

The Influence of Hand-Held Information and Communication Technology on Visitor Perceptions of Risk and Risk-Related Behavior

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Abstract—As devices like personal locator beacons become more readily available, more visitors may bring them into wilderness and use them to request rescues and may develop unrealistic expectations of rescue. In an exploratory study in 2009, 235 overnight visitors to the King Range Wilderness in California completed a written survey. Of the respondents, 40 percent considered themselves to be risk-takers. Of those, 80 percent admitted to having done something in a wilderness that they knew at the time was unsafe, and 85 percent admitted to having done something that in retrospect they considered unsafe. These risk takers were also significantly more likely to take chances that could increase their exposure to risk if they had information/communication technology with them. They were also significantly more likely to believe that technology reduces many of the dangers people associate with being in the wilderness. Both more-experienced visitors and visitors with personal experience of a serious wilderness accident were more likely to believe that technology creates a false sense of safety for wilderness users than were less-experienced visitors and those who have not been involved in a serious wilderness accident.

Introduction

John and Rebecca are backpacking in the John Muir Wilderness, a part of the High Sierra they have not visited before. They have a trail map. They are not carrying a compass, but neither really knows how to navigate by map and compass anyway. They do, however, have a state-of-the-art GPS, and have been using it to follow a highly recommended route they downloaded in advance from the internet. They know their exact UTM coordinates at any given time and with those could find their location on their trail map if they so desired, thus removing much of the anxiety they had about getting lost. Neither was particularly confident in their navigational skills. John and

Rebecca also have a smartphone with a SPOT Connect app, which not only allows their family and friends to track their progress via the internet, but also allows John and Rebecca to send custom messages of up to 41 characters to their social network contacts via Facebook and Twitter and to contact 9-1-1 emergency responders with their GPS coordinates and a custom SOS message if they need to be rescued (although few 9-1-1 centers are yet equipped to handle text messages). During the course of their seven-day trek, John and Rebecca spend quite a bit of time updating their Facebook pages with messages about their trip, and sending tweets to their family and friends via Twitter.

Managers and researchers (or anyone else for that matter) may be in no position to tell John and Rebecca whether or not they had an “authentic wilderness experience.” However, their experience might have been lacking some of the fundamental elements that have traditionally defined a wilderness experience, elements such as a certain degree of separation from the technologically-advanced aspects of modern civilization and the heightened opportunity for contemplation and self-reflection that may come with it; self-reliance; exposure to uncertainty and risk; and the sense of accomplishment derived from relying on one’s own skills to overcome uncertainty and risk. These are elements that contemporary wilderness visitors say contribute to a wilderness experience (Seekamp and others in press).

It is the fourth day of their trip and John and Rebecca are faced with a decision. Although it is not on their pre-programmed GPS route, they see on their map that there is a high alpine lake in a steep basin perched above them. It promises to be very scenic, but also quite exposed to weather, and will require some steep, off-trail climbing to get to; the footing could be difficult. They also notice some clouds starting to build up in the early afternoon and are wondering if a storm might be moving in. They stop for a snack and to talk about their options. Should they climb up to the lake? They discuss the fact that they have their GPS and SPOT, so if they do get into trouble, they can always request help. Based on the confidence that those devices give them, they decide to proceed to the lake. Was it the right decision? Do they return safely and on their own, or did the (over)confidence that stemmed from having their technological devices create a false sense of safety and

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an unrealistic expectation of rescue, ultimately resulting in a rescue operation that could have been avoided?

