

Preparing for the Unexpected: Community Framework for Social Media Use and Social Support by Trail Thru-Hikers

Lindah Kotut¹, Michael Horning², Timothy L. Stelter¹, D. Scott McCrickard¹

¹Department of Computer Science and Center for Human Computer Interaction

²Department of Communication and Center for Human Computer Interaction
Virginia Tech

Blacksburg, VA, USA

[lkotut, mhorning, tstelter, mccricks]@vt.edu

ABSTRACT

A months-long hike of the Appalachian Trail often involve long-term preparation and life-altering decisions. Would-be hikers leverage institutional knowledge from literature and online forums to physically and mentally prepare for such an arduous hike. Their use of social platforms provide useful insights on motivations for undertaking the thru-hike, how they deal with unexpected conditions on the trail and understand choices made in conditions of scarcity. By analyzing over 100,000 Reddit posts and comments in r/AppalachianTrail and applying a Sense of Community theory, we sought to understand hikers' identity as community members, how their emotional and practical needs are met, and how they evolve. We found that the role and language of thru-hikers change as they progress from pre-hike, on-hike, and post-hike stages, from a questioner early on, to an expert post-hike. We conclude with design recommendations to support offline communities online.

Author Keywords

Rural Computing; Trail Community; Long-Distance Hiking; Thru-Hike; Information Seeking; Appalachian Trail

CCS Concepts

•Human-centered computing → Empirical studies in collaborative and social computing;

INTRODUCTION

The Appalachian Trail (AT) is the most popular of the three trails that form the United States Triple Crown Trails [7]. This is due to its proximity to big population areas, its logistical ease, the available hiker support, the number of camps, and its fame [15]. Over 3300 people attempt an end-to-end hike (thru-hike) of the AT in a given year. From these thru-hike

attempts, only about 20% successfully complete their thru-hike by season's end [22]. The AT thru-hike can be completed northwards from Georgia to Maine, southwards from Maine to Georgia (Figure 1), or *flip-flopped* (started at a mid-point in one direction and returning to complete in the other). Given the rural nature of the trail, the changing weather, uncertain trail conditions, the time required to complete the hike, and the expense, it is critical for potential thru-hikers to prepare in advance to give themselves the best chance to succeed in a thru-hike [7]. As a result, thru-hikers often rely on contributed knowledge by experienced thru-hikers as they prepare. They seek help with the hike planning, mental preparation and sometimes social and economic support as they undertake the months-long, 2000+ mile trek on the AT [34].

Today there is a large involved community of trail hikers both online and offline who consist of current trail hikers, potential future hikers and those who have attempted a thru-hike. In this work, we seek to understand how these hikers utilize social platforms for support in the planning, during the hike, and in the reflections post-hike, and their changing role at every phase. We conducted a mixed method study of r/AppalachianTrail subreddit. We focused particularly on thru-hikers on the subreddit in order to understand their changing roles and changing needs in all the phases of their thru-hike. Discussions on trail-related forums typically rise and fall following the hike season. With the increased likelihood of thru-hikers carrying their smartphone on their hike, we approach this study with the assumption that thru-hikers posting and commenting during their hike period offer insights about trail conditions and hiker support: what they seek from the community and how the community best fulfills these needs. We apply the Sense of Community (SOC) theoretical framework [42], to understand how "community" manifests on the r/AppalachianTrail subreddit. We divide the discussions by identified thru-hikers on the subreddit based on their discussions pre-hike, on-hike, and post-hike, in order to offer new insights on how the SOC theory can be applied to support online communities. Specifically: (1) elements that thru-hikers consider to be important, (2) whether the order of these elements change at different stages of their hike and finally, (3) how hikers' concerns evolve over time.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.

CHI'20, CHI Conference on Human Factors in Computing Systems April 25–30, 2020, Honolulu, HI, USA

© 2020 ACM. ISBN 978-1-4503-6708-0/20/04...\$15.00

DOI: <https://doi.org/10.1145/3313831.3376391>

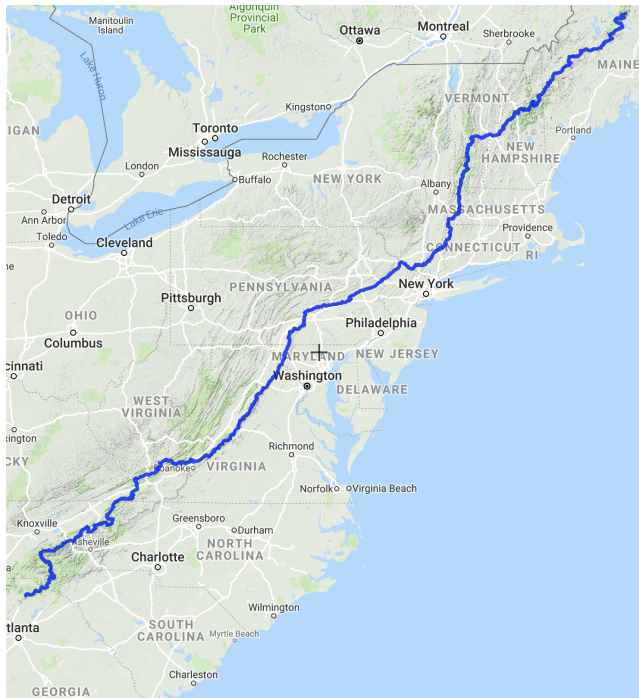


Figure 1. The Appalachian Trail overlaid on the U.S. Map. The trail spans over 2000 miles and covers 14 states between Springer Mountain in Georgia and Mt. Katahdin in Maine.

We make two major contributions: (1) we frame and extend the sociological “Sense of Community”(SOC) theory towards understanding how offline community interactions manifest online, and (2) we propose changes to the sense of community matrix towards adopting the framework for online communities. This work has implications for researchers who are interested in either applying the SOC theory, or are aiming to understand how offline communities interact in online forums. It also benefits stakeholders in the technology for the outdoor domain, in aiding their understanding the overall nature of discussions, particularly on Reddit.

RELATED WORK

In this section, we highlight previous work regarding trail users and their technology use. We intersect this by considering both online and geographical communities, and how the sense of community theory can be used to frame these communities.

Thru-Hikers and Thru-Hiking

The decision to thru-hike a long trail is critical, and requires extensive and often expensive planning. Writings by previous thru-hikers and studies on thru-hiking, provide insights on why people choose to undertake a thru-hike. These reasons have ranged from coping with war losses [56], responding to life crises [59], simply due to proximity to the trail, and/or a sense of adventure [15]. A surge of AT thru-hikers since the 1970s has been attributed to the search for individual meaning, self-sufficiency and as a reprieve from sociological pressure [7]. Subsequent research [19] have supported this, in concluding

that the motivations for thru-hiking are profoundly led by “self-drive” and “escape”– intrinsic motivations and gains, that are formalized as *flow experience* [43].

From a broader perspective, prior research surveying thru-hikers have used means-theory [28], place attachment [38], and other meaning construction frameworks [61], to understand motivations, reasons for perseverance through the hike challenges [4], and expected lessons from thru-hikes [29]. Surveying thru-hikers adjustment to life post-hike was also found to be important in understanding re-integration and elements of culture shock [20, 23]. The hiking motivations and perceived gains were then ranked based on attributes, consequences, and values gained from undertaking the hike. Individuals, it was concluded, thru-hiked as a means of self-expression, and tended to extract their identity based on the hike experience rather than the trail itself [38]. Thru-hikers were found to place importance on trail enjoyment [52] and warm relationships with others while on the trail [28, 34]. We build upon these previous works by our approach – where we extract hiker motivations through applying natural language processing methods to their Reddit discussions.

Technology on the Trail

Understanding technology use on the trail provide for a better comprehension of trail needs based on thru-hikers’ technology choices [3]. We view this as explicitly considering the devices hikers choose to take with them to the trail, and implicitly, by evaluating the rationales and the acceptable trade-offs when deciding between devices. Research in this domain typically focus on generic hikers, and propose designs at the confluence of technological and scarcity challenges [41], to meet a hiker’s trail needs. This includes the design of terrain navigators that support trail accessibility [54, 63], and other designs that provide for immersive experiences on trip-reporting post-trail [54]. The device and technology choices also allow for a better understanding of how hikers manifest, preserve, and prioritize their membership in the online community, based on their technology choices: a choice of social or asocial technology for example, provide insights on individual choice of community [50].

