

In-group Questions and Out-group Answers: Crowdsourcing Daily Living Advice for Individuals with Autism

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ABSTRACT

Difficulty in navigating daily life can lead to frustration and decrease independence for people with autism. While they turn to online autism communities for information and advice for coping with everyday challenges, these communities may present only a limited perspective because of their *in-group* nature. Obtaining support from *out-group* sources beyond the in-group community may prove valuable in dealing with challenging situations such as public anxiety and workplace conflicts. In this paper, we explore the value of supplementary out-group support from crowdsourced responders added to in-group support from a community of members. We find that out-group sources provide relatively rapid, concise responses with direct and structured information, socially appropriate coping strategies without compromising emotional value. Using an autism community as a motivating example, we conclude by providing design implications for combining in-group and out-group resources that may enhance the question-and-answer experience.

Author Keywords

Autism; social support; online community; crowdsourcing; Q&A; in-group, out-group;

ACM Classification Keywords

H.5.3. Information Interfaces and Presentation: Group and Organization Interfaces: Computer-supported cooperative work, Web-based interaction

INTRODUCTION

People living with autism¹ encounter a variety of difficult social situations throughout their daily lives [27], such as preparing for an upcoming phone interview, handling extreme anxiety at a crowded school dance party, or dealing with a noisy neighbor. The unwritten rules of a complex social world create barriers for people with autism [16]. Seeking clarification or advice about these social challenges is key to navigating everyday life more effectively [20].

An available social support network provides an important source for such advice. Physical support networks, comprised of immediate family, friends, and caretakers, can provide guidance for performing basic daily activities, but it is unrealistic and undesirable for them to be an individual's only resource, and they are not always available when needed. Fortunately, our increasingly Internet-connected society has created virtual social networks, increasing the pool of people who might supplement the advice provided by a local support network. Many literate individuals with autism have access to a virtual network of people via a variety of online communities, allowing them to satisfy their informational and emotional support needs by engaging in question-and-answer (Q&A) interactions [2].

Online communities have emerged as social platforms for people on the autism spectrum to self-disclose, vent, and share [17]. These *in-group* [22] communities provide a key benefit by forming communicative relationships with online peer groups and allowing members to share similar experiences or information to address other members' concerns [13]. However, the members of these communities may lack certain social skills themselves, which, in turn, may affect the nature of their advice.

Crowdsourcing is a common approach for recruiting a diverse set of people to provide information and advice online [10,14]. Prior research shows perspective-taking through interactions beyond autism peer groups is critical to improve interpersonal relationships and obtain socially appropriate knowledge [8,18]. Using crowdsourcing to generate *out-group* answers may compensate for the limited perspective of in-group members and may augment the existing in-group support for people living with autism.

In this paper, we seek to explore the potential of a crowdsourcing approach to enable individuals with autism to garner wider and more varied social support from out-group workers in order to cope with everyday issues and frustrations. We begin by following up on a preliminary content analysis of threads in a large online autism community in order to characterize common in-group questions. Our findings indicate that the community's in-group members either explicitly or implicitly solicit support to deal with a wide array of everyday problems, ranging from tips to partake in small talk at a hair salon to requests for financial planning advice.

¹ Throughout this paper, we use the term autism to refer to conditions related to both a medical diagnosis on the autism spectrum, including Asperger's Syndrome, as well as the social definition used by those who identify with the autistic life experience.

We examine whether valuable out-group answers to these in-group questions can be generated by a crowdsourcing approach using Amazon Mechanical Turk (MTurk). We present quantitative and qualitative findings about the differing characteristics and values in answers between groups, including the speed, relative directness, conciseness, informational and emotional support, and perceived helpfulness provided. Our results suggest that crowd workers rapidly provide concise and direct answers offering a broader out-group perspective without loss of emotional support than those obtained solely within the community itself. Building upon these findings, we suggest design opportunities that improve existing in-group communities by including user-initiated features to seek responses from an out-group. The features we propose include a tool that helps users identify better answer source based on the support-seeking context.

The contributions of this work include:

- A content analysis of 1,935 conversation threads from a large existing online autism community, aimed at characterizing in-group question-asking and support-seeking behaviors that reflect everyday concerns of this population.
- An empirical study to crowdsource out-group answers to questions generated in the online autism community, with quantitative and qualitative analysis to identify if out-group answers can provide added value to in-group support.

RELATED WORK

In-group Online Communities

Individuals with autism are known to have cognitive and social skills deficits that lead them to require support to cope with challenges in navigating daily life [27]. Many users with autism go to autism-specific communities to gather advice and foster self-advocacy from others with similar concerns and difficulties. We characterize the community as *in-group* as defined by Tajfel [22]. In-group is a social group to which an individual psychologically identifies as being a member based on the following one's cognition and value: 1) a sense of awareness to similarities and differences, 2) a perceived value connotations as being a member, and 3) a willingness to provide emotional comfort and support to its members. The conceptual in-group membership has been instantiated by computer-mediated communication (CMC) technologies, such as online communities dedicated to a particular group concerned with a range of issues, for example breast cancer [26], motherhood [21], and chronic disease [9].

Previous research has largely focused on how people fulfill their various social support needs by disclosing personal experiences to people with similar conditions in these specialized online communities. According to a breast cancer community study, both informational and emotional forms of support are critical to a support-seeker's satisfaction [24]. A study of CMC technology used by adults with autism revealed that these in-group online communities offer greater emotional support through the sharing of feelings which lead to a perceived increase in quality of life [5]. Thus, an online autism community is a place where myriads of conversations have been generated to meet emotional and socialization needs for increasing self-esteem and self-confidence of the users.

