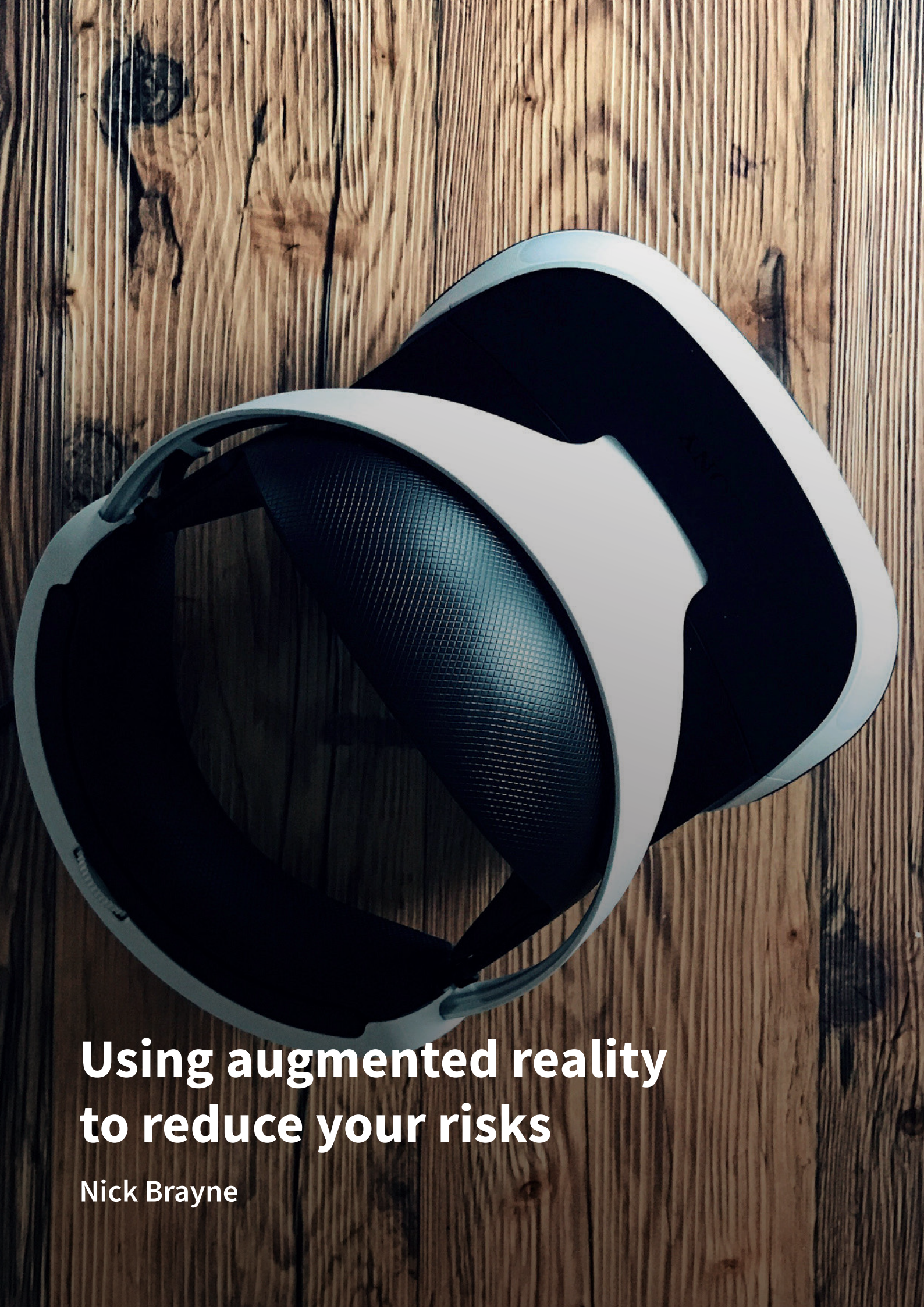

Using augmented reality to reduce your risks

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VIVE

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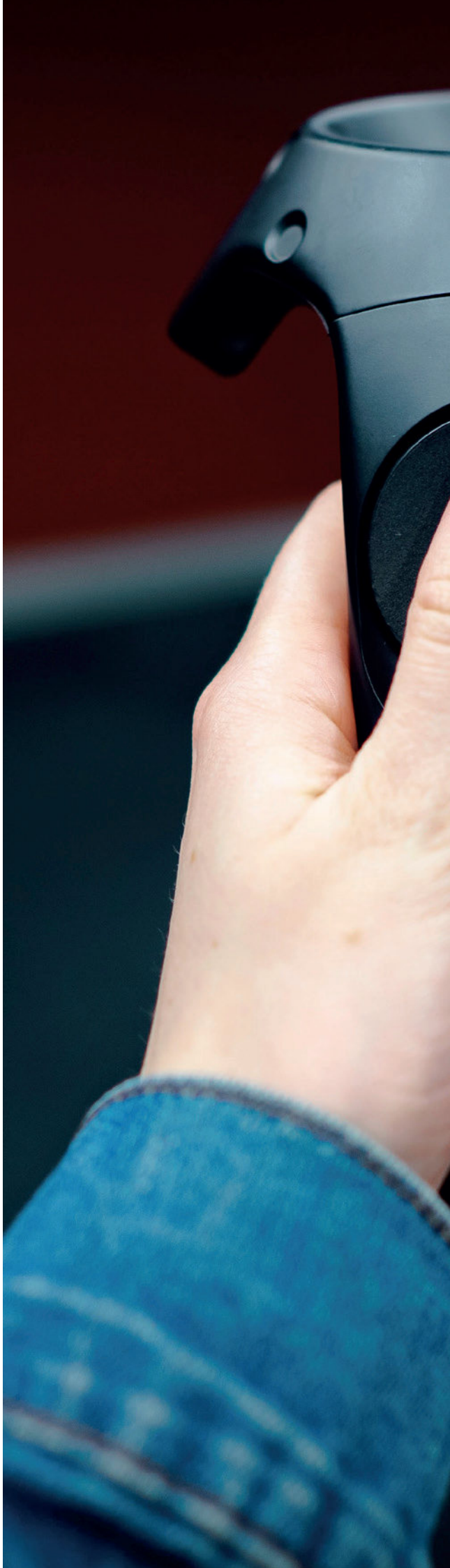
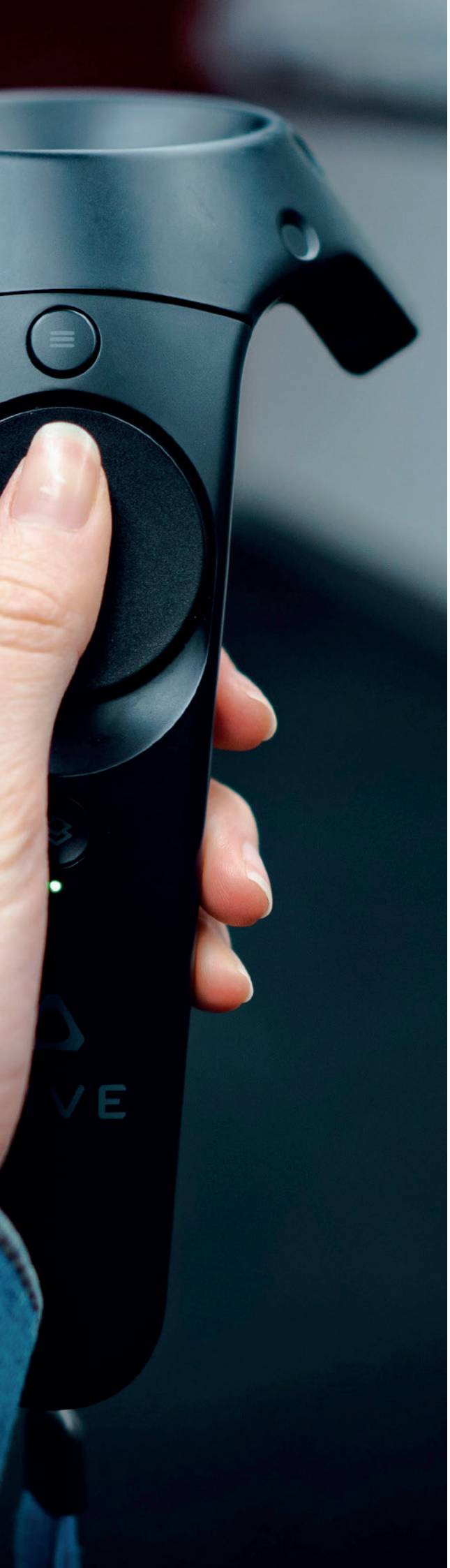
Welcome to the augmented world

From Google Glass to Pokémon Go, Augmented Reality (AR) has caught the public's imagination in the last few years. But what place does it have in the commercial world? And could it be used to help people work more safely, more efficiently, and with fewer errors?

