"Will I always be not social?": Re-Conceptualizing Sociality in the Context of a Minecraft Community for Autism

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ABSTRACT
Traditional face-to-face social interactions can be challenging for individuals with autism, leading some to perceive and categorize them as less social than their typically-developing peers. Individuals with autism may even see themselves as less social relative to their peers. Online communities can provide an alternative venue for social expression, enabling different types of communication beyond face-to-face, oral interaction. Using ethnographic methods, we studied the communication ecology that has emerged around a Minecraft server for children with autism and their allies. Our analysis shows how members of this community search for, practice, and define sociality through a variety of communication channels. These findings suggest an expansion in how sociality has traditionally been conceptualized for individuals with autism.

Author Keywords
Autism; Communication; Social Interaction; Virtual Worlds; Minecraft; Social Media.

ACM Classification Keywords
K.4.2 Social Issues: Assistive technologies for persons with disabilities.

INTRODUCTION
Positive social interaction can contribute to increased feelings of wellbeing. For people with autism[1], however, social interactions can be challenging, particularly in person and on the telephone [35,71]. Challenges include difficulty initiating social encounters, using and interpreting non-verbal cues (*e.g.,* gestures, eye contact), displaying emotional reciprocity, and a tendency to focus exclusively on one interest intently [1,49,59]. Such challenges in social interactions can be isolating, often leading to decreases in feelings of social connectedness or belonging [3,32,59,67] and increases in feelings of loneliness, depression, and anxiety [3,36,45,67]. Adolescents who feel cared for and as though they are part of a social group tend to report higher levels of emotional wellbeing and are less likely to abuse substances or engage in dangerous behavior [13,55,56,61]. Likewise, low levels of social connection, support, and competence tend to predict depression and low self-esteem [69].

Despite their challenges in social interactions and popular misconceptions about their sociability, individuals with autism typically express a desire to create social connections with others [45,48,52]. Some assistive technologies address difficulties surrounding social interaction by supporting discrete kinds of communication (*e.g.,* verbal speech). This focus on a single avenue for communication, however, may be inadequate in addressing the myriad ways in which people with autism can be expressive and social that extend beyond a singular medium. Alternatively, online communities, including social networking sites [7,24,25], can create multiple avenues for communication for those who struggle with face-to-face interactions, such as those with autism [52].

Despite the potential advantages online communication has for people with autism, these interactions also bring their own challenges. It can be difficult to know who is trustworthy in a space where multiple identities, some fraudulent, are easily created [7]. Cyberbullying can be harder to avoid than in-person bullying with increasing mobile and home connectivity [21,58,64]. Finally, as the norms of online communities rapidly change, and there are limited ways to explicitly indicate those changes, it can be particularly difficult to detect and emulate those changing norms [7,58].

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[1] The term *autism* will be used throughout this paper to denote Autism Spectrum Disorder as well as Asperger's Syndrome as previously defined before the DSM-V changes [1].

In this paper, we present the results of an ethnographic study of an online community surrounding a Minecraft server dedicated to children with autism and their allies. By studying the communication ecology surrounding this community—including social networking sites, online videos, a community website, and the Minecraft server itself—we describe how people with autism and their allies search for community and how they practice and define sociality (*i.e.,* the state of being social).

RELATED WORK

In this section, we first describe prior research focused on sociality among people with autism. We then examine technological supports developed to help individuals with autism communicate and interact socially with others.

Autism and Sociality

There has been much debate surrounding the sociality of individuals with autism. Autism is often accompanied by difficulty making eye contact, interpreting certain nonverbal cues, and, in some cases, performing coherent verbal utterances [1]. These challenges can often be interpreted as an inability or lack of desire for social interaction. However, autism is complex, nuanced, and occurs on a spectrum. Accordingly, researchers have begun exploring how sociality might be different, not less, for those with autism.

Müller *et al.*, for instance, found during interviews that individuals with autism do, in fact, desire social interaction with other people [45]. These social interactions are often complicated by sensory overload and other experiences associated with autism. These personal challenges are only partially at the heart of difficulties that individuals with autism experience when socializing [48]; sociality also depends on circumstance and context. For instance, face-to-face conversations may be much more difficult for a child with autism than an interaction that takes place side-by-side, without the need for eye contact or facial cues. Thus, enabling flexibility in the nature, context, and form of interactions may ease some of the challenges faced by these individuals.

The range of therapies available for those with autism is as wide and varied as the symptoms of autism itself [60]. In aiding the sociality of individuals with autism, therapies often support the social skills and social needs of individuals with autism but tend to support a particular view of sociality [48]. For instance, one such view may be that to be social, an individual must communicate in face-to-face conversations using body language, inflections in vocal tones, and eye contact. This social behavior is a large focus of therapies and technologies to support these therapies [48].

