Master's Thesis:

VIRTUAL REALITY (VR) STORYTELLING:
BUILDING AWARENESS AND REDUCING STIGMA TOWARD WASTE PICKERS

by

Bita Ebrahimi

B.A., Art University of Isfahan, 2014

M.A., Iran University of Art, 2017

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We acknowledge and respect the Lək̓ʷəŋən (Songhees and Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

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Abstract

This thesis explores the potential of Virtual Reality (VR) storytelling as an innovative tool to challenge dominant narratives, build critical awareness, reduce stigma, and foster empathy towards marginalized and stigmatized communities. Grounded on decolonial and critical frameworks, and drawing on Paulo Freire's problem-posing education and conscientization, the study investigates how Virtual Reality (VR) storytelling can bridge the gap between abstract understanding and emotional engagement, supporting social inclusion and knowledge democracy.

This research chose to work with waste pickers' community, who often experience marginalization, exclusion from policy decisions, and societal devaluation, despite their significant contributions to environmental sustainability. Through a participatory collaboration, with a waste pickers' community in São Paulo, Brazil, the research integrates Virtual Reality (VR) Storytelling with Community-Based Research (CBR). Following official coordination and respective ethical procedures, visual data are collected, including 360-degree video footage capturing the work environment of the waste pickers and their personal narratives. This combination of qualitative data (interviews and visual documentation) forms the core of the primary data integrated into a VR simulation.

The VR simulation created for this project allows users to experience the actual workplace of waste pickers and listen to their stories narrated by the waste pickers themselves in an intimate setting as if they were truly present in that environment. The final simulation has been showcased in three different venues in Canada. Impressively, audience feedback, both verbal and written, highlights that the developed method has a strong potential to contribute to critical education of people, by challenging preconceived notions, enhancing public awareness and fostering empathy among the participants.

Finally, based on the integration of VR storytelling with community engagement, this thesis argues that immersive storytelling would help us go beyond traditional learning processes and serve as a powerful medium for mobilizing knowledge, building critical awareness, ultimately fostering a more equitable and inclusive society.

Keywords: Virtual Reality (VR) Storytelling, Waste Pickers, Stigma, Community-Based Research (CBR), Environmental Education (EE), Knowledge Democracy

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Acknowledgements

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And last but not least, to my spouse, thank you for standing beside me every step of the way. Your encouragement gave me strength to pursue what I believed in. You were even there with me during my fieldwork in Brazil, offering help and unwavering support when I needed it most.

Dedication

To Elma, William, Sebastião, Angela, …

and all the waste pickers around the world—

silent guardians of the environment,

whose hands heal what the world discards,

though their names are too often unheard and forgotten…

Human beings are members of a whole,
In creation of one essence and soul.
If one member is afflicted with pain,
Other members uneasy will remain.
If you have no sympathy for human pain,
The name of human you cannot retain.
– Saadi Shirazi, Iranian poet

بنی آدم اعضای یک پیکرند — که در آفرینش ز یک گوهرند
چو عضوی به درد آورد روزگار — دگر عضوها را نماند قرار
تو کز محنت دیگران بی غمی — نشاید که نامت نهند آدمی

سعدی

Chapter One: Introduction

Individuals who work as waste pickers are a part of the informal waste management system. They work outside formal employment structures, collecting, sorting, and selling recyclable materials (such as paper, cardboard, aluminum, glass, wood, and plastics) from waste that has been discarded by households, industries and public spaces (Katusiimeh et al.,2013; Wilson et al. 2006). Some waste pickers may work in improvised workplaces like streets or illegal dumping sites, while others may work in cooperatives (See also Gutberlet et al., 2021). They may have different names depending on the local languages, the location of where they operate, or the resources they gather (Morais et al., 2022). Waste pickers do more than just collect materials; they help divert significant amounts of waste from landfills, contributing to recycling efforts and the circular economy (Morais et al., 2022). They remove waste from private buildings and public spaces, move it in weighty buggies, and separate recyclable waste from waste that will be dumped in landfills (Coletto & Bisschop, 2017).

Worldwide, it is estimated that 15 to 20 million people make a living through waste picking and recycling (International Labour Organization & WIEGO, 2013). According to IPEA sources (2013), estimates of the number of waste pickers in Brazil range from 400,000 to 600,000. The census shows that over 39% of people were arranged into groups, cooperatives, or networks. Women made up 31% of the total number of waste pickers although they were the majority of organized waste pickers. Most waste pickers (66% of them) were Afro-descendants, and 20% were still regarded as illiterate. The average age of waste pickers was 39 years. According to the IBGE (2012), just 25% of waste pickers have completed their basic education (see also Gutberlet, 2020).

According to Gutberlet (2020), Brazil has been a global leader in recognizing waste picking as a formal profession. In 2002, Brazil's Ministry of Labour and Employment officially recognized waste pickers under the professional category "catador" (collector of recyclable materials) in the national classification of occupations.

In general, waste pickers are crucial to recycling and solid waste management systems, but they are often invisible in the discussion of urban sustainability. They continue to be socially stigmatized, marginalized, and excluded from policy decisions in spite of their environmental contributions (Gutberlet & Jayme, 2010). Waste pickers are often seen by the

public as those who are criminalized, homeless, or economically unproductive, which serves to further marginalize them in society (Wilson et al., 2006; Tremblay, 2013). This thesis aims to explore, both theoretically and practically, the potential of Virtual Reality (VR) storytelling, framed through decolonial and critical approaches, to reduce stigma, promote empathy, and raise critical awareness of waste pickers' contributions to environmental sustainability. To put it differently, this study seeks to advance the application of immersive media and technologies like VR and its integration with a community-based approach, structured within a decolonial and critical framework, as a powerful mechanism for knowledge democracy, awareness-building, and social inclusion.

This thesis follows a paper-based structure and consists of six chapters plus an appendix. It begins with Chapter one, which serves as the introduction, providing background information on waste pickers, outlining the research goal, and presenting the thesis structure. Chapter two discusses the methodology, explaining the theoretical framework, research objectives, and methods applied in the study. The core of the thesis lies in Chapters three and four, which consist of two distinct but interconnected papers. The first paper (chapter three) focuses on the theoretical foundation and literature review, discussing how stigma operates as a social mechanism of exclusion and how storytelling through VR, when integrated with knowledge democracy and critical education, can counter these dominant narratives. Drawing upon Paulo Freire's (1996) "problem-posing" approach and "conscientization", it examines how VR storytelling offers a participatory and immersive means to educate the public about marginalized populations, ultimately fostering perspective-taking and a sense of empathy and social responsibility.

Chapter four, the second paper, discusses a field-based project, in which VR storytelling was applied to the case of waste pickers in São Paulo, Brazil. Through Community-Based Research (CBR), the study engaged directly with waste pickers at Coopervivabem, a cooperative where the research process was developed collaboratively with the workers themselves. This participatory process ensured that their voices, lived experiences, and daily realities were authentically represented. The research then transitioned into the technical creation of a VR simulation, allowing users to virtually enter the waste pickers' workspaces and hear their personal stories.

Following these two core chapters, Chapter five presents the research conclusion, synthesizing the findings and discussing the implications for theory and praxis while

identifying the study limitations and potential future directions. Finally, Chapter six compiles all references cited throughout the thesis.

Chapter Two: Methodology

This section provides an overview of the research objectives and methodology employed in this study.

2-1- Research Objectives

- Explore the conditions leading to social exclusion and stigmatization of waste pickers
- Explore VR Storytelling as an educational tool to increase critical awareness, challenge stigma, and foster empathy
- Integrate a Community-Based Research (CBR) Approach with VR Storytelling to co-create narratives *with* waste pickers at Coopervivabem in São Paulo, Brazil
- Develop and evaluate a VR simulation representing waste pickers' experiences and examine how the VR experience influences audience attitudes toward waste pickers

2-2- Literature Review and Theoretical Framework

The first component of the research conducted a comprehensive literature review on waste pickers' social exclusion, stigma formation, and the role of critical education in addressing societal biases. Central to this theoretical framework is:

- Stigma (Goffman, 2009; Link & Phelan, 2001): The concept explains how labeling, stereotyping, separation, status loss, and discrimination create social exclusion both broadly and specifically in the context of waste pickers.
- knowledge democracy as a form for fostering critical awareness, social inclusion, and destigmatization (Tandon et al., 2016): highlights how knowledge democracy can serve as a counter-narrative to dominant discourses of exclusion, as it is based on the acknowledgment of diverse lived experiences and can be deeply rooted in oral traditions, the arts, and storytelling in addition to being found in texts and academic discourse.
- Critical Environmental Education (Freire, 1996; Aguiar, 2023; Sterling, 2001; Korsant, 2024): Argues that participatory, community-based, problem-posing and

conscientization concepts can empower marginalized communities and encourage individuals to actively deconstruct and reshape dominant narratives while contributing to sustainable solutions and socio-environmental justice.

A systematic review of peer-reviewed literature was conducted, with key themes identified through coding and thematic analysis.

2-3- Integration of Community-Based Research and VR Storytelling

The second component involved a community-based field study and the development of a VR simulation based on waste pickers' narratives. By combining these methods (CBR and VR storytelling), the study ensures that the narrative is created with the waste pickers, allowing them to actively shape how their experiences are represented, rather than having their stories told for them. This collaborative approach enhances building trust-relationship with the community during the research process. The CBR method ensures that the waste pickers' voices and lived experiences are truly narrated in the project, while the VR storytelling method helps convey these narratives by immersing the audience in the workplace of the waste pickers and fostering their awareness, empathy and emotional engagement (Shin, 2018; Bos, 2021; Gomez and Jones, 2010; Dooley, 2017; Tassinari et al., 2022; Chen et al., 2021; Farmer & Maister, 2017).

