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Being Human in the Age of Algorithms: part 1

Учебное пособие

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PREFACE

Настоящее учебное пособие включает актуальные тексты (2017-2018гг.) учебно-познавательной тематики для студентов механико-математического факультета (направления 02.03.01 «Математика и компьютерные науки», 01.03.02 «Прикладная математика и информатика», 38.03.05 «Бизнес-информатика»).

Целью данного пособия является формирование навыка чтения и перевода научно-популярных текстов, а также развитие устной речи студентов (умение выразить свою точку зрения, дать оценку обсуждаемой проблеме).

Пособие состоит из 5 разделов, рассматривающих значение информационных технологий в современном мире. Каждый из них содержит аутентичные материалы (источники: *Aeon, BBC Future, Nautilus, Psychology Today, Quanta Magazine*) и упражнения к ним. Раздел “Supplementary reading“ служит материалом для расширения словарного запаса и дальнейшего закрепления навыков работы с текстами по специальности.

Пособие может успешно использоваться как для аудиторных занятий, так и для внеаудиторной практики.

1. The reasons you can't be anonymous anymore

Part 1

Exercise I.

Say what Russian words help to guess the meaning of the following words: reasons, anonymous, isolated, situation, monitored, company, individual, anonymity, sociocultural, phenomenon

Exercise II.

Make sure you know the following words and word combinations: far-flung, wellbeing, blase, to divulge, thawing, titbit, fleeting, to eschew, savvy, to curate

The reasons you can't be anonymous anymore

Imagine walking into a roomful of strangers. Perhaps you've travelled to a new city. You don't know anyone, and no one knows you. You're free to do anything or go anywhere or talk to anyone. How do you feel? Perhaps you feel free of the judgment and scrutiny from acquaintances or associates. Perhaps you feel energised that you can use this opportunity to experience life on your terms, at your own speed. But whatever your feelings would be, you would at least safely assume that you can enter this isolated situation without being monitored or tracked by a far-flung company or individual – right? Wrong. What you're experiencing as you walk into that room is anonymity: a sociocultural

phenomenon that's afforded privacy and freedom. But in the year 2018, it's pretty much all but dead. It's emerging as one of the major challenges of our age: how should we go about both ensuring national security and enhancing our lives through technology, whilst also maintaining a basic right to privacy that feels like it has existed since the beginning of human history?" Anonymity is a uniquely human psychological experience: it's the idea that we all have identities to present to the world, but under certain circumstances, can switch the identity off and operate in total secrecy. We need a public self to navigate the social world of family, friends, peers and co-workers, but we also need a private self – an internal space where we can reflect on our own thoughts and feelings apart from outside influence, where we can just be with our own psyche. Our identity is formed by both. Without one or the other, our wellbeing can easily become disrupted. Being anonymous allows us to try new things or express ideas without being judged. Being anonymous in an environment like the internet can help safeguard personal safety. People from all walks of life have reason, at one time or another, to seek anonymity. But while most internet users would like to remain anonymous, most don't think it's entirely possible. The study found that 59% of American internet users believe it is impossible to completely hide your identity online. And while some people are taking basic steps to preserve anonymity, like deleting their browsing history, many users who say they value anonymity aren't really walking the walk. Earlier this year, an analysis published in the Journal of Communication explored something called the "privacy paradox": the idea that, while people value privacy, they do

little in practice to preserve it. Think about it: when was the last time you actually read one of those many, lengthy privacy policy updates before clicking “I agree”? Our attitude toward privacy has become increasingly blasé. One could even argue it’s even detrimental not to divulge at least some info. Career coaches worldwide trumpet the professional importance of having a public photo complete with full name, headshot, full work history and more. Perhaps this is more of a cultural thawing toward previously uptight attitudes. In 1990s, internet service providers went to great, paranoid lengths to discourage users from divulging even basic tidbits in their public profiles, like first name, city, even gender. Today? Personal info flies freely and wildly across the web, often on our volition: Instagrammed selfies of ourselves and loved ones, complete with geotagged locations. Social media users engaging in political spats and horrible insults, despite the fact that the target of their harassment could click on their real names and real photos and see who they actually are. People tend to think of cyberspace as some kind of imaginary space without true boundaries, a space not to be taken too seriously – not subject to the same rules and standards as the ‘real’ world. In just the span of a few short years, people’s comfort level with the internet has risen to the point where information-sharing can be careless or reckless. Call it privacy fatigue, but our increased interdependence on our smart devices and social media has given some of us a largely lazy attitude toward staying totally anonymous. (1)

But what if you’re one of those people who eschews Facebook, has no social media presence, and goes to great lengths to leave a fleeting digital footprint? Sorry – your anonymity is at risk too.

While skipping a Facebook profile is a good way to disconnect, there are still ways people can sleuth out your identity. Paul Ohm, a law professor at Georgetown University, says there's "intentional anonymity" and "inferential anonymity": the former being what we choose to keep close to the vest, and the latter referring to the data that a Google-savvy sleuth can "infer" from you online – that is, dig up loads of personal information about you using a single fact as a starting point. "It's become increasingly clear that it's a losing game," Ohm says on achieving total anonymity in 2018. "As long as someone knows something about you, they can probably find other things about you, and do it really successfully – more than they have in the past." If you're a social media party pooper, that might mean old flames or long-lost classmates can't track you down. But that doesn't mean you're anonymous from big entities, like corporations or the government. "It's much harder to be anonymous than it was 20 years ago, at least from the biggest companies and the government," says Peter Swire, professor of law and ethics at Georgia Institute of Technology. Advertisers track your internet habits across your devices – phone, tablet, laptop – to know where you habitually go, shop, and what kind of websites you visit, and there has been growing controversy about what internet companies should be allowed to track and sell to third parties. Swire says we're living in a "golden age of surveillance": If you're a person of interest in an investigation, looking up details like financial records, medical records, web history or call history is a breeze. And that hints at a larger, serious privacy concern in the age of cybersecurity breaches. It's hard to go undetected these days. What's more? We're approaching

the “next great frontier in advertising: your location. Sure, websites can tweak adverts to zero in on your interests based on the web searches you’ve made on the same device, or sites visited. But companies and advertisers are chasing technology and business deals that pinpoint your exact whereabouts in real-time for ‘personalised’ advertising. For example, an advert could flash on your mobile phone’s screen offering a coupon for a store you’re half a mile away from. Unless you’re willing to live without the internet or without any smart device, it’s practically impossible to go completely off the grid. “This is a bad time to be a spy,” Swire says. In other words, even for people whose job it is to be anonymous, it’s hard to be anonymous. (2)

Still, there are plenty of instances in which anonymity is problematic, even dangerous. Is its demise actually a blessing for society? Swire says that anonymity is a relatively new construct, and that the rise of cities gave rise to it. So, we’ve spent far more time living without it than living with it. “Anonymity didn’t exist in small towns in the days of yore,” Swire says, where everybody knew everybody’s business. “To some extent, urban living created anonymity. The difference today is that even in a big city, each of us leaves breadcrumbs that an investigator can follow.” Anonymity also has a dark side. 53% of interviewees admitted to malicious activities, like hacking or harassing other internet users, or engaging in “socially undesirable activities", like visiting sites that depicted violence or pornography, or downloading files illegally. There may be signs that, while most people certainly want to keep sensitive information like bank accounts and medical records safe, others may not care about sacrificing true anonymity for a perceived greater good. Americans who were surveyed felt torn between

maintaining privacy rights and ensuring national security: 56% surveyed said that they were more concerned that the government's anti-terrorism policies hadn't gone far enough to protect citizens, even if that meant sacrificing some civil liberties, like online privacy. Meanwhile, the survey last year found that about nearly half of Britons said that "more should be done to help the security forces combat terrorism, even if this means the privacy of ordinary people suffers." In any case, efforts to completely anonymise our activities are more or less futile: With the rise of the internet of things, more and more of the devices we use every day will require our personal information to function, and the more they'll be integrated into our lives. "There is this huge disconnect," Ohm says. "Do we believe what people say when an interviewer asks them about privacy, or do we believe their purchasing habits?" (3)

Waning anonymity sounds inevitable. Still, if you do want to protect your privacy as best you can, the experts do offer a few tips. Most Americans don't trust big institutions like the government or social media sites to protect their personal information – and yet, ironically, most Americans don't follow best practices to protect their identities online. What are some of those best practices? Keeping your passwords under lock and key, making a different one for each service, and making them hard to guess. But if you're more concerned about your reputation than hackers, a little common sense goes a long way. Follow the front page test: don't put comments down in texts or emails that would bother you if they were on the front page of the newspaper. You might not care if an internet company can access those gossipy emails, but you'd really care if your boss sees them instead. Using encrypted messaging apps like WhatsApp make your messages more private and more difficult to

trace. But if we're going to reassign real cultural value to anonymity; to secure it as a basic right people are entitled to, it's going to take a lot more than just individual action, and a lot more than encryption apps you can load up your phone with. It's going to take sweeping societal change. It's going to take governments, advertisers, and tech corporations worldwide to agree on a societal system of ethics. It's not just about customers opting out of digital services – it's about the choice to opt out of their public-facing identities, as well. All of us need to keep some private space where our deepest dreams and darkest fantasies are hidden away from other people – it gives us room to develop as humans, to try out different thoughts and different sides of ourselves.That doesn't change because of the internet. There's a well-known contradiction in the way many of us behave online, which is this: we know we're being watched all the time, and pay lip service to the evils of surveillance by Google and the government. But the bounds of what's considered too personal or revealing to be uploaded to an app or shared with a circle of social media 'followers' seems to shrink by the day. When faced with an abundance of digital toys that offer magical levels of connectivity and convenience, many of us succumb to a giddy sense that privacy is kind of stupid. That's not to say that social media curbs our self-awareness, or that our internet selves aren't highly artificial and curated. Nor that people living in oppressive regimes, or as minorities in societies where they know they will be targeted, aren't justifiably anxious about what they say online. But the point remains that digital media have radically transformed our conceptions of intimacy and shame, and they've done so in ways that are unpredictable

and paradoxical. I moan about the lack of privacy, for example, and yet I willingly and routinely trade it for convenience. I am no longer forced to take my chances on a restaurant and guess which one is best; the app will tell me and then escort me to its front door. I no longer run the risk of unforeseen delays on public transport; Google Maps will inform me of the fastest route to my destination, and, in a pinch, another app can get me there via any number of hidden by-roads. I no longer need to remember my friend's birthdays; Facebook will nudge me, and lure me to post an update to remind people I exist. To avail myself of these applications, all I have to do is make my location, habits and beliefs transparent to their parent companies. (4)

