

# Cultural Heritage Visualization: Using Interactive Multimedia in Museum Environment

**Beata Dawson**

Ph.D. Candidate

Curtin University

Kent Street, Bentley, Perth,  
Western Australia 6102

+61405064163

[beata.dawson@postgrad.curtin.edu.au](mailto:beata.dawson@postgrad.curtin.edu.au);  
[www.beata-dawson.site](http://www.beata-dawson.site)

**Dr. Pauline Joseph**

Lecturer

Curtin University

Kent Street, Bentley, Perth,  
Western Australia 6102

+61892667180

[p.joseph@curtin.edu.au](mailto:p.joseph@curtin.edu.au);  
<http://oasisapps.curtin.edu.au/staff/profile/view/P.Joseph>

## ABSTRACT

Storytelling in museum environments can be ‘materialized’ using print and visual media formats. The use of graphical visualization techniques improves the interpretation in a narrative context, hence helps to convey information and deliver a better understanding of a story. This research was prompted by the rising use of interactive visualization techniques for ‘storytelling’ in museum environments.

## KEYWORDS

Visualization, multimedia, interactive, storytelling, digital humanities, virtual museum, museum environment

## 1. INTRODUCTION

The use of multimedia to present and communicate information is a popular trend in our society. This is evident in museums that are increasingly using multimedia technologies, online multimedia exhibitions, and virtual museums to successfully showcase their collections and to tell stories about their physical objects. Using multimedia technologies enables stories about museum collections to be discoverable by anyone and from anywhere in the world.

Innovative options for ‘storytelling’ open new ways to communicate and convey stories and to share information. Digital technologies play an increasingly important function in the digital humanities discipline, in cultural heritage areas, and in the museum environment. These emerging technologies raise questions about the future roles of professionals in the museum and digital humanities disciplines. What skill

sets do they need to apply these new techniques and methods? More importantly, how can they keep abreast of technological developments in the 21<sup>st</sup> century?

We answer these questions by sharing our experience in developing an interactive digital multimedia production to tell the story of the physical Markham car collection held by a state museum in Western Australia.

### a. Related Works

In a larger context, this research work is touching the field of Digital Humanities (DH) (see e.g. [1] and [2]), investigating the knowledge process in the humanities domain. The research work in particular addresses the utilization of modern visualization technology in the domain of DH, as e.g. [3] and [4, pp. 31–36] to make efficient use of information visualization [5] and its related aesthetics [6]. It also describes how latest multimedia technology can be applied in museum contexts, as e.g. described in [7]. The content and storytelling aspects are based on research conducted by the second author Pauline Joseph published in the academic peer-reviewed journal [8].

## 2. DIGITAL MEDIA TECHNOLOGY IN MUSEUM ENVIRONMENTS

### a. Visualization for Museum Collections

Using visual imagery is an excellent technique to convey and share information; and also to tell and comprehend stories. An “emerging class of visualization” combines “narratives with interactive graphics” [9, p. 1139], which supports storytelling in an efficient way [9, p. 1140]. Consequently, enabling the information or story to be more “comprehensible,

memorable and credible to the general public” [10, p. 19].

Skillful employment of visualization techniques enables a story to be told through the “graphical depiction of statistical information” [11]. Information visualization can also refer to “computer generated interactive graphical representations of information” [5], and its process [12, p. 387]. It can be functional and aesthetic [6].

Using just printed text without visual aids to communicate lots of information decreases comprehension of the messages being communicated. Hence, the inclusion of visual media is vital to survival in the current “information ocean” [13, p. 1].

This application especially follows Paivio’s (1971) ‘dual-coding hypothesis’, “pictorial elements are easier to retrieve from memory”. In Jacoby et al.’s view (1983), “the larger the number of sensory modes” to deliver a message is “the greater the likelihood of effective communication” [14, p. 378]. Furthermore, psychological research results indicate that, cognitively, information encoded in two forms – visual and verbal – is more easily retrieved from memory than single-format information [15, p. 921].

## **b. Multimedia Technology**

Using multimedia technologies to present information in a number of ways, including through visualization, has gained popularity in recent times. Combining different media elements/components - such as textual information, photographs, pictures, graphics, drawings, video, audios, sounds, and animation – digitally into one tool, results in multimedia.

