# SOCIAL MEDIA ENGAGEMENT OF NATIONAL LIBRARIES

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I declare that this dissertation embodies the results of my own work and that it has been composed by myself. Following normal academic conventions, I have made due acknowledgement to the work of others.

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**ABSTRACT**

Social media metrics and analyses are becoming increasingly more common as an information source for measuring the impact of libraries, and creating engagement is seen as a key method of facilitating this. However, to date very little literature exists on the social media presence and practises of national libraries.

Statistical analyses were performed on the Twitter and Facebook posts of five national libraries (the British Library, Library and Archives Canada, Library of Congress, the National Library of Australia and the National Library of Scotland) collected during a nine week period to see if correlations existed between common and easily adjusted factors and the numbers of responses that form the metrics used to measure engagement. The data was also analysed to see if it was possible to compare the engagement of the national libraries and the study offers reasons for the differing levels.

The study shows that multiple factors such as the presence of a link or photograph, the time of day posted, all influence social media engagement of the national libraries studied though at varying level, and recommends courses of actions based on the results of the analyses of the different factors.

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## 1. INTRODUCTION

As national libraries have additional responsibilities separate from standard libraries, specific performance indicators and measurement strategies to assess national libraries have been developed (Poll, 2008). However, despite the burgeoning research into going beyond indicators and measuring the impact and engagement of public and academic libraries, little research has been done on whether the impact and engagement of a national library can be qualified and therefore measured, analysed and improved.

The little research previously done has been primarily bibliometric in nature which, whilst informative, only shows the impact on a small proportion of the population and is at times self-admittedly simplistic (Hunter and Hambleton, 2011). Social media use and social media metrics for analysing accounts and impact are booming in use (Lipschultz, 2014) so it has been chosen to be the area of focus for this research to see if the same metrics can be applied to national libraries social media accounts and therefore measure impact and engagement.

Social media research provides an ideal method for researching national libraries. National libraries by their nature are open to large populations and have diverse collections that attract visitors from around the world, and social media gives a platform for everyone interested to interact with the institution, especially as digitisation allows more and more access to the institution without having to visit in person. Image 1 shows the wide variety of locations the National Library of Scotland received tweets from and is indicative of the wide reach of interactions that social media enables. Social media research also has the added advantage that the same platforms are used by different institutions meaning the same metrics and methods can be used to measure all institutions as they all provide access to the same information, unlike more traditional forms of measurement as systems used to operate libraries vary between locations and authorities (Showers, 2015). Furthermore, national libraries have expressed interest and have stated goals in their strategies in improving their social media presence (Sverrisdottir, 2009; NLS, 2014).


Image 1: Map of tweet locations the National Library of Scotland received during the test period.

The text based social media platforms of blogs, Facebook and Twitter were chosen as the focus of the research as they are comparatively longstanding and well researched platforms, and this focus ensured the research didn't expand beyond the limited timescale.

The libraries involved in the research were chosen because they are active on various social media platforms and use English as a primary language which was essential due to the language barrier of the researcher.

The primary question addressed in the research was 'what factors affect the social media engagement of national libraries?' with secondary questions of 'how can these evaluations and factors be used to improve national libraries social media engagement?' and 'how can national libraries social media engagement be compared?'.

## 2. LITERATURE REVIEW

### 2.1 National Libraries

The International Federation of Library Associations and Institutions (IFLA) defines a national library as having specific responsibilities separate from a standard library, often defined in the laws of the country the library represents. These responsibilities vary slightly from country to country but usually include: maintaining a legal deposit collection; providing reference and lending services to

users and other library and information services; creating and maintaining a national bibliography; preserving and promoting the nation's cultural heritage; providing leadership in national literacy campaigns; providing forums for international projects; helping with the development of national information policies, and often providing information services to legislature (IFLA, 2014).

There are other national libraries in name, such as the American National Library of Medicine, several national science libraries, National Art Library to name but a few, they are limited by subject matter, and whilst they often have some of the responsibilities of a national library, they generally do not have the same onus to be cultural or historical guardians or lead the development of information services that national libraries do nor have memberships in IFLA or the Conference of Directors of National Libraries.

National libraries serve much bigger populations than public or academic libraries, and as to be expected, their collections and budgets are larger. Also to be expected is the relative scarcity of national libraries compared to public or academic libraries. IFLA endorses the Wikipedia list of national libraries and currently there are approximately 220 national libraries worldwide (Wikipedia, 2015) compared to the nearly 4,200 public libraries and 1000 academic libraries in the United Kingdom alone (LISU, 2015).

### 2.1.1 British Library

The British Library (BL) was formed in 1972 under the British Library Act 1972 by the merging of the British Museum Library (itself dating from 1753), the National Library of Science and invention, the National Central Library, and the National Lending Library for Science and Technology. The British National Bibliography and the British Institute of Recorded Sound were added to the library in 1974 and 1983 respectively (BL, 2015c).

The British Library Act 1972 established the duties for the BL which are to manage the library as a national centre for reference, study, bibliographic and information services for the scientific and humanities sectors and the public, especially educational institutes and other libraries. The act also established the management board of the library, and the BL is a Non-Departmental Public Body (NDPB) with board members appointed by Government, and the members have a responsibility to ensure that the necessary governmental procedures are adhered to for the public funding the BL receives (BL, 2015b).

In 2013/2014, seventy-six percent of the BL's funding was received from the Department of Culture, Media and Sport, a government department. The rest of the income was generated through services such as document supply (BL, 2014).

The British Library operates over two sites: St Pancras, London, and Boston Spa (BL, 2015d). In 2013/2014, the BL website, www.bl.ac.uk, received over 77 million page views with over 470,000 visits to the BL's reading rooms from visitors around the world (BL, 2014). The BL has approximately 112,506,000 items in all formats in its collection, and digitisation continues with over 14,000 items digitised in 2013/2014 alone (BL, 2014). Currently the United Kingdom has a population of over 61 million with over 34 million visitors in 2014 (Visit Britain, 2015).

Currently, The British Library is present on Twitter and Facebook, as well as nineteen blogs hosted on the website (BL, 2015a). The blogs cover a wide variety of departments and collections ranging from American Studies and Endangered Archives to Innovation and Enterprise and Sound and Vision. The blogs are regularly updated.

The main Twitter account has been active since 1 February 2009 and currently has 1.01 million followers and 7035 tweets (Twitter, 2015c).

The main Facebook page was created in 2007 and currently has 206,962 likes and 70,816 have checked in, indicating they have visited the physical location. Just over 5000 people have talked to the Facebook page (Facebook, 2015a).

### 2.1.2 Library and Archives Canada

The Library and Archives Canada (LAC) was officially created in 2004 with the merger of the National Library of Canada and the National Archives of Canada with the Library and Archives of Canada Act (LAC, 2015d). Before then, the National Library of Canada started as the Canadian Bibliographic Centre, opening on 1st May 1950, and became the National Library of Canada after the National Library Act that came into force on the 1st January 1953 (Lunn, 1982). The LAC is part of the Department of Canadian Heritage and as such is reportable to the Canadian parliament (LAC, 2013). The LAC is primarily funded by the Canadian Government, but funds are also raised through the sales of goods and information services (LAC, 2015c).

The LAC's official mandate according to the Library and Archives of Canada Act are: to acquire and preserve the documentary heritage of Canada and make the heritage available to everyone, not just Canadians; to be the permanent repository of government publications; to aid information management and coordinate the library services of government institutions; and to support library and archival communities in Canada.

The LAC is primarily located in Ottawa, with an administration centre in Gatineau and thee regional services centres that serve federal offices across Canada (LAC, 2015b). Canada has a population of over 55.5 million and received over 25 million tourist visits in 2014 (Statistics Canada, 2015).

The LAC holds over 4.5 million megabytes of digitised items, with over 20 million physical books, over 3 million drawings and works of art, a collection of nearly 30 million images and over 90,000 films (LAC, 2015a).

The LAC has one blog, dating back to November 2011, which is regularly updated and is available in both English and French. The Twitter account was created in May 2011 and has over 4,200 tweets and 13,000 followers (Twitter, 2015d). The Facebook account was created in 2012 and has 6501 likes with 982 people talking about it. There is no visible information on the number of people who have checked in (Facebook, 2015b). Both Twitter and Facebook accounts have French-language counterparts that are equally active but these were discounted from the research due to the language barrier of the researcher.

**2.1.3 Library of Congress**

The Library of Congress (LoC) was created in 1800 as a parliamentary reference library for the Congress. In January 1815, after the collection was burnt to the ground in the War of 1812, the library was rebuilt using former President Jefferson's personal library. The copyright law of 1870 gave the LoC the right of legal deposit, and in 1897 the LoC became available to members of the public. The LoC is governed by the Joint Committee on the Library, with members comprised from Senate and Congress committees meaning the LoC is directly controlled by the United States Government (LoC, 2015c). The U.S. Copyright Office is part of the LoC, and the Office of Inspector General oversees all programmes and operations to ensure that all operations runs smoothly and according to government rules (LoC, 2015e). Over the years, programmes established by the LoC have included the American Folklife Center, National Film Preservation Foundation, Sound Recording Preservation Board and Foundation and National Digital Information Infrastructure and Preservation

Program (NDIIPP). The LoC also operates the National Library Service for the Blind and Physically Handicapped (LoC, 2015a).

The LoC's mission is to support the Congress in its duties as well as furthering knowledge, creativity and research for the benefit of the American people and researchers around the world (LoC, 2015d). Currently there are over 160 million physical items in the LoC, and over 7 million items were preserved in 2014 (LoC, 2015b).

The LoC receives most of its funding from the United States Government but also gains income from copyright registrations, cataloguing distribution service fees, donations and investments (LoC, 2015a).

The LoC is located in three buildings in Capitol Hill, Washington DC and in 2014 received more than 1.45 million visits a year and 78.1 million visits to the websites (LoC, 2015b). The United States of America has a population of over 318 million (US Census, 2015), and in 2014 74.8 million people visited the United States (Travel trade, 2015)

The LoC has a total of fifteen blogs which cover a wide array of different departments, programmes, events and exhibitions, and topics of interest. All but one of the blogs are regularly updated. The main LoC Twitter account was created in June 2007 and since then has published over 8,500 tweets and garnered over 769,000 followers (Twitter, 2015e). The main LoC Facebook account was created in 2009 and since then over 254,000 people have liked the page with over 107,000 people checking in and over 5,500 people talking about the page (Facebook, 2015c).

**2.1.4 National Library of Australia**

The National Library of Australia (NLA) originated in 1901 as the Commonwealth Parliamentary Library, and formally separated in 1960 under the National Library Act 1960 to become the National Library of Australia (NLA, 2015c).

The NLA is an agency within the Australian Ministry for the Arts and is responsible for maintaining and sharing the cultural heritage of the country. The library's role was defined by the National Library Act 1960 as ensuring that 'documentary resources of national significance relating to Australia and the Australian people, as well as significant non-Australian library materials, are collected, preserved and made accessible' (NLA, 2015d). As part of the Ministry for the Arts, the NLA

is part of the Attorney General's portfolio and is therefore subject to the Public Governance, Performance and Accountability Act 2013 which provides a reporting and accountability framework the NLA must follow.

In 2013-2014, nearly three-quarters of the NLA's income was funded by the Australian government, including additional funds to acquire materials for the collection, with the rest of the income externally generated from sources such as publication royalties and the sale of goods and services (NLA, 2015a).

