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Article

Application of Immersive Virtual Reality to Pragmatics Data Collection Methods: Insights from Interviews

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Abstract

This exploratory study investigated the usability of immersive virtual reality (VR) as a way of creating a role-play task to examine pragmatic competence, specifically the ability to produce the speech act of request. The study created a closed role-play task in two versions. One was a standard computer-based version in which participants read a written scenario displayed on the screen and produced the target speech act for the computer. The other one was a VR version in which participants put on a VR headset and produced the target speech act for the interlocutor in the virtual space. Five native and five non-native speakers of English completed both versions and participated in a follow-up interview. The purpose of the interview was to examine similarities and differences in participants' perceptions of the two role-play tasks in four areas: (1) thought processes (what they were thinking during the task), (2) recall (what they remembered about the task), (3) difficulty (what made the task difficult), and (4) enjoyment (whether the task was fun). Results revealed that the participants attended to various audio-visual cues in the VR scene and used them to guide their actions. The VR version also evoked greater emotional reactions from the participants.

KEYWORDS: VIRTUAL REALITY; PRAGMATICS; CLOSED ROLE-PLAY.

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1. Introduction

Pragmatics involves a complex interplay among linguistic forms, communicative functions performed using the forms, and the context where the form-function associations are realized (Levinson, 1983; Thomas, 1989). In order to become pragmatically competent, we need to have a body of linguistic repertoire at our disposal, so we can perform a variety of communicative functions. At the same time, we need to be aware of the specifics of a social context—whom we are speaking to, in what setting, and to achieve which goals—to make appropriate linguistic choices in context.

Because of the contextually grounded nature of pragmatic competence, a challenge for researchers is to collect data that closely reflect participants' linguistic manners in a social context (Taguchi & Roever, 2017). Because social contexts are the product of real-world settings, experimental data elicited through a researcher-made instrument are often criticized for their lack of correspondence to real-life language use (Nguyen, 2019). On the other hand, although naturalistic data collected in real-life settings have ecological validity, generalizability of the data is limited due to the small sample size and large variation across participants and data collection settings (Taguchi, 2018).

This study explores a possible solution to this dilemma by examining an alternative way to collect data on pragmatic competence. Considering the pros and cons of experimental and naturalistic data collection methods, this study adopts virtual reality (VR) technology to create a role-play task. Virtual reality provides an immersive experience where participants can situate themselves in a realistic context and interact with people in the virtual space. By administering the standardized VR instrument to a group of participants in a systematic manner, we can collect data that are comparable across participants. In this study, interview data collected from 10 participants (both native and non-native speakers of English) provide insights into the usability of VR for examining pragmatic competence. The findings of the study generate implications as to how VR can serve as a useful tool for pragmatics teaching and assessment.

2. Background

2.1 Data Collection Methods in Second Language Pragmatics

Second language pragmatics (L2 pragmatics) is the field that studies L2 learners' ability to comprehend and convey pragmatic meaning in the target language, and how that ability develops over time (Taguchi & Roever, 2017; Taguchi, 2019). Pragmatic competence involves two dimensions: pragmalinguistics and sociopragmatics (Levinson, 1983; Thomas, 1983). Pragmalinguistics refers to

linguistic resources for performing a communicative act, while sociopragmatics involves the knowledge of social conventions in the society. These two dimensions run parallel to functional and sociolinguistic knowledge in models of communicative competence (Bachman & Palmer, 1996; Canale & Swain, 1980). Functional knowledge involves the knowledge of form-function mappings, while sociolinguistic knowledge extends the form-function mappings to contexts of use (selecting appropriate forms to use in a specific context). Given the centrality of context of language use in pragmatics, it is critical to develop a context-rich instrument for eliciting and assessing pragmatic competence.

A variety of data collection methods have emerged in the field, ranging from an experimental, construct-eliciting instrument to naturalistic observations (Nguyen, 2019; Taguchi & Roever, 2017; Culpeper et al., 2018). Among the methods available in the field, a spoken discourse completion task (DCT) or a closed role-play (Kasper & Dahl, 1991) has been a popular method (Nguyen, 2019). A closed role-play (or spoken DCT) presents a brief scenario and prompts participants to respond orally to the computer by playing the role given in the scenario.

The popularity of a closed role-play in pragmatics research is mainly due to its practicality (Taguchi & Roever, 2017; Taguchi, 2018; Nguyen, 2019). The task allows researchers to collect data from a large number of participants in one setting. Because the format and scenarios are controlled and standardized, the data elicited via closed role-plays are comparable across participants. In addition, a closed role-play allows for the manipulation of social factors in a scenario (i.e., power difference and social distance between the speakers), so that researchers can examine how these factors affect participants' linguistic demeanors in terms of directness and formality.

