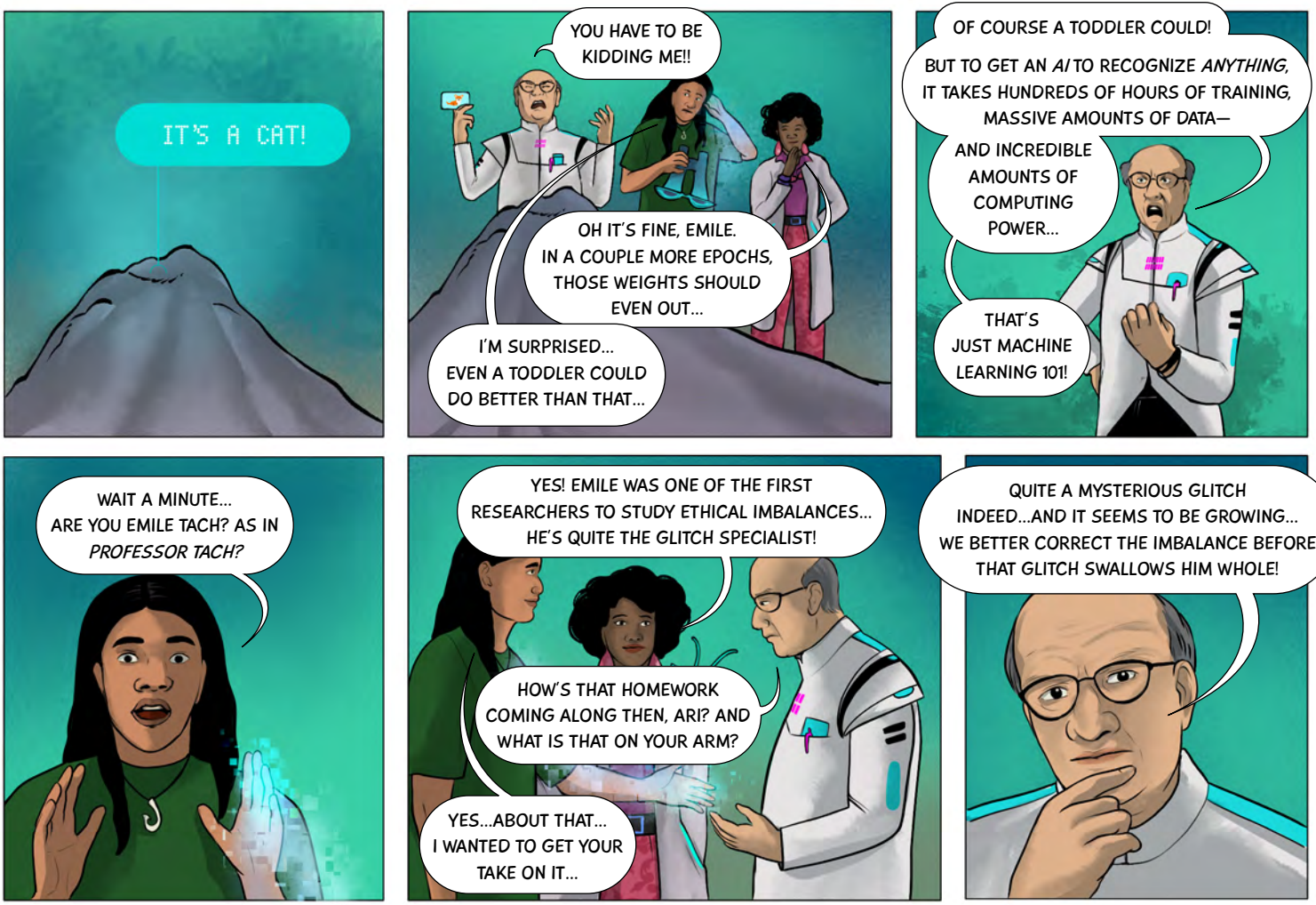

THE PROGRAMMER SHOWS A PICTURE OF A CAT OR DOG TO WHAT'S CALLED A 'NEURAL NET'...


ANT FORMATION:
Neural net
INPUT
OUTPUT
EACH NODE ON THE NET LOOKS FOR A SPECIFIC *FEATURE*—


SHORT TAIL
POINTY EARS
DROOPY EYES
SOME SMALL CLUE THAT THE PICTURE COULD BE OF A DOG.... MAYBE EAR SHAPE, EYE SIZE, FUR LENGTH OR COLOR...

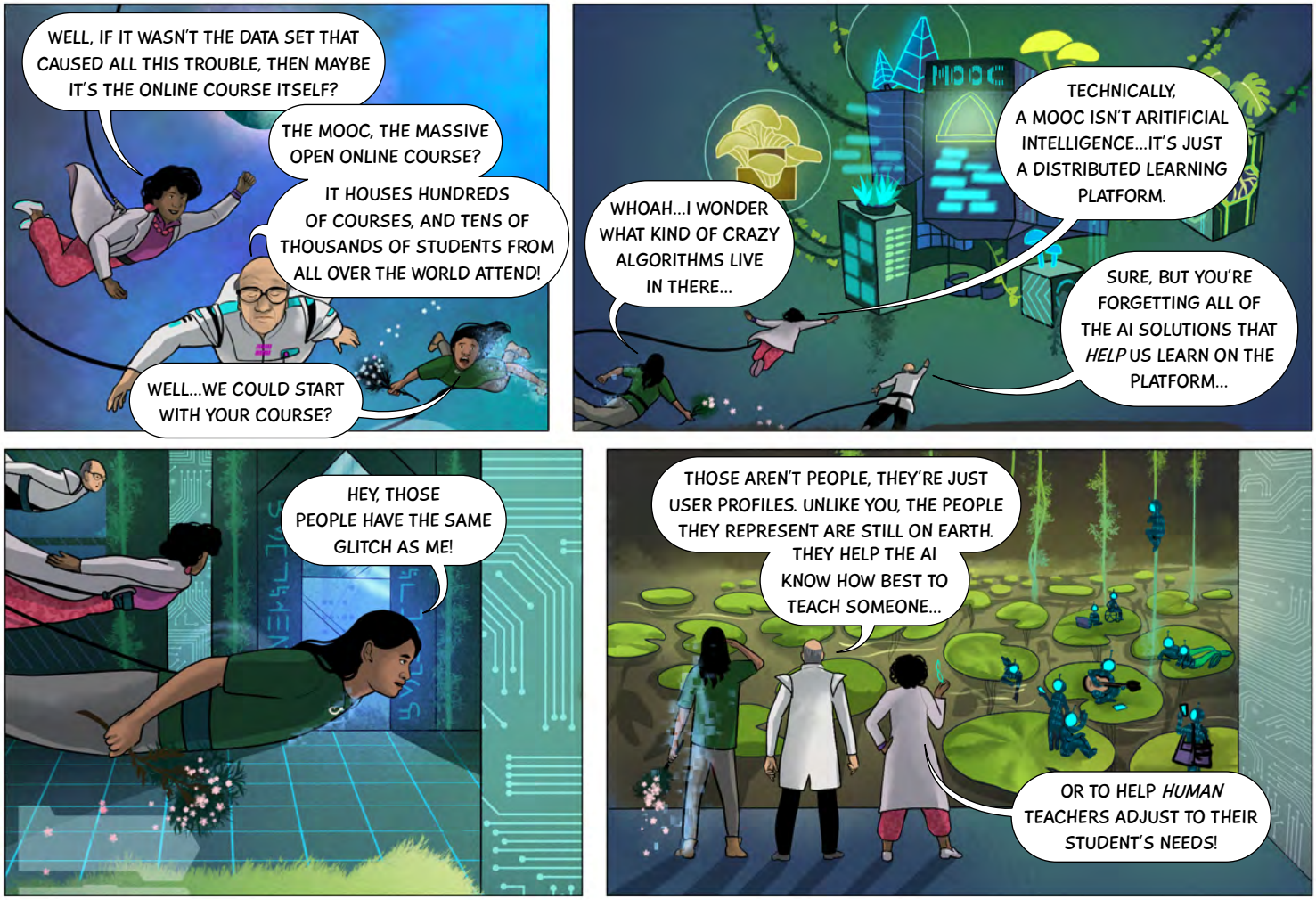

WHEN THE NODE SEES THE CLUE IT'S LOOKING FOR, IT SENDS A SIGNAL BACK TO THE NODES BEHIND IT.
SHORT TAIL + DROOPY EYES = DOG
POINTY EARS + LONG TAIL = CAT
THESE NODES LOOK FOR DIFFERENT MIXES OF CLUES, AND IF THEY FIND WHAT THEY'RE LOOKING FOR, THEY SEND A SIGNAL ON AS WELL!

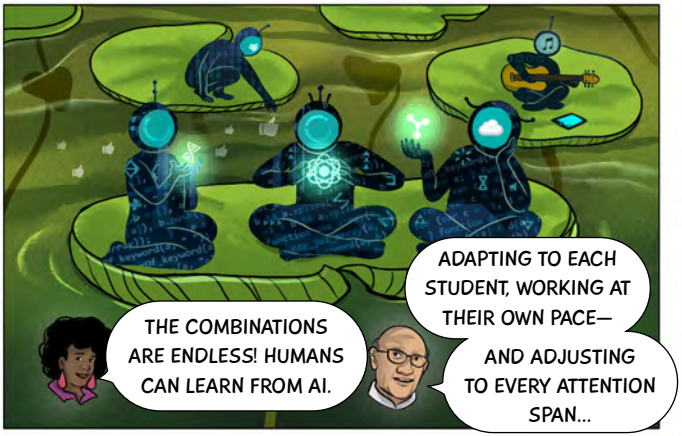

AT THE END, THE AI PIECES ALL THESE SIGNALS TOGETHER—
DOG
CAT
AND MAKES AN EDUCATED GUESS AS TO WHETHER THE PICTURE IS OF A CAT OR A DOG.

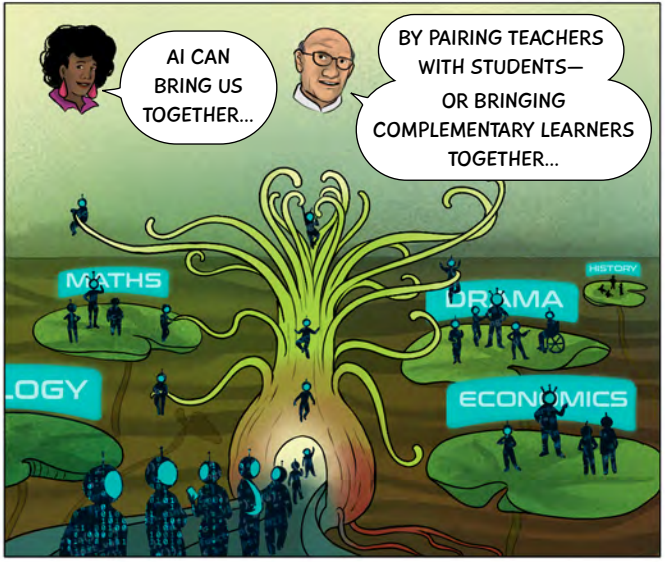

IT'S A CAT!
YOU HAVE TO BE KIDDING ME!!
OH IT'S FINE, EMILE. IN A COUPLE MORE EPOCHS, THOSE WEIGHTS SHOULD EVEN OUT...
I'M SURPRISED... EVEN A TODDLER COULD DO BETTER THAN THAT...
OF COURSE A TODDLER COULD!
BUT TO GET AN *AI* TO RECOGNIZE *ANYTHING*, IT TAKES HUNDREDS OF HOURS OF TRAINING, MASSIVE AMOUNTS OF DATA—
AND INCREDIBLE AMOUNTS OF COMPUTING POWER...
THAT'S JUST MACHINE LEARNING 101!
WAIT A MINUTE... ARE YOU EMILE TACH? AS IN *PROFESSOR TACH?*
YES! EMILE WAS ONE OF THE FIRST RESEARCHERS TO STUDY ETHICAL IMBALANCES... HE'S QUITE THE GLITCH SPECIALIST!
HOW'S THAT HOMEWORK COMING ALONG THEN, ARI? AND WHAT IS THAT ON YOUR ARM?
YES...ABOUT THAT... I WANTED TO GET YOUR TAKE ON IT...
QUITE A MYSTERIOUS GLITCH INDEED...AND IT SEEMS TO BE GROWING... WE BETTER CORRECT THE IMBALANCE BEFORE THAT GLITCH SWALLOWS HIM WHOLE!


WITH LITTLE TIME TO WASTE, OUR AI ADVENTURERS SET OUT IN SEARCH OF A WAY BACK HOME...
IN PLETHOR.A.I., EVERY ENTRANCE HAS AN EXIT, SO TO FIND YOURS, ARI, WE'LL NEED TO RETRACE YOUR STEPS.
ARI MUST HAVE DONE SOMETHING THAT TRIGGERED ALL OF THIS.
AN ETHICAL IMBALANCE SO BIG THAT IT CAUSED A GLITCH IN PLETHOR.A.I. ITSELF.
BUT WHERE SHOULD WE START? THERE ARE SO MANY STEPS TO RETRACE!
WELL, I THINK THE FIRST STOP SHOULD BE THE LOW-RESOURCE LANGUAGE DATA SET.
WE BOTH KNOW HOW RARE THOSE ARE, MAYBE THAT COULD HAVE THROWN THINGS OFF?
YES OF COURSE, IN MY HOMEWORK, FROM YOUR CLASS! I KNOW YOU HATE WHEN WE MISS DEADLINES, PROFESSOR... MAYBE—
—I DOUBT A LATE ASSIGNMENT COULD'VE BROKEN PLETHOR.A.I., ARI...
WAIT, WAS IT REALLY LATE? BECAUSE TECHNICALLY I UPLOADED THE FI—
—LET'S FOCUS, ARI!
LOOK, OVER THERE!

* MĀORI LANGUAGE


WELL, IF IT WASN'T THE DATA SET THAT CAUSED ALL THIS TROUBLE, THEN MAYBE IT'S THE ONLINE COURSE ITSELF?
THE MOOC, THE MASSIVE OPEN ONLINE COURSE?
IT HOUSES HUNDREDS OF COURSES, AND TENS OF THOUSANDS OF STUDENTS FROM ALL OVER THE WORLD ATTEND!
WELL...WE COULD START WITH YOUR COURSE?
WHOAH...I WONDER WHAT KIND OF CRAZY ALGORITHMS LIVE IN THERE...
TECHNICALLY, A MOOC ISN'T ARITIFICIAL INTELLIGENCE...IT'S JUST A DISTRIBUTED LEARNING PLATFORM.
SURE, BUT YOU'RE FORGETTING ALL OF THE AI SOLUTIONS THAT *HELP* US LEARN ON THE PLATFORM...
HEY, THOSE PEOPLE HAVE THE SAME GLITCH AS ME!
THOSE AREN'T PEOPLE, THEY'RE JUST USER PROFILES. UNLIKE YOU, THE PEOPLE THEY REPRESENT ARE STILL ON EARTH.
THEY HELP THE AI KNOW HOW BEST TO TEACH SOMEONE...
OR TO HELP *HUMAN* TEACHERS ADJUST TO THEIR STUDENT'S NEEDS!

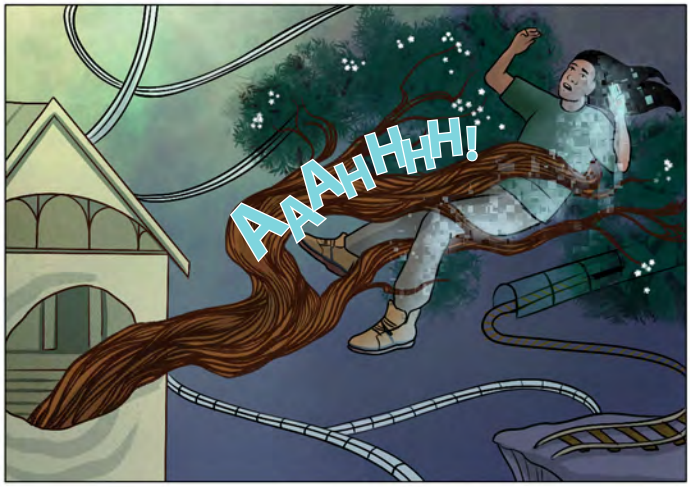

THE COMBINATIONS ARE ENDLESS! HUMANS CAN LEARN FROM AI.
ADAPTING TO EACH STUDENT, WORKING AT THEIR OWN PACE—
AND ADJUSTING TO EVERY ATTENTION SPAN...

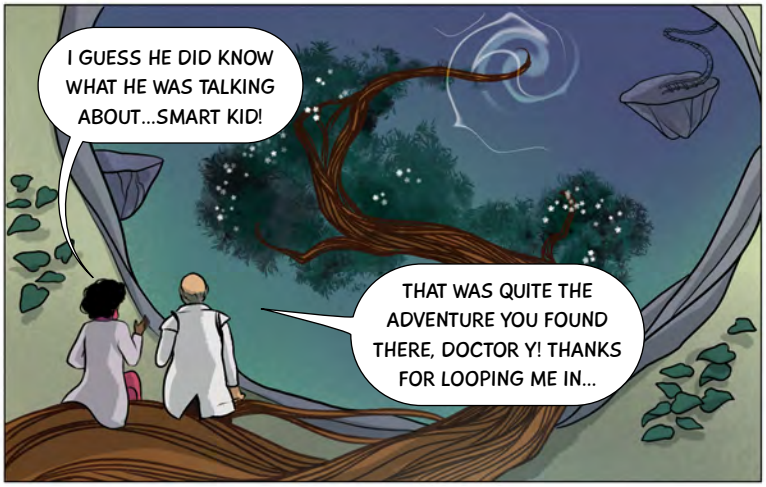

AI CAN BRING US TOGETHER...
BY PAIRING TEACHERS WITH STUDENTS—
OR BRINGING COMPLEMENTARY LEARNERS TOGETHER...
MATHS
DRAMA
HISTORY
ECONOMICS


WHAT IS MACHINE LEARNING?
A DATA-DRIVEN AI MODEL!
SOMETHING THAT IS MODELED AFTER THE HUMAN BRAIN!
SOMETHING THAT USES NEURAL NETS!
WE CAN EVEN TEACH IT A THING OR TWO...
THE BEST WAY TO LEARN IS TO TEACH SOMEONE, OR *SOMETHING* ELSE!


RIGHT!...DO YOU HAVE AN OFFICE HERE?
OR, WE CAN USE PLATFORMS LIKE THIS ONE TO LEARN ABOUT AI ITSELF...BUT I DON'T NEED TO TELL YOU THAT, RIGHT ARI?
SORT OF...
I DON'T EVEN KNOW WHERE TO START!
WHAT IS A GLITCH SUPPOSED TO LOOK LIKE??
I MIGHT HAVE AN IDEA...
THAT'S THE WAY HOME...
BUT WE HAVE TO THINK OF A WAY TO BRIDGE THE GAP...
DO YOU MEAN... THE DIGITAL DIVIDE?


ARI, THIS IS A LONG SHOT AT BEST!
WE DON'T WANT TO JUMP TO ANY CONCLUSIONS!
I THINK I'VE LEARNT ENOUGH TODAY TO KNOW WHAT I'M DOING...
IT ALL STARTS WITH ACCESSIBILITY...
HOPEFULLY YOU ALSO KNOW HOW IT ENDS, ARI!
TRUST ME...
A FEW MINUTES LATER...
SO...DOES ANYONE HAVE A PLAN B?
OK UMM...I JUST FELT LIKE THE FLOWERS WOULD SUDDENLY GROW INTO A SORT OF BR—
CRUNCH!

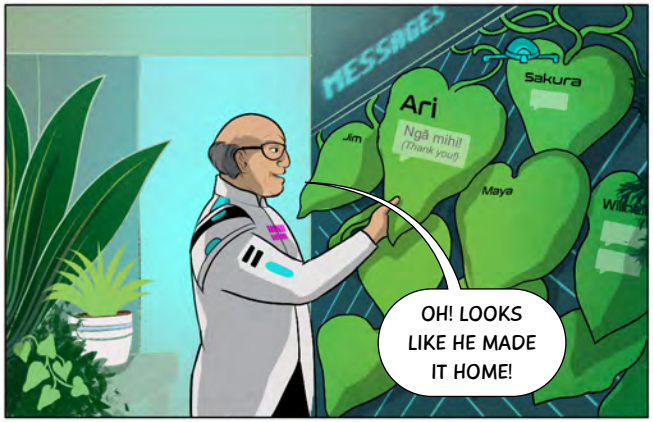

AAAHHHH!


I GUESS HE DID KNOW WHAT HE WAS TALKING ABOUT...SMART KID!
THAT WAS QUITE THE ADVENTURE YOU FOUND THERE, DOCTOR Y! THANKS FOR LOOPING ME IN...


HEY, GUESS WHAT ARI? THE FIBER OPTIC IS BACK UP!
I BELIEVE YOU! THAT WAS DEFINITELY FASTER THAN THE LAST TIME!
COMPUTER POWER & Human Reasoning
WEIZENBAUM


MOOC
MACHINE LEARNING 101
Supervising Professor:
Dr. Emile Tach
CHAT
Ngā mihi!*

* THANK YOU!


MESSAGES
Ari
Sakura
Jim
Ngā mihi! (Thank you!)
Maya
OH! LOOKS LIKE HE MADE IT HOME!


MISSION ACCOMPLISHED, DOCTOR Y! THE GLITCH IS SOLVED!
I'M NOT SO SURE, YOU BETTER COME AND SEE THIS...


NOW THAT *IS* A GLITCH!! WE MIGHT NEED TO WORK TOGETHER ON THIS ONE IF WE'RE GOING TO BEAT IT...
SOUNDS GOOD TO ME, EMILE...BECAUSE I'M STARTING TO THINK THIS IS NOT JUST ABOUT ACCESSIBILITY...
TO BE CONTINUED...

Glossary Terms

Augmented Intelligence

is a term which describes the cooperation of humans and AI towards a human goal, or within a socio-technical system. The AI can be both virtual (like a decision-assistance system), or embodied (like a robotic factory worker). In other words, augmented intelligence is what occurs when humans and AI work together and is seen to be more efficient than either party working on their own.

Chatbot

is a type of virtual AI assistant (a computer program) designed to mimic conversation with a human user, typically over the internet or some virtual interface, via text or text and speech. Chatbots can provide useful information to users or direct them to appropriate resources, and play a key role in addressing the needs of users at scale.

Dial-Up Connection

is an internet connection that is achieved using a regular telephone line. When the phone line is connected to a modem and configured to dial a particular number, this grants a user internet access. Dial-up is the slowest form of internet connection, and today, persists mainly in areas where it is not economically possible or viable to construct broadband lines.

Digital Divide

describes the gap between individuals, households, businesses or geographic areas in terms of access to, **a)** AI research, **b)** knowledge, education and human resources, **c)** training data, and **d)** connectivity and hardware. Put another way, the digital divide is what prevents a truly global and equal playing field in AI technology, where those who are disadvantaged lack the tools to be able to compete and collaborate with highly developed players in the AI ecosystem.

Epoch

is a type of hyperparameter in machine learning which denotes the number of times that the learning algorithm will work through the entire training dataset, adjusting its weights to each sample in the set. Most AI models run through many epochs (sometimes over 1000) across their training, since up to a certain point at least, each epoch helps the engineers to minimize the errors in the model, or to optimize its performance.

Fiber Optic

is a type of technology used to transmit information as pulses of light through strands of fiber made of glass or plastic over long distances. Because fiber optic cables transfer data signals in the form of light rather than by using the traditional method of electrical signals, the information is able to travel faster, over longer distances, and without the risk of electromagnetic interference (for instance, from storms or strong winds). Fiber optic cables are part of the essential infrastructure of modern-day AI practices.

Glossary Terms

Machine Learning

is also called 'data-driven' or 'bottom-up' AI, machine learning is an adaptive type of algorithmic process which allows computers to learn from experience, learn by example, or learn by analogy, using large amounts of data, where the learning processes improve the performance of the system over time. Closely related to Artificial Neural Networks (ANNs), many machine learning practices are inspired by the structure of the human brain. ANNs use very simple and highly connected processors (called neurons) with weighted links, which pass signals from one neuron to another. The learning process occurs when these weights are adjusted as the system receives training data input, eventually storing the 'trained' rules required for correctly solving a given problem — such as classification or pattern recognition — which are used in decision-making when new data is fed into the system.

Massive Open Online Courses (MOOCs)

are completely distributed and virtual learning platforms, available to students globally. One of the principal keys to life-long learning, MOOCs enable students, and more generally individuals, to engage with and learn from top-tier professionals in both the sciences and humanities with online courses. MOOCs come in many forms, from completely self-directed platforms that allow students to work through the course at their own pace, to accredited professional degree programs that allow students to bolster their formal education.

Moravec's Paradox

describes a surprising gap between the intellectual capacities of humans and even advanced AI systems, where AI systems can be seen to excel in a number of traditionally 'difficult' human fields (for instance, statistical reasoning, pattern recognition or playing checkers), but perform poorly in many areas that most humans can easily master: perception, mobility, common sense and value judgements, to name a few.

Symbolic AI

which is also called top-down, or 'expert systems', is a type of algorithmic process that follows explicit and transparent rules, given to the system by human programmers, to compute the solution to a problem. Symbolic AI constitutes the original and oldest approach to Artificial Intelligence, but it's still used today in many AI applications, especially in situations where high levels of human control are desirable, such as in the case of driverless cars.

Conclusion

Humans and AI have much to learn from one another. This means not only that *what we learn* must adapt to the fast-paced technological changes that are happening around us today, but also that *how we learn* must incorporate some of the innovative and useful tools that AI itself has to offer. By combining AI and education, we can create global classrooms, bring like-minds together, we can even teach AI how to better teach us.

Yet, if we do not work to ensure that each of us has an *equal* opportunity to benefit from the exciting possibilities of Artificial Intelligence—for instance, by generating open, inclusive data sets, or by breaking language barriers in AI research and natural language processing—these technological advances will only serve to increase the already striking disparities across the different corners of the world. In this sense, policies and agreements, both at a national and global level, must be put in place or revised to ensure that AI is not harmful, and cannot be used in harmful ways. ▪

Episode II

Maryam and the Data Basin Deep Dive

Conception and script: Dr. Katherine Evans

Illustration: Cassandra Okwaniuzor Mark

Introduction

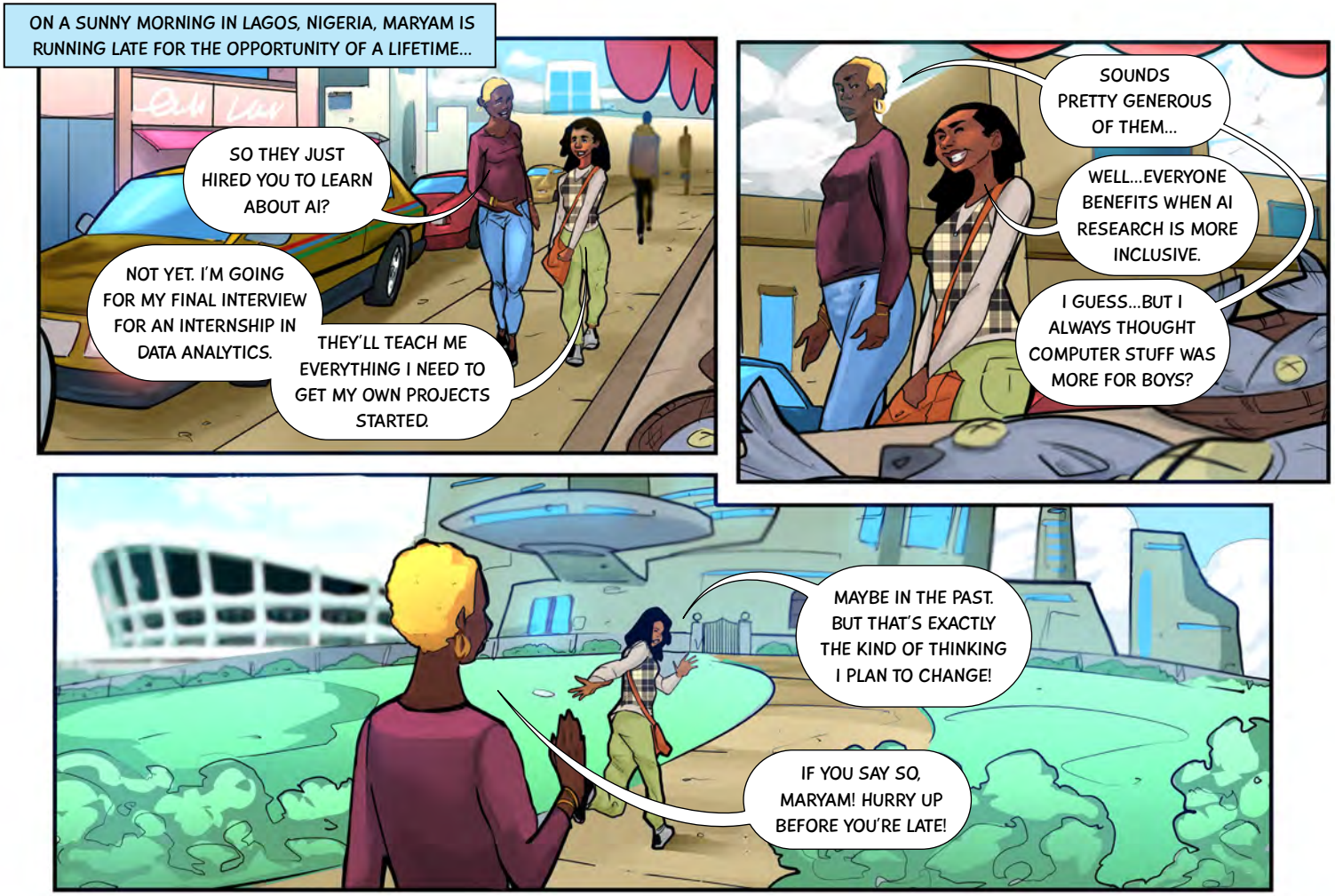
Artificial Intelligence is quickly becoming a critical element in the advancement of human development and the creation of inclusive knowledge societies. In an increasingly global and connected world, AI enables us to better understand and act within our environment, both at the level of individual users, and on a collective level in the public and private sector. AI can help us make better, more informed and accurate decisions across the board: pointing to patterns we might have missed, finding connections we might not have seen, and providing innovative recommendations we might never have imagined on our own.

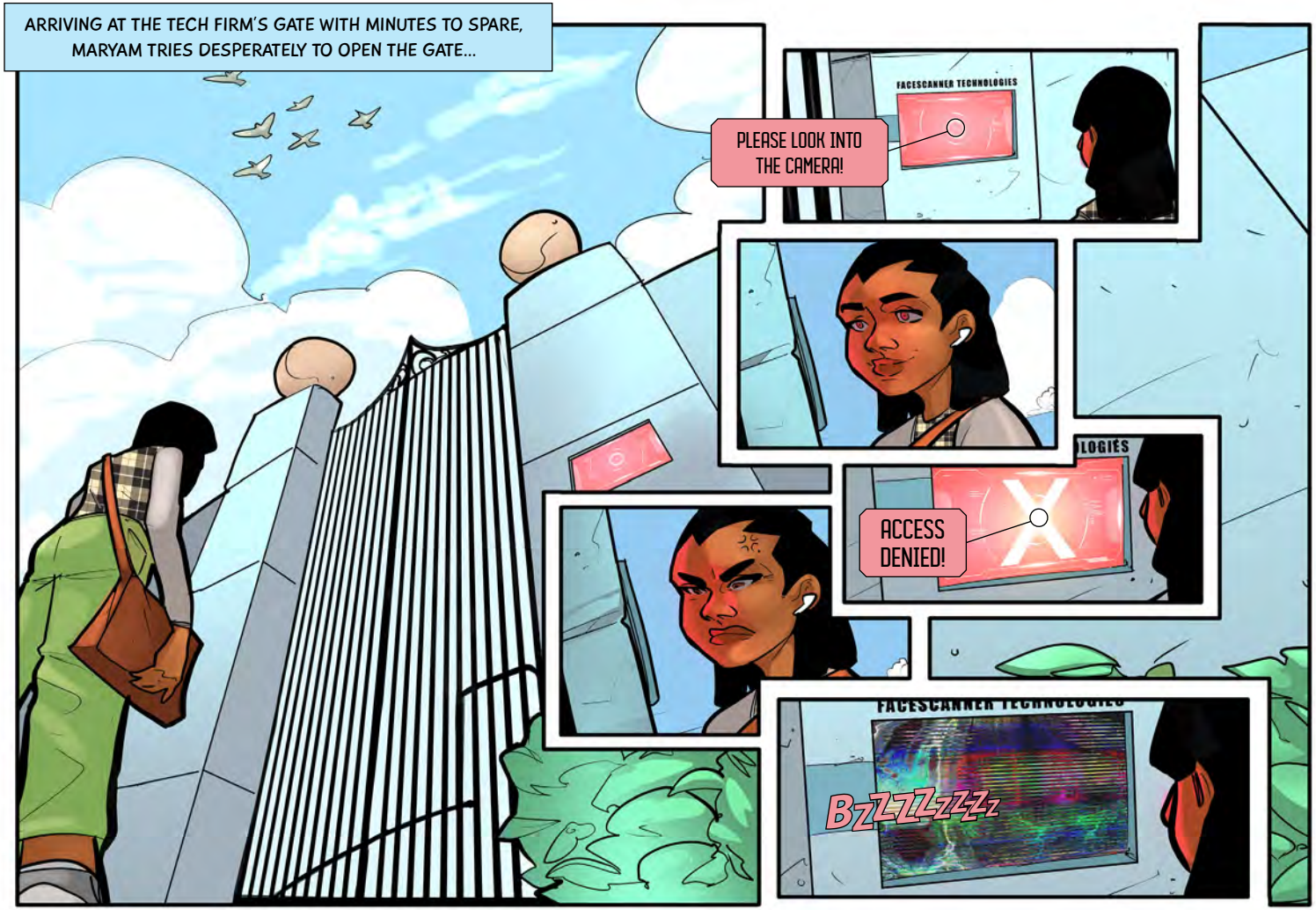
Nevertheless, if we are not mindful of the ways in which AI technology expands and develops, we run the risk of overlooking an impressive set of ethical challenges that threaten to interfere with, or even obstruct, fundamental human rights. Indeed, issues such as increased surveillance, data mining and profiling, as well as algorithmic bias and automated decision-making represent new risks to the rights to privacy and non-discrimination that each of us are owed. Worse still, while these risks pose a threat to human rights generally, they have been seen to disproportionately affect the rights of women, people of color, and other vulnerable minorities.

In one sense, the problem pertains to the shaky relationship between automated decision-making, data, and past prejudices. It is important to ensure that the moral mistakes of the past do not influence the decisions of the present: through the use of biased and antiquated data sets that represent a world we no longer wish to live in, or by blindly following the opaque recommendations of the AI tools which train on these types of data.

In another sense, the problem pertains to our own failure to understand and adequately represent just how diverse humankind can be. Inclusivity must act as a guiding light in the design of AI systems, ensuring that AI tools are given the chance to observe and learn from the full breadth of humanity's many facets, rather than a small sample of familiar, similar and readily available faces.

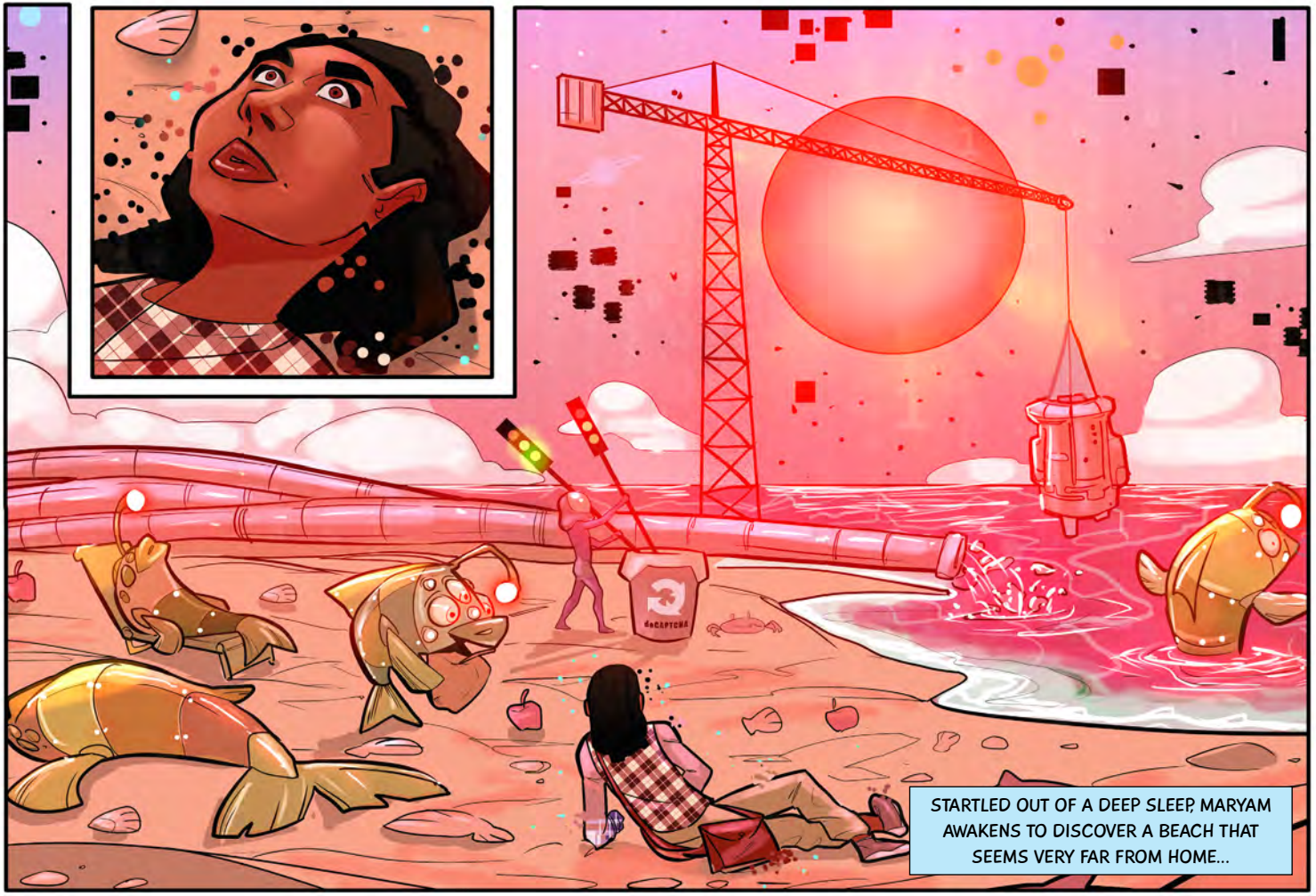
If we do not work to address these problems, we risk building an AI that fails to help all people equally and adequately. A world where AI perfectly caters to some, but hardly recognizes others; a world where some of us are virtually invisible… ▪


ON A SUNNY MORNING IN LAGOS, NIGERIA, MARYAM IS RUNNING LATE FOR THE OPPORTUNITY OF A LIFETIME...
SO THEY JUST HIRED YOU TO LEARN ABOUT AI?
NOT YET. I'M GOING FOR MY FINAL INTERVIEW FOR AN INTERNSHIP IN DATA ANALYTICS.
THEY'LL TEACH ME EVERYTHING I NEED TO GET MY OWN PROJECTS STARTED.
SOUNDS PRETTY GENEROUS OF THEM...
WELL...EVERYONE BENEFITS WHEN AI RESEARCH IS MORE INCLUSIVE.
I GUESS...BUT I ALWAYS THOUGHT COMPUTER STUFF WAS MORE FOR BOYS?
MAYBE IN THE PAST. BUT THAT'S EXACTLY THE KIND OF THINKING I PLAN TO CHANGE!
IF YOU SAY SO, MARYAM! HURRY UP BEFORE YOU'RE LATE!