The NLA is situated across four buildings in Canberra, Australia, and an office in the Australian Embassy in Jakarta, Indonesia. Visitors are local, national and international, totalling 645,000 visitors to the library in 2013-2014 with over 492 million page views to the NLA's websites. The NLA has approximately 10 million items in the collections and as of June 2014 has digitised over 227,000 items (NLA, 2015b).

Australia has a population of approximately 23 million with over 7.1 million visitors in the year ending May 2015 (Visit Australia, 2015).

The NLA are active on a number of social media platforms including Twitter, Facebook and blogs hosted on the NLA website. There are seven blogs in total, ranging from Behind the Scenes and Preservation to Exhibitions and Publishing, and they are all regularly updated. The main twitter account was created in May 2009 and since then has tweeted over 7,700 times and gained over 29,500 followers (Twitter, 2015f). The main Facebook account was created in 2009 and has over 16,000 likes. 954 people have talked about the page and over 8,600 people have checked in (Facebook, 2015d).

**2.1.5 National Library of Scotland**

The National Library of Scotland (NLS) was created in the early 1680's as the Advocates Library in Edinburgh, and in 1701 the Copyright Act gave the NLS the right of legal deposit and started the library on its way to becoming a national library. The NLS was officially established with the National Library of Scotland Act 1925, further reinforced by the National Library of Scotland Act 2012 (NLS, 2015b). In 2007, the Scottish Screen Archive (SSA) became part of the Collections Department at the NLS (Scottish Screen Archive, 2015).

The acts gave the NLS the following duties: manage the library as a national resource for reference and study as well as preserving the collection and making it available to the public, promote good practice and collaboration and interpret objects in the collection. The acts also stated that these functions should be carried out with the goals of encouraging education, increase understanding of the collections, promote the accessibility of the collections and contribute to the understanding of the national culture (NLS, 2014).

The NLS states its mission statement as 'to advance universal access to knowledge about Scotland and in Scotland' (NLS, 2015d).

As a NDPB, the NLS is directly responsible to the Scottish Government and receives public funding. The NLS is also a registered charity, and is governed by a board of thirteen members who are appointed by the Scottish Government when vacancies are advertised (NLS, 2015a and 2015e). In the 2014/2015 corporate plan (NLS, 2014), total revenue was revealed to be £14,911,000, of which approximately 88% was direct funding from the Scottish Government in the form of grants. The remaining income is from a mixture of activities such as the NLS shop, rentals, access charges and publishing.

The NLS is located in three places in Edinburgh, one for the main public building and reading room, the map reading room and the administration headquarters, and the SSA is headquartered in Glasgow (NLS, 2015c). Scotland has a population of around 5.2 million with visitors of over 6 million in 2013 (Visit Scotland, 2015).

The NLS holds over 22 million items in its physical collection and in 2013 digitised a total of 705,000 items (NLS, 2013). Visitors to the NLS buildings stood at almost 275,000 in 2011-2012, and in the same year over 1.85 million visitors used the NLS's websites (NLS, 2012).

There are a total of nine blogs hosted on the NLS website, three of which are for exhibitions or projects now ended, four that are regularly updated and two that seem abandoned. The main NLS twitter account was created in September 2009 and since then has tweeted over 3,800 times and has gained over 10,100 followers (Twitter, 2015g). The Facebook account was created in 2007 and has over 13,000 likes. Five hundred and sixty-seven people have talked about the page and nearly 2,500 people have checked in (Facebook, 2015e).

### 2.2.1 Impact of Libraries

Much is written about performance indicators and how to evaluate libraries, for example Baker and Lancaster (1991), Lancaster (1993) and Crawford (2000), using both quantitative and qualitative methods such as surveys, questionnaires, focus groups and more, though these are aimed at public and academic libraries. Specific protocols and measurements have been established for National Libraries (Poll, 2008); however, less has been written about measuring the actual impact of libraries, especially national libraries, and it is widely considered a difficult thing to measure in any library (Dunne et al., 2013). Brophy (2006) discusses impact, referring to the fact it is often considered a by-word for long-term outcomes rather than short term outcomes, and Dunne et al. (2013) backs this up, also showing that impact is seen as an aspect of value. This means that impact is often measured using surrogate methods that indicate the likelihood of impact occurring, such as quality of life, engagement and raising of standards, usually educational or health related, rather than a direct measurement (Brophy, 2006). There is also the additional complication that these measurements often include impacts that come from other sources which are extremely difficult to separate out from the impact of the libraries, skewing the measurement and results (Poll and Payne, 2006). Such methods are also time consuming, and can lead to difficulties in performing long term studies due to the expense and difficulty in retaining participants. Despite multiple studies researching the impact of libraries at specific times throughout the last century, there is no one definitive method for measuring impact (Rooney-Browne, 2011) and measuring is further complicated by the fact many institutions use different operating systems and have different needs so that institutions methods are often unique to their situation (Showers, 2015).

Passive methods of gathering information such as leaving comment cards or other ways of leaving feedback and gaining impact awareness without prompting users of libraries are growing, especially as these are less time consuming and are more easily added to staff members duties. As internet use grows, using blogs and social networks is becoming an increasingly attractive option for passive information gathering, though like other methods of gathering information they do have their own drawbacks (Hernon et al., 2015). As systems become digital, the analysing of metrics is also becoming an increasingly popular method of determining impact and engagement, with services and projects such as LAMP (JISCLAMP, 2015) being developed and increasing literature about metrics such as Showers (2015) though these are aimed at academic or public libraries and often rely on confidential to the institution data and therefore do not easily allow for institutions to be compared.

Further literature and research on the national level is scarce. Cram (1999) identifies numerous types of value libraries have, and the BL (2004) expands on this specifically for national libraries and states there are four forms of value and impact a national library can have: economic, cultural, social and intellectual and this is backed up by Poll and Payne (2006) and Showers (2015). Showers is also one of many who adds that cultural and social value are difficult to measure and often resists being defined by numbers. Economic value is easier to define and further research by the BL (2013) measures the economic impact the Library has using a cost-benefit analysis within a total economic valuation framework. However there is a great deal of variability in the measurement of economic impact (Poll and Payne, 2006) and such valuations are expensive, time consuming and in most cases have to be performed by external consultants as it is beyond the skillset of most library members of staff. Hunter and Hambleton (2011) put forward using bibliometric analysis as a straightforward and simple proxy for measuring the impact of national libraries. In this case, it was citations of the National Library of Scotland (NLS) in academic papers using Google Scholar and other academic search engines that was measured. The paper acknowledges it needs refinement, and it only attempts to measure intellectual impact of the NLS. However, given the advantages of bibliometric analysis over other evaluation methods: objective, reliable, cost effective, especially for national libraries where there is no set user base (Hunter and Hambleton, 2011), it is a method rising in use and one that could easily be applied to social media to measure more of the forms of impact identified using a wider section of the national library's users.

### 2.2.2 Impact of Other Institutions

Museums and archives are often publicly funded and face the same need to justify expenditure to the public and other stakeholders as libraries do (Wavell et al., 2002). Wavell et al. (2002) studied the literature on impact research in the museums and archives sectors and found that while in many cases social, learning and economic impacts were measured, it was often on a project by project basis and many of the results were anecdotal or not substantial enough to back up beliefs of impact. Furthermore in the case of economic impact, many of the methods used were of the sector as a whole rather than of individual institutions, which while valuable as a justification for their continued funding by governments, is not really helpful when it comes to measuring or comparing the impact of individual institutions. Again there was evidence that methods used were more interested than immediate outcomes and varied widely between institutions but this could again be explained by the unique combination of needs and systems each institution has. This could also explained by Williams et al. (2005) who found that since the introduction of standards in England, over a hundred different standards have been identified, not including those that have further

frameworks from their parent organisation, and institutions can choose what measurements are taken and analysed. Willaims et al. (2005) also show that like in libraries, these measurements are more measuring direct outputs rather than impact itself.

There is a matter of debate about developing more effective methods and Stanziola (2008) advocates against the development of any new method, instead arguing for the whole sector to work together and pick a number of pre-existing models that he admits will be unsatisfactory and apply them to the problem. However Stanziola's (2008) argument can be taken to be a political decision in this current economic environment, one where showing any value at is important to maintain funding. This can be a dangerous course of action though, as politics and economics can undergo sudden changes (Wilkinson, 2008). Stanziola's (2008) argument seems almost backwards, especially when more recent research such as Bryan et al. (2012) tests a framework for appraisal adapted from structural analysis, which while still limited by its pilot status, gave a good reflection of what was felt to be impact. Furthermore, Scott's (2007) research suggests a series of generic indicators that can be used to indicate value and indeed a set of indicators was agreed by the Australian Bureau of Statistics and Australian cultural heritage institutions (Scott, 2009). However these indicators are only valuable if the exercise is repeated over the course of several years to give long term results, and many of the indicators require detailed statistical record keeping that may not be in place or the data required is widely dispersed and time consuming to collate.

### 2.3 Social Media

There are six main categories of social media: forums and message boards, review and opinion sites, social networks, blogging, microblogging, bookmarking and media sharing (Sterne, 2010). For this research, the platforms Twitter, Facebook and blogs were chosen as the focus due to the mix of social media activities on these platforms by the institutes and the platforms' longevity compared to other platforms.

#### 2.3.1 Platforms

Twitter launched in 2006 and now has over 312 million active users a month (Twitter, 2015a). Users must first create an account and can then post tweets of up to 140 characters (including links and photographs) and these tweets are publicly viewable unless the user locks their account. Other users can then retweet that tweet to their own timeline or favourite the tweet as well as reply and initiate a conversation of tweets. There is a private messaging system called direct messaging but by its nature it is not publicly available. Users can follow other users to keep track of their tweets or users

can mention another user's name to the tweet to notify them of the tweet referring to them. Keywords or topics in a tweet are highlighted by the use of the hashtag symbol, and these hashtags can be searched or followed by anyone and are often used to keep track of interesting topics. The number of retweets, favourites and replies to visible tweets are visible to everyone (Twitter, 2015b).

Facebook launched in 2004 and has 1.4 billion active users a month (Statistica, 2015). Users must create an account and can then post updates on their wall, reply to other peoples' posts, and like and share posts on their own Facebook page. It is also necessary to create an account so that the full range of posts on pages can be seen. Posts can contain text, links and photographs and there is no limit, though in the case of longer posts, previews are provided when others are viewing the post on their feed. Share, like and comment information is publicly visible on posts that have been made publically visible. Users can add friends to keep up to date with people or message them privately, or follow organisations and business to get updates on their feeds but these are not always visible on feeds due to the way Facebook's algorithms work (Time, 2015).

Blogs can be run on a number of different platforms, and the platform and modules used are dependent on the user's needs (Moore et al, 2013). To create a post, an account on whatever platform being used must be made and after that users can post whatever size of post they want to on their blog with whatever content they want with tags or categories often used as a way of organising posts. Comment settings vary from blog to blog as some people allow anyone to comment, some only allow registered users to comment and in some cases comments are closed. Whilst the number of comments is usually visible if there are any comments, most metric information for blogs is private with only the user or authorised individuals able to see it. Some blogs do have a version of a like button, or share buttons for different social media sites that displays metrics, but these are not universal meaning this information is not always available. Follower information is harder to obtain, as there are numerous ways people can follow blogs such as email subscriptions, platform feeds or a variety of different RSS feed readers.

