INTRODUCTION

* ByHard has an established a niche in the market but the competition for mobile games similar to that of ByHard's has become competitive and oversaturated. It has been decided that for ByHard to maintain relevancy in a fiercely competitive market, it is time to adopt a new direction.​
* ByHard Studio in the development of 2D mobile games, our scope is focused on technologies and practices that are going to be the most useful for the studio with the best implementation that does not hinder our production of these games.​
* To achieve our goals and implement changes within the next 6-12 months the evaluation of three emerging technologies; Augmented Reality, Artificial Intelligence, Virtual Reality, as well as three emerging practices; Automated Testing, Working from Home Online and Streamlining the Game Dev Pipeline will be undertaken within this PowerPoint presentation.​
* A S.W.O.T analysis will be performed to determine the viability of each technology and practice within ByHard and to detail the potential opportunities and threats of their use. By conducting research, we will be able to successfully identify the best strategy to move forward as a studio and identify potential hurdles along the way. ​

# EMERGING TECHNOLOGIES

AUGMENTED REALITY

* Augmented Reality (AR) is an emerging technology that combines the virtual world with the real world. It has become widely popular over the last few years and has seen an increase in the gaming scene and other media.​
* AR technology displays digital elements in real life, often with some form of interaction with the user. AR technology is most seen on mobile devices as most phones are equipped with cameras.​
* Most AR programs use 3D models and information to display as it pushes the illusion that the digital models are active in the real world, where a 2D character may not generate the same effect. ​
* Augmented Reality could be adopted and used within the studio to enhance offerings with games featuring this technology. By combining knowledge from the development of previous titles into an AR game to create a captivating and highly interactive experience for the player. ​

POSITIVES OF ADOPTION

* By integrating the Augmented Reality technology into the studio, it moves the direction of the company out of an oversaturated market of 2D mobile games into a market that is still in its early stages. ​
* By creating a game using Augmented Reality technology it will create a unique experience for players by blending the best of both the digital and physical world. ​
* Augmented Reality is most commonly used on phones, this is a positive for the studio particularly because all prior game development has been for the mobile platform. ​
* Unity is commonly used to make many of the AR games already on the market, as this is the engine that the studio uses, it will be familiar in layout to use and learning the basics of the engine will not be necessary. ​

NEGATIVES OF ADOPTION

* Most AR games feature 3D assets to display within physical environments, as the studio currently develops games using 2D assets, we will need to both find staff capable of producing 3D assets and appropriate modelling software. ​
* As the studio has mainly focused on 2D games for the mobile platform, a change to an Augmented Reality game will require the programmers to adjust to a new development system and to learn all the tools that will be used. ​
* Development will take longer and cost more to produce as a result of the technology being unfamiliar to the team and more issues may appear during the process in the form of bugs and glitches. ​
* There is no guarantee that the game will be successful when it is finished and launched onto the market, and as AR development can be costly, it could result in a larger loss for the studio. ​

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| - The game studio has already established an audience from previously developed titles and will ensure that the AR game will receive recognition from fans of the studio. ​  ​  - The game studio has experience with releasing and developing for the mobile platform and as most AR games are made specifically for Android and IOS devices, there will already be a level of familiarity with part of the development process.​  ​  -Unity is widely used as an engine to create AR games and as the studio already uses it for its projects, the basics are already known for software layout and the usage of many of its tools. ​  ​ | -The studio is unfamiliar with developing AR games and will take time to learn the tools that are needed. ​  ​  - Most AR games utilise 3D assets for characters and other objects to appear in the real world, as the studio currently uses 2D assets for its games, it will need to find software for 3D modelling such as Blender and hire artists who are used to creating 3D assets.  ​  ​  -A lack of version control may disrupt workflow, especially considering the development of an AR game is a first for the studio.​  ​ |
| - If the AR game is successful, there is the potential of establishing a new audience and growing brand recognition. ​  ​  - By incorporating AR into the studio, it will diversify the offerings of games, and ensure that the studio is not stuck making one genre of game. ​  ​  - Creating the AR game will support the studio’s shift into a new market that is not oversaturated and highly competitive. ​  ​ | - The game may be overshadowed by other releases that are already on the market. ​  ​  - Other studios with more expertise with working with AR technology could rival our game studio and draw attention away from the game that we have produced.​   * ​   - Other studios with higher budgets and more workers could produce an AR game that simply could not be developed by a studio with our current limitations. ​  ​ |

