The Institution of Engineering and Technology

Virtually Reality

How children's imagination today will shape tomorrow

By Futurist Brian David Johnson

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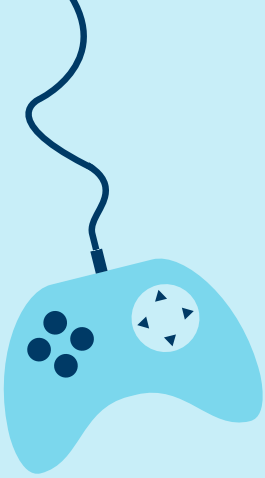


Introduction

The current generation of young minds is like nothing the world has ever seen. Our young people are living through a global pandemic, the mounting effects of climate change, and fracturing social unrest. They are also the generation that came after digital natives – making them not only comfortable with emerging technology, but almost-immediately proficient. In 2014, Dylan Collins, founder of SuperAwesome, proclaimed: "For the first time in our society's history, we're being presented with a generation of kids capable of exceeding our abilities while they are still kids." He was absolutely right.

Today's issues will make tomorrow's change makers. I wanted to meet the next generation and learn what they thought about the future, so I conducted a small series of interviews and conversations with kids (aged 8 to 13) across the UK via video chat[1]. We talked about the future and about what they want to do when they grow up. From there, the conversation followed each child's passions and interests.

I started every conversation with the same question: What do you think about the future? Every single one of these kids gave me an overwhelmingly optimistic response. Sometimes it was jump-out-of-their-seat positive. Other times, it was lean-very-close-to-the-camera excited. Technology fuelled their imaginations. And each child clearly felt exhilarated by the potential of technology and their ideas about the new things they might see and use in the future. We'll talk about a few of these a little later.

As I moved through the conversations, it became obvious that this generation isn't only incredibly comfortable with the technology all around them, they actually don't even see much of it. It is a given. But get them dreaming about the potential technologies of the future, and their eyes light up with pure excitement.

I began to understand that their excitement is key to all of our futures. If we want this next generation to be a success tomorrow, we must start supporting them today, by tapping into this passion. But how can we nurture and guide the next generation of young minds when they are already more adept with technological advances than their parents?

The work begins with us. We need to adopt a new way of thinking about the future.

A New Way of Thinking About the Future

The way we talk about the future is all wrong. When we ask: *What will the future look like? How do I prepare for the future? What does the future hold?* We're talking about the future as if it's a single destination. It's as if we are all travelling to Colchester: *How do I prepare for Colchester? What can I expect in Colchester when I arrive?* But the future doesn't work like that. It's not a single destination. Maybe you don't want to go to Colchester (no offence to Colchester). Maybe you want to go to Brighton or Edinburgh. Or some place that hasn't even been imagined yet.

The future isn't fixed. The future is not a set point on the horizon that we are all racing towards, unable to change course. We build the future with our actions. Individuals, families, communities and organisations shape how that future will look. Even in these testing and anxiety-laden times, we must remember that we still have control over our future and, more importantly, over the future of our kids.

From Preparing to Shaping

Our goal shouldn't be preparing for the future. Our goal should be shaping it. We have the power to shape our future and choose the direction we want to head in. We also have the extraordinary power to shape the lives and futures of the people around us.

The first step is to ask: What kind of future do we want? What kind of future do we want to avoid? What do we want our tomorrow and the tomorrows of our families, friends and communities to be? We have to imagine the future first – and only then can we start taking steps towards it.

It all starts with imagination. Every great human invention was imagined first and built second. Imagination is the single most valuable skill in education, business and life. It cannot only dream up great stories, breathtaking art or catchy pop songs. It's the starting point for every great business plan and groundbreaking product. Imagination helps us solve everyday problems and worldwide dilemmas. Human beings are imagination machines. And the first step in shaping the future for the next generation is to embrace the power and pragmatic value of the human imagination.

And imagining a better future couldn't be more important right now. We know that over the next 30 years, a whole range of scientific and technological advances are going to dramatically reshape every aspect of our lives. With our imaginations guiding how that looks.

An Imagination Deficit?

We need to encourage our children to embrace and grow their imaginations. But we're not doing that right now. And we know it. In a recent poll[2] from the Institution of Engineering and Technology, 80% of parents acknowledged that independent and imaginative free play is essential to their child's development. But 27% of those same parents reported that their kids spend less than 30 minutes per week day on independent play and 22% of them agreed or strongly agreed that their child rarely plays or makes things independently. More worrisome is that 53% of parents believe their child spends less time on imaginative play than they did at the same age.