The visual elements in multimedia technologies support the accompanying verbal information, thereby facilitating quick comprehension of information and stories being communicated.

“Multimedia includes any presentation combining more than one format (...) within a single sensory modality (...) or across modalities” [15, p. 918]. The application of multimedia elements gives the benefit of showing “movement and sound along with visuals”, and multimedia platforms give the opportunity to “stimulate real life situations” [16, p. 197]. Its use in education is ‘commonplace’, and now multimedia-use appears in a variety of other areas. Research findings indicate that “knowledge acquisition from multi-format sources has largely supported the effectiveness of multimedia relative to single-format learning”, and its

advantages are proven in the ease of understanding fact-based content and “comprehension of expository information” [15, pp. 918–919].

## **c. Virtual Exhibitions: Media Technology in Museums**

Museum environments are increasingly incorporating multimedia technology in their presentations [7]. Multimedia elements are usually used alongside museum objects or collections to inform the visitors about the physical exhibits and enable engagement to enhance their experience with the collection.

An example of multimedia use in the museum environments is the virtual museum. Many online multimedia museum exhibitions (virtual museums) successfully work, so that their collections, and stories are discoverable for anyone and from anywhere in the world. However, some issues need to be considered when creating virtual exhibitions. First and foremost the visual consistency in the user interface (UI) design must be maintained. Subsequently, the digital information must be clear, immersive, easily navigable, and interactive to enable the effective comprehension of the content without difficulty.

## **3. THE STORY OF THE MARKHAM CAR COLLECTION**

The story of the Markham car collection is an interactive digital multimedia production (DMMP). It tells the story of Percy Markham, an antique car collector, who wanted to leave a cultural heritage of antique cars for Western Australians. The story provides a historical account of how Markham sold his collection of 22 vintage and veteran cars for AUD 180,000 (much below the valued price) to the Western Australian Museum Board in 1969. However, in 1988 the Museum auctioned ten of these cars, which enraged the motoring community in Western Australia. Fortunately, one veteran car, the 1898 Star Vis-à-vis survived the auction and is displayed in a local motor museum.

There are future plans to offer the final DMMP to be displayed beside the exhibition of the 1898 Star at the museum for visitors to learn this story.

### **a. Description of the Production**

The production of the digital story is based on Joseph’s research article [8]. The story combines digitized and visualized information sources and different media

formats and modals into one complex multimedia production.

## b. Overview of the Structure of the Production

The production is partially interactive and mainly guided. However, the audience can also navigate it themselves. It comprises authentic 360-degree panoramic pictures (Figure 1) and partial 180-degree panoramas (Figure 2).



Figure 1. Motor Museum of Western Australia (authentic panorama).



Figure 2. Imaginary museum rooms (designed 180-degree panoramas).

These panoramas have been created as the virtual representation of a museum environment with various imaginary gallery showrooms. Each room represents a significant aspect and milestone in the history of the Markham car collection story.

## c. Opening Scene

The opening scene displays five antique doors (Figure 3) that lead to the different gallery showrooms (scenarios of the story) in this story. The virtual museum visitors can visit each room by entering these doors; they also can ‘walk’ through the different scenarios by clicking on the interactive arrows/icons in each showroom. The order of the scenes is interchangeable, however, the story cannot be modified. Users will have a greater comprehension of the story if they follow the predetermined sequence of the rooms.



Figure 3. The five doors - lead to the different gallery showrooms.

## d. Rooms and Levels of the Production

The first door is labeled with the numeric ‘one’ and with the prompt stating ‘Go to the room ‘STAR’’. This door leads visitors to where the 1898 Star Vis-à-vis is introduced (Figure 4). This physical museum object is currently displayed at the Motor Museum of Western Australia on loan from the Western Australian Museum.



Figure 4. The room behind the first door - introduces the 1898 Star Vis-à-vis.

The second from the five doors (or the interactive button from the first room) leads to the room titled ‘Markham family’ (Figure 5) Here visitors ‘meet’ Mr. Percy Markham, the owner of the 1898 Star and are introduced to his family.



Figure 5. The room behind the second door - introduces the Markham family.

