

Digital Ayoyote Rattle: The Design of a Portable Low-Cost Digital Media System for a Mediated XicanIndio Resolana

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ABSTRACT

In this paper, I present the design, construction, and implementation of an indigenous mixed-reality system I refer to as a *Digital Ayoyote Rattle* (Figure 1). This rattle is used to facilitate a digital media interaction called a *Mediated XicanIndio Resolana*, which is a place and process for community dialogues where participants use digital media to augment oratory with images and sounds. This work is inspired by Chicano and Native American rhetorical traditions. An earlier prototype that supports a *Mediated XicanIndio Resolana* does not meet cost or portability requirements for community distribution. The design goal of the *Digital Ayoyote Rattle* is to solve these issues while focusing on its ease of use for elders (community leaders) who are intended to administer this technology. The scope of this report includes (a.) a short description of the previous prototype, (b.) the design and brief analysis of 4 paper prototypes, (c.) the construction of a prototype based upon design analysis outcomes, and (d.) conclusions drawn from an early stakeholder design interview with a high school English Language Development teacher (Chicano Elder) who has used the *Mediated XicanIndio Resolana* as part of his curriculum.

Keywords

Indigenous media, social interaction, culturally responsive design, digital literacy, cultural sovereignty, rhetorical sovereignty.

1. INTRODUCTION

This report documents the early iterative design, construction, and use of a Mexican Ayoyote rattle embedded with a wireless physical computing system referred to as a Digital Ayoyote Rattle. An Ayoyote rattle is a Mexican and Chicano leg/wrist maraca traditionally worn during ceremonial dancing. The Ayoyote rattle was chosen as a way to culturally embed electronic technology within the framework of a local indigenous aesthetic. This use of the rattle fits within Chicano cultural traditions of using ancestral images and tools within artistic practices as an expression of cultural identity, ancestral remembrance, and self-determinism.

The Digital Ayoyote Rattle is a cultural implement designed

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to facilitate an indigenous media interaction for community dialogues called a Mediated XicanIndio Resolana [1]. This interaction is inspired by Northern New Mexican Resolanas and Native American Talking Circles, which are historical cultural practices that continue today as places and processes for delivering oratory. These traditions use protocols and tools for turn-taking, speaking, and active listening [1][2][3]. During a Mediated XicanIndio Resolana, participants gather to create a sense of place for communication through oratory augmented by digital images and sounds. To achieve this, digital media is shared and manipulated using a culturally situated tangible interface that responds to symbolic gestural choreography inspired by cultural traditions. For example, when a participant receives the Digital Ayoyote Rattle, she is required by protocol to shake the rattle while making a circular gesture. This is done to respectfully recognize the presence and perspectives of all those who have gathered, as well as call upon participants to listen carefully and reflectively. The rattle uses sensors and software to recognize this gesture, which is then used to project an image (previously uploaded by this participant) from the device onto the floor. Here it functions as a modality of story while oratory is delivered. In addition to this, the rattle is a signifier that designates the orator as participants take turns speaking. This is similar to how a talking stick is passed between participants within a Native American talking circle.

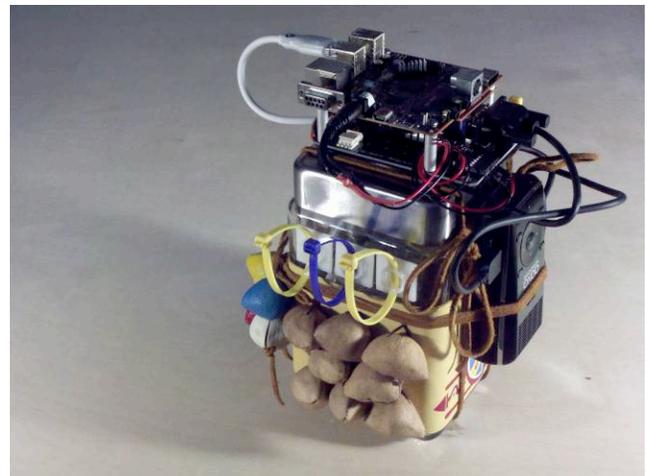


Figure 1: Photograph of the Digital Ayoyote Rattle.