Research on technology on the trail tend to focus on data to support the trail itself. Approaches have ranged from providing on-the-spot navigation of unmapped trails [55], to utilizing hiking data to generate hike-specific maps to support map construction technology [24], while taking into account the rurality and varied hike terrain. Map designs for the trail have also addressed the need for map glanceability [65] while also being hands-free [64]. Work examining these approaches that were crafted to support the goals of the hiker especially in their choice of smartphones [3, 31], inform our understanding of hiker preference for device use on the trail, because the smartphone provides continual opportunities for thru-hikers to update the hike community while on-hike, regardless of limited connectivity experienced [41]. Understanding their choices for doing so at a time when they are “away” from day to day life, further increases our understanding of hiker motivation, and how it affects the SOC framework.

Characteristic	Concept
<i>Membership</i>	feelings of belonging, identification with the community
<i>Influence</i>	feelings of influence and being influenced by the community
<i>Fulfillment of Needs</i>	feelings of being supported and providing support
<i>Shared Emotional Connection</i>	feeling shared history and relationships

Table 1. Characteristics of a Sense of Community (McMillan & Chavis)

Online and Geographically-Bounded Communities

The use of social media has meant that online communities have been widely studied towards understanding them. This has included how groups are formed, grow, and evolve around social networks [6], predicting group longevity [57], group characterizations [25], dynamics (and community building) [35], and understanding online community norms [17]. The role of individual members within the larger group is also important, and previous research has sought to understand member joining influences [57], and the importance of different individual contributors [27] towards the larger group. Communities of practice online [32, 45] have also been studied, and the importance of the sense of community amongst online learners for example [60], was found to have a positive effect on contributions. In addition, hybrid online/offline communities [26] that involve both online and offline interactions have been studied towards how they support and effect offline interactions. We add to this corpus of knowledge by considering how “community” manifests and evolves throughout a thru-hiker’s experience of the trail.

The impact that technology has impacted geographical communities has been a long-studied subject, particularly how communities form around little “niche” places (e.g. cafes) [49], in addition to the effect that technology has in both disrupting and providing new opportunities for cooperation of these geographic communities [53]. These geographically-bounded communities imply new role formation for the online community, with individuals taking-on roles [46] that facilitate online-mediated community goals [14], with the subsequent discussion and cooperation often having tangible outcomes impacting individual relationships [47] and/or the geographically-bound community itself [16, 33, 44].

The thru-hikers provide a unique community, given their long-stretches of isolation in rural areas with pocket of togetherness on the trail and online. The trail geographically bounds the trail community: in their interest on the trail and their hike, even though the community members often do not live close to the trail. Our work build upon the research on geographically-bounded communities, by considering the effect this dual-placed community has on members’ sense of community.

SENSE OF COMMUNITY AND TRAIL LIFE

Prior research has suggested that trail hikers use social network sites to establish their own online communities to discuss and share topics that are important to them as hikers [41]. However, while most studies take it for granted that thru-hikers

use social networks to support their community interests, few studies have examined what thru-hikers do and say on these social networks and how they use them to support their hiking goals. Prior research that has examined communities has distinguished them from other social phenomenon (e.g. groups) by suggesting that they have certain unique characteristics. Gusfield [30] was among the first to suggest that communities can be bound by either geography (e.g. a neighborhood or town) or they can be defined by their relational qualities. Religious communities, for example, may be not be bound by geography but by a shared sense of belief.

Other researchers have attempted to extend this notion of community by trying to understand why individuals are motivated to form communities in the first place. McMillan and Chavis theorized that communities form because they meet certain psychological needs. Specifically, that when four psychological needs are met, communities are formed. These include: *membership*, *influence*, *fulfillment of needs*, and a *shared emotional connection* [42]. According to the theory, individuals in a community first feel a *sense of membership*. This is often facilitated through a sense of belonging or a shared identity with the community. However, individuals also feel membership by establishing a common set of shared symbols (e.g. a university logo, a cross, town memorials) that help members associate themselves with one another. Members of a community also feel as if they have *influence*: that what they say or do in a community has an impact on others and the community self. Third, communities are formed when individuals experience a *fulfillment of needs*, which may vary from community to community and some may include needs for physical well-being. However, communities also fulfill other needs such as information, or they provide an individual with sense of value or status within the community. Finally, a sense of community is established through a *shared emotional connection* with the community. According to the theory, the more individuals interact with one another in a community and the more they invest time with one another, the more likely they are to establish shared emotional bonds. These shared emotional connections are also established as individuals participate collectively in events where the participation itself provides another avenue to bond and to establish close emotional ties. Table 1 provides a summary of the four elements and their characteristics.

Sense of Community vs Sense of Virtual Community

While the Sense of Community (SOC) Theory was initially used to describe the characteristics within a physical community that made it successful, Blanchard and Markus observed that a “sense of virtual community” (SOVC) can also exist in online environments [12]. In 2001, Markus and Blanchard applied the concept to a sports newsgroup dedicated to supporting people interested in training for sporting events like triathlons. They found that newsgroup users also exhibited characteristics similar to other communities. Specifically, members often used digital spaces to create their own unique identities and to exchange support. They felt attachment to the community and often formed bonds with other members. However, the researchers found less evidence for online communities providing feelings of influence.

In subsequent research, it was found that in online contexts, the ability to be relatively anonymous means that communities often lack the close personal connections that are typically found in physical and relational communities [11]. Other studies have found that SOVC can be diminished or enhanced by various features that exist in a social network. Toneri and colleagues observed that individuals who post messages and those who read them gain different benefits from these experiences. Specifically reading social messages leads to more personal sense of well-being, while posting to a group increases stronger feelings of needs fulfillment [62].

Other research has suggested that the quality of information plays an important role in SOVC. Chen and Lin conceptualized information quality a characteristic of interactivity, where websites which provided more opportunities for synchronous and asynchronous communication were found to increase feelings of sense of virtual community [18]. The same researchers also found that an important feature of online communities that had a strong SOVC was the ability to exchange information.

Our preference for SOC in this work is influenced by more recent studies that weigh the strength and weaknesses of SOC vs SOVC theories [10] and other work that contends that consensus is yet to be reached regarding how best to validate SOVC, while at the same time showing that SOC is also an appropriate way to measure virtual communities [1]. Further, in most previous work SOVC has been treated as a uni-dimensional measure, which SOC has often identified the four previously mentioned constructs (e.g. needs fulfillment). As a result, the four SOC dimensions provide an opportunity to look at each of these aspects in more depth, particularly as they apply to thru-hikers.

	Auth.	Max	Min	Med.	Mean	SD
<i>Pre-Hike</i>	81	611	1	21	42.2	79.5
<i>On-Hike</i>	61	94	1	11	20.5	21.9
<i>Post-Hike</i>	83	822	1	21	53.9	109.4

Table 2. Descriptive statistics for thru-hiker posts on *r/AppalachianTrail* dataset. Each row describes the number of unique authors and then post frequency for each section of the hike

METHOD

The Triple Crown Community on Reddit

In this paper, we focus on *r/AppalachianTrail*, a significant community of hikers and other people who are interested in issues surrounding the Appalachian trail. The subreddit is also the most active of the subreddits that constitute the Triple Crown trails (i.e. the Pacific Crest Trail, the Appalachian Trail, the Continental Divide Trail) [8]. The *r/AppalachianTrail* subreddit primarily serves the hiking community on the AT, and provides an avenue for members to share experiences on the AT, ask questions, and make plans about undertaking a hike on the AT. At the time of the writing of this paper, *r/AppalachianTrail* has been active for 8 years with a total of 55,979 subscribers. The discussions in the *r/AppalachianTrail* revolve around the people on the trail [37], trail conditions, and the communities who geographically live around the trail. We focus on posts and comments by hikers interested in thru-hiking the AT. The thru-hiking process is known to be long and

arduous, and preparations for undertaking the hike can take years. Online communities like *r/AppalachianTrail* provide a means by which these aspiring hikers can ask questions, solicit criticism about gear and provisions, act as a way to update the community, and as a means of keeping in touch with other hikers with the same mindset.