The steps included:

1. Community-Based Research (CBR) Approach:
    - The fieldwork took place in January 2024 in São Paulo, Brazil, in collaboration with Coopervivabem, a recycling cooperative.
    - Ethical considerations ensured informed consent, transparent communication, and collaborative storytelling, trying to minimize discomfort for the community.
2. Data Collection:
    - Participant and workplace observation: Engaging with waste pickers to understand their work environments.
    - Semi-structured interviews: Conducted with cooperative members, focusing on their experiences and challenges in their workplace.
    - Visual and multimedia data collection: 360-degree videos and photographs of the workplace and worker interactions, and interviews.

3. VR Simulation Development:
    - The raw video footage was edited into an immersive VR experience, featuring two main parts:
        - Workplace Environment Immersion: Showcasing the daily routine of waste pickers in their Workplace.
        - Personal Narratives: First-person storytelling by different waste pickers.
    - The VR simulation was developed applying different software such as Adobe Premiere, Photoshop, and GoPro Max 360-degree camera, and it was presented using Meta Quest 3 VR headsets.

2-4- Reflexivity: Situating Myself as a Researcher

My engagement with this research is rooted in my interest in storytelling as a method and the potential of emerging technologies like Virtual Reality (VR) to facilitate participatory projects and knowledge mobilization in a meaningful way. I believe that even small steps in fostering awareness can contribute to making the world a better place.

Through this research, I had the opportunity to pursue my interest in VR storytelling by working with a recycling cooperative in São Paulo, Brazil; an experience that provided me with valuable learning and real-world insights. This collaboration not only deepened my understanding of waste pickers' lived realities but also reinforced my awareness of the ethical responsibilities of authentic storytelling, which requires humility, active listening, and a commitment to ethical considerations when working with marginalized communities.

Chapter Three: Paper 1

BUILDING AWARENESS AND REDUCING STIGMA TOWARD WASTE PICKERS THROUGH VIRTUAL REALITY(VR) STORYTELLING: A LITERATURE REVIEW

Abstract

Waste pickers and what they do is truly invisible. Rarely do we notice them as they collect recyclables from streets, parks, and other public spaces. They protect the environment by collecting, sorting and recycling materials, but the sad point is that they continue to face marginalization, exclusion from policy decisions, and societal devaluation. It is important to pay attention to waste pickers who have little voice and power and acknowledge and recognize the value of their work. This paper investigates the potential of Virtual Reality (VR) storytelling as an innovative tool to reduce stigma and build critical awareness about waste pickers. By reviewing the existing body of literature on the concept of stigma and VR's application in critical education, it explores how VR, as an immersive experience, can challenge the stigma attached to waste pickers and their job, shift perceptions, and promote empathy. Bridging the empathy gap, this research advocates for a more inclusive and equitable society that promotes the image of “environmental stewards” toward waste pickers.

Keywords: Informal Waste Pickers, Stigma, VR Storytelling

3-1- Introduction

Waste pickers as informal “recyclers” are the actors who always play a crucial role in waste management systems, protecting the environment and supporting a circular economy in cities. Meanwhile, they are not protected in return as much as they are entitled to, and they also face different challenges in their work and life conditions. Public stigma, defined as the socially constructed devaluation or discrediting of individuals based on perceived undesirable traits (Goffman, 2009; Link & Phelan, 2001), is one of the significant challenges that makes waste pickers’ livelihoods very arduous. Let alone the stigma that intersects with variables such as gender, race, and migratory status (Porras Bulla et al., 2021). This stigma which is taken for granted makes waste pickers excluded from society to the point that their job is not even valued by others. However, recently the national and international waste pickers movements have gained more momentum, and significant advances have been achieved in countries like Brazil. Yet, of course, the majority particularly those working independently still suffer significantly from stigma on the ground, in the street, and their everyday life. They deserve greater attention, entitled to have a decent life. Therefore, there is still a need to raise critical awareness regarding their work conditions amongst the public.

To achieve that, much work has been done, each of which targeted the issue from a different point of view. For example, Gutberlet & Jayme (2010) carried out qualitative research using participatory video workshops to explore how waste pickers perceive the stigma they suffer. Also, Porras Bulla et al. (2021) worked on public policies regarding the stigma toward informal waste pickers in the Global North. However, in approaching this concern the potential of the recent technologies is not adequately utilized yet, specifically when it comes to Virtual Reality. VR can genuinely convey the everyday experience of these populations to policymakers and the public. In VR simulation, individuals may feel what these waste pickers experience in their workplace by being in the same space. In other contexts, studies have already shown VR's effectiveness in increasing visibility, educating, and raising awareness. For instance, Sulisworo et al. (2022) showed how VR promotes environmental awareness by immersing students in realistic 3D environments, with a focus on animals in their habitat, enhancing their critical thinking skills through interactive learning. Similarly, Fernandez (2017) investigated how virtual and augmented reality (VR/AR) can improve education by facilitating immersive, experiential learning while tackling

challenges like teacher preparation. Pivik et al. (2002) showed VR capacity to foster empathy and inclusivity by letting participants feel the difficulties that people with disabilities encounter. By addressing crucial issues such as the invisibility of greenhouse gas emissions, the psychological disconnect brought on by spatial and temporal distances, and the difficulty of directly experiencing or experimenting with environmental issues, Fauville et al. (2020) focus on advancing environmental literacy. To promote a deeper understanding and engagement with environmental issues, their research makes use of digital technologies, especially Virtual Reality (VR), to create immersive experiences that make the invisible visible, giving access to remote or inaccessible environments.

Accordingly, it can be said that Virtual Reality (VR) as a new way of education could have the most effect on increasing the public's awareness regarding waste pickers. This research aims to answer the following questions; how waste pickers are stigmatized and how VR storytelling can be an effective tool in building awareness and reducing the stigma attached to waste pickers and their job.

In this paper, the first section focuses on waste pickers as an informal sector in the waste management system and the difficulties they face in their working conditions. Subsequently, the second section focuses on one of the challenges faced by waste pickers, namely, "stigma". This section elaborates on the concept of stigma, and how the stigma process works, with a specific focus on its manifestation among waste pickers. In the subsequent part, the paper explores the potential of critical education and awareness as a viable approach to address and reconsider this stigma. Finally, the last section of the paper discusses the advantages of Virtual Reality and VR storytelling as an impactful tool to promote awareness, reduce prejudice, and alleviate stigma surrounding waste pickers.

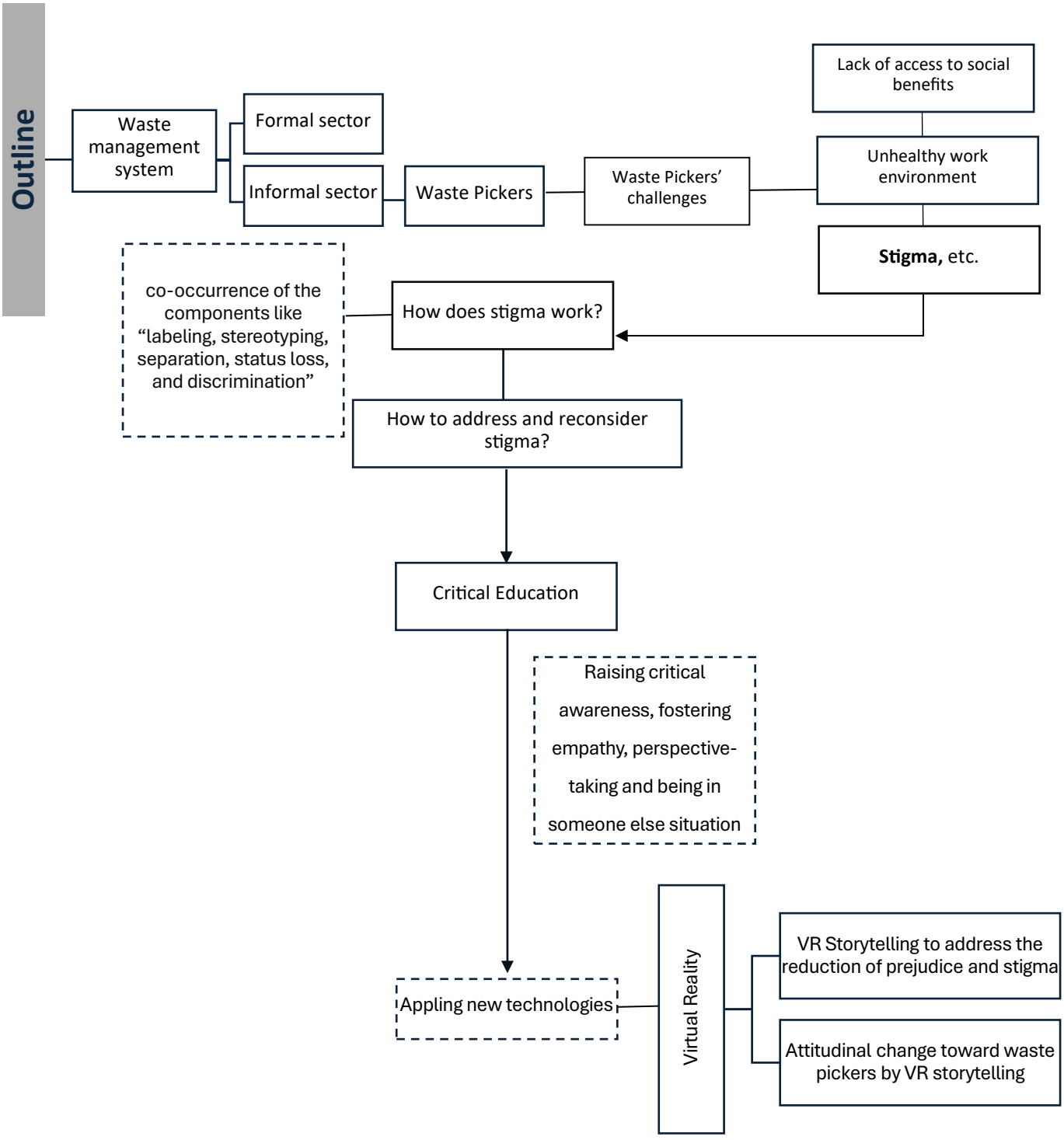

Figure 1: The paper's structure

3-2- Methodology

The study's main themes are informal waste pickers, stigma, critical education, critical awareness, Virtual Reality (VR) technology, and VR storytelling. These themes were developed through a systematic review of existing literature. These themes were prioritized using the following steps.