SOURCES

* [%2C%20typically%20movement](https://www.interaction-design.org/literature/topics/augmented-reality:~:text=Augmented%20reality%20(AR)%20is%20an,the%20user's%20environment%2C%20typically%20movement).​
* This source from the Interaction Design Foundation (IDF) describes Augmented Reality technology in depth with information regarding its place in extended reality and the appeal of the technology. The Interaction Design Foundation is a non-profit online educational organisation that provides open access to materials for learning design. The IDF was founded in 2002 in Denmark and has had over 125,000 graduates from its courses. It is intended for graduates and those seeking to learn about design by providing courses and materials to do so. The source is relevant to the topic as it explains the potential of Augmented Reality technology in our society and its appeal. It is a reliable source that aims to educate readers about AR technology. ​
* <https://www.digitalartsonline.co.uk/features/hacking-maker/everything-you-need-know-about-designing-with-augmented-reality/>​
* The source from Digital Arts Online is a magazine made for professional designers and artists. The magazine seeks to inform readers of different aspects of design including UX, 3D, VFX and both VR and AR technologies. The source about AR was published on the 10th of August in 2017 when the technology had become widely popular and offers information that is still extremely relevant today. The source is relevant to the research as it describes the technology, including what it is and how it works. The source is reliable as it informs the reader about the purpose of AR technology and its current uses. ​
* <https://www.intelivita.com/blog/benefits-of-augmented-reality/>​
* The blog post from Intelivita describes the many strategic benefits of Augmented Reality for use in businesses. Intelivita is an India based company that specialises in the development of mobile apps for businesses. The intended audience for the blog is businesses seeking to broaden their offerings and develop unique experiences for their customers. The source seeks to relay the usefulness of Augmented Reality to businesses. The source was published last year on the 29th of January and is entirely relevant to the research as it explains the benefits of the technology. The source can be believed to be credible as Intelivita offers mobile development services and has experts on the topic.​

ARTIFICIAL INTELLIGENCE

* Artificial Intelligence (AI) has been used in games for decades, typically in the form of enemies for the player to encounter. Most AI are typically built using a Finite State Machine (FSM) where the AI responds to a player with behaviour that is pre-programmed.​
* The drawback of the FSM is that it is predictable. However, AI with learning capabilities have begun to be used in games to give players a unique experience each time they play.​
* AI that are programmed with this behaviour in mind are unpredictable and can calculate the outcomes of certain actions and decide upon the best course to take. ​
* For the game studio, Artificial Intelligence could be adopted and utilised in its games to provide a suitable challenge for the player. By using a learning algorithm for the AI of a game, every time a player decides to play the game it would be unique and create more replayability for the player to continue playing the game.

POSITIVES OF ADOPTION

* An AI that can learn will provide a better challenge for players and is not predictable. Once the AI has found a pattern in how the player plays the game, it can formulate a way to counter the player's actions to encourage the player to constantly be aware of what is happening. ​
* Machine learning for an AI will make a game more replayable as the AI will be different each time and not suffer from repeating patterns. ​
* A learning AI will help to create a dynamic and realistic game experience that feels more interactive with the player as it changes how it behaves through player interaction. ​
* This form of AI is particularly useful in Real-Time-Strategy games, where players need to formulate suitable strategies to beat the enemy and would provide them with an experience closer to that of a real player as an opponent.

NEGATIVES OF ADOPTION

* An AI that learns is harder to program and implement into a game and would require a significant amount of work. ​
* This form of AI is also hard to test for developers, as it can change every time, they test the game. This also means that it is harder to know if the AI is performing as expected on not causing any unexpected behaviours that could impair a player's experience. ​
* If the AI adapts too quickly to player decisions, it could become too hard for the player to beat, leading to frustration. Player frustration could lead to poor media reception of the game.​
* Incorporating learning capabilities into an AI makes it so that developers can no longer completely control the experience of a game, whereas with other methods the developer can decide exactly what they want an AI to do