Clearly, not all wilderness experiences are the same—they vary greatly across people, across places, and across time. Indeed, what would Bob Marshall have thought of today's freeze-dried food, lightweight tents, tiny propane stoves, and Gore-Tex raingear? That said, do we risk losing something important if communication and information technology like that described above (and whatever else is coming next) removes much of what sets wilderness experiences apart from non-wilderness recreation? Today's backpacking equipment that Bob Marshall might scoff at makes wilderness travel easier and more comfortable, but is a lighter tent and better raingear as fundamentally different from the tents and raingear of his day as is the ability to communicate with the outside world via cell or satellite phone, fix your exact spot on a map by way of GPS, or request a helicopter rescue at the push of a button? As Grann (2010, p. 234) recounts in *The Lost City of Z*, even the Royal Geographic Society “recognized, wistfully, that a Rubicon had been crossed” when in 1925, explorer Alexander Rice first communicated via wireless radio with the outside world while on an expedition deep into the Amazon, and the New York Times reported that “the Brazilian jungle has ceased to be lonely.”

Setting aside the issue of whether such technology changes the very nature of the wilderness experience, to what extent might a dependence on such technology change visitor behavior (consciously or unconsciously), encouraging visitors to make decisions they otherwise would not have made and to take risks they otherwise would not have taken? Technology that reduces actual risk may change the very nature of experience, by reducing the consequences of visitors' decisions, and thereby may change visitors' decisions and behaviors, since those decisions and behaviors may now carry less risk. Even if technology reduces only the perception of risk, that may still lead visitors to make unsafe decisions they otherwise might not have made, with potentially disastrous consequences.

Information and communication technology that reduces exposure to risk, or that is believed to reduce risk, may have the effect of opening up areas for travel that were previously thought by some people to be beyond their skill level. In effect, the technology expands the areas or lands into which some people are comfortable pursuing their desired activities and experiences. Whereas before such technology existed, travel into remote and rugged areas, or cross-country travel across a trailless landscape, might have been considered too dangerous by some, now people equipped with a GPS and a SPOT, or a Smartphone with a SPOT Connect app, might not be deterred. While there may be some advantages to this, there are some obvious disadvantages as well. In addition to the potential for spreading visitor impacts into formerly pristine or near-pristine areas, there is also the potential for underprepared or overly confident users to substitute technology for common sense, experience and skill and to make decisions based on unrealistic perceptions of both risk and the ease and availability of rescue. This could lead to an increased number of accidents, injuries and deaths, and an increased number of search and rescue

events, which are expensive and potentially dangerous to the rescuers.

In this paper we will first review the literature on this topic. Then we will provide empirical results from a single exploratory study of wilderness visitors to a coastal wilderness in California, in which we examine beliefs and behaviors relative to information and communication technology in wilderness. The research questions that we asked were to what extent do information and communication technologies influence visitor perceptions of both risk and rescue in wilderness, and how might those perceptions in turn influence risk-related decisions that visitors make in wilderness?

Literature Review

McCool and Braithwaite (1992) define hazards as “uncontrollable components and processes encountered in natural environments that may lead to the injury or death of recreationists.” They describe risk as the “exposure to hazards” or “the likelihood of being harmed by a hazard.” They differentiate between risk that is voluntary, sought out as part of the recreation experience and seen as a controllable factor (what some have called challenge risk) and risk that is uncontrolled and not sought (what some have called danger risk), acknowledging that what is challenge risk to one person may be danger risk to another. As Ewert and Hollenhorst (1997) point out, it is the inclusion of and proximity to risk that “adds consequence to individual decision making.”

How might the introduction of handheld information and communication technology reduce risk (or at least the perception of risk), reduce the consequences of decisions, and influence visitors' decision-making? A number of authors have noted that such technology may serve to create the illusion of safety or a false sense of security (Borrie 2000; Ewert and Hollenhorst 1997; Stevenson 2011; Wiley 2005). For example, Ewert and Hollenhorst (1997) explain that while a GPS can provide navigational information, it cannot provide the knowledge necessary to safely use that navigational information in difficult terrain. GPS devices can make it more difficult to get lost and easier to specify one's location to rescuers (Wiley 2005), but can also, as Borrie (2000) points out, increase visitors' confidence in their ability to go anywhere and decrease their willingness to turn back. Holden (2004) wonders if this false sense of security makes participants feel less vulnerable to threats.