Data Collection, Ethics, and Thru-Hiker Identification

We collected threaded discussions consisting of posts and comments from *r/AppalachianTrail* through pushshift¹, and cross-referenced with Google BigQuery². The data spanned three years from January 2016 until October 2018 and included 7769 unique posts and 100214 comments together with all attendant metadata. The data included 9965 users who commented at least once. Table 2 provides the descriptive characteristics of both the community and the data collected. To support the Reddit data, we also leveraged supporting voluntary data provided by thru-hikers to the Appalachian Trail Conservancy [22].

Although the Reddit data is public, there were instances where Redditors revealed unique data such as full names. We made sure to anonymize that information in the data corpus. For the sample quotes in the paper, we strove to the best of our abilities to break up sentences and present them in a manner that, when copy-pasted to a search engine, would not directly lead to the original post, to further protect their privacy.

From the data corpus, we identified 7768 users with *author flairs* (tag lines they associate with their username) which provided us with a means of determining how they self-identified in the community. Flairs in this community are also used to identify the length that the author has hiked, interested in hiking, or planning on hiking on the Appalachian trail, and tended to change with their circumstances. For example, “2017 Hopeful” for a hiker planning to hike in 2017 changes to “2017 GAME” to signify both that the thru-hike was completed, having hiked through all the states between Georgia and Maine, and also to signify that that the hike was northbound (NOBO), southbound (SOBO) or flip-flopped. “2017 NOBO” will have a similar connotation, allowing the community to understand the explicit hike direction and the implicit states covered. We manually inspected all author flairs to select those authors that self-identified as thru-hikers. From this phase, we identified 230 self-described AT thru-hikers 119 of whom completed the AT between 2016 and 2018 which allowed us to find and examine their discussion pre-hike, on-hike and post-hike.

Trail Discussions

To glean topics from the Appalachian trail community, we first leverage Latent Dirichlet Allocation (LDA) [13] probabilistic model to analyze the discussion for the entire *r/AppalachianTrail* subreddit from 2016-2018. We then use Non-negative Matrix Factorization (NMF) [39] which is also a standard topic modeling algorithm [9, 66] to understand the topics discussed specifically by thru-hikers within the larger community. We found both modeling approaches to provide

¹pushshift.io

²bigquery.cloud.google.com

comparatively coherent topics [48, 58], and selected one with better coherence in each case.

We prepared the discussion data by first removing stop words and applying term-weighting using term frequency-inverse document frequency (tf-idf). Using Single Value Decomposition (SVD) - based initialization strategy [51] for the NMF model, we generated topic descriptors and then curated our themes based on sentences generated and selected from each topic. We computed and compared topic coherence of models generated for different topic numbers following TC-W2V [48] and using Gensim implementation of Word2Vec [2]. The number of topics (k) selected, is based on the coherence scores generated from each of the starting values. The final topic descriptors are based on the number of topics given the best k . The best k for each of the thru-hikers phases were $k = 8$ for pre-hike, $k=8$ for on-hike and $k = 9$ for post-hike. We showcase a max of 5 topics in the tables for brevity.

FINDINGS

Trail season influence on community discussions

Each hiking season on the AT is guided by the end and beginning of winter. Northbound (NOBO) hikers typically begin hiking from mid-February as icy and rainy conditions are less likely in Georgia. The end of the northbound hiking season is governed by the closing of the Baxter State Park for winter in mid-October [5]. Southbound (SOBO) hikers typically begin hiking after Baxter’s opening around mid-May. It is much less arduous to hike NOBO, making it the most favored direction for most hikers. Thru-hikers typically begin researching about the hike conditions and preparing, sometimes years in advance. Gear is expensive, and lightweight gear that is also designed to withstand the grueling hike even more so. Getting ready physically [19] with gear “shakedowns”(gear performance and fitness testing) is common. Once plans are in place, it is typical for the would-be thru-hiker to announce their plans to undertake the hike, either publicly or pseudo-anonymously on social platforms. Previous work has rationalized this as a way for the hiker to “reinforce motivation to succeed” [4]. From the data, we find that while there is a noticeable spike in registered hikers corresponding to the hiking season, a lot of discussion on /r/AppalachianTrail occur right before and at the beginning of the season.

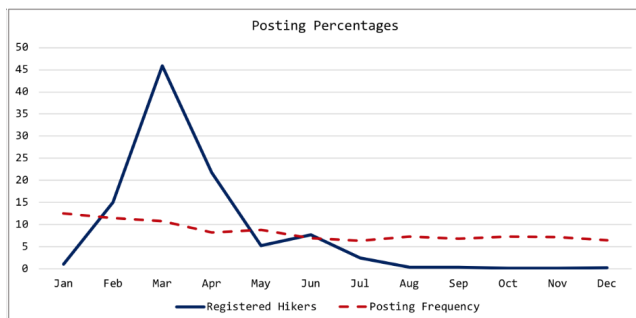


Figure 2. A 2018 comparison of registered thru-hikers embarking on their hike and the posting frequency for each month.

Technology Use on the Trail

When embarking on a months-long hike, every item weight matters. Advances in technology, propelled by the ultra-light movement, have led to the design of efficient yet light gear. Previous literature on hiker technology [3], found that cell phones were the most preferred technology device by hikers, followed by fitbits. To affirm this, and understand the type of devices the thru-hikers carried on their hike, we considered thru-hikers who listed their packing contents on LighterPack³ and shared their links on Reddit. LighterPack is a site devoted to posting hike gear by type and weight. The information from this site is anonymous, unless thru-hikers choose to reveal their name or link to their social media accounts.

We curated 119 lists of self-identified thru-hikers who revealed both their trail name and the year of their thru-hike to be, between 2016 and 2018. From the listed information on lighterpack, we extracted the devices listed, and found that smart phones were the predominant device carried by most thru-hikers ($n = 112$). Of the 32 users who reported the use of wrist watches/devices, rugged watches designed for the outdoors ($n=16$) or simple watches with alarms ($n=11$) were preferred over smart watches ($n=3$) and fitbits ($n=2$). 32 thru-hikers also reported carrying satellite communication devices (emergency beacons): only 11 specified the reasons why they needed them. Two users specified their use for pure GPS, and to keep in touch with family (“*my relatives will want this*” and “*to make my family happy.*”) One user each specified: use for GPS and texting, use for GPS and emergency locator, for pure texting, and logistics “*...for asking ahead about town information/weather.*” Technology acceptability seems to have evolved over the life of the trail:

“...the first 2 weeks of trying to ‘minimize technology’ wears off real fast when you have nothing to do all day other than just keep plinking the hours away.”

We found a marked increase of public hiker documentation as public social media posts on Instagram and Twitter, and through regular uploads on YouTube. We consider the motivations for these types of updates and the interaction of hikers with viewers and/or followers in future work.

For those who used phones and/or took pictures while on the trail, suggestions focused on people as the subject rather than vistas (with regrets about focusing on the latter). Hikers then curated those pictures by “*Turn[ing it] into [a] wall mosaic*”, or by “*choos[ing] a number from each state passed.*” Blogs and Instagram was also used for curation: frequent updates led the thru-hiker to pick daily/weekly favorites, and fresh perspective while on-hike helped to ease the decisions of what pictures to preserve and/or highlight.

Trail Topics: Overall Community vs Thru-Hikers

To understand what /r/AppalachianTrail users discuss on Reddit, we applied LDA topic modeling on the entire data corpus to glean themes from this subreddit. Table 3 provides an overview of the discussions, where we find they were predominantly related to trail logistics. This is supported by our

³lighterpack.com

Topic	Topic Descriptors
<i>Trail logistics</i>	water, carry, weight, sleeping, cheap
<i>Trail community</i>	trail, people, hiking, think, hiker,
<i>Trail Season</i>	start, trail, month, section, hiking
<i>Hike Preparations</i>	money, extra, question, worth, answer
<i>Trail Conditions</i>	mile, shelter, trail, never, place

Table 3. LDA Topics of the entire /r/AppalachianTrail subreddit 2016-2018 Discussions

observation of discussion frequency compared to the trail season showcased in Figure 2, where we note that the biggest spike of trail discussions occur right before and into the beginning of the hike season. Our thru-hiker selection was based on the possibility of having their pre-hike, on-hike, and post-hike discussions on /r/AppalachianTrail. We observed significantly fewer comments made by thru-hikers during their thru-hike (Figure 3). We expound on the topics that emerged from the discussions at each phase of the hike in the subsequent sections, and what these topics revealed about the thru-hiker's sense of community.