Indeed, not only do users of in-group communities seek emotional support from its members, but they also request information or advice in the form of an explicit question [24]. Requests or questions posted to an in-group community, in turn, can provide a lens for analyzing various types of social support sought by members of the special group. We focus on support-seeking threads in an online autism community to identify current needs and concerns of the members. We also investigate how their requests are addressed by the responses of others. While a large body of research has explored the emotional impact of responses provided to a requester, less is known about the practical value of responses from in-group who are likely struggling with similar concerns. Thus, we investigate the characteristics of autism community responses as well as the responses from outside of the community.

Crowdsourcing Advice from Out-Group Individuals

Soliciting online advice on daily living from both strong-ties as well as weak-ties is called *friendsourcing* and is a common information-seeking behavior [15]. One recent study explored a social media-based remote assistance for adolescents with autism [8]. The study revealed that obtaining ideas and perspectives from one's weak-ties beyond an immediate caregiver could improve their independence. Building upon the prior work, we seek to determine whether people outside of an in-group autism community could be leveraged to provide a wider perspective of everyday life.

Researchers are increasingly beginning to consider *crowdsourcing* approaches to exploiting non-ties, the crowd workers, to support information seeking in one's everyday life [10,14]. Crowd workers—belonging to what Tajfel calls an *out-group* when compared to a specific online community made up of self-selected members [22]—individually come and go, but the pool of workers is available to perform tasks at any moment. The notable example of taking advantage of crowdsourcing for seeking support in daily living is VizWiz [3], which assists visually impaired individuals with providing on-demand answers for performing everyday activities, such as providing subjective fashion advice [6]. Jeong et al. studied whether crowd workers could provide answers to everyday questions on Twitter, such as “about to get my nails done. What colour shall I get?” [10]. They found that the overall quality of crowdsourced answers was similar to the quality of friendsourced answers. Receiving answers from strangers can be a positive experience for some, as strangers could be more honest and provide a wider variety of responses while challenges associated with too many differing opinions and a decoupling from important context remain [14].

Not only does crowdsourcing provide useful information to the general population, but it also supports specialized communities. Crowd workers on Amazon Mechanical Turk (MTurk) have been used to provide helpful information to caregivers of individuals with autism [4]. However, it has not been investigated whether the crowd workers can directly benefit individuals with autism. We, therefore, hope to further clarify those benefits and identify an opportunity to improve upon the in-group discussion through the introduction of out-group answers.

METHOD

We describe the 6 steps of data collection and our analysis methods below. Our study starts with the selection of everyday life Q&A threads in a specific online autism community and ends with the evaluation of responses provided by both in-group and out-group members along a number of quality dimensions.

Research Site and Study Demographics

This study investigated threads from the public discussion boards of a large online autism community with more than 6,000 registered members and 19 discussion boards organized by such criteria as users (e.g., family and friends), topics of concern (e.g., love, relationship and dating), and interests (e.g., technology). In these boards, individuals that self-identify as being on the autism spectrum post questions, self-disclose personal stories, and impart health-related information (e.g., diagnosis, treatment). Thus, this discussion board platform is a rich environment for studying what kinds of support individuals with autism seek.

Individuals with autism can vary widely in their level of social and cognitive functioning. The present study focuses on individuals on the high-functioning end of the autism spectrum who are able to use an online community to seek social support. Members of the community do not necessarily have an official diagnosis of autism though the community's name suggested that they might have Asperger's syndrome. Neurotypical individuals (people who are not on the autism spectrum) are also allowed to participate in the community. Upon registering, the user is asked to generate a profile with a pseudonym and indicate his or her diagnostic status. Because of the level of privacy safeguards, it is virtually impossible to confirm the demographics of individual members. Our observations on the site suggest that its user base appears to consist largely of individuals with autism, but some are also family members, friends, or spouses of individuals with autism.

Data Collection and Analysis

As of September 2014, the community hosted 8,094 threads, and 145,865 individual posts. While various types of conversations have occurred in the community, we focused on the practice of asking for support. Thus, we wanted to analyze threads that either explicitly or implicitly elicit advice in the form of question-asking. We also aimed to specifically address topics related to day-to-day social struggles that out-group members could help with. We excluded topics that only in-group members could understand. Thus, the scope of our analysis is the subset of conversations that are "questions" about regular daily experiences, concerns, and challenges. For our analysis, we selected 5 discussion boards: Friendships and Social Skills; Education and Employment; Love, Relationships and Dating; Autism Spectrum Help and Support; PDD-NOS, Social Anxiety and Others. We collected 1,935 threads that were contained in those five discussion boards.

Step 1. Identifying question threads

To build our in-group Q&A dataset, we considered a thread as the unit of analysis. For each thread, we viewed the initial post as the (potential) question and the subsequent posts as the replies, or in-group answers. We wanted to analyze threads that began with a question and determined if a post was a question by using conventions from previous research [25]. Question detection

modeling has shown that one must go beyond applying simple heuristics (ending with a question mark and starting with one of the five "wh" question words). Indirect requests should be considered questions as well. Therefore, if an initial post had explicit or implicit indicators such as *want*, *wonder*, *need*, *advice*, *help*, *suggestion*, *tip*, *opinion*, *feedback*, *support*, *problem*, *issue*, *trouble*, *anyone*, or *someone* that garnered any actions by responders, we marked the initial post as a "question post" and included that thread in our subsequent analysis.

