Workplace Training

Case Study

Augmented Reality in Workplace Training & Practice

By

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Scope of the Case Study

This case study introduces readers to augmented reality (AR) and its application in workplace training and practice. After briefly exploring the concept of AR, the case study focuses on its use in training and the workplace including its key benefits, applications and findings from industry research. Lastly, the document outlines key considerations for those seeking to use AR in their workplace training processes and how our team at Augmented Reality Experts can help you realise your AR objectives.

Introducing Augmented Reality

What is Augmented Reality?

With the advancement of technology and changing demands of an increasingly digitally native a population [1], augmented reality (AR) continues to enter more and more facets of our lives. One of the earliest widespread examples of this was in sports coverage where additional information such as touchdown lines or 3-point markers have been superimposed over the live playing area – augmenting the viewer's experience. Similarly, gamers often engage with different forms of AR, one being when they look through a screen or lens containing supplementary information about health, targeting systems, location, weapons etc. that responds to their surrounds. AR is defined by this bringing together of the real and the virtual to enhance our knowledge and understanding and help us do things better and more efficiently [2].

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"With augmented reality we harness the affordances of technology to provide users with an enhanced experience by adding a layer of digital information to our experience of the world around us. This experience can be delivered in many ways using different technologies across different locations for various purposes and industries"

Alec, Augmented Reality Experts

AR can be conceptualised as being part of a continuum ranging from virtual reality (completely synthetic) through to telepresence (completely real)[3], which is the end AR falls closest to [4, 5]. Unlike virtual reality which takes the user to a new world, AR does not seek to replace reality, but rather use it as a background [6]. AR is not limited to certain tools or technologies, and has been understood as a technique comprising three key characteristics; that it combines real and virtual, is interactive in real time and registers in 3D (although 2D options are possible) [7]. Regardless of how one defines AR, when we use it we are no longer a "detached observer", but rather enter the digital environment and interact with it [2].

Why use Augmented Reality?

It is the blending of the real and digital that grants AR such widespread potential, yet has simultaneously posed technological challenges. For AR to function well objects need to be tracked in space and time so that the virtual and real visually align and coincide in real time. While these requires serious resourcing needs may have previously held the industry back, digital natives are now demanding more innovative and interactive opportunities. Coupled with the widespread adoption of smartphones and other personal devices, these drivers have spurred interest from developers and companies in recent times [8]. As a result, AR is becoming more widely known and better understood, especially since the successful release of PokemonGo in July 2016 which bough AR into the lives of millions across the globe [9].

Beyond its interactivity, ability to provide additional information and immersive nature, AR can assist with learning and memory processes. The key principle being that we tend to "remember things better when they are spatially associated with locations in 3D spaces rather than as abstract ideas" [2]. This process of remembering things by relating them to spatial locations can be used effectively to recall information by walking back through certain places or 'loki' [10]. These characteristics of AR make possible countless applications across industries ranging education and training, property, gaming, retail, personal and public use.

Augmented Reality in the Workplace

Applicability of Augmented Reality in Workplace Training and Practice

While the adoption of AR in business is still in its early stages, the use of AR is maturing and many organisations now use it effectively as an internal workplace tool to improve business processes, workflows and employee training[11, 12]. In this sense, the use of AR in-house seeks not to replace workers but to bring people and technology together to

improve operations and outcomes. For example, Ryan Pamplin, vice president of Meta, a Silicon Valley start-up, notes how AR is "dramatically speeding up the design process, reducing the need for physical prototypes and shortening time to market," and could even help save lives. "And I can't think of better ROI than that"[12]. Here we see the potential safety benefits of AR illustrated. AR workplace training enables workers to experience and respond to simulated hazardous or challenging situations in the safety of a controlled learning environment. It also means that new workers can immerse themselves in the work context without causing disruptions to production.

In particular, it is AR's ability to augment the user's experience of reality by facilitating interactivity, sensory immersion, mobility and location-specific contextualisation that makes it perfectly suited to workplace training [13]. The holograms made possible by AR are also "particularly useful tools for visualizing data because they engage the spatial awareness part of the brain that allows humans to understand complex concepts more quickly and promotes greater retention" [Mullins cited in 14]. Moreover, AR is able to replicate contexts that employees will encounter on-the-job and provide learning experiences that align with adult learning theory [13]. Namely, adults need to know why they should learn something; they prefer practical and applicable learning contexts; and are motivated to learn if the training will help them better cope with actual job and life tasks [15].