Pre-Hike: The Researchers

Topics emerging from this section of the thru-hike involves questions as the would-be thru-hikers prepare for the trail. Table 4 provides a summary, the topics emerging from discussions at this stage. We examined each of our topics through the SOC lens, to better understand what dimensions of community were evident among Reddit hikers. Specifically, five topics were among the most prevalent among hikers planning for their hikes. These included topics about gear considerations, thru-hike schedules, the best start for the hike, the hike as a sabbatical and relevant financial concerns. We probed further through each of the statements made in these topics to identify the ways in which they reflected various aspects of community life. We describe each topic below and their connection to sense of community.

Gear Considerations

Pre-hikers used Reddit to ask questions predominantly about trail gear or the kinds of equipment they needed, or planned to take on the hike: *"I have a dry bag for my quilt and puffy and a bag for my food. Besides that, most of my stuff is getting ..."* and solicited opinions on strategies for purchasing gear: *"Walmart has a 3 pack of dry bags for 10 bucks a small medium and large. The large fits all my clothes."*

Thru-hike Schedule

The second most prevalent topic among pre-hikers focused on hiking schedules. Specifically, we found that hikers spent a good deal of time discussing logistics of how they planned to tackle the trail. These included discussions about start date and specific directions bound (e.g. Georgia to Maine or Maine to Georgia). For example, commenters often simply posted a date like *"On trail March 12th"* or *"I'm starting the trail on the 6th – I'll see you out there, buddy."* These discussions highlight the importance of timing during the hike to avoid seasonal problems such as crowding, or winter weather that render the trail impassable.

Topic	Topic Descriptors
<i>Gear considerations</i>	bag, pack, gear, weight, tent
<i>Thru-Hike Schedule</i>	start, date, april, march, sobo
<i>Hike commencement</i>	start, leaving, flip, home, go
<i>Sabbatical/ Finances</i>	going, back, started, money, home
<i>Hiker preparation</i>	day, miles, start, back, section

Table 4. Thru-hikers discussions pre-hike: Top words are arranged according to term weight

Hike Commencement

These comments often focused on the start of the hike. Comments also reflected the social nature of the trail where hikers noted not only when they would leave, but that they were looking forward to interacting with other hikers who they had met on the Reddit site: *"I will be going up those stairs Monday. Maybe I will see you out there."* This was reference to the approach to the beginning of the trail at Springer Mountain. Other comments referenced specific dates such as *"I'll be there on the 20th and start 21st I may see you out there. Good luck on your thru."* or *"I'm starting June 14th... Can't wait to see you out there."*

Sabbatical and Finances

Several hikers used the pre-hike season to discuss how they financed the hike and how they planned the time to get away to complete the hike. These discussions often centered on how to save money for the hike. One commenter said, *"I'll be booking my flight to Atlanta for March 7th once I get my next paycheck."* Others discussed financial considerations to consider along the hike: *"It's only 85 bucks for the hiker hostel to pick you up at ATL spend the night eat breakfast."* Finally, many people discussed how they got off of work or how they were able to save up the money for the hike. One person mentioned saving up \$10,000 so that they could have the finances to complete the hike. Another said, *"I'm 25 but I have a career job where I got a leave of absence... [I] saved money by living like a college [student]."*

Hiker Preparations

The last topic emerged from hiker preparations that went beyond the categories of just purchasing hiking equipment. Often these focused on the physical challenges of the trail. One commenter said, *"I'm leaving NOBO in March. I just did a 70 mile training hike. Hiking isn't romantic, it's amazing."* Another hiker talked about preparing for the hike with a test hike to get a sense of the day-to-day challenges: *"Good idea. I've been recommended that hike to do a test hike... Might go there before my start date."*

On-Hike: The Sojourners

As showcased by the descriptive statistics in Table 2, there was less activity by thru-hikers at the on-hike phase of the thru-hike, which is expected given the scarcity of connectivity on the trail. Therefore, the fact that they chose to post on the trail, provide good insights about their connection to the online community while on the trail. Topics emerging during on-hike phase revolved around activities on the trail. While most comments involved those hikers on the trail, we found instances of comments from those hikers who had left the trail for a length of time due to family, health, or gear performance

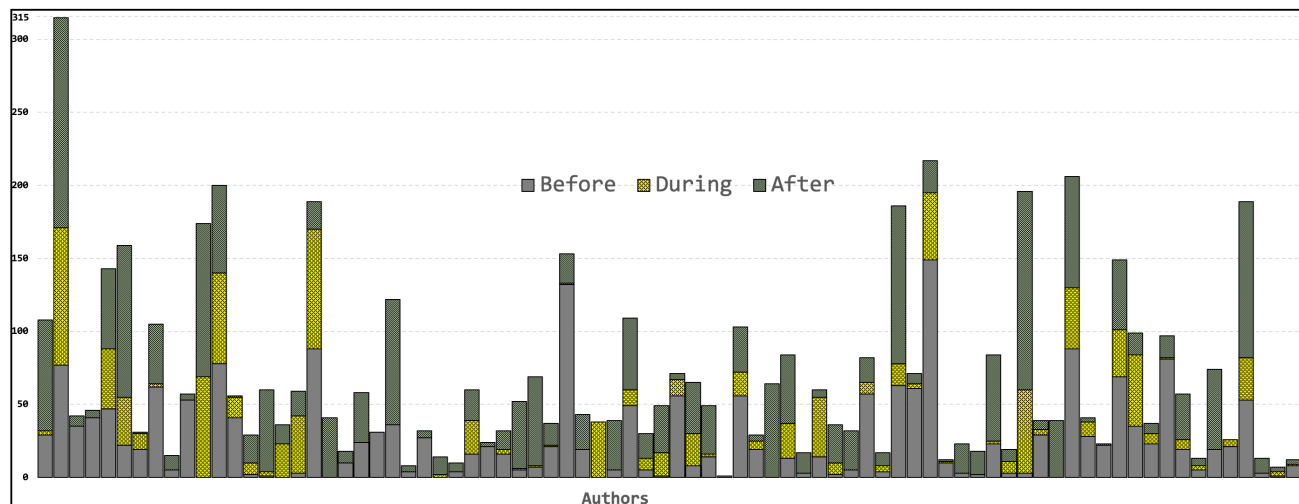


Figure 3. Normalized thru-Hikers comment frequency at each phase of the thru-hike: pre-hike (before), on-hike (during), and post-hike(after)

Topic	Top Words
Hike Updates	time, day, night, tent, food, gear
Trail community	trail, name, met, hiker, north
Trail blues	get, back, gear, home, town
Trail performance	hike, way, great, long, mind
Trail etiquette	people, need, know, shelter, hikers

Table 5. Thru-Hike discussions on-hike

concerns. Table 5 provides a summary of the topics with their descriptors. We expound on these topics below.

Hike Updates

The predominant discussion by thru-hikers on trail involved trail updates. The on-hikers for example reported on gear performance: “I had to replace my backpack in Pearisburg, and I got off the AT yesterday at Harper’s Ferry.” They also provided trail reports and shelter conditions (“Last week 5 bags got stolen in one night”), announcing social media updates: (“Just got my fifth video uploaded in Gatlinburg right now...”), reporting weather and trail conditions (“...got some rain that froze over. Had more snow along the Roan Highlands...”), and providing health updates (“Almost got the Lyme in PA. Took two weeks off I got about three weeks left.”) Discussions surrounding trail magic [21] (asking about/reporting about the presence of them) also happened in this stage.

Trail Community

Part of hiker culture involves giving of trail names, and once new thru-hikers acquire trail names, they begin to refer and identify themselves with those names. These names are often given to hikers in relation to either a highly personable trait or event on the trail: “I’m still on the trail. Changed my username on Instagram to reflect my trail name...” “Hi [John Doe] here. Trail name is now Stealth.”

The updates are also about other people on the trail “For those interested PM me for his trail name I just became aware of the situation yesterday when I stopped in at Uncle Johnny’s...” and would often post to the community whenever there was a concern about other hikers on the trail.