However, the use of closed role-play has been severely criticized (Taguchi & Roever, 2017). One major criticism is that the data collected via closed role-play lack the features of spoken interaction. Because the task only elicits a one-turn response, it does not elicit features of interaction such as turn-taking and speaker-listener collaboration (Youn & Bogorevich, 2019). In addition, the task has limited authenticity (Nguyen, 2019). Participants are asked to read a scenario and put themselves in an imaginary situation. Using only their imagination, they perform the assigned role and speak to a blank screen on the computer. Furthermore, scenarios in closed role-plays are often condensed into a few sentences, providing limited contextual information.

To overcome these limitations, recent studies have adopted technology to add audio-visual dimensions to closed role-plays. Halenko (2013) used an internet-based animated movie site to develop animated scenarios for virtual role-plays. Other studies have used video clips to elicit speech acts. Hui-Chun and Zapata-Rivera (2009) created a tool called "A Game of Persuasion," which

enabled participants to interact with an animated professor over a range of video-based academic settings through three-turn written role-plays. More recently, Rockey and associates (2020) developed a task to examine nonverbal aspects of attention-getting behaviors in request-making among L2-Spanish learners. They used FlipGrid to deliver a video prompt and to video-record participants' responses.

Although technology-enhanced closed role-plays have advanced current practice, contextualization is still limited in these tasks because contextual information is condensed into a short scenario involving a few sentences. Participants have to read the scenario and perform the imagined identities to act out the scenario. Even in the case of videos, participants often take the role of an observer, watching the situation from the third-person perspective, rather than being part of the situation or directly interacting with people in the situation.

2.2 Virtual Reality Application to Data Collection Methods

One way to overcome the limitations of a closed role-play is to use VR to create scenarios. VR technology allows users to experience a three-dimensional environment that can be seen from all angles. By providing sensory perceptions, VR simulates real-life experiences in which users feel like they are involved in another setting (Rheingold, 1991). A benefit of VR for language learning is that it can produce an immersive, context-rich environment where learners transport themselves to a realistic situation and engage in a simulation with real-life characters. A pioneering study was carried out by Vilar-Beltrán and Melchor-Couto (2013), who used Second Life as a platform for role-plays. They created a virtual village consisting of six huts, each featuring a refusal scenario (e.g., refusing a friend's invitation to a party). Learners of Spanish then created their own avatars and performed a role-play via text-based chat in each scenario.

Because the body of research using VR is still small, more research is needed to explore the potential of VR in pragmatics learning. Particularly valuable is a line of research which uses immersive VR rather than non-immersive desktop VR (Robertson et al., 1993). Most existing studies in pragmatics have used non-immersive VR where users explore the virtual world from the third-person perspective on a desktop computer using their avatars. Hence, more research is needed in using immersive VR where users can explore the world from the first-person perspective using a VR headset. Such research can help us further evaluate the usability of VR for creating immersive, realistic experiences.

Corresponding to the increasing affordability of VR equipment, VR has attracted much attention from researchers and teachers over the last two

decades. Lan (2020) presented five reasons for using VR for language learning: (1) visual experiences, (2) entertainment, (3) social networking, (4) operation, and (5) creation. VR technology can enhance learners' visual experiences by allowing them to visit places they cannot otherwise visit (e.g., outer space) (Lan, 2020). Activities can be created around these sites, so learners can observe new events and cultures using language skills. Those activities can enhance spatial knowledge of visual stimuli, helping learners to explore the visual cues in the VR space (Dalgarno & Lee, 2010). Entertainment VR games, on the other hand, can offer learners a community where they collaborate with other players to achieve in-game goals using the target language. In addition, VR can promote social interactions among learners in virtual locations. Studies have shown that interactions occurring in the virtual space could elicit emotional responses similar to those in real-life settings (e.g., happiness, anxiety) (Moustafa & Steed, 2018; Scanlon & Castaneda, 2018). Virtual reality also offers hands-on experience of manipulating or creating virtual objects and simulating real-life processes (e.g., job interviews).

Although VR has been applied to language teaching in a number of ways, most existing studies explored applications of VR to vocabulary learning and four skill areas (e.g., speaking) (Blyth, 2018; Lan, 2020). Studies that examined VR applications for pragmatics, especially those using immersive VR, are still rare (Sykes & Dubreil, 2019). Since pragmatics capitalizes on language use in context, VR technology can be an ideal tool for eliciting and examining learners' pragmatic knowledge. Rich graphics and animation in VR can offer an immersive space where learners can create and perform their own identities in diverse roles and social settings (Lan, 2020). Given the paucity of available findings, it is important to investigate whether VR serves as a useful site for pragmatics. The present study addresses this question from participants' perspectives. Using interviews, this study compares participants' perceptions between a VR-based role-play and a standard computer-based role-play. The study investigates what unique experiences VR can bring to participants, and how participants respond to those experiences.