In this article we will look at the benefits and limitations of AR, as well as some current and future applications for risk management.





What is AR?

AR is the use of technology to superimpose contextual, real-time information on top of the world around us. Essentially AR sees our surroundings, and then provides us with added detail on what it picks up.

Most applications use some kind of visual overlay to show information. That could be using a smartphone screen to display a camera image with additional information added to it. It could be a separate device such as a headset or glasses that displays information while still allowing the user to see through it. Alternatively, AR might use an existing window, for example being projected on a car windscreen. In the future we may see less intrusive forms of AR feedback, such as the AR contact lens or AR lens implants.

Although less common, AR can involve providing feedback through other senses. A system that provides a warning through sound or vibration in relation to live sensor information, for example, is also AR.

Why AR?

AR has many advantages over traditional use of computers or paper manuals and records. Depending on the use, an AR system can have some of the following benefits.

Relevant

AR provides contextual, real-time information. An engineer fixing machinery, for example, can be given details on the specific part they are working on overlaid with the part itself. There's no need to flip through a product manual or search a help file, the information is just where it is needed.

In the same scenario an AR device could also help to detect a fault, and display information on how to fix that fault specifically. This saves time in finding the right solution for an issue and helps to ensure that the wrong process isn't used.

Intuitive

AR adds information to the real world, where we are already familiar with how to interact with our surroundings. As a result, there should be very little to learn in order to manipulate the technology.

Some AR systems are passive, in that they display relevant information for their surroundings without the user needing to do anything other than look at a screen or turn on a set of glasses. In this case, as long as the information is in the right place, using AR should be no harder than reading a sign.

For systems that do require interaction, increasingly these are making use of voice commands or gesture controls to give users a seamless experience. A user can simply talk to their technology or grab at images to move them around in front of them. On a good system this could be as natural as talking to a person or picking something off a shelf. This is also helped by the rise in home devices such as the Amazon Echo introducing people to voice control systems.

Engaging

For training situations, it is much more engaging for people to interact with their environment rather than watching a video or reading a textbook.

AR systems allow trainees to experience virtual scenarios in real-life environments, and to physically go through the motions of handling the situation. Traditional training may only give trainees a theoretical understanding of how something should be done. AR can give them first-hand experience of dealing with an issue where they work, and this learning is more likely to be retained.

Providing simulation

AR can allow users to simulate situations which would be too dangerous or too impractical to create in real life. Using AR, a fire, an explosion, or an environmental hazard could be generated in a real environment. This allows the user to go through the process of dealing with a catastrophic event without risk, and in a real workplace.

Expanding senses

AR can allow a user to sense things that would otherwise be hidden to them. This could be something hidden from sight, for example the services in a building can be displayed for finding a fault in pipework, or for avoiding damage to electrical wiring during works.

Alternatively, AR might provide more information on something in plain view. An example would be displaying the temperature of a component just by looking at it, the speed at which something is turning, or the pressure in a vessel.

Storing information

Because AR systems rely on detecting the world and then overlaying it with information, they can also be used to record in real time. This applies across the board, from cameras on AR glasses, to sound, temperature and environmental sensors used to provide information, to location and activity information on the user themselves.

AR can be used as far more than a simple recording system, however. As AR interprets what it sees and hears in real time, it can store data in a meaningful way for later use. It can also be used for more specific data storage, such as transcribing notes as the user speaks in order to keep their hands free.

Potential limitations in AR technology

AR should only be implemented if it provides a net benefit against the financial cost and implementation time. Like any technology, it should not be used simply for the sake of appearing cutting edge or because it is a technology buzzword. It is therefore important to know the limitations and concerns that surround AR.

Dangerous or distracting information

It is important to make sure that an AR system is actually adding valuable information to the environment, rather than detracting from it.

When information pops up in the wrong place at the wrong time it can be a distraction or a danger. Messages that are irrelevant to the task being undertaken, for example, may lead to a user wasting time reading and dismissing these notifications. A greater concern is that a graphic could visually obscure a hazard such as an oncoming vehicle, putting the user at risk of physical harm.

Privacy concerns

AR can be seen as a form of surveillance technology, and that can lead to ethical, social, and legal concerns.

When Google Glass was launched for the consumer market it was plagued by privacy concerns in the media, with some shops and cafés even banning the Glass from being worn on their premises. In order to provide contextual information, AR has to detect the world around it. This causes concerns because it is not possible for a member of the public to tell whether this information is being deleted or recorded.

