Re(Connecting) through Shared Remote Outdoor Play

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Abstract
Shared participation in arousing recreational experiences, such as those involving the outdoors, contributes positively to well-being, relationship health, and human need-fulfillment. However, people often face barriers which hinder contact with nature and participation in outdoor recreation with relational partners. Loss of outdoor recreation opportunities could negatively affect a person's well-being and their ability to satisfy basic human needs. This research aims to explore design considerations for technology-based interventions intended to overcome select barriers to outdoor recreation. Critical to this goal is understanding these barriers, the reasons why people choose to engage in recreation activities involving the outdoors, and the needs they hope to fulfill through using the outdoors as a medium for such activities. We report on a survey study exploring such concerns, and thoughts on the Planet Runner concept, a technology-mediated indoor/outdoor experience designed to enable loved ones to play together while apart. We observed that differing user motivations for choosing to spend time outdoors could create conflicts and tensions within the user and between relational partners, and affect interest in technology-mediated outdoor recreation solutions.

Keywords
HCI Outdoors, Shared Recreation, Technology-Mediated Play, Location-based games

1. Introduction

Maslow [23] postulated that human behavior and well-being are heavily influenced by an individual's ability to fulfill "physiological", "safety", "belongingness and love", "esteem", and "self-actualization" needs. Subsequent research by psychologist Clayton Paul Alderfer and others provide further support to this assertion. Alderfer's exploration of this phenomenon resulted in another widely accepted classification system referred to as Alderfer's ERG (Existence, Relatedness and Growth) theory [3], where Alderfer grouped Maslow's "love and belongingness" needs, along with other social and external esteem needs involving friends, family, co-workers, into a classification referred to as "relatedness" needs [3]. Regardless of the classification system, research on human psychology generally agrees that humans are need-driven and that an individual's ability to fulfill human needs, such as those related to love, belonging, or relatedness, has a significant impact on their health and well-being [9, 10, 18, 19, 21, 23].

With respect to human needs and nature, there is a growing body of research providing evidence that time spent outdoors, either alone or in the company of loved ones, contributes positively to well-being and the fulfillment of needs [14, 15, 24, 27, 28]. Prior research has demonstrated that time spent alone in nature can have restorative effects, promoting relaxation and wellbeing [13, 14, 29], reducing anxiety and negative affect, and maintaining positive affect [8]. Young and Crandall [28] observed that wilderness users were more self-actualized than non-users (needs associated with an individual's desire to fulfill their potential in life). The authors argue that time spent in the wilderness, especially time "involving solitude and contact with nature" [28], could be a significant contributing factor to increased self-actualization need-fulfillment.

At a relatedness and social level, relationship research provides strong evidence that shared activities as a whole help to sustain healthy relationships better than many other strategies employed by romantic relationship partners [16]. These studies reason that shared participation in activities provides opportunities for relationship partners to build closeness and form positive mental and emotional links between activity satisfaction and their feelings towards their relationship [5,16]. Aron et al [5] provides evidence that shared participation in activities considered "novel and arousing", such as "outdoor activities, active sports, card games, and travel" were directly associated with higher levels of experienced relationship quality. Freeman and Zabriskie [15] explored this phenomenon with a more focused investigation on shared recreation involving the outdoors. Through two studies, the first involving 24 families who participated in an 8–hour outdoor adventure program, and the second with 11 families who took part in a residential camp experience, the researchers observed that participation in structured outdoor family recreation had a strong positive relationship with family strength [15]. In their investigation of family campers at St. Croix State Park Minnesota, West and Merriam [27] observed similar benefits, finding evidence to support the hypothesis that outdoor recreation with family helps maintain and increase family cohesiveness. Jirásek et al [20] also noted the positive impact of time engaged in outdoor recreation activities on familial relationships.