3. Research Question

This study was guided by the following research question: what differences, if any, emerge in participants' perceptions of the VR-based role-play as opposed to the computer-based role-play?

4. Methods

4.1 Participants

Ten students at a US university (five males and five females) participated in a one-on-one interview with the researcher. They were volunteer participants recruited from freshman composition classes. There were five native and five non-native speakers of English (average age 18.5 years; age range 18–19). The non-native speaker group, recruited from a different section of composition classes, included four international students from China and one international student from Korea. Their average TOEFL score was 112.8 (range 110–119). Seven participants reported that they had never used VR, while three had used it a few times. Both native and non-native speakers were recruited in the study to include participants of different language backgrounds, so the generalizability of the findings can be enhanced.

4.2 Target Pragmatic Feature: Speech Act of Request

A computer-based and a VR-based role-play were created to elicit participants' speech acts of request. Both tasks involved the same situations. The request was elicited in two situations that differed based on Brown and Levinson's (1987) three contextual factors: power (P), distance (D), and degree of imposition (R). Power refers to the perceived power difference between the interlocutors; distance refers to the perceived degree of social distance between the interlocutors; imposition refers to the degree of burden imposed on the hearer. One situation type involved a request that carried a larger size of imposition and was made to someone in a position of greater power and social distance than the role of the participant (PDR-high; asking a professor to reschedule a quiz), while the other situation type involved a small request made to someone of equal power and smaller social distance (PDR-low; asking a classmate to lend you a pen). The difference between these two situation types was confirmed in the author's previous studies (Taguchi, 2012).

> PDR-low request:
> You are in your English class. You forgot to bring a pen. You want to borrow a pen from your classmate. What do you say to your classmate?
>
> PDR-high request:
> You have a quiz in your history class on Monday. You can't take it because you have a doctor's appointment. You want to take it on a different day. What do you say to your professor?

In addition to these two request-making items, three distractor situations were included in each task. Different distractor items were used in the two tasks

(computer-based role-play: ordering food, asking for time, and refusing the offer of food; the VR-based role-play: ordering coffee, apologizing for spilled coffee, and complimenting on food).

4.3 The Computer-Based and VR-Based Role-Play

The computer-based role-play was created using LiveCode (RunRev, Ltd., 2013). In this task, a brief scenario written in English appeared on the computer screen and stayed there for 20 seconds. After the scenario disappeared, participants were prompted to speak to the computer as if they were in the situation performing the assigned role. When they finished, they clicked on a button to move to the next item. Their speech was recorded on the computer through the software. There were five items in total (two target requests and three distractor items).

The VR-based role-play instrument involved a series of short 360° videos recorded using an Insta360 camera (https://www.insta360.com). The following description illustrates the scene recorded for the PDR-high request scenario. Figure 1 shows a visual presentation of the scene.

> PDR-high request, VR scene description:
> It is a large history class. The class has come to an end. The professor announces homework and reminds students about a quiz on Monday. He says, "OK, make sure you do your homework. It's pp. 10–15 in the textbook. Oh, you also have a quiz on Monday. Review all the problems we covered this week." Students start leaving the class. A student goes up to the professor. The professor turns and looks at the student.

Figure 1. A visual presentation of the PDR-high request scene recorded with a 360° camera.

The VR task included five videos recorded on campus. The videos were edited and uploaded onto YouTube, and participants viewed them using an Oculus Go VR headset. As in the computer-based task, participants first saw the written scenario in English for 20 seconds. After the scenario disappeared, the video started. Participants were given 30 seconds in which the video played where they were able to look around, after which a person in the video would prompt the situation. Participants were instructed to talk to the person in the video performing the assigned role. Their speech was recorded using a digital voice recorder. After completing one item, they clicked on the forward button to move to the next item. There was one practice item in both the computer-based and VR-based task.

4.3.1 Interviews

A one-on-one interview was conducted in English in the researcher's office (about 30–40 minutes in length). During the interview, participants completed the computer-based and VR-based role-play tasks in front of the researcher (10 items in total; five computer-based and five VR-based tasks). The items were presented one by one in a randomized order. Half of the participants first completed the computer-based role-plays, followed by the VR version. The order was reversed for the remaining half of the participants.

Immediately after participants completed each role-play, the researcher asked questions. The questions were meant to gauge participants' thought processes while completing the item, as well as their perceived degree of difficulty, enjoyment, and memory for each item (see below). Participants' responses were recorded using a digital voice recorder.