The initiative to pursue this work was inspired by discourse from Stillwater for Network Art and Culture (2007) [4]. In this discourse Wampanoag elder Gkisedtanamoogk and his collaborator Joline Blais began to promote the practice of “indigenous media” to encourage indigenous peoples to claim

their digital commons for the purposes of enacting their self-determinism and for developing cross-cultural initiatives. Implicit in this idea is the importance for indigenous peoples to consider culturally responsive uses of digital media as an emergent aspect of indigenous culture.

To respond to this call, a conceptual framework for the *Mediated XicanIndio Resolana* was directed by Cristóbal Martínez and developed through co-intentional collaborations and contributions from members of Chicano, Native American, and academic communities (see acknowledgements section) [1]. Throughout a three-year collaborative and iterative design process, Martínez worked co-intentionally with indigenous collaborators to synthesize indigenous knowledge systems to produce an example of indigenous media that serves multiple purposes. One purpose is its use as an artistic artifact that indigenous communities can use to consider the cultural implications of indigenous media. The other purpose is to provide an example that has meaningful utility to local communities. In the case presented here, it is to mediate community dialogues while providing local indigenous peoples with opportunities to develop digital literacy skills within the context of their cultural ways of being.

The conceptual framework for a *Mediated XicanIndio Resolana* is based on Chicano dialogical practices extended by Northern New Mexico Chicano Elder, Thomas Atencio, who describes the resolana (mestizo dialogues based upon indigenous practices rooted to Northern New Mexico), as a traditional community gathering that takes place during New Mexico's colder months. Atencio cites that during a resolana people assemble on the south side of adobe structures as they reflect warmth from the winter-oriented sun that shines from the south. During these gatherings, community members practice reflective dialogues based upon free association and community issues. The word "resolana" means "the place where the sun shines." Atencio uses resolana as a metaphor for enlightenment. It is an action taken by people to illuminate each other with perspectives by shedding light on subject matter through dialogue [2].

The enactive framework for a *Mediated XicanIndio Resolana* is inspired from Native American talking circle protocols for speaking, listening, and turn taking. Respect through protocols enable trust, reciprocity, and accountability, and are key to the establishment of a *Mediated XicanIndio Resolana*. A circularly or feedback loop of this is highlighted by indigenous scholar Jo-ann Archibald who states that "ways of acquiring knowledge and codes of behavior are essential in cultural practices; one practice that plays a key role in the oral tradition is storytelling [3]."

Over the past three 3 years of design, the *Mediated XicanIndio Resolana* has been conducted using *SMALLab* to accomplish social and cultural work in formal and informal learning settings. In formal learning it has supported high school and college course curriculums that include community dialogues in cultural studies, and language-learning classes that were mostly populated by Mexican and Chicano students. In both contexts, the *Mediated XicanIndio Resolana* focused on student topics of concern such as immigration experiences, future aspirations, and violence in society. Through these efforts it provided indigenous students with a cultural practice for thinking critically about social justice issues while learning digital literacy skills such as media creation and the use of digital media as a method for communication (= encoding + decoding + comprehension + production + consumption + distribution). As an act of sovereignty in a digital age, the *Mediated XicanIndio Resolana* provided elders with a

self-reflexive tool (a tool that is in and of itself a cultural and technological representation of indigenous self-determinism) to teach students to think critically about the use of digital media while illustrating the relevance of ancestral knowledge in connection with digital literacy, indigenous identity and self-determinism. This provided indigenous peoples with a framework to gain digital literacy skills and the agency to produce and consume digital media in a manner consistent with their cultural ways of being.

To ensure greater accessibility to this education technology, there is a need to create a more affordable and portable prototype. These are the key design goals for the prototype presented in this paper. In the following sections I will illustrate the design of a *Digital Ayoyote Rattle* that addresses these design challenges. The scope of this report includes (a.) a short description of a previous prototype, (b.) the design and analysis of 4 paper prototypes, (c.) the construction of a prototype based upon conclusions drawn from the design analysis, and (d.) conclusions drawn from an early stakeholder design interview with a high school English Language Development teacher (Chicano Elder) who has used the *Mediated XicanIndio Resolana* as part of his curriculum.

