# Ready, Steady, Go: Professionally Designed Virtual Reality Physical Training Sessions During the COVID-19 Pandemic

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**Abstract.** The main objective of the study was to thoroughly evaluate 15-minute fitness training sessions and to assess the extent of the motivation of participants to participate in such sessions in virtual reality (VR) environments. The analysis was carried out using qualitative interviews. We recruited five participants, both male and female, who differed in their VR experiences and in the intensity of their weekly physical activity. The results show that people who had already experienced VR technology were the most willing to participate in VR training sessions. A key perceived advantage of VR training is the presence of trainers, which seemed to strongly motivate participants. To increase motivation to train, it is necessary to: explain the reasons for performing specific exercises; adjust the order of exercises during training sessions; and utilise the capabilities of VR environments. This article presents solutions that serve to enhance the attractiveness of VR fitness training.

**Keywords**: physical activity · VR fitness · UX design · workout motivation · workout plan satisfaction

## INTRODUCTION

During the COVID-19 pandemic, lockdowns and online learning have reduced physical activity, affecting even those who do not exercise regularly. The degree of effort to which many of our bodies were accustomed, for example, going to school, participating on spontaneous games in the playground, training sessions in the gym, visiting galleries, and attending concerts, has been significantly limited. The absence of physical activity leads to concentration problems, poor posture, obesity, and cardiovascular disease (Ly 2016). To counter these negative consequences, it is unnecessary to spend long hours exercising in the gym or running on a treadmill: studies show that being physically active for less than 20 minutes positively affects the functioning of our bodies, including our cognitive and learning abilities, stress levels, depression, and tension (Mualem et al. 2018).Such short trainings can be done in Virtual Reality. The popularity of VR technology increases every year, as evidenced by the increases in sales of VR headsets (Lang 2021; Steampowered.com 2021). During the COVID-19 pandemic, this form of training could serve as a particularly compelling alternative to traditional gym or online exercise sessions. There are some examples of this type of applications: FitXR, BoxVR,Oh Shape, Racket Nx etc. An important aspect of designing these applications is exercise satisfaction when exercises are tailored to the virtual reality environment. In VR it is not possible to perform all the exercises that can be performed without the headset. Wearing the headset requires rather upright posture and limits the possible movement. For example, too vigorous arm swings near the head might threaten the headset mounting, or the hands cannot be used to support the body weight due to holding the controllers. This might lead to lower exercise satisfaction. Even if you feel satisfied after performing the training, the exercises may not evoke positive emotions per se. Exercises that evoke negative emotions during training significantly reduce motivation to train in the future (Xu et al. 2020). Therefore, it is important to design a workout that not only provides the satisfactory level of fatigue to benefit health, but also produces positive feelings as such.

In this paper, we try to address these two challenges. The study described is part of a larger project called *VR technology as a tool for remote physical education ( PE – VR)*. The project aims to test VR technology as an element of remote learning and as a technique to increase physical activity among 18–30 year olds. This article focuses on the initial stage of the project in which we wanted to evaluate 15-minute VR-adjusted fitness training sessions of varying intensity in terms of participants' motivation to engage in such sessions in VR environments.

# METHOD

Our study consisted of two stages. In the first stage, the invited subjects participated in a live individual training with a live trainer that was carried out according to a predetermined plan. Next, interviews with the subjects were conducted that revolved

around attitudes towards the exercises and their expected suitability and attractiveness in the VR environment. The details of the study are given below.

## Training

Designing VR training sessions is a challenge on its own. To address it, we hired two professional coaches (a man and a woman) with many years of experience in the field and asked them to design six training sessions to be performed in a VR environment. Before designing the sessions, the trainers were familiarized with VR technology by playing games that involved total body movement. They designed their training plans taking into account the limitations in participant movement while wearing headsets.

After initial discussion with the trainers, we decided we will use 15-minute HIIT sessions. HIIT involves alternating short periods of high intensity exercise with short periods of moderate physical effort (Wikipedia.org). We opted to study this type of physical training, compared to classic aerobic exercises, as it results in the burning of more body fat with half as much energy effort and half as much training time (Tremblay et al. 1994). Less than 20 minutes of high intensity interval training (HIIT) improves the mood and cognitive capabilities of the exerciser, in addition to preserving fitness, maintaining or losing weight, and significantly reducing the risks of cancer and cardiovascular disease (Yeager, Mateo 2020).

With the intention of preparing the participants to perform HIITs in the future, we decided to gradually increase the intensity of the training. The trainers designed six HIIT sessions. The first session is the least intense, and the sixth the most intense. The first session includes 15 30-second high-intensity exercises, each of which is followed by a low-intensity activity (interval) lasting 30 seconds. A 15-minute session burns approximately 100–115 kcal. The values for session 6 are as follows: high intensity exercise = 45 seconds; interval = 15 seconds; kcal/15 minutes = 135–150. The session plans were then tested in a pilot study. For calibration purposes, the study tested the'middle' sessions, 3–5.

