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ESSAY

# Unpacking social media ‘engagement’: a practice theory approach to science on social media

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## **Abstract**

Social media engagement is typically associated with actions such as sharing, liking, or commenting, and is often measured as such in quantitative analyses. This essay explores what is being captured through these methods by ‘unpacking’ such engagement, arguing for a practice-oriented approach that takes into account the mundane ways in which non-scientists may encounter and use scientific content. We describe practice theory in the context of media production and use, before illustrating the approach with material from comments on Facebook posts produced by science-related sources. In showing the uses of science content in maintaining social bonds or performing particular identities (for instance), we argue that science communication research needs to study the wider contexts of how and why users encounter science online, and that the notion of social media practices can help us to do so.

## **Keywords**

Digital science communication; Public engagement with science and technology; Science communication: theory and models

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## 1 - Introduction

Social media is no longer 'new' media. In the US a majority of citizens get information about science from the internet [National Science Board, 2020], while the Covid 19 pandemic has heightened both the use of social media to access scientific information and concerns about the quality of such sources [Fähnrich, Weitkamp & Kupper, 2023; Wang, McKee, Torbica & Stuckler, 2019]. There is, accordingly, a wealth of literature that explores online science in different forms. Recent scholarship includes, for instance, discussions of the nature of 'quality' in online science communication [Cinelli et al., 2022; Fähnrich et al., 2023]; studies of mis- and disinformation in online sources [Cinelli et al., 2020; Gruzd, Abul-Fottouh, Song & Saiphoo, 2023; Xiao, Borah & Su, 2021]; investigation of the relations between social media use and trust in or awareness of science [Huber, Barnidge, Gil de Zúñiga & Liu, 2019; Mueller-Herbst, Xenos, Scheufele & Brossard, 2020; Taddicken & Krämer, 2021]; national or platform-based differences in science content or engagement [Habibi & Salim, 2021; Hwong, Oliver, Van Kranendonk, Sammut & Seroussi, 2017; Jang, Mckeever, Mckeever & Kim, 2019; Lundgren, Crippen & Bex, 2022]; and the experiences of scientists in such online encounters [Chen & Tang, 2023; Dalyot, Rozenblum & Baram-Tsabari, 2022; O'Grady, 2022].

One thing that many of these studies agree on is that there is a need for better understanding of how non-scientists engage with scientific content online, and in particular with science on social media. As Hargittai, Fuchslin and Schäfer [2018] note, studies of science on social media have often focused on its production rather than on its (active) consumption. In addition, research into users frequently draws on large scale survey data, and therefore explores patterns at an aggregate level (such as nations) rather than investigating more specific dynamics [Pearce, Niederer, Özkula & Sánchez Querubín, 2019]. In sum, "[t]here is an urgent need to understand how citizens engage with [online] science and how the way in which such scientific information [is] presented affects this engagement" [Taddicken & Krämer, 2021, p. 9].

This essay responds to these calls, firstly by arguing for the value of a *practice-oriented approach* to studying engagement with science on social media. We do this by discussing the ways in which 'engagement' is mobilised as an analytical device and means of measurement in both social media research and professional practice, and exploring what can be gained by 'unpacking' such engagement to identify the practices that lie behind it. Secondly, we seek to demonstrate what this practice orientation can offer to science communication scholarship by discussing an exploratory qualitative analysis of Facebook comments on science-related posts. By asking what is achieved through commenting we can, we suggest, gain insights into the complex ways in which online science content is folded into the rest of its users' lives.

The essay thus utilises a somewhat unusual form. While our central argument is conceptual, in that we wish to convince those who practice and study science communication that we should be concerned with practices as well as with content, we use snapshots from empirical work to illustrate this. In what follows we thus discuss practice theory approaches to (social) media, before briefly introducing exploratory research inspired by such approaches and what emerged from this, and, finally, reflecting on implications of our observations and arguments.