Are we developing a generation that is enabled by technology but imaginatively deficient?

Parents have the unique power to teach our kids that imagination is powerful and fun and useful – and many of us do. In the same IET poll, 67% of parents were glad to consider their children creative. We need to encourage our children to nurture their creativity. We need to show them that we value imagination in them and in ourselves. Because if we can't imagine a far better future, then they won't be able to either.

Top 10 Technologies That Will Shape the Next 30 Years:

1. Sentient Homes

- A collection of smart devices, sensors, and artificial intelligence (AI) will work together to make our homes aware of the people living in them.
- Sentient homes will work 24/7, minding our physical and digital security.
- Self-optimising, they'll help lessen our environmental impact by adjusting lights, temperature, energy collection and negotiation for utilities pricing.

- They could even tell us jokes when they sense we're having a bad day.

Girl (aged 8): It would be cool if my house could tell me jokes.

BDJ: Do you know any jokes?

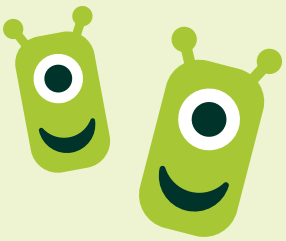
Girl: What do elves learn first in school?

BDJ: What?

Girl: The elf-a-bet! (peals of laughter)

2. Social Robots

- Robots will not only be used in factories and warehouses, we'll see them in homes, offices and even travelling around our nearest high street.
- Social robots will be designed to interact with us and will have their own distinct personalities.
- They might display feelings of happiness, sadness or excitement to better connect with us.
- Our robots would be able to interact with our friends' robots when we humans aren't around.



3. Self-Driving Everything

- From cars, trucks, ships and drones to vehicles we have yet to imagine – why would we need a driver's seat when there is no driver?
- The movement of people and things will be orchestrated into a global ballet – one that's efficient, sustainable, safe and easy.
- The configuration of roadways and even traffic signs will be reorganised. Who needs a stop sign when your car already knows when to stop?

Boy (aged 13):
If all the cars are connected it would be a lot safer. If that happens, I might not have to learn to drive a car. I think we'll have transport that's like cars, but more like a seat that just travels.

4. Robotic Clothing

- Miniaturised motors with sensors, paired with an intelligent and connected control system, will be integrated into clothing to help us move our bodies smarter and more easily.
- Athletes will wear robo-assisted workout gear to optimise their performance.
- Robotic clothing will help the elderly and others with physical challenges to gain greater freedom of movement.

5. Intelligent Food

- Advances in biology, technology and manufacturing will transform the ways we grow, produce, manufacture, transport, store, cook, enjoy and recycle our food.
- Vegetables and fruit will "self-report", telling us where and how they were grown.
- Food will have an "early warning" health-and-safety sensor to track contamination.

6. Connected Contact Lenses

- Thanks to the miniaturisation of optics and computational power, our contact lenses will become our computer screens.
- Augmented reality and virtual reality will combine into mixed reality – seamlessly blending the digital and real worlds.
- Just living with these devices will programme and tailor them to who we are and what we need.

7. Quantum Computers

- A regular computer can solve maths problems quickly. A quantum computer can solve all the maths problems all at once.
- Super-fast computers will solve seemingly unsolvable problems.
- A new form of mathematics is already being created to help us use these quantum machines.

8. Programmable DNA

- Biology will be programmable using computer software.
- Medicine and treatments for disease will be personalised.
- Biological robots will become self-replicating computational systems.

9. Cheap Space Flights

- Advances in science and technology will bring space and the stars closer to us than ever before.
- Travelling outside of Planet Earth will become commonplace, as space tourists pop up out of the atmosphere to enjoy the amazing views.
- The Moon, Mars and the rest of the planets will start to feel within our reach.

10. Home Power Plants

- The falling cost of solar and wind power will make home power-generation and grid management more accessible.
- Electric cars, personal drones and robots will be powered locally.
- AI energy brokers will sell and trade your power on your behalf.

Technology is a Tool

These ten innovations and technologies will make the future a fascinating and amazing place. But there's something we have to remember about each of them. They are only tools.