2. CONTEXT AND MOTIVATION

The current focus of my work is to contribute to research and scholarship at the intersection of indigenous culture and digital technology, referred to as *Indigenous Media* [4]. My narrative and assumptions concerning indigenous media derive from my own Northern New Mexican mestizo roots, as well as through my scholarship and cross-cultural partnerships. Because of the nature of my heritage, I approach my work through a XicanIndio (Native American and Chicano) perspective. From this perspective I strive to design digital media experiences that help promote decolonization, cultural sustainability, environmental sustainability, and respectful cross-cultural partnerships [4][13].

My practice of *Indigenous Media* is grounded by media theory extended and complicated by indigenous knowledge systems. Within the context of TribalCrit and LatCrit race theories, I argue that colonization is endemic to the use of electronic technology, and that the cultural and rhetorical expression of digital media is necessary for indigenous peoples to exercise their sovereignty in a digital age [5][6][7]. I refer to this potential expression as *Indigenous Tecno-Sovereignty*.

This idea is a response to the emergence of digital media as a central theme of people's everyday lived experiences in the United States and other parts of the world. The use of pervasive technologies is expected to become an increasing reality for indigenous peoples as accessibility to digital media increases throughout the globe [11]. The results of this can potentially lead to colonizing effects on indigenous peoples as consumers of foreign messages. However, it is also arguable that digital media can provide opportunities for self-determination if indigenous peoples produce and establish their own digital media [12][13].

Through my attempts to establish examples of *Indigenous Tecno-Sovereignty*, is not my intention to modify/augment traditional indigenous ceremonies. Nor is it my intention to devise a platform to study the effects of electronic media on indigenous ceremonial experiences. To do so may be considered disrespectful by the communities my work offers to serve. Many indigenous cultural practices have existed for thousands of years, and as a practice, *Indigenous Tecno-Sovereignty* neither has the authority nor an accepted community of practice to electronically augment

traditional sacred ceremonies. The work in this presentation is an artistic expression informed by indigenous practices and metaphors that complicate and extend discourse on the cultural implications of electronic technology through the creation of “re-imagined” or “newly-emergent” ceremonies. The *Digital Ayoyote Rattle* represents one example of an early effort to develop and think about questions such as: What do we, as indigenous peoples want to get out of electronic technology? Can electronic technology be meaningful within the framework of our epistemologies? What might indigenous electronic innovations look like? These questions are similar to the indigenous scholar Richard Scott Lyons asking the singular question: “*What do American Indians Want From Writing* [7]?”

As a scholar and member of my community, I apply indigenous knowledge systems to design digital media interactions that demonstrate *Indigenous Tecno-Sovereignty* within the domain of formal/informal learning. By doing this, I am working to design education technologies that facilitate culturally situated learning experiences that attempt to address the educational needs and goals of indigenous populations [8][9][10]. In addition to this, my designs also serve to promote critical discourse within community to determine best practices of *Indigenous Tecno-Sovereignty* [11].

3. DESIGN/ANALYSIS OF PROTOTYPES

The design of the Mediated XicanIndio Resolana was initially achieved through the indigenous appropriation of an interactive system called SMALLab (Situating Multimedia Arts Learning Lab) (Figure 2.). Early decisions to use SMALLab were due to its authoring tools for proto-typing and its interactive capabilities. SMALLab provides an environment that affords interaction by multiple co-located participants within a (15’W x 15’W x 12’H) mediated space. It also allows the physical body to function as an expressive interface. Within SMALLab, participants use motion-capture trackable objects to interact in real time with each other and with dynamic visual, textual, physical, and sonic media through full-body movements and gestures. Through this it establishes a porous relationship between physical movement and digital media [1]. These properties make SMALLab an interesting system for indigenous peoples to think about enactive digital ceremonial practices. Although SMALLab’s comprehensive mixed-reality capabilities are ideal for the enactment of ceremonial interactions, it is difficult to use it for the dissemination of indigenous media within indigenous communities due to its complexity, cost, and portability.