### 2.3.2 Metrics

There are at least a hundred different metrics that can be applied to data and the interactions they provide. It is important to search through them and find which ones are applicable to the platforms the organisation is on, as well as consider what metrics are needed or are useful to help meet the organisation's objectives or information needs. These metrics include measures of how many people think the organisation's message is worthy of repeating, tracking sentiment over time, overall reach,

number of followers and how many people interact with the organisation's accounts (Sterne, 2010). Tracking metrics allows organisations to control, evaluate, and improve their social media presence as well as allowing them to budget and manage the accounts properly and promote their presence, and perhaps most importantly, learn why the social media practises are or are not working (Benn, 2003).

Increasing social media engagement helps in the passive collection of data for impact evaluation (Hernon et al., 2015) and the best metrics to measure to evaluate this are: retweets, mentions, favourites, likes, shares and comments/replies (Hootsuite, 2014). Retweets and shares indicate the number of people who thought the institutions message was worth repeating and have the added advantage of spreading the message to unfamiliar users. Favourites and likes are also an indication that people enjoyed the message and content, as well as having a positive impact on others impressions of the content. Comments and replies are a direct measure of engagement and provide much clearer feedback of not only the positive aspects of people's thoughts about the institutions but the negative aspects as well, and the number of comments can indicate how interested people are in the content, especially if conversations start.

These metrics also provide indicators of how well an organisation is reaching their audience and also to increase brand awareness. Increasing brand awareness is an important factor to many organisations (Kotler and Kotler, 2000), however many of the other metrics that help with brand awareness (follower growth rate, percentage change in follower after an event, sentiment, reach by region) are not publicly visible (Hootsuite, 2014) and therefore were not appropriate for this research.

There are many other metrics available such as Google Analytics, which provides information such as page views, unique visitors, click through rates and traffic sources, but these are only available to the owners of the sites and those they allow access to so for the purposes of this research these were not taken into consideration either.

### 2.3.3 Social Media Analyses

The platforms used for social media are constantly evolving, with new platforms frequently emerging. However, at the moment there are several platforms that are readily established and look set to continue to be widely used, such as Facebook and Twitter, and many of the same principles and metrics can be applied to emerging platforms. Social media use is increasing around the world,

with many fields increasingly recognising its importance, meaning reliable and predictable analytic methods are developing and the use of data from social media to meet objectives and measure impact is gaining traction (Lipschultz, 2014). Xin et al. (2010) also support this, as social media analysis is attractive for many reasons as it is cheaper and faster than other forms of research, allows continuous and long term research to take place and provides results in real time.

Savigny (2002) found that to a large extent the internet is an area that users are free to express themselves and thus it represents a valuable source of information for monitoring public opinion (Madge et al., 2009; Woodly, 2007). This makes it ideal for research purposes as it can avoid many of the biases of other forms of research such as researcher bias in surveys in interviews. However, it can provide a very large dataset and this can overwhelm those performing the analyses with data if not handled carefully.

There are various methods of gathering data from social media sites. Collection using API access to gather the number of likes, replies, shares, mentions, etc. is common (Rahmani et al., 2014; Ceron et al., 2014; Neal, 2010) with data gathered daily (Rahmani et al., 2014) or retrospectively (Neal, 2010) with the time period often determined by researcher availability and the amount of data generated in the categories under investigation.

Library analytics of their own social media is still a relatively young field with most research currently being best practise guides (Harmon and Messina, 2013), guides to using social media (Thomsett-Scott, 2013; Bradley, 2015) which, while informative and keeping pace with technology innovations and their uses, either have little or no mentions of how to monitor or evaluate social media impact and presence. This is slowly beginning to change, as it is understood that metrics reveal an institutions impact and engagement online (Showers, 2015), though often it is still looked at from primarily from a marketing point of view (Koontz and Mon, 2014) and aimed at public or academic institutes though the advice could be transferable. Stewart (2015) is an example of the movement away from this, with the focus on general cultural heritage institutions, as the focus is on Benn (2003)'s reasons for analysing the available data and Stewart (2015) provides a good primer on the types of data that can be collected as well as what they can tell you and provides a starting point for the methods that can be used to gather and analyse. The top tips mentioned by Stewart (2015) are applicable to any social media analysis though and this is a little disappointing in the specialist literature. Malde et al. (2015) builds on their research into evaluating online success in museums, which concluded that there was a failure in attention grabbing, and developed key insights to be

considered by libraries and museums when analysing online engagements. Although these insights are similar to general advice, it is reassuring to know that they have been tested in the sector and that the research shows they are equally applicable.

In more general cases, libraries themselves track their own retweets and followers as well as activity generated by hashtags or keywords or influential users but the methods used are not immediately clear (NLA, 2013) and therefore give no useful information.

For organisations looking to study their own social media data, there are a plethora of services that will gather the data and give the organisations the tools and help to analyse it, for example Crimson Hexagon, Radian6, and Twitter Monitor, to name a few. The qualitative analysis package NVivo also has a social media capture tool, NCapture, which can be used by those with access to the package. For those with an understanding of the coding language Python, Tweepy can be installed to access the Twitter API to gather the required data, or the software Import Io can be used to set up API feeds with greater ease.

Simple data like the number of followers an account has can affect the perception of credibility (Westerman et al., 2012) and user comments can influence user intentions (Anderson et al., 2013; Lee and Shin, 2014; Van der Heide et al., 2013). However using simple data has its drawbacks and simple counts of numbers of tweets or mentions do not provide enough data for predictive analysis (Chung and Mustafaraj, 2011), and research showing that higher likes or retweets mean the information is perceived as desirable is still limited to specific information and may not hold true for all types of information (Stavrositu and Kim, 2014). It has also been demonstrated that number of mentions of political parties in blogposts are good indicators for forecasting election results (Veronis, 2007; Tumasjan et al., 2010), however there are also a number of studies where similar analysis have been unsuccessful (Gayo-Avello et al., 2011), in some cases overestimating the number of votes smaller, more socially active parties would receive (Albrecht et al., 2001). This demonstrates that while social media analysis can give valuable insights, it, like most other methods, should not be taken as the whole picture as it only captures a section of the population, with approximately 29% of the world's population active on social media (We are Social, 2015).

Qualitative analysis can also be performed on social media data, for example finding the highest or lowest ranked terms in a hashtag or account as well as the most distinctive terms in a dataset (Rahmani et al., 2014) which would allow engagement to be improved. Sentiment analysis can also

be performed to see what people are saying about the topic or institution in in question (Ceron et al., 2014). The most frequent terms used can lead onto discovering user intentions (Java et al., 2007) and detecting correlated keywords (Bansal et al., 2007) as well as detecting patterns, especially those about word of mouth patterns (Jansen et al., 2009), and identifying items that are paid large amounts of attention (Mathioudakis et al., 2010). These methods are all useful for gaining passive information about the impact and engagement of institutions, as well as allowing staff to improve the institutions social media presence. The same limitations apply as for quantitative analysis but the same benefits also apply. Although the method of data gathering is different, many of the methods used are the same as for non-social media research and this is a well-established field as Gorman and Clyton (2004), Bryman (2012) and Beck and Manuel (2008) all describe multiple methods that are tailored to social science and information professionals.

It must be remembered that people with internet access, and therefore those who interact on social media, don't necessarily represent the demographics of the users or audience of the institution (Sang and Bos, 2012), as often old age pensioners are underrepresented (Fox, 2010) and those with higher privileges of gender, education and wealth such as highly educated men are often overrepresented (Wei and Hindman, 2011). It must therefore be remembered that any results gained through social media analysis don't represent the users of the institution as a whole, and social media policy must reflect this i.e. understanding that social media is only one of the options to communicate with users or measure success, or including clear guidelines about how the social media platforms are used and moderated.

### 2.3.4 Social Media Practises

Libraries and librarians have been involved in social media for a long time, and studies have shown that over three-quarters of libraries use some form of social media to connect with users. However, disappointing returns for social media investments have increasingly been reported, meaning social media presence must be planned carefully to be fully effective and meet the library's needs (Steiner, 2012). Part of an effective social media strategy is having a clear policy and strategy in place so that staff and users have a clear understanding of why social media is being used by the libraries and what can be expected from the libraries (Tella, 2014). Success also means that staff will have to collaborate to ensure that the presence on social media is focused, up to date and well connected within the organisation, such as making sure the presence is visible in the organisations literature and website (Swanson, 2012).

The libraries involved in the research are all active on various social media platforms but the use of accounts and platforms and the ease of finding the accounts varies between the institutions.

The BL has no social media information immediately apparent on its homepage, rather the 'About' dropdown menu has to be selected before the main accounts are linked. This menu has a master list of blogs on the website but there is no such list for Facebook or Twitter accounts. Whilst the main accounts are linked, other Twitter accounts are found by looking at the widgets on the blog pages. This doesn't even list all of the Twitter accounts as at least fourteen other official accounts were found when Twitter itself was searched. The main account does retweet some of the other accounts but that does still not give a full picture of the variety of accounts, and some of the official accounts had no mention of the BL in their handle and didn't appear during the Twitter search. There are less Facebook accounts, but these are not linked on the website in any form whatsoever, and the two accounts were found by searching Facebook. Further searching through the website reveals no accessible social media policy or explanation of what the various accounts are used for and how they are run. Overall, whilst the main accounts are easily accessible, the others require more time to find, something research has shown not everyone has or is willing to give, and naming of the accounts often goes against marketing advice to keep branding consistent across social media platforms (Koontz and Mon, 2014) . That and the lack of what is expected from the accounts is disappointing and somewhat anomalous from an institution that seems otherwise savvy to social media, from the use of a variety of platforms, including newer ones such as Periscope, to the variety of material posted on all platforms and how active the accounts are.

The LAC has links to some of its social media accounts on different platforms, along with examples of posts and what material is posted, on the rotating banner at the top of the home page and the news section below. Also present on the home page are badges (images of the platforms logo) to all the social media platforms the LAC is on, though like all badges they are mainly useful if you know what the logos represent. It is possible to hover over the badge and see where the links lead but this is not appropriate for all devices used to access the internet. Also on the home page, there is a link in the footer to the full social media page. This page gives link to all the platforms the LAC is present on and like all other pages on the LAC website has a last modified date at the bottom so users know the information is up to date. More importantly there is also a link to the LAC's social media policy on the page, making it easy to find unlike on some of the other institutions website. The policy sets the tone for the LAC's interactions on social media and gives a clear commenting policy and what content, such as personal attacks and racist and other bigoted comments, which will be removed.

The LAC had one blog that is regularly updated and all posts are well tagged and categorized making them easy to search through. Some content is cross-posted across platforms but this accounts for those that don't visit every platform and it is not enough to annoy dedicated users. Further searching on Twitter and Facebook reveals no other accounts and the official accounts are clearly marketed as part of the LAC. The English version of the website links to the English language accounts and the French version corresponds to the French language accounts, and both versions link to their counterparts on the same platforms making it easy to switch languages if the user desires. When looking at other official Canadian websites, they all have the same background and layout as the LAC website which gives a consistent appearance that is easy to navigate and gives the impression that the LAC is a valued part of the Canadian government. The spread over two languages seems to have no effect on the activity of the LAC on social media, and the whole structure and policy makes it a pleasant, well thought experience.