As a result of the filtering process of a single coder, we collected 1,277 question threads (1,277 question posts and 20,472 reply posts), and these threads received an average of 17 responses. This represents a significant portion (66%) of the threads in the 5 discussion boards, indicating that Q&A behavior is very common in this online autism community. Furthermore, for 92% (n=1,174), of these 1,277 question threads, at least one person responded with an average first response time of 4.8 days. However, this period would have decreased to 21.6 hours if we had excluded the 10% of the threads that did not receive a first response for over a month.

Step 2. Identifying questions for navigating everyday life

From these 1,277 question threads, we wanted to select a random but representative sample of 20 threads that portrayed the variety of everyday life questions the community members were asking. For this fine-grained analysis, we randomly selected threads from Step 1. Our goal was to create a subset of 20 question threads to feed into the subsequent out-group analysis (Steps 4-6), but we wanted to make sure that questions were relevant to navigating everyday life and did not require too much expert knowledge in autism. We recruited two additional coders, who were neither part of the research team nor authors. Coders were asked to thoroughly investigate each thread to determine whether the initiating question sought information or advice on how to navigate everyday life (e.g., *how do you find out if you got the job after an interview?*). In addition, we wanted to exclude confidential and/or sensitive inquiries that were too specific to autism itself and that required validation by autism experts. More specifically, we excluded inquiries on the following topics: symptoms associated with autism (e.g., hyper-sensitivity), diagnoses, clinical treatments, and medication.

Step 3. Categorizing questions based on established themes

The Virginia Department of Education has proposed 7 categories of living skills that are necessary for adults with autism to attain independence [27]: 1) grooming/personal hygiene; 2) schedule planning; 3) physical or mental health habits; 4) school, work and professional life; 5) financial planning; 6) household chores management; and 7) leisure and social activity [8]. In order to find example question threads from each of these categories, our three coders (an author and two coders) independently categorized each of the randomly selected question threads accordingly. During this process, two additional categories emerged: 8) communication skills; and 9) initiating and maintaining social relationships. Once we completed the topical categorization, we selected one to three questions from each category so that all topics were covered.

Grooming and personal hygiene (2)
Matching clothes: My mom is continuously telling me that the clothes I wear don't match, even though they always look perfectly fine to me. I don't understand how people decide what matches and what doesn't and how they keep track of it. [...] Does anybody else have problems with this?
Daily planning (2)
Difficulty starting the day and doing stuff: It has taken me experiencing countless grumpy, irritable, and depressed weekends to realize I do not do well without a schedule or routine. If I don't start doing something within about 1-3 hours, my day is practically ruined. Does anyone else experience this?
Maintaining good health habits (physical / mental) (2)
Sleep and waking trouble: I often have trouble falling asleep. I could sleep through an explosion. I am told I'm rather violent when someone tries to wake me. Apparently I'm a sleep fighter! Any ideas or suggestions? Sleep aids only make this worse.
School, work and professional life (3)
First day back in school: I went to my first college class this summer, and I started having a panic attack even before I got into the classroom. I started pouring sweat and shaking [...]. I felt extremely embarrassed about how I must have looked [...] If you have any ideas about what to do to make this better, please let me know.
Financial planning and management (1)
Money management: I seriously suck at not just buying useless stuff. [...] The only time I don't buy stuff is when I'm depressed. And even then I'll just go out and buy something to try and make me feel happy (I know how materialistic that sounds). I have a \$160 monthly allowance and that's usually spent in two days. Does anyone else have an issue like that?
Managing household chores (3)
How do you cope with power cuts?: Just recently I've been having power cuts at my house and I haven't been able to post when I'm at home and I must say, it really sucked that I actually got to the point where I wanted to actually scream, shout or swear and I managed to survive 3 days of it. Anyways, how do you cope with power cuts?
Leisure and social activity (3)
Friend's wedding: I have a friend who's getting married in a couple months and he just asked me today if I'd be one of his Groomsman. [...] I get really anxious in front of a lot of people, even if the focus isn't on me. Does anyone have any hints on how to keep from having a major incident during the wedding? [...]
Initiating and maintaining social relationships (2)
Problem with friendships: Ever since I was a child, I've been overly attached to friends I feel very close to. I get jealous when they hang out with other people. I become crushed when they ignore my friend requests for Facebook. [...] I don't want to be overly attached to other people anymore. What should I do to have healthier friendships?
Communication and conversational skills (2)
Problem with phones: Does anyone else there have problems with making/receiving phone calls from people they don't know? I can talk on the phone with friends, but anything involving phone calls to unknown people is a major problem for me. [...]

Table 1. Example question posts categorized by areas for navigating everyday life. Note that number next to the category label indicates the total number of questions selected in each category.

Finally, we generated 20 questions for our crowdsourcing experiment presented in subsequent steps of our method. Table 1 shows an example of each of the 9 final question categories that our 20 final question threads fell into. In categorizing the questions into specific areas of daily living skills, we found requests for help in performing day-to-day activities related to home, hygiene, health habits (e.g., food, sleep), financial management, scheduling, or a combination of these areas (e.g., *I'm sharing an apartment with a roommate. How should we divide house chores and the budget for living expenses?*).

However, we found that social activities overlapped with almost every topic. For instance, the study classifies the “Matching clothes” question in Table 1 as primarily a hygiene and grooming question, but it also can be attributed to difficulty in understanding social norms. Rather than create a separate social norms category for this study, and introduce the problem of cross-categorization of questions, we simply point out the overlap between life skills and social skills that are inherent in many questions.