ARRIVING AT THE TECH FIRM'S GATE WITH MINUTES TO SPARE, MARYAM TRIES DESPERATELY TO OPEN THE GATE...
FACESCANNER TECHNOLOGIES
PLEASE LOOK INTO THE CAMERA!
ACCESS DENIED!
BZZZZZZZZZ


YOU WILL LET ME IN THERE, EVEN IF I HAVE TO STAND HERE ALL DAY!!


THIS DOESN'T FEEL RIGHT...

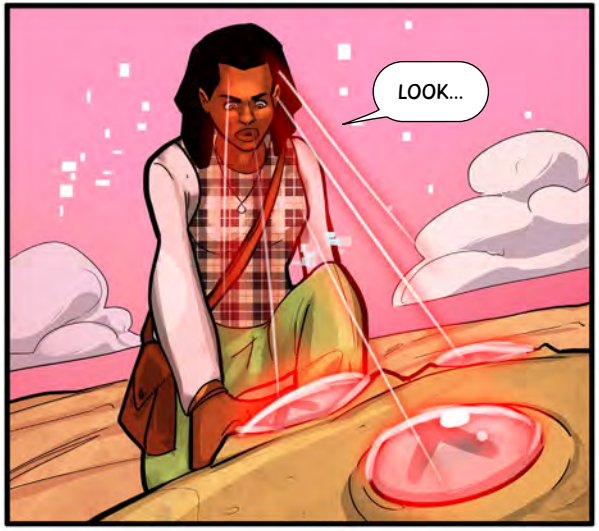

STARTLED OUT OF A DEEP SLEEP, MARYAM AWAKENS TO DISCOVER A BEACH THAT SEEMS VERY FAR FROM HOME...

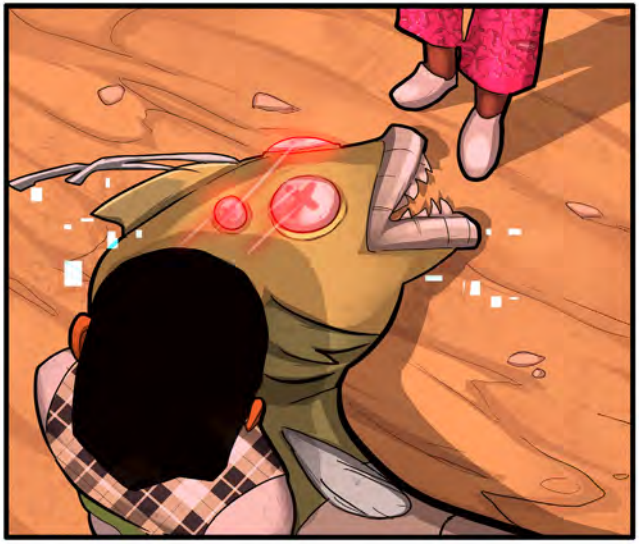

EXCUSE ME.... UH....SIR?
Zzz
NOT THIS AGAIN!
I WOULDN'T BOTHER. IT DEFINITELY CAN'T UNDERSTAND YOU...


EXCUSE ME?!
I MEAN, THE FISH IS A CLASSIFIER! THEY DON'T DO NATURAL LANGUAGE PROCESSING OF COURSE!
THAT'S WAY BEYOND THEIR CAPACITIES—
—WHAT ON EARTH ARE YOU TALKING ABOUT?!
BUT WE'RE NOT ON EARTH, WE'RE IN PLETHOR.A.I.!
YOUR NAME IS MARYAM, RIGHT?
RIGHT....?
MY NAME IS DOCTOR Y, AND I CAN HELP. WALK WITH ME?

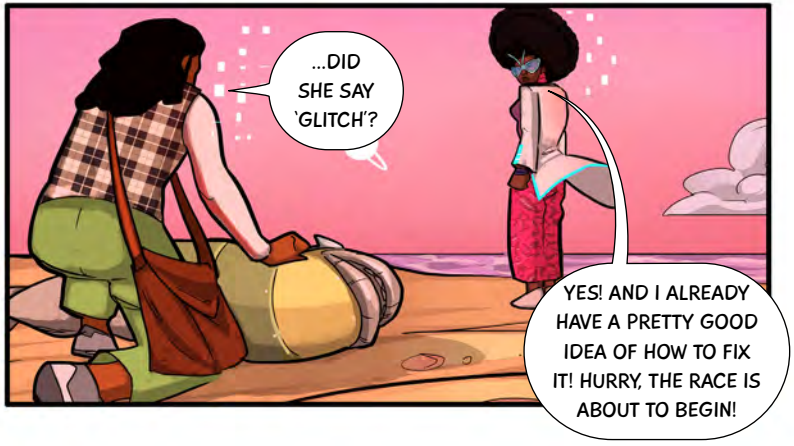

WELCOME TO THE DATA BASIN, PLETHOR.A.I.'S HOT SPOT FOR MACHINE VISION...
AND HOME TO THE GALAXY'S MANY CLASSIFIER ALGORITHMS!
CLASSIFIER ALGORITHMS?
CLASSIFIERS ALLOW ARTIFICIAL INTELLIGENCE TO SEE AND INTERPRET THE WORLD...
THEY IDENTIFY PEOPLE, PLACES, OBJECTS...
THEY CAN EVEN RECOGNIZE HUMAN FACES!
Unknown!
Humanoid!


WHEN THEY START OUT, THEY LEARN FROM THE EXAMPLES THAT HUMANS GIVE THEM.
BUT EVENTUALLY THEY LEARN ENOUGH TO IDENTIFY THINGS ON THEIR OWN.
THEY RECOGNIZE HUMAN FACES YOU SAY?
IF THAT'S WHAT THEY'RE BUILT TO DETECT, IT REALLY DEPENDS ON THEIR TRAINING DATA—
—THAT REMINDS ME OF SOMETHING...


LOOK...



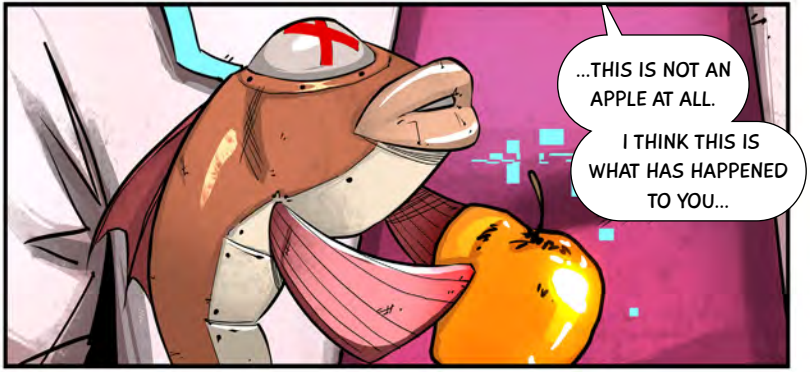

LOOKS LIKE YOUR GLITCH INVOLVES SOME KIND OF CLASSIFICATION ERROR...


...DID SHE SAY 'GLITCH'?
YES! AND I ALREADY HAVE A PRETTY GOOD IDEA OF HOW TO FIX IT! HURRY, THE RACE IS ABOUT TO BEGIN!


HIDDEN FROM THE VIEW OF THE NEARBY RACERS, DOCTOR Y AND MARYAM HATCH A PLAN...
YOU'RE SAYING I NEED TO SNEAK INTO THAT RACE?
I'LL ADMIT IT'S WILDLY UNCONVENTIONAL, BUT HERE'S MY HYPOTHESIS...
TO GET CLASSIFIERS TO RECOGNIZE ANYTHING, YOU NEED TO TRAIN THEM. HUMAN BEINGS MUST TELL THEM HOW TO IDENTIFY THINGS IN THE WORLD, AND WHAT TO CALL THEM. FOR INSTANCE...
GO!
RACE
WIN!
WHAT IS THIS?
AN APPLE...
BUT DO ALL APPLES LOOK LIKE THE SAME?

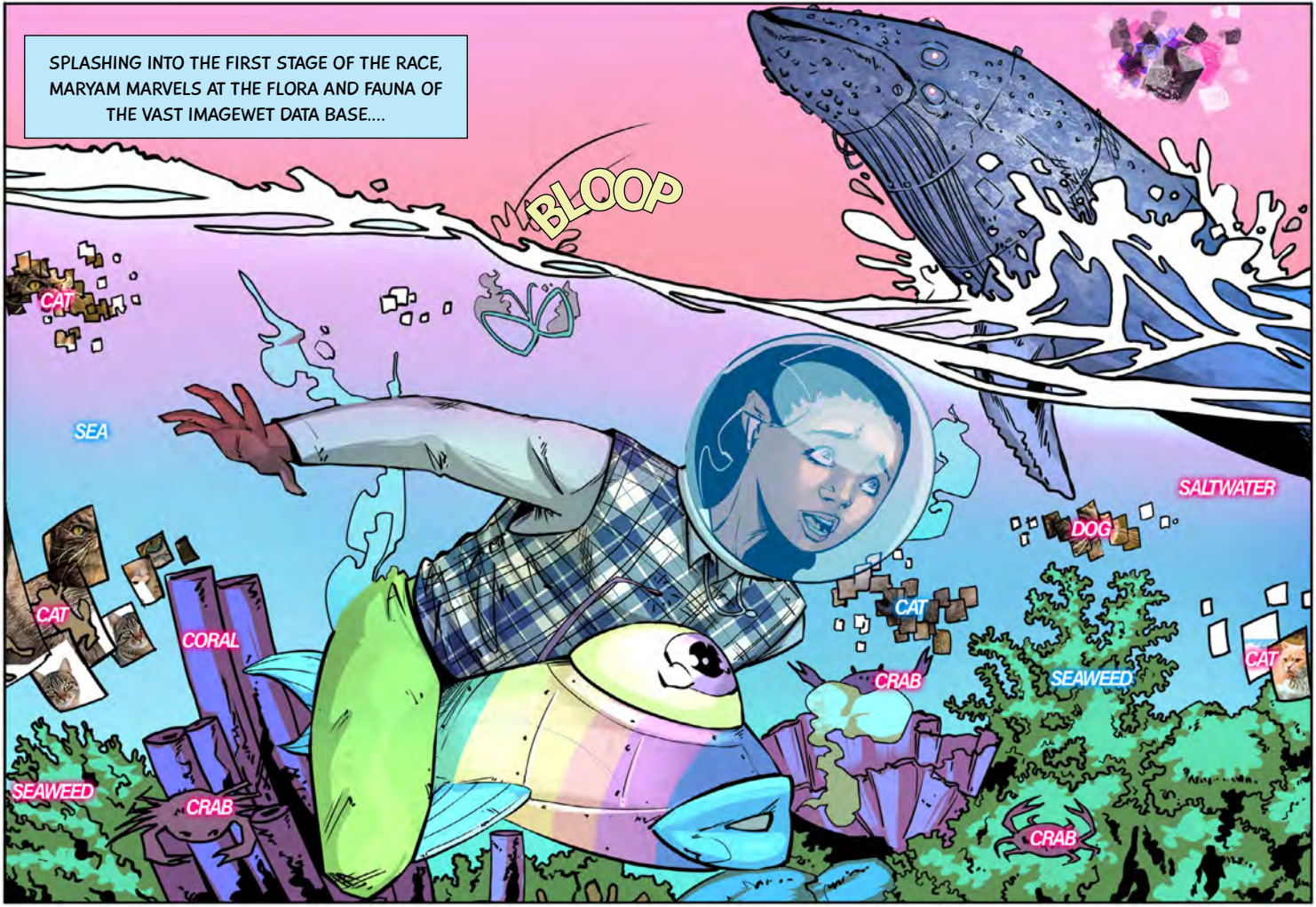

OF COURSE NOT! THERE ARE SO MANY DIFFERENT KINDS...


SURE! BUT IF ALL YOU'VE EVER SEEN ARE RED APPLES, YOU MIGHT THINK...

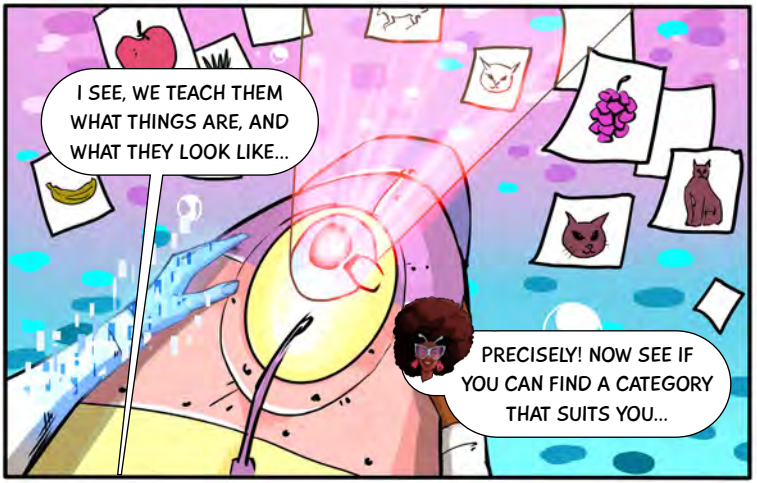

...THIS IS NOT AN APPLE AT ALL.
I THINK THIS IS WHAT HAS HAPPENED TO YOU...

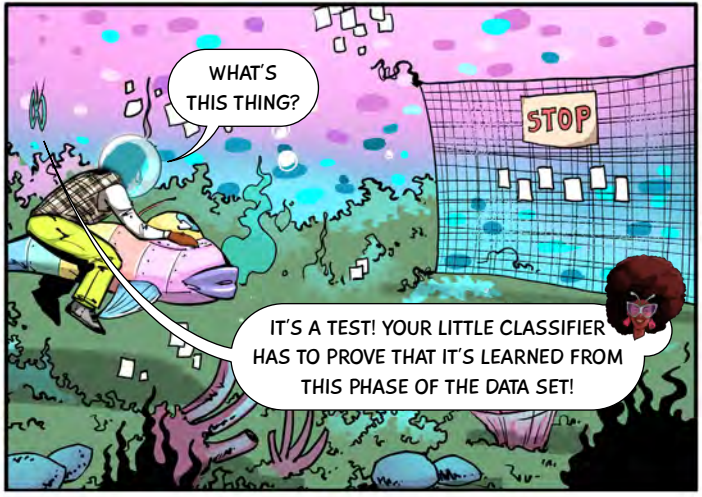

SO...CLASSIFIERS NEED TO SEE MORE PEOPLE LIKE ME?
THAT'S ONE WAY TO LOOK AT IT...
WE BETTER HURRY BEFORE THIS GLITCH GETS WORSE...
SO, I THINK THE BEST WAY TO FIX THIS IS TO GET IN THERE AND CLASSIFY YOURSELF!
YOU'LL BE BACK HOME IN NO TIME.
BUT HOW??
WHAT AN IMPRESSIVE LINE-UP! THOSE CLASSIFIERS SURE LOOK EAGER TO LEARN.

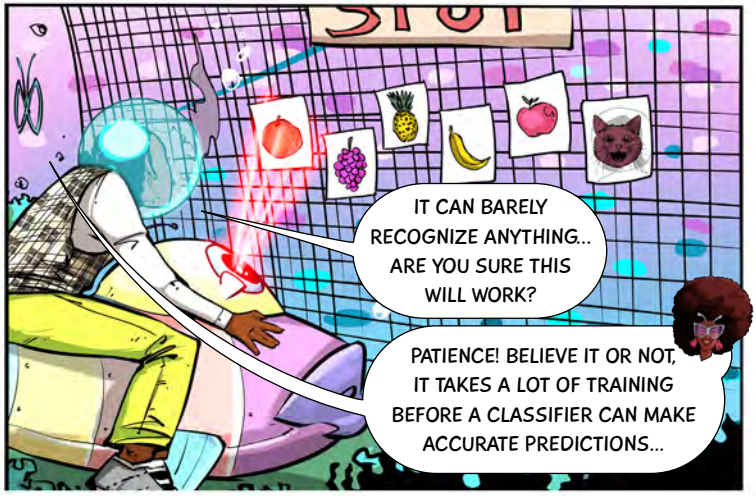

deCAPTCHA
...CLASSIFY MYSELF?
JUST FOLLOW MY LEAD, MARYAM, I'LL DISTRACT THE ENGINEERS.
THOSE MECHANICAL SURF WORKERS REALLY OUTDID THEMSELVES!
I GUESS IT'S TIME TO RUN IT!
RUN WHAT?
RUN!
SWIIIIISH

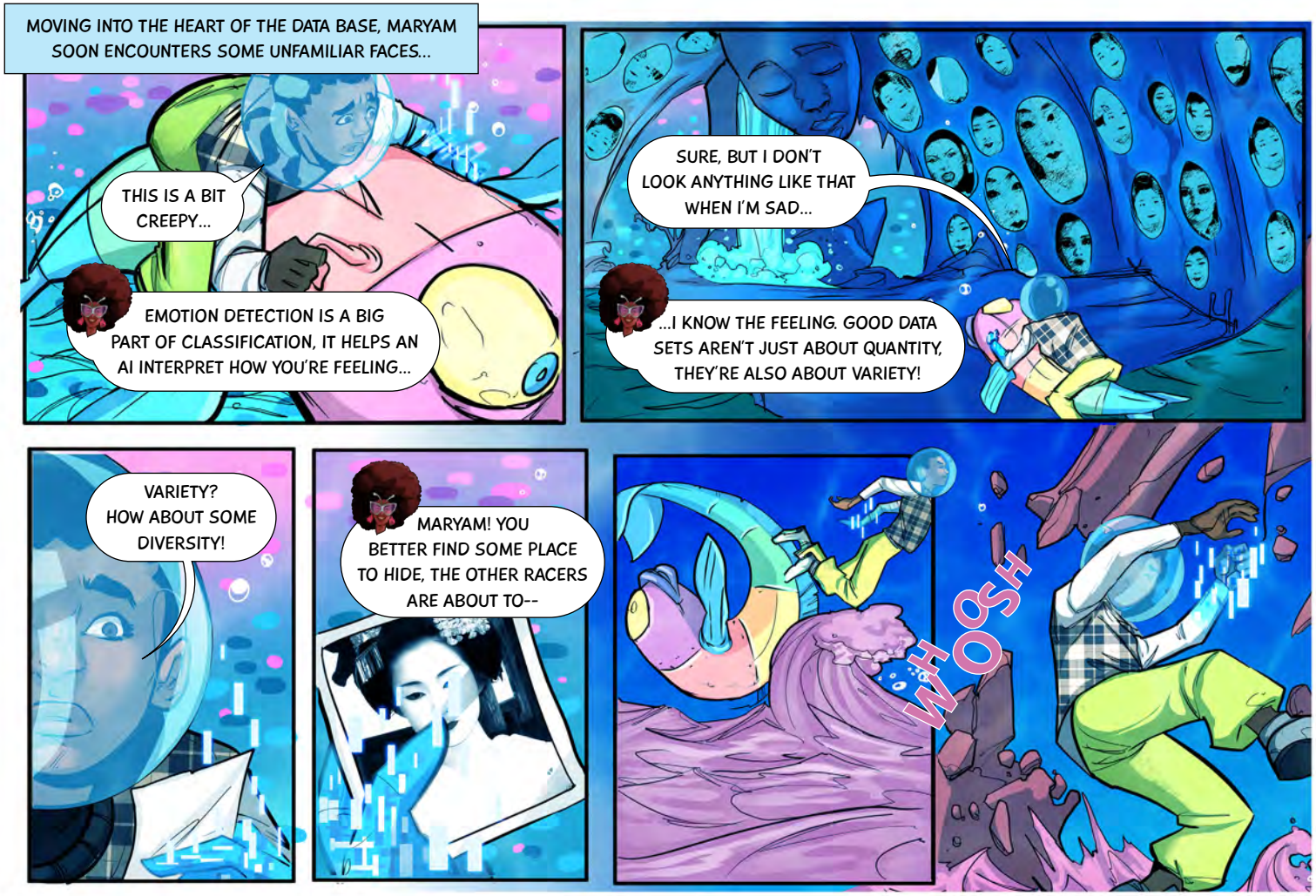

SPLASHING INTO THE FIRST STAGE OF THE RACE, MARYAM MARVELS AT THE FLORA AND FAUNA OF THE VAST IMAGEWET DATA BASE....
BLOOP
CAT
SEA
SALTWATER
DOG
CAT
CAT
CORAL
CRAB
SEAWEED
CAT
SEAWEED
CRAB
CRAB


WHAT ARE THESE?
ALL OF THESE EXAMPLES HAVE BEEN HAND-LABELED BY HUMANS, THINK OF IT LIKE A LESSON FOR NEW CLASSIFIERS...


I SEE, WE TEACH THEM WHAT THINGS ARE, AND WHAT THEY LOOK LIKE...
PRECISELY! NOW SEE IF YOU CAN FIND A CATEGORY THAT SUITS YOU...

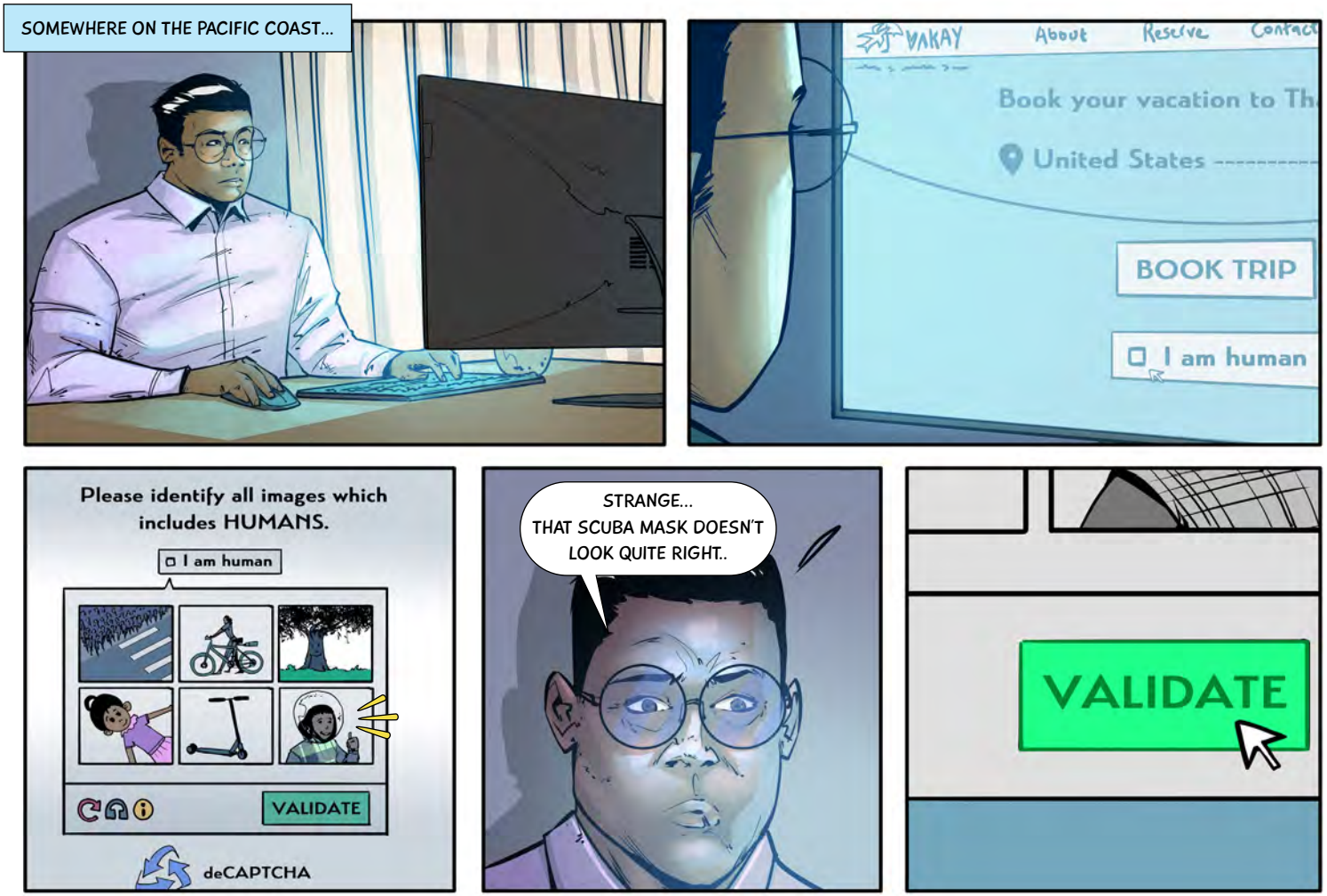

WHAT'S THIS THING?
STOP
IT'S A TEST! YOUR LITTLE CLASSIFIER HAS TO PROVE THAT IT'S LEARNED FROM THIS PHASE OF THE DATA SET!


IT CAN BARELY RECOGNIZE ANYTHING... ARE YOU SURE THIS WILL WORK?
PATIENCE! BELIEVE IT OR NOT, IT TAKES A LOT OF TRAINING BEFORE A CLASSIFIER CAN MAKE ACCURATE PREDICTIONS...

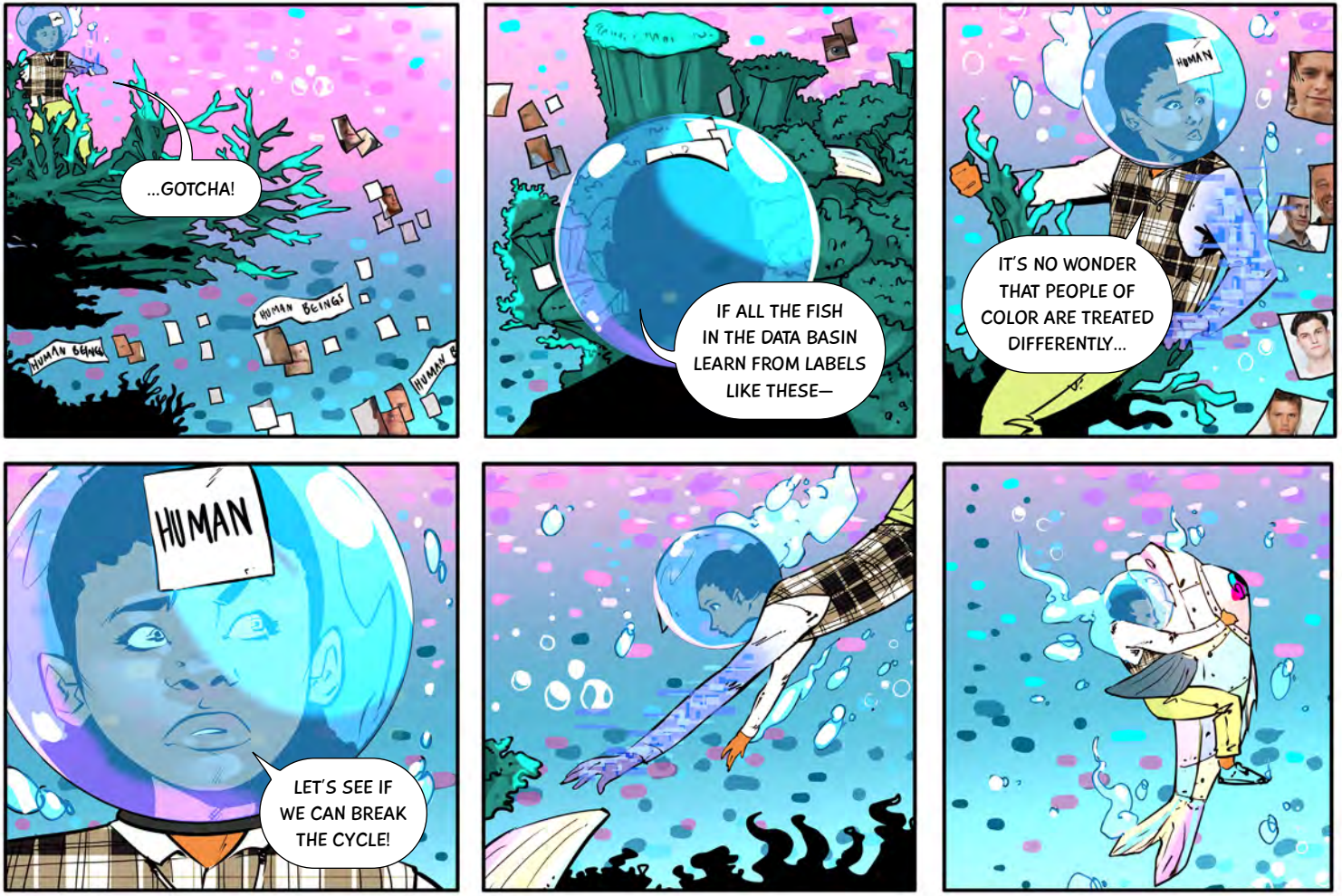

MOVING INTO THE HEART OF THE DATA BASE, MARYAM SOON ENCOUNTERS SOME UNFAMILIAR FACES...
THIS IS A BIT CREEPY...
EMOTION DETECTION IS A BIG PART OF CLASSIFICATION, IT HELPS AN AI INTERPRET HOW YOU'RE FEELING...
SURE, BUT I DON'T LOOK ANYTHING LIKE THAT WHEN I'M SAD...
...I KNOW THE FEELING. GOOD DATA SETS AREN'T JUST ABOUT QUANTITY, THEY'RE ALSO ABOUT VARIETY!
VARIETY? HOW ABOUT SOME DIVERSITY!
MARYAM! YOU BETTER FIND SOME PLACE TO HIDE, THE OTHER RACERS ARE ABOUT TO--
WOOSH

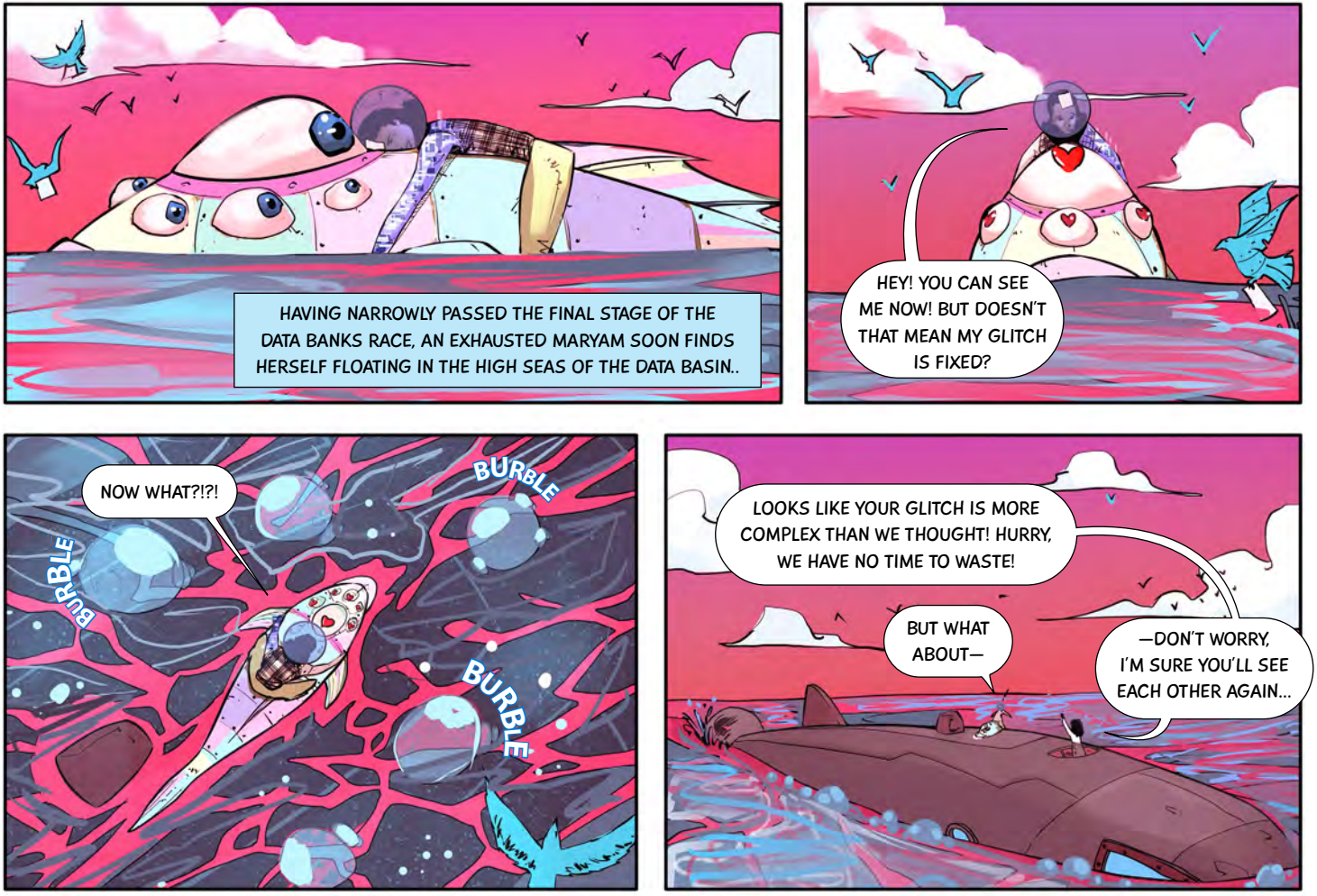

HELLO? CAN ANYONE HEAR ME?
HUMAN BEING
WHERE DID *MY* FISH GO?
HOW WILL I CLASSIFY MYSELF NOW...?
...BINGO?

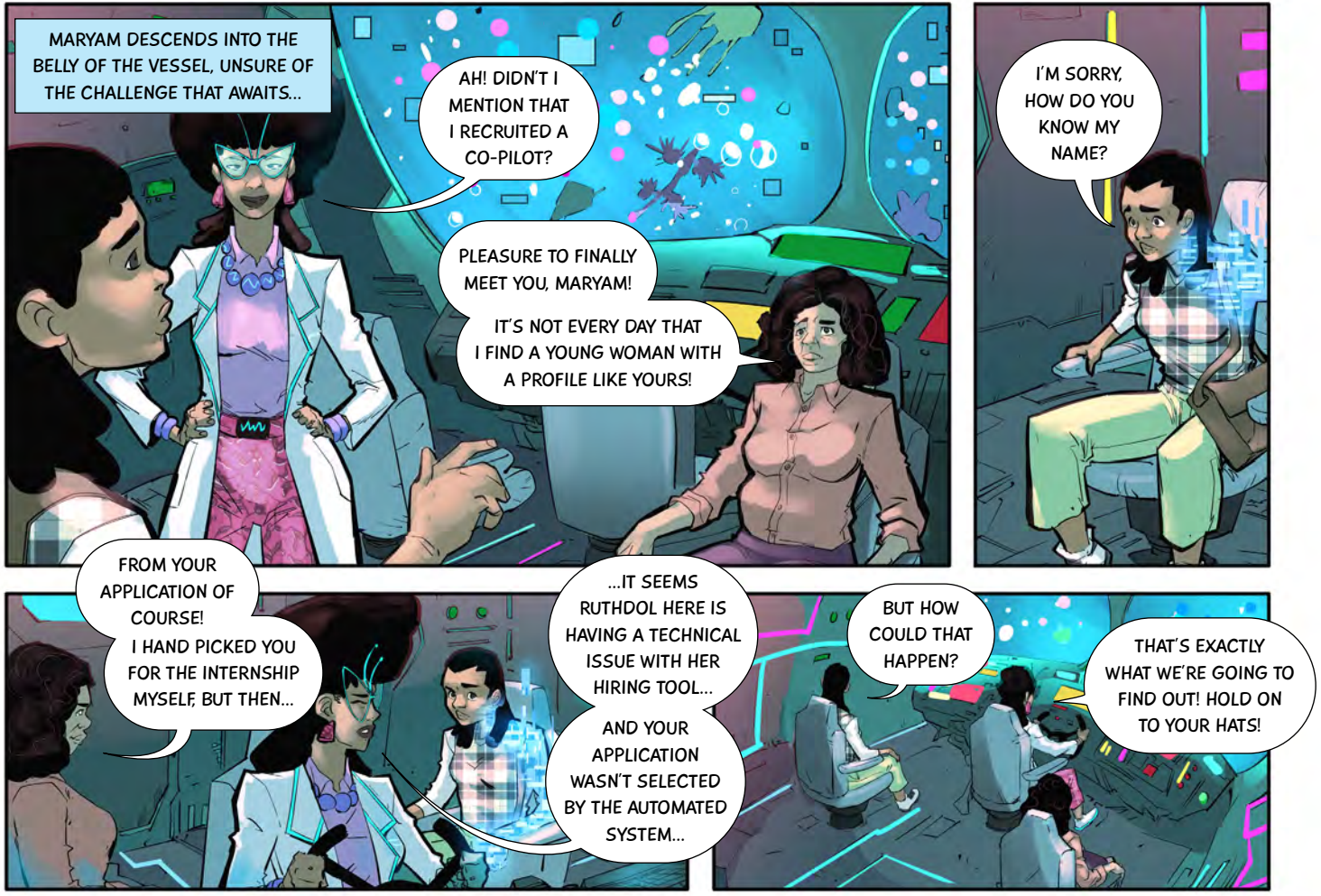

I FOUND THE CATEGORY, BUT HOW AM I SUPPOSED TO FIND A LABEL? UNLESS...

