

### Introduction

Augmented Reality and its associated fields have undergone considerable expansion in recent years, although the ideas involved in them are not necessarily new. The heritage field has been a major driver of augmenting realities, powered by the heritage lottery fund. Heritage curators are increasingly considering how to make use of the next generation of augmented reality devices to enhance the user experience. Most UK libraries however have yet to consider the potential of using similar technology to augment the library and expand the user experience within it. I believe that Augmented Reality should be of great interest to forward thinking libraries and of particular interest to cataloguers.

### So, what is Augmented Reality?

The terms are in flux; but ultimately Augmented Reality (AR) offers an alternative to Virtual Reality (VR). VR systems immerse the user in an entirely computer-simulated environment, with various degrees of sophistication. An augmented reality instead adds detail to the users interactions in an existing “real world” environment. Physical space thus remains the core environment in AR. Information and graphics are superimposed onto our perceptions of the real world and this differentiates AR from mediated reality (MR). In MR real world objects are removed from the observers perception to be replaced with computer generated artefacts. Some researchers consider MR a subset of AR (Azuma et al, 2001; Bimber & Raskar, 2006). It is increasingly common in the heritage field to move the conversation on from AR to Hybrid (or mixed) Reality (HR). HR emphasises an increased degree of interaction with the digital component compared to more primitive forms of AR, which will often simply incorporate embedded video material. This article considers HR to be the logical continuation of AR rather than a separate entity, but the ideas within it should inform the vision of what libraries can choose to become.

The proper role of AR is to add virtual informational material to our perceptions rather than to replace certain aspects, Three primary criteria have been posited within an AR system (Azuma et al 2001), and have become the standard, these are:

- The system 'combines real and virtual objects in a real-world environment'.
- The system '...(aligns) real and virtual objects with each other'.
- The system should run 'interactively and in real time'.

In the ideal form the results are interacted with via an eye-piece; either glasses or a visor, through which the real world is perceived whilst the augmented information is simultaneously over-layed. This form of interaction currently remains beyond the majority of the population. Googleglass failed to take off a couple of years ago; although that hasn't stopped technology firms continuing with substantial investment in the field (Molla, 2017).

Currently the best available interactive device is the smart-phone; probably the dominant tool in merging personal computing and communication. Smartphone applications commonly form the basis of the interactions of the informational society (Sarfwa & Soomro, 2013). Mobile platforms have been increasingly taken into account in envisioning the future of the catalogue (Chambers, 2013), naturally information literacy and induction sessions must place greater emphasis on drawing the users attention toward AR interactions.

## AR and the Library

Augmented Reality is already upon us. It has seen early use in public libraries in the UK during the 2014 Summer Reading Challenge with the Mythical Maze app (McGettigan 2014); in addition its impact on the area of Special Collections is being considered (Cullingford, 2016). AR is increasingly used in educational environments (teachthought.com, 2017) and in Europe and the US consideration is being given to the field, particularly from epistemological and pedagogical perspectives (Ariso, 2017; Wildermann 2014). Already publishers are bringing out AR books (<https://appeal-vr.com/blog/10-best-augmented-reality-books/>) and some thought should be given to how cataloguers will recognise and describe such material; particularly when specific apps are a prerequisite for their use.

However libraries should not only hold AR material; they should actively participate in the development of the Augmented Reality Library (AR-Library) and in doing so the cataloguer has a crucial part to play.

The heart of the traditional library is physicality, but much of the current emphasis in terms of access is based around digital library interactions, primarily through the catalogue. Such approaches form the basis of many components of information literacy teaching, because of the resulting disconnect of the user from physical holdings. Too often I have heard the argument that “*it doesn't matter where a book is put as long as you can find it on the catalogue*”; but classification and cataloguing are both undertaken to render connections meaningful to the user, to provide access-points and to create a sense of underlying order amongst holdings.

