B2C Business Models for Museum and Cultural Travel Mixed Reality Solutions

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ABSTRACT

In this paper B2C business models for cultural travel mixed reality solutions are analysed through both mobile application and video game business model frameworks. We argue that there are several business models that overlap both traditional application business in mobile ecosystems as well as video gaming and there are quite a few that are not (yet) feasible. This study presents a new improved model to comprehend and further analyse the MR business logic in museums and cultural travel business-to-customer business models.

CCS Concepts

• Human-centered computing→Human computer interaction (HCI)→Interaction paradigms→Mixed / augmented reality;500 • Human-centered computing→Ubiquitous and mobile computing→Ubiquitous and mobile devices→Mobile devices;500 • Social and professional topics→Professional topics→Computing and business;500 • Social and professionl topics→Professional topics→Software management;300

Keywords

Business model; Cultural travel; Mixed reality; Mobile applications; Museum; Video games

1. INTRODUCTION

Mixed Reality (MR) is the art and technology used to mix real-world elements with virtual reality (VR). This can be done by changing incoming information for any sense available – usually by visual and aural methods – but not forgetting olfaction, gustatory, and haptic (see e.g. [1,2,3]) . Visual effects can be e.g. computer-generated 2D and 3D images or information superimposed on the real-world view captured from the camera of smartphone, computer or other device [4]. Mixed image appears to its users like virtual and real objects coexisted in the same space. [5]

The interest towards the MR technology has been rapidly growing among the museums and cultural heritage sites around the world. However, the acceptance of MR applications can vary in different populations. Lee et al. made a cultural comparison between South Korea and Ireland, both having high smartphone penetration rates but different cultural profiles, and noticed that aesthetics of augmented reality (AR) – a subcategory of mixed reality – have the strongest influence on perceived enjoyment. Also, as expected, South Korea, having high collectivism and high uncertainty avoidance culture, displayed stronger dependence on social influence and hedonic characteristics of MR. [6, 7]

Smartphone or tablet device meet the main requirements posed by AR since it has a camera and capability of rendering and displaying the augmented graphics. [8] Hence, with explosive growth of penetration rates of smartphone, application-based AR has been more accessible to users. Especially, cultural heritage tourism is one of the most important areas served by mobile AR app [9, 10] which provides digitally restored artefacts, thereby preventing degradation of cultural heritage sites aggravated by frequent access by tourists and let them perceive fun and usefulness [11]. A number of cultural heritage institutions around the world, such as the Louvre Museum in Paris and the British Museum in London, have developed and provided with their mobile AR apps[1].

In this paper business models for cultural travel mixed reality solutions are analysed in theoretical framework. Business logic with MR can be divided to many different sections, e.g. providing platform, generating software, selling the software, providing/selling hardware etc. This research focuses on the provider-customer –relationship (B2C) where the business model *defines how the software is being sold and thus the type of the software that is being produced [12]*. Because of the nature of museums and cultural travel, some MR solutions can rely solely or partly on funding by regional, national or international funding

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[1] See e.g. http://www.museum-id.com/idea-detail.asp?id=336, https://www.qualcomm.com/news/spark/2012/04/20/museums-modernize-self-guided-tour

which may greatly increase the possibilities for financial success. Yet because of the B2C relationship and its' funding methods, discussing the public or "outside" funding is not on the scope of our research.

Because of the lack of literature from museum and cultural travel MR solutions and any MR application, business models similar fields of study had to be found to analyse these business models. Due to the fundamental similarities and overlap in MR and video game production [13], and because MR solutions are commonly used with mobile devices, in this paper mixed reality for cultural travel business logic is analysed through Heimo et al. model for analysing video game business logic model [12] which classifies the typology from game customers' perspective and through Hyrynsalmi et al. analysis on revenue models in mobile ecosystems [14] which classifies the typology from application developers' perspective. This is done with the aim to locate similarities and overlap between video game business logic, mobile application business logic and MR business logic. We argue that there are some similarities with these business logics but due to the nature of cultural travel MR there are more limits for the business possibilities.

2. MIXED REALITY

Mixed reality is a combination of different sets of levels of reality and digitally-generated material. Whereas the more known virtual reality experiences attempt to recreate all of these signals, augmented reality only attempts to complement the natural ones with some artificial flavour. It thus covers the area between the physical reality and completely simulated virtual reality, as seen in the famous Virtual Reality Continuum in Figure 1 [15].

