

RESEARCH PAPER

“We definitely need an audience”: experiences of Twitter, Twitter networks and tweet content in adults with severe communication disabilities who use augmentative and alternative communication (AAC)

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Abstract

Purpose: The aim of this study was to investigate the Twitter experiences of adults with severe communication disabilities who use augmentative and alternative communication (AAC) to inform Twitter training and further research on the use of Twitter in populations with communication disabilities. **Method:** This mixed methods research included five adults with severe communication disabilities who use AAC. It combined (a) quantitative analysis of Twitter networks and (b) manual coding of tweets with (c) narrative interviews with participants on their Twitter experiences and results. **Results:** The five participants who used AAC and Twitter were diverse in their patterns and experiences of using Twitter. Twitter networks reflected interaction with a close-knit network of people rather than with the broader publics on Twitter. Conversational, Broadcast and Pass Along tweets featured most prominently, with limited use of News or Social Presence tweets. Tweets appeared mostly within each participant's micro- or meso-structural layers of Twitter. **Conclusions:** People who use AAC report positive experiences in using Twitter. Obtaining help in Twitter, and engaging in hashtag communities facilitated higher frequency of tweets and establishment of Twitter networks. Results reflected an inter-connection of participant Twitter networks that might form part of a larger as yet unexplored emergent community of people who use AAC in Twitter.

Keywords

Communication disability, inclusion, mixed methods research, social media studies, Twitter network data, Twitter research

History

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► Implications for Rehabilitation

- Twitter can be used as an important vehicle for conversation and a forum for people with communication disabilities to exchange information and participate socially in online communities.
- It is important that information and resources relating to the effective use of Twitter for a range of purposes are made available to people with communication disabilities who wish to take up or maintain use of Twitter.
- People with communication disabilities might benefit from support in using Twitter to meet their goals relating to participation in online forums and information exchange. Practitioners need to consider how their own social media skills might impact on service delivery and supporting these goals.

Introduction

Twitter and tweet structure

Twitter launched in 2006 as a short messaging service intended to replicate and extend the limited text message capacity of mobile phones to provide a group-wide communication platform. It has become a mainstay of the text-based micro-blogging and live streaming platforms as it provides a combination of real-time broadcast and delayed response [1].

In its first eight years on the landscape of social media, the micro-blog social media site Twitter, involving publication of short messages (140 characters) on the Twitter website [2], has an estimated 500 million accounts [3] including 271 million monthly active users worldwide [4] creating 500 million tweets per day [5].

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Twitter offers a short text-based form of communication with multiple purposes that include maintaining a social presence, keeping in touch, breaking news and information sharing [6]. Indeed, communication *via* Twitter is not limited to text, as photos and videos taken on mobile devices can be tweeted easily and quickly – rendering the camera in mobile devices a communication–connection device [7]. Twitter is a communication technology and social media with its own syntax. Like other communication technologies, including augmentative and alternative communication (AAC), effective use of Twitter relies upon users developing operational (how to use it), linguistic (the words or language to use), social (using it in social ways) and strategic competence (developing ways to improve use strategically) [8,9]. Therefore, people with severe communication disabilities who use AAC and wish to use Twitter are likely to benefit from training to use and build Twitter networks for engagement and access to information [10].

The authors have previously outlined a rationale for Twitter use by people with severe communication disabilities, and proposed research to identify barriers to and facilitators for using Twitter to gain access to information [10]. Twitter might be particularly useful for adults who cannot rely on natural speech to communicate but wish to exchange information for increased participation and contribute to knowledge creation in the broader community on disability. Twitter bypasses speech impairments by using only short segments of text. Its use on small portable mobile devices, such as smart phones, has led to user tolerance and even preference for short messages, reduced importance of spelling and increased tolerance of poor grammar. Making fewer keystrokes for communication is also useful for those with poor motor control who fatigue easily, including people with cerebral palsy [9,11].

Media Access Australia [12] suggested that Twitter would be useful to people with disabilities for a range of purposes and Bundon and Hurd Clarke [13] reported on paralympians using blogs, Facebook, Twitter and other forms of online communication to access information, engage in advocacy and outreach, and form strong networks online that extend offline. While governments and businesses increasingly embrace social media to convey information to the public [14], people with communication disabilities lag behind the general population in their use of online Information Communication Technologies (ICT) [12,14].

The use of social media by people with physical and communication disabilities is likely to be affected by a range of factors including lack of training, lack of access to the necessary ICT and lack of policies, funds and provision of supports for its use [10]. However, as students, who already use communication technologies and social media are more likely to adopt Twitter than other students [15], people with communication disabilities who already use communication technologies in the form of AAC and/or social media may be primed for the adoption of Twitter. Currently, there are no reports on the use of Twitter by people with communication disabilities, and the extent to which Twitter is used by people with communication disabilities is unknown.

Twitter research

There is now a burgeoning literature on Twitter research methodology (e.g. ways to collect and analyse Twitter data and networks) that could inform and enrich research on Twitter use by people with severe communication disabilities. As only approximately 10% of Twitter accounts are “protected” by the user, Twitter researchers are able to source tweets using a range of retrieval methods [16]. Rogers [6] noted that Twitter is conducive to research because it is possible to gather tweets easily and analyse them using some of the inbuilt features, such as hashtag and followers–followees network analysis.

The most commonly used source of data in Twitter research to date is tweet data sourced by searching the Twitter website or using multiple techniques to harvest tweets from Twitter and visualize Twitter networks making use of “big data” sets. Bruns and Stieglitz [17] outlined widely applicable metrics for analyzing Twitter communication, particularly hashtag exchanges, that included user metrics (e.g. number and type of tweet, mentions, URLs sent), temporal metrics (e.g. tweets sent over a period of time) and combined user and temporal metrics for patterns over time. Twitter research encompasses many and diverse disciplines (see [16] for disciplines in Twitter research 2007–2012), and methods of data collection and analysis [17]. Yet to date, “disability” and “health” are not included as disciplines. Puschman and Burgess [3] postulated that in researching Twitter, social scientists will understand how lives are influenced by social media across the world.

Structural layers of Twitter

Bruns and Moe [18] described three structural layers of Twitter, determined by the use of the hashtag # and placement of the @ symbols. Simply tweets that begin with the @ symbol are directed to an individual user and are considered to be in the “Micro” structural layer of Twitter. Tweets without a hashtag are tweets intended for the user’s followers as they appear in followers’ timelines, and are described as “Meso” structural layer tweets. Tweets with a hashtag are at the “Macro” structural layer, and all users of Twitter can view the tweet if following that hashtag. Thus, the intended audience of the tweet being one user (Micro), all of an individual’s followers (Meso) or users who may not yet or ever be followers (Macro) will influence how tweets are composed structurally for direction to each of the structural layers [18].

