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# Designing a Mobile Game That Develops Emotional Resiliency in Indian Country

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## ABSTRACT

Communities in Indian Country experience severe behavioral health inequities [11, 12]. Based on recent research investigating scalable behavioral health interventions and therapeutic best practices for Native American (NA) communities, we propose ARORA, a social and emotional learning intervention delivered over a networked mobile game that uses geosocial gaming mechanisms enhanced with augmented reality technology. Focusing on the Navajo community, we take a community-based participatory research approach to include NA psychologists, community health workers, and educators as co-designers of the intervention activities and gaming mechanisms. Critical questions involve operation of the application across low-infrastructure landscapes as well scalability of design practices to be inclusive of the many diverse NA cultural communities in Indian Country.

## CCS CONCEPTS

• **Human-centered computing** → **Ubiquitous and mobile computing systems and tools**; *Mixed / augmented reality*; *Social networking sites*;

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**KEYWORDS**

mHealth, cultural design, Indigenous, behavioral health, gamification, rural computing

**INTRODUCTION**

<sup>1</sup>Indian Country is the legal term used to describe land (e.g., reservations, rancherias, reserves, pueblos, and trust lands) held in trust by the U.S. federal government on behalf of federally recognized sovereign tribes. When discussing communities living in Indian Country, we refer to communities that are predominantly ethnically Native American or Alaska Native.

Indian Country<sup>1</sup> experiences some of the most severe behavioral health disparities in the U.S. [11, 12]. A significant component of these disparities is the rurality associated with much of Indian Country—rural areas in general lack trained behavioral health professionals, locally-placed behavioral health clinics, community-based preventative measures, perceived anonymity associated with care, and perceived need for behavioral health care in addition to having strong stigmas around behavioral health care. For communities in Indian Country, these issues are often compounded with significant historical trauma and cultural dissonance with existing health care practices. Moreover, studies have observed that stress-inducing factors such as economic hardship and stressful life events (e.g., food insecurity, substance abuse, and death in the family) are much more prevalent in Indian Country.

Studies investigating behavioral health interventions that enhance and develop strengths and protections against behavioral health issues and mental illness reveal that positive psychology-focused universal interventions have long-term benefits for youth and adolescents [5]. Moreover, successful behavioral therapies for Native American (NA) and Alaska Native (AN) youth reveal that therapies that take a strengths-based approach and seek to be culturally relevant tend to be more effective than those that do not [11]. Given these findings, we propose ARORA, a positive psychology-focused behavioral health intervention for NA/AN adolescents designed to encourage engagement in targeted social and emotional learning activities through a networked, geosocial mobile game that leverages augmented reality and cultural themes. Critically, ARORA accounts for the significant digital inequities that exist in Indian Country (and rural communities in general) through the design of an edge-centered backend that facilitates the delivery of high bandwidth, delay-sensitive content at the edge without requiring a robust or high performance middle-mile connection to the Internet.

Our community of focus for the ARORA pilot is the Navajo Nation, which is located in the Four Corners area of the American Southwest. This paper will describe how we design social and emotional learning interventions and game mechanisms with respect to Navajo culture and values while ensuring that our system design is appropriate for deployment in Navajo Nation, which is predominantly rural and lacks robust telecommunications infrastructure.

**RELATED WORK**

For the past two decades, there have been numerous works that focus on behavioral health-focused mobile health (mHealth) interventions that leverage mobile devices to educate people about health-care options [3, 7], extend healthcare professional-patient communications [10], and deliver device-mediated health interventions [2, 6]. Most related to ARORA are mHealth interventions that use

gamification as a means for behavioral intervention delivery [1, 4, 7]. Most relevant is Coyle et al.'s Pesky gNATS, a mobile and desktop game that delivers cognitive behavioral therapy (CBT) interventions to youth. While Pesky gNATS is primarily focused on interventions in a clinical setting, ARORA seeks to operate as a more universal social and emotional learning intervention that seeks to build emotional coping, interpersonal, and strengths cultivation skills [5]. ARORA is also designed specifically for mobile platforms and seeks to tightly integrate with users' environments using geosocial gaming and augmented reality. Moreover, based on best practices for behavioral interventions for Indigenous communities, ARORA is designed to be culturally relevant by integrating words and phrases from Diné Bizaad, Navajo cultural values and images, and input from Navajo collaborators.