Whereas virtual reality can deviate greatly from the real world, augmented reality productions however must fit into the physical context in order to achieve an immersive and believable experience. At the minimum, a good AR application should 1) seamlessly combine the physical and virtual pieces of content, 2) be highly interactive in real-time and 3) allow the users to experience the content with free movement in the real three dimensional world. [16] The first condition is not to set limitations to artistic freedom in any sense, but to highlight the fact that at least the virtual content should react to as many changes and elements of the real world as possible. The second condition separates for example pre-rendered movie productions from augmented reality, as even if the contemporary film productions feature highly believable computer generated imagery, they do not represent a real-time simulation of reality from the end-users point of view. The third condition then emphasizes how important it is to the end users not to be limited in the ways they can "live" in the augmented space: they must be able to move freely and explore the content from any angle and location they like. The virtual content must always be fixed tightly in its place in the real world while the user moves about.

Mixed reality can be experienced via various types of devices. Currently the most used device platform is the mobile devices segment most consumers carry with them in their everyday life: mobile phones and tablets. The image from the rear camera of the device is displayed on the screen and the virtual content is drawn on top of it to create the seamless viewing experience. While traditional mobile devices allow widespread adoption of MR experiences, they can at most provide a window-type of an experience into the augmented world. The next phase, currently taking its initial steps will be in form of wearable eyewear: with see-through displays both the real world and the virtual elements can in the future be overlaid on top of the whole field of vision (FOV). Such devices, but with limited FOV are being prepared for consumer grade release by several international corporations, such as Google, Microsoft and Sony and many others have announced intentions of going into the market [17, 18, 19].

Figure 1. Levels of mixed reality

The first wave of augmented reality applications for mobile devices used purely geolocation based solutions for aligning (or, "registering") the content with the real world. With the user's geolocation and the device's orientation read from magnetometer and other sensors it is possible to do only very rough registering: the content might be meters away from the actual desired location and it usually also reacts to user's movements sluggishly and with imperfect results. Mostly the first applications were thus about displaying information about distant enough points of interest around the user, such as showing the restaurants in radius of 5 kilometers as seen in Here City Lens application in Figure 2. Yet the new popular *Pokemon GO* is also based on this type of MR.[2]

To acquire more accurate results the modern mixed reality technologies employ visual tracking as part of the process. The image from the device's camera is algorithmically analysed to find stable points that can be used as a reference to measure how the device is moved around. The reference points, or the feature points, can then also be matched to pre-created set of reference points. If they match with high enough accuracy, it can be deduced that the camera is pointed to a predefined area which can contain accurately placed virtual content. The currently more traditional approach with predefined content is to use basic printed imagery as recognizable 2D markers. Complex images with high contrast and thus high amount of stable feature points work more reliably, but in most cases, for example photographs, can be used as markers.

The more developing way of tracking is to use 3D objects as markers. They can produce both more accurate and stable

Figure 2. Here City Lens[20]

registration, but also allow more viewing directions than the 2D surfaces. 3D markers are however more time consuming to create and require more data and thus bandwidth to transfer and also require much more complex and computationally demanding

[2] See e.g. http://www.pokemon.com/us/pokemon-video-games/pokemon-go/

algorithms to be used. Since in the last few years mobile networks have gained higher transfer speeds and devices have become more powerful, it is now possible to employ large datasets of 3D markers as the basis for mobile mixed reality applications. The next step for accurate registration lies in actual environments being used as markers, instead of small rigid objects. This however requires even more complex solutions, as for example changing lighting in outdoor environments creates new challenges for the current algorithms.

In addition to just displaying information and small gadget type of application, there are some examples of more complex mixed reality products. Likely one of the most known currently is the AR conversion of the famous sandbox game MineCraft that Microsoft has used as a part of its HoloLens demonstrations and advertising [21]. Even if VR is likely the more suited medium of the two, for gaming, AR will probably also gain much traction from the sector.