Twitter and tweet content

Dann [1] created a taxonomy for Twitter content for individual or groups in five major categories with sub-categories for type: (i) Conversations, (ii) News as an announcement and journalism platform, (iii) Pass-along to share links to other internet content, (iv) Social presence showing connected presence with other Twitter users and (v) Broadcast, as a soapbox for opinion sharing and diarizing personal experiences. Although Dann [1] subcategorized “pass-along” tweets as “annotated media”, “curation”, “offline source” and “retweets”, Vis et al. [7] proposed a further analysis of the linked content on Twitter, specifically photos and video content, as an important mode of “connected communication” that receives little attention in the literature. Visual content of tweets, currently in an early phase of development, might be particularly important in AAC, given the use of visual symbols, visual scenes and visual supports as aids to communication by many people to enhance or replace text-based messages [7].

Twitter experiences

There is little information in the literature about user experiences of Twitter, with most qualitative research examining the qualitative content of user tweets. Qualitative data on the experiences of people who use Twitter add insights and context to the publicly available data used to determine user and temporal Twitter metrics outlined above [19]. Zimmer and Proferes [16] reported that 16% (60 of 382) of Twitter studies from 2007 to 2012 focused on properties of specific groups of users. Although qualitative techniques are most suitable for an in-depth understanding of human experiences [20], only two of 351 (or 0.5%) Twitter studies from 2007 to 2012 mapped according to research method involved qualitative data obtained from interviews, surveys or observations [16]. Despite mixed methods and qualitative research methods being under-utilised in Twitter research up to 2012, there is

growing recognition of the importance of these methods (see [19,21–24]).

To date, despite a growing body of literature relating to the use of social media by people with communication disabilities [25,26], there are no studies reporting on Twitter data, Twitter networks, tweet content or the Twitter experiences of people with severe communication disabilities or who use AAC. Therefore, the aim of this research was to explore the use of Twitter by people with severe communication disabilities who use AAC. This was done to inform the development of a population survey on the use of Twitter by people who use AAC and to add to evidence informing development of online training modules for Twitter, for use in future research [10].

Method

This research was ethically approved by The University of Newcastle, Australia. Ethical approval was not sought for directly reporting quotes from participants' tweets. Although quotes from tweets would serve to illustrate and potentially increase plausibility of the results, in a small sample in a specialized field where participants and readers might be known to one another providing quotes in addition to other data could render participants identifiable [27]. The characteristics of each participant are withheld to further protect identity in a small and tight-knit Twitter community.

The method selected for this study recognized the importance of both big data [17] and small data [1,18] approaches to Twitter research, in providing insights into participants' Twitter experiences [19]. Big data approaches lend themselves well to automated forms of analysis and representation, whereas small data approaches require close reading and manual coding of tweets [17]. The mixed methods design allowed for the integration of quantitative data, network analyses and Gephi visualisations [28,29] within and across participants' Twitter networks, with qualitative data, content analysis within participants' data sets and narrative interviews.

Participants

All participants were aged over 18 years, able to give their own informed consent, had severe communication disabilities arising from lifelong physical disabilities, unable to rely on natural speech to communicate and communicated using multiple modalities of AAC, able to access a computer and internet independently. Purposive and snowballing sampling techniques were used to reach adults who met the inclusion criteria. All participants were Twitter users and, as is typical for Twitter users, also used Facebook [30].

Twitter and tweet data analysis

Tweet data

Twitter data in this study comprised only tweets sent by participants (i.e. from the participant account) with no participant mention data included. Participants' tweets were harvested using the NCapture tool in Google Chrome for importing into NVivo10 and export to Excel software for further analysis of both Twitter Content and Twitter Networks [1].

Twitter network data analysis

Tweets in the Excel spreadsheet were reduced to two columns representing (i) participant (tweets and retweets) and (ii) mentions and undirected tweets. These were saved as a .csv file for analysis in Gephi software for visualisation of Twitter data. In the participant column, tweets sent as retweets were re-attributed to the retweeter (i.e. the participant, rather than the first author of the tweet). In order to properly represent the data in the mentions column: (a) the Twitter handles for @bronwynah and

@BronwynHemsley were consolidated to @BronwynHemsley to properly represent the one person or node in Twitter and (b) undirected tweets (i.e. those not mentioning any other users) were attributed as being undirected in the mentions column.

Twitter content analysis

All tweets were coded by the first author and a research assistant according to Bruns and Moe's [18] three structural layers of Twitter (Micro, Meso and Macro, see Supplementary Table S1), with interpretation of the intended audience guiding the codes. All tweets were also coded according to the five content categories described by Dann [1] (see Supplementary Table S2) with interpretation on the intention of the tweeter by the first two authors. Throughout the analysis all differences of opinion in coding were resolved by consensus. Sub-categories within the five content categories were not coded owing to the small number of tweets in three of the five participants' tweet data.

Narrative inquiry on experiences of Twitter

All participants were interviewed by the first author, one in person and four using Skype [31]. Interviews were audio recorded, transcribed and added to the Skype text transcripts. The interviews were designed to "walk through" tweets [31] and elicit stories of experience [32]. Before the interview, participants were sent their own tweet data harvested from Twitter and invited to remove any tweets prior to analysis. No participants removed tweets from the dataset. The tweets were imported into the Excel spreadsheet showing the text and date/time of the tweet sent, and Gephi visualisations were created for each participant, and one for all of the participants, showing all of the "nodes" in their network. The weight of "edges" or thickness of lines between the nodes reflected the relative number of tweets sent to that node. Interviews were 45 min long and conducted in a conversational style. Following the interviews, a summary re-storying of the participant's experience was formulated and sent to the participant for verification. All participants verified that the summary reflected their experiences as described in the interview and none suggested changes to the stories.

Results

Participant Twitter profile data

Participants had been using Twitter to write and/or read tweets on average for a period of 24 months (range 2–5 years). The five participants averaged 116 followers and were following an average of 95 other twitter users, with one having no followers nor following any accounts. Individual styles in patterns of use were evident: P1 was the only one to produce *only* original tweets and only *one* tweet with a link; P2 broadcast messages; a large proportion of P3's tweets contained links, and P3 was the only one to strategically send selected Facebook posts to Twitter to increase reach; while P5 only used Twitter as a "lurker" [33] for social reading, reflecting, listening to what others say and finding information. Frequency and percentages of tweets, tweets containing links, retweets, retweets containing links, links to photos and links to videos are presented in Table 1.