Trail Blues

The unglamorous slog through tough and monotonous trail sections is mentally taxing, and are considered the major cause for thru-hikers to end their hikes early. “Sometimes the trail isn’t a good fit no matter how hard you try... You are correct in that it’s boring”

Discussions by thru-hikers regarding trail blues involve asking for help on how to overcome it, or providing support from those who do it:

“Any time I lost motivation ... I’d imagine him giving me some friendly shit, telling me to get my old ass hiking. It would put a smile on my face and get me moving... even on the worst of mornings.” “This song helped me get out my bed in the hotel and get my ass back on the trail when I was sick.”

This can also involve providing context to others to alleviate the sense of aloneness:

“You are hitting the Virginia blues... you are in one of the hardest sections of the trail. I had the exact same thoughts on the exact same day.”

and/or offering justification for leaving the trail

“I was very lonely... I felt like the hike was doing more harm than good at that point.”

That they felt the need to update the subreddit with their reasoning behind prematurely ending their hike, speaks to the sense of community that we describe in later sections.

Trail Performance

As the thru-hikers progressed on their hike, their performance on on-the-ground observations and distance covered.

“I’m glad you are thinking about your dog. The best way to hike the AT with a dog is in sections...”

“...currently about 2/3 of the way through my thru hike on the AT...”

Topic	Topic Descriptors
<i>Gear performance</i>	bag, food, water, gear, weight
<i>Trail Nostalgia</i>	trail, name, magic, runners, town
<i>Trail Experience</i>	hike, start, months, enjoy, month
<i>Trail Advice</i>	get, rid, back, start, before, work
<i>Trail Characteristics</i>	people, hikers, saw, things, shelter

Table 6. Thru-hikers discussions post-hike

They also reported on emotional change and personal growth:

“I have become a different person on this hike Or maybe I’m just becoming me.” “I came in with the intention of working through problems and self-discovery.”

Trail Etiquette

Trail observations lead to discussions around (mostly) unsaid rules apart from Leave no Trace [40] and revolve around awareness and consideration of other hikers “[...] that people who blast music are rude and inconsiderate” and etiquette around food and trail hazards: *“People are bad at bear hangs... that’s how you get aggressive bears.”*

Post-Hike: The Experts

Discussions in the post-hike phase tended towards advice: for example, giving a voice of experience about crowds and their impact on the trail. Other advice topics ranged from gear related: best gear, trail conditions and resupply towns, to hike efficiency: optimum hike speed, and reasons on why people quit the trail. Table 6 showcases the themes that we elicited from the discussion in this phase.

Gear Performance

Predominant topic by thru-hikers post-hike, revolves around gear performance, usually as a means of answering questions by the *Questioners*: *“Buy a solid rain jacket. I used a Marmot Precip because ...”* Answering those questions involves providing personal anecdotes to give context: *“You probably will not need a 60L pack especially if you are planning on going ultralite. I had a 60L.” “It depends on the comfort... I used a rain skirt and loved it but mostly because I get cold easily.”*

Trail Nostalgia

Trail yearning plus post-trail depression was also discussed during this phase: supporting the notion of thru-hikers experiencing some culture shock on exiting the trail. Their use of Reddit was to seek understanding and community, but did not fill the yearning for the community to be found on the actual trail: *“Goddammit! I miss the trail.”*

This nostalgia extended to the friendship forged while on the trail *“[Appalachian Trail] people were kinder on the trail I’ll just go back there...”* and reminiscing and distilling pride from their achievements in conquering the AT thru-hike *“I have all the memories of the trail... I just can’t imagine that I actually did it.”*

Trail Experience

Personal anecdotes and experience gained by hindsight is another predominant topic that emerges during the post-hike. This mostly involved providing sage advice to those embarking, e.g., *“Do what makes you happy. Hike your own hike”*

together with personal anecdotes to clarify their posts, e.g., *“Male [age] at time of hike. Started at 160 [lbs], ended around 145... 6 months later [I’m at] 165”* and *“I found no use for a towel, but some people carry them.”*

Trail Advice

The experts notably provided intangible advice about how to undertake a thru-hike, especially an exhortation not to over-plan: *“Are you starting a thru-hike? If so, stop planning and just go with the flow...”* easing worries about solo hiking, and ways of navigating tensions on the trail [36]: *“Hike solo, you’ll make friends along the way...” “Don’t let a few loud people with opinions other than yours ruin it for you.”*

Trail Characteristics

As the *Sojourners* provided trail updates, as they evolved to the *Experts*, they provide information about trail characteristics. This included a focus on the hikers: *“I was really surprised by the [number] of women that I saw on trail and a lot of them were solo [hikers]...”* to the trail characteristics that provide a means by which both the *Questioners* and the *Sojourners* can use for logistics: *“Shelters in the whites are not free, and shelters in the Smokies can be booked by overnight hikers.”*

DISCUSSION

The goal of our research was to understand the unique trail community, how their sense of community manifested in their online interactions, and how it evolved throughout the thru-hiker phases. In this section, we discuss how the emerging topics fit in the SOC framework, if at all.

Pre-Hike Topics and Sense of Community

The pre-hike topics mapped well to various aspects of SOC. However, for pre-hikers, social network sites provided a key means of *needs fulfillment* found in geographic placed communities. In this case, pre-hikers use social network sites to solicit others for expertise and to gain feedback about the kinds of gear they were preparing to use. They also used the social network to plan for the hike by learning from others about the things they would need to do to prepare along the way, and to identify hike dates as a way of signaling significance and sharing with the community the moment when they would begin the hike.

The demarcation of a date also served several community functions: it was a marker of *membership*, that indicated when pre-hikers joined the group of thru hikers. It was also an emotional statement. Often, dates included exclamations, indicating the excitement pre-hikers felt about the anticipated moment. Lastly, pre-hikes also expressed certain statements about their commitment to the trail. This was conveyed through their conversations about time-off from work and financial arrangements. In many ways, these expressions demonstrated a seriousness of purpose that were the first steps towards becoming “members” of an elite group of thru-hikers, and as such, we saw it as an expression of identity with this group.

In summary, pre-hikers rely primarily on Reddit to fulfill several needs that they have in anticipation of the hike. These are both technical and informational in nature. However, the social network also served other functions. Reddit provided a way

	Pre-Hike	On-Hike	Post-Hike
Membership	<i>Sabbatical, Finances</i>	<i>Trail Community</i>	<i>Trail Characteristics</i>
Influence		<i>Hike updates, trail blues (giving support to others), Trail etiquette</i>	Trail advice
Fulfillment of Needs	<i>Hike preparation Gear considerations Thru-hike schedule</i>		<i>Gear performance</i>
Emotional Connection	<i>Hike commencement</i>	<i>Trail blues</i>	<i>Trail nostalgia</i>
Personal Reflection		<i>Trail performance and “why I quit”</i>	<i>Trail nostalgia, Trail experience</i>

Table 7. Sense of Community emerging trail topics

for new hikers to develop an initial identity as a serious hiker and to share the emotional experience of hiking with other hikers. We also note that one element of community which was not evident in our topics among pre-hikers was *influence*. While we observe this at later stages of the hike, pre-hike users seem to have little influence in the community of users at this stage, and instead rely primarily on being influenced by others with more expertise than themselves.

On-Hike Topics and Sense of Community

As with pre-hike topics, the on-hike topics also mapped well to the various aspects of the sense of community. Notably, no topic mapped onto *fulfillment of needs* aspect of the community. Based on the fact that these hikers are on the trail, they attain their fulfillment by the community on the actual trail and so the role of the virtual community is diminished on-hike. The use of online social network on-hike prominently features increasing influence on the community. The *Sojourners* provide updates about the trail: shelter conditions, closed sections and others in the community to the online community. Their update spark conversations on Reddit, which further showcases their changing roles and increased *influence*. They seek emotional connections when traversing through the hard and/or monotonous sections on the trail. The emotional is also bi-directional: soliciting help on how to overcome the trail blues, and simultaneously providing encouragement to others experiencing it, basing this on their own experience.

The use of social media extends to those hikers who left the trail temporarily or permanently, as a way to add to the knowledge repository about gear performance and personal health, and also as a catharsis. We find instances where we witness personal growth based on discussions that showcases that a hiker has a better belief of their capabilities, having been tried and tested on the trail, and also the sense of fulfillment in sometimes unnamed emotional needs.