Thought processes: What were you thinking while completing the role-play?
Recall: What do you remember about the situation?
Difficulty: How did you feel while completing the role-play? Easy or difficult? Why so?
Enjoyment: Was it fun to do the role-play? Why or why not?

These questions were used because previous studies showed that learning tasks assigned in the immersive VR environment tended to generate high cognitive loads (Lin et al., 2019); at the same time, they were perceived to be engaging, fun, and lifelike (Kaplan-Rakowski & Wojdynski, 2018; Xie et al., 2019). Hence, it was considered important to address the degree of enjoyment and satisfaction that participants experienced while completing the tasks, while addressing the degree of difficulty and ease of recall.

4.4 Data Analysis Procedures

Interview sessions were transcribed by the researcher. Transcriptions were categorized into eight sections according to the item type (PDR-low and PDR-high request), along with the response area (thought processes, recall, difficulty, and enjoyment). The transcripts were analyzed using the program MAXQDA (VERBI GmbH, 2020). Participants' responses were coded and categorized thematically to discern notable patterns. The frequency and nature of the coded segments were compared between the computer-based and VR-based role-play task.

5. Results

This study investigated whether participants' perceptions differ between VR-based and computer-based role-plays, and if so, what differences emerge. Results of the interview analysis are presented in the following subsections, according to the four questions asked during the interview.

5.1 Thought Processes

The first interview question asked participants to report what they were thinking when they were completing the two request-making role-plays: PDR-high request (asking a professor to reschedule a quiz) and PDR-low request (asking a classmate for a pen). A total of 56 unique responses were identified in the transcripts. After coding their responses, six areas of thought emerged: (1) social factors (interlocutor relationship, formality of the setting), (2) contextual information (details of the situation), (3) language and manner (e.g., word choice), (4) imagination (trying to imagine the situation), (5) scenario (setting and goal of communication), and (6) feelings (emotions). Figure 2 presents percentage distributions of these areas by situation type (PDR-high versus low) and task type (VR versus computer-based).

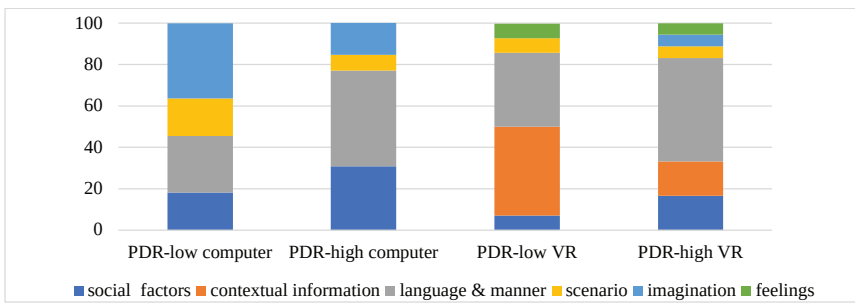

Figure 2. Areas of thought while performing role-plays (percentage distribution).

In both tasks, participants attended to social factors and language choice more in the PDR-high than in the PDR-low request. They commented that they were aware of the difference in the power relationship (talking to a professor versus a fellow classmate) and the degree of imposition (asking to reschedule a quiz versus asking for a pen) between these two requests. This awareness often co-occurred with their attention to language choice. As shown in excerpt 1, participant KS reported that he was thinking about sounding more "professional" when asking to reschedule a quiz because he was talking to a professor.

> Excerpt 1, participant KS (native speaker of English), computer-based role-play:
> In this situation you are talking to a professor. You can't talk casually like a friend, so I was thinking what kind of words to use, how to make it sound, I guess, more professional.

When the researcher asked what he meant by "being professional," KS responded that he first greeted the professor and called him by his title ("Hi, Professor"); he took responsibility for the circumstance by saying, "I understand that there is a quiz"; and he asked if it was possible to reschedule the quiz to another day, rather than demanding that he needed to reschedule the quiz. These findings indicate that social factors are more salient in a situation where those factors have more direct impact on people's linguistic demeanors. The participants were aware of the high-stakes nature of the PDR-high situation and were careful about their speech to avoid negative consequences.

While participants' attention to social factors was similar between the VR and computer-based instrument, notable differences emerged in the other three areas. It is not surprising that the participants used their imagination more in the computer-based role-play because they only had a short description of the situation. Without visual and auditory cues, they had to fill in many details using their own imagination. In contrast, those audio-visual cues came to their attention more in the VR role-plays: 43% of the responses were found in the area of attending to contextual information in the PDR-low request and 17% in the PDR-high request. The participants reported a variety of contextual details they noticed in the VR situation, including people and how they looked, the space and size of the room, and the arrangement of the furniture. These observations also evoked certain feelings in the participants. For example, participant IK reported that he felt nervous being surrounded by a number of students in the classroom setting. These findings indicate that audio-visual cues in VR scenes were prominent in the participants' thought processes when completing the role-plays. Because of the immersive nature of VR, those cues felt realistic and provoked certain emotions.

