The digital future: Artificial Intelligence

feature
Leaner, stronger, more innovative; the challenges and mega-trends facing modern mining as it comes of age.

technology
Finding knowledge just when it’s needed. Smart AI-based tools for industry and academia from a unique start-up.

topic
Productronica 2019: What was new at the world’s largest electronics development and production trade show?
Fabriquez des pièces parfaitements personnalisées grâce à l’impression 3D.

Enjeux industriels, matériaux, conception, chaîne numérique, contrôles et qualité : l’essentiel pour comprendre les perspectives offertes par ces nouvelles solutions de procédés de fabrication additive.


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On January 20, in Versailles, Emmanuel Macron led a skilful marketing operation to promote the merits of France to foreign investors. 200 international CEOs took part in the exercise, allowing the head of state to announce major investments. A statement bound to lift the spirit of a country that tends to indulge in self-deprecation and pessimism.

Despite over a year of demonstrations of « gilets jaunes », and despite a seemingly endless strike against the pension reform, which blocked public transport, international investors continue to answer Emmanuel Macron’s call: "Choose France".

France should not shy away from the pleasure of having regained its attractiveness after a long standstill. While foreign direct investment (FDI) has declined overall in the European Union, it continues to grow in France.

The implementation of the tax credit for competitiveness and employment (CICE) and the introduction of the research tax credit (CIR) have put France back in the race for attractiveness as soon as 2015. The current president has confirmed and accentuated this policy, which is starting to produce its full effects.

France has its own merits: good-quality infrastructure, competitive energy, skilled workforce, excellent engineers. What is more, producing there has become cheaper than in Germany, which, in terms of foreign investment projects, is now relegated to second place behind France. The newest decrease in social contributions and taxes, granted to companies in 2019, should allow the trend to continue.

However, France also benefits from the decline in attractiveness of its major competitors. The United Kingdom suffers from the uncertainties of Brexit, and the German model is declining. France should take advantage of this short-term situation. The United Kingdom, led by Boris Johnson, wants to become a new tax haven, and Germany has not lost its potential. In this context, France must preserve its advantages.

Attractiveness is a long-distance race, which leaves no respite!

Sincerely

[Signature]

Yves Valentin
CEO of Techniques de l’Ingénieur
Iris.ai – Democratizing science with AI tools

Iris.ai is one of a handful of companies that offers smart AI-based tools for academic and industrial researchers and helps them to avoid unnecessary delays in the process of finding the knowledge they need at the right time.

New network analyzer from R&S

Today's network analyzers have to meet multiple requirements. In the aerospace and defense sector the emphasis is on stable data, whereas in research institutes and universities the demand is for top performance and versatility.

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Canada

Canada is the second largest country in the world, has the longest coastline, the tenth largest GDP and the fourth highest total estimated value of natural resources. The country’s economy is dominated by the service industry which employs about three quarters of Canadians. Opportunities for engineering abound.

Gearless drive technology

A new thyssenkrupp overland conveyor belt in Peru powered by Siemens gearless drive technology will move 127,500 tons of primary crushed ore every day while increasing reliability and efficiency by up to 4 percent.

technology worldwide language

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Life on the Falkland Islands can be challenging. Not only is the weather in the South Atlantic harsh but the children attending the islands’ 2 schools are in constant danger of getting out of step with their peers in the rest of the world, especially when it comes to technology.

The islanders decided that measures should be taken to give their children the confidence to pursue studies and careers in technology – expertise much needed for the future. “There are vast possibilities that Information and Communication Technologies (ICTs) offer,” says Susannah Nightingale, the Falkland’s Communications Regulator. “More needs to be done to change misconceptions about the sector and invite children to imagine a future as more than an ICT user, but also a creator,” says Karen Armstrong, Teacher of Computing at the Infant and Junior School and Camp Education (IJS&CE). “Our young people need to aspire to use advanced technologies and what better way to do that but to see the process through from design to the final product, with the help of leading experts.”

They decided to set up a competition to create a design and see it come to life through 3D printing. They partnered with igus UK, part of Igus GmbH in Cologne to bring a taste of 3D printing to the school. Robert Dumayne, dry-tech director at igus, explains how 3D printing is relevant to children in the Falkland Islands: “3D technology has moved away from the scientific world and basic 3D objects to creating intricate designs for the fashion, automotive, medical and industrial automation sectors.”

The challenge was to simply take a piece of A4 paper, pick up a pen and draw a design on one of two themes. The first was a recycling robot or litter picker that could be used in the Falklands to keep streets or oceans clean. The second was to imagine what transport would be like in the future for the islanders. The winning design was sent to igus and converted into a digital design then 3D printed. The panel of judges considered over 40 entries. The overall winner was Hayden Stanworth with his innovative ‘Sieving’ robot, which separates out recyclable waste. Another winner was Toyah Wilson with her picker robotic arm. “With more people understanding the potential of 3D printing, the technology is set to revolutionize life in the Falkland Islands,” concludes Susannah Nightingale. “Perhaps in the not too distant future, items will no longer be manufactured in factories and shipped thousands of miles to users, but instead a file of the 3D product could simply be downloaded and printed locally.”

For more information, please visit: www.igus.co.uk
Microfocus X-ray Tubes

Viscom Vision Technology has expanded its development and production of microfocus X-ray tubes with three new X-ray laboratories certified to radiation levels up to 300 kV and 1500 W. Microfocus X-ray tubes have a small focal spot size, which enables them to generate extremely sharp images and meet even exacting technological standards for performance, resolution and stability. Viscom has established a 250 m² state-of-the-art competence center for X-ray tubes in its Hanover campus. Additional safety is offered by walls and ceilings made of radiation-shielding concrete with a density of 3.2 t/m³ as well as leaded gates and cable conduits, safety switches and camera surveillance. Microfocus X-ray tubes are used in high-quality inspection systems, deployed primarily for quality control in electronics manufacturing. They also are used in X-ray laboratories and installed as components in premium machinery. Thus, a wide range of applications in many different industries are addressed, from small workpieces to entire car bodies, can be reliably inspected and measured, also in combination with X-ray computer tomography.

Viscom offers both direct radiation and transmission tubes with voltages of up to 250 kV. Extensive approvals and permits are available for operation worldwide, including in North America and France.

The new X-ray laboratories enable Viscom’s engineers to conduct final inspections of finished X-ray tubes. Source: Viscom Vision Technologies

Viscom Vision Technologies

Understanding the Green New Deal

Figuring at the top of the agenda and the three words on everyone’s lips in Brussels, the Green New Deal positions the new European Commission as a global leader on climate action. The goal was to ensure the alignment of measures and avoid an unmanageable tangle of uncoordinated regulation. 2020 will be a decisive year which will demonstrate whether the Commission can succeed in bringing together all of its planned measures and successfully put them into practice.

Fulfilling the Paris Agreement goals and the goals of the UN Sustainable Development Goals are the trigger and international basis for the EU’s current action. Wanting to lead globally by example the EU wishes to anchor the goal of climate neutrality by 2050 into EU law. Working backwards the 2030 targets will likely be increased to somewhere between 50 and 55 % emissions reduction over levels in 1990. Building on this cornerstone of climate policy existing measures will be brought in line with this target and new ones should enable the concrete implementation.

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they soon found a common frustration with the access to and passion for the value of scientific knowledge, and as such Iris.ai – named after the Greek messenger goddess, bringing messages from the gods to the people – was born. The company’s mission is “democratizing science” with AI tools and decentralized applications for an open, transparent and unbiased world of science.

engine talked to Anita Schjøll Brede, Co-founder and CEO of Iris.ai to find out what the company does, what its philosophy is and where it is going...

engine: What can iris.ai offer that other, similar sized companies can’t?
Anita Schjøll Brede: iris.ai was founded at Singularity University in 2015; we are unique because we are a small, agile start-up offering a set of AI based tools to academics and researchers; an underserved market with a great need. We have spent the past four years building a powerful AI engine – Natural Language Processing (NLP) – that can understand scientific text. Most small companies like ourselves struggle to a) find the right AI/ML research and engineering skills, b) focus on large and important problems with long term positive impact on the world if solved while c) not fall into the trap of becoming a consultancy, taking on a variety of client challenges but not being able to produce the tools to work towards their big vision.

We are one of a handful of companies that can offer smart AI-based tools for academic and industrial researchers to avoid the tedious and error-prone process of finding the right knowledge at the right time.

Towards published scientific knowledge

Sharing and finding knowledge has gone through major paradigm shifts repeatedly throughout
history, each radically changing the world. From Gutenberg allowing scaling up of the distribution of knowledge with the printing press, to Diderot’s Encyclopédie going against the aristocracy and church for the free spread of ideas and knowledge, to the introduction of the internet which removed the need for physical moving of knowledge, we are again facing the next frontier. Much like Diderot and his collaborators’ aim was to collect all the knowledge and put it in a new system, so the world is moving rapidly towards a published body of scientific knowledge not just as individual pieces of knowledge - but connected pieces that should be automatically seen in light of each other.

As of 2019, the majority of the work researchers have to do to achieve their goals is largely manual. Using manual key word queries to try and navigate content using Google Scholar or USPTO, manually reading and noting down key data points, and then searching for those findings in manually curated databases like SciFinder for more elaborate references. There are reference manuals and advanced notepads that help structure the thought process, but at the end of the day the process is limited by the researcher’s own human capacity. To the solutions we propose, there are no existing alternatives beyond tedious, time consuming and error-prone human labor.

Granted, when it comes to the search part of this process, we have seen some novel approaches in the last few years, each following one of the following three schools of thought. The first one is taking the keyword search engines, like Google Scholar, and adding new smart semantic technologies to it. This means it is no longer a direct keyword to keyword match, but a machine that can understand semantically what you are looking for, perhaps suggest alternative key words to you, and find related papers even in instances where the key words do not entirely match up. While these projects surely incorporate value-adding technologies, the main challenge is that they are not shifting the paradigm in how the task is approached. This means that the very powerful technologies they apply are still limited by human capability. Their goal is still to simply find specific nodes of knowledge, and as such they will never be able to change the paradigm of how to extract the right bits of knowledge from within all the information and connect them.

Interdisciplinary connections

The second one is building social networks for researchers, with the idea that, if we connect the human beings behind the research, we can connect the ideas of the research beyond just the paper. This is great thinking, and some of these social networks – such as Academia.edu and Researchgate – had seen a certain amount of success and they are very useful and relevant in the new era of networked science, perhaps especially so in the Open Access movement and the spirit of open sharing. But even so, it does not solve the issue of finding “unknown”
or discovering interdisciplinary connections. It still very much keeps people in their own silos, although perhaps more social silos.

The third approach is not relying on limited human capability: neither on the human beings networking with each other, nor the human-limited existing search methods, but will actually let a machine connect the nodes of knowledge. These methods use breakthroughs in machine learning and natural language understanding to find patterns beyond what human beings can find and bring them back to the human so they can move forward with the important part of their work and not get bogged down with tedious manual labor. This is the category of projects where we operate, and also the category of technologies that will, we believe, bring on a new paradigm of knowledge.

Having said this, the approach we take is not entirely novel: anyone working on the cutting-edge of artificial intelligence will understand what we are aiming to do. Chemistry, however, is entirely underserved for smart tools. Most global companies deploying related technology go after marketing or sales or, when approaching science, the pharmaceutical industry. This places us in a unique position to evolve our technology and build a suite of specifically tailored tools that the chemical world has never seen before. The technology we are developing is at its core and in the longer run applicable to other fields, such as material science and biomedicine.

**engine: Can you describe in detail the products/services you offer?**

**Anita Schjøll Brede:** Iris.ai has two main product lines. One suite of tools is developed for academic researchers, the other for researchers in chemical industry R&D.

The Academic suite is a semi-automation approach to the literature review, or more specifically the systematic research landscape mapping. Traditionally this is done manually and requires highly skilled researchers to spend months building keyword queries and screening research paper titles and abstracts. The interdisciplinary Exploration tool bypasses the need for keyword query building. The Focus tool iteratively narrows down a large corpus to a precise reading list.

The first Academic product, the Exploration tool, is built for an academic to explore broadly and to identify a large batch of potentially relevant papers or patents across disciplines. Iris.ai starts from a free text problem statement of 300–500 words, “fingerprint” based on machine extracted keywords, contextual synonyms and hypernyms, and matches its fingerprint against the stored tens of millions of papers and patents sourced from the world’s leading scientific repositories. The Exploration tool bypasses keywords and citations and results are navigated using visual results maps.

The second Academic product, the Focus tool, helps the user with the automated distillation of a starting collection of documents (obtained via the
Exploration tool or an alternative starting point) into a precise list of the most relevant articles. The tool allows the creation of intelligent filters to include or exclude topics of interest, retraining the algorithm with each choice. The Focus tool reduces the average time it takes for researchers to compile a full report of relevant papers to support their work, reducing a process that could take weeks to as little as two days and increasing the confidence level of results by 15 percentage points.

Our technology applied in this context has been proven to reduce the systematic research landscape mapping process by 78% from 3–6 months down to a few weeks at full academic accuracy, while increasing inter-disciplinarity. When lowering accuracy requirements from 99.8% to 85%, the entire process of mapping out research can be reduced to a couple of days and open the door for researchers’ exploration of fields in which they are not domain experts. Both tools are powered by our core technology, Natural Language Processing (NLP) libraries and proprietary Machine Learning (ML) models. Each paper abstract stored in our database undergoes a series of analytical steps that include key information extraction, contextual understanding of the key information and neural topic modelling. The resulting word collection is converted into a high-dimensional vector space – generating the paper’s DNA-like numerical fingerprint.

The AI Chemist suite is an offering more specifically adapted to the industrial R&D process. Usually researchers are less concerned about systematically mapping out every piece of knowledge, and will rather find spot-on knowledge on a very specific challenge. The core AI engine is therefore reinforced with chemical knowledge to be able to handle chemical nomenclature much more accurately. The AI Chemist can then create a suite of tools that allows chemical researchers to extract vital information from research papers, patents, product sheets, internal documentation, etc.

The Extract tool does this by automating the extraction of key data from a set of patents or other scientific documents, and placing the data points in a database, ranging from something as simple as a spreadsheet or in a more complex knowledge graph. The key data points can, for example, be all details related to experiments performed, with all relevant temperatures, elements and processes, so it is easy for the researchers to follow the “recipe” from the table.

**Identifying novel applications**

The Identify tool allows researchers to identify novel application areas for their existing compounds. The tool allows the input of a molecular formula or common compound name, specification of any constraints (e.g. already known applications, known similar materials, or highlighting of important properties), and the tool will extract from existing literature a list of potential applications. The applications can be identified in patents, research papers or any other scientific documents, and can be found from entirely interdisciplinary sources.

The Content Based Recommendation engine is a module quite similar to the Academic Explore tool, except specifically reinforced with chemical knowledge and it can be applied to, for example, all information extracted using the Extract tool, or internal documentation from the company. Over the next 2–3 years, we will also offer a more advanced “Develop” tool which also allows for the development of new synthesis procedures, molecular formula changes and design of properties. The expert tool, “Invent”, will assist in the invention of approaches that have not yet been discovered by anyone else. This will be achieved by adding an inference layer on top of the previously described tools, drawing conclusions from the existing knowledge - or connecting the pieces of the puzzle.
engine: Given that we live in a very fast moving market - where do you see yourselves in 5 years from today?
Anita Schjøll Brede: In 5 years, with both the Academic and Chemist suite being commercial successes, and 2–3 other areas (biotechnology, nanotechnology, pharmaceuticals etc.) also having their own suites of tools, we will have started on the merging back of the general academic tools with the specialized chemist tools in order to build a powerful general engine for scientific understanding. Our goal is an entirely interdisciplinary AI engine that will be an invaluable Member of any research team – not only fetching all the right knowledge at the right time, but also with the ability to infer new knowledge from existing knowledge. Extracting the hypothesis, extracting and validating arguments from each document, building out a knowledge graph and a "truth tree" of each document, and then using this connected knowledge to propose and validate new hypotheses, will be core technical future developments. We will always focus on those work tasks that the human brain is best equipped to handle, making sure the AI is a valuable and helpful addition to and for the human researchers.

Iris.ai today

A team of 20 something scientists, more than 40 % women – speaking 14 languages fluently and distributed across 9 different countries. Iris.ai was one of the 10 most innovative artificial intelligence companies in 2017 according to Fast Company.

Iris.ai is aiming to build the world’s first "AI researcher", and is currently offering research discovery tools for Academia and the Chemical industry.

For more information: www.Iris.ai
Long-running trade disputes, the cyclical downturn in the economy and the structural change in the automotive industry are increasingly leaving their mark on East German mechanical engineering and plant construction. In the third quarter, fewer companies than before rated their economic situation as good. Business prospects for the rest of the year are also subdued. This was the result of a survey of the 350 members from Berlin, Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony-Anhalt and Thuringia conducted by the VDMA-Landesverband Ost, the engineering organization’s eastern chapter.