Initially, the search began by identifying relevant literature, applying academic search engines such as Google Scholar, Scopus, and Web of Science, as well as the University of Victoria (UVic) online library. The review focused on peer-reviewed articles and books, with a focus on more recent works and those found through the search engines applied. However, foundational works on stigma and education (such as Goffman, 2009 and Freire, 1996) were also included.

In order to evaluate the literature and pinpoint the key themes, the material was coded and classified by giving labels to central ideas. Following that, these codes were grouped into broad themes that directly addressed the study questions. Three main themes pillars emerge from this literature analysis process:

1. Stigmatization and social exclusion
2. Critical education and awareness
3. VR storytelling as a tool to foster empathy and critical awareness

3-3- Theoretical Framework

A decolonial viewpoint shapes the theoretical framework of this study, which provides a lens to examine how VR Storytelling can be applied to create narratives to destigmatize the group under study. This framework focuses on two main areas: (1) Conditions that generate social exclusion and stigma and (2) knowledge democracy as a form for fostering critical awareness, social inclusion, and destigmatization.

Central to this framework is the understanding of how colonial systems continue to marginalize informal workers by framing their contributions as undesirable or peripheral within neoliberal governance structures (Spivak, 2023; Goffman, 2009; Link & Phelan, 2001). This understanding highlights how knowledge democracy can play as a counter-narrative to dominant discourses of exclusion since it is based on the acknowledgment of a variety of lived experiences (Tandon et al., 2016). Tandon et al. (2016) claim that knowledge is deeply

rooted in oral traditions, the arts, and storytelling in addition to being found in texts and academic discourse. These alternative knowledge forms offer opportunities for social inclusion and increase the voices of the marginalized. By encouraging co-construction and active participation with excluded people, the democratization of knowledge undermines dominant epistemologies that perpetuate exclusion and injustice.

Furthermore, the ideas of "problem-posing" and "conscientization" as proposed by Paulo Freire in 1996 are essential to this framework. Conscientization is moving from a passively accepted understanding of reality to a critical awareness of the social, political, and economic forces that influence one's life. Freire explains this transition as a shift from "semi-intransitive" or magical awareness to "critical transitivity," where people learn to see the world as a dynamic, changeable structure influenced by human agency (Lawton, 2022).

Building on the concepts of knowledge democracy (Tandon et al., 2016), conscientization, and problem-posing education (Freire, 1996; Lawton, 2022), this research studies how VR storytelling can be applied to promote social inclusion and destigmatization. Research has shown that VR experiences can increase empathy and enhance understanding of marginalized groups (Shin, 2018; Chen et al., 2021). In this context, telling stories via virtual reality (VR) is an effective tool for raising critical awareness in addition to getting the voices of marginalized groups heard and allowing people to take these groups' perspective tangibly. Users are able to identify and critically consider the systemic oppressive forces that influence social realities through VR narrative engagement.

3-4- Literature review

3-4-1- A Review of Waste Pickers' Challenges

As informal workers, waste pickers encounter seriously diverse challenges in their working conditions and livelihood. As Marello and Helwege (2018) mention in Latin America, informal "waste pickers are largely denied access to social benefits such as health insurance, pensions, and unemployment insurance, physical debilitation, lack of education to accurately assess toxic risks, and income" (p.111). Simply put, they "work under precarious, risky, and unhealthy conditions" (Wilson et al.,2006, p.797); also, "their activities are generally labor-intensive, low-tech, low-paid, often managed autonomously or in the family" (Gutberlet, 2021, p.137).

Furthermore, the formal waste management sector including both public and private does not support inclusion by waste pickers, because they are seen as rivals for jobs and recyclable materials and resources (Marello and Helwege, 2018). In addition to that "the attitude of the formal waste management sector to informal recycling is often very negative," (Wilson et al., 2006, p.798). Besides, among the public, informal sector workers are often perceived as criminals, homeless, and unemployed people whose work is usually dangerous and performed in unsanitary environments (Wilson et al., 2006; Tremblay, 2013). According to Velis et al., "waste pickers are seen as victims, who are subject to social stigma and mainly belong to socially vulnerable groups, such as migrants, women, children, the elderly, the disabled, and the unemployed" (2012, p.43). This viewpoint tends to support the claim that discrimination against the informal sector may result in excluding this sector from solid waste management regulations (Tremblay, 2013). This stigma makes waste pickers' livelihood very arduous. The fact is that the public stigma attached to waste picking and waste pickers really affects the value of their job in that their job is undervalued or even not valued by others.

3-4-2- How does stigma work?

There are different multi-faceted factors involved in how waste pickers are stigmatized. According to Link and Phelan (2001) the five key components of stigma can be defined as the co-occurrence of various components like "labeling, stereotyping, separation, status loss, and discrimination" (p.363). It can be said that aspects of "labeling, stereotyping, separation, status loss, and discrimination" (Link & Phelan, 2001) can co-occur in the context of waste pickers and lead to stigmatization toward them.

In the first component, individuals identify and label human differences. Waste pickers are labeled by society not merely by their work but by a perception of their identity as inherently linked to waste and dirt. Porras Bulla et al. (2021) highlight that the activity of "waste picking" itself infects the individual's identity, creating a "negative stereotype" around those engaged in it.

In the second component, stereotyping, prevailing cultural attitudes associate labeled people with "undesirable characteristics—with negative stereotypes." Waste pickers are often stereotyped as homeless, criminal, or unemployed individuals who evade societal

norms, such as paying taxes or obeying formal regulatory structures (Marello & Helwege, 2017; Wilson et al., 2006).

The third component, separation, involves creating a divide between “us” (the society) and “them” (the waste pickers), resulting in their physical and social isolation. Waste pickers are marginalized individuals whose work is usually dangerous and performed in unsanitary environments which leads to a lack of access to certain services and separation from the rest of society (Tremblay, 2013; Porras Bulla et al., 2021).

The fourth, status loss and discrimination, involves labeled people suffering from status loss and discrimination that results in unfair outcomes. Ultimately, stigmatization depends totally on having access to the social, economic, and political power which as Link and Phelan (2001) state “allows the identification of differentness, the construction of stereotypes, the separation of labeled persons into distinct categories, and the full execution of disapproval, rejection, exclusion, and discrimination” (p.367). This emerges as waste pickers face diminished social status and frequent discrimination. This results in their exclusion from formal urban management systems, where regulatory frameworks tend to prioritize formal waste management entities and systematically exclude informal waste pickers (Tremblay, 2013). Besides, as Sternberg (2013) notes this stigma is consistent with the logic of the local neoliberal urban projects, which are aimed at controlling the physical and social landscape of the city. Regarding Marello and Helwege (2018) “neoliberal efforts to sanitize and regulate the urban landscape led to the exclusion of waste pickers, who are perceived as dirty and disorderly, from wealthy neighborhoods” (p.111).

On the other hand, neoliberalism is also obsessed with speed, a formal worker can stay on the scene without trouble, as there are contracts and pre-valued timing for projects, so it would take its reasoned time. However, informal workers would try to carry out their job as fast as possible, because they are under the pressure of shame received from the eyes of the streets. As Binion and Gutberlet (2012) refer “social stigma and marginalization create unnecessary stress” (p.47). A higher level of self-assessed vulnerability results from insecurity, which is accompanied by social isolation, perceived shame, and embarrassment. Stress can also result from insecure employment, stigmatization, and a lack of financial stability (Gutberlet, 2013).

3-4-3- Reconsidering Stigma Attached to Waste Pickers

Addressing stigma and prejudice requires a multifaceted approach based on critical social theory and critical education which includes raising awareness, community engagement, and perspective-taking. Among all these ways, the elaboration that Paulo Freire (1996) brought to the concept of “education” can shed light on the other ways. In his book, “The Pedagogy of Oppressed,” he profoundly explained how “problem-posing education” and “conscientization” can lead to the “awakening of critical consciousness.” It should be said that achieving critical awareness can not be possible unless researchers come to engage with the community exposed to the stigmatization and start a bottom-up and mutual process of participation. This community-based participation is an increasingly effective tool for “mobilizing, engaging, and linking communities and government, particularly within the context of development” (Gutberlet et al, 2017, p.709). In fact, it helps stigmatized populations to be seen and heard by individuals who have the power to reduce this stigma to reflect how they perceive the world and the stigma concept themselves rather than the ideas of scholars or policymakers in this regard.

From this standpoint, critical education can give the opportunity for people to adopt a subjective viewpoint regarding the stigma challenge toward marginalized groups and this subjective viewpoint should be shaped by the stigmatized community themselves regarding their experience in the world. Critical education is a transformative approach to education grounded in Paulo Freire’s critical pedagogy focuses on developing learners’ critical thinking and social awareness. This approach empowers individuals to challenge and question dominant ideologies like racism, capitalism, colonialism, and patriarchy through promoting dialogue. It is both a theoretical framework and a practical practice that aims not only to understand the world but also to actively transform it toward greater equity and justice and empower people to advocate for systemic change by addressing intersecting oppressions and integrating varied views (Freire, 1996; Apple et al., 2024; Amsler, 2024; Allman & Mojab, 2002). As a result, it may influence attitudes towards stigmatized groups of people and open the door to discussions about behavioural, attitudinal, and policy changes. It denotes a comprehension that is strongly influenced by the experiences and viewpoints of the stigmatized populations themselves rather than based on preconceived conceptions or stereotypes. To sum it up, education in this way can provide the platform for individuals to

develop a subjective viewpoint rooted in empathy and understanding towards waste pickers. By incorporating the perspectives and experiences of this community, education can enable a shift in social attitudes and perspectives of waste pickers seen as “criminals, homeless, victims and unemployed people” to “environmental stewards.” Informal waste pickers collect recyclables from households, and sometimes also from trash cans and the carelessly left-behind trash in streets, parks, drainages, and other public areas (Gutberlet et al. 2021). This approach empowers waste pickers to reclaim their narratives, fosters a sense of agency, and opens the door to constructive discussions about policy reform. Ultimately, critical education plays a pivotal role in creating a more inclusive and equitable society where the stigma challenge is acknowledged, understood, and effectively addressed.

