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Gameducation: a project prototyping games for education

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Abstract

We live in a time when technology is more prevalent than ever. It has become a key part of our everyday lives and drastically affects many areas of society in positive ways, including education. Educational institutions not only use these technologies day-to-day, they also invest in and undertake ventures in Ed-Tech (education technology) involving 'gaming' developers to create tools that assist teachers and accelerate student learning. This piece explores the factors inducing many creators to pursue technological ventures in healthcare and education and discusses the development of *Global-E* (Quentin, 2016), a prototype for an educational business studies game.

Keywords

gaming, games design, Ed-Tech, digital

Introduction

We use technology to fulfil many of our daily needs, such as communicating, working and socialising. Importantly, it also enables us to discover and learn new things. Interactive whiteboards, computers and portable devices are among the most commonly used support technologies employed in educational establishments today (Richard, 2014, p.42). Technology has an increasing presence that is reinforced by the internet, which enables educational institutions to provide countless amount of services. Online services provide access to document-sharing tools (via Google or Microsoft Office365) as well as digital repositories and applications, allowing institutions to manage course administration and student communication using Virtual Learning Environments (VLEs) like Moodle or Blackboard Learn (Richard, 2014, p.28-31). Technology Enhanced Learning (TEL) tools like these tend to deliver content and administer courses.

My research into Ed-Tech explores the potential capabilities of gaming design in classroom teaching. Games are tools that can enhance practical learning by applying facts and general knowledge and they can also monitor student progress. This article describes developments in digital economies over the past 15 years and discusses example games that have informed my Ed-Tech game prototype *Global-E*, targeted at students studying business or economics in higher education. My aim is to provide them with a tool that is challenging and can be used as frequently as required, in any location. The intention is that it will further 'meaningful' knowledge by showing how principles of business and economics are applied in reality. This game does not intend to contest how these subjects are taught or replace teaching; instead, it aims to promote learning and classroom teaching by simulating knowledge in a 'gamified' way.

