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Facebook monitoring metrics. Applications in museology

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Abstract: Social networks are a key medium for any institution's communication nowadays. Assessing the performance of social networks requires some reflection and systematic work both in the short as well as the long term. Yet such an investment may prove to be extremely profitable for the museums' communication departments, since it helps improve the content of the posts by adapting them to the target audience, fostering interaction and, in sum, improving the way the institution is run.

Today, free monitoring tools are available that provide account owners with a vast amount of information concerning the use thereof. Yet the metrics used to evaluate social networks often entail a number of difficulties in their interpretation as a result of being too generalist and all-embracing since they are aimed at all kinds of users: public authorities, firms, private users, etc. In the case of Facebook, many of these metrics have similar meanings, as both the number of users engaging in a communication of any kind and the number of actions are quantified.

The present work seeks to summarize and enhance the interpretation of Facebook's metrics using a multivariate technique, factor analysis, in an attempt to pinpoint which factors best explain communication in said network in the case of three Spanish museums. In addition, we aim to create an online activity indicator with a two-fold purpose in mind; firstly, to pinpoint the days corresponding to the highest values of the index and linking them to the events that occurred on those days, and secondly excluding them in order to assess the mean monthly evolution without the influence of exceptional events. Finally, and in order to better interpret the indicator's development over time, graphic analysis was used both for the index and the contributions thereto of the factors extracted, excluding outliers.

This research offers a technique that is relatively straightforward to apply and that is suitable to sum up the numerous and varied metrics available when monitoring this social network. Its usefulness is shown in its application to three museums that display extremely different features, providing tailor-made indicators for each that are able to reflect in each case how its online Facebook community behaves.

Keywords: Social Networks, Facebook, Key Performance Indicators, Factor Analysis

1. Introduction

The traditional role of museums has traditionally focused on collecting, researching and preserving objects for future generations. Yet since the 1990s, a new concept of what a museum should be has emerged, namely one that focuses on the public and that involves fresh demands for activities and facilities and which is forcing museums to re-think and to offer different services (Hooper-Greenhill 2013; Vacas 2011; Weil 1997). Dissemination, the museum's cultural action, pedagogical concerns and even the entertainment perspective have gained particular importance (Din 2015; Moore 2015; Sylaiou et al. 2017). Modern-day technological innovations such as virtual reality, 3D technologies or apps created ad hoc are clearly generating a scenario in which content can be conveyed in an attractive, academic and entertaining manner, thus helping enormously with the informative and educational task museums are engaged in (Carrozzino and Bergamasco 2010; Castilla 2012; Choi and Kim 2017; Chong and Smith 2017; Jung et al. 2016; Kiourt et al. 2016; Solano 2012; Sundar et al. 2015; Sylaiou et al. 2017).

Over the last thirty years, museum managers have had to embrace this new concept of what a museum is, and re-focus their managerial approach so as prioritize visitors who are increasingly demanding up-to-date quality information, which is one of the reasons why communication has taken on such a key role (Gilmore and Rentschler 2002; Oliveira and Capriotti 2013; Russo et al. 2008). Faced with these challenges, new information and communication technologies (ICT) have become key tools for expanding and publicising the institution as well as for engaging more closely with those who visit them (Capriotti and Kuklinski 2012; Celaya 2012; Gómez 2012; Marty 2008, Paül i Agustí 2015; Schweibenz 2010; Suzic et al. 2016). Through online communication, museums can attract new audiences and, in particular a younger public, the first group to have adopted digital forms of communication and who are increasingly becoming a key target group for museums (Drotner and Schrøder 2013). Online communication is a reality in all spheres and facets of daily life; hence the importance for museum managers of paying them the attention they deserve.