More recent work, notably in Anthropology and Psychology, has begun exploring other social behaviors and interactions that might be of use to individuals with autism. Social supports—such as structured social activities, creative outlets, and mediating objects—can facilitate alternative social interactions [45]. These social supports often lend themselves to being technologically mediated. Communication mediated by technology may reduce sensory overload and improve one's overall ability to socialize to the preferred level [48,52].

Social Play

Social play is how children practice and develop their social skills. Children engage in a range of playful practice roles and test the boundaries of social rules during social play sessions [16]. These skills are vital not only for children to grow into competent, functioning adults, but also to discover who they are and what kind of adults they want to become [16,41].

Difficulties in social play arise for children with autism because they often have challenges in the development of social skills and communication [1,33,34]. Thus, children with autism can be caught in a cycle of being unable to engage in social interactions which leads to impoverished social play which, in turn, leads to further deficits in social skills as the children age [33]. Children with autism have a tendency to become fixated on one toy, object, or theme, which can lead to alienating their peers with demands for more rigid and less attractive types of play [70]. Libby *et al.* found that while children with autism did not have difficulty with most forms of play (*e.g.,* sensorimotor play), they did exhibit less symbolic (*i.e.,* pretend) play than other children [38]. Looking more broadly, children with disabilities are found to engage in play, but the forms that play takes may not be "typical" [17,54]. For example, a child may be in a wheelchair and unable to play traditional outdoor running games (*e.g.,* tag), but can play in other ways, such as a game that uses only the upper body or modifies the game to fit their specific needs. Children with autism fall into this category of both wanting and being able to play, but are not able to engage in play in ways other children may consider typical.

Recognizing these difficulties, work has been conducted in the area of teaching children with autism how to engage in social play. These include peer-play training with models [31], using Integrated Play Groups [70], and adult-child interventions [2]. Strain and Schwartz demonstrate that social play cannot be taught with a discrete skillset because it is a highly contextual experience [62]. This has led to a need to mediate the play experience, either naturally occurring play or artificially produced play experiences, rather than teach children how to play. However, some therapies still teach specific social skills (*e.g.,* eye contact, joint attention), which may then be reflected on and practiced during social play [2]. Therapists can create structured play environments where a child with autism may have directed play, getting cues and positive feedback when exhibiting appropriate play behavior. Therapists have also found that narrative construction and storytelling are both useful in helping teach social skills, such as

reciprocation and emotion recognition, necessary to engage in social play [10,15,37,40]. These techniques are useful because they are already found in play and, when used in therapy, they can help children with autism gain social skills and enhance their play experience [15].

Technology to Support Social Interaction for Autism
Assistive technologies can support communication and act as social supports for people with autism [11,42]. Assistive technologies focused on socialization have taken many forms including, but not limited to, tabletops (*e.g.,* SIDES [53]), tablets (*e.g.,* [6,26,27]), and social media (*e.g.,* [23–25]), each with their own advantages and disadvantages, as we detail here.

Tabletops provide a large common focal point and all users can be collocated comfortably [53]. While tabletop applications have promise for creating a supportive environment for socializing, they have not been seen as feasible for general distribution, due to their high price point, large size, and lack of portability. Tablets provide many of the same advantages without the these large barriers and thus have been used for social support, creating a focal point for joint attention, and encouraging sharing and creativity [6,26,27].

Social media, which can be accessed from tablets or any other platform, can be also be a means of social support for people with autism or a way to deliver social skills based therapies. For example, SocialMirror was designed to connect people with autism to their social network and get support as they transition into adulthood [23–25]. On the other hand, Burke *et al.* have found that it may be difficult for users with autism to maintain online relationships [7]. As social media and its users continue to change, individuals with autism may find that computer-mediated interactions are effective for socializing regardless of these challenges [52]. In this work, we explore what these challenges and opportunities look like in the context of an online community using a virtual world and its surrounding technological artifacts to support people with autism, their allies, and broader social community.

METHODS
The data presented in this paper are from an on-going, immersive digital study of the community that has grown around a Minecraft server known as Autcraft[2]. The Autcraft community was created for children with autism and their allies. This community originated with the customized Minecraft virtual world initially, but a variety of channels are now used in tandem including YouTube, Twitch[3], Twitter, Facebook, and a community maintained website (including an administrator's blog, community forums, member profiles, and an in-browser web messenger). These

are all included in this work. Data were collected through interviews, participant-observations, field notes, directed and non-directed forum discussions, chat logs, and the retrieval of digital artifacts.

Setting
The Autcraft community populates social media, live video streaming, and a Minecraft virtual world. We describe each of these in turn in this section as part of the overall site.

Minecraft. Minecraft is an open-ended virtual world with no particular goals or play requirements [12,43,63]. Players can build and create new objects by manipulating blocks in the game. Minecraft virtual worlds are each unique, procedurally-generated environments [12,20]. Players can use Single Player Mode (in which case a unique world will be created just for them), or Multiplayer Mode, in which a unique, shared world is created and hosted on a server other players may join.

