**What People Study When They Study Tumblr: Classifying
Tumblr-related Academic Research**

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Structured Abstract

☐ Purpose

Since its launch in 2007, research has been carried out on the popular social networking website Tumblr. This paper identifies published Tumblr based research, classifies it to understand approaches and methods, and provides methodological recommendations for others.

☐ Design/methodology/approach

Research regarding Tumblr was identified. Following a review of the literature, a classification scheme was adapted and applied, to understand research focus. Papers were quantitatively classified using open coded content analysis of method, subject, approach, and topic.

☐ Findings

The majority of published work relating to Tumblr concentrates on conceptual issues, followed by aspects of the messages sent. This has evolved over time. Perceived benefits are the platform's long-form text posts, ability to track tags, and the multimodal nature of the platform. Severe research limitations are caused by the lack of demographic, geo-spatial, and temporal metadata attached to individual posts, the limited API, restricted access to data, and the large amounts of ephemeral posts on the site.

☐ Research limitations/implications

This study focuses on Tumblr: the applicability of the approach to other media is not considered. We focus on published research and conference papers: there will be book content which was not found using our method. Tumblr as a platform has falling user numbers which may be of concern to researchers.

☐ Practical implications

We identify practical barriers to research on the Tumblr platform including lack of metadata and access to big data, explaining why Tumblr is not as popular as Twitter in academic studies.

☐ Social implications

This paper highlights the breadth of topics covered by social media researchers, which allows us to understand popular online platforms.

☐ Originality/value

There has not yet been an overarching study to look at the methods and purpose of those who study Tumblr. We identify Tumblr related research papers from the first appearing in July 2011 until July 2015. Our classification derived here provides a framework that can be used to analyse social media research, and in which to position Tumblr related work, with recommendations on benefits and limitations of the platform for researchers.

Keywords:

Tumblr, Microblogging, Blog, Classification, Social Network Systems, Social Network Analysis, Twitter, Content Analysis, Keyword Analysis, Methodology.

Article Classification:

Research Paper

Introduction

Since its launch in 2007, the social media website Tumblr (www.tumblr.com) has become an incredibly popular platform which hosts over 308.9 million blogs containing 137.9 billion entries, claiming a current rate of 45.6 million daily posts (Tumblr 2016b). In 2015, one in ten online adults worldwide used Tumblr (Duggan 2015). In spite of its popularity, Tumblr has been described as the "forgotten" (Anderson 2015, p. 156) social network when compared to the fellow major platforms Facebook (www.facebook.com) and Twitter (www.twitter.com), which have inspired vast amounts of published academic research (Wilson et al 2012, Williams et al 2013). This paper sets out to evaluate and classify the research produced regarding Tumblr that is published in English, using a framework we developed to categorise Twitter based research outputs (Williams et al 2013). Published research on Tumblr has expanded in a wide variety of disciplines, and this paper aims to provide an in-depth identification, analysis and classification of the academic literature, identifying sixty-one research outputs which have been published before July 2015. This paper determines research focus on Tumblr, and methodologies applied in the course of academic analysis. We also investigate which subject matters and research methods have risen to prominence, and trace Tumblr's shift from occupying the periphery of research activity concerned with social media trends, to its positioning at the centre of a series of academic outputs.

Published literature on Tumblr remains very scarce. By compiling and analysing our corpus of sixty-one full academic papers and devising a classification of the research undertaken thus far, this study contributes to the understanding of Tumblr as a research subject, and by extension, to the study of social media and microblogging - a variant of blogging that describes online social network services providing a range of features to allow users to share, exchange, and interact with short posts and messages (Ross et al 2011). We show that the majority of papers published have a conceptual focus: explaining how Tumblr works in when positioned within a specific field of interest, closely followed by message-based works which study Tumblr content. User studies have become more popular. There are surprisingly few technological approaches to analysing Tumblr content by automation or scale. We identify the core aspects of Tumblr which have proved attractive to researchers (including long form

text posts, tagging structures, multimodality, and means for ethnographic research), and the features which are problematic when undertaking research on the platform (including processing abandoned blogs, and the vast amount of content (which can be inconsistent and ephemeral), the lack of access to large-scale data from the site, and the recent fall in Tumblr's popularity). We identify why there are fewer research outputs produced regarding the site compared to its main social media competitors, despite its large user base.

This paper therefore provides a useful overview for future work on Tumblr, and will be of value to researchers wanting to familiarise themselves with existing literature, those wishing to compare other social media research to that carried out on the platform, those wishing to learn more about the affordances of the platform for the research community, and those wishing to have examples of how the study of social media can inform us of current societal trends.

Understanding Tumblr

Tumblr is a rich resource for researchers to exploit. Since its launch in February 2007, it has provided a free hosting platform for short blogs with a minimal set up. Tumblr blogs have always been "unlocked" by default, making posts visible to any online user in possession of a free account. Unlike the limited 140 character length text posts which have come to define the microblogging site Twitter, Tumblr most closely resembles a traditional blogging platform in its support for long form text posts, allowing for text entries (its normal posting format) of varying character lengths[i]. It also hosts six other specially formatted post types: images (categorised as "photo"); videos; website links; chat transcripts; quotes; and audio files. Tumblr enables its users to interact with others through the creation of follower networks, leading to the growth of innumerable virtual communities. There are several different levels of interaction at play, as users can send each other special "Fan Mail" messages and ask questions. Users can follow other Tumblr blogs, track subjects based on tags, and "reblog" and "like" other users' content to show appreciation or participate in conversations. Reblogging allows posts to appear on user's own Tumblr page, where they may choose to add their own comments or tags; these operate in a similar method to hashtags on Twitter (Ross et al 2011). Up to thirty tags can be applied to each post, and

users can conduct searches based on the first twenty (Unwrapping Tumblr 2015). All the posts created or reblogged by a user, and all the posts made by the users they are following, are also displayed internally on the "dashboard" page: a continually updating stream of content representing each Tumblr user's tastes.

From its launch in 2007, Tumblr attracted a fiercely loyal and gradually growing user base (Trapani 2007). In June 2010, it "hit an inflection point" with a growth of 1540% of page views from the previous year (Schonfeld 2010): its one billionth post was created in August 2010 (ibid). This sudden growth was due to a conflation of different drivers: "web improvements, network effect, [its founder's] obsession, iPhone, etc" (Bijan Sabet, quoted in Schonfeld 2010). By the close of 2011 Tumblr had "grown from relative obscurity to start-up darling to international microblogging network" (Hockenson 2011), eclipsing "its platform competitor WordPress, largely due to its global reach and brand-building potential" (ibid). Acquired by Yahoo for $1.1bn in 2013 (Kim 2016), Tumblr consistently appeared in the top 10 most downloaded free iOS apps in the App store in 2014 and 2015 (Bell 2016, Fiegerman 2016). However, a recent failure to incorporate new product features has seen its popularity and active user base fall, and there are now issues with support from its owners and reports of severe financial problems (Fiegerman 2016).

Date	Total Posts	Total Blogs	Posts Per Day	Source
Nov 2008	n/a	n/a	155,824	Tumblr (2008)
January 2009	71,241,742	642,442	185,451	Tumblr (2009)
July 2010	840,790,015	6,394,023	4,378, 007	Tumblr (2010)
July 2011	7,998,023,976	24,124,502	36,301,844	Tumblr (2011)
July 2012	28.4bn	66.6m	70.7m	Tumblr (2012)
July 2013	56.7bn	127.6m	80.4m	Tumblr (2013)
July 2014	83.1bn	194.9m	97m	Tumblr (2014)
July 2015	114.1bn	243.5m	80.5m	Tumblr (2015)
August 2016	137.6bn	308.0m	45.2m	Tumblr (2016)

Table 1: Growth of Tumblr, featuring statistics available from Internet Archive captures of Tumblr sources closest to the end of July of the year in question. There is no information available prior to 2008, when the company began to post statistics to its "Explore", "About" then "Press" webpages.

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Note the rapid growth across total posts, and total blogs between 2011 and 2014, but also the recent decline in number of posts per day in 2015 and 2016.

Tumblr's wide range of multimedia posting types, and its open and public facing content stream, makes it an appealing and adaptable platform for a wide variety of international users, becoming a major social networking service over the past half-decade. Consequently, as we demonstrate, it is of interest to researchers who have used a variety of research methods. References to Tumblr first appear in academic publications in 2011 (Kaplan and Haenlein 2011): early mentions are largely superficial, involving little more than some variation on the phrase "social media sites such as Tumblr," before moving on to analyse alternative sites in more detail. By 2012, however, Tumblr had become the focus of an increasing number of academic publications; as we shall show, the number of Tumblr related research papers has effectively doubled each year since 2012. The principal concerns addressed by this body of published work on Tumblr mainly stem from researchers defining Tumblr and where it sits on the social media landscape, and how it might be used to good effect in various environments, from schools to art projects to mental health wards. Our research aims to elucidate these approaches and applications[ii].