The use of social networks in cultural organisations is establishing itself as a form of communication, and in scientific literature various analyses exploring their degree of penetration in museums may be found (Claes and Deltell 2014; Fletcher and Moon 2012; Kidd 2011; Padilla-Meléndez and Águila-Obra 2013; Sundar et al. 2015). Other studies analyse use, interaction or even dissemination of content through the online pressroom (Capriotti and González-Herrero 2013; Espinós 2014; Gerrard et al. 2017; Gronemann et al. 2015; Losada and Capriotti 2015). Privacy and transparency are also topical issues dealt with in various studies (Bertot et al. 2010; Fundación Compromiso Empresarial 2010; Kidd 2014; Wong 2010), reminding us that although ethical questions concerning these matters are not exactly new, they are emerging in a context that is different to the physical space of museums.

Yet merely having these new channels of communication is not enough: they must also be appealing and useful tools, and must help the institution to devise a communication strategy, the efficiency of which may be assessed if we have information available concerning user behaviour, their level of interaction, origin, which pages they visit, how long the visit lasts, and so on. As a result, web analytics are becoming powerful tools for evaluating the behaviour and interaction that internet users establish in the myriad of webpages. Some studies have already emerged exploring the issue, since assessing this kind of communication, both in the short as well as long term, is extremely useful and relatively straightforward thanks to the monitoring tools these online sites can offer. They also have the advantage of their immediacy, given that they afford the possibility of analysing trends and specific events instantly (Fletcher and Moon 2012; Gronemann et al. 2015; Román and Cabero 2013).

Assessment carried out using these tools at times evidences certain difficulties of interpretation as a result of them being too general, all-embracing and designed to meet the needs of all kinds of users (firms, public authorities, individuals, etc.). Given the need to find basic metrics that provide insights into user behaviour, scientific literature has come up with a number of different ideas in a range of research fields. Choosing the metrics that are felt to be most relevant to each institution is fairly common (Podobnik 2013; Spiliopoulou et al. 2014); constructing ratios (Bonsón and

Ratkai 2013; Cvijikj and Michahelles 2013; Oviedo-García et al. 2014; Peters et al. 2013; Rahman et al. 2016); generating regular reports for short-term assessment (Peters et al. 2013; Villaespesa 2013) or even resorting to the analysis of time series and the use of multivariate statistical techniques (Cvijikj and Michahelles 2013; Moral et al. 2014; Plaza 2009; Plaza 2011; Zafiropoulos et al. 2015).

To date, we are not aware of many studies exploring the web analytics of cultural institutions, particularly if we focus on museums and the use of Facebook. Most studies analysing social network communication are based on short-term monitoring of certain museum metrics. These include some studies of audiences in American museums (Holdgaard 2012) and European museums (Zafiropoulos et al. 2015); studies gauging the degree of implementation and engagement (Fletcher and Moon 2012), and an analysis of metrics in the British Museum using one-year data (Spiliopoulou et al. 2014). The possibility of analysing data series of one year or more offers a broader perspective that might prove extremely useful for museums' communication departments.

This work aims to fill a gap in this field of research by assessing the Facebook activity in three Spanish museums using long-term monitoring and providing a relatively simple and replicable methodology. The study seeks to offer analysis tools that are useful for evaluating the metrics offered by monitoring tools so as to enhance museums' communication through this social network.

After this introduction, the article is structured in a second section that deals with the formulation and method, followed by the results of the analysis, discussion, conclusions and the usual references section.

2. – Formulation and method

This work studies the communication in Facebook of three specific museums that have a very different theme and profile: the Valladolid Science Museum, the Castilla y León Contemporary Art Museum (MUSAC) in Leon, and the National Sculpture Museum (MNE) in Valladolid. The first of these is a leading institution in the dissemination of scientific knowledge in the region of Castilla y León, founded in 2003, and whose visitors are mainly families and children; opened in 2005, the MUSAC

houses a collection comprising the latest contemporary creations in a wide variety of mediums; and the National Sculpture Museum, which dates back to 1842, and is probably the most well-known and frequently visited in the city of Valladolid and is home to one of the finest collections of polychrome sculptures in the world.