The multiplayer virtual world in our study, Autcraft, is a semi-private server on Minecraft created for children with autism and their families. As such, anyone wishing to join must first complete an application to be added to the white list. This application includes a declaration of having autism or being a friend or family member of someone with autism who plays on the server. Only those who have been added to the white list can access the server. Autcraft currently has more than 5,000 white-listed members with a daily average of approximately 50 players in-world at peak hours of the day. Because the Autcraft server requires all chat activities to be in English, most players are located in English-speaking countries. This server has strict rules for behavior that are enforced both by software modifications and a group of volunteer administrators and "helpers."

Video. Autcraft community members use two main outlets for creating and publishing video content: Twitch and YouTube. Twitch is a live-streaming video platform used for streaming video game content while the user is playing [19]. Members use this platform to stream live videos of their activities within the Autcraft virtual world. Other Twitch users can search for the Autcraft keyword or find users by username to watch the desired community related content. Live stream videos are meant to be watched in the moment, but are occasionally recorded. Videos recorded and published on YouTube are generally edited before publishing, including title screens denoting the player's username and video title. YouTube videos are shared with other Autcraft members through the community's website.

Social Networking Sites. Autcraft administrators maintain a Twitter account and a Facebook group page, which are used to disseminate community news, post inspirational blogs by members of the community, and keep in touch with community members. Community discussions happen across these sites and are member-driven.

Autcraft Community Website. Autcraft administrators maintain a website that includes a main page with news and blog posts, a status page for the virtual world, forums, member profile pages, and an in-browser web messenger. The website allows members to "friend" each other through profile pages and displays "top forum posters" on the front page for those who have posted the most in the forums.

Data Collection

Our work employs methods established by other studies of virtual world communities [4,5,28,46,51]. The first author has four years experience playing Minecraft recreationally approximately 15 hours per month. As Autcraft is a semi-private server, we gained access to Autcraft via permission of the server's creator for the purposes of this study. From here, the first author created an account with an avatar labeled as a researcher. The researcher's presence and purpose was made clear to the community through both the Autcraft web-based forum as well as in the in-game chat. Additionally, community members were able to ask the researcher questions about the study through the forums or by visiting the researcher at an in-world home office created by the researcher during participant observations. Parents were informed of the lead researcher's presence via a parent message board and the Facebook page of the community. Parents and children were encouraged to voice their concerns and ask questions about the research through all communication platforms utilized by the community. The lead researcher also maintains a public website where members of the community are directed to see updates from the study, including any publications. The lead researcher collected approximately 60 hours of immersive in-game observations, including participating in activities on the server, recording chat-based dialogue, and field-notes on everyday practices and events as they occurred in the virtual world. The lead researcher also participated in community activities outside the virtual world, including observing discussions in the forums and on the social networking sites. In addition, focus groups were created informally on the forums through forum posts prompts, wherein the lead researcher asked open-ended questions of the community. Additionally, the first author collected a variety of digital artifacts from the various platforms used by the community. These data were collected over a period of sixteen months and include approximately 5000 forum threads and 150 blog posts created by players, parents, and administrators.

Data Analysis

Using an iterative, inductive approach, emergent phenomena were identified, named, and categorized following techniques similar to those employed in grounded theory [8]. We used an inductive method of analysis to understand how participants defined and enacted sociality through practice, rather than testing theoretical definitions found in the literature because we were explicitly interested in understanding how the community views and experiences sociality. Using open coding, the research team met weekly to discuss recurring themes in the data. As dominant codes emerged, they were incorporated into the categories presented in this paper. Through these preliminary codes, types of practices and meanings emerged, particularly patterns of common behaviors and situations around community, definitions of sociality, and practices of sociality. Additionally, through directed coding around the theme of social behaviors, we identified the dimensions and degrees of variation around these behaviors (*e.g.,* the various ways in which Autcraft community members define and practice sociality). We used affinity diagramming and axial coding to understand the relationship between, across, and within these codes.

RESULTS

Our analysis demonstrates how members of the Autcraft community search for, practice, and define sociality. These results indicate more broadly how people may increasingly find new ways to express themselves and create a sense of community as emergent forms of media change the nature of our social landscape.

Searching For and Finding Community

In this section, we describe how people with autism and their allies search out and find social interactions through Autcraft. Specifically, we examine how members of the Autcraft community articulate their entry into, and continued involvement with, this community. These results highlight how online communities can serve as sites of sociality and how the people who are a part of them seek out social interactions through the varied platforms available to them.