## 2 - A practice theory approach to social media

The notion of engagement has a long history in science communication scholarship [Taddicken & Krämer, 2021], in which it is framed as (ideally) involving deliberative, multi-way, or dialogic forms of communication, and contrasted with ‘deficit’ approaches [see Stilgoe, Lock & Wilsdon, 2014; Trench, 2008; Weingart, Joubert & Connaway, 2021]. However, ‘engagement’ as an analytical category is also prominent in the context of social media. In both professional practice and scholarly research, social media ‘engagement’ is framed as a key indicator for understanding the reach, impact, and success of particular online content [Kim, 2018; Tenenboim, 2022]. Such engagement is understood as being comprised of a number of different possible behaviours, including extending reach (sharing or forwarding); affective evaluations (such as liking); and deliberation (commenting; Alhabash and McAlister [2015]). Commenting — such as on a Facebook post, YouTube video, or by replying to tweets — is thus understood as the form of engagement that requires the most commitment on the part of users [Salgado & Bobba, 2019]. As such, the content of social media comments on particular topics or in particular locations has been subject to extensive investigation, for instance through text and sentiment analysis [Cinelli et al., 2021; Del Vicario, Zollo, Caldarelli, Scala & Quattrociochi, 2017; Zollo et al., 2015].<sup>1</sup>

While big data methods have been used to measure deliberation (in this sense of any form of commenting behaviour), much less is known about what such deliberation means at the micro-level of content and practice. It is often not clear, in other words, precisely what kinds of behaviours are being measured through these analytical approaches. It is here that recent efforts to mobilise practice theory in the context of media use become pertinent. Part of a move to recontextualise social media use within broader media environments, and thereby to emphasise the relational or ‘polymedia’ aspects of social media encounters [Boczkowski et al., 2022; Madianou, 2015; Pentzold, 2011; Picone, 2013], the use of the notion of practice highlights the active and generative nature of engagement with social media. Practices are routinised behaviours that achieve particular ends, and which are often understood as embodied and as entangled with particular material objects and contexts [Schatzki, Knorr Cetina & von Savigny, 2001]. To talk of (social) media practices is thus to foreground how such media are *done* — engaged with, used, or mobilised — by particular actors. This has been particularly relevant in the context of news production, which entails a highly routinised (and to some degree standardised) set of techniques through which information is systematically assembled into “meaningful textual forms that can be shared with and understood by mass audiences” [Carlson, 2020, p. 231]. But practice approaches have also been used in the context of news consumption, to refocus research on questions of “*how* incidental news consumption on social media happens” [Boczkowski, Mitchelstein & Matassi, 2018, 3524, emphasis in original] rather than on *what* its “socio-political effects” are [Boczkowski et al., 2018, p. 3524]. Similarly, Ostertag [2020] theorises the production, circulation, and consumption of news as a ‘relational social practice’ whereby “widespread moral stories of social order and reaffirmation” are expressed [p. 2853]. The emphasis is on the mundane doings in which particular forms of media play a part, and on what is achieved through them.

1. This double meaning of engagement is, of course, extremely important in the context of science communication scholarship, where there may be unintended slippage between the terms. In this essay we focus on engagement as defined by social media platforms, where the term has a very specific meaning (described in the main text) that only partially overlaps with how engagement is typically referred to in science communication and public engagement. However, it is worth noting that even within science communication, the notion of public engagement remains ‘contested’ and ‘vague’ [Weingart et al., 2021].

A practice approach might therefore be said to involve a focus not only on the content of particular forms of media, but on how this content is produced and used, and how these processes of production and consumption connect with wider settings (whether that is the use of mobile devices in everyday life, as in Boczkowski et al. [2018] study, or the ‘widespread moral stories’ of particular societies that Ostertag [2020] refers to). In the context of the metric of ‘engagement’ discussed above, such an approach orients us to the routinised behaviours and material contexts in which commenting on social media play a role. A practice approach encourages us to ask not so much *what* is being expressed (as might be measured through sentiment, stance or topic analysis, for instance), but *how* commenting is being done, and what it is achieving for those engaged in it.