Literature Review

Conceptual models of information science exist which aim to identify axes and parameters of specialisms (Hjørland 2002, Tennis 2003, Robinson 2009, Smiraglia 2012). Given the size of user communities involved in microblogging there has been much research into its use and application (Nardi et al 2004, Willians and Jacobs 2004, Tripathi and Kumar 2010, Tremayne 2012), theoretical analyses of blogging (Miller and Shepherd 2004, Liu 2007, Kjellberg 2009, Dean 2010), and a resulting interest in classifying social media research within information science, usually dependent on individual platforms. The size of Twitter's user community (at time of writing it has 313 million active users (Twitter 2016), more than double that of Tumblr (Flynn 2016)) has meant much published microblogging research is focussed on it: Williams et al (2013) identified over 1000 papers published by the close of 2011. Classifications of research approaches to Twitter have emerged which can help the community situate future work (Cormode et al 2010, Dann 2010, Cheong and Ray 2011, Barnes and Bohringer 2011, Williams et al 2013). Reviews exist of research

approaches that have been applied to the largest social network, Facebook (Aydin 2012, Wilson et al 2012, Khine 2015), and there are also reviews of how social networking services are analysed in specific academic domains (Zhang and Leung 2014). However, there are other microblogging platforms which have not yet had a comprehensive domain review of methods and approaches employed to study them and engage with a significant use and research community.

Despite the significant size of its online communities (Tumblr 2016b, see also Table 1), no prior analysis of Tumblr related research exists, and many authors are not aware of other Tumblr related studies. Anderson (2015, p. 161) is only able to identify two "scholarly resources" (Xu et al 2014b, Chang et al 2014), when as our findings will show, there were actually many more in circulation at the time of writing. Hillman et al (2014b) claim "We also found that nobody has studied Tumblr fandoms before", when other research was published on Tumblr fandoms devoted to film (Newman 2013) and television (Booth 2013)[iii]. We therefore believe that this paper is the first methodological approach to the study of Tumblr and the evaluation of the research undertaken on the platform, highlighting much literature which has not been discoverable by other researchers, whilst also providing an overview of the approaches used to study this particular social network service, and the affordances it offers.

Method

Building the Corpus

Online databases were used to build up a corpus of academic papers focused on Tumblr which could then be analysed. Web of Science (apps.webofknowledge.com), Scopus (www.scopus.com), and Google Scholar (scholar.google.co.uk) were chosen as they are widely used and cover the "major disciplinary groups [of] Arts and Humanities, Science and Social Sciences" (Levine-Clark and Gil, 2009, p. 987). However, although Google Scholar is "rich in content" (Levine-Clark and Gil, 2009, p. 987), it offers significantly fewer options for refining search results, making the prospective task of navigating in excess of 85,000 papers identified by Google practically insurmountable: the initial searches returned papers only indexed because the web page offered the option to share the paper on Tumblr. As a result, Google Scholar was excluded from our method, and we chose to focus on Web of Science

and Scopus which offer a more comprehensive range of functions for searching and sorting data. Web of Science is well established as providing coverage of "all disciplines one can think of or find in the curricula of universities in science, social sciences, arts and humanities" (Jasco 2005, p. 1539), while Scopus expands "the range of coverage beyond a core set of peer-reviewed journals" (Levine-Clark and Gil 2009, p. 994).

Papers were identified by searching for the term "Tumblr" in both databases, and filtering results to show records from July 2011 - when the earliest Tumblr paper appears in either database - to July 2015 - the last full calendar month of data gathering for this study. Unlike Twitter, which has introduced into the lexicon a variety of terms from specific site-based activities (tweet, tweeting), Tumblr does not have an equivalent vocabulary from which to derive alternative search terms[iv]. Our search therefore focussed on papers referencing Tumblr by name, in either title, abstract, keywords, topic, or content[v] in research published in the English language. In addition, to facilitate a classification by close reading, a full text version of each paper was consulted. Data cleansing was also used to remove duplicates found in both databases, including multiple versions of the same paper (such as pre- and post-publication). A total of sixty-one academic papers comprise our final corpus.

Most writing about Tumblr is journalistic rather than academic: the total number of research papers available for analysis is smaller than comparative samples for sites such as Facebook and Twitter. The research appearing within our corpus consists largely of journal articles and conference papers, with a small number of eBooks and industry publications. Overall, books and monographs appeared in the searches very infrequently; while these materials undeniably "have significant roles in social science and humanities research" (Kousha and Thelwall 2009 p. 1537), the databases used for data collection prioritise the coverage of "high-impact" (Kousha and Thelwall 2009, p. 1537) journals over the indexing of books. For this reason the resulting corpus may offer a more accurate representation of Tumblr-related journal articles and conference papers in circulation, and further work could pursue more extensive coverage in books.

Analysing the Corpus

Our approach takes as its foundation the structure used to classify Twitter papers on the basis of keywords and abstracts (Williams et al 2013), but adapted here, and extended to allow the analysis of full papers rather than abstracts, which was possible given the small number of papers identified. In our previous work, open coded content analysis (Corbin and Strauss 2008) was used to classify papers relating to Twitter, using a developing coding scheme to produce label variables that emerged from the data itself as each individual instance was examined by the first author, with classifications checked and discussed with the second author at regular intervals, allowing the results to be "validated in principle" (Krippendorff 2004, p. 39) in an iterative process. Based on a Grounded Theory methodology (Glaser and Strauss 1967) this technique assists in the synthesis of large amounts of data (Charmaz 2006: 42-60) and is an affective way to undertake summative evaluation of a set of documents (Hsieh and Shannon 2005). Working with a small set of documents which did not exceed "a single researcher's analytic capabilities" (Krippendorff 2004, p. 350) meant that this coding methodology was the most efficient for our application. For the research presented here, we first sorted papers into three categories to ascertain whether Tumblr was the main focus of research, or just mentioned tangentially:

Full. Where Tumblr is the primary focus of the paper. The researchers may be interested in: Tumblr users; content posted; developing methods of interacting; or understanding use in specific environments. The work undertaken by the researchers is wholly dependent on the use and/or study of Tumblr. For example, the sentiment analysis and test of multimodal conformity conducted by Vogel (2013) could be replicated on other microblogging platforms, but the entirety of the published paper is solely concerned with Tumblr users, blog names and content;

Partial. The paper makes significant reference to Tumblr, in addition to other social networks or sources, and uses Tumblr in some manner to explore research questions. For example, Newman's analysis of online Pulp Fiction fandom (2013) is partly predicated on Tumblr content and user base, but also relies on YouTube content.

Not focused. The paper makes a superficial reference to Tumblr, which is mentioned, returning the paper as a search result after filtering. However, close reading reveals that it does not make use of Tumblr in pursuit of realising its aims; a version of the phrase "social networking sites such as Tumblr…" is often the extent of the site's mention. No paper in this category mentions the word Tumblr more than three times.

The literature review conducted in Williams et al (2013) concluded that researchers approach microblogging from four main angles, or "aspects", identified as Message, User, Technology and Concept, and we used these aspects for a second categorisation of Tumblr related research with minor adjustments made to allow for the different technological affordances of this platform:

Message: Researchers are concerned with analysing the content and associated metadata of Tumblr posts. According to Chang et al (2014), photo and text constitute more than 92% of all posts, but they may also be audio or video content. An example of a "Message" paper is Kanai (2015) which analysed the Tumblr posts made by an online fan community dedicated to a popular actress;

User: Researchers concentrate on any details that relate to online identity as constructed on Tumblr. These details may include usernames, self-summary or "About" pages, posts users like or reblog, or blogs followed or followed by. For example, Gies and Martino (2014) identified and analysed personal blogs of those with eating disorders.

Technology: Researchers may focus on the hardware and/or software used to access Tumblr, the use of APIs, or data mining techniques to access data. For example, Thirumuruganathan et al (2014) developed new tools to improve data mining capabilities for researchers.

Concept: Researchers are interested in positioning Tumblr within a particular context. This may include introductory pieces explaining Tumblr's history and features; case studies on incorporation into a specific environment; or investigations into the appeal for different user groups. For example, Yunus and Salehi (2012) explored how teachers could use Tumblr blogs to help improve their students' writing skills.

Third, the research methodologies employed in the completion of each study were also analysed. Williams et al (2013) identified a set of four predominant microblogging research methods:

Analytic: Where researchers undertake some form of quantitative or qualitative analysis. Approaches include content analysis; data analysis; semantic analysis; sentiment analysis; social network analysis; textual analysis; visual narrative analysis;

Design, Development and Discovery: Where researchers propose, model, and implement new systems, and/or apply existing techniques from the fields of mathematics and statistics. Approaches include the application of computer algorithms; data mining techniques; inductive matrix completion methods; mathematical modelling;

Examination: Where researchers take an investigative approach or conduct a review. Approaches include auto-ethnography; biography; case study; interview; introductory overviews; longitudinal studies; surveys.

Fourth, keywords describing papers were noted for the paper's self-described focus. If the paper itself did not contain keywords, they were taken from the relevant electronic database's record page for the article: on Scopus, the "Author keywords"; on Web of Knowledge, the "Categories/Classification" keywords.

Finally, we collected information on the nature of the dataset used. Observations were based on both explicit and inferred information, as details regarding datasets and methods were rarely provided by authors.

Once Tumblr focus had been established, the papers marked as Full or Partial were re-read with special attention paid to the aspect (with each paper being assigned a primary, and in some instances secondary and tertiary aspects) and methodologies used. Keywords were noted and information about the dataset used was collected where possible. If a paper was classified as partially focused on Tumblr, the classification was judged in relation to the parts of the work related to the platform, rather than on the entirety of the study. Our overall classification is summarised in Table 2, below. Practically, this analysis was undertaken by the first author, with the classifications checked and agreed with the second author as part of an iterative process. This is best practice in content analysis to ensure accuracy of classification, although due to the size of the dataset presented here, it was not feasible to carry out any statistical analysis of differences in classification, which were instead checked and agreed at regular points during this research, allowing for validation of the coding to take place (Krippendorff 2004, p. 39).

