Social Media and Autism Support: Investigation on Autism Support Groups on Facebook

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Abstract
Given the fast permeation of social media into the health domain, this study centers on the investigation of how users interact and communicate within the autism support groups on Facebook. Based on the investigation on one of the largest autism-related group, we found that group members actively involved in the group interactions, and they preferred commenting more than liking and tagging. The group interactions such as making comments and giving “like” to other members’ group posts generated different types of social networks within the group based on group members’ activities. Influential actors emerged from the interaction networks generated from the social network analysis. The findings identified that the group administrator occupied the genuine dominator position from different perspectives. In addition, sentiment analysis discovered that group members expressed more positive emotions than negative emotions through the group communications.

Keywords: Autism support; Social media; Social network analysis; Sentiment analysis; Support group


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1 Introduction
Autism is a developmental disorder that appears in the first 3 years of life, and it is characterized by substantial deficits in communication and social functioning, as well as restrictive, repetitive and stereotyped behavior (Volker & Lopata, 2008). The online communities on social media sites provide an efficient platform to autism patients and their caregivers where they can ask for help and advice from other users, make contributions to others, receive assistance from the group members, and share their experiences in the community. This could also be a place where group members interact with each other and exchange information. However, there have been few studies that looked into what kind of information is being shared and how users interact with each other.

This study centers on the study of autism affected user’s behavior within communities on social media. The research object will be the autism support groups on Facebook. Those groups consist of autism patients, their relatives, caregivers, researchers and physicians. This study aims to address the following three research questions:

RQ1: How do the Facebook users interact with each other in the Facebook group?
RQ2: Who are the influential users among the group members?
RQ3: What are the sentiment characteristics of the autism groups on Facebook?

2 Related Research
Social support and health information seeking have been two main functions of many online forums (Vayreda & Antaki, 2009). As people increasingly rely on self-help resources, there is a need to understand what and how information is being exchanged in these social media groups. Some studies found that parents who participated in the group were satisfied with the support they received and found the group to be helpful (Clifford & Minnes, 2013). Researchers have also evaluated the impact of social media use on other diseases such as diabetes (Zhang, He, & Sang, 2013).
Support groups in social media can be seen as an interactive information network where a certain part of information dissemination appears along interaction edges. Social network analysis provides a framework that measures structural relations between members of a network. The recent growth of interest in using social network analysis techniques has been sparked partially by the proliferation of social media sites, such as Facebook and Twitter, which offer existing networks of friends and followers (Scott, 2012). One of the benefits of social network analysis is to target the significant actors based on a variety of network measures. Cha et al. (2012) demonstrated that different types of users play different functions in the information sharing process. Sentiment analysis is widely applied for determining the content of the text refers to a positive, negative, or neutral.

3 Methodology

3.1 Sampling

The purpose of this study is to investigate the autism support groups on Facebook, thus the sampling strategy will focus on finding the appropriate Facebook groups. Based on the definition from PubMed Health (Board, 2012), autism is also called autistic spectrum disorder (ASD) and pervasive developmental disorder (PDD). In order to reach broad data sources, the following autism-related terms were used to search the groups on Facebook: “autism”, “autistic”, “asperger”, “aspie”, “pervasive developmental disorder”, “ASP”, and “PDD”. However, the abbreviation “ASP” and “PDD” turned out to return too many unrelated groups in the pilot study since they could represent many words other than autistic spectrum disorder and pervasive developmental disorder. Therefore, five search terms were finally adopted to find targeted Facebook groups.

The Facebook search engine was utilized to search each of the following search terms: “autism”, “autistic”, “asperger”, “aspie”, and “pervasive developmental disorder”. The search was restricted to Facebook groups. In total, there were 341 Facebook groups that met the requirements. One of the largest group was selected for the preliminary investigation.

3.2 Data Collection

The data collection for the pilot study was conducted between August 5 and 29, 2015. The time range was set as between July 1, 2015, and August 1, 2015. For the sampled group, all of the wall posts and the related components appearing within the identified time period were extracted from Facebook manually. To protect the user privacy, all members were assigned a user number to substitute the Facebook username.

