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Promoting Access in a Mexican-American Museum during the Pandemic: Online Community Events and Robots

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Abstract

During COVID-19, many museums closed their physical structures and transitioned their exhibits to online platforms for public digital access. As museums reopen, there remains a need for some visitors to attend exhibits and cultural events with minimal risk. This article examines an innovative hybrid platform for museum digital access—personal telerobots to co-explore museums alongside community members. The way it works is as follows: a community member remains at home and remotely logs into the museum robot. A friend/family member is physically at the museum, and once the robot is embodied by the remote user, they can walk around the museum together, talk with each other, interact with artifacts, and experience the exhibits together. Ultimately, the robot user and the visitor can both be immersed in the venue, separate yet together at the same time. This article examines the use of online community events and personal robots in a Mexican-American history, art, and culture museum for cultural exhibits and how these technologies may facilitate the way community members learn, interact, and explore museum artifacts. It also explores the need for best practices on the use of online communities and personal robot technology in museums. This work contributes observations, reflections, and curatorial considerations on both forms of digital media for inclusive museum practices.

Keywords

Museums; Robots; Inclusion; Chicano Latino; Mexican American; History; Culture

Introduction

In recent times, museums have focused on social inclusion and cultural representation (Coleman 2016). During COVID-19, museums were faced with social inclusion challenges

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Informed Consent

The authors have obtained informed consent from all participants.

Conflict of Interest

The authors declare that there is no conflict of interest.

as physical structures were closed to the public due to a high risk of infection from COVID-19. How could museums continue their roles as inclusive cultural and historical centers for their communities when community members could not physically interact? Even before the global pandemic, ever-changing needs were considered one of the great “challenges of the 21st century for museums” (Semmel 2009, 30). The COVID-19 pandemic raised issues of both inclusion and attendance as health and safety concerns threatened important aspects of both cultural and social life. Traditional, in-person attendance shifted to virtual attendance as museums experienced a shift from predominately in-person attendance to online attendance of programs, special events, and virtual tours of museum spaces and artifacts. Despite the multi-pronged challenges of the pandemic, the virtual approach offered access to the museum for many community members—including members who faced barriers to attendance even before the mass-disabling event of COVID-19 (e.g., 9–5 work schedules, physical access due to health issues/disabilities, transportation issues). The additional challenges of the pandemic became opportunities to reimagine access and inclusion through novel digital means. In this article, we explore the experiences of a Mexican-American history, art, and culture museum as it navigated COVID-19 with online programs and adapted to explore the use of interactive personal robots in post-COVID-19 museum experiences.

Background

Digital Inclusion and Cultural Context

As the ways in which human beings interact with one another become increasingly digital, the museum focused on two forms of digital media for inclusion: 100 percent online community events and the pilot testing of social teleoperated robots (telerobots). Digital inclusion is not a new phenomenon but rather an expanding one (Zollinger 2021). Social telerobots have been used for children’s social and academic inclusion for a decade before COVID-19 (Newhart 2014; Fels et al. 2001). The exponential growth of digital means of engaging in the world, including museums, represents a quickening reality for those who are restricted to their homes due to medical conditions and/or disabilities. The museum as a positive force of cultural presentation, celebration, and representation of Mexican-American cultural identity in the state of California was especially important during COVID-19. However, without access, the positive offerings of a museum are not enough (McMillen and Alter 2017). In fact, if museums are not accessible to community members, they are at risk of re-creating the exclusion that they seek to both buffer and confront (Valverde Martínez 2021). The context of California as home to the largest Mexican-American population in the United States (US Census 2022) makes the Mexican-American museum a culturally and politically complex contributor to California’s present and future. Even though the majority of the population of California is Latin/Hispanic American, many academic and industrial power structures have often marginalized the Mexican-American population (Ahumada-Newhart, Hernandez, and Badillo-Urquiola 2021). Thus, the museum operates in a state context that marginalizes the majority of the state’s population. As a cultural institution, the museum seeks ways to be inclusive and accessible despite issues that are physical (open hours), conceptual (virtual vs. in-person attendance), and political (state/national context).