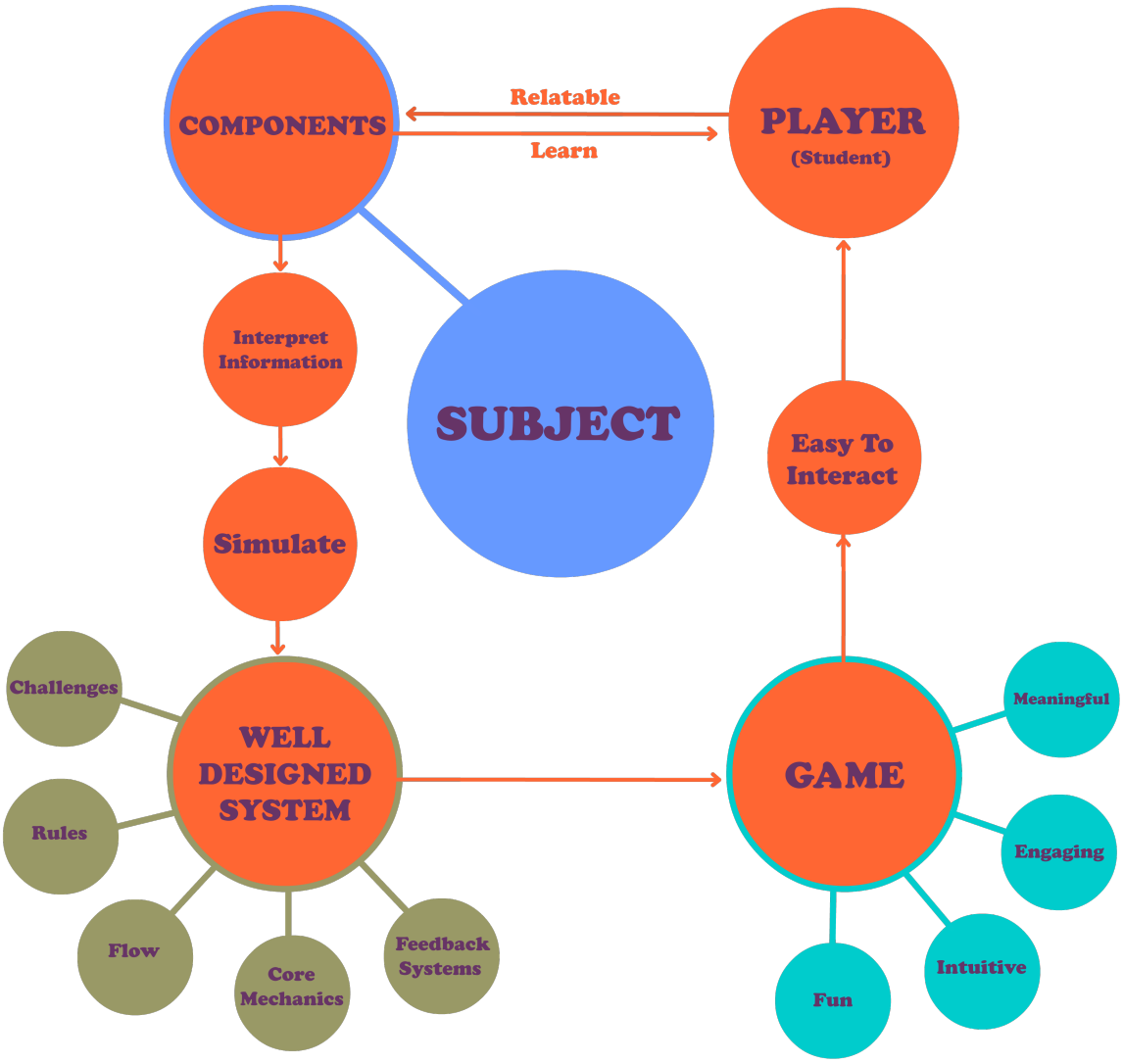

Figure 1: 'Gameducation: Prototyping for Education'. Image: authors own (Quentin, 2016).

The building blocks: digital economies of scale

Games prototyping used to be a costly process that required professional equipment and time. However, recent years have seen an entrepreneurial explosion as digital start-up companies use the internet to create a variety of products and services and reshape entire industries. We are living in what Ludwig Siegel describes as a 'Cambrian moment' (2014, p.1). In his editorial article for *The Economist*, Siegel says that digital companies fuel changes by disrupting the pre-established ways industries provide services to consumers by creating new institutions (2014, p.2). Figure 2 (below) maps a few of the well-known digital brands/applications that have radically re-invented products, services and markets in recent years.

Figure 2: Mapping companies and brands – the digital revolution. Image authors own (Quentin, 2016).

Today's entrepreneurial explosion is built upon digital foundations, as resources can be used easily and affordably. Contrary to the business-models of the past that depended upon heavy financial investment, Navi Radjou (Innovation and Leadership Strategist) describes this as a 'frugal innovation revolution' (2014). Radjou discusses how creative entrepreneurs are increasingly finding clever ways to solve problems, doing more with less to create high value products or services. Linda Hill (Professor of Business Administration, Harvard Business School) describes this frugal innovation as a process of creating things that are both new and useful (2014).

