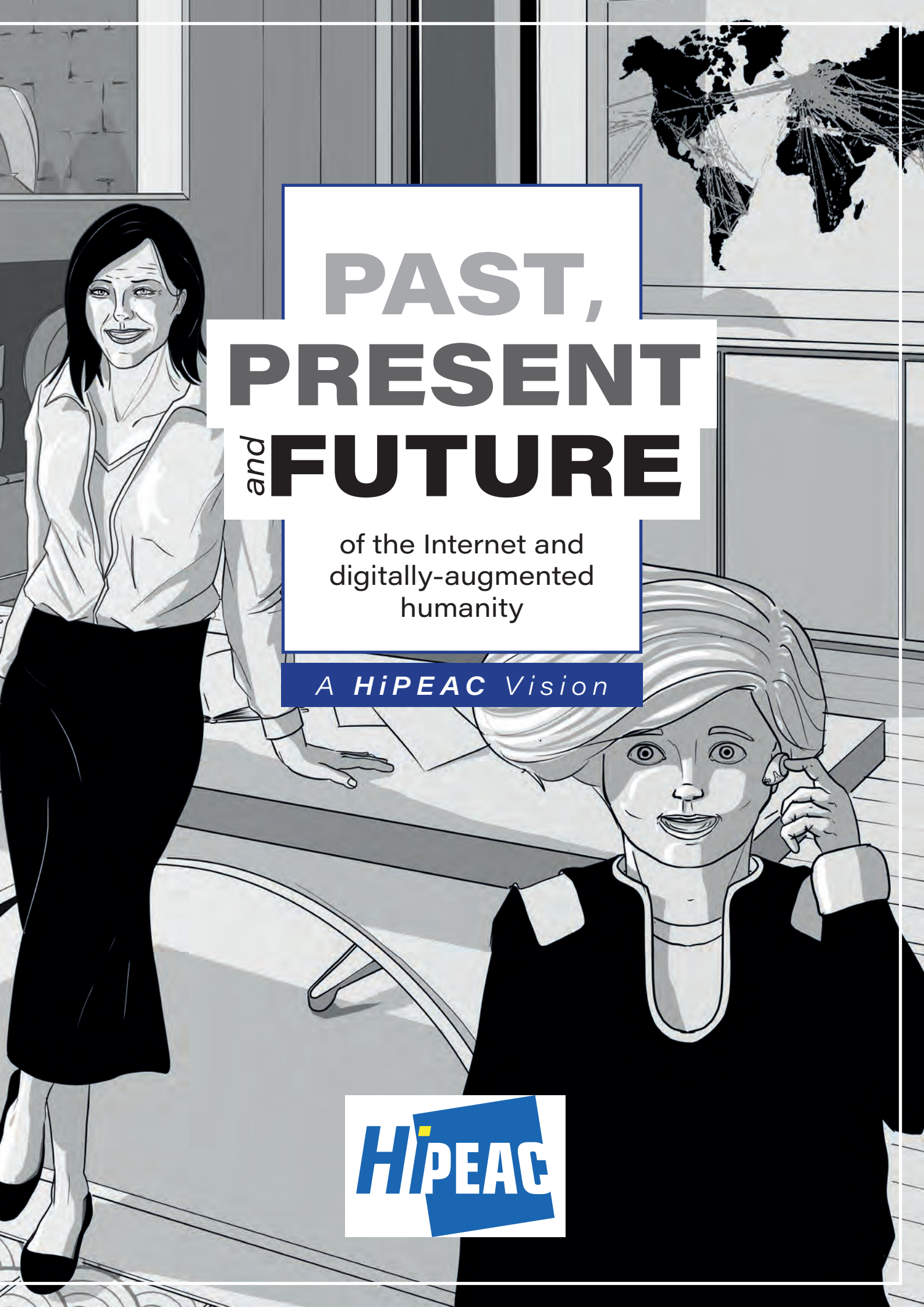

PAST, PRESENT and FUTURE

of the Internet and digitally-augmented humanity

A **HiPEAC** Vision

HiPEAC

HiPEAC

HiPEAC ***(High Performance Embedded Architecture and Compilation)*** is the premier European Network for dissemination, training, and collaboration activities for researchers, industry, and policy related to computing systems. Today, the network numbers over 2,000 specialists and is the biggest of its kind in Europe. Its objectives are to:

- **Secure** and strengthen a leading position for Europe in computing systems that support all aspects of modern society by advancing computing systems as a discipline.
- **Prepare** the next generation of world-class computing systems scientists and engineers in Europe by supporting their academic and professional development.
- **Build** a dynamic ecosystem for the design and implementation of computing systems in Europe by bringing together European research, industry, SMEs, and policy.
- **Align** research efforts in computing systems and strengthen research impact in Europe by identifying long-term challenges in computing systems and articulating their impact on modern society.