Technology is not always reliable and functional in a wilderness environment (Attarian 2002). For example, a hiker in New Zealand fell off a cliff, broke several bones, and lost his personal locator beacon (PLB) in the fall, leaving him stranded (Chapman and Stokes 2009). Another New Zealand camper went missing and activated his PLB, but the signals were not received, possibly due to canopy cover (Pepperell 2011). In April 2011 SPOT, a leading manufacturer of personal locator beacons in the U.S., recalled over 15,000 devices due to reports of product failure in temperatures below 40 degrees Fahrenheit (dBune News 2011). Inexperienced visitors relying on sometimes unreliable equipment, without experience to

serve as a backup in case of faulty technology, is a potentially dangerous combination.

Even if the devices work properly, one cannot assume that the user knows how to use them correctly. Stevenson (2011) points out that carrying a GPS and knowing how to use it are two different things. Sandrik (2010) reports that, in Yosemite National Park, search and rescue rangers are seeing more cases of people putting themselves in precarious positions because they relied too heavily on one type of technology—GPS. Valley District Ranger Eric Gabriel said, [It's] "more and more common, and what happens is that people rely solely on the GPS as opposed to having a map, a compass, and good judgment and skill to use those things." Lack of knowledge about device capabilities can also create dangerous situations. The Rocky Mountain Rescue Group spent two months searching for the source of a personal locator beacon that was triggered in Colorado nine times between December 2009 and February 2010. They finally solved the mystery, learning that a backcountry skier thought it was an avalanche beacon, activating it every time he went skiing. He had received it as a gift and never read the instructions (Willoughby 2010).

One of the major differences between devices (such as SPOT) and equipment (such as a topographical map and compass) is that equipment requires skill and practice as well as incorporating environmental knowledge; devices may provide instantaneous results, but they fail to involve or engage us with the surrounding environment (Pohl 2006). This lack of engagement with one's environment can contribute to a lack of visitor autonomy, self-sufficiency, and sense of self-responsibility. In turn, these factors may contribute to changes in visitor behavior and use patterns, including increased risk-taking behavior, not understanding the dangers involved with particular behaviors, and overestimating the availability of rescue assistance. Technology may serve to insulate visitors from the consequences of their actions to the point where they fail to recognize the severity of a situation (Borrie 2000).

Anecdotally, many wilderness managers feel that the average level of experience, knowledge and skill among users is decreasing as more people venture into the wilderness with information and communication technology. The technology may be used as a substitute for skill, knowledge, experience and preparation (Stevenson 2011) and may allow people with less skill to access areas that were once available only to the highly skilled (Hollenhorst 1995). Dickson (2004), commenting on the increase in rescue requests via cell or satellite phone, asks:

"But why do they need rescuing? Did they venture that far, or into that area, because they thought they could make a call and be rescued? Are they depending upon the technology and the knowledge and skills of others to keep themselves safe rather than developing personal skills to navigate and explore the outdoors? Would they have gone there if they had to depend totally upon their own skills?"

Many visitors may come to rely on these devices in the wilderness instead of developing appropriate knowledge, abilities, experience, and skills. The now-infamous Royal

Arches foursome (see Pope and Martin 2011) is an example of an inexperienced group that used their beacon as a substitute for appropriate knowledge, abilities, experience, and skills. When rescuers asked the men what they would have done had they not possessed a personal locator beacon, they said: "We would have never attempted this hike." As a result of this type of incident, some rescuers refer to personal locator beacons as "Yuppie 911" (Cone 2009).

There is little (if any) disagreement that technology like personal locator beacons, cell phones, and satellite phones makes it easier to request a rescue, often leading to an increased, and sometimes unrealistic, expectation of rescue. One of many examples is of hikers in British Columbia who ignored trail closure signs, became stranded because they were unprepared for conditions, called 9-1-1 to request rescue, then became impatient that the rescue was taking too long (Sullivan and Cooper 2011). Stevenson (2011) says that too many unprepared visitors treat technology like a "get out of trouble free" gadget instead of as an emergency backup. The subsequent diminished capacity for self-rescue can lead to a "society of rescuers and rescuees," where rescue (including self-rescue) is a specialized niche instead of an essential skill.