5.2 Recall

The second interview question asked what participants remembered about the situation. Their responses fell into two categories. They remembered either information about the scenario narrative given to them or contextual information observed in the situation; some remembered both. When doing the computer-based role-play, all 10 participants reported only the written scenario appeared on the screen, whereas in the VR role-play, most participants reported the contextual information they observed in the scene, while a few participants reported both (see Figure 3).

These results are complementary to those in the previous section, in that when doing the role-play in VR, participants were more attentive to contextual information (e.g., space, people), and they were able to recall details of the context. Those contextual details sometimes influenced their decision in terms of how to behave in the given situation. As excerpt 2 illustrates, KY verbalized details of the scene from the first-person perspective by using the pronoun "me" and "I," indicating that KY actually felt as if he was in the place and interacting with people in the scene. He noticed several contextual cues that were directly tied to the goal of the interaction (i.e., borrowing a pen from a classmate). He said that his paper was blank (because he didn't have a pen to write with). He also said that the person next to him had an extra pen, and he was even able to recall the color of the extra pen that he was going to borrow.

> Excerpt 2, participant KY (non-native speaker of English), VR role-play:
> Ah, I remember there is me and three other students sitting in a rectangle table. And so there are two girls in front of me and there is a guy to my left, and there is a professor, and he is using one of those smart board things and we all had papers in front of us, and mine is blank. And the guy is like making some sort of graphic art thing. I don't remember what the girls this side were doing, but this one has notes. Ah

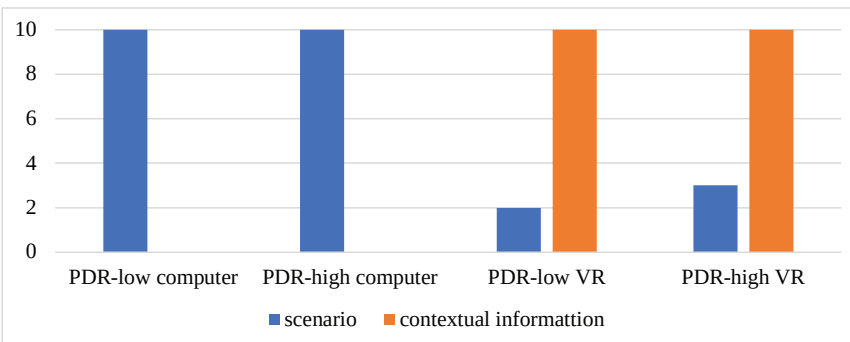

Figure 3. Aspects of the role-play situations recalled (frequency distribution).

> … I don't remember the color of the pen exactly, but I know that the extra one was blue. The one in front of the guy because he was using one and he had another one.

Participant KY added that he knew who to ask for a pen because the person next to him had an extra pen in front of him. He said that he was addressing him directly during the role-play. These findings show that the VR provided an embodied experience for the participants. Being placed in the surroundings of the situation, participants were able to analyze a number of contextual cues (both visual and auditory) to make sense of the situation. Accumulation of contextual cues helped them to interpret the situation in a certain way, which, in turn, influenced their course of action.

Audio-visual cues also enhanced authenticity in the VR situation. In excerpt 3, CW mentioned that she was hesitant about asking a professor to reschedule the quiz. Seeing the professor face to face added extra stress for her, making her pay extra attention to her speech and demeanor.

> Excerpt 3, participant CW (non-native speaker of English), VR role-play:
> I felt more hesitant, hesitated, because I was actually approaching the professor to talk about it. In this situation I'd probably say to him somewhere in the backdoor or something, but I was actually going up to the professor. Because I'm not the kind of person who can speak to someone who is at higher position than me like really confidently, so this situation, actually seeing him makes me, like, want to focus on grammar, my sounding, or my politeness more than if I were not actually seeing him.

5.3 Difficulty

The third interview question asked whether the participants felt the role-play was difficult to do, and if so, why. Of the 40 responses coded for this question (10 participants; two VR-based and two computer-based role-plays), 27 responses were rated on the difficult side (18 in the VR and 9 in the computer-based). These 27 responses were coded for the reasons of difficulty (what made it difficult). Four types of reasons emerged in the data: (1) social factors (e.g., power and social distance), (2) emotional factors (e.g., uncomfortable feelings), (3) amount of language production (e.g., long sentences and explanations required in the situation), and (4) lack of previous experience or familiarity with the situation. Figure 4 presents the frequency distribution of these reasons.