Accordingly, two out of three East German mechanical engineering companies assessed their current overall situation as positive. “These are as few as at the beginning of 2016,” says Reinhard Pätz, Managing Director of VDMA East. “In recent months, many companies have successfully defended themselves against the unfavorable economic and political conditions. Of course, well filled order books also helped,” he adds. In the meantime, however, the point has been reached at which customers are increasingly waiting and investing more timidly in new machines and services.

Sales and customer service

Meanwhile, companies are taking various measures to cushion the onset of an economic downturn. Among other things, by strengthening their sales activities, developing new business models, and intensifying customer service. “More companies should use the quieter phase to train employees and get them fit for new challenges such as digital production,” Patz pleads.

Short-time work, on the other hand, currently plays only a minor role in East German mechanical engineering companies. Instead, employees are primarily reducing temporary work accounts and companies are reducing the number of temporary workers.

Companies uncertain about the future

Companies are taking a differentiated view of the coming months: by the end of the year, two out of three mechanical engineering companies expect business to remain stable or improve. Every third company estimates its business opportunities to be worse than before.

Despite this, 80 percent of the companies intend to retain their workforce or hire new employees over the next six months. Every fifth company plans to cut jobs. The reason for this, however, is not only a poor order situation. There is also a shortage of skilled workers to be able to replace retiring employees.

Order situation poor

The cooling demand is noticeably reflected in the current order situation. In the third quarter, companies utilized their existing production capacities by an average of 85 percent, down from 89 and 92 percent in each of the previous two years. In addition, almost half of the companies recorded fewer orders than in the middle of the year. “This shows that growth is slowing down. But I would warn against speaking in general terms of an all-encompassing downturn,” stresses Patz. On the contrary, the decline in orders would affect companies with a positive and negative business situation to the same extent. Automotive suppliers are also more likely to be affected than niche suppliers.
A common language for all machines

In the digital production world, machines from different manufacturers must be able to communicate with each other. This requires uniform standards. Historically time conveyor belts and assembly cells were the hallmark of clear order in the factory. But in the digitalized world, production plants are much more complex to organize – which is precisely why clear rules are needed.

The design of complex, decentralized ecosystems requires interoperability, i.e. the seamless cooperation of all machines and systems. Standards enable networking and simplify communication across company and industry boundaries. And just as people have agreed on English as a world language with grammar and vocabulary in order to simplify communication, machine-to-machine communication must also be subject to a uniform, standardized grammar and vocabulary.

OPC UA guideline

“The VDMA recognized early on that the definition of a world language for mechanical and plant engineering would be crucial for the future,” says Hartmut Rauen, Deputy Managing Director of the VDMA. “The mechanical and plant engineering industry has therefore agreed on the OPC UA (Open Platform Communication Unified Architecture, IEC 62541) communication standard.” OPC UA is an open IoT interface standard for tomorrow’s digital production. It enables scalable, system-independent and secure communication from the shop floor to the cloud. OPC UA defines the grammar of the world language of mechanical and plant engineering.

Together with the Fraunhofer Application Center Industrial Automation, the VDMA has developed the guideline “Industry 4.0 Communication with OPC UA”. As a practice-oriented tool, it shows very concrete measures that help companies to successfully introduce industry 4.0 communication into their own production processes.

Companion specifications

The commitment to OPC UA was a first step towards digitally networked and interoperable production. However, with OPC UA “only” the grammar of the language is set for machine-to-machine communication. Now the vocabulary must be defined. The core work of the VDMA in the OPC UA world is to create the dictionary, i.e. to standardize the vocabulary of the functional description of the machine worlds. OPC UA Companion Specifications are the technical jargon for these standards, which the VDMA is developing with over 400 companies from all over the world. The openness of the approach – open source – offers all interested companies the opportunity to participate. With the website opcua.vdma.org, the VDMA provides an overview of its standardization activities. Here users can also find the OPC UA Companion Specifications which have already been completed and the OPC UA Companion Specifications which are in draft form brought together in one database.

Developing these standards is an ambitious goal – and one in which VDMA plays a decisive role. We are currently defining the world language of production,” says Andreas Faath, Project Manager at VDMA for Machine Communication. Together with a small team of experts, Faath is working on developing standards for individual machine types on the basis of OPC UA to enable them to “talk” to each other. They ensure that two machines, which are networked with each other, exchange indispensable
information uniformly: What type of machine is it? Who is the manufacturer? Which device configurations are available? And which process data must be exchanged? This communication can take place not only horizontally between the machines, but also vertically - i.e. with higher-level systems or a system right up to the cloud. “This is the only way to make plug and work possible in the factory,” explains Faath. “However, the development of such a standard, which is to become established worldwide, will take some time: the development takes around 2 years.

Entire process chains

OPC UA does not only revolve around interfaces between two machines, but also around entire process chains. In everyday operations, it is not only a question of developing communication, for example between two injection molding machines, but also their connection to robot systems, for example. It is therefore crucial that machine industries work together across the board. The industry-specific vocabulary must fit and be coordinated with each other.

VDMA is a key player

Experts agree that the VDMA is the only organization that is currently in a position to create these important standards. 3200 VDMA member companies with subsidiaries and partner companies around the globe not only bring knowledge to the process to an extent that is available nowhere else. At the same time, the development process takes place on the neutral VDMA platform – so there can be no suspicion at all that individual companies can assert their particular interests. The VDMA is thus laying the foundations for Plug & Produce, the basis for simpler and faster development of data-based business models for intelligently networked production.

The VDMA trade associations are therefore at work with a correspondingly high level of commitment. OPC UA Companion Specifications have already been published for some machine types, including machine tools, injection molding machines, machine vision systems, and robots. More than 20 other standards are in the works, such as for foundry machines, woodworking machines or electric drives. About 15 new OPC UA working groups per year are planned. “The critical mass of companies behind OPC UA has now been exceeded, and OPCUA serves as the basis for the factory of the future,” says Andreas Faath.

This was demonstrated at the first World Interoperability Conference at which, for the first time, more than 35 OPC UA working groups together presented to over 400 international participants. The conference was organized at the Hannover Messe 2019 by the VDMA with partners such as the OPC Foundation and Deutsche Messe AG.

Online training support

Together with the Munich-based start-up “University4industry”, the VDMA has developed an online training program for the implementation of OPC UA. Experts from industry and science, including Kuka, Bosch Rexroth, Pepperl Fuchs, Lenze, Vitronic and Fraunhofer IOSB, demonstrated the benefits of OPC UA in online workshops and video interviews and provided practical advice. Customizable playlists and personalized learning questions round off the online training concept. VDMA members can access the learning content free of charge at www.u4i.io/vdma.

Tower of Babel

In biblical literature, a structure built in Babylon soon after the great flood. The story of its construction, given in Genesis - 11:1–9, is an attempt to explain the existence of diverse human languages. According to Genesis, the Babylonians wanted to build a mighty city and a tower “with its top in the heavens.” God disrupted the work by so confusing the language of the workers that they could no longer understand one another. The city was never completed, and the people were dispersed over the face of the earth.

Source: Shutterstock / jorisvo

| assert, to | faire valoir |
| decisive | déterminant, crucial |
| disperse, to | répartir |
| hallmark | ce qui caractérise |
| networked | relié, mis en réseau |
| plant engineering | ingénierie industrielle |
| plug and work | se connecter et travailler |
| practice-oriented | axé sur la pratique |

Source: VDMA
Machine shop goes additive

By laying the groundwork early, Able Tool is preparing for the day when machine shops will regularly be called to produce metal parts via additive manufacturing.

If you had visited Able Tool before 2003, you would never have guessed that the Cincinnati-area machine shop was actively investing in the latest manufacturing technology. Back then, a quick glance around the shop would show mostly tool room-style equipment. However, that began to change when Paul Hayes took over as company president. For the business to thrive, he knew the operation would have to take a quantum leap by adopting much more advanced technology. Today, Able Tool’s shop floor consists of four- and five-axis machining centers and large horizontals and wire EDM. On-machine spindle and tool probes have reduced setup time on that equipment and enables in-process inspection for more effective process control.

The company’s commitment to adopting new technology did not end there. About six years ago, Mr. Hayes decided to take additive manufacturing from a concept he had researched to a process he could possibly apply on his shop floor, ultimately moving quickly from 3D printing plastic parts to printing metal parts. “To be certain, there is a case to be made for printing each type of material, depending on the application,” he says. In both cases, though, Mr. Hayes believes additive technology has helped his company better serve its customers by reducing the number of steps it takes to move from design to produced part. “Really, it’s just another arrow in our quiver, so to speak, to make things as efficient and cost effective as possible,” he states.

Not to sugar-coat it, investing in additive manufacturing was a risky move for Able Tool. While there is a clear ROI for more advanced machine tools and related equipment, additive technology’s ROI is murkier, especially for a shop not immediately using it for production. Yet, Mr. Hayes was determined to make sure Able Tool was not in a position of playing catch-up again. In order to get ahead of the additive learning curve, he decided to take a leap of faith.
Graduating to plastics

Able Tool is a milling, machining, fabrication and assembly shop that specializes in high-mix/low-volume production for a range of industries, applications and materials. Its facility boasts large horizontal mills, vertical machining centers and vertical turning lathes. Increasingly, the shop has been involved in full machine assembly, integration and testing rather than just individual part production.

Although additive capabilities are relatively new to Able, Mr. Hayes began looking into the technology about 15 years ago. He even hired a consulting firm to see if metal 3D printing technology was something his company should invest in, and two separate groups told him no. “They were probably right given the manufacturing environment at the time, what our company does, and the value associated with additive technology,” Mr. Hayes says. “None of those things aligned.”

Not to be deterred, Mr. Hayes continued to study the technology, convinced of its potential. Six years ago, he decided to purchase a MakerBot 3D plastic printer because it was a relatively small investment, the machine could sit on someone’s desk and no ancillary equipment was necessary. With the only consumable being the plastic material, Mr. Hayes says the MakerBot was a low-risk option for hands-on learning. If a part didn’t turn out as planned, or if it had to be scrapped, he didn’t have to worry about throwing away a high-priced metal experiment.

Four years later, Able invested in a Prusa 3D printer to produce closer-to-end-use parts. Two main features drew the company to the Prusa, says General Manager Mike Trovillo. First, it can print with more than one variety of plastic. Second, its heated build platform keeps the plastic warm to prevent warping. The company has used this machine to make a couple end-use parts for its customers, such as end-of-arm tooling for a robot and part nests for a CMM. Mostly though, Mr. Hayes says he uses it as a low-cost option for proving out concepts that would take time away from other jobs on his CNC machining centers or be cost prohibitive to make in metal. In some cases, the application simply merits a plastic solution.

Printing with metal

After gaining experience with printing plastic and seeing the technology that was emerging, Mr. Hayes decided the time was right to take the next step and begin 3D printing metal parts. “We had to rip the Band-Aid off and at least try to understand how we could use metal additive technology and sell it to our customers,” he says.

Though Able Tool had been building up to this moment for years, actually buying its Metal X 3D printer from MarkForged was a sudden move. At the end of last year, Mr. Hayes jumped on the opportunity to buy the new machine from Reynolds Machinery in Dayton, a new MarkForged distributor.

Despite the swift timing, Mr. Hayes was confident that this was the right decision for his company. Rather than choosing a laser-sintering or powder-bed machine, which would require a special lab environment, the Metal X has a lower barrier to entry and can make complex parts in its 300-by 220-by 180-mm build volume, he says. Also, learning from his experience printing with plastic, he knew he wanted the freedom to print with a variety of metals. Currently, the Metal X can print 17-4 PH stainless steel, H13 and A2 tool steel, but MarkForged plans to soon add the capability to print D2 tool steel, titanium, Inconel, copper and 316 stainless steel (which Able is particularly interested in) in the near future.

The Metal X is a fused-filament fabrication (FFF) printer that uses spools of metal powder and binding agent enclosed within a plastic enclosure. The second spool is ceramic powder enclosed within a plastic encasement. It works by feeding those spools through a heater block, where it is heated to the encasement’s melting point and fed through an extrusion nozzle. The nozzle first lays down layers of material mixed with ceramic where necessary, which will later act as the part’s release. (The ceramic can also be used to build support structures that once again will be removed at a later point.) The nozzle then lays the metal on top of that, building the part layer by layer. The machine uses disposable print sheets that are held down by a vacuum table to improve bed adhesion and ease part handling. Once a part is printed, the paper is easily removed from the vacuum table. Able Tool’s typical batch sizes range from one to four parts. However, Mr. Trovillo

Concept of 3D printing for fast prototypes. Source: Shutterstock / Nico El Nino
says that if a part is small enough, he estimates that he could fit as many as 30 parts on the build plate. “It really depends on the size of the part,” he says. “You can print whatever fits in the build volume.” The shop’s smaller parts print in about two to three hours, while the larger parts can take several days, depending on part mass and complexity.

Printed parts are weighed on a digital scale before being submerged into the MarkForged Wash-1 heated washing system, where Opeteon SF-79 cleaning fluid circulates around the parts to break down most of the plastic and wax binding agent. After washing, the air-dried part is weighed again to determine if a high enough percentage of the binding agent has been removed. If not, it goes back into the wash to remove more binder. If it has, the part is considered ready to be sintered.

Parts are placed on a ceramic tray and placed into the MarkForged Sinter-1, which has a 4,760-cubic-centimeter working volume. Although this is smaller than the maximum build volume of the Metal X, the company could send parts to an outside vendor for sintering. The purpose of sintering, which takes about 25 hours, is to fuse the metal powder into a solid metal. It also makes any of the printed ceramic very brittle. Once sintered, the part can snap off of the ceramic support structure and then be finish-machined if necessary.

For Mr. Hayes, one of the advantages of using the Metal X was that it is basically a pre-packaged system – MarkForged supplied the printer, washing system and sintering oven, and directs shops in the specifics of how to set them up, paying close attention to ventilation, equipment spacing and sintering gas mixture requirements. MarkForged also offers its Eiger 3D-printing software, which Mr. Hayes says is very easy to learn. Once a part is designed in CAD software, its STL file can be uploaded to the Eiger software, which uses algorithms to automatically compensate for the shrinkage a part experiences during the sintering process. The Eiger software enables him to manipulate the part and see the dimensions, print time, wash time, sinter time and more.

Brave new world

Within a week of Able purchasing the Metal X, the printer began to open doors for new business. A medical customer happened to notice it during a tour of the shop and began asking questions about its capabilities. Not only did that client award the machining work it came to investigate in the first place, but it also gave Able a job printing a metal prototype for a part – marking the first time the company had done any work for that customer.

Other customer prototypes are usually the result of Mr. Hayes printing parts for his customers as a surprise to show them what this alternate part-production technique is capable of. But for now, Able mainly uses the Metal X printer for custom fixturing to be used around the shop. According to Mr. Hayes, use of the metal 3D printer intentionally has been a slow, organic growth path. In fact, the shop does not even promote its additive capabilities on its website yet. “I want to be able to go to a customer with certainty and say that we can produce the part you want before we officially promote the capability,” he says.

Moving forward, Mr. Hayes hopes to use metal 3D printing capabilities not to go after new business per se, but to solidify the relationship he has with his current customers by helping them see design improvements and ways to produce parts more efficiently. He believes additive technology refinement will continue to the point in which it is just part of a machine shop’s everyday operation. Mr. Hayes predicts that most machine shops will have a 3D printer at some point, much like they have a three-axis VMC. “I believe the integration of additive technologies into a job shop environment is a matter of ‘when,’ and not ‘if.’ We need to understand how to use these tools to meet our customers’ needs. That’s why we bought the machine.”

Five tips for beginners

On the cusp of going public with his shop’s metal 3D printing capabilities, Mr. Hayes offers this advice for other shops considering the technology:

Start with plastic. It’s a simple matter of economics. Plastic is cheaper than metal. Even if your end goal is to 3D print metal production parts, it’s easier to learn (and make mistakes) in a medium that is not so costly.

Research surprise costs. Aside from the upfront costs associated with purchasing a 3D printer, there are other ancillary costs to consider. For one, argon gas is expensive, and if you do not have a working
relationship with your supplier, you might have to wait longer than expected for a refill while your sinter sits idle, Mr. Hayes says. You must also realize that even if you don’t use the gas, compression will make the gas bleed out. “Once you’ve purchased your 3D printer, you’re in a ‘use it, or lose it’ situation in terms of the gas,” Mr. Trovillo notes.

Find the right spot. Do not let the small footprint of a 3D printer fool you. Just as much forethought should go into the machine’s placement as you would give a VMC or HMC. Consider electrical and ventilation requirements. Consider possible workflow of parts from your printer to secondary operations on your shop floor. Able converted a small CMM room into the company’s metal 3D printing area. “Unfortunately, we did not consider the fact that you need 12 inches of space surrounding the sinter,” Mr. Trovillo says. That meant the wash station wouldn’t fit into that room. “The outcome of this is that we have to exit the 3D printing room to access the wash station, which had to be positioned just outside. Once washed, the parts must be walked back into the room for sintering.” While this is not a make-or-break issue, a little forethought would have saved a minor workflow annoyance.