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| - The studio has programmers who would be able to test and create the proper implementation of the AI after experimentation. ​  ​  - As most staff members are located in a head office, collaboration between programmers would be easy to help work out any problems with code as they can simply talk to each other to figure out what is causing any issues.​ | - A learning AI is hard to control and may warrant unexpected behaviours that the developers may not want for their game.​  ​  - Creating an AI that uses machine-learning is a complex process and as the studio has most likely only used Finite State Machines for previous games, creating a complex AI have issues in the first implementation.​  ​ |
| - Creating a game where the AI can learn and adapt to situations would draw media attention to the game as there haven't been many games that involve this type of AI. This would help to market the game and get people interested in it. ​  - By creating a unique implementation of AI for the studio's games, it could draw in new fans from customers looking for a new experience.​ | - Other studios with larger budgets than our game studio could create a better implementation for their games as they have more resources. This may lead to the company taking customers away from the game studio's game. ​  ​  - After the game is released, it may not receive much attention from the public due to other games on the market and would result in a loss of money. ​ |

SOURCES

* <https://sitn.hms.harvard.edu/flash/2017/ai-video-games-toward-intelligent-game/> ​
* This blog from Harvard University describes and depicts Artificial Intelligence and new innovations with algorithms that can help game designers to create unique experiences for their players. Harvard University is an institution that was originally founded in 1636 in Cambridge, Massachusetts and teaches a wide range of subjects to enrolled students. This source is intended to elaborate on innovations in AI technology and to explain past uses of the technology for games. The source is relevant as it explains both positives and negatives of AI that use machine-learning. ​
* <https://link.springer.com/content/pdf/10.1007/978-3-319-63519-4.pdf> ​
* The 'Artificial Intelligence and Games' eBook from Springer provides a thorough and in-depth analysis of AI as a technology and its usage in games. It describes the use of AI in games and both the why and how developers use AI. The publisher of the eBook, Springer, is a German multinational publishing company that publishes many scientific, technical and medical books and eBooks to a worldwide audience. The eBook is aimed at developers who are looking to advance their knowledge of Artificial Intelligence significantly by going into the ins-and-outs of the technology as a whole. It is relevant as it depicts machine-learning uses for Artificial Intelligence and how it can and has been used. ​
* <https://www.sciencefocus.com/future-technology/free-guy-artificial-intelligence-npc/>​
* The article from the British Broadcasting Corporation's (BBC) Science Focus Magazine elaborates on reasons why Artificial Intelligence for games should remain developer controlled without learning capabilities. The BBC is a public service broadcaster based in the United Kingdom and provides news and information worldwide. The article provides reasons as to why self-learning Artificial Intelligence has many negative aspects with the technology, such as increased computational power. It is relevant as it discusses why its incorporation into games could worsen or impact a game negatively as they can be much harder to work with for developers. ​

VIRTUAL REALITY

* Virtual Reality (VR) is computer generated or artificial 3D environments that are designed for the user to feel as if they are in there in real life. ​
* Whilst true VR has risen in recent decades the term Virtual Reality and the concepts behind it became popular in the 1980s and many failed attempts at VR soon followed.​
* Most famously the Nintendo Virtual Boy was a disaster which only incorporated a head set and somewhat "3D" like environment other than that it was uncomfortable and ugly to look at, having a very limited colour palette of reds and blacks, often leading to strain on the eyes.​
* If managed and incorporated well with the threats and opportunities in mind, taking on VR systems and development has the potential to be of great benefit to the studio by way of technological expansion, greater work variety possibilities, and broader audience reach. ​

POSITIVES OF ADOPTION

* Greater audience reach, including those of the existing 2D enthusiasts, and the 3D enthusiasts, as well as VR enthusiasts.​
* Increases future tenders available for business as the studio will acquire the ability to produce not only 3D assets but VR environments as well.​
* Increases the studio's viability for remaining on top of the technological market as VR has been seen to be rapidly increasing in popularity and is involved in one of this century's potential major technological advancements, in a similar vein to true virtual holographic projection (as seen in sci-fi movies like *Star Wars*), which is becoming increasingly likely to become reality considering VR's development since the 1980's.​
* Since the HQ is in the heart of the CBD, electrical, internet bandwidth, and security demands for incorporating VR systems and developing games would be at an advantage.​

NEGATIVES OF ADOPTION

* The cost of initial setup for implementing VR-ready development tools and training is substantially high. VR (and 3D asset) development tools are much more available and supported on Windows OS and devices, which would require an investment into at least a couple of new devices and software purchases. Training on these new tools will take a considerable amount of time, and potentially even a new staff hire to ease the process.​
* Being in a centralised CBD office space, there is bound to be a small lack of space required for the physical equipment to be stored and used. It would take time to rearrange the office space to allow for this new technology.​
* As the studio has only been familiar with 2D software and assets thus far, even with training, production will be notably slower than it has been with its previous projects. This may also affect staff morale negatively.​