Not surprisingly, social factors in the PDR-high situations were the major source of difficulty in both the VR-based and the computer-based role-plays. Participants reported feeling uncomfortable talking to a professor about rescheduling a quiz.

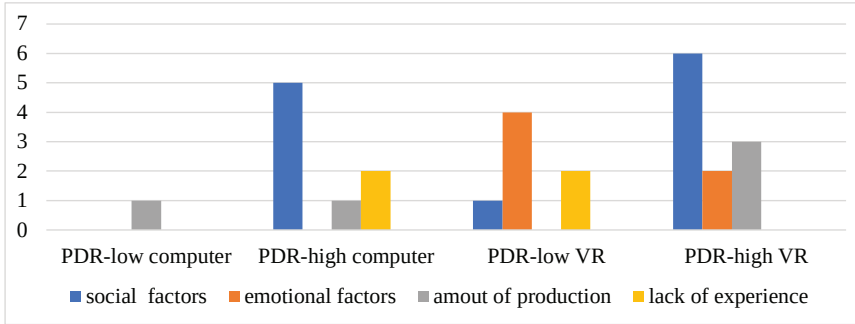

Figure 4. Reasons for difficulty (frequency distribution).

In addition to social factors, emotional factors added to the difficulty of the VR role-plays, while these factors played no role in the computer-based role-plays. Interestingly, emotional factors added more weight in the PDR-low than in the PDR-high request. This pattern was opposite to that for social factors, which showed that talking to someone of the same level of power about a small thing was perceived as less difficult. Interview data revealed that the setting where participants were placed in in the PDR-low role-play induced unpleasant feelings. Participant IK mentioned that he felt uncomfortable asking for a pen in the VR role-play because he did not have full control of what others say or do (excerpt 4). He said that in the VR situation, three classmates sitting at the desk all turned to him and looked at him at the same time. The degree of attention, combined with the silence in the room, made him uneasy about asking for a pen.

> Excerpt 4, participant IK (non-native speaker of English), VR role-play:
> I was talking more in a careful way because the situation that was shown was a quiet classroom, everyone focused and then at one point everyone just looked at me. So I'm like a little more careful about my word choices and those …

In fact, IK further commented that the PDR-high request (asking a professor to reschedule a quiz) was easier than this role-play because it was a one-on-one situation, and he did not have the entire class focusing on him. These emotional reactions coming from the immersive experience also affected the participants' perceptions of enjoyment, as shown in the next section.

5.4 Enjoyment

The last question asked whether the participants felt the role-play was fun and engaging. Figure 5 displays the 10 participants' responses for each role-play (fun, not fun, and neutral).

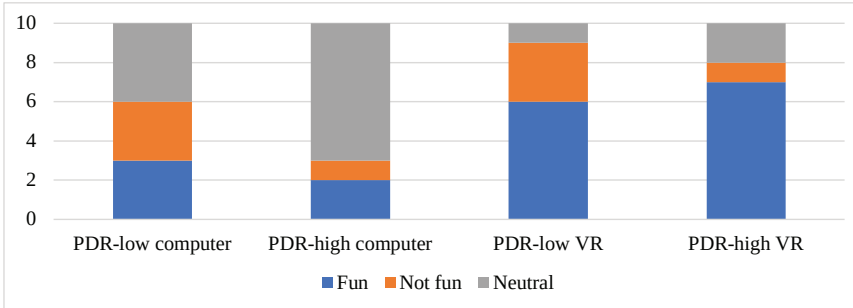

Figure 5. Number of participants who responded that the role-play was fun, not fun, or neutral.

As Figure 5 shows, the VR role-plays were perceived as more fun than the computer-based role-plays. Participants commented that VR is fun because "it is cool"; "it is realistic"; and "it makes me feel like being part of the space." The fun part of the VR experience often came from the fact that the participants were able to look around their surroundings and actually feel the environment. This was different from the computer-based role-play, where they had to construct a mental image of the situation and do items in a mechanical, test-like format.

However, this "real-life feel" was double-edged in that it made the participants more anxious. Like the case of IK in the previous section, several participants reported that the VR role-play was not fun. As TG mentioned in excerpt 5, going up to a professor and talking about an important thing made her feel nervous. On top of the pressure coming from the high-stakes situation, VR generates the additional pressure of face-to-face communication. Participant TG described this experience as "intense" and "stressful."

