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# Social Media and Information Overload: Survey Results

Kalina Bontcheva, Genevieve Gorrell, Bridgette Wessels

## Abstract

A UK-based online questionnaire investigating aspects of usage of user-generated media (UGM), such as Facebook, LinkedIn and Twitter, attracted 587 participants. Results show a high degree of engagement with social networking media such as Facebook, and a significant engagement with other media such as professional media, microblogs and blogs. Participants who experience information overload are those who engage less frequently with the media, rather than those who have fewer posts to read. Professional users show different behaviours to social users. Microbloggers complain of information overload to the greatest extent. Two thirds of Twitter-users have felt that they receive too many posts, and over half of Twitter-users have felt the need for a tool to filter out the irrelevant posts. Generally speaking, participants express satisfaction with the media, though a significant minority express a range of concerns including information overload and privacy.

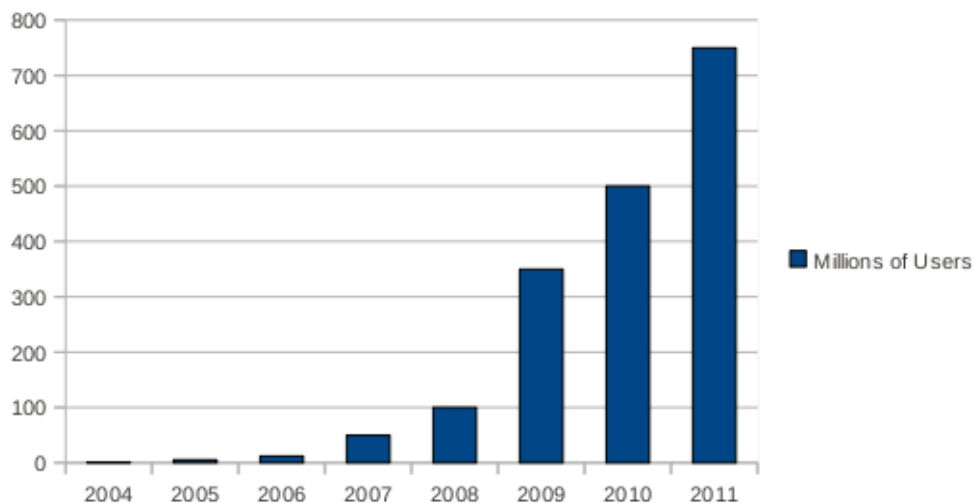
Keyword list: User-Generated Media, Social Networking, Information Overload, Information Overlook, Facebook, LinkedIn, Twitter

## 1 Introduction

User-Generated Media (UGM) are web services in which users share information and provide web content of various forms for the benefit of other users. Examples include Facebook, LinkedIn and Twitter. Due to the recent explosion of interest in these media, more people than ever before are publishing content on the internet. This makes a very large amount of information available, and makes the problem of consuming this information intelligently a pressing one for many people.

UGM generally feature some means of connecting to other users, either to document the relationship or to indicate an interest in what they have to say. Users may then create posts or status updates, and the service will provide to users the posts of those users to whom they are connected. Variations from this formula exist, but for the most popular services, this encapsulates the principle. Different UGM can be characterised in different ways, describing their aims and focus as positions on a spectrum. Interest-graph media [RR10] encourage users to form connections with others based on shared interests, regardless of whether they personally know the other person. They aim to provide the information to users that they will find most interesting. Twitter, a microblogging service in which users share short status

Figure 1: Number of Facebook Users by Year



updates, encourages this model, and the "following" relationship is often one-way, as a well known or particularly interesting person will attract large numbers of followers who are interested in what they have to say without themselves returning the compliment in most cases. Social-graph media encourage users to connect only with people they have real-life relationships with. Facebook provides a way for people to keep in touch with friends they might otherwise not talk to much, or share information between friends who see a lot of each other. LinkedIn aims to provide an introductions service in the context of work, where connecting to a person implies that you vouch for that person to a certain extent, and would recommend them as a work contact for others. Status update media encourage short contributions from users, often outlining current events in their lives or linking to something on the internet that they think others might enjoy. These status updates are combined into a time-ordered stream for each user to read. Blogs usually invite longer contributions. Readers might comment on these contributions, and some blog sites create a time stream of blog articles for followers to read.

As more users are drawn to a particular system, the growth rate seems to increase. Consider the growth of Facebook as the most striking example. As Figure 1 shows, prior to 2007, uptake was modest. From 2007 onwards, however, an explosion in the number of users took place, until now, in late 2011, the user base is more than twice that of the United States of America, the third most populous country in the world. Twitter shows a similar growth pattern [CE09].

There are reasons why a snowball effect might be taking place [PG90]. As more people congregate on a particular system, others may feel more incentive, or pressure, to join too. There is more utility to using the system on which one can

reach the greatest number of relevant people. People may put pressure others to join the system they use in order to increase their own utility on that system. This leads to a tendency for one player to dominate within each field, though applications making it very easy to partake in multiple media may counter this tendency as it becomes easy for a person to join several networks and have their posts automatically sent to all their networks.

These media have the effect of making the world seem a much smaller place, in terms of ease of communication with others regardless of geographical location. With this abundance of access comes a greater need to process the information input to make sense of it. "Information overload" describes the difficulty a person can have understanding an issue and making decisions in the presence of too much information. The term was popularised by Alvin Toffler in his bestseller, "Future Shock" [Tof84]. Part of the problem may come from a diminishing of the signal-to-noise ratio, a pollution of information with misleading, irrelevant or low quality material. Another aspect comes from human cognition and approaches to decision-making. We might assume that more information is always better, and these media provide large quantities of time-stamped material we feel compelled to keep up with for fear of missing anything. We may have difficulty prioritising based on our values and interests in the presence of so much information, always distracted by that new piece of information that due to recency of exposure, seems so important [JSK74]. A broader definition of information overload, however, might simply be that a person finds it difficult to keep up with the information they have chosen for themselves and often fails to find time to attend to the quantity of information that they feel they ought. Used in this way, the problem conceptualisation is not new; as early as 1985, researchers began to postulate a problem with computer-mediated communication systems such as email and message board systems, which so entirely changed communication compared with what had gone before [HT85]. It is this sense of the term that we focus on here, extended to a yet more recent communication paradigm.

There is no such thing as information overload, there's only filter failure

As this quote by Clay Shirky suggests, the profusion of information in itself isn't the problem. More information, technically speaking, ought to be a good thing, but to utilise it effectively, and protect ourselves from its hazards, we need to filter better. To take advantage of the unprecedented information availability, we need automatic processing of some kind. In this sense, information overload is more of an opportunity than a problem. We have an abundance of informational riches, but we need to develop filtering strategies in order to turn it to our advantage.

The research we describe here provided an opportunity to see how usage relates to different aspects of the media; for example, blogs and microblogs are united by their focus on the interest graph. What similarities will we see in the way people respond to these media? SNS and microblogs focus on short status updates. In

what ways will this similarity unite usage patterns? The main focus of our research however is on the information overload problem. To what extent are people aware of this as a problem? What do they think should be done about it? Who experiences information overload? Who doesn't? Does it attach more to some media than others, and what are the characteristics of those media?

## 2 Related Work

Literature regarding UGM is necessarily very recent, since the picture is evolving so rapidly and findings true in one year may not be the year after. Twitter, the microblogging service, has existed since 2006, and a rapid escalation of popularity has led to its having 300 million users just five years later. Its history indicates something of how its current usage deviates from the use intended when it was created. The first prototype was rolled out as an internal company service [Arr06]. Later, expansion was fuelled as it came into its own as a way to facilitate communication between attendees at the SXSW festival [Dou07]. Tweeters used the service to communicate about current events personally relevant to those reading. The earlier Twitter tagline of "What are you doing" invites primarily me-focused tweets; later this became "what's happening" perhaps to reflect a broadening usage [ES10]. Ehrlich and Shami [ES10] explore how company internal microblog usage (BlueTwit) differs from current Twitter usage across the same group of users, and find that company internal microblog usage focuses more on communication such as question asking, directed posts and directed questions and less on providing information and status updates. However, "what's happening" may still not reflect how Twitter is being used. Ehrlich and Shami found over 25% of tweets in their sample were directed posts, making Twitter into a short, public message service, in addition to a means of sharing status updates (11%) and information (29%).

Zhao and Rosson [ZR09] emphasise the "water cooler conversation" angle, again suggesting people tweet within cliques. However in 2010, Kwak *et al* [KLPM10], in a much larger study of 106 million tweets, find metrics suggesting a widespread deviation from social network-style usage. In particular, reciprocity is low, suggesting that people are "following" others based on the often one-way "interest graph" [RR10], that is to say, linking based on shared interests, rather than the by-definition two-way relationship of social acquaintance ("social graph"). Trending topics tend to be headline news or persistent news. "Retweeting", that is, repeating a tweet with acknowledgement, is responsible for rapid spreading of headlining information. Thus Kwak *et al* suggest, essentially, that Twitter is now a news medium. Particularly interesting is the emerging possibility of crowdsourcing news via microblogging services, capitalising on the fact that a major use of microblogging is to talk about significant events, and such news will tend to be passed on. Sakaki *et al* [SOM10] explore this possibility in the context of earthquake and typhoon detection.