Cognizant of the possible barriers to time outdoors and shared outdoor recreation, and, inspired by the aforementioned studies, we sought to explore how we may design technology to effectively motivate, mediate, enhance, and support remote play involving the outdoors, without detracting from the desired outdoor experience. To help us explore this space and elicit stakeholder perspectives and concerns regarding technology-based interventions which support outdoor recreation, we crafted the Planet Runner game concept, a technology-mediated remote indoor/outdoor recreation experience designed to enable loved ones to play together while apart. Using an online survey study we gathered details of perceived barriers to time outdoors; participant perspectives, needs, and interests regarding outdoor recreation; and their impressions of the Planet Runner concept. We briefly report on the initial findings and implications on future research.

2. Planet Runner

Planet Runner is a two-player digital physical game designed for people who wish to share outdoor running experiences with companions whose circumstances prevent co-located participation. The game provides an asymmetric interdependent play experience where each real-world running session is framed as an in-game scouting "mission". Players adopt the role of "Planet Runner" and "Overwatch" [17]. The game leverages interdependent and cooperative game elements which require Planet Runner and Overwatch to work together to complete mission objectives in order to win the game. Gameplay involves Planet Runner walking or running a real-world outdoor route.
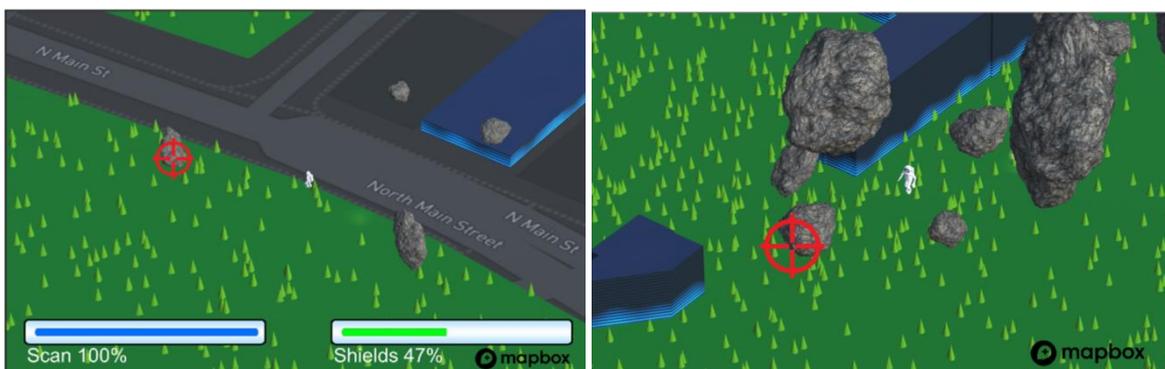
Figure 1: Game environment generated from real-world running route using ©Mapbox, ©OpenStreetMap [1, 2]. Picture on the right depicts Overwatch controlling the virtual drone's reticle to defend Planet Runner from falling debris.

As the Planet Runner moves in the real-world their location data is used in real-time to generate a virtual environment which represents the runner's real-world route (Figure 1). Planet Runner must maintain or adjust their running pace in response to in-game directives and scenarios. Overwatch plays the game remotely by interacting with the generated virtual environment remotely. Overwatch

virtually accompanies Planet Runner on their outdoor experience by controlling a virtual drone which keeps pace with Planet Runner within the generated virtual environment. Overwatch uses the virtual drone to provide Planet Runner with mission support. Overwatch plays by defending Planet Runner, completing Overwatch-specific challenges, and directing or assisting Planet Runner in completing mission objectives. Players use voice chat to communicate with each other during the game.

3. Study Methodology

Using an online survey study, we set out to understand participant perspectives on shared recreation, perceived barriers to shared recreation, and thoughts on using technology to support recreation with co-located and remote loved ones. One part of the study specifically explored participant perspectives on time spent connecting with nature and engaging in outdoor recreation, and participant impressions of the shared remote play concept, Planet Runner. We introduced Planet Runner to study participants through the use of narrative descriptions and images extracted from a medium-fidelity prototype of the game. Following the data collection phase, we used simple statistics on close-ended responses and open-coding and thematic analysis [12, 26] on responses to open-ended questions. A select portion of the findings will be shared in the sections to follow.

