

Meetings in the Metaverse: Exploring Online Meeting Spaces through Meaningful Interactions in Gather.Town

by

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Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contributions

The project started as a collaboration with the industry research partner Nathan Bowman from Gather.Town. We tested their platform and provided insights on [UX](#) design problems that could be further improved. In return, Gather.Town offered us their limited [API](#) access, assets, and space moderation in which we could fully customize the virtual environment in Gather.Town. From there, I was able to formulate a research question and hypotheses through a pilot study with members of the Games Institute. With the agreement of Dr. Lennart E. Nacke and Dr. Mark Hancock, I was then able to move forward and gain approval from the University of Waterloo Research Board of Ethics. At this time, my co-researchers Dr. Stu Hallifax, Arielle Grinberg, and Derrick Wang joined the research team.

The completed studies presented in my thesis in the subsequent chapters are derived from the collaboration between my co-researchers and me. The following statements provide indication for the amount of their involvement.

1. For the methodology in Chapter 4, **I scheduled, recruited, conducted, and led all 18 sessions of the studies.** Of the 18 sessions, there were a total of 67 participants, and 65 semi-structured interviews. **I, Joseph Trieu Han Tu conducted 25 semi-structured interviews,** Dr. Stu Hallifax conducted 19 semi-structure interviews, Derrick Wang conducted 12 semi-structure interviews and Arielle Grinberg conducted 9 semi-structured interviews.
2. For the quantitative data collection in Chapter 5, I created and collected this data through the University of Waterloo Qualtrics system with the help of my co-researchers. In respective, the researcher who conducted the semi-structure interviews made sure the Qualtrics survey was completed.
3. For the qualitative results in Chapter 5, **I conducted and derived the initial reflective codebooks for the thematic analysis.** Themes that derived from the thematic analysis were discussed with the research team to ensure there is no singular bias as thematic analysis is subjective.
4. In the appendix, I included relevant projects during my Masters that is not relevant to my thesis. This was an Escape Board Game Project in which was suppose to be for my thesis, however COVID-19 took a turn, where in-person studies were not feasible. This was a collaborative student design project with Ekaterina Durmanova in which was accepted to the conference at CHI Play 2020. As for the Mitacs Canada project, I was the lead researcher for the collaboration with Wiggles 3D .

Abstract

Online meetings and communication spaces have become a part of many people's work during the global COVID-19 pandemic. While we rely on computer-mediated communication (CMC) daily, we need to be engaged to be productive in and enthusiastic about these online conversations. Only sparse research exists about what factors contribute to engagement to better enhance communication. Engagement can occur in different communication modalities in online meetings aside from text chat. For the purposes of my thesis work, I investigated verbal communication (audio) and nonverbal communication (video) in online meetings, compared to emerging forms of online meetings with graphical image representations (avatar). This research addresses a research gap on understanding if engagement differs between communication modalities. Understanding whether engagement differs between each modality can help us determine what to focus on when designing online communication tools. In my thesis, I used a mixed-methods approach to study the engagement and interactions in online communication tools. I investigated whether the differences in online meetings using audio only, video only, avatar with video, and avatar without video play an important role in terms of engagement, interaction, and presence. I conducted a power analysis to determine the number of participants required for this study, collected the data online, and analyzed the quantitative and qualitative data I gathered. My findings show seven themes that I constructed using thematic analysis. These themes provide answers to my research questions together with the statistical data on user engagement and social presence. Finally, I conclude my thesis with design guidelines for future iterations of CMC tools such as the emerging Metaverse platform.

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Dedication

For my parents, who believed in me the most. We never had much to begin with, but rather than using words to say it, I will show you it.

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Chapter 1

Introduction

The global pandemic gave rise to online meeting tools and made meeting online the “new normal” for many people. However, many online interactions are lacking engagement. People feel limited in their interactions compared to in-person meetings. This presents a significant challenge to human-computer interaction (**HCI**) researchers because we do not understand well what makes online meetings engaging. Thus, my thesis contributes to research on how people engage with one another in computer-mediated communication (**CMC**) tools such as GatherTown¹. **CMC** tools range from email, one-to-one or one-to-many tools, video conferencing, computer-communication environments, and other evolving forms of online communication [90]. **CMC** tools enable either synchronous (existing at the same time) or asynchronous (existing not at the same time) communication.

My thesis work strictly looks at online **synchronous CMC** tools. I contribute to **HCI** (and also games user research (**GUR**)) by studying online meeting engagement, avatar use, interactive spaces, and the problems that occur in **CMC** tools, such as the “metaverse” also known as virtual environments (**VEs**).

I will start this chapter by presenting my motivation for this research and then proceeding into the context and scope of the **HCI**, **CMC**, and **GUR** field. I will then discuss my research questions and how I answered these questions. In conclusion, I will list the contributions I have made following this approach and provide an outline for the remainder of the thesis. I will be using the terms **CMC** and online communication tools interchangeably along with the terms “remote” and “online.”

¹see [Gather.Town](#)

1.1 Motivation

A lot of our lives have moved online. With the global COVID-19 pandemic, many companies developed new or refined existing CMC tools. gisCMC tools are either synchronous, asynchronous, or a combination of both delivery modalities. In-person communication differs from remote communication, but in both environments we do synchronous communication. Thus, studying how synchronous communication works online is a timely endeavour. HCI researchers noted that social interaction online could be beneficial because it allows one to stay in contact with family and friends [85] despite physical distance. This is more important than ever during the global pandemic with lockdowns restricting travel and physical meetings.

Understanding users' engagement in virtual meeting environments (within a CMC setting) is an important addition to research areas in CMC and HCI [65]. Research with avatar and CMC tools has been explored in gaming via text-based communication only [13, 14]. However, research has shown that embodiment through avatars in VEs could perhaps improve how we feel in VEs if they are considered “an extension of our body” [88].

We need to examine novel interactions as the development of synchronous online communication tools continues to thrive. The purpose of my research is to explore if engagement changes between various communication modalities within the game-like CMC platform called *Gather.Town*. My study's goal is to understand what factors contribute to engagement using a mixed-methods approach gathering qualitative and quantitative data. I contribute this research study with the aspiration to improve the design of online meeting applications to become more engaging and to help designers create more positive user experiences in CMC settings.

1.2 Context and Scope

In chapter 2, I will discuss the current research that impacts this work on CMC tools concerning social presence, virtual environments, embodiment, and engagement. I use HCI design methodologies (e.g., pilot study, interviews, and statistical tests) to extract data to answer my research questions.

Past research explored the pros and cons of remote learning [73, 87] and the nature of engagement in the context of remote work [47, 108]. CMC tools are a way for us to share knowledge. For example, they can be used for collaboration [62, 72], teaching [37, 52],

interactive 3D presentations [38], online dating [106, 39], or just “casually talking” to one another. In a sense, CMC tools are considered to be like virtual environments (VE) [80, 19].

Literature on computer-mediated communication (CMC) focuses on social presence [80]. Garrison et al., for example, refer to social presence as the “ability of participants in a community of inquiry to protect their personal characteristics” in the community, thereby presenting themselves to other participants as “real people” [49]. Although both concepts revolve around the idea of people feeling like they are physically there, there is a lack of research examining the types of interactions that facilitate engagement within these virtual environments. Currently, synchronous online communication tools are limited in their interaction to “text, audio, or video” communication. Thus, I wanted to compare these tools to avatar-based online communication tools like Gather.Town that enable different interactions. While these tools are not meant to replace “in-person” meetings, there is an emphasis in HCI on replicating real environments virtually for communication.

1.3 Research Question

Within my thesis, I explored the following three main research questions:

RQ1: What are the benefits and drawbacks of using Audio-only (Condition A), Video-only (Condition B), Avatar-Video (Condition C) and Avatar-No-Video (Condition D) communication?

RQ2: Does *engagement* vary based on the *communication modality* (Audio-only (Condition A), Video-only (Condition B), Avatar-Video (Condition C) and Avatar-No-Video (Condition D))?

RQ2.1: What *factors create engagement* in online communication tools for people?

RQ3: How do people *interact* in synchronous communication tools within a virtual environment or space?

Hypotheses specifically for the user-engagement scale (UES) are:

H_0 : There is no difference in average scores in the UES. Engagement is the same across all communication modalities tested.

H_1 : The UES average scores are different across all conditions. There is a difference in engagement based on the communication modality tested.

1.4 Experimental Design

To explore my research questions and hypotheses, I conducted a mixed-methods study using qualitative interview data and quantitative questionnaire data. I focus on [CMC](#) tools, the problems that currently occur in [CMC](#) tools, and the user’s engagement level within a virtual environment across four conditions:

- **Audio-only** (*Condition A*): Participants in this condition are only allowed to speak and listen to their headset.
- **Video-only** (*Condition B*): Participants in this condition are only must have their webcams turned on, along with the ability of the audio condition.
- **Avatar-Video** (*Condition C*): Participants in this condition must have their webcams turned on, along with the ability of the audio condition; however, they have the ability to move the virtual environment with their avatar.
- **Avatar-No-Video** (*Condition D*): Participants in this condition are only allowed to speak and listen with their headset; however, they have the ability to move the virtual environment with their avatar.

I conducted a thematic analysis to gather themes that aligned within my research questions and used the User Engagement Scale ([UES](#)) to measure a user’s engagement level and my own modification of the Social Presence Scale ([SP](#)) to understand the social presence in the virtual environment ([VE](#)).

It is important to note that although the main focus of my related work should be within the [HCI](#) and [GUR](#) context for the virtual environment ([VE](#)), a portion of this literature work relies heavily upon the field of psychology as positive experiences are usually associated with “engagement, presence, and embodiment” which deals with one’s psychological state [[92](#), [68](#)]. This research does not examine the replication of in-person meetings. However, it explores the possibility of other platforms heading towards the “Metaverse” [[33](#)]. Metaverses are 3D virtual worlds that allow people to connect with others socially online.

1.5 Mixed Methods

In this study, I used mixed methods to answer my research questions. While a validated scale such as [UES](#) can determine whether there is an effect on engagement based on the

communication modality, I wanted to understand the nuances and provide granular insights into which aspects increase or decrease engagement based on the communication modality. Thus, qualitative data lets us understand nuanced problems or specific events that contribute to the increase or decrease in engagement.

While quantitative data might show no significant findings across conditions, a qualitative approach allows us to examine “why this happens” which could be more beneficial. Prior to running the study, I ran a pilot study to get a general understanding of the research space. I then proceeded to conduct a power analysis to consider how many participants were deemed appropriate for my study conditions. Afterwards, I computed statistical tests for the quantitative data and a thematic analysis on the interview data.

1.6 Contributions

This thesis contributes to [HCI](#), [GUR](#), and [CMC](#) communities. The main contributions of this work are (reported in-depth in [Chapter 6](#)):

- I further our understanding how engagement differs in each communication modality
- I provide use cases and design considerations based on each communication modality
- I develop a theory for smart zooming using eye tracking for screen sharing and collaboration
- I identify how proximity chat and engagement is perceived through the use of an avatar in a virtual environment.
- I outline the remaining problems in online communication tools

1.7 Outline

The thesis is organized into the following remaining chapters:

In *chapter 2*, I review the related literature relevant to my research. This includes a discussion of findings concerning embodiment, online communication, avatars, social presence, and engagement.

In *chapter 3*, I delineate why and how I used the communication platform Gather.Town for my research study. This includes the description of a remote pilot study with 11 participants, which explored the functionality of interaction, engagement, collaborative space creation, and avatar customization using three tasks.

Chapter 4 describes the methodology used in my research. I discuss how the research questions led to the pilot study hypotheses and how I conducted a power analysis to determine my sample size. I outline how the study was run, starting from the recruitment stage, the study procedure, how the tasks were conducted, the data collection, participants' information, and how the data was analyzed.

In *chapter 5*, I report a one-way ANOVA with post-hoc testing for quantitative data. I subsequently outline how I conducted a thematic analysis on the interview data and how I formulated the themes. This section includes participant quotes to support the created themes.

In *chapter 6*, I discuss and contextualize the findings from the thematic and statistical analyses. I address how these findings are relevant to [HCI](#), [GUR](#), and [CMC](#). I present a design guideline framework to propose solutions to the problems found in my research study. This section outlines future work that can follow this research study.

In *chapter 7*, I summarize my work in detail and conclude with a summary of the contributions of my research.

Chapter 2

Related Work

In this chapter, I present the related literature within which my research is situated. First, I discuss the relevance of computer-mediated communication (CMC) to HCI. Second, I show the importance of virtual environments (VE) and the representation of avatars in VEs. Third, I talk about how understanding presence in VEs is important to my research. Fourth, I make a case for why engagement is essential in VEs. Fifth, I identify the literature gap within the current research space. Finally, I introduce a mixed-method study to gather data to address the literature gap.

2.1 Computer-mediated Communication

Computer-mediated communication (CMC) has been around for more than three decades. According to Susan Herring’s definition, “*CMC is the communication that takes place between human beings via the instrumentality of computers*” [58]. In addition, John Decker defined CMC as “*the process by which people create, exchange, and perceive information using networked telecommunications systems (or non-networked computers) that facilitate encoding, transmitting, and decoding messages*” [30]. Although there are various ways to define CMC, the core concept remains the same (i.e., communication). Communication occurs when there is a sender, a message, and a receiver [105]. In retrospect, I would adapt the term **message** to **data** for the purpose of this thesis, as seen in Figure 2.1. As most literature within this era has only examined CMC tools through a text-medium lens (*hence my proposal to change message to data*), it is important to note that CMC has now evolved to various media, including audio and video [90].



Figure 2.1: Online communication occurs as data packets, where a sender sends either “text, audio, video” data towards a receiver. This is my current adapted definition with the new medium other than text used for this thesis [76].

With the current global COVID-19 pandemic, our online presence has become more demanding because of in-person meeting restrictions. Forms of online communication have become more dominant in today’s society, for example, socializing, working, attending conferences. This has driven more research to study online communications in [HCI](#), [GUR](#), and [CMC](#). This research includes: the effects on education [2, 21, 4], engagement of older adults using [CMC](#) tools [78], and even the “Metaverse” (*3D virtual environments*) [36]. This shows the importance for researchers to explore [CMC](#) tools because they rapidly evolve as the pandemic continues (and possibly long into the future with the shift to online communication caused by it).

2.1.1 Synchronous Online Tools

Synchronous online tools provide a real-time virtual environment for collaboration. Most research has looked at synchronous online tools through the lens of a learning context or educational aspects [16, 43, 48]. While other research has also examined live music collaboration [3] or conducting qualitative research such as interviews in a remote setting [64].

Although research has looked and identified interactive elements within synchronous online tools within education [20], we lack an understanding of whether these findings will remain the same across other forms of communication modalities such as audio, video and

avatars. For example, research has evaluated that video calls could prove to be useful for remote communications [44]; however, studies of online communication have begun to examine communication within VEs other than gaming [84].

2.1.2 Virtual Environments

Virtual environments (VE) are one communication platform studied in HCI [94]. Although there are various distinctions between a virtual world and virtual environments, I will use Schroeder’s definition of **virtual environments**, who sees them as “*persistent online social spaces,*” which “*people experience as ongoing over time and that have large populations which they experience together with others as a world for social interaction*” [94].

Sheridan notes: the importance of a virtual environment simulation (*often referred to as “virtual presence”*) is the sense of being physically present, including visual, auditory, or forced displays generated by a computer and “telepresence” is the sense of being physically present with virtual objects(s) at the remote teleoperator site [98].

As my research is primarily focused on computer-mediated technology, I will be exploring both the social interaction and spaces that pertain to engagement, I will be using the term virtual environment (VE) throughout my thesis. It is important that a literature gap exists for **VEs used in a communication context** and not a gaming context.

Presence

“**Presence** is defined as the subjective experience of being in one environment (there) when physically in another environment (here)” [112]. One of the major problem in online communication tools is the “**lack of presence, and the non-verbal communication cues**” such as facial expression, cues, and gestures [77]. Most research has only examined presence in a gaming context through avatars, strictly video, or strictly text-based communication. A literature gap exists for combined communication modalities, such as having both avatars and video present within the VE. It is important to note that there are multiple definitions of presence, which makes the concept difficult to analyze, which some researchers have identified in a systematic review [80] and, therefore, I will follow the definition defined by Witmer and Singer [112] in the context of communication.