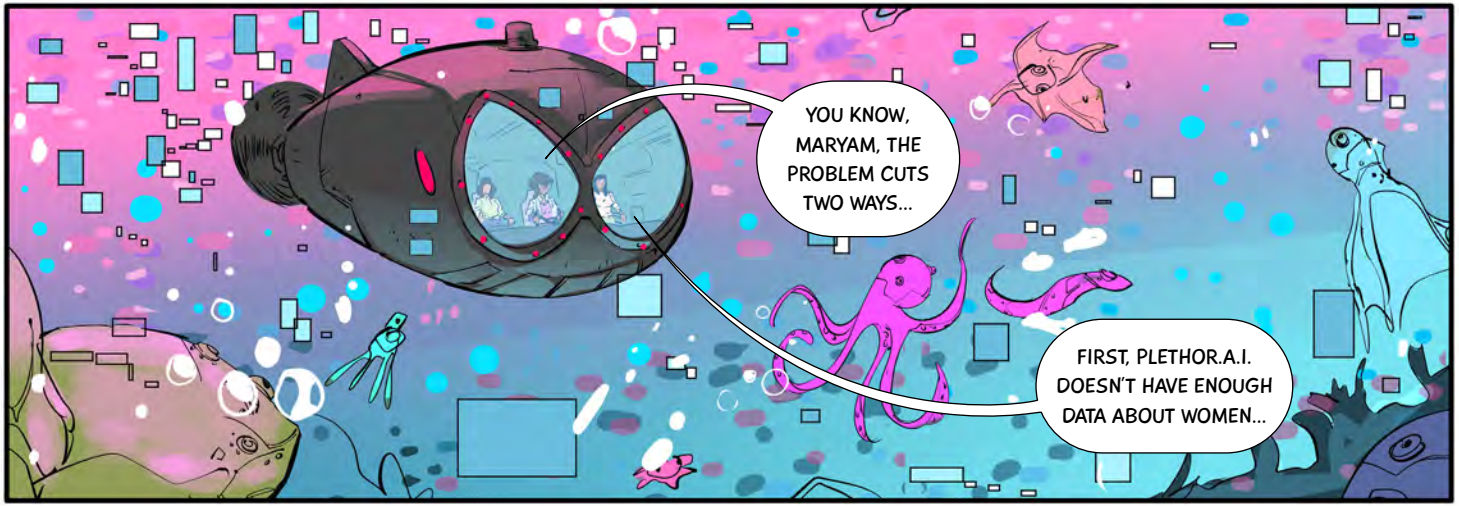

SOMEWHERE ON THE PACIFIC COAST...
VAKAY
About
Reserve
Book your vacation to Th
United States
BOOK TRIP
I am human
Please identify all images which includes HUMANS.
I am human
VALIDATE
deCAPTCHA
STRANGE...
THAT SCUBA MASK DOESN'T LOOK QUITE RIGHT..
VALIDATE


HUMAN
WELL, THAT'S *ONE* WAY TO GET A LABEL!
...NOW I JUST HAVE TO FIND THAT CLASSIFIER!

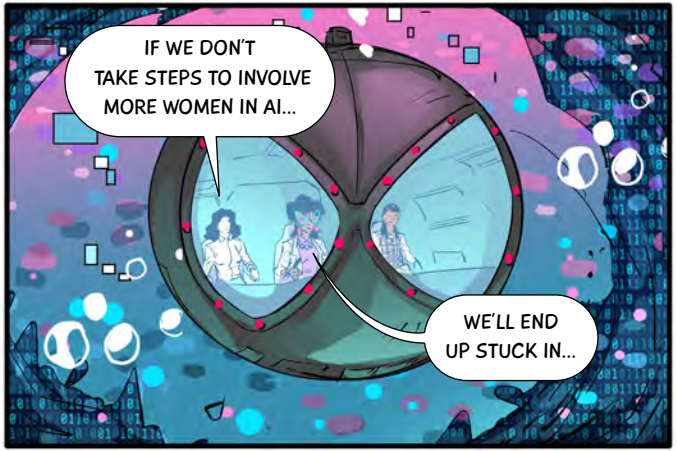

...GOTCHA!
HUMAN BEINGS
IF ALL THE FISH IN THE DATA BASIN LEARN FROM LABELS LIKE THESE—
HUMAN
IT'S NO WONDER THAT PEOPLE OF COLOR ARE TREATED DIFFERENTLY...
HUMAN
LET'S SEE IF WE CAN BREAK THE CYCLE!

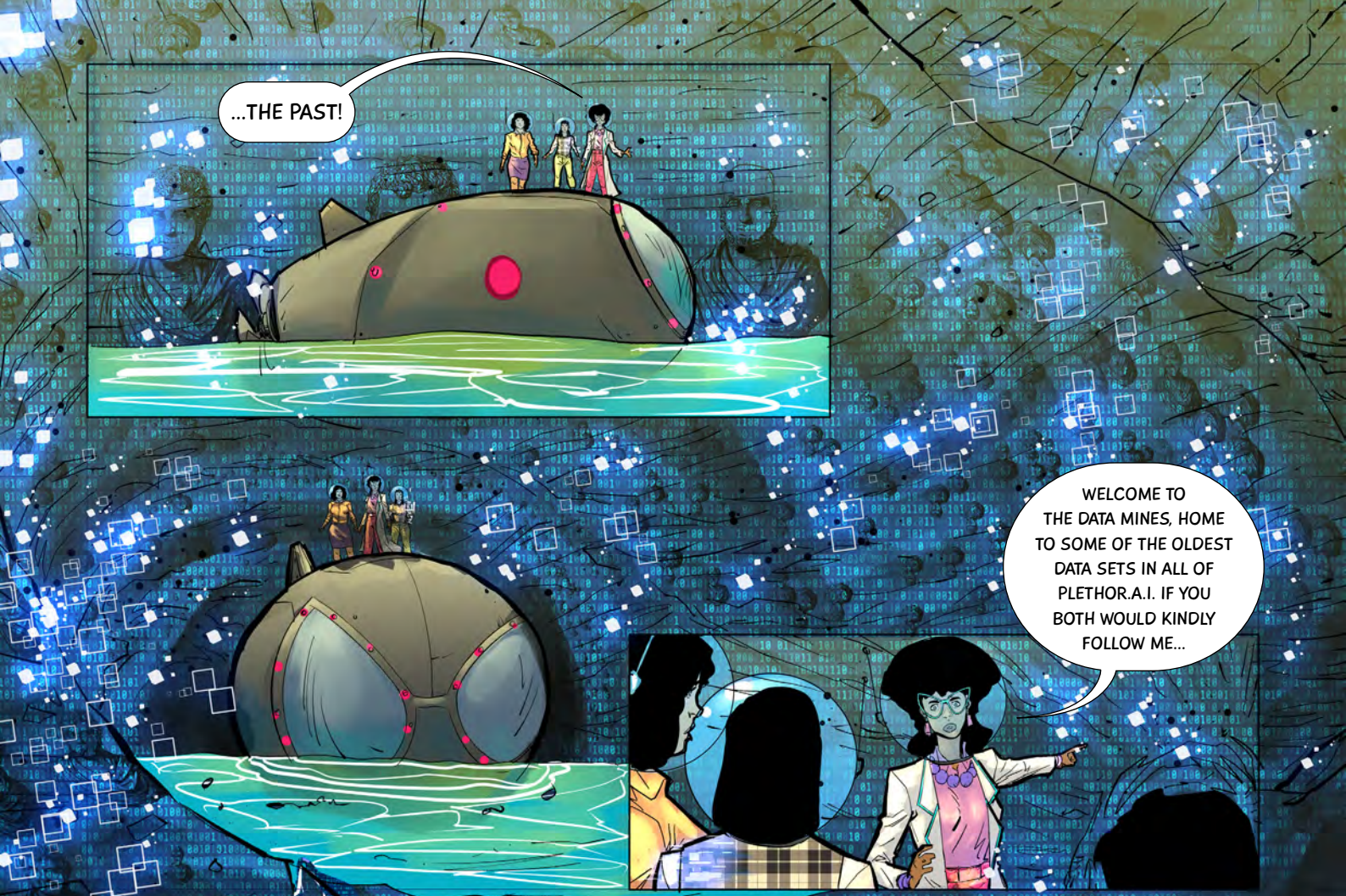

HAVING NARROWLY PASSED THE FINAL STAGE OF THE DATA BANKS RACE, AN EXHAUSTED MARYAM SOON FINDS HERSELF FLOATING IN THE HIGH SEAS OF THE DATA BASIN..
HEY! YOU CAN SEE ME NOW! BUT DOESN'T THAT MEAN MY GLITCH IS FIXED?
NOW WHAT?!?!
BURBLE
BURBLE
BURBLE
LOOKS LIKE YOUR GLITCH IS MORE COMPLEX THAN WE THOUGHT! HURRY, WE HAVE NO TIME TO WASTE!
BUT WHAT ABOUT—
—DON'T WORRY, I'M SURE YOU'LL SEE EACH OTHER AGAIN...


MARYAM DESCENDS INTO THE BELLY OF THE VESSEL, UNSURE OF THE CHALLENGE THAT AWAITS...
AH! DIDN'T I MENTION THAT I RECRUITED A CO-PILOT?
PLEASURE TO FINALLY MEET YOU, MARYAM!
IT'S NOT EVERY DAY THAT I FIND A YOUNG WOMAN WITH A PROFILE LIKE YOURS!
I'M SORRY, HOW DO YOU KNOW MY NAME?
FROM YOUR APPLICATION OF COURSE! I HAND PICKED YOU FOR THE INTERNSHIP MYSELF, BUT THEN...
...IT SEEMS RUTHDOL HERE IS HAVING A TECHNICAL ISSUE WITH HER HIRING TOOL...
AND YOUR APPLICATION WASN'T SELECTED BY THE AUTOMATED SYSTEM...
BUT HOW COULD THAT HAPPEN?
THAT'S EXACTLY WHAT WE'RE GOING TO FIND OUT! HOLD ON TO YOUR HATS!

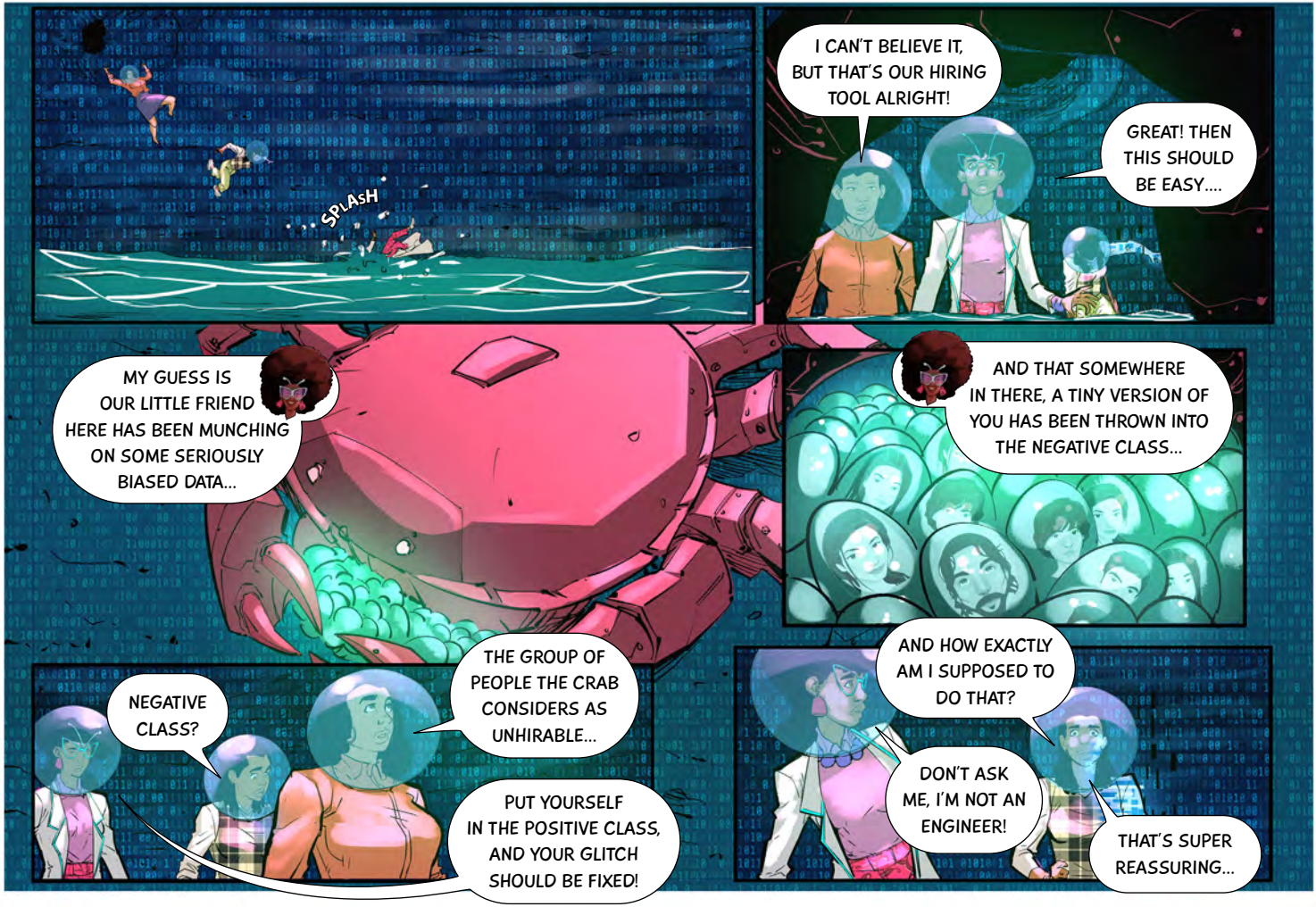

YOU KNOW, MARYAM, THE PROBLEM CUTS TWO WAYS...
FIRST, PLETHOR.A.I. DOESN'T HAVE ENOUGH DATA ABOUT WOMEN...

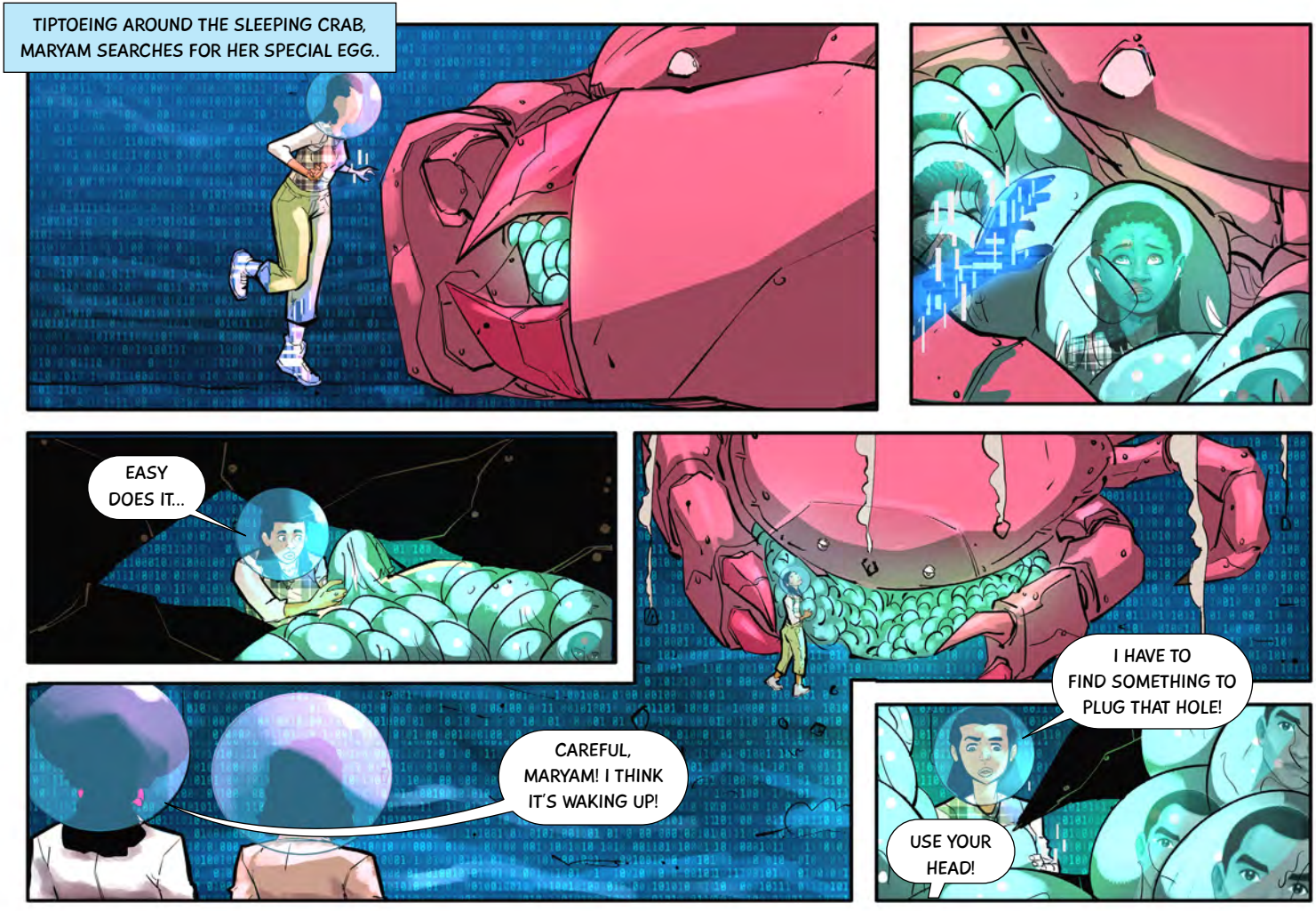

SECOND, WE DON'T HAVE ENOUGH WOMEN WORKING IN AI GENERALLY...
SOUNDS LIKE WE HAVE A *MISS*-REPRESENTATION PROBLEM!
GOOD ONE. BUT YOU KNOW, IT'S NO JOKE...

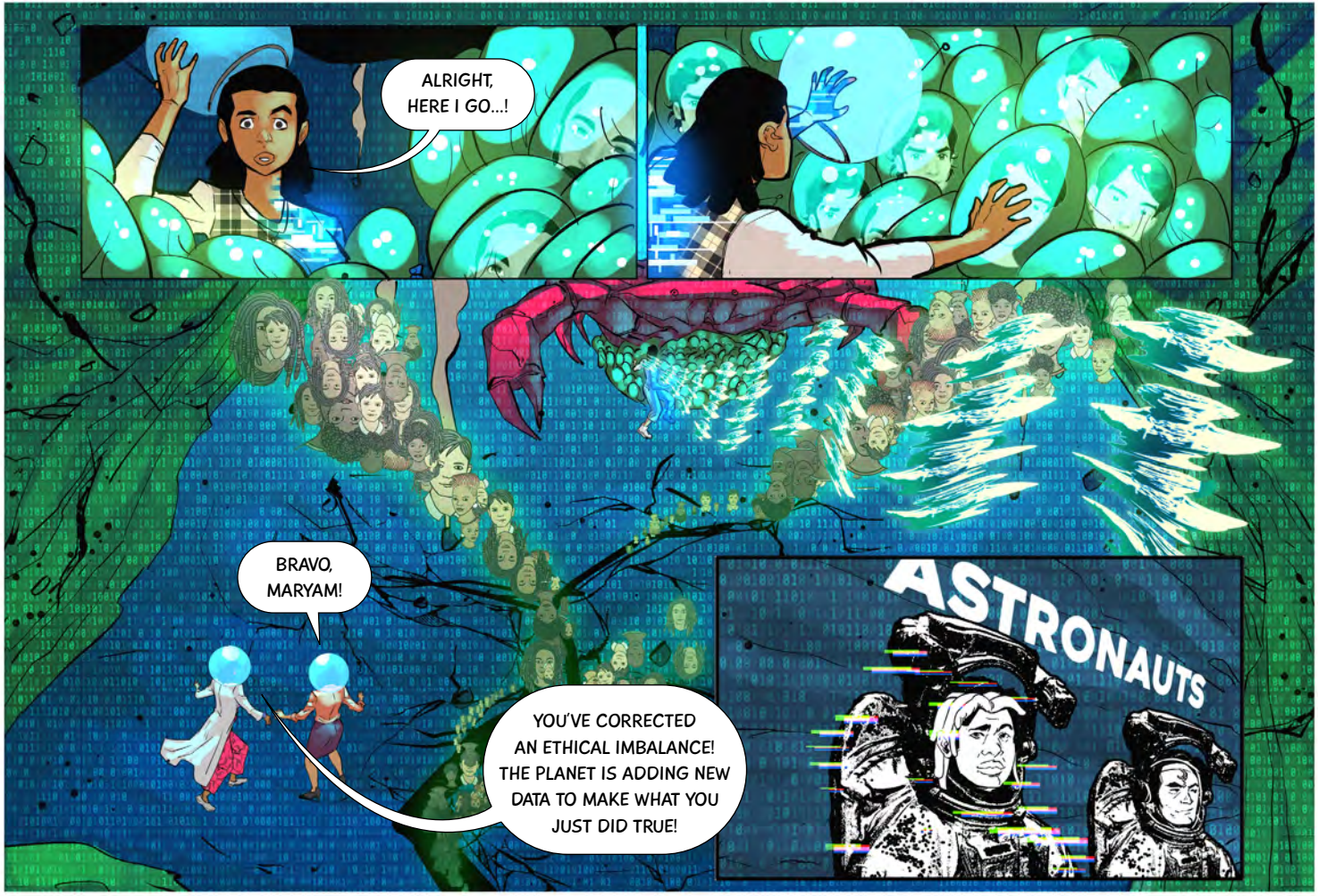

IF WE DON'T TAKE STEPS TO INVOLVE MORE WOMEN IN AI...
WE'LL END UP STUCK IN...


...THE PAST!
WELCOME TO THE DATA MINES, HOME TO SOME OF THE OLDEST DATA SETS IN ALL OF PLETHOR.A.I. IF YOU BOTH WOULD KINDLY FOLLOW ME...

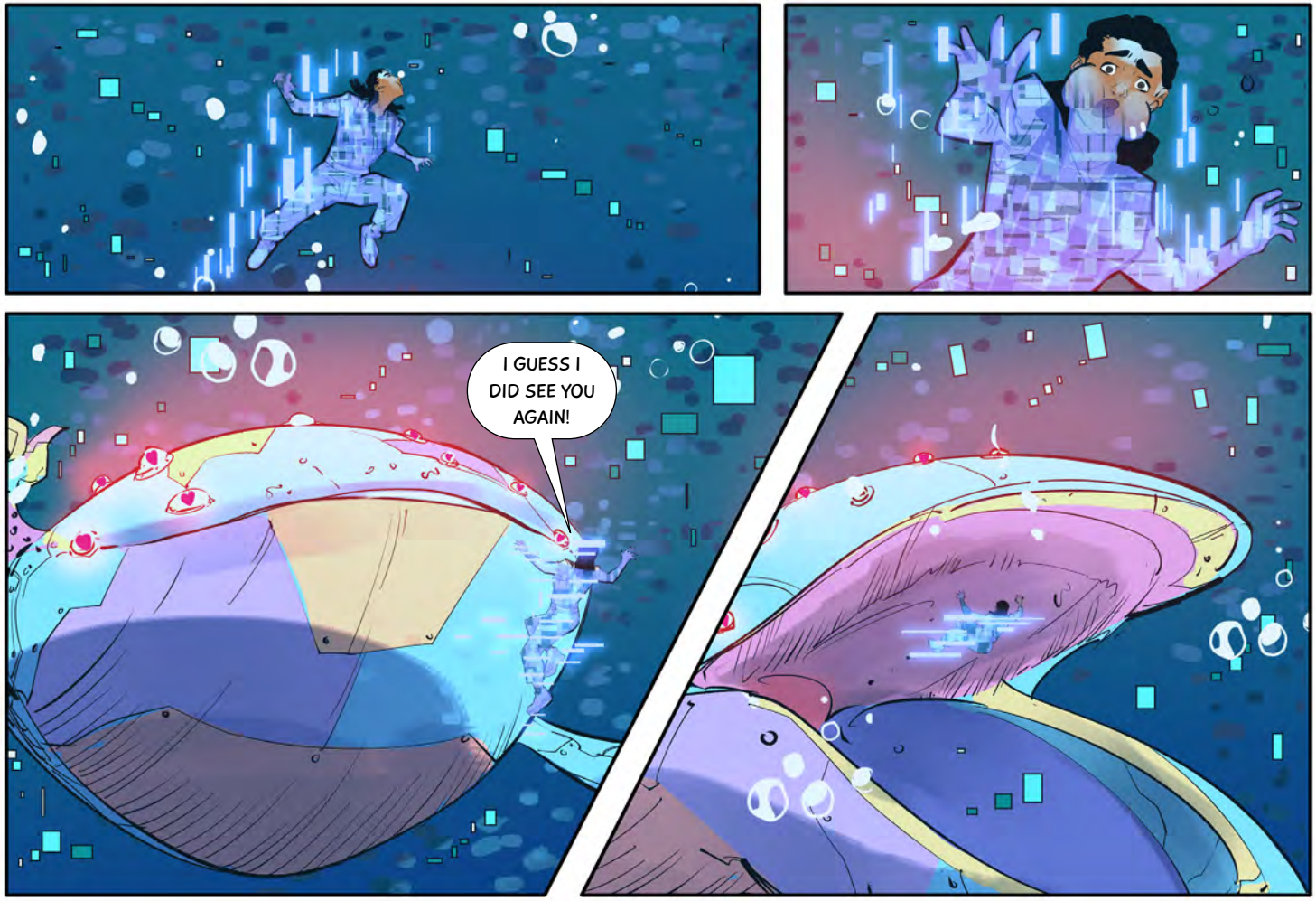

ALL SORTS OF NEW DATA FLOWS INTO PLETHOR.-A.I. EVERY DAY. IT GETS PROCESSED, STORED...
BUT WE ALSO HAVE DATA ABOUT HOW THINGS USED TO BE BEFORE AI. THAT'S WHAT YOU SEE HERE.
AI CAN USE THIS DATA TO HELP IT INTERPRET THE WORLD AND MAKE DECISIONS. EXCEPT...
I'M SENSING THERE'S A CATCH?
WELL, IF WE WANTED TO KNOW WHAT AN IDEAL ASTRONAUT LOOKS LIKE...
BASED ON WHAT YOU SEE HERE, WHAT MIGHT WE THINK AN IDEAL ASTRONAUT IS LIKE?
ASTRONAUTS
PROBABLY SOMETHING LIKE THEM....?
EXACTLY! EVEN IF MANY DIFFERENT KINDS OF PEOPLE COULD DO THE JOB!
THIS IS ONE PART OF WHAT WE CALL 'ALGORITHMIC BIAS', MARYAM, AND YOUR GLITCH IS AT THE HEART OF IT.
SO TO FIX IT, WE'RE GOING TO NEED TO STEAL AN EGG...
HUH?


SPLASH
I CAN'T BELIEVE IT, BUT THAT'S OUR HIRING TOOL ALRIGHT!
GREAT! THEN THIS SHOULD BE EASY....
MY GUESS IS OUR LITTLE FRIEND HERE HAS BEEN MUNCHING ON SOME SERIOUSLY BIASED DATA...
AND THAT SOMEWHERE IN THERE, A TINY VERSION OF YOU HAS BEEN THROWN INTO THE NEGATIVE CLASS...
NEGATIVE CLASS?
THE GROUP OF PEOPLE THE CRAB CONSIDERS AS UNHIRABLE...
PUT YOURSELF IN THE POSITIVE CLASS, AND YOUR GLITCH SHOULD BE FIXED!
AND HOW EXACTLY AM I SUPPOSED TO DO THAT?
DON'T ASK ME, I'M NOT AN ENGINEER!
THAT'S SUPER REASSURING...


TIPTOEING AROUND THE SLEEPING CRAB, MARYAM SEARCHES FOR HER SPECIAL EGG..
EASY DOES IT...
CAREFUL, MARYAM! I THINK IT'S WAKING UP!
I HAVE TO FIND SOMETHING TO PLUG THAT HOLE!
USE YOUR HEAD!


ALRIGHT, HERE I GO...!
BRAVO, MARYAM!
YOU'VE CORRECTED AN ETHICAL IMBALANCE! THE PLANET IS ADDING NEW DATA TO MAKE WHAT YOU JUST DID TRUE!
ASTRONAUTS


HEY YOU TWO! I THINK WE HAVE A PROBLEM!!
EVEN AS THE ENDLESS CAVERNS OF THE DATA MINES ARE FLOODED WITH MORE FAMILIAR FACES, MARYAM'S CELEBRATION IS SOON CUT SHORT...
SPLAAAAAAAASH


I GUESS I DID SEE YOU AGAIN!


RECONNAISSANCES FACIALI
ACCESS APPROVED!
THANK GOODNESS! I THOUGHT WE LOST YOU!
I DON'T THINK WE'LL BE LOSING PEOPLE LIKE US ANYTIME SOON...
BUT HOW DID YOU ESCAPE?
LET'S JUST SAY THAT'S CLASSIFIED...
TO BE CONTINUED...

Glossary Terms

Algorithmic Bias is an umbrella term which describes the ways in which certain AI systems can generate outputs, decisions or recommendations which display an inclination or prejudice for or against a person or group, especially in a way that is considered to be unfair. The causes of these biases are multiple, relating to how representative the data set is, how large the data set is, the weights of the AI model itself, and even the conscious and subconscious inclinations of the system's programmers. Even if most well-designed AI systems are free from algorithmic bias, ensuring that AI systems always operate fairly remains a thorny topic amongst AI professionals.

Classifier algorithms are models, in the case of supervised machine learning, that learn from input training data to eventually predict the likelihood that the samples from a new and different data set will fall into one of the predetermined categories of classification (also known as 'sub-populations'). In other words, the model first learns categories and their associations from the labels human engineers provide it during training, and then uses what it learns to sort new data into these same categories.

Data Set is sometimes called a 'database', a data set is simply a collection of structured data. In other words, it's a collection of things like facts, measurements, observations, images, text, audio or video, or representations thereof. Data sets are integral to Artificial Intelligence. In fact, without data sets, AI would not be able to learn, perceive, categorize, speak, listen or interpret, to name just a few. Data sets can be large or small, public or private, balanced or biased, but no matter the details, data sets provide the backbone for bottom-up, machine learning, or what we rightly call data-driven AI.

Natural Language Processing (NLP) is the branch of Artificial Intelligence research dedicated to giving computers the ability to understand text and spoken words in ways similar to humans. Typically, NLP combines traditional linguistic methods such as the rule-based modelling of a language, with statistical or machine learning methods. Traditionally a hard problem in AI research, natural language processing has greatly improved with the use of machine learning, and can be found in many everyday AI applications such as voice assistants, speech-to-text dictation software, automated translation and chatbots.

Recruitment Tools denote the use of Artificial Intelligence to automate some part of the hiring process. This can include the automatic scheduling of interviews with candidates, the shortlisting of candidates (through analysis and recommendation),

Glossary Terms

candidate matching, chatbots, or AI-based phone or video interviewers. Today, most recruitment processes are not fully automated, working instead to provide decision assistance to the humans in charge of the recruitment process.

Conclusion

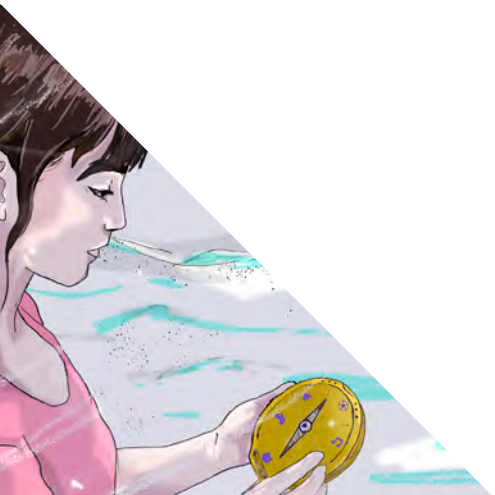
More and more, Artificial Intelligence exists to help humans make sense of an increasingly complex and fast-paced world. Yet, what kind of help can it offer if its very design and structure automatically privilege some to the detriment of others?

To ensure that this does not occur, steps must be taken to guarantee that the human rights of all are fully and adequately protected. Part of this solution begins at the design level, verifying that data sets are exhaustive, inclusive and sensitive to the vulnerabilities and particularities of each of us. Another step lies in the development of adequate oversight of AI systems: human beings at all levels of the AI ecosystem must work to develop and adhere to human-rights based international ethical standards, which help to ensure that AI tools are truly beneficial to all.