Classification	Format	Details
Focus	Fixed	F = fully focused on Tumblr P = partially focused on Tumblr N = not focused on Tumblr
Aspect	Fixed	Any from Message, User, Technology, Concept
Methodology	Fixed	Any from Analytic, Design and Development, Examination, Knowledge Discovery
Keywords	Free	List of keywords, such as: sexuality; social media; education
Data	Free	Indication of type of data, size, length of study

Table 2: Our final classification scheme for analysis of Tumblr related research papers.

Findings

The full list of sixty-one papers gathered in our corpus can be found in Appendix A, divided into: Papers which are fully focused on Tumblr; Papers which are partially focused on Tumblr; and Papers which mention Tumblr, but do not have it as a focus[vi].

It was found that, although they specifically mention Tumblr, twenty-three papers were focused on subjects almost entirely separate to the site. Several of these papers propose new systems for exploiting microblogging websites: Lin et al (2013) take an algorithmic approach to developing real-time search-indexing capabilities, while Campan et al (2014) test social network anonymity models. These papers make brief allusions to Tumblr, and typically, the results presented emerge from experiments conducted using other social networks, with eight of the twenty-three publications based on datasets taken primarily from Twitter. Four of the twenty-three papers which list Tumblr as a keyword function as introductory overviews to social media, but do not actually offer any insights to Tumblr. In fact, while the publication "Facebook and Twitter" (Gookin 2012), purports to also offer an introduction to Tumblr, it makes a solitary reference to one Tumblr account owned by the New York Public Library before moving on to cover Google + (plus.google.com). Nine further papers initially reference Tumblr as a social network or "mainstream content site" (Fallon 2015, p.49), but no actual research connected to the platform is mentioned. Two papers source some of their data from Tumblr, but do not offer insights to Tumblr in their analyses of drone technologies (Greene 2015), and perception of colour (Melgosa et al 2015). In these twenty-three papers, it was rare for a reference to the site to exceed two mentions, and so they can be excluded from further analysis. However, this shows Tumblr is a growing social media platform thought worthy of mention by researchers when describing online environments.

We now turn our focus to our corpus of thirty-eight papers focussing on Tumblr, which shows there is a growing interest in Tumblr as a main focus of research. More papers are directly using Tumblr in a meaningful way, and more of them are being produced each year (see Figure 1).
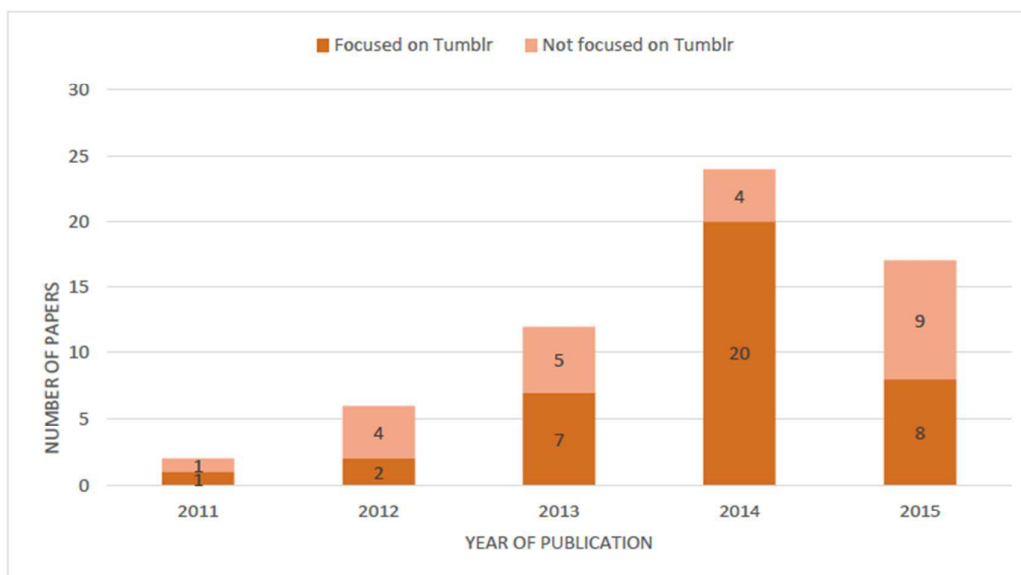
Figure 1: Tumblr-related papers published between July 2011 and July 2015. Note that the 2015 figures are incomplete as it refers to seven months of data for that year, when our data collection took place.

The remainder of our analysis focuses on these thirty-eight papers, of which fifteen were classified as having a partial focus on Tumblr, with the remaining twenty-three found to be fully focused on the site.

Aspects

All thirty-eight Tumblr-focused papers were found to explore at least one defined aspect; eighteen publications examined more than one, including eight papers which studied a total of three aspects. There were no papers that studied all four. The frequency with which each aspect appeared in Tumblr-focused papers is shown in Table 3; the spread of research aspects over the years 2011-2015 is illustrated in Figure 2.

Aspect	Total papers studying this topic	Papers studying this topic only
Concept	26	12
Message	20	4
User	10	2
Technology	5	2

Table 3: The aspects of Tumblr studied across the thirty-eight research papers.
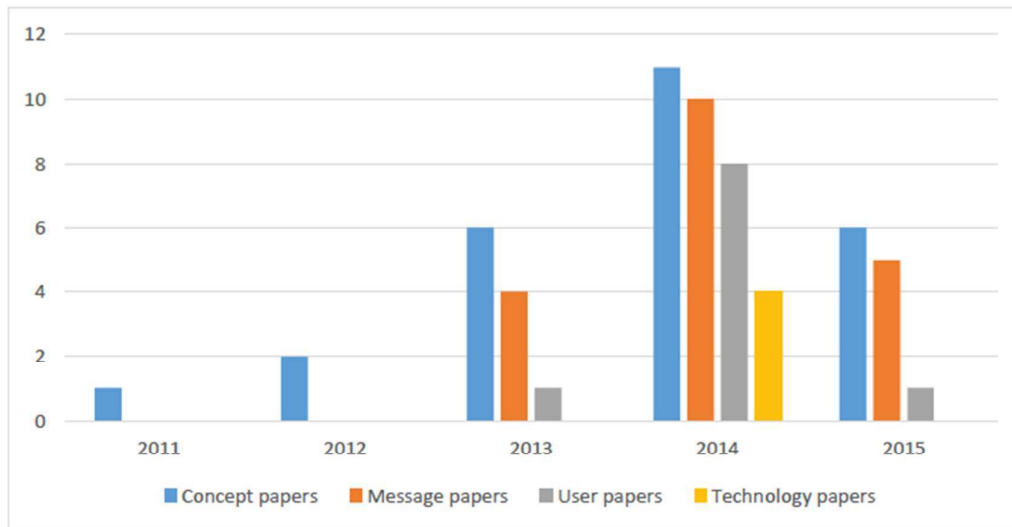
Figure 2: The aspects researched in Tumblr-focussed papers 2011-2015. Note that early papers focussed on the Concept of Tumblr, with growing interest in what was said (Message) and who was saying it (User) over time. There is a surprising lack of papers dealing with Tumblr related technology.

Table 3 shows the most commonly studied area in Tumblr-focused research is the Concept (how Tumblr works in a general sense, and positioning it within a field of interest); Figure 2 indicates it has been the most popular topic since the first publication in our corpus, and that it remains the most frequent area for academics to explore. The first researchers interested in Tumblr aimed to explain its relevance to a wider academic audience. The earliest papers related to Tumblr applied a Concept-oriented business-centric approach, offering a brief introduction to the site for academics. The very first Tumblr-focused publication was a biographical-style industry magazine article focusing on its founder, David Karp (Karp and Welch, 2011), with early academic papers introducing Tumblr to professionals in online publishing and digital marketing (Kaplan and Haenlein, 2011) or positioning it in relation to other blogging platforms (Martin, 2012).

The range of "conceptual issues" is very broad, including everything from generic explanatory pieces appraising Tumblr as a new microblogging platform academics might use to share interests (Duffy 2013), through to case studies investigating Tumblr for the fulfilment of specific user group requirements, from Malaysian trainee teachers (Moore 2013) to North American dermatologists (Correnti et al 2014).

Because of the diverse array of subjects embraced by these Concept papers, this aspect is also the topic most frequently investigated alongside other areas. In twelve papers, the Concept is studied alongside the consistently second most popular element, the Message. In almost one third of all Tumblr-focused research published since 2013, academics have been interested in researching *what* people are posting: with Message-driven research exploring it as a hub of fandom activities (Booth 2013) and meme culture (Milner 2013). More recent papers expand this field of interest, exploring the psychology behind memes popularised on Tumblr (Gegenfurtner et al 2015) and evaluating the platform's potential for aiding the dissemination of medical research (Hoang et al 2015). The Concept was also featured in combination with the User aspect in four publications, showing interest in studying *who* is using Tumblr. The types of materials posted on Tumblr and the people generating those posts are of obvious interest to researchers seeking to understand and explain it.