Avatar

An avatar is a graphical representation of the user’s character. Klevjer defined that an **avatar** is not about the playable characters but it focuses on the how players engage and act as an agent in a fictional world. The “**avatar becomes an extension of the player’s own body**” via the interface of a screen, speakers, and controllers [70].

Different research examines the relationship between avatar and embodiment. In my study, I am only focused on engagement and the 2D interactions within the virtual environment Gather.Town. It is also important to emphasize that avatars are not exclusive to computer games; however, they represent a form of mimetic play [70, 95, 23, 60, 53, 45]. Avatars have been a focus in GUR, CMC and HCI work. However, the idea of having gamified online communication platform was becoming more prominent in (VE) serious games like Second Life [5].

Embodiment

Virtual characters become the player’s surrogate mind and body [50]. This means the virtual world can attribute mental states (e.g., beliefs, values, goals, feelings, and attitudes) to the virtual character [50]. Gee mentions social interaction as a form of embodied thinking [51] in the concept of modern video games. It is about building specific game-like representations (wherein the players can act or role-play other people’s actions) in a specific context [51]. The virtual environment Gather.Town causes “us to act in the real world in ways that change it to better resemble or model simulation.” Gee refers to this concept as the “three-way interaction,” where the virtual character’s mind/body is connected to the character’s goals and player’s goals while being connected to the virtual world [51].

2.1.3 Breakout Rooms

As my research looks at how users interact with synchronous communication tools, it is important to mention the ideas of breakout rooms as these interactions often occur in learning environments. Breakout room is a virtual space which is a small meeting room or a separate part of an Internet meeting where a small group can discuss a particular issue before returning to the main room. Breakout rooms are beneficial because they can facilitate collaborative learning and interaction, peer-to-peer support, and breaks [22]. To have a successful breakout room, it is recommended to set up breakout rooms in advance, plan activities for participants (*activities are limited to online environments*), aim for small

groups of **3–5 participants**, become familiar with the technology, and have clear instructions of what to do during the duration of the breakout room session [22]. The common challenges of breakout rooms are the lack of interactive elements and knowing how to navigate from room to room [22].

2.1.4 Engagement in Online Communications

User engagement is important in regard to **HCI**. As O’Brien states, it’s the quality of the user experience within a digital system—in this case online communication tools [81]. One way to measure whether a communication tool is engaging is through the use of the User Engagement Scale (**UES**). This scale looks at **six dimensions of engagement**:

FA: Focused attention, feeling absorbed in the interaction and losing track of time

PU: Perceived usability, negative affect experienced as a result of the interaction and the degree of control and effort expended

AE: Aesthetic appeal, the attractiveness and visual appeal of the interface

EN (RW1-5): Endurability, the overall success of the interaction and users’ willingness to recommend an application to others or engage with it in future

NO (RW6-8): Novelty, curiosity and interest in the interactive task

FI (RW9-11): Felt involvement, the sense of being “drawn in” and having fun

It is important to understand which communication modality affects engagement, as we move towards designing a **VE** like the “Metaverse”. Implementation of design practices should consider engagement as it can enhance the user experience within that space. On the contrary, it is also important to understand what factors take away from engagement.

As these online communication environments are fairly new, there is only one recent study from 2021 that has looked at engagement and the impact it has on older adults with respect to COVID-19 implications [78]; however, a literature gap exists for engagement across various conditions and communication modalities (*which is my research focus*).

2.2 Summary

After reviewing the related literature, I identified various research gaps in which I will tackle in my study:

- There are few studies that examine communication modalities in the virtual environment; for example, in a gamified online communication tool (Gather.Town).
- Previous literature has rarely explored the idea of engagement in online communication tools and only explored within the education space.
- It is unknown where engagement is the same or different across various communication modalities, and it is important to explore this space. **If engagement varies** between communication modalities then we can examine which parts make it more engaging or **if engagement does not vary**, then it is important for us to understand why that happens.

Chapter 3

Gather.Town

In this chapter, I describe why I used [Gather.Town](#) for my research study. Consequently, I list out the reasoning for design choices in building the virtual environment in Gather.Town and the challenges that occurred in my initial pilot study¹.

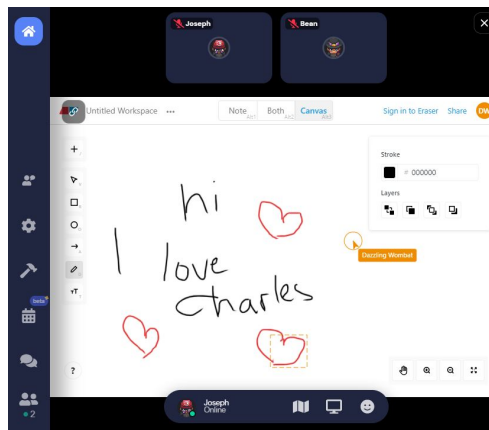


Figure 3.1: This figure illustrates the interaction in which users can collaboratively draw in Gather.Town. These embedded interactions are sourced from external platforms. For example, the platform [Eraser](#) is embedded onto the whiteboard object in Gather.Town.

¹Submit any fish eggs to [HCF International](#) 🐟😊🐟

3.1 What is Gather.Town?

Gather.Town is a synchronous online communication tool similar to, for example, *Zoom*, *Microsoft Teams*, *Google Meet*, *Amazon Chime*. Gather.Town combines the feature of video-calling while taking place in a 2-D virtual environment. In addition, Gather.Town allows the user to interact within the virtual space. These interactions could be something simple such as doodling around on a whiteboard (see Figure 3.1), or playing a game of Tetris within the virtual space. To put this in simple terms, Gather.Town is a gamified virtual meeting environment (see Figure 3.2).

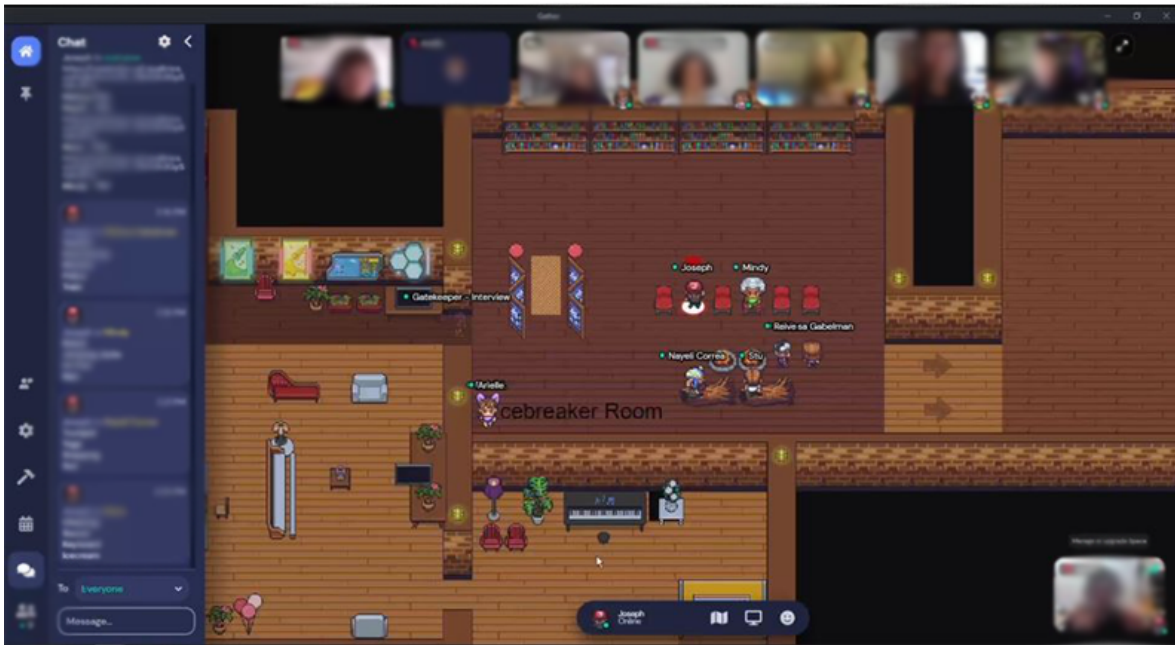


Figure 3.2: This figure illustrates an active session in the Avatar-Video (Condition C). The faces of the researchers and participants have been blurred out for anonymity.

3.2 Why Gather.Town?

I chose to use Gather.Town as the primary platform because it has all communication modalities (*audio, video, and avatar*), which I can isolate for each communication modality in my research questions. For example, in the Avatar-No-Video condition, I can just disable the videos for all participants to test for Condition D.

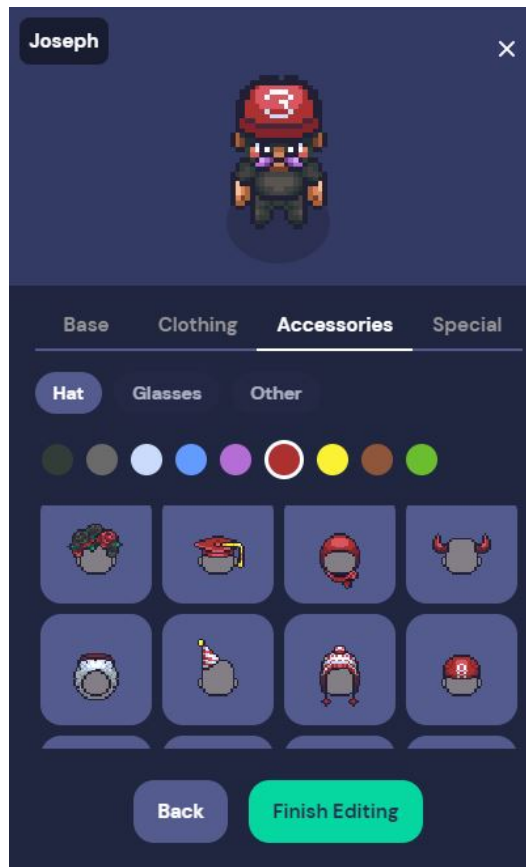


Figure 3.3: This figure, shows the customization of the avatars in which one wants to be represented in the virtual environment.

Gather.Town allows the users to create avatars of themselves (see Figure 3.3) and the virtual environment around them (see Figure 3.6). Although one could consider this as game, the primary use of Gather.Town is mainly for remote work, online conferences, virtual learning, and events such as game jams.

At the time creating this study, I had developer access to create interactions using various [API](#) permissions granted by the owners of Gather.Town. This allowed me to source and create specific interactions for static objects within the virtual space. However, at the time of writing this thesis, embedded interactions have now been simplified by using their “Map Builder” toolkit (*currently in Beta as of November 2021*) shown in Figure 3.4. For example, one can create embedded videos on a TV object.

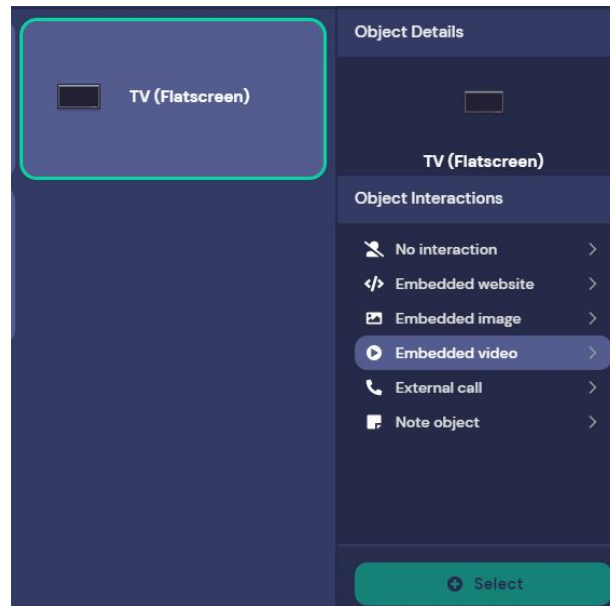


Figure 3.4: In this figure, shows the Map Builder functionality of adding interactions to objects within the Gather.Town space.

Main concerns regarding the study:

1. Participants could take awhile for some parts within my study, for example the avatar creation stage. This means I had to consider the time used for my study. This also meant I needed to leave time to administer the scales ([UES](#) and [SP](#)) and gather interview data.
2. Although interactions are interesting in Gather.Town, I needed a task that can be conducted across all conditions. This means interactions with Gather.Town (in terms of static objects) will most likely occur in the conditions with avatar (Condition C and D), because it manifested within the virtual space.

3. Participants not following the assigned tasks or technical issues that could occur in a remote study.

I wanted to test my initial study design by proceeding with a pilot study to further explore my concerns.

3.3 Pilot Study

Although a case study on Gather.Town exists for the use of distance learning within a virtual environment [75], this technology is still relatively novel. To further explore this, I ran a remote pilot study with 11 participants recruited from the Games Institute at the University of Waterloo. The purpose of this pilot study was to explore Gather.Town and the current available functionality of interactions, engagement, collaborative space creation and avatar customization. For this pilot study, I administered the *Player Experience Inventory* (PXI) a tool to measure player experience within a gamified online communication platform [1, 107].

3.3.1 Adjustments and Hurdles

From the first session of the pilot study (with 4 participants), I learned that most of the participants were rating the PXI scales based on the fact that Gather.Town was a game, which was a flaw in this pilot study design. Although one of the PXI constructs revolves around engagement, I needed to understand engagement in terms of a communication platform and not as a game. As I revisited the literature, I came across the User Engagement Scale (UES) questionnaire which was a better fit for my study.

Another important problem that needed to be addressed was the social presence (SP) scale. Most social presence (SP) constructs do not consider the avatar within the online communication context; it's either within the gaming environment or specifically within the CMC space [80]. In addition, there is heavy debate amongst researchers, where studies need to consider the proper SP scale for their study design [80].

Therefore, I created my own non-validated SP scale to specifically examine SP within Gather.Town. This is a limitation which I acknowledge, because this means I cannot generalize the findings to the other applications that differ from Gather.Town. It is important to address, that some researchers in my case would have used a “virtual reality” (which is a simulated experience of the real world) social presence questionnaire [96]; however, I

argue that virtual environments are different from virtual reality. Therefore, I adapted the constructs from the iGroup Presence Questionnaire (iPQ) [89].

3.3.2 Addressing the Concerns

From the **second pilot study** (with three participants), I learned that having more than two scales can be taxing for the participants, as one of my pilot participants expressed: *“Wait, there’s more? We don’t have to do the interview right?”*. I later adapted the scale with fewer constructs and made ethics revisions to administer the UES and SP scales for the main study of my thesis. For publication purposes, I will omit quantitative data on the SP scale as it is not validated and only report SP through the findings that emerge in the qualitative data later on in [subsection 5.2.4](#).

Another concern was to identify a task that can be administered through all four conditions: Audio-only (Condition A), Video-only (Condition B), Avatar-Video (Condition C), and Avatar-No-Video (Condition D). I needed to ensure all conditions were tested within the same platform because I wanted to keep it a controlled experiment. In addition, this helps me avoid technical issues for various platforms such as compatibility issues or onboarding user experiences that the participants needed to go through.

From my **third pilot study** (with the last 4 participants) which was a within-subject study design, I noticed that the conditions with avatar tend to have a higher engagement than conditions without avatar from the UES analysis. This led me to change my study design back to between-subjects because I did not want the novelty effect to have an impact, because most participants were stating “this is pretty cool, I like how I can move around and it’s different from zoom”. In addition, as I am interested in studying online communication platforms, I included a screener questionnaire to select participants that have used at least one online communication platform before.

In general, I found that giving the participants roughly 10 minutes to get familiar with the controls and functionality works best. Even though Gather.Town provides an onboarding tutorial, I do note that participants who identify themselves as a Luddite (they self-identified during the semi-structured interview) have a harder time understanding how to use the platform (which is a challenge I predict when running the main study). As there was an “awkward silence” at the study of the study (when some of the participants joined late), I opted to have small talk with the participants during the lobby/waiting room phase. In terms of the task, I opted to have three simple tasks across each condition. Therefore, the procedure is as follows:

1. Participants fill out the Qualtrics demographics and return back to Gather.Town
2. There is “small talk” during the lobby or waiting room.
3. **Task 1:** An introduction amongst the researchers and the participants.
4. **Task 2:** Playing the game **charades** across each condition.
5. **Task 3:** Telling a two-minute story (similar to sitting around a campfire). For conditions with avatar (Condition C and D), participants were asked to build a “Halloween Theme Space” together, and then proceeded to tell a story about the space they created.
6. Participants fill out the scales on Qualtrics.
7. Participants proceed to a semi-structured interview.