SOURCES

* <https://developer.oculus.com/documentation/unity/book-unity-gsg/> ​

Oculus, the company itself that designed and created the VR Headset and software, wrote out its requirements on their official website (*oculus.com*) for developers that are wanting to create VR games or programs that support the Oculus headset and several their other headsets.​

* <https://support.oculus.com/articles/getting-started/getting-started-with-quest-2/space-to-use-quest-2/> ​

Oculus' official company support team that help troubleshooting their virtual reality hardware and software, wrote out guidelines on the dimensions of physical space required to utilise their headsets, in the interests of consumer safety, practicality, and enjoyment.​

* <https://developer.oculus.com/documentation/unity/unity-cross-platform-dev/> ​

Oculus, a leading VR hardware/software company in the United States, wrote a more in-depth guide on the ins and outs of programming and producing software that is functional across multiple platforms, not just their own products. It demonstrates and aids developers to produce software or games with flexibility and robustness.​

* <https://www.oculus.com/blog/connect-future-of-work-vr/> ​

*Meta Platforms* (the company that owns Oculus) wrote to its consumers and the public about the current qualitative issues with the current hardware experienced with their products, and by evidence across all VR Headset-producing companies, common ones. They address what the future hardware might look like for VR systems and how practical it may be, thus contributing to any prospective gaming studios or companies' insght and analysis on use of VR systems.​

* <https://static1.squarespace.com/static/537bd8c9e4b0c89881877356/t/5383bc16e4b0bc0d91a758a6/1401142294892/yavb1g12_25879847_finalpaper.pdf> ​

Yuri Boas, a researcher for *School of Electronics and Computer Science University of Southampton*, wrote this paper in 2014 addressing a partly summerised history of virtual reality technology for fellow academics and personal research. In it, they state "*it is important to notice that virtual reality popularity is increasing as a result, as it can be seen through the recent success of emerging technologies and products throughout the decades.*" The relevance being that virtual reality, as a whole, is increasing in popularity even predicted 8 years ago and is only forecast to grow rapidly.​

* <https://virtualspeech.com/blog/history-of-vr> ​

VirtualSpeech is a training provider for VR solutions, a company that focuses on training people with social anxiety through the use of virtual reality. In their blog post written for the general public and consumers, they list and give overview to many virtual reality systems through the past 40 decades, giving relevant evidence to virtual reality systems' climb in practicality in daily life and popularity by the gaming community.

* <https://www.statista.com/statistics/591181/global-augmented-virtual-reality-market-size/> ​

Statista.com is a data consolidator at its root and has shared its data with the public in 2021 on virtual reality/augmented reality on the market and its predicted growth, from a monetary perspective.​

* <https://au.oberlo.com/blog/virtual-reality-statistics> (rapid VR growth and forecast)​

Written at the beginning of 2022, au.oberlo.com (a *dropshipping goods* company) wrote a blog post about their predictions and available data relating to VR systems for the general public. Relevant to any game studio looking at, or currently, developing VR games/software it is information worth considering when asking the question of opportunity for the studio; read parallel to other sources of prediction/forecast, such as statista.com.​

Other possible sources to use:​

* <https://www.oculus.com/blog/what-is-virtual-reality-all-about/>​

Oculus, a leader in VR technology, wrote a blog post at the end of 2021 for consumers of their products about the fundementals of VR – what it is, who uses it, and a brief touch on what you can do with it. The information provided from this direct source on VR systems would provide any studio valuable insight that would be considered when looking at potential opportunities for gaming, as well as identifying weaknesses when it comes to development with the VR technology.​

* <https://www.theguardian.com/technology/2016/nov/10/virtual-reality-guide-headsets-apps-games-vr>​

Freelance journalist for *The Guardian*, Suart Dredge, wrote in 2016 to the public about the then-current state of VR and HMD VR systems, along with their requirements and accurate costs (at the time of writing). They also go into synopsis of different applications of virtual reality. The article serves as a second-hand source of mixed qualitative and quantitative information that would aid in deciding the platform and scope of a VR project for an inexperienced studio. ​

* <https://abcnews.go.com/Technology/wireStory/missing-moment-virtual-realitys-breakout-elusive-78018239> ​