The LoC has text links to the main social media accounts in the footer of the home page which makes them easy to find. The footer also contains a link to the connect page which lists every single account the LoC has on all platforms it is present on. However the blog link in the footer is currently wrong, and though the blogs can still be found via the connect page, this is rather off putting and rather unexpected from such a large institutions home page. Further investigation found that while all the blogs are linked on the connect page, these links are also wrong, instead trying to take users to connect to the secure version that staff use instead of the public version. While adjusting the URL to remove the secure reference will give access to the blogs, and the blogs are clearly regularly updated, this is an alarming error on the website as it will stop a lot of people, especially those less tech savvy, from accessing the content and gives a rather unprofessional impression of the website, not an impression any institution wants to give. A message was sent to the website team using the web feedback option but so over a month later the links haven't been updated. The connect page also contains a brief description of the material and content posted on the less ubiquitous platforms and aside from the blog links error, this makes for a nice browsing experience on a page where it is easy to find what you are looking for. The different accounts on Facebook and Twitter all have similar branding as the account name contains either LC or LoC and profile images contain a version of the logo. The inconsistency between acronyms is the only confusing factor and this could be prevented by a cohesive social media policy, which if the LoC has one is not visible on the otherwise comprehensive website. Overall social media use by the LoC is comprehensive and active with the main problems not directly under the control of those staffing the social media accounts though the institution should be on top of these.

The NLA has text links to the main Twitter and Facebook accounts in the footer of the main website. It also has a link to more connections which gives direct links to the master list of blogs, master list of the five Twitter accounts and the other platforms the NLA is on apart from Facebook. In the profile of the main Twitter account, there is a direct link to the second most active account, @TroveAustralia, and a Twitter search reveals the others already listed but no unexpected accounts. Aside from the link to the main Facebook account, there are no links to the other three accounts found by searching Facebook. One of the accounts appears to merely be a placeholder but the other two are active, and in an otherwise clear and well thought out design, this omission is rather glaring. The social media policy that staff follow is easily found under the policy section of corporate documents, and clearly explained. However the more relevant information for the ordinary viewer is filed under Social Media Strategy in the same section. It is not immediately apparent that this is where the NLA would place the information about what type of content is posted to what platform, who handles the information, or the full list of the platforms the NLA is on, but the information itself is clearly laid out, along with the goals of the NLA when it comes to using social media. It also gives context for the NLA's use of social media as well as how the NLA currently evaluates the use of its social media accounts. Overall, it is easy to find the NLA's social media accounts and keep track of blog updates, making for a pleasant navigating experience.

The sidebar of the NLS website has text links to the social media platforms used, and the main footer of the website directs to a social networking page which contains a master list of the blogs. However there is no mention on this page of which blogs are now archived or indeed which blogs can be commented on. The page also links to the Facebook page along with the main Twitter account and Flickr and YouTube accounts. There is a brief description of the content NLS provides on each platform, as well as additional links to interesting audio/visual material the NLS has posted. However, although the main Twitter account does sometimes retweet the other NLS Twitter accounts, there is no mention of the other seven accounts the NLS maintains, all of which are active and must be found through a search on Twitter. The Facebook account is the only one, and it is easily found. The NLS does not have a visible social media policy on its website at all, and there is only one mention of social media in the corporate plan, and that is to raise public awareness and interaction through social media as part of a more general marketing strategy. It does mention that the library has a current Klout score of 64, which indicates that the NLS does monitor its social media activity. It is relatively straightforward to find most of the NLS's social media accounts, but the

missing Twitter accounts and inability to comment on some of the blogs pull down the overall experience.

Museums are also looking to expand their audiences and engage with new and existing groups (Kotler and Kotler, 2000) and in many cases are collaborating with libraries (Allen and Bishoff, 2002) therefore it is worth comparing national library social media presence with national museums' presence and not only see if lessons can be learnt or if ideas for further research or comparisons can be made.

For example, the British Museum (BM), has a master list of blogs in the header of the homepage. The master list is well laid out and displays all recent entries on all the blogs as well as the date of the entry so that people can instantly tell if there is anything new. There is also a dedicated page for videos, and Youtube and Flickr accounts are linked to in the footers of most pages. However no other social media accounts are in evidence on the website, despite Twitter and Facebook searches showing four clearly identified and active accounts. A search of the website using the search bar reveals there is an excellent social media policy that sets out what they will tolerate, how they will respond and how the accounts are monitored, which more institutions could learn from, and the main social media accounts are linked at the bottom. There is no apparent easy way to find the policy and the policy is the only mention of some of the accounts which detracts from the overall experience and shows an area where museums could learn from national libraries.

**2.4 Comparisons**

Various factors must be taken into consideration when comparing institutions including population size and density, means of communication, educational provision and level of development (Rogers, 1984). First and foremost is the fact that in new or developing countries, the functions of a national library will likely be performed by one institution, but in large or developed countries, the functions may be split between several institutions (Humphreys, 1966) which can dilute the results. It is also important to note that this economic environment, libraries may merge together with other institutions (Doucet, 2007) and this can also skew any results for comparisons.

The institutions involved in this research all serve different sized populations and population densities with different visitor numbers, receive different levels of funding, contain different collection sizes and have different origins and ages. There are significant similarities between the institutions though. All have government oversight and a high percentage of funding from their respective governments. All have to create further understanding of the country's cultural

understanding and enabling research as part of their mission, though the LoC is the only institution where serving the parliamentary process is explicitly stated so this will have an effect on the social media presence. The five countries are all developed countries, and use English as the primary language, though Canada is bi-lingual and this is reflected in the presence of LAC accounts in both English and French which may have an effect on the research. Also, the LAC is the youngest institution and this is reflected in the fact its social media accounts are the only ones that are less than five years old which again may have an effect on the research.

These similarities mean that the resulting research will have limited applications for global comparisons, though it will serve as a starting point for further research that has the timescale and linguistic abilities to explore the comparisons in depth and analyse more national libraries.

## 3. METHODOLOGY

### 3.1 Pilot

For the pilot test, data was collected from the NLS's Facebook and Twitter pages and blogs. Data was collected daily between 15th June and 21st June using the NCapture for NVivo extension in the Google Chrome browser, with the tweets and replies page on Twitter used as the data source to ensure all writings by the NLS were captured.

All NLS blogs were checked, but only two out of the nine blogs (Local and Family History, and Official Publications) had been updated within the time period, and given the lack of comments, and in one case comments being closed, no metrics were publicly available. Further checking of other national library blogs showed very similar results therefore it was decided not to proceed with analysis of blogs for this research.

NCapture for Facebook collection captured posts to the page, posts made by NLS, comments to posts, the time stamps of all posts and comments and number of likes as well as any links or photographs on the page. When the data was exported to Excel, columns were added for type of post (i.e. post to page or on page) to understand who posted the post, and the number of shares and comments were added manually as these numbers had not been captured though the comments themselves had been captured. Extraneous information such as post and comment ID numbers, and various profile information of commenters was removed as these were not being investigated at this stage. On looking at posts to the page, most within the sample were spam so they were removed from the dataset.

NCapture for Twitter collection captured tweets on the page, username, mentions, number of retweets, tweet type, hashtags and location. The data was exported to Excel and additional columns for number of favourites and number of replies were added and numbers added manually. Post ID numbers and duplicate information was removed from the dataset.

At this stage, different variables were checked, such as time of day posted, day posted, whether a link or photograph was present in the post against number of replies, shares, likes, retweets, favourites. Since the data had non-normal distribution, non-parametric statistical tests had to be used to analyse the data (Vaughan, 2001), and the level of significance for all tests was set at 0.05. Spearman's rho was performed on variables to see if there was correlation between them, and the Mann-Whitney test and Kruskal-Wallis test performed to see if there were differences between the variables (depending on the variable group size).

While performing the statistical analyses, it became apparent that the Twitter data was not properly formatted as some variables such as links, pictures, number of hashtags, number of mentions needed to be separated out of the tweet or hashtag and mention columns into their own columns to run the tests. In the main research, this will form part of the data formatting to ensure the analysis goes smoothly.

The Twitter data shows twenty four tweets over the collection period with tweets comprising fifty six percent and retweets forty six percent of the total. Nineteen tweets had no reply, three tweets had one and one tweet each had two and four replies. The number of favourites tweets received varied more widely, with only three receiving none, two outliers having 11 and 26 favourites and the rest receiving between one and eight favourites. Tweets were posted with an even spread between Monday and Friday at different times of the day with the earliest at 8am and the latest at 6pm. Fourteen of the tweets contained a link and eighteen contained a photograph. Ten tweets contained at least one hashtag, with one of those tweets containing two hashtags and another containing three. Seventeen of the tweets mentioned another Twitter user with most tweets containing one or two mentions per tweet but two tweets had three and there was one outlying tweet that had six users mentioned.

Table 1 Pilot Twitter Spearman's rho results

| Variable | No of retweets | | No of Favourites | | No of Replies | |
|---|---|---|---|---|---|---|
| | Correlation coefficient | P value | Correlation coefficient | P value | Correlation coefficient | P value |
| Time of day | .315 | .134 | .318 | .130 | .239 | .260 |
| Day of week | -.094 | .662 | -.232 | .276 | -.159 | .458 |
| Presence of link | -.276 | .191 | -.259 | .221 | .224 | .293 |
| Presence of photograph | -.514 | .010 | -.405 | .050 | -.261 | .217 |
| Presence of mentions | -.060 | .781 | -.107 | .618 | -.327 | .119 |
| Number of mentions | .053 | .807 | .012 | .955 | .308 | .143 |
| Presence of hashtags | -.571 | .004 | -.562 | .004 | -.189 | .375 |
| Number of hashtags | .691 | .000 | .596 | .002 | .259 | .221 |
| Type of Tweet | .322 | .125 | .183 | .391 | .366 | .078 |

Table 1 shows the only statistically significant correlations were of the presence of photographs and the presence and numbers of hashtags, and these were correlations with the number of shares and favourites, not the number of replies. The presence of photographs and presence of hashtags both had negative correlation coefficients, which given that Yes was given a value of 1 and No a value of two in the statistical processing software, indicated that the presence of a hashtag or photograph moderately correlated to a higher number of retweets and favourites. The number of hashtags had a positive correlation and as the number of hashtags was in numerical order, it indicated that there was a moderate correlation and the higher the number of hashtags, the higher the number of retweets and favourites. All correlation coefficients of significant value ranged between .405 to .691, suggesting moderate correlations which was enough to start predicting results such as number of retweets based on number of hashtags etc. but it would be more accurate to see the results from the bigger sample of the main research to ensure this was not a fluke of the small sample.

Table 2 Pilot Twitter Mann-Whitney Significance values

| Variable | No of retweets | No of Favourites | No of Replies |
|---|---|---|---|
| Presence of link | .192 | .235 | .472 |
| Presence of photograph | .012 | .053 | .406 |
| Presence of mentions | .804 | .619 | .288 |
| Presence of hashtags | .005 | .006 | .546 |
| Type of Tweet | .134 | .392 | .228 |

Table 2 shows the only statistically significant differences in the number of retweets received were caused by the presence of photographs or hashtags. The presence of hashtag also indicates a statistically significant difference in the number of favourites a tweet received, and the presence of photograph was borderline significant in causing a difference in the amount of favourites a tweet received. Whilst the other differences were obviously significant, it will be interesting to see which way the significance value for the presence of photographs in the number of favourite goes when the main research is performed.

The time of day and day of the week were treated as nominal data because the time elapsed wasn't measured, instead the time or day posted was used as a group identifier. As this resulted in more than two groups that could affect the metrics, the Kruskal-Wallis test was applied to these variables.

Table 3 Pilot Twitter Kruskal-Wallis significance values

| Variable | No of retweets | No of favourites | No of replies |
|---|---|---|---|
| Time of day | .428 | .780 | .879 |
| Day of week | .750 | .594 | .769 |

The Kruskal-Wallis test showed that neither the time of the day or the day of the week had any statistically significant effect on whether the tweets received differing levels of the metrics measured.