3-4-4- VR Storytelling as a Tool to Build Awareness and Reduce Stigma

Human Geography Representations in VR

Apparently, VR technology in geography is more used by physical geographers as a tool for data geo-visualization and communication in research and education (Fisher & Unwin, 2001 as cited in Bos, 2021). The fact that VR is used less in human geography could be because the phenomena in this field are embedded “within a highly complex, continually changing world,” tending to be more “relative” and “emotional” (Gomez & Jones, 2010, p.17). Accordingly, it seems more difficult to represent a phenomenon or issue in human geography through VR.

However, VR technology has the ability to address and illustrate important human geography issues as well, such as migration, social inequality, and conflict, by enhancing a “sense of presence” (Shin, 2018; Bos, 2021). Recent critical involvement with VR in human geography has included an investigation of the power and social difference relations that are evoked in such virtual environments (Bos, 2021). In fact, VR technology as a new method of mediating and may be used to represent people, places, and landscapes as well as their relations to society, culture, politics, and other aspects (Bos, 2021). Besides, there is an interest in exploring how the creation of such virtual environments might “challenge or alter dominant, expected or accepted ways of doing society, culture and politics” (Lievrouw, 2011, p. 19 as cited in Bose, 2021, p.5). Perhaps this is the right time for geographers to advocate for the wider usage of such immersive technology in society, create contexts for the

emergence of social, political, and environmental change and reduce the distance in ways that provoke feelings of responsibility, care, and empathy (Bos, 2021; see also Shin, 2018).

VR Storytelling

Virtual Reality storytelling is one of the most effective methods for raising awareness and fostering empathy. As Shin (2018, p.65) posits, through VR storytelling “users are dropped right into a scene or ‘virtually recreated scenario’ as if they were part of the story”. Through this experience, viewers may get closer to the world of other people and get insight into the thoughts and feelings of others. In virtual reality environments, users may have intense empathy with another person's feelings or position, by “being in the same space, close to that character” (Shin, 2018, p.66). Therefore, immersing oneself in VR can increase a user’s awareness and sense of empathy in a more realistic way (Shin, 2018).

On the other hand, using Virtual Reality for storytelling in a 360-degree environment necessitates “medium-specific, user-focused, engagement with time and place” (Dooley,2017, p.161). More precisely, narratives usually occur in real-time and in a certain place, whether they be actual or fictional. The usage of head-mounted displays (HMDs), mobile devices, and internet platforms are some ways that viewers can engage with virtual reality projects. The VR viewer is "present" as an active agent who interacts with “the unfolding narrative” instead of passively watching traditional media like movies or television (Dooley, 2017).

3-4-5- How VR Storytelling Can Address the Reduction of Prejudice and Stigma

According to the existing body of literature, it seems that VR has the potential to reduce prejudice towards different stigmatized groups. Based on these studies, the potential of VR storytelling in stigma and prejudice reduction can be followed through a layered process like layers of an onion in which each layer is built upon the previous one.

To start with, VR storytelling uses the "embodiment" and "ownership" illusions to assist users in understanding a story step by step into a 360-degree virtual world as if they were part of it. By allowing the user to fully feel the virtual world with their senses of sight and hearing while their immediate surrounding is not visible to the user, Virtual Reality is able to make immersion possible. This sense of immersion is closely related to the concept of embodiment which can be defined as having complete control over a virtual avatar and having the avatar's actions match those of the actual body. This creates the sense that the

user owns the virtual body or that they recognize their own body in the virtual body representation (Tassinari et al., 2022).

Going into the inner layer, this embodiment helps to take the perspective of someone else by being in their situation. “Perspective-taking is a person’s ability to interpret the world from other points of view” (Chen et al., 2021, p.2), and it enables them to experience other individuals’ lived-experience. Going deep, this perspective-taking affects the “bodily self” and “conceptual self” which is based on the neurocognitive basis of the self. In fact, the embodiment can help blur the lines between self and other, affecting both attitudes and more subconscious physiological reactions to different social groupings and people (Farmer & Maister, 2017). Farmer and Maister (2017) state that there is a lot of proof that adopting the identity of someone else causes individuals’ self-processing to shift based on our assumptions and preconceived notions about that person (see also Yee & Bailenson, 2007; Yee, Bailenson & Ducheneaut,2009). According to Farmer and Maister’s study (2017), this self-representation is engaged in the social cognitive processes that underpin prejudice. Thus, prejudice and unfavorable views toward other groups may be changed by altering an individual's closeness to the sense of self.

3-4-6- Attitudinal Change toward Waste Pickers by VR Storytelling

As Paulo Freire (1996) mentioned “people, as beings ‘in a situation’", find themselves rooted in temporal-spatial conditions which mark them and which they also mark” and “they will tend to reflect on their own ‘situationality’ “(p.109). In other words, by experiencing waste pickers’ situation, individuals can broaden their own ‘situationality,’ which can lead to a more empathetic understanding of the world around them. Accordingly, it seems that VR storytelling as a method that can make the “being in the situation” of waste pickers possible, could pave the way for individuals to discover waste pickers’ lived experiences.

This VR method allows individuals to take the perspective of waste pickers by simply putting people into their position in a VR environment and this simple embodiment could subsequently influence users’ attitudes (see also Chen et al., 2021). By having such an experience which reduces the distance between the self and that other (waste pickers), awareness might be raised, and feelings of responsibility, care, and empathy (Bos, 2021) could be enhanced with regard to vulnerable and stigmatized populations. Importantly, this VR experience is capable of providing new ways of witnessing and sharing experiences

through “multi-layered immersive” narratives and representations. Thus, this can lead not only to a reduction in prejudice against waste pickers, but it may also achieve this by creating new possibilities for public and geopolitical engagement (see also Osborne & Jones, 2022; Bos, 2021; Farmer & Maister, 2017).

3-5- Discussion

This study aims to demonstrate how VR storytelling can enhance social inclusion and destigmatization through the lens of knowledge democracy, problem-posing education, and conscientization. VR storytelling allows users to be immersed in someone else experiences and adopt a different viewpoint from their own which challenges stereotypes and preconceived notions. This is consistent with the claim made by Farmer and Maister (2017) that immersing in a virtual world might blur the distinction between self and other, impacting both conscious and subconscious biases. This immersive experience can help to strengthen the connection between excluded communities and the larger society by tangibly representing lived experiences (Chen et al., 2021; Shin, 2018). These findings can support the argument that VR storytelling can help lessen bias by facilitating perspective-taking which could ultimately lead to a greater understanding of the experiences of others (waste pickers).

Moreover, as VR storytelling bridges the gap between abstract understanding and emotional engagement, this study expands on Paulo Freire's concept of problem-posing and conscientization. According to Freire (1996), people's worldview is shaped by the situationality in which they live, but they can broaden their awareness of social injustices by being exposed to new and different viewpoints. Virtual reality (VR) enables a closer connection between marginalized groups, which their story is truly narrated, and their audiences by simulating the "being in the situation" of waste pickers. This process enables users to critically analyze their own positionality, identify the structural injustices that produce social hierarchies, and develop a sense of empathy toward those who are stigmatized. In this situation, VR storytelling can turn into a form of critical education that raises awareness and encourages social action to lessen stigma and support social inclusion.

It also can be discussed that VR storytelling can put into practice knowledge democracy by making knowledge more accessible and inclusive. The voices of marginalized communities are usually excluded by traditional epistemologies and colonial systems, but

according to Tandon et al. (2016), knowledge democracy places a strong emphasis on validating a variety of knowledge sources, such as lived experiences that are communicated through storytelling, the arts, and oral traditions. It can be said that this idea is embodied in VR storytelling, which provides multi-layered immersive narratives that are narrated by the community itself and let users experience the realities of waste pickers in a meaningful way. VR storytelling has the power to shift public attitudes and open up new opportunities for social and political engagement in order to challenge the stigma associated with hegemonic knowledge frameworks by offering an alternative method of knowing.

3-6- Conclusion

Stigmatization of waste pickers is a multifaceted phenomenon that has evolved over the course of human history. However, the rise of neoliberalism has further perpetuated and intensified this stigmatization to take advantage of its outcomes such as cheap labors, minimum wage, lack of insurance and vacations. By fostering critical awareness and empathy, this project explored how Virtual Reality (VR) storytelling might be an effective tool in addressing the stigma attached to waste pickers. Adopting a decolonial viewpoint including critical education and knowledge democracy, we have argued that Virtual Reality Storytelling has the capacity to change dominant stories and bring marginalized voices to the forefront. Through VR, people may better understand the lived experiences of waste pickers, which is crucial for promoting social inclusion and reducing stigma. By immersing individuals in the lived experiences of waste pickers, VR can facilitate perspective-taking, which is crucial for promoting social inclusion and reducing stigma.

This study highlights how important it is to engage with the community exposed to stigmatization to co-create narratives that reflect the authentic voices of waste pickers. These narratives are the foundation of the VR simulation, providing an impactful platform for increasing critical awareness and empathy. VR experience effectively puts viewers in the middle of the waste pickers' story as if they were a part of it. Such VR experience can enable individuals to better understand someone else lived experience.