Figure 2: Community of participants engaged in the first round of talks while gathered at our Mediated XicanIndio Resolana in SMALLab.

In this section I illustrate 4 paper prototype designs and evaluate their capabilities to facilitate a mobile low-cost Mediated *XicanIndio Resolana*. The following is a 6 point summary of the basic requirements that these designs must meet and why:

1. Must be portable. This is so that the technology can support ways of being associated with sharing common tools throughout a community.
2. Must be low-cost. This is so that communities of lower socio-economic status can obtain access to a *Mediated XicanIndio Resolana*. The prototype using *SMALLab* is inaccessible to Chicano and Native American communities due to cost and portability.
3. The design must meet interaction standards when benchmarked against *SMALLab*. This is to avoid contributing to the digital divide [11].
4. The technology must be able to support embodied neuro-muscular interactions necessary to perform a *Mediated XicanIndio Resolana*. This is because a *Mediated XicanIndio Resolana* is an interaction requiring movement and gestures that are translated into forms of computation.
5. The design must provide multi-modal feedback in order to successfully sustain a *Mediated XicanIndio Resolana*.
6. Indigenous peoples throughout history demonstrate the ability to resist assimilation through appropriate and modified uses of foreign technology [14]. One example of this kind of practice is Chicano rasquache [15][16]. Through this tradition, Chicano communities have demonstrated their ability to be creative and resourceful with foreign artifacts while keeping within the frameworks of their cultural systems. Chicanos have innovated designs for community and the home through appropriation, adaptive reuse, adaptations, recycling, and hacking. They have employed these methods through a process of creative improvisation in order to transform foreign artifacts into indigenous implements of symbolic, aesthetic, spiritual, functional, and monetary value. This kind of practice by indigenous peoples continues to inspire culturally sensible innovation, and can extend indigenous media frameworks for design. For the purposes of survivance in a digital age, it is imperative that indigenous peoples continue to apply these traditions to digital media practices. The design of the Digital Ayoyote Rattle must demonstrate the exercise of Chicano rasquache traditions.

In addition to the written conceptual designs provided in this section, I present a series of tables that parse discrete aspects of each design for evaluation. In my analysis, I chart levels of embodiment for each design based upon the immersive properties of each interaction. This is to determine which interaction most effectively enables a user to experience a sense of place and presence during a *Mediated XicanIndio Resolana*. In addition to this, I analyze the cost, portability, and setup of each system as criterion to determine the most appropriate prototype to construct. The following analysis uses the *Mediated XicanIndio Resolana* that was prototyped in SMALLab as a benchmark design [1][17]. This prototype represents an ideal system that supports a strong user sense of place and presence. This is primarily based upon the benefits of *SMALLab*’s immersive visual and interactive architecture. It is argued that a large visual display (*like what is used in SMALLab*) has benefits associated to spatial referencing that leads to reasoning associated to common shared space, shared topology, and movement [18][19].

To address the modality of sound and its immersive properties, Ayoyote shells are used in all of the paper prototypes

Figure 3 These tables demonstrate an \$8,500.00 USD jump in cost to interact with discrete elements of a projection as it is done using SMALLab. Although an orator could not use the Digital Ayoyote Rattle to directly point to a discrete image within a projection, she could still interact with an avatar within the projection using gestures.

Visual Immersion (Rep. of Ceremonial ground)	Mediated XicanIndio Resolana (SMALLab)	Bluetooth Jar w/OP Design 1	DroidX/Laser Jar Design 2	BeagleB./Laser Jar Design 3	iPad Design Design 4
Media demarcates & represents entire ceremonial ground	X	X			
Media demarcates & represents part of ceremonial ground			X	X	
Media does not demarcate or represent ceremonial ground					X
Visual Immersion (Rep. of Community)	Mediated XicanIndio Resolana (SMALLab)	Bluetooth Jar w/OP Design 1	DroidX/ Laser Jar Design 2	BeagleB/ Laser Jar Design 3	iPad Design Design 4
Media represents group & individuals with display of multiple images	X	X			
Media only represents 1 individual at a time (single image)			X	X	
Media only represents 1 individual at a time w/ decreased legibility					X
Visual Display as Human Computer Interface	Mediated XicanIndio Resolana (SMALLab)	Bluetooth Jar w/OP Design 1	DroidX/ Laser Jar Design 2	BeagleB/ Laser Jar Design 3	iPad Design Design 4
Interact with and animate entire and interact with and animate discrete pictorial elements of projection by pointing	X	X			
Interact with and animate entire projection			X	X	
No projection					X

Figure 4 This table demonstrates the neuro-muscular features that each prototype supports.