To conduct this analysis, daily data have been downloaded of the available metrics that provide information concerning the impact of the content published by the museum and concerning user commitment, descriptions of which are detailed in Table 1. It should be noted that two types of variables can be distinguished: those that refer to the number of users engaging in communication actions of any kind and those that count the number of these actions. In order to measure interaction in a relative manner, in this study a calculation has been made of the Engagement Rate as the quotient of Page Engaged Users over the Total Reach.

Daily metrics correspond to a period of approximately two years, on similar dates at the three museums. A look at the data (Table 2) reveals that the highest absolute mean figures in virtually all the variables correspond to the MUSAC, followed by the National Sculpture Museum, with the Science Museum in third place, which gives us an idea of the size of the Facebook community of the three museums. However, the statistical summary reveals the nuances for each particular museum. For example, the daily mean engagement rate is highest in the Science Museum (7.030), which a priori had the poorest absolute figures, followed by the MUSAC (6.438) and finally the National Sculpture Museum (5.114). We feel that these values respond to the content and online activities of each of the three museums, but also to the kind of public.

Table 1. Metrics in Facebook. Definition and classification.

Metrics	Definition	Concept	It counts
Lifetime Likes	The total number of people who have liked your Page. (Unique Users)	Engagement	Users
New Likes	The number of new people who liked your Page (Unique users)	Engagement	Users
Unlikes	The number of Unlikes of your Page (Unique Users)	Engagement	Users
Page Engaged Users	The number of people who engaged with your Page. Engagement includes any click or story created. (Unique Users)	Engagement	Users
Total Reach	The number of people who have seen any content associated with your Page. (Unique Users)	Size	Users
Total Impressions	The number of impressions seen of any content associated with your Page. (Total Count).	Size	Actions
Logged-in Page Views	Page Views from users logged into Facebook (Total Count)	Size	Actions
Reach of page post	The number of people who saw any of your Page posts. (Unique Users)	Size	Users
Total Impressions of your post	The number of impressions that came from all of your posts. (Total Count)	Size	Actions
Total Consumers	The number of people who clicked on any of your content. Stories that are created without clicking on Page content (ex, liking the Page from timeline) are not included. (Unique Users)	Engagement	Users
Page consumptions	The number of clicks on any of your content. Stories generated without clicks on page content (e.g., liking the page in Timeline) are not included. (Total Count)	Engagement	Actions
Daily count of fans online	The number of people who liked your Page and who were online on the specified day. (Unique Users)	Engagement	Users
People Talking About This	The number of people sharing stories about your page. These stories include liking your Page, posting to your Page's timeline, liking, commenting on or sharing one of your Page posts, answering a question you posted, responding to one of your events, mentioning your Page, tagging your Page in a photo or checking in at your location. (Unique Users)	Engagement	Users
Negative Feedback from Users	The number of people who have given negative feedback to your Page. (Unique Users)	Engagement	Actions
Engagement Rate	Page Engaged Users / Total Reach	Engagement	Users

Table 2. Daily Facebook metrics in the three museums. Statistical summary

Facebook Metrics	Science Museum April 2014- February 2016			MUSAC May 2014 – March 2016			MNE September 2014-April 2016		
	Mean	Variation Coefficient	Total	Mean	Variation Coefficient	Total	Mean	Variation Coefficient	Total
New Likes	3.08	82.71%	2153	12.55	55.85%	8797	5.66	61.96%	3441
Unlikes	0.31	177.55%	219	1.92	95.94%	1346	0.55	149.04%	337
Page Engaged Users	89.51	159.82%	61405	133.89	86.28%	93856	93.74	122.61%	56995
Total Reach	1296.20	146.15%	898264	2190.14	79.51%	1535288	1498.39	126.41%	911020
Total Impressions	2700.05	141.43%	1849530	4469.62	77.91%	3133201	3005.53	116.65%	1827360
Logged-in Page Views	17.16	71.50%	11291	30.15	62.85%	21136	17.40	77.27%	10579
Reach of page posts	722.00	217.89%	498899	1257.00	109.06%	881159	998.01	136.21%	606789
Total Impressions of your posts	1461.21	181.92%	1002390	2575.02	99.52%	1805086	1958.02	129.59%	1190480
Total Consumers	74.32	184.60%	50985	101.79	96.32%	71354	64.80	146.75%	39400
Page consumptions	150.95	239.29%	103553	265.63	179.28%	186204	152.41	155.19%	92667
Daily count of fans online	2053.58	24.48%	1186970	18935.96	9.61%	13274110	4168.13	15.76%	2534220
People Talking About This	22.23	103.02%	15183	45.08	93.80%	31601	42.64	121.59%	25926
Negative Feedback from Use	0.46	252.88%	317	0.71	150.13%	498	0.48	284.53%	291
Engagement Rate	7.030	51.81%		6.438	38.04%		5.114	80.00%	