Post-Hike Topics and Sense of Community

During the post-hike discussions, we are able to identify all of the four elements that describe the community emerging. There was an even distribution about each topic matching an aspect of the community, although we find one topic: *trail nostalgia* that mapped into both *emotional connection* and *personal reflection* depending on the sub-themes emerging from the discussions: “missing” the trail and the attendant culture and seeking commiserations from those who had undergone the hike as well fits within the notion of *emotional connection*. Culturally, the hikers refer to this as “post-trail depression”.

Another aspect of nostalgia evolves around the people met on the trail and thus also classify *trail nostalgia* under *personal connection*. We find that the thru-hikers act as the *Experts* and use social media to effect these characteristics. Describing the trail conditions and ethos, and providing personal views that anchor these hikers to the community, the post-hikers reflect their membership in the larger community. Their influence is reflected/imparted onto other hikers on the trail by their role of giving advice coming from a voice of influence.

Implications on the Sense of Community Framework

Table 7 includes each of the topics as they were mapped out during each stage of the hiker. It also provides a way of thinking about how each of the four aspects of community evolved over the course of the hike. In this sense, we find that sense of community on Reddit is not static concept, but one where each aspect of community is highly dependent on the current “stage” of the user on the hike. In addition, we note that some topics did not nicely fit into one of the original categories. We describe them below.

First, looking at just the *membership* characteristics, our topic modeling helps us understand how the hiker’s state of mind progresses as they make advances along the thru hike. Pre-hikers initially establish their identity on Reddit as “newbies” to the AT and as such, they are not fully integrated into the subreddit. They establish their membership to the group by identifying as a serious hiker, though their identity takes little shape than that. What they tend to do at this stage to establish membership is to describe the commitment they have made to the hike by saving up funds, getting a long-term work release or by making other financial statements which show their interest in becoming part of this community. However, once the hike has commenced, hikers express deeper membership by promoting their new identity as they receive their trail name. Trail names, often earned along the trail and given by other hikers, are one of the tell-tale hallmarks of a “true” thru-hiker. On the other hand, post-hikers identify themselves differently in Reddit forums, relying less on trail names but on other forms of membership. These individuals often show their membership in the society of thru-hikers by describing various characteristics of the trail that would only be known while hiking it. In this sense, important elements of the trail become shared symbols that contribute to feelings of membership.

We found that *influence* also changes as hikers take their journey. Hikers on Reddit have very little influence over others at the pre-stage hike on Reddit, while later in the hike as they

grow as “experts” on the trail, they often use the social network to influence others. During the hike they take on the role of trail informants, providing other hikers behind them with information. After hike completion, they seem to have the most influence on forums as true experts who provide advice to others. The Reddit community in this way has an understood hierarchy of influence, where new hikers join the community to learn from the wisdom of previous hikers.

In terms of *fulfillment of needs*, we find that a primary hiking needs across the entire space of hiking is focused on hiking equipment. This finding was expected given the importance of gear on the hike. While in the initial stages of the hike, thru hikers are primarily focused on information seeking, at the later stages, we see they take on more of advisory role. In one sense, post hikers seem to return to Reddit to give back to new hikers the same bits of wisdom they received at the start.

The only topic to emerge across our sense of community spectrum at every stage of the hike was a *shared emotional connection*. In the early stages, hikers use the social network to share their joy in starting the hike, but the hike becomes an important place of encouragement as hikers are on the hike itself. Later, as the hike commences, we saw hikers continue to share an emotional connection with other trail users by re-living their experiences on the trail. The Reddit group, in short, becomes an important hub for hikers to engage in a wide variety of emotions related to the trail experience.

Finally, we note that other topics emerged from our analysis that did not fully fit into one of the existing categories. Specifically, we found evidence to suggest that the Reddit site serves as a space for users to engage in personal reflection. While this was less evident at the start of the hike, we found numerous posts where users seem to engage in conversations with others about their reasons for quitting. Others used the network site to discuss their performance on the trail. In the post-hike stages, hikers also took a more reflective tone describing to others their experience or discussing nostalgically their personal hike.

A great deal of personal reflection often focused on the boredom that eventually came with the trail or that others left for medical reasons. However, some used the Reddit community to dig deeper into their motivations. One hiker said:

“A lot of the [hikers who] quit the trail for non-medical reasons did so because they came out just expecting the [Appalachian Trail] to make their narrative for them, and all they had to do was walk ...”

and another:

“Hell, I had friends who [completed] the trail, [and when they] got to the top of Katahdin, and were just like... now what?”

Statements like these lead us to consider the ways in which the trail grafts itself to the psyche of the hiker.

The trail begins with euphoria and excitement, but as the grueling days of isolation, rain and cold carry on the trail becomes an endurance test. The hike ends without fanfare,

without the excitement envisioned at the start, and instead, the hiker is only left with one thought, what now? This sense of “placelessness” is reflected in the conversations of some Reddit users. Others expressed a sense of nostalgia for the trail that also suggested a more reflective state. One user said, *“I have all the memories of the trail... I just can't imagine that I actually did it.”*

These types of comments indicate that Reddit users not only come to Reddit for membership, for emotional connections, needs fulfillment and influence, but to also engage with one another on what the hike on the AT means. Even years after the hike completion, users still seem to need the space to process the hike in their own way, and in this community of users who share this sentiment, they find a home.

Other Design Implications

The application of the SOC framework to an online community offers a means of distinction between online and offline communities. We provide insights by focusing on the Appalachian Trail community on Reddit, and specifically on the thru-hikers in this community, in order to understand how their SOC over time. Our observation and recommendations is culminated in Table 7 where we map the original SOC framework to show-case how it evolves as the pre-hiker evolves to an expert hiker. This has larger implications when studying online communities especially towards understanding how their membership is established in these communities, and how it evolves.

CONCLUSION

Our use of topic modeling provides a way to understand the conversations that are both common and important to users on the /r/AppalachianTrail subreddit. We find evidence to suggest that many of the factors that shape geographic communities map well to online communities on the trail. While prior research provide only observations that such needs exist, we observe in this work that those needs change over time and are dependent on the current role that the thru-hiker plays within the community itself. Further, we discover other motivations beyond the traditional factors that are often reflected in community, and we observe that communities online are also places that provide opportunities for members to reflect on their own actions. These findings are useful to researchers interested in understanding hybrid communities (that exist both offline and online), in the application/extension of the SOC framework, and/or stakeholders in the outdoor domain in how best to understand how communities in areas of scarce connectivity participate in online communities.

REFERENCES

- [1] Dagmar Abfalter, Melanie E. Zaglia, and Julia Mueller. 2012. Sense of Virtual Community: A Follow Up on Its Measurement. *Comput. Hum. Behav.* 28, 2 (March 2012), 400–404. DOI: <http://dx.doi.org/10.1016/j.chb.2011.10.010>
- [2] Nikolaos Aletras and Mark Stevenson. 2013. Evaluating topic coherence using distributional semantics. In *Proceedings of the 10th International Conference on Computational Semantics (IWCS 2013)–Long Papers.*