User-focused papers start appearing in 2013; six study the User alongside the Message, with this combination representing 60% of the overall User-focused output. An example is Zeglin and Miller's (2014) use of Tumblr to assess conceptualisations of sexuality: the authors identify specific user groups through the Tumblr tagging system, analysing photographs posted to understand online performance of sexual identity. Tumblr is revealed as a vehicle for both the personal and the political, through User and Concept based works by Fink and Miller (2014) and Tiidenberg (2014) which study the site's role in the online performance of gender and sexuality, through to Xu et al (2014a) which uses a Technology-focused approach to propose a system for detecting emerging civil unrest events. Others are principally concerned with understanding relationships: Xu and Lu (2015) concentrate on user networks created through the act of reblogging posts. In this group of publications, the content of the posts (the Message), is considered secondary to the study of the communities sharing them. Interest in studying Tumblr users does continue into 2015, although not at the rate observed over the previous year. This may be somewhat surprising: if the size of Tumblr's user community is driving researcher interest towards the platform, it may have been a reasonable expectation that analysis of user communities would have been a consistent central focus.

Table 3 shows that Technology has been the least commonly researched aspect regarding Tumblr to date: the first was published in 2014. Shin et al (2014) developed algorithms for recommending blogs to follow, and Thirumuruganathan et al (2014) proposed new tools to improve data mining capabilities. The lack of attention to the technical infrastructure of Tumblr in the published research is somewhat surprising. Version 2 of the Tumblr Advanced Programming Interface (API) was released in 2011 (api.tumblr.com); the release notes state that Tumblr's developers "have not attempted to provide complete feature parity with the website" (Tumblr Engineering, n.d.) with V2, and have instead focused on exposing core features such as blog descriptions, follower lists and photo posts. The elements exposed through the free-to-use API would be of use Message and User focused researchers, however, those interested in developing advanced research tools or generating visualisations require higher levels of access to the underlying data. This is supported by the papers collected for this study, as three of the five Technology papers involve the Message and the User as primary or secondary aspects. While none of the Technology papers dealing with large data sets offer commentaries on the usefulness or suitability of the Tumblr API to the authors' research, Xu et al (2014b) state that data was obtained via the Tumblr firehose instead. This firehose data is the result of Tumblr's collaboration with the commercial social network data seller GNIP (www.gnip.com), where access to Tumblr data has been available via purchase since 2012 (Moody 2012). We suggest that Technology focused researchers, or those interested in "big data" visualisation and data analytics, have only recently turned their attentions to Tumblr due to issues with obtaining sufficient access to large enough datasets without having to manually collect it themselves, lack of access to Tumblr data via the API (which has also restricted the scope of development of third party tools which would aid in analysis of the platform[vii]), and the high costs of obtaining Tumblr data from its third party reseller. This, in turn, provides another explanation as to why there is vastly more published research on Twitter, which, although only a year older than Tumblr, and with approximately only double the monthly active users (Flynn 2016) has a well supported, low-cost research infrastructure for both data collection and analysis (Burgess and Bruns 2012): support and access that Tumblr is lacking.

Methods Used

The thirty-eight Tumblr-focused papers used twenty-eight distinct research methods. These methods were sorted into the three overarching categories defined above as Analytic, Examination, and Design, Development and Discovery (DD&D).

Method	Total papers using this approach	Papers using this approach only
Analytic	23	8
Examination	22	11
Design, Development, and Discovery	9	2

Table 4: Methods used in Tumblr-focussed research papers.

It is evident that the majority of Tumblr-focused research employs Analytic and Examination based methods. For 50% of all papers taking an Examination approach, that is the only style of method used. Fink and Miller (2014) takes an auto-ethnographic approach to the exploration of queer self-representation in new media, and Kohen (2014) assesses student engagement via a case study of thirty students taking an ancient political theory course.

Analytic approaches encompass a similarly wide range of techniques. Daer et al (2014) apply semantic and sentiment analysis to the Message-focused study of rhetorical hashtags; a Message based paper focusing on memes related to the Occupy Wall Street protest movement (Milner, 2013) uses "critical discourse analysis" (Milner, 2013, p.2359) as its foundation. Since 2013 a total of ten papers have used a combination of Analytic and Examination methods (six using Examination methods, and four using Analytic methods as the primary style of approach).

Design, Development and Discovery based methods first appear in 2012, and have featured in less than a quarter of all publications. Xu et al (2014a) is one of just two papers to use only DD&D methods, involving the design and implementation of a text-based filter system to extract posts from two months' worth of Tumblr firehose data. One third of DD&D driven papers also implement Analytic methods in the course of the authors' research, for example Terunuma et al (2014) employ an algorithmic approach to identifying reblog structures in their model for identifying high-influence Tumblr users. A DD&D approach is the principal method of research

for papers primarily classified as Technology-focused (see Table 5 below); the creation of new systems and the application of mathematical and computer science-based techniques are key elements for academics looking to approach Tumblr from a computational standpoint (and the development of these tools could aid others who wish to analyse Tumblr). However, the issues previously described in gaining access to Tumblr data hampers this type of research.

Aspects and Methods

Table 5 shows the full relationship between the primary research aspects and the primary research methods used in Tumblr-focused papers.

		Primary research methods		
		Analytic methods	Examination methods	Design, Development and Discovery methods
Primary Research Concept	Concept	3	13	1
	Message	10	2	0
	User	2	3	1
	Technology	0	0	3

Table 5: Combinations of primary research methods and primary aspects considered across the Tumblr-focussed papers.

There is a strong relationship between papers which primarily focus on the Message and the use of Analytic research methods. In addition to semantic, sentiment, and critical discourse analysis, several Message papers have also been driven by textual and image analysis. The latter approach is employed in Bourlai and Herring's study of Tumblr gifs (2014), Zeglin and Mitchell's adaption of the "photovoice" method (Zeglin and Mitchell, 2014, p. 279), and Newman's exploration of the fandom surrounding the film Pulp Fiction (Newman, 2013). The reoccurrence of this pairing of aspect and methodology is understandable considering that Message-oriented researchers are principally seeking to interrogate Tumblr through the content posted on it; with text and images accounting for 92% of posts on Tumblr (Chang et al, 2014, p. 22).

Examination methods are featured more frequently than any other approach, and this is especially the case for research primarily based around the Concept of Tumblr. Several Concept papers make use of surveys, with sample sizes ranging from Yunus and Salehi's thirty trainee teachers in their evaluation of Tumblr as teaching tool (2012), to the seventy-three participants questioned about their use of social networking by La Sala et al (2014). Case studies also feature as a common Examination method: Ellis (2014) has a similar agenda to Yunus and Salehi (2012), but uses a university class trip to Estonia to test Tumblr's potential as a teaching device. One feature that can qualify a publication for classification as a Concept paper is that the work primarily seeks to position Tumblr within a particular environment. Case studies and surveys of specific user groups are therefore highly suited to facilitating Concept based research, hence the strong occurrence of Examination research methods among Concept papers. Additionally, given the previously discussed limited access to Tumblr data, Examination methods are the easiest way to carry out research on the platform, which would explain these methods' popularity.

User-driven papers represent a smaller proportion of the Tumblr-focused research output than Concept and Message based works, but publications focusing on this aspect offer the most variation in terms of primary research approaches. User is the only aspect that sees researchers using the full range of methodological categories, encompassing Vogel's use of lexical semantic analysis to measure the relationship between blog names and content (2013); the proposition of a new graph model for inferring user interests (Xu and Lu 2015); and the use of interviews to examine why users chose the platform to facilitate their participation in fandoms (Hillman et al 2014a).

Keywords, and Popular Research Topics

Keywords describing the thirty-eight Tumblr-focused papers were also used to discern the key areas of interest that have been explored. Keywords were collected from either the paper's front matter or from its record page on Scopus or Web of Science, resulting in a total of 207 terms. Aside from the terms one might expect to find in almost every paper (Tumblr, social media, blog, and internet), there was actually very little repetition amongst these keywords. Terms which were less generic and more informative include "dermatology", "postfeminism" and "discursive psychology". The 207 "explicit" keywords were used to assign each Tumblr-focused

paper a minimum of two "organisational" keywords; the obvious ("Tumblr", "article"), repetitive ("fanfiction; fan fiction; fan-fiction") and highly specific ("dermatology-related patient advocate groups", "Human resource codes of conduct") were simplified to aid classification. The full list of keywords used to describe common areas of research that are associated with more than one paper is provided.

Keyword	Number of Papers
social media	23
education	7
blogging	6
fandom	6
popular culture	5
libraries	3
medicine	3
sexuality	3
business	2
datamining	2
fanfiction	2
feminism	2
multimodality	2
photography	2
social networks	2
television	2

Table 6: List of keywords associated with research outputs, which are used more than once.

In addition to this list, there is at least one paper associated with one of the following keywords within our corpus: academia, activism, aggregate estimation, art, big data, celebrity, communication, consumption, content filtering, crowdsourcing, database, dating, demographics, dermatology, design, digital archiving, early event detection, eating disorders, environment, ethics, experiential learning, film, graph modelling, harassment, health, hobbies, identity, information propagation, integrative learning, interview, memes, mental health, new media, nursing, occupy wall street, participatory art, political theory, postfeminism, productivity, propaganda,

psychology, quotation culture, radiology, reblog networks, relationships, research, rhetoric, security, sentiment analysis, teenagers, terrorism, transgender, usability, visual culture, and visual narrative analysis. This shows the range of research feasible through investigation via Tumblr, but also indicates the many ways the social media platform is utilised by its various communities.