Social-graph services such as Facebook and LinkedIn enforce relationship reci-

procity by requiring that both parties consent to being linked. By *not* doing this, Twitter has allowed a fascinating evolution to take place, from a social-based small messaging service to a highly versatile social environment, finding its niche as the main interest-graph medium but not limited to that. Naaman *et al* [NBL10] found over 40% of their sample of tweets were "me now" messages, that is, posts by a user describing what they are currently doing, in the manner encouraged by the "what's happening" prompt. Next most common were statements and random thoughts, opinions and complaints and information sharing such as links, each taking over 20% of the total. Less common tweet themes were self-promotion, questions to followers, presence maintenance e.g. "I'm back!", anecdotes about oneself and anecdotes about another. Messages posted from mobile devices are more likely to be "me now" messages (51%). Females post more "me now" messages than males. A relatively small number of people undertake information sharing as a major activity; users can be grouped into "informers" and "meformers", where meformers mostly share information about themselves. Informers and meformers differ in various ways. Informers tend to be more conversational and have more contacts.

As well as enforced reciprocity, Facebook and LinkedIn differ from Twitter in that they involve a privacy system. Whereas all tweets are public, posts to Facebook and LinkedIn can be seen only by those to whom permission has been granted. Despite this, privacy is more of an issue among Facebook users than Twitter users, perhaps because some kind of decision-making process is entailed. Hoadly *et al* [HCLR10] investigate the reaction among users when Facebook, in 2006, introduced the news feed, in which information users previously would have had to seek out by going to each others' pages was now aggregated into a time-ordered digest and placed front and centre on the site. "Perceived control" and "ease of information access" were determined to be factors in how comfortable a person feels with privacy aspects of using Facebook. Anecdotally, people seem far more likely to run into trouble with privacy on Facebook than on Twitter; in the UK for example, there have been several convictions resulting from criminal evidence posted by offenders [Tra11]. There is also some suggestion that privacy settings, despite correct use by users, may be overcome relatively easily, making privacy relatively illusory [ZG09].

LinkedIn capitalises on its status as a permission-requiring social-graph medium in that it presents itself as a professional introductions service. The site encourages strictly professional information to be shared, and tends to attract older professionals [SG09]. In their review of social and professional media in the workplace context, Skeels and Grudin [SG09] find tension around privacy in social media use. However, they also report rapid adoption, as numerous benefits are found. They found, as will be echoed in our own findings, that users post more frequently to Facebook than LinkedIn, demonstrating a particular degree of attraction to that medium. Though users report great value to LinkedIn, they do not seem driven to visit the site so often. Our own investigation supports this observation; reasons for this will be explored later in the paper. LinkedIn usage seems limited to the profes-

sional context, whereas Twitter seems broadly undifferentiated in that regard, and a certain amount of Facebook usage will tend to be professional; for example, Facebook allows businesses to create pages on which they may publicise themselves.

Although Facebook is the most popular UGM, having over twice as many users as Twitter, its nearest competitor, the number of connections a person may have is limited to real-life acquaintances, at least in principle, and therefore has a practical upper limit of around a few hundred, with 90% of users having fewer than 500 Facebook friends [Tea11]. Interest-graph media users may follow many more people than they can reasonably keep up with. This can be as many as several hundred thousand, though Twitter may impose a limit, and "following" may have other purposes than reading what that person has to say. This makes microblogging more of a focus of interest when it comes to information overload. Ramage *et al* [RDL10] carried out a small scale web-based survey of 56 Twitter users from within Microsoft. The focus was on understanding following behaviour, i.e., how users decide who to follow, why they follow them, and why they unfollow people. Even though the focus of this survey was different, its results provide some useful insights into information overload resulting from Twitter. For instance, the authors report that "too many posts in general" was the most common reason for a person to be removed from the user's Twitter stream, i.e., un-followed. Similarly, with respect to deciding who to follow on Twitter, the study found that "...first, new users have difficulty discovering feeds worth subscribing to. Later, they have too much content in their feeds, and lose the most interesting/relevant posts in a stream of thousands of posts of lesser utility." The responses also indicate the need for better filtering of tweets to more closely match the person's interests, due to the fact that many Twitter users tend to cover diverse sets of topics. In that respect, respondents flagged "too much status/personal info" and "too much content outside my interest set" as reasons for un-following Twitter users. The first ties in with Naaman *et al*'s suggestion that "meformers" may attract fewer followers, being less likely to be a source of general interest. Also, in an open-ended question about how the Twitter interface could be improved, 30% of the respondents wanted a filtering functionality, presenting their feeds by user, topic and context.

Our research is a UK-based exploration of UGM use. Questions relating to usage patterns reflect the topics explored in the Pew Research survey [HGRP11], though our sample differs from the Pew sample in that it tends to be UK-based, and skewed toward the internet-savvy. In a rapidly changing field, we provide a current snapshot of UGM use, as well as looking ahead to emerging issues. In particular, we investigate issues relating to input volume and overload, so our sample preferentially features internet users, to increase input from those likely to have encountered those kinds of issues. We cover similar topics to Ramage *et al et al* [RDL10] with regards to input volume and overload, except that our sample size is larger and more diverse, comprising 587 users recruited via university contacts rather than being employees within one organisation.

### 3 Survey Outline, Aims and Participants

About half of the questions in our survey related to how people currently use and engage with UGM, whereas the rest try to gain an understanding of whether people are experiencing information overload and from which kinds of UGM. The survey ran over a period of 30 days, between 29 March 2011 and 29 April 2011. Since the survey is targeting user-generated media, such as Social Networking Sites (SNS), Professional Networking Sites (PNS), and micro-blogs, it was advertised via Facebook, LinkedIn, and Twitter, as the most widely used sites of these three kinds of UGM. The survey was publicised through several prolific Twitter users, tweeting in their professional capacity in computer science, and with between 1200 and 4000 followers each. On Facebook, an open public event was created around the survey which attracted around 250 participants (although it is not known how many of them actually completed the survey). On LinkedIn, the survey was publicised on several professional interest groups, namely Digital Humanities, Natural Language Processing, Semantic Web Research, Text Analytics, and User Modelling. In addition, participants were recruited via a Sheffield University volunteers mailing list, which is received by students and academic staff. We were particularly interested in recruiting a large percentage of young “digital natives”, due to their proficiency in and heavy use of social media.

Our questionnaire divides UGM into 5 main kinds:

- Social Networking Sites (SNS), e.g. Facebook, MySpace, Bebo;
- Professional Networking Sites (PNS), e.g., LinkedIn;
- Microblogging sites, and specifically Twitter. While we included several social and professional networking sites in the survey, to widen its validity, for microblogging we focused exclusively on Twitter. This is due to it having the biggest growth in data volumes and users amongst all UGM sites;
- Social news, e.g. Reddit, Digg, StumbleUpon;
- Blogs, e.g., Blogger.com, Wordpress.

The questionnaire begins with demographic questions. It then asks about the devices respondents use with which they might access the internet. We ask which social media respondents use. We then ask how frequently respondents read and post on each type of social media, how many connections they have on those media where connections are relevant, their perception of the number of posts they receive (whether they perceive it to be too many, about right or not enough, hereafter referred to as volume), the proportion of posts they find interesting (hereafter referred to as interestingness) and their ability to keep up with reading all their posts (hereafter referred to as overload). We ask about reasons for not using social media and competence to use media should they choose to do so. We ask about use of mobile phones to access media. We also ask some questions specifically about



Twitter use; to what purpose do respondents put Twitter. We ask some questions about overload in Twitter. A final comments field invites criticisms of social media access tools.

### **3.1 Participant Demographics**

We collected 587 complete responses and 228 incomplete ones. The results reported below are based on the completed answers only.

Our sampling method has impacted on some aspects of the sample. By gathering data through the university email service and professional social media presence, the sample contains more students and people working in related fields than might otherwise be expected. This contact-based approach to sampling is similar to that used by Pollet *et al* [PRD11], and resulted in similarly student-biased demographics. 548 of the respondents (93%) were users of at least one kind of social media site. This very high percentage is an artefact of the fact that social media were used as the primary recruitment mechanism. The figure amongst adults in general, according to a recent Pew Research Centre survey [HGRP11] in America, is now approaching 60% of all internet users.

42% of social media users in our sample are under 25, which is likely to be a result of the large proportion of student volunteers (46%). (Only 2.6% of the UK population are full-time students [Age11] and 31% are under 25 [fNS10]). 61% are female, which is similar to the 56% reported in [HGRP11]. 94% of respondents have a laptop computer, 64.5% have a smart phone, 8% have an internet-enabled table, and only 48% have a desktop computer.

With respect to country of origin, 493 (84%) of the participants are from the UK, 48 (8%) – from other European countries, 25 – from North America (USA and Canada), 19 – from Asia (primarily India), 1 from Australia and 1 from Africa.

In the ensuing analysis, where it is possible that the bias in our sample might impact significantly on findings, this is discussed. Results may be presented treating students and non-students separately, or above- and below-25s.

## **4 General Findings on Use of User-Generated Media**

This section outlines analysis of responses to our questions, focusing on questions relating to general usage. Each question is taken in turn. Questions relating to volume, interestingness and overload will be addressed in the following section in more depth, being of particular relevance to our research.