3.3 Data Analysis

Social network analysis and sentiment analysis were employed to evaluate the kinds of information users share in their group. In order to construct the social network among the group members, all of the involved Facebook users’ information will be extracted from the raw data sets and will serve as the nodes in the network. The relationships between the nodes are built based on the following interactions: commenting, liking, and tagging. Therefore, for each sampled group, there will be three social networks respectively representing each type of interaction behavior between the group members. Each social network data was imported to UCINET software to conduct further the social network analysis to find the interaction patterns and the influential users within the autism-related support group on Facebook.

The Semantria was employed to conduct an automated sentiment analysis of the dataset based on algorithms developed to extract sentiment from texts (Lawrence, 2014). After the processing of Semantria, each post was tagged with a numerical sentiment value ranging from -2.0 to +2.0 and a polarity of positive, neutral, or negative.
4 Results and Discussion

4.1 Descriptive Statistics

During the data collection period, 368 users participated in the three types of group actions: comment, like, and tag. It showed that more than half (56.5%) of the group members actually joined the group interactions. Such high participation rate demonstrated the activeness of this support group. Among the total of 404 original posts, 128 of them were links, 85 of them were photos, one of them was video, and the rest 190 posts were textual posts. More than 13 posts were created daily by the group members.

People make comments to other's information creation to express themselves. Comment is a more informative format than "like". It provides more text about people’s feelings than clicking a “like”. On average, each post received 4.07 comments and 3.69 likes, which identified that members preferred to make comments and express their thoughts rather than just give a thumbs up. Based on the number of members who participated in each action, it shows that users were more tend to make comments and express agreement on others’ posts than initial an original post. Only a few group members used the tag functions to embedded others within their posts.

<table>
<thead>
<tr>
<th></th>
<th>Frequency of the action</th>
<th>Number of members who conducted the action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post</td>
<td>404</td>
<td>83</td>
</tr>
<tr>
<td>Comment</td>
<td>1644</td>
<td>234</td>
</tr>
<tr>
<td>Like</td>
<td>1490</td>
<td>295</td>
</tr>
<tr>
<td>Tag</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 1. Descriptive statistics of the group interactions

4.2 Social Network Analysis of Interaction Networks

Commenting and liking are two of the most popular activities on Facebook. Both interactions created implicit relationships between members in a Facebook group. Hansen et al. (2010) even proposed that comments are better indicators of social ties than follower/friend relationships. Table 2 and Table 3 summarize the top 5 users based on the three network measures in the comment network and the like network, respectively. Considering the nature of the interaction of commenting and liking, both comment network and like network were treated as the directed network. In a directed graph, the out-degree measures the number of edges leaving a given vertex, and the in-degree measures the number of edges incident upon a given vertex (Butts, 2006). In the comment network, the in-degree means the number of comments a certain member received, whereas the out-degree indicates the number of comments a certain member created to others. It also applied to the like network. Relying on both Table 2 and Table 3, the user 178 possessed the highest in-degree, which showed that he/she gained the most attention from others. Cha et al. (2012) suggested that users with large in-degrees can effectively spread information to a large number of nodes. In this case, group members who had the high in-degrees such as the user 178, the user 144, and the user 325 had higher possibilities to propagate information and impact others in the group.

The top scorers in terms of out-degree (number of comments and likes sent out) were users actively creating the connections with others in the network and just to name a few of them, they are user 178, user 367, user 144, user 128, etc. Users with higher out-degrees showed more interests in interacting and communicating with others.

Apart from the raw degree of the actors, the centrality is one of the most important structural attributes of social networks (Freeman 1978). Tables 2 and 3 list the top 5 authors with the highest betweenness centralities in the comment network and the like network, respectively. Betweenness centrality is based upon the frequency with which a point falls between pairs of other points on the shortest or geodesic paths connecting them (Freeman, 1978). In terms of the commenting interactions, user 178 reached the
highest number of betweenness centrality value, followed by user 144, user 367, user 92, and user 128. Four of these five users also gained high out-degree in the comment network. When it comes to the like network, user 178 (16291.638), user 233 (979.464), user 255 (819.093), user 292 (815.783) and user 26 (749.643) claimed the first 5 positions, respectively. According to the research of Cheong & Cheong (2011), these users can be viewed as opinion leaders in the support group since being on the shortest paths between other members they are able to control the flow of information in the network.