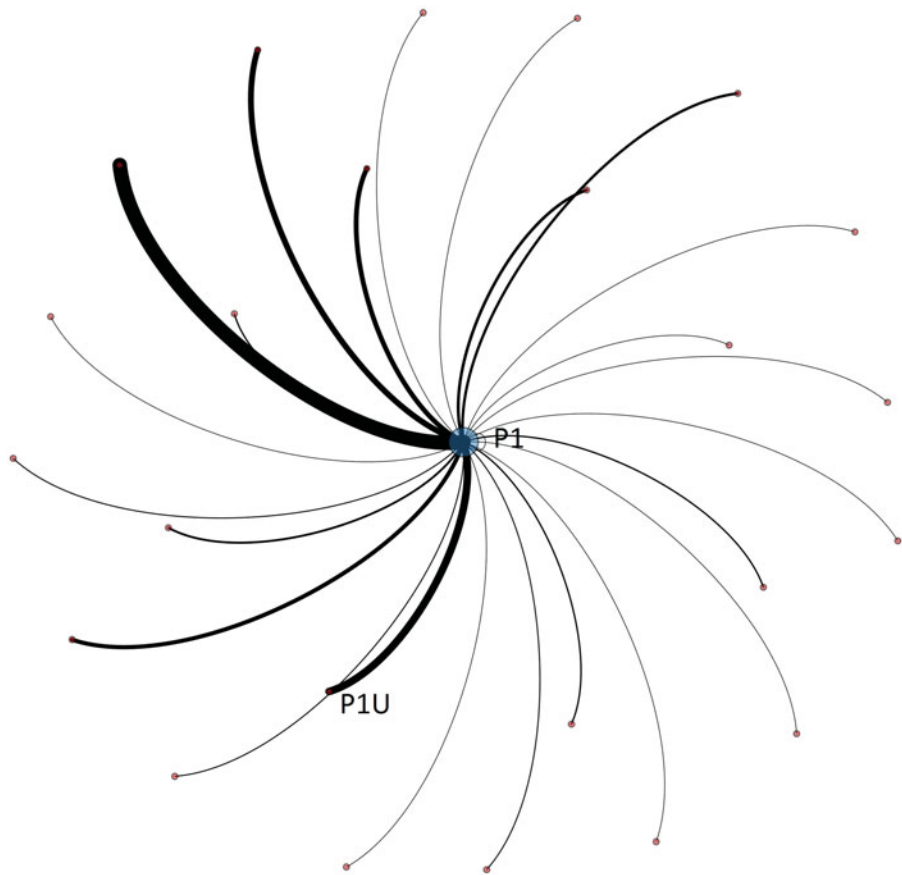
Gephi visualisation of Twitter network data

In Gephi [28], as data collection was confined to tweets from the account, the Twitter Network data transformed into a graphic Gephi visualisation forming a star network with the participant in the centre and tweets radiating outward. The Yifan Hu layout algorithm [34] used for all visualisations in this study, groups nodes by connection strength so that nodes (i.e. other Twitter users) with similar connections naturally cluster together.

Table 1. Participant tweet data.

Feature of tweet data	P1	P2	P3	P4	P5	Overall
Ratio of Twitter followers to followed	1.9:1	1.1:1	0.5:1	0.5:1	n/a	–
Number of tweets collected	177	222	2176	71	0	2646
Number of retweets (% of total tweets)	0 (0%)	52 (23.4%)	87 (3.9%)	20 (28.2%)	n/a	149 (5.6%)
Number of tweets containing links (% of total tweets)	1 (0.6%)	74 (33.3%)	729 (33.5%)	14 (19.7%)	n/a	818 (30.9%)
Number of retweets containing links (% of retweets)	n/a	24 (45%)	28 (32%)	0 (0%)	n/a	–
Number of links to photo sharing app or site (% of total links tweeted/% of total tweets)	0	4 (5.4%; 1.8%)	230 (31.5%; 10.5%)	3 (21.4%; 4.2%)		237 (28.9%; 8.9%)
Number of links to video sharing app or site (% of total links tweeted/% of total tweets)	0	1 (1.3%; 0.4%)	19 (2.6%; 0.9%)	3 (21.4%; 4.2%)		23 (2.8%; 0.8%)

Figure 1. P1 Gephi visualisation. Key: P1 = participant 1 node; P1U = undirected tweets from the participant’s handle to all followers (not mentioning any other profiles).



The Yifan Hu algorithm derived Gephi visualisations for Participant 1 (P1), Participant 2 (P2), Participant 3 (P3) and Participant 4 (P4) and all four Tweeting participants, respectively can be seen in Figures 1–5.

With the star form of visualisation, the number of edges is a measure of the size of the network. Relatively thin edges represent single tweets, while a small number of wider edges or lines represent many tweets from the participant to a particular node. The visualisations of results of the Network Analysis in Figures 1–5 show that the edges or lines in the visualisations of P2 and P4 Twitter networks are relatively thin, whereas edges or lines in visualisations of P1 and P3 are wider in parts, due either to a lot of undirected tweets (i.e. tweets that do not mention another Tweeter) or tweets mentioning a particular user (e.g. tweets mentioning the first author). When all the data for participants are pooled together (see Figure 5), there is some interconnection between nodes in the networks observed. Groups of nodes that are linked to various doublets and triplets of the participants can be seen, showing interconnectivity in the broader

“network” of the five participants. A visual inspection revealed that only @BronwynHemsley and @AGSOCI were Twitter handles that were mentioned by all four tweeting participants. One measure of the “influence” of @BronwynHemsley in the networks can be seen by the proportion of all mentions that mention @BronwynHemsley, the raw statistics are: P1 – 37.6% (of 177 tweets), P2 – 1.2% (of 222 tweets), P3 – 4.9% (of 2176 tweets) and P4 – 9.9% (of 71 tweets).

Structural layers of Twitter used

Participants in this study predominantly operated in Twitter at the meso-structural layer of engagement, with a secondary emphasis on the interpersonal micro-level communications. Meso-layer tweets used more of the broadcast capacity of Twitter to engage with the outside world, to have a voice and be heard in passing opinion on the state of the world. Micro layer tweet data focused on conversational engagement. As noted in the network analysis, the participants had a close-knit set of networks, and, interactions

Figure 2. P2 Gephi visualisation.

Key: P2 = participant 2 node;

P2U = undirected tweets from the participant's handle to all followers (not mentioning any other profiles).

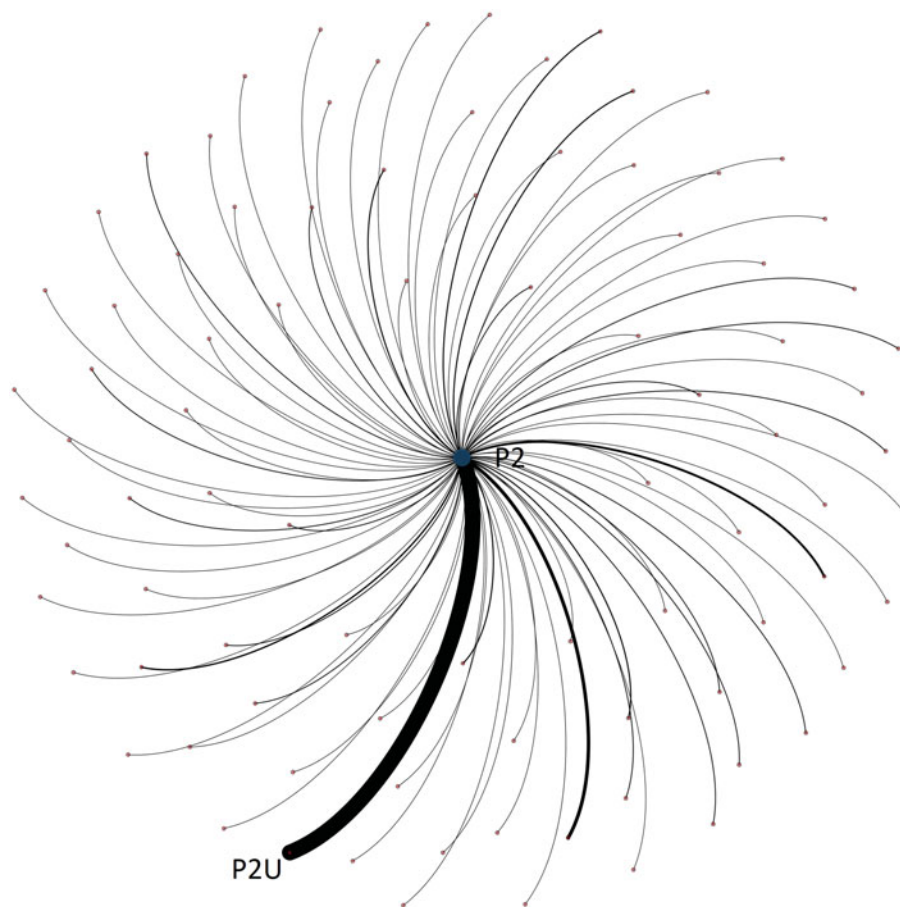


Figure 3. P2 Gephi visualisation.