3.1. Participants

Study participants were recruited using a combination of social media, email, snowball sampling, and the University Graduate School's listserv. We received eighty-seven responses to the online survey. Initial review revealed that 14 responses contained invalid or empty responses to many open-ended and attention check questions. These responses were therefore discarded from further analysis. Of the remaining 73 participants, 53 were female, 18 male, and 2 indicated other. Respondents ranged in age from 18 to 44 years old. Most participants (36 / 73) were living with a romantic partner or close family member(s) during the period of the study, 15 participants lived alone, 10 lived with an acquaintance or casual friend, 6 lived with close friends, and 6 lived with family members who were not considered to be "close family". Nineteen participants indicated that they were in an area issued with a "shelter-in-place" or "stay-at-home" order, 45 reported that they were not, and 9 were unsure. The vast majority of participants (70 out of 73) reported adhering to COVID-19 health and safety recommendations during the period of the study, where possible they avoided close contact, practiced social distancing, and remained at home.

4. Findings
4.1. Reasons for spending time in nature

We asked participants to identify or describe their top 4 reasons for spending time in nature. The following is a summary of participant responses and the accompanying percentage of participants who included a given reason within their top 4.

1. For health and exercise - 67% (49 / 73)
2. To get away from work, society, and other stressors - 64% (47 / 73)
3. To enjoy nature/commune with nature - 62% (45 / 73)
4. To visit an attraction or explore a stimulating and dynamic environment - 53% (39/ 73)
5. To enjoy recreation with family and loved ones - 49% (36 / 73)
6. To relax - 42% (31 / 73)
7. To get away from technology - 29% (21 /73)
8. To seek solitude - 18% (13 / 73)
9. To pursue challenges/goals that are directly associated with the outdoors - 7% (5 / 73)

Cursory statistical examination highlighted a few notable differences in participant selection of choices. Participants who lived with close friends did not identify option 1) "For health and exercise",

or option 8) "To seek solitude", within their selection of top 4 reasons. Participants who lived with acquaintances or casual friends did not select option 7) "To get away from technology", within their choice of top reasons. Additionally, option 2) was not a benefit sought by people who were not in a committed relationship. Expressed recreation preferences did not appear to influence participant selection of top reasons.

4.2. Barriers to time in nature

We asked participants to describe the single biggest thing that kept them from spending more time outdoors in nature. Responses to this question often included multiple types of barriers, with participants occasionally attempting to highlight some relationship between the named contributors. Forty-one participants indicated that "lack of time" was the main reason they did not spend more time in nature. Such responses often included commentary explaining that work, school, busy schedules, or other personal commitments such as childcare, were reasons for them not having free time to spend in nature. Eight participants described unfavorable weather conditions as their primary barrier. Circumstances associated with the COVID-19 pandemic emerged as another barrier to spending more time in nature, with six participants describing COVID-19 and associated concerns, such as fear of getting infected, health and safety regulations, and coming into contact with others. Ten participants specifically described intrapersonal concerns such as lack of energy, lack of motivation, stress, laziness, and fatigue. Five participants cited reasons of a social nature. These participants wished to be accompanied by friends or other loved ones when spending time in outdoor settings. They lamented that their friends were often unavailable or not interested in spending time outdoors, this in-turn affected their own interest in time outdoors. Six participants provided responses suggesting personal preferences to being indoors, a general disinterest in spending time outdoors, or an active dislike of features common to outdoor spaces, such as sunlight and bugs. Proximity to preferred outdoor spaces and difficulties in accessing them was another barrier. Three participants described barriers associated with distance from preferred outdoor locations and circumstances which hindered access to such spaces. For example, one participant did not have ready access to a vehicle. This in turn made travel difficult. Interestingly, safety concerns also emerged as a barrier. Two participants provided responses of this nature, both responses originated from female participants.
- *"I am worried about going outdoors alone as a female."*