3. CULTURAL TRAVEL

Field of cultural travel, including cultural heritage sites, museums, galleries as well as heritage and tourism organizations, has its special characteristics which must be taken into account when considering business models for the field. Many of the sites and organizations today are trying to cope with decreasing public funding. This has made them aware of the need to raise additional income, even from commercial activities. As a result, the field has been divided. On one hand are those who stress that museums and other agents on the field must respond to the consumer-led society and provide more what visitors want. On the other hand are the critics accusing the organizations of oversimplifications and preferring entertainment to education. [22, pp. 3–4, 216]

Paradoxically, while the reducing of the public funding has made the field of museums and cultural travel commercially more involved, it also has made the field more unwilling to take any risks. Adapting too novel technologies or business models not tested elsewhere might seem like waste of already scarce resources. The possibilities of activating new visitor groups or gaining more income are not viewed as results alluring enough or worth the risk.

Furthermore, even the commercialism itself is a controversial notion within the cultural travel sector. Because the sector consists mostly of non-profit organizations it has only gradually awakened to the realization that strive towards profitability might be unavoidable for maintaining their activity, at some extent at least. Yet, many organizations consider commercialism as a necessary evil rather than a window to new prospects. Even though this view of keeping profit seeking at minimum seems to be fading, it still has its hold on many organizations on the field. [22, pp. 148–150]

Traditional video games offer experiences by themselves but MR for museums and cultural heritage sites are a tad bit different: they offer another content layer in the overall experience. The MR therefore is a gamified or otherwise digitalised level of the experience, an experience which itself and even without the MR has gathered the audience! The main reason of existence for the museums and other cultural heritage sites is usually not making profit. Thus everything around it should support the meaning the site has. Hence the MR experience is not be-all-end-all solution, but only an augmentation of that what already is and should be considered as such.

This can generate additional visitors to a museum or cultural heritage sites, but the delivery method for acquiring the best cost-benefit ratio is yet under research and thus the business model is important in finding the optimal method.

There have been promising results from preliminary studies with augmented reality in museums and cultural heritage sites. E.g. when Seppälä et al. [7] tested their prototype in the Luostarinmäki museum of Turku, 78% of visitors agreed that AR brought added value to their museum visit. As MR is a growing field, Seppälä et al suppose more and more customers are willing to pay for AR experiences in museum and cultural travel sector. [7] Also Damala et al. [23] have achieved rather similar results suggesting that AR can bring added value to museums especially by increasing the possibility for interaction between the visitors and the exhibits. Furthermore, as Cabiria has stated, the fact that especially the younger generations are familiar with the latest devices and AR, is most likely to increase the need for immersive and engaging technology in museums and other educational institutions. [24: p. 234] Even the museums have noticed the significance of immersion in making the past more comprehensible and as a part of a successful museum experience. [25: p. 171]

4. BUSINESS MODELS

4.1 Business model for mixed reality software?

> "Here, a basic question affecting the choice between markets and communities is 'who sells to whom?'
> This issue is particularly important to external innovation as it determines who will typically control the direction of technology development, the income streams and the end-customer relationship"
> – Boudreau and Lakhani [26]

The term "Business model" has various meanings in academic literature depending on the research context and the addressed research question [27], In this study, the term is defined following the definition by Stewart and Zhao [28] as "a statement of how a firm will make money and sustain its profit stream over time". The main focus of the study is to use business model, as Zott, Amit, and Massa state, *"as cost/revenue architecture [...] in explaining the economic mechanisms that allow a firm to commercialize technological innovations"* [27]. In this paper the context of the analysis of business models (or business logic) is analysed in B2C sense where e.g. value chains and B2B business logic are not handled. It can be claimed that some of the models analysed in this study are more revenue models than business models. However, in the museum context the digital content services are still relatively small compared to main business, if operated by museums themselves. Also, the digital content can be seen as a completely separate business from the traditional museum operations. Therefore revenue-focused models define the current application focused business opportunities of the mixed reality solutions quite well. In the near future, when the mixed reality content becomes more integral part of the core museum operations, more holistic business model analysis will be needed.

There are various different roles in MR software production and thus there are various different business models in producing the MR product: there can be programming companies, producers of the script, those who provide the actors and voice actors for the productions, and those who just sell the final product. Business models for these can and will vary and it is possible they follow different business strategies that can be compared to

television/movie business, actor transfer business, education/pedagogical material delivery or many other fields of business. There is also a serious business potential for a MR platform, whether it is used in the field of cultural travel or outside of it. None the less any of these are not the main questions of this study.

