



## **Scientists and Twitter: How does this Group of Fact Finding Professionals use Twitter?**

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### **1 Introduction**

The use of social media by professionals to communicate to different audiences has become a modern day standard practice. In particular, Twitter has become a popular social media medium of choice for many professionals looking to reach vast audiences through simple and quick means (Gilpin, forthcoming). Twitter is a global online social network used by millions to communicate to their friends, family members and co-workers through their computers and mobile phones. It allows users to post short messages (up to 140 characters) that can be read by any other Twitter user. Users can follow other Twitter users, though a user who is being followed by another user does not necessarily have to reciprocate by following them back, which makes the links of the Twitter social network directed. Limiting communication to 140 character Tweets means professionals must select and narrow down their message to the most essential information before disseminating to followers. The benefit of quick and easy communication comes with the cost of potential information loss or possible miscommunication of the intended message. Yet the numbers of users on Twitter make it a very attractive option for anyone looking to spread information. As of February 2017 it is estimated that Twitter has around 320 million monthly active users (Reuters, 2017), with a total of 1.2 billion registered users (according to 2015 estimates) (Wagemakers, 2015).

This study provides first a background and rationale, followed by a review of relevant academic literature. The next section covers the approach which describes the research questions, the methodology, and finally a section on self reflection. Following this, is the core of the study, consisting of the assessment and findings, and subsequent conclusion.

#### **1.1 Background**

This study sets out to explore the nexus of Twitter and science. Broadly, it seeks to understand how one particular group of

professionals, scientists, uses Twitter. For scientists (or any profession) Twitter provides an opportunity to communicate with peers. This may be used as a means for disseminating research findings, following along live with academic conferences, sharing expertise with policy makers and journalists, as well as receiving feedback and discussing with other experts in their field. The use of social media, and especially Twitter, has been the topic of much discussion by scientists in popular media with some clearly in favour of the platform and others adamantly opposed to it. In one instance, a young academic wrote an op-ed in *The Guardian* titled “*I’m a serious academic, not a professional Instagrammer*” (Anonymous, 2016). In the piece, the author proclaims, “*It has got to the point where those of us who wish to keep our social media accounts private, or for personal use only, face being frowned upon for somehow being less enthusiastic about what we do.*” On the other side of the argument, Van Eperen & Marincola 2011 write, “*(...) ability to communicate to the masses via social media is critical to the distribution of scientific information amongst professionals in the field and to the general population.*” In a response to such discussions, the scientific community ironically started using the hashtags #seriousacademic and #nonseriousacademic when using Twitter.

One of the cornerstones of modern science is the peer-review process.<sup>1</sup> This means once a scientist (or group of scientists) completes a study they submit an article for publication where it is reviewed by several other scientists or “peers” within the same field. The reviewers, who are anonymous, provide comments and feedback on the article. The authors of the study must then, if they choose, revise their article and resubmit it for publication. When communicating research in an academic publication, scientists are required to provide detailed background of the field they are studying (e.g. state of the art), a description of the methodology they used including assumptions they made, and finally their findings as well as gaps in understanding or uncertainties.

In this regard, it could be assumed that scientists, as a group, might transfer this philosophy applied in the scientific community into other forms of communication - such as on Twitter. This would therefore link to the idea that people practice online reputation management, meaning scientists may apply strategies or approaches to ensure their reputation as a scientist is maintained to peers or followers. Therefore, this study asks the question: How do scientists perceive their participation on Twitter? Do scientists transfer philosophies of academic rigor based in the peer review process to Twitter? This study does not try to answer the question as to whether science as a whole is objective, i.e. whether scientists aim to eliminate personal bias, commitments or involvement in their research findings. This is assumed to be the case.

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<sup>1</sup> See [http://undsci.berkeley.edu/article/howscienceworks\\_16](http://undsci.berkeley.edu/article/howscienceworks_16)

## 1.2 Review

The research here could be considered Digital Anthropology in the sense that it is “internet related” – focusing on Twitter. However, as Miller et al 2016 point out - from an anthropological perspective, rather than focus on the platform of Twitter, *“it makes more sense to think of the millions of tweets, the core genres, and its social and emotional consequences for the users. It is the content rather than the platform that is most significant when it comes to why social media matters.”* In this sense, Twitter provides nothing more than the framework or boundaries (i.e. place) by which to study scientists, as a community, and the communication within this group.