### **4.1 Uptake**

Amongst respondents, SNS such as Facebook are most widely used (94% of all respondents), followed by PNS (predominantly LinkedIn) (39%), Twitter (37%), blogs (29%), and social news (11%). SNS usage percentage is comparable to the

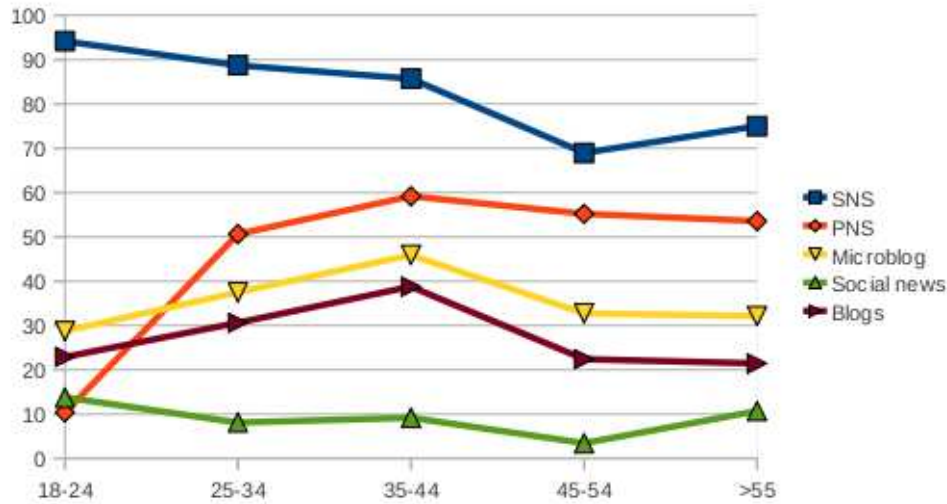
92% reported by the Pew Research study in the USA[HGRP11]. In contrast, reported usage of SNS and Twitter in our study is significantly higher (39/37 % vs 18/13 %), most likely due to us using these media to recruit participants (since we needed a sufficiently large number of users of these media, in order to study information overload issues).

With respect to the extent to which respondents engage with more than one medium, social networking media seem to occupy a default status; of those responding that they use SNS, microblogging, social news sites and blogs, on average 92.75% also use SNS. Microblogging comes in next, with 53.44% of users of other media on average also using microblogging. Next, SNS at 48.68%, then blogs at 42.24% and social news at 15.93%. In particular, social news users are most likely to blog (53.33% of social news users also blog) and bloggers are most likely to use social news (19.88%), bloggers are also most likely to microblog (62.11%), microbloggers are most likely to use SNS (56.56%) and social news users are most likely to use SNS (98.33%).

As shown in Figure 2, choice of UGM varies across different age groups. SNS users tend to be significantly younger ( $p < 0.001$ , as determined using a two-tailed Spearman's rank correlation coefficient, as our age data is ordinal) and SNS users tend to be older ( $p < 0.001$ ). Differences for other media are less pronounced. Those not using UGM are more likely to be older ( $p < 0.001$ ). Ramage's study [RDL10] found that 75% of Twitter users were between the ages of 26 and 45, which supports a mid-range age group for that medium. Significantly different patterns emerge ( $p < 0.001$ , Phi/Cramer's V used for nominal media choice data) in choice of media combinations when we split respondents into those younger than 25 and those older than 25. 84% of those under 25 are using SNS but not SNS, as opposed to 34% of those older than 25. In the under 25s, using SNS but not microblogging is very rare (4%) but 25% of older respondents do this. 63% of under 25s use only SNS, as opposed to 26% of over 25s. Older people are more likely to use SNS and SNS but not microblogging (23% as opposed to 4%). Older people are more likely to use all three of SNS, SNS and microblogging (26% as opposed to 7% of under 25s).

Students are significantly less likely to use SNS ( $p < 0.001$ , Phi/Cramer's V), and rather less likely to use microblogging ( $p < 0.005$ ) than non-students. Intuitively, students would most likely be less drawn to professional networking having generally not yet commenced their professional life. This is also reflected in significant differences ( $p < 0.001$ ) in patterns of media choice; among employed people, 27% use all three of SNS, SNS and microblogging, as opposed to 7% of students. 23% of employed people use SNS and SNS but don't tweet, as opposed to 7% of students. 25% of employed people use only SNS, whereas for students the figure is 59%. 78% of students use SNS but not SNS, as opposed to 34% of employed people. 66% of students use SNS but not microblogging, as opposed to 48% of employed people. 26% of employed people use SNS but not microblogging, whereas for students it is 7%. These findings broadly reflect the findings on age; note that the students in our sample are younger ( $p < 0.001$ ), with 79% being

Figure 2: Percentage of People Using Medium by Age Group



under 25, whereas in the rest of the sample, 91% are over 25. A sample containing a greater proportion of young people who are not students may have produced different findings.

Of female respondents, 89% use SNS, 31% use PNS, 29% use microblogging, 8% use social news sites and 22% use blogs. Of male respondents, 85% use SNS, 44% use PNS, 43% use microblogging, 13% use social news sites and 35% use blogs. Phi and Cramer's V tests show that the difference between genders in their uptake of these media is significantly different for microblogging at the 0.001 level and for PNS and blogs at the 0.005 level, showing in all these cases that males are more likely to use the medium, whereas for SNS, the genders are more similar. Males appear also to be more likely to use social news sites, but due to the smaller overall number of users, a statistically significant result was not obtained. Ramage's study [RDL10] found that 65% of Twitter users were male, which is a similar result to ours. Men and women show significantly different patterns in their choice of media ( $p < 0.001$ , Phi/Cramer's V). Men are more likely to use all three of the media of SNS, PNS and microblogging (24% of male respondents as opposed to 14% of female respondents). Women are more likely to use SNS only (47% as opposed to 32%). 61% of female respondents use SNS but not PNS, as opposed to 44% of male respondents. 62% of female respondents use SNS but not microblogging, as opposed to 49% of male respondents.

Respondents cover a broad range of ethnicities, ranging from white British (373 respondents) to black Caribbean (1 respondent). Due to the variation in numbers of respondents of each ethnicity, groups were combined into British and non-British for the purposes of observing differences between groups, as this yielded

the largest classes. Results show no significant difference in the uptake of SNS, microblogging and social news; however, non-Brits are significantly more likely to use PNS ( $p < 0.001$  Phi/Cramer's V) and blogs ( $p = 0.002$ ). More non-Brits also use SNS (90% vs. 63%); however the difference was not statistically significant. There are marked differences in the choices Brits and non-Brits make in their media combinations ( $p < 0.001$ , Phi/Cramer's V). 29% of non-British respondents use all three of SNS, PNS and microblogging, as opposed to 14% of Brits. 36% of non-British respondents use SNS but not PNS, as opposed to 63% of British respondents. 27% of non-British respondents use PNS but not microblogging, as opposed to 12% of British respondents. Generally speaking, non-Brits seem to have more interest in UGM in general and PNS in particular, and where only one of microblogging and PNS is used, for Brits it will tend to be microblogging and for non-Brits it will tend to be PNS. Since we don't have data about where respondents are living, it is unclear if this difference is due to cultural differences or if non-British respondents living in this country are perhaps using UGM to keep in touch with friends back home. However, the most likely explanation is that the difference arises primarily from age since our non-British respondents are significantly older ( $p < 0.001$ ) and the non-British contingent didn't contain so many students.

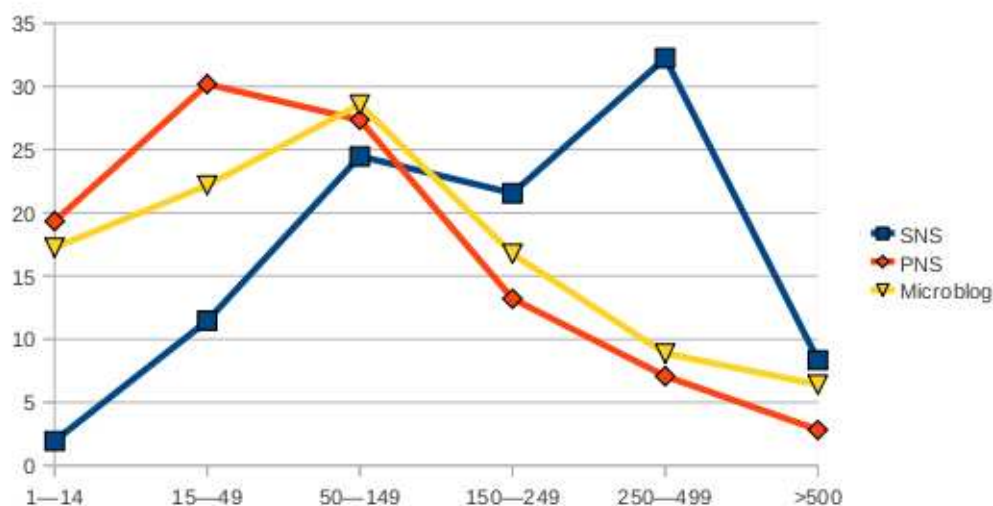
With respect to employment status, 36% of all microbloggers in our sample are students (compared to 46% in the overall sample), 60% are employed or self-employed, and 4% are currently not employed (primarily mothers on leave). 211 students in our sample use professional sites like LinkedIn. In contrast, 163 of the 292 employed and self-employed respondents of our survey use PNS.