As the use of technology expands into wilderness areas, it is important to address people's expectations of technology in a backcountry environment and the dangerous blending of expectations between frontcountry road-accessible areas and backcountry settings (Pohl 2006). Unrealistic expectations can occur when individuals bring technology into the wilderness, falsely believing they can rapidly summon help if needed. Likewise, bringing technology into the wilderness can create a false sense of security that may compromise a group's self-reliance (Borrie 2000; Holden 2004). Even when used successfully, it can still take a considerable amount of time for rescue crews to respond. Without appropriate self-rescue abilities, even the most technologically-equipped wilderness visitor can be in considerable danger waiting for help to arrive. As technology improves with time, it remains to be seen if these improvements will simply create ever higher expectations of safety and more unrealistic views of rescue.

Now that many wilderness visitors bring technology on trips and rely on this technology in the event of an emergency situation, they are often no longer prepared to, as Bob Marshall (1930) once said, "satisfy all requirements of existence," and may rely on professional rescuers to fill in the gaps. San Bernardino County Emergency Coordinator John Amrhein deals with the repercussions of this on a daily basis. "In the past, people who got in trouble self-rescued; they got on their hands and knees and crawled out," Amrhein said. "We saw the increase in non-emergencies with cell phones: people called saying 'I'm cold and damp. Come get me out.' These [devices] take it to another level" (Cone 2009). Some visitors may call for rescue prematurely before even attempting to self-rescue (Holden 2004), while others place rescue calls upon becoming temporarily disoriented (Huffman 1999). Heggie and Heggie (2009) noted a "general feeling among many search and rescue unit managers in the United States that cell phones are being used to request search and rescue assistance in what turns out

to be minor situations.” Or as Lomax (2006) notes, “We’ve confused emergency with convenience.” Examples of this (too numerous to even list) abound not only in the United States, but are becoming increasingly common in England, New Zealand, and Australia (see Fea 2011; Martin 2011; Roberts 2011).

Very little empirical research exists to support the notion that possessing this type of technology influences visitors’ risk-related behavior. Two studies, however, have examined this notion. Holden (2004) studied Outward Bound outings in North Carolina. The group leaders carried a satellite phone on the multi-day trips. The student participants in some of the groups knew that their group leader had a satellite phone; participants in the other groups did not know that their group had a satellite phone. Holden looked at whether knowledge of the satellite phone increased students’ propensity for risk-taking. In a written questionnaire administered after the trips, students answered questions about the extent to which they felt safe and the extent to which they felt comfortable taking risks. He found no significant difference between the two groups on either item. However the degree to which these findings are generalizable to other wilderness visitor populations is debatable, since most wilderness visitors are not students visiting in a structured, facilitated outing such as an Outward Bound trip.

Hohlreider and others (2005) studied the influence of avalanche transceivers (the equivalent of a personal locator beacon for skiers) on mortality rates from avalanches. They found that while the transceivers reduced the mortality rate during backcountry activities involving ski tourers in free alpine areas, it did not reduce mortality during off-piste activities near organized ski slopes. In searching for an explanation, they state that “our data suggest that those few off-piste skiers and snowboarders equipped with a transceiver tend to be involved in more [frequent] serious accidents. The perceived additional security offered by [the transceivers] may stimulate skiers and snowboarders to accept higher risks. As a consequence, mortality is unchanged or even increased in off-piste activities despite the use of [transceivers].” They conclude that a false sense of security created by transceivers may encourage skiers and snowboarders to enter more hazardous terrain.

One conclusion of this literature review is that information and communication technology is quickly changing the nature of the relationship between wilderness visitors and rescue organizations. Despite limited empirical evidence, there is much concern that this technology, and the new relationship it has forged between visitors and rescuers, could have the effect of encouraging more risk-taking on the part of visitors, a concern described very well by Stevenson (2011).