Learn how to price parts correctly. It’s not as easy as you think. Mr. Hayes says that while the Eiger software lets him know how much material he is using and a part’s run time, there’s more to quoting than that. “You still need to figure out the charge rate for the machine and how much gas and cleaning fluid you are using. Shops need to figure out what their actual operating costs are.”

Think like an engineer. “Integrating 3D printing into your facility is more a case of engineering learning’ than ‘manufacturing learning,”’ Mr. Hayes notes. It’s important to understand what the end result is to be and how to design the part to net that out. You may need to consider revising your design to fit the capabilities and limitations of your machine.

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Feature

Able Tool keeps its 3D printing system inside a vented room (like this) on its shop floor. After printing a part it is weighed, washed and then air-dried before going into the sintering machine. Source: Shutterstock / Moreno Soppeisa
Network analyzer steps up to the task

Network analyzers have to meet many demands. In the aerospace and defense sector, the emphasis is on stable data and reproducible measurements. Research institutes and universities demand top performance and versatility from a measuring instrument. The R&S®ZNA high-end vector network analyzer meets the needs of both user groups, as well as all other demanding users.

Today’s component characterization can be a challenging task due to the complexity of the DUTs. The new R&S®ZNA vector network analyzer masters this task like no other.

Network analyzers have to meet many demands. In the aerospace and defense sector, the emphasis is on stable data and reproducible measurements. Research institutes and universities demand top performance and versatility from a measuring instrument. The R&S®ZNA high-end vector network analyzer meets the needs of both user groups, as well as all other demanding users.

To fulfill the growing requirements on high-frequency components in practical applications, test and measurement equipment must be able to characterize components quickly and precisely. This requires excellent RF properties and versatile measurement functions. However, extensive instrument settings are usually necessary to use these functions, and it takes a lot of experience and familiarity to set them up properly.
Automatic test configuration and operating aids that support users can significantly boost productivity, especially when working with network analyzers. Development of the R&S®ZNA vector network analyzer was driven by these two main objectives: excellent data and efficient operation.

The R&S®ZNA offers the flexibility necessary to master current and future test requirements for characterizing active and passive components. Its modular, high-performance hardware architecture with four signal sources and eight measurement receivers supports complex tasks such as intermodulation measurements on mixers or beamforming and MIMO tests on 5G antenna arrays. The extremely low noise floor of less than 0.001 dB at 1 kHz IF bandwidth and an outstanding dynamic range of up to 170 dB provide the basis for stable and reproducible measurements.

A market innovation is the DUT-centric operating concept with configuration wizards that significantly accelerates and simplifies instrument setup. The R&S®ZNA is the first vector network analyzer to feature touch-only operation. This enables application-based configuration of the user interface to simplify and accelerate test setups as much as possible. The R&S®ZNA is initially available with frequency ranges up to 26.5 GHz or 43.5 GHz and with two or four test ports each. The 43.5 GHz version is available with a choice of 2.92 mm or 2.4 mm connectors. The 2.4 mm version is specified over the entire frequency range. The 2.92 mm version is specified up to 40 GHz with typical values provided for the range from 40 GHz to 43.5 GHz.

**Mixer and amplifier characterization**

Configuring measurement traces and various test parameters to determine the mixing loss in terms of amplitude and phase as well as for matching and isolation measurements is usually a time-consuming task. The DUT-centric operating concept of the R&S®ZNA make this task unnecessary. After selecting the DUT type and defining some basic parameters such as the frequency range and power level, the user directly selects the test parameters and quantities, and the instrument configures the test setup. This means measurements can be configured quickly without specific knowledge of the optimal analyzer settings, which saves time and ensures high reproducibility. The phase-coherent signal sources allow phase delay and group delay measurements without a reference mixer. The second internal local oscillator (LO) enables simultaneous measurement of RF and IF signals, resulting in higher measurement accuracy and doubling the measurement speed compared to previous test approaches.

Intermodulation measurements on active DUTs can be performed as a frequency sweep with fixed or variable carrier spacing, or as a level sweep. Digital automatic level control (ALC) delivers the precise amplitude of both carriers over the entire frequency range, regardless of the DUT’s input reflection coefficient. The electronic power sweep range up to 100 dB significantly simplifies compression point measurements on amplifiers and eliminates the influence of switching operations that occur with mechanical attenuators. The FFT-based spectrum analysis enables deeper analysis of the behavior of a DUT when S-parameter measurements are not sufficient. Interference signals in converters and TX/RX modules are detected quickly, while the measurement setup does not affect the measurement result thanks to the scalar system error correction.

The four internal pulse modulators, which can be driven either by internal or external pulse generators, enable point-in-pulse measurements with up to 30 MHz measurement bandwidth. They deliver pulse profile measurements up to 50 times faster than conventional measurements, with a resolution as fine as 8 ns. This capability is often required in the A&D and wireless sectors where many amplifiers can only be tested in pulse mode.

The multichannel architecture of the R&S®ZNA enables simultaneous amplitude and phase measurements on up to eight signals, making it ideal for testing antenna arrays. Source: Rohde & Schwarz
Fast, reliable measurements

Frequency converters without LO access, such as are used in the satellite industry, are difficult to measure due to their frequency drift. To solve this problem, Rohde & Schwarz has developed a patented test solution for determining phase delay and group delay. It uses a two-tone method to simultaneously measure both signal tones, making it immune to the effects of frequency converter drift. Since both tones are affected by this drift, they cancel each other out in the measurement result. The R&S®ZNA also features an LO tracking function to compensate for drift effects that exceed the measurement bandwidth. For such an application, the second internal LO doubles the measurement speed.

Highest dynamic range

The high-rejection filters used in A&D applications and base stations impose stringent requirements on the dynamic measurement range of network analyzers. Not only is a wide dynamic range essential for measuring very low signal levels, it also enables the use of a larger IF bandwidth for the desired dynamic range and leads to faster and simpler filter tuning.

In reverse coupler mode, the R&S®ZNA has a typical dynamic range of up to 170 dB. A segmented sweep with different measurement settings for the passband and cutoff band prevents saturation of the measurement receiver in the filter passband.

Fast antenna characterization

The high sensitivity and wide dynamic range of the R&S®ZNA are also required for fast antenna measurements (near-field and far-field measurements in CATRs, radar cross-section). The direct IF inputs on the rear of the instrument for frequencies up to 1 GHz cover a wide spectrum of IF frequencies used by external mixers in antenna systems. The parallel measurement receivers enable amplitude and phase recording of up to eight signals, which means the horizontal and vertical polarization of measurement and reference antennas can be determined simultaneously.

Into the Terahertz range

In addition to basic research, imaging, antenna measurements and material measurements, commercial applications such as automotive radar (77/79 GHz) and mobile communications (5G NR) in the millimeter-wave and terahertz range are becoming more common. The R&S®ZNA can be extended up to these frequencies with frequency converters. Rohde & Schwarz frequency converters feature high output levels and a wide dynamic range – both important for on-wafer measurements and antenna characterization. By using the direct IF inputs, effectively bypassing the input mixers, the dynamic range can be improved by an additional 7 dB. Up to four converters can be connected to the R&S®ZNA to characterize frequency-converting multiport and differential DUTs. Even with a two-port device, two converters can be used without an external signal generator for the LO signal.

Calibration for every task

A broad spectrum of calibration methods, including traditional TOSM, TRM, TSM, TOM, TRL/LRL, UOSM...
High output power and flexibility

Featuring four independent signal sources, the R&S®ZNA can even perform intermodulation measurements on mixers without requiring an external signal generator. The analyzer delivers high output power of up to +20 dBm per test port. If this is not sufficient, the R&S®ZNA can flexibly loop external amplifiers into the signal path and precisely control them via ALC.

Simplifying intermodulation measurements

The DUT-centric approach of the R&S®ZNA supports intuitive navigation during intermodulation measurements. To configure a measurement, the user first selects the DUT type and is then guided through a dialogue to define the test setup, the DUT connections, the measurement quantity or type (for example, IMx versus frequency, where x is 3, 5, 7, etc.), the power level at the DUT input and output, or a spectrum measurement. In the case of manual four-port calibration, for example, the DUT-centric approach reduces the number of required steps (i.e. connection of calibration standards and power sensors) from 26 to 16.

Conclusion

R&S®ZNA users can easily keep pace with the rising requirements of RF technology. With its high-performance and function-rich hardware, it can handle even the most challenging measurement tasks. The analyzer has four internal phase-coherent signal sources that enable independent control of the signal frequency at each port as well as phase measurements on mixers. It has two internal local oscillators, a true multichannel receiver architecture, pulse modulators and extensive trigger and synchronization options. These hardware features make the R&S®ZNA a universal, compact test system for characterizing passive and active DUTs. Intermodulation measurements on mixers and receivers can be performed without external signal generators, minimizing test times and simplifying test configuration. Finally, the DUT-centric approach boosts productivity with a configuration wizard and leads to valid measurement results without detours. The touch-only operation with two independent screens is unique.

Example

Intermodulation measurements on amplifiers and mixers with the R&S®ZNA. The R&S®ZNA determines the intermodulation properties of amplifiers and mixers quickly and with high accuracy. It offers three types of measurements:

- frequency sweep with fixed carrier spacing
- frequency sweep with variable carrier spacing
- level sweep with fixed carrier spacing.

Wide dynamic range and digital ALC for challenging intermodulation measurements. The R&S®ZNA offers major benefits especially when measuring amplifiers with very small intermodulation products. Its wide dynamic range and the excellent power handling capacity of its receivers make it possible to measure low intermodulation distortion within seconds instead of minutes.

When measuring intermodulation, precise control of the power applied to the DUT inputs is vital. The R&S®ZNA makes no compromises here. Automatic level control (ALC) combined with system error correction ensures a precise amplitude for the individual carriers over the entire frequency range, regardless of the DUT’s input reflection coefficient.

A&D analogique/numérique
array réseau
attenuator atténuateur
bandwidth bande passante
boost, to améliorer, augmenter
carrier porteuse
configuration wizards assistants de configuration
coupler couplure
DUT (device under test) dispositif sous essai
FFT (Fast Fourier Transformation) Transformée de Fourier Rapide
IF fréquence intermédiaire
kit dispositif
level multiples niveau MIMO (multiple intake) entrées et sorties
noise floor seuil de bruit, bruit de fond
passband bande passante
phase coherent cohérence de phase
property propriété, caractéristique
reverse inverse
RF fréquence radio
scalar scalaire
signal source source du signal
stringent strict, sévère
test setup montage d’essai
versatility polyvalence, souplesse, adaptabilité
wafer plaquette, disque
Intuitive, easy-to-use mini crane

The Jekko mini crane SPX532 includes concepts totally new to the world of cranes – such as simplicity, immediacy and efficiency in the same machine. Developed by the Italian company Jekko s.r.l. from Colle Umberto, an international leader in the mini crane sector, the SPX532 incorporates innovations such as a stabilizing system, electronics as well as hydraulic systems, greater ease of use, increased lifting capacity and a new and user friendly radio remote control.

Regarding the design and creation of new products, which will inevitably impact the development of future products: machines that are not only innovative and sophisticated but also easy to use and available to an increasingly wide customer base."

The intuitive mini crane SPX532 is the largest mini crane in its segment able to pass through a single door, it offers substantial lifting capacity in relation to its weight, dimensions and stabilization area. Important new features include the 1 tonne hydraulic jib, whose maximum height of 17.3 meters is close to that of higher category cranes, and an updated design with more sophisticated and resistant materials, like a column reinforced with two pistons and a sump no longer in fiberglass but in steel.

The SPX532 has a maximum lifting capacity of 3.2 tonnes and the possibility to lift either using the hook block or the hoist method.

The stability system has been updated so that slewing goes from 0° to 90° for each outrigger (previously 0° to 45°); it is also possible to adjust the outrigger tilting angle. This allows for more stabilization areas and more work areas, enabling the crane to work in previously impossible conditions, all thanks to its simple sensor system.

The SPX532 mini crane is narrow enough to allow it to pass through a single door. Source: Jekko s.r.l.
New jib position

The position of the resting jib is initially found inside the column. The jib is easily installed thanks to an innovative hooking system. This means a reduction in jib installation and disassembly times. The operator can therefore decide to store the jib in any one of three ways: a) rest on the column, b) on the ground or c) rest under the main arm. The first two ways allow the operator to work with the main arm, the last with the jib installed, with the great advantage of not having to put it to rest until the work is finished (as was necessary with the previous versions). Thanks to a double pump, the jib also allows for simultaneous use of both the extension and angle functions, for greater flexibility and precision.

New hydraulic system

The SPX532 is equipped with a hydraulic system that allows the crane to work with smooth and extremely precise movements. This is possible thanks to the use of a digital hydraulic pump that, together with the control electronics and an intuitive radio remote control, allows for active dynamic control of the crane's movements, so the user can select the ideal work method based on site requirements.

User-friendly radio remote control

All mini crane functions can be activated or deactivated directly via the radio remote control, using selectors that link to intuitive screens. Four different configurations can be selected on the radio remote control to facilitate the operator's work and guide the various operations: pick & carry, crane, outrigger ascent and descent, belts and crossbeam slewing.

Battery or diesel/electric

The SPX532 comes either with a lithium battery or a diesel engine combined with a single phase (220 V-2.2 kW) or three phase electric motor (400 V-5.5 kW). Depending on the workplace and requirements, the operator can easily switch from one solution to the other with significant flexibility of use.

Telemetry

Thanks to the J-Connect system and the use of a data SIM, the SPX532 can be connected to the internet. Via a specifically created portal, the crane can be monitored remotely by the customer, vendor and Jekko technical support staff.

Competitive advantage

It is the highest performing single door crane (of width less than 80 cm) on the market and it can be used for work in both confined spaces, particularly in the glass market, and open areas in the industrial maintenance and building sectors.

“It will be the best performing single door machine on the market” explains Jekko’s CEO Diego Tomasella. “The SPX532 is the first mini crane created as part of the project to update the entire range and this result was only possible thanks to the use of sophisticated materials and easily controlled electronics. Our markets of reference are primarily Germany, Holland and Belgium, followed by France, Spain, UK, Italy, Asia, the Middle East and America.”

Caption: The SPX532 has a maximum lifting capacity of 3.2 tonnes. Source: Jekko s.r.l.
Muscular micromotors

Freely moving arms are a well-established solution when it comes to handling tools within a three-dimensional space, and not just for robots. But most of the solutions available thus far have struggled to overcome the negative interaction between the necessary drive on the rotating axis and the required arm stability. By eliminating the mass from moving parts, the forces of inertia in the arm are reduced. The arm jib is lighter in weight and can work more dynamically, while providing the same level of stability.

We have all seen industrial robot arms: solid constructions for heavy tools – and they are pretty hefty themselves. In fact, these designs are simply too heavy for many applications. Engineers at igus in Cologne wanted to develop a multiple-axis joint that would allow small loads to be swiveled or turned around a jib. They needed high levels of flexibility and low weight, with simple upgrade options for additional axes. These requirements have now been elegantly translated into a new concept with a multiple-axis joint made from plastic and cable controls. The cables themselves are moved from the arm’s “shoulder joint” using compact, high-performance, brushless DC-Servomotors. This prevents inertia in the arm, allows dynamic movements and means the drive block can be compact in design.

Bionic approach

To avoid having to reinvent the wheel, the team of engineers looked at further refining the trusted human elbow joint. This allowed two degrees of freedom – rotation and swivel – to be incorporated in a single joint, thereby guaranteeing high levels of precision for the moving parts. The tribo-plastic joint is also maintenance-free and does not corrode or conduct electricity. The “bones” of the arm to which the joints are attached are also pared down to a lightweight construction. Aluminum, carbon fiber and fiberglass-reinforced plastic provide excellent rigidity and good vibration insulation. As in the human arm, the weakest components of this kind of robot arm are not the bones (i.e. the body tube) or the muscles (i.e. the drive motor) but rather the “tendons” which transfer the power. The high-tension “tendons” or control cables are therefore made of a highly wear resistant and tensile load resistant fiber made from highly crystalline, UHMW-PE (ultra-high molecular weight polyethylene). With tensile strength of 3000 to 4000 N/mm², it only breaks under its intrinsic weight at a length of 400 km. This design allows a load / intrinsic weight ratio of 1:1 to be achieved, or even less if the structure is optimized. As well as the traditional robot...
arm functions, the joint can be used for new functions such as special fittings for cameras, sensors or tools where lightweight construction is key. In the future, it may even be used on prosthetics. It is the separation of the tool, the moving parts, the control module and the actual drive that make it ideal for mobile use. As the components that have been “eliminated” from the moving parts represent a sort of counterweight to the mass of the arm, the overall structure is very light. A magnetic angle position sensor is built into every joint to improve precision. Combined with the highly dynamic drives, this produces a precision-controlled robot module.