One of the key contributions of this research is the way it integrates VR storytelling with a decolonial approach of knowledge democracy and critical awareness, offering an innovative methodology to engaging with marginalized communities. Various studies have explored stigma toward waste pickers; however, the potential of VR storytelling in reshaping

public perceptions and reducing this stigma toward waste pickers remains largely underutilized. This study emphasizes VR's capacity to challenge stereotypes, blur the lines between self and other, and create an immersive experience that humanizes waste pickers instead of limiting them to the preconceived notion of their job.

Nevertheless, despite its contributions, the application of VR storytelling has several limitations. First, although VR storytelling provides an immersive experience, its long-term effects on people's attitudes are still unknown. To evaluate the lasting impact of VR experiences on reducing stigma and promoting behavioral change, more empirical study is required. Furthermore, limited access to VR technology can be a barrier, especially in areas where these technologies are not widely available.

In conclusion, Virtual Reality storytelling seems to be a promising tool for social change, but its full potential may rely on the extent to which decolonial, critical, and community-driven approaches are incorporated to emphasize the voices of marginalized communities themselves. By fostering participatory knowledge creation and immersive storytelling, there is potential to move toward a more inclusive, empathetic, and equitable society where waste pickers may be increasingly recognized not as invisible laborers but as environmental stewards.

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Chapter Four: Paper 2

Virtual Reality (VR) Storytelling in Environmental Education

Abstract

This paper is written based on the processes and results of research attempting to couple the increasingly recognized strength of VR Storytelling in Environmental Education, with the very idea of what Paulo Freire termed “problem-posing education”, focusing on raising awareness toward marginalized people and overcoming the stigma associated to them. On this path, this paper explores the innovative integration of Virtual Reality (VR) storytelling and Community-Based Research (CBR), and the potential that this method can offer in raising critical awareness and Environmental Education (EE). To gather the required multi-media, this research chose to work with Coopervivabem, a waste picker cooperative in São Paulo, Brazil, who contributed to the research. The research started with gathering the multi-media data and information from the waste picker’s workplace, after the official coordination and respective ethical procedures. The next step included the VR simulation creation, and the technical details that are taken into consideration. Finally, the outcome is showcased in three different venues and enables the audience for a short time to get a glimpse of the world of waste pickers’ workplace virtually and hear their story from themselves. The verbal and written feedback received by these audiences suggests that the developed method has a strong potential to educate people through challenging preconceived notions and fostering empathy and understanding amongst the participants.

Keywords: Virtual Reality (VR) Storytelling, Environmental Education, Waste Pickers

4-1- Introduction

The rapid advancement of new technologies, especially Virtual Reality (VR) storytelling, has opened innovative pathways in human geography research and environmental education. With virtual reality systems, users can move around and explore their surroundings in a computer-generated 3-D scene (Chen, 2016). With its immersive and interactive capabilities, VR has the ability to address and illustrate important human geography and environmental issues, such as migration, social inequality, and conflict, by enhancing a “sense of presence” (Shin, 2018; Bos, 2021). This “sense of presence” makes users feel as if the virtual environment being presented to them is "real " and they are a part of it.

As a tool for environmental education, VR encourages experiential learning where users can interact with simulated environments to gain a deeper understanding of environmental issues and human impact on sustainability (Cho & Park, 2023). In recent years, VR has been increasingly recognized as a powerful educational tool that allows people to experience environments and perspectives they would otherwise never encounter (See also Bos, 2021). When applied to social research, VR storytelling can bridge the gap between remote or marginalized communities and wider audiences, promoting empathy, understanding and critical awareness. This study examines the potential of virtual reality technology to explore how it can be applied as an innovative method in environmental education, especially to address complex socio-environmental issues.

At the intersection of environmental education and social advocacy, this research focuses on waste picker communities in São Paulo, Brazil. Waste pickers, who play a crucial role in recycling and promoting urban sustainability, often work in hazardous conditions and face deep-rooted public stigma (Marques et al., 2021; Velis et al., 2012; Porras Bulla et al., 2021; Binion and Gutberlet, 2012). Despite their vital contribution to environmental management, they are marginalized and excluded from formal waste management systems (Gutberlet et al, 2020; Marello and Helwege, 2018). However, over the past two decades, the national and international waste picker movements have gained more momentum and significant advances have been achieved in countries like Brazil. Yet, they still suffer significantly from stigma on the ground, in the streets, in their everyday life. they still deserve greater attention than they have received to date, and, like every citizen on this

planet, they have a right to live with dignity. Therefore, there is still a need to raise critical awareness regarding their work conditions amongst the public.

By merging community-based research with virtual reality storytelling, this project aims to challenge this stigma and raise public environmental awareness of waste generation and the important but often overlooked contribution of waste pickers to urban sustainability and to maintaining environmental health.

Brazil was chosen as a case study for this project because of its long history of informal recycling and the significant progress it has made in integrating waste pickers in the waste management system. According to Gutberlet (2020), it appears that Brazil is the first nation to officially recognize the occupation "waste picker" after the Ministry of Labour and Employment established the professional category "catador," which translates to "collector of recyclable materials," in the country's official classification of occupations in 2002. São Paulo, in particular, represents a dynamic urban environment where recyclers are essential to the city's sustainability efforts. But despite these contributions, their work is largely invisible, undervalued, and stigmatized (Wilson et al., 2006; Gutberlet & Jayme, 2010; Gutberlet et al., 2021).

4-2- Literature Review

4-2-1- Critical Environmental Education

Critical environmental education is crucial for developing an integrated understanding of the environment, mobilizing social practices, and strengthening critical awareness and participation in environmental preservation actions (Aguiar, 2023). Paulo Freire’s (1996) concept of "problem-posing education" is foundational in this regard. Freire advocated an educational approach that encourages people to engage with the real world in a critical way and recognize their ability to change it (Sterling, 2001). In the context of environmental education, this approach helps learners explore the interplay of environmental and social issues, developing a critical awareness that promotes sustainable development and social justice (Sterling, 2001).

Freire's approach strongly resonates with current environmental education paradigms. Korsant (2024) states that the tension between imposing universal environmental values and promoting a “pluriversal” education could empower local

knowledge systems and practices. In line with Freirean pedagogy, this approach encourages learners to actively deconstruct dominant environmental narratives and contribute to justice-oriented, sustainable solutions that incorporate socio-environmental justice and marginalized people's lived experiences (Korsant, 2024).

On the other hand, regarding Freire (1996) and Gomez and Jones's (2010) work, critical environmental education can take positions that call for participation and engagement between scholars as active agents and a community. Through this mutual collaboration and interaction between the researcher and the target community, knowledge can be co-created or regenerated. Intervention research, in this context, plays a crucial role in advancing *knowledge democracy* by fostering inclusive, participatory processes that democratize the creation and dissemination of knowledge (Fraser & Galinsky, 2010).

Co-production of knowledge involves the active participation of different parties, such as researchers, policymakers, and community members. In other words, "co-production" model invites open collaboration across society, experts, and policymakers to negotiate priorities, responsibilities and actions for addressing complex environmental and social challenges (Hulme, 2009). As Gutberlet et al. (2017) explain co-production of knowledge and community learning offer practical and effective answers to significant social and environmental issues. In this sense, knowledge is not solely formed by experts, government agents and other groups seeking or sharing knowledge (community groups, interest groups, etc.), but rather it is constructed based on the mutual involvement of researchers and governments with those who are affected by the research. Thus, by incorporating a variety of voices and viewpoints, intervention research enhances knowledge democracy by shifting from hierarchical knowledge-creation structures to more equitable, community-driven approaches (Fraser & Galinsky, 2010).

4-2-2- VR Storytelling

Virtual reality storytelling is considered one of the most effective methods for raising awareness and fostering empathy (Schutte & Stilinović, 2017; Shin, 2018; Christofi et al., 2022). In fact, VR Storytelling can convey a narrative in a way that stimulates emotions that can motivate action. This goal can be enabled through the potential of VR to provide support for highly complicated stories in which the "line between reality and imagination is blurred" (Shin, 2018, p.65). Put simply, as Shin (2018) refers "users are dropped right into a scene or

‘virtually recreated scenario’ as if they were part of the story” (p.65). Through this experience, viewers may get closer to the world of other people and get better insights into the feelings of others. In virtual reality environments, users may have intense empathy with another person's feelings or position by “being in the same space, close to that character” (Shin, 2018, p. 66). Therefore, immersing oneself in VR can increase one’ s awareness and sense of empathy in a more realistic way (Shin, 2018).

Moreover, using Virtual Reality for storytelling in a 360-degree environment necessitates “medium-specific, user-focused, engagement with time and place” (Dooley, 2017, p.161). More precisely, narratives usually occur in real-time and in a certain place, whether they be actual or fictional. The VR viewer is "present" as an active agent who interacts with “the unfolding narrative” instead of passively watching traditional media like movies or television (Dooley, 2017).

Research has shown that immersive VR environments can evoke strong emotional responses, enabling users to feel a sense of connection with the characters and situations presented (Shin, 2018; Bos, 2021; Osborne & Jones, 2022; Chen et al., 2021). In the case of waste pickers, virtual reality storytelling can help educate the public about waste pickers' contributions to the environment and the social injustices they encounter.

To elaborate more, research on VR storytelling reflects on its potential to raise awareness, reduce stigma and promote empathy around a range of social and environmental issues, particularly in studies on refugees, migrants, and minority groups (Chen et al., 2021; Gorin, 2022; Gindi, 2018; Bystrom & Mosse, 2020; Schlembach & Clewer, 2021). Studies by Gorin (2022) and Gindi (2018), for instance, look at the use of virtual reality (VR) in humanitarian contexts, where users can feel the challenges of displaced people through virtual tours of refugee camps like Za'atari, in Jordan. In addition, Chen et al. (2021) show how VR might disrupt biases and possibly decrease prejudice, by enabling viewers to experience life from the viewpoint of people of color. According to studies, virtual reality (VR) not only helps users perceive social and environmental issues better, but it also encourages a change in perspective that leads to increased empathy and critical awareness (Christofi et al., 2022).