So what's going on? 'Visibility is a trap,' wrote the French philosopher Michel Foucault in Discipline and Punish: The Birth of the Prison (1975)**.** What he meant was that allowing oneself to be watched, and learning to watch others, is both seductive and dangerous. He drew upon Jeremy Bentham's 18th-century plans for a prison in which inmates are observed from a central tower manned by an invisible occupant, his watchful eye seeing but unseen. The idea is that in the presence of ever-watchful witnesses physical coercion is no longer necessary. People police themselves. They do not know what the observers are registering at any given moment, what they are looking for, exactly, or what the punishments are for disobedience. But the imagination keeps them pliant. Individuals not only accept this form of discipline, but it soon becomes invisible to them, and they willingly perpetuate it. So what would Foucault make of the current digital media landscape? In many ways, the modern surveillance state – enabled and expanded thanks to new technologies – is a shining example of that

prison with corporations now spying on us from numerous vantage points. To this we must add our audience followers, from colleagues and acquaintances to the public at large. Foucault's central claim is that such monitoring is worrisome, not just because of what corporations and states might do with our data, but because the act of watching is itself a devastating exercise of power. It has the capacity to influence behaviour and compel conformity, without our fully realising it. But something's not right here. The internet has no centre; we don't need hard evidence of a conspiracy between companies and governments to know that we are seen online. We seem to be surveilled from everywhere and nowhere, and yet the self-display continues. Yes, social media might spell the end of respectability; but doesn't it also embolden people to be frank and open, to say what they mean, without shame? We might be the democratic citizens, people willing to lay bare their lives for the sake of discussion and debate, people for whom nothing is hidden or out of bounds. But having a smartphone and access to the internet does not automatically equip us with the tools necessary for effective and respectful collaboration, negotiation and speech, such as democracy requires. (5)

Adapted from BBC Future.

Exercise III.

Find paragraphs, dealing with the following: roomful, scrutiny, wellbeing, safeguard, divulge, paradox, headshot, tidbits, harassment, cyberspace

Exercise IV.

Fill in the gaps.

1. It would be better to **……** the intermediate step and go straight to the Fair Tax.
2. Cooks tend to **…….** pumpkin for soups, and choose the related butternut squash.
3. Scholars continue to **…….** out new names, dates, attributions and other information.
4. The administration didn't seem eager to **…….** Thursday's announcement, though.
5. State law allows physicians to discontinue treatment they deem medically **……..**.
6. Yet, we shouldn't be too quick to **…….** that GDP growth is being underestimated.
7. Tom Campbell and his challenger, JT Wilcox, are both smart and **……..** .
8. His leadership and results focus will **…….** our already strong executive team.
9. Would you trust a **…….** of apprentice chefs unwilling to sample their wares?
10. He realizes that's much tougher ……. than any provided by the fans or media.

Exercise V.

Make up sentences of your own with the following word combinations:

to walk the walk, close to the vest, to zero in on smth, off the grid, sensitive information, vantage point, hard evidence, out of bounds, to sleuth out, to be taken seriously

Exercise VI.

Match the words to the definitions in the column on the right:

to skip	intensify, increase, or further improve the quality, value, or extent of
sleuth	deduce or conclude (information) from evidence and reasoning rather than from explicit statements
trumpet	deliberately avoid using; abstain from
futile	having or showing practical knowledge and experience
to infer	critical observation or examination
to enhance	a fact or situation that is observed to exist or happen, esp. one whose cause or explanation is in question
savvy	proclaim widely or loudly
eschew	to leave one thing or place, especially quickly, in order to go to another
scrutiny	incapable of producing any useful result; pointless
phenomenon	carry out a search or investigation in the manner of a detective

Exercise VII.

Summarize the article “The reasons you can't be anonymous anymore”

Part 2

Exercise I.

Identify the part of speech the words belong to.

Roomful, scrutiny, detrimental, volition, inferential, surveillance, societal, anonymous, careless , reckless

Exercise II .

Form nouns from the following words:

anonymous (1), imagine (1), associate (1), isolated (1), national (1), basic (1), exist (1), uniquely (1), human (1), psychological (1),

Exercise III.

Find synonyms to the following words. Translate them into Russian:

enhance (1), scrutiny (1), attitude (1), provider (1), skip (2), eschew (2), sleuth (2), futile (2), infer (2), savvy (2)

Exercise IV.

Find antonyms to the following words. Translate them into Russian:

public (1), internal (1), reflect (1),outside (1), anonymous (1), allow (1), safety (1), remain (1), possible (1), skip (2)

Exercise V.

Match the words to make word combinations:

lip	phenomenon
national	point

sensitive	fatigue
sociocultural	service
privacy	security
digital	information
social	evidence
smart	footprint
vantage	devices
hard	media

2. Are You a Self-Interrupter?

Part 1

Exercise I.

Say what Russian words help to guess the meaning of the following words: technology, information, sphere, group, biometric, cameras, minutes, computer, students, college

Exercise II.

Make sure you know the following words and word combinations:

glance, idle, peek, foray, enticing, corroborate, interference, to facilitate, mediate, devoid, disrupted, concurrently, plasticity, fascinating

Are You a Self-Interrupter?

Distraction in the technology age.

Our technology-rich world has proven to be both a blessing and a curse. While on the one hand we have access to information or people anywhere at any time, on the other hand we find our attention constantly drawn by the technological environments. Media multitasking—which is accomplished by your brain not performing two tasks simultaneously but instead by rapidly switching from one task to another—occurs in every sphere of our world including home, school, workplace, and our leisure life. And this is not just limited to the younger generation. A recent study followed a group of young adults and a group of older adults who wore biometric belts with embedded cameras for more than 300 hours of leisure time. While the younger adults switched from task

to task 27 times per hour—once every two minutes—the older adults were not all that great at maintaining their attention either, switching tasks 17 times per hour, or once every three to four minutes. Former Microsoft executive Linda Stone dubbed this constant multitasking "continuous partial attention." Frequent task switching is something we all do, and the more often we switch, the more detrimental it is to our real-world performance. Unless you monitor someone's computer as well as his or her smartphone and all his or her other devices, it is difficult to know how much task switching is truly occurring. However, several studies have used different research tools to try to assess real-world task switching. For example, in a recent study the Rosen's lab observed students—ranging from middle school to college age—studying for 15 minutes in an area where they normally study. Shockingly, students could not focus for more than three to five minutes even when they were told to study something very important. This study replicated work by Gloria Mark and her colleagues at the University of California, who observed that IT workers were similarly easily and frequently interrupted. Other researchers have asked people to keep detailed diaries of their daily media and technology use; one particular study of 3,048 13- to 65-year-old teens and adults found that people of all ages multitasked at least a quarter of the time—with teens dual tasking 31 percent of their day—although their most common combinations were different. While 13- to 16-year-olds preferred to combine listening to music with being online, engaging in social media, or viewing online videos, young adults (25 to 29) preferred combining email, watching television, and visiting websites, and older people (50 to

65) preferred combining more traditional media activities such as email and radio, television, and visiting websites. Other studies have validated and extended these results; research from Rosen's lab showed that, when asked how easy or difficult it was to pair a variety of tasks together, members of younger generations reported that they felt that it was rather easy to pair most tasks, while those of older generations felt that only more well-practiced tasks could be easily combined. (1)

One interesting aspect of this penchant for combining tasks is that we seem to have lost the ability to single task. Glance around a restaurant, look at people walking on a city street, pay attention to people waiting in line for a movie or the theater, and you will see busily tapping fingers. We act as though we are no longer interested in or able to stay idle and simply do nothing. We appear to care more about the people who are available through our devices than those who are right in front of our faces. And perhaps more critically, we appear to have lost the ability to simply be alone with our thoughts. Rosen's lab has been studying this phenomenon for the past decade and has seen a constant increase across generations in how often people check in with their devices. The vast majority of young people check their smartphones every 15 minutes or less, and 3 out of 4 young adults sleep with their phones nearby with the ringer on so as not to miss a nighttime alert. While the typical college student owns an average of seven tech devices, older adults are not far behind. Where we used to read, we now skim. Where we used to write, we now use shortened fragments to convey our thoughts. When Twitter first appeared we used to shake our head at the impossibility of putting our thoughts into "only" 140 characters. Now

this appears normal and fits our task-switching lifestyle. When was the last time you read a book, a long article, or literally anything more than a page or two without taking a quick peek at your phone or web browser or without the television on in the background? Eye-tracking studies show that when we read a webpage or any text on a screen we don't read it the same way that we read a book. Rather than our eyes passing from word to word along each successive line of text, we tend to read in an "F" pattern, where we read the top and left sides of the page, with a brief foray into the text somewhere in the middle, rather than the complete page line by line. Add in hyperlinks, ads, multimedia videos, scroll bars, and all of the other enticing distractions on a webpage, and it is not surprising that we have difficulty attending to anything for more than a few minutes. We are most certainly impatient, which you can verify by watching a group of people all checking their phones every three to five minutes regardless of what they are doing at the time or who they are with. A recent study from University of Massachusetts demonstrated our collective impatience by collecting data from 23 million online video views; the data showed that average viewers begin to abandon a video if it takes more than two seconds to buffer, and 6 percent more viewers click on something else every additional second of buffering. By these data, even a brief 10-second delay in starting a video provokes nearly two-thirds of viewers to leave that screen for another source of information. These quantitative data, collected without the knowledge of the viewers, corroborate survey and experimental data highlighting what was originally dubbed the "four-second rule," referring to the time that an average online shopper is likely to leave a website for another if it

does not download. More recent work has even suggested that the four-second rule may actually be closer to a “two-second rule” or even a “400 millisecond rule” (less than half a second), indicating that we are all quite impatient and prone to diverting our attention rapidly from one screen to the next if our needs are not being met instantly. (2)