Museums and Importance of Inclusion

Museums are viewed as having strong influence and power to change, uphold, and affirm society (Coleman 2016). Society is made up of many groups and identities—the individuals who make up these groups, in turn, are each made up of multiple, intersectional identities according to group affiliation (Coleman 2016). Social inclusion is at the heart of this power because social inclusion of all groups limits the marginalization of certain groups in societal narratives. An inclusive museum allows for cultural inclusion through representation, participation, and access of/for groups that are typically excluded. While there are opposing views on the benefits of museums as agents of social inclusion (e.g., the cultural policy-oriented conception of social inclusion, which implies a version of repairing the “flawed consumer” (Bauman 2004; Durrer and Miles 2009), and the way in which such policy is played out on the ground (Mason 2004; Galla 2016), for the purposes of this article we view social inclusion as integral to the purpose of the Mexican-American history, art, and culture museum where our work is based.

COVID-19

During COVID-19, the world shifted to online platforms and interactions due to the risks associated with a global pandemic. Our museum community transitioned to a completely online platform as a way to maintain social inclusion, cultural identity, and a sense of community. We discovered that our inclusive online community had strong support and that feedback from participants was overall positive. COVID-19 raised our awareness of the at-home condition many people experienced in pre-pandemic times due to medical conditions, disabilities, and transportation challenges. Research shows that social isolation increases the risk of loneliness, depression, and negative physical and cognitive health outcomes (Bhatti and ul Haq 2017; Nicholson 2012; Aoki et al. 2018; Cacioppo and Hawkley 2003). As an inclusive museum, we explored ways to increase access to our physical museum, artifacts, and social events for all members of our community once we resumed in-person activities. This inclusion would serve to both preserve culture and promote community equitably.

The Latin/Hispanic American community was disproportionately affected by COVID-19 in California, making up 65 to 70 percent of all COVID-19 fatalities (i.e., >15,000 fatalities) in the 18 to 64-year age group (Figure 1) (California Department of Public Health 2023). This age group is significant in that it is the working age group—these losses affect the financial and social pillars of family units as income earners and caregivers (i.e., parents, parents’ siblings, older children, younger grandparents). The devastating and inequitable effects of the pandemic will have a lasting impact on our community for generations. Understanding the tragic loss of lives and the impact of COVID-19 on our community, we saw the need for our museum to provide social support, belonging, and cultural history for all generations. To address the devastating impacts of this long-term natural disaster, we began to explore ways that the museum could provide virtual inclusion for 100 percent online and hybrid museum experiences when the museum reopened (i.e., some people attend in-person, others via robot).

Societal Impacts of COVID-19 on Mexican Americans—The ways in which society stratifies by race/ethnicity and socioeconomic classes were intensified during COVID-19

(Bambra et al. 2020). Economic and racial barriers that existed before the pandemic laid bare existing inequalities and, in many ways, intensified them (Gauthier et al. 2021). Being racially segregated through the mechanism of class and work caused greater exposure and, ultimately, sickness and fatalities due to COVID-19. This was partially due to a greater proportion of office jobs being performed virtually and a greater number of service jobs being performed in-person. Many healthcare workers performing public-facing roles with greater COVID-19 risk were considered “frontline workers,” but society still held a bias against marginalized groups. Publicly, much attention was paid to physicians and nurses as frontline workers, but less attention and appreciation was displayed toward other hospital frontline workers considered “working class” (e.g., cleaning services, food service, maintenance, security, etc.) (Williams and Cooper 2020). In California, Latino workers disproportionately occupy low-paid service and frontline jobs, occupying more than 50 percent of the frontline jobs with average earnings below \$30,000 a year (Alamo 2020).

During COVID-19, inequalities were also exacerbated through trends in federal financial support programs that demonstrated the compounding effects of inequality during COVID-19. Inequalities in financial support were seen in the federal systems designed to aid individuals and businesses, such as COVID-19 stimulus checks and the Paycheck Protection Program (PPP). Stimulus checks totaled \$804 billion in funds that went to individuals, and the PPP totaled \$1 trillion (Lobosco and Luhby 2021). However, many business owners did not need assistance to operate, let alone survive, and only 23 to 34 percent of the trillion-dollar PPP went directly to workers (Autor et al. 2022). Frontline and service workers in California are disproportionally members of the Latino community. These working-class community members were both praised for being essential workers while simultaneously treated as expendable, as evidenced by the glaring lack of recognition and funding Latina/os received during the pandemic. The intersectionality between Latin/Hispanic community membership and frontline/service-work membership left many Latin/Hispanic Americans in California doubly exposed to the pandemic risk due to marginalization (Bambra et al. 2020) and exclusion from public discussion. Media coverage, governmental support, and academic/healthcare literature all but failed to include equitable accountings of the societal and healthcare impacts of COVID-19 on California’s Mexican American and Latina/o populations—from the largest number of deaths in the working ages to the long-term societal impact of these losses.