In many commercial environments this may be less of a concern than in public facing roles. In a factory, for example, there will not be members of the general public on site and the premises may already be monitored by CCTV. Justifying having another device that can potentially record people in these circumstances is much easier.

The need for correct testing

An issue that applies to implementing AR (along with a wide range of other technologies) is the need to ensure that it is tested in a meaningful way.

A good example of this is the vehicle heads-up display (HUD), which displays driving information directly on a vehicle windscreen or on a separate transparent screen. HUDs are believed to improve driver safety and awareness compared to a traditional dashboard display. Some testing has however indicated that these benefits diminish or disappear altogether when driving a more demanding vehicle – such as a heavy industrial vehicle – or if the driver is required to multitask when driving. Essentially if the driver needs to take their eyes off the road for other tasks, there appears to be less benefit to displaying dashboard information on a HUD.

This example shows the need to understand and test technology in the specific environment it is intended for. It is not enough to know that a HUD has been shown to improve driver awareness. Instead the technology needs to be tested on an individual company's vehicles in the way that the company's drivers actually use them.

High set-up costs

There are a number of AR hardware manufacturers and software developers working in different sectors. At present, however, we are not at the stage of having off-the-shelf AR products for most industries. Even where an industry-specific software package is available, some bespoke development will be needed to bring AR into an organisation.

Bespoke development is costly. In addition to monetary cost there is a time cost related to identifying what a company's needs are, liaising with hardware and software developers, and testing and revising solutions. Again, this is true of most bespoke technology implementations, but it is important to be mindful of these potential high costs when going into an AR project.

* Google Glass: is it a threat to our privacy?; The Guardian; 06/03/2013; *https://www.theguardian.com/technology/2013/mar/06/google-glass-threat-to-our-privacy* [accessed 06/03/2020]

Privacy 'impossible' with Google Glass warn campaigners; BBC News; 23/03/2013; *https://www.bbc.co.uk/news/technology-21937145* [accessed 06/03/2020]

The need for durability

With dedicated AR hardware being generally quite expensive, it is important to ensure that it is durable enough to last in a commercial environment. Replacing paper sheets with AR instructions may improve productivity and record keeping, but those AR devices will need to last a long time to recoup their costs.

Because of the need for durability, AR may be more suitable for clerical and light manual work, as opposed to heavy manual and hazardous conditions. Alternatively, it may simply be necessary to test hardware in a hazardous environment to ensure it is up to the task before rolling it out.

Issues when using personal devices

Many AR applications overcome the obstacle of high hardware costs by running on existing smartphones and tablets. In this case it may be tempting to allow employees to install software on their own personal devices, rather than purchasing tablets specifically for AR use.

It is definitely possible for this approach to work, but it can also pose certain risks. One of these is the physical risk to the device. Where you expect an employee to use their smartphone for commercial purposes you may be asking them to put an expensive device at increased risk of damage. In this case you may need to offer some kind of insurance or guarantee to employees, or you may face reticence from employees about adopting the technology.

Another key risk is data protection. By requiring employees to install commercial applications on their own devices you allow them to take company data home with them at the end of the day. If that includes personal data, you may fall foul of data protection laws. If sensitive commercial information is involved, then this could find its way into the hands of competitors, posing a trading risk to you or your commercial clients. These risks arise if information is disclosed accidentally (e.g. a phone left on a train) or deliberately (e.g. a dishonest employee).

Managing commercial risks using AR

So far we have looked at the general advantages, and some of the potential pitfalls, of using AR. In this last section we will finish by detailing five practical examples of where you can use AR to reduce risks to your business.

Maintenance roles – making information available

There are a range of risk management benefits that AR can bring to maintenance roles. Examples include allowing junior engineers to access detailed information and confer with more experienced staff, and the logging and scheduling of work.

An AR system could be used by an engineer to recognise a specific component or fault and pull up information while they are working on it. Information can then be displayed next to the area being worked on, or even overlaid onto the equipment itself with practical step-by-step instructions. Alternatively, the device could be used to speak with a senior technician, complete with pictures or live videos of the issue to be reviewed. This is particularly useful in cases where there are a limited number of expert engineers for a particular type of work, and where properties are spread over a wide geographical area.

This decreases the risks inherent in using less experienced staff. In the absence of easily accessible information an engineer may try to complete their work without reference to technical manuals. By trying to remember or guess at the process they are more likely to make mistakes.