The visitor then, by clicking on an interactive arrow, seamlessly walks from the second into the third room, ‘Antique Auto Museum’ (Figure 6). Here, the visitors view an imaginary exhibition with 3D objects, photographs and moving slides of some cars and pictures of the museum in original conditions. Using the interactive icons they can watch short movies about the antique cars once displayed at Markham’s private museum that was open to the public on weekends in the 1960s.



**Figure 6. The room behind the third door - introduces Markham's Antique Auto Museum.**

Visitors, using the interactive icon/arrow, walk to the fourth room (which is two half-rooms), 'WA Museum'. In the first part of this imaginary museum area (Figure 7), the story unfolds about the advantageous sale of the 22 Markham cars to the Western Australian Museum in 1969. In the second half-room (Figure 8), the story describes what happened between 1988 and 1989. This room can be entered from the opening scene by clicking on the fourth door's interactive button.



**Figure 7. The room behind the fourth door - tells the story of what happened with the Markham cars between 1967 and 1969.**



**Figure 8. The second half of the room behind the fourth door - continues the story of what happened to the collection in 1988 and 1989.**

### e. Exiting the Virtual Tour: Final Imaginary Room

The final imaginary museum room, titled 'Christie's Auction' (Figure 9) behind the fifth door, (or following the arrow in the previous scenario) narrates the decision by the Western Australian Museum to auction ten cars in 1990. Photos of each of the ten cars published in Christie's catalog are presented.



**Figure 9. The room behind the fifth door - narrates the WA Museum decision and the Christie's auction.**

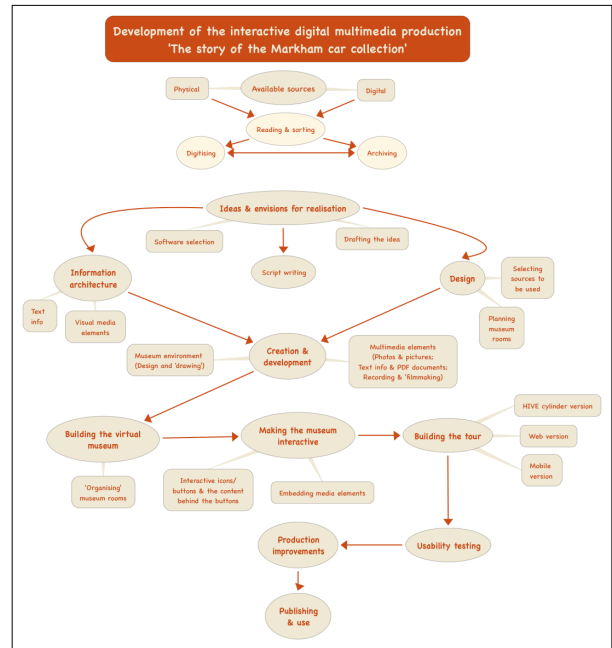
Leaving the 'Christie's Auction' imaginary room, the visitor can 'walk' to the Whiteman Park location and enter the front door of the Motor Museum of Western

Australia, where the 1898 Star Vis-à-vis is currently displayed. Authentic 360-degree panoramas were employed to showcase this environment, where the visitors can learn the story about these cars.

The different types of media appearing within the scenarios can be read, listened to, or watched according to the users' preferences.

## 4. DEVELOPMENT AND IMPLEMENTATION

The project to develop an interactive multimedia storytelling production commenced in 2015. The story line for the project was borrowed from Dr. Joseph's research about the heritage of the Markham car collection. It is published as a peer-reviewed article titled 'Heritage of the Markham car collection: Estrangement from the West Australian motoring community' [8]. In this article, Joseph researched what happened with the Percy Markham car collection sold to the Western Australian Museum in 1967 to understand how the controversial auction of ten of these cars disappointed the motoring community. Both Joseph's meticulous account of what happened and her use of a storyline writing style to report her research findings made it suitable to select this story for the development of this DMMP.



**Figure 10: Stages of production development.**

### a. Technical Setup

A complex virtual museum environment was designed and developed where 'visitors' can discover what



happened to the prestigious Markham cars. Its intention is to offer a unique and immersive experience for the audience. The story of the car collection is told using text, pictures, photographs, audio and video panels. The production is aimed to provide users with an immersive and interactive experience. Hence, users have the free will to select the information they want to read, view, listen to or watch.