<table>
<thead>
<tr>
<th>In-Degree</th>
<th>Out-Degree</th>
<th>Betweenness centrality</th>
</tr>
</thead>
<tbody>
<tr>
<td>User 178</td>
<td>39</td>
<td>User 178</td>
</tr>
<tr>
<td>User 144</td>
<td>24</td>
<td>User 367</td>
</tr>
<tr>
<td>User 152</td>
<td>19</td>
<td>User 144</td>
</tr>
<tr>
<td>User 128</td>
<td>17</td>
<td>User 352</td>
</tr>
<tr>
<td>User 233</td>
<td>17</td>
<td>User 92</td>
</tr>
</tbody>
</table>

Table 2. The top 5 users in the comment network based on the three network measures

<table>
<thead>
<tr>
<th>In-Degree</th>
<th>Out-Degree</th>
<th>Betweenness centrality</th>
</tr>
</thead>
<tbody>
<tr>
<td>User 178</td>
<td>166</td>
<td>User 178</td>
</tr>
<tr>
<td>User 325</td>
<td>57</td>
<td>User 128</td>
</tr>
<tr>
<td>User 83</td>
<td>42</td>
<td>User 309</td>
</tr>
<tr>
<td>User 255</td>
<td>41</td>
<td>User 104</td>
</tr>
<tr>
<td>User 269</td>
<td>41</td>
<td>User 233</td>
</tr>
</tbody>
</table>

Table 3. The top 5 users in the like network based on the three network measures

Figure 1 and Figure 2, respectively, depict the interaction networks among group members in terms of the commenting activities and the liking activities. The nodes represent individual group member and are shown as circles while the directed links represent commenting or liking movements from one to another. The size of the nodes indicated the betweenness centrality of the user in the network. The frequencies of the interactions defined the strength of the connections and were illustrated by the thickness of the ties between users. The top 5 users with highest betweenness centrality in both networks were highlighted with the red color in order to stand out from the dense diagrams. As illustrated in Figure 1 and Figure 2, those individuals who possessed larger betweenness centrality positioned as the hubs in the networks.

As shown in Table 2, Table 3, Figure 1, and Figure 2, user 178 was the absolute outstanding actor in this group. From all perspectives (in-degree, out-degree, and betweenness centrality), user 178 occupied the genuine dominator (or “star”) position regarding comment activity and like activity, which suggested that he/she possessed the potential communication ability as well as the possible ability to control the communication between other members of the group. In addition, we found out that user 178 was the group administrator. User 178 produced 155 comments to others and received 254 comments back from others, both of which were more than twice the number achieved by other group members. Moreover, user 178 produced 180 posts, which accounted for 44.6% of all group wall posts.
4.3 Sentiment Analysis of Posts and Comments

In total, 1303 textual posts were input into Semantria Program in the Microsoft Excel. According to the analysis, there were 489 positive posts, 492 neutral posts, and 321 negative posts. Apparently, the positive
and neutral content appeared much more frequently in the group. Figure 3 depicts the sentiment changes during the one-month group interactions. From the Figure 3, there was no obvious pattern shown about the sentiment changes over the one-month interval. The negative content emerged some time, which showed that the passive emotions occurred occasionally when group members discussed issues.

Previous studies have claimed that individuals with autism spectrum disorders (ASD) are at risk for remarkable social and emotional difficulties (Mazurek, 2013). However, we found that positive and neutral content were outnumbered the negative expressions in the group. It was surprising that group members expressed more positive emotions than negative emotions. A possible reason might be that people are used to suppressing negative emotions in public, since talking about negative emotions is not socially favorable in general (Lin & Qiu, 2012).

![Figure 3. Sentiment changes during the one-month group interactions](image)

5 Conclusion

This study investigated the user behaviors in the autism-related Facebook groups. Data collected from one of the largest autism-related group served as the data sample. The group statistics showed that group members actively engaged in the interactions, and they preferred commenting more than liking and tagging. Social network analysis was applied to examine the interactions among group members and reveal the influential users in the group. Through the investigation, users with high in-degree attained more attentions from others, while members with large out-degree showed more interests in interacting and communicating with others. In addition, 9 users (user 178, user 144, user 367, user 92, user 128, user 233, user 255, user 292, and user 26) were identified as the influential users or opinion leaders based on the betweenness centrality in the comment network and the like network. Interestingly, the group administrator (user 178) occupied the genuine dominator position from different perspectives. Finally, sentiment analysis discovered that group members expressed more positive emotions than negative emotions through the group communications. The results from this study suggested that the supportive atmosphere in the group may contribute to promoting the active involvement and positive expressions among group members.

6 References

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