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Author:
Tullio Vardanega

Co-authors:
Koen De Bosschere, Marc Duranton and Harm Munk

Editorial Support:
Madeleine Gray and Rebecca Gorby

Design:
Etienne Giorgetti, chat-noir.biz

Printing:
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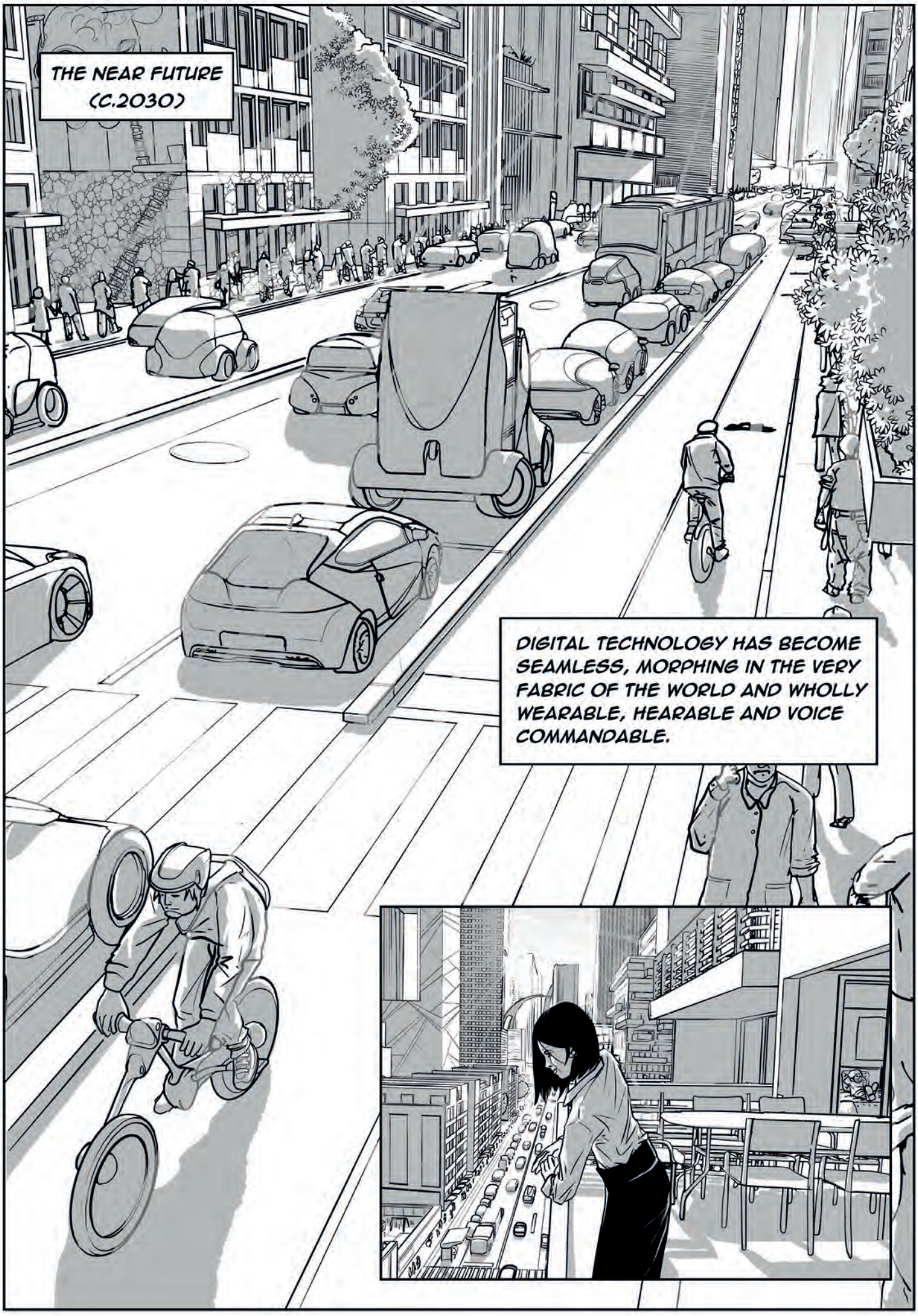
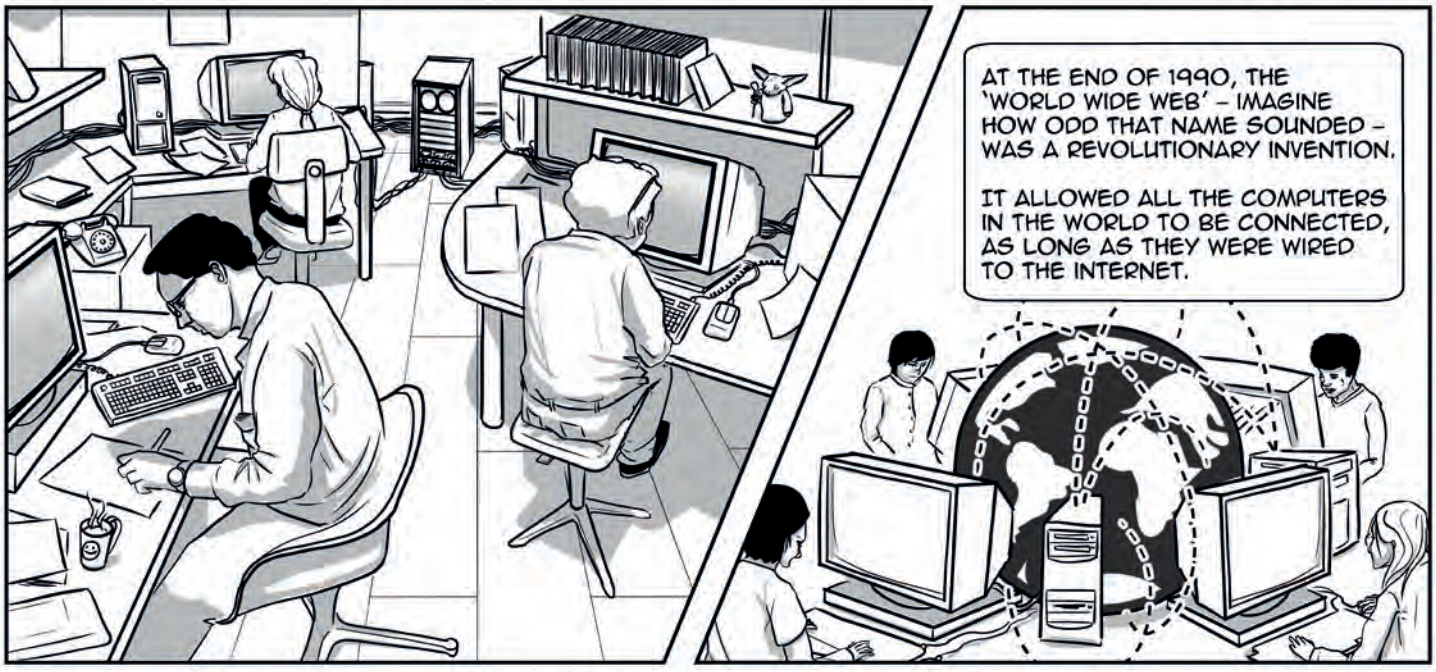
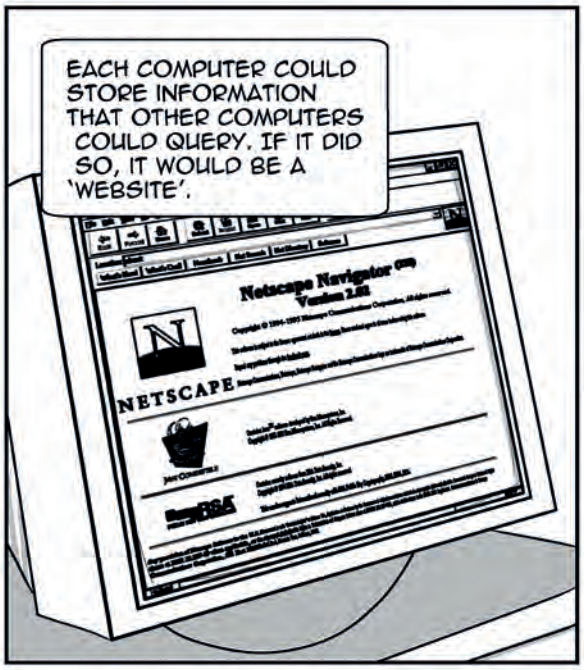

THE NEAR FUTURE
(C.2030)
DIGITAL TECHNOLOGY HAS BECOME SEAMLESS, MORPHING IN THE VERY FABRIC OF THE WORLD AND WHOLLY WEARABLE, HEARABLE AND VOICE COMMANDABLE.