It is important not to overstate the novelty of this idea in the context of science communication. While the practices of users, consumers, or audiences (for our purposes here, the terms can be considered synonymous) have largely not been a priority for research, a number of key studies have exactly considered the ‘how’ questions that a practice approach promotes. Sharon Macdonald’s [1995] study of how museum visitors actually engage with exhibits (through the lens of their own lives, interests, and immediate priorities) is a key example, while Horst and Michael [2011] similarly explore how one science exhibit becomes folded into the everyday lives of a group of teenagers. More recently, and in the context of online media, Hargittai et al. [2018] examined how young adults report engaging with social media, finding that “social media are an important site for engagement with science and research among young adults” [p. 7] but that there are important differences between different platforms with regard to such practices. Hodson et al. [2022] describe the kinds of calculations users report when deciding whether to share a Covid-19 related infographic, using the notion of the ‘imagined audience’ to show how their interviewees reflected on decisions to share or not share particular kinds of content. Finally, and most substantively, Oliver Marsh [2018, 2020] has examined the ways in which commenting on scientific topics on different social and digital media can function to signal one’s identity as a ‘lover’ of science and to build a sense of community. Participation in science-oriented fora allows users, he argues, to express “interest in receiving various perspectives on a given topic; combin[e] information-seeking and social enjoyment; find a sense of belonging amongst like-minded people; and/or to create a desired social identity of a ‘scientific person’” [Marsh, 2018, pp. 279–280].<sup>2</sup>

Marsh’s work is exemplary in its in-depth engagement with how and why social media users interact with scientific content, but he largely focuses on specialised online spaces (such as XKCDScience and r/EverythingScience). Both he and the other scholars mentioned also make use of interviews as a key means of investigating practices, rather than (or as well as) directly relying on social media material. A central question for research is thus whether, and how, it is possible to gain insight into social media practices by looking at the traces of these that are left on social media platforms.

2. A further key area of scholarship explores critical responses to scientific content online, including harassment and abuse of scientists and communicators and behaviours such as trolling [see, e.g., Dalyot et al., 2022; Gierth & Bromme, 2020; Valiveronen & Saikkonen, 2021; Vallury, Baird, Miller & Ward, 2021]. While this is, indeed, a central set of practices that deserve further study, it is outside the scope of this exploratory essay — though recent findings suggest that aggressive or conspiracy-oriented online commenting may itself vary in significant ways, and thus incorporate a range of practices and outcomes for commenters [Pilati, Venturini, Sacco & Gargiulo, 2024].

We start to answer this question by introducing exploratory research that used qualitative analysis of social media content to ‘unpack’ engagement. Specifically, and to return to the notion with which we opened this section, we are concerned with asking: *what practices are being captured and measured through the use of engagement metrics, and in particular through studies of (the content of) comments?*

### 3 - ‘Unpacking’ engagement metrics

These questions, and our interest in what is being done through commenting on science content on social media, have emerged from a larger study that explored the content of science on social media across Europe, and the nature of engagement with this [see Cinelli et al., 2022; Davies et al., 2019; Davies et al., 2021]. This study involved the automated collection of science-related content from Twitter, YouTube, and Facebook. As reported more fully elsewhere [Davies et al., 2019; Davies et al., 2021], we applied machine learning and natural language processing techniques to analyse text and to automatically extract relevant entities and concepts, their semantic relationships, and the emotional sentiments they express. In particular we used two metrics to study engagement: the overall engagement and the engagement volume (EV). The overall engagement is the total number of users who interact with a piece of content, and gives a general idea of audience size. The engagement volume is the number of users who interact with a piece of content in the context of the number of users who follow the account that published it, and gives a general idea of how engaging the content is.

While this quantitative analysis is not the focus here, we found, in brief, that the volume of science content<sup>3</sup> on these platforms had increased over time, that there were central differences in favoured platforms and most frequent topics between different European countries, and that engagement metrics also varied depending on platform, country, and type of content producer [Davies et al., 2019; Davies et al., 2021]. In many ways, then, this essay has emerged from our own experiences of using ‘engagement’ as a metric (as is standard practice in social media research; Alhabash and McAlister [2015]), and our curiosity regarding what, exactly, it is capturing.