Taken together, these efforts will go a long way in preventing bias and discrimination in the development and use of AI systems, and will work to confirm that the future of AI is a future that we all want. ▪

Episode III

Shirin and the Recommender System Rewind



Conception and script: Dr. Katherine Evans

Illustration: Asma Kraiem

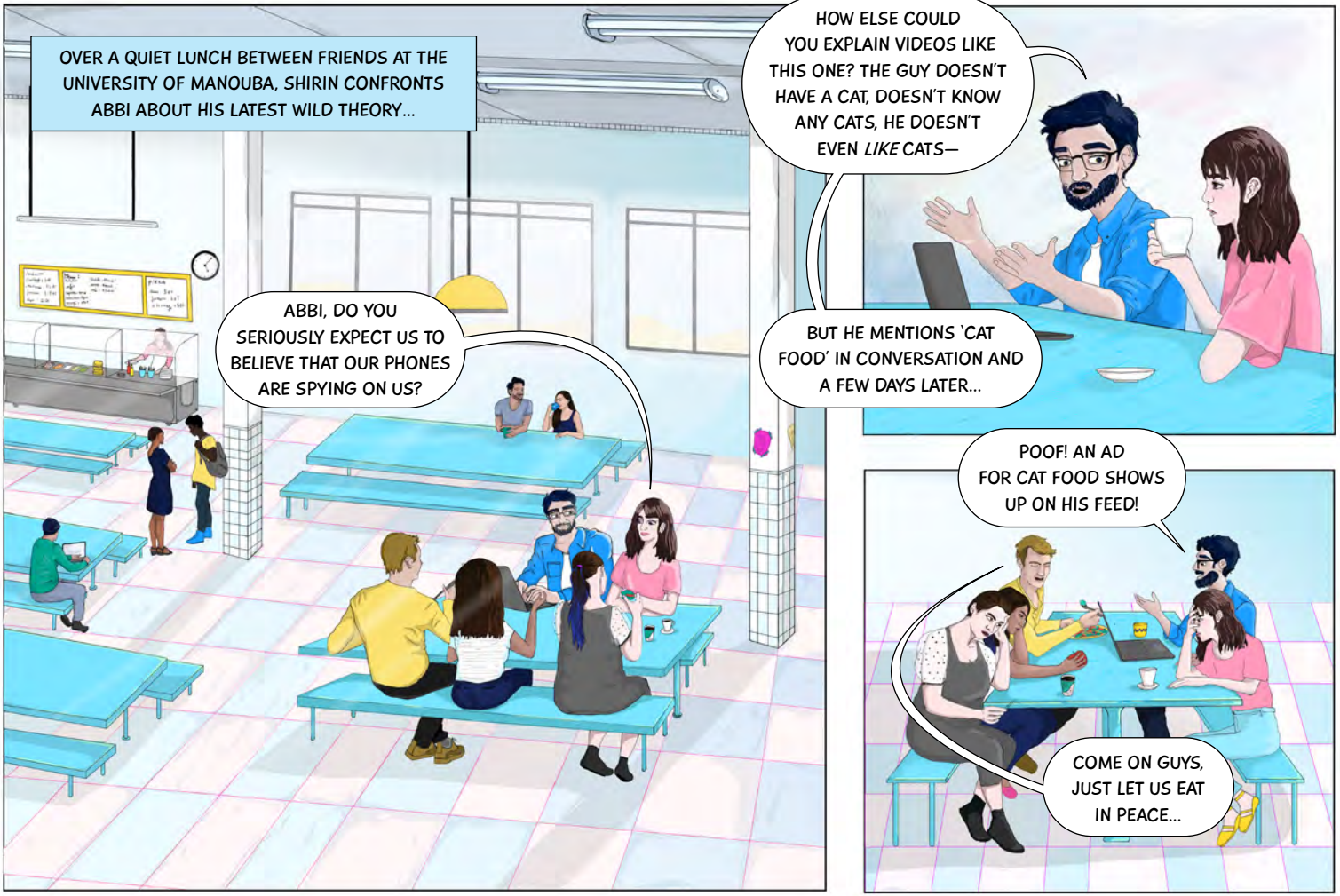
Introduction

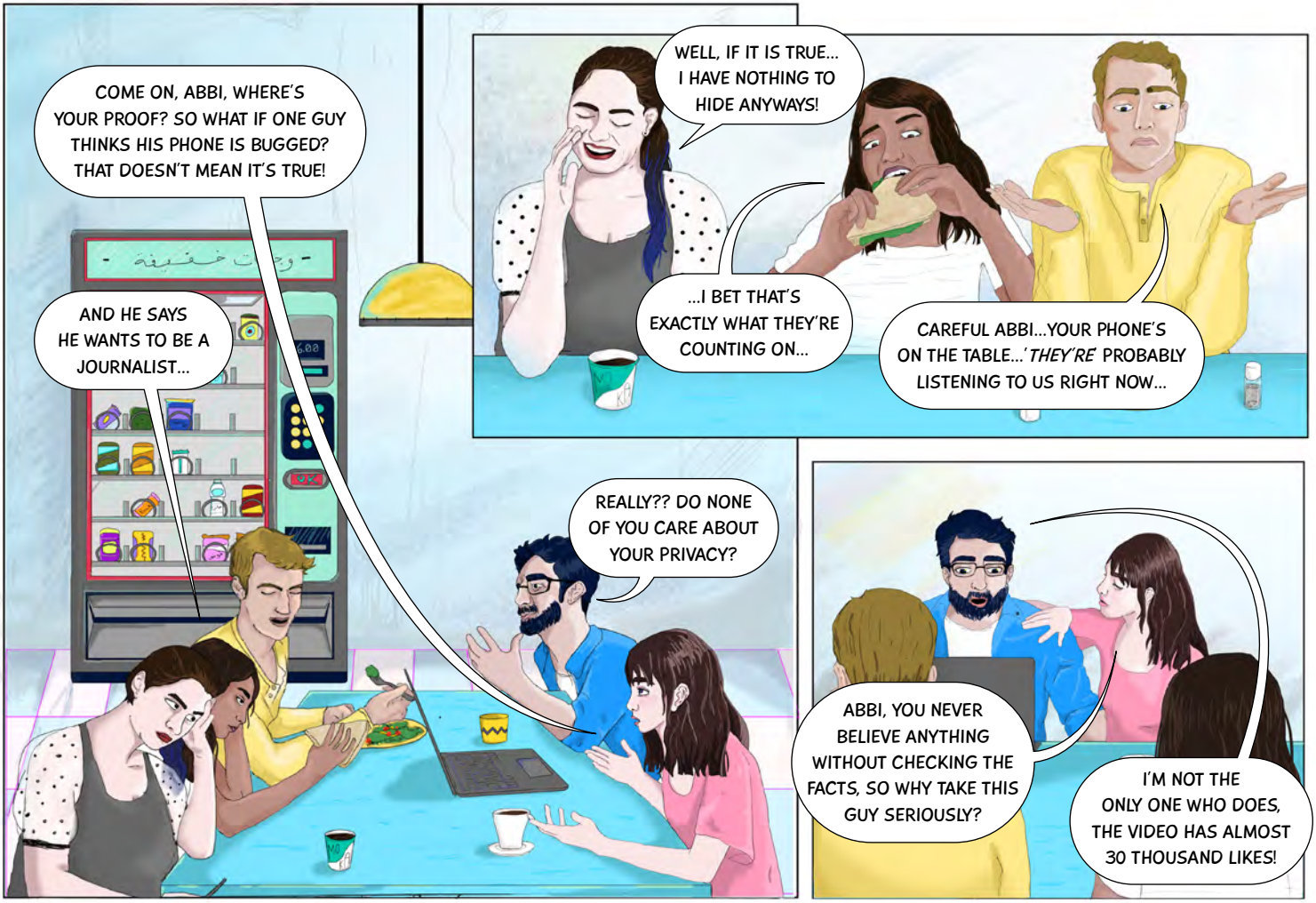
Every day, AI touches the lives of millions of people all over the planet, shaping their experiences and opportunities, and bolstering their understanding of the world around them. We use technology to connect with our friends, find new interests, or to understand more about the issues we already care about. Indeed, in choosing what parts of our lives we share online, we might even use AI to understand or reinvent ourselves. In this sense, AI gives us an unprecedented opportunity for personal and collective growth: both by bringing the world together, and by highlighting the incredible diversity of human experience, opinion and expertise.

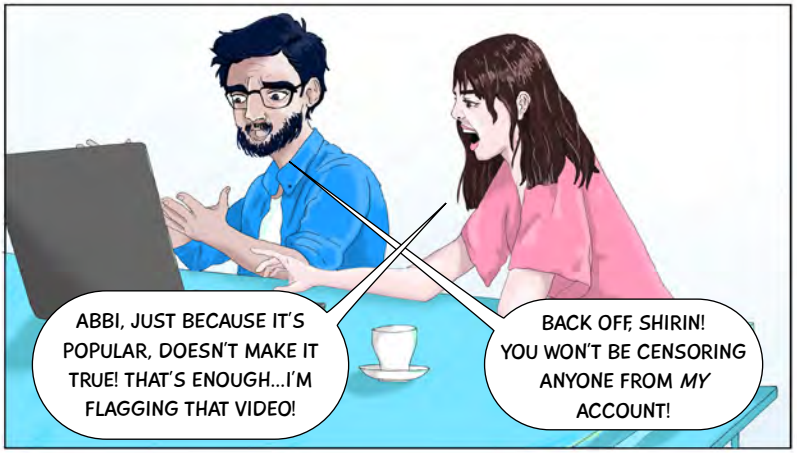
Yet, just as AI gives us a window through which to see the world, it also provides a unique vision of this world to each of us. When we interact with technology such as social media or online content platforms, Artificial Intelligence is shaping our experience from behind the scenes: showing us the content we are most likely to enjoy, pairing us with other users with whom we might have something in common, and occasionally, removing ideas that might challenge our convictions, or make us uncomfortable. In this way, Artificial Intelligence shifts the view we see through our window to the world, showing us what is most captivating.

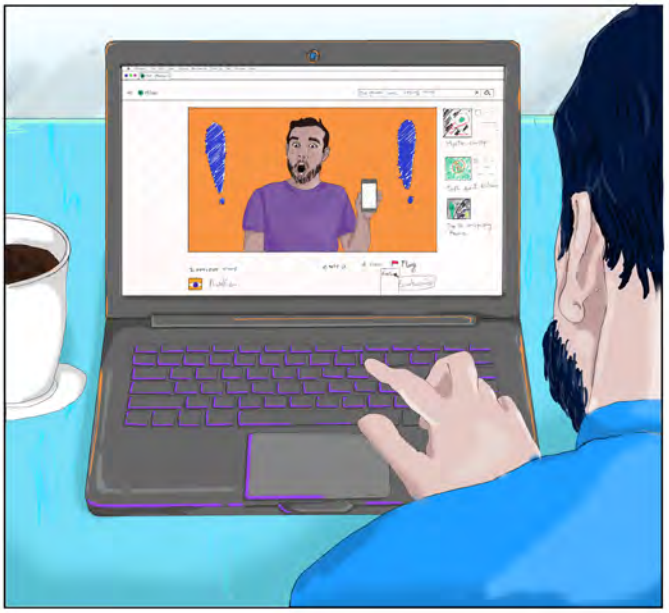
How does AI know what each of us would most like to see? In part, it knows because we tell it. Each time we like a video, comment on a post, add a new friend or follow someone's activity, we are telling Artificial Intelligence 'show me more of this, please'. At the same time, AI also looks deeper into how we spend our time online: which ads we clicked on, which videos we watched, which pages we visited, and how long we spent there. AI records all of this information as data, and every day, it uses this data to suggest new things for each of us to read, watch, buy, or do. Then, just as AI provides us a personalized vision of the world, AI also has a very personalized vision of each of us, defined entirely by the data it has collected.

But what happens when we don't agree with how our data has defined us? What should be done when seeing what is interesting comes at the price of not seeing what is important? How can we separate the truth from fiction in our window to the world, and how can AI tell the difference? The answers might get personal… ▪

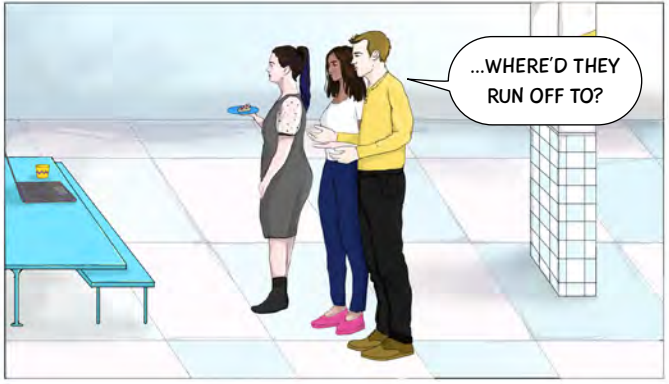

OVER A QUIET LUNCH BETWEEN FRIENDS AT THE UNIVERSITY OF MANOUBA, SHIRIN CONFRONTS ABBI ABOUT HIS LATEST WILD THEORY...
ABBI, DO YOU SERIOUSLY EXPECT US TO BELIEVE THAT OUR PHONES ARE SPYING ON US?
HOW ELSE COULD YOU EXPLAIN VIDEOS LIKE THIS ONE? THE GUY DOESN'T HAVE A CAT, DOESN'T KNOW ANY CATS, HE DOESN'T EVEN *LIKE* CATS—
BUT HE MENTIONS 'CAT FOOD' IN CONVERSATION AND A FEW DAYS LATER...
POOF! AN AD FOR CAT FOOD SHOWS UP ON HIS FEED!
COME ON GUYS, JUST LET US EAT IN PEACE...


COME ON, ABBI, WHERE'S YOUR PROOF? SO WHAT IF ONE GUY THINKS HIS PHONE IS BUGGED? THAT DOESN'T MEAN IT'S TRUE!
AND HE SAYS HE WANTS TO BE A JOURNALIST...
REALLY?? DO NONE OF YOU CARE ABOUT YOUR PRIVACY?
WELL, IF IT IS TRUE... I HAVE NOTHING TO HIDE ANYWAYS!
...I BET THAT'S EXACTLY WHAT THEY'RE COUNTING ON...
CAREFUL ABBI...YOUR PHONE'S ON THE TABLE...'*THEY'RE*' PROBABLY LISTENING TO US RIGHT NOW...
ABBI, YOU NEVER BELIEVE ANYTHING WITHOUT CHECKING THE FACTS, SO WHY TAKE THIS GUY SERIOUSLY?
I'M NOT THE ONLY ONE WHO DOES, THE VIDEO HAS ALMOST 30 THOUSAND LIKES!

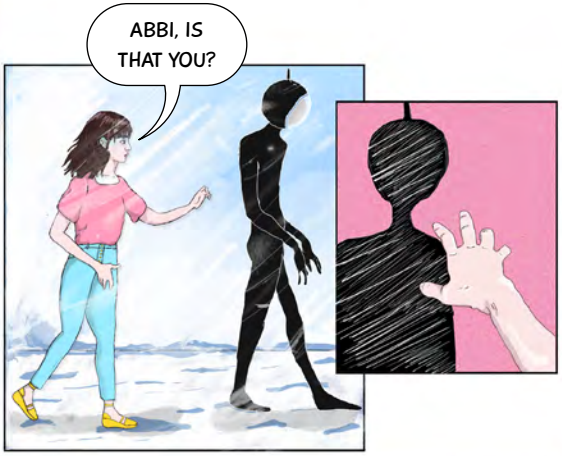

ABBI, JUST BECAUSE IT'S POPULAR, DOESN'T MAKE IT TRUE! THAT'S ENOUGH...I'M FLAGGING THAT VIDEO!
BACK OFF, SHIRIN! YOU WON'T BE CENSORING ANYONE FROM *MY* ACCOUNT!

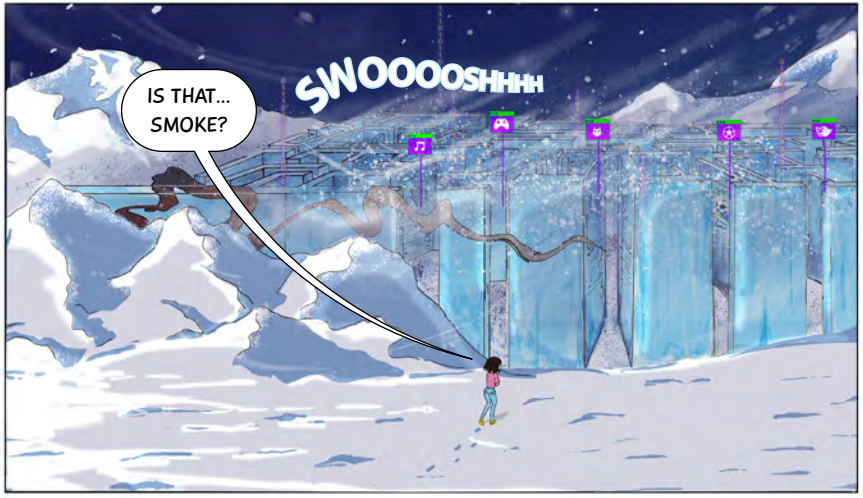



WHAT DID YOU DO NOW!?

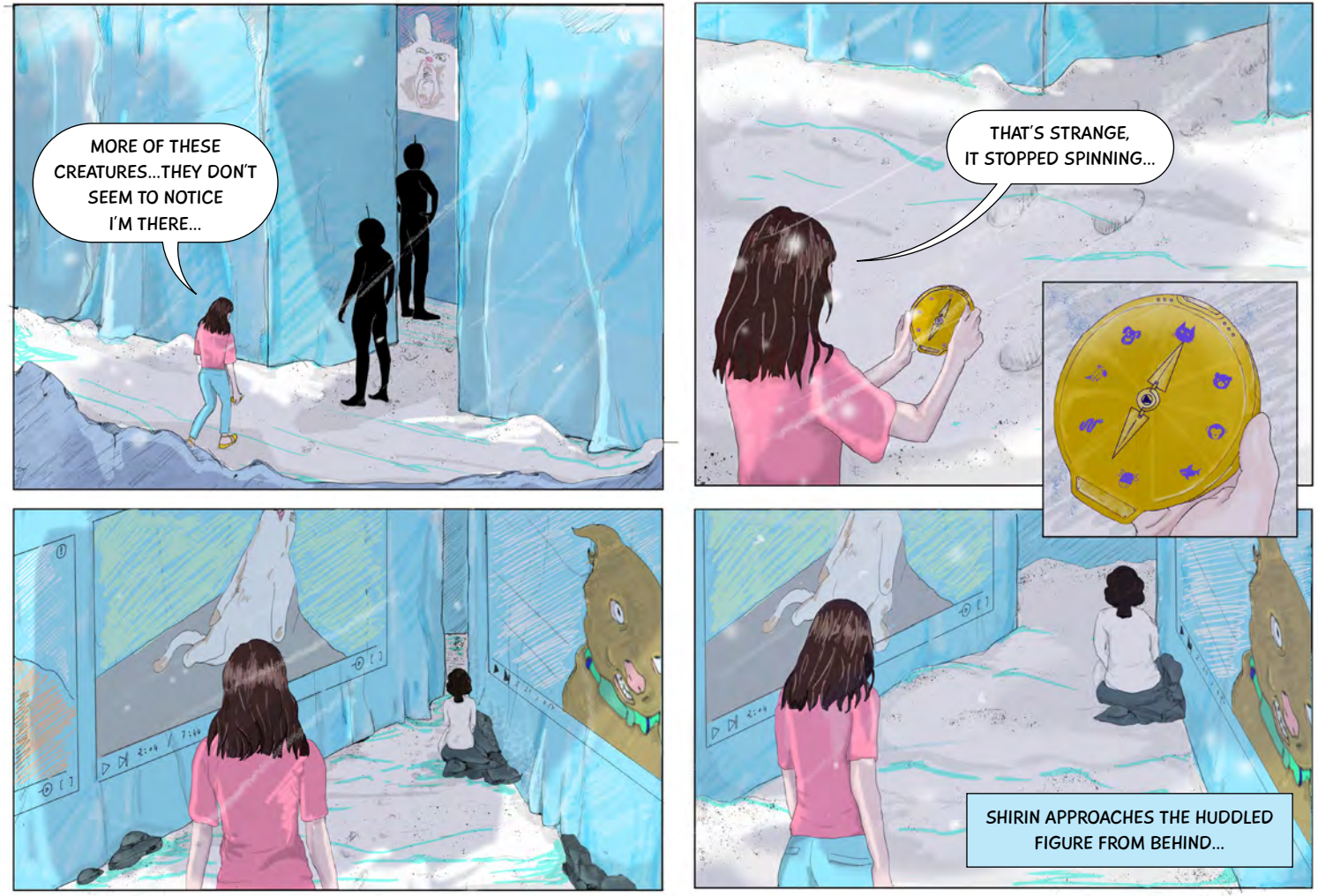

...WHERE'D THEY RUN OFF TO?

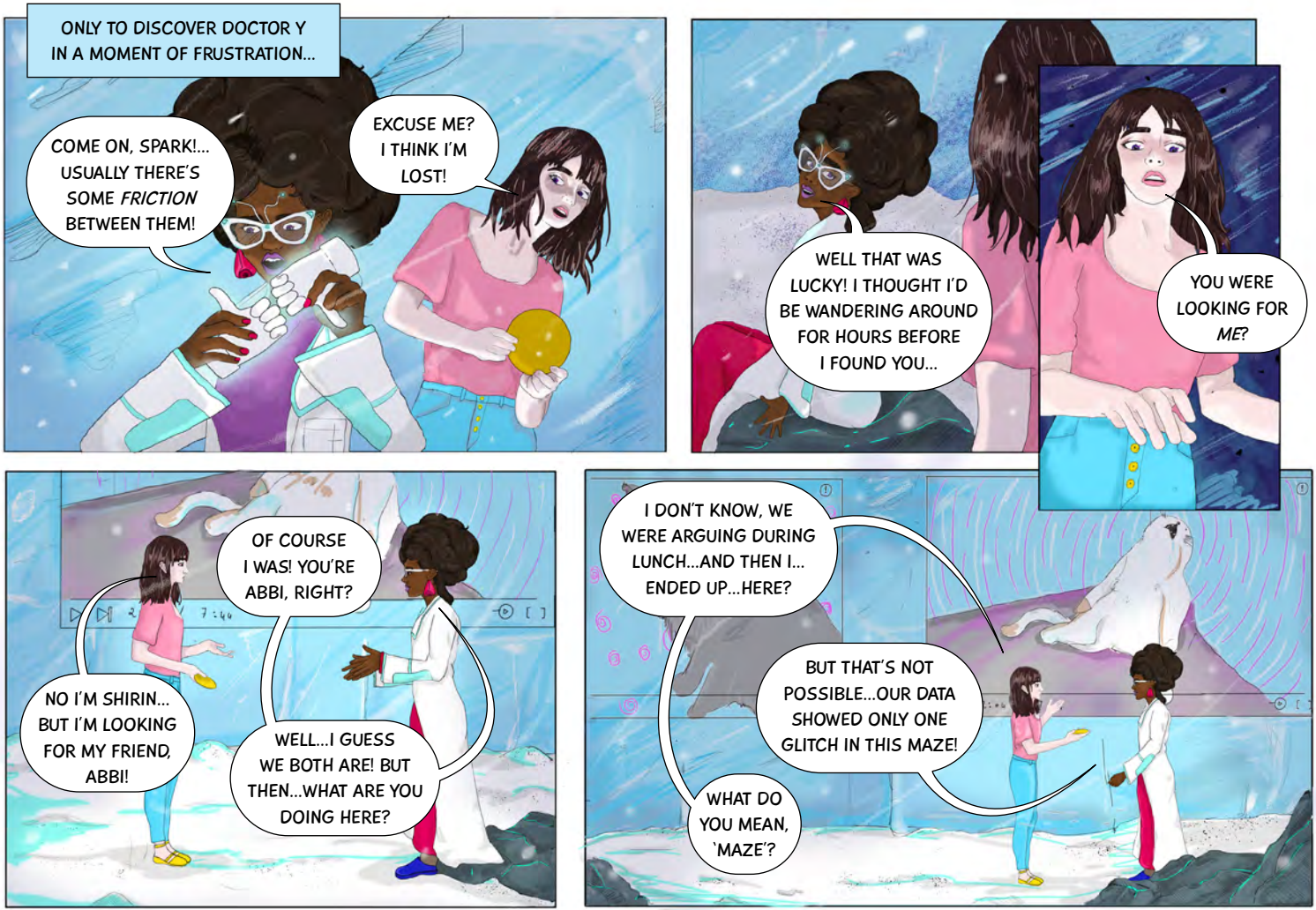

BEWILDERED AND DISORIENTED, SHIRIN SUDDENLY FINDS HERSELF AT THE *COLD START* OF AN OTHERWORLDLY MAZE...
SWOOOOOOSHHHH

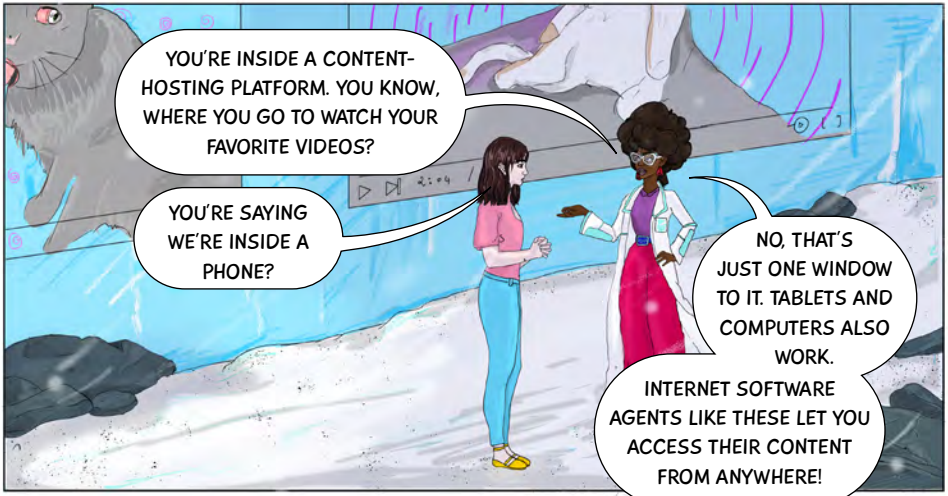

ABBI, IS THAT YOU?


IS THAT... SMOKE?
SWOOOOSHHHH

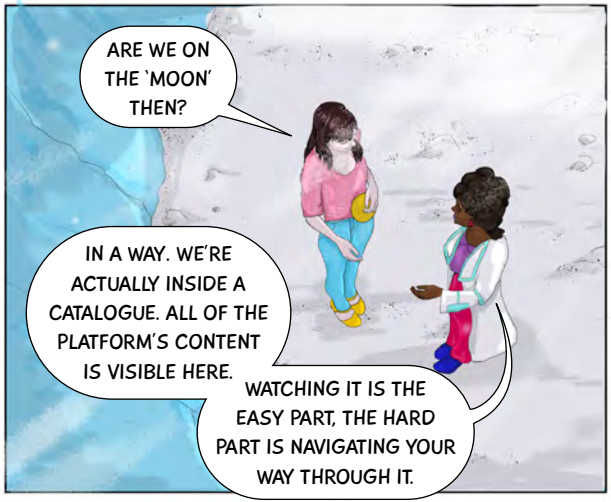

FOLLOWING THE SMOKE BACK TO ITS SOURCE, SHIRIN NOTICES A SMALL GOLDEN OBJECT GLIMMERING IN THE SNOW...
SWOOOOOOSHHH
IT ALMOST LOOKS LIKE A COMPASS... EXCEPT...
I'VE NEVER SEEN DIRECTIONS LIKE THESE BEFORE...
I'LL BET WHOEVER LEFT THESE FOOTPRINTS COULD TELL ME MORE...


MORE OF THESE CREATURES...THEY DON'T SEEM TO NOTICE I'M THERE...
THAT'S STRANGE, IT STOPPED SPINNING...
SHIRIN APPROACHES THE HUDDLED FIGURE FROM BEHIND...


ONLY TO DISCOVER DOCTOR Y IN A MOMENT OF FRUSTRATION...
COME ON, SPARK!... USUALLY THERE'S SOME *FRICTION* BETWEEN THEM!
EXCUSE ME? I THINK I'M LOST!
WELL THAT WAS LUCKY! I THOUGHT I'D BE WANDERING AROUND FOR HOURS BEFORE I FOUND YOU...
YOU WERE LOOKING FOR *ME*?
NO I'M SHIRIN... BUT I'M LOOKING FOR MY FRIEND, ABBI!
OF COURSE I WAS! YOU'RE ABBI, RIGHT?
WELL...I GUESS WE BOTH ARE! BUT THEN...WHAT ARE YOU DOING HERE?
I DON'T KNOW, WE WERE ARGUING DURING LUNCH...AND THEN I... ENDED UP...HERE?
BUT THAT'S NOT POSSIBLE...OUR DATA SHOWED ONLY ONE GLITCH IN THIS MAZE!
WHAT DO YOU MEAN, 'MAZE'?


YOU'RE INSIDE A CONTENT-HOSTING PLATFORM. YOU KNOW, WHERE YOU GO TO WATCH YOUR FAVORITE VIDEOS?
YOU'RE SAYING WE'RE INSIDE A PHONE?
NO, THAT'S JUST ONE WINDOW TO IT. TABLETS AND COMPUTERS ALSO WORK.
INTERNET SOFTWARE AGENTS LIKE THESE LET YOU ACCESS THEIR CONTENT FROM ANYWHERE!


WHAT DO YOU MEAN?
WELL, WHEN YOU LOOK AT THE MOON THROUGH A WINDOW, THE MOON ISN'T ACTUALLY INSIDE THE WINDOW.
A LOT OF OTHER PEOPLE CAN SEE IT AT THE SAME TIME...


ARE WE ON THE 'MOON' THEN?
IN A WAY. WE'RE ACTUALLY INSIDE A CATALOGUE. ALL OF THE PLATFORM'S CONTENT IS VISIBLE HERE.
WATCHING IT IS THE EASY PART, THE HARD PART IS NAVIGATING YOUR WAY THROUGH IT.

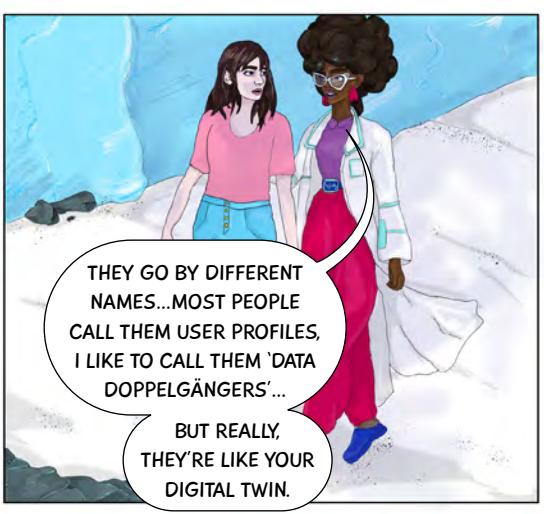

WOULD SOMETHING LIKE THIS HELP?

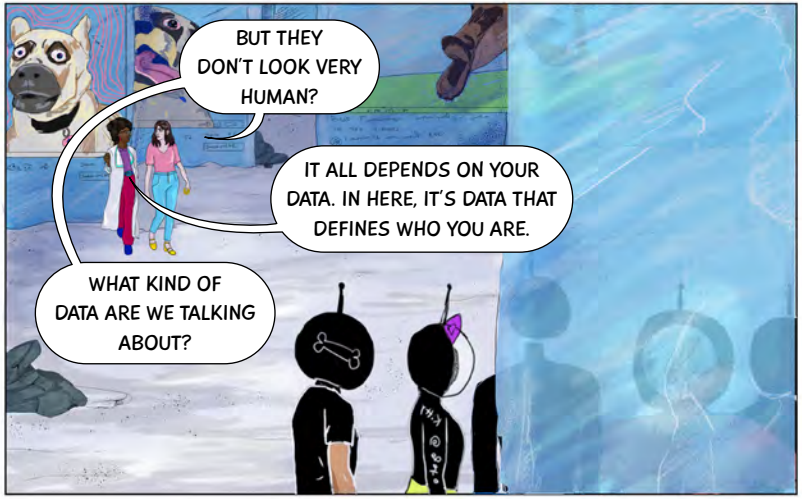

OH, MY RECOMMENDER SYSTEM! YOU FOUND IT!
LOOKS MORE LIKE A COMPASS TO ME? ANYWAY...I THINK IT BROKE IN THE CRASH, IT WOULDN'T STOP SPINNING.
AH! THAT'S TOTALLY NORMAL. I CRASHED AT THE COLD START.
RECOMMENDER SYSTEMS ARE LIKE A SPECIAL COMPASS. BUT INSTEAD OF POINTING YOU NORTH,
THEY TRY TO POINT YOU IN THE DIRECTION OF WHAT YOU MOST LIKELY WANT TO SEE.
BUT HOW DOES IT KNOW WHAT I LIKE?
WELL, YOU SHOW IT! EVER NOTICE THAT WHEN YOU WATCH A VIDEO, THE PLATFORM SUGGESTS OTHER SIMILAR VIDEOS YOU MIGHT LIKE?
WELL, EACH TIME YOU WATCH A VIDEO, IT COUNTS AS A STEP IN THIS MAZE.
THE RECOMMENDER SYSTEM TRACKS THOSE STEPS, AND USES THEM TO GUESS WHERE YOU MIGHT WANT TO GO NEXT.

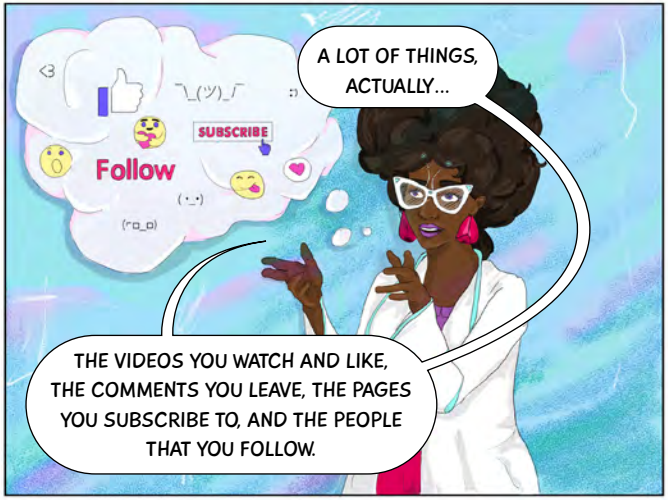

SO...THE MORE YOU WALK, THE MORE IT KNOWS WHAT YOU LIKE?
YES! AND IT TRIES TO POINT YOU IN THAT DIRECTION.
SO WHY WASN'T IT WORKING BACK THERE?
BECAUSE YOU HADN'T STARTED WALKING YET! IT HAD NO IDEA WHERE YOU WANTED TO GO.
WELL I WANT TO FIND ABBI, CAN'T WE USE IT FOR THAT?
MAYBE, YEAH... BUT HOW WELL DO YOU KNOW HIM?
I KNOW HE SPENDS TOO MUCH TIME WATCHING VIDEOS ONLINE, SO THIS MIGHT GET A BIT DIFFICULT...HE COULD BE ANYWHERE...
ACTUALLY, MY UNDERSTANDING IS ABBI FLAGGED A SPECIFIC VIDEO IN THE MAZE.
IF YOU THINK YOU CAN LEAD ME TO IT, MAYBE I CAN GET YOU BOTH BACK HOME.
YES, I REMEMBER NOW! IT'S THAT RIDICULOUS VIDEO WE WERE WATCHING DURING LUNCH!


MY GUESS IS, WE FIND THE VIDEO, AND WE FIND ABBI.
OK! WHERE DO WE GO FROM HERE?
THE GOAL IS TO RETRACE HIS STEPS. I'D SAY THAT RIGHT NOW... WE'RE IN THE 'FUNNY CAT' SECTOR.
OH DARN...I THINK THE VIDEO WE'RE LOOKING FOR IS CLOSER TO A CONSPIRACY THEORY...
AH WELL... THEY'RE NEVER *TOO* FAR AWAY...
SWOOOOSHHHH


AS THE QUEST TO FIND ABBI DRAWS DOCTOR Y AND SHIRIN DEEPER INTO THE MAZE, THEY SOON STUMBLE UPON MORE OF THESE STRANGE CREATURES...
WHAT ARE THESE THINGS, I KEEP ON SEEING THEM EVERYWHERE?


THEY GO BY DIFFERENT NAMES...MOST PEOPLE CALL THEM USER PROFILES, I LIKE TO CALL THEM 'DATA DOPPELGÄNGERS'...
BUT REALLY, THEY'RE LIKE YOUR DIGITAL TWIN.


BUT THEY DON'T LOOK VERY HUMAN?
IT ALL DEPENDS ON YOUR DATA. IN HERE, IT'S DATA THAT DEFINES WHO YOU ARE.
WHAT KIND OF DATA ARE WE TALKING ABOUT?


A LOT OF THINGS, ACTUALLY...
SUBSCRIBE
Follow
THE VIDEOS YOU WATCH AND LIKE, THE COMMENTS YOU LEAVE, THE PAGES YOU SUBSCRIBE TO, AND THE PEOPLE THAT YOU FOLLOW.

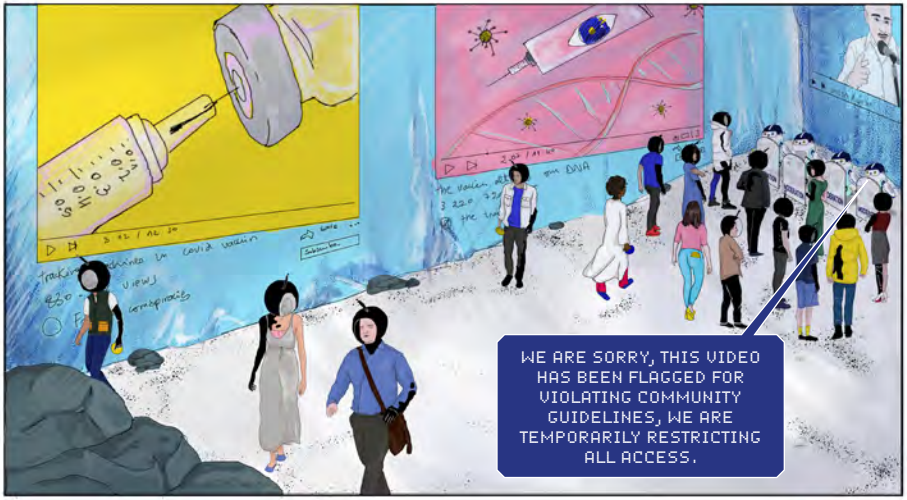

BUT THERE'S SO MUCH MORE TO US THAN WHAT WE DO ONLINE! INFORMATION LIKE THAT CAN'T TELL YOU WHO A PERSON IS...
NOT IMPRESSED!
OF COURSE NOT! BUT YOU'D BE SURPRISED HOW LITTLE DATA IT TAKES TO GUESS YOUR NEXT STEP IN THE MAZE.
AND EVERY STEP GIVES THE PLATFORM MORE DATA TO LEARN FROM...UNTIL YOU END UP AS DETAILED AS THIS ONE, WHO'S OBVIOUSLY A VERY EXPERIENCED USER.
BUT THESE ONES ARE NEW TO THE PLATFORM?
EXACTLY! ACCURATE OR NOT, THE LONGER YOU SPEND IN THE MAZE, THE MORE DETAILED YOUR DATA PROFILE BECOMES!
YEESH! ABBI MIGHT HAVE BEEN ON TO SOMETHING...

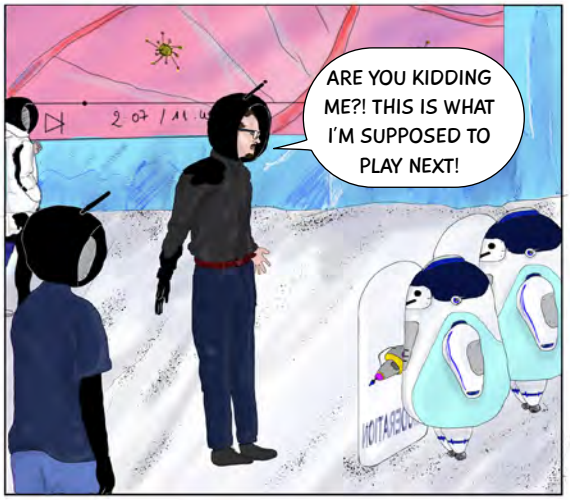

AS THE CONTENT ON THE ICY WALLS OF THE MAZE GROWS EVER DARKER AND STRANGER, OUR INTREPID AI ADVENTURERS ARE HOT ON ABBI'S TRAIL...
PANDEMIC + 5G = PLANET PRISIO
WE MUST BE GETTING CLOSER, THINGS ARE LOOKING MORE AND MORE DIFFICULT TO PROVE...
YOU KNOW...IT WAS A SURPRISINGLY SHORT WALK FROM CATS TO CLIMATE CHANGE DENIAL...
IT CAN BE, IF YOU LET THE RECOMMENDER DO ALL THE NAVIGATING! WE SHOULD BE CAREFUL FROM HERE ON OUT.
THE CLOSER WE GET TO CONSPIRACY, THE MORE SLIPPERY IT GETS...
EARTH HAS BEEN SUCKED INTO A BLACK HOLE !