Methods

The Lost Coast Trail follows 25 miles (40 km) of remote Northern California coastline, nestled between the Pacific Ocean and the mountains of the King Range National Conservation Area. Managed by the Bureau of Land Management (BLM), 42,585 out of the 68,000 acres in the King Range National Conservation Area are designated as wilderness. Visitation is

steadily increasing, from 3,302 self-registered visitors in 2007 to 4,646 in 2009, with an estimated registration compliance rate of 80 to 90 percent (Carr 2009, Pritchard-Peterson 2010). The topography is so rugged that engineers had to locate coastal roads farther inland. This rugged isolation makes the area an excellent place to study technology and rescue.

Lost Coast Wilderness dangers include high tides that leave miles of trail underwater, unexpectedly large “sneaker” waves, high winds, precarious cliffs, river crossings, slippery rocks, environmental hazards, and wildlife. Rescues often involve multiple agencies. No one agency keeps comprehensive records of Lost Coast Trail rescues.

From May through September 2009, 235 overnight visitors to the King Range Wilderness completed a survey along the Lost Coast Trail. Sampling occurred on a stratified sample of weekdays, weekends, and holidays at three points along the trail: the northern trailhead (Mattole Beach), southern trailhead (Black Sands Beach), and a popular resting spot three miles south of the northern trailhead (Punta Gorda Lighthouse). All adult visitors on an overnight backcountry trip were asked to complete the survey.

Respondents answered questions about their wilderness skills, experiences and beliefs regarding risk, rescue and technology in the wilderness. Questions consisted of logical items as suggested by the literature and personal experience, and were further refined by way of a focus group of experts. Respondents answered some questions on a 7-point scale (“not at all” to “a lot” or “not important” to “very important”). Other questions were answered by checking “yes” or “no” or one of several provided responses.

Results

The response rate was 92%. Respondents ranged in age from 18 to 80 (median age was 28). Sixty-five percent of respondents were male. Subjects reported a median of 10 years of experience making overnight wilderness trips, with a median of 2.5 trips (6 nights total) in the previous 12 months. Median group size was 4. Additionally, 32 visitors (14%) reported serving in a leadership or guide role on a wilderness trip in the previous 12 months.

We asked respondents to indicate the extent to which they believed different factors were responsible for visitors making unsafe decisions in wilderness. Overestimating one’s abilities and not fully understanding or realizing the consequences of one’s decisions were seen as the top two factors responsible for unsafe decisions in wilderness (Table 1).

We also asked respondents to indicate the extent to which they believed different factors contributed to the need for visitor rescue in wilderness. Poor judgment, lack of preparation and inexperience, all factors firmly in the control of the recreationist, were perceived to be the primary factors contributing to the need for visitor rescue (Table 2).

We used two measures to assess the degree to which respondents were risk takers. The first was a single item measured on a scale of 1 (not at all) to 7 (a lot), asking “Do you see yourself as a risk taker?” The second measure consisted of two

Table 1—Visitor perceptions of the factors responsible for unsafe decisions in wilderness.

	Percentage of respondents rating 1-3 on a 7-point scale ^a	Percentage of respondents rating 5-7 on a 7-point scale ^a
Overestimating abilities	5.4	76.3
Not realizing consequences	10.7	71.9
To prove themselves	13.6	60.5
Adrenalin/endorphin surge	25.1	49.3
Fear of looking weak	24.7	48.9
Feeling they can call for help	42.3	32.4

^a Measured on a 7 point scale, 1 "not at all," 7 "a lot"

Table 2—Visitor perceptions of the factors contributing to the need for rescue in wilderness.