This initial approach to the results gives us a general idea of the volume of communication and engagement, yet provides no information regarding what are the key points to understand the behaviour and progression of the online community over this period. The metrics available display high correlations with one another and may be suitably summed up using multivariate factor analysis with which to determine groups of variables that synthesise the initial information and build an indicator of activity in Facebook. Museums can thus assess whether they are achieving substantial increases in their audiences and whether these increases are accompanied by greater interaction that is able to secure user loyalty.

Factor analysis is a well-known data reduction technique (Hair 1999) that serves to find groups of homogenous variables based on a large set of variables that are correlated with one another. The method involves constructing new variables or uncorrelated factors, as a linear combination of the original variables, explaining a high percentage of common variance. These factors are interpreted taking into account their factor loadings or correlation coefficients with the original/initial variables. When several variables have high loadings in more than one factor, the interpretation is not clear and an equivalent rotated solution with the same percentage of common variance explained would be sought.

The present research uses this type of analysis in an effort to understand and sum up the vast amount of metrics to emerge when monitoring Facebook with the initial selection of variables defined in Table 1, classified according to the concept measured (Engagement / Size) and the type of item counted (Users / Actions). The variables included in the final refined models concur to a high degree in the three cases, but are not exactly the same due to the lack of data in some of the museums and to the fact that some of them evidenced low communality.

Bearing in mind that a social network is a meeting place whose activity consists of facilitating connectivity or proximity with audiences, providing services and guidance and encouraging participation, factor analysis may offer vital clues towards building an activity indicator in Facebook suited to each museum, defining it as the mean of the factor scores (F_i) weighted with the percentage of variance explained by each factor between the total percentage of variance explained (w_i):

$$I = w_1F_1 + \dots + w_kF_k$$

Analysis of the exceptionally high values of these indicators would serve a two-fold purpose: on the one hand, to pinpoint the days of greatest activity and determine what this is due to and, on the other, by excluding them it is possible to analyse the mean monthly progression without the influence of specific events that generate exceptionally high communication. To do this, graphic analysis is performed showing the mean monthly values of both the index and the factors' contributions to the index using the same scale.

3. -Results

The suitability of factor analysis is ensured by Bartlett's sphericity test in the three museums, as well as by the high Kaiser-Meyer-Olkin measures of adequacy (0.633 in the Science Museum, 0.653 in the MUSAC, and 0.763 in the MNE), and because all the variables employed in the factor analyses carried out have high communalities. The factor extraction method used was Principal Component Analysis with Varimax rotation to enhance the interpretation of the results in cases where the initial solution failed to provide a clear view. The models refined excluding the variables with low levels of sampling adequacy are summed up in Table 3.

Factor analysis for the Science Museum with Varimax rotation to enhance interpretation extracts three factors that explain 92.60% of common variance and taking into account their factor loadings could be interpreted as follows:

F1 = Interaction: highly correlated with the number of users interacting and with the number of interactions performed. This factor measures user commitment.

F2 = Content scope and visibility: related to the number of users that reach a post or site content and with the number of times content of any kind is seen.

F3: Active followers and fans: related to the number of people who like some content and talk about it on the social network.