Yet the B2C interface is the question of this study and it is somewhat defining feature of the overall product: it makes design-level possibilities and limits in market-wise sense. Whereas it is individual decision on how the actors are hired or which programming language is used and the platform gives possibilities and limits in larger scale, the B2C user-end gives the frames and thereby defines on how the product is offered and experienced. The main point is *how the customer feels about paying for the experience.*

When compared to more traditional museum and cultural travel augmentations, audio guides, MR solutions offer various different business models. Whereas audio guides are traditionally 1) rented or 2) included to entrance fee, MR solutions – being more game-like – can offer various different choices which are more common in video game industry than museum and cultural travel environment.

Business model requires revenue and revenue comes from someone who will pay. This of course does not necessarily require hard capital – at first, but in due time no company can do without it. MR is an emerging field of delivering information and at that it sets some challenges: people are more willing to pay when they know what they are paying for. Hence before achieving the level of familiarity as the audio guide has, various different business models may easily top the traditional pay-first-then-use –model.

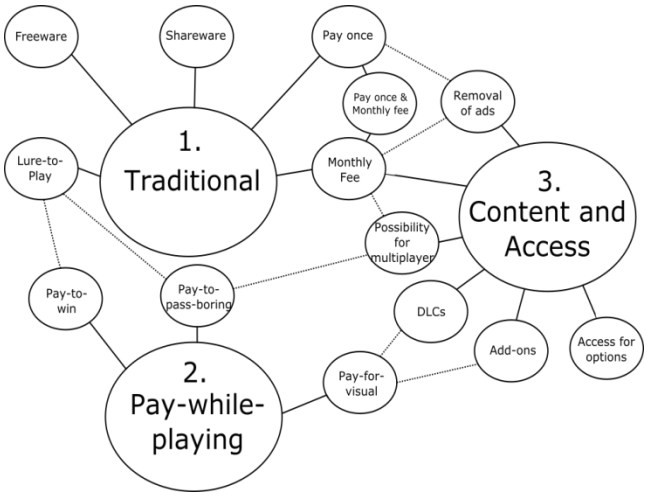

Figure 1. Heimo et al. Model (2016) [12]

As mentioned in Section 1, we have chosen as two base models for the analysis: Hyrynsalmi et al. model for application revenue models [14] and the Heimo et al. model which introduces different video game business models and their relations [12] (Figure 3). With these models the possibilities for the different business models for MR are analysed.

4.2 Mobile applications

Hyrynsalmi et al. [14] propose a model for revenue models in Android Market (Google Play) Ecosystem based on Coursaris & Hassanein [29] study. Their analysis is both quantitative and qualitative research app revenue models where they aim to categorize these models with top-to-bottom design method for the developers to use.

Revenue model according to Hyrynsalmi et al. [14]

- Paid download
- Free Trial
- Advertising
- Subscription
- Pay-per-use
- Hosting
- Point-of-Traffic

According to Hyrynsalmi et al. [14] the **Paid Downloads** model might be the most traditional revenue model in the mobile application business which – as the name states – relies on the money gathered before the download.

Free to trial is a subcategory of directly paid downloads where at least some parts of the application are free (but with restrictions or advertisement) and a full or premium version is available only with a price. [14]

Advertising is a rather common revenue stream in the Android Market where a content provider earns revenue by placing advertisements to the application. Basing on the subjective analysis majority of applications using ads as a stream of revenue stream were 'single-use' products i.e. *"they are most likely used few minutes every now and then"*. [14]

In **Subscription** the application provider gets revenue from subscriptions, e.g. by monthly fees. The application is usually part of a service where it works as a front-end for a service. [14]

Pay-Per-Use model or *In-application Purchase model* is a model where the customer is able to purchase increased amount or improved content. In the model customer can buy a single portion instead of whole offering, e.g. customer can buy chapters of books or levels for the game instead of the whole book or the whole game.

In **Hosting** model the content provider due to the lack of technology/expertise uses a third party to host their content. In this model *"[the] developers offer services to specific segments such as a platform for radio stations for mobile radio applications or a map application for travelers in a national park."*[14]

Point-to-Traffic aims for the created content will increase traffic to a third party website thus supporting the revenue model of the third party. The third party compensates the content provider. [14]

4.3 Gaming

4.3.1 Traditional

"Traditional" group is divided into categories "Pay once", "Pay periodically", "Freeware" and "First dose". The first model in this group is the most traditional off-the-shelf model **"Pay once"**. In this model the customer expects to get the whole game without other, hidden payments afterwards. Therefore, customer purchases the entire product and possibly the right for some free updates to it which typically is the case (although there are some exceptions). [12]