**Dynamic, powerful, compact**

Compact drive solutions are required in order to operate the largest possible number of cable controls within a confined space. Where high levels of dynamism, real power yield and precise, controllable use are required, electronically commuted servomotors like those from Faulhaber are the best option. The small compact drives have a low moving mass and an outstanding performance to volume ratio, making them ideal for dynamic use. The excellent heat deflection allows considerable overload when operated for short periods rather than permanently, which is an additional advantage, especially when it comes to fast swivel movements. The operating voltage of 24 V DC is perfectly tailored to battery power, which is crucial for mobile applications. With a 32 mm diameter, a high permanent output with 80 % efficiency can be achieved in 4-quadrant mode. The 97 mNm torque of the four-pole motors increases the diameter-compliant planetary gearheads to the values required to operate the arm. Depending on the area of application for the swivel movement, the planetary gearheads allow transformation ratios of 1:4 to 1600 or 6 to 20 Nm continuous torque at up to 96 % efficiency. The stainless-steel casing is as weatherproof as the plastic joints and cable controls.

The fact that brushless drives have no wearing components apart from the rotor bearing guarantees a long service life over many tens of thousands of hours. The precision gearheads also boast a long no-maintenance service life. The motor can be operated in a temperature range from -40 to +100 °C, the gearheads from -25 to +90 °C. This means they can both cope with environmental conditions from the Arctic to the tropics and thus a wide range of industrial operating conditions.

Modern servomotors are the tool of choice for various applications where movement is required in the construction process. High precision levels and a long service life combined with easy integration into the control system mean they can be used both for mobile applications and in compact engineering.

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**About FAULHABER**

Faulhaber is a family-run group of companies with its headquarters in Schönaich near Stuttgart in the German state of Baden-Württemberg, one of the economically strongest regions for industrial high technology in Europe. Founded in 1947, Faulhaber today designs drive solutions that work in the smallest of spaces. Applications include production automation and robotics, aerospace, optical systems as well as medicine and laboratory technology. In addition to Germany, Faulhaber maintains development and production locations in Switzerland, USA, Romania and Hungary has subsidiaries in more than 30 countries and over 1,900 employees.

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Source: Faulhaber Group
AI: There is no way around it...

...neither in everyday life nor in the workplace. But how profound will the change we are all facing be? This is just as open as the question: “How far can we trust AI?”

Can artificial intelligence replace people? Even theologians agree to disagree...
Source: Shutterstock / Metamorworks

Opinions on this diverge but there is at least general agreement that a dictatorship of the machines is not imminent. The reason why: “Artificial intelligence cannot replace people”, has been stressed by the theologian and former EKD Council Chair Professor Wolfgang Huber.

However, it remains controversial to what extent artificial intelligence, which is still in its infancy in many areas of application, should be regulated. From the point of view of ethicist and university professor Thomas Metzinger, there is certainly a danger that Europe will allow itself to be put under too much pressure by the USA and China in this respect and will forego stricter regulation. Metzinger claims that “trustworthy Artificial Intelligence made in Europe” which also includes social responsibility, is a ‘good idea’. However, he has concerns that ethics “could be misused as a decorative measure for investment strategies.”

So is there a threat of “ethics washing” that might work in a similar way to the “green washing” of some products? “Everyone takes the ethical issues in AI seriously, but it’s a very broad field. You have to consider very carefully what exactly should be regulated with ethical guidelines,” warns Dr. Stefan Wess, member of the supervisory board of the German Research Center for Artificial Intelligence (DFKI).

Others however believe that artificial intelligence will have a much more far-reaching effect than the steam engine because it changes all fields of life and not just a single sector. It will be even more comprehensive than the revolution triggered by letterpress printing at the time.

AI and mechanical engineering

Artificial intelligence will lead to considerable progress in mechanical engineering and manufacturing — without necessarily minimizing the role of humans. Engineering companies place particular emphasis on the technology behind “machine learning” and face up to their responsibility.

Man and machine

With the help of artificial intelligence, people will be able to work even more closely with machines in the future. Machine learning ensures that machines are increasingly able to recognize and respond to the needs of people or the process. For example, people with disabilities can be supported at the workplace and reintegrated into the working world.

In the future AI-based solutions could be employed to carry out simple tasks, which are often repetitive, such as checking invoices or monotonous quality
checks. Although more and more engineers and computer scientists will be needed over time to develop these systems and bring them to product maturity, as a society we need to consider how to re-train unskilled workers who lose out. Companies are already looking for specialists and engineers who can master the respective processes, because AI can only function in symbiosis with existing process knowledge.

The use of AI-based solutions does not replace people in mechanical engineering, but requires them as trainers or managers. Further training in this field therefore plays a decisive role. AI competence is not only required by IT specialists and programmers, but also by employees of all functions, levels and departments.

**Machine learning: the theory**

The first step on the way to machine learning is to train the machine with a large amount of learning data in order to later gain a suitable algorithm for production operation. This learning data must be very well prepared and exactly correspond with the process that is to be supported later. The selection and preparation of the data therefore make up the greatest effort in such a project.

The algorithm is then integrated into the productive system. From this point on it fulfils its learned task, but without gaining new experience or improving itself independently. The data input now leads to a data output that exactly corresponds with the learned behavior.

Various software tools that are already established on the market help set up such systems. New frameworks and platforms support the broad application of these previously rather "academic" topics in everyday project work. Machine learning will thus ensure that software and information technology continue to be the drivers of innovation in mechanical engineering.

**Machine learning in practice**

Machine learning can be used to optimize both product characteristics and internal processes. The possible uses of machine learning also differ with regard to its use in products: This can either take place in the product itself, or in the process environment of the machine, for example in the form of maintenance or additional value-added services.

One field of application of machine learning is machine operation. Expert Systems simplify this. A successful example of this is an operator assistance system from HOMAG Plattenaufteiltechnik, which reacts intelligently to the actions of the machine operator.

The significance of machine learning for mechanical engineering is demonstrated by a current survey undertaken by the VDMA. Solutions based on machine learning are of medium to high relevance, especially in the areas of customer service (64 %), design and development (54 %) and production (50 %). Around 46 percent of the participants reported that they already have a functioning solution in use in their organization. Machine learning is mainly used in design and development (14 %), customer service (13 %), production (13 %), accounting and controlling (10 %), condition monitoring (13 %) and remote service (13 %). In addition, those companies which participated in the survey plan to significantly increase their use of the processes and products over the next three years. By 2022, for example, more than half of companies want to use machine learning based solutions in customer service.
Canada: huge country, huge opportunities

Canada’s economy is the tenth largest by GDP in the world. As with other developed nations, the country’s economy is dominated by the service industry which employs about three quarters of Canadians. Canada has the fourth highest total estimated value of natural resources, valued at US$ 33.2 trillion in 2016. It has the world’s third largest proven petroleum reserves and is the fourth largest exporter of petroleum, which not a lot of people know! It is also the fourth largest exporter of natural gas. Canada is considered an “energy superpower” due to its abundant natural resources and a small population of 37 million inhabitants relative to its land area.

According to the Corruption Perceptions Index, Canada is one of the least corrupt countries in the world, and is one of the world’s top ten trading nations, with a highly globalized economy. Canada historically ranks above the US and most western European nations on The Heritage Foundation’s index of economic freedom, and experiences a relatively low level of income disparity. The country’s average household disposable income per capita is “well above” the OECD average.

Canada is unusual among developed countries in the importance of the primary sector, with the logging and oil industries being two of Canada’s most important. Canada also has a sizable manufacturing sector, based in Central Canada, with the automobile industry and aircraft industry being especially important. With the world’s longest coastline, Canada has the eighth largest commercial fishing and seafood industry in the world. Canada is one of the global leaders of the entertainment software
industry. It is a member of the APEC, NAFTA, G7, G20, OECD and WTO.

With the exception of a few island nations in the Caribbean, Canada is the only major Parliamentary system in the Western Hemisphere. As a result, Canada has developed its own social and political institutions, distinct from most other countries in the world. Though the Canadian economy is closely integrated with the American economy, it has developed unique economic institutions.

Canada has a private to public (Crown) property ratio of 60:40 and one of the highest levels of economic freedom in the world. Today Canada closely resembles the US in its market-oriented economic system and pattern of production. As of 2019, Canada has 56 companies in the Forbes Global 2000 list, ranking ninth behind South Korea and ahead of Saudi Arabia.

International trade makes up a large part of the Canadian economy, particularly of its natural resources. In 2016, agriculture, energy, forestry and mining exports accounted for about 58 % of Canada’s total exports. Machinery, equipment, automotive products and other manufactures accounted for a further 38 % of exports in 2016. In 2017, exports accounted for about 30 % of Canada’s GDP. The United States is by far its largest trading partner, accounting for about 73 % of exports and 63 % of imports as of 2009.

Many, if not most, towns in Canada, where agriculture is difficult, exist because of a nearby mine or source of timber. Canada is a world leader in the production of many natural resources such as gold, nickel, uranium, diamonds, lead, and in recent years, crude petroleum, which, with the world’s second-largest oil reserves, is taking an increasingly prominent position in natural resources extraction. Several of Canada’s largest companies are based in natural resource industries, such as Encana, Cameco, Goldcorp, and Barrick Gold. The vast majority of these products are exported, mainly to the United States. There are also many secondary and service industries that are directly linked to primary ones. For instance one of Canada’s largest manufacturing industries is the pulp and paper sector, which is directly linked to the logging business.

The reliance on natural resources has several effects on Canadian engineering and Canadian society as a whole. While manufacturing and service industries are easy to standardize, natural resources vary greatly by region. This ensures that differing engineering opportunities develop in each region of Canada, contributing to Canada’s strong regionalism. At the same time the vast majority of the country’s resources are exported, integrating Canada closely into the international economy.

Natural resource industries also raise important questions of sustainability. Despite many decades as a leading producer, there is little risk of depletion. Large discoveries continue to be made, such as the massive nickel find at Voisey’s Bay. Moreover, the far north remains largely undeveloped as producers await higher prices or new technologies as many operations in this region are not yet cost effective. In recent decades Canadians have become less willing to accept the environmental destruction associated with exploiting natural resources. High wages and Aboriginal land claims have also curbed expansion.

The depletion of renewable resources has raised concerns in recent years. After decades of escalating overutilization the cod fishery all but collapsed in the 1990s, and the Pacific salmon industry also suffered greatly. The logging industry, after many years of activism, has in recent years moved to a more sustainable model, or to other countries.

The general pattern of development for wealthy western nations was a transition from a raw material production based economy to a manufacturing based one, and then to a service based economy. At its World War II peak in 1944, Canada’s manufacturing sector accounted for 29 % of GDP, declining to 10.37 % in 2017. Canada has not suffered as greatly as most other rich, industrialized nations from the pains of the relative decline in the importance of manufacturing since the 1960s. A 2016 study by Statistics Canada also found that, while manufacturing declined as a relative percentage of GDP from 24.3 % in the 1960s to 15.6 % in 2005, manufacturing volumes between 1961 and 2005 kept pace with the overall growth in the volume index of GDP.

**Canadian growth industries**

Engineering industries in Canada have experienced steady growth over the past decade, especially in the mining, petrochemical, and construction fields. While every province has different demands for each type of engineering industry, these three fields have the greatest expected growth over the next several years.
Mining

The labor market in Canada for engineers is looking highly favorable as growth is expected to happen for most types of engineering industries. The mining industry is perhaps one of the biggest factors behind the predicted overall growth of engineering positions across Canada. Mining engineering positions are opening up all across Canada—especially in the provinces of British Columbia, Alberta, Quebec, and Ontario. Alberta, for example, needs mining engineers for resource extraction, which also includes the collection of oil and gas from deep inside of the earth. Surface mining, for instance, is needed in the Athabasca Oil Sands. Northern Ontario is another location that contains a significant amount of resources for mining. Therefore, the province of Ontario has also seen an increase in mining engineering positions.

Mining engineers are essential in the modern era and will therefore continue to be needed for many years to come. It is thus no surprise that the mining industry is turning to engineers for help in the resource extraction department.

Petrochemical industries

Another highly targeted industry for rapid job growth in Canada is petrochemical engineering otherwise known as “chemical” engineering. Petrochemical engineering is a type of chemical engineering that specifically focuses on the production of plastics. Since plastic materials are extensively used in our day-to-day lives, it is unlikely that they will fade out of use any time soon.

Petrochemical industries are constantly looking for new plastic inventions and need the help of engineers to produce plastics for them. There is an especially large concentration of petrochemical industries in Ontario and Alberta.

Construction industries

Finally, one of the most important industries that will experience rapid growth in Canada over the next several years is the construction industry. Construction and development requires the help of the most diverse team of engineers, ranging from civil to mechanical to electrical engineers.

All of their jobs are interconnected and are needed as modern technology advances. Urban areas need a lot of construction and maintenance, and rural areas also need construction and development.

Steel

Canada was the world’s nineteenth-largest steel exporter in 2018. In year-to-date 2019 (through March) – further referred to as YTD 2019 – Canada exported 1.39 million metric tons of steel, a 22 percent decrease from 1.79 million metric tons in YTD 2018. Canada’s exports represented about 1.5 percent of all steel exported globally in 2017, based on available data. By volume, Canada’s 2018 steel exports represented just over one-tenth the volume of the world’s largest exporter, China. In value terms, steel represented 1.4 percent of the total goods Canada exported in 2018.

Energy

Canada is one of the few developed nations that is a net exporter of energy – in 2015 net exports of energy products amounted to 2.9% of GDP. Most important are the large oil and gas resources centered in Alberta and the Northern Territories, but...
also present in neighboring British Columbia and Saskatchewan. The vast Athabasca oil sands give Canada the world’s third largest reserves of oil after Saudi Arabia and Venezuela according to USGS. In British Columbia and Quebec, as well as Ontario, Saskatchewan, Manitoba and the Labrador region, hydroelectric power is an inexpensive and relatively environmentally friendly source of abundant energy. In part because of this, Canada is also one of the world’s highest per capita consumers of energy. Cheap energy has enabled the creation of several important industries, such as the large aluminum industries in British Columbia and Quebec.

Historically, an important issue in Canadian politics is the interplay between the oil and energy industry in Western Canada and the industrial heartland of Southern Ontario. Foreign investment in Western oil projects has fueled Canada’s rising dollar. Agriculture

Canada is also one of the world’s largest suppliers of agricultural products, particularly of wheat and other grains. Canada is a major exporter of agricultural products, to the United States and Asia. As with all other developed nations the proportion of the population and GDP devoted to agriculture fell dramatically in the 20th century. The agriculture and agri-food manufacturing sector created $49.0 billion to Canada’s GDP in 2015, accounting for 2.6% of total GDP.

As with other developed nations, the Canadian agriculture industry receives significant government subsidies and supports. However, Canada has been a strong supporter of reducing market influencing subsidies through the World Trade Organization. In 2000, Canada spent approximately CDN$4.6 billion on supports for the industry. Of this, $2.32 billion was classified under the WTO designation of “green box” support, meaning it did not directly influence the market, such as money for research or disaster relief. All but $484.2 million were subsidies worth less than 5% of the value of the crops they were provided for.

Logging is still big business in Canada. Here a tug boat worker attaches a chain to a log boom in Vancouver’s Fraser River on Canada’s west coast. Source: Shutterstock / Eric Buermeyer

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The world’s second largest country

Canada is the northernmost country in North America and shares a border with the USA to the south. It covers a total area of 3,855,103 square miles, making it the second largest country in the world. Of this total area, 3,511,023 square miles is made up of land and 344,080 square miles is made up of freshwater.

World’s longest coastline

Although Canada is only the second largest country by territory; it has the longest coastline in the world. The coastline of Canada measures approximately 151,019 miles long. This distance is so long that walking a little over 12 miles per day would take over 30 years to complete! Some experts, however, estimate the coastline here differently and offer other measurements that are either slightly shorter or longer.

Ten of the provinces of this country have a shoreline; the longest of these is found in Newfoundland & Labrador. In total, this province has nearly 18,000 miles of coastline. The shortest coastline is found in the Yukon province, where it runs along the ocean for only 213 miles. Of the total population of Canada (approximately 35.75 million), only around 7 million people live at or near the coastal areas.

Measuring coastlines

Calculating an accurate coastline measurement can be difficult for researchers. This phenomenon is known as the coastline paradox, which posits that coastlines are difficult to measure due to their irregular shapes. In other words, a coastline length will vary based on the manner in which it was measured. When measuring irregular shapes, most researchers use a straight line from one point to the next. If that straight line is longer, the final measurement will be shorter because it does not take into account certain physical characteristics of the coastline. In contrast, the shorter the straight line, the longer the final measurement. This phenomenon is perhaps best illustrated with the measurement of the British Columbia province in Canada. Because of its many inlets and jutting coastal features, this coastline alone technically makes up 10 % of the entire coast of Canada at 15,985 miles in length. The coastline paradox also serves to explain...
why two major sources of global information, the World Resources Institute, and the World Factbook, have such varied measurements of the coastline of Canada. The World Resources Institute reports a length of 164,988 miles, while the World Factbook reports a measurement of 125,566 miles.