Much the same as being aware of an emerging technology's benefits, being informed on its issues and unpopular opinions would prove equally as valuable to anyone seeking to develop games for it. MAE ANDERSON AP wrote for the *ABC News* in their article in 2021 about the mistakes and issues that consumers are having with HMD VR systems and shares a possible qualitative reason as to why VR has not yet surged in popularity as many might thought it would as certain devices came to light.​

* <https://www.forbes.com/sites/bernardmarr/2021/06/04/future-predictions-of-how-virtual-reality-and-augmented-reality-will-reshape-our-lives/?sh=6ff6769768b4> ​

Bernard Marr wrote an article for *Forbes* magazine for their consumers in mid-2021, expressing predictions and possibilities to VR application to our daily lives now, and moreso in the future. While it is not a source of technical or calculated data, it carries value in congruency with other more quantitative sources about the longevity and expansion of the VR technology in the future. Any company looking to keep up with new technology might find this insight worth considering in their business analysis.

# EMERGING PRACTICES

AUTOMATED TESTING

* As a practice, Quality Assurance has been utilised and employed in the games industry for years to find glitches, bugs and inconsistencies that affect the game experience.​
* Quality Assurance requires a game tester to break a game in any possible way they can to root out issues that may be encountered by the thousands or even millions of players when playing the game. ​
* The use of Artificial Intelligence in the Quality Assurance process of games aims to speed up the process of testing by running thousands of test-cases within the span of 10-15 minutes, this practice is also known as Automated Testing. ​
* The practice of Automated Testing could be applied within the game studio to test for bugs within its upcoming game projects. The AI could point towards bugs in the game to assist programmers with the polishing of the game. By using Automated Testing, it could reduce development costs and identify any issues with the code of a game. ​

POSITIVES OF ADOPTION

* Can find bugs and glitches rapidly and assist developers with fixing issues with their games in a process that is generally much faster than with human play testers. ​
* An AI doesn’t get tired or bored of its work, unlike a human play tester. This means that the AI would be more efficient for the studio.​
* An AI can run thousands of different test cases in a short span of time to find errors and can help the studio to recognise if a games functionality is working according to plan. ​
* Asides from just testing a game, an AI can determine if there is code that could be potentially removed to improve performance without hindering the overall experience.

NEGATIVES OF ADOPTION

* Although an AI can perform thousands of test-cases at a time, they cannot match human testers in larger environments such as in an open-world game. ​
* AIs cannot determine whether or not a game is fun or enjoyable to play unlike a human tester, where they could provide input on the experience and offer critiques on the core elements of the game itself. ​
* To implement Automated Testing into projects, it can be quite expensive to develop the systems needed for the AI to work within the game. ​
* An AI will only follow what it is programmed to do and cannot replace manual testing where human play testers are used.

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| - Introducing Automated Testing into the game studio will assist developers with quality control and ensuring that any games ​  produced are relatively bug and glitch free. ​  ​  - As there currently are no Quality Assurance testers in the studio, introducing Automated Testing will significantly help programmers to identify issues. ​  ​ | - Automated Testing can be costly to implement, as the game studio has typically focused on smaller mobile games in the past, ​  implementing the practice could cost more than the studio can afford. ​  ​  - As the game studio has typically made 2D mobile games for past projects, implementing Automated Testing into future projects may be overkill and could take much-needed time away from the development of the game itself. ​  ​ |
| - The utilisation of AI in game development has become far more common than it was even five years ago, and there are companies that can assist with implementing Automated Testing practices into the studio.​   * ​   ​  - Automated Testing will help the studio remain competitive on the market as games will receive more polish in a shorter amount of time through the help of AI. ​ | - After producing a game with assistance from Automated Testing and creating a product of quality, it may not receive much attention from players as other games from much larger companies typically receive most of the market share. ​  ​  - The fierce competition on the market will make it harder to draw players onto the game, even if significant effort has been taken to ensure it is of utmost quality through Automated Testing. ​  ​ |

SOURCES

* <https://blog.qatestlab.com/2020/07/02/ai-game-testing/>​

QA Test Lab is a Ukrainian based company that provides independent software testing and QA services and has over fifteen years of experience delivering QA services across multiple different industries. The source is targeted towards those seeking to learn the appeal of AI for game testing purposes and informs the reader about the uses of the technology. The source is reliable as it is from a company that offers services similar to what is outlined the blog post. ​