As technology becomes more familiar to us, it is inevitable that it will catalyse innovations in education. The reliability of the internet and the computational power of user-friendly devices like smartphones or tablets, represent important pre-existing resources that are easily used by innovators to prototype educational games. These ingredients and other computing infrastructures are freely available online through open source or cheap pay-as-you-go services. Siegel describes these resources as 'the basic building blocks for digital products or services' (2014, p.2). Creators like myself are able to use this pre-existing infrastructure to manifest ideas. Other educational building blocks include books, digital and printed as well as websites. This infrastructure includes software development kits and programming frameworks, used to create applications or websites (Ruby on Rails, Xcode, Android Studios). Alternatively, there are services that allow people to find developers (eLance, Upwork) or 'shared code repertoires' that enable people to find solutions when building software (Stack Overflow, GitHub, Codepen). There are also distribution platforms that sell and publish applications (App Store, Steam, Google Play), payment services to manage potential income and purchases (PayPal, Apple Play), crowd funding services to raise capital (Kickstarter, Indiegogo), cloud computing services to host applications (Microsoft Cloud, Amazon's Cloud) and marketing services that promote products and services (Facebook, Twitter). People can also receive training at events where educators, bloggers or industry professionals teach through tutorials, walkthroughs or prototype testing (Udemy, Train2Game), collaborate and brainstorm new ideas (Game Jams, Hackathons) and trade shows that showcase work (E3,

Bett Show). In this supportive context, making applications is more feasible because resources are freely available.

Easy access to the cheap tools of frugal innovation allows creative individuals to pursue interests and passion-projects in their leisure time. Charles Leadbeater (Innovation and Creativity Consultant) defines individuals who pursue entrepreneurial passion-projects in this way as 'Pro-Ams: innovative, committed and networked amateurs working to professional standards' (2004, p.9). Pro-Am workers are people who take their leisure very seriously and invest time in acquiring and developing their skills with dedicated professionalism that leads to radical innovations (Leadbeater, 2004, p.20). The internet brings together passionate knowledgeable Pro-Am individuals like myself with access to the tools they need, leading to innovation. The rise of skill-sharing platforms enables Pro-Ams to disseminate insights to peers and professionals on a large scale. TED is an example, a video conferencing organisation using online platforms to disseminate accessible talks. These are also forums through which Leadbeater, Hill and Radjou have shared their theories on work habits and the digital economy. Their videos demonstrate the technological skills sharing they discuss.

Games for education: a different market

Educational games are developed as a result of the frugal revolution. For example, the online virtual learning game platform *EDLounge,* promotes knowledge in Maths, English and Science through video lessons, quizzes, puzzles, and games to make education more accessible. Despite a Pro-Am fuelled frugal digital revolution over the past 10 years, Ed-Tech game development has not grown in the same way. *Zzish* – an educational app platform aiming to be at the forefront of learning technology – reiterate this perceptible lack compared to the rate of app development in other industries (Zzish, 2016). The lower number is attributed to the difficulty and costly process of building tools that are ready-to-use and easily incorporated into classroom-based teaching. The huge amount of work involved in collaborating with different educational institutions, as well as training educators, has had a knock-on effect that has slowed Ed-Tech prototyping (Table Crowd, 2014). Furthermore, most Ed-Tech games are not aimed at educators; who often request teacher 'dashboards' that enable them to track pupil progress and performance. Dashboards involve complex multiple user login protocols, entailing a series of password-screens that make it difficult for teachers to access the app quickly and easily when teaching (Zzish, 2015). *Zzish* created a simple and effective classroom dashboard that works like an 'App-Store', made by consulting a community of 1,000 developers, alongside tutors and students to create an integrated learning analytics system that allows teachers to track progression/performance (Table Crowd, 2014). It offers users, who include designers and developers as well as teachers, quick access to multiple learning apps with a dashboard that is consistent across all applications. Currently it serves a worldwide community of approximately 10,000 teachers at around 2,000 schools in 103 different countries (Zzish, 2015), allowing teachers to be more responsive to the varied needs of all their pupils by tailoring tasks to individual skill levels.

Games in healthcare: implementation

Healthcare is another industry where the introduction of new technologies, such as digitised healthcare systems, telecare, analytics and mobile health applications, can be disruptive to services and slow to implement. According to a report compiled by Deloitte on *Digital Health in the UK: An Industry Study for the Office of Life Sciences* (2015), the global market is expected to almost double from £23 billion in 2014 to £43 billion by 2018. In 2015 the UK market was worth £2 billion and is expected to grow to £2.9 billion by 2018, with a Compound Annual Growth Rate (CAGR) of 11% (Monitor Deloitte, 2015, p.8).