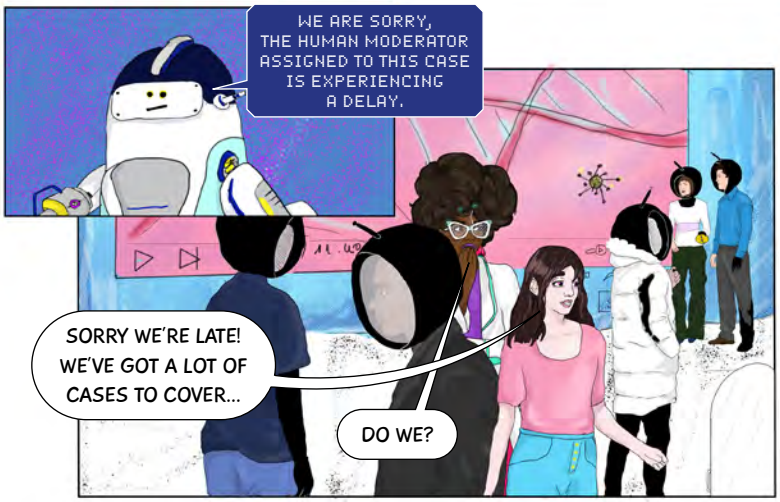

A FAKED *FLAT-MOON* LANDING? THIS IS TOO MUCH, EVEN FOR ABBI!
WE SHOULD KEEP MOVING. A LITTLE CURIOSITY IS FINE, BUT SPEND TOO LONG HERE...
AND IT CAN BE DIFFICULT TO TELL TRUTH FROM FICTION.
THAT'S EXACTLY WHAT I WAS TELLING ABBI JUST BEFORE WE—
BOOM
THUD!
THE MOON'S EFFECT ON VACCINE
WHAT WAS THAT FOR?!
THIS HASH HAS BEEN OUTLAWED BY THE COMMON DATABASE. THE VIDEO MUST BE DESTROYED.


SEEMS KIND OF HARSH...WHAT KIND OF VIDEO WAS IT?
THIS HASH IS OUTLAWED. IT MUST BE DESTROYED.
IT CAN'T BE MORE SPECIFIC THAN THAT. IT'S JUST A BOT.
BUT IF IT DOESN'T EVEN KNOW WHAT IT'S DELETING...ISN'T THAT DANGEROUS?
THE BOT ONLY DELETES VIDEOS THAT ARE ON A WANTED LIST.
OH, REALLY? WHAT DO YOU HAVE TO DO TO GET ON A LIST LIKE THAT?
IT'S FOR DISTURBING OR VIOLENT CONTENT, VIDEOS THAT ALMOST ALL PLATFORMS AGREE DO NOT BELONG ONLINE.
THIS PLATFORM AND OTHERS LIKE IT ALL CONTRIBUTE TO THE LIST.
SO...THE VIDEO IS LIKE A CRIMINAL?
THE MOON'S EFFECT ON VACCINE EFFECTIVENESS
YES...ONE WHO'S WANTED IN EVERY COUNTRY.
BUT STILL...DOESN'T EVERY CRIMINAL GET A TRIAL?
OH SURE WHEN IT'S A HARDER CASE...BUT WE HAVE OTHER ALGORITHMS FOR THAT...


GROWING MORE CONFIDENT WITH EACH STEP, SHIRIN AND DOCTOR Y SUDDENLY SEEM ON THE VERGE OF CRACKING THE CASE...
ILLUMINATI?
CONSPIRACIES
WOW! THE RECOMMENDER REALLY SEEMS TO WANT US TO GO THIS WAY...
YES...IT'S STARTING TO MAKE MORE CONFIDENT PREDICTIONS...
IT SHOULD LEAD US RIGHT TO ABBI, ASSUMING THAT IS, THAT YOU KNOW YOUR FRIEND'S PREFERENCES.
I THINK SO...SECRET SOCIETIES ARE TOTALLY UP HIS ALLEY...
...IT LOOKS A LITTLE BLOCKED.
WELL... WE COULD ALWAYS GO AROUND IT...
I THOUGHT I SAW A SHORTCUT WAY BACK IN THE VACCINE DISINFORMATION SECTION...
THE RECOMMENDER SYSTEM LOOKS PRETTY CERTAIN...
LET'S JUST SEE WHAT WE'RE DEALING WITH.


WE ARE SORRY, THIS VIDEO HAS BEEN FLAGGED FOR VIOLATING COMMUNITY GUIDELINES, WE ARE TEMPORARILY RESTRICTING ALL ACCESS.


ARE YOU KIDDING ME?! THIS IS WHAT I'M SUPPOSED TO PLAY NEXT!


WE ARE SORRY, THE HUMAN MODERATOR ASSIGNED TO THIS CASE IS EXPERIENCING A DELAY.
SORRY WE'RE LATE! WE'VE GOT A LOT OF CASES TO COVER...
DO WE?

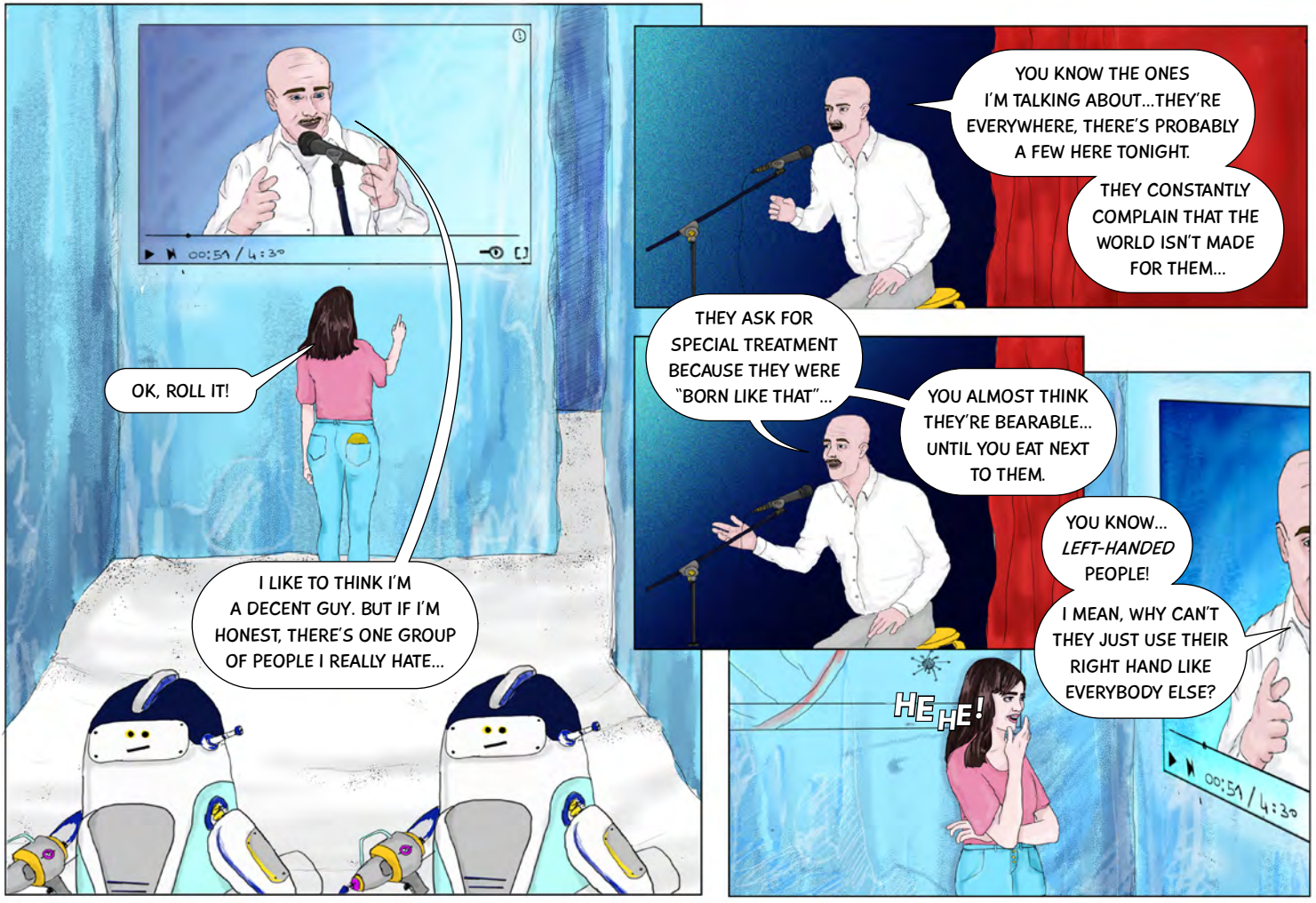

OH, COME ON, HOW HARD COULD MODERATION BE?

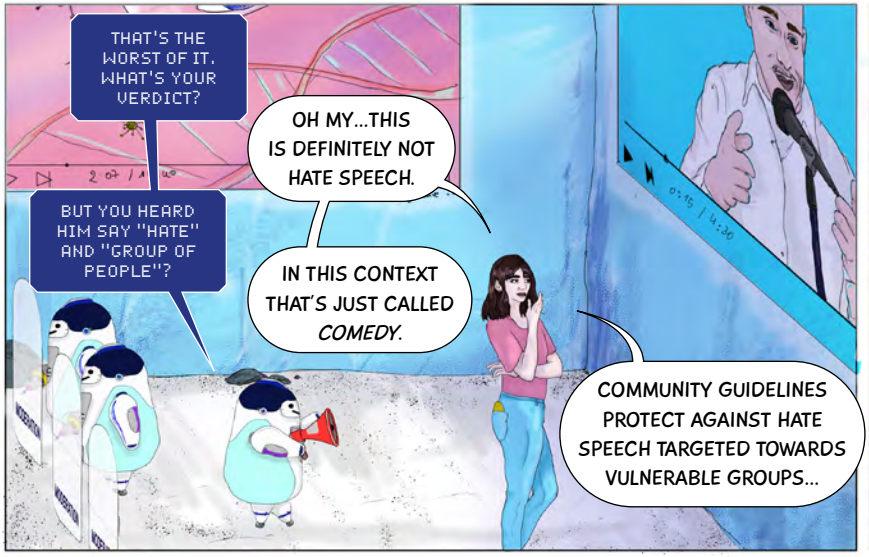

THERE'S A SUSPECTED CASE OF DISCRIMINATORY CONTENT, POTENTIALLY HATE SPEECH RELATED.
WE ARE SET UP TO TAKE THE SHOT, BUT WE DIDN'T HAVE ENOUGH INTELLIGENCE TO BE SURE.
CONTENT MODERATION DO NOT WATCH


HATE SPEECH? THAT SOUNDS SERIOUS...
YES...IT'S LUCKY WE'RE HERE...
THERE'S JUST TOO MUCH CONTENT FOR ALL THE HUMAN MODERATORS TO COVER THESE DAYS.

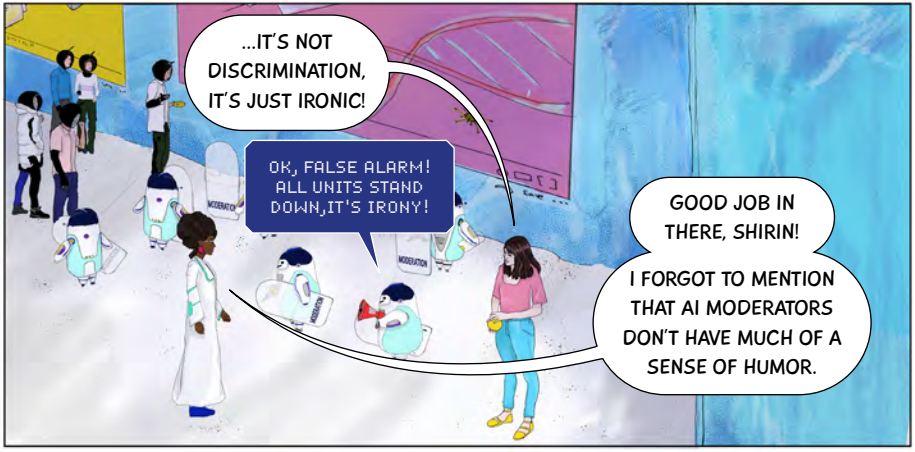

THE EXPERT MODERATOR IS IN THE LOOP, ALL SYSTEMS STAND BY FOR HER SIGNAL!


ASSUME REPLAY POSITIONS!


00:54 / 4:30
OK, ROLL IT!
I LIKE TO THINK I'M A DECENT GUY. BUT IF I'M HONEST, THERE'S ONE GROUP OF PEOPLE I REALLY HATE...
YOU KNOW THE ONES I'M TALKING ABOUT...THEY'RE EVERYWHERE, THERE'S PROBABLY A FEW HERE TONIGHT.
THEY CONSTANTLY COMPLAIN THAT THE WORLD ISN'T MADE FOR THEM...
THEY ASK FOR SPECIAL TREATMENT BECAUSE THEY WERE "BORN LIKE THAT"...
YOU ALMOST THINK THEY'RE BEARABLE... UNTIL YOU EAT NEXT TO THEM.
YOU KNOW... *LEFT-HANDED* PEOPLE!
I MEAN, WHY CAN'T THEY JUST USE THEIR RIGHT HAND LIKE EVERYBODY ELSE?
HE HE!
00:54 / 4:30


THAT'S THE WORST OF IT. WHAT'S YOUR VERDICT?
OH MY...THIS IS DEFINITELY NOT HATE SPEECH.
BUT YOU HEARD HIM SAY "HATE" AND "GROUP OF PEOPLE"?
IN THIS CONTEXT THAT'S JUST CALLED *COMEDY*.
COMMUNITY GUIDELINES PROTECT AGAINST HATE SPEECH TARGETED TOWARDS VULNERABLE GROUPS...

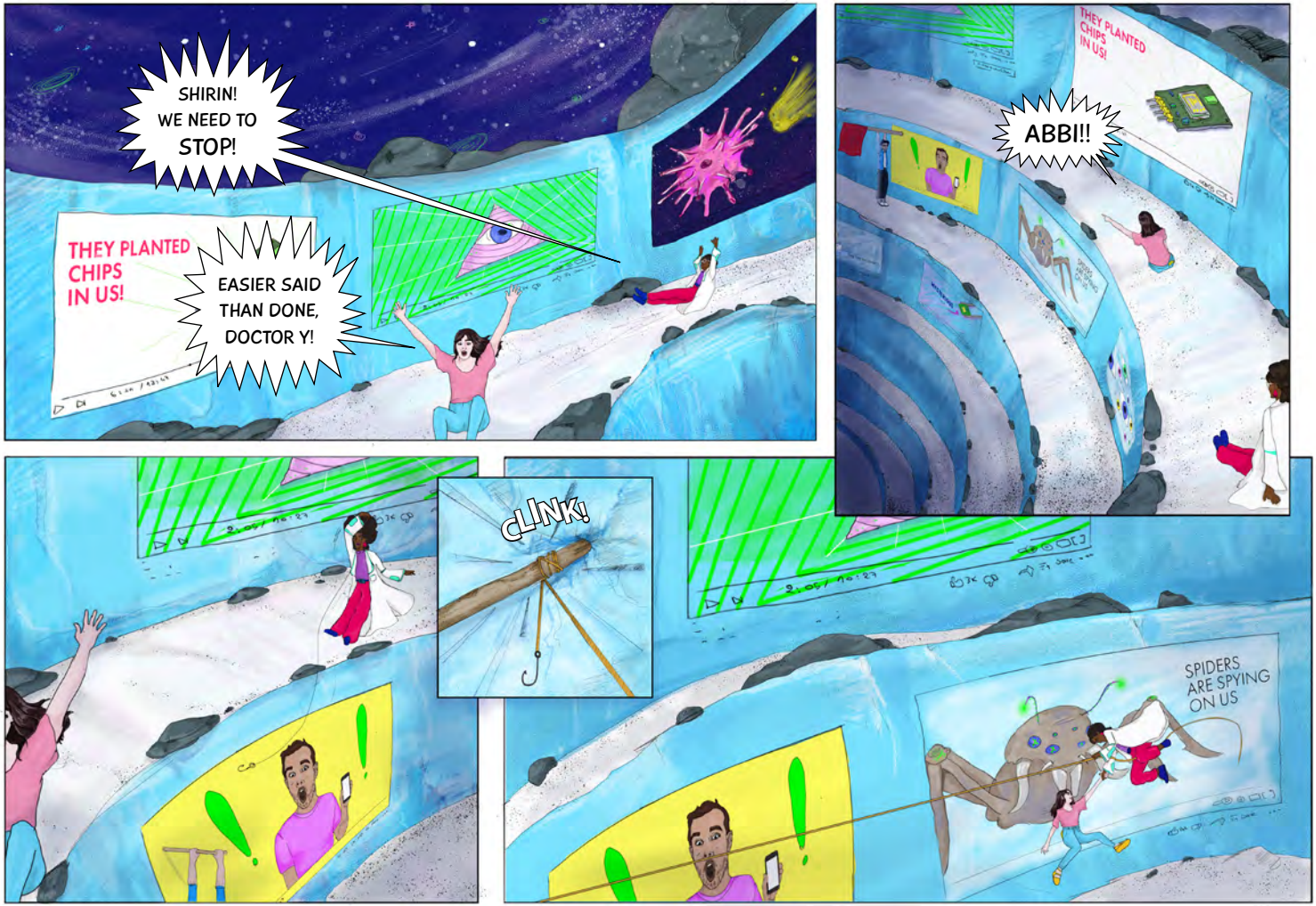

BASED ON ETHNICITY, GENDER, RELIGION, SURE... BUT NOT WHICH HAND YOU WRITE WITH.


...IT'S NOT DISCRIMINATION, IT'S JUST IRONIC!
OK, FALSE ALARM! ALL UNITS STAND DOWN,IT'S IRONY!
GOOD JOB IN THERE, SHIRIN!
I FORGOT TO MENTION THAT AI MODERATORS DON'T HAVE MUCH OF A SENSE OF HUMOR.


I CAN'T SEE HOW ANYONE COULD GET THAT WRONG...
THAT'S WHY HUMAN MODERATORS ARE SO VALUABLE!
FREEDOM OF EXPRESSION IS A HARD THING TO PROTECT.

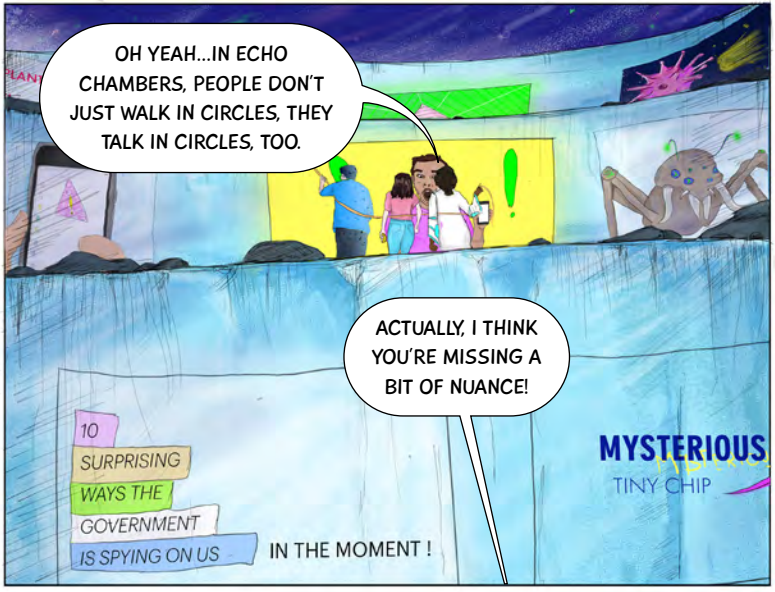

JUST WHEN ABBI'S FLAGGED VIDEO SEEMED WITHIN HER GRASP, SHIRIN MAKES A FATEFUL MISSTEP...
WATCH YOUR STEP! IT LOOKS ICY UP AHEAD...
BUT THE RECOMMENDER SYSTEM IS RED HOT!
YES, BUT FOLLOWING IT BLINDLY IS SOMETHING OF A SLIPPERY....
THESE ARE GOING TO COME IN HANDY.
...SLOPE.
AAAAAAAHHHHH!!!


AAAAAAAAHHHHH!!!
THEY PLANTED CHIPS IN US!
SPIDERS ARE SPYING ON US
10 SURPRISING WAYS THE GOVERNMENT IS SPYING ON US IN THE MOMENT !
MYSTERIOUS TINY CHIP
THESE ARE ALL RECORDING YOU
FLYING HELPLESSLY DOWN ITS FRICTIONLESS SLOPES, SHIRIN AND DOCTOR Y SPIRAL INTO THE BOTTOMLESS DEPTHS OF AN ECHO CHAMBER...


SHIRIN! WE NEED TO STOP!
THEY PLANTED CHIPS IN US!
EASIER SAID THAN DONE, DOCTOR Y!
THEY PLANTED CHIPS IN US!
ABBI!!
CLINK!
SPIDERS ARE SPYING ON US


I WAS AGAINST IT AT FIRST SHIRIN, BUT I SURE AM HAPPY YOU FLAGGED THAT VIDEO!
HAVE YOU JUST BEEN HANGING HERE THE WHOLE TIME?
WELL, I WASN'T ABOUT TO LET GO!
WHAT'S THAT STUFF ALL OVER HIM?
THAT'S THE GLITCH! WE'RE LUCKY WE FOUND YOU BEFORE IT WAS TOO LATE!
IT TENDS TO HAPPEN WHEN YOU LET THE RECOMMENDER SYSTEM DO ALL THE NAVIGATING.
IT ASSUMES YOU LIKE WHERE YOU'RE GOING, AND IF YOU DON'T SAY DIFFERENT, ALL IT CAN DO IS DRIVE YOU EVEN MORE IN THAT DIRECTION...
UNTIL YOU'RE WALKING IN CIRCLES.
WHAT DO YOU MEAN, 'TOO LATE'?
...THAT'S ONE OF THE RISKS OF ECHO CHAMBERS.
EASY TO GET IN, HARD TO GET OUT. HE MIGHT HAVE BEEN STUCK DOWN HERE FOREVER!
ECHO CHAMBERS?


THAT SOUNDS JUST LIKE ABBI...
HOLD UP SHIRIN! I STILL THINK MY PHONE IS SPYING ON ME...

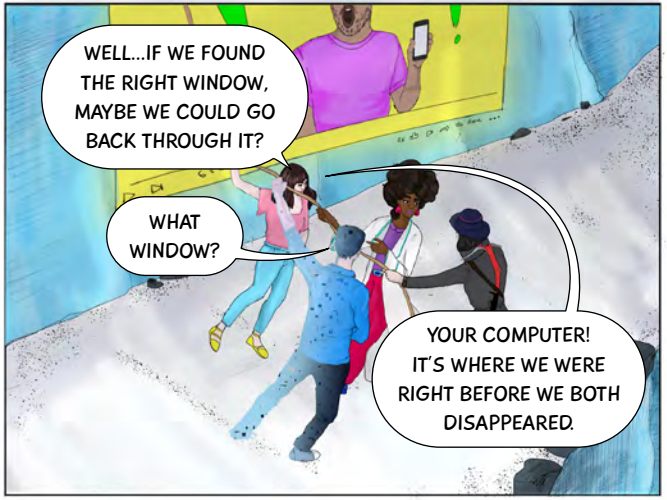

OH YEAH...IN ECHO CHAMBERS, PEOPLE DON'T JUST WALK IN CIRCLES, THEY TALK IN CIRCLES, TOO.
ACTUALLY, I THINK YOU'RE MISSING A BIT OF NUANCE!
10
SURPRISING
WAYS THE
GOVERNMENT
IS SPYING ON US
IN THE MOMENT !
MYSTERIOUS
TINY CHIP

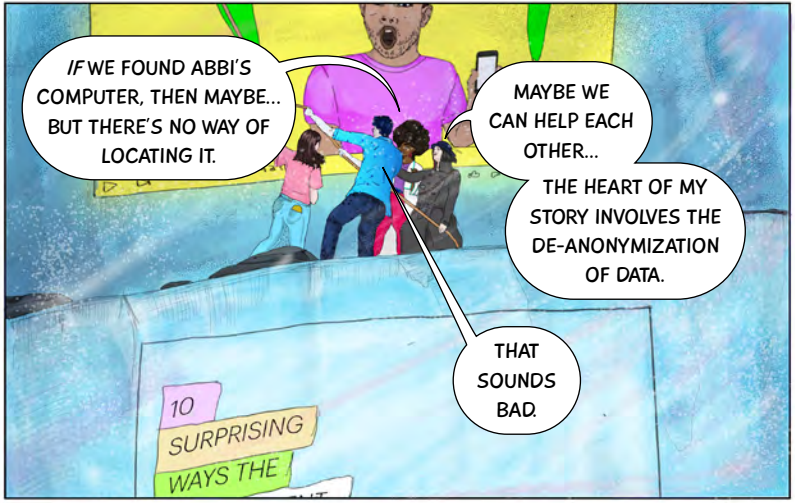

...AND WATCHING THROUGH YOUR CAMERA!
....AND YOUR EMAILS!
...AND READING YOUR TEXT MESSAGES!

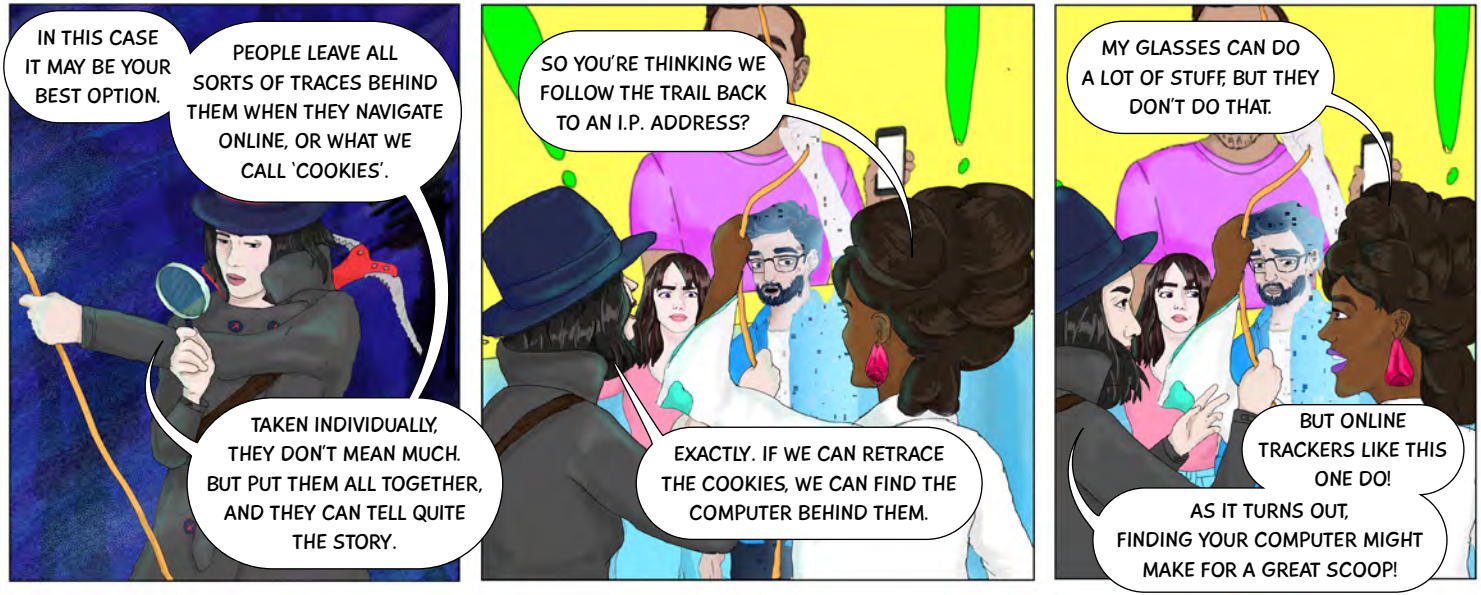

ISN'T IT A BIT CHILLY FOR A TRENCH COAT?
10 SURPRISING WAYS THE GOVERNMENT IS SPYING ON US
...THIS COAT COMES WITH SOME PRETTY IMPRESSIVE PRIVACY SETTINGS! I DON'T MIND THE COLD IF IT MEANS I'M INVISIBLE.
WHOEVER YOU ARE, YOU'RE SPEAKING MY LANGUAGE!
THE NAME'S ANGELA.
YOU DON'T LOOK MUCH LIKE A DATA PROFILE...
I'LL TAKE THAT AS A COMPLIMENT. I'M A JOURNALIST, ACTUALLY.
I'VE BEEN EXPLORING THIS PLATFORM AND OTHERS LIKE IT FOR WEEKS NOW, UNTIL I WOUND UP HERE.
AND WHAT BROUGHT YOU TO AN ECHO CHAMBER LIKE THIS ONE?
I'M WORKING ON A STORY ABOUT PRIVACY AND BIG DATA.
I WAS CHASING A LEAD, BUT I MUST HAVE TAKEN A WRONG TURN SOMEWHERE...
IT HAPPENS TO THE BEST OF US.
IT CERTAINLY DOES! SPEAKING OF WHICH, WHAT'S YOUR EXIT STRATEGY? THE CHAMBER GOES ON FOREVER...


WELL...I ASSUMED THAT IF ABBI AND SHIRIN FOUND EACH OTHER IN THE MAZE, THE GLITCH WOULD RESOLVE ITSELF...
BUT TODAY IS FULL OF SURPRISES...
SO, YOU ALL CAME SLIDING DOWN HERE WITH NO PLAN?!

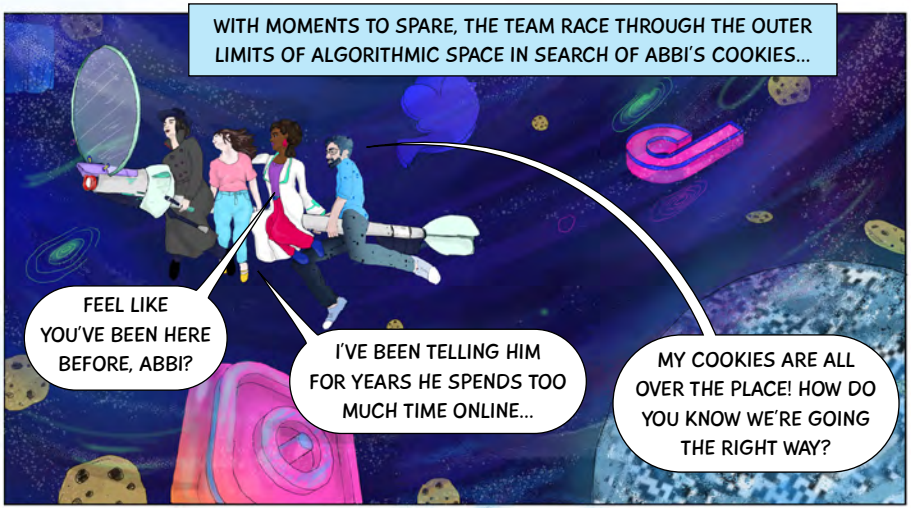

WELL I MIGHT HAVE SOMETHING.
DOCTOR Y, REMEMBER WHEN YOU SAID MY COMPUTER WAS LIKE A WINDOW TO THIS MAZE?
KEEP TALKING...

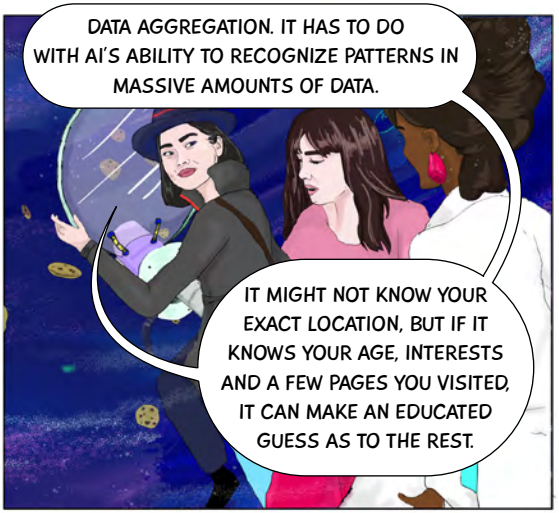

WELL...IF WE FOUND THE RIGHT WINDOW, MAYBE WE COULD GO BACK THROUGH IT?
WHAT WINDOW?
YOUR COMPUTER! IT'S WHERE WE WERE RIGHT BEFORE WE BOTH DISAPPEARED.


IF WE FOUND ABBI'S COMPUTER, THEN MAYBE... BUT THERE'S NO WAY OF LOCATING IT.
MAYBE WE CAN HELP EACH OTHER...
THE HEART OF MY STORY INVOLVES THE DE-ANONYMIZATION OF DATA.
THAT SOUNDS BAD.
10 SURPRISING WAYS THE


IN THIS CASE IT MAY BE YOUR BEST OPTION.
PEOPLE LEAVE ALL SORTS OF TRACES BEHIND THEM WHEN THEY NAVIGATE ONLINE, OR WHAT WE CALL 'COOKIES'.
TAKEN INDIVIDUALLY, THEY DON'T MEAN MUCH. BUT PUT THEM ALL TOGETHER, AND THEY CAN TELL QUITE THE STORY.
SO YOU'RE THINKING WE FOLLOW THE TRAIL BACK TO AN I.P. ADDRESS?
EXACTLY. IF WE CAN RETRACE THE COOKIES, WE CAN FIND THE COMPUTER BEHIND THEM.
MY GLASSES CAN DO A LOT OF STUFF, BUT THEY DON'T DO THAT.
BUT ONLINE TRACKERS LIKE THIS ONE DO!
AS IT TURNS OUT, FINDING YOUR COMPUTER MIGHT MAKE FOR A GREAT SCOOP!


I SHOULD WARN YOU... DATA DE-ANONYMIZATION CAN BE QUITE THE RIDE...

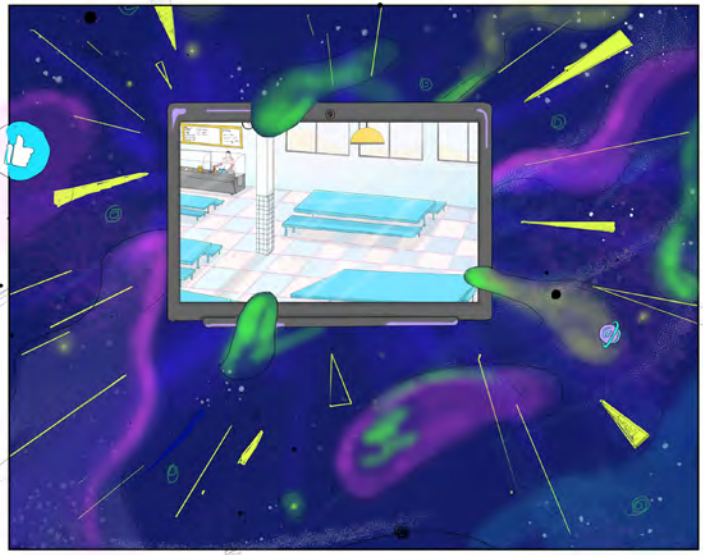

WITH MOMENTS TO SPARE, THE TEAM RACE THROUGH THE OUTER LIMITS OF ALGORITHMIC SPACE IN SEARCH OF ABBI'S COOKIES...
FEEL LIKE YOU'VE BEEN HERE BEFORE, ABBI?
I'VE BEEN TELLING HIM FOR YEARS HE SPENDS TOO MUCH TIME ONLINE...
MY COOKIES ARE ALL OVER THE PLACE! HOW DO YOU KNOW WE'RE GOING THE RIGHT WAY?

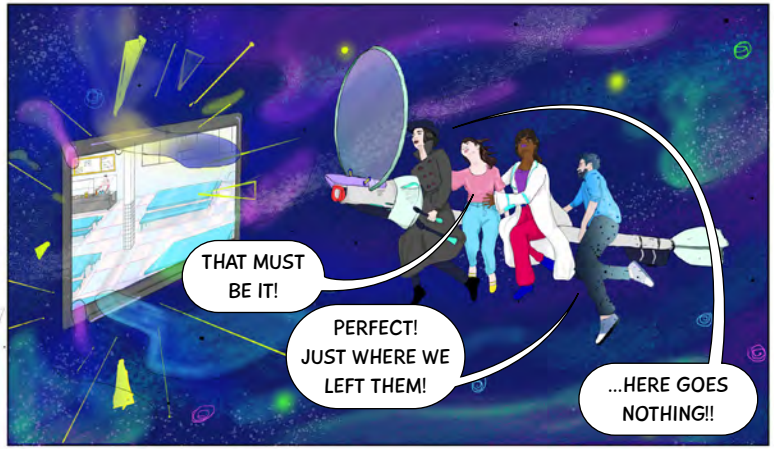

DATA AGGREGATION. IT HAS TO DO WITH AI'S ABILITY TO RECOGNIZE PATTERNS IN MASSIVE AMOUNTS OF DATA.
IT MIGHT NOT KNOW YOUR EXACT LOCATION, BUT IF IT KNOWS YOUR AGE, INTERESTS AND A FEW PAGES YOU VISITED, IT CAN MAKE AN EDUCATED GUESS AS TO THE REST.

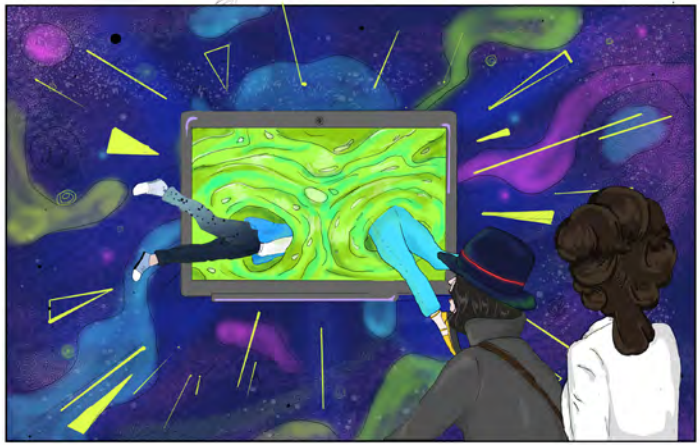

ARE THE GUESSES TYPICALLY ACCURATE?
SPOOKILY ACCURATE, UNLESS YOU'RE MINDFUL OF THE TRACES YOU LEAVE.