Early adolescence (*i.e.,* typically ages 9 to 13) is known to be a time of discovering one's own identity marked by shifting priorities from family to peer relations and a strong desire to conform to and be accepted by one's peers [72]. By middle adolescence (*i.e.,* typically ages 14 to 16), individual relationships become more important but "fitting in" remains a key value. There are no clear data on the average age of Minecraft players, but our extensive time spent in game and on forums would indicate that early adolescence and adolescence are sizable age groups for players on Minecraft and even more so for members of the Autcraft community. Thus, it is not particularly surprising that the awareness of, and a strong concern about, feelings of difference are salient aspects for Autcraft members. Being "different" can result in feelings of isolation, realized isolation, or even bullying. In this context, game play and the associated online communities can be a place of escape for those who are socially isolated or bullied in other areas of their lives. For example, one member describes being unhappy with the behavior of his school peers and notes that the forums are a place to vent these frustrations:

Everything I do just makes me more and more unhappy and stressed.....it's not like [me] to feel depressed but I just feel so depressed and down and stupid and just bad about

myself. People are saying mean things to me. I......don't want to post this but I need to get out of my system... (forums, P27, age 12, m)[4]

Using the forums, members of Autcraft are able to express their emotions, something they may not be comfortable doing elsewhere or be able to in "conventional" ways. These slower-paced, text-based interactions allow members to decide what and how to share—thus reducing the stress of improvised interactions and the need for interpreting nonverbal cues found in face-to-face interactions (*e.g.,* gestures, eye contact).

Despite enjoying the benefits of this outlet, Autcraft players must still navigate other places in their lives, where, in many cases, they feel bullied and isolated. As one member posted:

"*Still hard in the rest of the day - can't spend all day on Autcraft - Seriously!!" (forums, Q9, P23, age ?, m).*

Similarly, one member posted about her difficulties with bullying at school:

...so today i was thinking about how much i have been bullied and how many friends ditched me. so i need some advice on how to make friends plz help thx guys (forums, P10, age ?, f)

Here, we see her ability to cope with bullying at school, in part, related to her ability to leverage her online social network. Still, she is actively seeking out in-person friendships and asks her online friends for help.

Autcraft was created with the intent of being a Minecraft server free of bullying and as such attracts a large number of players with autism seeking a "safe" space [58]. Sometimes this support comes in the form of the implicit reassurance that there are other "people like me" in the world. For example, one poster in the forums asked how to deal with life when it becomes "overwhelming" due to sensory impairments that make many physical sensations uncomfortable for her:

When I'm getting to the point that I'm freaking out over something ... everything feels really overwhelming (like if I had to be out in a loud place with loads of people for a while it all builds up) and when it is being I guess let out everything feels horrible. Like I get to the point where I want to cut my hair off because the feeling of it on me gets too much. I'm not sure if anyone else gets like that or if it is just me being weird but it feels really horrible ... (forums, P21, age 14, f)

In this forum post, the writer wonders if her feelings are "weird" or if "anyone else gets like that." Although she is describing a *physical* discomfort, she is seeking *emotional*

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[4] Each quote includes: (source of quote, participant number, age of participant, and identified gender if available in member profile).

and *social* comfort from her network of peers, and she is not denied. Another poster quickly responded:

Yeah.. I'm so glad someone feels the same way - It's hard to find the words to explain it, especially with peers. Good to make friends on here. (forums, P23, age ?, m)

Not only were other posters supportive, they dispense advice related to these physical world problems such as "*crying it out*" or going to the school's "*learning support room*" and discussing these problems with a supportive teacher *(forums, P2, age 13, m).*

Thus, a dedicated social network of supportive people with relatable personal experiences can help members of the online community overcome challenges, both on and offline, and normalize the experiences of those with autism. This in and of itself is not particularly surprising. We know from the literature that online communities can support people with chronic health conditions [9,14,39], those who are members of minority groups [57], and typically developing adolescents [66]. What is unique here is the particular role that a game coupled with other, more common, forms of online community have on a population particularly known to struggle with finding social support [63]. Autcraft—including the game, forums, Facebook page, and community-related videos—helps community members to not feel "alone:"

I guess that's what Autcraft is for, meeting people who go through the same thing as you, so you don't feel alone? xD (forums, P28, age ?, m)

Autcraft members' descriptions of "hanging out" with their friends mirrors those of other youth online [30]. They spend time with their online friends by interacting through forums, instant messenger, and "hanging out" in the Autcraft virtual world. Although not typically physically collocated, members consider these relationships to be meaningful friendships. Autcraft, by its very nature of blending social interaction with strict rules of behavior and appealing game mechanics, comes together to form a space of cohesion, not difference, and of support, not scorn. This type of community allows people to redefine their views on sociality and of community more broadly as we examine in the next section.