We also identified a distinctive linguistic pattern from our 20 sampled questions. Nine questions included phrases like “*Similar problems?*” “*Anyone else?*” or “*Is it just me?*” aimed at either gaining empathy or seeking advice. While most question threads were likely to articulate the specific response expected by explicitly asking a question, some of the questions (n=4) appeared to be more in the nature of a self-disclosure. As noted elsewhere, the practice of self-disclosure is an implicit way of eliciting emotional support [24]. In addition, self-disclosing questions often revealed specific details about the individual’s personal problems in an effort to solicit coping strategies from others with similar experiences.

Step 4. Selecting representative answers from in-group responses

For purposes of a fair comparison with out-group responses, we wanted to determine five in-group community responses directed to the original question poster. However, the reply structure of this community (i.e., who is replying to whom) can become complex as threads get longer. Following Vlahovic et al.’s approach [24], we chose the first response as one of the best answer candidates because it is most likely to be dedicated to the initiating post. We then applied a manual filtering to exclude conversational posts not intending to answer a question as posed. Replies directed to a specific audience by quoting comments or mentioning an audience (@), and follow-up replies generated by the original question asker were also excluded. From the remaining responses, we randomly selected four responses, which we assumed were likely to be answers from community members to the initial question. We used the same procedure for each thread to select five responses (100 responses in total) from the 252 responses generated to the 20 questions.

Step 5. Generating out-group answers through MTurk

We created Amazon Mechanical Turk (MTurk) Human Intelligence Tasks (HITs) to generate out-group crowdsourced answers to the 20 questions garnered from Step 3. Each HIT included the following template:

<p>Introduction: Many individuals with autism visit online communities to ask questions about issues they are facing. We would like to know whether people outside of the specific community could provide answers for them. A question from a special autism community will be shown to you. Please read the question carefully, rate your confidence and provide your own answer to the question.</p>
<p>Question Title: Hair Salon</p> <p>Question Body: “Do any of you (especially the women) have to mentally prepare yourself to go to the hair salon? I have an appointment on Saturday and I find that I have to mentally prepare myself for not only the touching (I get body shivers from people touching my head) but also because I have to make small talk with the stylist. I just want to get up and out of there as soon as possible but my visits are at the minimum 2 hours.”</p>
<p>Tasks:</p> <ol style="list-style-type: none"> 1. Rate your confidence in being able to answer this question. <ul style="list-style-type: none"> (1) Not confident at all – (2) Slightly confident – (3) Somewhat confident – (4) Very confident – (5) Extremely confident 2. Explain the reason for your confidence rating: 3. Please answer the question, or explain why you cannot answer:

MTurk workers were provided with brief descriptions of the study objective and the title and body of the question post. They then read the content and provided their own answer to the question or the reason why they could not answer the question. As an optional task, they were asked to rate their confidence in being able to provide an answer and the reason behind the rating. We assigned 20 workers per HIT so that we could collect 400 answers. Each worker was paid \$0.20. We refer to the answers generated by these MTurk workers as “out-group crowdsourced answers.” In an attempt to determine the demographics of our workers, we sent them a follow-up demographic survey and received responses from 104 workers. As discussed in step 4, we focused on the responses that were intended to answer a question. To build a set of out-group response candidates, we excluded blank responses (n=3), or responses that explicitly stated, “I cannot answer” (n=29). Ultimately, we randomly selected 100 answers (5 per question) from a pool of 368 crowd responses.

Many of the crowdsourced answers arrived very quickly. We paid approximately \$90 to collect 400 responses to 20 questions from 149 workers within five hours and nine minutes on MTurk. The first answer arrived within three minutes after we posted the HITs. The demographic information collected on the responding workers demonstrated that the average age was 33.4 and that 51% of the workers were female. The majority of the workers (76%) were from the United States. Most interestingly, 70% of the workers indicated that they either had experience with autism in their personal or professional life. Seven of them had autism, while 40% indicated they regularly interacted with someone on the autism spectrum. With respect to the definition of out-group in this study, responses from the seven autism workers were eliminated from further analysis because they could be considered in-group. When asked to self-rate their own knowledge about autism (none, a little, a lot), 65% of the workers indicated that they knew a little and 29% indicated they knew a lot. Only a few workers (6%) indicated that they knew nothing about autism. Seeing that crowd workers could produce answers more quickly

than we saw in the online community, we next evaluated those answers to identify key differences between the groups.

Step 6. Characterizing in-group vs. out-group answers

To evaluate the answers, we characterized the responses from the two sources through several outcome measures to define the quality of the answers. We considered the five following subjective outcome measures in our analysis:

Directness (Yes/No)—*whether a response contains a direct answer*—is a primary measure of determining the quality of an answer [23]. Regardless of the length of the response and how the topic related to the question, this factor considered whether the response did or did not contain an answer to address the main point of the question.

Additional information (Yes/No)—*whether a response contains any other information (positive or negative) beyond the question*—was examined to identify the existence of extra information, or when viewed from the opposite perspective, how concise the response was.

Informational support (Yes/No) was measured to identify the type of social support provided [12]. The existence of informational support was determined by checking *whether the response provides advice, suggestions, or knowledge*.

Emotional support (Yes/No) was another measure of social support provision [12]. Emotional responses *offer empathy, concern, affection, love, trust, acceptance, intimacy, encouragement, or caring*. Both informational and emotional support measures are often used to analyze health-related discourse in online communities [26].