In addition, two participants mentioned health concerns that were unrelated to the pandemic, *"grass allergies, mental illness/executive dysfunction".*

Another two participants mentioned a need to remain constantly "tethered" to technology and a stable internet connection. Finally, one participant provided a response which suggested that a perceived disparity in "invested effort" vs "reward of time outdoors" was their main barrier. This participant alluded to having a sense for what they felt constituted a pleasant or acceptable outdoor experience, and a vision of the effort needed to plan and prepare for such an experience. This forethought of effort affected their interest in outdoor recreation.
- *"The feeling of needing a lot of preparation to be outside for a while (sunburn/overheat easily, lose track of time and miss good windows, investment in items needed for structured/enjoyable outside recreation,...)*

4.3. Perspectives on Planet Runner

Participants generally found the Planet Runner concept to be appealing, with 41 out of 73 participants expressing interest in using technologies of this nature to support shared outdoor recreation with loved ones. Participants indicated a strong affinity for the features that: allowed loved ones to play together while apart; accommodated different player locations, outdoor environments, climates/weather conditions, time zones; supported interdependent gameplay (each player needing the other to complete the game). Participants also liked the flexibility originating from the choice of roles and indoor and outdoor play options. This resonated with participants who 1) enjoyed outdoor

activities and recreation with loved ones 2) did not enjoy the outdoors or specific outdoor activities, or 3) had a preference for spending time indoors but still wished to engage in shared participation in a relation partner's preferred recreation activities [17].

- *"I can participate without having to run with him"*

One participant highlighted that such technology-mediated experiences could support intimacy and feelings of connection.

- *"The interdependence of needing one another to complete the game (as a reminder that it's okay to need support from remote loved ones) and the ability to experience the run together from different locations."*

While generally well received, a number of participants expressed concerns. Some felt that this concept conflicted with preferred forms of outdoor recreation and introduced risks to privacy

- *"I'm not a fan of running as my preference of outdoor fun is backpacking and camping, so I probably would not play this game as it is currently designed ...I'm always hesitant to play games which require GPS data because of privacy and tracking concerns"*

Others preferred options where both players could engage in the outdoors together, even if remotely.

- *"The concept of having one stay indoors and the other outdoors isn't very appealing. I believe both should do the same thing."*

Yet others still highlighted conflicts and tensions, specifically with respect to the reported reasons they engaged with the outdoors. For example, some participants noted that the interactions promoted by the game mechanics could be intrusive and detract from why they, or their loved one, chose to partake in a chosen outdoor or shared recreation activity.

- *" my boyfriend likes to run, I know he uses that time to be by himself and destress so I don't know if me talking to him telling him what to do would be good for him."*

- *"I would not like having to stay focused on rules/technology while trying to enjoy the outdoors."*

- *"Running was and is an independent task and having a partner play with you removes the solitude of the task of running."*

5. Discussion and Future Work

We began this study to develop a better understanding of the needs, perspectives, and concerns of people who enjoy individual and shared outdoor recreation, and the potential role of technology in motivating, supporting, and enhancing shared recreation experiences involving the outdoors. We recognized that understanding the perceived barriers to outdoor recreation, and the factors which motivate people to use the outdoors as a medium for recreation, was a critical step when considering the design of technology-based interventions. We believe that failure to consider such concerns during the design process could result in technologies that detract from the outdoor experience desired by users. We conclude by briefly discussing important design considerations originating from our study.