What the Research Says

While the use of AR in workplace training and development is becoming more common and Goldman Sachs predict that the hardware and software market for AR and VR will grow to about US$80 billion by

2025[16], the body of research in the area remains limited and focuses mostly on detailing single case study examples of use. However, some key insights are listed here.

The use of AR in the workplace and workplace training can:

- Reduce training costs [17]

- Reduce training times [17]

- Improve understanding, especially when dealing with complex content and ideas [14, 17]

- Increase engagement in the workplace [16]

- Reduce the time needed to perform certain tasks and checks [12-14]

- Facilitate and inform real-time decision making

- Be enjoyable for employees [12]

- Help visualise supply-chain and other critical data [14]

- Decrease the rates of errors that cause injuries at work [18]

Common challenges to consider:

1. **Costs.** Set-up costs have tended to limit the implementation of AR to medium and large businesses, however, with the costs of the related technologies set to keep decreasing this is making AR more and more accessible [12].

2. **Usability.** AR technologies need to enhance the experience of the user not hinder or obstruct employees. As such, ensuring the appropriate AR hardware and software mixes are used in different situations is critical to success and employee safety [12].

3. **Lack of applicable governance frameworks and policies.** Many businesses lack appropriate regulatory structures which can create reluctance to use AR or result in inappropriate and unsanctioned uses. As such, ensuring relevant policies are in place is foundational to success [16].

4. **Employee reluctance.** As with anything new, there is often resistance to change if it is not managed well. AR can be viewed as a threat to jobs or existing ways of doing things. As such, it is important to focus on how AR will improve the work experience for employees as well as overall outcomes and performance[12]

5. **Security concerns.** Such concerns highlight the need to build-in security protocols into every part of such processes these days. It also emphasises the importance of monitoring their use as one does with social media and other software platforms [16].

6. **Lack of knowledge and skills.** While this can be seen as an initial barrier, if the introduction of AR is supported by positive training and development it can offer a great opportunity to improve employee skills [16].

7. **Motion sickness / headaches.** In some limited cases this has been a limitation although it is more commonly associated with the use of VR [12].

Different uses of Augmented Reality in Workplace Training and Practice

Access to real time information

AR can be used to identify and draw attention to objects of interest in the vicinity such as those generating heat, creating radiation or moving. AR can also provide real time information (including remote assistance) to workers in hazardous situations, such as where to go when visibility is low. Supplementary information about objects of interest such as their size, distance, weight, danger level and model number etc. can also be augmented, helping employees make informed decisions.

Simulations and training

Through providing immersive simulations AR enables workers to learn and practice essential skills. For example, sailors on the USS Milius have used AR to improve emergency responses to fires using AR simulations. Computer-generated fire and smoke images superimposed on display screens inside AR-instrumented self-contained breathing apparatus masks create the realistic illusion that actual fires are burning on the ship [17]. Whether responding to fires, performing dangerous tasks or learning a new skill, AR simulations provide life-like opportunities to learn, reflect and refine employee actions in safe and controlled environments.

Design and modelling

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AR can provide 3D models of products and processes to assist staff to conceptualise items (especially for customised products), production processes, organisational structures and other complex relationships.

"I have always struggled with organizational charts because they were a two-dimensional map of a complex, very three-dimensional idea," but now I can *"visually represent not only direct reporting structures but also cross-functional teams and workflows using space instead of a flat plane. I can even walk around it."*

Meta's HR Director, Maggie Elkin [12]

Quality control and process improvement

Having access to step-by-step instructions in real time reduces the likelihood of employees making mistakes and enables them to perform complex tasks more efficiently. AR can also integrate interactive checklists and timely reminders that can help improve quality and safety [18]. For example, AGCO Corp., an agricultural equipment manufacturer in the US, successfully employed AR on the factory floor by giving their workers augmented-reality glasses that display diagrams and images of instructions to help them conduct quality checks on tractors and chemical sprayers [14].

Data collection and performance review

Recordings and other data captured through the use of AR technologies can also be used to identify issues, refine techniques and improve outcomes. While we may be overloaded with data these days, AR can help make better sense of it.