In the next few sections, we take a brief look at research performed in a variety of typical situations where we are prone to interference. For those of us who work with technology and are surrounded by other employees working with their technologies, interference has become the norm. We are constantly interrupted by others dropping by our desk to chat or attempting to connect with us through a variety of technological communication modalities, including the most popular workplace tool—email. A study by Judy Wajcman, a sociology professor at the London School of Economics, highlighted this phenomenon by shadowing 18 employees of an Australian telecommunications company during their entire workday. Wajcman selected this company because it was designed to facilitate interactions between workers with open-plan offices and other external distractors, including many large television screens mounted around the office. The employees in this study spent only half their workday on actual “work episodes,” which included any work-related activities. Strikingly, most of these work episodes lasted 10 minutes or less, with an average of just three minutes per work episode. And even more interesting, nearly two-thirds of the work episode interruptions were self-generated, and most of those involved some form of mediated communication using a technological device. In fact, of the approximately 86 daily changes in an employee’s work activity, the workers themselves generated 65 of

them internally, with the vast majority involving “checking in” with no obvious external alert or notification. Even without the “You’ve Got Mail” notification, these workers checked their email anyway and continued to check other sources of electronic communication and information without being externally directed to do so. Whether directed externally via an alert or notification or internally by an unseen process, it appears that in the work environment email and other communication modalities bear a major responsibility for interruptions. One field study that followed workers for two weeks discovered that they were interrupted 4.28 times per hour by email and an additional 3.21 times by instant message communications. And these communications appeared to have a strong draw for the employees, since 41 percent of them responded to the email immediately and 71 percent responded to an instant message immediately. On average, the workers spent 10 minutes dealing with the alerts and then took an additional 10 to 15 minutes to return to their appointed task, often visiting several other applications in the interim. Another study by the research group indicated that more than half of the 250 workers they queried spent over two hours a day reading and responding to email. A study of Loughborough University in England found that after dealing with an email, which itself took an average of just under two minutes, it took the studied workers an average of 68 seconds—more than half of the time required to read and respond to that email—to return to their work and remember what they were doing. This study also found that people are responding like Pavlov’s dogs to incoming email communication, waiting only an average of one minute and 44 seconds to open that message. Strikingly,

70 percent of those alerts were attended to within six seconds, which is about the time it takes a phone to ring three times. And yet another study found that even without an alert, while 1 in 3 people claimed to check their email every 15 minutes, they actually checked it about every five minutes. We are self-interrupting and not even aware of how often we are diverting our attention from our main task—in this case, our job—to another task that may be completely unrelated to work. (3)

Many studies have examined technology use related to education both in and out of the classroom and its impact on the Distracted Mind. Today's college students own an average of seven high-tech devices, and most students have at least three—smartphone, laptop, and tablet—in the classroom. These devices themselves tend to be used as multitasking tools. Only 1 in 5 apps on college students' smartphones were categorized as "productivity" apps. In the classroom, these devices provide a ready source of interruption that has been validated in many studies. For example, one study found that 9 in 10 students used their laptop computers for nonacademic reasons during class time, while another study found that 91 percent of students reported texting during class. Other studies have addressed how students use technology while they are studying outside the classroom. Terry Judd, a professor at the University of Melbourne, monitored more than 3,300 computer session logs from 1,229 students studying in the computer lab and found that the average time on task was only 2.3 minutes; multitasking was the name of the game, with less than 10 percent of the sessions being devoid of task switching to something other than studying, which turned out to be checking email, texting, and social media. In a laboratory study, a

researcher from Virginia Commonwealth University observed college students during a three-hour study session using video cameras and eye trackers and found that on average, students spent more than an hour listening to music and showed 35 interruptions of six seconds or longer, totaling 26 disrupted minutes in just three hours. The biggest cause of interruptions was the smartphone, which students checked close to nine times in the three-hour study session. Other major interrupting culprits included checking the Internet for information not related to the material being studied and checking email. (4)

Another report on the studying activities of students found that the reason behind the constant task switching is a desire to feed emotional needs—often by switching from school work to entertainment or social communication—rather than cognitive or intellectual needs. According to the study's authors, "This is worrisome because students begin to feel like they need to have the TV on or they need to continually check their text messages or computer while they do their homework. It's not helping them, but they get an emotional reward that keeps them doing it."More work has been done to document the impact of technology on student behavior than any other population, as technology is more readily available to these individuals and they are the first to have grown up immersed in a technology-rich environment with ever-increasing opportunities for interference. In one study, middle school, high school, and university students were observed while they were instructed to study something important for a short period of time (only 15 minutes). Regardless of age, students were able to stay focused and attend to that important work only for a short period of time—three to five minutes—before most students self-interrupted their studying to

switch to another task. During the 15-minute study period, students were able to actually study for only nine minutes. The major culprits that spurred the constant interruptions had two sources: social media and texting. Both of these were apparently offering such important information that the studying student's attention was transferred from the task at hand to another source of information through the two most popular communication modalities among the younger generations. (5)

There are two approaches by which we can diminish the negative impact of interference on our lives: changing our brains and changing our behavior. Note that these approaches are not mutually exclusive; they are complementary, and you will likely achieve the most beneficial outcomes if you pursue them concurrently. In terms of changing our brains, laboratories and companies around the world are now engaged in large-scale development and research efforts directed at understanding how we can enhance our brain's functioning to improve cognitive control and thus reduce the negative impact of goal interference. Approaches include traditional education, meditation, cognitive training, exposure to nature, physical exercise and brain stimulation. Interestingly, many of them use modern technology to harness neuroplasticity and induce brain changes. We are at the threshold of fascinating times, as the technology that has aggravated the Distracted Mind is now being formulated to offer remediation. When we have no choice but to engage in a high-interference environment, we can work to ensure we are as optimized as possible to diminish the detrimental effects of distractions and interruptions. (6)

Adapted from Nautilus.

Exercise III.

Find paragraphs, dealing with the following: multitasking, belts, detrimental, tools, lab, replicated, teens, email, validated, penchant

Exercise IV.

Fill in the gaps.

1. It appears at first ……. that the taxpayer has achieved a significant victory.

2. They wondered about increasing government ……. and higher fees or taxes.

3. Students work for a few minutes, then slip over to the incubator to take a ……...

4. She also hopes to …….. the relationship between government and businesses.

5. Most …….. companies also provide a speaking clock service as well.

6. Satoshi Iue is an astute and cautious businessman, not …… to hasty decisions.

7. The …… can then be used to puncture the canister so that it can be recycled.

8. The …… majority of private sector workers can't accrue sick and vacation time.

9…….. is mainly home to military and meteorological personnel and installations.

10. Google has been experimenting with many different types of …….. systems.

Exercise V.

Make up sentences of your own with the following word combinations: Penchant for, name of the game, be prone to, to take a peek at, to have a strong draw for, to click on, to leave a website for another, to take a brief look at, to open that message, on average

Exercise VI.

Match the words to the definitions in the column on the right:

glance	a warning to people to be prepared to deal with something dangerous:
telecommunication	make (an action or process) easy or easier
peek	tending
facilitate	a thing made or adapted for a particular purpose, esp. a piece of mechanical or electronic equipment
prone	communication over a distance by cable, telegraph, telephone, or broadcasting
device	look quickly, typically in a furtive manner
vast	take a brief or hurried look
alert	the action of notifying someone or something

notification	an immense space

ExerciseVIII.

Summarize the article “Are You a Self-Interrupter?”.

Part 2

Exercise I.

Identify the part of speech the words belong to.

approximately, activity, internally, majority, obvious, external, notification, normal, literally, successive

Exercise II .

Form verbs from the following words:

Distraction (1), information (1), continuous (1), performance (1), combinations (1), critically (2), collective (2), interference (3), notification (3), activity (3)

Exercise III.

Find synonyms to the following words. Translate them into Russian:

glance (2), peek (2), impatience (2), to buffer (2), brief (2), facilitate (3), external (3), device (3), vast (3), alert (3)

Exercise IV .

Find antonyms to the following words. Translate them into Russian: impatience (2), abandon (2), brief (2), recent (2), impatient (2), rapidly (2), instantly (2), norm (2), constantly (2), connect (2)

Exercise V.

Match the words to make word combinations:

workplace	screens
web	study
television	distractor
field	episode
television	views
four-second	screen
external	shopper
work	tool
video	browser
online	rule

3. **A Cure for Disconnection**

Part 1

Exercise I.

Say what Russian words help to guess the meaning of the following words: problem, epidemic, proportions, millions, epidemic, metaphorical, serious, physical, risk, factor

Exercise II.

Make sure you know the following words and word combinations.
Alienation, societal, to upend, comparable, quarantine, to afflict, scaffold, counterintuitive, hyper vigilant, to wither

A Cure for Disconnection

Loneliness is a problem of epidemic proportions, affecting millions from all walks of life. But while its roots are complex, remedies may be within reach.(1)

Researchers sound the alarm about societal changes driving new levels of isolation and alienation and warn that we are in the midst of a loneliness epidemic, and they aren't being metaphorical when they speak of loneliness as a disease. Loneliness poses a serious physical risk—it can be, quite literally, deadly. As a predictor of premature death, insufficient social connection is a bigger risk factor than obesity and the equivalent of smoking up to 15 cigarettes a day, according to Julianne Holt-Lunstad, a psychology professor at Brigham Young University and

one of the leading figures in loneliness research. And, she says, the epidemic is only getting worse. New research is upending much of what we've long taken for granted about loneliness. Loneliness causes serious hurt, acting on the same parts of the brain as physical pain. And while past research has treated loneliness as a synonym for social isolation, recent studies are revealing that the subjective feeling of loneliness—the internal experience of disconnection or rejection—is at the heart of the problem. More of us than ever before are feeling its sting, whether we're young or old, married or single, urban-dwelling or living in remote mountain villages. (In fact, some remote mountain villagers are much less likely to be lonely, as we'll see.) This is what makes loneliness so insidious: It hides in plain sight and, unlike smoking or obesity, isn't typically seen as a threat, even though it takes a greater toll on our well-being. But before we can fight back, we need to know exactly what we're up against—and start taking it seriously. (2)