Ocean management in Canada

Of the entire coastline of Canada, the government has declared 5 coastline sections to be Large Ocean Management Areas (LOMAs). These coastline sections are protected by the government as key ecosystems for conservation, management, and planning. The 5 LOMAs of Canada include: the Pacific North Coast, the Placentia Bay, the Eastern Scotian Shelf, the Beaufort Sea, and the Gulf of St. Lawrence.

The Pacific North Coast is of particular ecological importance and comprises nearly one-quarter of the Canadian Pacific waters. This coastal zone is home to dolphins, porpoises, sea lions, seals, and 27 whale species. In addition to these marine animals, the Pacific North Coast is also an important habitat for a number of seabirds. In fact, 80 % of the global population of Cassin's auklets inhabit this area. One of the oldest species found here are the glass sponge reefs, which date back over 9,000 years. These reefs are some of the tallest ever recorded, reaching heights equal to 5-floor buildings.

The Placentia Bay region, located off the coast of Newfoundland and Labrador, is another of the Canadian LOMA areas along the coastline. This area has been experiencing an increase in economic development, which has caused some degradation to the shore. In fact, it serves as the largest port for oil exports in the country. Additionally, this bay is home to a number of plant species, 14 marine mammal species, at least 49 bird species, and 23 fish species.

In the Eastern Scotian Shelf is located off the coastline of the province of Nova Scotia. This area primarily relies on the fishing industry and petroleum exploration, which led the government to declare it an official LOMA region. Researchers have also identified a significant amount of contaminants throughout the waters. A number of marine animals inhabit the Eastern Scotian Shelf, making it an important place to concentrate conservation efforts.

The effects of climate change

The coastal areas of Canada are particularly susceptible to the effects of global climate change. Some researchers believe that the very diversity of this coastline is what puts it at risk. Rising levels of ocean water can affect every aspect of the coast, from the lowest-lying areas to those with the highest rock cliffs. Additionally, global climate change has also had a significant impact on sea ice throughout the Canadian coastline. This ice can be found in all areas, although it is less common on the west coast. The amount of sea ice along the coastline affects both shipping capabilities and changes in the shore areas. Because temperatures have been increasing along the coastline, the amount of sea ice is diminishing. This decreased amount of sea ice means that the ocean is exposed and able to be navigated by large ships for increased periods of time. It also means that the coastline is exposed to extreme weather conditions, which results in erosion of the shore.

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Source: worldatlas.com
Famous Canadians

Leonard Cohen
1934–2016, singer, songwriter, poet and novelist. Perhaps his most famous song was “Suzanne” from his 1967 debut album. Another of Cohen’s famous songs, “Hallelujah” was first released in 1984.

Joni Mitchell
Born 1943, singer, songwriter, drawing from folk, pop, rock, and jazz, Rolling Stone called her “one of the greatest songwriters ever.” Some of her best known songs are “Chelsea Morning”, “Both Sides, Now,” “Big Yellow Taxi” and “Woodstock”.

Donald Sutherland

William Shatner
Born 1931, actor, author, producer, director and singer, he became a cultural icon for his portrayal of Captain James T. Kirk of the USS Enterprise in “Star Trek”. Has written a series of books about his experiences playing Captain Kirk and being a part of Star Trek.

Pierre Trudeau
1919–2000, politician, Canada’s 15th Prime Minister and first “Pop Star” politician – because of his youthful nature and non-violent stance. He implemented bilingualism. He was prime minister for 16 years, retired in 1984 and died on September 28, 2000.

Pamela Anderson
Born in British Columbia 1967. Front cover of Playboy 1986. She was cast in the TV program “Baywatch”, which showed the life of coastguards. Outside showbiz, Anderson is active in animal rights and fundraising for AIDS and HIV.

Donovan Bailey
Born 1967, retired world class sprinter. Naturalized Canadian, held the world record for his 1996 Olympic Games 100 meters race. He is most widely renowned for his speed, recorded at 27.07 mph (12.10 m/s) in his 1996 Olympic title run.

Dan Aykroyd
Born 1952, actor, writer and film producer. His partnership with John Belushi led to “The Blues Brothers”. “Ghostbusters” with Bill Murray followed it in 1984 and in 1989 Aykroyd was Oscar-nominated for his role in “Driving Miss Daisy”.

Julie Payette
Born 1963, Governor General of Canada since 2017, the fourth woman to hold the post. An engineer and a member of the Canadian Astronaut Corps. She completed two spaceflights, 25 days in space, served the Canadian Space Agency and NASA.

Margaret Atwood
Novelist, poet and critic, born Ontario in 1939. Began writing at age 6, inspired by the tales of Edgar Allen Poe. She has authored more than forty volumes of poetry, fiction, non-fiction as well as children’s literature. She won the Booker Prize in 2000.
Gearless drive for overland conveyor belt

A new conveyor system in Quellaveco, Peru, based on Siemens’ gearless drive technology will move 127,500 tons of primary crushed ore every day. Furthermore, it will increase reliability and efficiency by up to 4 percent and significantly reduce maintenance requirements of the drive system.

Thyssenkrupp high-capacity overland conveyor belt powered by Siemens’ new gearless drive technology will soon go into service at one of the world’s largest copper reserves in Quellaveco. The Quellaveco mine in Peru contains approximately 7.5 million tons of copper in ore reserves – enough to wire 80 million homes or equip 90 million electric vehicles. With the rugged landscape in Quellaveco, transporting the primary crushed ore requires durable and efficient technology systems. By employing Siemens’ technology on this project, Thyssenkrupp’s new conveyor system will transport 127,500 tons of primary crushed ore per day from the pit to the stockpile adjacent to the copper concentrator. Vast sections of the overland conveyor must traverse from one valley to another through a 3.2 km long tunnel. After exiting the tunnel, the conveyor will pass over hilly terrain before feeding the stockpile.

Benefits of a gearless drive solution

Compared to the combination of high-speed motor and gearboxes otherwise used in belt conveyor systems, the gearless drive solution offers a range of benefits. The size of the motor is no longer limited by the size of gearbox, thus eliminating the necessity to install multi-motor drives. The required belt driving power can be provided with one drive per drive pulley. This means that the number of switch-gear enclosures could also be scaled down, saving space and weight within the e-house. The elimination of a whole series of mechanical and electrical components increases the reliability and efficiency of the overall system by between 3-4%.

Less maintenance

Another important factor is that the maintenance requirements of the drive system have been reduced significantly. This is important as gear maintenance work alone can account for up to 5% per year of the original investment volume for the gears.

Thyssenkrupp’s overland conveyor is 4,700 m long, 1,830 mm wide featuring Siemens’ dual 5.5 MW gearless drives operating at a design tonnage of nearly 11,000 tons per hour. Siemens also provides the e-house with MV and LV power distribution and the cooling system for motors and e-house. The automation of the conveyor system, as well as for the complete mine, will be realized with the process control system Simatic PCS-7.

Thyssenkrupp-Siemens partnership

“This order again shows how gearless conveyor systems meet today’s demand for ever more efficient mining solutions and increased safety requirements,” Torsten Gerlach, CEO of Thyssenkrupp’s Mining Technologies business unit explains. “It is the seventh overland conveyor project of this magnitude utilizing gearless drives that have been awarded to us since 2010. Together with our partner Siemens, we have managed to become one of the world leaders in bringing this technology to the market.”

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A pan-European drug discovery platform

The European Lead Factory (ELF) is giving drug discovery in Europe a boost by connecting innovative drug targets to a high-quality compound library and high-throughput screening facilities backed by an overall budget of EUR 196 million (2013-2018). The European Commission takes a positive view: "ELF is leading the way in the discovery of new medicines." Universities, research organizations and SMEs have a diverse range of potential drug targets but cannot easily access suitable compound libraries and screening facilities other than by approaching large pharmaceutical companies. These companies in turn need access to high quality targets to bring innovative therapies to the patient. The European Lead Factory combines the large high-quality compound libraries derived from the pharmaceutical industry, the Public Compound Collection and Europe’s leading screening facility with the innovative targets of academic organizations in a public-private partnership. This creates an ideal platform to translate early-stage fundamental biological research into credible and investable starting points for drug discovery campaigns.

From the very beginning, Taros Chemicals have both headed the ELF’s Chemistry Consortium that jointly designed and delivered more than 200,000 out of 550,000 novel screening compounds from the Joint European Compound Library (JECL), as the innovation gap, or “valley of death” between scientific basic research in academia and industrial, application-oriented drug development is where the European Lead Factory is positioned. Source: ELF
well as being an ELF SME Consortia Partner, having synthesized more than 40,000 innovative molecules in its Dortmund labs. In May 2019, ELF secured an additional budget of EUR 36.5 million under the Innovative Medicines Initiative (IMI). Over the next five years (from 2019 to 2023), 20 partners from 7 countries will develop potential drug targets for new medicines as part of ELF’s ESCulab (European Screening Centre: unique library for attractive biology). Here ELF will initiate 185 new drug discovery projects by screening medically relevant drug targets from European researchers, small and medium-sized enterprises and the pharmaceutical industry.

The route to drug discovery

Because of the lengthy and costly process involved in gaining approval for new drugs, many projects started during the early days of the ELF will first materialize in quite a few years time. Researching a preclinical drug candidate can easily take five to seven years, followed by another seven year of clinical trials before the new drug hits the market. While promising early drug discovery projects often stem from basic academic research, their maturity can fall short of big pharma’s drug development and commercialization requirements. Closing this gap between disruptive academic scientific research and more application-oriented drug development approaches in the pharma industry has been the main focus of the ELF. Therefore, ELF invested in the establishment of both its own High Throughput Screening infrastructure (HTS) and a unique screening compound library holding around 550,000 chemical molecules, in this way, JECL is helping to boost Europe’s drug discovery capabilities.

Public Compound Collection

One of ELF’s original core objectives was to create a unique screening compound library. Therefore, organic chemists, medicinal and computational chemists from academia and specialized SMEs came together to form ELF’s virtual synthesis factory. Between 2013 and 2019, seven SMEs with their assigned academic partners from all over Europe thought, developed and created a substance library containing more than 200,000 drug-like compounds called the Public Compound Collection (PCC). The seven participating large pharmaceutical companies have added another 326,486 highly selected substances from their own proprietary collections to complete the ELF library, known as the Joint European Library Collection (JECL) with approximately 550,000 readily available substances. This Library is accessible for High Throughput Screenings (HTS) in ELF’s Screening Center facilities in Oss, Holland.

When contributing their compounds, the pharmaceutical companies Bayer, Janssen Pharmaceutica, Lundbeck, AstraZeneca, Merck, UCB and Sanofi, all of whom are members of the European Federation of Pharmaceutical Industries and Associations (efpia) carefully applied stringent, mutually agreed selection criteria for their compounds, thus fostering ELF’s open innovation approach.

Crowd sourcing

One of ELF’s specific project aims was to address un served sectors of the chemical space, complementary to both big pharma’s own collections and commercially available substance libraries. To achieve this, public crowd sourcing through “calls for proposals” amongst EU organizations was initiated and promoted over a 5 year period to source innovative, unique and novel chemical scaffold ideas. Youri Mesmoudi, Executive Vice President Taros and ELF Call Manager: “For the first time an EU funded Early Drug Discovery project decided to actively engage scientists from a wide range of disciplines to contribute their ideas. We managed to collect more than 1,000 scaffold ideas which, after careful assessment and selection, led to the synthesis of more than 200,000 unprecedented molecules.” To achieve a balanced, scientifically sound and transparent selection process, a committee of seasoned European expert chemists from academia and industry assessed each single proposal which the originator could easily upload to a web-based submission portal for validation. Members of the committee then ranked each proposal against criteria such as novelty, economic synthesizability, drug-like physicochemical properties, chemical diversity, and medicinal as well as biological relevance. As soon as a submitted idea had successfully been admitted to ELF, the five ELF SMEs produced the subsequent substances and delivered them to the PCC while Taros, as the Chemistry Consortium Leader, coordinated all elements related to synthetic and medicinal chemistry. On several occasions EU Officials pointed out the key role played by EU SMEs as a highly agile and result-oriented link between academic research and pharmaceutical companies.

In the meantime, the JECL has screened more than 200 disease-relevant biological targets in molecular assays, helping to identify some 7,500 hit compounds. These hits qualify as the starting points for further development towards much needed drugs. On another level, the scientific work carried out as part of the ELF project resulted in more than eighty peer-reviewed articles, six patent applications and two biotech Start-ups:

• Scandinavian Scandicure is pursuing new inhibitors to act against nonalcoholic steatohepatitis
(an inflammation in conjunction with fatty liver disease (FLD), not induced by alcohol consumption, NASH) and to treat Type 2 diabetes. In April 2018 Scandicure entered into a research cooperation with the French pharmaceutical company Servier.

• UK based Keapstone Therapeutics is engaged in research into new inhibitors for the treatment of Parkinson’s disease backed by financial commitment from Parkinson’s UK.

What happens next?

In May 2019 ELF announced that it had secured a new project budget totaling EUR 36.5 million under the second framework of the Innovative Medicines Initiative (IMI). From 2019 to 2023, 20 partners in 7 countries will push forward the transformation of potential drug targets to new medicines as part of the new project ESCulab (European Screening Centre: unique library for attractive biology) under the ELF brand. Over the next five years, ELF will initiate 185 new drug discovery projects by screening medically relevant drug targets from European researchers, small and medium-sized enterprises and the pharmaceutical industry as part of the ELF JECL of 550,000 unique chemical compounds.

The successful concept of the European Lead Factory has already encouraged additional private partners to join. The ESCulab Project welcomes the pharmaceutical companies Servier and Grünenthal as well as the Medicines for Malaria Venture (MMV), the leading product development partnership in the field of antimalarial drug research and development.

In summary both EU Officials and Consortia Partners agree: setting up and running such a unique drug discovery platform in an open innovation approach, successfully managing all of its legal issues and intellectual property rights implications throughout all involved ELF entities will surely serve as a blueprint for future public private partnership (PPP) undertakings.

Source:
Youri R. Mesmoudi,
Executive Vice President,
Taros Chemicals GmbH & Co. KG

2) T. Bartfai, G. V. Lees, Drug Discovery from Bedside to Wall Street, Elsevier Academic, Press, 2006
Minimizing factory cycle times

At Productronica in Munich last November, developments in the area of “Smart Factory” could be seen everywhere. For example Viscom, a technology leader in optical and X-ray inspection systems for electronics manufacturing, presented several new developments.

The company focuses on smart-factory solutions that minimize cycle times, increase process efficiency and prevent defects, thus ensuring greater safety and reliability in SMT production. This requires innovations like AI-assisted verification, ultra-fast inspection and high-precision defect inspection of sophisticated assemblies. In addition, developments such as e-mobility, new energy technologies, LEDs and high-performance electronics require new inspection solutions, for example inline X-ray inspection with integrated workpiece carrier handling. In the area of X-ray technology Viscom offers offline and inline X-ray systems that include further innovations for high-performance electronics and components in e-mobility and renewable energy. A new inline system carries out fully automated inspections of large and solid objects. The inline system is equipped with an integrated transport system with workpiece carriers which can inspect the connection of semiconductors and other quality-critical areas such as surface solder joints. Viscom also offers a customer-specific adaptation of the system to facilitate seamless integration in the production line.

Inline X-ray inspection

The X7056-II is an X-ray inspection system, with fast AXI inspection and combined 3D AOI and 3D AXI inspection in a single system. The X7056-II achieves inspection of hidden solder joints and components in high-volume production. The 3D reconstruction of the X7056-II is based on planar computer tomography, which renders invisible defects clearly visible in sharp slice images. In the area of 3D AOI Viscom have developed the S3016 ultra, a system that enables 3D inspection from below for the first time. Moreover, the company now offers a range of sensors designed for dual-lane operation in series production. The system is flexible enough to facilitate inspections including 3D AOI (Automated Optical Inspection), 3D SPI (Solder Paste Inspection), CCI (China Certification and Inspection) and UFI (Underfill Inspection). This in turn increases inspection quality and throughput.

To meet demanding smart factory requirements, Viscom offers open interfaces and in-house software solutions to integrate inspection systems in Industry 4.0 process lines. Particularly with regard to smart maintenance and traceability, the company offers intelligent concepts that prevent defects right from the start, significantly increasing production efficiency and elevating inspection system performance to a high level.

Viscom offers customer-specific optical and X-ray inspection systems to facilitate seamless integration in the production line. Source: Viscom.com

<table>
<thead>
<tr>
<th>cycle times</th>
<th>temps de cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>planar</td>
<td>planaire</td>
</tr>
<tr>
<td>reliability</td>
<td>fiabilité</td>
</tr>
<tr>
<td>solder joints</td>
<td>brasures</td>
</tr>
</tbody>
</table>

Source: Viscom.com
Where is electronics manufacturing going?

The purpose of trade fairs and exhibitions has always been to give insights into, and examine the outlook for, the future. That applies even more so when an international exhibition presents electronics production and development in a manner that is both comprehensive and unique. At Productronica these topics were very much in focus.