Deloitte's projection reveals that the most promising market for growth is mobile health applications, set to increase by 35% by 2018. Despite being the smallest digital health market it is still the biggest growing area and as Deloitte discuss, mobile healthcare aids in prevention, diagnosis and monitoring conditions/diseases. For instance, *Healthy.io* is an app that allows patients to analyse their urine at home using a small kit and their camera phone to get a medical reading within 2-3 minutes. Another example is *MedShr*, which enables doctors to use their smartphone to securely share and discuss cases as part of their everyday clinical practice (Monitor Deloitte, 2015, p.21). The President of the American Medical Association, Dr Robert M. Wah observes that technologies like mobile health applications have the power to enhance patient care whilst improving productivity, efficiency and slowing rises in health care costs. These benefits occur when physicians, policymakers and technology vendors work together (Bresnick, 2015). Mobile health applications can provide a fast efficient way for doctors and patients to communicate and share healthcare related information. According to another report compiled by the Universities and Colleges Information Systems Association (UCISA), healthcare research in higher education makes more extensive use of Technology Enhanced Learning tools than other fields (Walker *et-al*., 2014, p.36). As the mobile industry continues to grow, the most popular healthcare technologies will most likely emerge in this sector (Carey, 2015, p.10).

Medical games are currently one of the most popular types of mobile health apps. *Amateur Surgeon 3* (Mediatonic, 2014), is a game that allows users to experience cutting-edge surgical procedures. The player is tasked with performing life and death operations on a variety of interesting characters using tools that include a pizza cutter, staple, chainsaw, lighter, car battery, a vacuum and other objects. Procedures include stitching and cauterizing wounds, extracting items from injuries, crushing bones, sucking-out blood or poison and using injectors to boost heart rate or to prevent patients from dying due to the shock caused by mistakes. The game delivers an insightful simulation of surgery in a fun cartoonish style with a crude medical humour. Users inhabit a variety of wild scenarios, where you heal critically wounded characters under external pressures with limited time constraints (Sheridan, 2013). When looking up 'medical games' on App-Stores like Google Play, it is apparent that these games are used to encourage individuals to take more responsibility for their own wellbeing as well as foster understanding of how healthcare is administered, especially in areas such as surgery and dentistry, the most gamified areas of medicine.

Gaming has great potential within healthcare education, especially in an era when technology increasingly plays a key role in this sector. 'Games for Health' is an important innovator and 'leading voice' in healthcare gaming (Games for Health, 2015). Games for Health Finland hosted their annual 'Health Game Jam' in September 2013, an annual weekend-long event that brings together communities of game designers, programmers, sound designers, graphic artists, healthcare experts, students, professionals and others (Arpola and Holopainen, 2014, p.209). The event provides the opportunity to experiment with amazing technologies like *eMotion Faros from Mega Electronics,* or *mBody* trousers from Myontec, which are used to measure muscles. There were also *leap* motion sensors from Leap Motion Inc, as well as *Myo-armband* from Thalmic-Labs-Myo and *Fitbit Charge* heart-rate monitors from Fitbit Inc, including Microsoft *Kinect 2* movement sensors. The latest Health Game Jam winners "Team Pelintakojat" was nominated for the best idea with their game *Neovirus* (Kuopio Innovation, 2015). It allowed players to move sliders containing a virus inside a cube, which are controlled by activating abdominal muscles when using the 'Exerium' gaming chair. The Exerium chair combines gaming with exercise to prevent back problems. When speaking at a conference co-hosted by the Healthcare Information and Management Systems Society (HIMSS) and

Games for Health – held in Washington D.C. (16 June 2015) – the Vice President of the Personal Connected Health Alliance (PCHA), Richard Scarfo observed that gaming 'technology is playing an increasing role in care delivery and the management of health and wellness' (Games for Health, 2015). Healthcare oriented Game Jams have resulted in many ideas and concepts, producing prototypes that lead to new innovative healthcare and ways of encouraging people to improve their health through physical activities like the Exerium *Neovirus* game (Arpola and Holopainen, 2014, p.210-211).