Looking to understand how a group uses Twitter, or social media, as a professional tool, first raises the questions of whether this is truly the case. Not surprisingly, several researchers have explored the idea of, and pointed to the blurred lines between, professional and personal use of online platforms (Andrejevic, 2004; Lüders, 2008; Papacharissi, 2009). Lüders 2008 highlights that these lines can only truly be explored on a case by case basis, reviewing the structure and content of an individual.

Naaman et al. 2010 analysed data from 350 Twitter users in order to examine their activity and understand the content of their messages and their conclusion is that Twitter users can be separated into two ‘content camps’. The majority of users focus on the ‘self’ while a smaller group is driven by sharing information. The first group, which they call “Meformers”, may use Twitter as a way to maintain relationships, but the second group “Informers”, tend to be *“more conversational, posting mentions, and replies to other users, and are more embedded in social interaction on Twitter, having more social contacts.”*

Research also shows that individuals have a sense of audience in mediated conversations, whether Twitter, Facebook, blogs, or WhatsApp. With audiences in mind, whether constructed or imagined, individuals aim to present themselves appropriately based on the context (Marwick and Boyd, 2010). Of course, the disconnect between individual and audience must be considered. While Twitter accounts can be made private – most are public, meaning anyone can view the account. The option of re-tweeting or forwarding Tweets via email, shows that it is unlikely that an individual knows who is reading (Marwick and Boyd, 2010). Other types of social media sites where anonymity is the norm, may provide a platform for users to post or communicate information without concern of managing their online reputation (Corre, Araújo, Mondal et al 2015).

Priem & Costello in their 2010 study sought to find out if scientists used Twitter to cite science, how they did this, and whether this carried any impact within their scientific careers. Based on interviews with 28 scientists and a selected sample of 2,483 Tweets they determined that scientists in fact do use Twitter to cite articles, but that they do this differently from standard scientific practice. They also showed that scientists directly link to a resource about half the time they tweet, while using an intermediary source (indirect link) the other 50 percent

of their Tweets. Moreover, they found that Twitter is often used more as a conversation platform, not only to speak to scientists within their field, but across disciplines. In the end, their study also highlighted that the use of Twitter by scientists may also represent some form of impact within the scientific community. Similarly, Letierce et al 2010, by following hashtags used at three academic conferences, set out to understand the type of content scientists tweet, how they do it, and if their Tweets reach communities beyond their own. They determined that by studying conference hashtags, one could identify the trend topics of such events by counting the number of Tweets posted with conference hashtags as well as re-tweets, and that those scientists who have some kind of authority at the event, are likely to have a high 'authority' on Twitter (e.g. retweets). More broadly, Van Eperen & Marincola 2011 asked how scientists use social media to communicate their results, and after doing a statistical review of various social media platforms determined that social media use is quite broad amongst this group.

## 2 Approach

This section aims to explain the research questions that are trying to be answered in this study, followed by a description of the methodology to be used, and finally a personal reflection about the study.

### 2.1 Research questions

The research question at the heart of this study is:

1. *How do scientists perceive their participation on Twitter? Do scientists transfer philosophies of academic rigor based in the peer review process to Twitter?*

Additional sub-questions are also relevant and therefore explored within the scope of the study:

2. *Are scientists concerned with communicating complex topics accurately i.e. with 140 characters? Is anything lost? Do scientists seek to maintain any kind of academic legitimacy of results?*
3. *Do they employ any tactics to "boost" readers/followers which may misrepresent their science?*

### 2.2 Methodology

Participant observation as well as semi-structured interviews was used to explore answers to the above questions. Three scientists were selected and agreed to participate. From these three, all were working on 'applied policy' science topics, meaning that their science is focused on and funded through research grants intending to provide insight to and ultimately improve public policy. Of them, two came from the

social science fields of political science and economics while the third focused on natural science (i.e. freshwater biology).

These scientists were selected because they were already Twitter users. While one was newer to Twitter (less than 1 year). In this sense, the study is biased towards scientists who are already Twitter users and therefore those who may view Twitter negatively as not to use it, are not covered in this study. But more so, the limited number of participants means that the study could not be argued to be representative of scientists using Twitter. Two participants come from my personal network, while the third is someone I am following on Twitter, and who follows me as well.