Virtual Inclusion

In this article, virtual inclusion is operationalized as a social practice that allows a community member to attend museum events through an interactive technology platform in such a way that the member can engage with others, view artifacts, and experience relatedness as if they were physically present. Virtual inclusion is possible through the concept of telepresence, which refers to the user’s compelling sense of being in a mediated space and not where the physical body is located (Kim and Biocca 1997). Our goal with online events and programming was to transport the community to virtual museum events where they could engage with the presenters, learn from the content, and interact with other members in such a way that they felt a sense of belonging, learning, and community.

Museums and Disabilities

Museums are under legal strictures that require physical access to people with disabilities (Salmen 1998). However, the positionality of museums to accessibility practices can be rooted not only in legality but also in social responsibility (Starr 2016). The shift from legal compliance to ethical obligation may lead to inclusivity that is rooted in community care rather than seeking to avoid legal ramifications (Starr 2016). While discussions about social responsibility driving access should—and often do—highlight socioeconomic and racial and ethnic sensitivity, social responsibility can also drive the inclusion of those in the disability community. Although The Americans with Disabilities Act (ADA) (Civil Rights Division US Department of Justice 1990) set forth requirements for museums as physical environments, technology is emerging as a further way to consider who can access the museum and how. The difference between meeting legal obligations and creating a truly welcoming and accessible experience for all types of visitors can be measured not so much by legal compliance as by visitor experience (Starr 2016).

We found that our online programs provided access not only for our former in-person members but also for members in our community with medical conditions and disabilities. Our community is both a large demographic presence at 40 percent of the state's population (US Census 2022) and a marginalized majority in California due to structural inequalities (Menchaca 1995). The population of people with disabilities in the US are similarly both large (1 out of 4 people in the US) (CDC, n.d.) and marginalized via structures both systemic and literal, such as physical accessibility and non-inclusive public space design (Hanson 2004). Because both groups are non-monolithic, there is significant overlap and intersectionality (Collins et al. 2009). There are many people who belong to both Latina/o and disability communities who thus face issues of access and inclusion to cultural spaces (such as museums) in both representation and access (Gurulé 2020).

Museums and Social Media

Prior research has found Facebook communication to be inherently interactional (Irwin et al. 2012; Kurtz 2013). Additionally, research on the museum's use of Facebook has found that museums and audiences co-construct meaning (the communicative dimension), participation (social dimension), and knowledge/action (discursive dimension) (Gronemann, Kristiansen, and Drotner 2015). For online events, we wanted to move beyond using digital media as a “message board” to establish and maintain social connectedness with our community through personal modes of address, participant input on content, and joint knowledge formation.

Online Community Events

In March 2020, the museum was faced with the challenge of closing its physical doors due to COVID-19. There was a rapid transition to online community engagement via real-time online presentations, conversations, demonstrations, and performances via Zoom video conferencing platform and live streaming on Facebook. As Latin/Hispanic American communities tend to be close-knit with concepts of family and home extending beyond traditional family units (Clutter and Zubieta 2009), the museum titled the events “En Casa

con LA Plaza” [At Home with LA Plaza]. The museum host operated the online sessions from home, and guests logged in to the Zoom meeting. Visitors were able to log in remotely, view the sessions, and interact via a moderated chat thread on Zoom or via the comments feature on Facebook. The sessions were recorded, and videos were made available online on the YouTube platform and archived on the museum’s website.

Topics covered in online sessions included Mexican and Mexican-American cooking; local history, such as the Chicano Movement; the museum’s exhibitions; the impact of COVID-19 on cultural organizations and schools; and important holidays. The most popular topics were how to make Papel Picado (88,000+ views) (Figure 2), conversations with notable Latina/o entertainers (Figure 3), and presentations on Latina/o cultural traditions and local Mexican-American history (Figures 4 and 5).