DragoxBox Algebra (WeWantToKnow, 2016), is another great educational game that allows children to learn how to solve basic equations in a fun way. In response to the 'boring' stigma and negative labels often attributed to Maths at school, the purpose of *DragonBox Algebra* is to encourage children to learn the principles of algebra without realising that this is Maths. WeWantToKnow, the developers of *Dragonbox*, believe that children are actively engaged in learning when they encounter activities that trigger their curiosity and appeal to their naturally inquisitive nature. The steps of algebra involve abstract mathematical characters like 'x' and 'y', distinguishing between such characters, separating them, looking for 'like' terms and changing whole numbers into fractions. The game practices these steps by using avatars and objects, characters that are more familiar than abstract letters, making it easier to understand and retain this content. From birth we learn things by asking questions and by experimenting, using trial and error and *DragonBox Algebra* draws upon these traits, allowing players to interpret algebra in a 'natural' fun way that stimulates confidence in mathematics (WeWantToKnow, 2013, p.2). The game is engaging and intuitive because it is presented in an exciting way.

There is a distinct lack of research measuring to what extent gamified learning benefits pupils, but examples of games like *DragonBox Algebra* point to this potential, revealing that prototyping for education can be extremely meaningful and have a huge impact on learning.

Learning 'Business'

My own experience as a student learning Business subjects in college, determined why I pursued this venture to create a game where players can practice to oversee the various elements involved with running a business in a risk-free environment. At college, this subject was often taught in a manner that failed to engage or excite and did not present the content in a meaningful real-world context. Business is the most subscribed higher education course in the UK, with over 50,000 people studying it in 2015/2016 (Ali, 2015). It touches on pretty much every aspect of modern society. As Charles R. Nelson (Professor at the Department of Economics, University of Washington) says, 'every society must provide goods and services for the welfare of its citizens', fostering activities that build an economy (Nelson, 2009, p.2).

Business is one of the biggest properties of economics. I took inspiration from business and economics, to create a game that not only allows players to conduct business activities but also show how both subjects are entwined with each other. I developed my *Global-E* prototype to support platforms like *Zzish* and *EdLounge*, where pupils can have access to educational games like *Global-E* or *DragonBox Algebra*. I always craved a system that fellow pupils could use to test how capable they are at actually conducting business activities. Not long after I finished my own business course in college, I started planning this prototype. I wanted to make a game that not only had a close resemblance to how the global economy works, but also allowed students to challenge themselves, experiment and while doing so increase their awareness of both subjects.

I started developing the prototype at the end of the first year at University. I had gained enough knowledge and skills in programming and designing by then. The game itself required a lot of information, given that both subjects are very broad and complex. I mainly focused on fundamentals, like setting up buildings in different countries, designing and advertising products, managing orders, and closing deals (pictures below, Figure 3-6).