The objective of the participant observation was primarily to provide context by which to answer the research questions above. In this sense it answers the 'what' part of the study. The interviews are used to go deeper into the questions and understand the thinking of the participants regarding Twitter and their use of the platform. This part focuses on the 'why' and 'how'.

For participant observation, the Twitter feeds of the three participants were analyzed. In particular the last 50 tweets (including re-tweets) were used to provide a boundary for the study, without necessarily linking to a specific time frame e.g. Tweets within the last 60 days. This also ensured consistency that the three participants were covered equally in this regard, which would not have been the case if a time frame was selected due to their own Twitter habits.

In the analysis, the Twitter feed of one participant was quickly scanned in order to provide a general understanding of the feed. There was no tagging or assessment in this first step. In the next step, the feed was reviewed and observations were tagged, followed by coding and finally a categorization of the feed. This process was subsequently followed for each of the other two participants.

In a next step, short semi-structured interviews of about 15 to 20 minutes were conducted with each of the participants. A short questionnaire (see appendix) was used to loosely guide the discussions, but participants were encouraged to speak freely on the topic and not feel 'bound' to answering the question specifically but instead provide insight from their experiences. Two interviews were conducted over Skype, and one was done in person. The interviews were then transcribed and coded to assess the results and group them.

### 2.3 Self reflection

In addition to the methods outlined above, I maintained a field diary – both to reflect my experience for referral in the future, as well as to jot down observations, thoughts or questions I had throughout the course of conducting research.

Few ethical concerns arose during this study. The main consideration was how to deal with the identity of the participants and the data and information they provide. I selected to keep the participants anonymous as this made things easier for me – in terms of asking them to provide data, as some are people I work with. I also

believed that this may support the participants to answer more freely, knowing that their identity would not be linked to the answers.

I also want to include a short explanation of how I selected this study, based on my field notes. My choice stemmed from my own growing use and therefore interest in Twitter. Originally, I was interested in the use of Twitter by online activists. Any individual with a Twitter account can post whatever they choose (some extreme uses may cause public authorities to take notice). This is one of the ongoing discussions in current US dialogue and the actual topic of 'fake news'. Personally, I also use Twitter on a regular basis. I do this both for personal and professional reasons. Working in a field at the science-policy interface, Twitter offers a means for me to share what I produce (e.g. reports, briefs) with others, including policy makers, scientists, and the general public. However, I realized in my own use that it is rare that I check or even consider much about what I post on Twitter (I mostly re-tweet, sometimes with comments). I do not consider, or check, the facts behind much of what I do on Twitter and mostly use the medium to spread messages which support my personal beliefs and world views. Within my job, I work with many scientists and researchers – a community which is driven by the pursuit of understanding. The basis of science is facts. My line of thinking then brought me to wonder whether scientists, who pursue facts perhaps more so than any other group are more aware or take deeper consideration about their own Twitter use and the messages they post.

### 3 Assessment

This section aims to summarise the findings of the data, providing first the results of the participant observation (Twitter feeds) followed by the results of the one on one interviews.

#### 3.1 Results from participant observation

As described above, in a first step participant observation was used to study the three selected Twitter feeds. To do this, the three feeds were studied on the same day – one Saturday in March 2017, and the last 50 Tweets or retweets were used for the analysis. The feeds were tagged in an effort to characterise the Tweets of the participants. The assessment of the coding step provided a first look at the feeds. These codes were then grouped together based on the identified objective as well as context of the Tweets and retweets of the three individuals. The identified groups covered the range of the Tweets and re-tweets by the three participants observed. The groups include:

1. Promoting and discussing science: These are Tweets or retweets which spread scientific findings (e.g. publications, data sets) supported by the individual and may be promoted in some way through commenting.
2. Advocacy: These focus on advocating for a specific cause (e.g. climate change) or group (e.g. women scientists).

3. Participation and communication: As scientists are often attending or holding events (e.g. workshops, conferences) a portion of their Twitter usage is also dedicated to these activities, such as communicating that an event is happening or that they are in attendance at one.
4. Humour: Twitter is also used to spread humour by the observed participants.
5. Other: This last group covers those Tweets which do not fit in the other groups, and are somewhat stand alone in relation to the overarching patterns identified and are, as well, not representative of multiple Tweets or retweets so it did not justify a new category. An example of this is commenting on political elections.