Thank you so much! I really appreciate the thoroughness of the instruction!!
Looking forward to making our first papel picado for mi hijo por Día de Los Muertos!! (How to Make Papel Picado with Mario A. Hernandez)

How fabulous this showcase of the music of Latin America, which has given us an opportunity to see Linda and Louie. I am a lifelong fan and to be able to see them here in Australia, which is where I saw Linda in the late 70s. Thank you all, and my blessings to you and your fans for a healthy and happy new year 2021. Love you, Linda. (Dan Guerrero Happy Hour w/ Louie Perez and Linda Ronstadt)

A great interview. So enjoyable. You always hear about how talented Lucy was, so it was refreshing to hear good things about Desi. I liked that Desi was recognized for the good things that he brought to the TV industry. (Dan Guerrero Happy Hour w/ Lucie Arnaz)

Felicidades, increíble oportunidad para que esa comunidad afro-latina que es desapercibida ahora tenga la oportunidad de expresar su voz [When Community Creates Exhibitions: The Making of “afroLatinidad: mi casa, my city”].

Curatorial Considerations Guiding Online Events

For our online community engagement during COVID-19, the digital structures of these activities were paired with curatorial considerations (i.e., factors considered in the selection, organization, and presentation of online sessions). For example, most events were scheduled after 5 p.m. on weekdays to allow people working during the day to access museum talks and other community-supporting events after typical work hours. This represents a consideration of the community members who might otherwise be precluded from museum attendance altogether. The cost incurred by the attendees for the offerings was also considered. The selection of platforms chosen by the museum was based on not only quality and functionality but also affordability, and platforms such as Facebook, YouTube, and Zoom were selected to minimize financial barriers to participation by community members. Moreover, such platforms were selected because they have user-friendly and familiar interfaces that are accessible via smartphones and tablets without the need for home Wi-Fi service. Museum staff and community members participated in the selection of content streamed across the platforms. Final decisions on content resided with the museum

staff to align with events that reflected the museum's mission and culture. The cost to the museum to support events was considered and was ultimately considered neutral cost because the museum employed existing personnel for the events and paid stipends to guest lecturers, participants, and performers similar to in-person activities.

Best Practices

Honoring the museum's mission to honor the past, inspire the future, and recognize the enduring cultural influence of Mexicans, Mexican Americans, and Latin/Hispanic Americans through transformative exhibitions, programming, and educational experiences is a central focus of all online events. As our future includes digital media and robots, some best practices include the need to adapt social protocols so that visitors have realistic expectations. As technology amplifies human efforts, visitors should be respectful of other visitors in online spaces similar to how they would behave if everyone were there in person. Comments, posts, behaviors, and so on should remain respectful of other individuals.

Lessons Learned: Shared History and Social Identity

The online sessions and their recordings have over 415,000 views on Zoom, Facebook, YouTube, Instagram, and counting. Feedback on these sessions included comments on the virtual connectivity, interactivity, and regularly scheduled aspects of community building. In addition to local/international online views, the community also left comments on family, history, culture, and diversity. Attendance, online comments, and general feedback affirmed the contributions of these events to the social identities that our community members valued pre-pandemic. As our community lived through a shared history of natural disaster and tragic disproportionate loss, the museum provided a digital platform to provide continued support for the community's collective experience, experiential learning (e.g., papel picado, cooking classes), online cultural representation, and socialization.

Virtual Inclusion via Telerobots

During the second year of the pandemic, while the museum was still closed, we began to explore the use of telerobots (Figure 6) as a means of virtual inclusion that could be utilized for people who remained at home due to the risk of infection, medical conditions, or disabilities. A telerobot is a social robot that is teleoperated by a remote person.

telerobots

Telerobots are an innovative technology that can improve physical access to public spaces. An embodied robot can provide levels of presence that vary from simply being collocated to cooperating, being richly engaged in the organic environment, and collaborating with other in-person attendees (Ahumada-Newhart and Eccles 2020; Matsumoto et al. 2022; Riek and Watson 2010). Telerobots are mobile robot units that can be moved and controlled by a remote person (e.g., someone at home) in a local environment (e.g., museums). Telerobots provide real-time audio and video exchange, with the person's face typically shown on the robot's "head" via face screen. Figure 6 displays the Double 3 being operated by a remote user. The remote user is in control of the movement and behavior of the robot in the local

environment. This control provides the remote user with a degree of embodiment in the robot and the opportunity to be present and engage in the local environment.