Industry 4.0, the Smart Factory, 3D printing in electronics manufacturing: things that sounded like science fiction a few years ago are now technically feasible and offer unlimited potential for the widest variety of applications. But what will actually prevail, and what will remain little more than an empty theory?

Future markets

Due to the industrial Internet of Things, the prerequisites for production and manufacturing electronics are undergoing fundamental change. The “smart factory” is just around the corner: in the future, production facilities and value chains will be connected to one another.
digitally. Which poses some considerable challenges to companies: How can they prepare for this development? What opportunities and what risks are associated with this development? How can intelligent production planning further optimize the utilization rate of manufacturing facilities? What is important when it comes to infrastructure and security of industrial IT? How can existing systems be adapted for modern cloud, mobility and analysis functions?

Among other things, 3D printing in the electronics industry played an important role in the Future Markets cluster at Productronica 2019. After all, this new technology is already having a strong influence on the market of the future, particularly given the fact that it has almost unlimited potential for new products. The possibilities are practically endless. While plastic is currently the focus of the materials being used, there are also concepts that call for the use of metals or would even make electrically conductive connections possible. Future capabilities will increase the potential even further. Even if high-end, professional-quality 3D printers are still relatively expensive right now, they will become increasingly affordable as the use of this new technology continues to spread. Like mobile telephones, it is even conceivable that 3D printers could be an everyday product for normal consumers in the foreseeable future. Could this even cause innovation and production processes to shift to consumers in the long term?

**What sectors were covered by the Future Markets cluster?**

- Cyber-physical systems
- Industry 4.0 in electronics manufacturing/the smart factory
- 3D printing in electronics manufacturing
- IT to Production
- Manufacturing technologies for batteries and electrical energy storage
- Organic and printed electronics
- Additive manufacturing

Visitors and exhibitors in Productronica’s Future Markets cluster gained insights into the entire spectrum of current trends in electronics production. Visitors learned about exciting topics such as autonomously networked microsystems, sensor and actuator networks or cyber-physical systems. Future-oriented developments were also on display in the sector for manufacturing technologies for batteries and electrical energy storage. New materials, new manufacturing techniques and test systems are driving these developments further.

**Smart maintenance**

A “Smart Maintenance Pavilion” was introduced at Productronica this year for the very first time. This special ‘show within a show’ highlighted the growing importance of maintenance as digitization of production processes increases. The Smart Maintenance Pavilion provided an overview of current and future applications, solutions, and products for efficient maintenance.

**One trillion euros!**

Smart maintenance is necessary to optimize production. According to a recent study by acatech (the German Academy of Science and Engineering), industrial maintenance generates productivity gains to the equivalent of one trillion euros in Germany each year. In the course of digitization and the associated networking of plants, products and materials, the number of maintenance tasks and responsibilities will continue to grow. In this context, achieving almost 100 percent availability of highly flexible production systems is one of the major challenges. Electronics production places high demands on plant availability and safety. Integration of smart maintenance on the path to the smart factory is therefore an important addition. Plant planning
and management must be coordinated holistically to achieve optimum production efficiency. The companies that presented their solutions at the Smart Maintenance Pavilion during Productronica included: Elunic who showed its ideas for quality assurance based on deep learning, where visitors were able to test machine in a fun way with regard to the speed and precision of the algorithms used. With live demonstrations, Status Pro Maschinendiagnostik provided insights into online monitoring of machinery in smart factories.

In addition, the Maintenance and Facility Society of Austria (mfa), the Forum Vision Instandhaltung (FVI), Dankl+Partner and the technology partner Messfeld also participated in the Smart Maintenance Pavilion.

Theory and practice on one platform

The Smart Maintenance Pavilion provided a compact overview of current and future applications, solutions, and products for efficient maintenance. Focal topics included predictive maintenance, condition monitoring, mobile maintenance and augmented reality. Visitors could experience specific maintenance processes in practice, and learn from the experiences of others. With a combination of applications (Demo Park maintenance), guided tours and “Meet the Experts’ workshops, visitors were shown a consolidated mixture of information, practical examples, and experience reports.

Experiencing the experience factor

The Demo Park presented real-life problems and innovative solutions under everyday production conditions while other visitors tested out possibilities “hands-on” and could meet experts and obtain professional expertise.

Many maintenance processes require specific solutions and applications. In small, exclusive discussion forums, experts from participating companies provided valuable knowledge based on case study examples in interactive formats.

The Hackathon

A Hackathon premiered at this year’s Productronica. At a hackathon, a group of hackers completes a 48-hour “marathon” working on concrete problems (challenges). The cross-disciplinary teams develop approaches that provide food for thought and innovative solutions.

The “hackers” in this case were of course engineers, young professionals or students from the fields of electrical engineering, automation, mechanical engineering and industrial engineering. The challenges were submitted by the exhibitors. They were real and challenging and offered participants a good opportunity to get to know potential employers.

The buzz words of the show!

At Productronica 2019 Artificial Intelligence (AI) was high on everyone’s technology roadmap, as were the terms “Deep Learning” and “Machine Learning”.

1. But what do the terms Deep Learning, Machine Learning and Artificial Intelligence mean in the context of modern manufacturing and what are the most important differences?

The topics are not, in principle, differentiated – but they each represent different methods that can be used together in different applications. In fact the generic term for all three is AI.

2. What opportunities do these technologies open up?

Manufacturers are continually striving to operate their equipment with fewer personnel. On the one hand this has to do with general cost pressure, while on the other hand new technologies offer opportunities for quality improvement. Here AI can gradually take over more and more tasks: if an operator learns how to be supported by AI, then AI can gradually take over more and more tasks after successful validation.

3. Where are these technologies currently being used?

The first pilot installations are already underway, for example in the field of assembly inspection. Here images and data are collected in advance to establish a basis for field tests. AI thrives on masses of image data. To this end, inspection systems supported by AI can provide high-quality images in combination with 2D, 2.5D or 3D output.

<table>
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<tr>
<th>actuator</th>
<th>actionneur</th>
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<tr>
<td>cluster</td>
<td>groupe, ensemble, réseau</td>
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<tr>
<td>conceivable</td>
<td>plausible, imaginable</td>
</tr>
<tr>
<td>consolidated</td>
<td>consolidé</td>
</tr>
<tr>
<td>feasible</td>
<td>réalisable</td>
</tr>
<tr>
<td>focal</td>
<td>central, principal, prioritaire</td>
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<tr>
<td>prerequisite</td>
<td>condition</td>
</tr>
<tr>
<td>prevail</td>
<td>prévaloir, l’emporter</td>
</tr>
<tr>
<td>quality assurance</td>
<td>assurance qualité</td>
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<tr>
<td>utilization rate</td>
<td>taux d’utilisation</td>
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</tbody>
</table>
In general, companies are facing two almost juxtaposed challenges: finding expert employees in a competitive environment and weeding out candidates who might turn out to be low performers simply adding to headcount without being a valuable asset to the company. HR departments have developed comprehensive people strategies, well-structured selection programs and recruitment assessments to find staff who match their job and their organization. One central idea revolves around “personality tests” and profiling.

**Profiler**

The job of a profiler is quite the myth reinforced by crime shows and movies. There are, however, law enforcement agencies like the FBI who employ investigative/forensic psychologists in a behavioral unit.

profiler (noun): a person or device that creates a profile, esp. someone with psychological training who assists police investigations by identifying the likely characteristics of the perpetrator of a particular crime (https://www.thefreedictionary.com/profiler)

“Profiling" potential employees has become increasingly popular in the past few years. Yet, what does this actually mean? Have we become detectives who investigate white collar crime? Public speakers calling themselves “profilers" advertise for their work by promising employers that their strategy will help find ideal candidates. This issue looks at how promising profiling in the recruitment process really is.
There seem to be a few reasons why the idea of profiling people in our normal lives seems so appealing. Certainly, we feel a desire to use quantitative social science to exert more control in order to achieve desirable outcomes. In other words: we want to feel in control over our environment by being able to assess (or judge?) the people around us faster and more easily. It is, however, problematic when we think about future employees as “more or less valuable” human beings; just as preventive crime units are highly debatable – we only need to watch Minority Report to understand why.

We know that employees show lower engagement when they are placed in a position that does not match their personality. Many mismatches like this lead to an overall lower productivity and higher turnover in staff. Yet, the question remains whether profiling candidates is an appropriate measure to mitigate this issue.

Job and skills profiling

A successful and often neglected (because work intensive) strategy to find the right candidates for job vacancies is to develop accurate job descriptions. It is astonishing how many departments still do not define roles and responsibilities clearly – even after people have been working there for years. It is essential to determine the roles an individual will fill, required skill sets, relevant experience, and, yes, also personality attributes. To find the ideal employee for key positions it might be a good idea to interview and assess top performers, and identify skills and attributes that distinguish them from others. Job adverts should, of course, include this information and appear in media that reach the right target groups. Be careful: using algorithms to ensure only a very specific group (e.g. younger candidates) sees job postings, has been ruled to be discriminatory practice (ageism) in court.

Another possible court issue in the recruitment process has been social media screening. Whereas LinkedIn, for instance, is a professional platform created exactly for this purpose, and thus is legitimate to use. Yet, researching a candidate’s Twitter, Instagram or Facebook profiles opens the path to discriminatory hiring decisions, if, for example, the usually public profile picture shows that the applicant has a disability.

The traditional way might be the better option: resumes/CVs help identify the best candidates; phone screenings allow you to talk to a handful of applicants, and classic job interviews usually leave you with only a small selection of potential candidates. Many companies rely on assessment centers at this point, or make candidates fill in a pre-selective personality test.

Personality profiles

Personality profiling makes sense when we assume that people and jobs are not complex, for instance a sales person should be an extrovert, whereas an introvert would be ideal for a clerical position. Personality tests often follow this logic: whose character traits are best suited for a specific position. However, particularly “show profilers” also tell employers that they can target critical behaviors – be it low-performance or psychopathic tendencies.

The first systematic personality testing was the Rorschach test (1921); the two most popular tests today are DiSC and Myers-Briggs. The DiSC Behavioral Inventory distinguishes four personality types: dominant, influential, steady, compliant. It can be seen as a temperament assessment. The Myers-Briggs Type assessment identifies 16 personality types, but also mainly differentiate four either/or binaries, meaning that a person leans towards one of two tendencies: extroverted vs. introverted; thinking vs. feeling, sensing or intuitive, judging or perceiving.

Looking back in history, we can find many four-types models. The idea of blood type personalities, for instance, was extremely influential for centuries. These so-called bodily humors (sanguine, phlegmatic, choleric, melancholic) date as far back as Hippocrates and – as the name suggests – even impacted medical treatment. Today they are regarded as superstition – comparable to astrological signs, and they do show parallels. Assuming that the human condition boils down to only four (!) different temperaments seems such a simplification that there are only two possibilities: These character profiles are either so generalizing that every human being can identify with all four descriptions, or they are only helpful to determine what a person
is NOT. Reading a list of adjectives attributed to the DiSC personality types, and taking into account that similar models all state that people usually are a combination of at least two, and even sometimes three (!) types, it is highly doubtful that any precise assessment can be made. Despite the fact that so many companies use these “scientific” models, taking a test whether you are Gryffindor, Hufflepuff, Ravenclaw or Slytherin might be just as useful. I am Ravenclaw, by the way.

An illusion of control

Criticisms does not stop here. As a linguist, I would like to add that words are concepts; they are arbitrarily assigned, and their connotation and association might differ between groups or individuals. Thus, how can we even agree what it means to be an introvert? This is particularly problematic since all these tests rely on self-reporting, which means that people have to be highly self-reflective and have excellent language skills to provide assessable answers. Plus, many characteristics are not mutually exclusive. Human beings are complex. A person might be a stage hog, thriving at theater performances, and be very shy in their private lives. The same might apply to a professional self and a private self.

The dialectic concepts (or opposites) many of these test base their findings on, are helpful to keep the world in order. Good or bad, heaven or hell, introvert or extrovert: we form prototypes in our minds to organize the world and our experience, to assess situations and exert control. We freely diagnose people all the time, as a “narcissist” or a “free-loader” and it helps us deal with daily challenges. Cultural products reinforce these concepts – a good example are how C.G. Jung’s Psychological types were drawn from and reentered our “collective memory”. However, emphasizing these ideas to the extent that our prototypical versions become the one and only “truth” usually means stereotyping people and simplifying complex experiences, situations or ideas. We need to be careful to keep an open mind and not give in to this illusion of control.

Last but not least, we need to acknowledge that personality itself has not been shown to be a reliable indicator of job-specific success. Not taking risks in the recruiting process often means employing more of the same people. Yet, research has shown that diverse groups make better decisions. How can anyone know ahead of time what an innovative and open-minded team might look like? One thing is clear: being overly judgmental and attaching a value to people’s personalities does not seem to be a healthy approach in recruiting an inspiring team. More complex personality tests have been developed in the past few years - and some might be valid. However, no matter which assessment tool your company chooses, make sure it is dependable and inclusive.

appealing  séduisant
arbitrarily  arbitrairement, abusivement
assess, to  évaluer
assign, to  attribuer, affecter
association  association (de mots)
attribute  trait, qualité
behavioral  comportemental
collective memory  mémoire collective
critical behavior  comportement critique
debatable  discutable
desirable  désirable
dialectic  dialectique
disability  déficience, handicap
discriminatory  discriminatoire
either/or binary  approche soit/soit
exert control, to  exercer un contrôle
free-loader  pique-assiette, parasite
judge, to  juger
juxtaposed  juxtaposé
law enforcement agency  service de maintien de l’ordre, chargé de l’exécution de la loi
mitigate, to  atténuer
mutually exclusive  incompatibles
reinforce, to  renforcer
resume/CV  curriculum vitae
self-reflective  introspectif, autoréflexif
self-report, to  auto-vérifier
stage hog  personne qui monopolise la scène
target, to  cibler
thrive, to  réussir
weed out, to  éliminer
white collar crime  criminalité en col blanc

L’auteur, Karin Hirmer, est traductrice, professeur d’anglais et conférencière. karinhirmer@hirmerls.com
Food issues

Here are some frequently confused words. Choose the best option.

a. Tim is just (preparing/making) a cup of tea. The water is already (cooking/boiling).

b. We are (eating/having) dinner at a restaurant. Do you want to join us?

c. I’m too tired for cooking. I’m going to order some take (out/off) food.

d. And as the final course, we offer (an assortment/a selection) of cheese.

e. I think I’d like a dessert. Can I have another look at the (card/menu), please?

f. You should take your visitors to La Bouche. They offer excellent French (cuisine/kitchen).

g. Chris is visiting a (cooking/cookery) class in the evenings.

Which fungus is it: mildew, mold, mushroom, or toadstool?

a. (edible) ____________________________

b. (poisonous) ____________________________

c. (rust) ____________________________

d. ____________________________

Some expressions do not translate one to one. Choose the best option.

a. « Bon appetit. »

☐ Enjoy your meal. (1)
☐ Good appetite. (2)
☐ Tuck in. (3)

c. « C’est vraiment très bon. »

☐ This is really nice. (1)
☐ This tastes really nicely. (2)
☐ This tastes really nice. (3)

b. « Je n’aime pas trop cela. »

☐ I don’t crave it. (1)
☐ I don’t really like it. (2)
☐ I don’t care for it. (3)

d. « Je vais prendre... »

☐ I’m having... (1)
☐ I have... (2)
☐ I’ll have... (3)

Make sure you get these words and phrases right when you are out for dinner.
Shall I compare thee ...

1. Match the sentence beginnings and the endings including an idiom with a simile.

<table>
<thead>
<tr>
<th>a. I’m afraid our choices in the past year have left us like</th>
<th>wildfire.</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. The department leader is very happy,</td>
<td>a hawk.</td>
</tr>
<tr>
<td>because Susan’s presentation to the management went like</td>
<td>chicken scratch.</td>
</tr>
<tr>
<td>c. Don’t worry. Tom knows the technical details like</td>
<td>Fort Knox.</td>
</tr>
<tr>
<td>d. The new colleague and Jim get along really well.</td>
<td>a lead balloon.</td>
</tr>
<tr>
<td>They’re like</td>
<td>a sitting duck in</td>
</tr>
<tr>
<td>e. The new colleague and Jim don’t get along at all.</td>
<td>this market.</td>
</tr>
<tr>
<td>They’re like</td>
<td>hotcakes.</td>
</tr>
<tr>
<td>f. Peter doesn’t trust his staff. He’s been watching</td>
<td>two peas in a pod.</td>
</tr>
<tr>
<td>them like</td>
<td>clockwork.</td>
</tr>
<tr>
<td>g. Could you please type this? Your handwriting is</td>
<td>oil and water.</td>
</tr>
<tr>
<td>like</td>
<td>an open book.</td>
</tr>
<tr>
<td>h. The new product line isn’t a success. It went over</td>
<td>the back of his</td>
</tr>
<tr>
<td>like</td>
<td>hand.</td>
</tr>
<tr>
<td>i. The new product line is a success. It sold like</td>
<td></td>
</tr>
<tr>
<td>j. Frank is trying to hide that he’s late with the</td>
<td></td>
</tr>
<tr>
<td>project. But I can read him like</td>
<td></td>
</tr>
<tr>
<td>k. The pen test has shown that our system basically is</td>
<td></td>
</tr>
<tr>
<td>like</td>
<td></td>
</tr>
<tr>
<td>l. I guess everybody’s heard the news. They really</td>
<td></td>
</tr>
<tr>
<td>spread like</td>
<td></td>
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</tbody>
</table>

2. Easy to confuse: differentiate, differ and distinguish

In some context all of these verbs may mean the French “différencier” or “diverger”. However, only to differ means “to be different” and is used with from and in: “This new project differs from previous ones in a number of respects.” You can also differ on or about something, meaning you have a different opinion. Both to differentiate and to distinguish can be used as “recognizing a difference” (between two things and from something), and “representing a difference” with an intransitive pronoun. Differentiate is more formal.