With regard to the MUSAC, factor analysis detects two factors that explain 86.26% of common variance, whose factor loadings without the need for rotation may be interpreted as follows:

F1 = Scope and Interaction: related to all the variables that measure both actions as well as users, referring to reaching posts and all kinds of content, as well as interaction in general.

F2 = Fans: factor correlated with the number of people connected daily to the museum's Facebook page and with the accumulated net "Like".

Finally, in the case of the National Sculpture Museum (MNE), the factor method determines three factors that explain 87.54% of common variance. Interpretation of the rotated solution, observing the factor loadings, is as follows:

F1 = Scope and interaction: correlated with reaching all kinds of content, impressions thereof and certain kinds of interaction.

F2 = Visibility and active followers: related to the scope and visibility of the museum's publications and the number of active users connected to Facebook.

F3 = Fans online: number of online fans.

After adding the factors weighted by the percentages of variance explained and after excluding index values that are considered exceptionally high (over 2.5 standard deviations from the mean), Graph 1 shows the mean monthly progression of both the indicator and the contributions of the factors for the three museums. The unusual values reflect particularly successful activities in each museum, and which had an enormous impact in social networks, and which are detailed in Table 4. In the three cases, the index grows although the progression differs enormously.

Graphic analysis shows the indicator's clear growth over time in the case of the Science Museum as well as the increased contribution of the two first factors, with a very high percentage of variance explained in both cases, although with a greater F2 slope (scope and visibility). Also evident is the stability of the third factor (followers and active fans) with a slope very close to zero, which gives food for thought since it contributes to the indicator with 15.029% of variance explained.

Table 3. Factor Analysis. Results

Science Museum (Varimax Rotation)	F1	F2	F3
Total Consumers	0.975	0.131	0.129
Page consumptions	0.967	0.056	0.071
Page Engaged Users	0.962	0.162	0.188
Reach of page posts	-0.005	0.990	0.065
Total Impressions of your posts	0.004	0.988	0.100
Total Reach	0.437	0.877	0.096
Total Impressions	0.639	0.738	0.101
New Likes	0.048	-0.019	0.928
People Talking About This	0.352	0.358	0.633
% of Variance Explained (92.60%)	39.292%	38.282%	15.029%
MUSAC			
Total Reach	0.962	-0.070	
Total Impressions	0.942	-0.177	
Total Impressions of your posts	0.904	0.112	
Reach of page posts	0.896	0.189	
Page Engaged Users	0.887	-0.303	
People Talking About This	0.831	-0.045	
Total Consumers	0.811	-0.356	
Daily count of fans online	0.301	0.929	
Lifetime Total Likes	0.302	0.920	
% of Variance Explained (86.26%)	63.881%	22.380%	
MNE			
(Varimax Rotation)			
Total Consumers	0.923	0.305	-0.055
Negative feedback	0.894	-0.050	-0.040
Total reach	0.847	0.465	0.107
Page engaged users	0.833	0.506	-0.054
Total impressions	0.823	0.517	0.054
Page consumptions	0.765	0.395	-0.145
Total Impressions of your posts	0.296	0.932	0.054
Reach of page posts	0.289	0.908	0.137
People talking about this	0.298	0.895	-0.047
Logged-in page views	0.207	0.563	-0.549
Daily count of fans online	0.025	0.155	0.898
% of Variance Explained (87.54%)	42.09%	34.78%	10.68%

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization

Graph 1. Indicator of activity in Facebook for the three museums. Contributions of factors.