It's been well established that lonely people are more likely than the nonlonely to die from cardiovascular disease, cancer, respiratory illness, and gastrointestinal causes—essentially, everything. One study found that those with fewer than three people they could confide in and count on for social support were more than twice as likely to die from heart disease than those with more confidants. They were also roughly twice as likely to die of all causes, even when age, income, and smoking status were comparable. Apart from the risk of premature death, loneliness contributes to seemingly countless health woes. Consider the common cold: A study published last year, in which lonely and nonlonely people were given cold-inducing nasal drops and

quarantined in hotel rooms for five days, found that the lonely people who got sick suffered more severe symptoms than the nonlonely. Put simply, lonelier people feel worse when they are sick than do less lonely people. But what does it mean to be lonely, exactly? One of the most surprising revelations is the extent to which loneliness afflicts those of us who aren't isolated in any traditional sense of the term, including people who are married or who have relatively large networks of friends and family. "Loneliness is not simply being alone," says John Cacioppo, the author of Loneliness: Human Nature and the Need for Social Connection. He points out that many of us crave solitude, which feels restorative and peaceful when desired. What might qualify as pleasant for some, however, can be misery for others—or even for the same person at different times. Unlike most previous research, which has focused on the number of people in a patient's social network, LeRoy's study looked at both objective social isolation and subjective loneliness: the discrepancy between the patient's actual and desired social relationships. Loneliness is a perceptual state that depends more on the quality of a person's relationships than on their sheer number. People with few friends can feel fulfilled; people with vast social networks can feel empty and disconnected. What LeRoy and her colleagues found was that subjective loneliness was a far bigger risk factor than sheer social isolation. "It's all about how the person feels," she says. "Feelings really matter." And how exactly does the feeling of chronic loneliness hurt us? In addition to making us more susceptible to viruses, it's also strongly correlated with cognitive decline and dementia. It's easy to see how loneliness and depression would go hand in hand; the two states seem to

feed off each other. But recent studies show that while loneliness can be an accurate predictor of depression, depression doesn't necessarily predict loneliness. (And, of course, loneliness is far from the only trigger for depression.) The key difference between the two is that loneliness not only leads to an increase in depressive symptoms but also to increased stress, anxiety, and even anger. These data suggest that a perceived sense of social connectedness serves as a scaffold for the self. Damage the scaffold, and the rest of the self begins to crumble. Our drive for social connectedness is so deeply wired that being rejected or socially excluded hurts like an actual wound. Naomi Eisenberger demonstrated the overlap between social and physical pain with an experiment in which subjects played an online game, tossing a virtual ball back and forth, while their brain activity was measured. Only one player was human; the others were created by a computer program. At some point, the computer "players" stopped tossing the ball to their human teammate. What Eisenberger found was that the brain activity of the rejected player strongly resembled that of someone experiencing physical pain. Likewise, Eisenberger has found that the same painkillers we take for physical suffering can ease the ache of loneliness. It's no accident that loneliness hurts. Like the pain receptors that evolution planted in our bodies so we would keep our distance from a fire, the pain of loneliness grabs our attention and urges us to seek a remedy. Humans are social animals, after all, and collaboration has insured our survival against other animals. In our early days, the pain of loneliness would have been a powerful reminder to rejoin the pack when we strayed or risk fiercer pain if we encountered a predator all alone. Loneliness

evolved like any other form of pain, it is a signal to change behavior, very much like hunger, thirst, or physical pain, to motivate us to renew the connections we need to survive and prosper. While the pain of loneliness was an adaptive advantage in humanity's early days, when separating from the tribe could mean becoming lion food, it doesn't serve the same purpose now that we can technically survive entirely on our own, given a microwave and an endless supply of Hot Pockets. The force of the feeling may seem like overkill now that it has evolved from a life-or-death alarm bell into a more abstract warning that our need for connection is not being met. But that's only until you consider that the need, left unmet, still has the power to kill us—just by a slower, more invisible mechanism than starvation or predation. Counterintuitively, the pain of isolation can make us more likely to lash out at the people we feel alienated from. Once our fight-or-flight system is activated, we're more likely to fight others than to hug them. The emerging theory of loneliness, in other words, is that it doesn't just make people yearn to engage with the world around them. It makes them hypervigilant to the possibility that others mean to do them harm—which makes it even less likely that they'll be able to connect meaningfully. This negative feedback loop is what makes chronic loneliness (as opposed to situational loneliness, which comes and goes in everyone's life) so frustratingly intractable. Chronically lonely people tend to approach a social interaction with the expectation that it will be unfulfilling and to look for evidence that they're right. Lonely people pay more attention to negative signals from others, interpreting judgment and rejection where it is not intended. Without being aware of it, they sabotage their own

efforts to connect with others. Experts are approaching this problem from two angles: how to stop the feedback loop once it starts and, perhaps more promisingly, how to prevent it from starting at all. That means working to beef up social opportunities and deepen connections among those likely to become chronically lonely. But first they have to identify the people most at risk. (3)

More Americans are living alone than ever before, making us more likely to become socially isolated, especially as we age. The number of older people without a spouse, child, or any living relatives is growing. That's one reason we're lonelier. But it's not the whole story. Being married doesn't protect you from loneliness, according to the study, which followed 1,600 adults over 60 for six years. Out of the 43 percent of participants who reported chronic loneliness, more than half were married. Loneliness has also skyrocketed among teens and young adults, despite their sizeable peer groups. A recent British study found that the youngest people surveyed—those between 16 and 24—were the most likely of all age groups to report feeling lonely. Many experts blame the growing loneliness of young people on their social media use, which they argue may hinder the development of the real-world social skills necessary to build close friendships. Sherry Turkle, the author of Alone Together: Why We Ask More From Technology and Less From Each Other, places blame squarely on the rise of digital culture. Connecting meaningfully with others in person requires us to be ourselves, openly and genuinely. Conversations by text or Facebook messenger may be filled with smile emojis, but they leave us feeling empty because they lack depth. "Without the demands and rewards of intimacy and empathy, we end up feeling alone while together online,"

Turkle says. "And when we get together, we are less prepared than before to listen. We have lost empathy skills. And of course, this, too, makes us more alone." (4)

But even friends we interact with in the real world can put us at risk if they themselves become lonely. A stunning study by Cacioppo and fellow researchers Nicholas Christakis and James Fowler concluded that loneliness is contagious: It spreads in clusters throughout social networks. Their research, based on a 10-year study of more than 5,000 people, showed that those who became lonely typically passed that feeling along to others before cutting ties with the group. As they describe it, ripples of loneliness along the margins of a social network, where people tend to have fewer friends to begin with, move inward toward the group's center, infecting the friends of those lonely people, then friends of friends, leading to weakened ties among all. What's missing for lonely people, after all, is not just social contact but meaningful contact—the bonds that come from being your authentic self with another person. One of the best ways to foster meaningful engagement is through the creative arts, says health researcher Jeremy Nobel, who is spearheading an initiative called The UnLonely Project, which focuses on creative expression as a way to lessen the burden of loneliness. While an easy fix for loneliness is elusive, researchers are optimistic. It wasn't so long ago, after all, that we connected meaningfully with each other more or less by default. We can figure it out again.Once we understand the toll loneliness takes on our mental and physical health, what can we do to protect ourselves? **DO TALK TO STRANGERS.** Small talk isn't so small, so take the plunge and converse with someone beside you on the bus or in line at a store. Just

chatting makes us happier and healthier. We can feel much better after just 30 seconds of talking to someone in person, whereas we don't get that benefit from online interaction. **GIVE IT SEVEN MINUTES.** According to the "seven-minute rule," it takes that long to know if a conversation is going to be interesting. **SCHEDULE FACE TIME.** What does face-to-face contact with friends and family give us that virtual communication lacks? For one thing, it boosts our production of endorphins, the brain chemicals that ease pain and enhance well-being. That's one reason in-person interaction improves our physical health, researchers say. **IF YOU CAN'T GET FACE TIME, CHOOSE FACETIME.** Being there in person is always best, but video conferencing by Skype or FaceTime can help people divided by distance maintain the bonds they built in person, according to researchers. Phone calls are the next best thing—hearing the other person's voice is a form of connection—while relationships conducted primarily by email or text tend to wither fastest. **USE FACEBOOK WISELY.** Social media isn't inherently alienating, but to create sustainable connections, it should be used purposefully. If you're just using Facebook to show pictures of yourself smiling on vacation, you're not going to connect authentically. Instead, within the larger platforms, create smaller social networks, such as an online book club where you can share meaningful personal reactions with a select group of people. **THROW A DINNER PARTY.** Evidence of communal eating dates back at least 12,000 years: Sharing food was a way to resolve conflicts and create a group identity among hunter-gatherers long before villages existed. **GET CREATIVE.** Participating in the creative arts helps us connect deeply without talking

directly about ourselves. A lot of people can't find the spoken words to express their feelings, but they can draw them, write expressively about them, or even dance them. **TALK ABOUT IT.** When Julia Bainbridge struggled with loneliness as a single New Yorker, she started a podcast, The Lonely Hour, and found that just talking about her feelings made her feel less lonely. She was surprised to find out how many people felt the same way—and what a relief it was to know that she wasn't alone in her loneliness. Whether to a podcast audience, a friend, or a therapist, we can all benefit from talking about feelings of isolation. **REACH OUT AND TOUCH SOMEONE—LITERALLY.** Hugging, holding hands, or even just patting someone on the back is powerful medicine. Physical touch can lower our physiological stress response. (5)

Adapted from Psychology Today.

Exercise III.

Find paragraphs, dealing with the following: rejection, urban-dwelling, insidious, toll, confide, income, premature, woes, nasal

Exercise IV.

Fill in the gaps.

1. Yet as we will show this week, illiteracy is almost more **……** than poverty.

2. It was later determined that he had an infection of his **……..** system.

3. It features German-style baked goods made from organic, **……** ingredients.

4. However, the regional governor, Abdel Wahab Mabrouk, said he suspected **……...**

5. However groups can also **……..** decision-making if a correct answer is not clear.

6. At least 1 million Pakistanis have crippling diarrhea or **……** infections.

7. Our souls**……** for the nourishment that close and healthy relationships provide.

8. At 19, you need 6 to 8 hours of **……** sleep every night to be at your best.

9. The effects of oxytocin **……** spray are not limited to those with autism either

10. When the QT interval is prolonged, the heart is more **……** to arrhythmias.

Exercise V.