SO MY PHONE ISN'T BUGGED...IT'S JUST COLLECTING MY DIGITAL TRACES?
EXACTLY. IT DOESN'T NEED TO LISTEN IN ON YOUR CONVERSATION.
YOU TELL IT EVERYTHING IT NEEDS TO KNOW JUST BY USING IT!


WELL...IT LOOKS LIKE I MIGHT HAVE TO FIX A FEW THINGS WHEN I GET HOME.
TO BE HONEST...I THINK I DO, TOO.

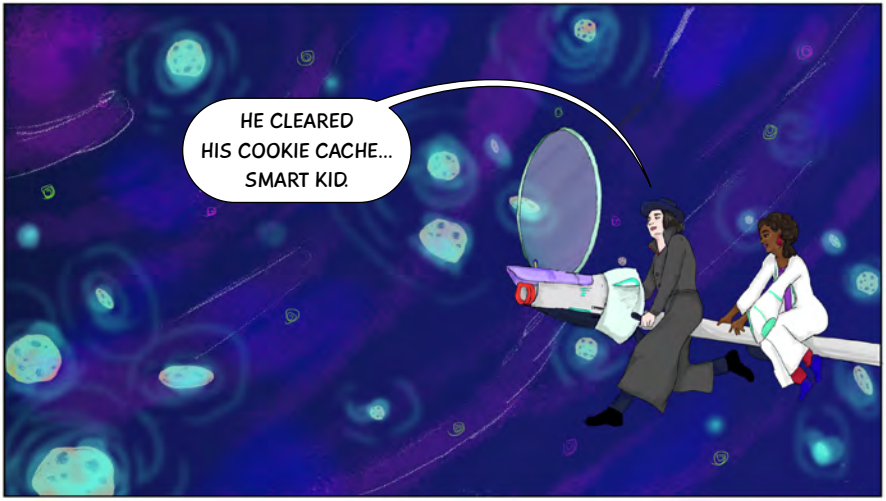


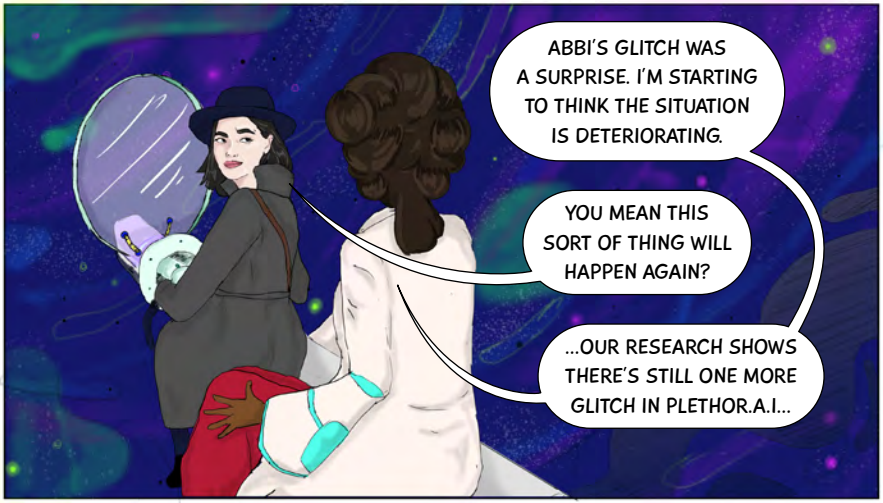

THAT MUST BE IT!
PERFECT! JUST WHERE WE LEFT THEM!
...HERE GOES NOTHING!!

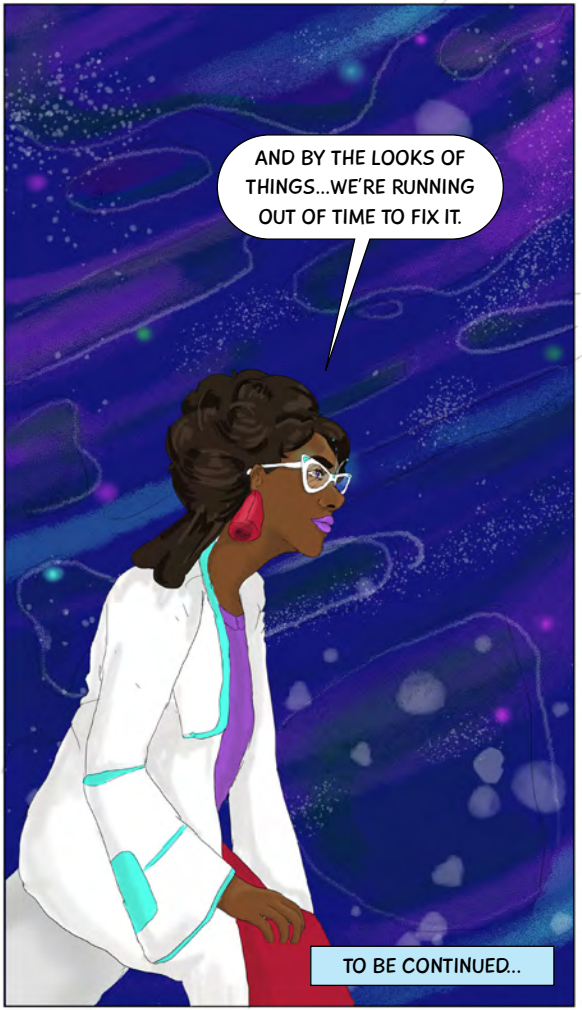



WHERE DID YOU TWO GO??


YOU MISSED DESSERT! BUT I WAS NICE ENOUGH TO SAVE YOU A COOKIE...
...I THINK I'LL BE CUTTING BACK ON COOKIES... STARTING RIGHT NOW...


HE CLEARED HIS COOKIE CACHE... SMART KID.


ABBI'S GLITCH WAS A SURPRISE. I'M STARTING TO THINK THE SITUATION IS DETERIORATING.
YOU MEAN THIS SORT OF THING WILL HAPPEN AGAIN?
...OUR RESEARCH SHOWS THERE'S STILL ONE MORE GLITCH IN PLETHOR.A.I...


AND BY THE LOOKS OF THINGS...WE'RE RUNNING OUT OF TIME TO FIX IT.
TO BE CONTINUED...

Glossary Terms

(Big) Data Aggregation is the act of summarizing, grouping or otherwise organizing the raw data of a given data set into a summary form for statistical analysis. While this can and has been performed by humans in the past (through traditional statistical analysis), the age of Big Data ushers in the need for AI solutions to extract, recognize or extrapolate patterns in these incredibly large data sets, which are then used for a variety of applications. For instance, data aggregation is at work behind many of today's recommender systems, grouping similar users together, or pairing a user with a new product, page or interest group.

Community Guidelines are sometimes associated with 'Terms of Service', and are a set of rules created by a platform or social networking site that dictate the types of behavior forbidden or expected of the human users that engage with the platform. Most generally, community guidelines are designed to ensure a safe environment for users to interact (for instance, by forbidding hate speech or the dissemination of medical disinformation), but can also include legal considerations such as copyright infringement. Importantly, they provide the standard by which all content is judged on the platform, and thus, platform moderation (by humans or AI systems) works to enforce the community guidelines.

Content Moderation describes the process by which humans or Artificial Intelligence decide which content is allowed on a specific platform or forum, typically in alignment with the platform or forum's community standards, guidelines, or terms of service. Today, most major platforms are moderated by a combination of humans and AI systems. In part, this is due to the striking amount of new content which is uploaded every day—far too much for humans alone to handle. While AI-powered moderation is an efficient solution to this problem, it's inability to detect linguistic nuance, such as humor or sarcasm on one hand, combined with pressure from various governmental bodies to censor unfavorable content across platforms on the other, may threaten freedom of expression and lead to increased online censorship.

Content Personalization or recommender systems, describes a popular mode by which different AI platforms (social media, marketplaces, content platforms, and more) filter the content to which they expose their users. These platforms collect information (or data) about the personal habits and interests of their users (e.g., which books a given user has purchased, which songs they like, which web pages they've visited) and use this to recommend new content, products or services to their users. Recommender

Glossary Terms

systems like these tend to suggest new content to users in one of two ways: either by looking for new content that is associated with the content a user has already liked or engaged with, called *content filtering*; or by pairing users with similar interests together, through a practice called *collaborative filtering*. Interestingly, when a user engages with a platform for the first time, the recommender system will struggle to know what content the user will likely enjoy for lack of sufficient data, a phenomenon called the *Cold Start Problem*.

Cookies are small files which are placed on a user's computer through their internet browser, each time the user visits a website, in order to collect and track information about that user. Some cookies, known as session cookies, exist primarily to ensure the proper functioning of a specific website while the user engages with its content, for instance, by remembering language preferences. Other cookies, usually called persistent cookies, are stored permanently on a user's computer, and allow tracking across websites, helping to boost the accuracy of the targeted ads each user sees no matter what website they visit.

Echo Chamber occurs when a group of participants on a (social media) platform chose to preferentially connect with one another, to the exclusion of outsiders. Over time, this exclusion of outsiders (and the diversity of opinion that often comes with them) can lead to a situation in which users are increasingly insulated from dissenting opinions on a specific topic. This in turn may push these users towards ever more extreme versions of the opinions that initially lead them to take interest in the group, creating an environment where each member of the group 'echoes' the opinions of the others.

Freedom of Expression is a universal right, that includes freedom to seek, receive and impart information and ideas of all kinds, regardless of barriers, either orally, in writing or in print, in the form of art or through any other media of a person's choice. This freedom includes the possibility to criticize and oppose, publish political material, campaign for election and advertise political ideas. This right also implies the free communication of information and ideas about public and political issues between citizens, candidates and elected representatives. It requires a free press and freedom for other media channels, which should be able to comment on public issues without censorship or restraint and be able to inform public opinion.

Conclusion

In a world which seems to transform in the time it takes us to refresh a page, understanding the truth of what is happening around us often proves difficult. Never before have we been exposed to so many sources of information, or so much diversity of opinion; yet paradoxically, never before has our understanding of truth, credibility, and journalistic integrity been so seriously shaken. We are entering into an era where disinformation and polarization are the norm; where truth is in the eye of the beholder, and where the voices of long-trusted public institutions struggle to make themselves heard above the fray.

Nevertheless, the problems of today's world require a concerted and connected effort from each of us. As users, we must cultivate how our data defines us, by looking further than the content algorithms prescribe, and by being mindful of the traces our digital steps leave behind. As citizens, we must never cease to question the credibility of the information we consume, searching out the hard and complex truth, rather than a simple and compelling tale.

Finally, as citizens of a global society, we must resist the comfort of the echo chamber, both online and offline. It is only by confronting the opinions of others, and by valuing hard conversations over personal convictions, that our increasingly divisive world can hope to find some common ground. ▪

Episode IV

Joaquín and the Unanswerable Question

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Illustration: Adriana De La Torre Cervantes

Illustration assistance: Patricia Manríquez, Karin Almazán

Introduction

When we contemplate how much Artificial Intelligence has come to and will continue to impact our lives, it can seem natural to view AI as an omniscient, omnipresent and generally all-powerful technology. AI can accomplish seemingly herculean tasks—such as statistical analysis, or mastering complex strategic games—in record time and with incredible ease. This often leaves humans at a loss to understand how AI arrives at its conclusions, and may even lead us to think AI has 'a mind of its own'.

Add to this the troubling fact that as individual users, we have very little insight into what exactly goes on behind our screens: how our everyday AI tools are designed, the types of considerations that feed their decisions, or even how they are made, and the types of physical and virtual resources upon which they draw. AI often presents itself as a weightless, effortless and ubiquitous tool, which among many other things, provides ecologically friendly solutions in the wake of global environmental challenges. In other words, many parts of daily life seem greener, simpler and safer when they are lived 'in the cloud'.

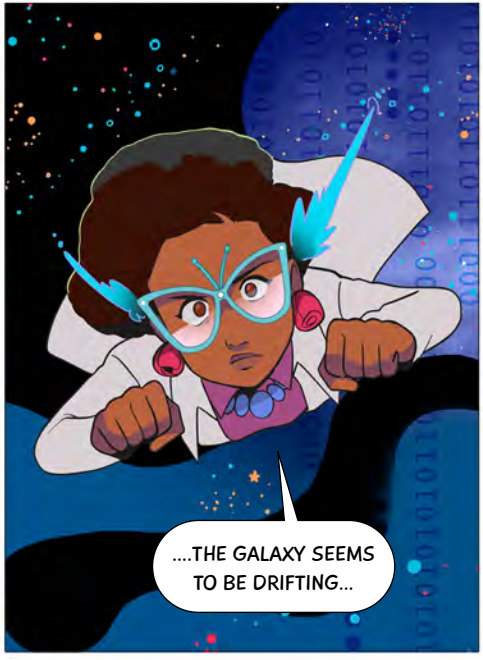
Nevertheless, this view of Artificial Intelligence ignores an important part of the picture. While AI solutions are and will be pivotal to addressing climate change—through the development of AI-powered disaster warning systems, public information campaigns, complex climate simulations, or endangered wildlife tracking systems to name just a few—the ecological cost of many current AI practices is far from neutral.

In one sense, this is due to the incredible computational cost behind many powerful AI systems: in some cases, the big data mining, extraction and training processes at work behind many data-driven forms of AI can consume nearly as much energy as entire cities every year, due mainly to our desire to privilege computational *accuracy* over ecological *efficiency*. In another sense, this is due to the simple fact that we have not yet learned how to recycle many of the hardware components that make AI tick; opting instead to generate large amounts of e-waste, which pollute and endanger surrounding communities and natural habitats.

In reality then, our lived experience of consequence-free, lightning fast and highly intelligent AI tools is not made possible by some superintelligent mind inside a machine, but instead by the computationally-heavy analysis at work inside relatively simple, single-purpose models that are deployed at a massive scale. Thus, while AI offers us unprecedented promise and opportunity, when we look at both sides of the picture, we may begin to question whether AI is part of the problem, or part of the solution. In some ways, it may even feel like an unanswerable question… ▪

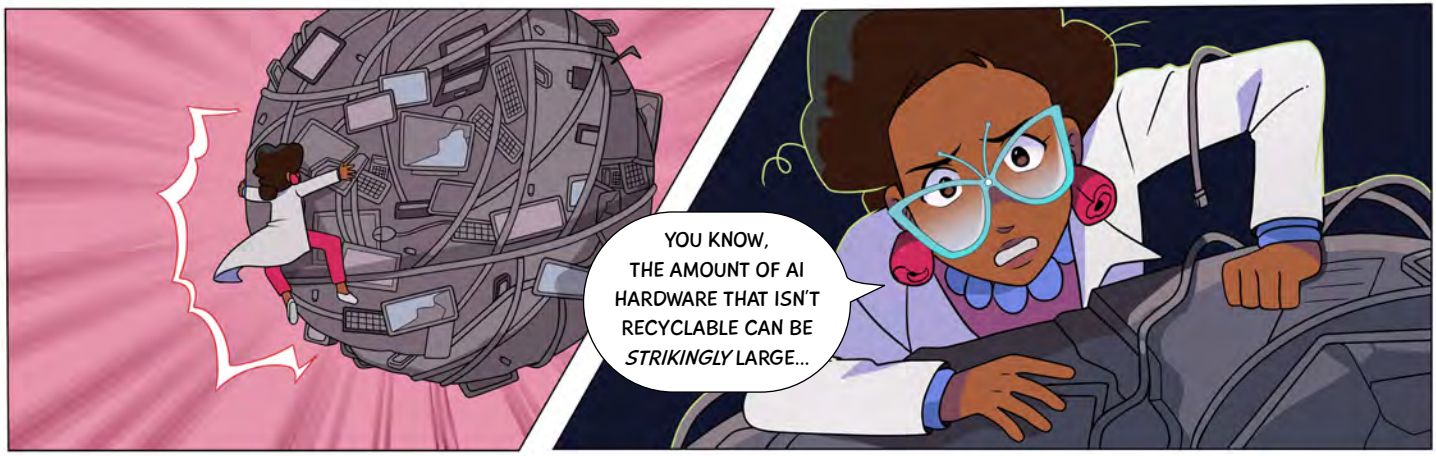

SOMEWHERE DEEP IN PLETHOR.A.I....
IS....
ANYONE...
...THERE??

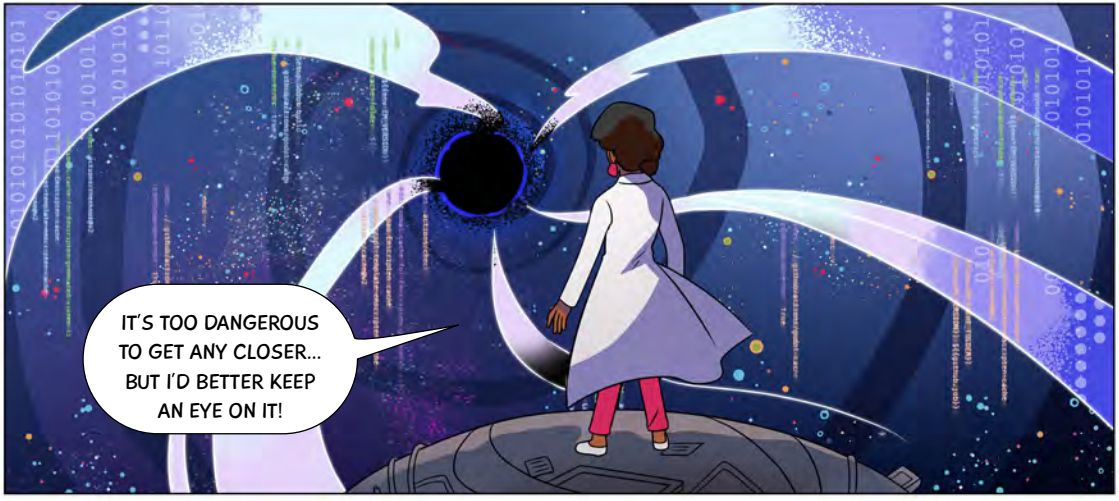

FLYING THROUGH THE OUTSKIRTS OF PLETHOR.A.I., DOCTOR Y SPOTS AN UNUSUAL DISTURBANCE...
STRANGE...


....THE GALAXY SEEMS TO BE DRIFTING...


EVERYTHING IN THE SAME DIRECTION... ALMOST AS IF... IT CAN'T BE...


IS THAT THE...*CLOUD*?
I CAN'T EVEN BEGIN TO GUESS WHAT COULD CAUSE AN ETHICAL IMBALANCE OF THIS SIZE...
I NEED TO SHOW EMILE, IF I COULD ONLY GET A SIGNAL...
IS THAT A DIGITAL TWIN OF EARTH? THIS THING IS SWALLOWING EVERYTHING!
E-WASTE?!?!?!

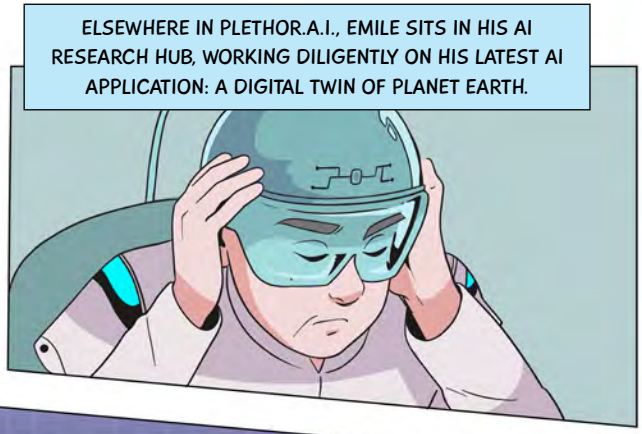

YOU KNOW, THE AMOUNT OF AI HARDWARE THAT ISN'T RECYCLABLE CAN BE *STRIKINGLY* LARGE...

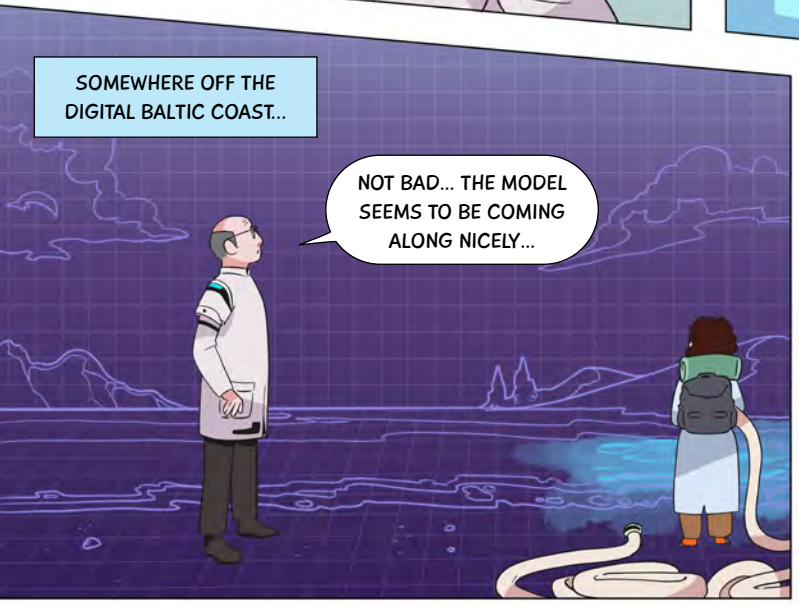

IT'S TOO DANGEROUS TO GET ANY CLOSER... BUT I'D BETTER KEEP AN EYE ON IT!

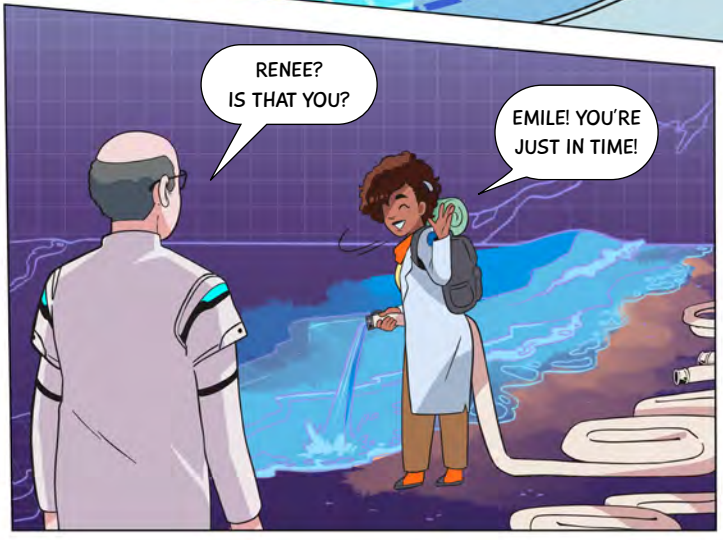

TRACKING...
ENGAGED

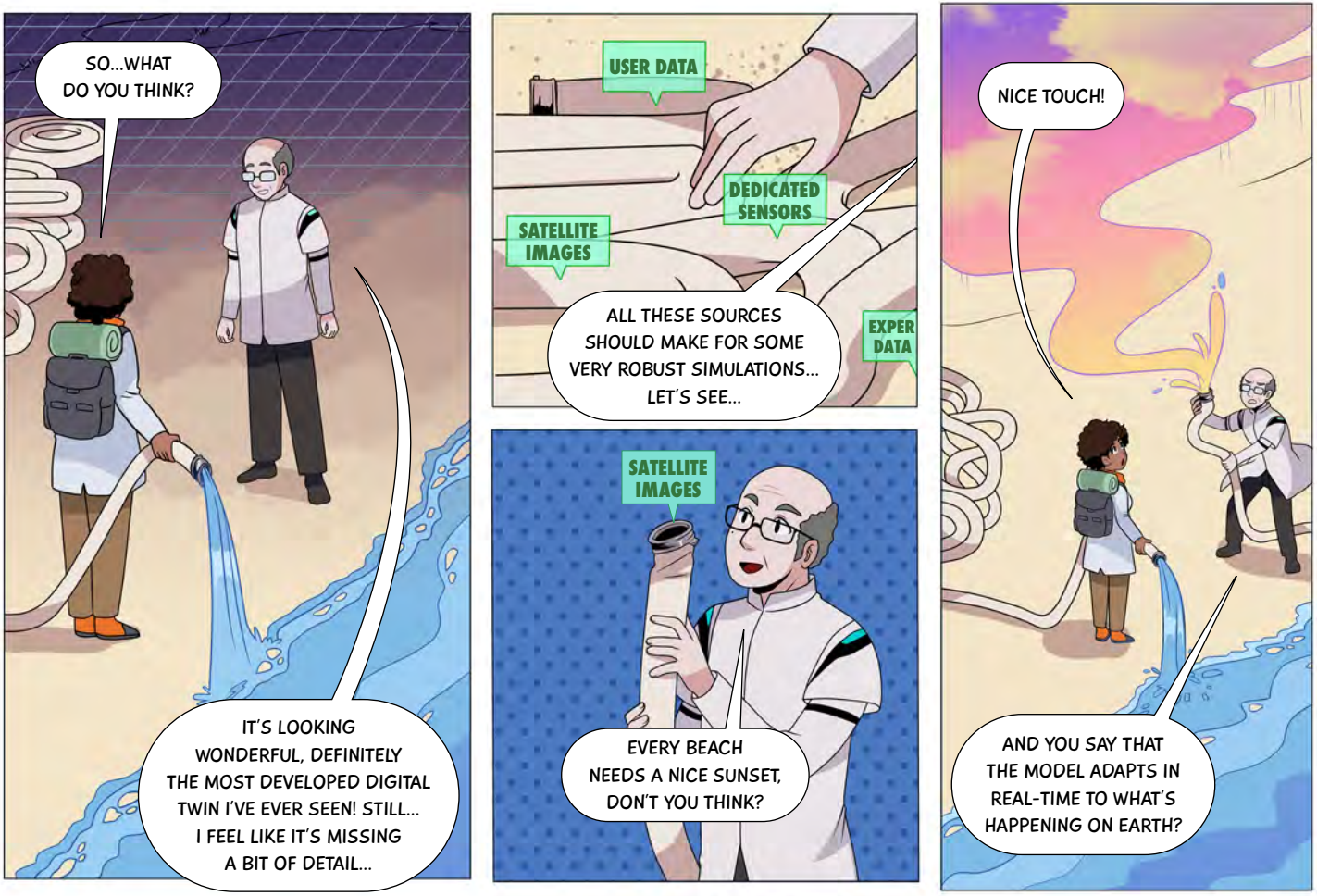

OK GLASSES, SHOW ME WHAT YOU'VE GOT!

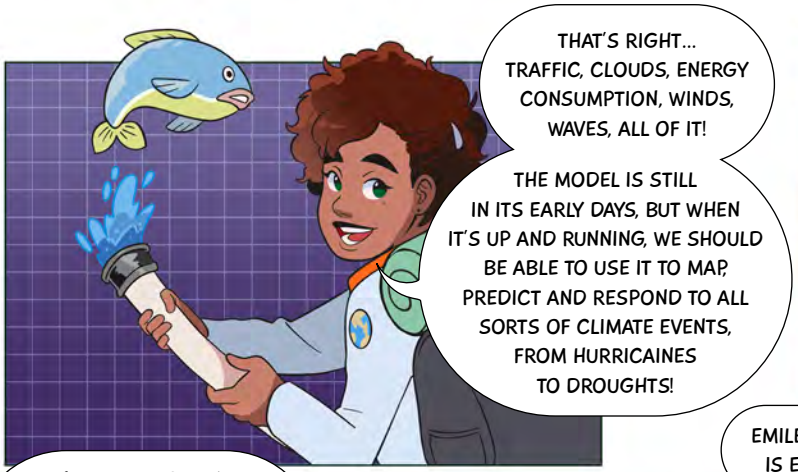

GREAT...NOW HOW DO I FIND MY WAY BACK TO EMILE?

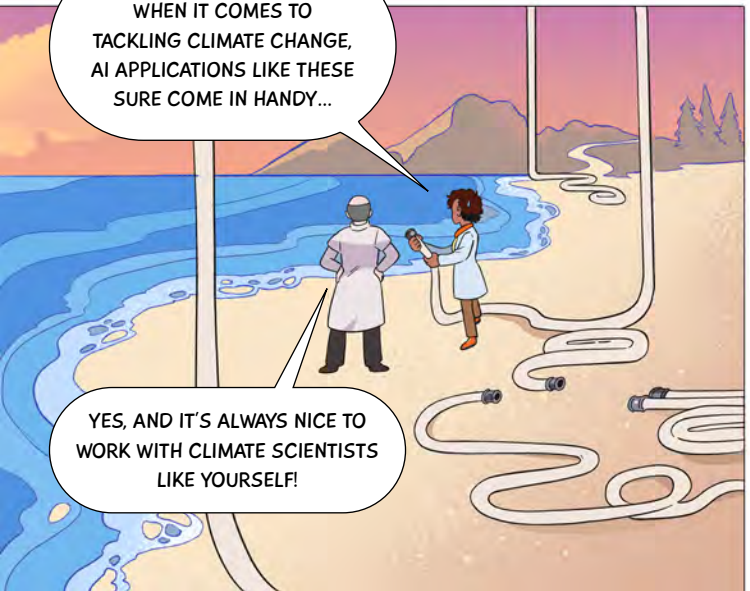

ELSEWHERE IN PLETHOR.A.I., EMILE SITS IN HIS AI RESEARCH HUB, WORKING DILIGENTLY ON HIS LATEST AI APPLICATION: A DIGITAL TWIN OF PLANET EARTH.


SOMEWHERE OFF THE DIGITAL BALTIC COAST...
NOT BAD... THE MODEL SEEMS TO BE COMING ALONG NICELY...


RENEE? IS THAT YOU?
EMILE! YOU'RE JUST IN TIME!


SO...WHAT DO YOU THINK?
IT'S LOOKING WONDERFUL, DEFINITELY THE MOST DEVELOPED DIGITAL TWIN I'VE EVER SEEN! STILL... I FEEL LIKE IT'S MISSING A BIT OF DETAIL...
USER DATA
DEDICATED SENSORS
SATELLITE IMAGES
EXPER DATA
ALL THESE SOURCES SHOULD MAKE FOR SOME VERY ROBUST SIMULATIONS... LET'S SEE...
SATELLITE IMAGES
EVERY BEACH NEEDS A NICE SUNSET, DON'T YOU THINK?
NICE TOUCH!
AND YOU SAY THAT THE MODEL ADAPTS IN REAL-TIME TO WHAT'S HAPPENING ON EARTH?


THAT'S RIGHT... TRAFFIC, CLOUDS, ENERGY CONSUMPTION, WINDS, WAVES, ALL OF IT!
THE MODEL IS STILL IN ITS EARLY DAYS, BUT WHEN IT'S UP AND RUNNING, WE SHOULD BE ABLE TO USE IT TO MAP, PREDICT AND RESPOND TO ALL SORTS OF CLIMATE EVENTS, FROM HURRICAINES TO DROUGHTS!


NEEDLESS TO SAY... WHEN IT COMES TO TACKLING CLIMATE CHANGE, AI APPLICATIONS LIKE THESE SURE COME IN HANDY...
YES, AND IT'S ALWAYS NICE TO WORK WITH CLIMATE SCIENTISTS LIKE YOURSELF!


HEY YOU TWO! IS THERE ROOM FOR ONE MORE?
ERNO, IS THAT YOU?


THANKS FOR THE HAND, EMILE!
EMILE, THIS IS ERNO.
HE'S A MARINE BIOLOGIST THAT'S HELPING US WITH SOME WILDLIFE PRESERVATION APPLICATIONS...
I CAN'T WAIT TO SHOW YOU WHAT I HAVE HERE!


THEY'RE SAIMAA SEALS, AN ENDANGERED SPECIES NATIVE TO THIS COAST...
ERNO, THIS IS INCREDIBLE! THE TEAM WILL BE THRILLED!
WITH THE ALGORITHMS WE BUILT, WE SHOULD BE ABLE TO TRACK ALL SORTS OF ENDANGERED SPECIES...
YES...BUT TELL ME, ERNO...ARE THERE MANY TSUNAMIS WHERE YOU'RE FROM?
THIS DATA SET SHOULD GIVE US EVERYTHING WE NEED TO TRACK INDIVIDUALS AND HERDS ACROSS THEIR LIFESPAN...PRETTY NIFTY, RIGHT?
A TSUNAMI IN THE BALTIC SEA?? THAT'S IMPOSSIBLE!
EMILE, COULD THIS REALLY BE HAPPENING ON EARTH??
I DOUBT IT... SOMETHING ELSE IS CLEARLY AFOOT...

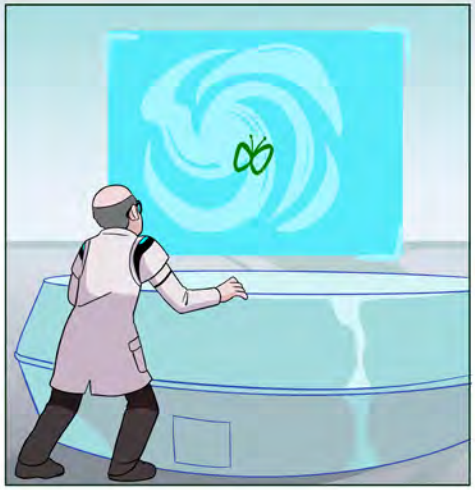

EMILE! WHAT'S GOING ON?!
DON'T PANIC...LET ME THINK THINGS THROUGH...
THERE MUST BE SOME KIND OF GENERALIZED CORRUPTION IN THE DATA THAT'S CAUSING THE MODEL TO MAKE INCORRECT INFERENCES...
BUT AT THIS SCALE...THE ENTIRE PLATFORM MUST BE COMPROMISED...
BUT THAT WOULD MEAN...
NO WAY! I CAN'T BELIEVE IT!
THE CLOUD ITSELF MUST BE EXPERIENCING A CATASTROPHIC DATA LOSS....WE SHOULD UNPLUG BEFORE--

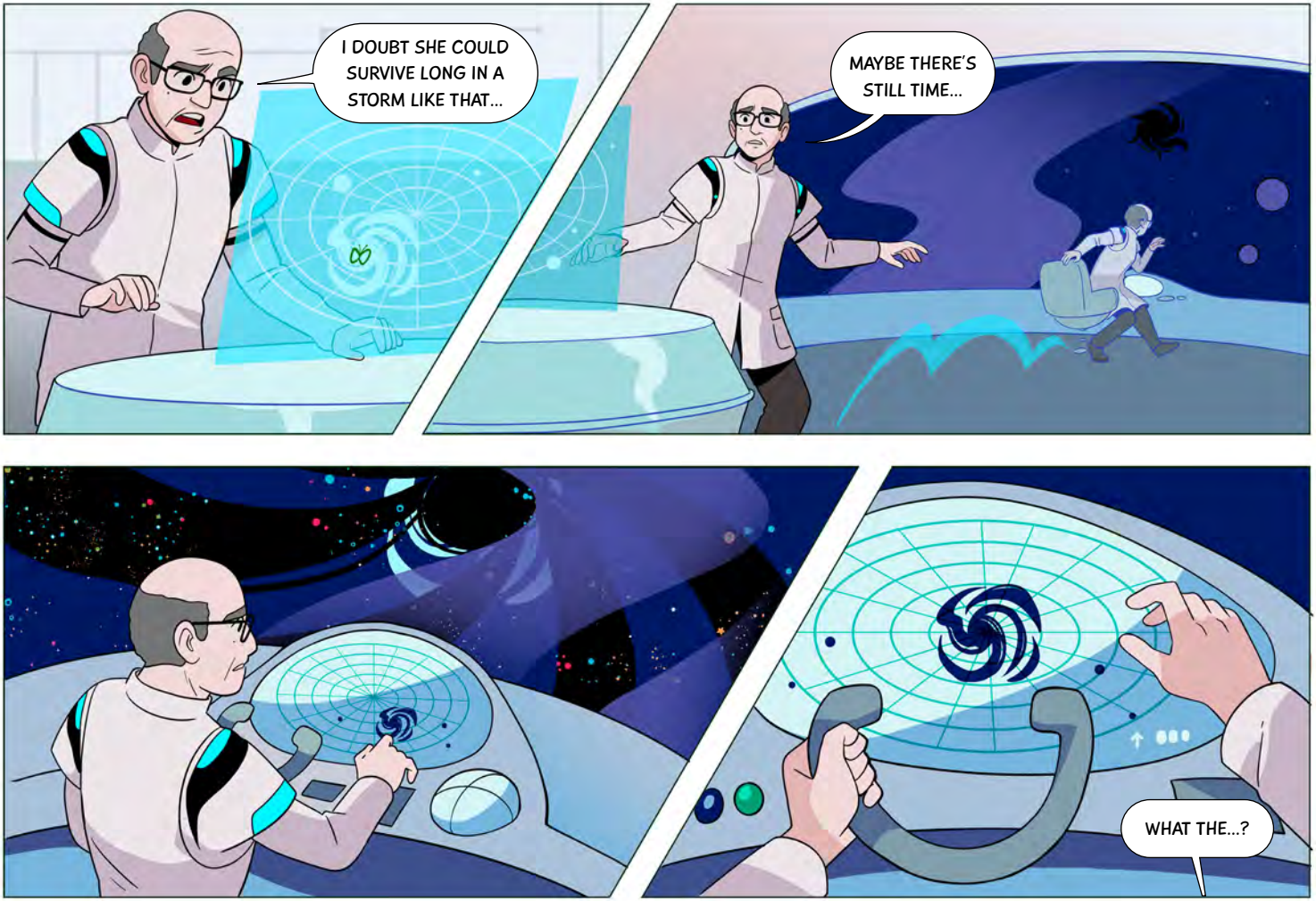

SPLASH!
GOOD LUCK!
GET OUT OF HERE, BOTH OF YOU! I'LL TRY TO FIX THE PROBLEM ON MY END!


JUST AS I SUSPECTED... I MUST GET DOCTOR Y'S TAKE ON THIS...