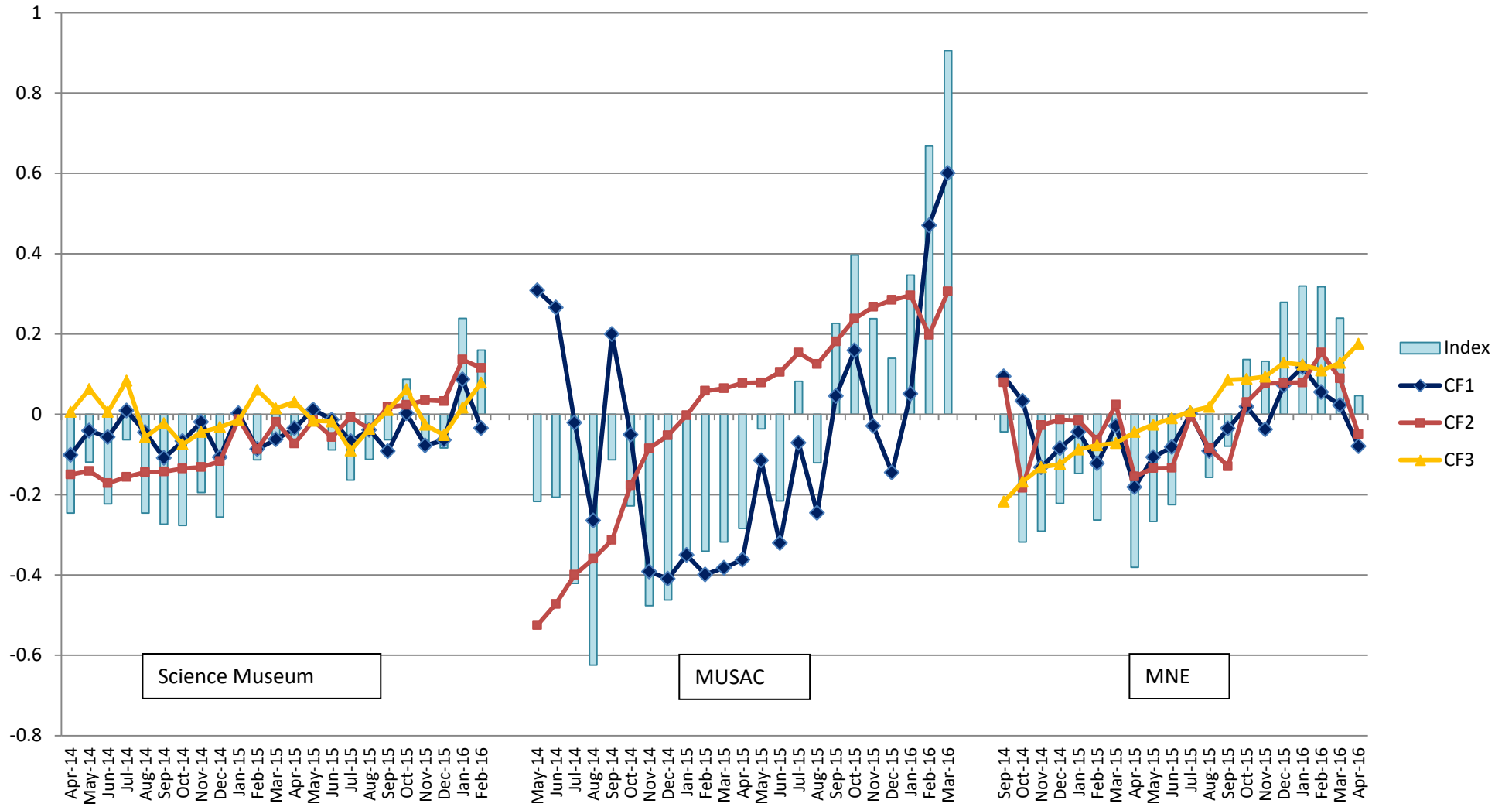


Table 4. Dates of major activity in Facebook and related activities

MUSEUM	Date	Event
Science Museum	15, 16 May 2014	Night and Day of the Museums / Science Race
	22,23 Jun 2014	Screening of the finalists in the contest "Las Matemáticas del Planeta Tierra"
	14 Jul 2014	Summer School "Con ideas de Bombero"
	17-25 Dec 2014	Wikimarathon / Christmas Workshops Exhibitions: "BOMBEROS. VALLADOLID 500 AÑOS, 1515 – 2015", "Érase Una Vez... La Informática. Del Ábaco a la Smart City En Viñetas y Más"
	14, 15, 17 May 2015	Night and Day of the Museums / Science Race Mathematics + Chemistry = magic The magic of the Periodic Table
	11, 12 Feb 2016	Exhibition: "ARÁCNIDOS? ¡SÍ, GRACIAS"
MUSAC	4 Feb 2015	Exhibitions: "Entorno Crítico", "De ayer a hoy"
	2, 23 Sep 2015	Guided tours: artist, museum, spectator Exhibitions: "Good save the Queen", "Ver (re)velar. Usos y representaciones de lo inexplicable", "TYIN tegnestue: en detalle"
	3, 4, 21 Oct 2015	Exhibition: "Sombras del Viento" by Alberto García-Alix
	10, 18 Nov 2015	V Meeting on Networks in Museums and Art Centres. Content and digital strategies
	13 Jan 2016	Exhibitions: "Pamen Pereira. La mujer de piedra se levanta y baila", "¡Chicas! ¿Por qué decidisteis montar un grupo en el Proyecto Vitrinas?" Activities related to the exhibition: "El iris de Lucy"
MNE	10, 18 Dec 2015	"Oro de Nápoles". Newly installed Nativity Scene from Naples
	22, 26, 30 Jan 2016	Series of lectures on Santa Teresa de Jesús
	19, 21, 25, 28 Feb 2016	VI course The art of looking. "Antiguos y modernos: querellas y paradojas" Exhibition: "Nada temas, dice ella. Cuando el arte revela verdades místicas"
	28, 31 Mar 2016	Holy Week in 2016 (extended opening hours and free)

The Facebook activity indicator in the MUSAC, as well as the contributions of the two factors, point to a positive progression over the period studied. The first factor has enormous explanatory power for this institution (63.881%), and the role played by Fans (22.380%) is extremely important in this museum. It can also be seen that the slope of its progression over the two years studied evidences greater growth than the first factor.

Finally, in the case of the National Sculpture Museum both the indicator and the contributions of the factors can be seen to have progressed positively. The first two factors explain a very high percentage of variance, displaying moderate growth, whereas the contribution of the third factor, online fans, explaining 10.68% of common variance, has the greatest slope of the three factors.