Fill in the right word.

a. In the end we had to agree to disagree. We simply ________________________ on that point.

b. It’s impossible to ________________________ all these kinds of bolts. That must take years of training.

c. To find our USP, we need to determine how we ________________________ ourselves from our competition.

d. Sam is so bad at languages, he can’t ________________________ Russian from French.

e. Patrick and Wayne ________________________ in so many ways, I don’t even know where to start.

3. Various meanings of “as”

In comparisons, as never means “en tant que/comme” but is used to compare to things (French “aussi/autant ... que”): “As good as it gets.” Remember that like has no business here, it is only used in similes, likening one thing to another. There are only two instances when as means “en tant que/comme”. First, when talking about the function, role or job or purpose of an item or a person: “He can work as a clerk.” “This can serve as a coaster.” Second, when referring to time to describe two simultaneous events: “As the roof came crashing down, everyone ran out.” Most of the time, however, the temporal “comme” needs to be translated as when. An additional meaning of as is “comme, puisque”.

Choose the right word.

a. (As/When) we were children, we used to go outside everyday.

b. Frederic isn’t (as/so) good (as/like) he thinks.

c. I know things needed to change, but the department isn’t the same (as/like) it used to be.

d. Mr. Smith is far more successful (as/than) his predecessor.

e. We can use this (as/for) a placeholder for the filing cabinet.
4. Find 12 verbs (and phrasal verbs) that can all mean “comparer” in the right context.
I'm calling about the offer advertised in the latest issue of ...

I was wondering if you would be interested in working with us.

Do you still offer consulting services on ...?

Would you be available for a construction job in March?

We are searching for a new business partner and I wanted to know whether you would be available for ...

Thank you for your interest in our products.

Many thanks for your email enquiring about our product range.

Attached you will find brochures and our price list.

For a detailed quotation, we need some further information.

Delivery cost are not included.

If I could just summarize what we've agreed on.

If this is acceptable for everyone, I would like to sum up today's results.

So, to round up our discussion, let me finish ...

Let me run through the main aspects one last time to make sure we all agree.

Let me conclude by saying that I see this as a win-win situation for all of us.

Je vous appelle à propos de l'offre publiée dans le dernier numéro de...

Je voudrais savoir si travailler avec nous ne vous intéresserait pas.

Proposez-vous toujours des services de consulting ?

Seriez-vous disponible pour un chantier de construction en mars ?

Nous recherchons un nouvel associé et je voudrais savoir si vous seriez disponible pour...

Nous vous remercions de votre intérêt pour nos produits.

Un grand merci pour votre message et votre demande de renseignements sur notre gamme de produits.

Vous trouverez ci-joint des brochures et notre grille de tarifs.

Pour fournir un devis précis, nous aurons besoin de plus d'informations.

Les frais de port ne sont pas inclus.

Si je résume ce sur quoi nous nous sommes mis d'accord...

Si cela convient à tout le monde, je voudrais dresser le bilan d'aujourd'hui.

Donc, pour récapituler notre discussion, laissez-moi terminer en disant...

Permettez-moi de rappeler une dernière fois les principaux aspects pour être sûrs que nous sommes d'accord.

Je terminerai en disant que je considère cela comme une situation gagnante pour chacun de nous.
Back to basics: Perfect tenses

In 2020, the grammar section goes “back to basics” and reviews formation, rules and common mistakes regarding the tenses. This issue deals with the perfect tenses – admittedly a topic that is not very “basic” anymore.

Linking time. The perfect tenses are “in-between” tenses, linking the past and the present, or the present and the future. It is important to understand that the speaker’s perspective matters. Someone tells a story in the past tense (past simple/progressive) and refers to an event that took place even before: this past-in-the-past is expressed by the past perfect (had + 3rd form).

We didn’t have to wait, because we had booked the tickets in advance.
Nous n’avons pas eu besoin d’attendre car nous avions acheté les billets en avance.

However, if the speaker refers to this moment, the present perfect (have/has + 3rd form) applies.

Exercise 1
1. Try: Fill in the verb in the correct perfect tense.
   a. By the time we’ll arrive in London, Pia _____________________________ (leave) for her holidays.
   b. Last time we went to Paris, we _____________________________ (organize) everything ahead. This time we _____________________________ (not, plan) anything.
   c. Peter will be so happy next weekend! He _____________________________ (finish) this long-term project.
   d. _____________________________ (ever, be) to China?
   e. I _____________________________ (never, try) Dim Sum before I went to China, but I quite liked it.
   f. Can you believe it? Ruth _____________________________ (already, complete) all the paperwork.

We don’t have to wait, because we have booked the tickets in advance.
Nous n’avons pas besoin d’attendre car nous avons acheté les billets en avance.

And if the speaker dwells on the future, future perfect (will have+ 3rd form) is required.

We won’t have to wait, because we will have booked the tickets in advance.
Nous n’aurons pas besoin d’attendre car nous aurons acheté les billets en avance.
Exercise 2

2. Try: Choose the correct tense

a. Sid (has waited / has been waiting) here for hours. I wonder when his customer will arrive.

b. Sid (has waited / has been waiting) for these customers so many times. They are really unreliable.

c. By the time we’ll reach Paris, we (will have travelled / will have been travelling) for six hours. And then we’ll still have another six to go.

d. When the Berlin Wall fell in 1989, people (had protested / had been protesting) for years.

e. I (haven’t talked / haven’t been talking) to Kate since my sister’s wedding, because she went abroad the day after.

f. I (haven’t talked / haven’t been talking) to Kate since my sister’s wedding, because she behaved so inappropriately.

Present perfect vs. past simple. Among all tenses, this differentiation is certainly the most addressed issue. Though the past simple always refers to completed actions, it is not true that the present perfect only refers to incomplete ones. It is the speaker’s emphasis and intention that matters. If he or she emphasizes the result or a consequence for now, the present perfect is correct.

Marcus went to London three times last year.
Marc est allé trois fois à Londres l’an dernier.

Marcus has been to London three times. He loves it.
Marc est allé trois fois à Londres. Il adore cette ville.
Exercise 3

3. Try: Choose the correct option.
   a. I’ll hand in the documents today, I’ve finished them. (1)
      I finished them. (2)  
   b. Peter called this morning. He has wanted to speak to you. (1)
      He wanted to speak to you. (2)  
   c. Mr. Smith is still at home, he has been sick all week. (1)
      he was sick all week. (2)  
   d. Have you seen Viola? Yes, I have seen her in the kitchen earlier. (1)
      Yes, I saw her in the kitchen earlier. (2)

adverbs with the perfect tenses. Adverbs of frequency (always, often) and temporal adverbs (already, still, never, ever, just) usually take the middle position in front of the second part of the verb. Yet, lately and recently take the end position. Already, yet and still are often confused. Note that already means “déjà” in affirmative sentences, whereas yet means “déjà” in questions but “encore” in negative statements. Still means “toujours” in the sense of something that is ongoing.

Exercise 4

4. Try: Translate into English.
   a. Le colis n’est pas encore arrivé.
      ____________________________________________________________
   b. Paul a toujours rendu service à ses collègues.
      ____________________________________________________________
   c. Les clients ont déjà vérifié le cahier des charges par courriel.
      ____________________________________________________________
   d. Les fournisseurs ont souvent eu du retard ces derniers temps.
      ____________________________________________________________
   e. Est-ce que tu as déjà parlé avec le Chef ?
      ____________________________________________________________

perfect modals. Modal auxiliaries in the perfect infinitive take the modal verb plus have:

could have, may have, might have, should have, would have, must have, needn’t have. Similar to all perfect tenses, the full verb takes the 3rd form (Verb -ed or past participle). These perfect infinitives express a reference to the past. This often implies an unfulfilled condition or activity.

Laura should learn English.
Laura devrait apprendre l’anglais. (c’est encore possible)

Laura should have learned English.
Laura aurait dû apprendre l’anglais. (ce n’est plus possible)

Exercise 5

5. Try: Fill in the verb in the correct tense.
   a. I found Tom’s wallet in the kitchen. He _______________________ lost it when he emptied the dishwasher.
   b. The meeting started at two, but I was there at one o’clock. I ______________________ (not) come so early.
   c. We _______________________ made a mistake when we agreed to these terms. They aren’t working for us.
   d. George _______________________ helped his colleague if he had asked.
   e. You _______________________ worried so much. Everything turned out alright.
Our written work reflects our professionalism where we used to be able to leave an impression in person: instead of entering a meeting room, our documents now enter the virtual realm and shape the idea of who we are and what our work is like. Thus, it is crucial that these texts are created carefully and proof-read. Getting the formatting right and spending some time on editing will take your documents to the next level. The following presents the most common issues I encounter when revising texts or presentations.

### Style sheets and choices

Companies should have a style sheet detailing certain aspects of language and formatting for various reasons. First, when creating documents, the author does not need to research formatting issues. Second, if team members refer to the same guidelines, presentations or other documents can be shared much more effectively. Just imagine you need to prepare a presentation for a potential client and your colleague has already prepared a lot of useful slides in another context. Since you all refer to the same style sheet you can simply take individual slides and integrate them in your presentation. And the next time, your colleague can benefit from the work you have already completed. Having a style sheet not only makes all corporate communication look better – it is also an actual time-saver.

A style sheet should include basics, such as font types and sizes, colors and spacing; but there are also some decisions that need to be made, for instance which language variety to use, when to capitalize or how to use bullet points.

### Formatting and editing

In today’s “global workplace” team members, colleagues and customers-suppliers frequently communicate in written documents, be it presentations or technical texts. Due to remote teams, different time zones or cooperations between non-native speakers (whose reading skills are usually better than speaking/listening), written communication now often represents our work.
• US spelling vs. British spelling, e.g. -ize vs. -ise.
• Capitalization: standard capital letters vs. headlines (e.g. every important word).
• Bullet points: capital vs. lower case; end on which punctuation mark?

Both variations are correct, but it is important to choose one and be consistent throughout the document. The same applies to all other decisions regarding language variety, formatting or style. Consistency and coherence are key to any professional text.

### Standards: numbers and currencies

The following lists the most common mistakes when editing documents in regard to numbers, figures and currencies.

**Example:** English: €4,235.86 = French 4.235,86 €

**Comma and period:** Vice versa to French, in English the comma separates thousands and the period marks the decimal point.

**Currency symbols:** The currency both as an abbreviation and as a symbol comes before the amount in English.

**Example:** USD 6.7 million dollar but US$6.7 million dollar

**Currency abbreviation:** The abbreviation is followed by a space. Do not abbreviate the name of the currency when it is mentioned without an amount; and use words for large amounts, e.g. rather 6.7 million than 6,700,000.

**Currency spelling:** Currencies are usually not capitalized. Interestingly, “Euro” with a capital “E” is not uncommon, but the correct (and official) spelling is “euro”. The currency does not take the plural with figures, but may do so in everyday English.

**Counting:** Remember big amounts translate literally up to “million” (Million) but then English deviates from German, as one “billion” is one “Milliarde”, one “trillion” is one “Billion” and so forth.

### Standards: dates

All of the following ways to note down a date are correct. My advice is to choose one unambiguous way and always use the same. Particularly confusing is the fact that US English mentions the months before the day, and in the UK this is vice versa. All months can be shortened to three letters except May and June. For September both “Sept” and “Sep” are common.

**Year – month – day:**
- 2020-01-20
- 2020 January 20

**Year in end position:**
- 20 January 2020
- 20/1/2020 (UK) – 1/20/2020 (US)
- 20-1-2020
- 20.1.2020
- 20Jan2020
- 20-Jan-20

**Day before months:** no comma (UK and related)
- 20 Jan 2020
- 20th Jan 2020
- 20 January 2020

**Month before day:** comma (US and Canada)
- Jan 20, 2020
- January twentieth, 2020

**In a sentence:**
- On Jan 20, 2020, the company will …
- The company will … on the 20th of January / on the twentieth.
- On Monday, Jan 20, 2020, the company will …

### Standards: units of measure

In general, write out units of measure in texts and abbreviate them in tables or technical documents. Note that in compounds the units are hyphenated,
as in “100-feet building”. There is a space before US units of measure, e.g. 100 ft.; and a period after abbreviations in US English “ft.”, which is less common in UK English. There are, however, no periods with the metric system or International System of Units. There is no space before either the percentage sign or the degrees sign. Yet, there is no complete consensus on the space/no space before the percentage symbol, and the International System of Units recommends a space in line with other units of measure. Remember to use a non-breaking space between numerical values and symbols.

Checklist: proof-reading and editing

- Revise sentences: avoid fragments and sentence sprawl. Declutter your sentences.
- Make references clear: cut misplaced and dangling modifiers, or unclear pronouns.
- Check inconsistencies regarding plural/singular or pronoun case.
- Take a close look at apostrophes and misspellings.
- Cut repetitions. Eliminate redundancies.
- Write down what you think. Do not leave the final conclusion up to the reader.
- Be aware of clichés both in language and in content. Cut colloquialisms.
- Use the active voice. Be precise by choosing a good sentence subject. Avoid too many pronouns, or nonspecific “it”, “this”.
- Do not use undefined abbreviations and vocabulary.

<table>
<thead>
<tr>
<th>billion</th>
<th>milliard</th>
</tr>
</thead>
<tbody>
<tr>
<td>capitalize, to</td>
<td>mettre une majuscule</td>
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<td>currency</td>
<td>devise</td>
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<td>lié par un trait d’union</td>
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<td>espace insécable</td>
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<td>domaine</td>
</tr>
<tr>
<td>sentence sprawl</td>
<td>phrase trop longue</td>
</tr>
<tr>
<td>unambiguous</td>
<td>sans équivoque</td>
</tr>
</tbody>
</table>

Exercises: Vocabulary from the language section

1. Collocations: Match the verbs with the nouns.
   a. reinforce  candidates
   b. expand  behavior
   c. identify  roles
   d. screen  ideas
   e. target  skills
   f. define  business

2. Anagrams: Decipher these words.
   a. eruptionsits  _______________________________________________________________________________________________________________
   b. emersonpint  _______________________________________________________________________________________________________________
   c. abutconceal  _______________________________________________________________________________________________________________
   d. appretorter  _______________________________________________________________________________________________________________

3. Word building: Complete the word families.

<table>
<thead>
<tr>
<th>verb</th>
<th>noun (abstract)</th>
<th>noun (person or item)</th>
<th>adjective</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td></td>
<td>--</td>
<td>bearable</td>
</tr>
<tr>
<td>b. to assess</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>attribute</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td></td>
<td></td>
<td>victimized</td>
</tr>
</tbody>
</table>
small talk with friends

Fiction and reality

Conversation entre amis autour d’un verre un vendredi soir…

Christine: (yawns) Michael, I have to say you’re looking tired. What happened to your resolution to get more sleep? At least I know why I’m tired. Our little one is teething.

Michael: Oh, right where it hurts, Christine. I’ll confess, I’ve been binge watching this show called The Sinner. There are only eight episodes in a season – and it was already midnight when I realized I had only one episode left. What can I say – five hours sleep is clearly not enough for me. Thank God it’s Friday.

Christine: Sounds interesting, though. Which genre is it?

Michael: Crime. Not quite a procedural, but an investigation into why a young woman killed a guy on a beach, in front of everyone. I’m not going to say much more, without a warning: Spoiler alert!

Peter: Stop, no don’t spoil it, please, as long as I’m sitting here with you. That show is next on our watchlist. We’ve been watching Unbelievable. It’s about two policewomen who team up to catch a serial rapist. It’s tough to watch, though. The first victim’s story serves as a subplot, and it’s almost unbearable to watch how the police don’t believe her,, but the investigation and basically continue to abuse her. As Sarah said to me yesterday: the way it’s depicted is so realistic that it hurts. But it’s an excellent program.

That was one of the conspiracy theories you told us about. Speaking of conspiracies, I’ve been watching some political shows, but I have to say – compared to what’s going on in the real White House they were quite tame.

Christine: True. I’ve been wondering lately if all these shows don’t contribute to our cultural pessimism. You know, statistics clearly say that crime has decreased over the last three decades. But being surrounded by all these stories about crime and violence, it often doesn’t feel like it. I miss shows without villains and perpetrators. Even if they get caught in the end, I find the idea that there are a lot of people around who are simply evil people very depressing.