* <https://www.gamedesigning.org/video-game-tester/>​

GameDesigning.org is an organisation that serves to encourage readers to explore and learn about game design aspects. The audience for this article is those that are aspiring to become video game testers as the purpose of the article is to thoroughly explain the ins-and-outs of game testing. ​

* <https://venturebeat.com/2021/10/07/reinforcement-learning-improves-game-testing-ai-team-finds/>​

VentureBeat is an American technology website that covers emerging technologies and is considered a media authority for Artificial Intelligence and Machine Learning. The article is aimed at businesses to advise them about the workings of AI in Quality Assurance.​

* <https://www.testbytes.net/blog/pros-cons-automated-testing/>​

Testbytes is a software testing and QA consulting company based in India and was founded in 2013. The article from the company intends to list the positives and negatives of Automated Testing to inform businesses of the benefits and downsides of the technology.

WORKING FROM HOME ONLINE

* Working from Home has become a common practice amongst many workplaces worldwide as an effect of the COVID-19 pandemic and allows staff members to complete their work outside of the traditional office space.​
* For a game studio, all work can be completed from an employee's home as most tasks are undertaken via a computer and it has become unnecessary for most workers to be at their workplace to complete their work tasks. ​
* This practice could be adopted within our game studio as many work environments are transitioning away from the traditional face-to-face environment and as all work could be completed digitally.​
* It could benefit the studio to adopt this practice as well as employees as it would no longer need to pay for the office space for employees as they can all work from their homes. It may also raise employee morale as they are more flexible at home and no longer need to commute to work every day.

POSITIVES OF ADOPTION

* For the game studio, there is less of a cost from working from home online as they no longer need to pay for an office space for employees to use. They also do not need to pay for equipment such as computers as employees are likely to have their own. ​
* Working from home online makes employees more flexible and can increase their productivity as they can relax more at home and do not need to spend extra time travelling to and from work. ​
* Working from home may be easier for certain employees as there is less noise from other colleagues in the office, allowing for them to focus better on the task at hand. ​
* A distributed workforce will help to keep most of the game studio operating in cases such as an internet or power outage. Whereas if employees were at the studio and had no power, no work could be completed.

NEGATIVES OF ADOPTION

* Not all employees may have a good internet connection, severely limiting how much work they could complete at home. Their technology at home could also be outdated and not properly run the software that is required such as Unity. ​
* At home, an employee could be distracted by other family members, children or pets and not work as efficiently and effectively as they could normally. These distractions could inhibit progress of a game and disrupt overall workflow. ​
* Staff members may feel the need to overwork themselves as their home has become their office and it may feel like they've never left. This is especially so when there is an approaching deadline, where they may feel the need to continue work outside of their traditional time. ​
* Staff members will also need to pay for their own internet connections instead of having it all set up at their workplace.

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| - As most operations take place via a computer, transitioning from home wouldn't hinder how the game studio operates. ​  ​  - Working from home could increase the studio's productivity as staff members have a quieter and more relaxing environment at their homes. ​ | - Communication would be harder between staff members of the studio as they would need to rely on software such as Teams or Zoom instead of talking face-to-face. ​  ​  - As there is no version-control for staff currently, collaboration on a game project at home could become disorganised. ​  ​ |
| - Working from home provides the studio with the opportunity to divert costs away from the building and into development. As the building is located in an expensive office space, working from home could help the studio to finance other operations. ​  ​  - With a working from home environment, it would help the studio to find new staff members as they wouldn't need to travel to the office.​ | - The game studio may not have the infrastructure that would be needed to support the remote work of all of its employees. The implementation of the appropriate servers could be expensive.​  ​  - Working from home online has a higher security risk for the studio as staff will need to be more attentive about cybersecurity threats such as phishing, instead of relying on an IT team. This could lead to a breach in data for the game studio. ​ |

SOURCES

* <https://www.investopedia.com/personal-finance/work-from-home-guide/>​

Investopedia is a financial website founded in 1999 in New York. It is run by a team of data scientists and financial exports and offers advice, reviews and a dictionary of different terms relating to economics. The source from Investopedia provides an explanation of effective ways to work from home and the drawbacks of the practice. It is relevant as it shows the appeal of the practice for both businesses and for employees. ​

* <https://www.nytimes.com/2020/05/05/business/pandemic-work-from-home-coronavirus.html>​