Neuro-muscular engagement	Mediated XicanIndio Resolana (SMALLab)	Bluetooth Jar w/OP Design 1	DroidX/Laser Jar Design 2	BeagleB./Laser Jar Design 3	iPad Design Design 4
Locomotion	X	X	X	X	
Semiotic Gestures as Meta-system commands	X	X	X	X	X
Metaphoric Gestures as Meta-system commands	X	X	X	X	X
Pointing	X	X	X	X	X
Passing interface (turn taking)	X	X	X	X	X

Figure 5. The table below demonstrates that prototypes 2 - 4 require the least amount of setup.

Portability and Setup	Mediated XicanIndio Resolana (SMALLab)	Bluetooth Jar w/OP Design 1	DroidX/Laser Jar Design 2	BeagleB./Laser Jar Design 3	iPad Design Design 4
Fits in a backpack		X	X	X	X
Setup time under 30 minutes by a single person		X	X	X	X
Installation of multiple devices required	X	X			
Self-contained hardware device			X	X	X

4. DESIGN CONCLUSIONS

My assessment of the 4 paper designs is that the *Bluetooth Jar with Overhead Projection*, and *BeagleBoard/Laser Jar* best meet the design criteria necessary to suitably port the *Mediated XicanIndio Resolana* interaction to a *Digital Ayoyote Rattle*. Both of these prototypes show the ability to support the highest levels of embodiment when compared to the *Mediated XicanIndio*

Resolana (SMALLab) as a design benchmark. In the case of the *DroidX/Laser Jar*, the interaction reasonably met all design criteria, but was not a suitable design due to cost. My conclusion is that the same interaction could be constructed at a lower cost using open source hardware and software development tools demonstrated in design 3. The added value of the *BeagleBoard/Laser Jar* is its creative implementation of Chicano rasquache frameworks for design. This expression of the

floor-projection images that are shared throughout the course of a Mediated XicanIndio Resolana.

6. INTERACTION DESCRIPTION

Prior to performing a *Mediated XicanIndio Resolana*, participants are required to collect images and place them in a designated image folder on the *BeagleBoard xM*. This allows participants to access or contribute media content for their resolana. To do this, the elder leader provides participants with a special topic, and with this information participants are expected to go out into their communities with digital cameras and collect images that are responsive to the topic at hand. Images provided by an individual can consist of content that she may find relevant to her reaction to the topic (these images can be abstract or literal).

The current version of the *Digital Ayoyote Rattle* supports two rounds of talks. The first round is designed to act as a prerequisite to the second round. This is so that interaction protocols can evolve throughout the course of the resolana. In a ritual context, this creates a rite of passage that participants must go through to prepare for self-directed and respectful conversational dialogue. During the first round of talks, indigenous ceremonial protocols determine methods for taking turns, speaking, and expectations for listening. In the case of the first round of talks, participants follow cultural protocols to gather around the outside of a circle while facing inward toward each other. This arrangement physically situates participants so they have equal access to a shared projected floor display that emanates from the *Digital Ayoyote Rattle* itself (Figure 8). The circular arrangement also creates a shared space where participants face towards each other.