However, the literature also raises ethical considerations, particularly when complex issues are portrayed through virtual reality. The "empathy machine" effect of virtual reality is critically examined by Bystrom and Mosse (2020) and Schlembach and Clewer (2021), who

highlight that although VR can foster empathy, it may also take advantage of emotional reactions without fostering true and deep understanding. It can be said that there is a risk of oversimplifying complex issues and short-term empathy. Thus, this can lead to producing a voyeuristic, detached experience and superficial engagement in which viewers empathize without being inspired to take meaningful action.

4-2-3- Environmental Stewards: Waste Pickers

Waste pickers are part of the informal waste management system (Katusiimeh et al.,2013). They unofficially collect, sort and sell recyclable materials from waste discarded by households and industries. They work in different settings depending on the local context and level of organization, as autonomous workers in the streets and at dumping sites or as a collective in waste picker organizations such as cooperatives or associations (Gutberlet et al., 2021). Despite their marginal status, they are crucial for all phases of integrated solid waste management (ISWM), which include removing waste from public spaces and recycling materials such as paper, cardboard, plastics, metals and glass (Coletto & Bisschop, 2017).

Waste pickers greatly contribute to the circular economy, an economic system that prioritizes reducing, reusing, and recycling materials for environmental, economic, and social benefits (Morais et al., 2022). It can be said that they are truly "environmental agents" (Gutberlet et al., 2020) who reduce waste in landfills and prevent illegal dumping and promote resource recovery. Their work helps close the loop in the circular economy by turning waste into valuable resources and increasing urban sustainability (Morais et al., 2022).

However, as informal workers, waste pickers face many challenges. As Marello and Helwege (2018) note, informal “waste pickers are largely denied access to social benefits such as health insurance, pensions, and unemployment insurance, physical debilitation, lack of education to accurately assess toxic risks, and income” (p.111). Furthermore, waste pickers, as informal sector workers, are perceived as criminals, homeless, unemployed people who work in usually unsafe and unsanitary conditions (Wilson et al., 2006; Tremblay, 2013). According to Velis et al., “waste pickers are seen as victims, who are subject to social stigma and mainly belong to socially vulnerable groups, such as migrants, women, children, the elderly, the disabled, and the unemployed” (2012, p.43).

This stigma makes waste pickers' livelihoods very arduous. The fact is that the public stigma attached to waste picking and waste pickers really affects the importance of their job in that their job is undervalued or even not valued by others. This perspective can lead to discrimination against waste pickers and their exclusion from policies in solid waste management system, perpetuating cycles of marginalization (Tremblay, 2013; Velis et al., 2012).

4-3- Methodology

4-3-1- Integration of Community-Based Research and VR Storytelling

This research integrates virtual reality (VR) storytelling with community-based research (CBR) to create a common ground that allows waste pickers to share their stories directly from their community. Generally, CBR, as a collaborative research methodology, aims to address issues that are important to the community through the creation of shared knowledge (Israel et al., 1998; Wallerstein & Duran, 2006). As Gutberlet et al. mention, in CBR, community members "provide input, information and insights to the research, however they do not necessarily participate in the research; nor would they become co-leaders in the research process." (2022, p.6).

By combining these approaches and methods (CBR and VR storytelling), the study ensures that the narrative is created *with* the waste pickers, allowing them to actively shape how their experiences are represented, rather than having their stories told *for* them. This collaborative approach enhances building trust-relationship with the community during the research process. The CBR method ensures that the waste pickers' voices and lived experiences are truly narrated in the project, while the VR storytelling method helps convey these narratives by immersing the audience in the workplace of the waste pickers and fostering their emotional engagement.

4-3-2- Case Study

The case study site with the cooperative involved was chosen based on feasibility and convenience for the researcher. It was essential to ensure that the cooperative was willing and able to participate in this project. The cooperative selected for this study is *Coopervivabem*, located in São Paulo, Brazil. This cooperative was selected not only based

on experience and willingness to participate in the research process, but also because of the long-term relations that already existed between the supervisor, Dr. Jutta Gutberlet, and this cooperative, based on previous research.

4-3-3- Ethics and Community Engagement

It can be said that this research embraces a decolonial approach to storytelling, prioritizing the community's voice and agency. To elaborate more, engaging with the Coopervivabem waste pickers' cooperative involved careful communication to ensure transparency and respect for the community's agency. The foundation of this collaboration was built on a trust relationship between the researcher and the community. Through the established research program of Dr. Gutberlet, who had years of experience working with waste pickers in São Paulo, and the facilitator team, known and trusted within the community, the researcher was welcomed into the community.

As Walsh (2024) emphasizes, ethical storytelling seems to be about "… not actively thinking about how to use your creative process, but rather accepting the layers of knowing that are often hidden within the lived experience of the people that you are encountering" (p. 12). By acknowledging my positionality as an outsider, I sought to move beyond the researcher-subject dichotomy. Drawing from Walsh's (2024) book, this approach involved actively reflecting on my preconceptions to ensure that the process centered the perspectives and lived realities of the waste pickers, rather than my interpretation of their experiences.

Before visiting the cooperative, the waste pickers were informed about the project through their president and the facilitator team. The first visit served as an introductory meeting, where I, as the researcher, along with the facilitator team, provided a detailed explanation of the research objectives and expected outcomes. In this session, we also discussed the use of video recordings and obtained informed consent from participants. Only those who consented to being recorded were included in the video footage, and no videos nor photos were taken of individuals who did not provide consent. Besides, a poster was prepared, explaining the project and was pinpointed to the board of the common lunch place in the cooperative. Interested waste pickers were recruited through the facilitator team for interviews. Subsequent visits involved video documentation of the waste pickers at work, capturing their daily activities, as well as conducting individual interviews. This process

ensured that the community's stories were documented in a way that “their voices and perspectives are accurately and respectfully represented” (Walsh, 2024, p.127).

It also should be said that since this part of the research involved video recording, our presence could potentially disrupt their routine or make them uncomfortable. As Walsh (2024) emphasizes, filmmakers and researchers must critically engage with the implications of their presence, acknowledging the potential for disruption and discomfort. To minimize such effects, we worked closely with the waste picker’s community to schedule visits and data collection at times that were most convenient for them. Also, a compensation was provided to the leader of the cooperative as a token of appreciation for their time and efforts, which were instrumental in supporting the cooperative.

4-3-4- Data Collection

During two weeks of engaged community fieldwork in the *Coopervivabem recycling cooperative* (January 2024), qualitative methods were applied. My visit for gathering visual data, in January 2024, includes participant observation, workplace observation, semi-structured, in-depth, and informal interviews. This fieldwork process was facilitated by two master’s students from the University of São Paulo, known and trusted within the community, who acted as local facilitators. These interviews provided personal stories that were later integrated into the VR simulation. In addition to personal narratives, visual data were collected, including photographs and 360-degree videos capturing the work environment of the waste pickers. This combination of qualitative data (interviews and visual documentation) forms the core of the primary data used in this research.

4-3-5- Creation of VR Simulation

The core methodology for data analysis in this research is VR storytelling. The goal of VR storytelling is to immerse users in a narrative that can evoke emotion and stimulate action or behavioural change. This method was chosen to convey the personal and environmental significance of waste pickers' work in a way that engages users deeply, leveraging the immersive potential of VR (Shin, 2018).

The first phase of the analysis involved crafting the narrative of the waste pickers’ workplace and daily tasks as well as the semi-structured interviews. These narratives were paired with visual data, 360-degree photos and videos, to create a realistic representation of

the environment and the people within it. The second phase focused on the technical aspects of VR simulation. This phase involved decisions about what technological devices and content can be used to provide a sense of "immersion," "presence," and "engagement" within the VR experience (Bos, 2021).

Accordingly, we decided that an immersive experience, representing the *real situation* of waste pickers would convey a more immersive and deeper sense of “presence” and “being in someone else’s situation” compared to computer-generated models and designs. To do so, we applied 360-degree videos rather than static images, aiming to enhance users’ ability to not only observe the waste pickers while working but also hear the sounds of the waste pickers’ work environment, and feel as if they were truly present in that environment. To capture and present the 360-degree videos, a GoPro Max camera was used. The raw footage was edited through different graphical software, such as Adobe Premiere and Adobe Photoshop, through a graphically multi-layered edit process, ensuring the final product was not only polished but also compatible with VR systems. The Meta Quest 3 headset was employed to deliver the VR experience.

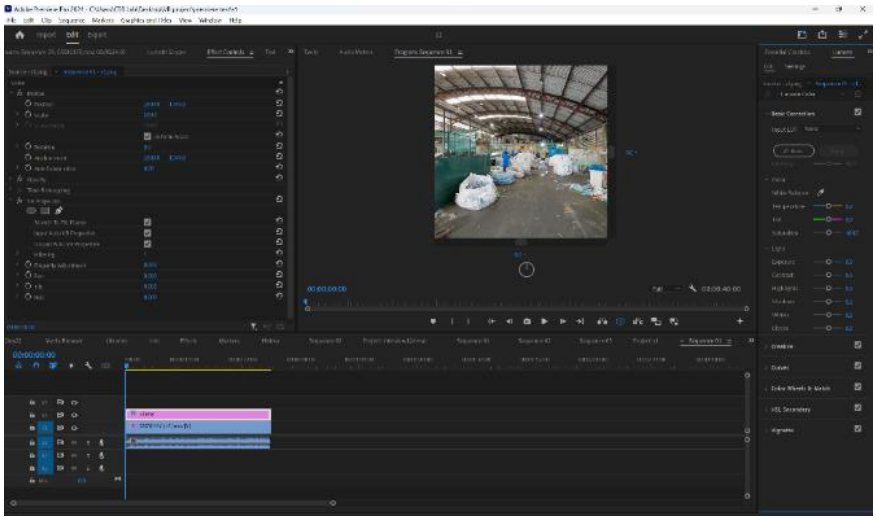

Figure 2: View of Adobe Premiere Pro software during the post-production process.