## 4.2 Connection Number

Next, we looked into the number of connections that people have on SNS, PNS, and microblogs. For these three kinds of media, connections tend to mean somewhat different things:

- On SNS, such as Facebook, people tend to be connected primarily to friends and acquaintances. In addition, as reported by Facebook [Fac 11], the average user is following up to 80 community pages, groups and events, but these were excluded from our study.
- PNS connections reflect the size of a user's professional network. Users also tend to participate in professional groups around specific interests, e.g. text analysis, and online activity in those groups (e.g. posting articles or jobs, commenting) could lead new professional connections, where the link is established purely due to this virtual communication;
- On Twitter people and organisations are followed, primarily due to shared interests, i.e. following/follower networks form the so called *interest graph*. In many cases, the user has not met his connections face-to-face.

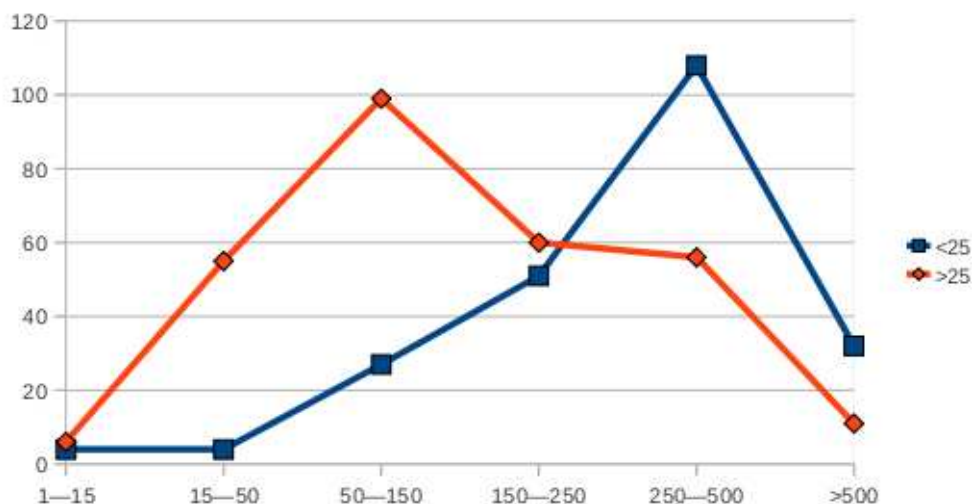
Figure 3: Number of Connections by Percentage of Users



SNS appears to be the medium that attracts the largest networks, see Figure 3. In our sample, 41% of SNS users have more than 250 connections, a similar result to the average of 229 reported by Pew Internet [HGRP11] and the 180.42 average from the study by Pollet *et al* [PRD11]. The graph peaks at 50–149 connections and again at 250–499 connections. Breaking down the data into two groups by age helps to explain this; Figure 4 shows that for the under 25s, the most usual network size is 250–499 whereas for the over 25s, it is 50–149. For the under 25s, (44% of SNS users in our sample), SNS are the user-generated media of choice, with most users (62%) having in excess of 250 connections. Younger people have significantly more connections on SNS than older users ( $p < 0.001$ , Spearman's), a result more striking given that younger people have had less time to collect acquaintances in their lives. In contrast, SNS users who are 35 or older most commonly have 50–150 friends in their network (36%), with 68% having 150 connections or fewer. Given that 64% of them also use a PNS, 42% use a micro-blogging service and 36% are also bloggers, our findings suggest that older users tend to have separate online identities and networks maintained through different UGM sites.

For PNS, 105 (49.5%) of our respondents have 49 or fewer connections. From these, 16 (15%) are students (the rest are employed or self-employed) and 19 (18%) are under the age of 25. In contrast, there are only 3 students and only 6 under-25s (5.6%) amongst the 107 respondents with more than 50 connections. In our sample, 25–34 year olds are just as likely to have under 50 connections as they are to have more (41 vs 40), whereas 60% of over 35s have more than 50 professional connections. These findings are in themselves not surprising, since professional networking sites are designed exactly for employed users, whose professional net-

Figure 4: Number of SNS Connections by Number of Users

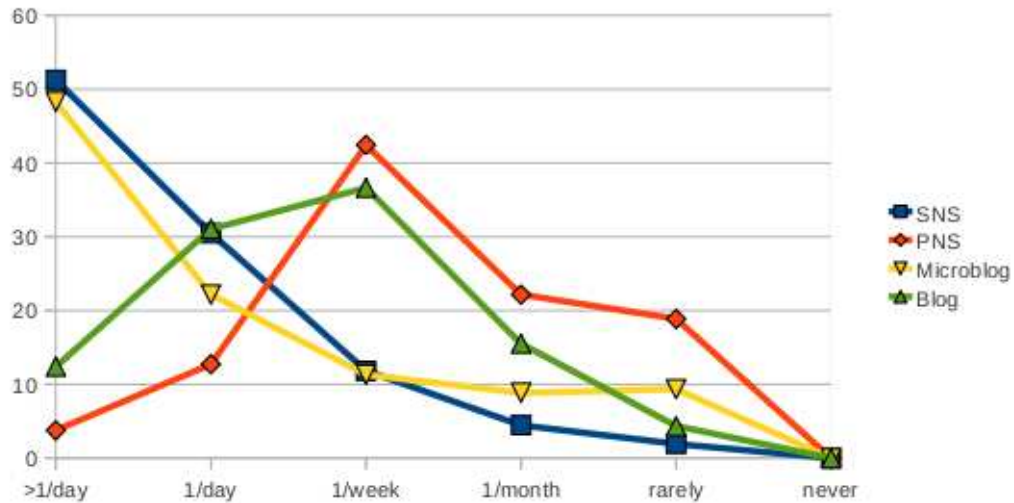


works grow as they meet more people throughout their career (hence the connections increasing with age).

The average number of connections on micro-blogging sites is 138, with the largest number (58) in the region of 50–149 connections. However, unlike PNS, here only 40% of users have fewer than 50 connections and the number of users with 500+ connections is double that for PNS. Two years ago, a Twitter survey [CE09] reported that 92% of Twitter users follow less than 100 people. However, since then the number of Twitter accounts has grown from 11.5 million to more than 200 million and consequently, so has the average number of people and organisations followed. Age has little impact on the number of connections respondents have on microblogs.

There is little evidence of a gender difference in the number of connections respondents have on SNS, PNS and microblogs. As noted earlier, non-Brits are more likely to use PNS; however even within PNS users, non-Brits are significantly more likely to have more connections ( $p=0.001$ ). On other media, number of connections are similar for Brits and non-Brits. Mobile-users have slightly more connections on SNS ( $p=0.001$ ), though not on PNS or microblogs. It might seem that this could be accounted for if mobile users tend to be younger, since younger people have more connections on SNS; however no evidence was found that mobile users tend to be younger.

Figure 5: Frequency of Reading

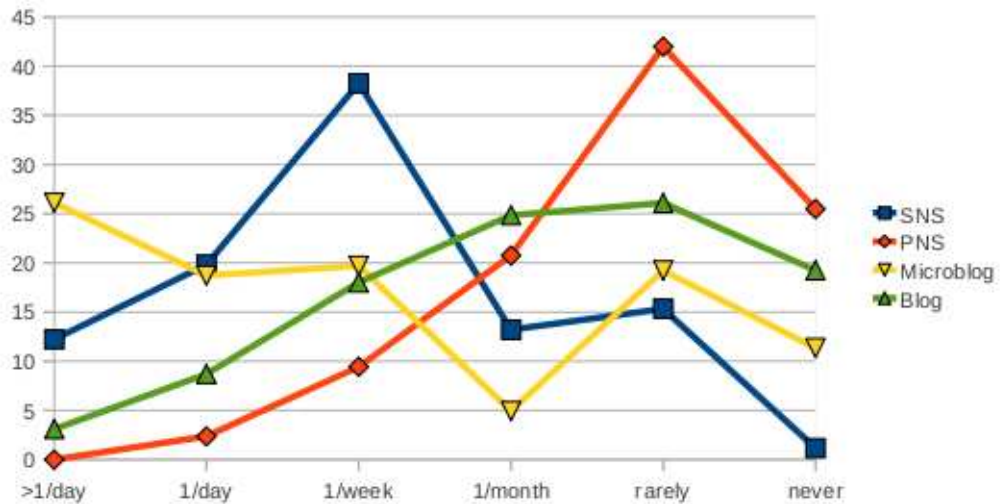


### 4.3 Frequency of Access

With respect to frequency of media use, there are significant differences between SNS and microblog engagement on one hand, and PNS (LinkedIn) on the other (with blogging falling in the middle). Figure 5 shows the frequency with which users of each medium read posts. Note that percentages are calculated within the medium, not across the entire sample. The graph shows that almost 82% of SNS and 71% of microblog users read posts daily or more, whereas only 44% of bloggers do so, falling sharply to below 17% for PNS users. Blogs and PNS show a peak around reading once per week. Similar results are reported also by Pew Internet [HGRP11] and reflect the predominantly real-time, status-like content on Facebook and Twitter. However, it is also possible that the higher volumes of content shared daily through these kinds of UGM, might lead to many people feeling the need to check their streams at least twice daily, in order to stay on top of important, real-time information.