Key: P3 = participant 3 node;

P3U = undirected tweets from the participant's handle to all followers (not mentioning any other profiles).

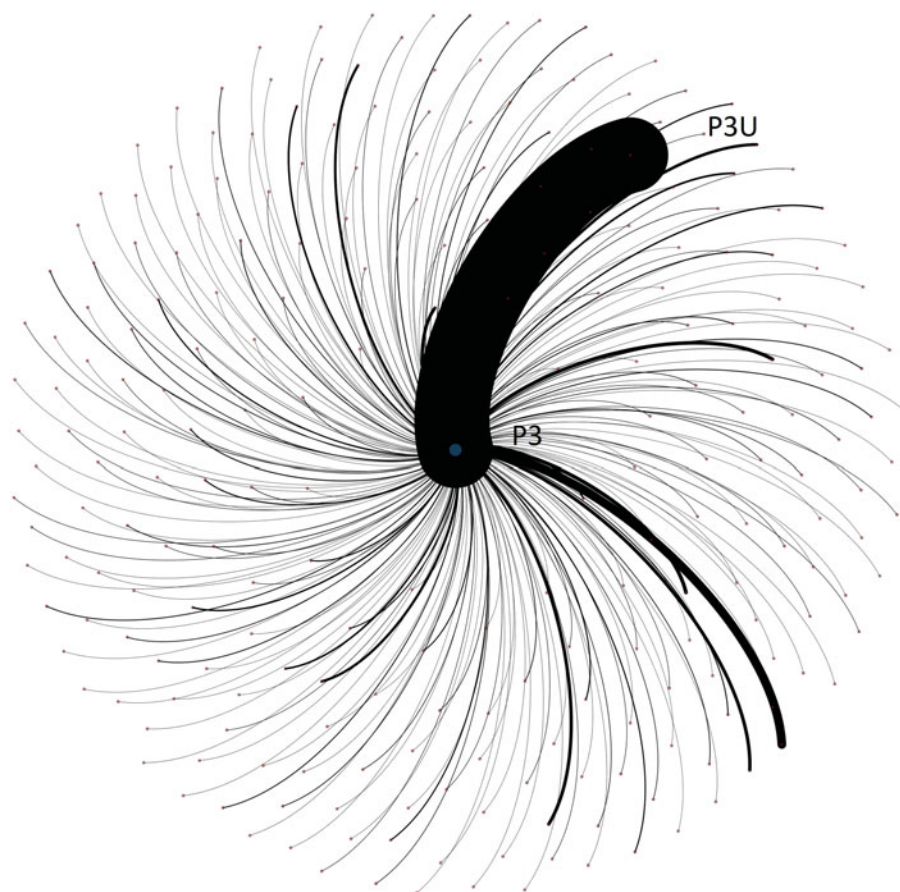


Figure 4. P4 Gephi visualisation.

Key: P4 = participant 4 node;
 P4U = undirected tweets from the participant's handle to all followers (not mentioning any other profiles).

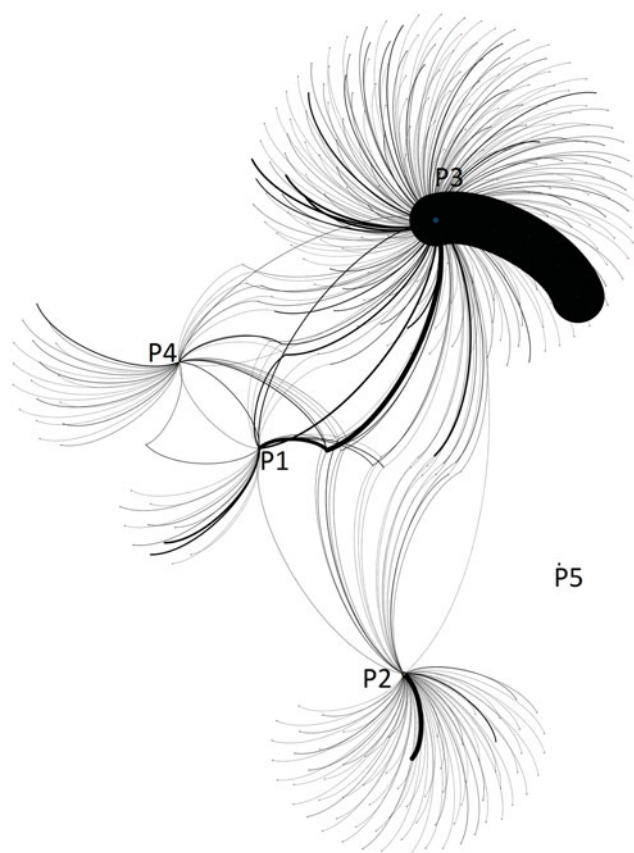
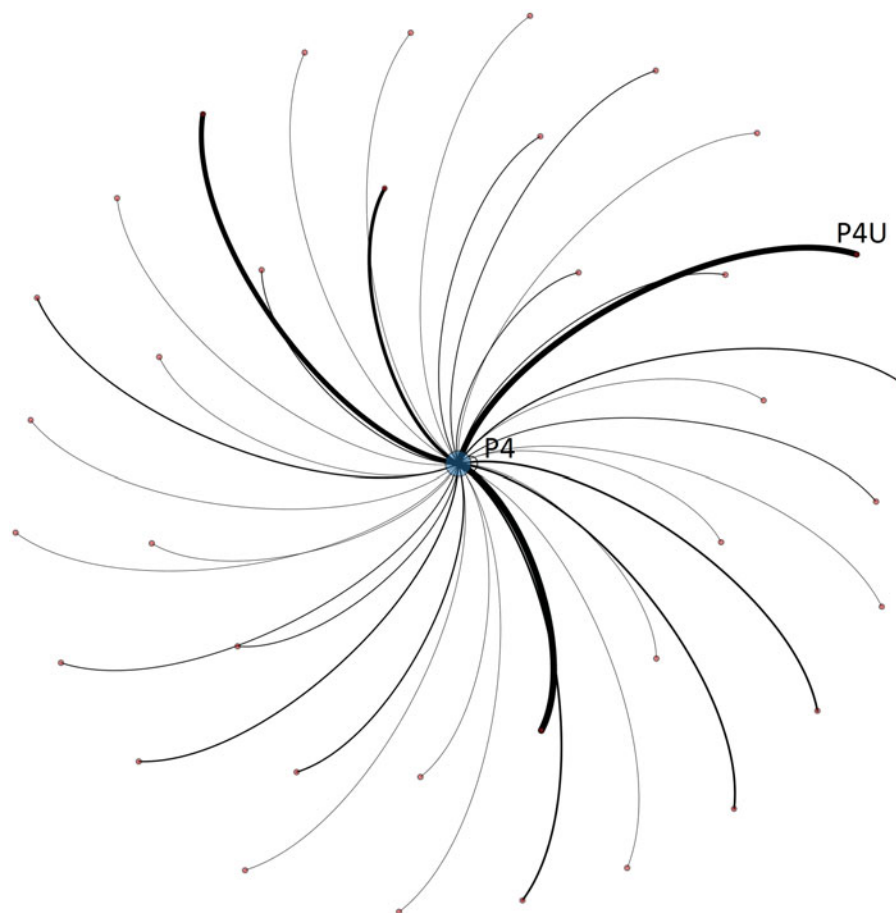