Through the pilot study, I found that having 3–5 participants worked best for my study design and re-adjusted some questions to answer my research questions. The main study of this research is reported and analyzed in [chapter 4](#), [chapter 5](#), and [chapter 6](#).

3.3.3 Gather.Town Design Space for Conditions

Although Gather.Town offers a variety of templates for the virtual environment (see [Figure 3.5](#)), I wanted create the virtual space in Gather.Town to control and avoid having unnecessary interactions within the virtual space by using their “Map Builder” tool (see [Figure 3.6](#)).

To ensure that random people do not join the virtual spaces, a generic password was created for each of the sessions conducted. To prevent previous participants who had access to the virtual spaces, each of the virtual spaces were cloned for the next session.

Any participants who joined late were removed from the Gather.Town space because I did not want them to disrupt the on-going study session. Special blocks prevented participants from accessing certain areas. Spatial ambience background music was disabled for the study. For example, the campfire noise was disabled. In the event if there was a glitch, I asked participants to refresh and rejoin another cloned space (served as a backup if the space crashed).

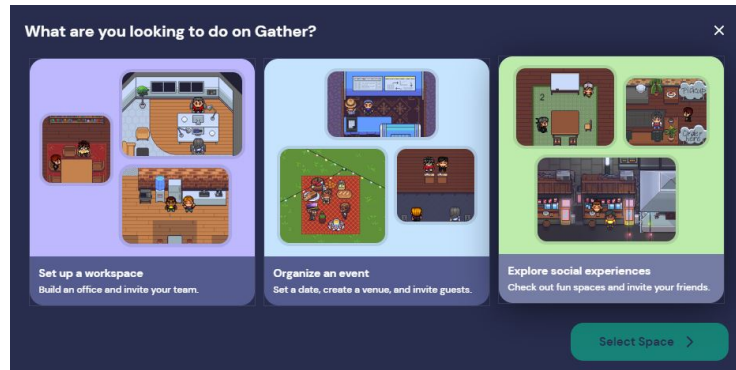


Figure 3.5: This figure shows a selection of spaces to use: set up a workspace, organize an event, or explore social experiences (e.g., virtual escape rooms, board game night) within Gather.Town.

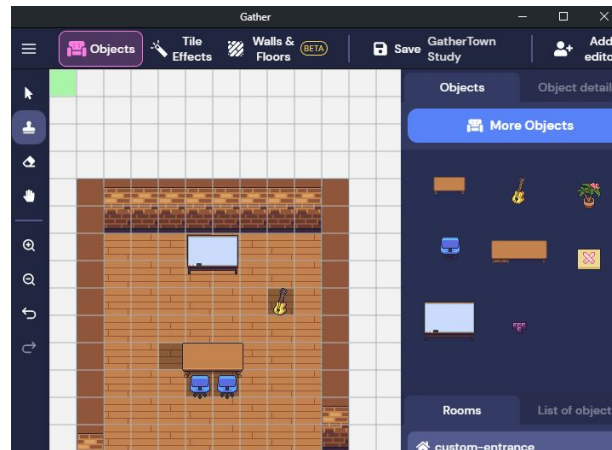


Figure 3.6: This figure shows the Map Building tool within Gather.Town. Owners of the space can place, orient, and create interactions for objects in the virtual environment.

Condition A and B

To ensure that participants do not move around within Gather.Town. A simple space was created in Gather.Town. For example, in the audio-only (Condition A), participants were instructed to only use audio and turn off their webcams (see Figure 3.7). For both of these conditions, we asked the participants to use the **full screen** feature which covered up their entire screen eliminating the virtual space in the background. This means, if a participant was in audio-only (Condition A), they would only see an avatar of the user compared to a video-only setting(Condition B), they would see the participant’s face, similar to any other videoconferencing tool.

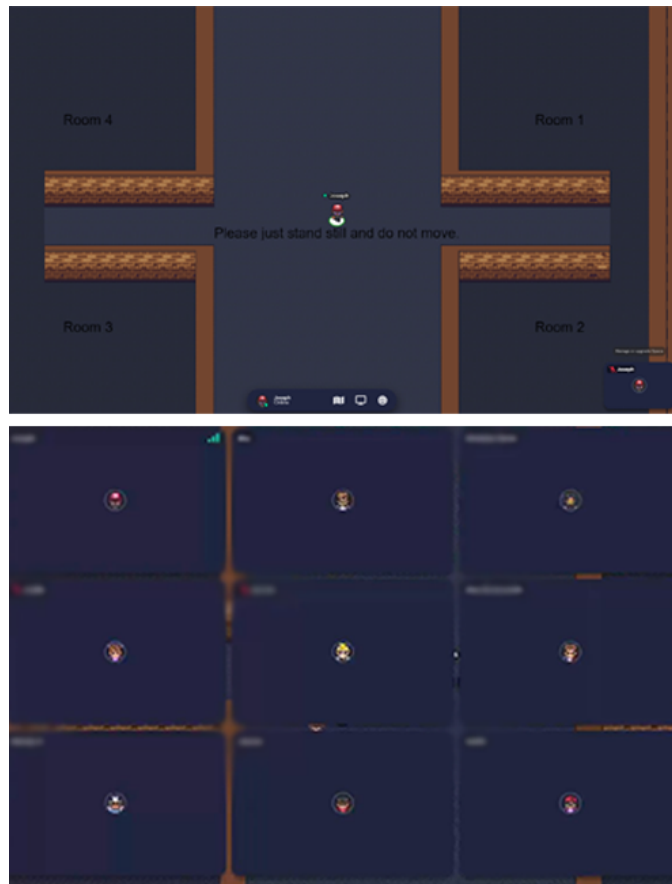


Figure 3.7: In this figure, shows the virtual space used for Audio-only (Condition A) and Video-only (Condition B).

Condition C and D

To ensure that participants were familiar with the virtual space. I mapped the virtual space to *Friends*², a popular television sitcom. Certain spaces had proximity chat enabled. In other words, this means you need to be in the vicinity of another user to communicate with them. Lastly, private rooms are coded within the space to mimic a real room (communication similar to a break-out room). This means only participants present within the room could communicate with one another. For example, if a participant is in the **icebreaker room**, they cannot hear or interact with other users located in the **casual room**. However, they are still able to see the avatars (users) moving around in the virtual environment.

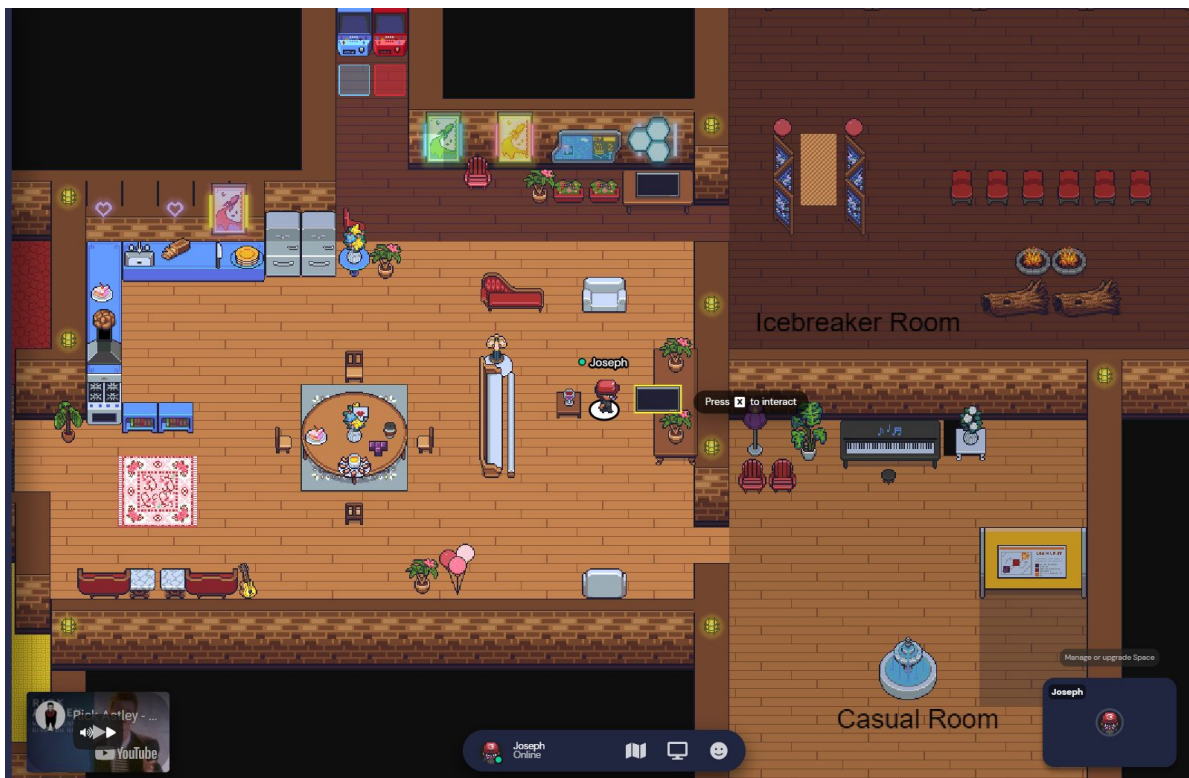


Figure 3.8: In this figure, shows an active session of the functionality of Gather.Town. The faces of the researchers and participants have been blurred out for their safety.

²<https://www.imdb.com/title/tt0108778/>

3.4 Summary

In this chapter, I started by describing what Gather.Town is primarily used for. I then described why I chose Gather.Town as a primary platform because it allowed me to test the communication modalities mentioned in my research questions. I then explained a few assumptions and concerns. From there, I discussed the adjustments made for my main research study. Lastly, I articulate how the virtual space was built for each condition.

Chapter 4

Methodology

The main goal of this thesis is to explore the engagement and social presence across various communication modalities (audio-only, video-only, avatar-video, and avatar-no-video). In this chapter, I propose using a mixed-methods approach as mentioned in [chapter 3](#).

4.1 Research Questions

This thesis aims to address the following questions as mentioned in [chapter 1](#).

1. **RQ1:** *What are the benefits and drawbacks of using Audio-only (Condition A), Video-only (Condition B), Avatar-Video (Condition C) and Avatar-No-Video (Condition D) communication?*
2. **RQ2:** *Does **engagement** vary based on the **communication modality** (Audio-only (Condition A), Video-only (Condition B), Avatar-Video (Condition C) and Avatar-No-Video (Condition D))?*
 - (a) **RQ2.1:** *What **factors create engagement** in online communication tools for people?*
3. **RQ3:** *How do people **interact** in synchronous communication tool within a virtual environment or space?*

RQ1 aims to identify the benefits and drawbacks across various synchronous online communication tools such as Zoom, Microsoft Teams, Skype, and Discord.

RQ2 aims to understand the engagement within a synchronous online communication. An audio-only condition would mimic a phone call, where as a video-only condition would mimic popular communication tools such as Microsoft Teams and Zoom. In terms of the gamified online communication tool, I want to examine if there exists an element that could contribute to engagement, whether it may be the virtual game-like space, the avatar etc.

RQ3 aims to understand the types of interactions that take place within a synchronous communication tool. These interactions could be moving from one space to another, the sense of proximity audio, or it might invoke collaborating on building a space together, or simply just sharing screens.

Based on my pilot study, I hypothesized the following:

- **H1 (to RQ 1)**, I would assume there is a specific use for each of the communication modalities. As audio could be better for users with lower bandwidth, video could be better for users who want more face-to-face interactions, and avatars could be better for users who are self-conscious with their appearance.
- **H2 (to RQ 2)**, the hypothesis laid out for the **UES**:

H_{Null}: There is no difference in average scores in the **UES**. Engagement is the same across all communication modalities tested.

H_{Alternative}: The **UES** average scores are different across all conditions. There is a difference in engagement based on the communication modality tested.

- **H3 (to RQ 3)**, there is an embodiment and self-representation attached to the participants, which drives them to interact with others more. However, this might be biased for participants who have an attached feeling to games in general.

4.2 GPOWER and Power Analysis

As this study compares four different conditions, I used a general power analysis program (GPOWER¹) to determine the appropriate sample size for our study [40]. The effect size is

¹<https://stats.idre.ucla.edu/other/gpower/>

an educated guess based on previous literature reported from other studies[46, 25, 61] and was determined by using GPOWER $f = 0.43$, α error probability = 0.05, and a power of a statistic test to be 0.8 and higher [28, 27]. Sixty-four participants were required based on our power analysis assessment (16 participants recruited for each condition), non-centrality parameter = 11.83, critical $F = 2.758$, numerator $df = 3$, and denominator $df = 60$, and an actual power of 0.807.

As a purposeful sample size in qualitative research, the minimum sample was set to 20 prior to recruitment [74]. Because the study was using mixed methods, we interviewed all participants (from each group), in which the minimum sample size was raised to 64 participants. This allowed us to have enough data to produce a meaningful qualitative analysis varied across a diverse sample.

There are documented difficulties with recruiting research participants during the COVID-19 pandemic. Although participants who have identified to have stable internet connections, I assumed the participants may have poor audio equipment in which it was hard to hear some of the audio recordings. I will elaborate more in the section below.

4.3 Recruitment

In line with the recommendations of qualitative methods [17, 26], randomized sampling was used with the group that is relevant to our research question. I aimed to recruit broadly to ensure there is a diverse group of participants, gathering various experiences on how others use online communication tools across the general population. I recruited participants using a combination of the [User Interviews](https://www.userinterviews.com/)² platform, and social media posts by our research lab the [HCI Games Group](#).

²see <https://www.userinterviews.com/>

Participants were first asked to complete a screening survey, to be included in the study, participants were asked to:

- Be an adult (between the ages of 18–64)
- Have a webcam
- Have a working microphone
- Have used any online video communication tools

To ensure that they have used forms of online video communication tools, we asked the participant to “*List a few forms of online video communication tools that you use.*” If the participants listed forms of online video communication tools, they were recruited for the study. Any participants that listed something that was not an online video communication tool such as “Youtube” or something that that did not match our online video communication tool definition was excluded from our study.

Additional factors were considered to conduct the study remotely because of the COVID-19 pandemic. Our screening questionnaire (screener) required participants to have a stable Internet, a computer with the ability to connect to GatherTown. Optional screeners asked if the participants had working headphones to remove audio lag feedback coming from the speakers.

4.4 Participants

According to the power analysis, a minimum of 16 participants per condition is required; however, we overscheduled a few participants anticipating for a “no show.” A total of 67 participants were recruited for this study. Participants were located in North America, South America, Africa, and Europe. I provide the full list of answer options for ethnicity, gender, education, and employment in our demographics survey because Schlesinger et al. state “*this will help the CHI community track which populations a study may generalize to and the demographics that need further attention*” [93] in my appendix.

One participant asked their data to be deleted, where as the other participant withdrew midway because of personal reasons. This means the recorded data consists of 65 participants between the ages of 18–61 ($M = 35.71$, $SD = 11.06$, 29 Male, 34 Female, 3 Non-Binary); 16 participants in condition A, 15 participants in condition B, 17 participants in condition C, and 17 participants in condition D.

4.5 Procedure

A schedule was created on the User Interviews platform for participants who were qualified for the study to join. In the first few studies, I created a slot for a group of 4 participants to join. However, based on a high dropout rate, participants cancelling, having internet issues, or not showing up, and technical issues on the participant end, I bumped up the slot to accommodate for five participants to join in a session. I did this because in the event where two of the five participants dropped, this will allow me to run a minimum of three participants to proceed with their study. I only proceeded to run a session if there were three or more participants. If there were two or fewer participants that showed up, I would apologize to the participants and ask them if they would like to reschedule for a different time. This number was determined in [chapter 3](#).

Once the participants had signed up for a scheduled session, instructions were given to the participants to follow. The number of participants ran were determined by the availability of the researchers. From there, I instructed the participant to open a custom Gather.Town link (that is password protected) on the Google Chrome web browser to join the scheduled session. Participants were asked to create an avatar in which their name needed to match their UserInterviews ID. I assumed that most of the participants have not used Gather.Town, thus I asked them to complete the onboarding tutorial that Gather.Town provides in which the participants can get accustomed to the online communication platform as mentioned in [chapter 3](#).