There are numerous stages in the development of the production with each of them requiring advanced technical skill sets, knowledge and experience (Figure 10). Further skills in archiving the research records and archives gathered, writing the storyline, producing the digital content and writing computer code were also required.

The production is currently in its final stages of the development. Next, usability testing is planned to employ eight to ten user experience (UX) experts. Then, these experts' feedbacks will be utilized to improve and finalize the production. Finally, the production will be promoted to tell the digital story of the Markham car collection for both live and virtual visitors.

## b. From Available Source Materials to Building the Complete Tour

### Information Management

Firstly, the available physical and digital records that were provided by the Markham family and Dr Joseph needed to be appraised and processed: read, sorted, archived, and digitized.

These sources were: aged photographs, old manuscripts, and original copies of archival records, paper-based newspaper clippings, magazines, books, digital photos, and panoramas.



Figure 11. Processing and archiving the paper-based research materials.

The archives collection provided by the Markham family is unique and has heritage value. Its preservation was an important aspect of the archival process (Figure 11).



Figure 12. Archiving the Markham records.

Considering the age of the different manuscripts, their protection from damage and deterioration was essential. Handling (organizing, managing) the archival materials required wearing cotton gloves to ensure their protection from salt, acid, and contamination. Also, the use of acid-free paper files and storage containers was vitally important (Figure 12). A simple descriptive catalog was created using Microsoft Excel to register and describe in detail each archival record. The Excel spreadsheet format allowed easy access for anyone to search, retrieve and access this archive register (Figure 13).

Folder	DATE	FROM	TO	KEYWORDS	DESCRIPTION	NOTE
A	1962-08-05	Evidence: Robert Markham, Libris	MARKHAM	cars	napkins, silver glass, 1900, damier	
A	1965-04-13		MARKHAM	press	newspaper	
A	1967-11-02	MARKHAM	David Brand Premier of WA	cars	antique car museum	*
A	1968-01-15	MARKHAM		note	new address note	
A	1968-07-01	Rolls-Royce Owners Club of Australia	MARKHAM	advert	advertising	
#	1969-03-20	MARKHAM	David Brand Premier of WA	cars	antique car museum	
#	1969-03-26	David Brand Premier of WA	MARKHAM	cars	antique car museum	*
#	1969-04-21	MARKHAM	David Brand Premier of WA	cars	antique car museum	

Figure 13. Excerpt from the Markham archives' description.

Once the source archival records were registered and organized, the project focused on identifying suitable software to develop the MMDP.

### Information Technology Issues

The key software selected to vivify the 'story' was the Kolor PanoTour Pro 2.5. It was primarily selected owing to its functionalities that are suitable for and capable of creating a museum environment and for building an immersive virtual tour (Figure 14). It provides functionality to insert different hotspots (e.g. navigation icons, buttons), which enabled the creation of the 'museum' to be interactive.

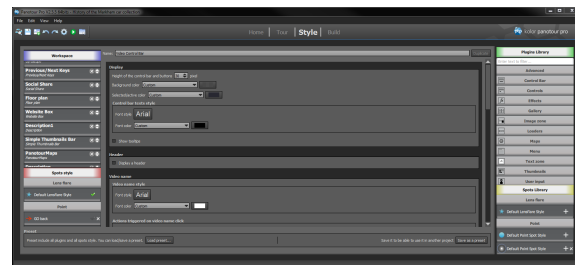


Figure 14. Kolor PanoTour Pro 2.5 user interface.

In addition, other computing software and applications, such as Adobe Photoshop, Audition, Premier Pro,

iMovie, Photos, and Sublime Text 2 were used in the production design and development (Table 1).