Figure 5. All participants Gephi visualisation.

Key: P1 = participant 1; P2 = participant 2; P3 = participant 3;
 P4 = participant 4; P5 = participant 5.

were focused around a small group of individuals, rather than engagement in the wider community [35]. Table 2 presents the results for tweets for each structural layer of Twitter [18] and Figure 6 (below) outlines the relative frequencies on types of tweets by structural layer (micro, macro, meso) for the respondents individually.

Content analysis of tweets

Overall, the content analysis [1] of the four actively tweeting participants revealed that: (i) Conversational Engagement varied between respondents as either the primary use of the platform (P1, P4) or a tertiary task (P2, P3); (ii) News accounted for few messages in the group, which, by the nature of the domain is consistent with average Twitter usage; (iii) Pass-along was often the dominant alternative to Conversational content as the primary use for the platform; (iv) Social presence was smaller than would be expected from ordinary use, with less self-awareness of Twitter as a medium for social presence evident than in other data sets observed by the second author in the development of Dann [36] and Dann [1] and (v) The category ‘Broadcast tweets’ was either equal, or closely second as the main use for participants’ accounts. This is consistent with early statements that Twitter provided a platform for voicing opinion, and a mechanism for self-expression [36]. Table 3 outlines the group results of the content coding and Figure 7 depicts the relative content of tweets by participants.

Given the disparity in the volume of tweets across participants, results were normalized to compare between the four tweeting participants. Result normalization divides the n count for each content category count by the largest result for that respondent, to create a spectrum of 0–1, to compare proportions of Twitter use across users with wide ranging total tweet counts. Figure 8 presents the normalized results of tweet Content for the four

active Tweeters. Two trends are evident in the normalized data on tweet Content. First, Twitter as a means to share curated links was highly valued among the respondents, with three users prioritizing the sharing aspect over their own conversations or opinions. Second, the data support the idea of Twitter as the platform of self-expression, with Conversation and Broadcast used as a means for communicating with the world at large by the active users.

Although P2, P3 and P4 tweeted several links to photos or videos, the coding category for photos and videos proposed by Vis et al. [7] related to what would be considered the News category (Real Time Event) [1], and the News category was rarely used by participants (see Table 3). Inductive coding of the topics and subjects represented in the pictures and video links in the tweets was not conducted as it was beyond the scope of this study which was limited to Twitter data. The only further analysis of photo or video content in the tweets was descriptive statistics on the proportion of tweets with links that contained links to photos versus video files and these are presented in Table 1.

Narrative inquiry into Twitter experiences

Quotes and excerpts provided in the results are as written by participants during the interviews with potentially identifying information removed. Participant stories of experiences yielded different central motivations across participants as using Twitter for: conversational connection (P1), keeping up with technology and information (P2), reaching an audience (P3), communicating and engaging (P4) and listening (P5). P3 asserted that “devices now have the tools to directly send tweets too and most people don’t know about that”. P3 urged people who use AAC to “have fun with it, don’t always be serious” acknowledging that Twitter is also funny, and “search out your heroes”. P5 recommended that readers “don’t believe everything you read but be open, and it’s great for thinking about what comes up and it helps strengthens own opinion”.

All participants considered that the short text supported by Twitter facilitated its use for self-expression. P1 viewed Twitter as

suitable for people who use AAC as “our language is getting as much out as possible with a few words” and P1 was “getting expert at getting a lot into few words”. P4 reflected that “it’s definitely a good method for connecting and expressing opinions because there is the character limit and people who use AAC often struggle with typing, but obviously it depends on what they want to get out of it”. P5 agreed with P1 and P4 that Twitter was ideally suited to people who use AAC because of its short message format offering “10 words versus 200”. These participants, as well as having previous experience using communication technologies, were accustomed to formulate shorter messages for efficiency in communication and were at ease in Twitter; using on average 77 characters including spaces, per tweet. P2 noted that the short messages did not curtail P2’s personality and “What ever I do I try to use some humours”.

Experiences in getting started in Twitter

A range of events motivated participants towards using Twitter. P1 joined Twitter after attending a tutorial about Twitter at a conference, to contact a local politician P1 already connected with in Facebook: “I knew [the politician] would have a Twitter account”. [P1]. Within a month, P1 was interacting with people already known in real life and through them, people that P1 had not yet met. P1’s sporadic use of Twitter over the time period sampled was repeatedly prompted by socio-political events – a conference related to AAC and a local election. P2’s main motivation to give Twitter a try was through “being a geek, thought I best try – want to keep on top. I really haven’t got hooked yet, but getting trying more now to keep abreast of other topics”. P2 had used Twitter sporadically over the sampled period with long periods away annually from Twitter when P2 “got busy” with working, study, assignments and writing. Like all of the participants, P2 had self-taught Twitter, and sometimes sought help on “how to use Twitter” from a “good friend” in Twitter that P2 also knew in real life. P2 was not sure how to delete tweets, asking the researcher: “if you del it, does it really del???”

Table 2. Structural layers of tweets in the sample: macro-, meso- and micro-layers.

	Macro		Meso		Micro		Totals
P1	32	18%	137	77%	8	5%	177
P2	33	15%	132	59%	57	26%	222
P3	343	16%	1178	54%	655	30%	2176
P4	6	8%	60	85%	5	7%	71
	414		1507		725		2646

Table 3. Group results of tweets by content.

	Conversational	News	Pass Along	Social Presence	Broadcast	
P1	81.9%	0.6%	0.6%	2.8%	14.1%	100.0%
P2	23.0%	0.0%	43.7%	0.0%	33.3%	100.0%
P3	24.5%	1.8%	36.0%	1.6%	36.0%	100.0%
P4	50.7%	0.0%	39.4%	0.0%	9.9%	100.0%
Mean	28.9%	1.5%	34.4%	1.5%	33.6%	100.0%

Figure 6. Individual participant’s micro-, meso- and macro-layers of tweets. Key: P1 = participant 1; P2 = participant 2; P3 = participant 3; P4 = participant 4; P5 = participant 5. Note: Percentages are of the individual’s total tweets, so that each individual adds up to 100% and categories are mutually exclusive.