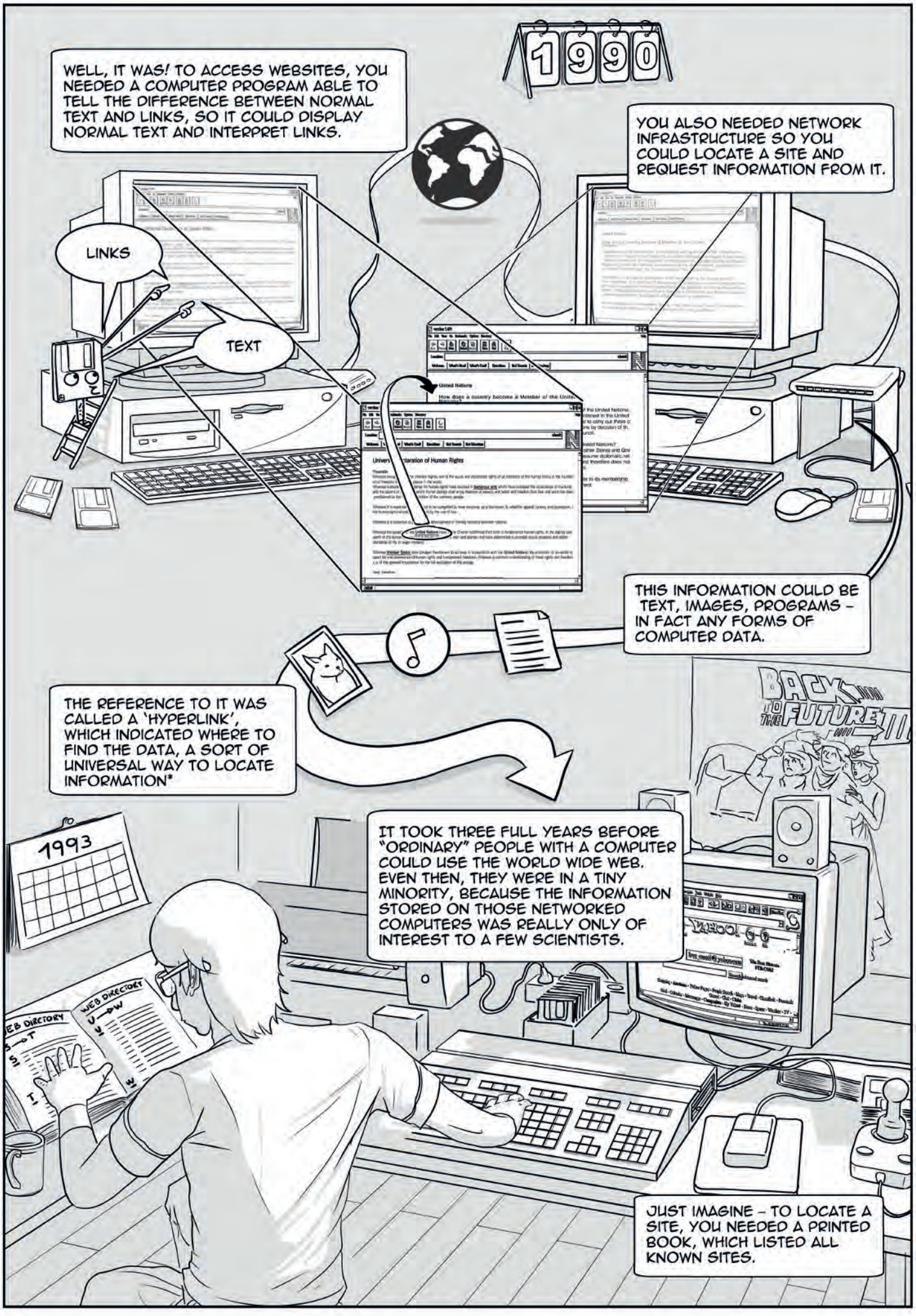

COME AND LOOK AT THE SUNSET; IT'S A BEAUTIFUL EVENING.
...
I WAS JUST FINISHING MY HOMEWORK. I'VE TOLD ALMOND TO RUN A COUPLE OF SOLUTIONS FOR MY SCHOOL ASSIGNMENT.
FORTUNATELY, I HAVE ALMOND.
YOU SHOULD HAVE SEEN THINGS WHEN I WAS YOUR AGE.
UH, WHEN WAS THAT?
WELL, ...
THAT WAS FORTY YEARS AGO.
BACK THEN, DIGITAL TECHNOLOGY LOOKED VERY DIFFERENT.
YEAH... I'VE SEEN IT IN OLD FILMS.
THEY EVEN HAD PHONES WITH WIRES AND STRANGE ROUND THINGS ON TOP! AND I HAVE NO IDEA HOW YOU WOULD USE THAT STUFF.
DO YOU WANT ME TO TELL YOU MORE ABOUT THAT WHOLE STORY?
YEAH! HANG ON...
ALMOND, GET US SOME ICED TEA, WILL YOU?


WINTER 1990, SOON AFTER THE LAUNCH OF THE PUBLIC WEB
– GENEVA –

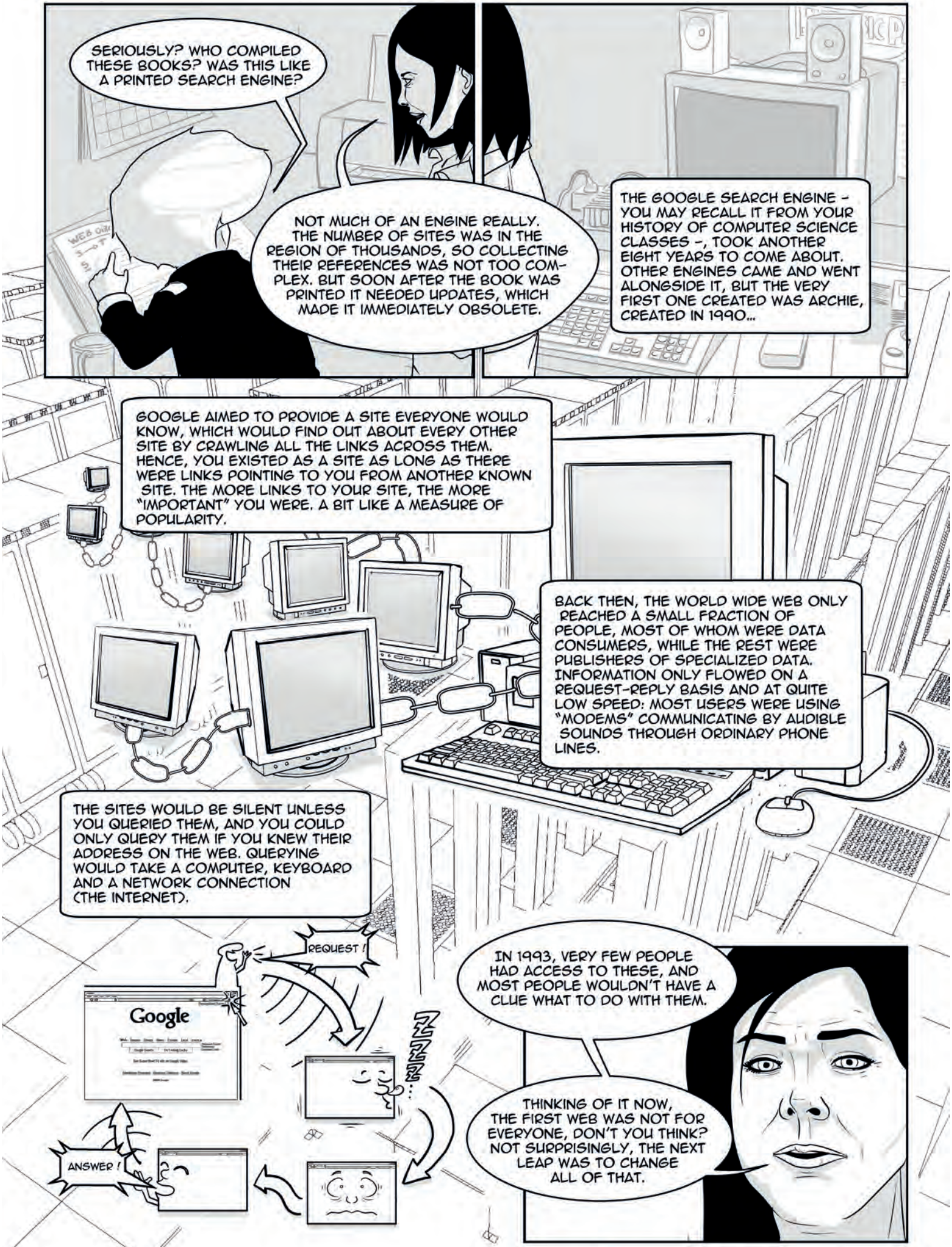

AT THE END OF 1990, THE 'WORLD WIDE WEB' – IMAGINE HOW ODD THAT NAME SOUNDED – WAS A REVOLUTIONARY INVENTION.
IT ALLOWED ALL THE COMPUTERS IN THE WORLD TO BE CONNECTED, AS LONG AS THEY WERE WIRED TO THE INTERNET.


EACH COMPUTER COULD STORE INFORMATION THAT OTHER COMPUTERS COULD QUERY. IF IT DID SO, IT WOULD BE A 'WEBSITE'.
Netscape Navigator
NETSCAPE


WITHIN THAT SITE, YOU COULD ALSO LINK TO SITES ON OTHER COMPUTERS.
WOW,...
REVOLUTIONARY ...