Let me explain – a hammer is just a hammer. A hammer really isn't that interesting in and of itself. What makes a hammer interesting and useful is when we use it to build a house. Our tools, technologies and scientific breakthroughs cannot shape our future. That's down to the humans using those tools to invent, create and improve the lives of us all.

We start by imagining the kind of future we want and then using these tools to make it happen. That's how we shape our future.

Because these innovations will be so life changing, it's clear how important understanding and getting comfortable with science, technology, engineering and maths (STEM) is going to be for the next generation. Just as these technologies and innovations will touch every aspect of our lives in the future, so too will STEM.

Flipping the Script on STEM

If we accept that the future isn't fixed and that it is up to us to shape it, it's clear that we cannot just passively wait for it to happen. We need to be actively shaping the future we want. Now that we have "flipped the script" on how we think about the future, it's time to do the same for how we think about STEM.

People think STEM is something to be learned and understood. The title makes you think of science experiments, high-tech devices, building bridges and algebra. And yes, STEM does encompass these things. But its reach is far wider and much more interesting than just that.

Like the future, STEM really isn't fixed. It's a collection of skills and experiences that kids can apply to nearly every part of their lives. If we flip the script on how we and our kids think about STEM then the questions become:

- How do the next generation want to put STEM skills to work?
- What are they passionate about and how will these skills help them fulfil their dreams?
- How will the next generation use STEM to shape their futures?
- How can we enable them to get there?

The next generation already use so many aspects of STEM without even knowing it. But they are going to need a deeper understanding of STEM if they are to thrive in the future.

I had a chat with a boy who wanted to be a designer. But when I asked if he needed to use STEM skills like engineering, he didn't think they were relevant to him. "I always thought of a designer as being different than an engineer. One designs, one builds," he replied. When we talked about STEM in more depth – about skills like using a computer to design, doing maths to calculate the size of a product and analytical problem solving – he agreed that all of these would be necessary.

Those STEM skills and more will be essential not only to this boy's career as a designer, but to almost every career in the future. When we flip how we think about STEM, then we change how we think about the jobs of the future. The coming decades will push us to reimagine these careers and how we can prepare the next generation for them.

The Incredible Jobs of the Future

Designer of the Future

BDJ: Would you like to collaborate with two robots to design a building?

Girl (aged 11): It'd be really fun. Two robots could tell you different things. They could argue whether you should or shouldn't make a design and you can make the final decision.

BDJ: What would you name your robots?

Girl: Lucy and Lilly.

In the future, creativity and technology will live side by side, one enabling the other.

Just imagine...

- Designing a sleek, new sports car or a dress that fits the latest trends just by talking to your computer.
- Collaborating with multiple robots and artificial intelligence to create a new building.
- Diving into a mixed-reality rig to write a new song with a collaborator across the ocean.
- Shopping as self-expression – we could move effortlessly between the digital and physical, experiencing and customising new products.

We have all heard someone claim they are creative and therefore bad at technical things. And we've met someone who's highly technical and professes to not have a creative bone in their body. But these beliefs are completely false. Binary labels like these do not and will not apply to the next generation. 'Creative' and 'technical' are terms that describe skills, not people. Artists are some of the most technically minded people you will ever meet. And engineers are wildly creative.

Optimised Athlete

The most successful footballers of tomorrow will all be engineers. Athletes in the future will work with technology to become stronger, faster and smarter. Thanks to wearable devices, robotic workout gear and sentient gyms that track their progress, these optimised athletes will need to understand the tech if they want to beat the competition.

Just imagine...

- Jogging in a smart city that optimises your route, making your run harder when it senses you are not being challenged enough.
- Working out in a sentient gym that knows you right down to your DNA.
- AI coaching you through your day, not only preparing for the game, but for school and life as well.
- Advances in biology and nutrition that inform what you eat and drink, making sure everything is optimised for peak performance.

Girl (aged 11): Having a robot coach would be weird and fun. You'd be used to having a human coach so it might be weird but it would be fun to see how a robot would be different from the human.

Boy (aged 12): I think we'll still be able to play football. The crowds might be robots.

Part-Time Astronaut

According to IET research released last year[3], 48% of kids under 16 believe a human colony on Mars will be established in their lifetime and 59% expect that they will be able to visit space on holiday in the future. The far reaches of space are becoming closer every year. Advances in space travel are not driven by one single technology or scientific advance. Over the next 30 years, a constellation of technologies and a growing culture of innovators around space travel will open up the possibilities of the universe

Girl (aged 11): Space hotels! We could go up in a spaceship and have a little holiday. I would like to go to space. It'd be really cool to fly and feel weightless.