After the spam content was removed (all posts to the page by other users), the Facebook dataset shrunk from ten entries to seven, four of which were posts and three of which were comments in reply to those posts, meaning the actual dataset was comprised of four posts to measure the metrics of. Of the four posts, three contained photographs and one contained a link. All four had varying levels of likes and shares ranging from one of each on one post to forty likes and seventeen shares on the most popular post. All posts were posted at different times of the day and on different days of the week.

Table 4 Pilot Facebook Spearman's rho results

| Variable | No of shares | | No of likes | | No of comments | |
|---|---|---|---|---|---|---|
| | Correlation coefficient | P value | Correlation coefficient | P value | Correlation coefficient | P value |
| Time of day | -.833 | .167 | -.949 | .051 | -.500 | .500 |
| Day of week | .105 | .895 | -.200 | .800 | -.105 | .895 |
| Presence of link | -.272 | .728 | -.258 | .742 | -.816 | .184 |
| Presence of photograph | .272 | .728 | .258 | .742 | .816 | .184 |

Table 5 Pilot Facebook Mann-Whitney significance values

| Variable | No of shares | No of likes | No of comments |
|---|---|---|---|
| Presence of link | 1 | 1 | .500 |
| Presence of photograph | 1 | 1 | .500 |

Table 6 Pilot Facebook Kruskal-Wallis significance values

| Variable | No of shares | No of likes | No of comments |
|---|---|---|---|
| Time of day | .325 | .259 | .632 |
| Day of week | .392 | .392 | .392 |

The Facebook data collected showed no statistically significant correlation or differences between the variables and the metrics but this could be due to the very small sample size which makes it hard to gain significant insight.

Overall, little of significance was shown by the analyses but this could be due to the small size of the datasets and trends may become more apparent in the larger dataset of the main research. The pilot research had some impacts on the main research, mainly during the data collection stage with some in the analysis stage. For the main research, the separation and manual entry of number of favourites, shares, number of replies and whether tweets contain a link or a photograph will occur before analysis starts to ensure the analysis goes smoothly. Furthermore, after checking the other national libraries and the content (if the library allowed any) of the posts to the Facebook page, it was discovered that a lot of the posts contained spam so the decision was taken to remove posts to the page by other users as this ensured the focus was on engagement by the libraries. Extraneous information such as biographic details and location will be removed and as it is became apparent that due to time constraints the comments or replies would not be able to be analysed, the comment information other than the number of replies was removed to make the dataset easier to navigate. The analysis itself will not change much but the main difference will be the number labelling of Yes and No answers being changed from 1 = Yes and 2 = No to 1 = No and 2 = Yes to make the results in the statistical analysis software easier to read.

**3.2 Main Research**

Using NCapture, data was collected from the tweets with replies pages on Twitter and the Facebook walls of the BL, LAC, the NLA, the LoC and the NLS primary accounts. The primary accounts were focused on due to their high visibility and linkage by the institutions and the timescale of the research. The data collection this time was retrospective as timestamps were recorded by NCapture in the pilot, giving full details without collecting daily and allowing more data to be analysed within the time constraints of the research. The collection date was Sunday 5th July, going back to Monday 4th May, giving nine full weeks of data and covering the months of May and June.

NCapture for Facebook collection captured posts to the page, posts made by the institute, comments to posts, the time stamps of all posts and comments and number of likes as well as any links or photographs on the page. When the data was exported to Excel, the number of shares and day of the week were added manually as these numbers had not been captured. Extraneous information such as post and comment ID numbers, various profile information of commenters such as gender, religion, hometown and relationship status and any posts made to the page by others was removed as these were not being investigated at this stage.

NCapture for Twitter collection captured tweets on the page, username of the tweet and retweet, mentions, number of retweets, tweet type, hashtags, location and bio. The data was exported to Excel and additional columns for number of favourites, number of replies, time of day and the day of the week were added. Post ID numbers and location co-ordinates were removed from the dataset and information about links, such as the links themselves, total number of links, any picture, hashtag or mention information was separated out from the tweet column into their own columns.

Spearman's rho was performed to see if there was correlation between the variables and metrics in table 7 and the Mann-Whitney test and Kruskal-Wallis test were preformed to see if these variables caused a difference in the metrics measured. The tests were performed within each library's dataset.

Table 7 Variables and Metrics measured

| Twitter Variables | Twitter Metrics | Facebook Metrics | Facebook Metrics |
|---|---|---|---|
| Time of day* | Number of retweets | Time of day* | Number of shares |
| Day of week* | Number of favourites | Day of week* | Number of likes |
| Presence of link | Number of replies | Presence of link | Number of comments |
| Presence of photograph | | Presence of photograph | |
| Presence of mentions | | | |
| Number of mentions | | | |
| Presence of hashtags | | | |
| Number of hashtags | | | |
| Type of tweet | | | |

* Kruskal-Wallis test was performed on these variables rather than the Mann-Whitney test.

Libraries were then compared using the total number of posts made by each library and the averages of responses made to the posts. This allowed for comparisons of engagement by each library and to see if any library was over or under performing.

## 4. ANALYSIS

### 4.1 British Library

Three hundred and thirteen tweets in total were gathered from the BL during the research period. Of these, 75 percent of the tweets were original tweets with the remaining 25 percent being tweets retweeted by the BL. The time of day that tweets were posted varied although the majority were posted between 9am and 7pm, with a few outliers posted at 10pm and midnight. The hours of

10am, 2pm and 3pm were the most active. Tweets were posted on all days of the week with Sundays having a smaller number of tweets posted and Wednesdays and Fridays having a larger number. Fifty five percent of the tweets contained links and thirty eight percent of the tweets contained a photograph. Seventy percent of the tweets contained a hashtag with one or two hashtags being the most predominant, and a few outliers contained three or four hashtags. Half of the tweets contained at least one mention, with one or two mentions being the most common and a few tweets contained between three and six mentions.

Only five tweets received no retweets at all, with most receiving between one and thirty retweets. Two tweets received no favourites and the number of favourites a tweet received was much more diverse as more than half received seventeen or less with numbers higher than that generally only applying to one or two tweets. One hundred and twenty-eight tweets received no replies, and those that did receive replies, the most common response rate was between one and five replies.

Table 8 BL Twitter Spearman's rho results

| Variable | No of retweets | | No of Favourites | | No of Replies | |
|---|---|---|---|---|---|---|
| | Correlation coefficient | P value | Correlation coefficient | P value | Correlation coefficient | P value |
| Time of day | -.317 | .000 | -.302 | .000 | -.167 | .003 |
| Day of week | -.061 | .279 | -.002 | .976 | .028 | .624 |
| Presence of link | .400 | .000 | .298 | .000 | -.067 | .237 |
| Presence of photograph | .459 | .000 | .527 | .000 | .284 | .000 |
| Presence of mentions | -.014 | .806 | -.045 | .422 | .029 | .608 |
| Number of mentions | -.018 | .745 | -.036 | .526 | -.009 | .878 |
| Presence of hashtags | .042 | .459 | -.018 | .744 | .015 | .795 |
| Number of hashtags | -.018 | .757 | -.087 | .123 | -.031 | .590 |
| Type of Tweet | .175 | .002 | .182 | .001 | .169 | .003 |

Table 8 shows that time of day posted has a statistically significant correlation with the number of retweets, favourites and replies a tweet receives. In all cases the correlation coefficient is negative meaning as it gets later in the day, the less responses a tweet gets. The correlations for number of retweets and favourites are weak though, and the correlation for number of replies is even weaker, all of which indicate that while the time of day the tweet is posted could be used to predict the number of responses, it is not the most reliable method nor is time of day the most important factor.

The presence of a link in a tweet shows statistically significant positive correlation with number of retweets and number of favourites a tweet received and again they are weak correlations. The presence of a photo in a tweet shows significant positive correlation for all three metrics, with a moderate correlation for both number of retweets and favourites received. The type of tweet posted shows a positive correlation with all methods of response, and because of values used in SPSS (1= tweet, 2= retweet) this indicates that retweets are more likely to get responses. This is not entirely surprising considering the way Twitter metrics are measured; the statistics for the retweet are of the original tweet, not the library's instance of the retweet. For all responses this is a relatively weak level of correlation though so it might not be too much of a consideration for libraries as long as they are retweeting an interesting and relevant mix that appeals to their audience.

The presence and number of mentions and hashtags show no statistically significant correlations.

Table 9 BL Twitter Mann-Whitney Significance values

| Variable | No of retweets | No of Favourites | No of Replies |
|---|---|---|---|
| Presence of link | .000 | .000 | .239 |
| Presence of photograph | .000 | .000 | .000 |
| Presence of mentions | .214 | .139 | .524 |
| Presence of hashtags | .204 | .198 | .562 |
| Type of Tweet | .003 | .002 | .009 |

Table 9 shows that the presence of a photograph and the type of tweet affect all three types of response while presence of link affected number of retweets and number of favourites.

Table 10 BL Twitter Kruskal-Wallis significance values

| Variable | No of retweets | No of favourites | No of replies |
|---|---|---|---|
| Time of day | .000 | .000 | .142 |
| Day of week | .000 | .000 | .003 |

Table 10 shows that what day of the week a tweet is posted on completely affects all responses, while the time of day affects the number of retweets and favourites the tweet receives.

Overall the Twitter results show that the presence of a link or a photograph and the type of tweet impact the BL's engagement on Twitter, with the time of day and the day of the week impacting it to a lesser extent.

Sixty-three posts were gathered from the BL Facebook during the research period. All posts were posted between 8am and 7pm with the hours between 10am and 4pm the most active. Posts were posted on every day of the week, with similar numbers posted on each day, except for Sunday which saw half the amount of posts. Two-thirds of the posts contained a link and 80% percent of the posts contained a photograph.

Every post was shared at least once though there is a large variation in the number of shares received. Every post also received at least six likes and again there is a large variation in the number of likes received. Nineteen posts received no comments and the majority of the posts received up to seven comments with single posts receiving more.

Table 11 BL Facebook Spearman's rho results

| Variable | No of shares | | No of likes | | No of comments | |
|---|---|---|---|---|---|---|
| | Correlation coefficient | P value | Correlation coefficient | P value | Correlation coefficient | P value |
| Time of day | -.245 | .053 | -.273 | .031 | -.105 | .413 |
| Day of week | .011 | .931 | .054 | .674 | .046 | .718 |
| Presence of link | -.338 | .007 | -.345 | .006 | -.381 | .002 |
| Presence of photograph | -.160 | .211 | -.047 | .712 | .060 | .639 |

Table 11 shows that neither the day of the week or the presence of a photograph have any statistically significant correlation with the number of responses a post on Facebook will receive. The time of day posted only has a statistically significant correlation with the number of likes a post receives, indicating that like Twitter, the later a post is posted the fewer likes it will receive, but the correlation coefficient indicates that is it a weak correlation and therefore not very useful in predicting the responses to a post. The presence of link shows moderate statistically significant correlation to all three types of responses and the negative correlation coefficient indicates that posts with links present will receive fewer responses. This could be due to people clicking through the links and responding elsewhere or forgetting to come back and respond to the Facebook post.

Table 12 BL Facebook Mann-Whitney significance values

| Variable | No of shares | No of likes | No of comments |
|---|---|---|---|
| Presence of link | .008 | .007 | .003 |
| Presence of photograph | .209 | .709 | .635 |

Table 12 shows that the presence of link gave statistically significant differences in all post responses whilst the presence of photographs didn't, but this could be down to the large number of posts within the dataset that have photographs distorting the analysis.