When it comes to frequency of posting, the picture is more complex. As Figure 6 shows, microblogging is the only medium where users are most likely to post more than once per day, with 26% of microblog users doing so. SNS shows the most similar posting pattern to microblogging, with something of a bimodal pattern emerging as users are divided into more or less frequent posters, lending credence to the anecdotal "lurker" pattern; a user who rarely posts but reads regularly. Blog and PNS use most commonly post "hardly ever" (26.09% and 41.98% respectively), with very small numbers posting once per day or more. Younger SNS users read more ( $p < 0.001$ , Spearman's) and post more ( $p < 0.001$ ). Ramage's

Figure 6: Frequency of Posting



study [RDL10] found that 67% of Twitter users were very active consumers of information, reading posts several times a day. 37% posted more than once per day, and 54% posted with frequency between once a day and once a month. This is not dissimilar to our findings.

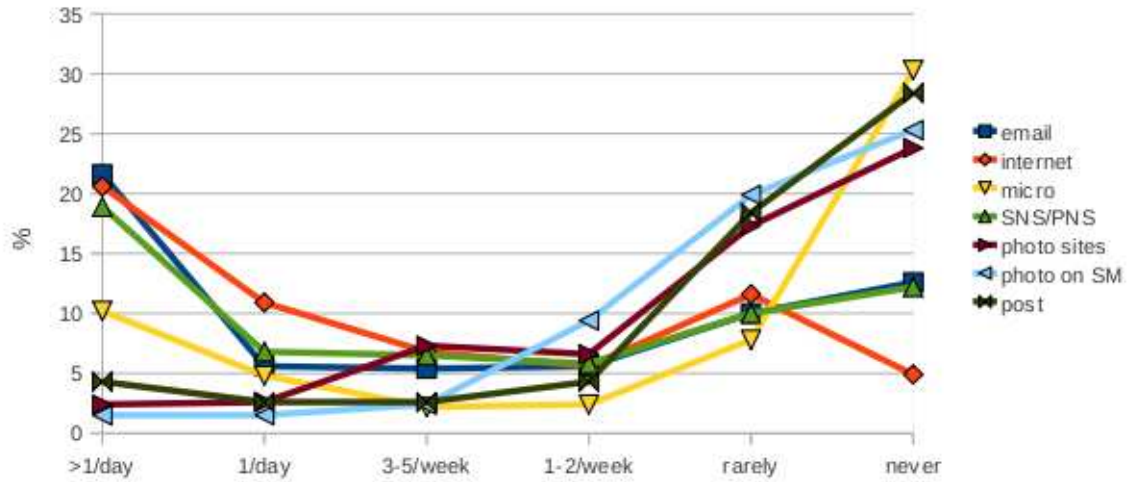
There is little evidence of a gender difference in frequency of posting and reading, except that males are slightly more likely to post to microblogs ( $p < 0.005$ , Phi/Cramer's V). Brits post more on SNS ( $p = 0.001$ ). Non-Brits do not read or post more on PNS despite the greater uptake and number of connections, suggesting the difference may be accounted for more by prevalence in certain communities than a greater cultural enthusiasm for the medium.

In general, users who frequently engage with one medium are somewhat more likely to engage frequently with the others also. Reading SNS correlates significantly with reading microblogging sites ( $p = 0.001$ ). Reading microblogging sites also correlates significantly with reading blogs ( $p < 0.001$ ). In other respects, though positive, correlations are not significant. Posting, however, shows a more consistent relationship across media. Frequent posters on SNS are likely to be frequent posters on PNS ( $p < 0.001$ ), microblogs ( $p < 0.001$ ) and blogs ( $p = 0.002$ ). PNS posters are also bloggers ( $p = 0.002$ ), and microbloggers are also bloggers ( $p = 0.001$ ). There may be a slight suggestion here that reading behaviour is governed more by preferred media, whereas posters will post on a wide range of media. Number of connections over SNS, PNS and microblogs is in all cases correlated to a highly significant degree.

358 respondents of 515 (61%) indicated that they have an internet-enabled mo-



Figure 7: Frequency of Use of Mobile Devices for Different Purposes



bile phone. It might be theorised that users with internet-enabled phones would access UGM more frequently since it is convenient for them to do so. However, no significant result was found to this effect.

#### 4.4 Mobile Devices and Social Media

A number of questions specifically targeted those with web-enabled phones. Respondents were asked about the frequency with which they use their web-enabled phone to check email, read the internet, read microblogs, read SNS and PNS sites, use photo and video sharing sites, take and share photos on social media and share web content on social media. Responses to these questions show a bimodal distribution, with users typically either doing these things often or else rarely or never. In particular, email (27.2%), reading sites such as news on the internet (31.5%) and using social media (25.7%) are those tasks that a significant percentage of users do once per day or more on their web-enabled phone. 15% of respondents use their phone for microblogging once per day or more. Other tasks were not popular usages of these devices. Figure 7 illustrates responses to these questions.

#### 4.5 Not Using Social Media

The responses from the 7% (39) of survey participants who do not use any UGM indicate that 61% of them are female, 44% are under the age of 35, and 72% hold one or more university degrees.

When asked why they do not use Twitter or Facebook, the majority response (25.45%) is that they are not interested in doing so. Those that provide more

specific information commonly cite content value (18.18%) and privacy concerns (16.36%) as their reasons for not using the media. Lifestyle aspects such as preference for face-to-face interaction or not often using the computer or preferring not to account for a further 18.18% of reasons given. 12.72% don't have time to use the media and 7.27% are concerned about bullying and abuse. One user (1.81%) specifically cites trouble with finding the relevant content. For PNS, the picture is slightly different, with the majority reason for not using being a perception that it is irrelevant or that they don't know what it is. This perhaps reflects the large number of students in the sample.

76% of respondents who say they do not use social media say they know enough about UGM, but do not wish to use it. In other words, for our participant sample, non-use of social media is not due to being older or lacking knowledge/expertise.

There is a colourful variety in the ways people express their lack of interest in the content provided on microblogging sites. "Worthless drivel", "self-important ramblings", "trivial rubbish", "not interested in what celebrities had for breakfast", "narcissistic" and "people shout about their own lives too much" are some of the comments people made, and largely reflect the tone of comments with regards to not using microblogging.

For SNS, some similar comments appear, such as "indifferent to other people's trivia". However, comments are often more personal, reflecting a complexity in fitting Facebook into their lives. One user's boyfriend wanted them to stop using the site. Another spends "all day at work on the computer" and doesn't want to spend leisure time in front of the screen. One user thinks "it's a bullying tool"; another thinks it is "too fraught with risks". One user perceives that their profession requires them to remain private. Other similar comments reflect a thoughtful, more involved relationship with not using social networking.

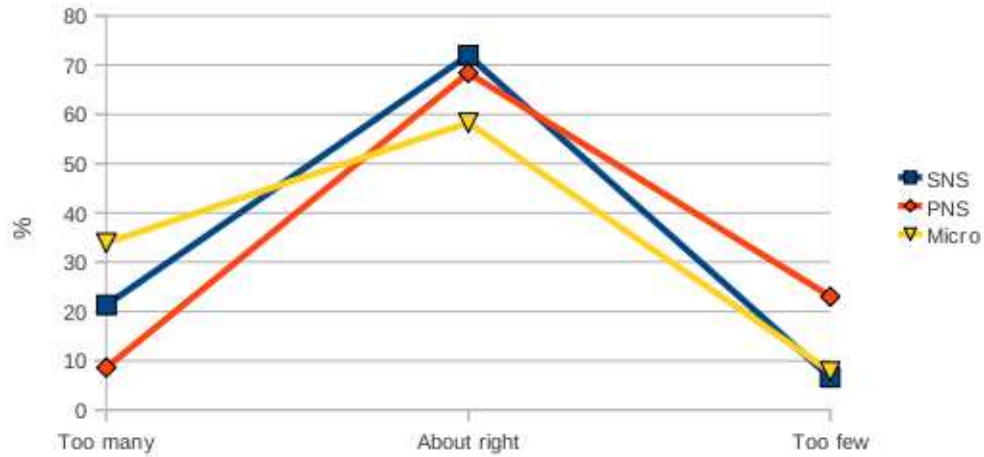
## **5 Findings Related to Volume, Interestingness and Overload**

This section outlines findings related to volume of posts/comments received, the level of interest respondents have in these posts and whether they perceive that they are receiving too many. Each of these will be taken in turn. Then the issues will be explored in the broader context of responses to other questions for each medium in turn. Finally, respondents' overall comments will be discussed with particular attention to volume, interestingness and overload.