To conduct a discussion, all participants are provided with an opportunity to speak by turn taking. This is facilitated as participants pass the rattle to each other. This method of turn taking will start with a leader and then be passed from person-to-person in a clockwise direction until the rattle returns back to the leader. The leader both opens and closes the circle with guiding oratory that helps to facilitate the ceremony and model oratory. During a *Mediated XicanIndio Resolana*, interaction protocols require that those who do not possess the rattle must practice respectful and active listening and reflection [1]. To begin a *Mediated XicanIndio Resolana*, the discussion leader introduces the first round of talks as well as a teaching image that helps participants learn local cultural expectations for speaking and listening during the interaction. The first round of talks allows participants to introduce themselves by sharing digitized hand drawn symbols that represent themselves in various ways. In this round orators take turns explaining the symbols, and share how the symbols signify representations of themselves. The purpose of this round of talks is to facilitate introductions, to build trust, and to learn how to speak and listen. During the second round of talks, participants continue to share their symbols with each other, but in addition to this, they also share photographs along with oratories focused on the special topic that has been assigned. The function of the second round of talks is to enable the group to generate knowledge, create meaning, and address issues associated to a specific topic. This allows people to share perspectives, learn from each other's viewpoints, and form group cohesion [1].

To operate the *Digital Ayoyote Rattle*, an orator will receive the rattle and begin to shake it while gesturing in a circular fashion. This is done to respectfully recognize all of the participants. Once the leader has done this, he or she will tilt the rattle as if pouring or placing the image onto the floor (Figure 19).

Once these gestures have been made, the orator will then angle the bottom of the jar at approximately -45 degrees from the bottom of the jar to the surface of the floor. Upon doing this a laser beam projects the orator's image onto the floor for everyone to see. The image then begins to rotate so that everyone in the circle can see it upright as the orator speaks. As this is happening, the orator has the ability to mute or show the image at will. If the speaker would like to show the image, he or she will simply shine the rattle like a flashlight, as if to shine a beam of light onto the center point of the circle demarcated by the participants. If the speaker wishes to mute the image, he or she just has to relax and point the bottom of the rattle so that it is parallel to the floor.



Figure 8: Left: Shaking the rattle while making a circular gesture. Center: Tilting rattle to place image. Right: Shining the laser beam projection onto the projection surface.

7. STAKEHOLDER INTERVIEW AND USER CONTEXT

Following the construction of the *Digital Ayoyote Rattle*, I conducted a stakeholder interview with a Chicano Elder and

English Language Development teacher at a local high school. This teacher has been using the *Mediated XicanIndio Resolana* as part of his high school English as a Second Language course curriculum for over the past two academic years. During this time he has been successful with the interaction while working in *SMALLab*. He cites that the outcomes of this work have led to a focused practice of English conversational skills, student attention and responsiveness to instruction, and the establishment of social inclusiveness in his classroom. To achieve this in the classroom, the exercise of *Mediated XicanIndio Resolana* (a) enables a discussion group to recognize their group identity, (b) helps individuals understand and appreciate the complexities of their own identities in the context of diversity, (c) allows students the opportunity to consider how their perspectives feed back into the group, and (d) provides teachers with a way to strengthen the sense of classroom community through the discussion of topics that are relevant to the student's lived experiences. All of this is accomplished through the idea that the rhetorical practice of digital literacy can empower students to generate and control meaning [20].

The following paragraphs provide a brief description of how a bi-weekly practice of a *Mediated XicanIndio Resolana* was established in the English Language Development classroom.

This place and process was used to provide students with peer-to-peer support where they could comfortably practice speaking and comprehending English. To motivate learning, students were provided with the opportunity to speak English by encouraging them to use the language to share personal stories and perspectives associated to topics that were relevant to their lives (topics included immigration, future aspirations, folk tales, cultural identity, politics, and experiences in school). Parallel to this, students were challenged to think about image construction, decoding, and comprehension as a form of communication. This provided students with the ability to use images in literal, abstract, and metaphorical ways as a part of their storytelling. Students were taught protocols for respect and accountability towards each other, as well as how and why protocols help to facilitate trust.

In the classroom, students initially prepared to participate in *Mediated XicanIndio Resolana(s)* through a series of workshops. These workshops taught students computer skills associated to media creation, how to enact interaction protocols, and provided students with collaborative challenges (such as working together to create graphic designs that are used as background images that become part of the interaction). Once students established the ability to collaborate, they were provided with the opportunity to articulate their identities to each other by using digitized hand drawings of symbols that represented aspects of who they were. This was done while using the digital interaction. This exercise enabled students to get to know each other in meaningful ways, while also enabling a community context to emerge.