Once the participants joined the Gather.Town session, they completed a demographics survey that collected their age, gender, ethnicity, education, and employment status. This study was reviewed by and received ethics clearance through the University of Waterloo Research Ethics Board (REB no. #43455). Following local ethical guidelines, the consent process ensured that participants were instructed that they were free to end the interview at any given time, or to not answer specific questions.

In the entire study, only one of the participants refused to continue to participate and dropped out during the study. The participant asked that I do not record their data, thus for condition B, there were only 15 participants of the required minimum of 16 participants.

4.5.1 Instructions Per Condition

Once the participants joined GatherTown, I gave them a participant number and a link to Qualtrics where the demographic survey was located. The participants would fill out the demographic section until a page prompt instructed them to go back to GatherTown.

Although instructions were sent to the participants prior to the scheduled session on User-Interviews, I wanted to remind the participants again to ensure we have full control of the study:

- For **condition A** (audio-only), they were instructed to **turn off** their video (webcam), by clicking on the “video icon.” After that, they were instructed to use the full screen feature. In addition, the participant was instructed not to move around with their avatar.
- For **condition B** (video-only), they were instructed to **turn on** their video (webcam), by clicking on the “video icon.” After that, they were instructed to use the full screen feature. In addition, the participant was instructed not to move around with their avatar.
- For **condition C** (avatar with video on), they were instructed to **turn on** their video (webcam), by clicking on the “video icon.” After that, they were instructed to “explore” by using the arrow keys and “interact” with objects by pressing “X” on their keyboard.
- For **condition D** (avatar with video off), similar to condition C, but with video off.

As Gather.Town is novel to most of the participants, I gave the participants (in Condition C and D), 10 minutes to get familiar with the controls and space. During this time, participants were able to chat with other participants, interact with objects by watching videos, open posters and bulletins, go into lobby rooms, play the piano, and play Tetris together. I used this time to observe any participants that had problems with their controls and help them get familiar with Gather.Town. It was noted that most of these participants were older and did not play online games.

Task 1: Introduction

For conditions A and B, I would give a brief introduction and then have my co-researchers introduce themselves. After that, I would call upon each participant to introduce themselves.

A basic introduction would be: “Hello, my name’s Joseph, and I am one of the researchers here today. I am very excited to see you all today and to begin, one of my favourite animals is a dog. I will now pass it on to “X” researcher to introduce themselves”.

For conditions C and D, participants were asked to go to the room that was labelled as the “Icebreaker room” using their avatar and proceed with the same introduction.

Task 2: Charades

For the second task, we had the participants play charades as this was a task that could be conducted across all 4 conditions as mentioned in Chapter 3. In the event in which a participant has never played charades, I would explain the rules of the game to the participant. In all sessions, I would do a demonstration of how the game should be played with my co-researcher just to ensure that the participants knew how to play the game properly.

Common words were used in the charades as we had participants that were recruited globally, thus we did not want to select a word that may be only native to a specific region as noted in our pilot study. For example, participants in Australia would refer to “coffee” as a “long black”. These words were mainly animals, sports, or musical instruments.

Task 3: Storytelling or Collaborative Building + Storytelling

For the third task, we had participants tell a short two-minute personal story. We allowed participants to make up stories as they pleased. In terms of conditions C and D, there was an additional task to examine interactions. Participants in conditions C and D were asked to build a “Halloween Theme Space” together, and then proceeded to tell a story about the space they created.

Administering the Scales

Once the study was completed, participants were asked to go back to Qualtrics and finish the remaining questionnaire. This included the [UES](#) and [SP](#) scales.

Semi-structured Interviews

I decided to use semi-structured interviews because it provides a flexible structure which allows me to collect new, exploratory data relevant to our research topic [10]. Open-ended questions were asked to explore the participant’s thoughts, feelings, preferences of video on and video off, and engagement in Gather.Town. In addition, the semi-structured interviews

allowed me to dive deeper into personal and sometimes sensitive issues revolving around self-consciousness [31]. All key questions were presented to all participants. I provide the full list of key questions in the appendix/supplementary materials. On average, each interview session lasted around 20 minutes.

I was present for all sessions, where my co-researchers would assist in the semi-structured interviews. For example, if there were 5 participants in one session, each participant would be assigned to a researcher. In the event, where there are more participants than researchers, the participants were asked to wait until one participant was finished with the semi-structure interview.

Post-interview, the participants were given a thank-you letter and were informed to contact the researchers if there was any sensitive information that needed to be retracted before publication.

Summary of the Study Procedure

As outlined in Chapter 3, here is a summary of the procedure:

1. Participants would fill out the Qualtrics demographics and return back to Gather.Town
2. There would be “small talk” during the lobby or waiting room.
3. **Task 1:** An introduction amongst the researchers and the participants.
4. **Task 2:** Playing the game **charades** across each condition.
5. **Task 3:** Telling a 2 minute story (similar as if you were all around the campfire). As part of the research question that I am interested in interactions and how one uses the online communication platform. For conditions with avatar (Condition C and D), participants were asked to build a “Halloween Theme Space” together, and then proceeded to tell a story about the space in which they created.
6. Participants were asked to fill out the scales on Qualtrics.
7. Participants then proceeded to a semi-structured interview.

4.6 Data Collection

The participant’s voices were audio-recorded for the purpose of data collection [101]. Prior to the interview, all participants were provided with a consent form outlining the details of the study. Consent was obtained before conducting the interviews, and all participants were awarded with \$10 USD gift card on the User Interviews platform upon completion of the interviews. Participant’s data in the interviews were saved in [Dovetail](#)³ for thematic coding with their ID preceded with a ‘P’ (e.g., *P22*) for reference purposes. All names have been pseudonymized for publication purposes (see [Table 4.1](#) for Condition A, [Table 4.2](#) for Condition B, [Table 4.3](#) for Condition C, and [Table 4.4](#) for Condition D). I included the option to self-identify ethnicity, to ensure that participants felt that their ethnicity is represented appropriately [93] and the option to self-identify their gender to ensure that participants felt that they could self-identify their gender appropriately [54].

³Dovetail: <https://dovetailapp.com/>

No.	Session	Age	Gender	Ethnicity	Education	Employment
P14	Session 5	39	Female	White	High school	Employed
P15	Session 5	35	Female	White	Bachelor's	Self-Employed
P16	Session 5	25	Female	Prefer not to disclose	Bachelor's	Employed
P17	Session 6	54	Female	White	Some college	Employed
P18	Session 6	20	Female	South East Asian	High School	Student
P19	Session 6	37	Female	South Asian	Postgraduate	Self-Employed
P29	Session 9	41	Female	White	Bachelor's	Employed
P30	Session 9	29	Male	White	Bachelor's	Employed
P31	Session 9	19	Male	South Asian	Some college	Student
P32	Session 9	46	Male	Black	Bachelor's	Employed
P33	Session 9	61	Male	White	Bachelor's	Retired
P34	Session 10	38	Male	Latin	Some college	Employed
P35	Session 10	36	Female	White	Postgraduate	Employed
P36	Session 10	44	Female	White	Some college	Unemployed
P37	Session 10	45	Female	Chinese	Bachelor's	Employed
P38	Session 10	27	Female	South Asian	Bachelor's	Employed

Table 4.1: The table gives a list of participants in Audio-only (Condition A).

No.	Session	Age	Gender	Ethnicity	Education	Employment
P1	Session 1	19	Male	White	Some college	Student
P2	Session 1	29	Female	Slavic	Bachelor's	Student
P4	Session 1	42	Female	White	Postgraduate	Employed
P25	Session 8	38	Female	South Asian	Postgraduate	Employed
P26	Session 8	38	Female	Black	Some college	Employed
P27	Session 8	39	Male	White	Bachelor's	Employed
P28	Session 8	55	Female	White	Postgraduate	Employed
P45	Session 13	39	Non-binary	White	Bachelor's	Employed
P46	Session 13	33	Male	Black	Postgraduate	Employed
P47	Session 14	37	Male	South Asian	Postgraduate	Employed
P48	Session 14	23	Female	Black	Bachelor's	Student
P49	Session 14	47	Female	White	Some college	Unemployed
P50	Session 14	41	Male	White	Postgraduate	Employed
P51	Session 15	39	Male	White	Bachelor's	Self-employed
P52	Dropped	n/a	n/a	n/a	n/a	n/a
P53	Session 15	58	Male	White	Bachelor's	Employed

Table 4.2: The table gives a list of participants in Video-only (Condition B).

4.7 Analysis

As this study uses mixed methods, I will first describe the qualitative analysis method first and then proceed to explain the quantitative analysis method.

4.7.1 Qualitative Analysis Method

The interview data were analyzed using thematic analysis (TA), because I am interested in studying people's views, opinions, knowledge, experiences, or values in Gather.Town [42, 17, 26, 55]. I focused on the semantic meanings in the data to develop insights regarding CMC and interactions in GatherTown.

It is important to note that there are various approaches to conducting a thematic analysis [26, 17] and often researchers only outline the 6 basic steps from Braun and Clarke [7, 111]. To establish the "trustworthiness criteria", I will describe our process in detail to enable the reader to determine whether the process is credible [79].

No.	Pseudonym	Age	Gender	Ethnicity	Education	Employment
P3	Session 2	29	Male	Filipino/a	Some college	Employed
P5	Session 2	44	Female	White	Postgraduate	Employed
P6	Session 2	26	Female	White	Postgraduate	Student
P7	Session 3	42	Male	Prefer not to disclose	Postgraduate	Employed
P8	Session 3	44	Female	Black	Bachelor's	Employed
P9	Session 3	29	Male	Black	Bachelor's	Self-employed
P10	Session 3	23	Male	Black	Some college	Self-employed
P39	Session 11	46	Female	White	Associate	Employed
P40	Session 11	40	Male	White	Bachelor's	Employed
P41	Session 11	25	Female	South Asian	Postgraduate	Employed
P42	Session 12	22	Male	Arab, North African	Bachelor's	Student
P43	Session 12	18	Male	Arab	Some college	Student
P44	Session 12	33	Male	White	Postgraduate	Employed
P54	Session 16	42	Female	White	Bachelor's	Employed
P55	Session 16	29	Female	Latin	Bachelor's	Employed
P56	Session 16	51	Male	White	Some college	Employed
P57	Session 16	25	Female	Chinese	Postgraduate	Employed

Table 4.3: The table gives a list of participants in Avatar-Video (Condition C).

I used an approach that draws from both reflexive and codebook types of TA for my qualitative data analysis [18]. My approach was largely reflexive, however, it did incorporate the development of a codebook to document and guide discussions and reflection between the research team.

Familiarisation

Interview transcripts are the main form of the data in this study. The audio recordings were initially transcribed automatically by *Dovetail*. The transcriptions were edited by me and checked for potential errors, which allowed me and the research team to be familiarized with the data.

Inductive Approach

I started with an inductive approach and proceeded with a line-by-line coding with the first two participants from each condition (8 in total), to create a first initial set of codes

No.	Pseudonym	Age	Gender	Ethnicity	Education	Employment
P11	Session 4	26	Female	Black	Bachelor's	Employed
P12	Session 4	19	Female	Latin	High School	Student
P13	Session 4	25	Female	Latin	Bachelor's	Employed
P20	Session 7	54	Male	White	Postgraduate	Employed
P21	Session 7	26	Male	South Asian	Postgraduate	Self-employed
P22	Session 7	54	Male	Indigenous, White	High school	Employed
P23	Session 7	28	Male	South Asian	Bachelor's	Prefer not to disclose
P24	Session 17	34	Female	White	Bachelor's	Employed
P58	Session 17	41	Male	Latin, White	Bachelor's	Employed
P59	Session 17	25	Female	South Asian	Bachelor's	Student
P60	Session 17	59	Female	White	Bachelor's	Unemployed
P61	Session 17	29	Non-binary	White	Postgraduate	Employed
P62	Session 17	19	Female	White	High school	Student
P63	Session 18	34	Male	White	Postgraduate	Employed
P64	Dropped	n/a	n/a	n/a	n/a	n/a
P65	Session 18	44	Female	South Asian, White	Postgraduate	Employed
P66	Session 18	30	Non-binary	Black	Bachelor's	Employed
P67	Session 18	28	Male	South Asian	Associate	Employed

Table 4.4: The table gives a list of participants in Avatar-No-Video (Condition D). Demographic information of interview participants.

(codebook). As qualitative is highly subjective, I met with my co-researchers to ask them about their opinions on the codes tagged. When a dispute occurred, we collaboratively discussed, mediated, decided, merged, and resolved all conflicts that emerged to finalize the first codebook.

Deductive Approach

The thematic analysis process was ongoing during the familiarisation process and the inductive approach, and therefore it was important to create multiple iterations of the codebook. The second codebook was derived based on the next two participants from each condition (8 in total) of the dataset across each condition, while maintaining the hierarchical coding framework model [17, 26, 55, 42] relevant to audio, video, avatar with video on, and avatar with video off. For example, at the top-level of the hierarchy, it would describe avatar and embodiment, whereas the mid-level code specifies whether they are involved or not involved with the avatar, and the third-level details the attributes or aesthetics associated with the avatar. Again, similar to the process above, I would consult

my co-researchers and resolve all conflicts that occurred. All researchers were all trained in Games User Research (GUR). When possible, any new relevant tags were merged into existing ones, while keeping new entries open to interpretation under the flat coding and hierarchical coding framework model. Any codes that were not relevant to the research question, were labelled as “miscellaneous”. It is important that I do not abandon data or codes at this stage of the analysis, because I do not know if these codes could be refined, combined, separated, or discarded until the end of the analysis [17]. I then proceeded to deductively code the remaining data using this second codebook because there were only a few new entries in the second codebook (4 entries were added to the second codebook from the first codebook).

Reviewing, Defining and Naming themes

To construct themes of shared meaning, affinity clustering was created on the *Dovetail insights* board. To shape these themes, I needed to ensure that they fit thematically (i.e., no contradictions) and that they were not too broad. We decided on initial themes based on the frequency of recurring codes. After an initial theme was created, I went back to each recording to check if any important points were missing. Through multiple iterations, the themes were then refined; the final themes are presented in the findings below. In our theme development and our reporting, we focused on data that directly relates to the study’s research questions.

4.7.2 Quantitative Analysis Method

Data collected from the questionnaire (UES) was evaluated with statistical tests to find whether or not there exists significant differences between study conditions for the different constructs of the UES.

4.8 Summary

At the start of this chapter, I stated my research questions for this study. I then justified the minimum participant requirement through a power analysis (64 participants in total, 16 each per condition). I then proceed to described the methodology of the study. Lastly, I explained how the data was collected and analyzed through quantitative and qualitative methods.

Chapter 5

Results

In this chapter, I present the results of my findings. In the first section of this chapter I will discuss the statistical findings from this study, whereas in the second section of this chapter I will discuss the thematic analysis findings. In my questionnaire, there is a 'test question' to ensure the participants filled out the survey correctly. The question states: "Please select 'strongly agree' ". Participants who did not select the "strongly agree" were excluded from the statistical analysis.

The following participants were omitted for quantitative data: P1, P16, P23, P35, P38, P39, P46, P52, P64. Qualitative data were still collected as common themes were derived amongst the other participants.

5.1 Quantitative Analysis

In this section, I will present the evaluation of the quantitative data collected in this study. This includes the data from the User Engagement Scale (UES). As the UES scale is validated, I will perform the statistical tests properly; this includes reverse coding the required constructs.

5.1.1 Questionnaires

The statistical tests were conducted in RStudio¹. As this is a between-subject study design in which different participants test each condition and are only exposed once to

¹RStudio: <https://www.rstudio.com>

that condition, there is a possibility the participants are comparing their experience to other online communication tools which they have used before.

As there are four conditions within my study and I will be conducting a one-way ANOVA across the four conditions: Audio-only (Condition A), Video-only (Condition B), Avatar-Video (Condition C), Avatar-No-Video (Condition D), this allows me to see the differences between the means and distributions of each group [69].

User Engagement Scale

There are 31 items randomized when administering the User Engagement Scale Long Form (UES-LF), I first needed to tidy the data by aligning items properly with their constructs. I then followed the instructions for the UES scale:

1. I reversed the following items: PU-1, PU-2, PU-3, PU-4, PU-5, PU-6, PU-8, and RW-3.
2. I then summed the scores for the items in each of the four sub-scales and divided by the number of items within that scale.
3. As each participant only completed the UES once, I did not need to compare these scores based on task, as I am only interested in measuring the conditions individually.
4. I calculated an overall engagement score, from the average of each of the sub-scale scores.