Researchers situated in the fields of education, fandom and popular culture, and libraries have produced the most academic literature focused on Tumblr. Another popular area, consists of sexuality, photography and feminism; papers labelled with these keywords all employ at least two of these three terms, and can be broadly understood by the broader term "identity". In keeping with the overall findings for the whole corpus of Tumblr-focused papers, the majority of education, fandom, and library-centric research publications are Concept papers. Identity papers are more frequently concentrated on the Message, which also has a strong presence within fandom research. Research methods are divided equally between Analytic and Examination style approaches, as education and libraries favour the former and Fandom and Identity research is biased towards the latter.

The popularity of fandom and its associated keywords fanfiction and popular culture is to be expected. Tumblr is an immensely popular site for users seeking to participate in fan activities inspired by various cultural phenomena, such as writing fanfiction. In December 2014 it was reported that over 1% of all posts made on Tumblr were dedicated entirely to the band One Direction, so one can only imagine the proportion of the site that is dedicated to fandoms as a whole (Romano 2014). It follows that a source of such a large amount of data would provoke interest amongst scholars, some of whom are members of Tumblr fandoms themselves.

Benefits of Tumblr for Researchers

Our analysis of research method indicates that Tumblr has a range of functions that researchers have based their data collection and analysis around, given the lack of tools which support data mining and analysis of the site. Text posts, tagging and tracking mechanisms, and multimodal posting have all been at the centre of research methods. Researchers have also adopted ethnographic approaches to create their own

accounts, around which research projects are structured. None of the features described below are exclusive to Tumblr, but as a collective set of technological affordances they offer "a mode of engagement distinct to the site" (Fink and Miller 2014, p.614). Likewise, Petersen (2014, p.93) noted: "the types of conversations that take place on Tumblr are only possible because of the affordances put forth on Tumblr… This type of response or contribution to a conversation is dependent on the media technology." Despite Tumblr's limitations, these tools can provide a basis to build studies upon, and our summary of their methodological benefits should be of interest to others undertaking Tumblr research.

Analysis of Text Posts

Tumblr allows users to post text entries of various lengths: this provides data suitable for analysis via textual analysis. For example Martin and Carter (2015) undertook textual analysis of the structure of blog posts made by students using Tumblr to keep mandatory reflective journals. Unconstrained by character limits, the students submitted twenty-five posts which the authors used to judge relationships to environmental sustainability. Access to the posts' metadata allowed researchers to see where and when posts were made, which enabled an understanding of how the student's perspective had developed over time.

Using Tagging and Tracking

Tumblr tag search allows users to locate specific user groups, monitor activities based on themes, and to observe both over time, displaying all relevant content in reverse chronological order. This has facilitated research into political uprisings (Barberá and Metzger 2014) and reactions to the deaths of famous figures (Deller 2011). The use of tags was central to the data collection stage of a partially Tumblr-focused investigation by Al-khateeb and Agarwal (2015) into social media activity of the extremist group ISIL. enabling researchers to determine focus– the ISIL study trialled Twitter, Tumblr, YouTube and Facebook – then provided a method for gathering the latest posts on their chosen platform(s). Newman's study of the online Pulp Fiction fandom also benefitted from Tumblr's tagging system, with the author stating: "In collecting examples for this analysis, I have often searched Tumblr by tag" (Newman 2013, p. 128). Research into the rhetorical functions of tags (Daer et al 2014) even

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goes as far as to suggest that the application and searching of tags is important for reasons which go beyond findability: "users now tag social media posts with words and phrase that are not necessarily intended to appear in a standard data search. Instead, these "metacomments" offer a user's own thoughts on the post itself" (Daer et al 2014, p. 1). For Message and User-oriented researchers, the ability to gain access to the content posted by distinct user communities through the navigation of Tumblr tags, both in the form of the tags themselves and the posts to which they are attached, is a powerful data gathering tool with much research potential.

Analysing Multimodality

The multimodality of Tumblr posts has attracted researchers interested in media studies, and the construction of digital identities. Many publications are shaped around Tumblr "photo" posts, which can be single images, curated photosets, and moving gifs. Tumblr's support of gifs has proven integral to research, from Newman's fan studies-centric paper (2013) to Milner's work on internet memes (2013), and Bourlai and Herring's development of a codebook for analysing emotions (2014).

The creating, adapting, and posting of images and moving gifs to suggest opinions or reactions is a well established online practice that is especially popular in fan communities (Highfield and Duguay 2015). The use of "reaction gifs" (Bourlai and Herring 2014, p.171) is most prevalent on Tumblr it has supported them since August 2011 (Arqueete 2011)[viii]. In an analysis of the Tumblr fandom surrounding the television programme Sherlock, Petersen argues that gifs allow interactions to "take on a complex, visual layered form" (Petersen 2014, p.88):

> the types of conversations that take place on Tumblr are only possible because of the affordances put forth on Tumblr. In a face-to-face, non-mediated conversation, a person cannot respond through a reaction gif of Martin Freeman playing John Watson. This type of response or contribution to a conversation is dependent on the media technology (ibid, p.93).

Petersen is one of several authors to describe Tumblr as a significant online space for fan activities, and therefore a rich source of material for the study of fandoms. The multimodality of Tumblr supports fan practices of "appropriating, recycling, sharing,

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and remixing popular culture" (Newman 2013, p.135) which are coming to define a "new era of fan culture" (Booth, 2013, p.150). Similarly, in education-based research, Tumblr's provision of different post formats and the capacity for interactivity have helped to distinguish it as the platform of choice for educators seeking to encourage student engagement (Kohen 2014, p. 406). For researchers focused on identity, Tumblr has proved essential in studying those who have suffered from erasure by "mainstream media outlets and cultural productions" (Fink and Miller 2014, p.615). Minority groups have been able to create "intricate networks of digital self-representation" in the "hybrid media space" (ibid, p.611) offered by Tumblr.

Researchers's Own Use of Tumblr

It is common for researchers to create their own accounts on Tumblr to facilitate research. Fink and Miller (2014) used Tumblr extensively prior to the development of their method, with their reflective "autho-ethnographic dialogue" (ibid, p.611.) being inspired by their personal experience. Maintaining a Tumblr presence enabled several researchers to acquire a fuller understanding of their chosen communities and practices. Hillman et al (2014b) state that their participation on Tumblr was responsible for their discovery of the fan spaces studied, and for their acclimatisation to the "unique culture of practice" (ibid, p.775) found within. Daer et al's (2014) study of the rhetorical function of hashtags across social media used similar methods:

> Over a period of 18 months, we became participatory observers and regular users of the social media communities we studied… interpretation of meaning was indeterminable without knowledge of context, timing, affordances, and personalities of each social media network (ibid, p. 18).

However, their decision to collect data by "randomly" sorting through their social media feeds resulted in a "relatively unscientific sampling" which left methodological questions unanswered (ibid, p.18).

Newman (2013) and Petersen (2014) created their own Tumblr pages for their respective studies on Pulp Fiction and Sherlock, with each author reblogging hundreds of posts to build up a corpus, including links to their pages in their papers. For Petersen, this approach serves the additional purpose of creating "methodological transparency", as readers will be able to measure the paper's conclusions against the

posts online which did not feature in the published outcome (Petersen 2014, p. 92). However, the homogeneity of some Tumblr communities joined by researchers has presented obstacles. Tumblr users interviewed in Hillman et al (2014) were all "deeply integrated in to the community", and "displayed harmonious interactions", negative interactions - which do occur on the site (Tumblr 2016c) - and the users who had given up on Tumblr, were not represented or recorded (ibid, p. 779). Researchers' own use of Tumblr raises methodological questions for others planning to undertake studies on the site: this approach should acknowledge digital anthropology and ethnographic methodologies (Murthy 2008, Coleman 2010, Fink and Miller 2014, Pink et al 2015).

Challenges Facing Tumblr Researchers

We summarise here identified research challenges including: considering abandoned blogs, keeping up with the vast stream of Tumblr content; processing inconsistent and ephemeral information; and dealing with restricted data regarding geolocation, date, and commenting history. Understanding these limitations should prove useful to other researchers.

Abandoned Blogs

It is not uncommon for people to open accounts to try a service, only to abandon them (Cormode 2010). User behaviour studies can be skewed by these "dormant entities": the number of Tumblr accounts exceeds the number of active users (ibid)[ix]. Researchers methods will need to encompass how to process abandoned Tumblr accounts[x].

The Tumblr Stream

Research on social media platforms is firmly established as part of the "vital and rapidly changing landscape of technologies that mediate peoples' contemporary interactions with information" (Efron 2011, p.1006). The permanent state of flux of these platforms is an issue encountered by researchers. Researchers cannot easily archive Tumblr, nor easily return to blogs on the site as represented at particular junctures, therefore the number and changing nature of blog posts poses methodological issues for researchers: the "number of blogs is a constantly moving target and difficult to pin down" (Anderson 2015, p. 169)[xi].

Inconsistent and Ephemeral Content

The simplicity of joining Tumblr can mean many opaque accounts to study: users only need to provide an email address, password, and name for the new blog. Tumblr posts are easily deleted and usernames are changed, with the latter action also altering the blog URL[xii]. Basic profile information (name, age, gender, occupation, location, likes, dislikes) is not required, which can present a problem for those conducting profile analysis studies (Chang et al 2014, p.22)[xiii]. The inconsistency of user demographic information will limit research direction of research and authority.