**Table 1. Software used for design and development of the DMMP.**

Software/ application	Used for/to	Required skills/knowledge
Adobe Photoshop CS6 Version 13.0.4 x64	Edit, improve quality of photos, documents; create 3D objects, and partial 180 degrees panoramas	Advanced
Adobe Audition CS6 Version 5.0.2	Editing sound recording	Professional
iMovie Version 10.1.3	Creating short clips and movies	Advanced
Photos (Apple) Version 2.0	Creating built-in clips/slides	Advanced
Adobe Premier Pro CS6 Version 6.0.5	Postproduction editing (audio and video)	Professional
Sublime Text 2 Version 2.0.2.	Editing HTML codes / sources (web publishing)	Professional
Adobe Acrobat X Pro Version 10.0.0	Creating PDFs	Basic
Kolor PanoTour Pro Version 2.5.5 64 bits	Develop the virtual tour	Professional

### c. Developing the Story Elements

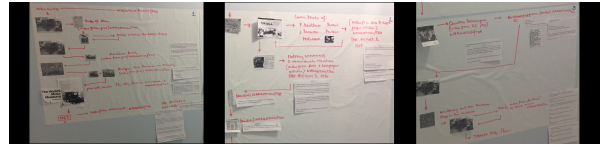
#### *Scriptwriting*

The next major step in developing the DMMP was the scriptwriting for the story. From the available and organized sources (e.g. Joseph’s article, archival records, magazines, newspaper clips, photographs) the

storyline had to be composed. As stated previously, the narrative was based on research article [8], and the supporting materials to visualize the story were used to compile the ‘screenplays’. Additionally, the first author also conducted research to source for media elements (e.g. the video clip of the London to Brighton Rally 1938, where the 1898 Star Vis-à-vis also appears), and other photographs (e.g. “participants” in the story other than the Markham family) while scriptwriting the story.

#### *From Storyboard to Storyline*

Drawing the storyboard was the next stage in developing the production (Figure 15). During this juncture, decisions were made about where the different media elements, such as textual information, pictures, audio, video or film clips would be embedded in the digital story.



**Figure 15. Drawing storyboard.**

### d. Digital Media Design

#### *Design Approach*

After the complete storyline implementation plan had been outlined, the next phase was to select and sort the appropriate pictures, and records. Lacking personal artistic ability and drawing skills, stock photos, pictures, and vectors (e.g. doors, rooms, objects) needed to be purchased to design the imaginary museum rooms. This decision was also made to afford a professional look and feel of a museum setting. From these elements and the available photographs, using Adobe software, 3D objects were created; and imaginary museum rooms were designed and developed.

The rooms were developed to provide an 180-degree panoramic view, with a size of 5048x1200 pixels to fit on the Cylinder screen located in Curtin University’s [HIVE](#) (Hub for Immersive Visualisation and eResearch), in Perth, Western Australia. The full authentic spherical panoramas that were provided by Dr Joseph, developed with the assistance of A/Prof Paul Bourke (iVEC@UWA) did not require a new design, development, editing or modifications.

#### *Improving the Quality of Media Elements*

After designing the museum environment, another significant step was to edit and improve the quality of the aged original archival records, and photographs. Using the Adobe Photoshop software, the image quality of these deteriorated photographs was enhanced until its colour qualities appeared brighter, sharper and clearer.

### Multimedia Work

The next crucial steps were to create the multimedia elements of the production. This process consisted of generating PDF documents, recording – cutting – editing voice-overs, making movie clips and short films.

The multimedia development (Figure 16) required advanced knowledge, understanding, and proficiency in the use of different software (e.g. Adobe Audition, Premier Pro, iMovie). These procedures were extremely time-consuming, as it required hours of patience to pay meticulous attention to the details (e.g. design principles and elements to enhance the quality of the archival materials, preciseness in the sound editing process, inserting layers of various media elements, aligning of image and sound components).



Figure 16. Multimedia work.

The multimedia work stage was followed by the next phase in the production development: building the virtual museum.

The production consists of eight authentic panoramic pictures (Whiteman Park, and the Motor Museum of WA), and thirteen partial panoramas (imaginary scenes and museum environment) (Figure 17). Every museum room represents a key point of the story, and the rooms are organized in chronological order.

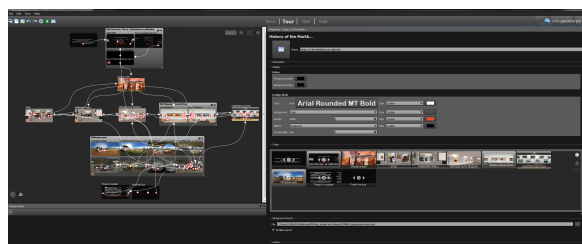


Figure 17. PanoTour Pro in use.