The five groups above allow for the categorisation and collection of Tweets or retweets of the three participants. However, in many instances Tweets or retweets may actually fall into two groups e.g. a Tweet which intends to be humorous, but uses elements of science within the context, or similarly one that advocates for the role of science in government decision making. In these cases, the Tweets or retweets are categorised first by the objectives (i.e. humour, or advocacy) and second by the context (i.e. science). Indeed, ‘science’ is a common thread throughout the feeds of the observed participants. Examples about the identified groups are provided below.

While not the purpose of the study to provide a quantitative assessment of the participants’ Twitter feeds, the Table below is helpful to show that the three participants demonstrated somewhat similar Tweeting or retweeting objectives. All tended to focus their efforts on Group 1, while Participant 3 had the most focus on science, followed by participation and communication – which is also linked to science. Participant 2 had the strongest focus on advocacy. Participant 1 had the most covering the 4 Humour and 5 Other groups.

Group	Participant 1	Participant 2	Participant 3
1 Promoting and discussing science	26	22	34
2 Advocacy	7	17	3
3 Participation and communication	11	8	12
4 Humour	4	2	0
5 Other	2	1	1

Table 1: Overview of groups per participant

The example demonstrates the use of Twitter to promote and discuss scientific findings from a publication. A comment from the participant promotes the article, and a link is provided to the paper. The hashtag #nudges is also used, and places the tweet in the discussion on that topic.

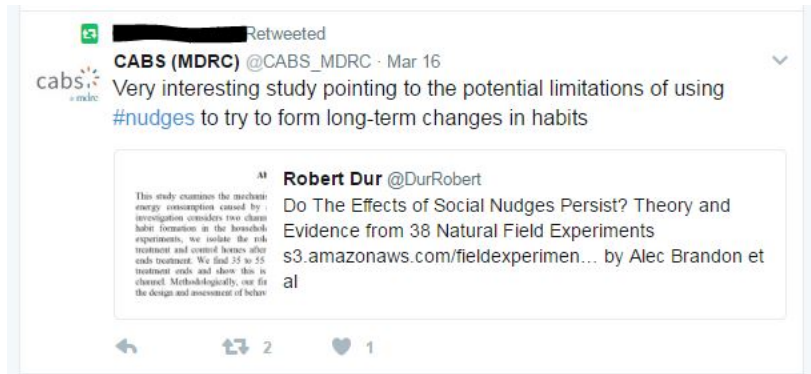


Figure 1: *Promoting and discussing science*

The next example shows the use of Twitter to advocate for environmental protection and political action. Here a link to an article promoted by an organisation, as well as a hashtag, are given.



Figure 2: *Advocacy – example 1*

Similarly, the third example shows the use of Twitter to advocate for the use of science in political decision making.

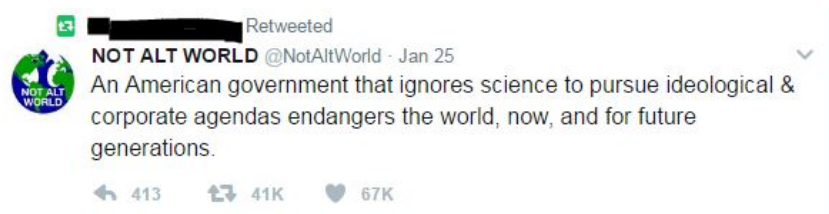


Figure 3: *Advocacy – example 2*

The next example shows Twitter used to demonstrate participation in an event, where a participant promotes an event that they are attending by retweeting one from the organiser. The event is a scientific discussion (i.e. workshop).





Figure 4: *Participation and communication*

The last example demonstrates a typical joke on Twitter. The retweet still includes an element of science as related to the PhD thesis of the Tweet’s author.



Figure 5: *Humor*

### 3.2 Results from individual interviews

The second step of the assessment was to conduct individual interviews with the three participants to understand more about why they use Twitter and how they perceive their use of the platform. The following is the assessment of these interviews.