Telerobots that assist people in everyday public life have been a long-standing area of research (Riek 2007; Newhart, Warschauer, and Sender 2016; Matsumoto et al. 2023). This article describes observations, reflections, and curatorial considerations during the test pilot phase of deploying a commercially available telerobot (i.e., Double Robot) for future visitor use in a museum. This article focuses on the robot's primary capabilities to access and navigate museum spaces during test pilot phases. For our work, we used the Double 2 and Double 3 robots. Both robot models have real-time audio/video, remote mobility, adjustable height control, and semi-autonomous navigation capabilities. We found that the telerobot enabled remote users to log in to the robot and control the robot's movement through museum exhibits. Additionally, the virtual test pilots were able to speak and interact with others as well as navigate the physical environment from their home environments. The primary challenges that were encountered included connectivity, physical environment, obstacle avoidance features, and robot vision.

Observations and Reflections on Robot Test Drives

1st Phase, Test Pilot Scenario (n = 3)—One researcher (female), one staff member (male), and one community member (male) conducted pilot studies of the robot one year before remote users were able to test-pilot the robot in the museum. Initially, a Double 2 robot was placed in the museum, but issues with connectivity, microphone, and speaker created challenges to moving forward with the Double 2 for future testing. After the Double 2 was upgraded to a Double 3, the microphone and speaker issues were resolved, but the connectivity issues remained, and the robot could not function beyond the confines of one hallway.

These connectivity issues were mainly due to the historical nature of the building because it was built in 1893 and underwent extensive renovations in 2006–2011. External construction is mainly brick, and internal Wi-Fi routers were not sufficient for accessible navigation around the museum. After some trial and error, the museum updated its Wi-Fi capabilities, enabling the robot to navigate a permanent exhibit on the second floor called *Calle Principal: Mi México en Los Angeles* (Figure 7). The *Calle Principal* exhibit was selected due to its permanence as an exhibit versus other exhibit floors that undergo several changes throughout the year.

Piloting of the robot began with the Double 2 model. Pilots were continued a year later with the Double 3 to test pilot the newer model of the robot and validate museum experiences in real-time.

second Phase, Test Pilot Scenario (n = 6)—During this phase of pilot studies, participants were able to log in to the Double 3 and explore the museum remotely from their homes. The six participants were five females and one male located in Southern California; Ontario, Canada; and an undisclosed location. Our test pilot exercises were conducted on Calle Principal within six designated spaces to accomplish eight specific tasks. Participants were invited to pilot the telerobots for future inclusive museum practices.

Once the remote users logged in to the robot, they were instructed on the basics of navigation, including turning left and right, moving forward and backward, using the semi-autonomous navigation feature (pointing at areas on the floor where the robot could navigate), and raising/lowering the robot's height. After remote users had managed these features, they were instructed to complete the following tasks to test the robot's capabilities in a general museum visit:

1. Stroll up and down Calle Principal using the navigation feature (e.g., arrows on the floor) and the direction keys.
2. Practice using the camera's zoom feature by reading signs and buttons of various sizes.
3. View themselves on the robot by visiting the department store and navigating to its mirror.
4. Test lag of connectivity outside Mercado Plaza.
5. Navigate between two stools to view the table and artifacts and read words on the table.
6. Enter Mercado Plaza, read canned goods, view legumes, and pick out the bin with lentils.
7. Navigate to a room with a window, view outside objects (closest to farthest buildings, traffic/people descriptions, trees), and navigate a narrow space between table and wall if possible.
8. Return to Calle Principal.

Telerobots: Challenges and Solutions

Telerobots require strong Wi-Fi connectivity at the location of the remote user and the physical location of the robot. Additionally, telerobots rely on the following three main capabilities for human-robot interaction: (1) remote-controlled mobility, (2) real-time vision capabilities that enable the remote user to see and be seen, and (3) real-time audio (i.e., hearing and speaking) capabilities that allow the remote user to hear and be heard (Ahumada-Newhart et al. 2023; Elmimouni et al. 2022; Newhart and Olson 2017). A total of six users accessed the telerobot from remote locations outside the museum. The users were able to accomplish most tasks after receiving initial instructions. Table 1 lists the challenges and solutions (when applicable) that were encountered during the remote test pilot phase.