*URL: Uniform Resource Locator


SERIOUSLY? WHO COMPILED THESE BOOKS? WAS THIS LIKE A PRINTED SEARCH ENGINE?
NOT MUCH OF AN ENGINE REALLY. THE NUMBER OF SITES WAS IN THE REGION OF THOUSANDS, SO COLLECTING THEIR REFERENCES WAS NOT TOO COMPLEX. BUT SOON AFTER THE BOOK WAS PRINTED IT NEEDED UPDATES, WHICH MADE IT IMMEDIATELY OBSOLETE.
THE GOOGLE SEARCH ENGINE – YOU MAY RECALL IT FROM YOUR HISTORY OF COMPUTER SCIENCE CLASSES –, TOOK ANOTHER EIGHT YEARS TO COME ABOUT. OTHER ENGINES CAME AND WENT ALONGSIDE IT, BUT THE VERY FIRST ONE CREATED WAS ARCHIE, CREATED IN 1990...
GOOGLE AIMED TO PROVIDE A SITE EVERYONE WOULD KNOW, WHICH WOULD FIND OUT ABOUT EVERY OTHER SITE BY CRAWLING ALL THE LINKS ACROSS THEM. HENCE, YOU EXISTED AS A SITE AS LONG AS THERE WERE LINKS POINTING TO YOU FROM ANOTHER KNOWN SITE. THE MORE LINKS TO YOUR SITE, THE MORE "IMPORTANT" YOU WERE. A BIT LIKE A MEASURE OF POPULARITY.
BACK THEN, THE WORLD WIDE WEB ONLY REACHED A SMALL FRACTION OF PEOPLE, MOST OF WHOM WERE DATA CONSUMERS, WHILE THE REST WERE PUBLISHERS OF SPECIALIZED DATA. INFORMATION ONLY FLOWED ON A REQUEST-REPLY BASIS AND AT QUITE LOW SPEED: MOST USERS WERE USING "MODEMS" COMMUNICATING BY AUDIBLE SOUNDS THROUGH ORDINARY PHONE LINES.
THE SITES WOULD BE SILENT UNLESS YOU QUERIED THEM, AND YOU COULD ONLY QUERY THEM IF YOU KNEW THEIR ADDRESS ON THE WEB. QUERYING WOULD TAKE A COMPUTER, KEYBOARD AND A NETWORK CONNECTION (THE INTERNET).
REQUEST !
Google
ZZZZ...
ANSWER !
IN 1993, VERY FEW PEOPLE HAD ACCESS TO THESE, AND MOST PEOPLE WOULDN'T HAVE A CLUE WHAT TO DO WITH THEM.
THINKING OF IT NOW, THE FIRST WEB WAS NOT FOR EVERYONE, DON'T YOU THINK? NOT SURPRISINGLY, THE NEXT LEAP WAS TO CHANGE ALL OF THAT.


1994
1995
1996
1997
1998
1999
2000
2001
2004
2008
2009
2010
2011
2012
2013
2014
Encyclopédie
Vol. III
Encyclopédie de la
mythologie
2006
Histoire d'Internet
Wikipedia


IF YOU THINK OF THE FIRST WEB AS A ROAD, IT WOULD HAVE BEEN A ONE-WAY STREET OF REQUEST -REPLY CONVERSATIONS, LIKE PLACING AN ORDER AT A SHOP (THE REQUEST) AND HAVING THE GOODS DELIVERED TO YOUR HOME (THE REPLY).
THE DOCUMENT YOU REQUESTED
WEATHER FORECAST
INFORMATION