Defining Sociality and Community
Although Autcraft community members often seek out social relationships through Autcraft as an augment to in-person relationships, some do not wish to seek out these in-person friendships. Those who prefer the bulk of their sociality to occur online struggle with what it means to be "social." For example, one teen described himself on the forums as "not social" while, in the same post, describing many online, and offline, social interactions:

So, I dont ever social lize. The only way i am social is online. I never hang out with my family or do anything. The only time i come out of my room is if we watch a family

movie, i play baseball we go for a car ride or i go to work. Other than that i am in my room 24/7 on PC, YouTube texting etc. Anyone else like this? Will i always be not social :(I really want to be social but its hard D: (forums, P22, age 13, m)

This participant questions his own sociality by comparing his social behavior to more normative views of sociality. While he describes thinking that he should be communicating more face-to-face, he finds his online communications satisfying in their own right. For individuals with autism, face-to-face interactions can prove difficult and take a great deal of energy. Therefore, these users may find that online interactions are less "costly" and derive from them the same satisfaction as face-to-face interactions.

Some interview participants, on the other hand, directly defined their online activities in Autcraft as social. For example, one called it out as particularly social, noting that it was a way to find people with common interests, an issue to which we return in the following section:

Even being on [Autcraft] is social. Those are good ways of talking to people. ... I asked [my dad] and he said try to find people with similar interests. (forums, P5, age ?, ?)

Of course, online interactions are not always positive, and, in other online environments, negative interactions can erupt around labels and definitions. For example, one Autcraft player described responses to the word "Autistic" as part of his username when playing Minecraft on another server:

"*people would swear call me names break my builds etc…becuz i am defrent... i didnt relize people would be mean about [the username]… and i liked the name… theres other people on here [Autcraft] with *autism* or *Autistic* in there names…Yeah... thats another reason i am happy to have [autism]*" (interview, P22, age 13, m)

For P22, having autism was something he wanted to disclose to others until that label led to negative responses from other Minecraft players. Recognizing this commonality with other Autcraft players then led him to play exclusively on the Autcraft server rather than other places in Minecraft. He was able, in this way, to define not only what being social meant for him but also who his community might be.

Members of Autcraft find that they can lean on one another for social support. In turn, they learn the valuable lesson of social reciprocity by providing aid and comfort for other members when they are troubled. For example, one member described being *"so into talking"* that he would forget to actually play the game, going on to express:

"i like to help people with there problems… Like if someone is sad about bullies i help cheer them up" (interview, P22, age 13, m)

For many members, being helpful and supportive is one of the most important parts of their sociality. The community has found this important enough to write into their rules, and has actively encouraged helpful behavior by giving the most helpful members advanced ranks and other rewards.

More broadly, Autcraft community members frequently articulate their membership as being part of the Autcraft "family." In much the same way players of MMOs might feel a strong bond with their guild members, members of the Autcraft community bond with each other and feel connected to one another [47,68]. Particularly for adolescents, who are actively exploring their identities and places in the world, this "family" membership allows them a sense of connection and affiliation with others beyond their biological family.

Being a part of the Autcraft "family" means being a member of the group, having a support network to lean on, feeling included, and participating in activities and events together. A participating parent details:

Well, I love being a member of the [Autcraft] community and love spending time with my 'family' here. …finally just felt like I found a place that I fit in. A place I was accepted for being shy … and just being "different" than others. ... Most of my life I've never felt like I fit in anywhere and never could make friends my age. Here--it doesn't matter where I live, my age, how shy and/or anti-social i can be at times, that I have anxiety over really weird things, or that I can talk too much--I'm accepted. And for that, I want to go to these events and just either hang out and have fun with other people, or help make an event happen. (directed forum, P25, age 45, f)

As we see in the above quote, "family" as it relates to the Autcraft community, incorporates the idea of being accepted for who you are, including faults and quirks. Across our analysis, we saw this acceptance as a cornerstone to making being "different" more tolerable and reducing the social isolation and loneliness that frequently surrounds difference. Definitions—whether of sociality, community, or even family—are shaped both by conceptualizations and ways of thinking, but also through practice. Thus, in the next section, we examine the ways people in the Autcraft community practice sociality.

Practicing Sociality
In this section, we consider practices of social connection at both the community and interpersonal level. For the Autcraft community, these social connections are formed and maintained through a variety of media technologies, allowing members to use communicative practices best suited for them, both as individuals and as a group.

Community: Setting the Stage for Sociality
The guidelines of the Autcraft community explicitly encourage people to *"Be Kind, Be Respectful, Be Responsible"* (community rules, from website). Reminders of these rules are automatically sent to the personal chat

window of Autcraft players. However, no rules would matter if the community were not engaged in these supportive behaviors. Additionally, the emergent ecology of other non-Minecraft platforms around Autcraft makes rule enforcement difficult, if not impossible. What makes the Autcraft community noteworthy is that the culture and norms of the community ensure positive behaviors cross these platforms and are adapted to the features of the particular communications media being used.

Administrators foster the sense of "family" that is core to this community's definition of sociality by creating community events, including parties, special battles during which members collaboratively fight monsters, and even local in-person events. For example, when the community celebrated its second anniversary, there were dragon fights, a dance party in-world, live-streaming of the weekend's events through Twitch, YouTube, and giveaways:

"Well, the day is coming to a close... Autcraft's 2nd birthday.