Lessons Learned: Commitment to Social Inclusion

We found that the museum continued to evolve throughout the pandemic to meet the needs of our community by engaging in digital and in-person forums. Transitioning between these forums allowed for open dialogue where learning was social, contextual, and co-constructed. After experiencing the success of online platforms for social inclusion and viewing the potential of personal robots to continue social inclusion efforts, we remain committed to exploring novel methods of digital access to continue growing our inclusive museum. This commitment is an expression of our values to include members who experience

medical, disability, or transportation challenges to museum engagement. Through this work, we adopted the following three principles of inclusion: (1) equity, (2) access, and (3) opportunity for community relationships, shared experiences, advocacy, and a sense of cultural identity. We now provide a brief overview of best practices for online events and the deployment of robots in a museum. Future work will pilot these guidelines.

Telerobot Best Practices

Robot visitors should be provided with the following:

- **Backup Communication:** Museum should provide a backup phone number that robot visitors can call if they become disconnected or encounter challenges while visiting the museum from home.
- **Personalization Option:** Robot visitors should have the option to personalize their robot visit with a shirt and a name tag to increase presence and facilitate interactions.
- **Spatial Awareness Tools:** Robot visitors should receive a floor map of the museum exhibit so that they are aware of the physical spaces they are visiting.

Interactants (in-person) visitors should be aware of the following:

- **Privacy:** Video recording from the robot is not enabled. Remote robot visitors cannot video record their visits or other visitors. By the same courtesy, in-person visitors should not take pictures or record the robot moving around the museum. The remote telerobot visitor should be respected much like any other in-person visitor.
- **Accessibility:** in-person visitors should be aware that the telerobot visitor may have some mobility issues and should perform the same courtesies they would to someone using other assistive devices.

Curatorial Considerations for Future Robot Use

Additionally, after test piloting the robots through the museum, we make the following recommendations for Curatorial Considerations of Future Robot Use:

1. Scheduling can be designed by staff regarding the availability of the robot. The scheduler can send the electronic invite to the visitor and determine the length of time the visitor will have access.
2. The cost to the museum to deploy a robot program should leverage existing personnel and/or volunteers to facilitate accessibility for visitors.
3. Cost to community members should be free of charge; most commercially available robot platforms do not require an account or access fees.
4. Access/Wi-Fi considerations should be minimal; the robot has a user-friendly interface that is accessible via smartphones without the need for broadband service.

5. Museum content should be accessible and supported by the museum spaces that are compliant with The American Disabilities Act to ensure that the robot will have access to the physical environment comparable to someone who is using other assistive devices.

Conclusion

The Mexican-American/Latina/o community suffered devastating losses during the recent global pandemic. As the museum was forced to close, it refocused its efforts to establish and maintain social connectedness with the community through online events. The challenges brought on by a global natural disaster also afforded a rich opportunity to adapt approaches for greater inclusion. This sudden shift to online platforms afforded the museum vast opportunities to connect with local, national, and international community members who were interested in attending online exhibits. As an inclusive museum, LA Plaza is committed to continuing these human-technology interactions via online platforms and exploring the use of telerobots for virtual visitors.

It is well known that history, art, and culture museums may both reflect and influence the development of values within a community. As LA Plaza continues its mission to honor the past, inspire the future, and recognize the enduring cultural influence of Mexicans, Mexican Americans, and Latina/os, LA Plaza also strives to promote the inclusion of multiple voices, multiple intersectional identities, and a complex core of cultural and stakeholder communities. Our community's experience and our museum's work during COVID-19 challenged us to move beyond traditional in-person attendance and explore human-technology interfaces to increase access for community members who face challenges to in-person attendance due to medical conditions, disabilities, or transportation challenges. COVID-19 remains to be fully explored in its longitudinal disabling effects, and the need for greater inclusion will persist due to this and other health and systemic factors.

Our contributions to the field include empirical data on technology-mediated cultural, historical, and entertainment exhibits. This data may serve as a blueprint or guide for other history/cultural museums that serve other communities that are seeking to increase the inclusion of community members. Our future work will continue exploring innovative technology-mediated museum experiences and inclusion efforts.