In B2B **"Pay periodically"** has been used for a longer time, but due the possibilities granted by Internet, it expanded to the B2C video game business. In this model customers pay a period of time at a time. [12]

The most clear of software delivery business models is **Freeware.** The freeware distributors give that particular game or the version

of the game away for free. The business can be e.g. to advertise for the next version of the game or another (future?) game by the same producer. [12]

Shareware quite often is actually an advertisement of the whole game. Many older games e.g. *Doom*, *Scorched Earth* or *Wolfenstein 3D*, but also more modern ones, such as *Water!* or *Van Helsing* use this model. There are certain types of shareware, such as adware (ads in screen or in between the gameplay), crippleware (vital features of the game, e.g., saving are removed), trialware (built-in time limit), donationware (in various ways tries to remind the player to make donations), and nagware (keeps on reminding to pay, usually very annoying manner[3]) which all somewhat vary from the traditional shareware model. [12]

Most modern category in "Traditional" group and a very popular method in modern games is **lure-to-play**. Almost all *freemium* (not to be confused with free-to-play) games belong to this group. This method offers – in various ways – the customer a substantial amount of the game for 'free' to play. The main point is that when the player has invested *a serious amount of* time on the game, it may feel important for the players to advance and thus they are willing (fooled?) to pay to get the next part out of it (see e.g., [30]). [12]

4.3.2 Pay-while-playing

"**Pay while playing**" group contains "Pay to win", "Pay to pass boring" and "Pay for visual" methods. In these methods the game company brings real-world money in a form or another to the game. With that money one can ease up the gaming and either a) **Pay-to-pass-boring** which allows player skip through "boring parts" of the game thus allowing a more pleasurable gaming experience[4] or b) **Pay-to-win**, where player is given perks to get advantage over the other players. Sometimes "offline progress" is also used as a tool: game recharges energy needed for activity or makes player to wait for example the growth time of "plants" while a player waits for the possibility play again, and players can skip or diminish such downtimes by paying [31].[12]

Pay-for-visual grants the player visual materials in games to improve either visual appearance of the game or the visual appearance of players' avatar. Many games e.g. World of Warcraft generate revenue by selling these visual effects without pay-to-win mode but by using pay periodically method as their main model of income, while others, such as *Team Fortress* or *Path of Exile*, generate their revenue solely by this model.

4.3.3 Content and Access

"Content and Access" group consist of the most modern methods e.g. *new gaming content, access to use some options in the game, add-ons, downloadable content (DLC), episodic releasing, possibility for multiplayer, and removal of unwanted content such as advertisement*, all through payment but perhaps not so obviously – limitedly [12][30,32].

This model relies for the both the actual game to be something the customer desires to pay more for and the trust the customer has to the publisher to get a product worth the money.

Before DLCs, **Add-ons**, expansion modules or expansion sets (not to be confused with free in-game add-ons) were quite useful method to sell extra levels, extra modules and other additional content for a game. Yet modern examples include Civilization series and its' expansions. [12]

Removal of advertisements is a model where by paying – usually by either paying once or paying periodically – customer can achieve more pleasurable playing experience without ads whereas those who refuse to pay generate revenue by being forced to watch advertisements. [12]

Yet there are more content and access models where the customer by paying can acquire a **possibility to play multiplayer** in an otherwise free game, **access** some **options** (e.g., saving) otherwise not included in the game. These are usually experimental, and are not that common. [12]

5. ANALYSIS

As it seems at the first glance, these classifications seem to have a lot of overlap but some of the former are more comprehensive whereas the latter is more in-depth. The direction of the analysis in monetary transaction (top-to-bottom vs. bottom-to-top) makes differences on how the payment is viewed. Next the analysis goes in-depth on how these methods relates to MR in museum and cultural heritage.

5.1 Gaming analysis

In museums and cultural travel sector it is usual for a customer to visit the same site quite that often. Thus those gaming sector business models which rely on the user to repeatedly do the same or similar action are not as suitable for a museum and cultural travel. For example it is understandable that **Lure-to-play**, **Pay-to-win**, **Pay-to-pass-boring** and **Pay-for-visual** models are unfit for quicker and more place-dependent game or adventure whereas e.g. **Pay once**, **Removal of advertisements** and **Shareware** models are rather tempting solutions. That is, when the user uses the software only once or very rarely, they are ready to use the software as-is rather than pay for the shortcuts whereas a player who spends hours per day for the favourite game can see these investments more tempting. Therefore one could rule out the *"pay while playing"* –business models because the model depends on "hooking" the customer to the game-as-service which requires immensely more time than what a museum or cultural site experience traditionally takes.

