



A Study on the Effectiveness of Using Telepresence and Multiple Cameras in Remote Physical Therapy

(Award No. 1839974 and 1840131)

PI(s): Henry Fuchs¹, Jeremy Bailenson², Michael Lewek¹ Graduate Research Assistants: Hanseul Jun², Husam Shaik¹

¹University of North Carolina at Chapel Hill ²Stanford University,

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Overview

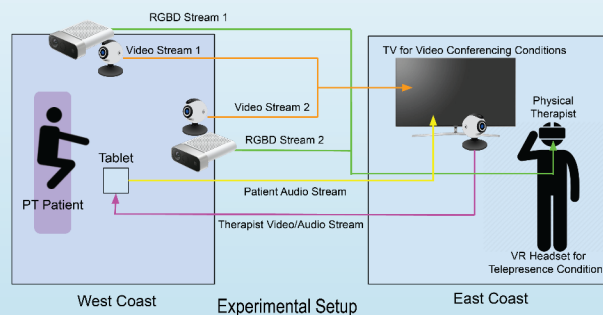
- Physical Therapists (PT) observe patients from multiple perspectives when providing care face to face.
- Remote physical therapy using video conferencing (VC) tools and a single video camera shows a patient from one perspective at a time thus, making it difficult for PTs to provide care remotely.
- Our telepresence system (TP), **Telegie**, using 1 or 2 depth+color cameras renders patients as a 3D color point cloud in a VR headset.
- We studied a sample of experts (11 graduate Physical Therapy students) and subjects (n=76) to examine how spatial information improves remote physical therapy, by comparing our telepresence system to video, each of which could either use one camera or two cameras from separate views.

Experimental Setup

- Physical Therapists (UNC): 11 PT graduate students
- Patient subjects (Stanford): 76 participants

Independent Variables

	Video Conferencing (VC): Google Meet	Telepresence (TP): Telegie
1 Camera	VC with 1 Camera	TP with 1 Camera
2 Cameras	VC with 2 Cameras	TP with 2 Cameras

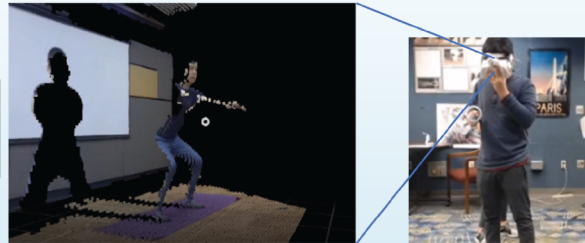


Experimental Procedure

- Therapists did 8 experimental sessions for 4 conditions based on a 4x4 Latin Square. Each patient did 1 session.
- Therapists saw patients using different experimental conditions while all patients saw the therapist through 1 video camera conferencing on a tablet.
- Audio and Video were recorded for all experimental sessions for further analysis.

Procedure Steps:

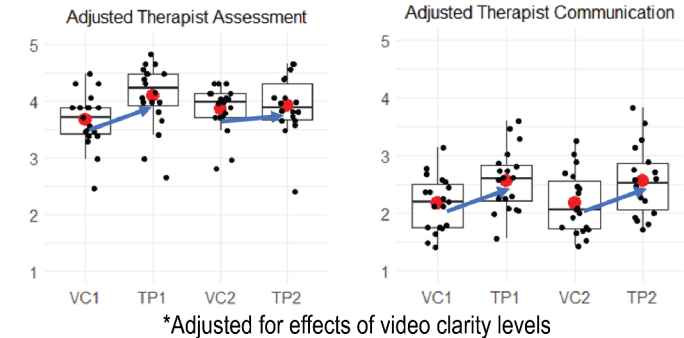
- Before each session both therapists and patients filled out a pre-questionnaire, took a spatial ability test, and were given a tutorial on TP and VC systems.
- The therapists taught and evaluated the patients on 6 exercises (**lunge, elastic band bilateral horizontal abduction, plank, ball bridge upper back, side lying external rotation, squat**) of 2 sets each for 15-20 minutes a session.
- After each session both types of participants filled out a post-questionnaire. Therapists were then interviewed.