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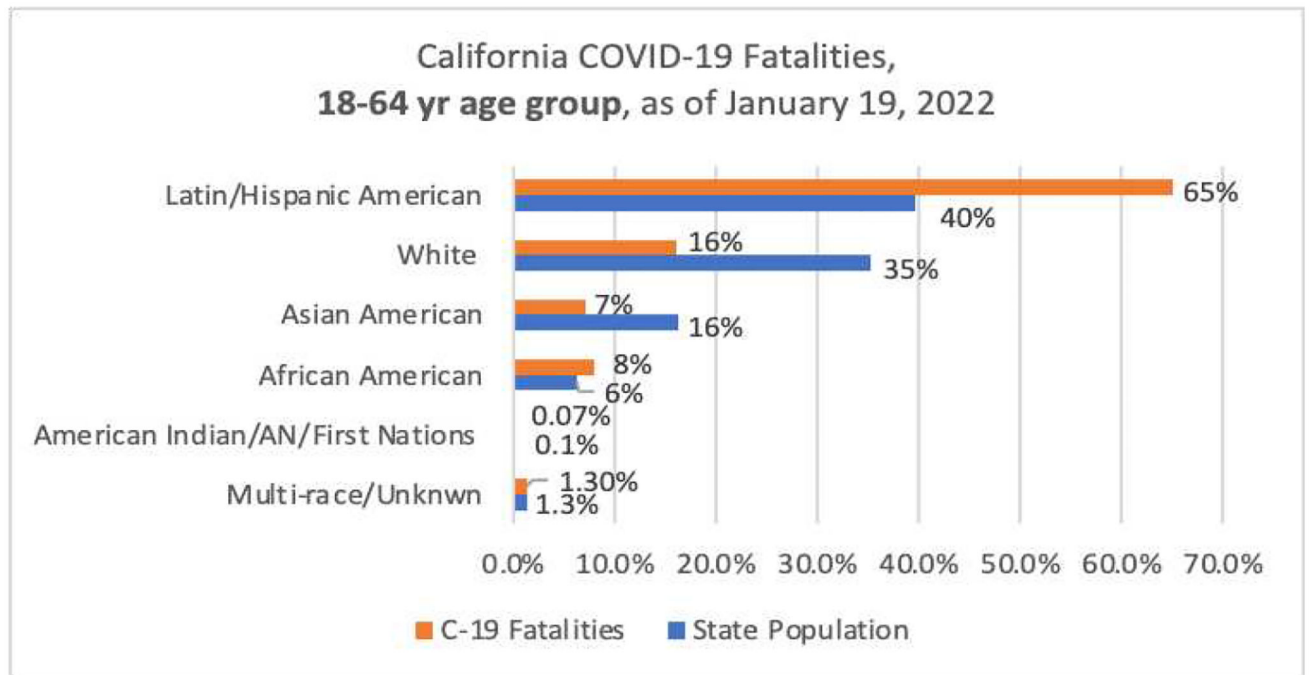


Figure 1:
 COVID-19 Fatalities in California
 Source: California Department of Public Health 2023



Figure 2:
Papel Picado w/ Mario A. Hernandez
Source: En Casa con LA Plaza



Figure 3:
Happy Hour with Louie Perez and Linda Ronstadt
Source: En Casa con LA Plaza