> Excerpt 5, participant TG (non-native speaker of English), VR role-play:
> I didn't really enjoy. Because ah … I get nervous when I'm thinking about what I need to say to a professor, and based on the fact that it is something pretty important and serious, ah, I get pretty intense, so it wasn't the fun part. I think both computer and VR they were not really enjoyable based on the main context, but they give different level of intensity? Ah … for the computer test, because it's just computer you don't actually see the professor or you feel like you are in the, in the environment of a class, so it is less stressful, or it gives you less sense of nervous feeling than when you are having the same scenario in the VR scene … In term of intensity, the VR one is more intense because you feel like you are actually talking to a real person.

These findings indicate that the immersive environment created via VR is realistic enough to provoke emotional reactions from the participants.

6. Discussion

This exploratory study investigated the usability of immersive VR as a way of creating a role-play task to elicit and examine pragmatic competence. Several trends emerged in participants' interview responses. First, in both tasks, the participants were more attentive to their manner of speaking when performing a high-stakes, PDR-high request. This finding lends support to previous findings (Ren, 2014; Taguchi, 2007); when pragmatics-situational demands are high (talking to someone in a higher social status about a serious issue), people tend to use more politeness strategies (e.g., hedging and indirect expressions) to rectify the potential face threats for the hearer. Social factors such as power, social distance, and degree of imposition (Brown & Levinson, 1987) affect people's perceptions of a situation and their corresponding linguistic choices. The present findings revealed that perceptions of situational demands and attention to language use resulting from the demands were similar between text-based (computer-based) and audio-visual (VR-based) input.

However, a notable difference between the two role-play tasks is that the situational demands evoked emotional reactions from participants in the VR version of the task. The actual presence of the interlocutor and a direct face-to-face interaction with him made participants feel nervous and anxious, prompting them to attend to their language use even more. Expressions of emotions and feelings (e.g., intense, nervous) never appeared when the participants were reporting their experiences with the computer-based role-play. These findings support existing findings that VR users experience strong affective states that are comparable to affective experiences in the real world (Moustafa & Steed, 2018; Scanlon & Castaneda, 2018). The present findings showed that affective responses could also emerge in an experimental, laboratory VR setting involving scripted scenarios.

Affective state was the most salient part of the participants' thought processes while performing the VR role-play. The participants recognized their feelings and emotions, both positive and negative. Positive emotions were often related to the experiences afforded by the VR platform and hardware. The participants described the feeling of actually being in the situation and looking around the surroundings as fun and exciting, whereas they felt that talking to a blank computer screen was boring and exam-like. Specific details of VR scenes that the participants were able to recall imply that they had strong spatial awareness of their surroundings. Interview accounts featured first-person pronouns (e.g., "I walked up to him"; "There were people around me"), indicating that the participants clearly attained a sense of virtual presence, or what Schultze and Leahy (2009) called telepresence—the feeling that one is actually part of the world they are experiencing.

This feeling of telepresence evoked negative emotions when the situation involved a high-stakes, face-threatening act (PDR-high request). However, what was interesting in the present findings is that the negative emotions prompted by the telepresence were also present in a low-stakes situation that requires minimum face-work (Ren, 2014). Several participants reported that asking a classmate for a pen (PDR-low request) was difficult and not enjoyable because of the particular physical setting—being under the spotlight in a quiet classroom (i.e., three classmates looking at the participants in a quiet classroom when they had to ask for a pen). These findings indicate that Brown and Levinson's (1987) social factors used to create scenarios (power, social distance, and imposition), which have been used widely in L2 pragmatics research, are just one criterion for operationalizing pragmatics task demands. Other physical, situational factors (speakers' position, eye gaze, and noise level) may also affect task difficulty. These findings provide a new insight into the design of data collection measures in pragmatics research.

Another unique insight from the findings is how multimodal cues in immersive VR guided participants' decisions on how to act and what to say. Meaning-making is grounded in physical experience involving body movement, gaze, posture, facial expression, and artifacts such as objects. All these cues in the physical environment shape how we talk and behave.

Participants were sensitive to these contextual cues and used them when planning their course of action. Some participants noticed that their paper was blank and they had to ask for a pen to take notes. They also noticed someone with an extra pen, directing their request to that person. Other participants noticed that the virtual professor was smiling and looked approachable, which made them feel more comfortable putting forward the request. These findings imply that the actual physical presence provides unique contextual information which guides our pragmatic language use, information which is not available in a mental construction of an imaginary situation. The results also indicate that learners can gain enhanced spatial knowledge of visual stimuli via VR (Dalgarno & Lee, 2010), which, in turn, affects their cognitive processes and behaviors.