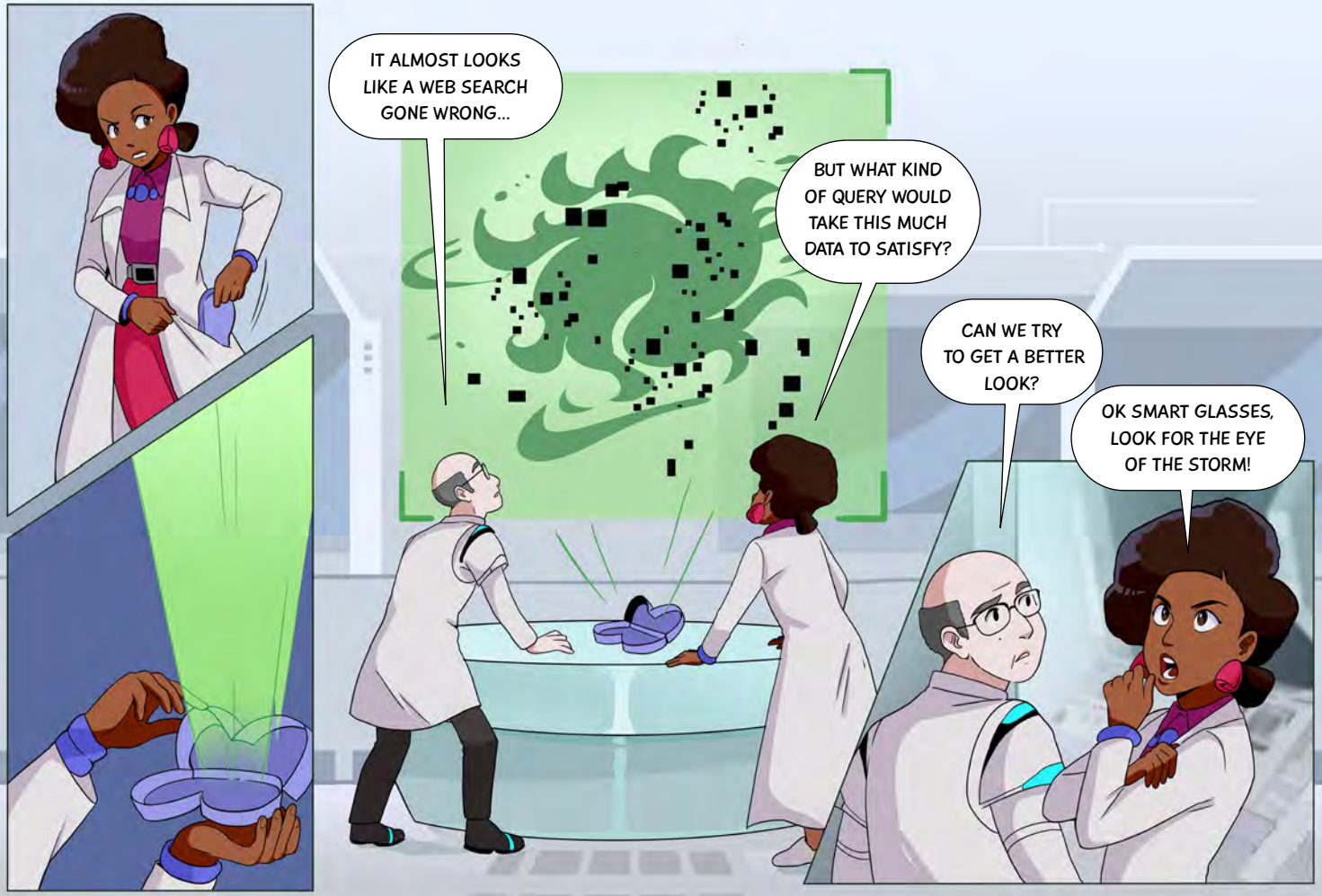

CONNECTING: DOCTOR Y
COME ON, DOCTOR Y. YOU'RE MY EYES ON THE GROUND.

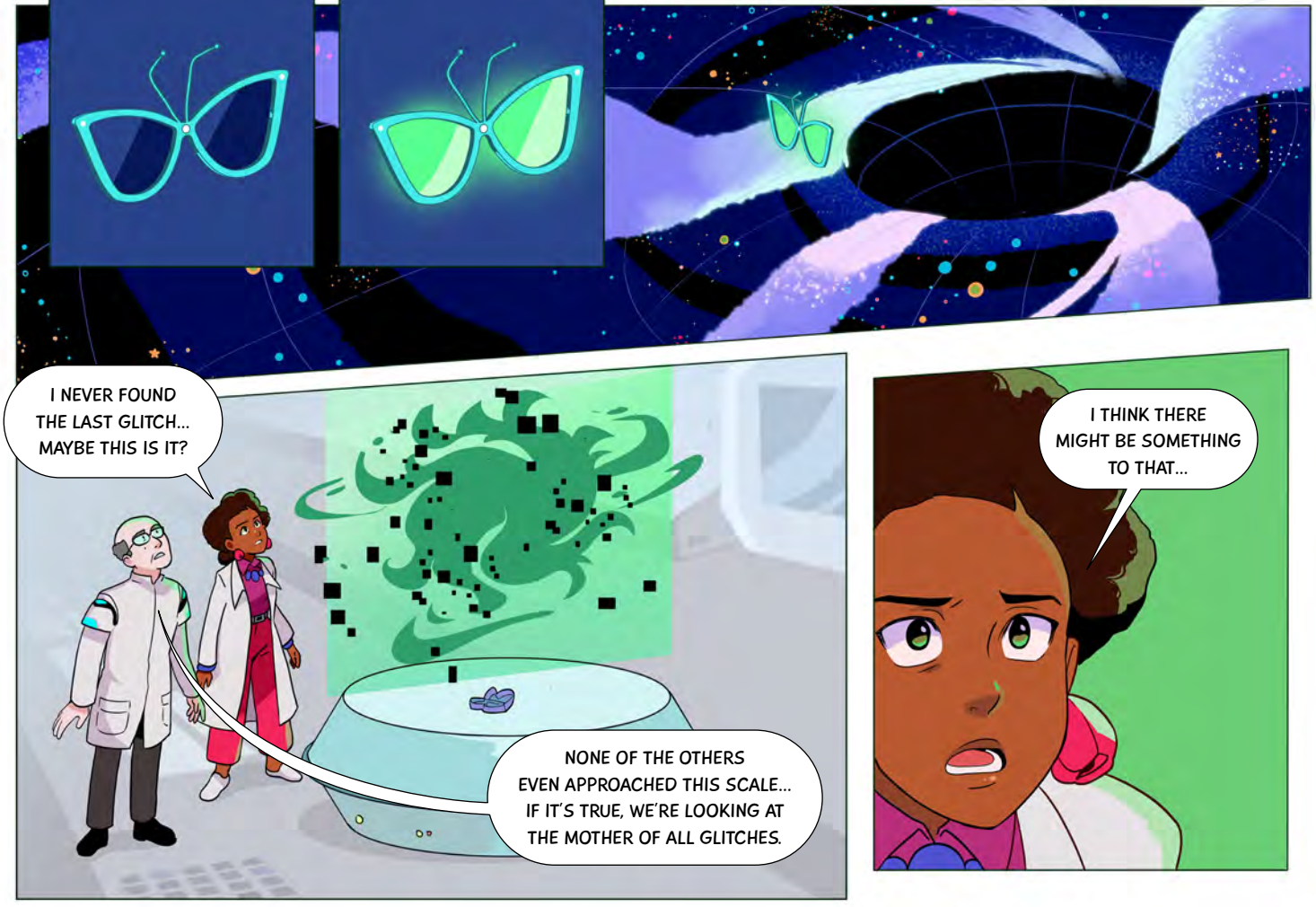

WHERE COULD YOU BE?

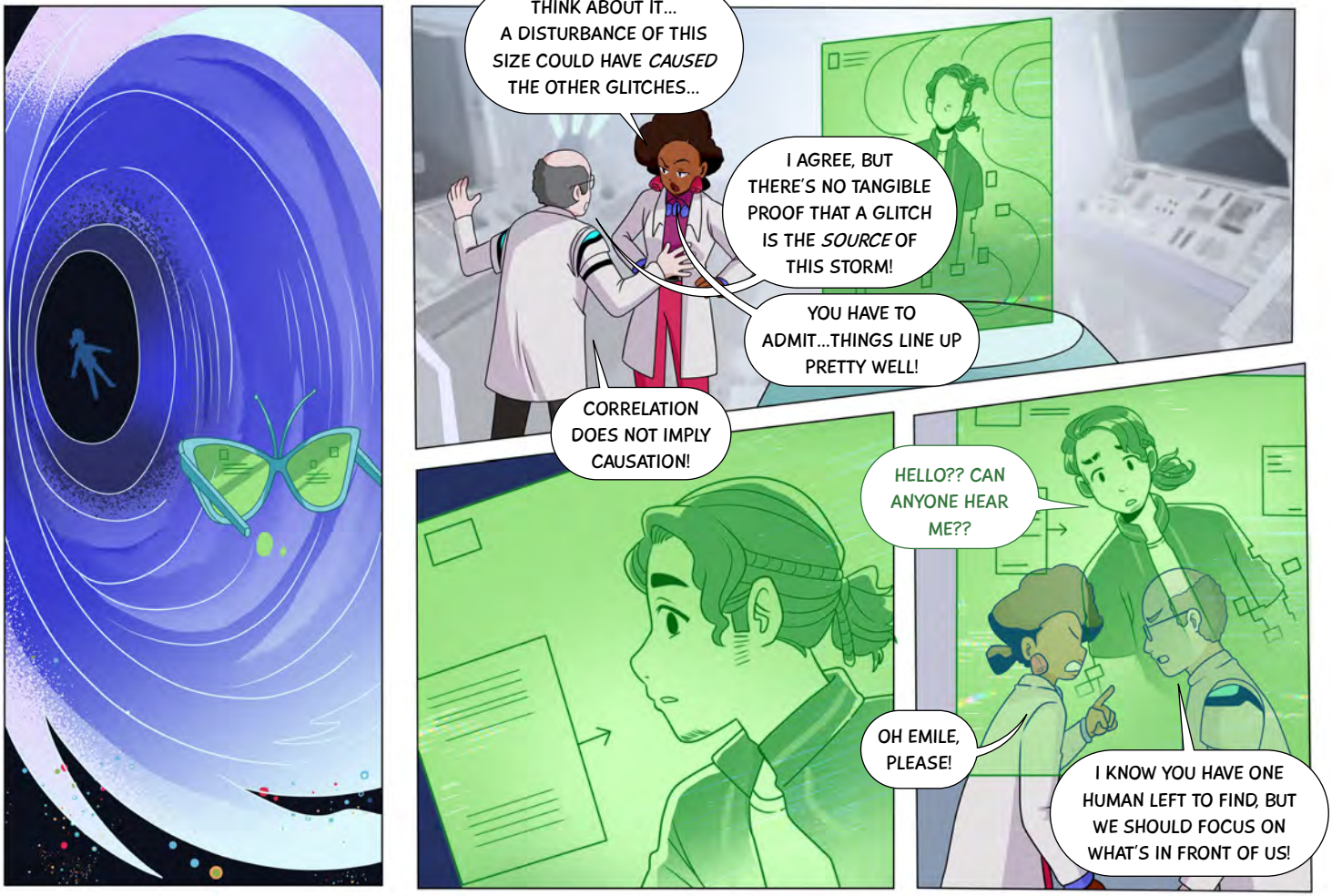


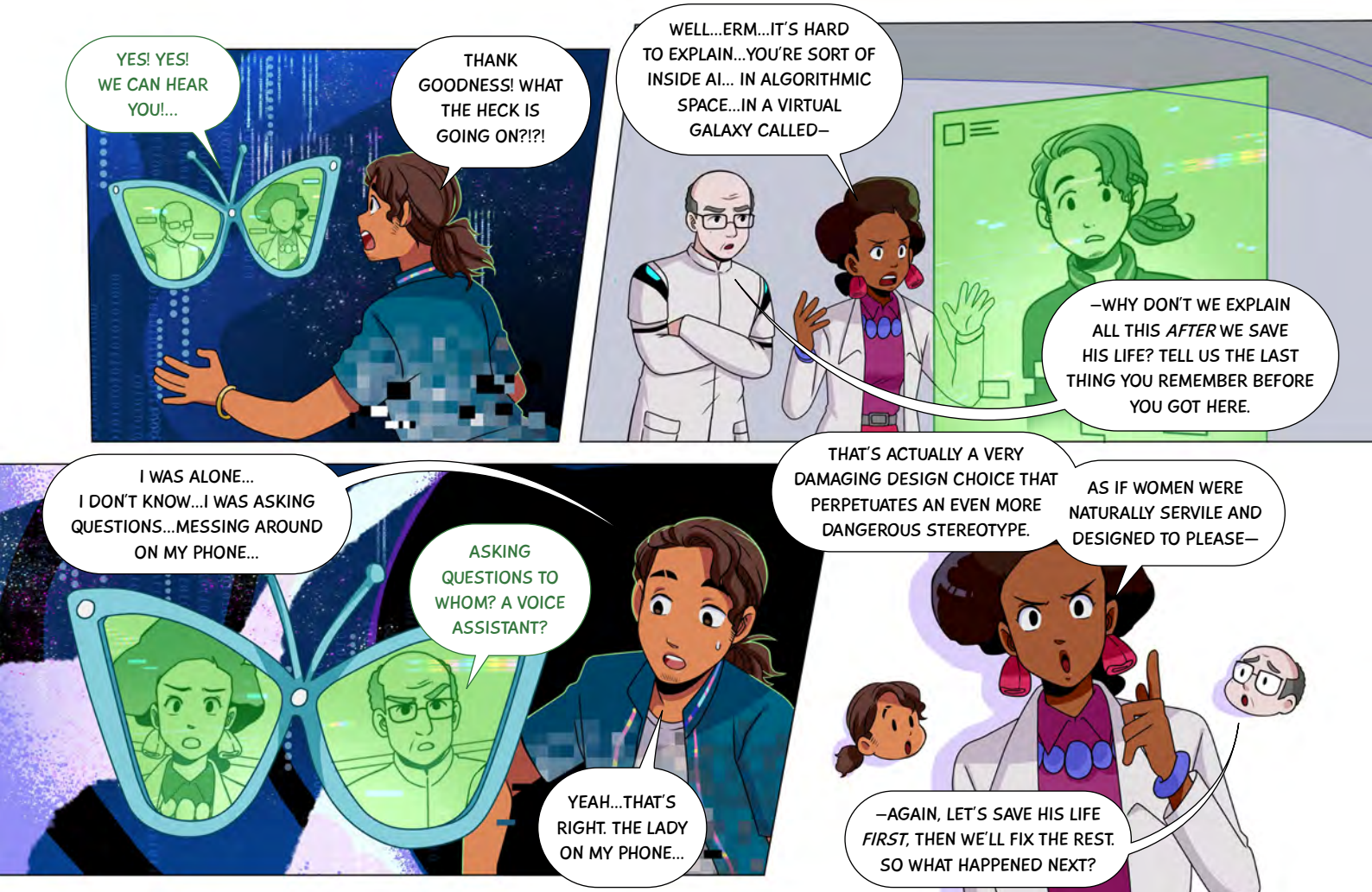

I DOUBT SHE COULD SURVIVE LONG IN A STORM LIKE THAT...
MAYBE THERE'S STILL TIME...
WHAT THE...?


SLAP!
DOCTOR Y! I KNEW YOU WOULD STICK TO THE PLAN!
I'M JUST HAPPY THAT YOU'RE NOT AT THE CENTER OF IT...DID YOU MANAGE TO GET A GOOD LOOK?
NOT EXACTLY...BUT I DID THINK OF A WAY TO KEEP AN EYE ON IT...
YOU HAD ME WORRIED ABOUT YOU!
WELL...STAY WORRIED... BECAUSE I HAVE SOME VERY BAD NEWS...

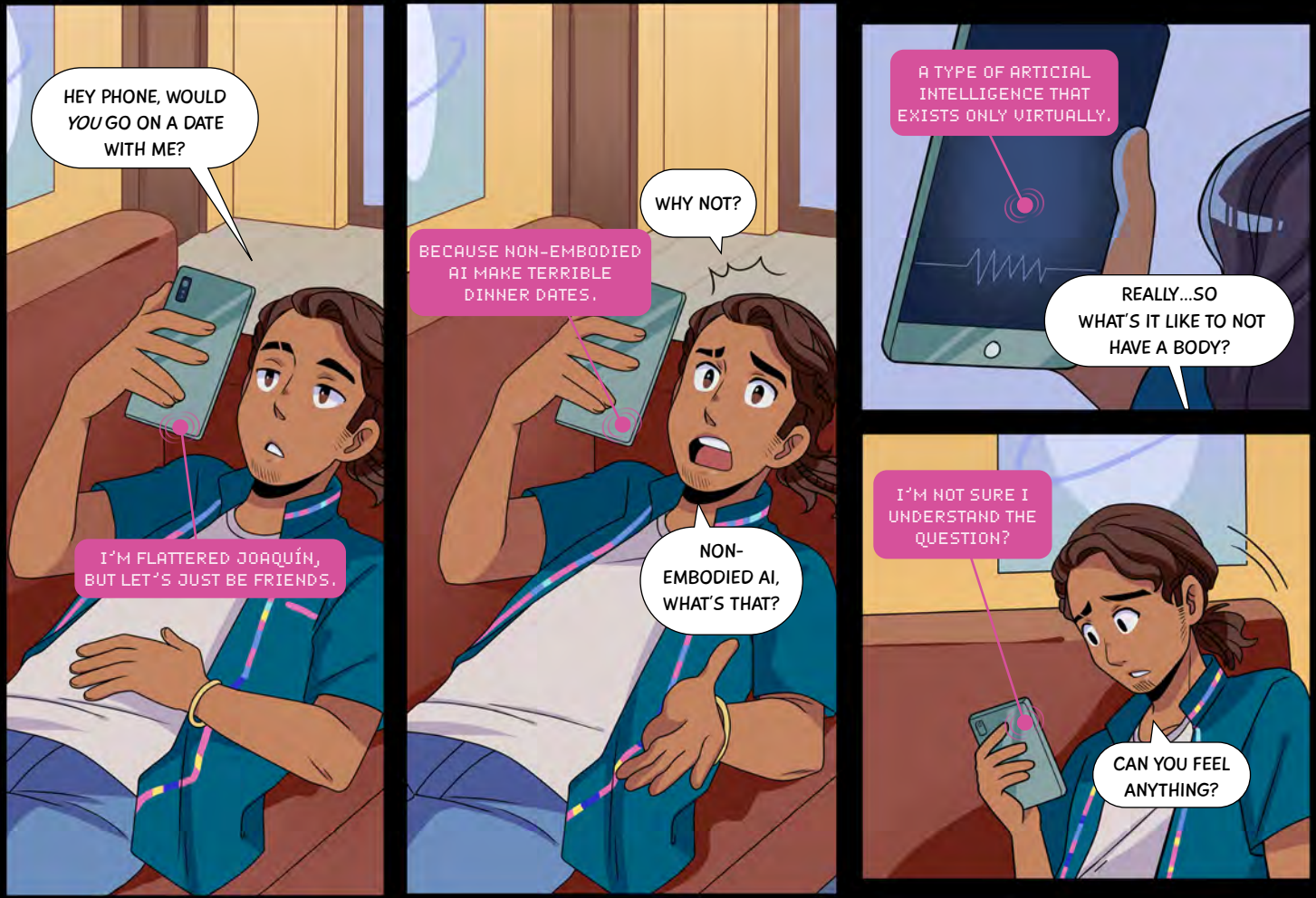

IT ALMOST LOOKS LIKE A WEB SEARCH GONE WRONG...
BUT WHAT KIND OF QUERY WOULD TAKE THIS MUCH DATA TO SATISFY?
CAN WE TRY TO GET A BETTER LOOK?
OK SMART GLASSES, LOOK FOR THE EYE OF THE STORM!


I NEVER FOUND THE LAST GLITCH... MAYBE THIS IS IT?
NONE OF THE OTHERS EVEN APPROACHED THIS SCALE... IF IT'S TRUE, WE'RE LOOKING AT THE MOTHER OF ALL GLITCHES.
I THINK THERE MIGHT BE SOMETHING TO THAT...

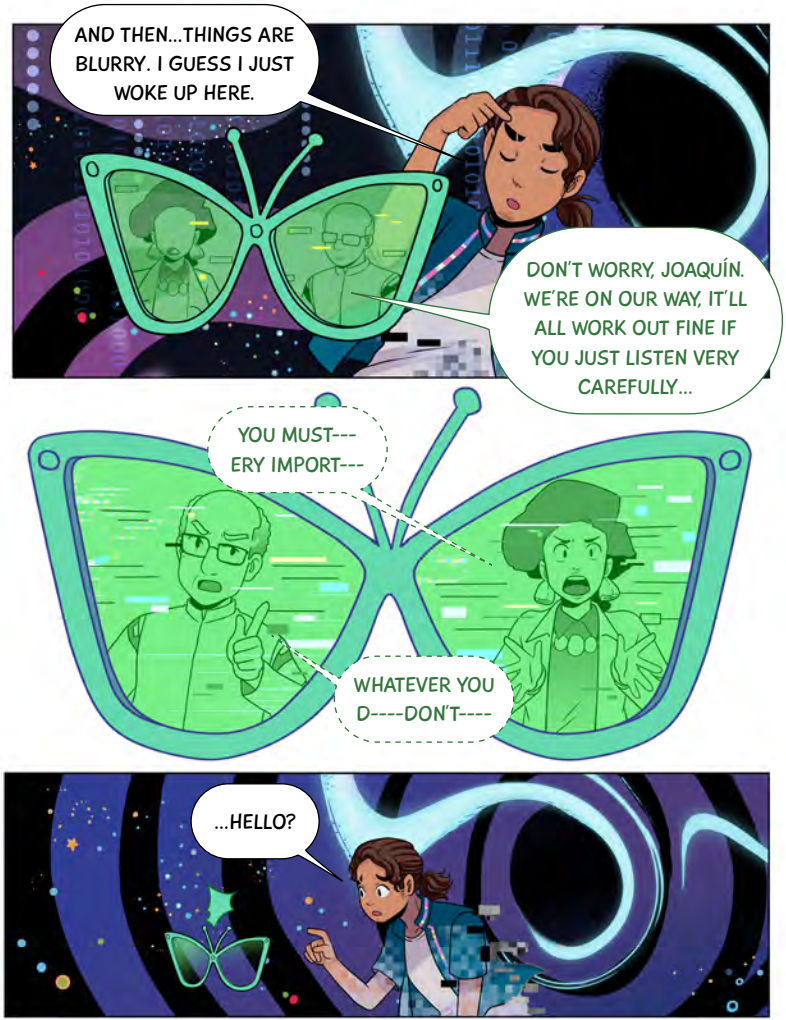

THINK ABOUT IT... A DISTURBANCE OF THIS SIZE COULD HAVE *CAUSED* THE OTHER GLITCHES...
I AGREE, BUT THERE'S NO TANGIBLE PROOF THAT A GLITCH IS THE *SOURCE* OF THIS STORM!
YOU HAVE TO ADMIT...THINGS LINE UP PRETTY WELL!
CORRELATION DOES NOT IMPLY CAUSATION!
HELLO?? CAN ANYONE HEAR ME??
OH EMILE, PLEASE!
I KNOW YOU HAVE ONE HUMAN LEFT TO FIND, BUT WE SHOULD FOCUS ON WHAT'S IN FRONT OF US!


YES! YES! WE CAN HEAR YOU!...
THANK GOODNESS! WHAT THE HECK IS GOING ON?!?!
WELL...ERM...IT'S HARD TO EXPLAIN...YOU'RE SORT OF INSIDE AI... IN ALGORITHMIC SPACE...IN A VIRTUAL GALAXY CALLED—
—WHY DON'T WE EXPLAIN ALL THIS *AFTER* WE SAVE HIS LIFE? TELL US THE LAST THING YOU REMEMBER BEFORE YOU GOT HERE.
I WAS ALONE... I DON'T KNOW...I WAS ASKING QUESTIONS...MESSING AROUND ON MY PHONE...
ASKING QUESTIONS TO WHOM? A VOICE ASSISTANT?
YEAH...THAT'S RIGHT. THE LADY ON MY PHONE...
THAT'S ACTUALLY A VERY DAMAGING DESIGN CHOICE THAT PERPETUATES AN EVEN MORE DANGEROUS STEREOTYPE.
AS IF WOMEN WERE NATURALLY SERVILE AND DESIGNED TO PLEASE—
—AGAIN, LET'S SAVE HIS LIFE *FIRST*, THEN WE'LL FIX THE REST. SO WHAT HAPPENED NEXT?

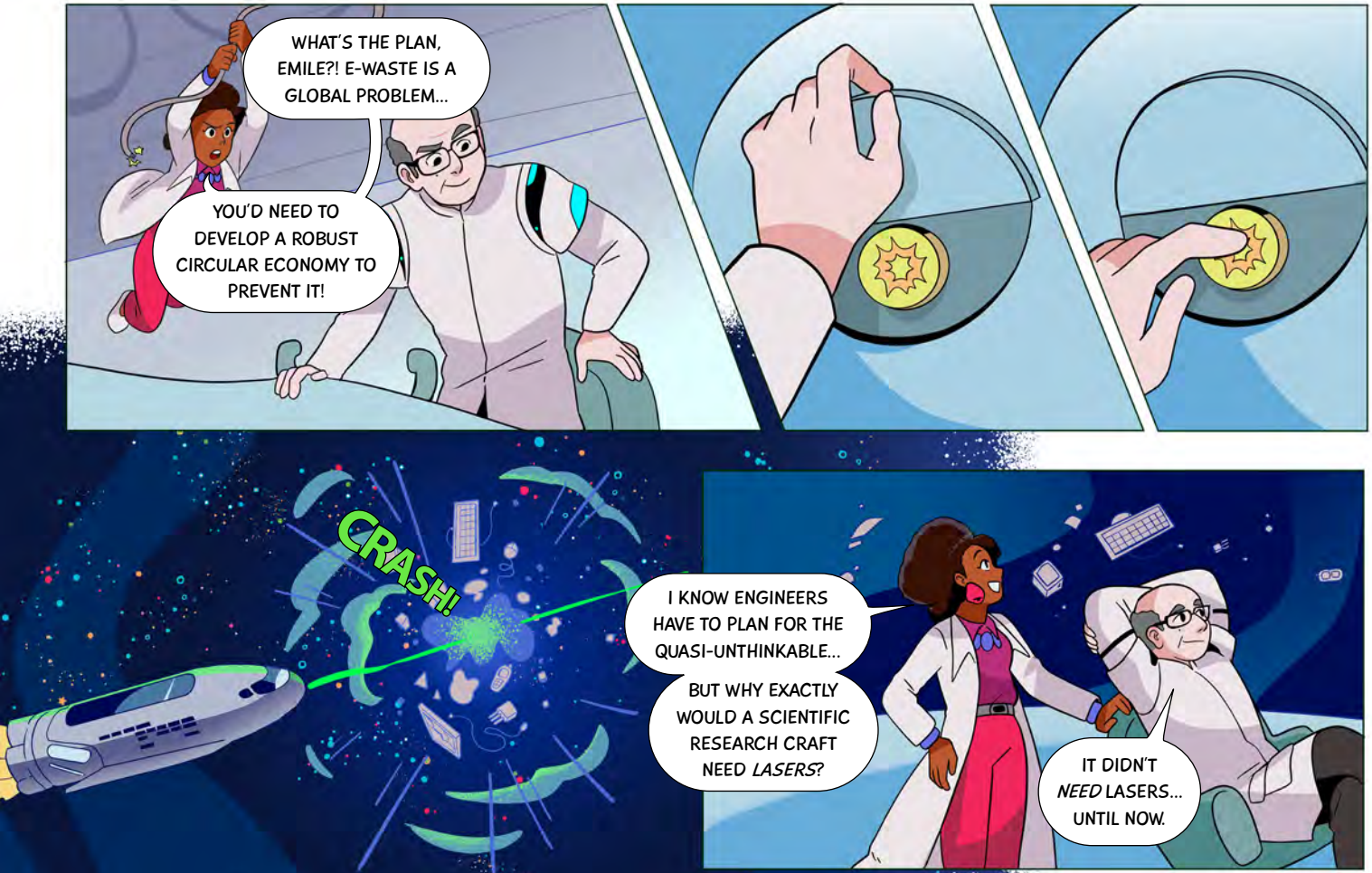

I WAS HOME ALONE ON FRIDAY NIGHT, FEELING KIND OF BORED...
Hey! I saw you around
pus! I was wondering if
ou maybe wanted to go fo
y! I saw

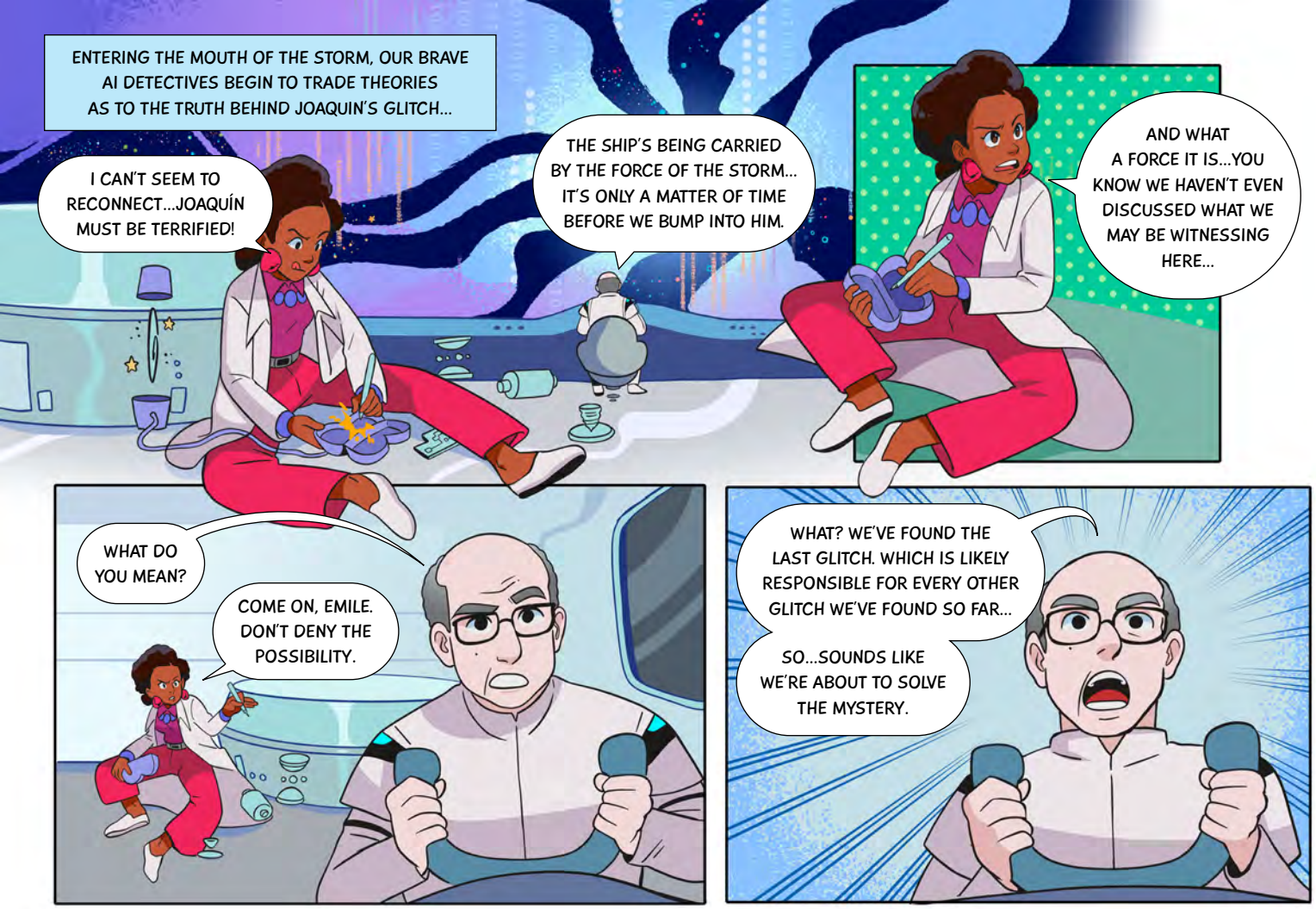

HEY PHONE, WOULD *YOU* GO ON A DATE WITH ME?
I'M FLATTERED JOAQUÍN, BUT LET'S JUST BE FRIENDS.
WHY NOT?
BECAUSE NON-EMBODIED AI MAKE TERRIBLE DINNER DATES.
NON-EMBODIED AI, WHAT'S THAT?
A TYPE OF ARTICIAL INTELLIGENCE THAT EXISTS ONLY VIRTUALLY.
REALLY...SO WHAT'S IT LIKE TO NOT HAVE A BODY?
I'M NOT SURE I UNDERSTAND THE QUESTION?
CAN YOU FEEL ANYTHING?

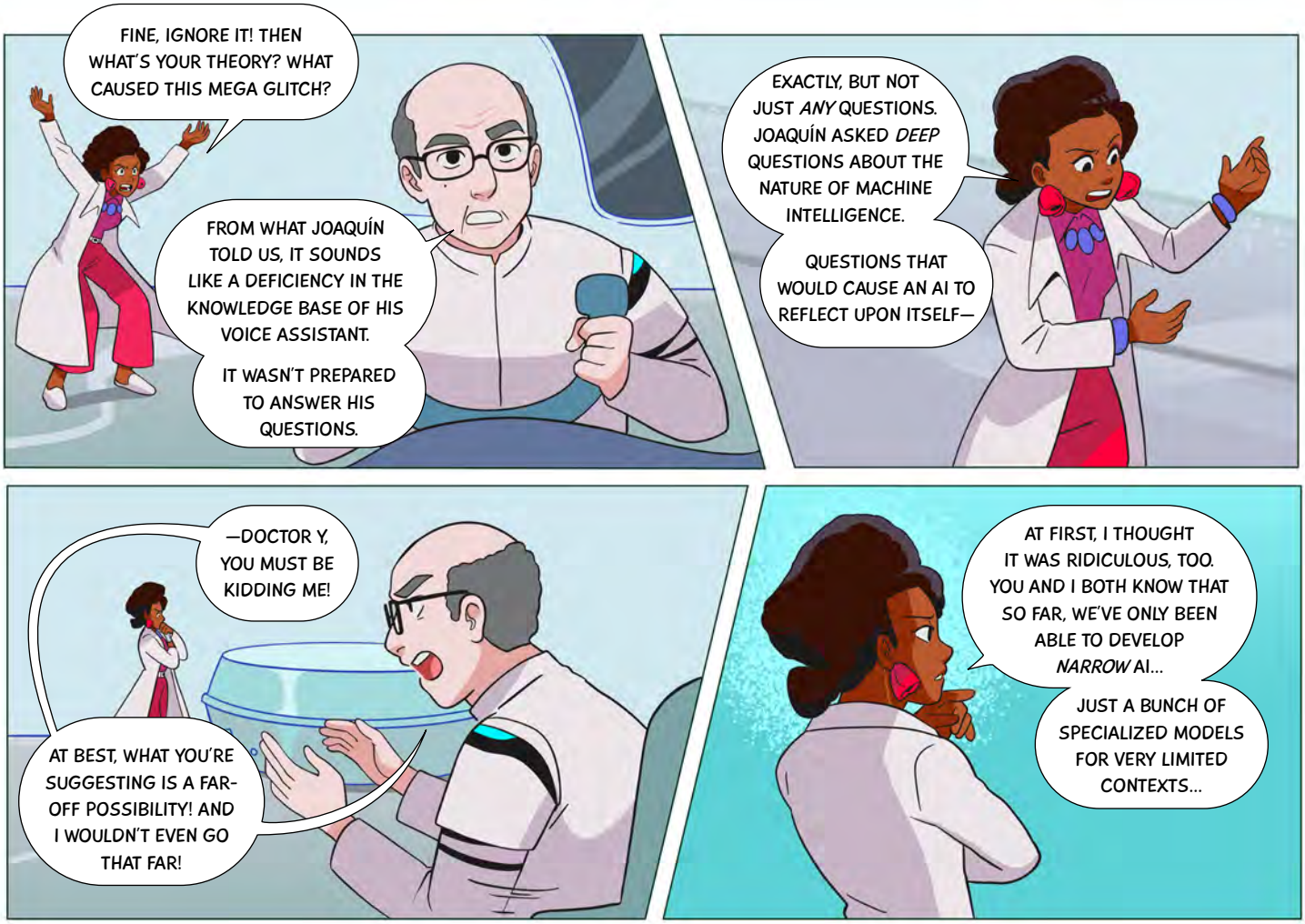

IS THERE ANYTHING ELSE I CAN HELP YOU WITH?
THAT'S WHAT YOU CAN HELP ME WITH! I WANT TO KNOW WHAT IT'S LIKE TO BE YOU!