#### Intervention Categories

**Coping Skills:** Teaches users how to cope cognitively and emotionally with day-to-day challenges.

**Interpersonal Skills:** Teaches users how to connect with others and learn how to be more assertive in their social interactions.

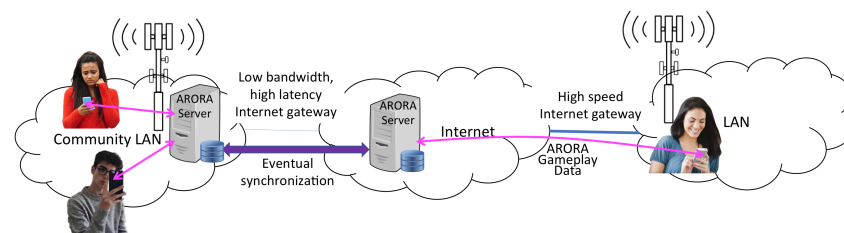
**Cultivating Strengths:** Helps users connect with underlying values and cultivate mindfulness, gratitude, and self-compassion.

#### Sidebar 1: Definitions of ARORA intervention categories.

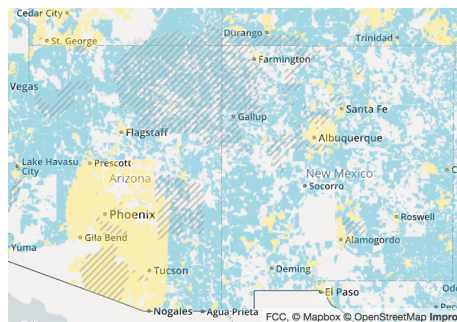
#### GAMIFYING CULTURALLY-CENTERED EMOTIONAL RESILIENCY INTERVENTIONS

Based on successful interventions aimed at developing emotional resiliency, we identified three intervention categories in Sidebar 1. A significant challenge involves translating interventions into mechanisms of gameplay. Thus, a driving research and design question is: *How do we effectively use augmented reality and gamification in order to scaffold emotional resiliency development so that users can transfer in-game skills and knowledge into the real world?* Initial conceptual work has leveraged the idea of a spirit animal that functions as a user's avatar in-game and as an unobtrusive guide that helps users reflect on skills and lessons learned in-game.

Another major challenge associated with designing ARORA is the scalability of culturally-centered design for Indian Country, which does not represent a single, monolithic culture, but is comprised of 573 federally recognized tribes with many different languages and cultural practices. Designing an interface to be culturally relevant for a particular cultural group has several critical implications for design, including the need for community-based participatory research and precautions against cultural appropriation. To do this for a pilot implementation, we are assembling a community advisory board that will include Navajo, Hopi, and other Southwestern tribal healthcare professionals and educators who have experience working with NA adolescents. Our team also includes a researcher who is Navajo and is able to assist in the initial conceptual design of intervention and learning activities that leverage images and concepts that are particularly relevant to Navajo. While these are critical steps to ensuring that the psychological interventions resonate with ARORA users, it is challenging to understand how this process might be made to scale to many different culturally oriented instantiations of the game without requiring a team of software development experts to customize and modify the system for each cultural community. Thus, a longterm research question is: *What are mechanisms that are required to ensure that cultural communities can easily modify and appropriate human-interfacing technologies in order to make them culturally relevant?*



**Figure 2: ARORA backend architecture uses edge-based networking to enable gameplay in low-infrastructure environments.**



**Figure 1: Map of fixed broadband availability in Four Corners area. Blue represents areas without any access to broadband Internet that meets 25 Mbps download and 3 Mbps upload speeds. Lined areas represent tribal lands.**

## CONSIDERING NETWORK INFRASTRUCTURE

The ARORA backend uses a REST API, where the app populates game options with data stored on the backend server. This is a typical model for many networked mobile apps that want to take advantage of a server to perform more resource intensive computations as well as to maintain state for social interactions that take place among different users who are playing the game. While this model works well in areas that have ubiquitous Internet connectivity, it does not work well in Indian Country, which experiences some of the worst rates of access and quality of access in the United States (see 1).