To obtain an understanding about what motivates individuals, and in particular, scientists to use Twitter as a platform, the initial question asked was about their objective(s). In general, all interviewees primary

objective was both to share and receive information, and specifically research. But it is not just about sharing and receiving – but also about being closer to the source and obtaining information more directly, which allows one to feel more up-to-date. It also serves a practical function to collect one’s own work, as pointed out by one researcher *“I also use twitter as my personal ‘just published’ list – this way a personal twitter feed has characteristics, which are comparable to personal blogs.”* However, one participant was following the recommendation from her employer to begin Twitter for professional use, showing that it is more common and perhaps expected of scientists to participate on Twitter. A number of secondary objectives to participate as explained in the interviews include, keeping up-to-date with peers, obtaining new academic and policy contacts, keeping up to date on news, politics and gossip and finally connecting with old academic institutions.

In addition to objective, it is important to understand who individuals are using Twitter to reach – whether real or perceived, (as shown by the literature). Understanding who scientists perceive, or know, to be their audience may tell something about how they engage with them or what approaches they may employ to reach them. The interviews showed that the participants have an audience in mind, while these are actually rather mixed groups and are often quite broad. These audiences range from those working in public policy (e.g. analysts, researchers, economists) but also philosophers, activists, and journalists – and not always other scientists as the main group as they may be more easily reached via other channels (i.e. publications). So Twitter is a platform to expand to other groups, perhaps not reached through the standard in-group channels. As one participant said, *“The ‘general public’ is also an important audience for me, since I try to get some information out which have the potential to change opinions or behaviours or even given arguments to those who are fighting for social or environmental change.”*

Nevertheless, none of the interviewees tried to ensure their information reached any of these groups and the only approach employed to target audiences was by applying specific hashtags. They also did not seek any other ways to boost their followers or retweets and relied more on the interests of the followers, considering interest of and potential use of the information by followers to be more valuable than numbers of followers or retweets. But still, there was no practice mentioned which was employed to gain followers or influence within Twitter. However, one participant did explain, *“The only thing I do is retweeting my stuff with other accounts I manage, as I also strategically retweet stuff from projects and accounts that I am affiliated to.”* This how-ever goes against statements from the interviewees that it is not about the numbers on Twitter for them.

Along these lines there was little monitoring to determine whether their Twitter use was leading to any kind of impact or being taken up by the audiences they were seeking to reach. As one stated *“(…) I’m sceptical of most measures of impact, especially on social media. Follower numbers mean very little. It’s easy to have lots of reach with shallow or snarky posts and I try to avoid that (though don’t always succeed). There are some users that have high quality posts but few followers; these*

*matter most to me.*” While another reported, *“I do not track my efforts. I do appear in an environmental influencers ranking in Germany, which triggers a bit my aim to stay there but further tracking is too vague for me. The most logical tracking method is to keep track who does follow or retweet.”* It is difficult to draw clear conclusions from these statements – other than to state that the participants, while mildly self aware of themselves on Twitter and to their audiences, had little concern about gaining numbers or status on the platform.

When asked about challenges in communicating science accurately, the respondents were rather mixed. With one saying it was not a problem and the other saying it was a challenge. The one saying it was not a problem was more concerned with the ability of the audience to understand his communication, or paying enough attention to what was being said. Another said that the challenge of trying to communicate so simply on Twitter was also the benefit. None of the respondents were concerned with oversimplifying, *“I feel ok with this. The bigger issue for me is to tweet at all, because I only want to tweet things I'm either super excited about or stuff I think is really interesting. Which both doesn't happen so often.”* The one method that all participants employed to deal with any issues with accuracy was to add links to original sources in Tweets so that followers could find the primary source of information if interested.

The researchers interviewed are also not concerned with losing legitimacy or scientific standing by using Twitter, as one pointed *“I think people are aware that if they want to know more about a tweet they have to read the attached document(s). I see the tweets as a means to attract people to a certain topic.”* Which is related to how Twitter is viewed – as a tool to talk to people, and many outside the scientific community, and therefore they have their research (i.e. scientific publications) by which to communicate science. Moreover, Twitter or even science itself might be seen as way of positioning within larger discussions. As one respondent said, *“I also believe science should reach the people, not to “change the world”, but because science is being paid by, the people’. Of course, there is always a trade-off between being nice for communication and being accurate and dense in terms of data and information, but a real loss of legitimacy would have more reasons than just oversimplification.”*

### 3.3 Interpretation of results

This section aims to provide an understanding of the assessments, the participant observation and interviews as described above and interpret the results.