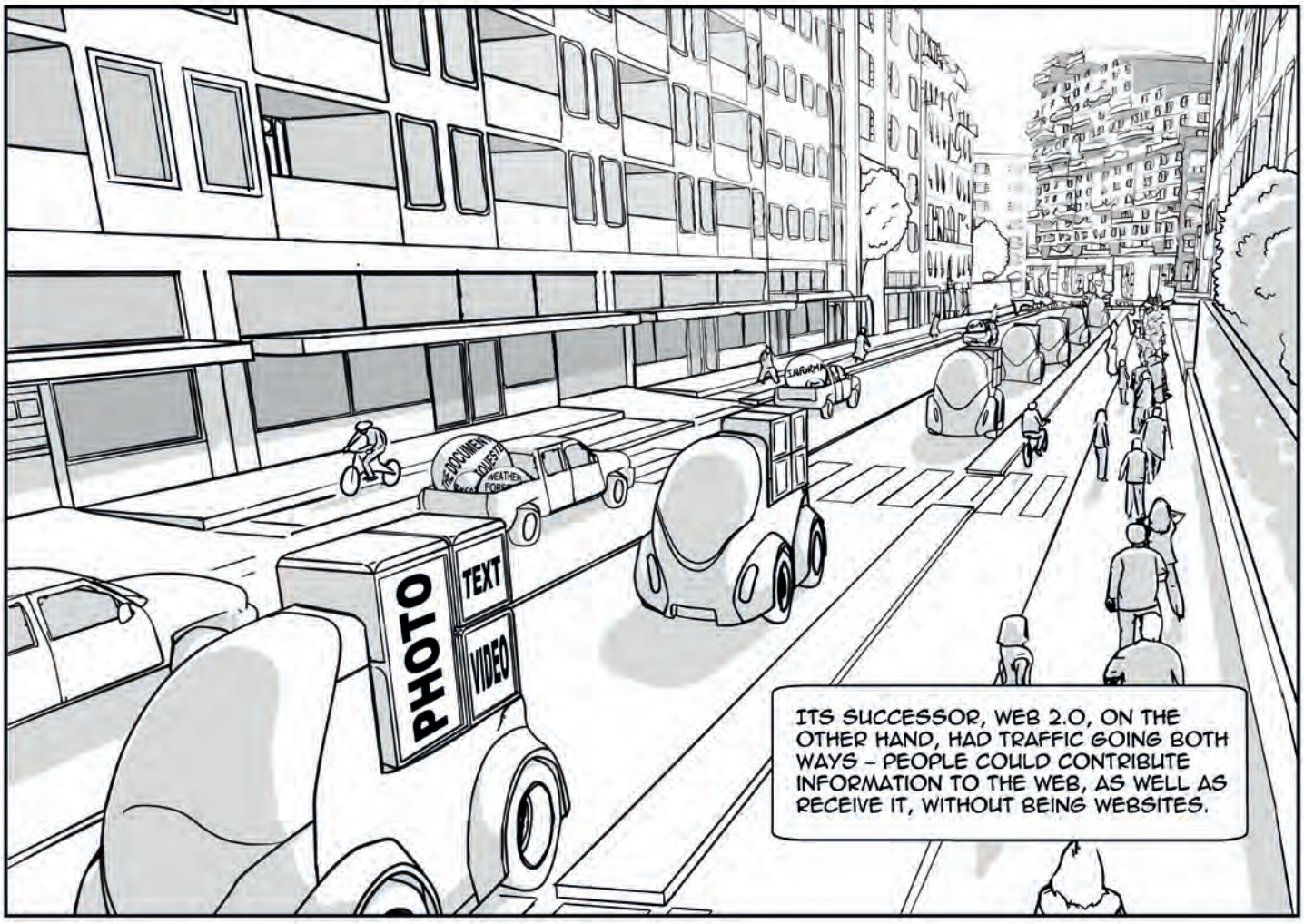
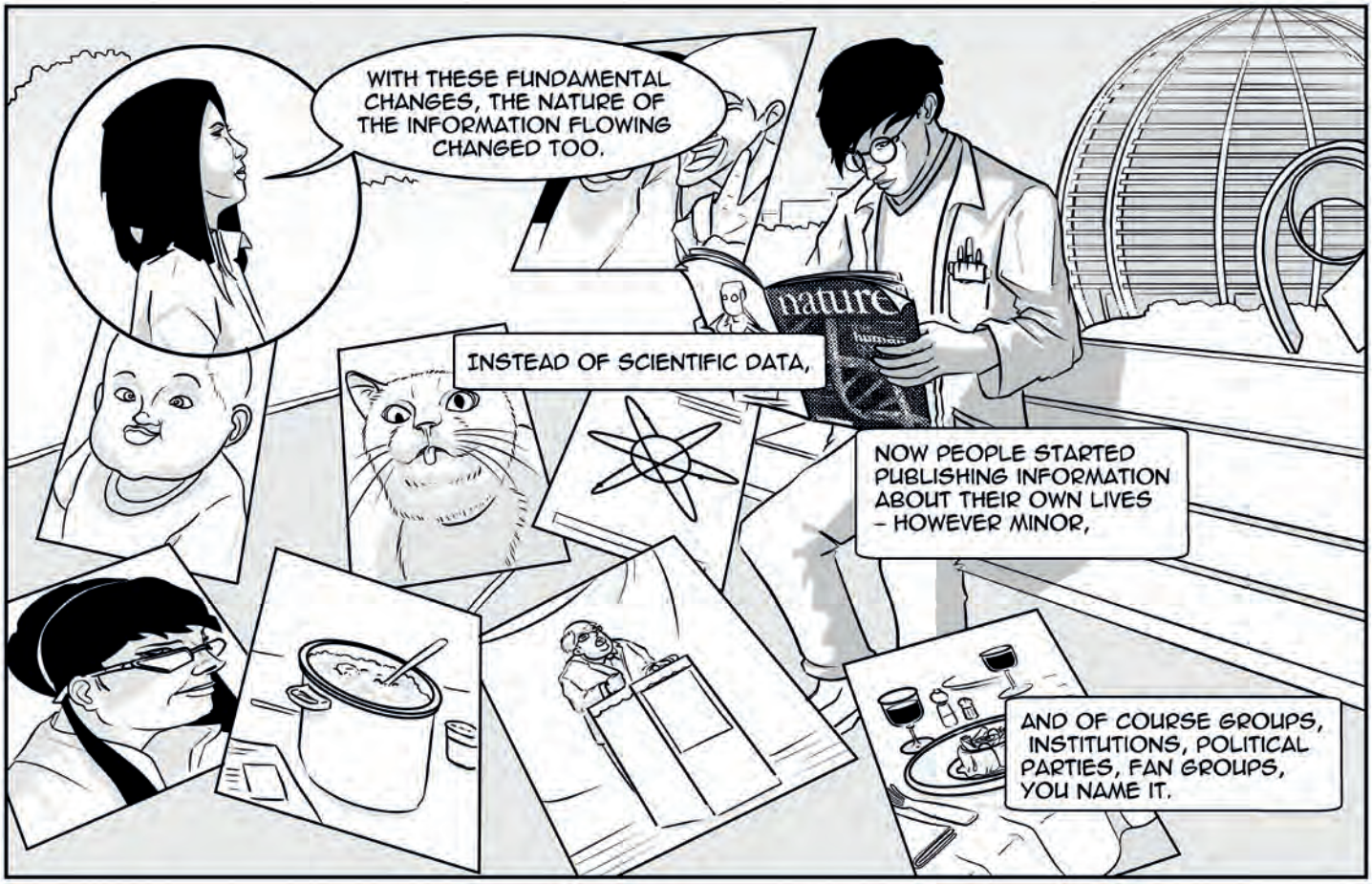
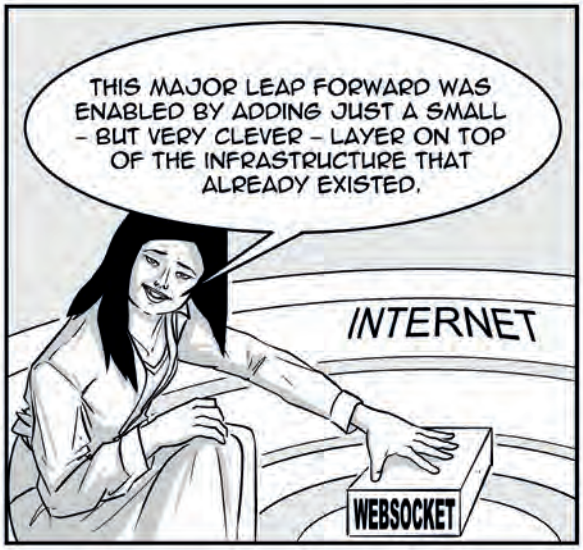
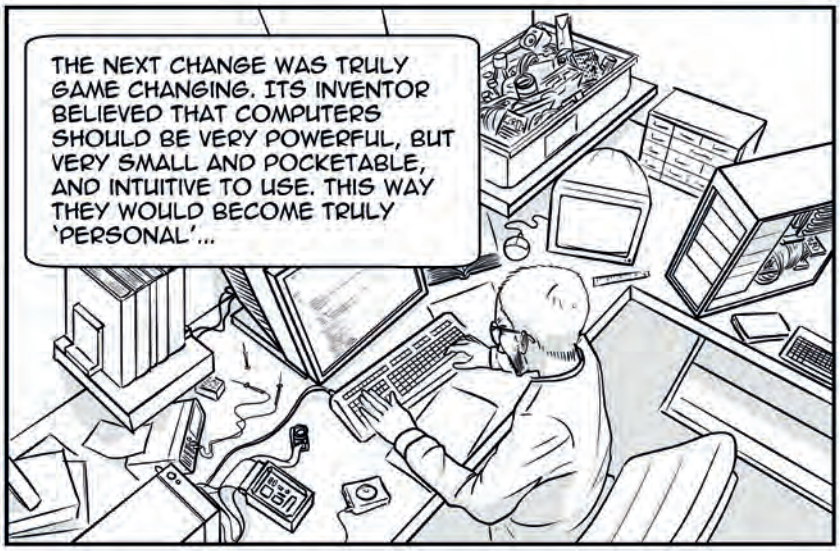
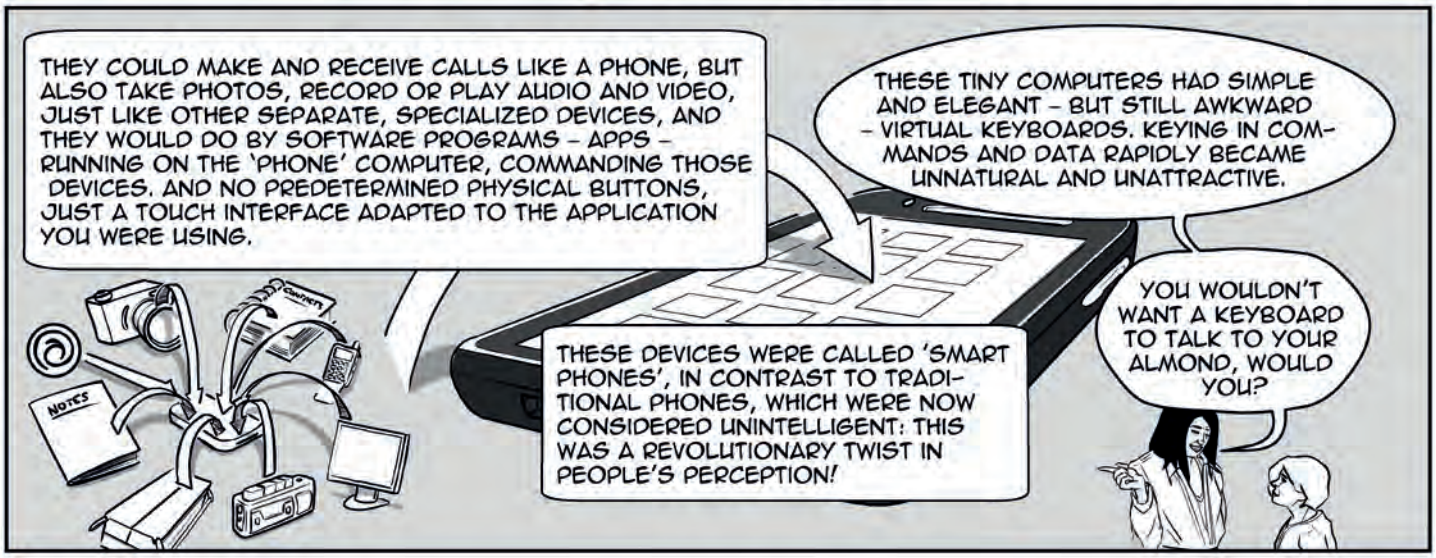


PHOTO
TEXT
VIDEO
ITS SUCCESSOR, WEB 2.0, ON THE OTHER HAND, HAD TRAFFIC GOING BOTH WAYS – PEOPLE COULD CONTRIBUTE INFORMATION TO THE WEB, AS WELL AS RECEIVE IT, WITHOUT BEING WEBSITES.