In order to design ARORA to be accessible and playable in communities that lack robust, high speed Internet connectivity, the ARORA backend is designed to be able to use a distributed, edge-centered network architecture (see Figure 2). This means that a community can run its own instance of an ARORA backend server on a local network accessible via public access points, such as WiFi hotspots or small-scale cellular networks. This local, edge-based point of service means that the backend server can minimize the time it takes to deliver data to the devices, mitigating latency that might lead to lower quality of experience. While we anticipate that the majority of in-game interactions will take place on the same local network, we also design for the diasporic nature that often characterizes Indian Country, where people often leave their homelands to gain greater access to educational and economic opportunities. To do this, the ARORA backend is designed to be distributed across multiple ARORA server instances, which can be eventually synchronized to each other [9].

## DISCUSSION AND FUTURE WORK

We are currently working to establish a pilot that targets adolescents ages 14-19 at Flagstaff High School (FHS) in Flagstaff, AZ. We are working with the FHS Native American Counselor to recruit Navajo students who live in Flagstaff, live on Navajo Nation (at least an hour commute), or live at the Kinlani Dormitory (for Navajo students whose homes are on Navajo Nation, but too far to commute

so they live at a dormitory during the academic year). In addition, we will be conducting system stress tests over small-scale cellular networks to evaluate the edge-based performance of ARORA.

There are some unique aspects to this work that represent new challenges for the HCI community. One critical challenge is developing mechanisms that facilitate the scalability of designing culturally relevant interfaces. For instance, the pilot iteration of ARORA is focused on relevance to Navajo adolescents, which means that certain animals, music, words, and symbols can be used in-game to ensure intervention efficacy. However, these cultural elements may not work for an intervention focusing on Lakota adolescents or Chumash adolescents. In order for ARORA to meaningfully address gaps in behavioral health in Indian Country, it is imperative that there is an easy way for communities to customize some of the interface elements without requiring communities to establish a team of software developers to modify the app in order to make it culturally relevant.

In addition to the need for easy customization, scalability also depends on the backend server being easily maintainable. Since ARORA is designed to be run at the edge of the Internet, it requires communities to install and maintain ARORA servers (Ubuntu with Django, Gunicorn, and Postgres) on their local area network (or community network). This is simultaneously a critical challenge as well as a significant new paradigm. Many communities in Indian Country experience the “brain drain” that is typical of rural places, where people who develop technical skills often leave an area due to lack of local employment and educational opportunities [8]. However, it can be argued that this design brings economic opportunity to a community by bringing technical work into communities. Moreover, the locally-based architectures give communities power and control over the data that is generated and served by the ARORA backend, allowing them to exercise data sovereignty around how their culture might be represented in the game and how metadata generated as part of game play is managed.

Finally, a significant challenge will be measuring and promoting impact in a manner that is meaningful but also does not detract from the user experience. In order to evaluate efficacy of the ARORA intervention, we will have users complete a baseline survey before and after using ARORA as part of the pilot trial. However, to get a detailed understanding of how specific interventions might help develop coping and social skills and cultivate a sense of strength, we will also administer unobtrusive mood and mindfulness surveys before and after each quest. Additionally, we want users to reflect on the psychological skills they are building in the game as skills that might be beneficial outside of gameplay. We plan to do this by occasionally having users reflect on themes and lessons learned after the completion of an in-game quest. The challenge is to integrate these surveys and reflections into gameplay so as not to annoy users. While we plan to use the spirit animal as a mechanism by which a few questions are asked of participants in an engaging manner, it is still unclear as to how invasive this will seem to adolescent users.

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