Table 13 BL Facebook Kruskal-Wallis significance values

| Variable | No of shares | No of likes | No of comments |
|---|---|---|---|
| Time of day | .528 | .395 | .584 |
| Day of week | .061 | .054 | .974 |

Table 13 shows that neither the time of day or the day of the week the post was posted has any statistically significant level of impact on the responses received to posts, though day of week was close to having impact on the number of shares and likes.

Overall, analysis of the Facebook data does not give a lot of information except for the fact that responses to posts with links are lesser than posts without.

**4.2 Library and Archives Canada**

Three hundred and fifty-three tweets were collected during the research period. All bar two of these were posted between 1pm and 11pm and tweets were posted on all days of the week, with Tuesday, Thursday and Friday being the most active and only a few tweets were posted at the weekend. Eighty percent of the tweets contained a link and 37% of tweets contained a photograph. Just under 46% of tweets contained a mention, and the number of mentions ranged from one to three and in a few cases four. Just under 85% of tweets contained a hashtag, with most of those containing one or two hashtags, though a small number did contain up to five hashtags. Of the tweets, 83% were original tweets by the LAC and the remaining were retweets.

Ten percent of the tweets were not retweeted at all, with the majority of tweets being retweeted between 1 and 10 times though numbers of up to 79 were occasionally seen. Twenty percent of the tweets did not receive a single favourite and of the remaining 80%, the majority received between 1 and 8 favourites, with individual tweets receiving up to 55 favourites. Just under 84% of all the tweets received no reply with 19% receiving one reply and small numbers receiving up to 5 replies.

Table 14 LAC Twitter Spearman's rho results

| Variable | No of retweets | | No of Favourites | | No of Replies | |
|---|---|---|---|---|---|---|
| | Correlation coefficient | P value | Correlation coefficient | P value | Correlation coefficient | P value |
| Time of day | -.035 | .514 | .030 | .573 | .025 | .640 |
| Day of week | -.052 | .326 | -.070 | .190 | -.015 | .774 |
| Presence of link | .125 | .019 | .106 | .048 | .418 | .080 |
| Presence of photograph | .183 | .001 | .437 | .000 | .080 | .132 |
| Presence of mentions | .018 | .732 | -.138 | .010 | .036 | .505 |
| Number of mentions | .012 | .817 | -.111 | .038 | -.009 | .869 |
| Presence of hashtags | .166 | .002 | .157 | .003 | -.066 | .220 |
| Number of hashtags | .131 | .013 | .097 | .069 | -.091 | .089 |
| Type of Tweet | .283 | .000 | .134 | .012 | .067 | .213 |

Table 14 shows that the presence of a link has a very weak positive statistically significant correlation with the number of retweets and favourite a tweet receives. The presence of a photograph shows a very weak positive statistically significant correlation with the number of retweets and a slightly stronger positive correlation with the number of favourites a tweet receives. The presence of a mention and the number of mentions both have a very weak negative statistically significant correlation with the number of favourites a tweet receives while the presence and number of hashtags have a very weak statistically significant positive correlation with the number of retweets and favourites a tweet receives. The type of tweet shows a weak statistically significant positive correlation with the number of retweets and a weaker correlation with the number of favourites a tweet receives.

Table 15 LAC Twitter Mann-Whitney Significance values

| Variable | No of retweets | No of Favourites | No of Replies |
|---|---|---|---|
| Presence of link | .029 | .073 | .682 |
| Presence of photograph | .001 | .000 | .309 |
| Presence of mentions | .286 | .009 | .309 |
| Presence of hashtags | .004 | .008 | .387 |
| Type of Tweet | .000 | .024 | .443 |

Table 15 shows that none of the variables had a differing effect on the number of replies a post received. The presence of a photograph or hashtag and the type of tweet all made a statistical difference in the number of retweets and favourites a tweet received while the presence of a link caused a statistically different numbers of retweets and the presence of a mention caused a statistical difference in the number of favourites a tweet received.

Table 16 LAC Twitter Kruskal-Wallis significance values

| Variable | No of retweets | No of favourites | No of replies |
|---|---|---|---|
| Time of day | .258 | .896 | .979 |
| Day of week | .287 | .043 | .856 |

Table 16 shows that the only statistically significant differences in the number of responses a tweet was received was the day of the week affecting the number of favourites a tweet received.

Over all, the data collected from the LAC showed that time of day and the day of the week a tweet was post had no significant effect on the response received and none of the variable effected the number of responses received. With the other variables, if there was a correlation, with the exception of the presence of a photograph having a positive moderate effect, the correlations were all very weak and it is difficult to tell if the variables would have a negligible impact on the LAC's Twitter engagement.

During the research period 242 posts were gathered from the LAC's Facebook page. Most of the posts were posted between 1pm and 9pm with a few earlier and later posts. Posting during the week was spread evenly between Monday and Friday with a small number of posts on Saturdays and Sundays. Three-quarters of the posts contained links and just under half of the posts contained a photograph.

One-third of the posts received no shares and of the posts that did, the majority received between 1 and 11 with two posts receiving 42 and 140 shares. Every post received at least one like and the numbers received were thinly spread out until 100 likes then a few posts received a higher level after that to a maximum of 250 likes. Sixty percent of the posts received no comments and the majority of the posts that did receive comments received between one and five with a few outliers receiving 12 and 15 comments.

Table 17 LAC Facebook Spearman's rho results

| Variable | No of shares | | No of likes | | No of comments | |
|---|---|---|---|---|---|---|
| | Correlation coefficient | P value | Correlation coefficient | P value | Correlation coefficient | P value |
| Time of day | .066 | .306 | -.261 | .000 | -.231 | .001 |
| Day of week | .042 | .512 | -.043 | .506 | .027 | .678 |
| Presence of link | -.064 | .323 | -.266 | .000 | -.221 | .001 |
| Presence of photograph | .152 | .018 | .292 | .000 | .226 | .000 |

Table 17 shows that the time of day and the presence of link have a statistically significant very weak negative correlation with the number of likes and comments a post receives. The presence of a photograph is shown to have a statistically significant very weak correlation on all three measurements. The presence of a link or photographs in such a high proportion of the posts could be responsible for these very weak correlations so too much importance should not be placed on these results.

Table 18 LAC Facebook Mann-Whitney significance values

| Variable | No of shares | No of likes | No of comments |
|---|---|---|---|
| Presence of link | .321 | .001 | .001 |
| Presence of photograph | .019 | .000 | .000 |

Table 18 shows that the presence of a link or photograph causes a statistically significant difference in the number of likes and comments a post receives and the presence of a photograph also affects the number of times a post is shared.

Table 19 LAC Facebook Kruskal-Wallis significance values

| Variable | No of shares | No of likes | No of comments |
|---|---|---|---|
| Time of day | .630 | .014 | .188 |
| Day of week | .854 | .023 | .633 |

Table 19 shows that both time of day and the day of the week the post was posted on caused statistically significant differences in the number of likes received but not the number of shares or comments.

Overall, the LAC Facebook data showed that when the variables did cause a statistical difference in the number of responses received, the correlation between the variable and the response was statistically very weak though over all a photograph increased the number of responses and a link decreased the number of responses.

**4.3 Library of Congress**

Three hundred and forty-five tweets were gathered during the research period. Most were posted between the hours of 12noon and 9pm though there were a few tweeted at 10 and 11pm. Tweets were spread evenly through the week with a peak of tweets appearing on Thursdays and Fridays. Just over 83% of tweets contained a link and just over 52% of tweets contained a photograph. Forty-two percent of the tweets contained a mention with one or two mentions being the most frequent though a few posts did contain three or four mentions. Just over 53% of the tweets contained a hashtag with one hashtag being the most frequent and lesser numbers of tweets containing two or three hashtags. One tweet contained four hashtags. One-third of the tweets were retweets.

Just over 95% of the tweets received at least one retweet, with the numbers received thinly spread from 1 to 168. Just under 98% of the tweets received at least one favourite, with the number of favourites received varying from 1 to 135. Just under half of the tweets received a reply with the majority receiving between one and seven replies and a few single tweets receiving between 8 and 13 replies.

Table 20 LoC Twitter Spearman's rho results

| Variable | No of retweets | | No of Favourites | | No of Replies | |
|---|---|---|---|---|---|---|
| | Correlation coefficient | P value | Correlation coefficient | P value | Correlation coefficient | P value |
| Time of day | .029 | .293 | .008 | .884 | -.016 | .767 |
| Day of week | .168 | .002 | .187 | .000 | -.015 | .788 |
| Presence of link | .349 | .000 | .182 | .000 | -.113 | .035 |
| Presence of photograph | .448 | .000 | .530 | .000 | .300 | .000 |
| Presence of mentions | -.300 | .000 | -.224 | .000 | .119 | .028 |
| Number of mentions | -.315 | .000 | -.208 | .000 | .095 | .077 |
| Presence of hashtags | .188 | .000 | .155 | .004 | .094 | .083 |
| Number of hashtags | .244 | .000 | .198 | .000 | .143 | .008 |
| Type of Tweet | -.118 | .028 | -.029 | .590 | .149 | .005 |

Table 20 shows most of the variables measured do have a statistically significant correlation with some of the numbers of responses received. The day of the week posted and the presence of hashtags have a weak positive correlation with the number of retweets and favourites, and the number of hashtags shows a weak positive correlation with all three types of responses. The presence of a link has a weak positive correlation with the number of retweets received, a weaker positive correlation with the number of favourites and a very weak negative correlation with the number of replies received. The presence of a photograph has a moderate positive correlation with

the number of retweets and favourites received and a slightly weaker positive correlation with the number of replies received. The presence and numbers of mentions have a weak negative correlation with the number of retweets and favourites a tweet receives and the presence of mentions has a very weak positive correlation with the number of replies a tweet receives. The type of tweet has a negative very weak statistically significant correlation with the number of retweets a tweet receives and a very weak positive correlation with the number of replies it receives.

Table 21 LoC Twitter Mann-Whitney Significance values

| Variable | No of retweets | No of Favourites | No of Replies |
|---|---|---|---|
| Presence of link | .000 | .001 | .035 |
| Presence of photograph | .000 | .000 | .000 |
| Presence of mentions | .000 | .000 | .028 |
| Presence of hashtags | .000 | .004 | .083 |
| Type of Tweet | .028 | .589 | .006 |

Table 21 shows that the presence of a link, photograph and mention all cause a statistically significant difference in number of all three types of response received. The presence of a hashtag causes a statistically significant difference in the numbers of retweets and favourites received and the type of tweet causes a difference in the number or retweets and replies received.

Table 22 LoC Twitter Kruskal-Wallis significance values

| Variable | No of retweets | No of favourites | No of replies |
|---|---|---|---|
| Time of day | .041 | .039 | .486 |
| Day of week | .000 | .000 | .989 |

Tables 22 shows that the time of day and the day of the week posted caused a statistically significant difference in the number of retweets and favourites a tweets received.

Overall the data collected from the LoC's Twitter page showed that with the exception of the time of day post, the variables caused a statistical difference in the number of responses received though in most cases it was a weak or very weak statistically significant correlation. The time of day posted

was shown to have a statistical difference in the number of retweets and favourites but no statistically significant correlation was shown to explain the difference.

During the research period, 116 posts were collected from the LoC's Facebook page. Most were posted between the hours of 1pm and 9pm with one earlier post and a few posted at 10 and 11pm. Posts were posted on all days of the week with Mondays less active and Fridays and Saturdays more active. Just over 90% of the posts contained a link and just under 70% of posts contained a photograph.