- Association for Computational Linguistics, Potsdam, Germany, 13–22.
- [3] Zann Anderson, Candice Lusk, and Michael D. Jones. 2017. Towards Understanding Hikers’ Technology Preferences. In *Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2017 ACM International Symposium on Wearable Computers (UbiComp ’17)*. ACM, New York, NY, USA, 1–4. DOI: <http://dx.doi.org/10.1145/3123024.3123089>
- [4] Karen D Arnold. 2007. Education on the appalachian trail: What 2,000 miles can teach us about learning. *About Campus* 12, 5 (2007), 2–9.
- [5] Baxter State Park Authority. 2017. Baxter State Park Authority Rules and Regulations. (Mar 2017). Retrieved March 29, 2019 from <https://www.baxterstatepark.org/wp-content/uploads/2017/03/RulesRegsBSP2017.pdf>
- [6] Lars Backstrom, Dan Huttenlocher, Jon Kleinberg, and Xiangyang Lan. 2006. Group Formation in Large Social Networks: Membership, Growth, and Evolution. In *Proceedings of the 12th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD ’06)*. ACM, New York, NY, USA, 44–54. DOI: <http://dx.doi.org/10.1145/1150402.1150412>
- [7] Adam Berg. 2015. “To Conquer Myself”: The New Strenuousness and the Emergence of “Thru-hiking” on the Appalachian Trail in the 1970s. *Journal of Sport History* 42, 1 (2015), 1–19.
- [8] Karen Berger. 2001. *Hiking the Triple Crown* (1st. ed.). Mountaineers Books, Seattle, WA.
- [9] Michael W. Berry and Murray Browne. 2005. Email Surveillance Using Non-negative Matrix Factorization. *Computational & Mathematical Organization Theory* 11, 3 (01 Oct 2005), 249–264. DOI: <http://dx.doi.org/10.1007/s10588-005-5380-5>
- [10] Anita L. Blanchard. 2008. Testing a Model of Sense of Virtual Community. *Comput. Hum. Behav.* 24, 5 (Sept. 2008), 2107–2123. DOI: <http://dx.doi.org/10.1016/j.chb.2007.10.002>
- [11] Anita L Blanchard and M Lynne Markus. 2002. Sense of virtual community-maintaining the experience of belonging. In *Proceedings of the 35th Annual Hawaii International Conference on System Sciences*. IEEE, New York, NY, USA, 3566–3575. DOI: <http://dx.doi.org/10.1109/HICSS.2002.994449>
- [12] Anita L Blanchard and M Lynne Markus. 2004. The experienced sense of a virtual community: Characteristics and processes. *ACM SIGMIS Database: the DATABASE for Advances in Information Systems* 35, 1 (2004), 64–79.
- [13] David M. Blei, Andrew Y. Ng, and Michael I. Jordan. 2003. Latent Dirichlet Allocation. *J. Mach. Learn. Res.* 3 (March 2003), 993–1022. <http://dl.acm.org/citation.cfm?id=944919.944937>
- [14] Amy Bruckman and Mitchel Resnick. 1993. Education on the appalachian trail: What 2,000 miles can teach us about learning. *Third International Conference on Cyberspaces* 12, 5 (1993), 2–9.
- [15] Bill Bryson. 1999. *A Walk in the Woods: Rediscovering America on the Appalachian Trail* (1st. ed.). Random House, New York, NY.
- [16] John M Carroll and Mary Beth Rosson. 2003. A trajectory for community networks special issue: ICTs and community networking. *The Information Society* 19, 5 (2003), 381–393.
- [17] Stevie Chancellor, Andrea Hu, and Munmun De Choudhury. 2018. Norms Matter: Contrasting Social Support Around Behavior Change in Online Weight Loss Communities. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI ’18)*. ACM, New York, NY, USA, Article 666, 14 pages. DOI: <http://dx.doi.org/10.1145/3173574.3174240>
- [18] Chi-Wen Chen and Chiun-Sin Lin. 2014. Building a sense of virtual community: The role of the features of social networking sites. *Cyberpsychology, Behavior, and Social Networking* 17, 7 (2014), 460–465.
- [19] Taylor Rose Cole. 2018. *Investigating the Thru-Hiking Experience: A Study on the Pacific NorthWest National Scenic Trail*. Master’s thesis. University of Montana.
- [20] Noga Collins-Kreiner and Nurit Kliot. 2017. Why Do People Hike? Hiking the Israel National Trail. *Tijdschrift voor economische en sociale geografie* 108, 5 (2017), 669–687.
- [21] Appalachian Trail Conservancy. 2017. Trail Magic. (2017). Retrieved April 2, 2019 from <http://appalachiantrail.org/home/explore-the-trail/thru-hiking/trail-magic>
- [22] Appalachian Trail Conservancy. 2019. A.T. Camper Registration. (2019). Retrieved April 2, 2019 from <https://atcamp.org/atthruhikerreports.cfm>
- [23] Lucas Cooper. 2014. *Returning from the Wild: Exploring Participant’s Experiences of Re-entry from Extended Wilderness Trips*. Master’s thesis. Brock University.
- [24] David Duran, Vera Sacristán, and Rodrigo I. Silveira. 2016. Map Construction Algorithms: An Evaluation Through Hiking Data. In *Proceedings of the 5th ACM SIGSPATIAL International Workshop on Mobile Geographic Information Systems (MobiGIS ’16)*. ACM, New York, NY, USA, 74–83. DOI: <http://dx.doi.org/10.1145/3004725.3004734>
- [25] Katherine Ellis, Moises Goldszmidt, Gert Lanckriet, Nina Mishra, and Omer Reingold. 2016. Equality and Social Mobility in Twitter Discussion Groups. In *Proceedings of the Ninth ACM International Conference on Web Search and Data Mining (WSDM ’16)*. ACM, New York, NY, USA, 523–532. DOI: <http://dx.doi.org/10.1145/2835776.2835814>

- [26] Rosta Farzan, Di Lu, and Yu-Ru Lin. 2016. What Happens Offline Stays Offline?: Examining Sustainability of a Hybrid Social System. In *Proceedings of the 27th ACM Conference on Hypertext and Social Media (HT '16)*. ACM, New York, NY, USA, 261–266. DOI : <http://dx.doi.org/10.1145/2914586.2914625>
- [27] Adabriand Furtado, Nazareno Andrade, Nigini Oliveira, and Francisco Brasileiro. 2013. Contributor Profiles, Their Dynamics, and Their Importance in Five Q&A Sites. In *Proceedings of the 2013 Conference on Computer Supported Cooperative Work (CSCW '13)*. ACM, New York, NY, USA, 1237–1252. DOI : <http://dx.doi.org/10.1145/2441776.2441916>
- [28] Marni Goldenberg, Eddie Hill, and Barbara Freidt. 2008. Why individuals hike the Appalachian Trail: A qualitative approach to benefits. *Journal of Experiential Education* 30, 3 (2008), 277–281.
- [29] Mamie Goldenberg, David B. Klenosky, Leo H. McAvoy, Tom Holman, and Giordana Mt. 2002. Using Means-end Theory to Understand the Outdoor Adventure Experience. *Research in Outdoor Education* 6 (2002), 40–47.
- [30] J.R. Gusfield. 1975. *The community: A critical response* (1st. ed.). Harper Colophon, New York.
- [31] Mary E Harmon. 2015. *Computing as context: Experiences of dis/connection beyond the moment of non/use*. Ph.D. Dissertation. UC Irvine.
- [32] Ridley Jones, Lucas Colusso, Katharina Reinecke, and Gary Hsieh. 2019. R/Science: Challenges and Opportunities in Online Science Communication. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19)*. ACM, New York, NY, USA, Article 153, 14 pages. DOI : <http://dx.doi.org/10.1145/3290605.3300383>
- [33] Andrea Kavanaugh, John M Carroll, Mary Beth Rosson, Than Than Zin, and Debbie Denise Reese. 2005. Community networks: Where offline communities meet online. *Journal of Computer-Mediated Communication* 10, 4 (2005), JCMC10417.
- [34] William Piatt Ketterer. 2010. *Psychological Change among Appalachian Trail Thru-Hikers An Interpretive Phenomenological Analysis*. Ph.D. Dissertation. Antioch University New England, Keene, NH. UMI Order Number: 3437713.
- [35] Amy Jo Kim. 2000. *Community Building on the Web: Secret Strategies for Successful Online Communities* (1st ed.). Addison-Wesley Longman Publishing Co., Inc., Boston, MA, USA.
- [36] Linda Kotut, Michael A. Horning, Steve Harrison, and D. Scott McCrickard. 2018b. Opportunity in Conflict: Understanding Tension Among Key Groups on the Trail. (2018). <http://arxiv.org/abs/1802.05534>
- [37] Linda Kotut, Michael A. Horning, and D. Scott McCrickard. 2018a. Who's on the Trail: Identifying Trail Uses with Affinity Diagrams. (2018). Retrieved April 2, 2019 from <http://people.cs.vt.edu/lkotut/papers/whos-on-the-trail-affinity.pdf>
- [38] Gerard Kyle, Alan Graefe, Robert Manning, and James Bacon. 2003. An Examination of the Relationship between Leisure Activity Involvement and Place Attachment among Hikers Along the Appalachian Trail. *Journal of Leisure Research* 35, 3 (2003), 249–273. DOI : <http://dx.doi.org/10.1080/00222216.2003.11949993>
- [39] Daniel D. Lee and H. Sebastian Seung. 2000. Algorithms for Non-negative Matrix Factorization. In *Proceedings of the 13th International Conference on Neural Information Processing Systems (NIPS'00)*. MIT Press, Cambridge, MA, USA, 535–541. <http://dl.acm.org/citation.cfm?id=3008751.3008829>
- [40] Jeffrey L Marion and Scott E Reid. 2001. Development of the US Leave No Trace program: an historical perspective. (2001).
- [41] D. Scott McCrickard, Michael A. Horning, Steve Harrison, Ellie Harmon, Alan Dix, Norman Makoto Su, and Timothy Stelter. 2018. Technology on the Trail. In *Proceedings of the 2018 ACM Conference on Supporting Groupwork (GROUP '18)*. ACM, New York, NY, USA, 365–368. DOI : <http://dx.doi.org/10.1145/3148330.3152161>
- [42] David W McMillan and David M Chavis. 1986. Sense of community: A definition and theory. *Journal of community psychology* 14, 1 (1986), 6–23.
- [43] Allan S. Mills and Thomas S. Butler. 2005. Flow Experience Among Appalachian Trail Thru-hikers. In *Proceedings of the 2005 northeastern recreation research symposium (U.S. Forest Service)*. U.S. Forest Service, Northeastern Research Station, Newtown Square, PA, USA, 366–370. <https://www.nrs.fs.fed.us/pubs/8037>
- [44] Elizabeth D Mynatt, Annette Adler, Mizuko Ito, and Vicki L O'Day. 1997. Design for network communities.
- [45] Drashko Nakikj and Lena Mamykina. 2018. Lost in Migration: Information Management and Community Building in an Online Health Community. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI '18)*. ACM, New York, NY, USA, Article 146, 14 pages. DOI : <http://dx.doi.org/10.1145/3173574.3173720>
- [46] Bonnie Nardi and Justin Harris. 2006. Strangers and friends: Collaborative play in World of Warcraft. In *Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work*. ACM, 149–158.
- [47] Bonnie A. Nardi, Diane J. Schiano, and Michelle Gumbrecht. 2004. Blogging As Social Activity, or, Would You Let 900 Million People Read Your Diary?. In *Proceedings of the 2004 ACM Conference on Computer Supported Cooperative Work (CSCW '04)*. ACM, New York, NY, USA, 222–231. DOI : <http://dx.doi.org/10.1145/1031607.1031643>