Helpfulness (1-5 scale)—*whether the response helped to address the question*—is used to determine the perceived value of the answer in addressing the issue raised. This was rated on a 5-point scale (1:poor, 2:fair, 3:good, 4:very good, 5:excellent). An excellent answer should convey positive emotions that can relieve a requester’s concern as well as provide implementable and useful information.

Three groups of raters participated in the evaluation:

Researchers (n=2)—Two coders (both non-authors) who had already participated in the question classification process described above evaluated all 200 answers using the five measures. These research raters were shown the 20 question sets and the sets of ten related community and crowdsourced answers. Answers were shuffled in random order and the answers’ origins were not revealed.

Individuals with autism (n=6)—Raters self-identified as having high-functioning autism participated in the evaluation process to provide a view of how someone with autism perceives the helpfulness of the responses. These raters limited their analysis to the helpfulness measure in order to lessen the cognitive load during the evaluation.

Autism experts (n=11)—We also wanted to include raters who regularly interact with someone with autism (i.e., professionals, parents), and to compare how their ratings differed from the other groups’ perspectives. We recruited autism experts at an official

Raters	Intra-class correlation
Researchers (R)	0.79
Individuals with Autism (A)	0.70
Autism experts (E)	0.67
R + A	0.82
R + E	0.72
E + A	0.75
R + A + E	0.79

Table 2. Intra-class correlations for helpfulness between raters.

meeting organized by teachers and staff members who were designing a workplace transition plan for students with autism in the post-school stage. We created an online evaluation form for rating the helpfulness. Due to the time-consuming nature of the rating process, autism expert raters were shown only two randomly sampled answer sets (20 answers for two questions). In total, 11 autism expert raters (vocational and transitional specialists (n=4), special education teachers (n=2), job developers (n=3), a behavior analyst (n=1), and a mother of a son with autism (n=1)) completed the online evaluation. We collected their ratings of about 100 answers corresponding to ten question sets.

RESULTS

Assessing Raters Agreement

For the Yes/No measures (directness, additional information, informational support and emotional support), performed only by the research raters, we converted Yes=1 and No=0 and calculated an average. Krippendorff's α were calculated in order to determine the multi-coder agreement [11]. Measures appear to be internally consistent (directness: $\alpha=0.62$; additional information: $\alpha=0.48$; informational support: $\alpha=0.71$; emotional support: $\alpha=0.44$), indicating they are in the range of moderate agreement on additional information and emotional support and substantial agreement on directness and informational support.

To assess agreement on the helpfulness scale, we computed intra-class correlations (ICC). ICC allows us to understand what proportion of the total variance within the measure that is explained by the variance between raters [1]. Table 2 shows the ICC values within and between various groups, all indicating strong agreement.

In-group and Out-group Characterization

To evaluate the value of the in-group and out-group answers, Mann-Whitney U tests (two-tailed, reported with a z score and p-value) were conducted to evaluate the statistical significance of the reported non-parametric differences between in-group and out-group answers. Table 3 shows the average score of five measures for the answers from the two sources: in-group community answers and out-group crowdsourced answers. Keeping the high-level findings from the descriptive analysis in mind, we analyzed the qualitatively collected data in order to gain a detailed understanding of the characteristics of the answers in which these patterns occurred.

Answer source	Mean (μ)	Median	SD (σ)	Min	Max
Directness ($z=-4.03, p=0.000053$)					
In-group	0.69	0.70	0.26	0	1
Out-group	0.97	1.00	0.06	0.80	1
Additional Information ($z=0.28, p=0.777391$)					
In-group	0.25	0.20	0.22	0.00	0.80
Out-group	0.23	0.20	0.20	0.00	0.75
Informational Support ($z=-4.34, p=0.000015$)					
In-group	0.41	0.35	0.30	0	1
Out-group	0.91	0.90	0.10	0.70	1
Emotional Support ($z=0.25, p=0.797197$)					
In-group	0.38	0.35	0.17	0.10	0.80
Out-group	0.36	0.40	0.22	0.00	0.80
Helpfulness ($z=-4.98, p=0.000001$)					
In-group	2.18	2.09	0.48	1.43	3.25
Out-group	3.24	3.22	0.26	2.87	3.87

Table 3. Descriptive statistics for the five outcome measures comparing in-group (N=100) and out-group (N=100) answers for 20 questions. The z statistic is the Mann-Whitney U score.

Directness and Additional Information

The out-group responders were more likely to provide direct answers addressing the question asked, as shown in Table 3 ($z=-4.03, p=0.000053$). The out-group directness measures were extremely consistent ($\sigma=0.06$), as contrasted with the directness of the in-group answers ($\sigma=0.26$). Both the in-group and out-group provided some degree of additional information that might positively or negatively affect the ability to comprehend the answers. No statistically significant differences were found between the in-group and out-group on the additional information measure.

We observed, on average, that out-group answers contained fewer words ($\mu=64.31$ words, $\sigma=51.01$) than in-group answers ($\mu=118.49$ words, $\sigma=109.39$). Regardless of the length of the message, an in-group answer was less likely to contain a direct answer to a question. Our empirical observation determined that in-group community responses were varied and not necessarily related to the original question posted. These community responses included off-topic discussions, and discussions between responders. Even though we excluded the first response that was likely to provide a direct answer, the results indicate that the chance of receiving a direct answer for the in-group was lower than from the out-group.