Make up sentences of your own with the following word combinations: to take a toll, in plain sight, to confide in, fight or flight, to beef up, to take for granted, take something seriously, susceptible to viruses, to go hand in hand, to feed off each other

Exercise VI .

Match the words to the definitions in the column on the right:

insidious	create difficulties for (someone or something), resulting in delay or obstruction

gastrointestinal	of, relating to, or affecting respiration or the organs of respiration
sustainable	proceeding in a gradual, subtle way, but with harmful effects
sabotage	having the ability to restore health, strength, or a feeling of well-being
to hinder	Of, for, or relating to the nose
respiratory	likely or liable to be influenced or harmed by a particular thing
to yearn	of or relating to the stomach and the intestines
restorative	able to be maintained at a certain rate or level
nasal	have an intense feeling of loss or lack and longing for something
susceptible	deliberately destroy, damage, or obstruct (something), esp. for political or military advantage

Exercise VII.

Summarize the article “A Cure for Disconnection”

Part 2

Exercise I.

Identify the part of speech the words belong to.

insidious, sustainable , restorative, nasal, traditional, loneliness, social, connection, peaceful, isolation

Exercise II .

Form adjectives from the following words: psychology (2), loneliness (2), typically (2), exactly (2), seriously(2), essentially (3), risk (3), health (3), nature (3)

Exercise III.

Find synonyms to the following words. Translate them into Russian:

restorative (3), yearn (3), sabotage (3), connection (3), solitude (3), loneliness (3), actual (3), difference (3), anger(3), hinder (5)

Exercise IV.

Find antonyms to the following words. Translate them into Russian: peaceful (3), pleasant (3), previous (3), isolation (3), discrepancy (3), empty (3), exactly (3), depression (3), increase (3), anxiety (3)

Exercise V.

Match the words to make word combinations:

severe	illness
chronic	drops

cardiovascular	factor
respiratory	decline
social	death
nasal	risk
risk	isolation
physical	loneliness
premature	symptoms
cognitive	disease

4. The attention economy

Part 1

Exercise I.

Say what Russian words help to guess the meaning of the following words: economy, static, total, planet, mobile, economists, moments, product, data, facts

Exercise II.

Make sure you know the following words and word combination

adage, hoard, upworthy, tweak, slumped, to woo, well-disposed, compelling, free-range

The attention economy

It costs nothing to click, respond and retweet. But what price do we pay in our relationships and our peace of mind?(1)

How many other things are you doing right now while you're reading this piece? Are you also checking your email, glancing at your Twitter feed, and updating your Facebook page? What five years ago David Foster Wallace labelled 'Total Noise' — 'the seething static of every particular thing and experience, and one's total freedom of infinite choice about what to choose to attend to' — is today just part of the texture of living on a planet that will, by next year, boast one mobile phone for each of its seven billion inhabitants. We are all amateur attention economists, hoarding and bartering our moments — or watching them slip away down the cracks of a thousand YouTube clips.

If you're using a free online service, the adage goes, you are the product. It's an arresting line, but one that deserves putting more precisely: it's not you, but your behavioural data and the quantifiable facts of your engagement that are constantly blended for sale, with the aggregate of every single interaction (yours included) becoming a mechanism for ever-more-finely tuning the business of attracting and retaining users. (2)

Consider the confessional slide show by Upworthy, the 'website for viral content', which detailed the mechanics of its online attention-seeking. To be truly viral, they note, content needs to make people want to click on it and share it with others who will also click and share. This means selecting stuff with instant appeal — and then precisely calibrating the summary text, headline, excerpt, image and tweet that will spread it. This in turn means producing at least 25 different versions of your material, testing the best ones, and being prepared to constantly tweak every aspect of your site. To play the odds, you also need to publish content constantly, in quantity, to maximise the likelihood of a hit — while keeping one eye glued to Facebook. But even Upworthy's efforts pale into insignificance compared with the algorithmic might of sites such as Yahoo! — which, according to the American author and marketer Ryan Holiday, tests more than 45,000 combinations of headlines and images every five minutes on its home page. Much as corporations incrementally improve the taste and sheer enticement of food and drink by measuring how hard it is to stop eating and drinking them, the actions of every individual online are fed back into measures where more inexorably means better: more readers, more viewers, more exposure, more influence, more ads, more opportunities to unfurl the

integrated apparatus of gathering and selling data. Attention, thus conceived, is an inert and finite resource, like oil or gold: a tradable asset that the wise manipulator auctions off to the highest bidder, or speculates upon to lucrative effect. There has even been talk of the world reaching ‘peak attention’, by analogy to peak oil production, meaning the moment at which there is no more spare attention left to spend. (3)

This is one way of conceiving of our time. But it’s also a quantification that tramples across other, qualitative questions — a fact that the American author Michael Goldhaber recognised long ago, in a piece for Wired magazine called ‘Attention Shoppers!’. Attention, he argued, ‘comes in many forms: love, recognition, heeding, obedience, thoughtfulness, caring, praising, watching over, attending to one’s desires, aiding, advising, assistance in developing new skills, etc.’ For all the sophistication of a world in which most of our waking hours are spent consuming or interacting with media, we have scarcely advanced in our understanding of what attention means. What are we actually talking about when we base both business and mental models on a ‘resource’ that, to all intents and purposes, is fabricated from scratch every time a new way of measuring it comes along? In Latin, the verb attendere — from which our word ‘attention’ derives — literally means to stretch towards. A compound of ad (‘towards’) and tendere (‘to stretch’), it invokes an image of one person bending towards another in order to attend to them. Attending is closely connected to anticipation. Soldiers snap to attention to signify readiness and respect — and to embody it. Unable to read each others’ minds, we demand outward shows of mental engagement. Teachers shout ‘Pay attention!’ at

slumped students whose thoughts have meandered, calling them back to the place they're in. Time, presence and physical attentiveness are our most basic proxies for something ultimately unprovable: that we are understood. The best teachers, one hopes, don't shout at their students — because they are skilled at wooing as well as demanding the best efforts of others. As the manual on classical rhetoric put it more than 2,000 years ago: 'We wish to have our hearer receptive, well-disposed, and attentive.' Underpinning this was neither honour nor idealism, but pragmatism embodied in a five-part process. Come up with a compelling proposition, arrange its elements in elegant sequence, polish your style, commit the result to memory or media, then pitch your delivery for maximum impact. However, when it comes to automated systems for garnering attention, there's more at play than one person listening to another. As far as getting the world to pay attention to me online, either I play by the rules of the system — likes, links, comments, clicks, shares, retweets — or I become ineligible for any of its glittering prizes. Because computers cannot come to us and meet us in our world, we must continue to adjust our world and bring ourselves to them. We will define our lives, including our social lives and our perceptions of our selves, in ways that are conducive to what a computer can 'understand'. Their dumbness will become ours. In computing terms, to do things in a way the system does not 'understand' is to do nothing at all. It is to be absurd, like trying to feed a banana instead of paper into a printer. All of which seems to place immense power, not to mention responsibility, into the hands of the system architects: the coders, designers, advertisers,

professional media manipulators and social media gurus devoted to profitable clicking. (4)

Yet this vision of puppeteers effortlessly pulling everyone else's strings is distinctly dubious. As the British economist Charles Goodhart argued in 1975 in an aphorism that has come to be known as Goodhart's law, 'When a measure becomes a target, it ceases to be a good measure.' There are few better summaries of the central flaw in attention economics. No matter how cunning the algorithms and filters, entire industries of manufactured attention bloom and fade around every possibility of profit. Every target is continually being moved, refined and undermined. Nobody is in control. And who is to say that they should be? We confuse information with mastery, yet this is at best a category error, and at worst a submission to wishful bullshit: a mix of convenient propaganda and comforting self-deception, without pausing to acknowledge the speciousness of much of what's on offer. In 1909 the English author G.K. Chesterton told the fable of two boys who were each granted a wish. One chose to become a giant, and one to become extremely small. The giant, to his surprise, found himself bored by the shrunken land beneath him. The tiny boy, however, set off gladly to explore the endless world of wonders his garden had become. The moral, as Chesterton saw it, was one of perspective. There's a similarly reductive exaltation in defining attention as the contents of a global reservoir, slopping interchangeably between the brains of every human being alive. Where is the space, here, for the idea of attention as a mutual construction more akin to empathy than budgetary expenditure — or for those unregistered moments in which we attend to ourselves, to the space around us, or to nothing at all? (5)

From the loftiest perspective of all, information itself is pulling the strings: free-ranging memes whose ‘purposes’ are pure self-propagation, and whose frantic evolution outstrips all retrospective accounts. Seen from such a height, you signify nothing beyond your recorded actions. Like all totalising visions, it’s at once powerful and — viewed sufficiently closely — ragged with illusions. Zoom in on individual experience, and something obscure from afar becomes obvious: in making our attentiveness a fungible asset, we’re not so much conjuring currency out of thin air as chronically undervaluing our time. We watch a 30-second ad in exchange for a video; we solicit a friend’s endorsement; we freely pour sentence after sentence, hour after hour, into status updates and responses. None of this depletes our bank balances. Yet its cumulative cost, while hard to quantify, affects many of those things we hope to put at the heart of a happy life: rich relationships, rewarding leisure, meaningful work, peace of mind. (6)

What kind of attention do we deserve from those around us, or owe to them in return? What kind of attention do we ourselves deserve, or need, if we are to be ‘us’ in the fullest possible sense? These aren’t questions that even the most finely tuned popularity contest can resolve. Yet, if contentment and a sense of control are partial measures of success, many of us are selling ourselves far too cheap. Are you still paying attention? I can look for signs, but in the end I can’t control what you think or do. And this must be the beginning of any sensible discussion. No matter who or what tells you otherwise, you have the perfect right to ignore me — and to decide for yourself what waits in each waking moment. (7)

Adapted from Aeon.

Exercise III.

Find paragraphs, dealing with the following: note, stuff, tweak, odds, pale, sheer, inert, oil, tramples, heeding.

Exercise IV.

Fill in the gaps.