Just imagine...

- Global and local problems in agriculture, communications, security and health solved by innovators and startups making use of the increased access to space.
- Tourism blooms, giving the next generation first-hand appreciation of the wonder of space and the expectation that space travel is within their grasp.
- Robots pave the way for human-based missions further away from Earth.
- Personal space-flight begins to develop.
- Larger space agencies push deeper into space, exploring further and pushing towards Mars.
- Careers like tech inventors, programmers, doctors, and architects incorporate 'part-time astronaut' into their job spec.

In the future, STEM will be a part of every athlete's life and training plan. Just as we need to dissolve the old distinction between creative and technical, we'll need to do the same with the idea of what it means to be an athlete. In fact, the better a future footballer is at using STEM, the better they will be in the game.

Virtual Veterinarian

Advances in genomics, synthetic biology, personal devices and AI will all work together to transform our understanding of health – even when the patient is a cat or a dog. Personalised medicine and health data will give virtual vets the ability to not only understand the patient's ailments today, but also predict what they will be next year and in the years to come.

Just imagine...

- Genomics give vets an understanding of their patients' complete and current health status.
- A self-driving lorry lab takes them from house call to house call.
- A small, implantable pharmacy allows vets to administer custom medicine remotely to larger animals.
- Virtual vets can practice tricky surgeries on an exact digital model of the animal in augmented reality/virtual reality/mixed reality, days before the operation.

Boy (aged 12): In the future we might have a robot dog walker. The collar might be able to pull them without anyone going outside. You'd be able to tell them where to go and what to do.

Climate Change Agent

Girl (aged 13): I'm worried about global warming getting worse as time goes on…it can destroy habitats for animals.

In my conversations with the kids, there was only one anxiety that came up around the future: climate change. Research shows this is a looming concern for kids. According to a 2019 IET survey[3], 61% of children feel anxious about the environment on Earth, with 34% of children saying they don't think enough is being done to solve the world's environmental problems.

Just imagine...

- AI, home-power plants, AR/VR/MR, and access to space allow us to manage a global network of devices – making us more efficient, and helping us understand the planet's current state, moment by moment.
- Smart cities and sentient buildings are optimised for sustainability and safety during climate events.
- Intelligent food allows us to lessen our impact on the planet, while making sure no one goes without.
- Autonomous transportation improves how we move people and goods in order to have the least impact possible.
- Quantum computing allows us to model and solve problems that up until now were impossible for even the most advanced computer to tackle.

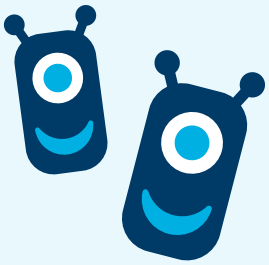
Boy (aged 10): I think technology will help the planet. People will make inventions to help pick up the plastic in the oceans and save the animals – that will be super cool.

The Classroom of Tomorrow – Not what you might predict

In many ways, the most shocking thing about the classroom of the future is that it's going to look a lot like the classroom of today. Education will still be all about people – teachers teaching and students learning. And in some cases, that will mean having traditional schools with traditional classrooms.

However, the next few decades will see many changes to how, where and what we learn.

Girl (aged 11):
If I didn't have a human teacher, I'd miss them.



Your Own Personal Teacher

AI, relationship computing, smart cities and sentient schools will give future students an AI teacher of their own, along with all the other teachers and administrators. Imagine an AI that is focused primarily on a single student, making sure that they're not only doing the schoolwork, but getting the skills and knowledge needed to be successful. The AI will know how they learn and how best to communicate with them.

There might even be more than one AI. Students could have two different AIs that have different learning approaches and different personalities – all working to make sure that they get what they need.

Everywhere School

School will no longer just be a place but a state of mind, a mode of learning that continues through an entire lifetime. Learning happens throughout a student's day and the school moves with them – intertwined with their community, family and passions.

Students would spend less time in the classroom and more time out in the world, conducting experiments, applying learning and working with the community. This pervasive schooling will allow teachers and parents to educate the whole student, understanding their passions, interests and connection to the world.

Art Class in Space!

The mingling of the digital and physical world with AR/VR/MR will open up new vistas for learning. In these new spaces, art and science will overlap – connecting young minds with new places and fascinating people. Imagine children being able to collaborate with astronaut teachers in a space station for their next art projects!