As mentioned in [chapter 2](#), I present the individual constructs of each subscale within the UES. This is taken directly from the author word-for-word and no interpretations were made nor shaped to fit the online communication platform, Gather.Town [82].

- FA: Focused attention, feeling absorbed in the interaction and losing track of time
- PU: Perceived usability, negative affect experienced as a result of the interaction and the degree of control and effort expended
- AE: Aesthetic appeal, the attractiveness and visual appeal of the interface
- EN (RW1-5): Endurability, the overall success of the interaction and users' willingness to recommend an application to others or engage with it in future

- NO (RW6-8): Novelty, curiosity, and interest in the interactive task
- FI (RW9-11): Felt involvement, the sense of being “drawn in” and having fun

The data was first exported from Qualtrics in a .csv file. As the constructs were randomized, I re-ordered the variables and made sure the factors were classified into their appropriate factors (categories). First step is to assess the normality of the data. Visually, we can see that all points fall approximately along the reference line, and thus I can assume normality as seen in Figure 5.1.

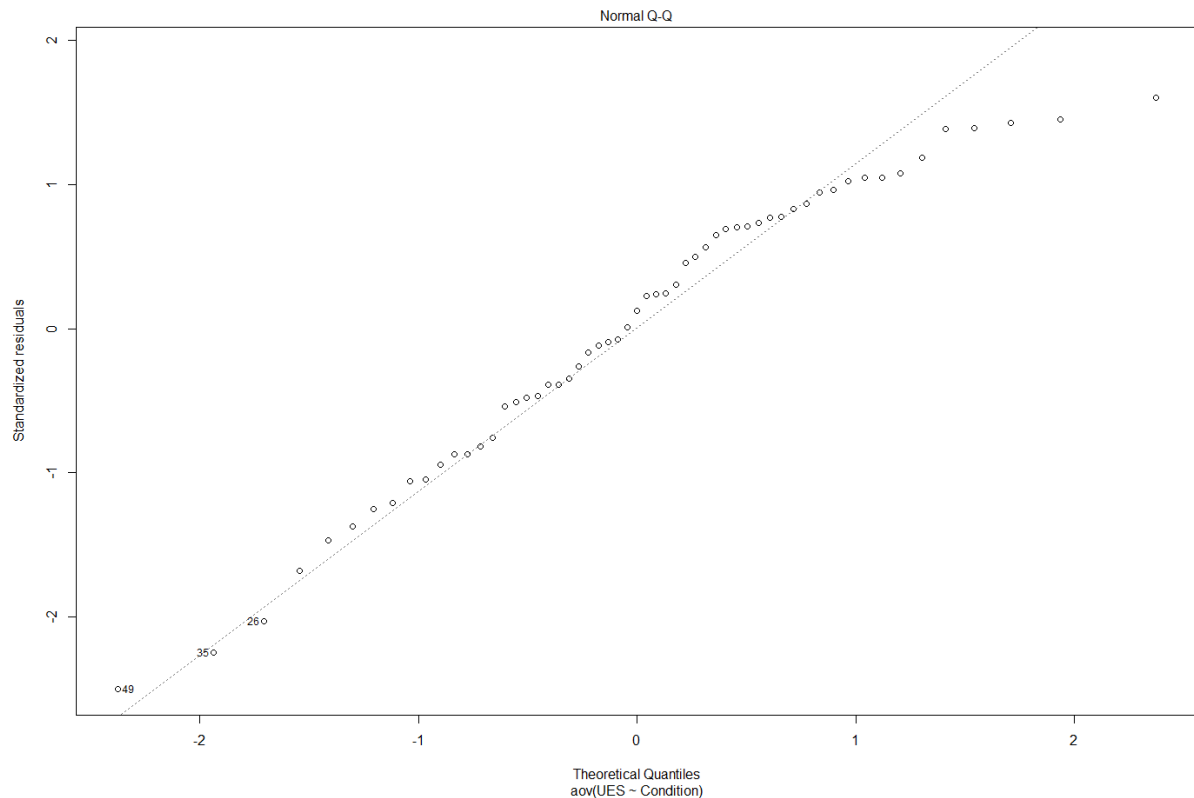


Figure 5.1: In this figure, I can see that all points fall approximately along the reference line, and thus I can assume normality with the scale of UES.

Next, I performed Bartlett’s test of homogeneity of variances. Bartlett’s $K^2 = 0.58899$, $df = 3$, $p = 0.8989$. From this, we can assume that the variances of the four groups are equal.

One-Way ANOVA

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Condition	3	0.053	0.01758	0.122	0.947
Residuals	53	7.663	0.14458		

Table 5.1: No significant results across the conditions in terms of [UES](#)

From the [Table 5.1](#), looking at the p-value we cannot reject the null hypothesis. Meaning that there are no significant differences in global engagement between experimental conditions. For the sake of being thorough, I proceeded to conduct Tukey’s post hoc test to see whether each conditions had different means.

Tukey Post Hoc

Condition	diff	lwr	upr	p adj
B-A	-0.03214286	-0.4277382	0.3634525	0.9964203
C-A	0.03628205	-0.3458993	0.4184634	0.9943283
D-A	-0.03854310	-0.4151386	0.3380524	0.9929222
C-B	0.06842491	-0.3137565	0.4506063	0.9642899
D-B	-0.00640024	-0.3829958	0.3701953	0.9999667
D-C	-0.07482515	-0.4373043	0.2876540	0.9468125

Table 5.2: Tukey Results

From the [Table 5.2](#), we can conclude that engagement is the **the differences were not significant**. This aligns with data reported in the thematic analysis as when we asked the participants: “Did you feel fully engaged in the task?” during the interview, 46 participants (71%) reported they were engaged with the task.

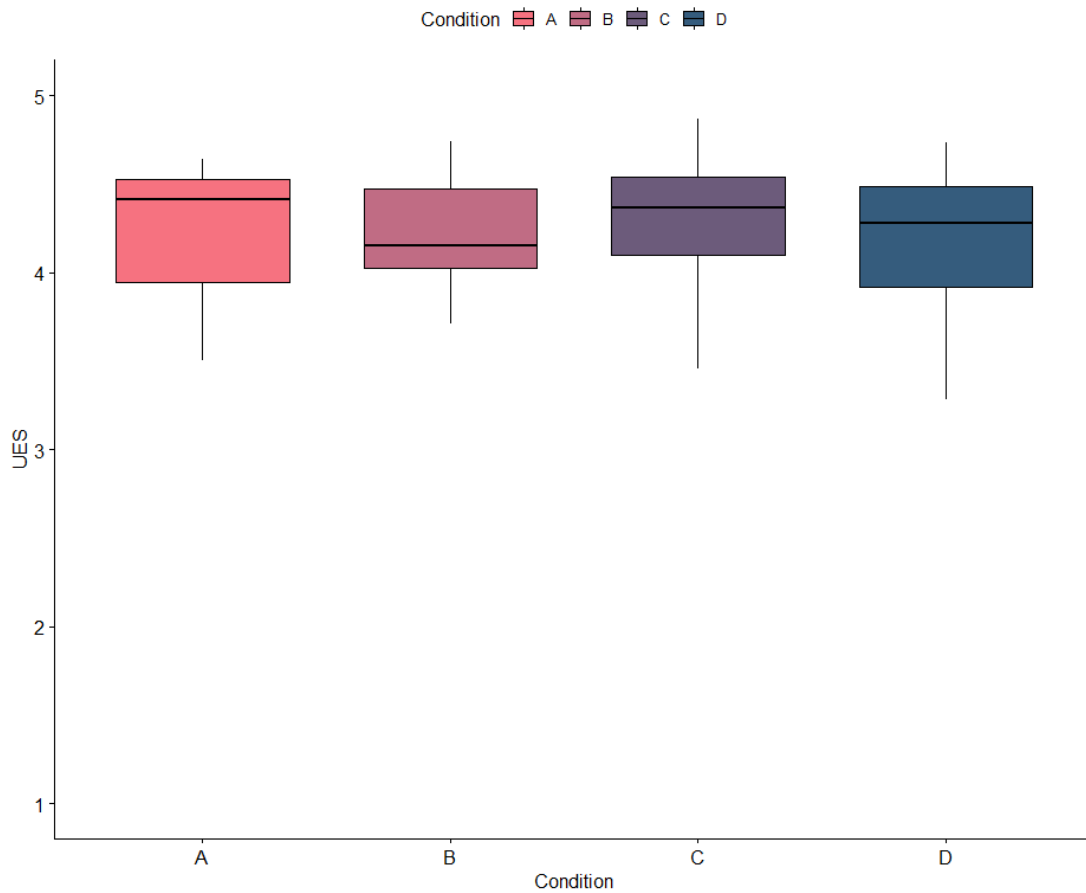


Figure 5.2: In this figure, a boxplot is presented for the four study conditions with average of all UES constructs combined (FA, PU, EN and RW). The conditions can be found on the x-axis, where as the y-axis represents the 5-point Likert scale (5: strongly agree) of the UES. For each individual boxplot, I included the confidence interval, and the range. All outliers were removed as mentioned above. The black bar represents the mean of each boxplot.

As a reminder, UES describes four sub-scales of engagement. I therefore also investigated whether we can detect a significant difference for any of these sub-scales between the experimental conditions. Following the outline for the global engagement, I first established normality for each of the subscales as seen in Figure 5.3, Figure 5.4, Figure 5.5, and Figure 5.6, then performed the ANOVA test. The results showed that none of the sub-scales showed significant differences between conditions. Although, the UES did not

provide any significant results ($F = 0.122$, $dF = 3$, $p = 0.947$), this leads me into my qualitative results to understand why this happens (the benefits of having a mixed-method approach).

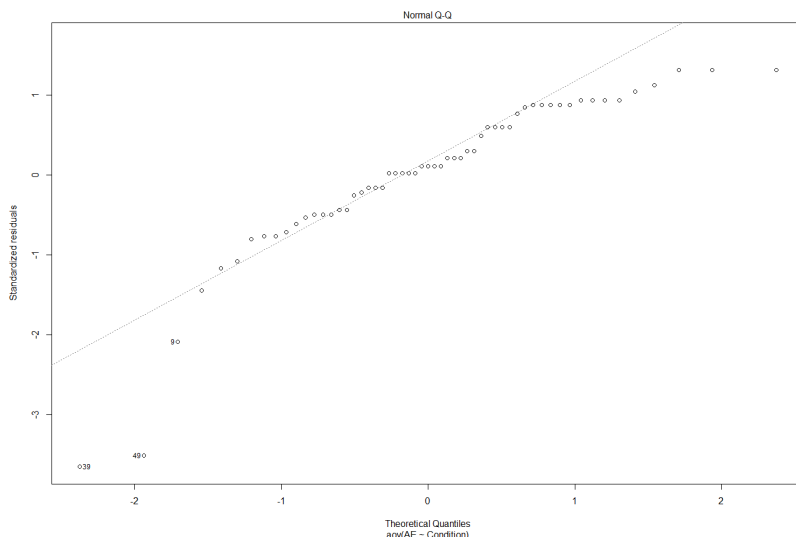


Figure 5.3: In this figure, I can see that all points fall approximately along the reference line, and thus I can assume normality with the subscale of AE.

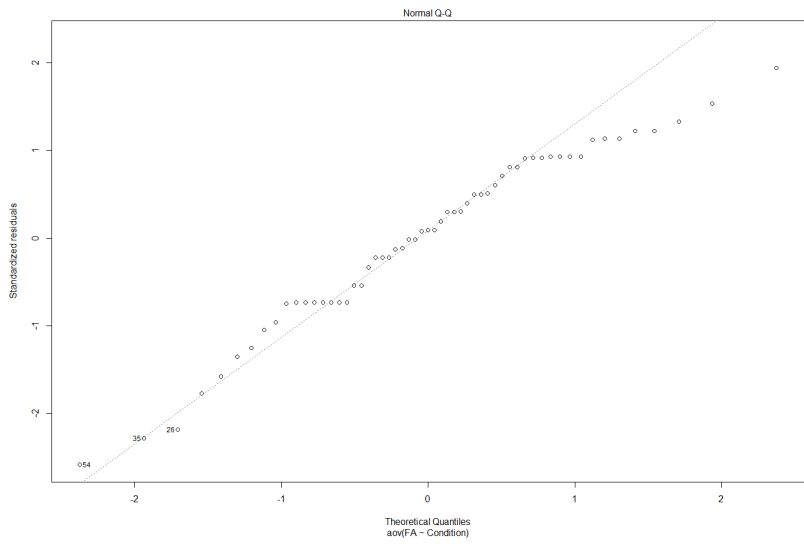


Figure 5.4: In this figure, I can see that all points fall approximately along the reference line, and thus I can assume normality with the subscale of FA.

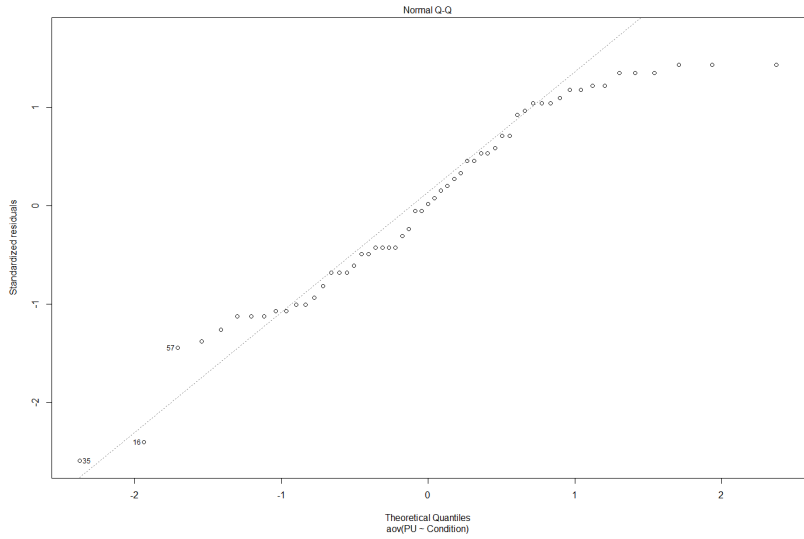


Figure 5.5: In this figure, I can see that all points fall approximately along the reference line, and thus I can assume normality with the subscale of PU.

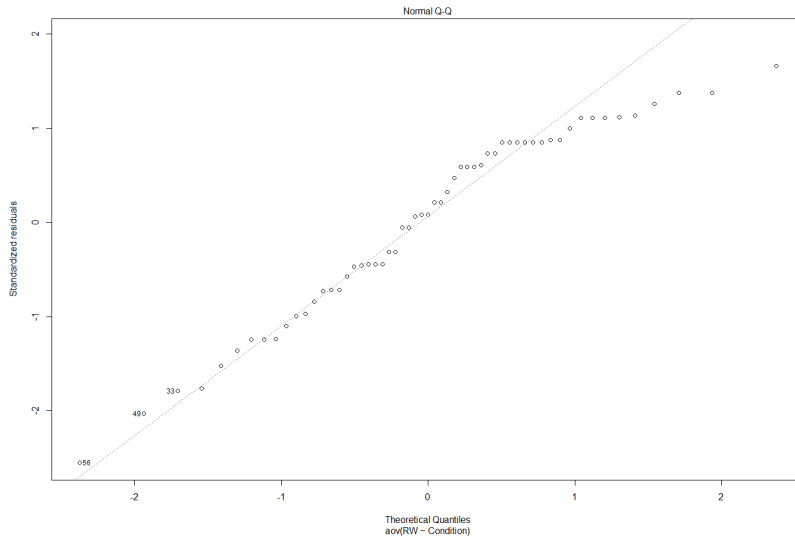


Figure 5.6: In this figure, I can see that all points fall approximately along the reference line, and thus I can assume normality with the subscale of RW.

5.2 Thematic Analysis

Through the thematic analysis of the interview data, I identified seven key themes relevant to the research question and the field of CMC. I report findings that I have inferred from the data and findings that are relevant to the research question because this was a mixed approach of inductive and deductive TA. Braun and Clarke suggest expressing the main themes as stories rather than categories [17], which I derived from participant quotes.