Just under 90% of posts received at least one share and the number of shares received was thinly spread from 5 to 358 with an outlier receiving 905 shares. Every post received at least 53 likes with a thin spread up to a majority of 500 likes though a few posts did receive more than this, with one receiving 2693 likes. Just under 18% of posts received no comments, and the majority of posts received between 1 and 15 comments though the rest of the posts received up to a maximum of 83 comments.

Table 23 LoC Facebook Spearman's rho results

| Variable | No of shares | | No of likes | | No of comments | |
|---|---|---|---|---|---|---|
| | Correlation coefficient | P value | Correlation coefficient | P value | Correlation coefficient | P value |
| Time of day | -.169 | .072 | -.268 | .004 | -.261 | .005 |
| Day of week | .017 | .861 | .185 | .047 | .018 | .850 |
| Presence of link | .122 | .194 | .247 | .007 | .170 | .069 |
| Presence of photograph | .511 | .000 | .171 | .067 | .131 | .161 |

Table 23 shows that the time of day a post was posted had a statistically significant weak negative correlation with the number of like and comments the post received. This indicates that the later a post was posted, a slightly smaller numbers of likes and comments were received. The day of the week a post was posted and the presence of a link showed very weak statistically significant correlations with the number of likes a post received but given the high number of posts that contained a link this might not be useful information. The presence of a photograph showed a stronger statistically significant correlation with the number of shares a post received.

Table 24 LoC Facebook Mann-Whitney significance values

| Variable | No of shares | No of likes | No of comments |
|---|---|---|---|
| Presence of link | .192 | .008 | .069 |
| Presence of photograph | .000 | .067 | .160 |

Table 24 shows that the presence of a link caused a statistically significant difference in the number of likes a post received and the presence of a photograph caused a difference in the number of shares received.

Table 25 LoC Facebook Kruskal-Wallis significance values

| Variable | No of shares | No of likes | No of comments |
|---|---|---|---|
| Time of day | .188 | .286 | .124 |
| Day of week | .254 | .443 | .505 |

Table 25 shows that the time of day or the day of the week a post is posted on has no statistically significant impact on the number of responses a posts receives.

Overall, none of the variables effected all three types of response, though the presence of a photograph has a statistical impact and correlation with the number of shares a post received and the presence of a link has a statistical impact and correlation with the number of likes received. Time of day posted had a weak statistical correlation with the number of likes and comments received but these were not enough to cause a statistical difference in the response rate.

**4.4 National Library of Australia**

Two hundred and forty-four tweets were collection during the research period. The majority were posted between 10am and 7pm though there were also a few tweets as late as 11pm. Tweets were mainly posted between Monday to Friday, with a peak on Tuesdays and a small number of tweets posted at the weekend. Seventy percent of tweets contained a link and 59% of tweets contained a photograph. Eighty-two percent of tweets contained a mention, with most containing up to three and several tweets containing four. Just over 52% of tweets contained a hashtag with most

containing one hashtag with small numbers containing two or three and a single tweet containing four hashtags. Half of the tweets were retweets.

Nearly 90% of the tweets received at least one retweet with the majority receiving up to 10 retweets and smaller numbers receiving up to a maximum of 65 retweets. Eighty-four percent of the tweets received at least one favourite with the majority receiving up to six favourites and smaller numbers receiving up to a maximum of 52 favourites. Just over 31% of the tweets received a reply with the majority receiving between one and three replies with smaller numbers receiving up to 10 and in one outlying case, 20 replies were received.

Table 26 NLA Twitter Spearman's rho results

| Variable | No of retweets | | No of Favourites | | No of Replies | |
|---|---|---|---|---|---|---|
| | Correlation coefficient | P value | Correlation coefficient | P value | Correlation coefficient | P value |
| Time of day | -.029 | .649 | .050 | .440 | -.111 | .082 |
| Day of week | .003 | .959 | .054 | .404 | -.056 | .386 |
| Presence of link | .177 | .006 | .062 | .332 | -.022 | .727 |
| Presence of photograph | .386 | .000 | .412 | .000 | .181 | .005 |
| Presence of mentions | -.136 | .034 | -.204 | .001 | -.009 | .894 |
| Number of mentions | -.227 | .000 | -.243 | .000 | -.144 | .025 |
| Presence of hashtags | .110 | .088 | .191 | .003 | -.054 | .398 |
| Number of hashtags | .121 | .059 | .201 | .002 | -.071 | .270 |
| Type of Tweet | .244 | .000 | .107 | .097 | .044 | .490 |

Table 26 shows the presence of a link has a very weak positive statistically significant correlation with the number of retweets a tweet receives. The presence of a photograph has a weak positive correlation with the number of retweets and favourites and a slightly weaker positive correlation

with the number of replies received. The presence and number of mentions in a tweet have a very weak negative correlation with the number or retweets and favourites received, and the number of mentions also have a very weak negative correlation with the number of replies received. The presence and number of hashtags have a very weak positive correlation with the number of favourites received and the type of tweet has a weak positive correlation with the number of retweets received.

Table 27 NLA Twitter Mann-Whitney Significance values

| Variable | No of retweets | No of Favourites | No of Replies |
|---|---|---|---|
| Presence of link | .006 | .726 | .331 |
| Presence of photograph | .000 | .005 | .000 |
| Presence of mentions | .035 | .893 | .001 |
| Presence of hashtags | .088 | .397 | .003 |
| Type of Tweet | .000 | .489 | .096 |

Table 27 shows that the presence of a link and the type of tweet cause a statistically significant difference in the number of retweets a tweet receives. The presence of a photograph causes a difference in all three types of response while a mention causes a difference in the number of retweets and replies. The presence of a hashtag only causes a difference in the number of replies.

Table 28 NLA Twitter Kruskal-Wallis significance values

| Variable | No of retweets | No of favourites | No of replies |
|---|---|---|---|
| Time of day | .024 | .032 | .114 |
| Day of week | .021 | .131 | .109 |

Table 28 shows that the time of day has a statistically significant effect on the number of retweets and favourites a tweet receives while the day of the week only has an effect on the number of retweets.

Overall, numerous factors affect the NLA's Twitter engagement with users. The presence of a link or photograph causes a statistical difference in the number of responses received and there are shown to be weak correlated. The presence of mentions has a weak negative correlation with the number of responses, enough to cause a statistical difference in the numbers of responses received in tweets that have mentions. The type of tweet does cause a statistical difference in the number of retweets a tweet receives and there is shown to be a weak correlation that retweets gain higher numbers. The time of day and day of the weak posted do have a statistical difference in the number of responses received but there is no statistical correlation to explain it.

During the research period 69 posts were collected from the NLA Facebook page. Of these, the majority were posted at 9am or earlier, with the rest posted between 9pm and 11pm. Posts were spread evenly throughout the week though Fridays did see more posts. Eighty-eight percent of the posts contained links, and ninety-one percent contained a photograph.

Over 65% of the posts received at least one share, with the most common share rate being one, two or three per post through numbers did climb above 20 and in once case reached 154. Every post received a minimum of six likes and the numbers of likes were thinly spread out between six and 385 with an outlier post receiving 701 likes. Eighty percent of the posts received at least one comment and the majority of posts received between one and nine comments with individual posts receiving 33, 47 and 635 comments.

Table 29 NLA Facebook Spearman's rho results

| Variable | No of shares | | No of likes | | No of comments | |
|---|---|---|---|---|---|---|
| | Correlation coefficient | P value | Correlation coefficient | P value | Correlation coefficient | P value |
| Time of day | .237 | .050 | -.168 | .168 | -.139 | .256 |
| Day of week | .083 | .500 | -.017 | .892 | .075 | .541 |
| Presence of link | .040 | .746 | .159 | .192 | .070 | .567 |
| Presence of photograph | .265 | .028 | -.025 | .841 | -.060 | .624 |

Table 29 shows that the only statistically significant correlations are the time of day posted and the presence of a photograph affecting the number of shares received. Both correlations are positive,

indicating that the later a post is posted or if the post contains a photograph then the number of shares received is higher, but both correlations are weak indicating that this isn't always the case.

Table 30 NLA Facebook Mann-Whitney significance values

| Variable | No of shares | No of likes | No of comments |
|---|---|---|---|
| Presence of link | .744 | .189 | .563 |
| Presence of photograph | .032 | .844 | .640 |

Table 31 NLA Facebook Kruskal-Wallis significance values

| Variable | No of shares | No of likes | No of comments |
|---|---|---|---|
| Time of day | .136 | .050 | .227 |
| Day of week | .275 | .271 | .506 |

Tables 30 and 31 show that only the presence of a photograph and the time of day post had a statistically significant difference on the number of shares and likes respectively.

Overall, very little was shown to affect the NLA's Facebook engagement. The time of day and the presence of a photograph had a weak correlation with the number of shares, and presence of a photograph was also shown to cause a statistical difference in the number of shares a post received.

**4.5 National Library of Scotland**

Two hundred and ninety-four tweets were collected during the research period. Most tweets were posted between 8am and 6pm, though there were a few later posts. Tweets were mainly posted between Monday and Friday with a small number posted at the weekend. Over 60% of the tweets contained a link and over 66% contained a photograph. Sixty-two percent of tweets contained a hashtag with most containing one or two hashtags but the occasional tweet contained four hashtags. Nearly 70% of tweets contained a mention with one or two mentions being the most common. Nearly 20% of the tweets were retweets.

Just over 80% of the tweets were retweeted with the majority being retweeted up to 10 times though there were a few that were retweeted up to 24 times. Just over 80% of tweets were favourited with most receiving between one and eight favourites, though individual tweets did

receive up to a maximum of 26. Just over 70% of the tweets received no reply, with the majority of those that did received one reply and a few tweets received up to four replies.

Table 32 NLS Twitter Spearman's rho results

| Variable | No of retweets | | No of Favourites | | No of Replies | |
|---|---|---|---|---|---|---|
| | Correlation coefficient | P value | Correlation coefficient | P value | Correlation coefficient | P value |
| Time of day | .242 | .028 | .199 | .071 | .108 | .332 |
| Day of week | .001 | .994 | -.013 | .908 | -.123 | .269 |
| Presence of link | .216 | .050 | .109 | .328 | -.301 | .006 |
| Presence of photograph | .408 | .000 | .417 | .000 | .167 | .130 |
| Presence of mentions | .356 | .001 | .265 | .265 | .152 | .170 |
| Number of mentions | .366 | .001 | .259 | .018 | .152 | .170 |
| Presence of hashtags | .046 | .681 | .112 | .314 | .024 | .210 |
| Number of hashtags | .046 | .681 | .112 | .314 | .210 | .057 |
| Type of Tweet | .384 | .000 | .344 | .001 | .146 | .187 |

Table 32 shows that the presence of a link has a weak positive statistically significant correlation with the number of retweets a tweet receives and a weak negative statistically significant correlation with the number of replies. The presence of a photograph has a slightly stronger, but still weak, positive statistically significant correlation with the number of retweets and favourites a tweet receives. The presence and number of hashtags both have a weak positive statistically significant correlation with the number of retweets a tweet receives. The type of tweet also has a weak positive statistically correlation, this time with the number of retweets and the number of favourites a tweet receives.

Table 33 NLS Twitter Mann-Whitney Significance values

| Variable | No of retweets | No of Favourites | No of Replies |
|---|---|---|---|
| Presence of link | .088 | .291 | .013 |
| Presence of photograph | .001 | .001 | .314 |
| Presence of mentions | .004 | .038 | .382 |
| Presence of hashtags | .360 | .342 | .082 |
| Type of Tweet | .002 | .006 | .407 |

Table 33 shows that the presence of a link significantly causes a statistical difference in the number of replies a tweet receives. The presence of a photograph of a mention and the type of tweet affect the number or retweets and favourites received.