The Different Types of Social Support

We were interested in whether out-group differed from the in-group as to the form of social support provided. Table 3 shows that out-group workers provided superior informational value compared to community members ($z=-4.34, p=0.000015$). The

informational value of an in-group answer was dependent on the question at the issue of the question (min=0 to max=1). The groups did not differ statistically in the measure of emotional support. Both groups may equally provide emotional support through their responses, but the results did not present the type of emotional statement (negative or positive) provided. Thus, we revisit this issue by analyzing sampled answers qualitatively.

Is the Answer Helpful?

Helpfulness was rated by investigating whether the response provided a constructive answer that would assist individuals with autism in coping with the challenge identified in the question. All 15 judges rated the out-group answers as more helpful than the in-group answers ($z=-4.98$, $p=0.000001$). Even though the ICC values (Table 2) for each group showed substantial and moderate agreement, we separately examined how individuals with autism and the autism experts perceived the helpfulness. The results showed that the rater with autism rated the helpfulness of the out-group higher than the in-group (in-group μ : 2.20 (σ :0.59), out-group μ : 3.10 (σ : 0.30) $z=-4.79$, $p=0.000002$) as well as autism experts group (in-group μ : 2.16 (σ :0.54), out-group μ : 3.15 (σ : 0.58), $z=-3.20$, $p= 0.001354$).

Qualitative Analysis

Which Out-group Members Provide More Helpful Answers?

While the majority of crowd workers indicated that they were not on the spectrum, many of them (40%) regularly interacted with someone with autism. Over one-half indicated that they knew little or nothing about autism. However, we found no correlations between the helpfulness of the response and 1) the crowd worker's confidence in being able to answer the question, 2) his or her level of knowledge about autism, or 3) the crowd worker's personal connection to someone with autism. The results may be due to most of the questions requiring autism-specific knowledge at the question-sampling stage. Another possible explanation is that the sampled questions likely have common situations occurring in everyone's life, making experience with autism less relevant. One-half of the total crowd responses ($n=195$) indicated that their past experience was the reason they could answer a question: *"I've overcome spending issues of my own."* *"I have moved out to a friend's house before for the first time, and I am in almost the same situation."*

Emotional Support

The majority of questions collected through Steps 1-3 elicited subjective opinions. In particular, the in-group community questions often disclosed problems already experienced by the asker and sought feedback from people who have been involved in similar situations, either to receive an opinion or to gain empathy (e.g., *"Last night I went to my school's annual dance. I spent the entire time checking my watch and wanting desperately to leave so that I could go home. There were too many people and too much talking. I felt so overstimulated. Similar problems, advice, anyone?"*). Community responses to this question appeared to have emotional phrases such as *"I felt like drunk, extremely anxious and my head was empty."*, *"Never liked dances either. I always found them boring."* These comments could help the asker find people in similar situations who might provide fellowship through shared experiences, a big potential advantage for in-group responses.

Surprisingly, out-group answers contained similar emotional statements: *"I feel this way a lot if I am in a situation where there are too many people."* Almost 30% of the crowdsourced responses ($n=118$) contained similarly sympathetic messages, and some of them affirmed that the problem was not related to autism, but rather was a general issue for everyone: *"You are not alone having this problem. The only difference is that the percentage of this anxiety."*, *"It's natural to worry. Everyone worries about loved ones sometimes."*, *"NO ONE likes going to the dentist! My ex-husband totally freaked out when he had to go and he didn't have autism."*

Socially-appropriate Coping Strategies

Although most in-group answers provided emotional value such as trust and companionship, we found some in-group answers that did not match general social norms and expectations. For instance, in response to a question about dealing with noisy neighbors, one in-group responder suggested: *"Buy a drum kit, wait those neighbors falling asleep, and that's when you practice the living daylights out of that kit. Negotiate with them after, say, three or four sessions."* However, it is unclear if this type of answers can be attributed to informal nature of in-group forums or characteristics of autism. Nevertheless, one of the characteristics for individuals with autism is a difference in social understanding when compared to neurotypicals [19]. Their tendency to take things literally would lead them to misunderstand the nuances of a joke or sarcastic phrases. Thus, the nuanced responses may impact them more than it would for others. While some responses from in-group provided no further advice for coping with the problematic situation, we found that crowd answers commonly contain actionable coping strategies: *"I think that approaching your landlord first, would be a great move. Getting his or her take on the situation will give you another perspective. Also, if you have alerted your landlord with the situation the landlord may be able to do the next steps for you. If this plan is not possible, then I think you should approach the loud people either in passing or in the most non-confrontational way."*

Structured Social and Behavioral Prescriptions

We were also surprised to observe that many crowdsourced responses provided step-by-step coping strategies for various social situations (e.g., feeling isolated on Facebook, extreme anxiety when the partner is away, a panic attack at the first class in the college). One crowd worker offered the following way of relieving stress when away from a partner: *"First, try talking with your partner about how you feel. [...] Talk with him about those worst scenarios you've been imagining. Having a course of action and back-up plan for each scenario will help you both feel more in control. Finally, trust your partner. Try to keep in mind the fact that he's a responsible person who is doing everything possible to keep himself safe."* Many individuals with autism need such assistance in devising explicit rules or strategies for appropriate social behavior [4]. We found that crowdsourced responders prescribed remedies for social and behavioral challenges that are well-suited to the needs of individuals with autism.