### **5.1 Perceptions of Number of Posts Received (Volume)**

For SNS, the majority perceive the number of posts they receive to be about right for them (72%), and of the remainder, slightly more perceive that they receive too many posts rather than too few (21.3% as opposed to 6.6%). For PNS, the picture

Figure 8: Volume



changes slightly. Again, most (68.4%) perceive that they receive the right number of posts, but of the remainder, 23%, as opposed to 8.6%, would rather receive more. This ties in with the earlier finding that PNS users post less (88.3% of users posting monthly or less on PNS, whereas 70.3% of SNS users post at least weekly). Microblogging users again mostly perceive that they receive the right number of posts for them (58.3%), but this time, more users perceive that they receive too many posts (33.9%), with only 7.8% receiving too few. Respondents who use both SNS and PNS are significantly more likely to perceive that they receive too many posts on SNS than PNS ( $p < 0.001$ , determined using Wilcoxon signed rank test, a non-parametric paired test). Those who use microblogs and PNS are significantly more likely to perceive that they receive too many posts on microblogs ( $p < 0.001$ ).

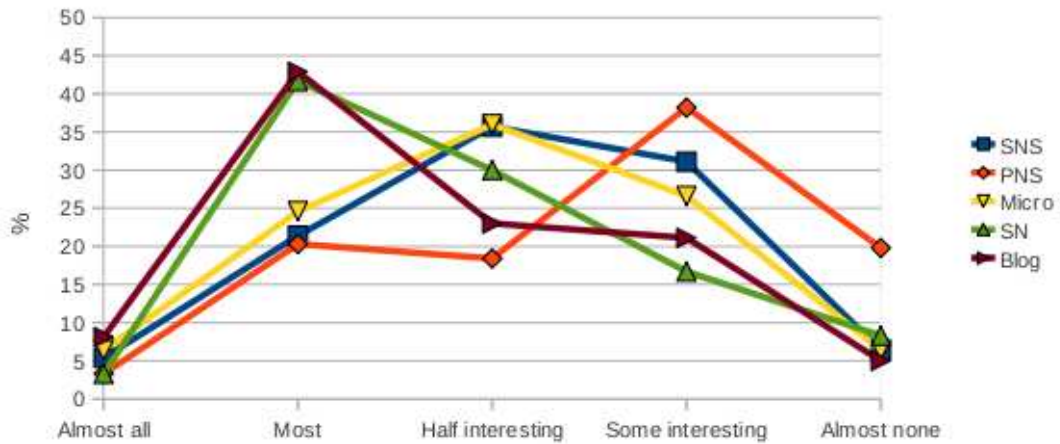
Respondents who perceive that they receive too many posts on social media are significantly more likely to have the same perception on PNS ( $p = 0.001$ ) and microblogging sites ( $p < 0.001$ ). However, perception of number of posts received on PNS does not correlate quite so well with perception of number of posts received on microblogging sites.

There was no evidence to suggest that gender, occupation (student or not) or whether a respondent uses an internet-enabled mobile phone have any influence on users' perception of volume. However younger users were less likely to perceive that they receive too many posts on SNS ( $p = 0.001$ , Spearman's) and microblogging sites ( $p = 0.006$ ). No age correlation was found with perception of volume on PNS.

## 5.2 Interest Level in Posts Received (Interestingness)

For SNS, the majority, 35.7%, say that the posts they receive are half interesting, half boring, with slightly more of the remainder (37.5% as opposed to 26.8%) say-

Figure 9: Interestingness

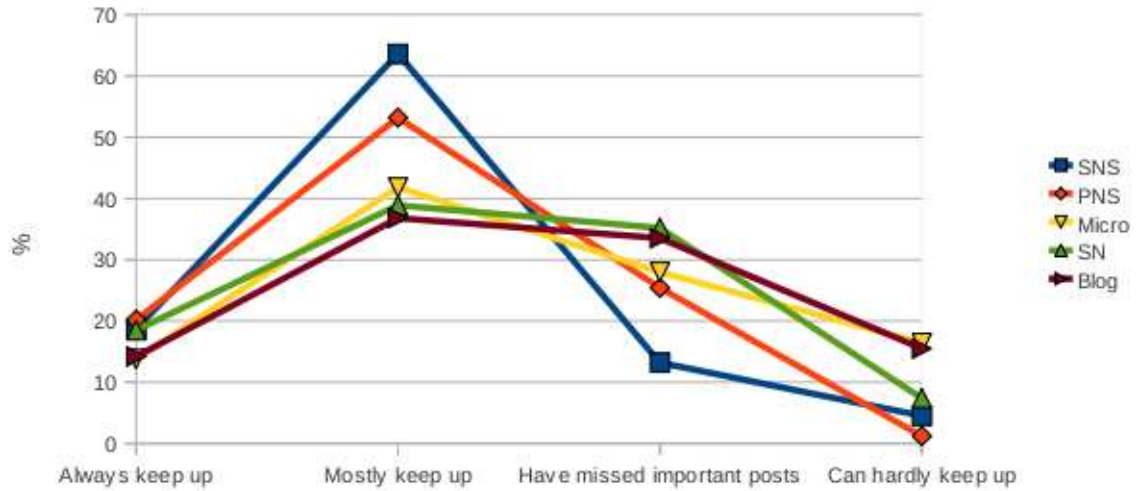


ing that they find more of the posts uninteresting than interesting. With regards to the proportion of interesting posts received, opinion is more spread on PNS. 18.4% say they find the posts half interesting, half boring, with 58% more bored, and 23.6% less bored. Generally speaking, PNS are perceived to be more boring. Of microblog users, 36% find the posts they receive half interesting, half boring, with 31% generally more interested than that, and 33% less interested. This gives microblogging a slightly higher interest level than social or professional networking media, perhaps because Twitter is based on the interest graph (linking those with similar interests) rather than the social graph of describing existing relationships. In terms of interest level, social news sites and blogs take the prize, as the majority response for both media was that most posts are of interest to them (41.7% for social news sites and 42.9% for blogs). Comparing the responses of those respondents who use both media, blogs were found significantly more interesting than SNS ( $p < 0.001$ , Wilcoxon) and significantly more interesting than PNS ( $p < 0.001$ ) and blogs were significantly more interesting than microblogs ( $p = 0.001$ ). Other results were less marked, though SNS is perceived as somewhat more interesting than PNS by those users who use both ( $p < 0.05$ ).

Generally speaking, respondents who perceive a high degree of interest in one social medium are likely to perceive more interest in others; all correlations were positive, and all were significant, except for interest levels in social news, which did not correlate so well with the other media. (SNS, PNS,  $p < 0.001$ ; SNS, micro,  $p = 0.008$ ; SNS, blogs,  $p = 0.005$ ; PNS, micro,  $p = 0.006$ ; PNS, blogs,  $p = 0.005$ ; micro, blogs,  $p < 0.001$ ).

Respondents with internet-enabled mobile phones are slightly more likely to find PNS interesting than those with no mobile internet access ( $p = 0.01$ , Phi/Cramer's V). There was no evidence to suggest that gender, occupation (student or not) or

Figure 10: Overload



whether a respondent uses an internet-enabled mobile phone have any influence on the extent to which the media are perceived as interesting. Younger people find posts more interesting on SNS ( $p < 0.001$ ) and PNS ( $p = 0.002$ ), with less significant correlations to a similar effect on microblogs and social news. Perhaps older people have read it all before?

### 5.3 Ability to Keep Up with Posts Received (Overload)

Most SNS users are able to keep up with reading the posts they receive (82.3% say they always or mostly read and respond to others' posts) with the remainder missing important posts or failing to keep up with the volumes received. 73.4% of PNS users mostly or always keep on top of the posts they receive, with 26.6% missing important posts or failing to keep on top of posts received. Notice that despite fewer PNS users perceiving that they are overloaded, they nonetheless are less likely to keep up. Generally speaking, microbloggers are able to keep on top of the posts they receive (55.6% mostly or always reading and replying to posts received); however at 44.4%, microbloggers are those most often failing to keep up. Social news users and blog-users show a similar profile to microbloggers in terms of their ability to keep on top of their reading, perhaps reflecting that these sites all focus on the interest graph. Those respondents who use both microblog sites and SNS are significantly more likely to keep up with the SNS site ( $p < 0.001$ , Wilcoxon); those who use social news sites and SNS are significantly more likely to keep up with the SNS ( $p = 0.001$ ); likewise those who use blogs and SNS are significantly more likely to keep up with the SNS ( $p < 0.001$ ).

In the general case, respondents who claim to keep up with their reading on one

medium also keep up with their reading on other media, though the relationship is not significant in all cases (SNS, PNS,  $p < 0.001$ ; PNS, micro,  $p < 0.001$ ; PNS, blogs,  $p < 0.001$ ; micro, SN,  $p < 0.001$ ; micro, blogs,  $p < 0.001$ ; SN, blogs,  $p = 0.009$ ).

There was no evidence to suggest that gender, occupation (student or not) or whether a respondent uses an internet-enabled mobile phone have any influence on overload. Younger people say that they keep up better with their SNS reading ( $p < 0.001$ ), with no significant correlations found between age and ability to keep up with reading on other media.

#### **5.4 Facebook and Social Networking Analysis**

Frequency of reading and posting are highly correlated ( $p < 0.001$ , Spearman's). Those who read and post frequently are more likely to find posts interesting ( $p < 0.001$ ,  $p < 0.001$ ) and less likely to experience overload ( $p < 0.001$ ,  $p = 0.000$ ), and those who read frequently are less likely to perceive themselves to be receiving too great a volume of posts ( $p < 0.001$ ).