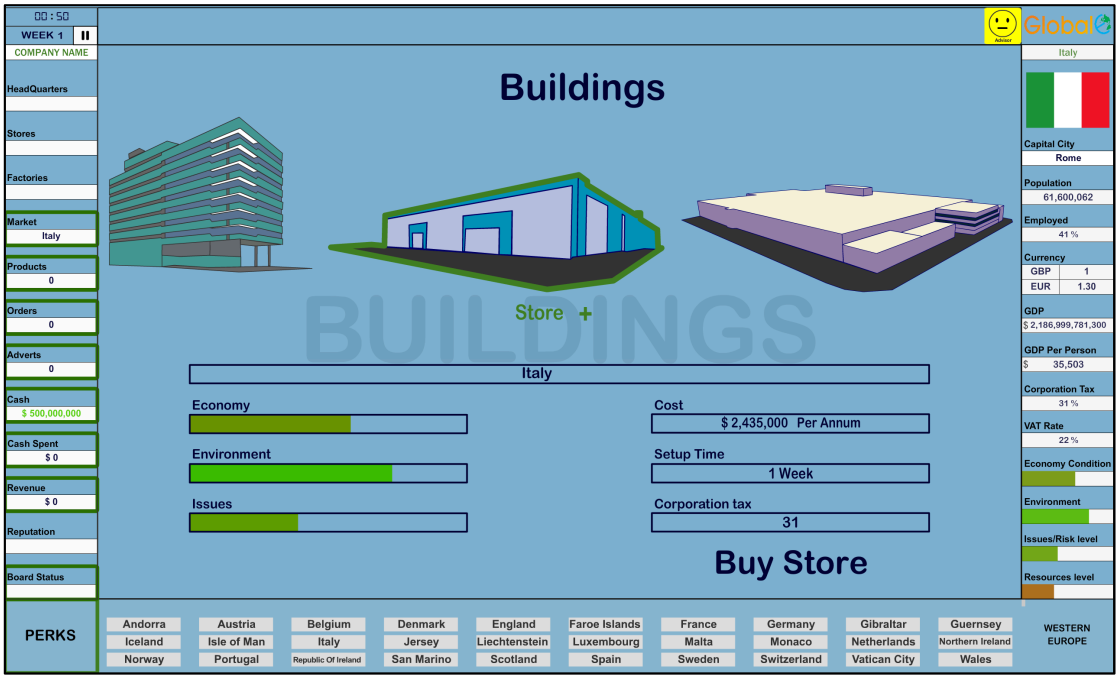

Figure 3: 'Global-E Prototype: Buildings menu. Image: authors own (Quentin, 2016).

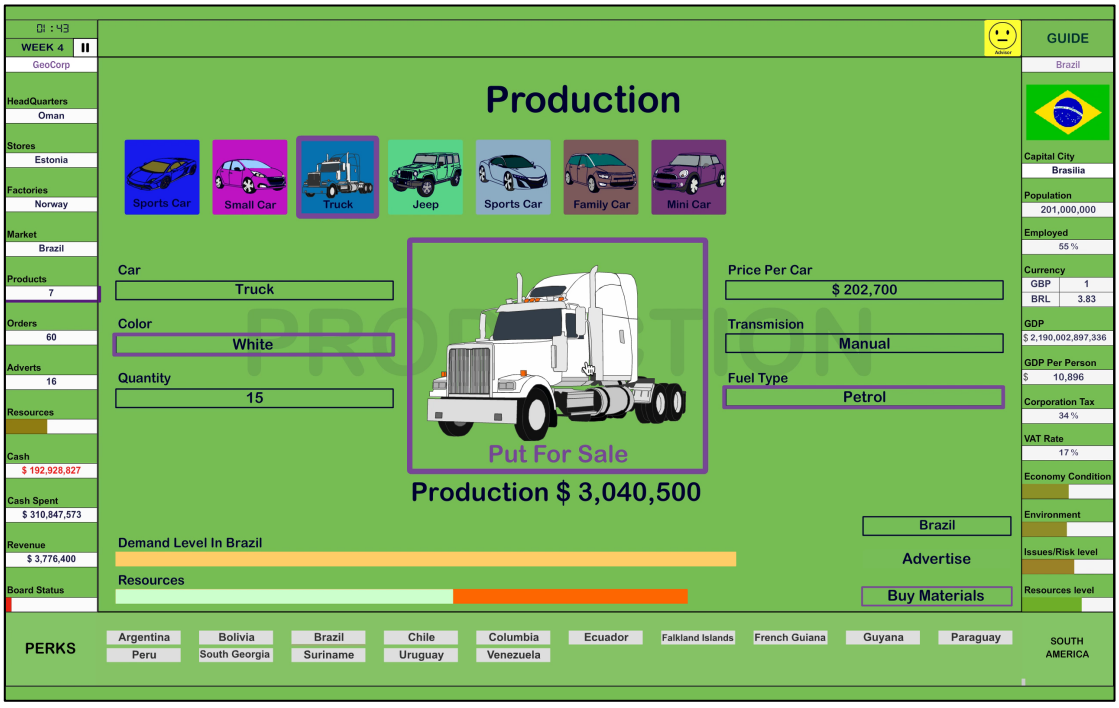

Figure 4: 'Global-E Prototype: Production menu. Image: authors own (Quentin, 2016).