The assessments of the three participants suggest that a primary reason for being active on Twitter is to spread scientific information – as shown by the number of Tweets identified with this objective in the participant observation and confirmed in the interviews. However, whether for personal or professional reasons, the participants view Twitter as a way in engaging in a broader societal discussion on relevant topics with people outside their group and perhaps less as a means for validating findings or engaging in scientific debate. This may also be argued, as a large portion of Tweets fit into the advocacy group.

The case is also likely that the different groups of Tweets are intended to reach different audiences, where some are intended for broader groups and others for those closer (e.g. other participants at a workshop).

However, the participants only loosely have an audience in mind, and do not seek to ensure that audience is reached other than using appropriate hashtags. This may be because the discussion on Twitter is both quick and never ending, and for the most part one directional. Once an individual Tweets, it is on the platform and new Tweets are following in instances. This may lead scientists, to treat it as a blog with opinions or a log of 'interesting' reads and not consider the information in detail as much as one might perhaps when participating in some other activity which may feel permanent such as writing an article.

Along these lines, those interviewed were unconcerned whether their activities on Twitter were scientific or potentially losing meaning through the use of only 140 characters. This may be due to the awareness that they are aiming to enter into this broader discussion with different groups, where clarity or truth may even be less important than the objective of promoting their ideas and world view. This raises the question, as to whether 'science' is the approach in Twitter to be heard and followed. In other words, by having the position of scientist, one may gain a position of authority when it comes to providing information, in which one can benefit from within discussions on Twitter.

This leads to the interpretation that Twitter is a massive discussion embedded in the ongoing conversations across society and the world and played out in news and media sources such as newspapers, television news, podcasts and books as well as entertainment. Engaging in Twitter provides a platform to push individual perspectives and world views into the broader conversation. It could also be argued that Twitter is a mode within society where one group aims to dominate other groups through knowledge until that world view becomes the accepted norm.

#### 4 Conclusions

In this study several questions were explored, while the main question was: *How do scientists perceive their participation on Twitter?* The hypothesis was that scientists, as a group driven by knowledge and the pursuit of information would look at Twitter differently than the average user. They may reflect on the information they spread on the platform to ensure that the 'scientific' information they promote is factual and correct (i.e. based in science).

To answer this, participant observation and interviews with three individuals were conducted. The primary method to answer this question was therefore dependent on qualitative findings from the interviews and the interpretation of these results. Qualitative findings from interviews were selected because they can provide insight into human behaviour and social norms, going beyond just describing or characterizing Twitter users.

The findings suggest that scientists are not highly concerned with the information they spread through Tweets or retweets in regard to accuracy. They do not see this as their responsibility for the information they spread and trust that followers will check for themselves if they have questions about what is posted. The study also suggests that a motivating factor to participate in Twitter by the interviewees is to promote topics or ideas in line with one's own world view – and that this objective may take precedent to providing information which is correct or considered scientific.

Twitter is an immense place to conduct ethnographic research. Public interaction on Twitter is fast paced and numerous, making it difficult to figure out who or what one is studying and many questions come up as one is navigating throughout Twitter. Indeed, the number of questions which could be asked about Twitter is endless. Twitter is also embedded within the larger system and societal context, and it must be considered that what happens on Twitter may not be particularly unique from other social media platforms. Questions asked about Twitter intrinsically link to broader questions about, for example, social groups or social norms.

Finally, these findings cannot be considered conclusive by any means, and further research would be needed to answer these questions. This would benefit from assessing a larger number of participants across Twitter over a larger period of time and number of Tweets. In addition, it would also be highly useful to conduct a comparative study across not only scientific disciplines but also professions to understand how these groups use Twitter differently, if at all. An additional study would be to explore how scientists use different social media platforms, and if they use them uniquely or in a common way.

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## Appendix

The questions used to structure the interviews with the individual scientists:

- What is your main objective in using Twitter?
- Who is your main target audience(s)?
- Do you try to ensure your scientific results reach the intended audience(s)? How?
- Do you aim to monitor the impact of your social media use?
- How do you seek to accurately communicate findings?
- How do you feel about minimizing complex topics to 140 characters?
- Are you concerned that meaning and scientific rigor is lost? And do you seek to maintain legitimacy of results?
- Do you seek to employ any specific tactics to “boost” followers/likes/reads?
- Are you concerned that this may misrepresent your science?