Figure 4:
Happy Hour w/ Lucie Arnaz
Source: En Casa con LA Plaza



Figure 5:
When Community Creates Exhibitions
Source: En Casa con LA Plaza



Figure 6:
Double 3 in the Museum
Source: LA Plaza de Cultura y Artes

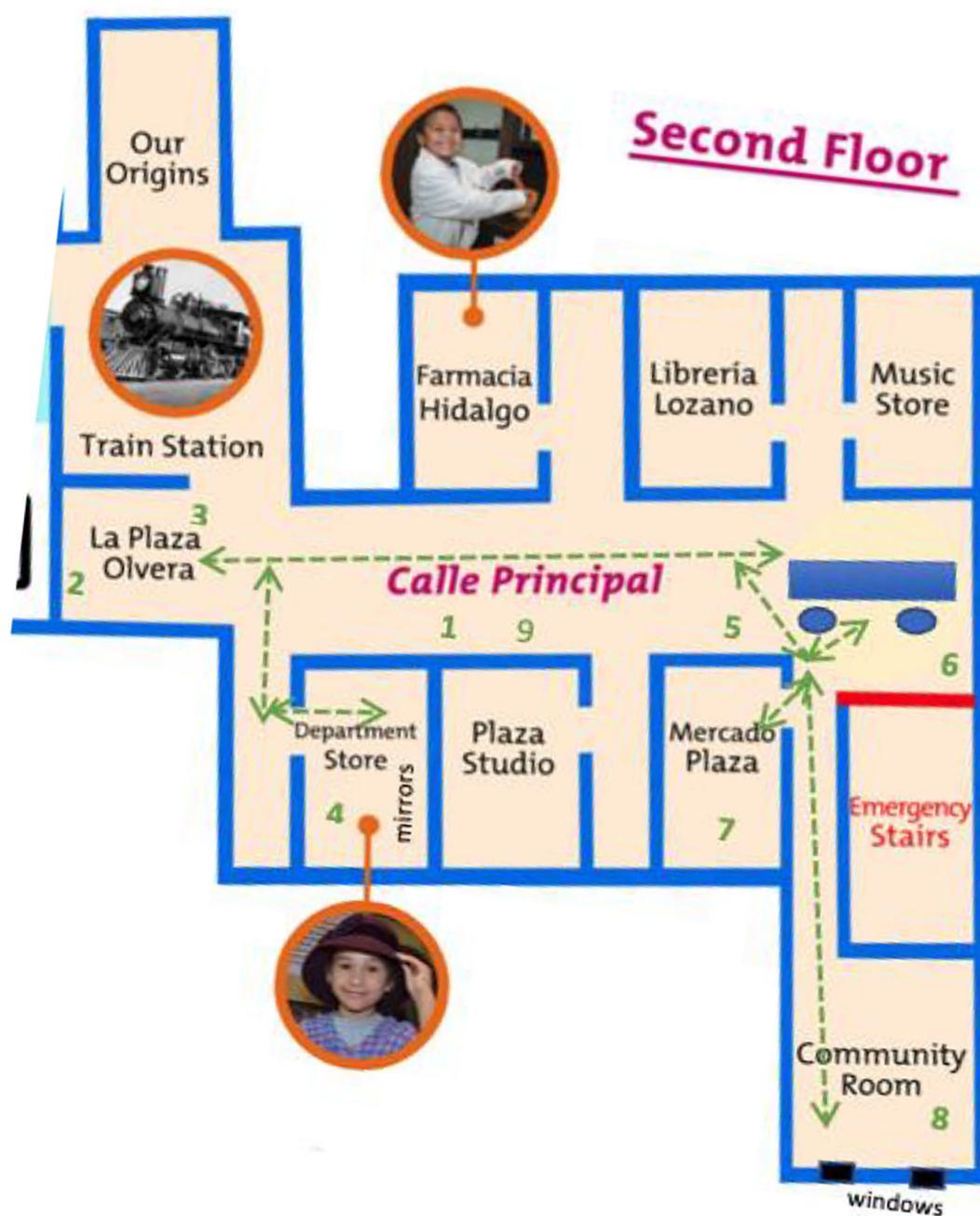


Figure 7:
Museum Floor Plan
Source: LA Plaza de Cultura y Artes

Table 1:

Challenges and Solutions, Telerobot Test Pilots

Area	Challenges	Solutions
<i>Connectivity</i>		
#5	Loss of signal and Wi-Fi connectivity when stopped in front of vegetables in front of Mercado Plaza	Driving past weak areas without stopping allows for a transition between routers without full disconnection
	Connectivity issues delayed 1 st phase test pilots and created challenges during 2 nd phase test pilots.	Phase 1—museum updated the Wi-Fi system and routers Phase 2—reboot the robot and move it to areas with stronger signal
<i>Mobility</i>		
#6	Obstacle avoidance is an issue when navigating to a table in between chairs	Navigate slowly between chairs
#8	Obstacle avoidance is an issue when navigating to a window that is between chairs and a wall	Slow, deliberate navigation and exiting along the same path as was used for approaching the window
	Navigation feature did not always function properly	Use arrow keys to navigate
<i>Vision</i>		
#2–3	Needed to get very close to view the writing on the walls	Introduce zoom feature
#6	Inability to view objects on a table in the area	Because the camera does not have a full pan and tilt, backing away from the table allowed for the field of view to capture words and artifacts on the table
#7	Inability to distinguish lentils from other legumes in Mercado Plaza bins from the doorway (distance of about 3 ft)	No solution
<i>Audio</i>		
#1–9	Remote user had trouble hearing people in the museum	Unclear whether this was from the robot or the remote user's device. No adjustments were made as it only occurred with one test pilot