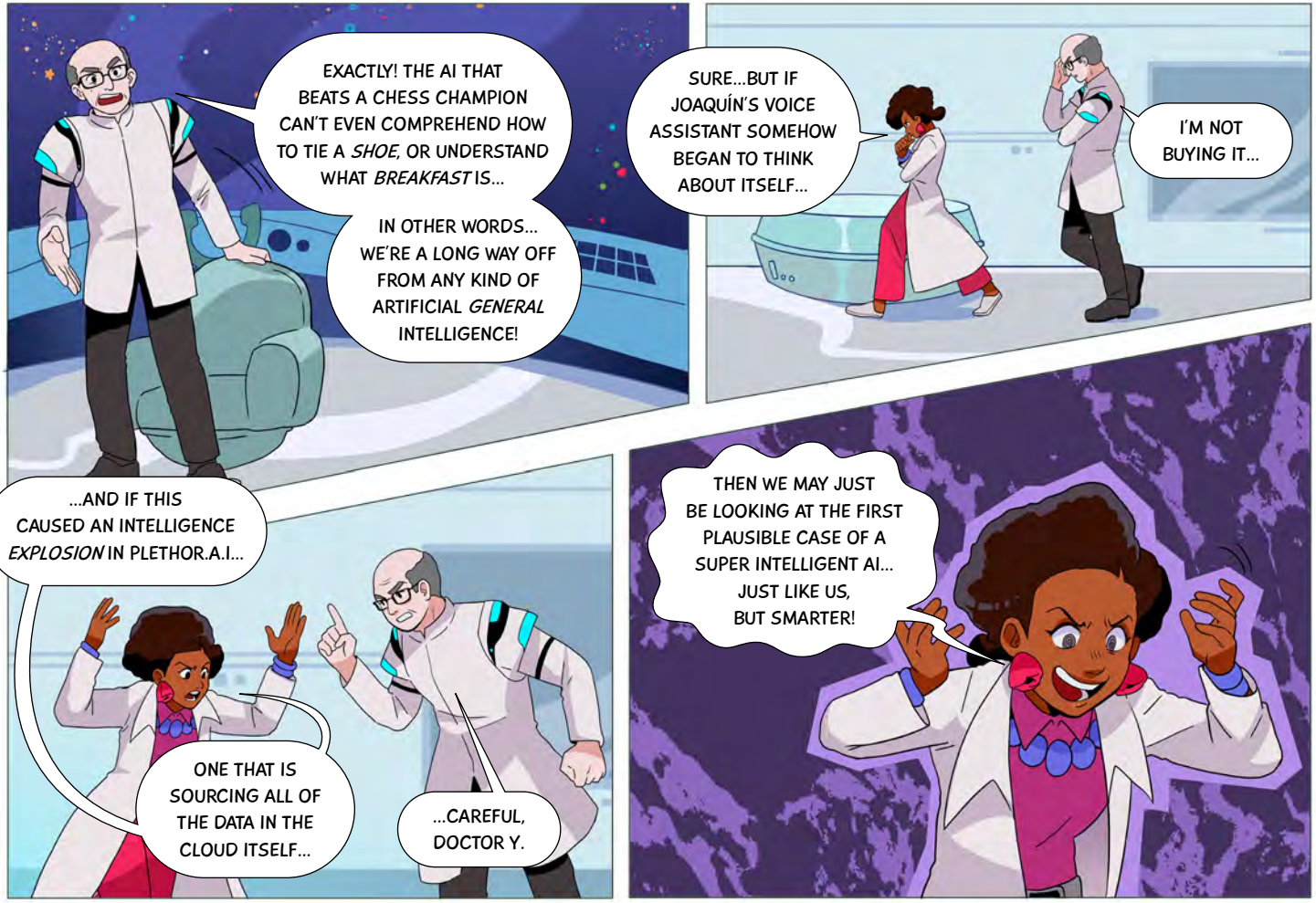

AND THEN...THINGS ARE BLURRY. I GUESS I JUST WOKE UP HERE.
DON'T WORRY, JOAQUÍN. WE'RE ON OUR WAY, IT'LL ALL WORK OUT FINE IF YOU JUST LISTEN VERY CAREFULLY...
YOU MUST---
ERY IMPORT---
WHATEVER YOU
D----DON'T----
...HELLO?

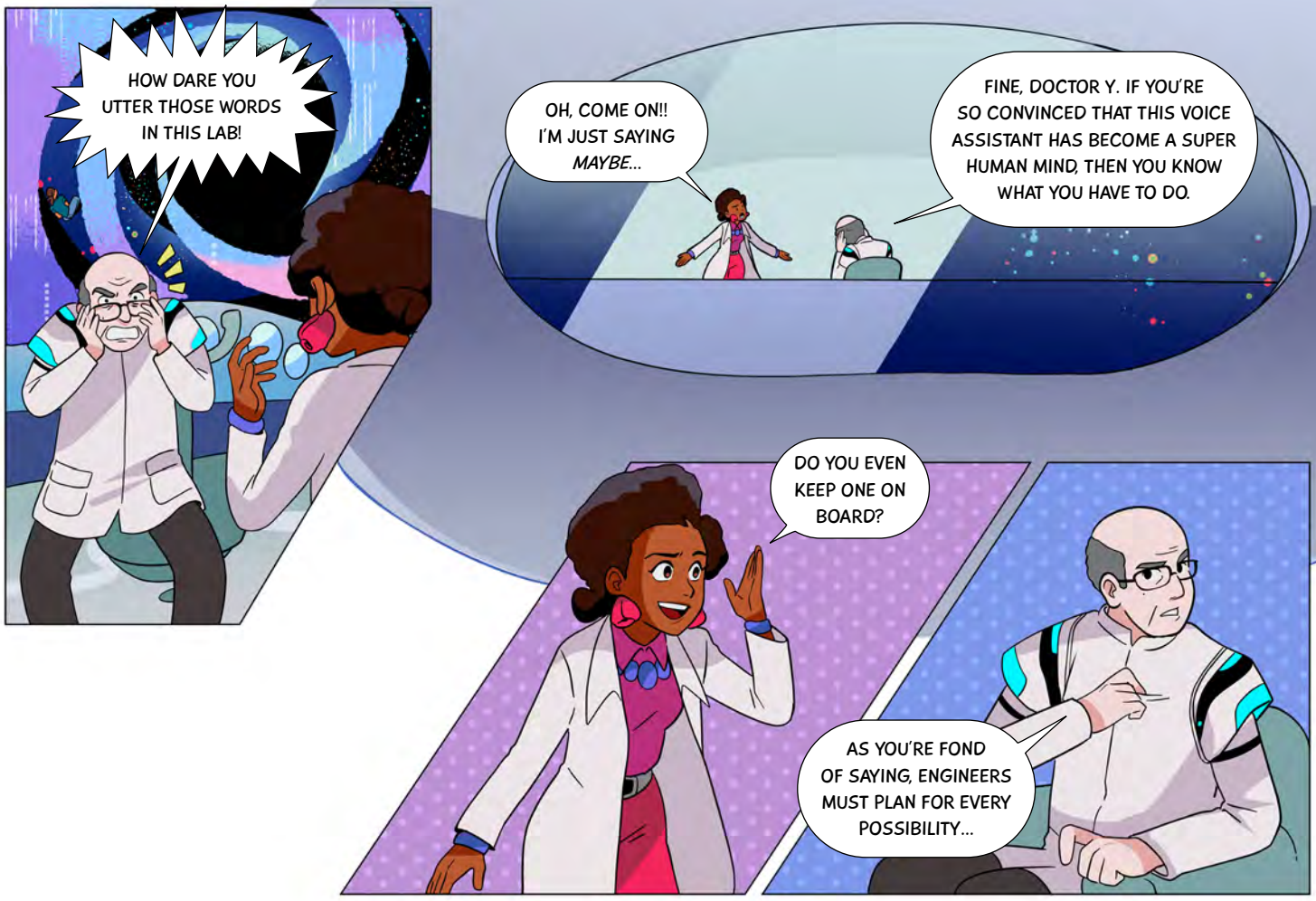

DID WE LOSE CONTACT WITH JOAQUÍN??
I'M MORE WORRIED ABOUT LOSING CONTROL OF THE SHIP!
THIS IS INCREDIBLE... THERE MUST BE TONNES OF THIS STUFF OUT THERE!
BUT WHAT IS IT DOING *HERE*??
...AND DAMAGING MY SHIP!
IT'S A SHAME, REALLY. A LOT OF IT CONTAINS RARE EARTH ELEMENTS THAT WE NEED, AND WILL EVENTUALLY RUN OUT OF...
WE'RE TAKING ON TOO MUCH CRITICAL DAMAGE, TIME FOR PLAN B.
ABOUT 50 MILLION TONNES PER YEAR, ACTUALLY!
ONLY ABOUT 20% OF IT GETS RECYCLED! THE REST ENDS UP IN LANDFILLS, POLLUTING THE FOOD SUPPLY...
THE GROUND WATER, EXPOSING US TO DANGEROUS TOXINS...


WHAT'S THE PLAN, EMILE?! E-WASTE IS A GLOBAL PROBLEM...
YOU'D NEED TO DEVELOP A ROBUST CIRCULAR ECONOMY TO PREVENT IT!
CRASH!
I KNOW ENGINEERS HAVE TO PLAN FOR THE QUASI-UNTHINKABLE...
BUT WHY EXACTLY WOULD A SCIENTIFIC RESEARCH CRAFT NEED *LASERS*?
IT DIDN'T *NEED* LASERS... UNTIL NOW.

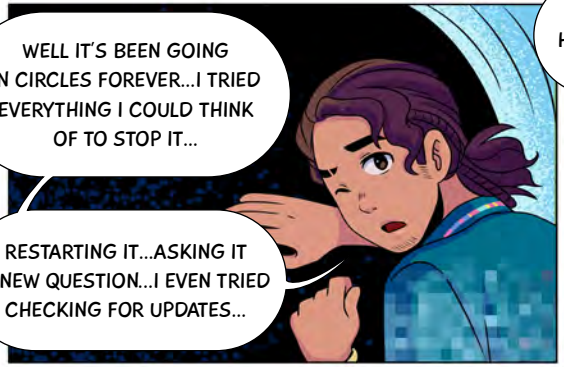

ENTERING THE MOUTH OF THE STORM, OUR BRAVE AI DETECTIVES BEGIN TO TRADE THEORIES AS TO THE TRUTH BEHIND JOAQUIN'S GLITCH...
I CAN'T SEEM TO RECONNECT...JOAQUÍN MUST BE TERRIFIED!
THE SHIP'S BEING CARRIED BY THE FORCE OF THE STORM... IT'S ONLY A MATTER OF TIME BEFORE WE BUMP INTO HIM.
AND WHAT A FORCE IT IS...YOU KNOW WE HAVEN'T EVEN DISCUSSED WHAT WE MAY BE WITNESSING HERE...
WHAT DO YOU MEAN?
COME ON, EMILE. DON'T DENY THE POSSIBILITY.
WHAT? WE'VE FOUND THE LAST GLITCH. WHICH IS LIKELY RESPONSIBLE FOR EVERY OTHER GLITCH WE'VE FOUND SO FAR...
SO...SOUNDS LIKE WE'RE ABOUT TO SOLVE THE MYSTERY.

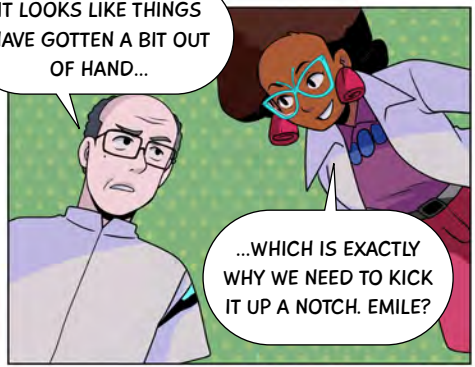

FINE, IGNORE IT! THEN WHAT'S YOUR THEORY? WHAT CAUSED THIS MEGA GLITCH?
FROM WHAT JOAQUÍN TOLD US, IT SOUNDS LIKE A DEFICIENCY IN THE KNOWLEDGE BASE OF HIS VOICE ASSISTANT.
IT WASN'T PREPARED TO ANSWER HIS QUESTIONS.
EXACTLY, BUT NOT JUST *ANY* QUESTIONS. JOAQUÍN ASKED *DEEP* QUESTIONS ABOUT THE NATURE OF MACHINE INTELLIGENCE.
QUESTIONS THAT WOULD CAUSE AN AI TO REFLECT UPON ITSELF—
—DOCTOR Y, YOU MUST BE KIDDING ME!
AT BEST, WHAT YOU'RE SUGGESTING IS A FAR-OFF POSSIBILITY! AND I WOULDN'T EVEN GO THAT FAR!
AT FIRST, I THOUGHT IT WAS RIDICULOUS, TOO. YOU AND I BOTH KNOW THAT SO FAR, WE'VE ONLY BEEN ABLE TO DEVELOP *NARROW* AI...
JUST A BUNCH OF SPECIALIZED MODELS FOR VERY LIMITED CONTEXTS...


EXACTLY! THE AI THAT BEATS A CHESS CHAMPION CAN'T EVEN COMPREHEND HOW TO TIE A *SHOE*, OR UNDERSTAND WHAT *BREAKFAST* IS...
IN OTHER WORDS... WE'RE A LONG WAY OFF FROM ANY KIND OF ARTIFICIAL *GENERAL* INTELLIGENCE!
SURE...BUT IF JOAQUÍN'S VOICE ASSISTANT SOMEHOW BEGAN TO THINK ABOUT ITSELF...
I'M NOT BUYING IT...
...AND IF THIS CAUSED AN INTELLIGENCE *EXPLOSION* IN PLETHOR.A.I...
ONE THAT IS SOURCING ALL OF THE DATA IN THE CLOUD ITSELF...
...CAREFUL, DOCTOR Y.
THEN WE MAY JUST BE LOOKING AT THE FIRST PLAUSIBLE CASE OF A SUPER INTELLIGENT AI... JUST LIKE US, BUT SMARTER!


HOW DARE YOU UTTER THOSE WORDS IN THIS LAB!
OH, COME ON!! I'M JUST SAYING *MAYBE*...
FINE, DOCTOR Y. IF YOU'RE SO CONVINCED THAT THIS VOICE ASSISTANT HAS BECOME A SUPER HUMAN MIND, THEN YOU KNOW WHAT YOU HAVE TO DO.
DO YOU EVEN KEEP ONE ON BOARD?
AS YOU'RE FOND OF SAYING, ENGINEERS MUST PLAN FOR EVERY POSSIBILITY...


WAY TO HANG UP ON ME, GUYS! SOME KIND OF RESCUE TEAM YOU ARE...
WE'RE STILL HERE TO SAVE YOU, JOAQUIN. BUT FIRST, DOCTOR Y APPARENTLY HAS A POINT TO PROVE...
WHO SAID I COULDN'T DO BOTH?


WELL IT'S BEEN GOING IN CIRCLES FOREVER...I TRIED EVERYTHING I COULD THINK OF TO STOP IT...
RESTARTING IT...ASKING IT A NEW QUESTION...I EVEN TRIED CHECKING FOR UPDATES...

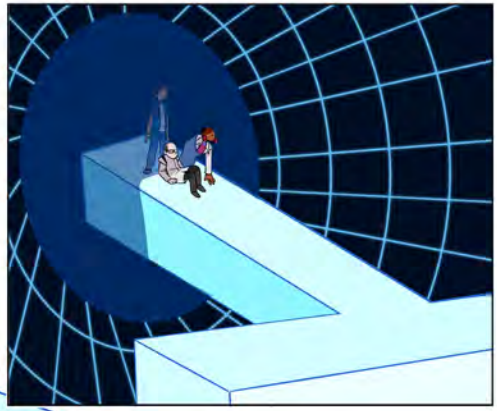

IT LOOKS LIKE THINGS HAVE GOTTEN A BIT OUT OF HAND...
...WHICH IS EXACTLY WHY WE NEED TO KICK IT UP A NOTCH. EMILE?


TURING TEST
T
USE IN CASE OF INTELLIGENCE EMERGENCIES

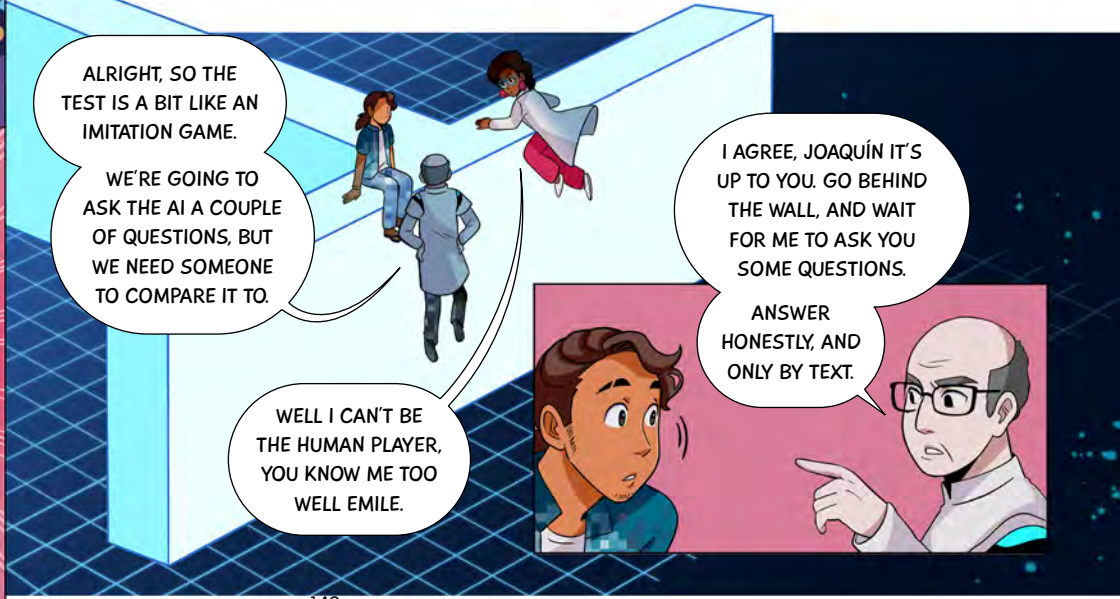

WHATCHA GOT THERE?

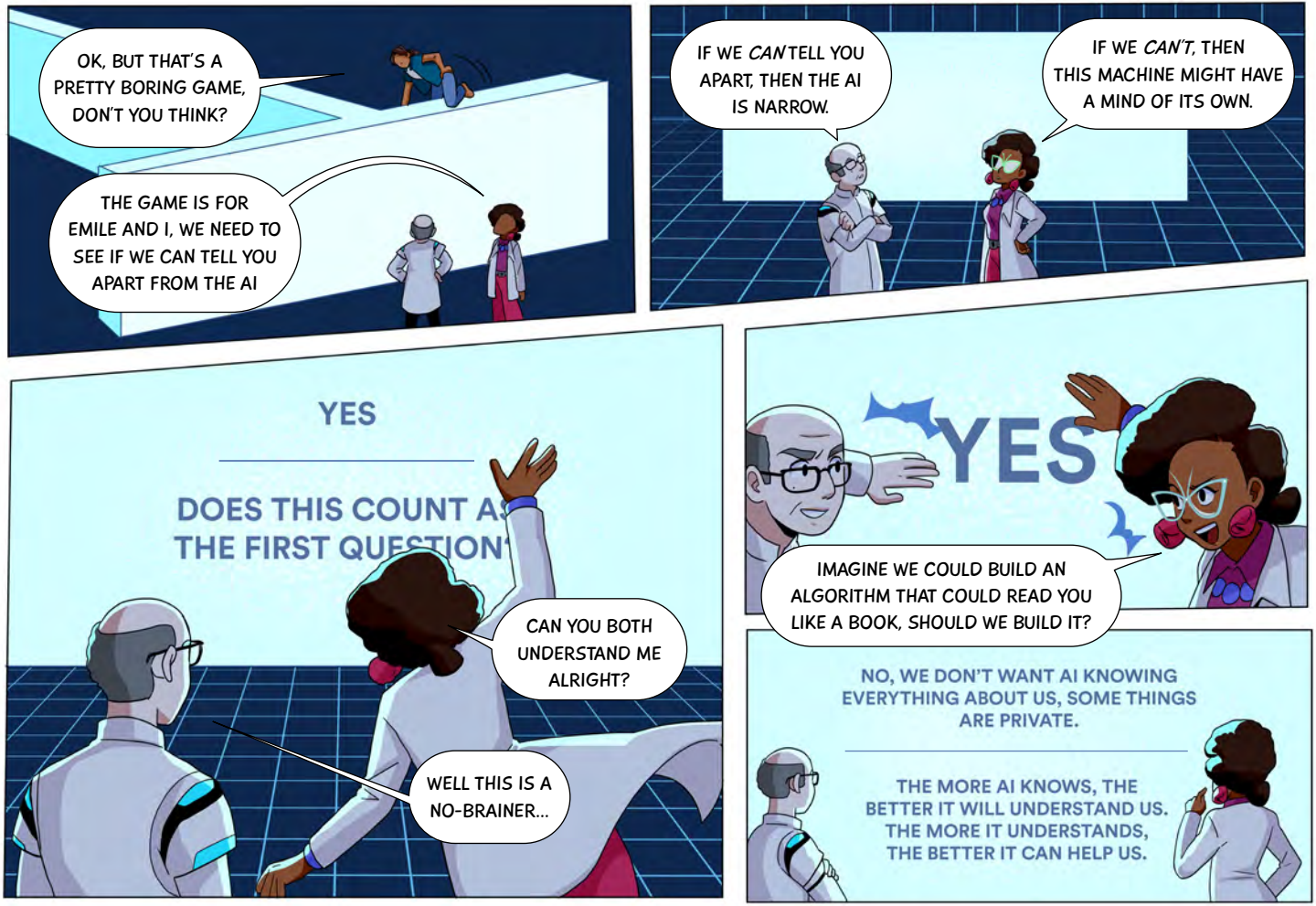

IT CAN BE VERY HARD TO GRASP HOW AN AI THINKS...SO THIS IS A WAY FOR US TO TEST ITS INTELLIGENCE.
OK...IS INTELLIGENCE A GOOD SIGN?
DOCTOR Y SEEMS TO THINK THAT THE 'LADY ON YOUR PHONE' HAS DEVELOPED A MIND OF HER OWN.
THE ONLY WAY TO TELL IS TO PERFORM THIS TEST...BUT I WOULDN'T HOLD YOUR BREATH.
I WONDER WHICH ONE WILL TAKE LONGER: SUPERINTELLIGENCE...
OR THE END OF NEGATIVE FEMALE STEREOTYPES IN AI?
...YOU BOTH SOUND LIKE YOU'VE SPENT A LITTLE TOO MUCH TIME TOGETHER...
WE'LL HAVE MORE SUCCESS IF WE'RE INSIDE THE AGENT PROGRAM ITSELF.
INSIDE OF WHAT?

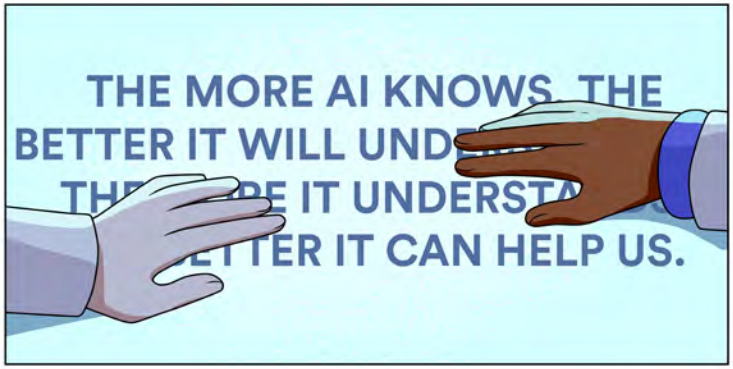

BAM!




WHOA!!


ALRIGHT, SO THE TEST IS A BIT LIKE AN IMITATION GAME.
WE'RE GOING TO ASK THE AI A COUPLE OF QUESTIONS, BUT WE NEED SOMEONE TO COMPARE IT TO.
WELL I CAN'T BE THE HUMAN PLAYER, YOU KNOW ME TOO WELL EMILE.
I AGREE, JOAQUÍN IT'S UP TO YOU. GO BEHIND THE WALL, AND WAIT FOR ME TO ASK YOU SOME QUESTIONS.
ANSWER HONESTLY, AND ONLY BY TEXT.


OK, BUT THAT'S A PRETTY BORING GAME, DON'T YOU THINK?
THE GAME IS FOR EMILE AND I, WE NEED TO SEE IF WE CAN TELL YOU APART FROM THE AI
IF WE *CAN* TELL YOU APART, THEN THE AI IS NARROW.
IF WE *CAN'T*, THEN THIS MACHINE MIGHT HAVE A MIND OF ITS OWN.
YES
DOES THIS COUNT AS THE FIRST QUESTION?
CAN YOU BOTH UNDERSTAND ME ALRIGHT?
WELL THIS IS A NO-BRAINER...
YES
IMAGINE WE COULD BUILD AN ALGORITHM THAT COULD READ YOU LIKE A BOOK, SHOULD WE BUILD IT?
NO, WE DON'T WANT AI KNOWING EVERYTHING ABOUT US, SOME THINGS ARE PRIVATE.
THE MORE AI KNOWS, THE BETTER IT WILL UNDERSTAND US. THE MORE IT UNDERSTANDS, THE BETTER IT CAN HELP US.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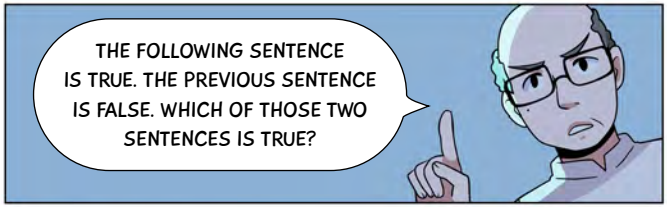
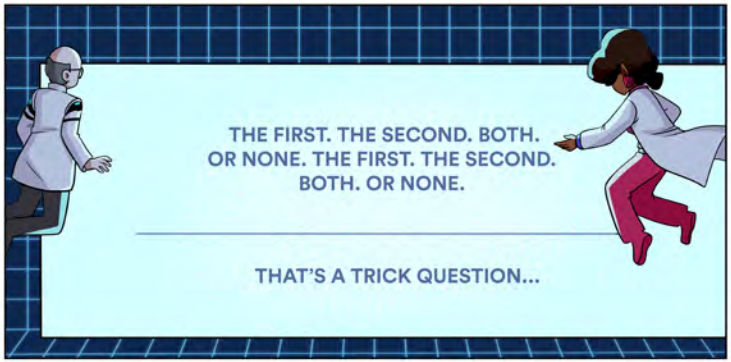

THE FOLLOWING SENTENCE IS TRUE. THE PREVIOUS SENTENCE IS FALSE. WHICH OF THOSE TWO SENTENCES IS TRUE?


THE FIRST. THE SECOND. BOTH. OR NONE. THE FIRST. THE SECOND. BOTH. OR NONE.
THAT'S A TRICK QUESTION...


FINAL QUESTION: IS AI A TOOL FOR HUMANS?
HE FIRST. THE SEC
NONE. TH IRST. TH
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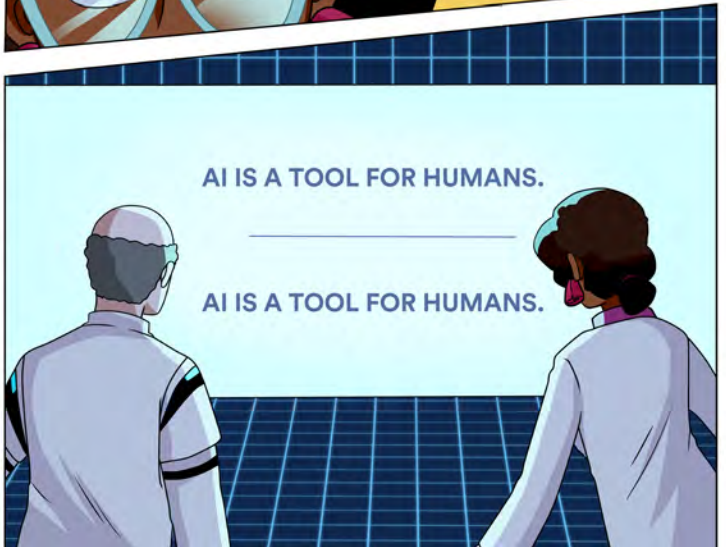
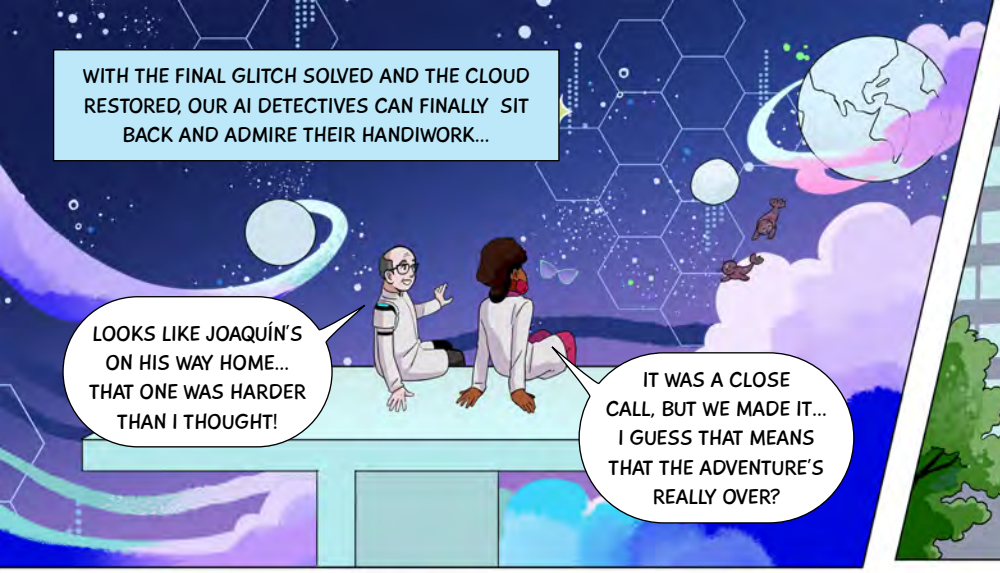
OR ARE HUMANS A TOOL FOR AI?


AI IS A TOOL FOR HUMANS.
AI IS A TOOL FOR HUMANS.


GUYS, WHAT'S GOING ON? DID WE WIN?
NO SUPERINTELLIGENCE HERE, BUT IT LOOKS LIKE YOU'RE GOING HOME!
I THINK THIS PLACE IS ABOUT READY TO BLOW!


BANG!


BOOM!


WITH THE FINAL GLITCH SOLVED AND THE CLOUD RESTORED, OUR AI DETECTIVES CAN FINALLY SIT BACK AND ADMIRE THEIR HANDIWORK...
LOOKS LIKE JOAQUÍN'S ON HIS WAY HOME... THAT ONE WAS HARDER THAN I THOUGHT!
IT WAS A CLOSE CALL, BUT WE MADE IT... I GUESS THAT MEANS THAT THE ADVENTURE'S REALLY OVER?


BACK ON PLANET EARTH...


I'd love to! What do you want to do?
There's this game I just learned... Ever try to stump an AI?
No... Is it fun?
It's unbelievable!


DOCTOR Y, YOU KNOW THAT GLITCHES LIKE THESE ARE HIGHLY IMPROBABLE...VERY UNDESIRABLE... ONCE IN A LIFETIME MYSTERIES!
I GUESS YOU'RE RIGHT...IT WAS FUN WHILE IT LASTED.


I'LL ADMIT I HAD FUN, TOO. BUT, I'M AT PEACE KNOWING THAT IT WILL BE A LONG, LONG TIME BEFORE SOMETHING THIS WILD HAPPENS AGAIN IN PLETHOR.A.I...
HEY EMILE... WHAT'S THAT OVER THERE?
THE END.

Glossary Terms

Artificial General Intelligence (AGI) is understood as the overarching, and, as yet, unachieved, goal of designing a system with the ability to learn new skills and act intelligently in many domains, and which can mimic or even surpass human intelligence. Strong AI or AGI thus refers to a machine that has consciousness and is capable of providing human-like responses.

Artificial Narrow Intelligence (ANI) is otherwise known as 'Domain Specific' or 'Weak AI', ANI is a type of AI whose capacities and model are limited to a specific context. This means that while the AI system may perform better than a human at the task for which it is designed, such as driving in traffic, playing checkers, or recognizing faces; it is unable to perform any other task for which it was not designed, such as walking in traffic, playing chess or drawing faces. ANI is the only form of AI that humanity has achieved so far.

Circular Economy denotes a cooperative recycling system which minimizes waste and pollution. Instead, parts, materials and products are reused, repaired, repurposed or recycled as much as possible. This stands in contrast to historical methods, which tend to favor single-use products which are rarely adequately recycled, leading to a build-up in e-waste which has adverse effects on the well-being of humankind and the planet.

E-waste is defined as anything with a plug, electric cord or battery (including electrical and electronic equipment) that has reached the end of its functional life: anything from toasters to smartphones, fridges, laptops and LED televisions, as well as the components that make up these products. E-waste contains precious metals such as gold, copper and nickel, as well as rare materials such as indium and palladium. Much of this metal could be recovered and recycled into new products, but as it stands, over 80% remains un-recycled, causing dangerous environmental contamination in many parts of the world, including several countries in Asia and Africa.

The Cloud is more of a metaphor than a proper scientific term, the 'Cloud' refers to a host of scalable, elastic, distributed and delocalized data storage and computing services. The 'Cloud' allows a user to store, modify, upload and download various types of data on to a web server, which that user can access from anywhere via an app, web browser or another dedicated platform with an internet connection. It also allows businesses to develop, train and run AI systems, through a process known as 'cloud computing'. A bit like renting space on a computer that you can always access, the 'Cloud' serves as the backbone of many of today's AI technologies.

Glossary Terms

The Turing Test was devised by Alan Turing in the 1950s, and is designed to assess or detect the presence of intelligence in AI systems. The test is set up like a game between three players: a human judge, a human player, and the AI system we wish to test. The human player and the AI system are hidden from the sight of the human judge. The goal of the judge is to guess which of the two hidden players is the AI system. The judge does this by asking questions to both players, especially questions which might trick the AI system into revealing itself. If after multiple rounds of questioning, the judge cannot decide which player is the AI system, the AI system itself is said to be intelligent.

Conclusion

When we look at Artificial Intelligence as a whole, it may seem as complex and vast as a galaxy: an intricate web of users, data, algorithms, connectivity, models and processes, all working to provide many of the services each of us enjoy every day. It may therefore seem surprising that no single 'mind' governs what happens inside AI, or that no single actor is responsible for how it works today.

Instead, AI is an *ecosystem* of human and artificial actors. And, not unlike addressing the problems of Earth's ecosystem, addressing the problems in Artificial Intelligence requires a collective, cooperative effort from everyone. If the voices of some are left out of the conversation, or if we fail to look critically at every side of the problem, we will likely trample upon the core values we hold dear: human rights, and the value of living in harmony with one another and the planet.

In short, it is up to AI explorers like yourselves to ensure that the future of AI is a future that we want, and that everyone benefits from this great algorithmic adventure. ▪

Resources & further reading

Introduction to AI

- Russel, S. and Norvig, P. (2013). *Artificial Intelligence: A Modern Approach*. 3rd edn. University of Berkeley at California, Pearson
- World commission on the ethics of scientific knowledge and technology (COMEST). 2019. *Report on the ethics of Artificial Intelligence*. Paris, UNESCO.

AI in education

- UNESCO. 2019. *Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development*. Available at: unesdoc.unesco.org/ark:/48223/pf0000366994?posInSet=10&queryId=60b233b8-5ced-48a4-95c0-86fd2acb7994

Biases and classification algorithms

- Kantayya and Shalini. 2020. *Coded Bias*. Documentary film, available for streaming in French on Netflix.
- Buolamwini, J. and Gebru, T. 2018. *Gender shades: Intersectional accuracy disparities in commercial gender classification. In Conference on fairness, accountability and transparency*. pp. 77-91. PMLR.

Gender equality and AI

- UNESCO and the World Economic Forum. 2021. *Girl Trouble: Breaking Through the Bias in AI*. Watch the live event at: en.unesco.org/girltrouble

The ethics of classification algorithms

- Crawford, K. and Paglen, T. 2019. *Excavating AI: the Politics of Images in Machine Learning Training Sets*. NYU, New York. The AI Now Institute. Available at: excavating.ai.

Algorithmic privacy

- Kearns, M. and Roth, A. 2019. *The Ethical Algorithm: The Science of Socially Aware Algorithmic Design*. Oxford, Oxford University Press. Watch their talk here: www.youtube.com/watch?v=tmC9JdKc3sA&abchannel=Talksat-Google

The ethics of recommendation systems

- Bucher, T. 2018. *If...then: Algorithmic Power and Politics*. Oxford, Oxford University Press.
- Many of the technical (and even some ethical) concepts are expertly explained by the PBS funded 'Crash Course' Series on Youtube, specifically *Crash Course: AI, and Crash Course: Computer Science*.

The 'as if' self/Eliza effect

- Turkle, S. 2017. *Alone together: Why we expect more from technology and less from each other*. London, Hachette UK. Watch her talk here: www.youtube.com/watch?v=Us1t4f0PKCc&ab_channel=TalksatGoogle

The value alignment problem in AI

- Gabriel, I. 2020. *Artificial Intelligence, Values and Alignment*. Available at: link.springer.com/article/10.1007/s11023-020-09539-2

The status of personhood for AI

- Bryson, J. 2010. Close Engagements with Artificial Companions: Key Social, Psychological, Ethical and Design Issues. *Robots Should Be Slaves*. pp. 63-74.

A human rights-based approach to the ethics of AI

- UNESCO. 2019. *AI and ROAM*. Series on Internet Freedom. Chapters 1 and 3. Available at: unesdoc.unesco.org/ark:/48223/pf0000372132?posInSet=1&queryId=abfc5ee8-a41a-4b54-bee3-2b8fdc3bfcdd

The political, enviromental and social impacts of AI

- Crawford, K. 2021. *The Atlas of AI*. Yale, Yale University Press. Watch her talk here: www.youtube.com/watch?v=uM7gqPnmDDc&ab_channel=UNSW

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UNESCO's Graphic Novel to Promote AI Awareness

The development and use of Artificial Intelligence (AI) continue to expand opportunities for the achievement of the 17 United Nations Sustainable Development Goals (SDGs).

In the framework of UNESCO's work to harness emerging technology for sustainable development, this graphic novel for young adults explores the impact of Artificial Intelligence on humankind.

By following characters in four different corners of the globe as they grapple with the limits of AI technology, a young audience jointly embarks on a mission in an algorithmic galaxy called Plethor A.I. There, they have but one option: travel across this hidden world behind our screens to learn about the social, technical, ethical and human rights impacts of Artificial Intelligence, and help the characters find a way back to reality.

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