Tumblr posts have inconsistent metadata (unlike Twitter). Posts are normally dated, and depending on the customisable display theme applied, the time may also feature. In posts that consist of a series of interactions between multiple users, including those that are reblogged, there is no indication when any comments were made. Petersen (2014) summaries this confusion, which gives "an illusion of the conversation being on-going and current, even though comments may have been added over weeks or months" (ibid, p. 98).

Restricted Information

No data is provided on geographic location of users when they make posts on Tumblr (unless specifically provided). It is also not clear whether a post has been made by a user through the desktop site, through the Tumblr mobile application, through a third party mobile application or via email. Xu et al consider access to location information is "crucial" (Xu et al 2014a, p.406), and note that geo-tagged content is supported by other microblogging platforms including Twitter. Tumblr's deficiency in these areas can be a deterrent to researchers.

Tumblr's Changing Popularity

Tumblr's current perilous financial state and falling user base could become a major limitation to academic research (Bell 2016, Fiegerman 2016, Kim 2016, Flynn 2016). Tumblr has potential for research, but only while the platform is developed and supported. Those considering future research on Tumblr should ascertain the health of the platform before proceeding.

Limitations

Our analysis is based on a relatively small corpus of Tumblr papers. Further work could be incorporated: data collection of papers and analysis ceased in July 2015, and this could be extended. Tumblr related research in monographs and edited books could expand the corpus. Research published in languages other than English could also be included. Researchers rarely talk about the size and scope of their datasets, we would encourage researchers to discuss these fully in their methods section. Contacting researchers who had a presence on Tumblr yielded no response: future work could gain further insight into their experiences. Alternate classifications of the academic research focused on other microblogging platforms could be used to compare the most recent trends identified to further situate Tumblr-focused research

Conclusion

Since 2011, Tumblr has moved from being a social network site "forgotten" by academic researchers, to a platform which now makes regular appearances at the centre of social media research. This paper has answered the previously unexplored question of what people study when they study Tumblr. It has identified sixty-one relevant research papers, and analysed thirty-eight research papers that significantly focus on Tumblr published between July 2011 and July 2015. An existing Twitter-related research classification scheme was adjusted and expanded to create a new framework against which Tumblr-related research was judged (indicating that this existing framework is appropriate for analysing different social media platforms). Our analysis indicates how academic researchers have focussed on Tumblr, identifying specific technological affordances that have made Tumblr an attractive research choice, while also highlighting barriers to use, and identifying potential reasons for why more research is not carried out on the site.

The majority of Tumblr-focused research has studied Conceptual issues connected to Tumblr, closely followed by Message-based works concerned with studying Tumblr content. Recently published literature utilises Tumblr to study both the personal and the political use of social media platforms, focussing on its users. Latterly, social media researchers have developed computational approaches for engaging with

Tumblr content: however, the lack of advanced research tools, and the complexities of gaining access to Tumblr data (which is often inconsistent, ephemeral, not time-stamped nor geolocated, with difficulty in following or reconstructing dialogue and interchanges upon the platform) have hampered larger scale analysis: this explains why there is significantly less research done on Tumblr than Twitter. As a result, researchers tend to use ethnographic rather than data science approaches, building up an understanding of the online interface, and engaging within the user communities themselves. The most common methodological approach involves the application of analytic techniques, with analyses of images, networks of social interaction, semantics, sentiments, and texts. The platform's capacity for long-form text posts, the ability to use tagging and tracked tags to discover content, and the multimodal nature of communication on Tumblr are attributes highly rated by researchers. The absence of data pertaining to user demographics and locations, and the inconsistency of metadata attached to individual posts, have complicated several studies. There are also recent concerns about Tumblr's growth and stability that should be attended to by other researchers planning a research project based on the platform.

Our research has shown that blogging, education, libraries, identity, and fandom are the most frequent topics in Tumblr-focused research. The range of wider topics we identify summarises the usefulness of social media platforms to society: Tumblr supports users in exploration of popular culture, to gender identity, from visual culture, to mental health.

We expect the academic interest in Tumblr to continue, and the number of publications to increase (even if the platform itself appears to be entering a period of uncertainty or decline). Our analysis of previously published research, and the knowledge of the advantages and disadvantages of focusing on Tumblr as the object of academic study, will inform future scholars interested in analysing Tumblr content. At time of writing, Tumblr remains a popular and well-used social media platform, and there is much potential for future research. Our analysis should inform prospective researchers of the path previously trodden, and the benefits and pitfalls which will help scope out future Tumblr based studies effectively.

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Proceedings of the 2014 ACM conference on Web science, June 23-26, Bloomington, IN. New York: ACM, pp. 13-22.

Xu, J. and Lu, T. (2015). "Inferring User Interests on Tumblr". In: Agarwal, N. ed. *Social Computing, Behavioral-Cultural Modeling, and Prediction. 8th International Conference, SBP 2015, March 31-April 3, Washington, DC.* Springer International, pp. 458-463.

Yunus, M.M. and Salehi, H. (2012). "Tumblr as a Medium to Improve Students' Writing Skills". *Journal of Applied Sciences Research*. 8(1), pp. 383-389.

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Appendix A: Tumblr-related research papers

A1. Papers which are fully focused on Tumblr:

Anderson, K.E. (2015). "Libraries and Tumblr: A Quantitative Analysis". *Reference Service Review*. Vol 43(2), pp. 156-181.

Bourlai, E. and Herring, S.C. (2014). "Multimodal communication on Tumblr: "i have so many feels!"". In: *WebSci '14 Proceedings of the 2014 ACM conference on Web science, June 23-26, Bloomington, IN*. New York: ACM, pp. 171-175.

Elliot, D., Rohlman, D. and Parish, M., (2015). "Focus Groups Move Online: Feasibility of Tumblr Use for eHealth Curriculum Development". *JMIR research protocols*, *4*(1). http://www.researchprotocols.org/2015/1/e34/.

Fink, M. and Miller, Q. (2014). "Trans media moments: Tumblr, 2011-2013". *Television and New Media.* 15(7), pp. 611-626.

Gies, J. and Martino, S. (2014). "Uncovering ED: A Qualitative Analysis of Personal Blogs Managed by Individuals with Eating Disorders". *The Qualitative Report 2014.* 19, pp. 1-15.

Hillman, S., Procyk, J., and Neustaedter, C. (2014). "Tumblr fandoms, community & culture". In *Proceedings of the companion publication of the 17th ACM conference on Computer supported cooperative work & social computing.* ACM, pp. 285-288.

Hillman, S., Procyk, J. and Neustaedter, C., (2014). "'alksjdf; Lksfd': tumblr and the fandom user experience". In Proceedings of the 2014 conference on Designing interactive systems ACM, pp. 775-784.

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Moore, A.J. (2013). "Communicating experiential learning through an online portfolio in Tumblr". In: Ferris, S. and Wilder, H. eds. *The Plugged-In Professor: Tips and Techniques for Teaching with Social Media.* Cambridge: Woodhead Publishing, pp. 201-210.

Petersen, L.N. (2014). "Sherlock fans talk: Mediatized talk on tumblr". *Northern Lights: Film & Media Studies Yearbook.* 12(1), pp. 87-104.

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Shin, D., Cetintas, S., and Kuang-Chih, L. (2014). "Recommending tumblr blogs to follow with inductive matrix completion". In: *CEUR Workshop Proceedings, 8th*

ACM Conference on Recommender Systems, RecSys 2014, 6-10 October 2014, Silicon Valley, Foster City. pp. 1-2.

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Tiidenberg, K. (2014). "Bringing sexy back: Reclaiming the body aesthetic via self-shooting". *Cyberpsychology: Journal of Psychosocial Research on Cyberspace*. 8(1). http://cyberpsychology.eu/view.php?cisloclanku=2014021701

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Xu, J. and Lu, T. (2015). "Inferring User Interests on Tumblr". In: Agarwal, N., ed. *Social Computing, Behavioral-Cultural Modeling, and Prediction. 8th International Conference, SBP 2015, March 31-April 3, Washington, DC.* Springer International, pp. 458-463.

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Yunus, M.M. and Salehi, H. (2012). "Tumblr as a Medium to Improve Students' Writing Skills". *Journal of Applied Sciences Research*. 8(1), pp. 383-389.

Zeglin, R.J. and Mitchell, J. (2014). "Using Social Media to Assess Conceptualizations of Sexuality". *American Journal of Sexuality Education.* 9(3), pp. 276-291.

A2. Papers which are partially focused on Tumblr

Al-khateeb, S. and Agarwal, N. (2015). "Analyzing Deviant Cyber Flash Mobs of ISIL on Twitter". In: *Social Computing, Behavioral-Cultural Modeling, and Prediction. 8th International Conference, SBP 2015, March 31-April 3, Washington, DC.* Springer International, pp. 1519-1530.

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Hanzalik, K. (2014). "The modular form: A review of Pafford and Fancher's Potent Object Project". *Journal of Writing in Creative Practice.* 7(1), pp. 75-83.

Hoang, J.K. McCall, J., Dixon, A. F., Fitzgerald, R. T., Gaillard, F. (2015). "Using Social Media to Share Your Radiology Research: How Effective Is a Blog Post?". *Journal of the American College of Radiology.* 12(7), pp.760-765.

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A3. Papers which significantly reference Tumblr, but do not focus on it

Armentano, M.G. (2012). "Topology-Based Recommendation of Users in Micro-Blogging Communities". *Journal of Computer Science and Technology.* 27(3), pp. 624-634.