	Percentage of respondents rating 1-3 on a 7-point scale ^a	Percentage of respondents rating 5-7 on a 7-point scale ^a
Poor judgment	3.9	86.1
Inexperience	6.5	84.9
Lack of preparation	4.8	84.8
Bad weather	8.7	61.3
Equipment failure /wrong equipment	33.2	28.3
Bad luck	47.3	24.3

^a Measured on a 7 point scale, 1 "not at all," 7 "a lot"

behavior-based questions: (1) "Have you ever done something in the wilderness that you felt at the time was unsafe?" and (2) "Have you ever done something in the wilderness that you felt in retrospect was unsafe?" Of the 69 respondents (31% of the sample) who considered themselves to be non or low risk takers (less than 4 on the 7-point scale), half still admitted to having done something in a wilderness that they knew at the time was unsafe, and half also admitted to having done something that in retrospect they considered unsafe. But of the 89 respondents (40% of the sample) who considered themselves to be risk takers (greater than 4 on the 7-point scale), 80% admitted to having done something in a wilderness that they knew at the time was unsafe and 85% admitted to having done something that in retrospect they considered unsafe. The self-identified risk takers were, in fact, much more likely to make decisions and take actions in wilderness that were admittedly unsafe, and they usually knew at the time that their action or decision was unsafe.

For the purposes of our survey and to make our questions clearer to our respondents, we defined technology as information and communication devices such as GPS, cell and satellite phones, and personal locator beacons. We then asked a series of questions about this type of technology and its place in

the wilderness. Most respondents reported that this technology was not a successful substitute for skill, experience, and knowledge in the wilderness, nor would they be likely to take chances that could increase risks if they had technology with them. Nor did they believe that technology reduces many of the dangers people associate with being in the wilderness. Half of the respondents felt that technology creates a genuine increase in safety for wilderness users, while a little more than half felt that it creates a false sense of safety. Respondents were equally split on whether they would feel safer by having technology with them, and whether or not having technology makes people feel their safety is not their personal responsibility (Table 3).

Next, we used our two measures of risk (the self-assessment and the behavioral questions) to group respondents into one of three levels of risk takers—low, moderate, and high—and compared the responses of the three groups on each of the eight technology questions. We used a Kruskal-Wallis test to identify significant differences across the three levels of risk-takers and a Student-Newman-Keuls post-hoc comparison test to identify which specific groups differed from one another (Table 4).

The question on which the three groups differed the most was "Would you be more likely to take chances that could increase risk if you had technology with you in the wilderness?" Although the mean for all three groups was below the mid-point of the scale, all three groups differed significantly from one another. The higher the level of risk taking, the more likely they were to report that they would take chances that could increase their exposure to risk if they had information/communication technology with them. Both moderate and high risk takers were significantly more likely to believe that technology reduces many of the dangers people associate with being in the wilderness, and both were significantly more likely to think that having technology makes people think that their safety is not their personal responsibility. Finally, moderate and high risk takers were more likely to believe that technology creates a genuine increase in safety for wilderness users.

We also used the questions in Table 3 to do a K-means cluster analysis and classify respondents based on their beliefs about technology in wilderness. A "pro-technology" group (55% of the sample) felt that technology increased one's safety in wilderness. This group was more likely than the "anti-technology" group to use technology to request a rescue, take chances that could increase risk if they had technology with them, and believe that technology can successfully substitute for skill, experience, and knowledge. The "anti-technology" group felt quite strongly that technology cannot substitute for skill, experience, and knowledge. Members of this group were very unlikely to take chances that could increase risk just because they had technology with them, and did not agree that technology reduced dangers and made them feel safer in the wilderness. An analysis of these two technology clusters and the three levels of risk taking indicated that high risk takers are significantly overrepresented in the pro-technology cluster (23% of the sample), and significantly underrepresented in the anti-technology cluster (Chi-square, $p = .013$).

Table 3—Visitor perceptions of technology use in wilderness (n from 218 to 224).