## Sample

To gather various opinions, we recruited five participants, both men and women, whose experience with VR and the intensity of their weekly physical activity differed. Their ages ranged between 25 and 30 years old; the women's BMI ranged between 16.36 and 18.07 (underweight) and the men between 23.08 and 27.77 (normal weight and overweight). The sessions in which the participants engaged differed in intensity (3-5). Table 1 presents the characteristics of the participants. Each participant was rewarded with $5 and a power bank.

Table 1. Sample by participants' characteristics

| | | | Physical activity | |
|---|---|---|---|---|
| | | | Yes | No |
| VR experience | Yes | Male | - | n=1 (4) |
| | | Female | n=1 (3)* | - |

| | | | | |
|---|---|---|---|---|
| | No** | Male | - | n=2 (3); (5) |
| | | Female | n=1 (5) | - |

Physical activity: 'Yes' = trains twice a week for at least 30 minutes; 'No' = trains incidentally – less than once a month. * The numbers in brackets denote the intensity of the training of the participants. ** Prior to the study, the participants had not worn a headset, but they knew what VR was – for example, they had seen VR applications (games) displayed on flat screens.

## Procedure

Before the study, participants signed declarations that they had no contraindications to exercise. They were also informed that they could stop participating at any time. The participants were paired with a trainer of the same sex as theirs: women participants with the female professional and men participants with the male professional. The training sessions were individual, meaning each subject exercised independently with the trainer only. When the training began, the trainer explained the chosen session and the participant was asked to perform exercises following the trainer's moves. Next, the trainers delivered individual 15-minute training sessions according to predetermined plans (differing intensity levels). Sessions were held in a room appropriately equipped and adapted for the study.

## Interview

The interview was divided into three parts. First, the general attitude towards the training was assessed. The participants were asked how tired they were and a series of statements based on a multicomponent model of attitude was used (Eagly, Chaiken 1993). The so-called ABC model assumes that attitudes consist of three components: affective, behavioral, and cognitive. The statements were presented as semantic differentials and evaluated on a seven-point scale. The following pairs describing the training were used: 'I don't like it'–'I like it', 'Boring'–'Interesting', 'Make me unhappy – Make me happy' (affective component); 'Not beneficial to my health' - 'Beneficial to my health', 'Don't suit me' – 'Suit me' (cognitive component); and 'Not worth the effort'–'Worth the effort', 'The series of exercises are difficult to follow'–'The series of exercises are easy to follow' (behavioral component). Next, we asked respondents to rate the training on a seven point scale from 'Unsatisfactory' to 'Satisfactory'. All measurements were taken only to facilitate the discussion of performing the exercises in VR in the third part of the interview. Due to the qualitative character of the study and its small size, no formal analysis of the measurements was performed.

The second part of the interview was a more relaxed discussion. The participants were asked to highlight the advantages and disadvantages of their completed training sessions and to suggest how they could be made more compelling. The participants also analysed and evaluated individual exercises from their sessions. To facilitate this task, they received their training plans. They indicated which exercises they found difficult to follow.

The final stage of the interview focused on transferring the training sessions to VR. Participants could try on a VR headset and ask questions about it. Next, they were asked to imagine training in a headset and re-evaluate their sessions assuming they would be performed in a headset. They could look at their initial evaluations done in the first part of the interview and adjust them accordingly. They were also handed their training plans once again and asked to evaluate each exercise with respect to VR.

# RESULTS

## Anticipated Willingness to Train in VR

Participants who had no experience with VR prior to the study were reluctant to engage in physical activity using the technology. In comparison to training sessions in 'real life', the assessment of VR sessions was particularly low in the following aspects: 'Suit me' (cognitive), 'Worth the effort' (behavioural), and 'Satisfactory' (overall), in the opinions of a physically active 27-year-old woman and a physically inactive 25-year-old man. All types of physical activity in VR were categorically criticised by one 27-year-old male who trained regularly. The assessments conducted by one physically inactive 28-year-old male participant were similar for both the VR and 'real-life' sessions. He added, however, that if he were to engage in any physical activity, he would rather exercise outdoors. The participants agreed that the headset was a serious barrier to engagement in the VR sessions, due to its weight, the participants sweating under the helmets, and the extra effort necessary to arrange sessions, including the suitable arrangement of rooms in their homes, and ensuring that all of the equipment works as intended. Participants did not find a compelling reason to wear a VR headset during exercise.

Participants who had experienced VR prior to the study did not dismiss the possibility of engaging in physical activity in such environments. Their assessments regarding the VR and 'real-life' training sessions were similar. Unlike the participants who had no previous VR experience, a physically active 30-year-old female participant evaluated VR higher, selecting „I like it" and „Interesting" (emotional). In her opinion, *'being closed in VR is being cut off from all unnecessary outside stimuli that our brains analyse involuntarily*'. A key advantage of VR for physically inactive users is the opportunity to participate in interactive environments and receive feedback, for example, on whether an exercise is being performed correctly. One physically inactive 30-year-old male participant stated that *'a choice between a VR and real-life training is a trade-off. A VR training session, despite the inconvenience of wearing a headset, offers better interaction possibilities compared to, for example, YouTube exercises at home. A session can also be like a game: I can touch, smash, avoid objects, and do whatever I want'*. A noticeable distinction can be observed between the assessments of physically active and physically inactive participants in the 'Suit me' (cognitive) aspect: both the 'real life' and VR sessions were assessed lower by physically active participants.