Once this process was accomplished *Mediated XicanIndio Resolana(s)* were administered bi-weekly. Each *Mediated XicanIndio Resolana* was composed of three rounds of talks by the students, and required about 8 hours of classroom time to accomplish. For a detailed description of the interaction please refer to the article titled *Culturally Sensible Digital Place-Making: Design of the Mediated XicanIndio Resolana* [1].

Throughout the academic year students were able establish a meaningful and well-distributed social network within their classroom that enabled them to support each other's learning. This emerged over time through a series of *resolanas* expressed through student experiences that were reflective. These

experiences emerged over time through their expressions of patience, critical thinking, and thoughtfulness. This was also made possible by an installation of *SMALLab* at this particular school. After having observed feedback on the importance of the interaction in this and other community contexts, I began to consider ways to scale this work so that it is more accessible to our local indigenous communities.

Once the prototype of the *Digital Ayoyote Rattle* was completed, I chose to conduct an informal demonstration and interview. I chose to interview an English Language Development Teacher because of his extensive experience in facilitating a *Mediated XicanIndio Resolana* in the context of formal schooling. The purpose of doing this was to receive some early reactions to my design. My intent is to use this information in future work to improve the design of the *Digital Ayoyote Rattle* before using it to develop a community of practice outside of *SMALLab*. Once a community of practice is established I can then set out to determine if the device is capable of sustaining the level of interaction and sense of place that participants experience when performing a *Mediated XicanIndio Resolana* using *SMALLab*. The following information is an informal critique, and represents the early stages of design. What I am presenting here is a precursor to user studies that focus on the *Digital Ayoyote Rattle's* ability to sustain a meaningful experience. The purpose of this information is to focus on the user-friendliness of the technology from the perspective of a leader who would administer the technology in community settings. Future work and user studies will compare the effectiveness of the *Digital Ayoyote Rattle* to the effectiveness of the prototype using *SMALLab*. These studies will also try to determine if participants view the use of the *Digital Ayoyote Rattle* as the focus of a *Mediated XicanIndio Resolana*, or if participants perceive it as a tool that helps mediate an experience of oratory and reflection. The latter is the design end goal.

During my meeting with the teacher, I demonstrated the *Digital Ayoyote Rattle* that followed with an informal conversation where he provided user feedback. This was from his perspective as a teacher who might use it in his classroom (*Figure 9*). Throughout the demonstration, the teacher was encouraged to share feedback, and was asked to share his thoughts about whether he would find the *Digital Ayoyote Rattle* useful for his classroom. During the demonstration, the rattle performed accordingly to how it was designed to function. The following are bullet points highlighting the teacher's feedback:



Figure 9: These photographs illustrate the system components presented at the demonstration/interview.

- Teacher appreciated the possible ease of use in preparing and loading images onto the device (*Figure 10*). To do this the user must connect the rattle to a mouse, keyboard, and monitor. The teacher's response was that this process could

be made much simpler if I shifted the system from that of a standalone computer to a peripheral that a user could connect to a computer in order to sync up the images (similar to a USB thumb drive).



Figure 10: Digital Ayoyote Rattle connected to keyboard, mouse and monitor as a standalone computer.