WITH THESE FUNDAMENTAL CHANGES, THE NATURE OF THE INFORMATION FLOWING CHANGED TOO.
nature
INSTEAD OF SCIENTIFIC DATA,
NOW PEOPLE STARTED PUBLISHING INFORMATION ABOUT THEIR OWN LIVES – HOWEVER MINOR,
AND OF COURSE GROUPS, INSTITUTIONS, POLITICAL PARTIES, FAN GROUPS, YOU NAME IT.


THIS MAJOR LEAP FORWARD WAS ENABLED BY ADDING JUST A SMALL – BUT VERY CLEVER – LAYER ON TOP OF THE INFRASTRUCTURE THAT ALREADY EXISTED.
INTERNET
WEBSOCKET


THE NEXT CHANGE WAS TRULY GAME CHANGING. ITS INVENTOR BELIEVED THAT COMPUTERS SHOULD BE VERY POWERFUL, BUT VERY SMALL AND POCKETABLE, AND INTUITIVE TO USE. THIS WAY THEY WOULD BECOME TRULY 'PERSONAL'...

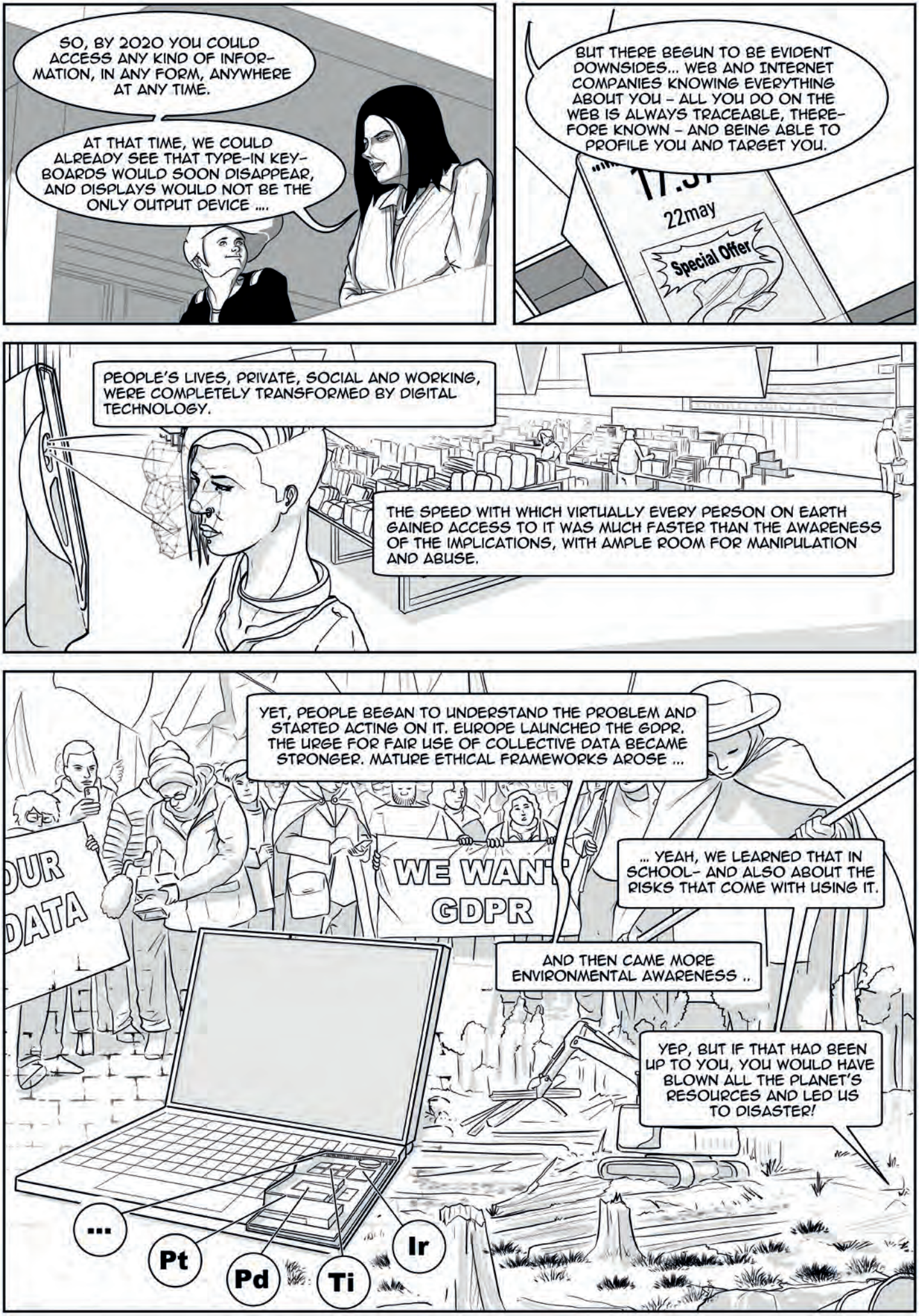

THEY COULD MAKE AND RECEIVE CALLS LIKE A PHONE, BUT ALSO TAKE PHOTOS, RECORD OR PLAY AUDIO AND VIDEO, JUST LIKE OTHER SEPARATE, SPECIALIZED DEVICES, AND THEY WOULD DO BY SOFTWARE PROGRAMS – APPS – RUNNING ON THE 'PHONE' COMPUTER, COMMANDING THOSE DEVICES. AND NO PREDETERMINED PHYSICAL BUTTONS, JUST A TOUCH INTERFACE ADAPTED TO THE APPLICATION YOU WERE USING.
THESE TINY COMPUTERS HAD SIMPLE AND ELEGANT – BUT STILL AWKWARD – VIRTUAL KEYBOARDS. KEYING IN COMMANDS AND DATA RAPIDLY BECAME UNNATURAL AND UNATTRACTIVE.
YOU WOULDN'T WANT A KEYBOARD TO TALK TO YOUR ALMOND, WOULD YOU?
THESE DEVICES WERE CALLED 'SMART PHONES', IN CONTRAST TO TRADITIONAL PHONES, WHICH WERE NOW CONSIDERED UNINTELLIGENT: THIS WAS A REVOLUTIONARY TWIST IN PEOPLE'S PERCEPTION!
NOTES