I have been up for a very long time but we did 4 epic community dragon fights, shared tons of great memories and had lots of fun partying in the ballroom on the server." (Facebook post, P29, age 39, m)

Community members hold these events in places that are marked with in-world monuments that honor the events. Given the importance of these events, administrators have worked to expand their reach beyond Minecraft players to curious parents or others who are interested. For example, an administrator who helped run a major community event posted a recap on Facebook and used Twitch to live stream the event:

I've heard from parents that told me that they were able to see their children interacting with others in the videos. They loved to see their kids having fun! Another parent told me that her son saw himself in one of the videos and he couldn't stop talking about what a great day it was. (Facebook post, P29, age 39, m)

Even members who may not be able to participate fully, such as parents who have other obligations, are still able to connect:

This year for autism awareness day I had to work, but was able to listen to [Autcraft]'s stream off and on and participate in chat once in awhile. (directed forum, P25, age 45, f)

Members are able to watch these videos and read posts about the event in order to relive the experience. One member told the story of when *"famous youtubers"* (*i.e.,* Minecraft players who produce YouTube videos and have a substantial following) came to visit the virtual world:

On April 2nd, 2015 (Autism Awareness day) We had a bunch of famous youtubers come and visit, including some of my favorites that I never thought I would be able to see.

It was one of the best days ever for me! (directed forum, P30, age 16, m)

The poster included links to the YouTube videos created by an administrator who recorded the event, showing again the ways community members and administrators are creating, capturing, and assembling content in new and ever evolving ways. Various modes of creating and capturing community events give members a variety of options for participating in the events and fostering their own sense of belonging.

…I am still feeling really great [about the event] because even though they were just words on the screen, I could see the happiness in so many people today. They had the time of their lives. And so, I did too." (Facebook post, P29, age 39, m)

To P29, the happiness felt by other members of the community was still impactful and meaningful to him, even though "they were just words on the screen." Being able to navigate between video, audio, and text-based communication enhances the community's ability to express shared joy.

When asked why they would participate in community events, such as the dragon fight, members recalled stories of working together to complete a goal. These events create a sense of shared pride that directly connects to an overall sense of belonging.

It's cool to be slaying a huge dragon with other people, because then you can all be proud when it dies! (directed forum, P25, age 13, f)

Another member described that everyone had a common goal in slaying the dragon. When the dragon died it left behind loot for the players, including a dragonhead, which is used for various recipes and decorating.

Trying to get a head was what everyone was doing, and that was part of the fun! I ended up getting one, and so did a lot of others because of how many dragons there were. (directed forum, P26 , age 13, f)

The poster also included a screen shot as part of his story about the dragon fight, to give readers a sense of what the in-game experience was like. When the event "lagged" or froze on screen because too many people were online at once, all the arrows were frozen in the sky (See Image 1). Again we see here the merging of varying media types all in an effort to help others experience this highly social interaction. Although reading forum posts and viewing screenshots may not seem traditionally "social," the participants in these events are actively redefining belonging, community, and sociality.

The inherent nature of how tasks are accomplished within the virtual world forces members to seek out connections in their network. To create new objects within the game, players must go to their network of other players to get the
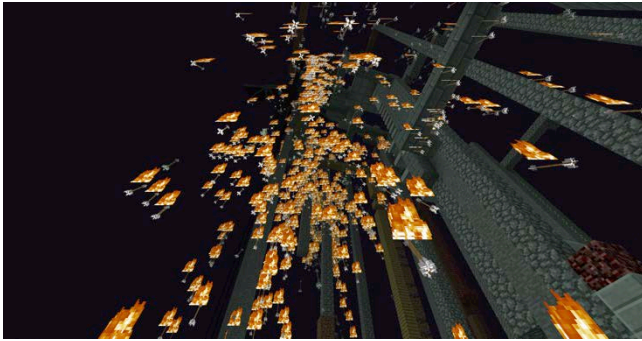
Image 1. Fire arrows frozen in the air due to lag during dragon fight.

information, or "recipes" they need [44] from Reddit, YouTube, forums, or direct communication.

The Autcraft community engenders a sense of "family" in its members employing the different platforms at its disposal. As members each have their own unique communication needs and desired levels of participation with the group, there are a variety of available platforms for them to use. Events held within the Autcraft virtual world are also available across the Autcraft community's many platforms, allowing members to participate at their own desired level and ability (*e.g.,* direct participation, in-world observation, or through the website or live-streaming). Indeed, having these multiple options not only enables members to feel like part of the "family" as they occur, but also facilitate the remembrance of events after they have passed, enabling a sort of retelling of the "family stories."