To what extent...	Percentage of respondents rating 1-3 on a 7-point scale ^a	Percentage of respondents rating 5-7 on a 7-point scale ^a	Overall mean score ^a
Do you think technology in the wilderness can successfully substitute for skill/experience/knowledge?	82.0	6.8	2.2
Would you be more likely to take chances that could increase risk if you had technology with you in the wilderness?	68.9	16.3	2.7
Do you feel technology reduces many of the dangers people associate with being in the wilderness?	56.2	17.1	3.2
Would you be more likely to use technology to request rescue when you could make it out on your own but the process of self-rescue would be long and uncomfortable?	42.6	37.2	3.8
Do you think technology in the wilderness makes people feel that their safety is not their personal responsibility?	39.0	38.6	3.9
Do you / would you feel safer by having technology with you on a wilderness trip?	34.3	36.2	4.0
Do you think technology creates a genuine increase in safety for wilderness users?	18.7	50.9	4.6
Do you think technology creates a false sense of safety for wilderness users?	13.8	56.3	4.8

^a Measured on a 7 point scale, 1 "not at all," 7 "a lot."

Table 4—Contrasting perceptions of information and communication technology in wilderness across levels of risk-takers.

To what extent...	Low risk takers n=81	Mod. risk takers n=64	High risk takers n=77
Do you think technology in the wilderness can successfully substitute for skill/experience/knowledge?	2.1 ^a	2.4 ^a	2.2 ^a
Would you be more likely to take chances that could increase risk if you had technology with you in the wilderness?^d	2.2 ^a	2.7 ^b	3.3 ^c
Do you feel technology reduces many of the dangers people associate with being in the wilderness?	2.9 ^a	3.4 ^b	3.4 ^b
Would you be more likely to use technology to request rescue when you could make it out on your own but the process of self-rescue would be long and uncomfortable?	3.7 ^a	3.9 ^a	3.7 ^a
Do you think technology in the wilderness makes people feel that their safety is not their personal responsibility?	3.5 ^a	4.0 ^b	4.1 ^b
Do you/would you feel safer by having technology with you on a wilderness trip?	4.0 ^a	3.9 ^a	4.1 ^a
Do you think technology creates a genuine increase in safety for wilderness users?	4.2 ^a	4.7 ^b	4.9 ^b
Do you think technology creates a false sense of safety for wilderness users?	4.6 ^a	4.8 ^a	5.0 ^a

Values are mean scores on a 7 point scale, 1 "not at all," 7 "a lot." Scores with different superscripts are significantly different at p < 0.05, Student-Newman-Keuls post-hoc comparison test.

Amount of previous wilderness experience may also be a factor when assessing beliefs about these devices. Experience (measured by combining both number of overnight trips in the last 12 months and number of years making overnight wilderness trips) is positively correlated with the belief that technology creates a false sense of safety ($r(211) = 0.194, p < .01$). The more experience visitors had, the more likely they were to believe that technology makes wilderness visitors feel they have a safety net that in reality may not exist. Experience is also positively correlated with the belief that technology makes people feel that their safety is not their personal responsibility ($r(205) = 0.159, p < .05$).

About 11% of King Range Wilderness visitors reported having been personally involved in a serious wilderness accident and 41% knew someone involved in a serious wilderness accident. Half (52%) of the respondents who reported personal involvement in a wilderness accident said they had used a technological device in a wilderness emergency. Tellingly, those with personal experience of a serious wilderness accident are more likely to believe that technology creates a false sense of safety for wilderness users than those who have not been involved in a serious wilderness accident (Mann-Whitney U test, $p < .05$), as do those who know someone who was involved in a serious wilderness accident (Mann-Whitney U test, $p < .05$).

Discussion

Our results are consistent with what many authors have previously speculated. In our sample of wilderness users, a majority of respondents (56%), particularly experienced visitors and visitors who have been involved in a serious wilderness accident, believe that possessing information/communication technology creates a false sense of safety (though some may also concurrently believe that it increases safety). A reliance on technology to summon rescue may create a false perception of a “safety net” when people’s expectations of technology and rescue do not correspond with the actual capabilities of the technology and the rescuers. It may also lead to people taking more risks than they otherwise would take, relying on technology to “take up the slack.” Our empirical findings suggest this as well, as self-identified risk takers were significantly more likely to take chances that could increase their exposure to risk if they had information/communication technology with them.