### Training Evaluation

Regardless of the participants' experience with VR and their everyday physical activity, we observed that:

- Performing exercises demonstrated by the trainers did not cause any problems;
- The presence of trainers was a strong motivating factor for participants to exercise;
- It was necessary to explain the reasons for performing particular training session;
- Overtraining particular groups of muscles (e.g. the quadriceps femoris) discouraged participants from engaging in the training sessions;
- The participants preferred sessions in which the intensity was spread evenly throughout. They did not enjoy sessions with easy beginnings (e.g. arm swings, arm circles, jogging) and difficult endings (e.g. jumps, squats, lunges). We also discovered that series of similar exercises (e.g. squats, jumps, side lunges) caused weariness and made sessions less compelling;
- A training program should exclude exercises in which the hands touch each other (e.g. jumping jacks) to mitigate the risk of the VR controllers being damaged;
- VR training sessions are perceived to be more intense than comparable 'real-life' sessions, because participants wear helmets; this causes exercisers to sweat under helmets and maintain a straight position of the neck and back (this requirement, paradoxically, forces users to perform exercises correctly, as this position is recommended for nearly all types of exercise);
- Despite feeling tired after their sessions, the participants felt better or much better (despite some of them stating that they *'gasped for air', 'felt blood pulsing'* in their heads, and '*sweating all over'*);
- The participants would agree to engage in similar training sessions three times a week, regardless of their intensity.

## DISCUSSION

### Participants in a Planned Quantitative Study

There is a risk that individuals who have no VR experience will refuse to engage in physical activity in VR, even for research purposes. This applies in particular to those who already train on a regular basis. Obtaining the approval of such individuals to participate in VR physical training studies could prove troublesome – even if they are paid to participate.

Individuals with previous VR experience who are aware of its benefits are willing to engage in physical activity in such environments, despite the inconvenience of wearing a headset. They find the VR environment interesting and see interaction with objects as an advantage over flat screens and 'real life' – the latter is limited by the laws of physics. (Bohdanowicz et al. 2021) draw similar conclusions from a study in which participants experienced VR for the first time. The key benefits of immersion in VR mentioned by individuals aged 20-25 included increased interactivity and the absence of physical limitations. However, such objects must not disrupt the demonstrations presented by

the trainer's avatars; they will be incorporated to force users to perform the exercises correctly and maintain a suitable pace. Objects might include a moving beam over which users are instructed to jump or glowing auras that they are instructed to follow using their hands.

### Training Evaluation and Training in VR

The participants accepted the training sessions: they raised no objections to the exercises (figures) proposed by the trainers and reported no difficulties following them. However, it is necessary to strengthen the emotional aspect of the attitude towards training sessions. The results suggest that future sessions should be less intense. It is also necessary to adjust the order in which the exercises were performed and the number of leg exercises, such as squats, jumps, and lunges, that the sessions incorporate. We believe that the aforementioned changes will have a positive impact on feelings experienced during exercise. The presence of personal trainers motivated the subjects to exert physical effort. Therefore, we believe that the project should incorporate avatars of male and female trainers performing exercises. The study points to the need to clarify the benefits and objectives of the proposed physical activity. The solution may be messages from male and female trainer avatars that explain the benefits and objectives of the proposed physical activity.

## FUTHER RESEARCH

The last stage of work on the VR application will focus on UX pertaining to the solutions that are going to be implemented. This process will involve the same people who participated in the study. This will enable us to gather their opinions on the changes introduced and adjust individual elements and functionalities before commencement of the main study. In addition, it will be possible to investigate the relationship with the avatar according to his/her gender or appearance. It might also be interesting to hear the opinions of those who disliked VR training sessions due to their lack of experience with VR.

## CONCLUSIONS

To increase motivation to train and make training more satisfying in VR environment, it is necessary to: a) adjust the order of exercises during training sessions, b) explain the reasons for performing specific exercises; and c) utilise the capabilities of VR environments. To implement the conclusions of the study, we will reduce the number of leg exercises and alternate them with upper body muscle exercises, such as arm swings and arm circles. These changes will reduce the intensity of the sessions without altering the lengths of individual intervals. Next, we will record the session with the trainers, create 3D models depicting them, and animate the models to reflect the updated training programme. The resulting avatars will be added to the VR environment. As the participants felt that they had been provided with insufficient reason to engage in physical activity, before the first training session the avatars will explain the goals and

benefits of taking regular exercise. Before each workout, they will motivate participants to perform with commitment. Finally, the individuals showed an interest in exercising in relaxing locations and interacting with virtual elements. We intend to design *'charming'*, *'quiet'*, location *'where one could easily concentrate'*, such as on a beach, in the mountains, or in the forest, and incorporate interactive objects.

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