Interpersonal Relationships Across Platforms
For adolescents, the Internet can be an important social space for developing and maintain one-on-one friendships. Contrary to early findings regarding online socialization, more recent research indicates that Internet use has positive social consequences [65]. Autcraft provides powerful common ground for players, a key foundation to many friendships. Not only do those who join the community share a common interest in Minecraft, they also all have claimed to be either an ally of, or someone with, autism. This is a requirement the community regulates carefully. These two components of the community help lay the groundwork for friendship because they represent part of a person's shared interest. Of course, this foundation is not enough to foster long-term friendships, and indeed not every player on Autcraft likes every other player nor considers them friends. However, the shared space of the Autcraft server facilitates making new acquaintances with some assurance that you have some commonality. In-game chatting, text-based communication out of game, gift giving, and shared activities work together to enable players to strengthen the bonds of friendship, a phenomenon we unpack in this section.

In-game chat, which is by far the dominant mode of communication for Autcraft players, includes everyone who is currently online in the virtual world regardless of their location within said virtual world. Much of the discussion occurs within this main chat, making this space a powerful venue for establishing new friendships:

I wasn't feeling well at that time and needed someone to talk to. [Another player] listened to everything I said and made me feel better that's when we became friends. Since that day we talked a lot we joked around and had a lot of [fun]. after some time we ended up talking every day, when I was sad she would cheer me up, she would make me laugh through my tears and eventually I learned to trust her. I don't trust many people (except for some people on [Autcraft]) so that was really special for me. And I think that's why I'm able to call her a friend. We still talk everyday and we have so much fun. We have so many inside jokes and she is always there for me. (directed forum, P31, age 15, f)

When one is feeling emotionally fragile and in need of friendship, online communications can fill that void. However, this quote also brings to mind issues with trust online. Burke *et al.* found that individuals with autism had difficulty knowing who to trust and when to disclose information in online communications [7]. Autcraft administrators enforce server rules to ensure that no abuse occurs; this protection, however is only a first step in building trust—P31, for instance, say that she only trusts "some people" on Autcraft. Trust can be essential in developing deeper friendships.

Members also reported installing applications on their mobile devices to continue chatting with those in-world, without accessing Minecraft. This technology enables continued connection without Minecraft game features, demonstrating how Minecraft has been appropriated as a platform for social media beyond game play.

In addition to text communication, virtual possessions and gifts are also a way members demonstrate friendship. One member described how he made one of his friends when they first joined the community:

…another new person joined. She was fun and I felt like I could be myself with her. At the end of the first day we met, she gave me a lead⁵ named 'Friendship Bracelet' that I still have today and we are still really good friends. (directed forum, P30, age 16, m)

In this instance, an in-world object bestowed as a gift signified the importance of the relationship. Sharing objects created by users and sharing virtual space (*e.g.,* jointly owned houses, villages, common play areas) contribute to

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⁵ In-world object that is a rope for leading horses or cows, used here as a bracelet because jewelry does not otherwise exist in the world as of this writing.

relationships in much the same way as equivalent physical objects and space might contribute to out of game sociality.

Building objects was originally, and still is, the main attraction of Minecraft for most players. While building can be done by an individual, having a partner or team enables the creation of more complex architecture. Formation of building teams can also be a way to make friends:

while building that village I met this friend name [player name] and to this day he is still my friend (directed forum, P32, age ?, m)

To form these teams, a member usually asks others if they would like to help build the project. In some cases, the project is advertised on the forums or in-world to see who would like to join in (See Image 2). While administrators and parents sometimes organize these teams to help build large-scale projects, by and large, the younger members organize the teams. This is significant because in other social situations, it is challenging for individuals with autism to take on leadership positions [45]. Müller *et al.* found that while small groups were a desirable format for social interaction for individuals with autism, a facilitator was needed to sustain the group. It seems in the context of the Autcraft community, the technology facilitates younger members practicing leadership roles.

Usually, one member has a project idea that they would like to see realized. They then organize the rest of the team to fulfill the project goal, as in the following:

i sometimes ask others to help me... Usally i would show them a picture on how to build it and we pick either get the items or start the build... i usally let them start becuase i am not the best builder ;p (interview, P22, age 13, m)

P22 explained his process for leading his team in a build project. He would send images of project ideas found through Google Images or Minecraft videos on YouTube to

Image 2. Advertisement for a team to build the picture project.

his project team through the Autcraft website's messenger. The team would then coordinate the actual building in-world through the chat functionality.