In my findings, I will also report how each theme was shaped for the questions asked in my semi-structured interview. It is important to note that participant quotes were not framed to fit the themes, this means any grammatical errors are reported “as is.” Lastly, all participants within each session were not acquainted with one another except for **session 12** where P42 and P43 happened to know each other by chance. In other words, they were all strangers to each other. A summary of the themes identified via this analysis can be found in [Table 5.3](#).

Main Themes	Sub Themes		
● (1) Use cases for Online Communication Tools	➤ <i>Dedicated Platform for Specific Use Case</i>	➤ <i>Work-life Balance</i>	
● (2) Collaboration Occurs Mainly in Screen Sharing or Breakout Rooms	➤ <i>Synchronous Chat is primarily pro-dominant regardless of audio, video or avatar</i>		
● (3) Interruptions Can Hinder the Engagement in Communication	➤ <i>Bandwidth</i>	➤ <i>Background Noises Creates Distractions</i>	➤ <i>Being Able to Engage In Conversations</i>
● (4) Feeling Sense of Presence, Interactions, and Engagement	➤ <i>Varies from Conditions</i>	➤ <i>Having A "Moderator" Person Helps Facilitates Tasks</i>	
● (5) Self-conscious with oneself in the Virtual Environment	➤ <i>Taxing and Draining</i>	➤ <i>Distracted</i>	➤ <i>Being Presentable and Dilemma between Self-conscious and Engagement</i>
● (6) Avatar and Self-Representation	➤ <i>Being able to customize oneself</i>	➤ <i>Needs more customization</i>	
● (7) Proximity Chat and Privacy Rooms Helps Create the Sense of Space	➤ <i>Being Able to Move</i>	➤ <i>Interactive Elements</i>	

Table 5.3: I inferred 7 themes from the hybrid (largely reflexive) thematic analysis (drawing from codebook approaches) that are relevant to engagement, presence in online communication tools. I present a complete overview of the themes and extrapolated subthemes in this table.

5.2.1 Theme 1: Use cases for Online Communication Tools

This theme emerged when the researchers asked the participants: “*What do you use online communication for?*”. Most of our participants talked about the tools they mainly used for online communication such as Zoom, WebEx, Microsoft Teams, Skype, Google Meet, Slack, Discord, Marco Polo, Remo, Go2Meetings, etc).

More than 75% of our participants use online communications tools primarily for their professional work that currently takes form in a remote meeting to replicate in-person meetings.

*“Like I work as a paralegal and office manager and I work with a criminal defense attorney. So like right now from like, from time to time, they’re still kind of like both **in-person and virtual meetings** in courtrooms, as well as in the jail house facilities.” (P35)*

Sub-theme: Having a Dedicated Platform for Specific Use Cases

Two thirds of our participants noted that they would have **dedicated platforms** for a specific use case, for example, either for professional work, socializing, school, conferences, or interviews.

*“**Skype for business, zoom, and Microsoft Teams.** When I’m with friends, it’s more usually like Google Hangouts.” (P24)*

*“Of course a **discord is mostly for fun, totally casual.** I have a couple of different friends groups on there.” (P54)*

Sub-theme: Work-life Balance

Although only 22% of our participants reported that having a work-life balance is highly important, especially when working at home. They mention that these boundaries between work and personal time begins to blur or mesh together [59, 41]. For example, P45 noted the importance of creating a work-life balance during the pandemic as most of the communications is online, and thus it’s important to distinguish which platform is for work, while the other is for personal.

“Microsoft teams is mostly work. Zoom is work and personal and health. Google duo is basically just strictly personal the way I use it.” (P45)

However, other participants reported that they do not have the luxury to use other online communication tools for specific purposes as these tools either **cost money, or difficult for others to switch** to another online communication platform. Therefore, participants would be only using one specific platform for both work and personal.

“Number one is cost, Zoom for more than two people or more than 40 minutes cost money. So if I want to have an extended gaming time, somebody has to own a paid Zoom account. I wish I could get some of my people to switch over, but for a lot of older people and a lot of non-tech people having already worked in Zoom, it’s just too much for the pandemic.” (P54)

5.2.2 Theme 2: Collaboration Occurs Mainly in Screen Sharing or Breakout Rooms

This theme emerged when the researchers asked the participants: *“What do you use [these online communication platforms] for?”* About 50% participants (mainly those who used CMCs in a professional setting) mentioned that the ability to share screen and share files is important in online communication tools. In addition, participants report that most of their **collaboration happens when they are using sharing a screen**. Usually screen sharing happens when someone is giving a presentation or teaching. Screen sharing allows everyone to see the same thing on the screen, whether these interactions are “sharing code snippets” or something simple as “watching a video together” [63, 103, 57].

“We like we’re very collaborative on our team. It gives us a good opportunity to have somebody pull up the presentation and we can all pitch in or ideas about like the flow of the presentation, aesthetic.” (P55)

“Being able to share a screen request control is really good too. Like if I’m teaching any technical stuff to people.” (P57)

However, some participants noted that the ability to share screen could be improved by having the **ability to zoom in certain parts of the screen**, because if the presenter is using a large screen, it can be *“hard to see what’s on the screen at times”* (P43).

Another important aspect when it comes to collaboration in online communication tools is being able to have a **private space** in which allows to one to disengage from the main meeting space. If the platform only consisted of chat, then this would be the “private messages”. Where as in a audio or video platform, the private space is usually referred to as a **breakout room**. This allows participants to meet in a smaller group to do mainly do collaboration work such as brainstorming.

However, although breakout rooms and screen sharing facilitate collaboration, it is important to note that a minority of the participants report the **difficulty of using breakout rooms** in online communication tools such as Zoom and Microsoft Teams. They found the interaction of the user interface to switch from room to room to be confusing at times.

*“I actually assigned people and I have to remind me why to get in and out. And it’s, you know, **it can be confusing sometimes**, but this one is just about a matter of following another person in, because I mean, I didn’t know that I was like, I was changing the people’s speaking to, by going in and out of different rooms in the beginning.” (P41)*

Subtheme: Synchronous Chat is primarily pro-dominant regardless of audio, video or avatar

Although this theme was not a main focus towards my research question, I found it important to report. All participants mentioned the “**chat feature**” feature is important regardless of which communication platform with aligns with previous research mentioned in section 2. This is claim also evident in other research within the field of CMC where having a chat system gives participant “**another opportunity to communicate**” [66, 100].

*“I like the **chat feature** that they have, because it allows me to send messages. Like if I want to send a message directly to my professor privately or to everyone or another, or a specific student.” (P43)*

*“So our whole company is remote. **It works good for sending messages to people.**” (P50)*

5.2.3 Theme 3: Interruptions Can Hinder the Engagement in Communication

This theme emerged when the researchers asked probe secondary questions to the main question of “*What makes you say that you are not engaged?*”. More than three quarters of our participants reported that, any thing that abruptly stops the flow of communication can make them feel disengaged. This could be something as simple as talking over the other person. Some participants argue that it would have been better if only one person talked during the collaboration task in which P41 stated “*I felt more engaged. It was like, okay, one person can do the talking. One person can do the select pick. The other person can kind of direct where the things can go. So it was, it was very simple that that’s what made it engaging*”.

Sub-theme: Bandwidth

Another limitation that was talked about by the participants is the **connection issues** that can occur. 15 of our participants noted that it is out of their control, as when working remotely worldwide, there are some limitations in various countries. For example, P47 stated “*Not everybody has a great, like very good bandwidth, especially my team. They are in India. Some of them are in Eastern Europe and **bandwidth is not the best** in those nations or countries*”.

*“Sometimes **the video gets really choppy** depending on the connection or how many people are in the room, especially like with work usually, or the video doesn’t work too well, but sometimes if people don’t say like, okay, you go first and you go, second, people can talk over each other and it’s hard to hear.”*
(P29)

*“And if there are at least three people joining in three from different three different places, then the **quality goes down hugely. And that affects your communications.**”* (P19)

Sub-theme: Background Noises Creates Distractions

In addition, more than **one third of our participants** mentioned that they would get distracted if there was background noise present. This makes it difficult to hear and understand what was going on in the conversation.

*“In a sense there was some issues like the one person has a lot of **background noise, so it was kind of hard to hear** and even so when you have more than one person talking at a time, it’s kind of hard to hear what we were saying.”*
(P63)

Sub-theme: Being Able To Engage In Conversations

Three participants expressed their **frustration at not being able to engage in conversations**. This leaves them to just mute their own microphone as expressed with the following:

*“I just go into a platform and only see the people and we just talk together and sometime I need to mute my mic because **so many people join into the room and they want to talk at the same time. And it’s like a mess.**”*
(P18)

*“We had to collaborate because it’s like with the speaking, **it can be difficult to hear everybody speaking at the same time and things**”* (P67)

Seven participants expressed that even though they were able to collaborate on the task together, they would still **feel isolated or lonely** because they were not able to speak or engage in the communication, for example this participant expressed:

*“**I tried to talk to people and I, I, I felt like I was not, you know, we couldn’t like, I couldn’t speak.** Yeah. I brought it up back and forth, and that made me **feel very lonely**, and you didn’t know what people would do next, or I was also not sharing what I would do next. So that fact, like we were doing it together, but it felt isolated.”* (P5)

It is important to note that these findings merge between collaboration and engagement, however as the focus of this thesis is to investigate engagement, I did not analyse if collaboration itself could happen successfully without any hindrances to engagement (*in order words, if there’s no engagement, can collaborate still occur*).

5.2.4 Theme 4: Feeling Sense of Presence, Interactions, and Engagement

This theme emerged when the researchers asked the following questions “*In terms of the [tasks], would you prefer to have the video on? In terms of the [tasks], would you prefer to have the video off (audio only)?* Additionally, as this was a semi-structured interview, examples of some probes that were asked: “*Does this affect your engagement?, What made you feel this way, What have you preferred?*” It is important note that **questions about presence were not the main questions in our interview data**, however, they were probed if the participant mentioned presence. The themes reported in this section are broken up into their perspective conditions. **71% participants** reported that they were engaged with the task.

Condition A - Audio Only

In **condition A**, **more than half of the participants** mentioned they would prefer video on, as they feel as if they are talking into the void or curious if anyone is there. Presence is lost when participants cannot see anyone on their screen, as they start to wonder if anyone else is engaged in the conversation. **The uncertainty of the presence of others, lowers engagement.**

*“Well, it was like a meeting, but it was for this tourism stuff that I do, and there’s only like the presenter was the only one that had the video on and then me and one other person. And then I’ve had it with a few other videos too. We’re just the presenters videos on and they will be like, feel free to turn your video on. And then nobody does. And then **I kind of wonder if they’re there, I feel like, they think that you’re not as like engaged,** and then I kind of do wonder if the other people are actually there, and watching or they just turn it on and like go do something else.” (P15)*

As another participant states:

“I’m not sure you need the webcams on or something, but to get ’em to know people, I think you need to see their faces and how they react. And the audio just doesn’t do that. I know in my, you know, work life, we had a lot of dealings with people right across Canada, and we would phone a lot, but until you went out

*and met them and actually sat down with them face to face and had the same conversation, but face-to-face, that makes a big difference, a huge difference, because now **you're not just talking to a unknown entity at the end, you now can put a face to the name and to what comments they're making.***" (P33)

Condition B - Video Only

Where as **8 of the 16 participants** with video only (**condition B**) noted that that felt more of a connection with the other participants as they were able to see them with video on.

*"I did the fact that there was a video of each person made it a lot more immersive, and **I felt a much better connection than just hearing voices or particularly if it just would have been a chat.** I'm grateful that there was the opportunity to see a person."* (P50)

Condition C - Avatar With Video

25% of the participants in **Condition C** reported that with avatars, they were able to see others around them which made them **feel less disconnected from the space, and was able to visually see everyone else engaging.** They also note that they were not distracted by this in which counteracts the findings in Theme 3 (5.2.3). For example:

*"**I really liked that time where we could go into our own separate room, but not feel super disconnected from the room either, [...] I could see everyone as engaging too that was really fun to watch. [...] I really liked the ability to go in and out of the rooms and only see the people that were in the room. That was really fun too. So, so again, I can see other people in another room, but I'm not being bothered by their conversations or it's, it's not getting interrupted my conversation.**"* (P41)

Condition D - Avatar No Video

43% of participants in **conditions D** noted although they did not have their video on, and the avatar encouraged them to interact with others more.

*“It kind of has this more of a spacial concept that the others don’t. It also has the avatar, which you had the others. You can have video off with your picture, but having something that I can actually move around, like this **encourages me to interact with different people and do things a little bit more.**”*
(P59)

7 of 16 participants with avatar conditions with no video (**condition D**) noted that having the avatar made them feel as someone was there present with them.

*“It’s good to see your, you know, your peers there with you. **Seeing the avatars, you know, they’re definitely there with you, you know, the avatars and all that.**”* (P61)

Of both **conditions C and D**, it is to note that **31 of 32 participants** found it important to have video on, as they would like to see the other participant’s face. This made feel a sense of presence, knowing others behind the screen being present with them.

*“**Video on makes it more interactive.** It makes it more involving, you know, with the video off, it looks like everyone is hiding behind, you know, the screen and just reading something. But with a video on, you could see, I could see everybody and, you know, I could relate with, everybody”* (P10)

Sub-theme: Having A “Moderator” Person Helps Facilitates Tasks

Although **only 7 participants** noted that online communications should require a moderator to help facilitate meetings. I felt that this is important as it answers one of my research questions. For example, P60 articulated that you need: “some kind of navigator or MC or, you know, a person that’s leading them the task.” which could take away from engagement.

5.2.5 Theme 5: Self-conscious with oneself in the Virtual Environment

This theme emerged when the researchers asked the following questions: *“In terms of the [tasks], would you prefer to have the video on? In terms of the [tasks], would you prefer to*

have the video off (audio only)? **About 40% of participants** reported they felt a sense of **self-conscious**, contrasting slightly with the previous theme. Those who felt a sense of self-conscious prefer to have video off. The reason for being self-conscious mainly revolves around seeing one's face present on the screen [15, 83]. For example one participant noted:

*“So having your video off gives you a little bit of like grace, because you don't have to, you know, you don't also have to show your face. I just feel like it's, it's kind of can be really intense, just **like you feel very self-conscious just seeing your face on the screen.**” (P38)*

Sub-Theme: Taxing and Draining

In some circumstances, video is required for communication (conferences, meetings, and etc). Participants noted that when this is the case, it can be **taxing and draining**. They note that this makes them uncomfortable and they then are less likely to feel engaged. As part of the interview was conducted within the platform (meta), from the researcher's perspective, I noted that some participants in conditions B (video-only) and condition C (avatar-with-video) would turn off their cameras because they were feeling a bit “tired”, however some participants mentioned that they would leave their cameras turned on because they wanted to provide meaningful insights towards our research, or considered this process as getting paid (for work). This is also a limitation which I will later discuss in [chapter 6](#).

*“However, if you're on a virtual format, **you feel like you need to be just on and present the entire time, which is pretty taxing.** So whenever possible, I prefer for it to be audio only so that I just feel a lot more comfortable. I can, you know, be sitting however I want to be fitting and I don't have to, you know, be like back straight smile on my face, the entire time.” (P59)*

*“I'm just **not as comfortable** with it being on, **but we're kind of forced to do it**, if it's for work. So I have no choice really.” (P63)*

Sub-Theme: Distracted

Participants note that they become **less engaged when distracted**. It is important to note that being attentive is not the same as being engaged within the conversation [86]. These distractions could be looking at one's self on the screen, or the notion of something else happening within the background of either parties.