The article from the New York Times expounds upon many of the benefits that were seen as a result of shifting workplaces to homes because of the COVID-19 pandemic. The New York Times is an American newspaper company founded in 1851 and provides news about events worldwide. This article is relevant to the research of Working from Home as a practice as it gives examples of how effective it has been for other companies and employee opinions of the practice. ​

* <https://ied.eu/blog/opportunities-and-threats-of-remote-working-for-a-company/>​

The blog post from the Institute of Entrepreneurship Development highlights the opportunities and the threats of remote work from home by exploring perspectives of both businesses and employees. The Institute of Entrepreneurship Development is a non-profit organisation based in Europe and is committed to promoting innovation and enhancement of entrepreneurship in Europe and across the entire world. As a source it is relevant as it explains the Opportunities working from Home presents and the threats it poses. ​

* <https://www.kaspersky.com.au/resource-center/threats/remote-working-how-to-stay-safe>​

The security article from Kaspersky Lab reveals many of the potential cybersecurity risks of Working from Home. Kaspersky Lab is a Russian cybersecurity company that offers anti-virus solutions to customers globally and provides protection and information about potential threat-actors on the internet. The source is relevant and informative as it elaborates on what risks Working from Home may have and offers a guide on practices to better protect employees from malware and to keep company data safe.

STREAMLINING THE GAMEDEV PIPELINE

* The Game Development pipeline helps to organise the flow of work and ensure that everyone is aware of what they need to deliver and when.​
* By streamlining the development pipeline, it means that the studio would work more efficiently and effectively by using faster or simpler methods to work with.​
* Typically, game development is broken up into three separate processes: pre-production, production and post-production. But by streamlining the process, these phases are broken up into smaller and more manageable segments with different teams working on specific parts before moving to the next phase.​
* By incorporating this practice into the game studio, it could help to make the process of developing and releasing a game more efficient and lower the time it takes to go from a concept to a fully-developed game. This practice could also help to keep the studio well-organised and on-task.

POSITIVES OF ADOPTION

* Streamlining the game development pipeline will make the process of building a game faster for the game studio and allow it to produce more in a shorter amount of time. ​
* Adopting this practice could help to keep staff members on track with their work as a streamlined process is more organised as staff know what they need to work towards and have a better idea of how to get there. ​
* For the game studio, a streamlined process of development means there will be less wasted time going from potential concepts to the execution and production of a game. ​
* There are less risks involved with streamlining the game development pipeline as the process is more repeatable and involves less experimentation. As the process has achieved success before, it will most likely have the same result for the next project the studio undertakes.

NEGATIVES OF ADOPTION

* Although a streamlined game development pipeline may lead to faster development for the studio, the quality of games produced may not be of the same quality as developers are given less time to expand upon their ideas for a game. ​
* Streamlining the pipeline of game development into a repeatable process may increase the efficiency of the process but it can end up with the studio producing similar products as experimentation is cut out in favour of the process. ​
* A streamlined pipeline has the potential to lessen consumer satisfaction with games produced by the studio as the pipeline will follow a process for what has been working in the past instead of taking a risk to make something new.​
* Continuously following a pipeline process that has worked in the past will only weaken consumer interest as innovation is a significant key to success in the gaming industry.

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| --- | --- |
| - Streamlining the GD pipeline will offer the studio stronger foundations of development for games and increase productivity and robustness in the long term.​  - Games developed by the studio will have a proven process that could provide an advantage in acquiring new tenders.​  - Implementing and training on new technology and/or software to the studio will be an easier ordeal due to a predictable process in place that can apply to many situations.​  - Can prove to be cost and time efficient when compared to an experimentative pipeline.​  - Since the studio is already working with Unity it will have access to Unity built-and-provided streamlining tools such as Unity Teams that will simplify the implementation of the new process.​ | - Being a new GD pipeline to the studio, it will take time to become cost and time efficient.​  ​  - Games developed by the studio using this pipeline process will have a threshold of quality that can be produced due to the simplification and time-saving techniques in content.​  ​  - Compartmentalising/breaking down the development pipeline will result in many more tasks and objectives to complete, despite being small, and may result in more meetings required each week. A by-product of this may be lower staff morale.​ |
| - Since implementing this new streamlining process becomes time and cost efficient if done well, hiring an experienced project manager to train and oversee the studio's first game developed with this new process could provide a distinct advantage for the large tender acquired and set up the studio well for future tenders/games.​  ​  - Streamlining the GD pipeline is done in conjunction with productive work towards the game's completion, thus can provide the studio with time-efficient learning and potentially provide marketing advantage before other companies.​ | - Other companies, including larger ones, may already have such a process and could create games that overshadow the one(s) produced by the studio, especially if they have a larger budget.​  ​  - If the process is not managed correctly or trained on appropriately, games developed by the studio could become boring and/or fall short of their goal, reducing sales and popularity and affecting studio reputation.​  ​  ​ |