Another benefit is that an engineer will always have the correct information to hand. For emergency maintenance this avoids the need to leave the site of a problem to find a solution. It is much better, for example, to pull up information on how to turn off water to a pipe as soon as a leak is detected, rather than searching for this information while the leak continues to cause damage.

Finally, the AR system can decrease the risk of key information or preventative maintenance being missed, by incorporating record keeping and scheduling in the device. This also has the benefit that notes are taken at the time of the work being undertaken, avoiding errors and missed information if something is forgotten after the fact.

Connected buildings – tracking unseen services

Where buildings are purpose built with AR in mind, AR systems become an even more powerful risk management tool. By including identifiers and sensors within the building services, AR users can see what is going on in the walls of the building in real time.

At its most basic level, this allows users to see exactly where all of a building's services are immediately, in order to find them for repair work or to avoid them during alteration works. In addition to the more conventional AR methods of showing information on a headset, smartphone or tablet, the services could be projected directly on to the walls of the building. This has the benefit of showing the exact positioning of services to a group of users simultaneously.

Beyond simply locating services, AR can be used to show problems in real time. Combining an AR system with pressure sensors in pipework, for example, would mean that a user could visually monitor system pressure throughout the building. In the event of a leak, the user could then see the point at which the pressure drops to locate the issue.

These applications mean that issues can be detected early and precisely, lessening the likely damage caused by faulty services. In addition, they lessen the damage done in repairing a problem, as it is not necessary to physically undertake exploratory investigations when services are easily traced.

Training – creating a safe and immersive experience

AR has extensive applications in training, where it can allow trainees to get higher-quality training and have first-hand experiences of virtual situations that it would be too impractical or dangerous to expose them to in real life.

Historically, AR has its roots in Virtual Reality (VR), which puts the user in a fully virtual environment rather than augmenting a real environment. VR, in the form of flight simulators, is now commonplace for aviation training, where it allows trainee pilots to learn skills without the risk and cost of using a real aeroplane. VR is perfect for these types of applications, where the trainee needs experience which involves remaining in a single seat with a fixed set of controls arrayed around them.

Where AR improves on VR is in situations where trainees will be more mobile. In these cases, training is more true to life if trainees can move around their workplace and experience the situation they are being trained on first hand. AR allows trainees to do just that, interacting with their real workplace but with an overlay of a specific situation.

This training works well for hazardous tasks, as it allows trainers to simulate the hazard in a safe environment without risk to the trainee or the premises. It also provides more immersive training for general use, which can improve overall training standards.

Hazardous environments – providing safety warnings and guides

Static warning signs can be overlooked once people become used to their presence, and even warning lights are only useful if they are seen by employees at the right time. AR has the potential to provide key safety improvements in hazardous environments, because it can ensure that a warning is always in an employee's field of vision and only appears when they might be at risk.

Such displays are linked to sensors in the environment, such as temperature sensors for very hot or cold equipment, pressure sensors in boilers, motion sensors for fast moving equipment, and more specific sensors such as radiation sensors. Feedback on the display can then be given in a way that is intuitive to the employee. An item that is hot might appear to glow red, for example, whereas a freezing item might glow blue.

In addition, AR can be used to help people take the safest routes out of hazardous environments. Arrows or lines can appear to be on the floor in front of an employee, guiding them out by the quickest and safest route. This technology is currently being used in Gatwick airport to help passengers find their departure gate with a smartphone, but the same application could guide the public to exits in the event of an emergency.

Driving – minimising distraction and recognising hazards

The HUD is the most common form of AR system used for driving. It displays driving information such as speed and revolution count, or navigation information, in the driver's field of view rather than on a conventional dashboard. The idea behind a HUD is to reduce risk by keeping a driver's eyes on the road, as removing the need to look in different directions and focus on different distances allows them to stay more alert to hazards.

In addition to standard HUDs which are projected on a car windscreen or a separate screen, it is also possible to buy helmet mounted displays. These are currently available for motorcyclists, and the same technology could be placed in commercial environments.

There are, however, more powerful uses for AR while driving. One example would be to display night vision information over the windscreen, making drivers aware of objects outside the beam of their headlights. In a similar vein, heat-vision cameras could alert a driver to an animal hidden behind a hedge about to jump into the road.

For commercial vehicles on a premises instead of a road, AR could be used to highlight areas to avoid. This would be useful for temporary weight or height restrictions on a building site, for example. It could also be used to highlight potential hazards from other vehicles and from work being undertaken in real time, as well as acting as a navigation aid throughout the site.

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