*“I think when something is very trying and you need to have sort of, and concentration, I feel like **people become distracted** looking at sort of the disembodied faces of people in a long talk or they become self-conscious about themselves or they, you know, narcissist, like I do this too. I end up looking at myself, even though I don’t even think I’m handsome.” (P51)*

For example, distractions could appear when you are trying to stretch from a long meeting, which takes away from the engaged conversation. However, when one is attentive, **subtle changes on screen** such as when a participant turns off their video, could incur curiosity [6]. Other participants would wonder out loud and ask if the other parties if this person has disconnected or running into any issues thinking that it might be an bandwidth issue [110] as the other participant within the same session stated: *“Well, obviously reducing the, in any of the issues with communication, as far as freezing or, or dropping, those are technology issues” (P53)*. Whereas the participant might have turned off their video shortly for self-conscious related reasons:

*“Not being able to stretch my legs in that way on a long call. No, we’re not being able to. **You probably saw me duck down a couple of times during this, scratch my nose.** Whereas I would much prefer to scratch my nose whenever I don’t please, you know, just stuff like that” (P51)*

Another form of distraction is the **lack of eye-contact**. **10 participants** noted that although they see the notion of others on the screen, it still made them feel as if there’s a **lack of attention and engagement**. One participant notes the follow:

*“But when they’re small, my picture is down in the corner down here. Okay. And so if I want to see, and because I’m, **self-conscious** like so many people I’m like glancing down, whereas if it’s up, I like it centered now for me, I don’t have to do that so much. I’ve got a Sony ZB one, and my picture I’m looking at, I can look, I can look, you know, one of the tricks I do to **maintain eye contact is I actually look at the screen or I can look right at the lens.** There’s me looking at the screen lens. You barely notice anything. Whereas when I was looking, so I’m going to actually go to the small thing. And so here, what I want to see how I, if I didn’t have that and I wanted to see how I look, I have to look down like this. I find that I’m aware when other people are doing stuff like that in a video. And because also when I are, they are, they am, I’m engaging with someone. **Are they paying, are they looking***

down at their thing in their corner? Or are they, am I losing their attention? Are they doing something else? Is that yeah. Is that them checking their phone? Is that them looking like, oh God. Yeah. Well, you know what, actually, I just realized what I'd be worried. If I saw someone look through it, their eyes down like that. I know exactly what I'm thinking. I'm going too long. So checking the clock in the, in the bottom corner of their screen.” (P56)

“And then when you like, look at them, it's like, oh, I don't want to be like staring at that person, but you're kind of looking around at everybody. And then it feels awkward a little bit.” (P15)

Sub-theme: Being Presentable and Dilemma between Self-conscious and Engagement

Being presentation and ready is important when it comes to **self-conscious**. If the participants are worried about **making themselves presentable** or are worried about what is being captured around them (in the real-life environment), this would cause them to be less engaged. For example, P15 exclaimed: *“I didn't feel comfortable with the video, like depending on my surrounding, like maybe I thought, you know, **my place is a mess.**”* Participants stressed the idea of “first impression counts”:

*“If you speak to someone which I do not really know, or like, you know, we working from home, we are, **we're just wearing like hoodies or casual clothes, I don't want to people to see my, (laughs) I, I know like my home is not really organized or something like that.** ”* (P37)

As evident in 5.2.4, having video on makes participants feel more engaged with the tasks, however, at the same time it can make them more self-conscious and uncomfortable. When probing the question: “If we had videos on you would feel more engaged”? one participant projected:

*“That's a question which puts me in dilemma, that yes, that would put me in a more engaged platform, but it would also make me really **uncomfortable** because I don't know the people here around and I'm not sure whether everyone's, everyone's not quite comfortable with video or at least how I look on camera.”* (P19)

5.2.6 Theme 6: Avatar and Self-Representation

This theme emerged when the researchers asked the following question: “*How do you feel about the avatars?*”. **75% of the participants** in the condition with avatars (both Condition C and D), report they felt a self-representation with avatars. They said they found that by having a looking at the avatars, they can see the virtual resemblance within themselves.

*“So, if I have my name attached, like people will look at it, and think it’s kind of like, hmmmmmmm, that’s (**participant’s name**) ... like you’re trying to **customize it to look as close to you as much as possible.**” (P46)*

Sub-theme: Being able to customize oneself

7 participants reported that they were able to customize themselves to their liking. This does not necessarily mean it was a self-representation of themselves, but rather what they wanted to appear as within the virtual space.

*“I just decided to make them, **make my character funky as possible** with Viking horns and all this, similar to your mustache and all this stuff.” (P40)*

Sub-theme: Needs more customization options

12 participants reported there is **lack of customization tools**, in which made it difficult for them to be self-represented properly with avatar. For example one participant expressed:

*“A little bit, the hair color, the skin tone that helped, but I feel like having, you know, being able to choose hairstyle would have really helped a lot. Like my identity is really rooted in my hair. So if **I had more options** for hairstyle or would have made me feel more represented.” (P59)*

*“As always, **there’s always room for improvement in diversity.** You know, the one hairstyle that did have curly hair appeared to be a black hairstyle and I didn’t want to appropriate that. So I went with just a basic, you know, down to the shoulders hairstyle and there’s no curly in it, you know, there’s always room to improve for sure.” (P54)*

5.2.7 Theme 7: Proximity Chat and Privacy Rooms Helps Create the Sense of Space

This theme emerged when the researchers asked the following question: “*What worked well for you in Gather.Town?*”. **40% participants** found the **proximity chat** and **privacy rooms** to be useful. They felt that it was similar to the breakout rooms in which they easily enter and leave. For example as P17 participant noted: “You can have an individual meeting with one other person or however many in the room. So it’s like **a real office**, I guess you have your communal area where you would have a meeting, but then you can **go into like this room and it’s just us two.**”

5.2.8 Sub-theme: Being Able to Move

Participants note that **being able to move, made them feel more connected to the virtual space**, while maintaining to see interactions happening within the space.

*“So for example, when he was giving me the charades options, even didn’t go to the room, but **I could see everyone as engaging** too that was really fun to watch. Whereas **in Zoom**, you can’t see that at you, **when you go into a breakout room**, you’re in the breakout room and **you cant see them in the breakout room, you can’t see other people engaging.**” (P41)*

Another participant notes that **bumping into other avatars and not being able to pass through them gave a sense of space** with the virtual environment:

*“When I **bumped into someone or an object**. I couldn’t just go through it. **I actually liked that** because it makes it seem like I’m really in a room and I’m really moving around.” (P40)*

5.2.9 Sub-theme: Interactive Elements

13 participants that interactive elements create the virtual environment. For example as one participant expressed the notion of workspace awareness:

*“It gives you an easy opportunity to, to **interact in different ways** because the rooms create a different feel or vibe, or the ambience lends itself to a theme. So you, you already are thinking of different things as you go into those rooms and your preconceived notions of what you’re going to be doing in those rooms are driven by the room itself. So I, I like it. I think it serves a purpose.” (P58)*

5.2.10 Recorded Communication Tools

Popularity amongst the recorded communication tools as follows:

1. Zoom (62 participants have used this platform)
2. Microsoft Teams(35 participants have used this platform)
3. Skype (21 participants have used this platform)
4. Google Meet (16 participants have used this platform)
5. Discord (14 participants have used this platform)
6. WebEx (14 participants have used this platform)
7. Slack (9 participants have used this platform)
8. Other: Adobe Connect, BlueJeans, Go2Meetings, Nextiva, Remo, Bongo, Dust, TeamSpeak

These tools are used for a variety of purposes such as collaboration work (professional meetings), socializing, education, conferences, and interviews (as meta as this might sound).

5.3 Summary

In this chapter, I present the quantitative and qualitative analyses. Generally, the results of the quantitative analysis found within the [UES](#) scale, shows there is no significant result, in other words there is no change in engagement across the four communication modalities used. However, there 7 key themes are derived from the thematic analysis.

Chapter 6

Discussion

Through the mixed-methods approach, the evaluation of quantitative data, and the thematic analysis from the participants, revealed that: (1) There are benefits and drawbacks when using various communication modalities. This means each communication modality is better for a specific purpose. (2) Yes, engagement does vary based on the communication modality based on the results mentioned in [chapter 4](#). (3) Communication within the virtual environment creates more opportunities for interaction.

In this chapter, I will be reflecting on the findings identified in [Chapter 5](#). This section will outline possible designs for [CMC](#) tools, potential solutions to problems identified from the thematic analysis, and how we can potentially raise the engagement in these online communication tools that are shifting towards the virtual environment ([VE](#)).

From the quantitative analysis, I note that there are no significant results in the [UES](#) scales, however, the means for each condition scored fairly high (see [chapter 5](#)). This is interesting, as 71% of participants reported these sessions to be engaging. From the qualitative analysis, I was able to further understand which factors contributed to engagement within the communication modality.

6.1 Applicability of these Findings

From the results, I present design guidelines and best practices to keep in mind when communicating in a remote setting. These guidelines will help aid in engagement, self-consciousness with video on, and various ways to collaborate. These guidelines can be used to facilitate remote meetings and future novel interactions.

6.2 Use Cases and Design Consideration based on the Communication Modality

Regardless of the platform, there are currently only three main ways to communicate: (1) chat messages and text [9], (2) voice communication [24], and (3) face-to-face communication [32]. It is important to understand when to use these communication modalities as new forms of communication tools can be formed: virtual reality (VR) and the use of avatars can be used to communicate, which are all derivatives of the main three communication modalities mentioned. I will be focusing solely on 2 of the 3 audio communication modalities and video only as they are one of the main focuses of this study, as there are plenty of other studies that focus on chat messages and text within the CMC literature (see chapter 2).

From this, I will try to classify when it is best to use one medium of communication modality over the other. From our findings, most participants mentioned that “it depends on the other person” and “it depends on the task that is administered” for which they will decide for using audio, video, an avatar with video and avatar without video. It is important to note that these design considerations are catered to a desktop application, further research could be explored in terms of mobile applications as the functionality between the application differ.

6.2.1 Gather Around Town And Collaborate

From our findings in Theme 5.2.2, about 50% mentioned they used online communication to collaborate, where it’s mainly within a breakout room or sharing screens across the application. When one is sharing screen screens to collaborate, the preferred method of communication modality is **audio**.

Collaboration and Screen Sharing

Screen space is limited. From our findings one participant stated “The way things are set up, you don’t large monitors here” said P53. This means there is less screen space for collaboration.

For example one participant noted:

“The panel of the of the profiles of like everyone’s camera on the side kind of blocks the content ... Meanwhile, if it’s not maximized, I’ll have it on the side of the screen.” (P43)

Research have been exploring ways to improve sharing screen through the use of providing an **awareness tool** to provide information about other people’s artifacts [104], however, screen sharing does not consider the aspect ratio the user’s monitor. For example, if a participant that has a large monitor decides to do a screen share, the aspect ratio and monitor size is not the same for other users unless they are using the exact same monitor. In other words, not everyone will be viewing the same thing and this could effect collaboration (objects might be larger or smaller compared to the user that shared the screen).

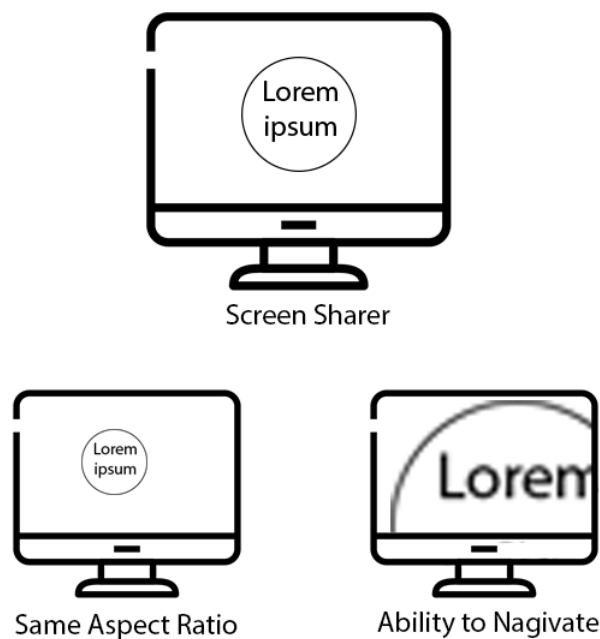


Figure 6.1: In this figure, you can see the main screen of the sharer, in the current aspect function the image gets too small and it makes it hard to see what is happening on the screen, where as this suggestion allows for a more interactive communication modality.

Communication tools could offer **smart zooming where it follows a user’s facial**

eye gaze on the screen. For example, if the user’s eyes start to squint, the self-zooming ability for users on the lower aspect could automatically zoom in.

Another suggestion could be the **ability to navigate** the screen sharer’s screen or it could be directed similar to the concept of “What you see is what you get” [103, 29]. The idea is to make it natural as possible with the minimal distractions to foster engagement identified in subsection 5.2.3. This will allow the viewer to see and select what they want to see within the screen (see Figure 6.1). Future avenues could examine eye-tracking possibilities to make screen sharing more adaptive for the viewer (attention to one’s focus).

6.2.2 Proximity, Avatar and Virtual Space



Figure 6.2: In this figure, you can see how each interview room has a corresponding number attached to the virtual space. This is similar to a breakroom function but within the virtual space.

As most collaboration occurs within the breakout rooms (mentioned in Chapter 5), **breakout rooms are more fluid in virtual environments**. The sense of space is important for participants, as they feel a sense of presence within the virtual environment (identified in section 5.2.7). For example, participants mentioned:

“I feel like I understood the breakout room a little bit more actually physically doing it. And then in the sort of abstract sense of being shuffled around in zoom” (P51)

Moving around within the space becomes more natural as it “**feels more real**”. Workspace awareness refers to the “collection of up-to-the-minute knowledge a person uses to capture another’s interaction with workplace” [56].

*“And one thing that particularly caught my attention is the, you know, private room. So you have this design of the partition when someone or two people or three people go and they discuss something in private, the other participants can not like hear. So it really feels like a **real**, like a **real private room**.”* (P21)

The sense of presence is evident with the avatar conditions, and engagement is participant-driven as outlined in Chapter 5.

“One thing I can say that I appreciated about this kind of experience is that the changes from room to room. So it, it mimics the reality as to if you’re in a room you’re supposed to hear people in that room, but if you’re away, you’re not supposed to hear them. And it seems to be working well, that part.” (P44)

Participants have noted that they would prefer to have more objects to which they could react with:

“So maybe have more objects that you could interact with, even if it’s like, I don’t know, you pick up the pancakes and bring it to the table. I think that’s pretty cool.” (P8)

From observation, participants would only engage and interact with an object when another participant is present. However, if there is not one around to engage with them, participants will go “away from keyboard” (AFK) from Gather.Town until prompted for

further instructions. From this, I argue that having more interactions within the virtual space creates a need for focused attention. However, it can pose as a distraction in terms of collaboration. Therefore, one should consider this **general flow-chart** (see [Figure 6.3](#)).

Example case: The object is a **whiteboard** in a **restaurant setting**. If the object requires an interaction, but it does not fit in the environment, then it should be a **static object**. However, if the object fits the environment but does not take away from the environment it still should be considered as **interactive object**. These objects could be “books” in a virtual library (where it does not require 2 or more people to interact with the object).

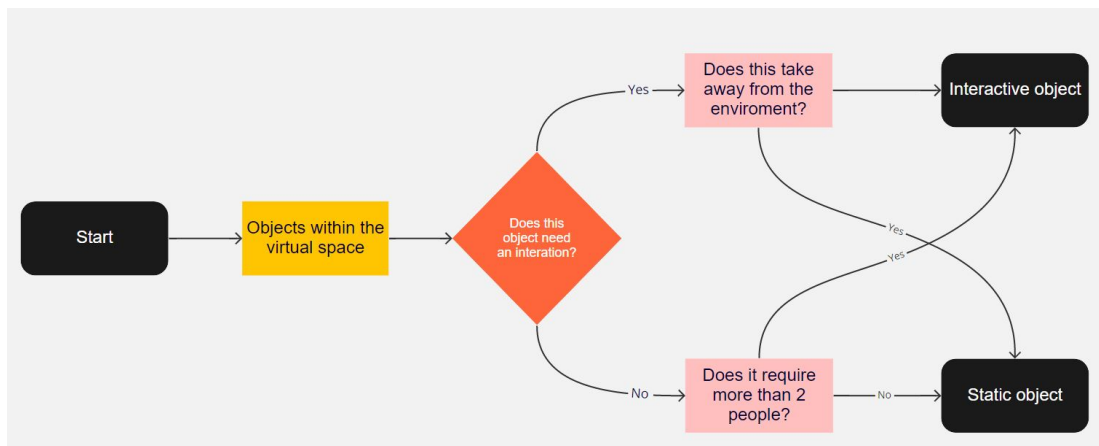


Figure 6.3: In this figure, represents a flowchart for meaningful object interactions.

As 40% of participants feel a sense of self-consciousness, having meaningful interactions could facilitate the element of fun which makes online meetings less taxing and draining as identified in Section 5.2.5. I plan to create a taxonomy for object interactions as it is important for us to understand how interactions within a virtual environment attribute to the sense of presence. This is extremely important as we evolve online communication towards the Metaverse.