Pay Periodically at first glance seems unfeasible due the nature of the museums and cultural travel where one-time payment is usually the way to proceed and it is not so common to visit the same museum multiple times within a small timeframe. However, there are museums which offer memberships, year-passes or other long-time accesses and the business model could be tailored to complement or mimic these. This however is both only a small sector of museum and cultural sector, and always a case-dependent solution and thus is not relevant to discuss any further. Yet again when different museums offer periodic passes to various different museums e.g. weekly, monthly or yearly passes where the customer can enter various museums or cultural sites within the time period. [5] Combining or copying such a system to museum and cultural travel MR software seems feasible enough offer to complement other revenue models.

Therefore, we are left with *freeware, shareware, pay once, removal of ads, DLCs, add-ons* and *access for options*. Also possibility for multiplayer can in this sense be extended to various social media and thus can be included to the list with this modification.

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[3] Thus the term nagware.

[4] Or as Heimo et al. point out, remove built-in unpleasant elements from the game. [12]

[5] See e.g. Finnish Museum Card, http://www.museot.fi/en.php

As noted before, **freeware** as a business model best serves as an advertisement. This could be quite promising method while MR technology still emerges and the company requires both practice and fame but – as always – requires some amount of capital because this model produces none. Also when the service provider is the museum or cultural travel site itself, they can promote themselves, their exhibition or other experience with free MR application.

However, **shareware** method serves both as an ad and a possibility to generate revenue with full version. Though this method can be seen as a demo version, a sneak-peak advertisement for the whole software, it also can serve as a platform to be interconnected with add-ons, DLCs and access for options to ease up the decision for the customers whether they are willing to pay for the full (or less limited) experience or not.

Pay once is the simplest form of business model amongst the ones mentioned by Heimo et al. for MR for cultural travel. The model is easiest for the customer to understand how much they are investing as well as for the producer to calculate possible revenue. The problem in this is the aforementioned emerging nature of the MR technology: people do not know what the product itself is and the threshold of paying for it might be too high. Thus it is advisable to counter this effect with advertising (see also shareware). This problem though should disappear when the MR solutions become more commonplace. [12]

Advertising and thus **removal of ads** has received more polarized responses from the users. While numerous younger users do not see problem with advertising in cultural sites, the more mature users see it more problematic. [7] The use of the advertising thus requires a lot of planning and analysis weather it suits the atmosphere of the museum or cultural site itself. Of course, there are some places that advertising can be outright dismissed e.g. active sites of worship and thus it is also very important to understand the nature of the site before implementing ads to the MR solution. If taken in use though it can be debated if the model suits at all because the idea behind the removal of ads is usually using some nagging and annoying form of advertising thus forcing the user to buy a view not bothered by blinking or popping ads. As mentioned before, MR solutions for museums and cultural travel are usually used only for a relatively short period of time which might not be enough to annoy the user to pay. It should also be noted, that most of the museums make direct agreements with the sponsors in contrast of using online advertisement networks as most mobile and game developers do. In these cases removal of ads of the sponsors is not a viable option.

DLCs and **add-ons** can be used with MR in cultural travel in various ways. First, the software can be designed to be used at many different locations and the additional content for different places are bought separately. Secondly, the software can offer some content and the additional content can be bought if the customer so desires. Thirdly, the extra content can be sold after the customer has exited the site as a "souvenir". This model – in contrast to pay once – can decrease customers' willingness to pay for the software in the first place if they are aware of extra payments but not aware of the nature of them. However, if the museum is able to publish new content periodically, the model provides added value to the visitors as they have a reason to re-visit the museum and have new experiences. If this is communicated clearly, the visitors might be willing to pay "again" from the same application if the content is new.

Access for options and possibility for multiplayer are models that could also generate revenue, but possibly only when combined with other methods. These include but are not limited to see others or communicate with them in the MR environment (multiplayer), options to get aforementioned souvenirs e.g. pose with historical characters ("selfies" etc.), order 3D printed models of these characters, save own adventures in video format, etc. As these models are experimental in video game business, they are even more experimental in an emerging MR business environment.