Derek: Well, you might have a point there. But maybe we’ve just become more aware of some issues, like personal safety. A reality check certainly helps from time to time.

Michael: I still regard TV shows as escapism. But maybe they do influence our perception on a subconscious level.

Christine: I absolutely believe they do, as do media in general. We’re exposed to so much information every day; it’s hard to distinguish between fiction and reality.

Luke: By the way, it’s not only TV shows and reality that clash. My bosses have also come up with...
ideas that must be based in fiction. The situation has become so bad, I'm thinking about changing my job.

**Sonya:** Seriously? What happened?

**Luke:** There was a meeting on Monday with upper management in which they presented the goals for 2020. Nothing new or shocking there: expanding business, minimizing costs. You know, we hardly think about this anymore – but in fact these two goals should be a contradiction. I mean, I've told you about the way we have been working these past few years, one work-around after the next, *chipping* projects into *chunks* to hide the total cost, out-sourcing as much work as possible. And we've somehow come to accept this now.

**Sonya:** Sure, you've told us often enough. It must be frustrating on a daily basis. But you've never talked about leaving before.

**Luke:** Yes, that's because all in all I always thought this was just temporary. But not anymore. Now, the latest idea they've had really makes me doubt it will ever get better. Believe it or not, they want to go agile. The problem is that they don't understand the concept. Like at all.

**Christine:** What do you mean? We've also introduced agile management in some departments, and I have to say, I'm quite a fan. For me it means that my role and tasks are defined much more clearly than they used to be. And I don't report to one boss anymore but to various project leaders. That means I'm now *accountable* for my actual work and not office politics.

**Luke:** You're right. But in our company, agile management simply means reducing head-count. They've mainly *embraced* the concept of "knowledge centers" – which to them means centralizing work and reducing one person per department.

**Christine:** I am confused. This is what they said?

**Luke:** They even had a visual! I have to say that this makes me lose sleep at night. I already know that these "knowledge centers" can't work the way management expect them to, because all our sites are different in their equipment, processes and general structure. Plus, our company has refused to establish basic project management tools. Everybody is just winging it. The best prerequisites for an agile structure. NOT.

**Michael:** That doesn't sound good, Luke. Maybe it is time to leave. One of my customers is looking for a new project engineer. Not quite the same industry, but it's also in production. Should I put you in contact? After all, you have been really unhappy with your work for two years now.

**Luke:** You know what, yes. At least I should check out the market and job opportunities and make a well-informed decision. I need a reality check on my own market value.

**Sonya:** That sounds like a very reasonable idea. I know you hate change, Luke. But it looks as if things are about to change anyway. Why not try to take charge of your own *fate* a bit more actively?

**Luke:** I haven't looked at things this way, I have to admit. Thanks, everyone. I'm already feeling a bit better. The next round is on me.

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<table>
<thead>
<tr>
<th>accountable</th>
<th>responsable</th>
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<tr>
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<td>conspirer</td>
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<td>contribute, to</td>
<td>contribuer à, apporter de l’eau au moulin</td>
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<td>malfaiteur, coupable</td>
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<td>averti spoil !</td>
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<td>faire ses dents</td>
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<td>tribu</td>
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<tr>
<td>unbearable</td>
<td>insupportable</td>
</tr>
<tr>
<td>villain</td>
<td>méchant, bandit</td>
</tr>
</tbody>
</table>
Across:
4) additional, supplementary (adj.)
6) expert language (noun)
7) from a distance, not local, isolated (adj.)
8) the bad person in a story (noun)
14) required as a prior condition (noun)
16) including all or much (adj.)
19) projecting part from which fluid is discharged (noun)

Down:
1) to prove, verify (verb)
2) wear and ... (noun)
3) do without (verb)
4) to gain speed (verb)
5) reduction, (weight) loss (noun)
9) be for oil pan (noun)
10) destiny, fortune (noun)
11) syn. differentiate (verb)
12) twice the radius (noun)
13) the industry working with trees and wood (noun)
15) the process of finding new employees (gerund)
17) telling the twist or the end of a story (noun)
The safety of those who work in mines and the potential damage caused by mining to the environment are major issues the industry has to face up to. Fortunately the geological supply of metals within the Earth remains robust and new technologies will help bring new deposits on stream. But these will increasingly be located in more remote regions, raising production and investment costs. Minerals in general and metals in particular have specific properties which give them a central role in everyday life and economic development. These are their high strength, durability, capacity to conduct heat and electricity. The search for metals has been international since antiquity. Mining turned truly global before most other branches of industry. Tracing the center of gravity of global mining over the past two centuries demonstrates its role as a foundation of society throughout history.

Open pit mining

Production is undergoing a significant shift towards open pit mining. Surface mining involves the extraction of minerals by way of an open pit, which does not require tunneling as older extractive methods did. Today, the majority of operations industry-wide use the open pit technique. The International Council on Mining and Metals reports that, “Technological developments have made it possible to mine ores of declining grades and more complex mineralogy without increasing costs.”

Extraction

Extraction activities have become more economical and innovative. Many mining companies focus on extraction activities that later form part of a chain of production, such as smelting, refining, manufacturing and commodity trading. This extraction trend is already visible in the number of steel companies seeking to enter mining to secure their supplies of iron ore and coking coal at reasonable cost.

Innovative energy sources

Commercial industries are focusing on applying new technologies and methods to their processes in order to reduce energy consumption and cultivate their renewable energy sources. This trend is so widespread, not just because of the environmental benefit, but also because many companies have seen significant cost savings by implementing renewable energy. In a recent report on the mining industry trends, it was noted that some mines have realized energy savings of 10% to 40% by investing in renewable energy installations.

Technological progress

Modern technologies create a huge potential for a positive shift of the global mining industry. These include data collection and sharing via cloud-based networks, machine learning to reduce labor costs, genomic mining solutions, wearable technologies, and even hybrid airships to more easily transport equipment to remote regions.

<table>
<thead>
<tr>
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<th>French</th>
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<tbody>
<tr>
<td>coking coal</td>
<td>charbon à coke</td>
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<td>mettre en œuvre</td>
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<tr>
<td>remote</td>
<td>éloigné</td>
</tr>
<tr>
<td>smelting</td>
<td>fusion</td>
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</tbody>
</table>

Source: ICMM (International Council on Mining & Metals)
Digitization is key to modern mining

Tumbling commodity prices, declining global demand, rising safety and security risks: the global mining industry faces major challenges while needing to meet mounting stakeholder expectations. In order to stay competitive, companies have to become leaner, stronger, and more innovative. In this context, digitization plays a crucial role by offering new possibilities to increase productivity – and operational excellence.

Demand for minerals however will remain strong, so satisfying this demand requires finding and developing new mines, even as resource use becomes more efficient and recycling systems ramp up. Fortunately the geological supply of metals within the Earth remains robust and new technologies will help bring new deposits on stream. But these will increasingly be located in more remote regions, raising production and investment costs. In the past, enhancing operational excellence in the mining industry often meant cutting costs. Today, modern technology opens up ways to set new benchmarks in productivity. Leading mining companies all over the world rely on state-of-the-art automation, energy, and drilling systems to increase mining intensity with reduced personnel and energy costs. Some of them are able to achieve energy savings of 10 to 40 % through renewable energy installations, innovative energy technologies, and highly automated mining processes.

Streamlining operations: MES

Productivity and operational excellence are key to staying competitive in the minerals industry. For this, modern information technology offers new possibilities: leading minerals companies globally are continually investing in state-of-the-art IT technologies in order to increase mineral levels with lower personnel and operational costs. For greater flexibility, improved decision-making, shorter system downtime and less unproductive hours, one option is tailor-made MES (Manufacturing Execution System) solutions. MES users gain comprehensive transparency along the entire value chain and at all facilities, e.g. from the mines to the railway and port facilities. In concrete terms, operating performance indicators from across all sites can be displayed and compared to each other. To make this possible, state-of-the-art MES solutions are capable of processing a large amount of real-time data and
serving thousands of users simultaneously. The high level of integration with automation systems reduces unproductive time since data are provided immediately and reliably also reducing manual work like typing. Additionally, a single system allows the standardization of concepts, workflows, and indicators in different units of the company. All the operational expertise of these units is gathered in a digital database, facilitating the replication of best practices and internal benchmarking.

**Stockpile management**

To optimize throughput times and guarantee requested quality output, storage and transport systems are an important part of advanced facilities for the transfer of bulk materials. What is more, with an unmanned operation of stackers, reclaimers, and combined machines, one can achieve higher performance, increased accuracy, full utilization of the stockpile area, and optimized energy consumption compared to manned operation.

Modern advanced automation solutions secure autonomous operation of stackers and reclaimers. Thus, they help to reduce operational costs and achieve a smoother and safer operation with less wear and tear of the mechanical parts of the equipment. The core element of the management system is often a stockpile 3D model which keeps a record of both quantity and quality of materials. The model is updated regularly with data delivered by stackers and reclaimers. The use also benefits from higher safety as all staff work is performed remotely. After working area and parameters for each job are specified, the details are calculated automatically and approved by the operator – then the job is transferred to the equipment. The rest is automatic. To prevent collisions and therefore equipment outages, the stockpile equipment comes with a protection system that uses data which were delivered by sensors.

**Optimizing conveyor belt systems**

With decreasing erection phases, there is no time to waste in the construction and design of open-pit mines – particularly when it comes to dimensioning belt conveyor systems. But to reveal the dynamic behavior of the whole system and to explore and improve how the individual belt conveyor components work together, it needs more than a common calculation method. Work with digital simulation tools to develop new systems as well as observing the behavior and interaction of the belt conveyor mechanics and drive solution is essential. By means of simulation, it is possible to investigate changes, influences, and consequences in the system performance during modernization. Many companies use the simulation results internally for planning and commissioning the drive solutions. Simulation simplifies the selection of the suitable drive solution and controller in order to optimize the operational and productivity ratios. In Greenfield projects, engineers have the information they need to decide, for example, whether a drive solution with a hydraulic coupling is sufficient, or whether a drive solution with a frequency converter is more suitable. Simulation also allows improvements to be made in system operation and to minimize down time.

**Improving operational excellence**

Intelligence software collects, analyzes and presents operational and business data, thereby enabling real-time performance management, and decision support – for better productivity and competitiveness. This data transparency can help mining companies optimize entire supply chains, and, where necessary, rethink their operating model. For example, how should one deal with secondary processes? Whether they should keep, sell, or expand their water treatment, power generation, etc. or whether they should consider a greater collaboration with their business partners, including shared infrastructures.

<table>
<thead>
<tr>
<th>comprehensive</th>
<th>complet</th>
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<td>erection</td>
<td>construction</td>
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<td>frequency converter</td>
<td>convertisseur de fréquence</td>
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<td>couplage hydraulique</td>
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<tr>
<td>tailor-made</td>
<td>sur mesure</td>
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Sources:
- Wikipedia, Siemens AG, miningtoday.com
Nonfiction: User Friendly by Cliff Kuang with Robert Fabricant

In their book User Friendly, How the hidden rules of design are changing the way we live, work, and play, co-authors Kuang and Fabricant explore what this actually means – to be user-friendly. After all, as they state, "user experience now occupies the center of modern life." Fabricant's second part of the book provides a brief look at how design works and ends on essential tips for user-friendly design, from "Start with the user" to "Form follows emotion". This is hands-on and a quick, interesting read. Yet, it is Kuang's text that is really inspiring. Kuang delves deeply into the 20th century to see at which moments in history this concept of "user friendly" was invented, shaped and how it expanded from a province of computer geeks and futurists to our daily lives. Kuang's text shows that usually a moment of crisis, a "monumental machine disaster", the Great Depression or two World Wars spurred great innovation since, on the one hand, usable design became a question of life or death, and, on the other hand, industrial design more than once was "a cure for flagging markets". He provides anecdotal and well-researched insight into the minds of creators and innovators, such as Henry Dreyfuss, Don Norman and Bill Atkinson, and explores which conclusions these individuals drew from their experience, and which lessons we can take away in regard to design and user-friendliness. For instance, we might believe that machines have always been designed to "fit the man", but indeed industries had to learn to work around people's "foibles and limitations": The reader can take away valuable insight, like how feedback is the keystone of the user-friendly world. Many arguments resonate with what we already know: "No matter how complex the technology, or how familiar, our expectations remain the same." However, Kuang also looks into the future and in no naive manner. He addresses trust issues with technology, for instance driverless cars, or the ethics of AI and robots acting as humans. What basically presents as a history of design and industry, and the rise of the market and consumerism also observes how human interaction has changed by "user-friendly" innovations (the Like button) and which perils this may bring to the human condition. Kuang is critical about our contemporary "world of countless transitions" but remains positive that we might solve this issue. Most importantly, he shows that all these developments are only one possible future and none of the things we make are irreversible. In the end, Kuang states, "The things we make reflect the things we value. Those values can change."

User Friendly: How the hidden rules of design are changing the way we live, work, and play by Cliff Kuang with Robert Fabricant (MCD Farrar, Straus and Giroux, 2019).

Podcast: True Crime (Audible)

There has been an insatiable market demand for "True crime" stories, and many producers and publishers have responded. There are podcasts that simple retell interesting historical cases, often with a sensationalist focus on the villain's psyche or gruesome details of their crimes. The gold standard of this format, Serial, was among the first to also focus on investigations and potential miscarriages of justice. Three podcasts series, all Audible originals, stand out due to their journalistic approach and empathy with the victims.

Evil has a name. The Untold Story of the Golden Killer Investigation is highly interesting because its focus lies on the investigative strategies and corresponding new technologies to catch a serial rapist and murderer. It highlights the investigators’ devotion to the case over thirty years, and with this introduces every major innovation in criminal forensics, from DNA to genealogy. Ponzi Supernova is different because it looks at the most famous white-collar crime of our era - the Bernie Madoff case. And finally, The Last Days of August is Jon Ronson's follow up on a podcast series of how digitalization has changed the porn industry (The Butterfly Effect). When a porn star he met during this first series, August Ames, allegedly commits suicide after being bullied on Twitter, Ronson starts his own investigation into the circumstances of August's death and reveals quite a different story.

www.audible.de - Evil has a name. / Ponzi Supernova. / The Last Days of August.
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The UK electoral system

Over the past few months people all over the world have followed events in Westminster as the long, and sometimes bizarre, Brexit saga played out.

The UK is divided into 650 constituencies, all of which have a similar number of inhabitants. Each constituency is represented by one MP who has a “seat” in the House of Commons, the UK’s lower chamber of parliament. Before a general election, political parties choose candidates for each constituency, although some of the smaller parties may propose candidates in only a few constituencies. Individuals can also run as independent candidates. In UK elections, the candidate who receives the most votes is the sole winner in each constituency — it is a “First past the post” system.

The members of the upper chamber of the parliament, the House of Lords, are not elected. They are appointed by the Queen on the advice of the Prime Minister.

UK governments usually last for five years; a winning party needs more than half of the 650 seats. The leader of the winning party is appointed by the Queen as Prime Minister and forms a Cabinet. If none of the parties win more than half of the seats, the result is a “hung parliament”. In this case, the party with the largest number of seats has two options: it can form a coalition with a smaller party or try to govern on its own with informal support from smaller parties.

What is the role of the Prime Minister? It is technically the highest executive office in the UK — since there is no president. The Queen is the head of state but is not responsible for governing.

The UK’s electoral system favors big parties, and the two biggest are the Centre-right Conservatives, also known as the Tories, and the Centre-left Labour Party. There are also parties that are linked to particular countries within the UK like the Scottish National Party, Plaid Cymru in Wales and numerous parties in Northern Ireland. Other parties are the Liberal Democrats, the rightwing and Eurosceptic UK Independence Party and the Green Party.

How are members of parliament chosen in the UK?

The Speaker is the presiding officer and his-her function is to oversee proceedings in the Commons. The speaker is responsible for ensuring that the House passes legislation supported by the majority party. In pursuing this goal, speakers may use their power to determine when each bill reaches the floor.

The Speaker’s duties include administering the oath of office to Members, calling the House to order, preserving order and decorum within the House chamber and galleries, recognizing members to speak on the House floor, and making rulings about House procedures.

How the Speaker is elected

Any MP can stand to be Speaker. All they need to do is get at least 12 colleagues to support them — but these have to be drawn from three different political parties because the role requires them to be neutral and command cross-party support. If any candidate gets over 50 % they are automatically elected. If not, MPs will be asked to vote again - but this time the candidate who received the fewest votes is removed from the ballot paper, as well as anyone who gets less than 5 % in the first round or any candidates who withdraw after the initial ballot. MPs continue to vote until only one candidate remains or one of them gets over 50 %.

Sources:

James Bryant
Financialtimes.co.uk

Speaker of the House of Commons

John Bercow, probably the most famous Speaker of the House of Commons in history.

Source: Shutterstock / Gints Ivuskans
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