Those with more connections on Facebook and other SNS post more ( $p < 0.001$ ) and read more ( $p < 0.001$ ). They are also significantly more likely to claim interest in a greater proportion of the posts they receive ( $p < 0.001$ ). Whether a user has many connections or few has little impact on perception of volume. In other words, the number of posts received in absolute terms does not affect whether a respondent perceives themselves to be receiving the right number of posts (since receiving more posts inevitably results from having more connections). This suggests that those who are more invested in the medium, having more connections and reading and posting more often, are the ones who experience less overload, not those with fewer posts to read. In fact, a weak correlation was found ( $p < 0.05$ ) to the effect that those with fewer connections are more likely to experience overload.

Those who perceive that they receive too great a volume of posts are less likely to find the posts interesting ( $p < 0.001$ ) and more likely to experience overload ( $p < 0.001$ ). Those who find the posts interesting are less likely to experience overload ( $p < 0.001$ ).

#### **5.5 LinkedIn and Professional Networking Analysis**

As with social networking sites, professional networking site users who read more also post more ( $p < 0.001$ , Spearman's), have more connections ( $p < 0.001$ ), are less likely to perceive that they are receiving too great a volume of comments ( $p = 0.001$ ) and find more of the posts interesting ( $p < 0.001$ ). Users who post more have more connections ( $p < 0.001$ ) and find more of the posts interesting ( $p < 0.001$ ); however there is no correlation between posting frequently and perception of volume, unlike in SNS where frequent posters are less likely to perceive that they receive too great a volume of posts. No correlation was found between frequency of reading and posting and overload.

Unlike with social networking, where no relationship was found, for PNS, well-connected users are less likely to perceive that they receive too great a volume of posts ( $p < 0.01$ ). Well-connected users, on the other hand, are not especially more likely to find the posts they receive interesting. The fact that users have a greater appetite for posts on professional media may reflect that people are posting less on these media; the most common frequency of posting on social media is "weekly" (38.3%), with most users posting at least weekly (70.3%), whereas for professional media, it is "hardly ever" (42%), with the majority of users posting hardly ever or never (67.5%). There are quite simply fewer posts on professional media. Having more connections does not correlate with overload or lack thereof.

It is interesting that well connected users do not find the posts they receive more interesting than less well connected users. This suggests that interest in others' posts is not the driving factor in investment in the medium. Perhaps this reflects that professional networking is something one does with the aim of professional advancement, so users may be tolerant of a lower level of gratification. It may be that users connect with others on PNS for the purposes of documenting and extending their network rather than as a means to access certain peoples' posts; in other words, PNS may not primarily be about posts and updates. The relationship between perceiving excessive volume in the number of posts received and overload is weaker in professional media as opposed to social, suggesting unclear desires or a more complex relationship with regards to posts received.

## **5.6 Twitter and Other Status Update Media Analysis**

As with social and professional media, reading frequently correlates with posting frequently ( $p < 0.001$ ), having more connections ( $p < 0.001$ ), finding more of those posts interesting ( $p < 0.001$ ) and not experiencing overload ( $p = 0.002$ ). Posting frequently correlates with having more connections ( $p < 0.001$ ), finding more posts interesting ( $p < 0.001$ ) and not being overloaded ( $p = 0.005$ ). Having more connections correlates with finding more posts interesting ( $p = 0.001$ ) though not with (lack of) overload, as for PNS. Predictably, those who perceive that they are receiving too great a volume of posts are also those who are more overloaded ( $p < 0.001$ ). Those who find the posts more interesting are less overloaded ( $p < 0.001$ ).

We included a number of questions specifically relating to overload on Twitter, in order to gain an insight into how people use the micro-blogging platform. 38% of tweeters in our study were using it both in personal and professional capacity, 38% for personal use only and 24% for professional use only, making usage fairly balanced. 51.5% use Twitter to follow the status updates of friends, family and/or celebrities. 48.5% use it to get professional information from colleagues. 46.6% get news updates via twitter and 34.3% converse with friends. 15.2% ask questions and get help via Twitter. Those who use Twitter for personal use are more likely to follow friends, family and celebrities (63.04% as opposed to 36.61%). Those who use Twitter for professional purposes are more likely to use Twitter to get professional information (73.21% as opposed to 42.75%).

Of Twitter users, 64.9% have at some time unfollowed a user because they post too much, with 20.2% doing this in the last week or "all the time". 70.4% have found it difficult to locate the important/interesting posts amongst the others, with 23.7% finding this all the time, and 24.7% having found this within the last week. 66.3% have felt at some time that they receive too many tweets and can't keep up, with 21.2% of those feeling this way all the time, and 24.5% having felt this way in the last week.

44.1% have unfollowed a user because they did not post enough interesting information, with 18.8% doing so in the last week or all the time. 55.6% have felt the need for a tool that filters out irrelevant posts.

Those who use Twitter in a personal capacity read more ( $p < 0.01$ , Phi/Cramer's V), post more ( $p < 0.05$ ), perceive less excess of volume ( $p < 0.01$ ) and experience less overload ( $p < 0.01$ ) than those who use Twitter in a professional capacity only. They are somewhat more likely to un-follow another user because they do not post enough interesting information than those who use Twitter in a professional capacity only ( $p < 0.05$ ). They are also slightly more likely to feel the need for a tool that filters out irrelevant posts ( $p = 0.05$ ).

Those who use Twitter in a professional capacity do not especially read more or less than those who use Twitter in a personal capacity only; however they post more ( $p < 0.05$ ), have more connections ( $p < 0.05$ ) and are more likely to perceive that they receive too great a volume of posts ( $p < 0.01$ ). They are significantly more likely ( $p < 0.001$ ) to feel that they receive too many posts and are overloaded than those who use Twitter in a personal capacity only.

These results echo those found in social and professional media, where social users have less tolerance for uninteresting posts, and professional users don't keep up as well with their reading. A picture also starts to emerge of professional users being perhaps more focused on attracting attention than giving it; perhaps there are more broadcasters or self-promoters among professional users. Intuitively speaking, some successful broadcasters such as known celebrities will be using Twitter in a professional capacity only, and their followers will perceive themselves to be using Twitter in a personal capacity, following those people out of pure interest. This takes the difference between personal and professional users to its extreme, illustrating how a personal user may be interest-led, where a professional user may be focused on projecting an image or attracting fans. It is unclear how many successful celebrities responded to our survey, but the same dynamic may play out to a lesser extent among more typical users.

Note however that there are potentially different models of professional Twitter use, with self-publicisers, who are likely to be "meformers" [Naaman et al], being only one possibility. Experts such as professional bloggers may be classic "informers" [Naaman et al], primarily attracting followers through the dissemination of interesting information, although research has shown that these are rarer. Another type of professional use may take the form of workplace or workgroup cliques, where Twitter is used as the medium of communication within the group. Further research would be required to determine the prevalence of these patterns,



but the clique pattern seems more likely to reflect social media usage patterns, and thus wouldn't affect our findings here other than to weaken the difference between social and professional use.

Those who use Twitter in both a personal and a professional capacity, as opposed to those who use Twitter for either professional or personal purposes but not both, read more ( $p < 0.01$ ) and post more ( $p < 0.01$ ), have more connections ( $p < 0.001$ ) and are more overloaded ( $p < 0.05$ ). They are more likely to have unfollowed a user because they post too much ( $p < 0.01$ ) and more likely to have unfollowed a user because they did not post enough interesting information ( $p < 0.05$ ).

## **5.7 Social News and Blogs Analysis**

For social news sites, again, posting and reading are correlated, though less significantly so than for other media ( $p = 0.01$ ), perhaps due to the smaller number of respondents. Those who read more also tend to find more of the posts interesting and tend to experience less overload, though this result was not significant. Those who post more do not especially tend to keep up better and find more of the posts interesting, perhaps hinting that the medium attracts a "broadcaster" user subtype, more focused on disseminating information than receiving it, though more data would have to be gathered to form any conclusions regarding this medium.

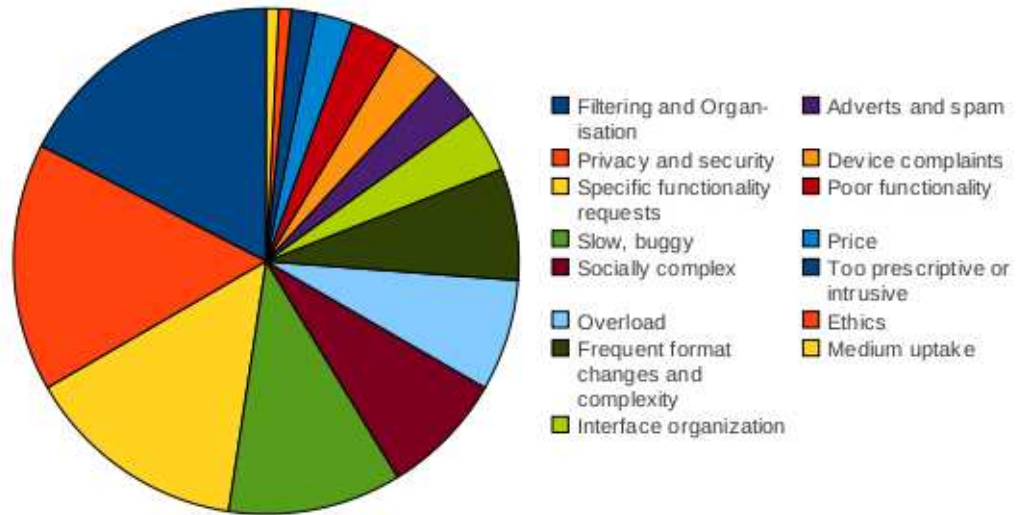
Bloggers who read more also post significantly more ( $p < 0.001$ ), as for the other media. They are also significantly more likely to find the posts they read interesting ( $p < 0.001$ ) and less likely to be overloaded ( $p < 0.01$ ). Bloggers who post more find posts more interesting ( $p < 0.001$ ) and experience less overload ( $p < 0.01$ ). Those who find blogs interesting are less likely to be overloaded ( $p < 0.001$ ).