1. In a sense they still cannot imagine the system can operate to **……..** itself.
2. The works **……..** the hopes and aspirations of the people who made them, he said.
3. Injecting an **…….** saline solution reduced the symptoms of Parkinson's disease.
4. Drama and theatre studies degrees also **…….** the practical with the theoretical.
5. They need strategists, who **……..** a Web site's approach to roping in visitors.
6. He said he'd likely **…….** advice from other kickers who have played in a dome.
7. In the western world whole lives are lived in **……..** of the next vacation.
8. This time Irish **……..** possession at the restart and continue to apply pressure.
9. Bright glossy green leaves **……** in the spring ranging from 4 to 8 inches long.

10. Government **……** on social housing, health and education remains positive.

Exercise V.

Make up sentences of your own with the following word combinations:

Peace of mind, to play the odds, to watch over, to snap to attention, out of thin air, to trample across,

Exercise VI .

Match the words to the definitions in the column on the right:

to undermine	the action of anticipating something; expectation or prediction
to embody	form or devise (a plan or idea) in the mind
inert	the action of spending funds
blend	make or become spread out from a rolled or folded state, esp. in order to be open to the wind
to conceive	damage or weaken (someone or something), esp. gradually or insidiously
solicit	to represent a quality or an idea exactly
anticipation	continue to have (something); keep possession of

to retain	chemically inactive
to unfurl	ask for or try to obtain (something) from someone
expenditure	put or combine (abstract things) together

Exercise VII.

Summarize the article "The attention economy".

Part 2

Exercise I.

Identify the part of speech the words belong to.

quantification, obedience, thoughtfulness, wishful, frantic, contentment, attentive, idealism, pragmatism, proposition

Exercise II .

Form adverbs from the following words:

peace (1), particular (1), total (1), instant (1), different (1), insignificance (1), incrementally (1), individual (1), mental (2), physical (2)

Exercise III.

Find synonyms to the following words. Translate them into Russian:

manual (4), classical (4), attentive (4), honour (4), elegant (4), sequence (4), style (4), delivery (4), impact (4), system (4)

Exercise IV .

Find antonyms to the following words. Translate them into Russian:

ultimately (4), shout (4), maximum (4), sensible (7), perfect (7), cheap (7), partial (7), success (7), possible (7), return (7)

Exercise V.

Match the words to make word combinations:

budgetary	experience
global	accounts
meaningful	evolution
cumulative	memes
bank	being
individual	expenditure
retrospective	reservoir
frantic	work
free-ranging	cost
human	balances

SUPPLEMENTARY READING

1. Clever Machines Learn How to Be Curious

Computer scientists are finding ways to code curiosity into intelligent machines.

You probably can't remember what it feels like to play Super Mario Bros. for the very first time, but try to picture it. An 8-bit game world blinks into being: baby blue sky, tessellated stone ground, and in between, a squat, red-suited man standing still — waiting. He's facing rightward; you nudge him farther in that direction. A few more steps reveal a row of bricks hovering overhead and what looks like an angry, ambulatory mushroom. Another twitch of the game controls makes the man spring up, his four-pixel fist pointed skyward. What now? Maybe try combining nudge-rightward and spring-skyward? Done. Then, a surprise: The little man bumps his head against one of the hovering bricks, which flexes upward and then snaps back down as if spring-loaded, propelling the man earthward onto the approaching angry mushroom and flattening it instantly. Mario bounces off the squished remains with a gentle hop. Above, copper-colored boxes with glowing "?" symbols seem to ask: What now?

This scene will sound familiar to anyone who grew up in the 1980s, but you can watch a much younger player on Pulkit Agrawal's YouTube channel. Agrawal, a computer science researcher at the University of California, Berkeley, is studying how innate curiosity can make learning an unfamiliar task — like playing Super Mario Bros. for the very first time — more efficient. The catch is that the novice player in Agrawal's video isn't human, or even alive. Like Mario, it's just software. But this software comes equipped with experimental machine-learning algorithms designed by Agrawal and his colleagues Deepak Pathak, Alexei A. Efros and Trevor Darrell at the Berkeley Artificial Intelligence Research Lab for a surprising purpose: to make a machine curious.

"You can think of curiosity as a kind of reward which the agent generates internally on its own, so that it can go explore more about its world," Agrawal said. This internally generated reward signal is known in cognitive psychology as "intrinsic motivation." The feeling you may have vicariously experienced while reading the game-play description above — an urge to reveal more of whatever's waiting just out of sight,

or just beyond your reach, just to see what happens — that's intrinsic motivation.

Humans also respond to extrinsic motivations, which originate in the environment. Examples of these include everything from the salary you receive at work to a demand delivered at gunpoint. Computer scientists apply a similar approach called reinforcement learning to train their algorithms: The software gets "points" when it performs a desired task, while penalties follow unwanted behavior.

But this carrot-and-stick approach to machine learning has its limits, and artificial intelligence researchers are starting to view intrinsic motivation as an important component of software agents that can learn efficiently and flexibly — that is, less like brittle machines and more like humans and animals. Approaches to using intrinsic motivation in AI have taken inspiration from psychology and neurobiology — not to mention decades-old AI research itself, now newly relevant. ("Nothing is really new in machine learning," said Rein Houthooft, a research scientist at OpenAI, an independent artificial intelligence research organization.)

Such agents may be trained on video games now, but the impact of developing meaningfully "curious" AI would transcend any novelty appeal. "Pick your favorite application area and I'll give you an example," said Darrell, co-director of the Berkeley Artificial Intelligence lab. "At home, we want to automate cleaning up and organizing objects. In logistics, we want inventory to be moved around and manipulated. We want vehicles that can navigate complicated environments and rescue robots that can explore a building and find people who need rescuing. In all of these cases, we are trying to figure out this really hard problem: How do you make a machine that can figure its own task out?"

Reinforcement learning is a big part of what helped Google's AlphaGo software beat the world's best human player at Go, an ancient and intuitive game long considered invulnerable to machine learning. The details of successfully using reinforcement learning in a particular domain are complex, but the general idea is simple: Give a learning algorithm, or "agent," a reward function, a mathematically defined signal to seek out and maximize. Then set it loose in an environment, which could be any real or virtual world. As the agent operates in the environment, actions that increase the value of the reward function get reinforced. With enough repetition — and if there's anything that computers are better at than people, it's repetition — the agent learns

patterns of action, or policies, that maximize its reward function. Ideally, these policies will result in the agent reaching some desirable end state (like "win at Go"), without a programmer or engineer having to hand-code every step the agent needs to take along the way.

In other words, a reward function is the guidance system that keeps a reinforcement-learning-powered agent locked on target. The more clearly that target is defined, the better the agent performs — that is why many of them are currently tested on old video games, which often provide simple extrinsic reward schemes based on points. (The blocky, two-dimensional graphics are useful, too: Researchers can run and repeat their experiments quickly because the games are relatively simple to emulate.)

Yet "in the real world, there are no points," said Agrawal. Computer scientists want to have their creations explore novel environments that don't come preloaded with quantifiable objectives.

In addition, if the environment doesn't supply extrinsic rewards quickly and regularly enough, the agent "has no clue whether it's doing something right or wrong," Houthooft said. Like a heat-seeking missile unable to lock onto a target, "it doesn't have any way of [guiding itself through] its environment, so it just goes haywire."

Moreover, even painstakingly defined extrinsic reward functions that can guide an agent to display impressively intelligent behavior — like AlphaGo's ability to best the world's top human Go player — won't easily transfer or generalize to any other context without extensive modification. And that work must be done by hand, which is precisely the kind of labor that machine learning is supposed to help us sidestep in the first place.

Instead of a battery of pseudo-intelligent agents that can reliably hit specified targets like those missiles, what we really want from AI is more like an internal piloting ability. "You make your own rewards, right?" Agrawal said. "There's no god constantly telling you 'plus one' for doing this or 'minus one' for doing that."

Deepak Pathak never set out to model anything as airily psychological as curiosity in code. "The word 'curiosity' is nothing but saying, 'a model which leads an agent to efficiently explore its environment in the presence of noise,'" said Pathak, a researcher in Darrell's lab at Berkeley and the lead author of the recent work.

But in 2016, Pathak was interested in the sparse-rewards problem for reinforcement learning. Deep-learning software, powered by

reinforcement learning techniques, had recently made significant gains in playing simple score-driven Atari games like Space Invaders and Breakout. But even slightly more complex games like Super Mario Bros. — which require navigating toward a goal distant in time and space without constant rewards, not to mention an ability to learn and successfully execute composite moves like running and jumping at the same time — were still beyond an AI's grasp.

Pathak and Agrawal, working with Darrell and Efros, equipped their learning agent with what they call an intrinsic curiosity module (ICM) designed to pull it forward through the game without going haywire (to borrow Houthooft's term). The agent, after all, has absolutely no prior understanding of how to play Super Mario Bros. — in fact, it's less like a novice player and more like a newborn infant.

Indeed, Agrawal and Pathak took inspiration from the work of Alison Gopnik and Laura Schulz, developmental psychologists at Berkeley and at the Massachusetts Institute of Technology, respectively, who showed that babies and toddlers are naturally drawn to play with objects that surprise them the most, rather than with objects that are useful to achieving some extrinsic goal. "One way to [explain] this kind of curiosity in children is that they build a model of what they know about the world, and then they conduct experiments to learn more about what they don't know," Agrawal said. These "experiments" can be anything that generates an outcome which the agent (in this case, an infant) finds unusual or unexpected. The child might start with random limb movements that cause new sensations (known as "motor babbling"), then progress up to more coordinated behaviors like chewing on a toy or knocking over a pile of blocks to see what happens.

In Pathak and Agrawal's machine-learning version of this surprise-driven curiosity, the AI first mathematically represents what the current video frame of Super Mario Bros. looks like. Then it predicts what the game will look like several frames hence. Such a feat is well within the powers of current deep-learning systems. But then Pathak and Agrawal's ICM does something more. It generates an intrinsic reward signal defined by how wrong this prediction model turns out to be. The higher the error rate — that is, the more surprised it is — the higher the value of its intrinsic reward function. In other words, if a surprise is equivalent to noticing when something doesn't turn out as expected — that is, to being wrong — then Pathak and Agrawal's system gets rewarded for being surprised.

This internally generated signal draws the agent toward unexplored states in the game: informally speaking, it gets curious about what it doesn't yet know. And as the agent learns — that is, as its prediction model becomes less and less wrong — its reward signal from the ICM decreases, freeing the agent up to maximize the reward signal by exploring other, more surprising situations. "It's a way to make exploration go faster," Pathak said.