"AR can be a game changer in data and analytics because it's so much more immersive,"

MIT Researcher, Dr. Winkenbach [14]

Desktop and office enhancement

AR headsets can be used in ways that do away with the need for laptop and desktop computers. For example, gestures can be used instead of the traditional keyboard and mouse to check emails and complete other office tasks in a much more visual and mobile environment.

Future of Augmented Reality in the Workplace

Despite being dominated by big business, the use of AR is predicted to increase sharply in coming years. Estimates suggest that some 14.4 million U.S. workers will be using smart glasses by 2025 with large companies spending $3.6 billion, up from the $6 million spent in 2016 [14]. As technology and hardware develop further, costs will continue to decrease, opening up the scope and market for AR in the workforce. With researchers at Stanford University's Human Interaction Lab already exploring ways to add smell and touch to virtual reality experiences, the quality of the immersive learning experiences made possible by AR will only continue to increase.

Twenty years from now, AR may be seamlessly integrated into all jobs and across industries, or it might just make sense for specific,

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highly technical uses. It's the beginning for this sci-fi-like tech—and while its position in the workplace of the future is still unknown, its potential is very real.

N. Kroc, Staff Writer at Society for Human Resource Management [12]

How ARE Can Work with You

The use of AR in the workplace in Australia is an exciting and developing opportunity for businesses of all sizes to capitalise on as they mix the boundaries between mobile, online and the real world. At ARE we are a team of specialised individuals that combine skills across business, architecture and engineering, software development, animation and 3D rendering to create innovative AR applications. We are passionate about AR and work closely with our clients to find new and creative ways to leverage the affordances of AR to meet their diverse objectives. We are based in Melbourne with representation in Sydney and Adelaide and look forward to realising your AR ideas with you.

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AR App Design Considerations

Project Title:

Key Objectives

☐ Improve processes &/ or product quality
☐ Improve employee efficiency & skill (decrease reliance on specialist individuals)
☐ Collect & visualise data
☐ Reduce employee risks (improve OH&S)
☐ Reduce employee training time & costs
☐ Improve hazard responses
☐ Improve employee engagement
☐ Other (specify)

Relevant AR Affordances and Characteristics

☐ Provide employees with additional on-the-job information
☐ Provide immersive, life like training simulations
☐ Geotagging and GPS tracking
☐ Interactive gaming
☐ Offer the ability to virtually try-on or try-out products (incl. smart mirror)
☐ Provide 3D virtual product & process visualisations
☐ Provide interactive checklists, review tools & site inductions
☐ Provide access to step-by-step guides in real time
☐ Enable remote assistance to employees
☐ Change up the traditional desk environment
☐ Other functions (specify)

Data Collection

Which, if any, key data metrics or analytics would you like to capture?

Context of App Use*

Intended location/s of use (shop floor, warehouse, home etc.), activities being performed (operating machinery, driving etc.) and clothing or PPE in use.

*Note: Context of use will have implications on hardware choices and safety considerations

Safety and Security Considerations

What potential security risks need to be considered?
  Access to personnel/client information
☐ Access to company data & intellectual property
☐ Other (specify)

What potential safety risks need to be considered?
  User distraction
  Hardware obstruction / interference with work duties
  Provision of inaccurate information
  Other safety & security risks (specify)

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Hardware

☐ Smartphones   Laptops
   Tablets   Desktops
   Smart glasses   Other (specify)
   HoloLens

Software Considerations

Licensing	Integration with existing platforms
Updatability & modifiability	Intended audience (public, internal)
Ability to work offline	Individual or group use
Data exporting formats	Intended duration of availability

Which platforms do you want it supported on?
  Android
  iOS
  Other (Specify)

Relevant Policies

What company, government or regulatory policies are relevant?

Workplace Readiness

- How does AR fit with existing workplace practices?
- Are staff members familiar with AR technologies?
- Is there sufficient and appropriate tech support?
- Do employees understand the potential of AR to enhance the work situation?
- How will AR influence and potentially challenge current norms or expectations?

Content, Design and Messages

- Design priorities - ease of use, practicality, enjoyment, look, feel
- Key topics and/or processes to be included
- Information layering
- Legibility, flexibility, interactivity
- Visual clues - images, graphics and video
- Key phrases and messages
- Relevant teaching and training approaches and pedagogies
- Examples of themes or storylines from similar applications
- Colour schemes, fonts, branding
- Specific characters, products, animals or objects
- Information delivery (visually, aurally or both)

Notes

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