Each room has multiple media elements embedded: e.g. text, audio, and video. These components assist

telling the story at a particular time intended for the showroom.

## 5. USER EXPERIENCE AND ENGAGEMENT: NAVIGATING THROUGH THE VIRTUAL MUSEUM

### a. Giving Life to the Tour

To animate the production and make the virtual museum experience engaging for users, interactive icons and navigation buttons were designed and positioned where required in the DMMP. Similarly, different media elements were embedded to make the story interactive. Navigating through the virtual museum, users can perform various actions, move backward and forward between the museum rooms or open links to a website. They can view digitized photographs/pictures, listen to audios, read information, read archived documents or watch videos to learn and understand the story of the Markham car collection.

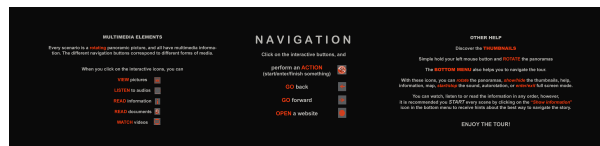


Figure 18. Information and navigation screen in the production.

Finally, three forms (one tour for three platforms) of the virtual tour have been built to cater for the multiple computing interfaces in which the digital story will be presented to the users (Table 2).

Table 2. Features of the different versions of the virtual tour.

	Web	Cylinder	Mobile
Text information	✓	✓	✓
PDF document	✓	✓	✓
Pictures and photos	✓	✓	✓
Built-in clips	✓	X	X
Movie	✓	✓	X

Audio	✓	✓	✓
Website	✓	✓	✗
Rotation	✓	✗	✓
VR	✓	✗	✓

Firstly, a full version of the production was built for a web interface (Figure 19). The PanoTour Pro software generates the tour in .html format. Sublime Text 2 software was used to modify and improve some of the source code. This version contains the full range of multimedia elements: textual information, pictures and photos, different audio components, short movies, built-in video clips, and PDF documents. The advantage of using the web version on mobile devices is - in the case of full panoramas, users wearing Virtual Reality (VR) headset can enjoy a VR environment.

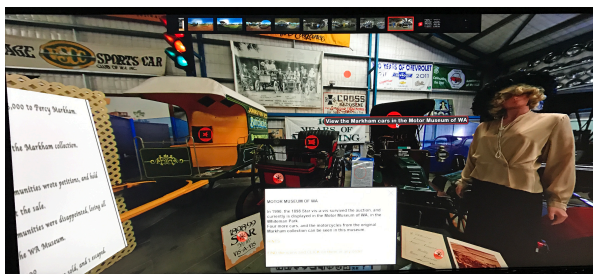


Figure 19. DMMP in use on the web interface

Secondly, the tour was developed and built for presentation on the wide [Cylinder](#) screen at the Curtin’s HIVE (Figure 20). This second version of the production omitted built-in video clips. The cylinder interface allows users to have an immersive experience, with a more engaging and satisfying visual view of the story.



Figure 20. DMMP demo showcase on the Cylinder (Photograph was taken by Prof Erik Champion at GLAMVR16 symposium).

Thirdly, the tour was generated in a different file format (.pvt) so that it can be used on iOS and Android

devices if the users download the free PanoViewer application (Figure 21). The disadvantage of this version is that some media components (e.g. built-in clips and movies) do not work correctly. However, its advantage is that users will be provided some form of VR experience by moving/rotating the mobile device, the users can look around as they walk through the museum rooms.

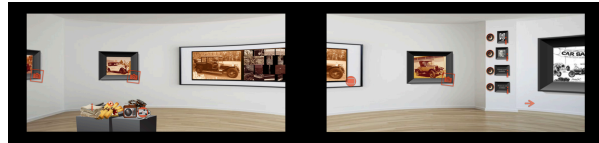


Figure 21. Using mobile application to interact with the story.