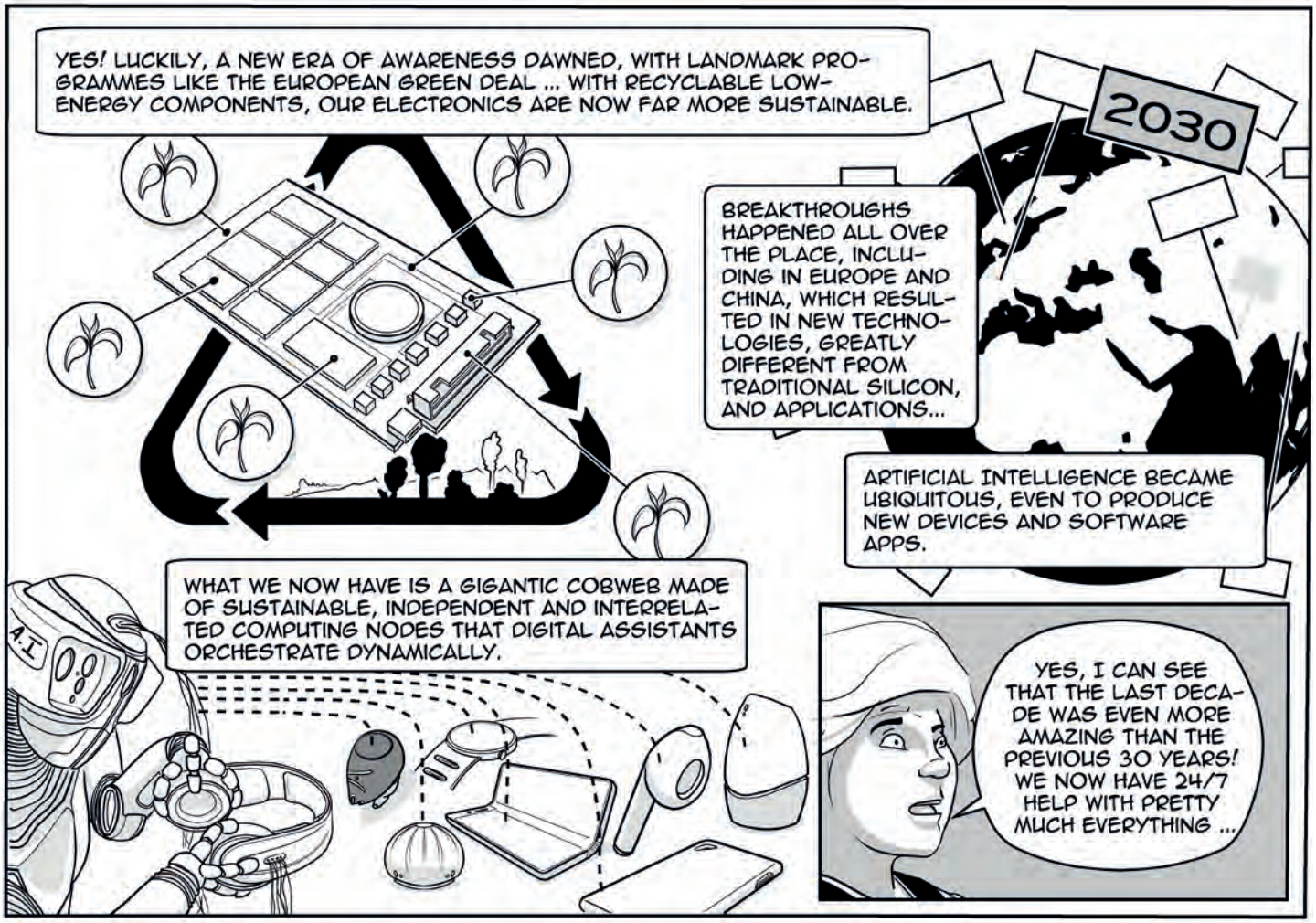

THESE POCKETABLE DEVICES WERE MORE POWERFUL THAN THE PERSONAL AND LAPTOP COMPUTERS THAT PRECEDED THEM. OLDER FORMS OF TECHNOLOGY CEASED TO BE RELEVANT.
TELEPHONES FOR EXAMPLE – DID YOU KNOW THEY WERE ONCE FIXED?

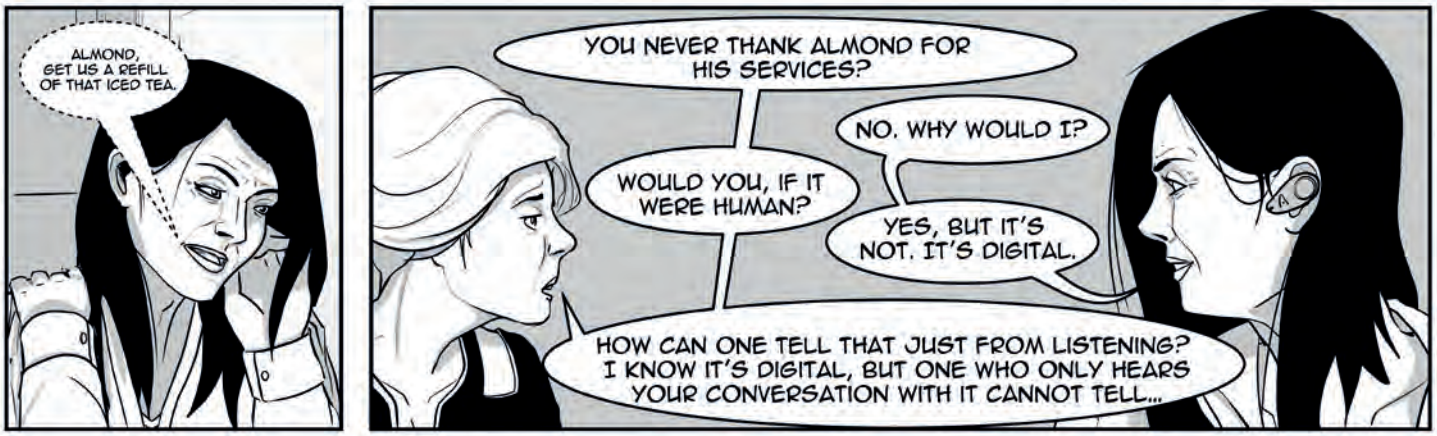

WITH SMARTPHONES, YOU COULD SPEAK ON THE PHONE WHILE GOING ABOUT YOUR OWN BUSINESS.


THE SAME HAPPENED WITH TV.
WHEN I WAS YOUNG, YOU COULD ONLY WATCH VIDEO ON A SINGLE DEVICE, THE TV, WHICH HAD A VERY LIMITED CHOICE OF BROADCASTING CHANNELS: CAN YOU BELIEVE THAT?
YOU HAD TO WATCH A PROGRAMME AT THE TIME WHEN IT WAS SHOWN, ON A DEVICE WHICH WAS FIXED AT YOUR HOME, OR ELSE RECORD IT, WITH THE HASSLE OF PHYSICALLY STORING THE RECORDING AND REPLAYING IT FROM A FIXED LOCATION.


THOSE TWO STEPS OF EVOLUTION, WEB 2.0 AND SMARTPHONES, MEANT THAT CONTENT COULD REACH YOU WHEREVER YOU WERE. AND YOU COULD ALSO EXCHANGE CONTENT WITH ANYONE YOU'D LIKE, ANYWHERE IN THE WORLD.


SO, BY 2020 YOU COULD ACCESS ANY KIND OF INFORMATION, IN ANY FORM, ANYWHERE AT ANY TIME.
AT THAT TIME, WE COULD ALREADY SEE THAT TYPE-IN KEYBOARDS WOULD SOON DISAPPEAR, AND DISPLAYS WOULD NOT BE THE ONLY OUTPUT DEVICE ....
BUT THERE BEGUN TO BE EVIDENT DOWNSIDES... WEB AND INTERNET COMPANIES KNOWING EVERYTHING ABOUT YOU – ALL YOU DO ON THE WEB IS ALWAYS TRACEABLE, THEREFORE KNOWN – AND BEING ABLE TO PROFILE YOU AND TARGET YOU.
22may
Special Offer
PEOPLE'S LIVES, PRIVATE, SOCIAL AND WORKING, WERE COMPLETELY TRANSFORMED BY DIGITAL TECHNOLOGY.
THE SPEED WITH WHICH VIRTUALLY EVERY PERSON ON EARTH GAINED ACCESS TO IT WAS MUCH FASTER THAN THE AWARENESS OF THE IMPLICATIONS, WITH AMPLE ROOM FOR MANIPULATION AND ABUSE.
YET, PEOPLE BEGAN TO UNDERSTAND THE PROBLEM AND STARTED ACTING ON IT. EUROPE LAUNCHED THE GDPR. THE URGE FOR FAIR USE OF COLLECTIVE DATA BECAME STRONGER. MATURE ETHICAL FRAMEWORKS AROSE ...
GDPR
... YEAH, WE LEARNED THAT IN SCHOOL- AND ALSO ABOUT THE RISKS THAT COME WITH USING IT.
AND THEN CAME MORE ENVIRONMENTAL AWARENESS ..
YEP, BUT IF THAT HAD BEEN UP TO YOU, YOU WOULD HAVE BLOWN ALL THE PLANET'S RESOURCES AND LED US TO DISASTER!
...
Pt
Pd
Ti
Ir