While chatting and working in groups both require one-on-one communication and interaction, other activities can be done in parallel, reducing the stress of interacting. These parallel activities are favored by members who are younger, are less skilled at communicating via text, or just want a less intense social interaction. As found in Müller *et al.*, having the options for one-on-one interaction *and* parallel activities is preferable for individuals with autism [45]. Parallel interactions give individuals a shared focus, allowing them to still form friendships and foster social connectedness, as we see in the following vignette:

A member asks in chat if anyone wants to mine with them. Another player volunteers. Together they go to the mining world within the virtual world armed with pickaxes. There is very little talking, the first player takes the lead in choosing a dig site. Together they work in parallel digging down into the earth, looking for minerals to take home to use as building materials. When they hit lava, the first player says he has to get off for now because dinner is ready and asks the second player if they will be on again tomorrow. The second player says yes. The first player logs off. (adapted from field notes)

By using various platforms, members of the Autcraft community are able to form deeper friendships with one another, if so desired. Being able to foster these relationships across the myriad platforms creates cohesion in the community. Two members may meet through an advertisement on the forums for builders, build a project together, and then go on to create YouTube videos together of the experience. This facilitates the expansion of how members can socialize with one another, giving them opportunity to explore their own sociality, expand how they would like to be able to socialize, and deepen their connection with other members of the Autcraft community.

DISCUSSION

Over the past two years, members of the Autcraft community have been organically incorporating many different communication channels to support the social interactions of community members. These practices have created a communication ecology, enabling sociality by providing flexible means of social expression. For this community, key aspects of sociality include searching for and finding community, defining sociality and community, and practicing sociality. Through these practices, this community creates and shapes social norms and relations that flourish throughout multiple platforms. By examining this network of communication channels, we are able to tease apart a variety of social behaviors that Autcraft community members are engaged in, witnessing how even taking screenshots and videos of game play or building oneself a fort can be seen as a social community-building practice. Rather than a focus exclusively on face-to-face,

oral interactions, Autcraft is a community built by members who interact through a variety of computer-mediated channels, such as chats, forum message boards, videos, Minecraft avatars, and creations in-world. There are many ways to be social and Autcraft's communication ecology gives members technological options to express that diversity.

The social practices of Autcraft community members demonstrate that individuals with autism are as social as anyone else and that the social interactions of those with autism can be as complex and intimate as those without. Exploring these social practices—with all their richness and diversity—extends our understanding of what forms of technology we might consider to be "assistive." Although neither the game Minecraft itself, nor any of the online platforms in Autcraft's communication ecology are explicitly designed as assistive technologies, their flexibility allows for them to take on assistive qualities when brought together in practice. This flexibility allows for nuance, multiplicity, spontaneity, and personal preference, all touchstones of communicative, social skills.

There is a tension found in this form of communication as well. Using computers to mediate communication will not work for every child, in every situation. The children on this server must also learn how social engagement works in other parts of their world, such as school and home. As we saw in this work, they sometimes rely on the relationships formed online as the only place they perceive themselves to be socializing, which may constrain offline social behavior. At the same time, emergent evidence indicates that contrary to what we may believe instinctively, these online activities can actually improve and enhance offline behaviors. We leave this interesting area of research open for future inquiry.

Part of the challenge, particularly as new media continue to emerge, is expanding definitions of sociality that help to weave on- and offline behavior and resonate with the people engaging in them. At one time, talking on the phone was considered an asocial activity compared with face-to-face encounters. As popular opinion changes and more evidence is amassed in the research, we must be prepared as a scholarly community to understand—if not accept—these community-based definitions of terms we may think we already know. Similarly, methods and modes of communication may differ across these contexts, though the resulting feelings of connection and affiliation endure. Relying solely on any individual form of communication may make it more difficult for people to connect with people in alternate environments. For children with autism, for whom structure and predictability can be such a comfort, the challenges are even greater. While learning to communicate solely online may understandably inhibit children in connecting with others in environments that require face-to-face communication in adulthood, being able to socialize in an online environment that feels safe

and supportive may encourage children to socialize offline. Similarly, pre-established online relationships can pave the way to in-person connections, such as is seen regularly with services like online dating. In particular, for this population, the online environment may, in fact, be the first place these children have ever experienced social support and friendship. Having success in this environment then lays the basic foundation for practicing and honing a wide variety of social skills to be used in a wide variety of environments, a good first (not final) step towards enhanced social experiences.

The communication ecology we see emerging around Autcraft mirrors broadening practices of online communities whose communications can sometimes span multiple platforms. As people communicate, they bring together many devices and platforms, extending beyond any one singular website, app, or game. For example, members of virtual world games frequently continue their in-world interactions on websites and forums [4,50,63]. Our exploration of Autcraft adds to this work by showing how flexible, multimodal communications not only "keep the game going" but also can have profound effects for self-expression and feelings of social belonging.

CONCLUSION AND FUTURE WORK
In this work, our results have demonstrated both how a community can organically create its own communication ecology through multimodal, multisensory technological options and how that ecology represents the diversity of sociality amongst the community's members (both those with autism and their allies). Our results show how individuals with autism search for community and define and practice sociality.

While this work looks explicitly at the Autcraft community, the sociality revealed here could also be explored in other online communities (*e.g.,* those dedicated to other hobbies or interests). Further work could reveal more about how this sociality exhibits itself in the physical world (*i.e.,* at school, home, or work) and also what kind of therapeutic impact this kind of community has on its individuals.

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