This feedback loop also allows the AI to quickly bootstrap itself out of a nearly blank-slate state of ignorance. At first, the agent is curious about any basic movement available to its onscreen body: Pressing right nudges Mario to the right, and then he stops; pressing right several times in a row makes Mario move without immediately stopping; pressing up makes him spring into the air, and then come down again; pressing down has no effect. This simulated motor babbling quickly converges on useful actions that move the agent forward into the game, even though the agent doesn't know it.

For example, since pressing down always has the same effect — nothing — the agent quickly learns to perfectly predict the effect of that action, which cancels the curiosity-supplied reward signal associated with it. Pressing up, however, has all kinds of unpredictable effects: Sometimes Mario goes straight up, sometimes in an arc; sometimes he takes a short hop, other times a long jump; sometimes he doesn't come down again (if, say, he happens to land on top of an obstacle). All of these outcomes register as errors in the agent's prediction model, resulting in a reward signal from the ICM, which makes the agent keep experimenting with that action. Moving to the right (which almost always reveals more game world) has similar curiosity-engaging effects. The impulse to move up and to the right can clearly be seen in Agrawal's demo video: Within seconds, the AI-controlled Mario starts hopping rightward like a hyperactive toddler, causing ever-more-unpredictable effects (like bumping against a hovering brick, or accidentally squishing a mushroom), all of which drive further exploration.

"By using this curiosity, the agent learns how to do all the things it needs to explore the world, like jump and kill enemies," explained Agrawal. "It doesn't even get penalized for dying. But it learns to avoid dying, because not-dying maximizes its exploration. It's reinforcing itself, not getting reinforcement from the game."

Artificial curiosity has been a subject of AI research since at least the early 1990s. One way of formalizing curiosity in software centers on novelty-seeking: The agent is programmed to explore unfamiliar states in its environment. This broad definition seems to capture an intuitive understanding of the experience of curiosity, but in practice it can cause the agent to become trapped in states that satisfy its built-in incentive but prevent any further exploration.

For example, imagine a television displaying nothing but static on its screen. Such a thing would quickly engage the curiosity of a purely novelty-seeking agent, because a square of randomly flickering visual noise is, by definition, totally unpredictable from one moment to the next. Since every pattern of static appears entirely novel to the agent, its intrinsic reward function will ensure that it can never cease paying attention to this single, useless feature of the environment — and it becomes trapped.

It turns out that this type of pointless novelty is ubiquitous in the kind of richly featured environments — virtual or physical — that AI must learn to cope with to become truly useful. For example, a self-driving delivery vehicle equipped with a novelty-seeking intrinsic reward function might never make it past the end of the block. “Say you’re moving along a street and the wind is blowing and the leaves of a tree are moving,” Agrawal said. “It’s very, very hard to predict where every leaf is going to go. If you’re predicting pixels, these kinds of interactions will cause you to have high prediction errors, and make you very curious. We want to avoid that.”

Agrawal and Pathak had to come up with a way to keep their agent curious, but not too curious. Predicting pixels — that is, using deep learning and computer vision to model an agent’s visual field in its entirety from moment to moment — makes it hard to filter out potential distractions. It’s computationally expensive, too.

So instead, the Berkeley researchers engineered their Mario-playing agent to translate its visual input from raw pixels into an abstracted version of reality. This abstraction incorporates only features of the environment that have the potential to affect the agent (or that the agent can influence). In essence, if the agent can’t interact with a thing, it won’t even be perceived in the first place.

Using this stripped-down “feature space” (versus the unprocessed “pixel space”) not only simplifies the agent’s learning process, it also neatly sidesteps the novelty trap. “The agent can’t get any benefit out of

modeling, say, clouds moving overhead, to predict the effects of its actions," explained Darrell. "So it's just not going to pay attention to the clouds when it's being curious. The previous versions of curiosity — at least some of them — were really only considering pixel-level prediction. Which is great, except for when you suddenly pass a very unpredictable but very boring thing."

Darrell conceded that this model of curiosity isn't perfect. "The system learns what's relevant, but there's no guarantee it'll always get it right," he said. Indeed, the agent makes it only about halfway through the first level of Super Mario Bros. before getting trapped in its own peculiar local optimum. "There's this big gap which the agent has to jump across, which requires executing 15 or 16 continuous actions in a very, very specific order," Agrawal said. "Because it is never able to jump this gap, it dies every time by going there. And when it learns to perfectly predict this outcome, it stops becoming curious about going any further in the game." (In the agent's defense, Agrawal notes that this flaw emerges because the AI can press its simulated directional controls only in discrete intervals, which makes certain moves impossible.)

Ultimately, the problem with artificial curiosity is that even researchers who have studied intrinsic motivation for years still can't precisely define what curiosity is. Paul Schrater, a neuroscientist who leads the Computational Perception and Action Lab at the University of Minnesota, said that the Berkeley model "is the most intelligent thing to do in the short term to get an agent to automatically learn a novel environment," but he thinks it has less to do with "the intuitive concept of curiosity" than with motor learning and control. "It's controlling things that are beneath cognition, and more in the details of what the body does," he said.

To Schrater, the Berkeley team's novel idea comes in attaching their intrinsic curiosity module to an agent that perceives Super Mario Bros. as a feature space rather than as sequential frames of pixels. He argues that this approach may roughly approximate the way our own brains "extract visual features that are relevant for a particular kind of task."

Curiosity may also require an agent to be at least somewhat embodied (virtually or physically) within an environment to have any real meaning, said Pierre-Yves Oudeyer, a research director at Inria in Bordeaux, France. Oudeyer has been creating computational models of curiosity for over a decade. He pointed out that the world is so large and

rich that an agent can find surprises everywhere. But this isn't itself enough. "If you've got a disembodied agent using curiosity to explore a large feature space, its behavior is going to just end up looking like random exploration because it doesn't have any constraints on its actions," Oudeyer said. "The constraints of, for example, a body enable a simplification of the world." They focus the attention and help to guide exploration.

But not all embodied agents need intrinsic motivation, either — as the history of industrial robotics makes clear. For tasks that are simpler to specify — say, shuttling cargo from place to place using a robot that follows a yellow line painted on the floor — adding curiosity to the mix would be machine-learning overkill.

"You could just give that kind of agent a perfect reward function — everything it needs to know in advance," Darrell explained. "We could solve that problem 10 years ago. But if you're putting a robot in a situation that can't be modeled in advance, like disaster search-and-rescue, it has to go out and learn to explore on its own. That's more than just mapping — it has to learn the effects of its own actions in the environment. You definitely want an agent to be curious when it's learning how to do its job."

AI is often informally defined as "whatever computers can't do yet." If intrinsic motivation and artificial curiosity are methods for getting agents to figure out tasks that we don't already know how to automate, then "that's something I'm pretty sure we'd want any AI to have," said Houthooft, the OpenAI researcher. "The difficulty is in tuning it." Agrawal and Pathak's Mario-playing agent may not be able to get past World 1-1 on its own. But that's probably what tuning curiosity — artificial or otherwise — will look like: a series of baby steps.

Adapted from Quanta Magazine.

2. Why Self-Taught Artificial Intelligence Has Trouble With the Real World

The latest artificial intelligence systems start from zero knowledge of a game and grow to world-beating in a matter of hours. But researchers are struggling to apply these systems beyond the arcade.

Until very recently, the machines that could trounce champions were at least respectful enough to start by learning from human experience. To beat Garry Kasparov at chess in 1997, IBM engineers made use of centuries of chess wisdom in their Deep Blue computer. In

2016, Google DeepMind's AlphaGo thrashed champion Lee Sedol at the ancient board game Go after poring over millions of positions from tens of thousands of human games.

But now artificial intelligence researchers are rethinking the way their bots incorporate the totality of human knowledge. The current trend is: Don't bother. Last October, the DeepMind team published details of a new Go-playing system, AlphaGo Zero, that studied no human games at all. Instead, it started with the game's rules and played against itself. The first moves it made were completely random. After each game, it folded in new knowledge of what led to a win and what didn't. At the end of these scrimmages, AlphaGo Zero went head to head with the already superhuman version of AlphaGo that had beaten Lee Sedol. It won 100 games to zero.

The team went on to create what would become another master gamer in the AlphaGo family, this one called simply AlphaZero. In a paper posted to the scientific preprint site arxiv.org in December, DeepMind researchers revealed that after starting again from scratch, the trained-up AlphaZero outperformed AlphaGo Zero — in other words, it beat the bot that beat the bot that beat the best Go players in the world. And when it was given the rules for chess or the Japanese chess variant shogi, AlphaZero quickly learned to defeat bespoke top-level algorithms for those games, too. Experts marveled at the program's aggressive, unfamiliar style. "I always wondered how it would be if a superior species landed on Earth and showed us how they played chess," Danish grandmaster Peter Heine Nielsen told a BBC interviewer. "Now I know."

The past year also saw otherworldly self-taught bots emerge in settings as diverse as no-limit poker and Dota 2, a hugely popular multiplayer online video game in which fantasy-themed heroes battle for control of an alien world. Of course, the companies investing money in these and similar systems have grander ambitions than just dominating video-game tournaments. Research teams like DeepMind hope to apply similar methods to real-world problems like building room-temperature superconductors, or understanding the origami needed to fold proteins into potent drug molecules. And of course, many practitioners hope to eventually build up to artificial general intelligence, an ill-defined but captivating goal in which a machine could think like a person, with the versatility to attack many different kinds of problems.

Yet despite the investments being made in these systems, it isn't yet clear how far past the game board the current techniques can go. "I'm not sure the ideas in AlphaZero generalize readily," said Pedro Domingos, a computer scientist at the University of Washington. "Games are a very, very unusual thing." One characteristic shared by many games, chess and Go included, is that players can see all the pieces on both sides at all times. Each player always has what's termed "perfect information" about the state of the game. However devilishly complex the game gets, all you need to do is think forward from the current situation.