The advantage of the catalogue is that it provides access to digital only material, and allows users to describe particular search connections beyond those espoused by the classification scheme alone. Explicating how to undertake this process forms the basis of information literacy provision and also takes up a surprising proportion of library assistants' time. Having served as a library assistant in both public and academic libraries I was intrigued both by the similarities and differences in users interactions with the catalogue. Many users would utilise OPAC terminals to undertake basic searches, but rarely more complex ones. In addition a particular approach by students would be to find a promising item on the catalogue, then take out their phone and take a photograph of the screen to help remember the shelf-mark. They would then go to the shelf, find the book, peruse others in the area (often finding several more items) and return to the OPAC to continue their search. Many expressed surprise they could access the catalogue in other ways, and especially that they might do it on their phone! In effect the OPAC served as a non-portable subject guide and as a hindrance to accessing e-resources, which students tended to locate in alternative ways, because the OPAC is commonly logged in guest mode, problematizing the act of downloading e-resources “mid-search”. The catalogue therefore is best used for the location of a specific piece of information, such a shelf-mark or a precisely targeted item or article.

The alternative, a serendipitous approach of shelf-browsing via the classification scheme is still an important access point to the holdings; often regarded as a key approach by humanities scholars. As a process it helps users find material they would not otherwise search for on the catalogue, and contributes to expanding the students understanding of broader themes in their subject through experiential interaction with the collection. The process has no chance of introducing the student to e-resources and can incorporate substantial inefficiencies of time, although the potential pay-off in creating new knowledge and understanding should not be understated. The classification scheme thereby supports the user in internalising a broader level of knowledge, widening a search and considering connections in the creation of new knowledge.

In the AR-Library these distinctions between catalogue and classification can be harmonised and the two aspects synchronised. AR-Library brings the catalogue to the shelves creating a liminal space where knowledge location and knowledge creation are increasingly merged, and facets collected and combined by the user.

## **AR-Library and the cataloguer:**

AR-Library aligns virtual objects to the physical components of the library. These physical components primarily consist of the shelves and the physical stock. Interaction with these virtual objects will then occur in situ through a display device, allowing the user to perceive the various digital layers simultaneously superimposed on the physical reality by leveraging the classification scheme and subject-headings. This will allow the integration of e-resources (such as those held in institutional repositories) and backroom materials into the serendipitous experience of shelf browsing. Although some consideration must be given to copyright issues in deciding the degree to which materials can be made accessible, the catalogue aspect of AR-Library may well circumvent many of these issues.

Alongside e-resources the user is connected with a range of metadata, supporting the users information literacy. Controlled vocabularies for example can be rendered more visual as a digital overlay and the same applies to usage stats, with popular items on a topic more readily identified and user customised recommendations provided. Folksonomies can also be accessed by the user through overlay visualisations and potentially linked to subject-headings to enhance search strategies. This could place the user at the centre of a web of links, allowing the construction and reconstruction of faceted searches at point of need within the browsing experience. In achieving this the quality and completeness of metadata is paramount and in-house cataloguing and metadata creation skills are a crucial resource in effectively undertaking the AR approach.

Precise methods of interaction will develop further over-time but initially emphasise a QR-code approach, although barcode scanning is currently faster in terms of computational response speed. As the technology advances however more futuristic interaction with the digital overlays will become possible (Castellanos & Perez, 2017).

The use of Geographical Information Systems (GIS) can also leverage the classification scheme to support way-finding around the library stacks. AR-Library can draw on the strength of the catalogue in creating connections between multiple holdings in different physical areas and guide the user between them. The Topic-space project provides an excellent example of the tools in use (<http://journal.code4lib.org/articles/10881>). This project leveraged both subject headings and classification to connect stock across the library, classmarks were initially used to provide recommendations of further reading and with improvements in AR supporting technologies this approach will become increasingly efficient. Personalised recommendations, increasingly used as an approach in marketing, were incorporated alongside way-finding technologies. The project represents valuable advances in implementing AR aspects into the library.

## **Conclusion:**

AR-Library melds the catalogue and classification scheme to expand access points. It is underpinned by GIS technology; with interaction through smart-phones, although alternatives will present themselves in the future. Already a number of libraries around the world are leading advancements in making AR-Library a reality and UK libraries should not be left behind. Crucially AR-Library enhances user connectivity to metadata, placing the cataloguer in a critical position for the realisation of AR-Library's goal of a more completely faceted and interlinked serendipitous browsing experience.

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