YES! LUCKILY, A NEW ERA OF AWARENESS DAWNED, WITH LANDMARK PROGRAMMES LIKE THE EUROPEAN GREEN DEAL ... WITH RECYCLABLE LOW-ENERGY COMPONENTS, OUR ELECTRONICS ARE NOW FAR MORE SUSTAINABLE.
2030
BREAKTHROUGHS HAPPENED ALL OVER THE PLACE, INCLUDING IN EUROPE AND CHINA, WHICH RESULTED IN NEW TECHNOLOGIES, GREATLY DIFFERENT FROM TRADITIONAL SILICON, AND APPLICATIONS...
ARTIFICIAL INTELLIGENCE BECAME UBIQUITOUS, EVEN TO PRODUCE NEW DEVICES AND SOFTWARE APPS.
WHAT WE NOW HAVE IS A GIGANTIC COBWEB MADE OF SUSTAINABLE, INDEPENDENT AND INTERRELATED COMPUTING NODES THAT DIGITAL ASSISTANTS ORCHESTRATE DYNAMICALLY.
AI
YES, I CAN SEE THAT THE LAST DECADE WAS EVEN MORE AMAZING THAN THE PREVIOUS 30 YEARS! WE NOW HAVE 24/7 HELP WITH PRETTY MUCH EVERYTHING ...


ALMOND, GET US A REFILL OF THAT ICED TEA.
YOU NEVER THANK ALMOND FOR HIS SERVICES?
NO. WHY WOULD I?
WOULD YOU, IF IT WERE HUMAN?
YES, BUT IT'S NOT. IT'S DIGITAL.
HOW CAN ONE TELL THAT JUST FROM LISTENING? I KNOW IT'S DIGITAL, BUT ONE WHO ONLY HEARS YOUR CONVERSATION WITH IT CANNOT TELL...


WELL, IN FACT, WE NOW HAVE A LOT OF CONVERSATIONS WITH OUR ASSISTANTS. MAYBE MORE THAN WITH REAL PEOPLE.
AND THEY [THE ASSISTANTS] ALSO TALK AMONG THEMSELVES WITHOUT INCLUDING US, IN ORDER TO HELP US IN THE BEST WAY POSSIBLE. THEY ARE PROTECTING US FROM ATTACKS AND LOOK AFTER OUR DATA TO PROTECT OUR PRIVACY.
MY ALMOND REALLY IS MY GUARDIAN ANGEL...
SO IS THAT HOW YOU SEE TECHNOLOGY? YOUR ASSISTANT IS YOUR GUARDIAN ANGEL?


YEAH, I GUESS.

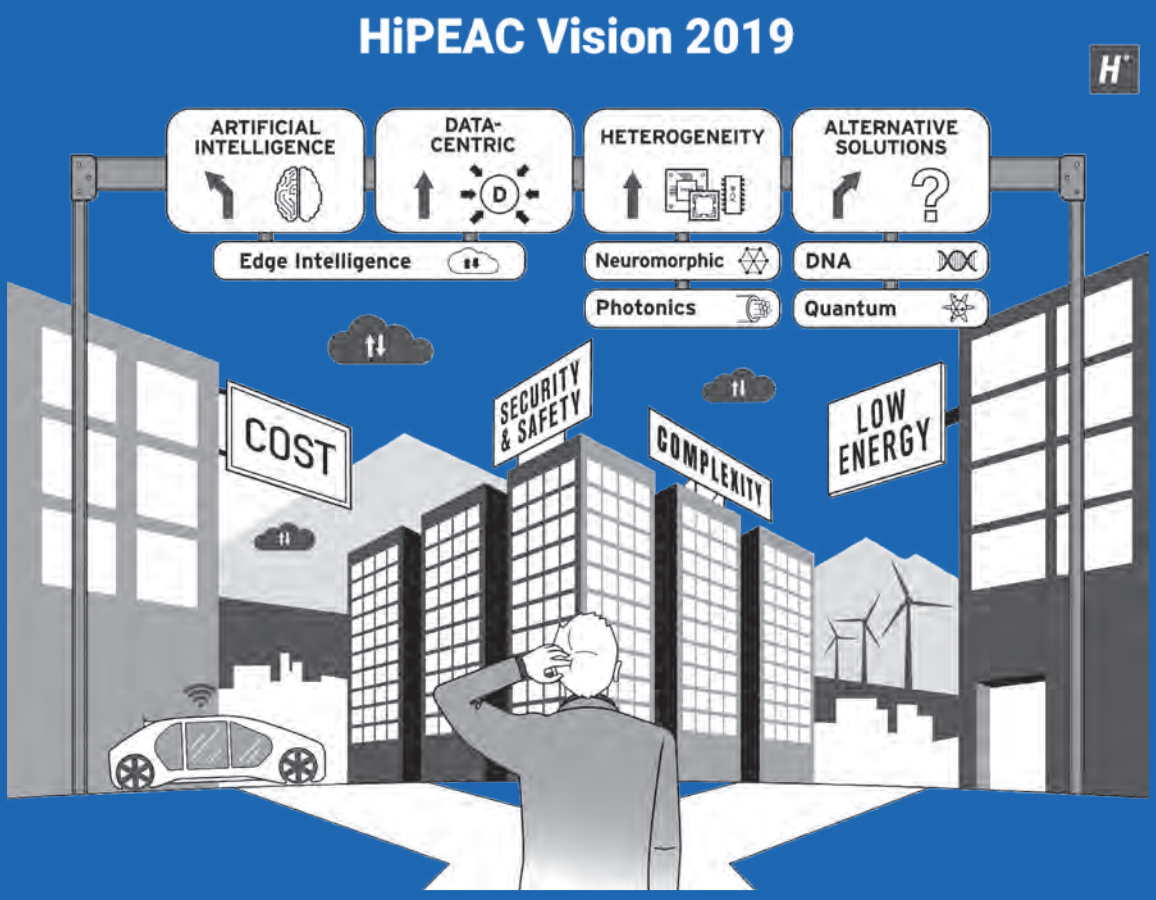

EVERYONE HAS THEIR OWN GUARDIAN ANGEL, WHO CAN PROTECT THEM,
SO THAT EVERYONE CAN MAKE THEIR WAY SAFELY THROUGH OUR DIGITAL WORLD.

Looking into the future of computing:
THE HiPEAC VISION

We've seen how the World Wide Web transformed human experience. But what other areas of digital technology?

Every two years, HiPEAC produces its roadmapping document, the HiPEAC Vision. Taking into account business dimensions, conditions to make computing acceptable - such as trustability and energy restrictions - as well as technology trends, system-level directions and the impact of computing on society, the Vision aims to be holistic.

In the HiPEAC Vision, you will find out how computing technology has transformed our world in just over half a century, and how the HiPEAC community of computing experts thinks it will continue to do so over the next ten years.



Like to read more?
Check out the HiPEAC Vision here: ***hipeac.net/vision***

Can you imagine life without the Web? Can you picture a world in which you have to go online instead of being online? Where you would have to walk to fetch information? 30 years ago, that was exactly how our everyday lives looked!

This booklet recalls how we got to where we are today in our connected world, and pictures where new technology developments can take us in the next ten years to a world in which reliable and trustworthy digital technology is part of the fabric of our lives.

Design and layout by Etienne Giorgetti / chat-noir.biz / 2020