A summary of this chapter can be found from Table 1.

Table 1. Methods from Heimo et al.[12]

Method	Include	Reason
Freeware	Yes	
Shareware	Yes	
Pay once	Yes	
Monthly fee	Yes	
Lure-to-play	No	Time
Pay-to-win	No	Time
Pay-to-pass-boring	No	Time
Pay-for-visual	No	Time
Removal of ads	Yes	
Possibility to multiplayer	Combine	Experimental
DLCs	Combine	
Add-ons	Combine	
Access for options	Yes	

5.2 Mobile App Analysis

Paid download can be directly compared to pay once and thus shares all attributes to **pay once** discussed earlier.

Its' subcategory **free trial** though consists of many different groups different methods discussed earlier. Many of those fall into the Heimo et al. model [12] second group *Pay-while-playing* but has many different variations such as shareware, DLCs, Add-ons, and access for options. Within them it seems that this group shares the attributes as shown earlier.

In Hyrynsalmi et al. [14] model **advertising** comprehends a larger group than in Heimo et al. [12] where the revenue comes both from the ads as well as from removing them. It can be argued though that one must be careful when adding ads to a museum or cultural travel software because those places – as discussed earlier – can be deemed as holy or otherwise important enough to be "ruined" with advertising. However, the visitors are used to see private parties to sponsor certain museums, so this type of advertisement is probably acceptable in the MR apps also.

Subscription model can be directly compared to earlier mentioned pay periodically –method.

Pay-per-use model combines the methods from earlier mentioned DLCs, access for options, shareware and add-ons as free trial does. The main difference here seems to be the first (free) use compared to the customer being asked money from the start. The analysis seems to be shared by both the paid download (and thus pay once) as well as free trial (and its' counterparts).

Hosting and **point-of-traffic** seem to be unfeasible to be used in MR in museums and cultural travel for they serve no additional

benefits for the user nor the developer to be implemented to the application at the first place.

A summary of this chapter can be found from Table 2.

Table 2. Methods from Hyrynsalmi et al.[14]

Method	Include	Reason
Paid download	Yes	
Subscription	Yes	
Advertising	Yes	
Free Trial	Yes	
Pay-per-use	Yes	
Hosting	No	Unfeasible
Point-of-traffic	No	Unfeasible

6. SYNTHESIS

As shown earlier the categorisation by Heimo et al. [12] and by Hyrynsalmi et al. [14] overlap in crucial points when examining the museum and cultural travel MR applications. The synthesis of these methods can be seen in Figure 4.

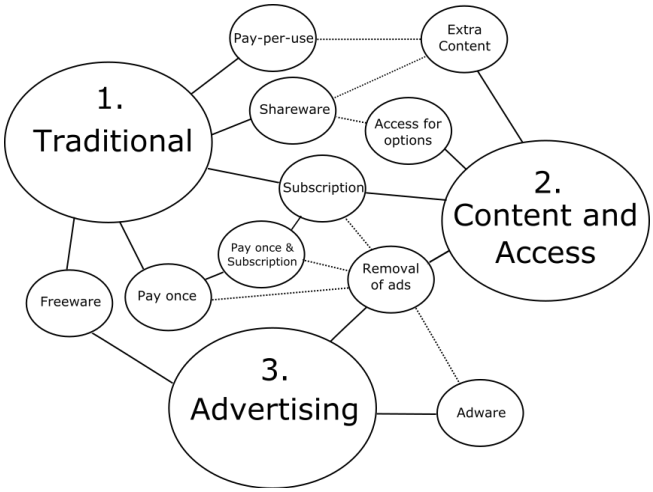

Figure 2, B2C Business models for MR for Museums and Cultural Travel

The main synthesis of these methods for MR in museums and cultural travel is the removing of unnecessary models from both and promoting the main issues. In this model the **Advertising** has gotten a larger role due its bigger role in the mobile application business by Hyrynsalmi et al. [14] whereas more gamified methods i.e. *Pay while playing* (and its' subcategories) and *lure-to play*; and most internet-based solutions, hosting and point-to-traffic have also been deemed unnecessary for these kinds of B2C application business models.