DISCUSSION

Our results suggest that crowdsourcing can generate extremely fast, direct, and informational answers from a diverse set of responders with differing perspectives. The crowdsourcing approach shows a potential to provide advice at least as good as that provided by members of a dedicated autism community. In

this section, we discuss the implications of these results focusing on the trade-off between the benefits of in-group Q&A behavior and the potential for including an out-group as a supplementary source of support.

Crowds offer quick responses throughout the day

Our investigation reveals that crowd workers are able to provide timely (arguably more timely) answers. For individuals with autism who seek information, the noteworthy speed of crowdsourcing can promise potential support around the clock. This may be particularly helpful since individuals with autism can experience unexpected social situations at any time. In some situations like contextualized health issues, a support-seeker's satisfaction with provided answers depends on what she is seeking in the first place. If she explicitly asks a question to seek informational support and receives only emotional support in return, the requester is likely to be less satisfied [24]. If a requester with autism primarily wants prompt, straight answer to cope with a problem, obtaining responses from crowd workers may be more promising than culling the large volume of conversations often provided by an in-group community. Acknowledging the fact that in-group community has the initiative to seek help, below we propose design directions that enhance the performance of the existing community with the immediate crowdsourced responses.

Crowds can answer the autism community's questions

Our findings suggest that crowd workers are able to answer a question asked by individuals with autism, regardless of their knowledge or experience with autism. As we noted, we found that a responder's level of knowledge and experience with autism were not correlated with the helpfulness of the response. While the majority of crowd workers in this study were not on the spectrum, they noted that they have had frustrating situations similar to those that individuals with autism suffer from. About one-half of the crowd workers cited such prior experiences in responding to the questions: *"This definitely happened to me when I've been to a club that I don't want to go to."*, *"While I'm not autistic, I have issues with being touched sometimes"*, *"As a woman, this is based on my own experience going to the salon every 6-8 weeks."* In addition, some crowd workers showed strong confidence in being able to answer a question because of the relationship between the question topic and their current occupation. For instance, a crowd worker noted in a message that *"I work part time in fashion industry"* as the basis for her ability to answer a question on how to match clothes. For a problem involving workplace conflict, one crowd responder provided advice based on her *"experience as a supervisor, years of coaching experience."* Thus, an extended pool of crowdsourced out-group responders may increase the chance to find potential topical experts in various areas of daily living.

Crowds provide direct and informational support

Our findings suggest that in-group and out-group answers provide different perspectives. In general, the three groups of raters agreed that the out-group answers were more helpful than the in-group answers. One possible reason for this difference may be related to the methodology we used. Given the conversational nature of in-group communities, a collection of answers in a thread may be more valuable than a single post. Unlike the rhetorically-oriented

nature of an in-group community, a crowdsourcing platform allows out-group responders to provide isolated and direct answers (i.e., independent judgment [14]). Perhaps by virtue of the isolated nature of crowdsourcing, crowd responders are likely to focus on the concerns of the person asking the question.

Crowds offer helpful advice with emotional support

Online autism communities are intended to engender interaction with a sympathetic group. One might be concerned about the lack of emotional support while engaging in out-group answers. Interestingly, our results suggest our-group answers convey informational value without corresponding loss of the emotional value. We noticed crowd workers sometimes expressed positive emotions such as empathy and encouragement affirming out-group people can also suffer from the same issues. In-group emotional responses were likely to resonate with the poster's suffering, confusion, and frustration (e.g., constantly losing friends, feeling isolated). However, the overexposure to personal, emotionally-laden responses without further helpful insight into their suffering may amplify some negative aspects of life [13]. If an asker were susceptible to absorbing the negative emotions of the responders, the emotional content in the response would no longer be helpful. Further research should address how individuals with autism perceive the value of emotional support provided by in-group members and out-group members differently.

Crowds provide actionable advice with concise language

We found that out-group answers had less words compared to answers provided by community members. While length has been found to be a positive indicator of answer quality in general online Q&A forums [7], overly verbose answers may not convey greater relevant information. More importantly, out-group answers tended to offer social and behavioral prescriptions such as remedies for extreme anxiety when being apart from a partner, coping strategies in a public presentation, and plans of action for first dates in a structured manner (e.g., numbering, bullet points). This strategy resonates with a commonly used autism intervention, SocialStories™, in which scenarios guide the person through the sequence of steps needed to carry out a particular task or learn appropriate behavior for social situations. Prior research has shown that crowd workers are effective in developing social scripts which can be used to assist teachers in generating content for social skills training [4]. Future research should address whether individuals with autism find value in concise and structured, playbook-style answers like those generated by out-group responders.

Crowds broaden the perspective to the autism community

Crowdsourcing provides a wide variety of perspectives obtained via out-group information that can supplement in-group perspective. We found that a majority of the questions we classified were associated with social skills. The fact that members elicited feedback from others with the same core social challenges may indicate that the current in-group structure presents a limited perspective on problem-solving. The notion of broadening the perspective of individuals with autism is a positive endeavor supported by a study of a social networking service used by young adults with autism [8]. The study revealed that members could

benefit from obtaining diverse perspectives from a variety of network members, including neurotypical responders such as friends, relatives, parents' friends, and volunteers [8]. Our results demonstrate that such out-group responders could be leveraged with an existing crowdsourcing platform and that out-group answers could be constructive and useful in addressing questions asked by individuals with autism.