Hypotheses and Research Questions

Hypotheses: Does TP outperform VC, or 2 cameras outperform 1 camera in evaluations of **interpersonal communication and physical therapy effectiveness?**
Research Questions: Does including the following in the analysis affect the hypothesis: **prior VR experience, prior physical therapy experience, spatial ability, video clarity, and level of motivation of patients perceived by therapists?**

Results



Conclusion

- Hypothesis that this TP outperforms this VC was not supported based on the t-tests. Linear mixed models were used to further analyze the data.
- The main finding from the study is that when accounting for the therapists' subjective attitudes for the video fidelity of the patient, the assessments of patients' learning by the therapist was higher in TP compared to VC. (see Results).
- Patient evaluations were not affected by TP or VC, perhaps because they all saw the therapist on a tablet for all conditions.
- Spatial ability had a significant positive effect on experimental conditions.
- In the therapist interviews, most preferred two camera video conferencing over this TP system.
- Two camera TP did not have a positive outcome as therapists only used the side view 10% of the time. Training therapists to more effectively use such immersive TP systems may affect outcome.
- Video clarity was found to be the most important factor when designing this TP system.



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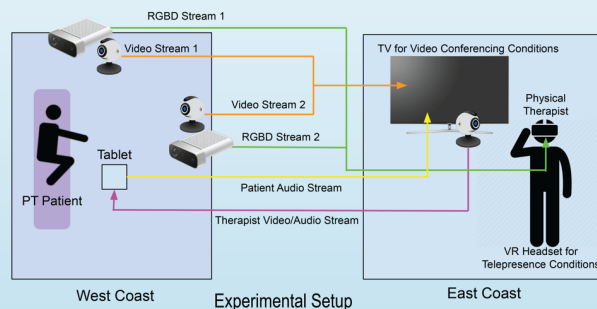
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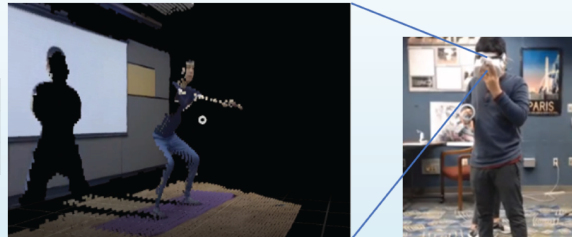


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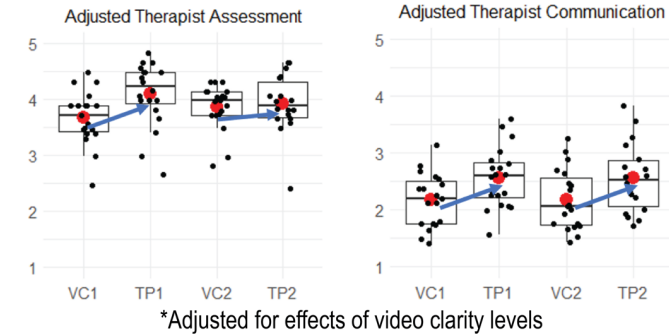


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Graduate RAs: Hanseul Jun*, Husam Shaik*

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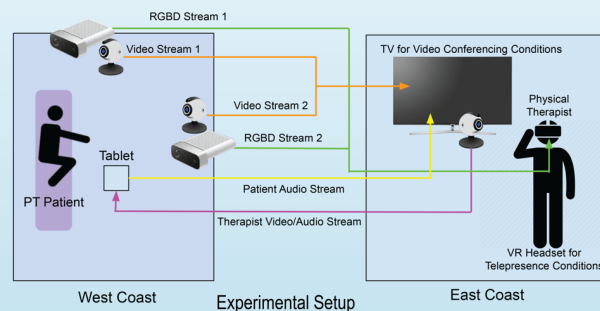
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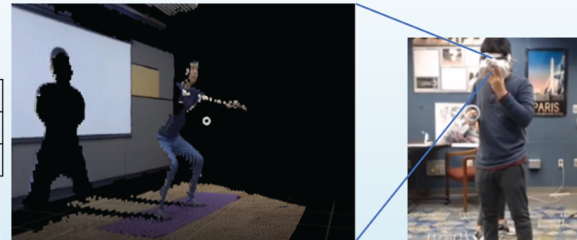


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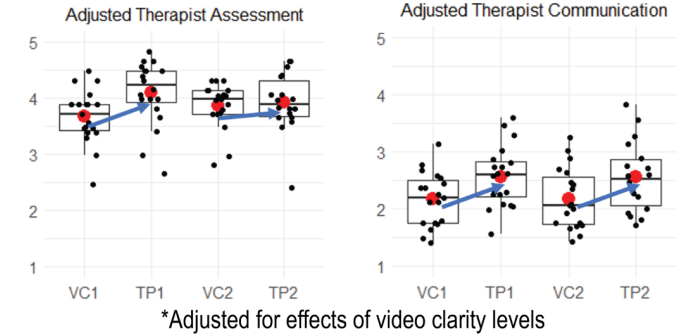


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