Not Your Average Robot

With the increasing affordability of hardware and computers, robots will become as common as smartphones in school. Each student will create their own personalised robot, programming its features and personality through conversation with it. These new robots will become an extension of the student's creativity and imagination.

But what can parents do today to start preparing for these careers and classrooms of tomorrow?

Start Imagining and Building a Better Future[4]

Is your kid a future footballer or the next great architect? Are they a wannabe chef or doctor? Do they want to go to space or do they want to save the planet? Maybe they don't know yet... and that's OK.

Research by the IET in 2019[5], showed that 54% of parents feel they would struggle to guide their children in gaining more experience in science, technology, engineering and maths (STEM) fields. As we move into summer, what can parents do to help support the next generation? It all starts with one child – one young mind.

Try the following steps to engage young minds with STEM-based learning, and help the next generation imagine a different future and their role within it:

1. Design hands-on activities for you and your children to do together.
2. Age-grade STEM activities, with 'graduation' onto the next level.
3. Present engineering as encouraging the sharing and development of ideas.

The Future Footballer

1. Use technology (e.g. wearable tech, apps and AI) to track and measure incremental improvements in fitness and game play.
2. Continuously increase the intensity and complexity, and show how the tech has improved play.
3. Share the experience with the team and invite teammates to join in.

Words Matter: How to be a Future Champion

Most of the kids I talked to said maths was one of their favourite subjects. Art and PE scored pretty high, but maths was also surprisingly popular. This generation's passion for technology and maths (even when it is hard) reveals an inherent interest in STEM. I don't believe they realise that (nor do they have to). But it is something that needs to be encouraged.

Girl (aged 11): It's frustrating when you can't get the answer straight away, but when you get the answer you really feel good.

BDJ: What's it like when it's hard?

Girl: I get frustrated and just want to quit.

BDJ: How do you stick with it to get the answer?

Girl: My teachers help me then I get the answer and I feel good.

We as parents, have an immense and powerful influence on the future of our children. We are not only shaping the future of our children, but the future of the UK – and possibly even the world.

The words that we use matter. The way we talk about the future and STEM will resonate with our children. Research by the IET in 2018[6] revealed that parents' lack of confidence in subjects such as science and maths was discouraging the younger generation from pursuing those subjects at school and beyond.

If we can flip the script and empower our kids, they will see the future and STEM differently. By applying it to jobs and tasks they never imagined, we can change the relationship they have with these technologies. How we talk to and support our children will have a deep effect on their imagination and their relationship to STEM.

Failing our Girls, Failing our Future

BDJ: Would you like to be an engineer?

Sisters (aged 8 and 11) simultaneously: No!

BDJ: Why?

Sisters: It would be too hard.

The girls I spoke to were comfortable with STEM subjects, even though they may not have expressly said as much. They had no aversion to technology, maths or invention. But it's clear that, as girls get older, we need to continue to talk to them about technology and encourage them to engage with it.

Adult woman (aged 48): When I was 10 years old, no one told me I could be a mathematician even though I grew up loving maths. Worse than that, their actions told me that maths was not a thing that girls do. So, I didn't study maths. I went to school and prepared to enter the family business. I regret that.[7]

Words matter. The conversations we have with our girls can shape how they imagine themselves in the future. Often our language can exclude them, which in turn can prevent them seeing themselves as future scientists, engineers, technologists or mathematicians.

The IET's 2019 'Inspiring the next generation of engineers' report[8] – which looked at perceptions of STEM – found that when parents think about their child's career, very clear gender stereotypes emerge. Parents of girls think they would be most interested in the arts, education, childcare, healthcare, and hair and beauty. Whilst parents of boys think they would most like to go into technology, information technology, engineering, and sport.

Now is the time to bust these stereotypes so our girls don't get left behind.

Here are some guidelines to help encourage our girls to stick with STEM:

- Have conversations that support your child's imagination and interest in STEM, while challenging gender, racial and geographical divides.
- Prominently support girls doing practical experiments.
- Design open-ended and imaginative projects that explore problem solving and which may be more appealing to girls.

BDJ: What's your favourite subject in school?

Girl (aged 8): I like maths.

BDJ: Why's that?

Girl: Because I'm good at it!