- [48] Derek O’Callaghan, Derek Greene, Joe Carthy, and Pádraig Cunningham. 2015. An analysis of the coherence of descriptors in topic modeling. *Expert Systems with Applications* 42, 13 (2015), 5645 – 5657. DOI: <http://dx.doi.org/10.1016/j.eswa.2015.02.055>
- [49] Ray Oldenburg. 1999. *The great good place: Cafes, coffee shops, bookstores, bars, hair salons, and other hangouts at the heart of a community* (2nd. ed.). Da Capo Press, Philadelphia, PA.
- [50] Maaret Posti, Johannes Schöning, and Jonna Häkkinen. 2014. Unexpected Journeys with the HOBBIT: The Design and Evaluation of an Asocial Hiking App. In *Proceedings of the 2014 Conference on Designing Interactive Systems (DIS ’14)*. ACM, New York, NY, USA, 637–646. DOI: <http://dx.doi.org/10.1145/2598510.2598592>
- [51] Hanli Qiao. 2015. New SVD based initialization strategy for non-negative matrix factorization. *Pattern Recognition Letters* 63 (2015), 71 – 77. DOI: <http://dx.doi.org/10.1016/j.patrec.2015.05.019>
- [52] IV R. Bruce Hull and William P. Stewart. 1995. The Landscape Encountered and Experienced While Hiking. *Environment and Behavior* 27, 3 (1995), 404–426. DOI: <http://dx.doi.org/10.1177/0013916595273007>
- [53] Howard Rheingold. 2000. *The Virtual Community: Homesteading on the Electronic Frontier*. MIT press.
- [54] L. Tiina Sarjakoski, Pyry Kettunen, Hanna-Marika Flink, Mari Laakso, Mikko Rönneberg, and Tapani Sarjakoski. 2012. Analysis of Verbal Route Descriptions and Landmarks for Hiking. *Personal Ubiquitous Comput.* 16, 8 (Dec. 2012), 1001–1011. DOI: <http://dx.doi.org/10.1007/s00779-011-0460-7>
- [55] Johannes Schöning, Antonio Krüger, Keith Cheverst, Michael Rohs, Markus Löchtfeld, and Faisal Taher. 2009. PhotoMap: Using Spontaneously Taken Images of Public Maps for Pedestrian Navigation Tasks on Mobile Devices. In *Proceedings of the 11th International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI ’09)*. ACM, New York, NY, USA, Article 14, 10 pages. DOI: <http://dx.doi.org/10.1145/1613858.1613876>
- [56] Earl V. Shaffer. 2004. *Walking with Spring* (1st. ed.). Appalachian Trail Conference, Harpers Ferry, WV.
- [57] Xiaolin Shi, Jun Zhu, Rui Cai, and Lei Zhang. 2009. User Grouping Behavior in Online Forums. In *Proceedings of the 15th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD ’09)*. ACM, New York, NY, USA, 777–786. DOI: <http://dx.doi.org/10.1145/1557019.1557105>
- [58] Keith Stevens, Philip Kegelmeyer, David Andrzejewski, and David Buttler. 2012. Exploring Topic Coherence over Many Models and Many Topics. In *Proceedings of the 2012 Joint Conference on Empirical Methods in Natural Language Processing and Computational Natural Language Learning (EMNLP-CoNLL ’12)*. Association for Computational Linguistics, Stroudsburg, PA, USA, 952–961. <http://dl.acm.org/citation.cfm?id=2390948.2391052>
- [59] Cheryl Strayed. 2012. *Wild: From lost to found on the Pacific Crest Trail*. Vintage, New York, NY, USA.
- [60] Na Sun, Mary Beth Rosson, and John M. Carroll. 2018. Where is Community Among Online Learners?: Identity, Efficacy and Personal Ties. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI ’18)*. ACM, New York, NY, USA, Article 292, 13 pages. DOI: <http://dx.doi.org/10.1145/3173574.3173866>
- [61] Hanne Svarstad. 2010. Why Hiking? Rationality and Reflexivity Within Three Categories of Meaning Construction. *Journal of Leisure Research* 42, 1 (2010), 91–110. DOI: <http://dx.doi.org/10.1080/00222216.2010.11950196>
- [62] Lisbeth Tonteri, Miia Kosonen, Hanna-Kaisa Ellonen, and Anssi Tarkiainen. 2011. Antecedents of an experienced sense of virtual community. *Computers in Human Behavior* 27, 6 (2011), 2215–2223.
- [63] Sarah Trankle. 2013. The Blind Hiker: How one man used technology to conquer the 2,000-mile Appalachian Trail. (Jan. 2013). Retrieved March 30, 2019 from <https://bit.ly/2TNRHFH>
- [64] Dirk Wenig, Florian Heller, and Johannes Schöning. 2016. StrapMaps: Bringing Map-based Navigation to the Straps of Bags. In *Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct (UbiComp ’16)*. ACM, New York, NY, USA, Article 7, 4 pages. DOI: <http://dx.doi.org/10.1145/2968219.2993411>
- [65] Dirk Wenig, Johannes Schöning, Brent Hecht, and Rainer Malaka. 2015. StripeMaps: Improving Map-based Pedestrian Navigation for Smartwatches. In *Proceedings of the 17th International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI ’15)*. ACM, New York, NY, USA, Article 9, 11 pages. DOI: <http://dx.doi.org/10.1145/2785830.2785862>
- [66] Wei Xu, Xin Liu, and Yihong Gong. 2003. Document Clustering Based on Non-negative Matrix Factorization. In *Proceedings of the 26th Annual International ACM SIGIR Conference on Research and Development in Informaion Retrieval (SIGIR ’03)*. ACM, New York, NY, USA, Article 37, 7 pages. DOI: <http://dx.doi.org/10.1145/860435.860485>