4-4- Result

4-4-1- VR simulation

The VR simulation created for this project illustrates the actual workplace of waste pickers, providing an immersive experience that captures both their physical work environment and their personal stories. The simulation is structured into two different parts,

including the story of their workplace environment and the personal stories of waste pickers which each intended to highlight different aspects of the daily reality of waste pickers.

The story of the workplace environment

The first part of the VR simulation focuses on the story of the waste pickers' workplace. This section consists of three main sequences that provide a comprehensive overview of the work environment. The VR simulation begins at the entrance of the recycling cooperative, where audiences are introduced to the initial stage within the cooperative. From there, they are transported to a focal point in the cooperative, where the waste pickers are sorting and separating recyclable materials such as plastics, metals, bottles, and cardboard into designated bags. This part of the simulation offers users a comprehensive understanding of the waste pickers' workflow, showing the scope and complexity of their tasks.

Figure 3: View of a 360-degree video, Coopervivabem Recycling Cooperative

Personal Stories of Waste Pickers

The second part is about personal narratives, where different waste pickers tell their individual stories. These stories provide insight into their daily experiences at work, detailing the challenges they face and the routines they follow during a typical shift. Additionally, they

discuss how they became involved in waste picking and reflect on the public's perception of their work. This storytelling aspect combined with the camera setup allows users to connect with the workers on a personal level, as if they were standing or sitting right in front of them and listening to their stories in an intimate setting.

Figure 4: View of a 360-degree video, the waste pickers narrating their story

Overall, when participants put on the VR headset, they go through three different cooperative spots, experiencing an immersive 360-degree view of the recycling facility. They then joined two waste pickers to hear their stories in a face-to-face interaction. In the process of capturing videos, the camera angles, shot composition, interview setup and framing all aimed to foster a sense of closeness and face-to-face dialogue, allowing users to experience the workplace from the viewpoint of the waste pickers.

4-4-2- User's feedback after experiencing VR

The VR simulation was showcased at three events. The first was a four-day exhibition held at the McPherson Library, University of Victoria, which attracted both faculty and students. Approximately 45 individuals experienced the VR simulation. To collect feedback, participants were invited to complete a QR-coded survey. Out of all attendees, 11 individuals provided feedback through the survey. To analyze the received feedback, "sentiment analysis" was applied, categorizing the responses into positive, neutral, or negative sentiments (Cambria et al., 2017). Some of the participants were already familiar with the concept of Virtual Reality (VR). Regarding their perceptions of waste pickers before the simulation, the feedback was mixed (uneducated on the topic, already viewed waste pickers positively, and had a negative view). After the experience, most of the participants felt a positive change in their perspective toward waste pickers, viewing their role more positively. In this research, positive, neutral, or negative sentiments are categorized as following:

- **Positive Sentiment:** Positive opinions or emotional responses that indicate engagement, appreciation, or positive change in perception about the waste pickers or the VR experience. Most users expressed a positive change in their perception of waste pickers after the VR experience.

"I think it gave me a better idea of what waste pickers do. I think this does give a better perspective of what people do rather than hearing about it."

"Yes! I am considering how much waste we produce (each person)"

"After this experience, I thought that individuals working jobs that many avoid or look down on, and as a result face prejudice, are the most significant helpers of today and the future of this world."

"This experience changed my perspective. Just hearing and seeing these people talk about their life brings insight into why they do what they do. You see them as people no different than yourself."

Additionally, most of the users found the immersive nature of VR engaging and highlighted specific positive experiences, such as the emotional impact of hearing personal stories and the immersive 360-degree view in the VR environment.

"I think standing there, turning 360 degrees was a very cool thing to better understand the situation that waste pickers put themselves in."

"Listening to their stories were inspiring to me. Despite all odds, they are resilient!"

They also found VR more engaging compared to other tools like viewing pictures or videos in a learning process.

"Since it is an uncommon and more immersive experience, I definitely found the process of learning more captivating."'

"It makes me feel I stand there. Far more impressive than pictures and videos"

"Compared to a normal video experience, this VR experience made me part of this distant world by making me experience being surrounded by many waste bags."

"When the woman stared at me, I felt active in the space"

- **Neutral Sentiment**: Refers to the lack of any strong emotional reactions or feelings, often expressed as factual, objective or unemotional comments that indicate the need for improvement but are not critical, like "*adding interactive elements*", or "*A walk-through parts would have been interesting*" is considered neutral.

- **Negative Sentiment**: This category includes criticism or negative feedback, particularly about the VR simulation, waste pickers and their work. Interestingly, no comments reflected strong negative sentiment. However, as mentioned, a few users provided some suggestions, such as reducing the duration or enhancing interactivity (e.g., "*The testimonials could be shorter*").

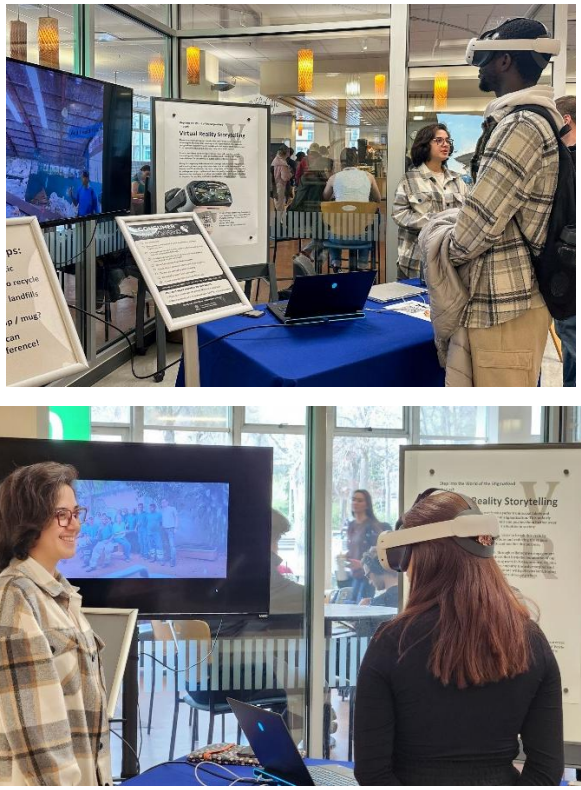

Figure 5: Showcasing the VR simulation at McPherson Library, University of Victoria.

The second event took place in Science Rendezvous 2024 at Camosun College in Victoria, Canada, and children of all ages with their parents participated. Approximately 30 children experienced the VR simulation. Unlike the UVic exhibition, no written feedback was collected at this event. Instead, considering the younger audiences, feedback was gathered verbally from children immediately after the VR experience.

The verbal responses indicated that attendees generally had less prior knowledge of waste pickers and their environmental role compared to the UVic participants at the UVic exhibition. The VR experience was not only enjoyable for them, but also it opened up the window to spark questions, such as what happens to disposed waste, what is their environmental responsibility, and who are the waste pickers. This experience was an endeavor to give them a prompt, encouraging them to reflect on this matter that waste does

not simply disappear once being thrown in the trash bins. Instead, there are people who carefully sort and manage waste and make an important contribution to making the environment more sustainable.

Figure 6: Showcasing the VR simulation at Science Rendezvous 2024, Victoria, Canada

The third event was at a middle school in Victoria, BC, Canada, focusing on zero waste. Approximately 20 middle school students participated in this session, which included three main activities: experiencing the VR simulation, engaging in group discussions, and participatory mapping. Based on the comments, while students mentioned liking mapping and group discussions, the VR experience appears to have been their favorite among the activities. Comments such as "My favorite activity was the VR because it gives you a chance to feel it yourself rather than getting showed things without any room to explore".

Several students noted it was their first time using the technology, making it an impactful learning method. As two students commented, "*I liked the VR because it was a unique experience to see people work hard around the world"; "I liked VR the most, partly because I have never used one until then, and because it's a cool way to show kids instead of sitting for an hour"*. Others highlighted how the simulation provided a visual representation of waste issues, "*I got to experience what waste pickers actually do," and "It helped me properly envision what waste looks like…."*

Figure 7: Showcasing the VR simulation at a middle school in Victoria, BC, Canada

4-5- Discussion

The findings affirm existing research on VR's ability to foster empathy and critical awareness (Shin, 2018; Schutte & Stilinović, 2017; Korsant, 2024). The immersive experience allowed participants to connect emotionally with waste pickers' narratives, supporting Freire's (1996) concept of problem-posing education. Overall, the feedback collected from the three events was overwhelmingly positive, highlighting the method's effectiveness in fostering empathy, enhancing engagement, and raising awareness about waste pickers. However, the project also highlights critical gaps and challenges, including superficial engagement and short-term empathy (Bystrom & Mosse, 2020; Schlembach & Clewer, 2021), as well as the risk of oversimplifying complex issues (Gorin, 2022). Due to the lack of long-term feedback in this research, the sustained impact of VR storytelling on audience attitudes and behaviors remains unclear. Future research is needed to explore these long-term effects.

The study offers several innovations, like the innovative integration of Virtual Reality (VR) storytelling with Community-Based Research (CBR) to raise critical awareness. It also adopts a decolonial approach to storytelling (Walsh, 2023; Finlay, 2002). Following Walsh (2023), this project prioritized ethical storytelling by enabling waste pickers to speak in their own voices, ensuring authenticity and respect for their agency. By centering their lived experiences, the research challenges traditional power dynamics in knowledge production and highlights the importance of co-production models in fostering community-driven change (Gutberlet et al., 2017; Israel et al., 1998). There were, of course, some limitations in both the technical aspects and the community engagement components of the research

process. These included challenges in deciding the degree of immersion, which depended closely on the technical tools and was influenced by financial support. Additional challenges were in the process of filmmaking, such as adverse weather conditions, scheduling with the community, and the ongoing nature of obtaining consent. Participants were regularly consulted and had the option to withdraw their consent at any point.