SOURCES

* <https://unity.com/how-to/set-smart-game-development-pipeline>​

The article from Unity Technologies provides an informative guide for developers on how to set up and start an effective game development pipeline for their projects. Unity Technologies is a software development company based in San Francisco that is responsible for the development and management of the game engine Unity. The source seeks to encourage developers to establish a smart pipeline process by offering approaches to managing aspects of it. It is entirely relevant to the topic of research as it breaks up the typical game development pipeline into an approachable and repeatable process. The game engine Unity is also the same product that the studio primarily uses for the development of its games and the source can be considered wholly reliable. ​

* <https://www.cgspectrum.com/blog/game-development-process>​

CG Spectrum, a game development school that partnered with the Unreal engine released this article in 2019 to give insight about the game development pipeline and the various stages that a game goes through whilst being built. It is available to educate aspiring developers and studios about practices currently used in the games industry and the contributions that each role make towards a games development. ​

* <https://www.youtube.com/watch?v=4FrmY1U7K7s>  ​

In 2017 Unity produced (live) a demonstration and discussion on their new tool *Unity Teams* to help Unity developers with streamlining their game or software development process. Useful information and tools to consider when adopting the streamlining process.​

* <https://www.youtube.com/watch?v=W1LRYfKx6FE> ​

Mark Darrah, former executive producer for *BioWare* and lead producer for Dragon Age 2, published a public video discussion early 2022 voicing his opinion and observations on the company's approach to their game development pipeline, which was clearly lacking in structure. A useful bit of information to consider when looking at how streamlining could go in the wrong direction.​

* <https://gameworldobserver.com/2022/01/19/mark-darrah-on-bioware-magic-being-terrible-for-development-thats-where-crunch-comes-from> ​

Gameworldobserver.com, a public journalising company geared to games and gamers, wrote an article beginning of 2022 summerising Mark Darrah's comments about BioWare's GD pipeline process used for decades. Relevant to verifying sources of BioWare information regarding their pipeline.

* <https://dragonage.fandom.com/wiki/Developers_(Origins)#Producers>

Fandom.com, a company focused on creating, maintaining, and writing information on everything game related in the format of wikis, videos, etc for the public and game enthusiasts, maintains its Dragon Age wiki relating to BioWare's previous staff (including producers) for the game franchise, and used in conjunction with other sources across the internet, one can verify Mark Darrah's claim to executive producer for BioWare in the past.

* <https://game-wisdom.com/critical/3-tips-streamlining-games>

In 2016 Josh Bycer wrote a public article on game-wisdom.com about their opinion on game development pipeline streamlining, and the information they provide is useful advice to those looking to incorporate the streamlining process in their development.

* <https://android-developers.googleblog.com/2018/08/streamlining-developer-experience-for.html>

Google, the multi-billion-dollar company, wrote a developer blog for Android developers looking to create games or applications that are more streamlined in their development and integration, using a successfully implemented feature the company developed. It is a good example of results and usefulness to streamlining a game development pipeline.

* <https://forums.tigsource.com/index.php?topic=19228.0>

While being a much more unreliable source of quantifiable or quantitative data for deciding about GD pipeline streamlining, the public forum discussion on tigsource.com (all about independent games) provides a wider-scope insight to the general public's qualitative opinion on what exactly the process is and what its shortcomings and benefits might be.

CONTRIBUTIONS

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| --- | --- |
| **Name​** | **Contributions​** |
| Laura​ | Augmented Reality (Information Research), Editing of PowerPoint Information.​ |
| Lunar​ | Virtual Reality (Positives and Negatives, SWOT Analysis, Sources), Streamlining the Game Dev Pipeline (SWOT Analysis, Sources).​ |
| Brandon​ | Introduction, Augmented Reality, Artificial Intelligence, Automated Testing, Working from Home Online, Streamlining the Game Dev Pipeline (Functions and Features, Positives and Negatives).​ |
| Morgan​ | Virtual Reality (Functions and Features, Sources), PowerPoint Design and Images.​ |