In order to ‘unpack’ the engagement that was being measured through these analytical techniques, we then decided to explore a (very) small subset of this material through an exploratory qualitative analysis. Based on the theories of practice described above, we sought to do this through attention to what was being achieved through different forms of commenting. Out of a dataset of public material from 214 UK-based Facebook accounts (designed to include a range of different source types<sup>4</sup>), we randomly extracted a sample of 527 comments (on posts that had at least 10 comments, with comments maintained in their original threads) from the larger dataset. Using Atlas.ti, this material was collaboratively coded by two coders, in iterative cycles of coding and discussion. Within this process, codes were developed using an abductive grounded theory approach [Timmermans & Tavory, 2012] whereby open coding was framed through an interest in what the content of comments could

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3. Where science content is defined as content produced by science communication sources. In this study, the categories of science communication sources were: Science Festival; University; Industry or CEO; Science Journalist; Institution, Organization, or Association; Magazine or Publication (including online); and Scientist/Expert. See Cinelli et al. [2022] for further details.

4. See note 3 for the list of source types.

tell us about social media practices.<sup>5</sup> We were attentive, then, to (our shared interpretation of) what was being achieved by the content of particular comments. While we decided to extract and work with a sample of approximately 500 comments based on what was realistic for an initial qualitative analysis [cf. Eschmann, Groshek, Chanderdatt, Chang & Whyte, 2020], it is worth noting that by the end of analysis the coding had reached saturation (with no new codes emerging).

We view the results of this process, which are discussed below, as of interest on two grounds. The first is methodological. In coding for what is being done through particular kinds of comments (through analysis of their content), this approach offers a means of engaging with social media data in a manner attuned to social media practices. The second is with regard to the categories identified, and the functions of social media engagement that they represent, which we view as a starting point for further exploring how and why citizens engage with online science [cf. Taddicken & Krämer, 2021, p. 9]. In both cases the findings should be regarded as exploratory, given that we are examining a limited number of comments, on one platform, from content producers based in a single national context. Our aim is to illustrate what a practice-oriented approach to science on social media might look like, and to initiate further discussion about this within the science communication community.

#### 4 - What is being done through Facebook commenting?

Coding the comments — which were of varying lengths, from single words to extended paragraphs — resulted in 26 codes which, after discussion between coders, were grouped into six categories. These categories each represent particular social media practices, in the sense of describing what is being achieved through commenting; importantly, they are overlapping rather than distinct, so that multiple functions might be achieved by a single comment. We briefly describe these categories below. While the data was publicly accessible, in line with current best practice in social media studies [Williams, Burnap & Sloan, 2017], and given that users have not consented to involvement in the research, we do not directly quote any of the content. Instead we describe the forms that such comments take, and where appropriate create indicative examples in the tradition of ‘ethnographic fictions’ [Taylor & Breeze, 2020].

Our first category is that of *tagging friends*. Such tags may appear alone (i.e. one word comments that alert a single person in one’s network), as lists of names (alerting a group of people), or as parts of comments (e.g. ‘NAME this will be useful to you!’), and minimally function to notify existing contacts of particular content (and the fact that a specific user has shared it with them). Similar to Marsh’s [2018] study, such tags were extremely frequent within this data, and are, indeed, a central affordance of the platform [Miller & Venkatraman, 2018]. With regard to what is being achieved by such tagging — and in line with other research [Miller et al., 2016] — we can say that it functions to support social interaction between an existing community (people who are already in contact, at least on social media).