- Methods DLCs, add-ons and possibility for multiplayer have been combined to **Extra Content** due their smaller role in MR solutions for museums and cultural travel.
- **Pay-per-use** model is very close to Shareware but the ideology is different. Whereas shareware is more varied in crippling, nagging, etc., pay-per-use promotes the payment by the use time, not payment to complete the software as full (or partially full).
- **Shareware** works as in Heimo et al. [12] but is seen in this model by having stronger connection to Extra Content as in Free to Trial in Hyrynsalmi et al. [14].
- **Pay once** is similar than in Pay once in Heimo et al. [12] and Paid downloads in Hyrynsalmi et al. [14]
- **Subscription** works as in the pay periodically in Heimo et al. [12] and similarly named model in Hyrynsalmi et al. [14]. **Pay once & Subscription** is a combination of both.
- **Freeware** works in both Freeware in Heimo et al. [12] but is also a subcategory to advertising.
- **Adware** is similar to Advertising in Hyrynsalmi et al. [14].
- The most interconnected method **Removal of ads** is as in Heimo et al. [12].
- **Access for options** is as in Heimo et al. [12].
- **N/A** for those methods that are present in Heimo et al [12] or Hyrynsalmi et al. [14] but are not necessary in this model.

The overlapping of these 3 models is represented in table 3.

Table 3. Model synthesis

Hyrynsalmi et al. model [14]	Heimo et al. model [12]	Synthesis
Paid download	Pay Once	Pay once
Subscription	Monthly fee	Subscription
N/A	Pay once & Monthly fee	Pay once & subscription
Advertising	N/A	Adware
	Removal of ads	Removal of ads
Free trial	Freeware	Freeware
	Shareware	Shareware
Pay-per-use	N/A	Pay-per-use
	Possibility to multiplayer	Extra content
	DLCs	
	Add-ons	
N/A	Access for options	Access for options
Hosting	N/A	N/A
Point-of-Traffic		
N/A	Lure-to-play	
	Pay-to-win	
	Pay-to-pass-boring	
	Pay-for-visual	

As with Heimo et al. [12], the application can utilise several different business models, for example:

- When a museum wishes to implement new MR experience to their latest exhibition and they decide that a sum of money should be paid on top of the entrance fee to be able to use the MR software, the software uses *pay once* model. In addition the museum desires to advertise their future exhibitions during the MR experience, the app is also *adware*.
- A cultural site wants to promote itself during the season and offers the app for free to get more customers. The app is *freeware*.
- A national museum organisation offers yearly museum passes which also allows the customer get all the MR content in any museum under the national organisation for that year. The app is *subscription* model. If one wishes to get 3D printed models from the MR experiences, they can order them for a fee. The app is also an *extra content* model.

It should be noted, that one of the simplest and most evident models for the museums to monetize the MR applications is simply to add the approximated value of the application to the admission prices regardless whether the visitor uses the application or not. From the visitor's / user's perspective the application uses the Freeware model, but the museum has to carefully calculate the effect of the MR application to the ticket prices. If the museum gets public or other external funding for its operations and exhibitions, this seemingly simple model becomes highly complex. Since this type of model is not common in gaming or mobile markets, the deeper analysis of the model is omitted in this paper.

7. CONCLUSIONS

As discussed before there are various ways to include MR experience to museum and cultural site experience. Numerous business models derived from video game industry seem feasible while some can be ruled out, but which of those – if any – will prove themselves proper lies in the future. More MR piloting and solutions for museum and cultural travel sector must be made to fully comprehend the true commercial potential of this technology.

It also seems that MR solutions for museums and cultural travel have various different possibilities compared to e.g. more traditional audio guide systems but – due to the nature of museum and cultural travel sector – fewer than video game industry. Situational understanding of both customer base and the nature of the site itself is still required.

The new model of this research will present feasible framework on how the new MR solutions for museums and cultural travels can have a good possible revenue models, business logic and business models. It must be remembered that due the emerging nature of this technology this is of course not the be-all-end-all limits to overrule all other possibilities. Yet it shows possibilities to developers to find methods and ideas to get revenue from their hard work.

Our further research on subject will focus on both the MR solutions in museums and cultural travel as well as their business potential. The focus is in the financial feasibility of combinations of museum and cultural travel content, MR-augmentation of the previous and how those are offered to the customer. MR as an emerging technology must form a more stable position in our society before its possibilities and limits can be fully analysed.

Moreover the MR is an emerging business itself and thus its business models both with and without museums and cultural heritage sites requires a lot more research. Before that these ideas can be used to develop this fine technology further.

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