Table 34 NLS Twitter Kruskal-Wallis significance values

| Variable | No of retweets | No of favourites | No of replies |
|---|---|---|---|
| Time of day | .538 | .508 | .373 |
| Day of week | .445 | .885 | .711 |

Table 34 showed that neither the time of day nor the day of the week caused any statistically significant differences in the number of responses received.

Overall, mentions, time of day or the day of week posted have no impact on the NLS's Twitter engagement. Hashtags effect the number of retweets a tweet receives, and this is difference is shown to be weakly correlated. The presence of a photograph and the type of tweet effect the number of retweets and favourites a tweet receives and these differences are shown to be weak positive correlations.

Thirty-six posts were collected from Facebook during the research period. Most of the posts were posted between 9am and 4pm though one was posted at 10pm. Posts showed normal distribution over the hours of the day, with a peak of posts at 12noon. With one exception of a Saturday post, posts were posted between Monday and Friday, with Thursday and Friday being the most active days. One-third of the posts contained a link and 86% of the posts contained a photograph.

One-third of the posts received no shares, with the majority of the rest receiving between one and five shares with two outlying posts being shared 34 and 66 times. Only two of the posts received no likes, with the rest of the posts receiving a fairly even spread of up to 50 shares with one post receiving a total of 78 likes. Twenty of the posts received no comment, with one comment being the most common number of replies and three replies being the maximum.

Table 35 NLS Facebook Spearman's rho results

| Variable | No of shares | | No of likes | | No of comments | |
|---|---|---|---|---|---|---|
| | Correlation coefficient | P value | Correlation coefficient | P value | Correlation coefficient | P value |
| Time of day | .061 | .726 | -.151 | .379 | -.213 | .213 |
| Day of week | -.166 | .501 | -.215 | .209 | -.106 | .539 |
| Presence of link | -.080 | .642 | -.284 | .093 | -.009 | .957 |
| Presence of photograph | -.095 | .580 | -.089 | .580 | -.272 | .108 |

Table 36 NLS Facebook Mann-Whitney significance values

| Variable | No of shares | No of likes | No of comments |
|---|---|---|---|
| Presence of link | .649 | .093 | .974 |
| Presence of photograph | .594 | .625 | .161 |

Table 37 NLS Facebook Kruskal-Wallis significance values

| Variable | No of shares | No of likes | No of comments |
|---|---|---|---|
| Time of day | .852 | .377 | .570 |
| Day of week | .160 | .696 | .349 |

Tables 35, 36 and 37 show that there is no significant correlation or differences between the variables measured and the responses measured. However, this was a smaller sample size so it could be that the size was too small to show any trends.

Overall, the analyses of the NLS Facebook shows that nothing NLS did during the time period affected Facebook engagement.

### 4.6 Comparisons of National Libraries

Table 38 Twitter Totals

| Library | Total number of tweets | Retweets | | Favourites | | Replies | |
|---|---|---|---|---|---|---|---|
| | | Total | Average | Total | Average | Total | Average |
| British Library | 311 | 11913 | 38.3 | 9383 | 30.2 | 742 | 2.4 |
| Library and Archives Canada | 352 | 2392 | 6.8 | 1458 | 4.1 | 103 | 0.3 |
| Library of Congress | 345 | 9575 | 27.8 | 7449 | 21.6 | 399 | 1.2 |
| National Library of Australia | 245 | 1527 | 6.2 | 1106 | 4.5 | 173 | 0.7 |
| National Library of Scotland | 194 | 1191 | 6.1 | 882 | 4.5 | 74 | 0.4 |

Table 38 shows that whilst at first glance similar levels of posts on Twitter don't necessarily equal the same response rates, three of the libraries actually have very similar average levels of engagement. The BL's and LoC's higher numbers could be attributed to the higher populations of the United Kingdom and the United States of America as well as the higher visitor numbers to the countries. If it was strictly visitor numbers affecting engagement though you would expect the LoC's number to be much higher than the BL's. The numbers do indicate that the BL strategy on Twitter is successful and other national libraries could learn from them. The fact that Scotland's population is so small compared to the other countries suggests that the NLS is also performing well to maintain engagement levels similar that of more populous countries. The LAC's slight lag in response rates compared to its population size and funding could be attributed to that fact that its social media accounts are younger plus its services and accounts are spread over two languages whilst the other libraries are not.

Table 39 Facebook Totals

| Library | Total number of posts | Shares | | Likes | | Comments | |
|---|---|---|---|---|---|---|---|
| | | total | average | total | average | total | average |
| British Library | 63 | 5643 | 89.6 | 10791 | 171.3 | 363 | 5.8 |
| Library and Archives Canada | 242 | 782 | 3.2 | 8751 | 36.2 | 231 | 0.95 |
| Library of Congress | 116 | 10599 | 91.4 | 42856 | 369.4 | 813 | 7 |
| National Library of Australia | 69 | 1017 | 14.7 | 7731 | 112 | 975 | 14.1 |
| National Library of Scotland | 36 | 212 | 5.9 | 842 | 23.4 | 22 | 0.6 |

Table 39 shows that the libraries with the highest and lowest number of posts also have very low average response rates on Facebook compared to the other libraries. This could suggest that Facebook users are seeing too much or too little of the library when checking Facebook and the libraries are therefore not attracting as much attention and engagement as they could. Again the two most populated countries national libraries have the highest rates of engagement, with the LoC having better rates than the BL on Facebook. However, the BL has very similar number of shares as the LoC indicating that the BL's strategy is holding its own, and the NLA has an extremely high rate of comments, double that of the LoC. Evidently part of their strategy is working and further research in content analysis of posts could uncover the reasons behind their high comment rate. There is also the case on Facebook that algorithms are constantly changing what users see on their feed and this can have an unpredictable effect on the number of users that can see a libraries posts and thus affect engagement through no fault of the library.

Population is just one reason for differing levels of engagement between the libraries. Although all libraries are mostly publicly funded, the level of funding each library receives varies widely and this will affect how many staff and how many resources libraries can allocate to social media accounts and presence. This is especially apparent in the response rates of the BL and the LoC, the two libraries that receive the most funding, as on both platforms both libraries outperform the others, though the fact that libraries with smaller levels of funding can sometimes outperform them is indicative that it is not necessarily the amount of resources but how they are used that matters.

Collection size must also be taken into account as those libraries with larger collections will have a greater chance of attracting people and therefore have a greater opportunity to create engagement on social media. As digitisation increases though, the sizes of collections that anyone can access are in flux and this may have a significant impact on a library's level of social media engagement in years to come.

## 5. CONCLUSIONS AND RECOMMENDATIONS

Multiple factors have been shown to affect the social media engagement of national libraries. The time of day a post or tweet is posted is often shown to have a statistically significant weak correlation with the number of responses they receive. The correlation is negative, indicating that posts later in the day receive fewer responses, though the level of correlation is weak enough and the level of statistical difference significant enough to suggest that posts remain spread out throughout the day, while remembering that if interactive sessions such as question and answer session are scheduled, posting them earlier in the day may result in a slightly higher response rate.

The day of the week a post or tweet is posted on is shown to have no statistically significant impact on the number of responses received, either positive or negative, but then the days of posts in the samples were fairly evenly spread out between Monday and Friday for the most part so this could be an indication that the level of spread works for the institutions as users are interacting on all days. More research would be required to be sure.

The presence of links was often shown to statistically affect the number of shares/retweets and likes/favourites a post received and not the number of replies. This could be because people are responding more on the page that is linked to, and just liking/retweeting the posts on the social media platform. It is recommended that institutions still post links as they are shown to be effective at increasing engagement but also monitor the pages they link to if possible to see if the links are increasing traffic and responses to those pages.

The presence of a photograph was often shown to have a statistically significant impact on the number of responses a post receives and in many cases there was a statistically significant moderate positive correlation between the presence of a photograph and the number of responses received. The correlation could partially be due to the large numbers of posts with photographs in the datasets but the impact on engagement caused by the presence of the photograph is enough to recommend that the current practise of post a high proportion of photographs especially when so

many of them are either of events taking place in the library or are examples of the continuing digitisation processes that are bringing the material to a new audience. Further research could be performed to evaluate the effect different styles and types of photographs have on engagement levels and give further recommendations.

In most cases the presence and number of mentions in tweets was shown to have either no statistically significant impact in the number of responses received, or a statistically significant weak negative correlation in the number of retweets and favourites received. This negative correlation could be due to the fact mentions often occur when conversations are taking place and thus only a limited set of users are interested and engaged. While mentions in general do attract the users that are mentioned, care must be taken to ensure that the post is relevant to the user and not spamming them. It is recommended that the current practise by national libraries continues with careful thought about who the post is relevant to, such as similar organisations or accounts, if mentions are to be added.

The presence and number of hashtags in a tweet was shown to have no or little impact in the number of responses received. The use of hashtags can also add another complicating factor as the hashtags used can trend without any interference from the library, or it could be an already popular hashtag that the library is responding to which gives better coverage that would not necessarily be predicted. However it is still recommended that hashtags be used but awareness maintained of what hashtags are popular, both with the library's social media followers and in general, so that relevant hashtags can be used to provide new audiences for posts as well as keeping on trend with popular ideas that could be used to further the library's engagement.

The type of tweet posted, such as it is an original tweet or a retweet, was shown to have a weak statistically significant correlation with the number of responses a tweet receives. This could be due to the complicating factor of the metrics for the retweet displayed being for the original tweet, not the library's instance of it. However there seems to be no negative impact caused by retweet other users tweets so it is recommended that the current practise of retweeting tweets the institution has been mentioned in or might be relevant to users continues.

The ease of finding accounts and using the libraries' websites varied considerably, and it is recommended that all libraries link to all their accounts from master lists on their websites as well as make sure social media policies are visible and easily found on their websites in order to make the

whole experience much more pleasant and so that everyone can understand what the libraries uses the varying platforms for, what behaviour is expected of everyone and what sort of content can be discovered.

It is important to remember that social media is often a conversation and this can skew the metric results. For example, one post or tweet may spark a conversation but have none of the normal indicators of success i.e. a link, or a post may be shared by someone who has a lot of followers so gets a lot of exposure that wouldn't be reflected in the normal predictors but could give large metrics. Also, the character limit on Twitter can often mean that a point can be made over numerous tweets and this isn't taken into account into the analysis as each tweet has individual metrics. Therefore it is important to look at the metrics as a whole rather than judging on a post by post basis. Averaging the response rates allows for this, and also allows the comparison of national libraries, at least for the variable studied in this research.

The main limitation of the research was that only a small sample of national libraries were analysed so the results are narrowly applicable to developed countries with English as a main language. Further research could take this beyond the small sample, as well as involving some other national institutions to see if national libraries can be compared against them, for example national museums as there is a lot of crossover in literature and working practises and models. The other limitation was that most of the analysis was relatively simplistic with the analysis of variables individually, though it needed to be as nothing specific existed for national libraries. Video was not a variable checked as it is just beginning to be more prevalent and not every institution posted videos. Further research could go more in depth to see if the variables work with or against each other and have a synergistic effect on metrics and the combination of variables that have the most effect. For example it was observed that many of the highest ranking posts had both photos and links, though this wasn't analysed. Qualitative research, for example into keywords of highest rated posts, or word frequency in datasets or looking into the observation that many high ranked tweets asked questions, is a large area to be explored as well.

For all the limitations, there were some advantages to the research. The data collected was naturalistic and was not dependant on response rate or suffer from interview bias and no costs were involved in collecting or analysing the data nor were specialist staff needed.

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