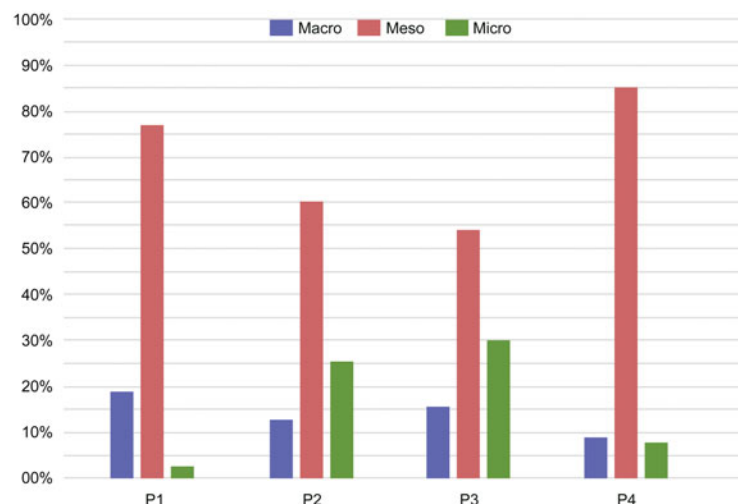


Figure 7. Individual participant percentage of content of tweets. Key: P1 = participant 1; P2 = participant 2; P3 = participant 3; P4 = participant 4; P5 = participant 5. Note: Percentages are of the individual's total tweets, so that each individual adds up to 100% and categories are mutually exclusive.

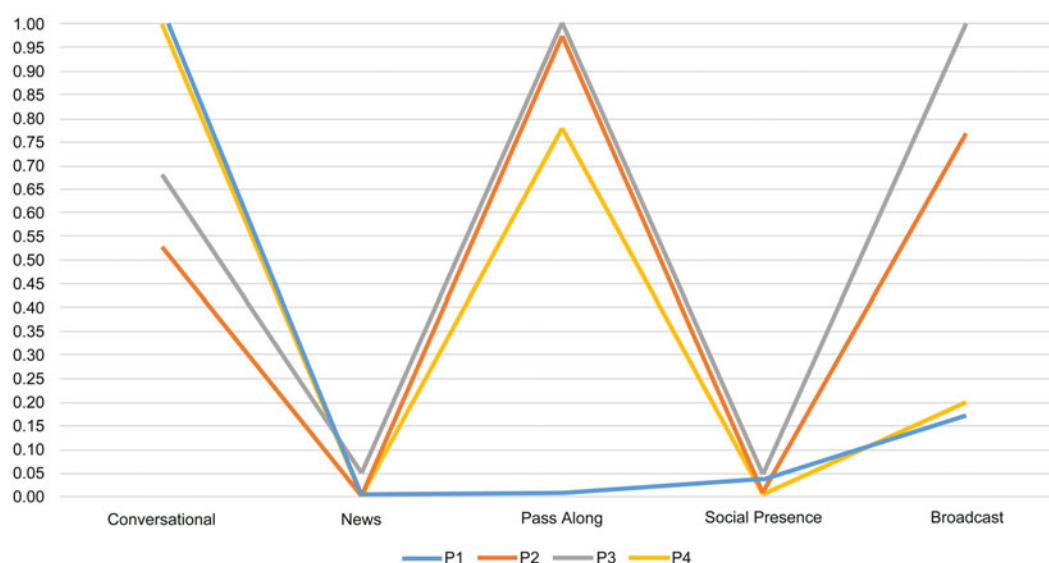
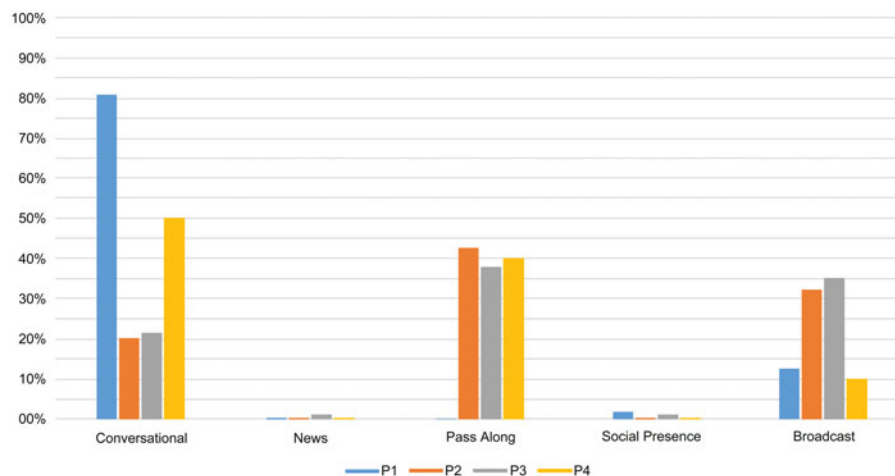


Figure 8. Normalized results of tweet content for four active users. Key: P1 = participant 1; P2 = participant 2; P3 = participant 3; P4 = participant 4; P5 = participant 5.

The interview reflected P2 still learning Twitter, want to understand managing lists and admitting to being unsure about which hashtag to use or how to search for or keep in touch with people to be following. P2 was interested in the social sciences and had recently tried to actively engage in Twitter for finding information about that topic and was “using it more and more” in an attempt to keep up with information.

Like P2, P3 had three distinct “starts” in Twitter, over a period of 14 months. P2 wrote on Skype: “I was wnging it” when reflecting on the first Tweet in our data set, which included a hashtag for a popular TV show, and a link (to Tweet Longer). After three months P3 was still “not getting the hang of Twitter” so stopped using it. P3’s second and third attempts at using Twitter started six and 14 months after the first, respectively, with observations about life and beginning to find well-known identities in Twitter. Since the third attempt, P3 has consistently used Twitter on an almost daily basis. Twitter use for P3 was described as “weekly, my assistant just said hourly but I aint that obsessive”. P3 accounted for the constant presence of Twitter through use of Facebook, in that even on days when not writing “fresh” tweets, “My public posts on facebook I send to Twitter ... Anything with an fb link is from facebook”.

P3 now classified many different personal networks in Twitter as: “Social expression, voluntary capacity, professional, and personal – and networking in various sectors, like education and speechie/therapists”. Although using Twitter in relation to a personal topic, P3 said: “I haven’t had many replies about that, but mostly likes, but I retweet stuff from others I get”. She also used Twitter when sick “just to vent ... I had to calm (another person) down a few times for the same thing ... (name) did the same for me”.

In contrast to all other participants, P4 was first motivated to use Twitter through the encouragement of a family member and since only logged in when mentioned in tweets or when wanting to use it contact companies or promote AAC:

[my family member] actually got me into twitter, for that reason, [they] thought I would enjoy vicariously following people’s lives and interests. I just gathered hashtags were a thing, I think Facebook just had introduced them into their news feed. I don’t go on there (Twitter) much, unless I’m tagged or want to contact someone specific or promoting [group] ... and then I look at the people I am following and what they are doing.