Campan, A., Alufaisan, Y. and Truta, T. M. (2014). "Community detection in anonymized social networks". In: *Proceedings of the Workshops of the EDBT/ICDT 2014 Joint Conference, March 24-28 2014, Athens.* Springer, pp. 396-405.

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Fuchs, C. (2014). Social Media and the Public Sphere. *TripleC.* 12(1), pp. 57-101.

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Gookin, D. (2012). "Facebook and Twitter". In: Ballard, T. ed. *Google This! Putting Google and Other Social Media Sites to Work for your Library.* Cambridge: Chandos Publishing, pp. 27-42

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Kimura, A. (2014). "Large-scale cross-media analysis and mining from socially curated contents". *Progress in Informatics.* **11**, pp. 19-30.

Kumar, M., Dubey, A., Sinha, M. and Malviya, R. (2012). "Concept of a system for Addressing Bad Publicity in Social Media Using Knowledge in Business Process Models". In: *18th Americas Conference on Information Systems 2012, AMCIS 2012, August 9-11 2012, Seattle, WA*. New York: Curran Associates, Inc.

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Melgosa, M., Gomez-Robledo, L., Sure, M. I., and Fairchild, M. D. (2015). "What can we learn from a dress with ambiguous colors?". *Color Research & Application.* 40(5), pp. 525-529.

Murthy, D. and Petto, L.R. (2015). "Comparing Print Coverage and Tweets in Elections: A Case Study of the 2011–2012 U.S. Republican Primaries". *Social Science Computer Review.* 33(3), pp. 298-314.

Nichols, J. (2013). "Using public social media to find answers to questions". *Proceedings of the 2013 International Conference on Collaboration Technologies and Systems, CTS 2013, May 20-24 2013, San Diego, CA.* New York: Curran Associates, Inc, pp. 86-88.

Parker-Gibson, N. (2015). "We See You! Managing Profiles—about Them, about You". *Science & Technology Libraries.* 34(2), pp. 122-133.

Valkanas, G. and Gunopulos, D. (2013). "How the live web feels about events". In: *CIKM '13 Proceedings of the 22nd ACM international conference on Information & Knowledge Management, October 27-November 1, 2013, San Francisco, CA.* New York: ACM, pp. 639-648.

Vasanth, R. and Swamy, S. (2013). "Social Media's Impact on Teenagers". In: *Cross-Cultural Design. Methods, Practice, and Case Studies. 5th International Conference, CCD 2013, Held as Part of HCI International 2013, July 21-26 2013, Las Vegas, NV, USA, Proceedings, Part I.* Springer International, pp. 477-485.

Wauters, E., Lievens, E., and Valcke, P. (2015). "Children as social network actors: A European legal perspective on challenges concerning membership, rights, conduct and liability". *Computer Law & Security Review.* 31(3), pp. 351-364.

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[i] Information on the maximum length of basic text posts varies, with some sources stating a 10,500 character limit (High Alex 2015) and others claiming there is no limit at all (Mahoney 2012). Shorter posts are bound by a lower character limit should the entry be classed as a 'reply' to another user's question.

[ii] The analysis presented here was undertaken as part of an MA Dissertation in Digital Humanities within UCL Department of Information Studies (Attu 2015), supervised by Melissa Terras. The paper presented here is an updated and expanded analysis incorporating this dissertation's materials.

[iii] This may be caused by delays in the publication process.

[iv] Occasionally magazine articles have referred to the practice of using the site as "tumbling", but even this is usually framed as a play on words rather than as a genuine description (Cheshire 2012), and Tumblr's own "How To" pages do not propagate this term or variations of it (Tumblr, n.d.). Searching Tumblr for occurrences of the term "tumbling" only returns posts concerned with gymnastics. Searching "tumbling" on Scopus returned 4,807 papers, primarily from the disciplines of physics, engineering and chemistry, while Web of Science returned 20,208 papers on biochemistry, engineering, and physics.

[v] It may have been possible to identify Tumblr-related papers by using the academic databases to perform searches using the terms 'reblog', or 'like', as these represent two Tumblr core actions. These terms are more representative of the language employed by Tumblr users to describe their activity on the site, and they often do make an appearance in the papers studied. However, neither 'like' or

'reblog' are terms exclusive to social networking or microblogging activity on Tumblr; 'liking' is a key facet of Facebook (www.facebook.com), for instance, while 'reblogging' is also used on Wordpress (wordpress.com). The terms are not as unique to Tumblr as the Twitter equivalent terms are to that site. Searching on these less specific terms therefore returned a vast number of results, the majority of which were entirely unrelated to Tumblr and to social media research in general. Searching the term 'like' on Web of Knowledge yields upwards of 3.7 million records, however with filtering it becomes evident that only eight of these papers contain both the term and any reference to Tumblr. It was therefore decided that there was little utility in identifying papers which qualified as results under the vaguer search terms. This observation also points to the changing nature of nomenclature and vocabulary surrounding social media spaces and the need for researchers to be cognisant of these vocabularies when pursuing research across different platforms.

[vi] We include these papers for completeness as it may be of use for others to see how Tumblr is often mentioned in a list of important media platforms, but frequently glossed over.

[vii] There are various third party apps developed to operate on the Tumblr API, for example Xkit, which adds more functionality to the platform (Perez 2014). These are aimed at users, and there has been little attention from researchers using the API to build a tool kit to aid in analyzing the Tumblr stream, or interest from Tumblr in providing more access to the stream for researchers.

[viii] Moving gifs have only been supported on Twitter since June 2014 and Facebook since June 2015 (Twitter Support 2014, Chowdhry 2015).

[ix] It was not possible to ascertain how many Tumblr accounts are currently inactive: like most social media platforms, Tumblr has not made that information publicly available. However, recent analyses suggest that the number of users abandoning Tumblr is increasing (Bell 2016, Fiegerman 2016, Kim 2016).

[x] Research into the Tumblr presence of journals, organizations, and groups focused on dermatology (Correnti et al 2014) excluded blogs which were not active in the six months prior to the date of data collection, to prevent the authors' perception of the dermatology-related activity on the site from becoming distorted.