Kotut et al. [22] observed that conflict and tension could exist between and among different types of trail users, each with different priorities involving the trail, different goals associated with a given outdoor experience, or different ideas regarding how to use an outdoor space. Similarly, our participant feedback revealed areas of conflict and tension that may exist within an individual trail user, and between two or more users who may wish to engage in an outdoor activity together. Naturally, such conflict and tensions could have a negative impact on an individual's ability to fulfill wants or needs associated with their reasons for spending time outdoors. Our findings highlight the importance of developing a better understanding of such conflicts and tensions, and their implications, when intending to design outdoor technology that serves to enhance, not detract from, an outdoor experience. For example, feedback on Planet Runner illustrates that the concept may be suitable for

outdoor enthusiasts who prioritize "health and exercise" and "To enjoy recreation with family and loved ones" as their main reasons for spending time outdoors. Games of this nature would therefore likely not appeal to outdoor enthusiasts who prioritize reasons like - "To enjoy nature/commune with nature", "To seek solitude", "To get away from technology", "To get away from work, society, and other stressors", or goals associated with skill mastery or performance improvement.

-"I am a competitive runner and would not enjoy this concept because it would make my normal running routine too complicated so I would not enjoy my run".

Some participants expressed that safety while outdoors was an area of concern. This matched with one of the reported barriers to time outdoors. This concern involved specific elements of the game and the fact that it promoted play involving the outdoors, a space where some users felt unsafe. This feedback highlighted the need to consider the user's physical safety and peace of mind such concerns when designing outdoor play technologies. With respect to Planet Runner and similar solutions, such applications should avoid gameplay which place users in hazardous circumstances. For example, gameplay involving collecting virtual objects should avoid positioning such objects in real-world spaces with vehicular traffic and other potential hazards. Furthermore, technology designers should seek to strike a balance between immersing users within the technology-mediated experience, while still allowing them to maintain awareness of their outdoor environment.

Through reflecting on participant feedback the authors recognize that knowledge of the barriers and reasons for outdoor recreation provides a lens that technology designers can use to consider gaps and opportunities for technology interventions. For example, while the Planet Runner concept may motivate time outdoors, it does not motivate deeper connections with nature. We acknowledge that time outdoors provides opportunities to (re)connect with nature, but additional interventions may be necessary to motivate users to connect deeply with nature and outdoor spaces. With this in mind we plan to update Planet Runner to include high quality virtual replicas of outdoor landmarks found along the Runner's real-world route. At present, the game provides players with an overhead view and low-fidelity placeholders for buildings, roads, and outdoor artifacts. We believe that including high quality replicas of recognizable outdoor landmarks would enhance the play experience and have a positive effect on feelings of connection with relational partners and with the outdoor space. Further, we expect that such replicas would promote feelings of co-presence for remote players who are familiar with the outdoor area in question. This feature would also provide remote players with the opportunity to virtually explore the outdoor area in the company of the "on location" relational partner.

6. Conclusion

This paper presented early work exploring the design of technology which motivates, enhances, and facilitates remote outdoor social play experiences which provides opportunities for users to connect with loved ones and nature. We highlighted a number of barriers to time spent in the outdoors and participant perspectives on the shared outdoor recreation game concept, Planet Runner. Participants appreciated the Planet Runner concept but expressed concerns in instances where the interactions promoted by the game conflicted with their primary reasons for spending time outdoors, reasons that were closely associated with the fulfillment of some want or need. We are further motivated by the insights shared by participants highlighting how conflicts and tensions arising out of the reasons people opt to use outdoor spaces, and the gratifications they seek [25], may affect the suitability of a given technology-mediated outdoor experience for specific types of users. We plan on conducting further research in this area, specifically focusing more thoroughly on how people use outdoor spaces and the gratifications they seek, and to use these insights to drive the evolution and development of the Planet Runner game concept into a fully realized prototype, and subsequently, to formally evaluate it through user-experience studies. We hope through formal study to derive a better understanding of how user's personal characteristics and interests in outdoor recreation affect their enjoyment of mediated remote recreation experiences involving the outdoors. Further, we hope to better understand how, through careful design, we may craft such experiences to enhance, not detract, from time outdoors connecting with nature and with loved ones.

7. References

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