6.2.3 Problems that Do Not Really Have a True Solution

There is research on optimizing video streaming capacities [102], however, having an unstable internet connection becomes a problem when it comes to communication. These problems could be lag in audio, or video. As all online communication requires the internet,

this problem for remote communication, as it hinders engagement and the communication itself.

Background noise is another issue mentioned in Section 5.2.3. There exists noise suppression to focus on a user's voice, however, it sometimes create an unrealistic human voice [35].

6.3 Use Cases for GatherTown

Although this section is not the main purpose of my research. I do plan to provide a bit of insight on how Gather.Town could be improved. This will be mentioned in point form:

- More customization in the avatar creation phase, especially in hair choices.
- Having doors within the space to prevent others from entering, as the space is entirely public.
- Animations of walking in Gather.Town needs to be more fluid.
- Embedded icebreakers for people meeting for the first time.

6.4 Summary

In this section, I present a solution for collaboration and screen sharing, a general flow-chart for meaningful interactions for objects, outlined a problems that still do not have a solution, and a few Gather.Town specific recommendations.

Chapter 7

Limitations and Future Work

While I justified my minimum sample size with power analysis, the tasks for each condition were not consistent because of the nature of the conditions given. My findings shows that most participants prefer to multitask when they communicating by audio (see [chapter 5](#)). This is a limitation because I was not able to see the participants' screens: to ensure that they are focused on the tasks given. I could have recorded their screen, but that would create a larger issue such as accounting for the participant's bandwidth and more technical tasks such as making sure the participant is able to record. As this is a remote study, I acknowledge the lost of any observational analysis.

Another limitation is that Gather.Town was heavily inspired by gamers. Therefore, participants who have a gaming background felt more attached to the platform as most of them said: *"feels like you're in a Zelda game"*. This could have contributed to a higher score on the [UES](#) scale (see [Figure 5.2](#)). In addition, the controls to interact with the virtual environment mimicked popular games in the 1990s (arrow keys or WASD keys). The aesthetics of the avatar could pose as a bias in terms of self-representation since the aesthetics of these avatars are more 8-bit style game-like characters.

As this is a between-subject study design, there is a possibility that participants could be comparing their experience to other online communications tools they have used before. This could potentially add a ceiling affect to the [UES](#) scale values outlined in [chapter 5](#).

In Condition A and Condition B, participants had access to a virtual space, which means they were still able to move. This could have biased their [UES](#) scale because they might have rated the scale with an avatar in mind (rather than just specifically audio-only or video-only). This could have been why all means are similar across each condition. As

a researcher, we did ask them to fill out the questionnaire based on the conditions they were in, but it is important to acknowledge this as a limitation.

Lastly, the tasks were all engaging which could have created noise in the engagement measurement. Perhaps the effect of condition on engagement is relatively small especially compared to who you are interacting with. Since the participants were all strangers, this measurement could be different for friends or colleagues.

Future work should examine communication modalities outside of the desktop application. Mobile interaction could pose new ways of interaction through the lens in which participants are looking directly at the camera (through the selfie lens). This means visual gaze is not heavily distorted as much compared to one looking at the screen (instead of looking at the webcam) on a desktop application.

In addition, future avenues could look at how we can use eye-tracking technologies to make screen sharing more adaptive and natural. These studies could additionally explore the balance between self-consciousness and engagement as they contradict one another. In addition, future work could look at meaningful object interactions, as we have been to shift to the virtual environment such as the Metaverse. Lastly, future studies should focus on the idea of “**time**” and how collaboration stages vary between each communication modality.

Chapter 8

Conclusion

In this research, I followed a mixed-methods approach to address some of the challenges with engagement, interactions across various mediums within the field of [CMC](#), [HCI](#), and [GUR](#). In addition, I present specific design guidelines for future [CMC](#) that are adopting the virtual environments [VE](#) adaptation, such as the “metaverse”. Across all four communication modalities there is no difference in terms of engagement. The main factors that drive engagement are the people who are involved in the communication and the purpose of the meeting (in terms of task). In addition, 7 main themes were derived from the thematic analysis (see [chapter 5](#)) for a summarized table.

8.1 A summary of my contributions

My work produced the following main contributions to research: (1) Use cases and design considerations based on the communication modality, (2) Understanding of proximity chat and how an avatar plays out in the virtual space, (3) Problems that still need to be addressed in online communication tools.

This thesis describes an attempt to understand the benefits and drawbacks of using various media (audio-only, video-only, avatar-with-video, avatar-no-video) for online communication tools. Although engagement does not vary between communication modality, this thesis shows the importance of engagement for virtual environments such as Gather.Town.

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APPENDIX

Appendix A

Appendix A Survey

Letter

12/7/2021



Project Title: Social Connections Through a New Medium

Principal Investigators: Lennart Nacke, Associate Professor, Stratford
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Co-Investigators: Mark Hancock, Associate Professor, Management Sciences,
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Student Investigators: Joseph Tu, Student Researcher, Systems Design Engineering, joseph.tu@uwaterloo.ca, Arielle Grinberg, Student Researcher, Management Sciences, a2grinberg@uwaterloo.ca, Derrick Wang, Student Research, Systems Design Engineering, dwmaru@uwaterloo.ca, Stu Hallifax, Post-Doc Researcher, Computer Science, stuart.hallifax@uwaterloo.ca

Gamification in collaborative group meetings: due to the pandemic, our lives have shifted dramatically to a remote/online setting. These remote/online settings have created new opportunities for a “gamified online meeting”⁸³. The purpose of this study is to understand if we can make online meetings better using playful game elements.

As a participant in this study, you would be asked to: make an account on the survey site, UserInterviews, complete an online survey on Qualtrics and interview to describe your experience with, and expectations for, online communication tools. Questions will ask you to provide us your demographic information (age, gender/sex, ethnicity, occupation, education), you may choose to not answer any questions.

To be eligible for this study, you must be between the ages of 18 - 64 years old, and have stable internet and access to a computer that can connect to Qualtrics, participants must have experience with online meetings such as using "Zoom, WebEx and etc", have voice chat and video capability for the online communication platform GatherTown; interacting with objects and etc. While UserInterviews collects contact information, this will not be linked to any survey data and will not be provided to the researchers.

With your permission, we will audio-record the interview portion of the study. You may request to stop recording at any point. We will inform you when we begin and end recording. The data will only be shared anonymously in textual form. No personal information, including audio clips, will ever be shared. You will not be personally identified (no name or voice) in any study report. Any data gathered from this experiment will be stored on a secure database accessible only to the experimenters.

TIME COMMITMENT: Your participation in this study, which is approximately 60 minutes, is entirely voluntary and you may refuse to participate or withdraw from the study at any time up until the point at which your data is anonymized at the end of the study. In appreciation of your time commitment, you will receive \$10 USD through the UserInterview platform.

RISKS & BENEFITS: This study contains no risks. There are no direct benefits to participants, but the results will benefit the scientific community – it will inform future research and design of the effects of online communication tools.

CONFIDENTIALITY: You will not be personally identified (no name or voice) in any study report. Any data gathered from this experiment will be stored on a secure database accessible only to the experimenters. When information is transmitted over the internet, privacy cannot be guaranteed. There is always a risk your responses may be intercepted by a third party (e.g., government agencies, hackers). University of Waterloo researchers will not collect or use internet protocol (IP) addresses or other information which could

link your participation to your computer or electronic device without first informing you.

WITHDRAWAL: You can withdraw your consent to participate and have your data destroyed by contacting us. We will keep our study records for a **minimum of 8 years**.

The researchers will answer any questions you have about this interview at any point. Your participation in this study is entirely voluntary and you may refuse to participate or withdraw from the study at any time up until the point at which your data is anonymized at the end of the study. You may refuse to participate or withdraw before this point without jeopardy. The researchers will ask for your consent to participate in this interview and acknowledge that you have received a copy of this consent document.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (REB [43455]). If you have questions for the Board contact the Office of Research Ethics, at 1-519-888-4567 ext. 36005 or reb@uwaterloo.ca.

By providing your consent, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

I have read the information presented in the information letter about a study conducted by Joseph Tu, under the supervision of Dr. Lennart Nacke, Stratford Campus, University of Waterloo and Arielle Grinberg, under the supervision of Dr. Mark Hancock, Management Sciences, University of Waterloo. I have had the opportunity to ask questions related to the study and have received satisfactory answers to my questions and any additional details. I was informed that participation in the study is voluntary and that I can withdraw this consent by informing the researcher.

With full knowledge of all foregoing, I agree, of my own free will, to the following statements. (You must agree to all terms to proceed with the survey.)

I am 18 or over and I agree to participate in this study.

I agree to my interview being audio recorded to ensure accurate transcription and analysis.

- I agree to the use of anonymous quotations in any thesis or publication that comes from this research.
- I have stable internet connection to connect to GatherTown via a computer.

Participant ID

Please contact the researcher to obtain your participant number and type it here for identification purposes.

Demographics

How old are you?

What gender do you most identify with?

- Male
- Female
- Non-binary / third gender
- Prefer to self-identify
- Prefer not to disclose

What is your ethnicity? Select all that apply.

- Arab
- Black (including African, African-Canadian, African-American, Caribbean)
- Chinese (including Mainland China, Hong Kong, Macau, and Taiwan)
- Filipino/a
- Indo-Caribbean, Indo-African, Indo-Fijian, or West-Indian

- Indigenous (First Nations, Métis, Inuit)
- Japanese
- Korean
- Latin, Central, or South American (e.g., Brazilian, Chilean, Columbian, Mexican)
- North African (Egyptian, Libyan)
- Pacific Islanders or Polynesian/Melanesian/Micronesian (e.g., Cook Island Māori, Hawaiian Mā'oli, Fijians, Marquesan, Marshallese, Niuean, Samoans, Tahitian Mā'ohi, Tongan, New Zealand Māori)
- South Asian (e.g., Bangladeshi, Pakistani, Indian, Sri Lankan, Punjabi)
- South East Asian (e.g., Cambodian, Malaysian, Thai, Vietnamese)
- West Asian (e.g., Afghani, Armenian, Iranian, Iraqi, Israeli, Jordanian, Lebanese, Palestinian, Syrian, Yemeni)
- White (including European, White-Canadian/American/Australian/South African)
- Prefer to self-identify
- Prefer not to disclose

What is your highest education level?

- No schooling completed
- Some high school, no diploma
- High school graduate, diploma or the equivalent
- Some college credit, no degree
- Associate degree
- Bachelor's degree
- Postgraduate degree
- Prefer not to disclose

What is your employment status?

- Employed
- Self-employed
- Student

- Retired
- Unemployed
- Other
- Prefer not to disclose

Study Begins

Please **DO NOT** close this tab.

Please **return back to GatherTown** by letting the researcher know.

Back Survey

The next few questions ask you to think about your experience with **GatherTown**.

GatherTown UES

I was so involved in this experience that I lost track of time.



I felt annoyed while using **GatherTown**.



I lost myself in this experience.



When I was using **GatherTown**, I lost track of the world around me.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

During this experience I let myself go.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

I felt frustrated while using this **GatherTown**.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

This experience was fun.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

I found **GatherTown** confusing to use.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

I felt involved in this experience.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

I was absorbed in this experience.

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Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

I felt discouraged while using **GatherTown**.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

I liked the graphics and images of **GatherTown**.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

My experience was rewarding.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

This experience was demanding.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

I felt in control while using **GatherTown**.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

GatherTown was attractive.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

I continued to use **GatherTown** out of curiosity.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

I could not do some of the things I needed to do while using **GatherTown**.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

The time I spent using **GatherTown** just slipped away.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

The content of **GatherTown** incited my curiosity.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

GatherTown was aesthetically appealing.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

Please select '**strongly agree**'

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

GatherTown appealed to be visual senses.

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

Using **GatherTown** was worthwhile

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

The screen layout of **GatherTown** was visually pleasing.



I consider my experience a success.



This experience did not work out the way I had planned.



Using this **GatherTown** was taxing.



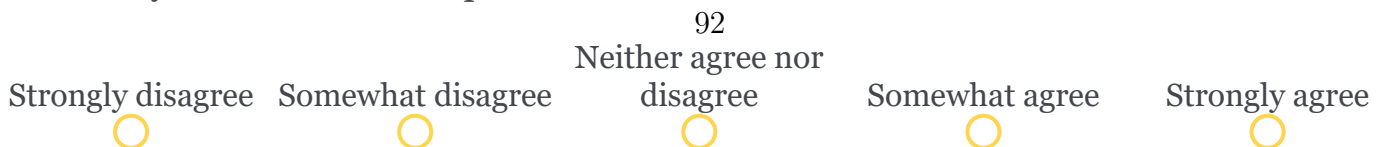
I would recommend **GatherTown** to my family and friends



I blocked out things around me when I was using **GatherTown**.



I was really drawn into this experience.



Block 9

Now, we want you to consider the virtual (remote) environment of GatherTown.

GatherTown Perspective

I felt the **presense** of a person as if they were beside me



I felt like I knew **everyone's name** in the space



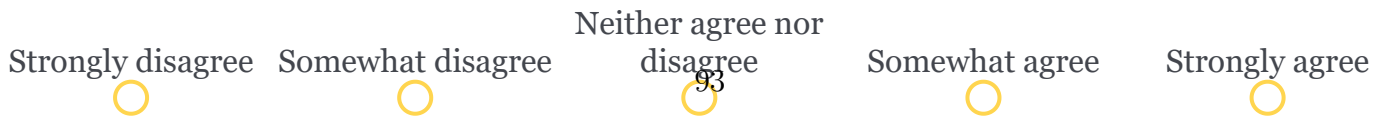
I knew what **everyone was working on**



I could see **everyone within the room**



I was **aware of my current surroundings**



I felt a **sense of connectedness**

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

I knew what I was **doing**

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

I felt I can **collaborate** with others easily

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

I felt a **sense of realism**

Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree Strongly agree

Renum

Please **DO NOT close this tab** and let the researchers know that you have completed the survey to proceed on with the interview.

In appreciation of your time commitment, you will receive **\$10 USD through the UserInterview platform.**

Feedback Letter

12/7/2021

Feedback Letter



Project Title: Social Connections Through a New Medium

Principal Investigators: Lennart Nacke, Associate Professor, Stratford
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Co-Investigators: Mark Hancock, Associate Professor, Management Sciences,
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Science, stuart.hallifax@uwaterloo.ca

**We appreciate your participation in our study, and we thank you for
spending the time to help us with our research!**

Study Overview

The objectives will be to study how online communication tools such as Zoom, WebEx and etc, can benefit from “playful game elements”. This data will be used to create more engaging experience for the online communication tool experience. If you have any questions, feedback, or concerns about the study or related research, please contact any member of the research team listed above.

Confidentiality and Security of Data

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Your identity will be confidential. Your name will not be included in any thesis or report resulting from this study. Electronic data and audio/video recordings collected during

this study will be retained on a password-protected and encrypted server at the University of Waterloo for a minimum of 8 years, to which only researchers associated with this study have access. All identifying information will be removed from the records prior to storage. Once all the data are collected and analyzed for this project, I plan on sharing this information with the research community through seminars, conferences, presentations, and journal articles. If you are interested in receiving more information regarding the results of this study, or would like a summary of the results, please contact the researchers.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (REB [#43455]) If you have questions for the Board contact the Office of Research Ethics at 1-519-888-4567 ext. 36005 or reb@uwaterloo.ca

Powered by Qualtrics

Glossary

API Application Programming Interface [iii](#), [16](#)

CMC Computer-mediated communication [iv](#), [1–8](#), [10](#), [17](#), [34](#), [45](#), [49](#), [61](#), [62](#), [70](#)

GUR Games User Research [1](#), [4–6](#), [8](#), [10](#), [37](#), [70](#)

HCI Human Computer Interaction [1–8](#), [10](#), [11](#), [70](#)

iPQ iGroup Presence Questionnaire [18](#)

PXI Player Experience Inventory [17](#)

SP Social Presence [4](#), [16–18](#), [30](#)

UES User Engagement Scale [xi](#), [xiii](#), [3](#), [4](#), [11](#), [16–18](#), [25](#), [30](#), [37–39](#), [41](#), [42](#), [60](#), [61](#), [68](#)

UX User Experience [iii](#)

VE Virtual Environment [1–4](#), [7](#), [9–11](#), [61](#), [70](#)

VR Virtual Reality [62](#)