Figure 5: 'Global-E Prototype: Closing Deal. Image: authors own (Quentin, 2016).

These were the main business activities in the game that required countries' economic factors like GDP, population, currencies, tax rates, and special events (see Figure 6) to be the cause of adversity that impaired player's activities in the game.

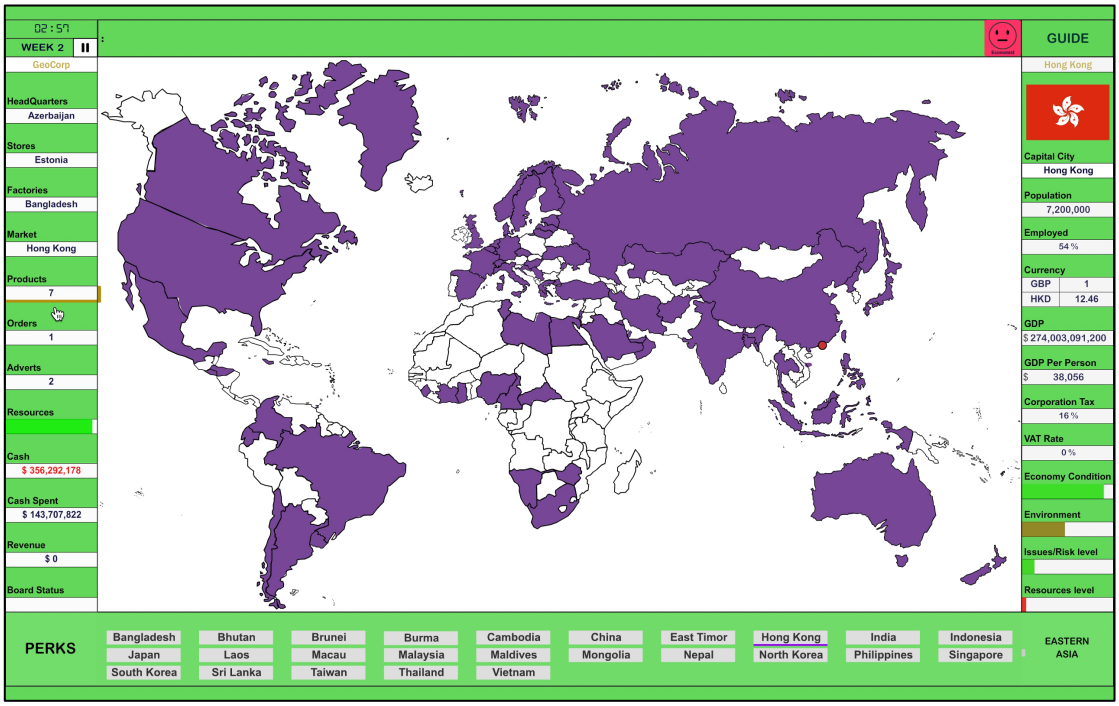

Figure 6: 'Global-E Prototype: Special events around the world. Image: authors own (Quentin, 2016).