7. Limitations and Future Directions

This study created a VR-based role-play task in order to overcome the limitations of a popular research instrument in pragmatics, namely, a closed role-play (or spoken DCT). The immersive VR provided a realistic and context-rich situation where participants spoke directly to people in the virtual space, rather than speaking in their imaginary space. The fact that participants perceived the space from the first-person perspective, experienced emotional reactions,

and attended to physical cues to determine their course of action tell us that the VR role-play works differently from a traditional role-play. These unique perceptions found in the data indicate that the VR technology can be usefully employed to develop a task that could simulate real-life interactions; at the same time, the technology helps to maintain the characteristics of a standardized, structured task used to collect data that are comparable across participants and settings. More future research is needed to confirm the generalizability of the current findings with a large participant pool across diverse nationalities and language groups. Of particular importance is the necessity of collecting data from beginning and intermediate-level learners of English.

Because the non-native speaker participants in this study were all highly advanced speakers of L2-English, it is uncertain whether the VR tool developed in this study is accessible to learners of lower proficiency levels, and whether the same perceptions will emerge in the data. Furthermore, future research could examine the accessibility of the VR tool through data triangulation. This study used only interview data to examine participants' perceptions of the VR-based role-play. Interview data could be supplemented by observations of participants' behaviors in order to better understand their reactions to the VR technology. In addition, although this study focused on learners' perceptions of VR experiences, additional analyses could be conducted to document learners' actual speech act performance we can understand how their linguistic strategies and other performance features (e.g., fluency) differ between the VR-based and computer-based role-plays.

Another limitation is that the study did not use objective measures to assess participants' familiarity of the situations. It is possible that the differences in participants' perceptions between the computer-based and VR-based role-play were due to their prior experiences of the situations used in the study. Unfamiliar situations can be more difficult to handle, regardless of the instrument modality; as a result, different thought processes might emerge between familiar and unfamiliar situations. Future research could use a survey to document participants' familiarity with the target situations and explore how their degree of familiarity may interact with their perceptions of the instruments.

In addition, future research should explore a more nuanced construct of "engagement" rather than "enjoyment" examined in this study. Simulating a social interaction is not necessarily enjoyable when the simulation involves a face-threatening act (e.g., a request). To support this, several participants reported that VR-based role-plays made them feel nervous when they faced the real-life-like interlocutor in the virtual space. These findings indicate that the VR simulations were authentic for participants, reflecting their real-life situations. Hence, the concept of "engagement" is more appropriate to use in future studies, given the existing literature showing that authenticity promotes

participants' meaningful engagement with material (Sykes & Reinhardt, 2012). Correspondingly, how to authenticate VR-based simulations so that we can develop a task that is meaningful and relevant to participants' lives is also a topic for future research.

Research instruments using immersive VR could expand the scope of pragmatic competence under study, going beyond linguistic forms and strategies that L2 learners use in speech acts. Virtual role-play could assess L2 learners' ability to attend to contextual cues and use them to create meaning in the given physical space. Future research could examine whether learners can recognize contextual cues in their surroundings, and how they adapt their linguistic resources to a given situation after attending to those cues. For example, researchers could use a number of distinct scenes eliciting the same speech act in one setting in order to examine how learners change their speech act strategies across scenes. A follow-up interview can be used to explore what contextual differences learners notice across scenes, and how they change their linguistic demeanors corresponding to the differences.

Finally, the extent to which VR can be beneficial to pragmatics learning is still unexplored territory. Future studies could examine learning processes and outcomes of VR-based instructional methods in order to evaluate the effectiveness of VR as a platform for learning pragmatics. For example, a series of simulations created in this study could be used to teach the speech act of request. After receiving explicit instruction on request-making strategies, learners could practice the speech act in the immersive VR context with a real-life-like interlocutor. Learning outcomes from the VR-based simulations could be compared with those from common instructional activities such as peer-to-peer role-plays. Another pedagogical idea involving the immersive VR is to incorporate the interlocutor's reactions into instructional materials. The interlocutor's reactions to learners' speech acts could be programmed differently corresponding to learners' choice of a particular speech act strategy. A more desirable choice could be followed by the interlocutor's positive reaction (e.g., a big smile), while a less desirable choice can be followed by a confused or annoyed face. By being exposed to different interlocutor reactions that are mapped to different speech act strategies, learners can understand the impact of their linguistic choice on their interlocutor, which can lead to the learning of pragmatics.

These pedagogical implications grounded in the affordances of immersive VR essentially support van Lier's (1996) pedagogical proposal that emphasizes three concepts: awareness, autonomy, and authenticity. Awareness involves the process of attending to new experiences and relating them to existing knowledge. Autonomy refers to learners' choice-making capacity and responsibility in their learning. Authenticity refers to learners' genuine desire to learn.

Immersive VR can provide an authentic context for learners to create meaning and decide how to act in a certain situation, which can enhance their awareness of the critical connection among language use, language users, and context of use.

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