While the results of our study are promising, further research may fill existing gaps identified by other studies related to crowdsourcing advice for everyday decisions. The major concerns include the mismatch between crowd workers and question answerers, differing opinions, decoupling context, trust, and cost [10,14]. Our results suggest an opportunity for improving the question-asking experience through a mixture of in-group and out-group support. Crowdsourcing can serve as a supplemental approach to bridge the gaps in existing support provided by in-group communities.

DESIGN OPPORTUNITIES

In this section, we discuss the design opportunities for existing in-group communities that are being repurposed for question-asking and support-seeking. We also propose the design of interfaces or systems that can maximize the benefit of combining in-group members with out-group input.

Motivating to Seek Help from the Crowds

Our study with crowdsourced responders demonstrates that such a crowdsourcing approach can complement in-group communities by providing rapid, socially appropriate answers that offer a broader out-group perspective. Thus, the in-group community could be augmented if it is capable of embedding a crowdsourcing mechanism in some situations, such as when a more immediate or methodical response is needed. A simple visual component such as an "Ask Turk" button could motivate individuals with autism to consider other answer sources when submitting a question. One can imagine that this feature could serve as a "hotline" in which on-demand online volunteers are ready to respond 24/7. We used Amazon Mechanical Turk for this study, but the notion of a hotline serviced by online volunteers suggests that it might be worthwhile to consider the creation of specialized crowd communities. We return to this idea of specialized crowd communities later.

Opportunities for Automation

Individuals with autism may find it difficult to determine if and when they should look to in-group or out-group sources to elicit helpful feedback. We found that out-group sources could provide valuable advice on in-group questions in nine areas of daily activity that were not autism-specific. The manual question filtering and classification performed by coders might be replaced by sophisticated natural language processing techniques. Algorithms could be trained to learn the topics of questions and the level of knowledge about autism required for each topic, and suggest a question-asker to consider seeking advice from the crowd as well.

Our goal with this work was never to replace online communities, but rather to determine ways to improve upon them. As others have found, we saw a preponderance of Q&A behavior and our

manual techniques for determining whether an initial post in a thread is a question or not suggests that it might be useful to simply predict whether a post contains a question at all. Automated techniques could attempt to understand different nuances of a question (e.g., is there an immediate informational need or is emotional support being sought). However, directing a question to the out-group should not be automatic. Our suggestion is to augment existing communities by including a user-initiated feature to seek responses from crowds.

Finding a Way to Foster Trust in Strangers

Our autism experts initially expressed skepticism about the credibility and safety of consulting anonymous crowd workers. While our results indicate that strangers may be able to provide direct and helpful answers, it still does not mean that those who care for individuals with autism would be comfortable with all of the out-group answers. To increase trust in responses from crowd workers, potential workers could be given a reminder of the "do's and don'ts" of good answers. The crowd workers in our study represented caregivers (33%) and some autism professionals (4%) without any specific recruiting. These types of crowd workers could also be leveraged to validate answers from other crowd workers. However, this process may inject additional cost and time into the process.

POTENTIAL LIMITATIONS OF OUR STUDY

It is possible that the autism community we sampled is not representative of individuals with autism at large. This issue is mitigated by our empirical observation to characterize several autism communities prior to the study. Our observation reveals that these communities share many similarities which impact the pattern of interaction: discussion board structure and topical discussion board (e.g., social skills : social skills and friendships, work and finding a job : education and employment). Such in-group community discussion boards appear to have the same threading structure composed of initiating posts and reply posts. Thus, we picked a community that already generated a vast amount of threads and that were accessible to our research team.

Our methodology also has shortcomings. First, since out-group membership was critical to our study, we excluded responses generated by crowd workers who stated they had autism. However, we see studying crowd workers that have autism as an exciting future avenue for leveraging their experience to verify the appropriateness of answers. Second, we recognized the imbalanced comparison between selected community threads from a whole conversation and isolated crowd answers. Future research will benefit from the holistic comparison of MTurk answers and community threads. Thirdly, it is also plausible that the helpfulness rating differences between the groups were simply artifacts of worker self-selection or the nature of being paid. The framing of the HIT introduction on MTurk that was visible to potential workers before accepting the HIT may have drawn more individuals with a relationship to autism than what is characteristic of the broader MTurk community. Indeed, we believe that the explicit presentation of the goals and motivations for our published HITs helped us recruit crowd workers that were motivated by the task rather than just the monetary value. In our future work, we hope to explore the possibility of a "philanthropic

turk” [4], where online volunteers provide answers not because they are being paid, but because they want to help others in need.

Our work with MTurk responders introduces socio-ethical issues related to the use of a crowdsourcing labor force that is global. One potential drawback is the lack of cultural sensitivity to localized questions about daily living that may often require a nuanced understanding of particular social worlds (e.g., conventions around landlords and apartment rental). To account for cultural contexts and social norms, we envision the creation of specialized crowd communities by leveraging local volunteers who are familiar with the particular contexts of a question asker.

CONCLUSION

The goal of this study was to explore the possibility of crowdsourcing answers to garner a wider perspective of information and advice for individuals with autism. The evaluation of in-group and out-group answers illuminated key differences between the groups. Our results show out-group information obtained through crowdsourcing provides added value with its relatively rapid turnaround time, and a wide variety of responses in a concise and structured manner, without loss of the emotional support when compared with the online community's responses. These differences led to set of design features for augmenting the in-group community support—a nudge to be aware of available answer providers beyond the community, automated question classifier to find better answer source, and a validation mechanism to foster trust. These implications may also encourage researchers to explore issues faced by other specialized communities whose individuals seek advice to navigate their daily lives effectively.

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