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5. Abductive coding and analysis represent a meeting point between inductive (emergent) and deductive (theory oriented) approaches [Timmermans & Tavory, 2012]. In our case, an interest in practices — understood as (routinised) behaviours that achieve particular ends [Schatzki et al., 2001] — comprised the more theory-directed aspect of our analysis, whilst an openness to the categories that emerged represents a more inductive approach. Due to the very limited existing research on social media practices (none of which has sought to categorise those practices), we chose not to implement existing schemas or frameworks, but rather to develop our own from emergent findings.

Such tagging creates conversations or engagement between those who already know each other in some way.

A second category of codes relates to particular *utilitarian functions* being achieved — in particular, to competition entries, on the one hand, and to general requests for information, action, or help, on the other. ‘Competition entry’ comments were made in response to the possibility of winning or accessing something if one commented; these might either involve tagging another person (thereby overlapping with ‘tagging friends’ above) or creating, for instance, a humorous caption or response (overlapping with the category humour below). General requests focused not on the topic of the post but instead were more general calls for information or for people to behave in particular ways (e.g. ‘What are good ways to look after our nature better?’).

The third category includes comments that function as *expressions of affect*. This includes the use of emojis to signal particular affective responses; expressions of awe, wonder, or enthusiasm (‘wow, this is amazing!’); praise, gratitude, or critique directed at the poster (‘well done keep up the good work’); and personal memories or reflections that were triggered by the post (e.g. ‘I well remember seeing those birds as a kid’; such comments often also included tagging friends). There is therefore substantial variety within this category (including with regard to the expression of both positive and negative emotions); all such comments, however, function to perform particular emotional responses on the part of the commenter and to insert these into the online space around the original post.

In this regard there is overlap with the next category, which involves performances of *humour*. This is another type of commenting behaviour that has been extensively documented by Marsh [2018, 2020], who describes the ways in which users of online fora oriented to science use humour to signal that they are part of the ‘in-group’ of that community. Jokes, wordplay, and ironic comments were similarly a key aspect of our material, with users responding to the content of the post in some humorous way (for instance, a response to a post about snakes in the UK might involve a comment that ‘there are plenty in Westminster’). We understand both of these categories — expressions of affect and of humour — as *identity performances* directed at the general audience of the original post (as well as at one’s existing community, whom you might choose to specifically alert through the use of tags). Such comments allow a user to insert a particular version of themselves into a public space, and thus to realise a specific identity (as enthusiastic lover of science, for instance, or as an ironic joker; cf. Marsh [2018]).

We titled the fifth category *deliberation*, as the content captured here relates most clearly to the imagination of substantive commenting behaviours discussed earlier [Alhabash & McAlister, 2015]. These comments directly respond to and engage with the content of the original post, doing so in a number of ways: they might offer commentary (including political commentary) on it; ask a direct question of the poster about it; make reference to previous comments; contain critique or complaint; involve a response by the original poster; or propose fringe science theories that relate to the content of the post. In these respects they involve deliberating the scientific content presented in a manner similar to science communication traditions of dialogue or participation, and to what is often discussed as an ideal form of engagement with science on social media [Chen, Hara & McKay, 2021; Taddicken & Krämer, 2021]. What is being achieved is the direct negotiation, re-framing, and/or production of scientific knowledge.

Finally, our last category was simply titled *uncategorised content*, and included comments that we struggled to make sense of. This included fringe science (and related links) that bore no relation to the content of the original post, other forms of spam, posts in languages other than English, and comments whose meaning or function we simply didn't understand.<sup>6</sup>

## 5 - Discussion

These six categories are, as we emphasised, preliminary and exploratory. We have already noted the limitations of the dataset; further limitations are that we focused on the text of comments, without analysing the use of particular emojis (we coded only for emojis as a general category; cf. Kralj Novak, Smailović, Sluban and Mozetič [2015]), images, or hyperlinks, and that while we maintained comments in threads we sampled only a few comments from each post so were not able to analyse them in their full context. Future research should certainly engage more with practices in context — both material and virtual — in order to better understand what is actually taking place through commenting, and to identify the actual intentions that lie behind the practices we have identified. In addition, it will also be important to explore how practices at the micro-level — individual commenting behaviours — relate to wider communities and collectives, and how such practices are normalised and learned within these [cf. Felton, Middaugh & Fan, 2024], as well as the nature of social media practices that are experienced as abusive [O'Grady, 2022]. Our aim in introducing this material is thus not a comprehensive account of how social media is practiced in the context of science, but to illustrate what such an analysis might look like based on a practice theory approach.