After a proficient but relatively quiet start, P4 increased Twitter use when receiving responses from a colleague. Of P4's Twitter Gephi network, P4 acknowledged "it's quite diverse, but so is my friend network". P4 reflected that "[my] biggest followers are mainly speech pathologists ... obviously they are interest in AAC". P4 agreed that P4's use of Twitter was relatively sophisticated for a novice, perhaps because of many years technology experience and being quite good at just "picking it up" and using it intuitively. P4 accounted for this at least in part as "my generation I think" but also that "AAC users are used to writing concisely and figuring out ways to communicate and adapt".

Before the interview, P5 noted that P5 had only used Twitter through reading as a bystander (i.e. over the shoulder of another person with a Twitter account). P5 had started reading tweets well before an AAC conference, while watching TV. P5 said: "I rely on subtext on tv so it got me use to reading Twitter underneath". The tweets were also read out loud on screen. P5 said that the only difficult aspect of "lurking" or reading tweets was "maybe the pace of it is fast at times". When asked about the value of reading tweets, P5 said "I'm interested in what others say and it gives me useful info at times to think about" – reading tweets was a way of listening in and hearing "what's the buzz". P5 enjoyed reading about politics and the arts, and was also interested in disability issues discussed in Twitter. When asked what useful information P5 had found through Twitter, P5 said: "I can't pin exact info but it's been things about book refs and refs to certain politicians that has made me think on or look up". Even with snippets of info from Twitter, P5 could get a lead to go and find information elsewhere on the Internet. Of future Twitter use if switching from lurker to tweeter, P5 expected to "to see what others say and offer comments insights".

Experiences of using Twitter

Conferences

Twitter use at conferences featured in all participants' narratives of Twitter experience. As noted above, P1 started using Twitter after attending a tutorial on Twitter at an AAC conference, and had since used Twitter at conferences as a way to keep in touch with other delegates and make arrangements for meeting up in person. P1 had also used Twitter in a playful way by creating a hoax message as a joke. P2's diverse network of follower/following personalities had also grown gradually, and by use of a hashtag at the same conference about AAC attended by other participants. Tweeting at a conference had increased P3's real world contacts: "I met this lecturer at (conference) and hearing (the lecturer) talk ... we had tweeted through the hash tag, but I followed (the lecturer) as soon as I heard (the) lecture". P3 got good at Twitter because of "the twitter army as they form at conferences and stuff – ya just learn from those ... And (a speech language pathologist) posts great tips". Like other participants, P5 got interested in Twitter at an AAC conference "via others", but "(conference) this year I wasn't as interested, not sure why".

Tweeting companies: information and accountability

All tweeting participants had used Twitter to obtain information on AAC systems from AAC companies. Engaging with AAC and other companies in Twitter was a deliberate act to hold companies accountable. As P3 said: "Its made me more aware of processes, I am currently trying to get to the bottom of an issue with [company] and [company] ... they kept saying direct message us but I wanted to make it a bit public" [P3]. P4, had also used Twitter to contact AAC technology companies about equipment problems, as "definitely it hold them accountable".

Hashtag chat

More than two years after joining Twitter, P1 took part in a "hashtag chat", that increased P1's maximum number of tweets produced in one day ($n=22$). However, hashtag chats were not easy for all participants. Although P2 found tag discussions were interesting, following a hashtag chat was "difficult at times, hard to keep up" with tweets "flying past". P4 was peripherally aware of hashtags being used to chat and recalled: "I think I read that chat after the fact". P3 urged people who use AAC to "participate in threads too" noting of public threads: "I just read them, I think maybe once or twice, but if you disagree with a bigwig they get bit academic or try to over power you".

TV and politics facilitating Twitter use

P1, P2 and P3 were all motivated to use Twitter to interact with politicians or interact about political issues. P1 and P3's first tweets were both prompted by wanting to communicate with a politician directly, about an election and a political discussion on a TV, respectively. P2, P3 and P5 described using Twitter while listening to or commenting on a popular TV show featuring politicians, through following the show's hashtag "backchannel" chat. P5 had especially enjoyed the use of Twitter alongside the same popular TV show that displayed tweets from the virtual audience on the screen. P3's second Tweet soon after the first, during the same TV show, also included a tag and a link "cos it was too long, I was writing too long a tweets to start ... I think a few retweeted the first one because it had the tag". Indeed some of the P2 and P3's earliest tweets occurred during TV shows when participants had few followers – effectively becoming a tool for increasing their Twitter networks.

Twitter in relation to other social media

Participants expressed variation in preferring Twitter (P1), preferring Facebook (P2, P4) or using both social networking sites in tandem (P3). Although using Twitter sporadically and with relatively low volume of tweets over the time period sampled, P1 reported "definitely prefer it to FB". P2 was more used to using Facebook, and agreed that using both Facebook and Twitter demanded more focus than just using one and it is "hard to focus on both at once" as this meant having to switch between platforms. Although P2 considered that "fb [Facebook] is instant too, and generally gives you more info on external links", P2 also found the speed of following tweets harder, and said "I know that's not the idea. But ur right re waterfall – fb is very similar but slower". P2 was still not sure whether Twitter was going to be helpful and was yet to benefit greatly from using Twitter. Indeed, using Twitter took time and as P2 was also on Facebook, P2 would probably only continue to use Twitter if it was time efficient in terms of finding information. In terms of Twitter being a vehicle for self-expression, P3 recommended linking Facebook posts to Twitter to "make things easier and cut down double work", explaining: "if its relevant on Facebook enough to make public, then put it on Twitter to reach a larger audience". However, P3 did not recommend the opposite – sending tweets through to Facebook – "it gets lost in translation I think – I have friends who do it – tweets and sends to Facebook – and unless you know Twitter it doesn't make sense, and lots of my Facebook connections don't understand Twitter".

Compared to Facebook, P4 considered that: "twitter is more direct and less trashy I think". P4, who commented that Twitter is "not my native interface", did not know if more people who use AAC might use Twitter to connect – "I don't know, I was on there

the other day, and just saw that there are groups, and I didn't know it was possible on twitter, but yeah, on Facebook, there are a few groups for AAC and maybe that translates to twitter'. P5 used Facebook "too much at times probably" but noted that social media in general:

has a lot to offer me. I try to think of what I put out there.... I like it to be positive, reflective and useful in some way to others – I love the way it has connected me to my [interest] circle to boarder beyond disability that is incredibly powerful... I feel like I've connected to my interests and passions and the feedback is equally powerful.

Trouble in Twitter

Participants were asked about any trouble, difficulties or things that had "gone wrong" in Twitter and only four comments across the group reflected negative experiences. P4 cautioned that Twitter was "very public" and P2 explained: "I posted something last week I realized a day later it said the wrong thing! Opposite to my points! Duh – a political comment ... It was a bit embarrassing". P4 had received spam links in direct messages, and P3, the most active tweeter in the sample, had only occasionally been "trolled" in the form of receiving criticism or put-down from a "random" Tweeter (e.g. through popular threads): "I just give it back, like one stranger was a bit crude and I gave it back, and they shut up" and had blocked one person in the past.