## **5.8 Applications Used, Shortcomings and Desired Functionalities**

A final question asked users to comment on "which applications do you use to read social media, their main shortcomings, and what an ideal social media access tool would have in terms of functionalities, which you're currently missing?" Responses illustrated a varying degree of technological sophistication among respondents. For example, with regards to the applications used to access the media, responses range from "not sure what's meant by applications", "I have already said I have a laptop and internet-accessible phone", "The internet?" through to "hootsuite, tweetdeck", "Twitter.com, qTwitter, gwibber", "Twitbird Pro, Official Twitter App, Osfoora" and other such responses reflecting an awareness of options for accessing the media. Of 272 respondents to this question, only 80 demonstrated in their response a clear understanding of what an application is. The others, potentially, remain limited to the official website or default client on their device through an unawareness of alternatives.

As a result of a poor understanding of the concept of an application, responses to this question included comments on media and devices as well as applications. The responses were interesting nonetheless. 126 respondents gave complaints and

Figure 11: Complaints and Concerns



described desired functionality, with the remainder having no opinion or expressing satisfaction with the functionality already available to them. The most common response, from 22 respondents, was that better functionality for filtering out the relevant from the irrelevant posts would be desirable; a further 9 respondents complained of overload in the posts they receive. 15 respondents are concerned about privacy, with a further 5 concerned about security issues. 14 find their application slow or buggy. 16 users expressed a desire for a specific piece of functionality. These were generally speaking very varied: for example, three users would like an application that combines all their media into one; two users would like to see video chat included and one user would like to see summarisation functionality. 10 respondents find the media socially or personally challenging in some way; addictive, demanding, distracting or leading to tension. Other concerns include price, ethical concerns and adverts and spam. 9 respondents complained about interface complexity, with the majority of those specifically citing Facebook's recent frequent interface changes. Figure 11 shows the proportion of respondents expressing the different concern types in graphical form.

Some of those respondents who focused on filtering and overload made statements of the problem; "gets too cluttered with rubbish," "not optimal for filtering og searching [sic]," "the main problem is the volume of information," "too many useless and time wasting tweets," "I particularly dislike people who post the same

thing many times.” Other respondents stated possible solutions, some vague and others more specific; ”would be good to have a facility that automatically puts tweets into a folder categorized by specified hashtags,” ”tool to categorize topics by importance,” ”something that conflates identical posts would be useful,” ”social sites could do with a digest option,” ”Increased filtering options would be nice,” ”it would be great if it could delete irrelevant posts for me.” Others perhaps more optimistically focus on quite advanced desired functionality; ”I think the automatic summarization on public opinions would be great!” and ”I would like some tool to, regardless the twitter account I am using (if more than one) allow me to have a single but also debriefed glimpse of my interest.”

## 6 Discussion

Results generally speaking show a high degree of engagement with social networking media, and a significant engagement with other media. The general picture presented by our findings is one of broad satisfaction, with the majority of the users perceiving that they have no major complaints regarding the media. Employed users make more use of professional media than students. Male users are more likely to use a range of media, with women more likely than men to use social media only. Younger respondents are more likely to use social media only, with older respondents using a range of media, though note that our younger respondents were more likely to be students and therefore have less interest in professional media. Under 25s have more connections on social media and older people have fewer. The number of connections people have on professional media and microblogging sites tends to be lower. Social media and microblogs are most often read once a day or more, whereas blogs and professional media are most often read once per week. Males post more often to microblogs. Blogs and professional media receive a lower volume of posts. For social media and microblogs, users may fall into two camps; frequent posters and infrequent posters.

Most users are satisfied with the amount of information they receive and are able to keep up with it. Overload appears better related to the extent of engagement with the media than with quantity of posts received in absolute terms; users with more connections report less overload despite their inevitably receiving more posts. Users engage frequently with the media despite middling-to-low perceptions of the interest of posts received in some cases; this seems to be accepted as par for the course. However a significant minority express a desire to improve the situation through filtering functionality.

It is possible that the questions about Twitter, in particular, ”[have you] Felt the need for a tool that filters out irrelevant posts”, may have primed the user to give more answers around this topic in the final comments section. However, although this may have influenced the number of users making this kind of comment, it doesn’t change the original finding that 55.6% of respondents indicate that they have felt the need for such a tool, and the free text section at the end of the question-

naire provided a valuable forum for users to speak more freely on the matter. For example, some users talk about wanting a ranking system, whereas others would like irrelevant posts to be deleted. Some users talk about quality control where others want the posts of closer friends to be prioritised. It is clear that investigations in the area of ranking at summarisation would be welcomed by a significant number of users.

One of the questions in the survey asks users about their ability to keep up with the information they receive; for example, have they missed important/interesting information. Microbloggers complain of overload to the greatest extent. The majority of users, especially for SNS and PNS, claim that they mostly keep up and do not miss important posts; however, this raises the question of how they would know if they had missed an important post. Information overload leads to the problem of information overlook; "missing critical information that has been clouded by information overload" [Lansing Taylor], and the user will be unaware that they have missed this information, creating the illusion that they are better informed than they actually are (in the words of Donald Rumsfeld, they are "unknown unknowns"). The deception may be compounded by the "recency illusion" []; a user who has recently become aware of a new concept on social media may feel pleased to be informed of it in a timely manner, and it may not occur to them that the concept may have been around for years or decades unbeknownst to them. In fact, the extent to which a person feels satisfied that they are informed relates better to how recently they have invested time in it, and learned something, whatever it may be, than it does to the actual extent to which they are informed, a quantity they cannot possibly know.

A survey such as this can only scratch the surface of this issue, depending as it does on respondents' own subjective perceptions of the efficacy of the media in bringing the right information to their attention. Controlled tests would need to be developed to assess the extent of the problem in practical terms; however, on a philosophical level the question answers itself. The amount of information in the world is vast and ever increasing, and one human being can only ever hope to scratch the surface of it.

The subject of overload and filtering can be approached from another angle. The problem facing a Twitter user is twofold; firstly to optimise the ratio of interesting tweets read to total number of tweets read (precision) and secondly to maximise the total number of interesting posts read (recall). Users complaining of requiring a filtering tool are dissatisfied with their precision, that is to say, they are having to read too much uninteresting input. But precision and recall trade off against each other; a user may increase precision by focusing on, for example, only reliably interesting tweeters, if they are prepared to sacrifice some recall, i.e. obtain in total a lower amount of interesting information. A hypothetical user, given a way of improving their precision (such as a filtering tool) will simply increase the amount of material consumed to bring precision back down to their personal tolerance level and benefiting from improved recall whilst holding precision constant. Provision of filtering tools isn't really about improving precision, that is to

say, getting the uninteresting posts off people's screens. Filtering tools are about improving accessible recall.

A difference in professional and personal media usage emerged in the research, with professional users being less interest-driven, posting and connecting despite a lower degree of interest in reading what other users have to say. This raises questions about what captures people's interest. It seems that when it comes to social media, people are making more of an effort to keep up, perhaps because connections are personal on social media, and one wouldn't want to ignore a friend. However, keeping up isn't purely obligation driven, as respondents also find social media more consistently interesting. It seems likely there is a tendency to find people more interesting purely because they are people we know, and may be talking about events that affect us or other people that we also know. When it comes to the interest graph, however, the picture is different. Number of followers on Twitter follows a Zipf-like pattern (<http://www.hubspot.com/Portals/53/docs/01.10.sot.report.pdf>), with a small number of users having a very high number of followers, and number of followers having no clear relationship with the number of followed. Personal relationships force a more even distribution, as these are people we have to make time for in our lives, but the interest distribution is decidedly unfair. As soon as we move into professional usage, our research has shown, usage patterns drift closer to the interest model, with a disparity between the amount of attention sought and the amount of attention given. This works well on media such as Twitter, where personal-usage "receivers" follow professional-usage "broadcasters"; however on PNS a level of tension is evident in the response pattern to our questions about the medium. Somehow, as a status update medium, it falls awkwardly in the gap between social- and interest-graph media.

Most participants are unaware of the possibility of using alternative clients to customise their experience of the media. This has implications for the provision of filtering functionality, as many users may not be sufficiently technologically sophisticated to benefit. Technological and social sophistication required by the media also emerge as themes in the free text section. Filtering, organisation and overload feature prominently; however privacy, security and the perceived dangers of the internet also loom large. Interface complexity also comes up as a concern. There is a sense that in order to benefit from the media, a level of investment is required in learning how to use the technology and keeping abreast of its updates, and that for some people, this may be prohibitive.

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