However, we already see some potentially interesting dynamics based on this initial analysis. The first of these relates to the hint that this material provides that scientific content is, at least in some cases, rather incidental to social media practices in the context of science. Only one of our categories — deliberation — directly relates to substantive engagement with the content of scientific information online. Other aspects of the material suggest that what is more important is, for instance, maintaining social bonds (tagging friends), the opportunity to gain something (utilitarian functions), or enacting a particular identity in a public space (through articulating particular forms of affect and humour). In this regard there are key similarities with Boczkowski et al.'s [2018] account of news consumption, which finds that “incidental news consumption is not necessarily — and not primarily — about the news, but about exercising sociability and passing time” [p. 3533], and with Macdonald's finding that “‘science’ as a specific motivation for visiting [a science museum] did not arise” [1995, p. 18]. While there are certainly some online communities where users deliberately seek to substantively engage with scientific content [e.g. Chen et al., 2021], it seems vital that studies of online science content in the context of social media practices seek to explore the full context of how and why users encounter — and make use of — such content. The lack of novelty of these findings — the fact that there appears to be overlap with social media engagement with other kinds of content — is thus itself a central and highly suggestive finding: perhaps scientific content is not a special case, but should be studied as part of a wider range of forms of consumption by lay audiences [cf. Davies, 2019].

6. Some of this ‘uncategorised’ material might be understood as trolling, or other forms of disruptive online behaviour. However, given that trolling is extremely difficult to identify from comments alone (without further information on a user's profile or commenting history), we chose not to use this as a category for analysis [see Phillips & Milner, 2017, for further discussion].

A further reflection concerns the nature of this content, and what ‘science’ in online spaces actually means. As described above (and in Davies et al. [2019]), the full dataset was collected through identification of key producers of science communication — including museums, science journalists, popular science publications, and high profile researchers — across Europe, and automated collection of their social media posts and of comments on these. In carrying out the qualitative analysis, however, it was clear that this content only partly involved sharing scientific facts, stories, or information; just as often, posts advertised events, asked questions of audiences, or provided practical information about whoever was posting (for instance). We have focused on the comments, and have not analysed the content of posts, but this observation leads us to wonder if we also need to ‘unpack’ what gets labelled as science content online (in particular within computational and other big data analyses), just as we have started to unpack what gets measured as engagement.

This relates to a final reflection. This essay has emerged from an earlier quantitative analysis, and from our sense that we needed to ‘unpack’ exactly what was being measured by engagement metrics. Such computational analyses allow for engagement with many more diverse sites and contexts than is usually possible in qualitative research (though equitable access to data to carry out such analyses is increasingly at risk; Roozenbeek and Zollo [2022]). One interesting avenue for future research is thus how computational and qualitative methods can be further combined in studying social media practices. Is it possible for big data methods to capture the kinds of categories — which speak to what is being done by commenting — that we have described? How might notions of practice be operationalised at a larger scale? As well as obvious extensions of this research (for instance looking at other platforms and at other national contexts), the possibility of integrated, mixed method approaches to social media analysis is one important area for future work.

To conclude, we have introduced practice theory as a central approach to studying engagement with science on social media, illustrating what such an approach could look like through an exploratory analysis of comments on Facebook posts produced by science-related sources. While our findings are interesting in and of themselves — and suggest that future research into engagement with online science should continue to explore how science content is actually encountered and used — the study also raises points of methodological interest, in particular with regard to how it is possible to study social media practices through, and alongside, social media content. A practice approach encourages us to re-frame at least some of our research questions, from ‘what is the content of (online) science communication?’, to ‘how is it encountered, and what does it do?’.

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