Twitter as a tool for "becoming visible"

Being in Twitter had expanded P3's contacts with people and that "I've had people direct message me and ask 'do you have a disability?', unless its stated in your profile ya don't know". P3 has used Twitter for many things (e.g. commenting on the TV, crowdsourcing funds), "I didn't reach the (funding) target, but it also prompted people to contact me personally". As a result of having a large social media profile across multiple social networking sites (Facebook, Twitter, Instagram), P3 had been invited to give talks in the community: "I gave a talk on social media – that wouldn't have happened if I wasn't on various platforms ... its building my profile, and I hope a good reputation mostly ... I try to, get a few gigs (consulting) a year". P3 is a student in the arts industry and saw Twitter as, among other things, "a tool" to build a profile towards a job. P5 considered that use of social media was a window to the wider world, enabling connections to other people in similar interest areas – beyond disability. P5 said "it makes me feel people SEE me and HEAR me... example I wheel down the street and people probably perceive me as being 'disabled' and end of sentence". Social media gave P5 "a chance" at being visible, "at least they've taken the time to see a bit more". Having been part of the Twitter "audience", P5 agreed that the lurkers in Twitter were really important and said that people who use AAC "definitely need audience".

Discussion

The results of this study support the notion that Twitter might suit people with severe communication disabilities by offering a medium where short text-based messages are not only acceptable but are required. However, people who use AAC have other motivations for making use of this mode of social media communication. As Dann [1] noted: "For the individual ... the tone of the Twitter account develops in response to the interaction, personal desires and individual taste". (p.x). Operational competence in the medium was developed through

incidental learning, such as watching others, being introduced by others, attending meetings where Twitter is discussed. While people who use AAC easily created accounts and composed tweets, their tweets, twitter networks and narrative interviews reflected that increased use came after persistent attempts and some struggle, and often a period of hiatus, before returning to try again. The content analysis of tweets reflected strategic competence in use of a communication technology but little of the "social presence" category. The primary use of Twitter was for conversation and broadcast messages. As such, people with severe communication disabilities might need information and guidance on strategies for utilizing all communicative functions and purposes of Twitter if they are to become more visible in the online publics [1,6,12,18].

Participant networks whether small or large showed engagement with a tight-knit small group over the broader community. Putnam [35] described community networks as being formed through "bonding" with strong ties, supporting a feeling of belonging, and "bridging" with weak ties supporting dissemination of information. Four participants in this study were proficient at using Twitter for Pass-Along, Curation and Conversation tweets, and their self-expression was evident mostly in the micro- and meso-structural layers of Twitter [18]. This might limit their reach in the broader social media community or their access to information or advocacy outside their close networks, one of the affordances of public social media for people with disabilities [13]. This type of engagement might limit the extent to which Twitter could prove useful for the purposes described by Media Access Australia [12], including activism or protest. Nonetheless, tweeting participants were keen to interact with politicians and on topics of interest to the general public (e.g. TV shows) and were quick to increase their engagement in the macro-structural layer of Twitter if opportunities were taken up (e.g. in scheduled hashtag chats, back-channel chats on TV, and conferences using hashtags and handles). This study included one lurker (P5) who emphasised the value of reading tweets for access to information. Lurkers, who regularly log in to an online forum but rarely post [37], are a hard to reach group [38,39], but form the majority (90%) of the Twitter audience and provide "return on contribution" for the tweeting minority [38]. Therefore, their inclusion in studies is vital to fully understanding the Twitter experience and network. P5's insights as a lurker reflect thoughtful and *active* participation experiences including reading, reflecting, listening, being interested in and following-up information, thus supporting a positive definition of lurking [33].

Use of Twitter to contact companies may mean that Twitter affords communication access to businesses who engage with tweeters. It is possible that, as for other Twitter communities, the vast majority of people with severe communication disabilities in Twitter are "invisible" to researchers and to one another. Future studies on using Twitter to increase information exchange for people with severe communication disabilities therefore needs to include consideration of the "social readers" in the group who may not wish to contribute by tweeting, but who benefit by being actively involved in Twitter in other ways. The results of this study suggest that online training modules on Twitter might need to include information and guidance on the lurker phase (how do I lurk? de-lurk?), demonstration on the basic functions of Twitter (e.g. how to compose and delete tweets, choose and use hashtags) along with strategies for increasing network size and engaging with a broader audience for "bonding" (belonging) and "bridging" (exchanging information) [13,35]. Furthermore, as participants in this study did not make much use of the "social presence" or "news" content category in tweets, or the Macro structural layer of Twitter, online training could involve

explanations of the five types of content that can be conveyed, and the impact of choosing different structural layers of Twitter to deliver messages. This might lead to a more conscious use of the Twitter skills and strategies that users have already developed. Providing tools for reflection on how Twitter is currently being used (e.g. self-assessment techniques to measure proportion of tweets in each of the categories) and strategies for increasing particular types of tweets to meet their own purposes of Twitter more effectively could also be included.

Limitations and directions for future research

With only a small sample of participants, and diversity in the experiences represented, the results of this study should be interpreted with caution and results cannot be generalized to other people who use AAC and Twitter. The Twitter data collected in this study did not include mentions back to the participant. The non-inclusion of Twitter mention data related to the Twitter accounts of the participants means that the Twitter network visualisations presented are necessarily incomplete and do not represent the full complexity of the Twitter communication network of the participants during the period under consideration.

Larger-scale survey research on the use of Twitter is needed to verify and expand upon the findings of this research. The data collected in this study yield important insights into patterns of use and areas that could be strengthened with online training and coaching in Twitter. Further research is needed to inform training to increase relevance in relation to populations with communication disabilities, including examination of Twitter data, networks and experiences for similar populations who have acquired communication disabilities (e.g. through motor neuron disease or traumatic brain injury) and may have less experience with communication technologies and with short message communication. An increased understanding of Twitter as a visual communication mode for people with communication disabilities could also be obtained through an analysis of pictures and video links in their tweets.

Conclusions

This Twitter research, which adds to the growing body of literature relating to social media experiences of people with disabilities, reveals important insights on the experiences of people with severe communication disabilities who use AAC on ways to approach using Twitter to suit individual preferences and styles. Even with limited introduction or explanation of Twitter, novice Tweeters who used AAC exhibited early operational competence in the medium, writing and retweeting tweets, inserting links and adding hashtags to tweets (for backchannel chat initially, then organized hashtag chats). Participants' stories reflected that they interact with a wide range of personalities in Twitter, including many key stakeholders in the field of AAC. This interaction and the interconnection of networks across participants suggest that Twitter might be useful for building AAC communities through close-knit bonds, and enhancing AAC information and advocacy through bridging with the wider network in Twitter. The results provide important descriptive triangulated information on patterns of use and pave the way for future consideration of cultural and linguistic features of Twitter in larger groups of people with severe communication disabilities in Twitter.

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Supplementary material available online
Supplementary Tables S1 and S2