Four in five (79%) girls are considered creative by their parents, compared to just three in five (58%) boys.[2]

Playing our Part

Over the next 30 years, the world will change in amazing, fascinating and unexpected ways. We all need to be active participants, helping to shape the future for the good of humanity and the planet. One of the most powerful steps we can take is to help the next generation prepare to play their part. That starts with empowering our children to imagine a bigger, bolder and more awesome future. And helping them understand that they are the ones who will be shaping that future and bringing it into reality.

Next, we need to give them the tools so they can do just that. That means giving them not just an understanding of STEM but an ease with using it. We need to help them see that STEM subjects are the skills and tools that will help them accomplish their dreams, make them more successful and have a positive impact on their families, communities and the world.

Our kids are our future. And that future is living in our own homes right now. We have the unique ability to encourage, empower, amplify and support our kids to shape it. It's going to be an awesome summer!

#STEMintoSummer

To help inspire the next generation of inventors, the IET is encouraging young people and their parents to #STEMintoSummer with a package of activities for children to use over the summer months. These will inspire free play and help to develop science, technology, engineering and maths (STEM) skills. For more information, visit www.engineer-a-better-world.org

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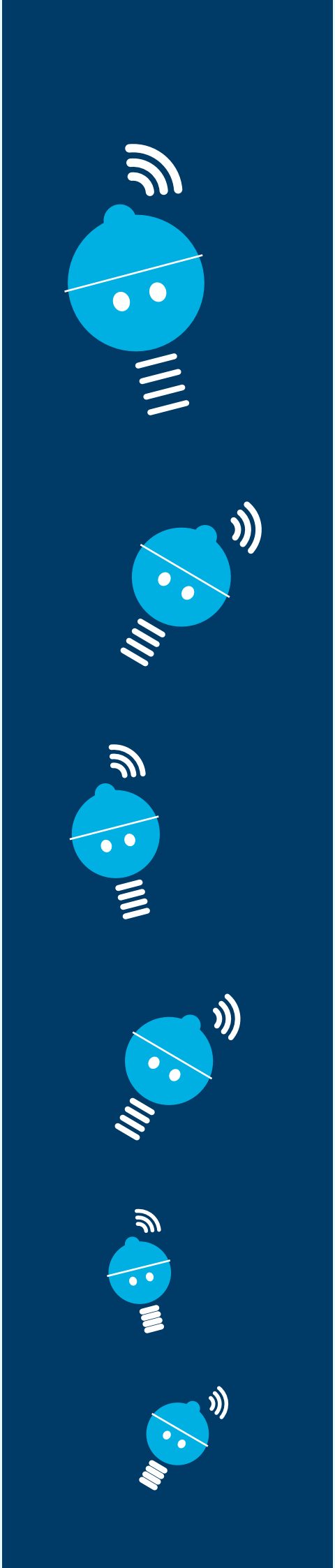

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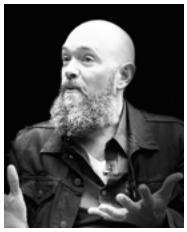
About Brian David Johnson



The future is Brian David Johnson's business. As a futurist he works with organisations to develop an actionable 10-15-year vision and help people understand what living in the future will really feel like. Johnson has worked with governments, trade organisations, start-ups and multinational corporations to envision their future and specify the steps needed to get there. Johnson holds over 40 patents and is the author of both science-fiction and fact books – including *Wizards & Robots*, which he created and wrote with musician and technology enthusiast will.i.am. He has directed feature films and is an illustrator and commissioned painter. In 2016, Samuel Goldwyn released *Vintage Tomorrows* a documentary based upon Johnson's book of the same name.

About the IET

The Institution of Engineering and Technology (IET) is one of the world's largest engineering institutions with 167,000 members in over 150 countries.

One of its biggest remits is helping to inspire the next generation of young people to get excited about, and take an active interest in, science, technology, engineering and mathematics (otherwise known as STEM) – both at school and as a career.

Every year the IET runs its 'Engineer a Better World' campaign to give parents and children an insight into what engineering and technology is all about – and to help them understand the connection between engineering and technology and the other subjects that interest them, like music, entertainment and space discovery.

To support this latest report and to ensure the next pipeline of engineering and technology talent, the IET is encouraging young people and their parents to #STEMintoSummer with a package of activities for children to use over the summer months, inspiring free play that will also help to develop science, technology, engineering and maths (STEM) skills. To find out more, please visit engineer-a-better-world.org