4. Discussion

Results indicate that the first factors, in other words, those explaining the greatest percentage of common variance, tend to point to interaction and scope but with slight differences in each museum and, in the final factor the effect of the museum's fans in Facebook tends to be isolated. Graphic analysis show that increases both in the indicator and in the contributions of the factors in the MUSAC have more pronounced growth slopes than in the other two museums.

In the Valladolid Science Museum, three factors emerge that explain 92.60% of common variance, with a clear separation between the interaction variables, which remain in the first factor, and the variables that measure the scope or size of the audience and that are found together in the second factor, and finally fans. The fact that the contribution of the interaction factor evidences less of a slope than scope does not mean progression has been poor, bearing in mind that this museum had the highest daily engagement rate of the three museums, since once high levels of commitment have been reached, it is not easy to increase them further. Attention should be drawn to the fact that the number of active fans has not increased, these being a key feature in all Facebook communities, since they can help "viralize" the museum's publications. In this aspect, the museum might need to further its efforts and strategies, given that a large part of its public are children and could be highly

receptive to communication in social networks.

Factor analysis of the MUSAC explains 86.26% of common variance and only two clear factors are formed without the need to apply rotation: the first measures scope and interaction together, and the second and last, the fans effect. This museum focuses its communication on social networks, which is reflected in the fact that the first factor displays such a high percentage of common variance, where scope and interaction progress favourably together, as well as a second factor reflecting the effect of fans, showing considerable growth over the period studied and which explains 22.38% of common variance. The topicality of its collection, together with a highly active and well-trained communication department, coupled with an audience that makes frequent use of social networks, no doubt account for this phenomenon.