Plenty of real situations aren't like that. Imagine asking a computer to diagnose an illness or conduct a business negotiation. "Most real-world strategic interactions involve hidden information," said Noam Brown, a doctoral student in computer science at Carnegie Mellon University. "I feel like that's been neglected by the majority of the AI community." Poker, which Brown specializes in, offers a different challenge. You can't see your opponent's cards. But here too, machines that learn by playing against themselves are now reaching superhuman levels. In January 2017, a program called Libratus created by Brown and his adviser, Tuomas Sandholm, outplayed four professional poker players at heads-up, no-limit Texas Hold' em, finishing $1.7 million ahead of its competitors at the end of a 20-day competition.

An even more daunting game involving imperfect information is StarCraft II, another multiplayer online video game with a vast following. Players pick a team, build an army and wage war across a sci-fi landscape. But that landscape is shrouded in a fog of war that only lets players see areas where they have soldiers or buildings. Even the decision to scout your opponent is fraught with uncertainty.

This is one game that AI still can't beat. Barriers to success include the sheer number of moves in a game, which often stretches into the thousands, and the speed at which they must be made. Every player — human or machine — has to worry about a vast set of possible futures with every click. For now, going toe-to-toe with top humans in this arena is beyond the reach of AI. But it's a target. In August 2017, DeepMind partnered with Blizzard Entertainment, the company that made StarCraft II, to release tools that they say will help open up the game to AI researchers.

Despite its challenges, StarCraft II comes down to a simply enunciated goal: Eradicate your enemy. That's something it shares with

chess, Go, poker, Dota 2 and just about every other game. In games, you can win.

From an algorithm's perspective, problems need to have an "objective function," a goal to be sought. When AlphaZero played chess, this wasn't so hard. A loss counted as minus one, a draw was zero, and a win was plus one. AlphaZero's objective function was to maximize its score. The objective function of a poker bot is just as simple: Win lots of money.

Real-life situations are not so straightforward. For example, a self-driving car needs a more nuanced objective function, something akin to the kind of careful phrasing you'd use to explain a wish to a genie. For example: Promptly deliver your passenger to the correct location, obeying all laws and appropriately weighing the value of human life in dangerous and uncertain situations. How researchers craft the objective function, Domingos said, "is one of the things that distinguishes a great machine-learning researcher from an average one." Consider Tay, a Twitter chatbot released by Microsoft in 2016. Tay's objective was to engage people, and it did. "What unfortunately Tay discovered," Domingos said, "is that the best way to maximize engagement is to spew out racist insults." It was snatched back offline less than a day later.

Some things don't change. The methods used by today's dominant game bots employ strategies devised decades ago. "It's almost a blast from the past, with just more computation being thrown at it," said David Duvenaud, a computer scientist at the University of Toronto. The strategies often rely on reinforcement learning, a hands-off technique. Instead of micromanaging an algorithm with detailed instructions, engineers let the machine explore an environment and learn to meet goals through trial and error. Before the release of AlphaGo and its progeny, the DeepMind team achieved its first big, headline-grabbing result in 2013, when they used reinforcement learning to make a bot that learned to play seven Atari 2600 games, three of them at an expert level.

That progress has continued. On February 5, DeepMind released IMPALA, an AI system that can learn 57 Atari 2600 games, plus 30 more levels built by DeepMind in three dimensions. In these, the player roams through different environments, accomplishing goals like unlocking doors or harvesting mushrooms. IMPALA seems to transfer knowledge between tasks, meaning time spent playing one game also helps it improve at others.

But within the larger category of reinforcement learning, board games and multiplayer games allow for an even more specific approach. Here, exploration can take the form of self-play, where an algorithm gains strategic supremacy by repeatedly wrestling with its own close copy. This idea dates back decades. In the 1950s, IBM engineer Arthur Samuel created a checkers-playing program that learned in part by matching an alpha side against a beta side. And in the 1990s, Gerald Tesauro, also from IBM, built a backgammon program that pitted the algorithm against itself. The program reached human expert levels, devising unorthodox but effective strategies along the way.

In game after game, an algorithm in a self-play system faces an equally matched foe. This means that changes in strategy lead to different outcomes, giving the algorithm immediate feedback. “Anytime you learn something, anytime you discover a small thing, your opponent immediately uses it against you,” said Ilya Sutskever, the research director at OpenAI, a nonprofit he co-founded with Elon Musk that is devoted to developing and sharing AI technology and shepherding it toward safe applications. In August 2017, the organization released a Dota 2 bot controlling the character Shadow Fiend — a sort of demon-necromancer — that beat the world’s best players in one-on-one battles. Another OpenAI project pits simulated humans against one another in a sumo match, where they end up teaching themselves how to tackle and feint. During self-play, “you can never rest, you must always improve,” Sutskever said.

But the old idea of self-play is just one ingredient in today’s dominant bots, which also need a way to translate their play experiences into deeper understanding. Chess, Go and video games like Dota 2 have many more permutations than there are atoms in the universe. Even over the course of many lifetimes spent battling its own shadow across echoless virtual arenas, a machine can’t encounter every scenario, write it down in a look-up table, and consult that table when it sees the same situation again.

To stay afloat in this sea of possibilities, “you need to generalize, capture the essence,” said Pieter Abbeel, a computer scientist at the University of California, Berkeley. IBM’s Deep Blue did this with its built-in chess formula. Armed with the ability to gauge the strength of board positions it hadn’t seen before, it could adopt moves and strategies that would increase its chances of winning. In recent years, though, a new technique has made it possible to skip the formula altogether.

“Now, all of a sudden, the ‘deep net’ just captures all of that,” Abbeel said. Deep neural networks, which have soared in popularity in the last few years, are built out of layers of artificial “neurons” that stack like pancakes. When neurons in one layer fire, they send signals to the next layer up, which sends them to the next layer, and so on.

By tweaking how the layers connect, these networks become fantastic at morphing inputs into a related output, even if the connection seems abstract. Give them a phrase in English, and they could train themselves to translate it into Turkish. Give them pictures from an animal shelter and they can identify which ones contain cats. Or show them a game board, and they can grok what their probability of winning is. Typically, though, you need to first give these networks reams of labeled examples to practice on.

That’s why self-play and deep neural networks fit together so well. Self-play churns out troves of games, giving deep neural networks a theoretically unlimited supply of the data they need to teach themselves. In turn, the deep neural networks offer a way to internalize the experiences and patterns encountered in self-play.

But there’s a catch. For self-play systems to produce helpful data, they need a realistic place to play in. “All these games, all of these results, have been in settings where you can perfectly simulate the world,” said Chelsea Finn, a Berkeley doctoral student who uses AI to control robot arms and interpret data from sensors. Other domains are not so easy to mock up. Self-driving cars, for example, have a hard time dealing with bad weather, or cyclists. Or they might not capture bizarre possibilities that turn up in real data, like a bird that happens to fly directly toward the car’s camera. For robot arms, Finn said, initial simulations provide basic physics, allowing the arm to at least learn how to learn. But they fail to capture the details involved in touching surfaces, which means that tasks like screwing on a bottle cap — or conducting an intricate surgical procedure — require real-world experience, too.

For problems that are hard to simulate, then, self-play is not so useful. “There is a huge difference between a true perfect model of the environment and a learned estimated one, especially when that reality is complex,” wrote Yoshua Bengio, a pioneer of deep learning at the University of Montreal, in an email. But that still leaves AI researchers with ways to move forward. It’s hard to pinpoint the dawn of AI gaming supremacy. You could choose Kasparov’s loss in chess, or Lee Sedol’s

defeat at the virtual hands of AlphaGo. Another popular option would be when legendary Jeopardy! champion Ken Jennings lost to IBM's Watson in 2011. Watson could parse the game's clues and handle wordplay. The two-day match wasn't close. "I for one welcome our new computer overlords," Jennings wrote under his final answer.

Watson seemed to be endowed with the kind of clerical skills humans use on a host of real-world problems. It could take a prompt in English, rummage through relevant documents at lightning speed, come up with the relevant snippets of information, and settle on a single best answer. But seven years later, the real world continues to present stubborn challenges for AI. A September report by the health publication Stat found that researching and designing personalized cancer treatments, as Watson's descendant Watson for Oncology aims to do, is proving difficult.

"The questions in Jeopardy! are easier in the sense that they don't need much common sense," wrote Bengio, who has collaborated with the Watson team, when asked to compare the two cases from the AI perspective. "Understanding a medical article is much harder. Again, much basic research is needed."

As special as games are, there are still a few real-world problems they resemble. Researchers from DeepMind declined to be interviewed for this article, citing the fact that their AlphaZero work is currently under peer review. But the team has suggested that its techniques may soon help biomedical researchers, who would like to understand protein folding.

To do this, they need to figure out how the various amino acids that make up a protein kink and fold into a little three-dimensional machine with a function that depends on its shape. That's tricky in the same ways chess is tricky: Chemists know the rules roughly well enough to calculate specific scenarios, but there are still so many possible configurations, it's a hopeless task to search through them all. But what if protein folding could be configured as a game? In fact, it already has been. Since 2008, hundreds of thousands of human players have attempted Foldit, an online game where users are scored on the stability and feasibility of the protein structures they fold. A machine could train itself in a similar manner, perhaps by trying to beat its previous best score with general reinforcement learning.

Reinforcement learning and self-play might also help train dialogue systems, Sutskever suggests. That would give robots meant to

speak to humans a chance to train by talking to themselves. And considering that specialized AI hardware is becoming faster and more available, engineers will have an incentive to pose more and more problems in the form of games. “I think that in the future, self-play and other ways of consuming a very large amount of computing power will become more and more important,” Sutskever said.

But if the ultimate goal is for machines to do as much as humans can, even a self-taught, generalist board-game champ like AlphaZero may have a ways to go. “You have to see, to my mind at least, what’s really a huge gulf between the real activities of thinking, creative exploration of ideas, and what we currently see in AI,” said Josh Tenenbaum, a cognitive scientist at the Massachusetts Institute of Technology. “That kind of intelligence is there, but it’s mostly going on in the minds of the great AI researchers.” Many other researchers, conscious of the hype that surrounds their field, offer their own qualifiers. “I would be careful not to overestimate the significance of playing these games, for AI or jobs in general. Humans are not very good at games,” said François Chollet, a deep-learning researcher at Google. “But keep in mind that very simple, specialized tools can actually achieve a lot,” he said.

Adapted from Quanta Magazine