## b. From Usability Testing to Publishing

It is important to understand user requirements when developing virtual museums. Such online interactive user interfaces need to be designed to be intuitive and captivating for the users to stay online and explore the DMMP and the story it conveys. Hence, conducting usability testing is vital before finalizing the production for public access.

Usability tests for this project will be conducted to investigate the interactive DMMP’s usability and the users’ expectations against four criteria: learnability, understandability, attractiveness, and satisfaction. Its aim is to have UX experts conduct an ‘expert review’ of the production and elicit their feedback. These expert testers’ feedback will be applied to improve the DMMP before releasing it for public access for the next phase of the research goals.

## c. Current Implementation Status

This interactive DMMP, ‘The story of the Markham car collection’, is currently being reviewed by usability experts, it will then be refined before making it accessible to users. It will be released online and showcased on the Cylinder in Curtin’s HIVE in mid-2017.

The final version of the DMMP will be used by Dawson, in her Ph.D. research, to investigate if museum visitors prefer discovering stories about the exhibited physical collections by reading about the object from printed sources like Joseph’s (2016) article or by engaging with an interactive DMMP or both.

Dr. Joseph uses this DMMP as an educational resource for her information studies’ students to explore lessons



learned from this empirical case study of the Markham car collection. Pedagogy topics concerning ethics, role of cultural institutions, and community engagement issues are discussed using this digital production. The storytelling design of the DMMP allows for easy use of this production for educational purposes both when teaching online and face-to-face. Other academics may see the potential in using this DMMP in an educational context for pedagogy reasons.

## 6. CONCLUSIONS

Applying 21<sup>st</sup>-century digital technologies is vital in the digital humanities discipline, especially in museum environments. The benefits of visualization and the use of multimedia presentations are to convey visually impressive stories or share information about museum collections. This improved type of ‘communication’ simplifies the way in which the users/museum visitors access the relevant information. Also, the rich visualization and the immersive experience afforded by DMMPs enable the fuller understanding of a story for the visitors.

We feel it is worthwhile for professionals in the digital humanities and possibly in the GLAM sector to equip some of their staff with DMMP development skill sets. It requires learning and engagement with different hardware, software, and applications. This investment and the implementation of the evolving technologies would yield success in showcasing their collections; improve community involvement and position museums as destination for tourist attractions.

### a. Future Development

Future plans and challenges are to develop/engineer the content to achieve a more immersive Virtual Reality and/or Augmented Reality and/or Mixed Reality experience. Also, another goal is to apply the proximity beacon (Bluetooth Low Energy transmitter) technology (e.g. iBeacon, Eddystone, Estimote) on museum objects (e.g. cars, 1898 Star Vis-à-vis) to deliver the content (the story or part of the story) contextually and provide personalized experiences to users on location.

## ACKNOWLEDGEMENTS

The first author expresses special thanks to her Ph.D. supervisors Dr. Pauline Joseph and Professor Erik Champion for the continuing assistance and encouragement through the production of the creative work.

The authors’ sincere thanks go to the Markham family for providing access to Percy Markham’s archival records and the family photographs. The authors thank Ronan Sulich, Director and Australian Representative from Christie’s for granting permission to reproduce the photos of the Markham cars published in Christie’s auction catalog. The authors are thankful to Thomas Benson-Lidholm, a motoring enthusiast, for providing expertise in historical motorcars that greatly assisted the research.

We are appreciative of the valuable technical assistance provided by Jesse Helliwell (HIVE), Adam Barrett and Joachim Strand (CPSU). We are grateful to Luke Worthington for lending voice to the story.