Our analysis found a substantial subset of visitors (high risk takers in the pro-technology cluster; 23% of the sample) with a combination of traits that managers have expressed concern over—high risk takers who (1) believe that technology reduces many of the dangers people associate with being in the wilderness, (2) think that having technology makes people think their safety is not their personal responsibility, (3) believe that technology creates a genuine increase in safety for wilderness users, and (4) are willing to take more risks and then use that technology to bail themselves out of trouble.

Other results may also give managers pause. Our sample of visitors admitted that not fully understanding or realizing the consequences of one’s decisions was one of the top two factors responsible for visitors making unsafe decisions in

wilderness. They noted that poor judgment, lack of preparation, and inexperience were the primary factors contributing to the need for visitor rescue. All of these factors may be susceptible to, or exacerbated by, an inappropriate reliance on technology. While off-site access to information may help some visitors better prepare for a trip (sometimes to the extent of removing virtually all the uncertainty and mystery), Stevenson (2011) laments the potential influence of technology on creating unprepared visitors who head into the mountains without having done their homework, relying instead on their GPS for navigation and their cell phone and/or personal locator beacon if they happen to get into trouble.

We found that amount of previous wilderness experience may influence perceptions of technology and the safety net that it provides. This could prove dangerous given findings that individuals who lack experience often reach inaccurate conclusions and make bad choices. They often do not realize that their conclusions and choices are poor, falsely believing they are doing everything right. Novices have fewer metacognitive skills than experts, and are less likely to accurately judge the difficulty of the problem at hand (Kruger and Dunning 1999). Optimism bias also affects the perception of risk, leading people to believe they are less at risk than others would be in a similar situation. This is particularly prevalent when people believe they can control the risk, that it is unlikely to happen, or if they lack experience with the risk (Powell 2007). Optimism bias can “harness us to a wishful, thereby inaccurate, and therefore dangerous image of the world,” with misperceptions leading to accidents (Udall 1987). Coupling inexperience with a reliance on technology would thus seem a recipe for disaster.

Conclusion

As technological devices such as cell phones, satellite phones, and personal locator beacons become more readily available, greater numbers of recreation visitors will undoubtedly bring these devices into the wilderness and use them to request rescues. While these devices have sometimes alerted rescuers to emergencies early enough to save lives, some visitors, particularly those with limited wilderness experience and skills, appear to be developing unrealistic perceptions of the inherent risks of wilderness travel, as well as unrealistic expectations of the institutional capacity for rescue, based on their possession of and reliance on these devices.

The combination of our results and the findings of Hohlreider and others (2005) paints a cautionary tale for agencies and other organizations responsible for backcountry rescues—a decline in the ability and/or willingness of wilderness visitors to self-rescue, an increased expectation of the institutional capacity for rescue, and an increase in the number of rescue requests from visitors, particularly requests that turn out to be non-emergencies. Stevenson (2011) suggests that what is needed is to “create new guidelines and training for how satellite-enhanced communication devices should be used on the trail. For instance, no gadget should be considered a substitute for a detailed map and compass. . . . treat cell phones and satellite beacons just like the emergency kit in the trunk of your

car: You know the kit is there, but you should do everything possible not to use it.” In other words, if you take technology with you, whether for navigation (GPS) or communication (cell/sat phone, PLB), learn to use it as the last resort, not the first resort.

Limitations

In interpreting our results, we acknowledge several limitations. This was an exploratory study and the questions we used to assess beliefs about technology in wilderness are, to our knowledge, the first such survey questions formulated to examine this issue. They would undoubtedly benefit from further refinement. Some of those questions asked about “you,” while some asked about “others.” This difference in question phrasing style should be noted. It is less a concern in this study, since the scores from these items were never combined into a summative scale score. However, future research using summative scales should bear this in mind if adapting the items used here. Finally, although we used a bivariate measure of experience use history (number of trips in the last 12 months, and number of years participating in the activity), we did not use a common third measure—a self-assessment by respondents of how experienced they believe themselves to be. Further research into this topic would benefit from such a multivariate measure of experience use history.

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