- Teacher commented that the image projection is smaller than what he is used to working with in *SMALLab*, but states that he thinks it could work.
- He liked the idea of being able to facilitate the interaction within his own classroom, as opposed to going to another location at the school where *SMALLab* is installed.
- He observed the need to make his classroom a little bit darker in order for the projection to be more legible, but concluded that the image was fairly legible given the ambient light that was present throughout the demonstration.
- Teacher appreciated how the interaction appeared to enable him to spotlight the image onto the center of the circle by tilting the rattle at an angle toward the center of the circle. He comments that it feels similar to shining a beam of light from a flashlight.
- Teacher commented that the rasquache nature of the design caused him to feel too aware of the rattle in terms of accidentally damaging the loose wires and exposed electronic components.
- He suggested that I relocate USB cable on the rattle so that it does not protrude toward the user's torso. This would make it easier to relax and hold the object closer to the torso.
- Teacher cited the value of the second round of talks designed for the *Mediated XicanIndio Resolana* (*SMALLab*) (This has not yet been ported to the Digital Ayoyote Rattle). He explained that this aspect of the *Mediated XicanIndio Resolana* is vital because it allowed participants to use each other's media. He cited that this round of talks helps reinforce the need for participants to listen. He also cited that this is an important step that allows participants to respond to each other in a more direct way. He requested that this aspect of the interaction be ported over to the *Digital Ayoyote Rattle*.
- The teacher commented that the portability is exciting, and he appreciated its potential to be mobile within communities.
- He comments that he is looking forward to trying the *Digital Ayoyote Rattle* in his classroom.
- Teacher commented that shaking the rattle while gesturing in a circular fashion works well as a metaphor and a cultural gesture, but that tilting the rattle is an interaction gesture that functions most as a utilitarian operation. He did not believe that this gesture contained local indigenous semiotic value.

- The primary concern highlighted by teacher is the issue of handling and passing the rattle. Passing the rattle was the greatest concern raised by the teacher. He mentions this because passing and receiving the rattle is a sacred moment that requires presence and strengthens relationships. He cited that this focus could be broken if the passer and receiver are too busy trying to figure out how to pass the rattle. He cited that the current configuration could cause anxiety, and that the exchange could lead to dropping and breaking the device. He recommended that I solve this problem by mounting larger handles to enable the orator greater control and comfortable handling of the object. He also suggested that I design a handle configuration that enables the rattle to be easily handed off from one person to another. His conclusion was that the current design does not allow for this.

8. CONCLUSION

After reviewing the teacher's critique of the *Digital Ayoyote Rattle* it becomes clear that the design has potential, but that there are tensions that exist between the cultural (rasquache) nature of the rattle construction, and the teacher's concern with how aspects of this could adversely affect the sense of place and uninterrupted processes attributed to a *Mediated XicanIndio Resolana* enacted in *SMALLab*. The teacher appreciated the rasquache approach to the rattle's design, and believed that it could be inspiring to students, but also noted that this approach needed to be reexamined in order to ensure that vital aspects of functionality are not compromised. Through this work, I have come to the conclusion that the use of rasquache as an aesthetic and innovation framework has led to an interesting and unique design solution. I have concluded that this framework can continue to inform the design process, but that I must apply it to the functionality of the device. The outcomes must lead to improvements that respond to the teacher's feedback without eliminating the cultural aesthetic purposes of the design. The goal is to create a design that enables participants to focus on meaningful shared experiences without having to be conscious of the tool as an agent of disruption or focus.

Now that a prototype with basic functionality has been constructed, the next design iteration will focus on aspects of functionality that are responsive to the teacher's feedback. Achieving this will be necessary before conducting user studies in the classroom.

9. FUTURE WORK

From a human computer interaction (HCI) perspective, future work includes addressing the issues cited by the teacher associated to handling and passing the rattle. In addition to this, a third round of talks needs to be developed in order to address the teacher's concern that the *Mediated XicanIndio Resolana* (*SMALLab*) second round of talks be ported over to the rattle [1]. Once these goals and issues have been addressed, I will begin to develop a more robust software application using Java or Python. This application will include image stabilization and avatar interaction features that will be added to create a stronger immersive experience. In addition to this future work, the teacher encouraged me to consider designing the rattle as a peripheral that connects to a computer, as opposed to its current operation as a standalone computer. By doing this, I could set the device up as a server that runs an application allowing images to be easily uploaded onto the device via Ethernet connection or perhaps I could also configure the rattle to behave as a USB storage device.

In addition to making design modifications I will begin pilot testing to examine the system's robustness, which is its ability to sustain the interaction for 1.5 hours without breaking down or exhibiting technical difficulties. I will also make observations regarding the handling of the device, and conduct informal informational interviews with participants to receive their critiques of the system, as well as to gain insights about their overall experience while using the *Digital Ayoyote Rattle*.

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