Finally, in the National Sculpture Museum, factor analysis explains 87.54% of common variance and extracts three factors, the first of which measures scope and interaction of all kinds of content jointly, the second, the visibility or specific reach of the museum's publications and in the third, again, the fans. The first two factors, which explain high percentages of variance, display positive albeit moderate growth. The progression of fans, however, shows much greater growth. In this case, the museum's communication strategy needs to be strengthened in an effort to increase the size of its online community and to encourage greater interaction, perhaps making better use of fans' motivation and participation. This museum is a key cultural landmark for the city of Valladolid, attracts many tourists, schedules high quality exhibitions and enjoys a very broad audience, such that focusing attention on social networks might offer a number of benefits in terms of projecting its image better.

The events reflected in Table 4 show dates whose Facebook activity indicator was over 2.5 standard deviations from the mean together with the associated activities. Prominent in the Science Museum is the Christmas programme and that corresponding to the Day of the Museums. Key dates in the MUSAC were those related to dissemination and activities corresponding to certain exhibitions, as well as the 5th Meeting of Museum Networks and Art Centres. Finally, particularly important in the MNE were exhibitions and activities related to the fifth centenary of Santa Teresa, the recently set up Naples Nativity Scene and the communication generated for Holy Week in 2016. Linking major traffic in Facebook to the activities that generate it is necessary

in order to ascertain whether the online community responds more intensely on dates when a greater effort has been made in the social networks since, should this not be the case, the communication strategy would need to rethink its focus.

5. Conclusions

It is vital for museums to chart how their communication is progressing in social networks since this helps to enhance their strengths and to optimize their resources. The results to emerge from analyses of this kind reflect each institution's profile, which is closely linked to the features of their collections and their public and also provides an idea of whether the museum is fulfilling its mission, whether its goals are being achieved and whether it is implementing the right communication strategy.

One contribution of this research is to highlight for museum managers the usefulness and interest of paying careful attention to social networks and of benefitting from the information that monitoring tools provide, both on an everyday basis as well as in the long term. One commonly held opinion nowadays is that museums do not use social networks enough (Caerols-Mateo et al. 2017; Cordón and González 2016; Holdgaard 2011; Oliveira and Capriotti 2013), a fact we have seen in these three museums in Castilla y León (Spain). The reasons for not using social networks sufficiently usually relate to the lack of material and human resources, managerial lack of awareness of the potential that monitoring tools offer, and the communication department's inability to select relevant metrics (Villaespesa 2014). This research has sought to provide solutions to this latter aspect.

Analysing Facebook metrics is extremely useful when assessing the long-term progression of activity in this social network, since a cultural institution's audience behaviour might be subject to change depending on cultural supply and how the institution handles its information. Factor analysis and constructing the activity indicator based on the factors applied to the three museums is a suitable, replicable and simple technique that enables long-term assessment in Facebook, summing up the information that monitoring tools offer.

The study carried out shows that the first factors merge the key aspects of communication in networks: scope, visibility and commitment but with slight differences in the case of each museum. We have also seen how scope and

commitment do not always go hand in hand, a fact reflected by the indicator built using data from each museum. When these two elements are not developed in tandem, strategies should be used to enhance the aspect that is more poorly addressed. Another interesting feature is that fans are always in the final factor, explaining a significant percentage of common variance in the three cases (10.68%, 15.03% and 22.38%), such that they need to be nurtured and maintained in an effort to allow them to grow. Their importance is due to the fact that having many fans inspires confidence in the institution, since they are in a position to comment on and share content, thereby contributing positively to dissemination. If they are not already, these fans can become onsite visitors and help to enhance the institution's position in online mediums.

In the three cases studied, clear information has been provided concerning the weaknesses and strengths of their communication in Facebook, which might prove to be invaluable to the communication departments should they wish to secure positive progress in all the aspects involved. Moreover, the method used allows different styles of online communication to be evaluated, since the indicator constructed is specific to each museum. Carrying out this kind of assessment regularly helps to cultivate social networks and provides for a better planned communication strategy that encourages specific actions which will swell the online community and help to enhance the institution's image.

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