[xi] In their Message and Concept based research paper on the representation of eating disorders on Tumblr blogs, Gies and Martino (2014) acknowledge that the rate at which their fifteen sample blogs were growing potentially limits the application of their findings to future work, warning "the blogs are continuously being updated on a day to day basis…the appearance of themes found in this study using the selected blogs may change minimally or drastically if a similar study was completed using fifteen different blogs" (ibid, p.11). Managing the volume of posts was also a challenge for Kohen (2014). Changing links to Tumblr posts were encountered by Bourlai and Herring, who saved screenshots of every image they analysed; this will have been time-intensive for over 2100 posts (Bourlai and Herring, 2014, p. 172).
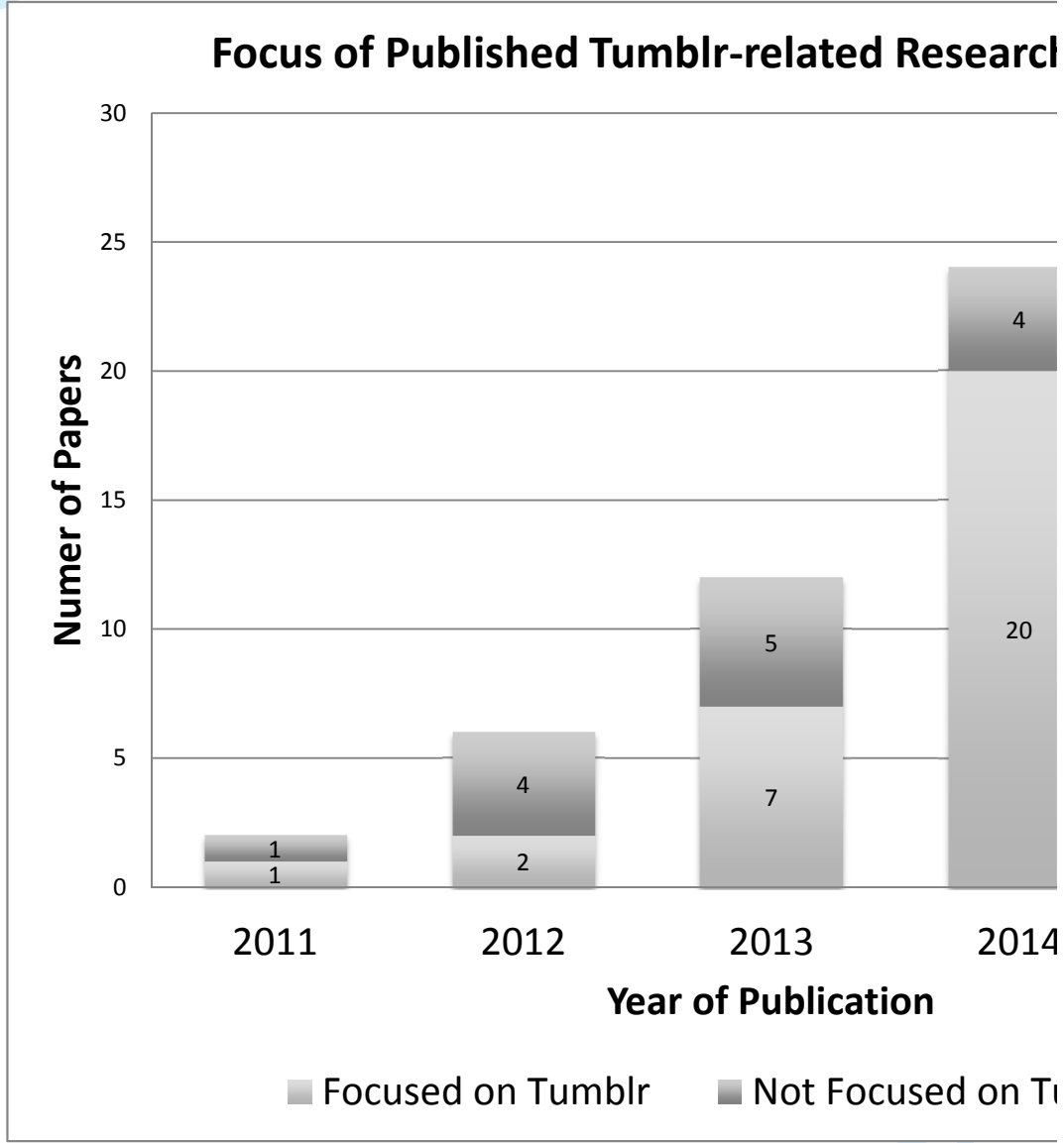
[xiii] In one study, researchers were able to identify the gender of the users for "1,698 posts out of the total 2,152" they studied, but this leaves more than 20% of their sample unaccounted for (Bourlai and Herring, 2014, p.172).
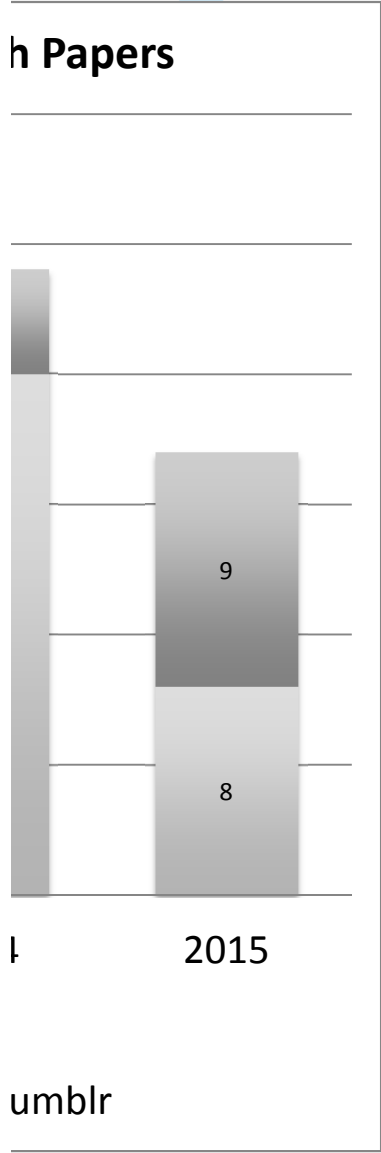
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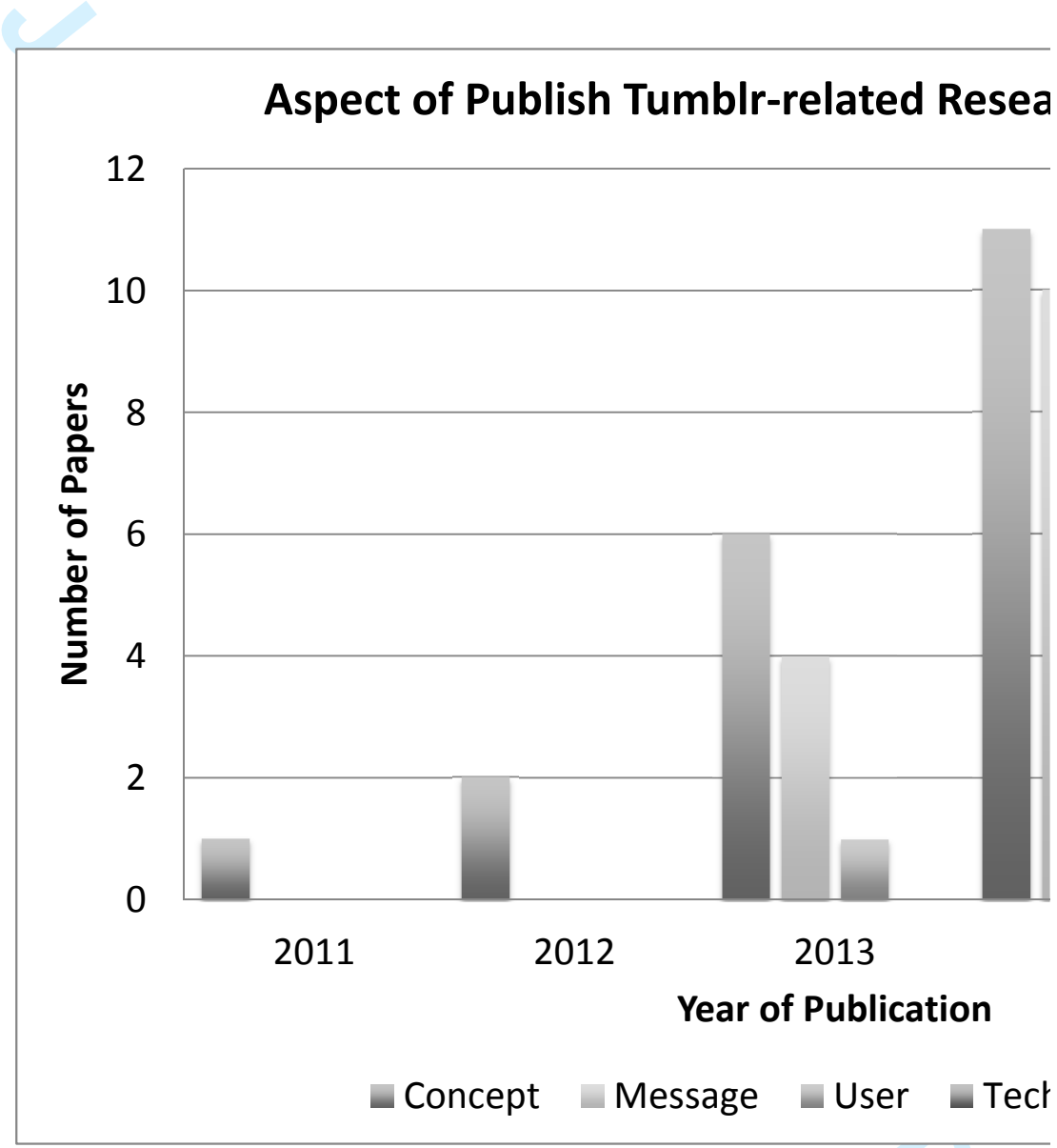45
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Year of Publication	Focused on Tumblr	Not Focused on Tumblr
2011	1	1
2012	2	4
2013	7	5
2014	20	4
2015	8	9

Focus of Published Tumblr-related Research

(Chart — Number of Papers by Year of Publication)

- 2011: Focused on Tumblr = 1, Not Focused on Tumblr = 1
- 2012: Focused on Tumblr = 2, Not Focused on Tumblr = 4
- 2013: Focused on Tumblr = 7, Not Focused on Tumblr = 5
- 2014: Focused on Tumblr = 20, Not Focused on Tumblr = 4

Legend: Focused on Tumblr | Not Focused on Tumblr

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	Concept	Message	User	Technology
2011	1			
2012	2			
2013	6	4	1	
2014	11	10	8	4
2015	6	5	1	

Aspect of Publish Tumblr-related Resea[rch]

(Bar chart: X-axis "Year of Publication" with years 2011, 2012, 2013; Y-axis "Number of Papers" from 0 to 12. Legend: Concept, Message, User, Tech[nology])
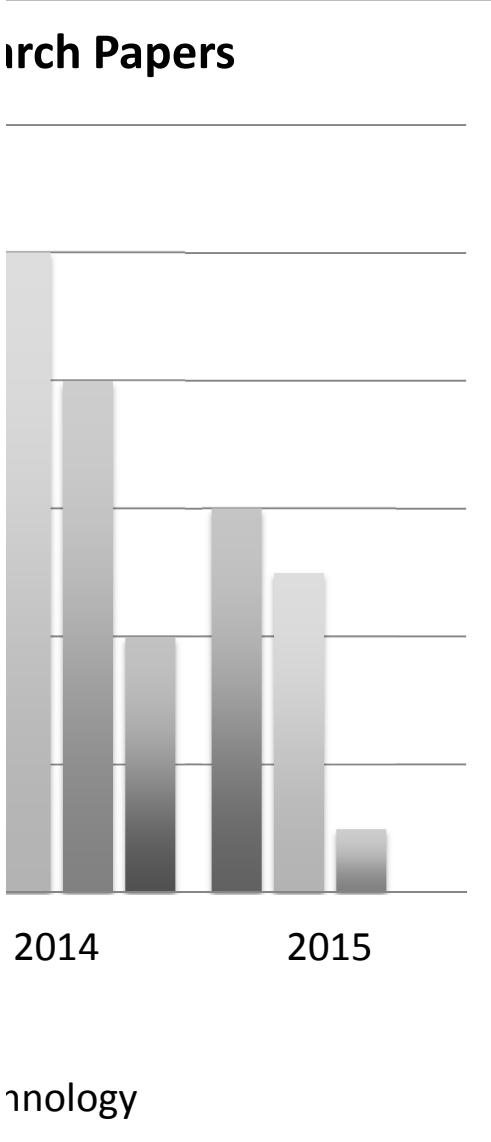
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