Taking everything into consideration, while there are criticisms of the VR storytelling method—particularly the argument that the empathy it generates may not last long enough to lead to meaningful social change—the findings of this research highlight its undeniable power to immerse audiences in the realities of others. By placing users in someone else's situation as though they are truly present, VR storytelling effectively captures attention, even if only for the short term. It serves as a powerful starting point and opens up new windows in raising awareness and environmental education. When people experience something themselves and observe it with their own eyes, knowing it is real, it creates a fundamentally different impact compared to simply hearing about social and environmental issues or passively watching them as an outsider. Hence, VR storytelling is particularly powerful in educational settings, with the opportunity to follow-up and deepen the knowledge on the topic under focus.

4-6- Conclusion

"You see them as people no different than yourself!" – A participant at the Making Our Waste Visible exhibition.

These are the words of a participant after experiencing our Virtual Reality (VR) simulation, immersing them in the workplace of the waste pickers. In light of such comment, we can accentuate two major points in my research: first, the very sad concern of stigmatization to which waste pickers are just one subjugated group of people, and second, the promising strength of the method being used in providing this transformative experience for the users.

Through VR experience, this research has proven that users can develop a sense of connection with the stories and situations that are being presented. Empowered by the effect of real-time narrations, this simulation of situations and stories can bring the experiences so close to what otherwise remains unseen, unheard, and unfelt; in inaccessible distances.

Briefly, in this research I coupled the increasingly recognized and appreciated potential of VR in educational spheres, with the very idea of the “problem-posing education”, and tried to develop a tool that can bring marginalized people closer to their societies. In doing so, the research proudly worked with a community of waste pickers in São Paulo, Brazil who play a crucial societal role, specifically in such times of mass consumption and environmental degradation. This is an example of actively working with waste pickers who without doubt prefigure environmental stewards. Thus, by integrating VR storytelling with community-based research the research developed an innovative form of sharing about their everyday contributions and challenges.

Finally, the outcome has enabled diverse audiences to step into the VR world of waste pickers. The result went beyond expectations since overall, most participants evaluated the VR experience as positively impactful and as a viable problem-based educational learning tool. Based on this experience, the research reiterates the potential of VR storytelling in increasing awareness and environmental education. This tool allows environmental education to go beyond traditional learning processes and the method provides a rich, hands-on, and immersive platform that inspires reflection and empathy.

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Chapter Five: Conclusion

This research demonstrates that Virtual Reality (VR) storytelling can serve as a powerful tool for social inclusion, environmental education, and stigma reduction. by integrating VR storytelling with community-based research the research developed an innovative form of knowledge democracy to challenge dominant narratives and make the invisible realities of waste pickers visible to the public. Building upon the approaches of "problem-posing" and "conscientization" (Freire, 1996; Lawton, 2022), knowledge democracy (Tandon et al., 2016), critical environmental education (Aguiar, 2023; Sterling, 2001; Korsant, 2024), the VR experience can encourage users to reflect critically on social and environmental issues.

To test the impact of the VR storytelling intervention, the simulation was showcased at three different venues in Canada, including an exhibition at the University of Victoria and two other community education events. During these venues, participants were invited to share their feedback both verbally and written. After the VR experience, most of the participants felt a positive change in their perspective toward waste pickers, viewing their role more positively, highlighting the potential of VR storytelling to foster deeper emotional connections with marginalized communities.

Beyond educating audiences and raising their awareness, this research reinforced the importance of a decolonial approach to storytelling, prioritizing the community's voice and agency. By actively involving waste pickers in the creation of the VR narrative, the study ensured that the narrative is created with the waste pickers, allowing them to actively shape how their experiences are represented, rather than having their stories told for them. This participatory approach challenged traditional researcher-subject dynamics, empowering waste pickers as co-creators of knowledge rather than passive subjects of study.

Taking everything into consideration, this study emphasizes how VR storytelling could transform social and environmental education. VR storytelling bridges the empathy gap by immersing viewers in the daily activities of waste pickers, bringing social and environmental issues to life and encouraging audiences to reflect on their own responsibilities. When integrated with community-based research (CBR) principles, VR storytelling can act as a catalyst for greater social inclusion, fostering a more equitable society where waste pickers are recognized for their invaluable contributions.

5-1- Implications for Theory and Praxis

This study contributes to theory in two ways. First, it critically reviews the conditions that lead to the stigmatization and social exclusion of waste pickers. Second, it bridges decolonial approaches (such as knowledge democracy, critical environmental education, and conscientization) with community-based research (CBR) and VR storytelling, creating an integrated framework for increasing critical awareness.

On a practical level, the research effectively integrates CBR and VR storytelling in a real-world setting, working directly with waste pickers at Coopervivabem in São Paulo, Brazil. This innovative method ensures that waste pickers' voices and lived experiences are authentically represented. VR storytelling enhances the impact of these narratives by immersing audiences in the waste pickers' workplace and fostering emotional engagement. The findings demonstrate VR's potential to raise public awareness, challenge stereotypes, and build empathy toward waste pickers.

5-2- Limitations and Suggestions for Future Studies

This study has several limitations, which open avenues for further research. First, although VR storytelling has demonstrated a positive impact on increasing empathy and awareness, its long-term effects on people's attitudes remain uncertain. Future research should assess whether VR experiences lead to sustained changes in social attitudes and behavioral transformations. Second, limited access to VR technology can be a barrier, particularly in regions where these technologies are not widely available. Third, this study focused on one waste pickers' community in São Paulo, Brazil. Future research could conduct comparative studies across different global contexts.

Lastly, while this study used VR storytelling to represent waste pickers' real-life experiences, VR technology offers many more opportunities for critical awareness and education. Future research could incorporate gamification and game-based learning to engage children and students, allowing them to experience the role of waste pickers in urban sustainability. This approach could foster greater environmental responsibility among younger generations and broaden the educational applications of VR in environmental awareness.

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Appendix

- **Link to the VR simulation:**

Link to the complete VR simulation (the story of the workplace and waste pickers):
https://drive.google.com/drive/folders/1FOoWfENWZbRrh-0RmMrdpBh_hgYrA4-p?usp=sharing

YouTube (The story of the workplace):
https://youtu.be/FTdrA2f_Kig
https://youtu.be/3F0tEFIXzN8
https://youtu.be/jPO8JSxXIhM

- **Ethics Approval:**

PANEL ON RESEARCH ETHICS
Navigating the ethics of human research

TCPS 2: CORE 2022

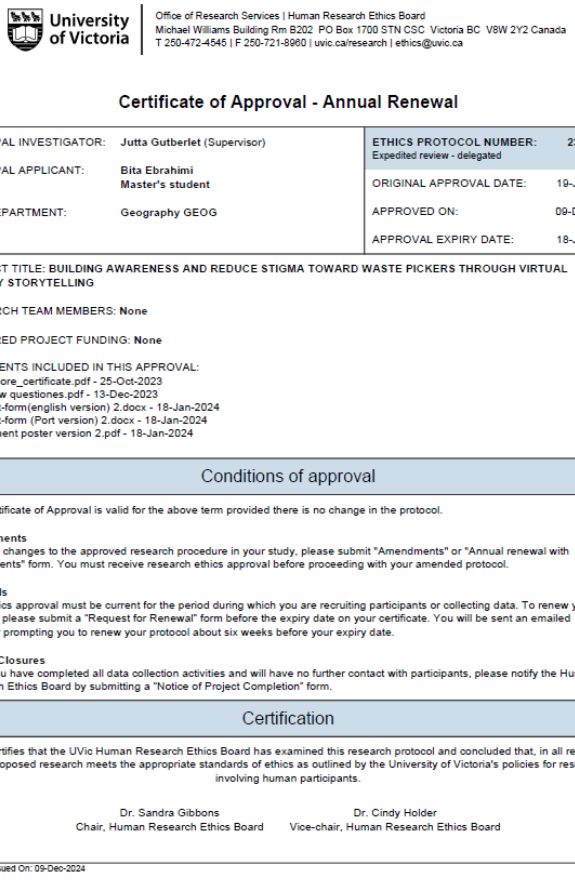
Certificate of Completion

This document certifies that

Bita Ebrahimi

successfully completed the Course on Research Ethics based on the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2: CORE 2022)

Certificate # 0000950569 **8 October, 2023**



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Certificate of Approval - Annual Renewal

PRINCIPAL INVESTIGATOR:	**Jutta Gutberlet** (Supervisor)	**ETHICS PROTOCOL NUMBER:** Expedited review - delegated	**23-0530**
PRINCIPAL APPLICANT:	**Bita Ebrahimi** **Master's student**	ORIGINAL APPROVAL DATE:	19-Jan-2024
UVIC DEPARTMENT:	**Geography GEOG**	APPROVED ON:	09-Dec-2024
		APPROVAL EXPIRY DATE:	18-Jan-2026

PROJECT TITLE: **BUILDING AWARENESS AND REDUCE STIGMA TOWARD WASTE PICKERS THROUGH VIRTUAL REALITY STORYTELLING**

RESEARCH TEAM MEMBERS: **None**

DECLARED PROJECT FUNDING: **None**

DOCUMENTS INCLUDED IN THIS APPROVAL:
tcps2_core_certificate.pdf - 25-Oct-2023
Interview questiones.pdf - 13-Dec-2023
consent-form(english version) 2.docx - 18-Jan-2024
consent-form (Port version) 2.docx - 18-Jan-2024
recruitment poster version 2.pdf - 18-Jan-2024

Conditions of approval

This Certificate of Approval is valid for the above term provided there is no change in the protocol.

Amendments
To make changes to the approved research procedure in your study, please submit "Amendments" or "Annual renewal with amendments" form. You must receive research ethics approval before proceeding with your amended protocol.

Renewals
Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.

Project Closures
When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria's policies for research involving human participants.

Dr. Sandra Gibbons
Chair, Human Research Ethics Board

Dr. Cindy Holder
Vice-chair, Human Research Ethics Board

Certificate Issued On: 09-Dec-2024