My main intention was to let players choose the industry and product they want to sell (i.e. automobile industry to sell cars). In addition, I focused on creating a system that allowed players to grasp the process of starting with nothing, having a budget and taking their company to great lengths to succeed and be profitable. The prototype was built around this

notion, and was supported by my research, which involved collecting data of countries (data from CIA, The Economist, Exchange Rates, Trading Economics), and automobiles (data from Carfolio, Carcare, Wisebuyers), as well as taking inspiration from other games (for example, McDonalds game, Corporate Inc, Democracy3, Crusader Kings) which really helped bring the game to life. The end product was a global economy game (hence the name, 'Global-E') where players can grow their automobile company, selling as many cars as possible around the world, overseeing transactions in favour of their business in order to make profit. As a result, such a system can be used to exercise a student's know-how in business, where they can practise how to operate a company, free of any real financial risk.

Games design and pedagogy

Educational games like *Global-E* can supplement the teaching methods (pedagogy) applied in the classroom by altering the nature of engagement between tutors and students. Peter Mortimore, suggest that the best way to look at pedagogy is to see it as a craft of teaching; where one person intends to enhance the learning of another (Mortimore, 1999, p.3). The 'Dale Cone Model' measures learning experience to interpret how educators provide effective teaching. Named after Edgar Dale, it ranks several teaching processes in terms of their effectiveness (Dale, 1969, p.106). Dr Heidi Anderson outlines that he created this model to emphasize how learners retain more information through what they 'do' and not merely through what is 'heard', 'read' or 'observed' in a lesson. Today, this notion is known as 'experiential learning' or 'action learning'. According to the model, action learning techniques resulted in up to 90% retention and people learn better through teaching styles that involve 'perceptual learning' through instructional activities that build upon real-life experiences.

Video games can develop experiential learning by challenging students through meaningful activities and experiments. As these theories indicate, to be an effective experiential learning tool a game has to be engaging enough to keep people interested, relevant to the subject, and also fun. The venture of developing a prototype for college level business pupils also applies techniques I have learnt as a games enthusiast. Many of these are relevant to education, for example the notion of 'Flow' (Csikszentmihalyi, 1975).

Flow describes how players experience immersion for longer periods when a game has well-designed challenging activities relative to their skills (Baron, 2012). Ways of keeping players in the flow state often integrate rewards systems in the form of perks, points and 'unlockables' that motivate and sustain players' attention. Responsive feedback allows players to understand how what they did translated into what happens in the game, to see a reaction to their action (Pallesen, 2013, p.2-17). Creating a well-designed system and involving mechanics that are appropriate to experiential learning involves the player being challenged with activities that are related to elements of business and economics such as marketing, management, trading and budgeting. Such aspects enable game designers to construct spaces of meaningful play, which is, as Professor Richard Garfield says, the goal of successful game design (in Salen and Zimmerman, 2004, p.34). The development of the *Global-E* (prototype) involved a great deal of trial and error as well as playtest feedback from the game and education community like lecturers/students of Business or Economics, game designers and others. The process of developing the game revealed that direct consultation with teachers and students was the best way to apply elements of business and economics in activities of a satisfactory quality and suitable standard for higher education.

Conclusions

The 'building block' resources and applications available today make designing a prototype for an educational game highly viable. The theories of education, gaming and examples discussed in this article have informed the development of *Global-E* (itch.io, 2015). Business subjects are by nature complex and cover many other interconnected areas such as economics. Which consequently hardened the challenge of simulating elements of business and economics, and as a result presented the most difficult part of the design process. However, though *Global-E* is still a prototype, for it to be really viable for educational purposes, it needs to provide an emotional and psychological experience that allows users to inhabit a well-designed system of play and maintain the player's inhabitation of the flow state of attention. In addition, it requires the necessary information and challenges that students would be able to relate to and feel as if they are practically engaging in a system that will better prepare them in a real world environment of business or economics.

The next phase in developing *Global-E* will carefully consider feedback from educators, tutors and students alike, as I begin the most challenging stage: making its content as meaningful and relevant as possible.

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Biography

George Quentin graduated from BA (Hons) Games Design at LCC in July 2016. He has a great interest in technology-enhanced learning tools, especially games and applications. His biggest goal is to design stuff for education. Example of George's work can be found at: www.geo-games.com and you can follow him on Twitter @Geoo993