## REFERENCES

- [1] A. Burdick, J. Drucker, P. Lunenfeld, T. Presner, and J. Schnapp, *Digital Humanities*. Cambridge, USA: Massachusetts Institute of Technology (MIT), MIT Press, 2012.
- [2] J. Drucker, D. Kim, I. Salehian, and Bushong, “Introduction to Digital Humanities.” 2014.
- [3] A. Lugmayr and M. Teräs, “Immersive interactive technologies in Digital Humanities: A review and basic concepts,” in *Proceedings of the 3rd International Workshop on Immersive Media Experiences*, Brisbane, Australia, 2015, pp. 31–36.
- [4] A. Lugmayr, A. Greenfeld, A. Woods, and P. Joseph, “Cultural visualisation of a cultural photographic collection in 3D environments - Development of ‘PAV 3D’ (Photographic Archive Visualisation) In: Wallner G, Kriglstein S, Hlavacs H, Malaka R, Lugmayr A, Yang H-S, editors. Entertainment Computing,” presented at the ICEC 2016: 15th IFIP TC 14 International Conference, September 28-30, 2016, Vienna, Austria, 2016, pp. 272–277.
- [5] C. Chen, *Information visualization: beyond the horizon*, Second. London: Springer London, 2006.
- [6] A. R. Gaviria, “When is visualization art? Determining the critical criteria,” *Leonardo*, vol. 41, no. 5, pp. 479–482, 2008.
- [7] F.-S. Hsu and W.-Y. Lin, “A multimedia presentation system using a 3D gesture interface in museums,” *Multimed. Tools Appl.*, vol. 69, no. 1, pp. 53–77, 2014.
- [8] P. Joseph, “Heritage of the Markham car collection: Estrangement from the West Australian Motoring Community,” *Collect. J. Mus. Arch. Prof.*, vol. 12, no. 1, pp. 21–44, 2016.

- [9] E. Segel and J. Heer, "Narrative visualization: telling stories with data," *IEEE Trans. Vis. Comput. Graph.*, vol. 16, no. 6, pp. 1139–1149, 2010.
- [10] K.-L. Ma, I. Liao, J. Frazier, H. Hauser, and H.-N. Kostis, "Scientific storytelling using visualization," *IEEE Comput. Graph. Appl.*, vol. 32, no. 1, pp. 12–19, 2012.
- [11] J. Stikeleather, "How to tell a story with data," *Harv. Bus. Rev.*, 2013.
- [12] C. Chen, "Information visualiation," *Issue Wiley Interdiscip. Rev. Comput. Stat. Wiley Interdiscip. Rev. Comput. Stat.*, vol. 2, no. 4, pp. 387–403, 2010.
- [13] J. Sviokla, "Swimming in data? Benefits of visualisation," *Knowledge Management*, 2009. .
- [14] M. Dijkstra, H. Buijtels, and W. F. van Raaij, "Separate and joint effects of medium type on consumer responses: a comparison of television, print, and the Internet," *J. Bus. Res.*, vol. 58, no. 3, pp. 377–386, 2005.
- [15] T. T. Brunyé, H. A. Taylor, D. N. Rapp, and Spiro Alexander B, "Learning procedures: the role of working memory in multimedia learning experiences," *Appl. Cogn. Psychol.*, vol. 26, no. 7, pp. 917–940, 2006.
- [16] A. Gaur and K. K. Grover, "Application of multimedia in the industrial sector," *Comput. Control Eng. J.*, vol. 12, no. 4, pp. 197–200, 2001.

## AUTHORS



**Beata Dawson** is a Ph.D. candidate at Curtin University (Media Culture and Creative Arts / Information Studies). She holds a Master's Degree in Information Management from Curtin University (2014), and a Bachelor Degree in Pedagogy from Eszterházy Károly Főiskola (currently Eszterházy Károly University of Applied Sciences), in Eger, Hungary (2001). Before she moved to Perth, Australia she partially completed her postgraduate degree in Library Informatics (2007), and had qualifications in Foreign Trade and Customs Administration (1993, 1994), as well.

She previously worked in foreign economics area, and as an educator, and is currently working in information management.

She has conducted research in educational history, child protection, drug prevention, and in the information field: in library history, and in online information retrieval.

Her current research is cross-disciplinary and related to communication technology, digital media, heritage and museum studies.



**Pauline Joseph (Ph.D.)** is a Lecturer in Records and Archives Management at the Department of Information Studies at Curtin University. Pauline studies how information is perceived and used in organizations and communities. With this focus in mind, she completed her Ph.D. at the University of

Western Australia in 2011, studying how knowledge workers search for corporate information in the electronic document and records management systems (EDRMS). Her Ph.D. research is titled "EDRMS search behaviour: implications for records management practices".

Pauline's current research interests are about the sustainability of community-based information management practices using the motorsport community as a case study. An aspect of this research investigated how and why the motoring community became estranged with cultural institutions.