White Lies in Virtual Reality: Impact on Enjoyment and Fatigue

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ABSTRACT

This study examined the impact of a "white lie" designed to boost motivation during virtual reality exercise on enjoyment and mental fatigue. Participants engaged in a ball-throwing or ball-targeting task and were randomly assigned to groups with or without the white lie. Results indicated that both groups experienced similar levels of enjoyment and fatigue, suggesting the white lie had minimal effect on these factors. All participants, regardless of group, reported high levels of enjoyment, with 17 out of 18 indicating they had fun, no significant differences in mental fatigue were found between groups while participants generally favored the white lie. However, the positive experience across all participants highlights the potential of Virtual Reality for promoting exercise engagement.

CCS CONCEPTS

• **Computing methodologies** → **Virtual reality**; • **Human-centered computing** → **Virtual reality**.

KEYWORDS

Virtual Reality, Enjoyment, Fatigue, White Lies

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1 INTRODUCTION

In recent years, virtual reality (VR) technology has emerged as an active area of research as a new exercise tool due to its advantages, such as fewer environmental constraints compared to the real world and the ease of motion tracking. VR has improved physical and cognitive performance, particularly in rehabilitation settings [1–4]. Enhancing exercise motivation is seen to improve rehabilitation outcomes and encourage habit formation, and prior studies have shown that exergames in VR make exercise more enjoyable [2, 3]. It is generally believed that, in games, difficulty adjustment plays a critical role in creating enjoyment alongside content design. In VR, there have been numerous attempts to boost motivation by subtly modifying performance results without making it apparent to the player—a technique often referred to as a gentle lie. However, little research has been conducted on the mental factors that this lie contributes to. This paper refers to the lie as a "White Lie" and investigated the effects of the presence or absence of White Lie on the enjoyment and fatigue of the play experience.

We conducted an experiment to investigate: I) whether participants enjoy tasks more with or without a clear goal, II) whether the white lie enhances task enjoyment and fatigue, III) whether participants notice the white lie.

2 VR SYSTEM

We used HTC Vive Pro as a HMD, with Trackers 2 and Base Stations (Fig 1). Using Unity, we developed two simple tasks related to throwing a ball. In one task, participants performed a maximum distance ball-throwing task, and the distance result was given verbally. In the other, they engaged in a target-hitting task, and successful hits were rewarded with audiovisual feedback. We implemented a white lie in the target-hitting task to enhance motivation by giving the player the sense that they were "almost there". This happened through a feature that changes the trajectory of the ball in order to push it closer to the center of the target. We used a coefficient named support rate s; a 0% support rate means that users throw solo, while a 100% means that the ball is completely controlled by the system and all throws will hit the target.

3 EXPERIMENTAL DESIGN

We experimented with 18 participants (ave. age 20.61, 10F, 8M) who were capable of repeated pitching, dividing them into four groups:

(1) Control Group: Without White Lie (WL);
(2) Fixed WL Group: With fixed high-rate WL;
(3) Fade-in and Fade-out WL Group: With rate-shifting WL;
(4) Ball Throwing Group: Without WL, without target.

At the beginning of the experiment, participants were informed of the possible presence of support during phases 2 or 3, or both.

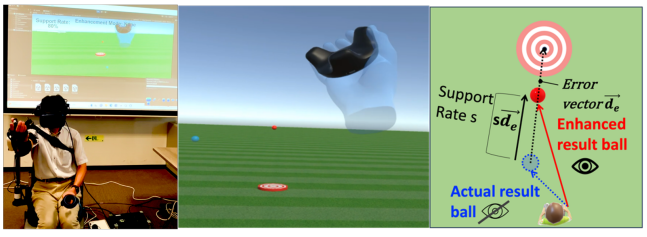

Figure 1: Playing scene and application of white lie in VR ball target shooting.

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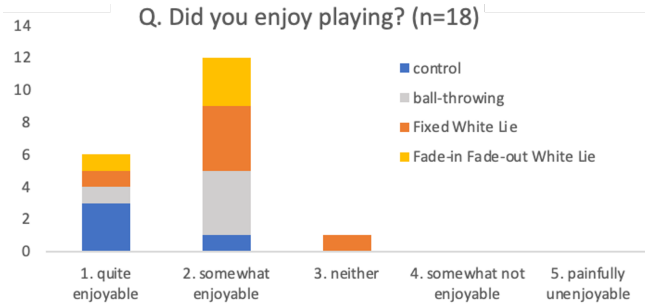

Figure 2: Results on Enjoyment

Each test consisted of 50 throws. The first 10 throws are warm-up and served to assess the user's shooting ability, here users are asked to throw as far as possible. The goal of the remaining 40 throws depends on the group: groups 1-3 were instructed to hit a target, placed 1.2 times the maximum distance they threw during the testing phase. This 40 shots were divided into 3 phases: Throws 1-10: Users were throwing without any support; Throws 11-30: support varied based on the group; Throws 31-40: same as first 10 shots. Group 4 continued to throw 40 times with distance result feedback. At the end of the experiment, participants were asked to fill the following questionnaire:

- **Q1** Did you enjoy playing (rated on a five-point scale)?
- **Q2** Please freely share your thoughts about throwing 50 balls as described before and after the experiment.
- **Q3** Did you think you received support? Which phase?
- **Q4** How fatigued are you physically/mentally now compared to before the experiment?

4 RESULTS AND DISCUSSION

The results of the responses given by subjects to **Q1** are shown in Figure 2. As a result, 94.4% of participants, 17 out of 18, reported enjoying the throwing experience. No significant difference in enjoyment whether White Lie was present or not. The White Lie group tended to highlight hitting the target as a reason for their enjoyment, while the non-White Lie group appreciated the trial-and-error process. Interestingly, even tasks with no clear goal were found to be as enjoyable as those with a clear objective.

In **Q2**, 13 respondents were asked about their first impression when they were told to throw 50 times and their impression after doing it. Despite the fact that it was an open-ended question, 11 out of 13 people responded to the effect that "I thought it was hard when I heard it, but when I tried it, it was very quick." Those indicate that VR can make simple motor tasks enjoyable and reduce psychological burden. Table 1 summarizes **Q3** responses. While all participants in the fixed-rate group accurately identified the white lie, only 25% of those in the fade group did, often confusing that they got support in Phase 3. Some in the fade group attributed improvement to the White Lie. The control group correctly identified 80% of the attempts as self-initiated. Notably, even the Ball-throwing group (no White Lie) incorrectly attributed improvement to support 75% of the time. Of the four participants exposed to White Lie, three preferred support, suggesting individual differences in the impact of support on motivation. In conclusion, the results of the responses

Table 1: Results of white lies evidence

Did you feel you get the support? When? (n=18)	Control(5)	Fixed rate White lie(5)	Valuable rate White lie(4)	Ball throwing(4)	total
Correct	4	5	1	1	11
Incorrect	1	0	3	3	7
Accuracy rate	0.80	1.00	0.25	0.25	0.61

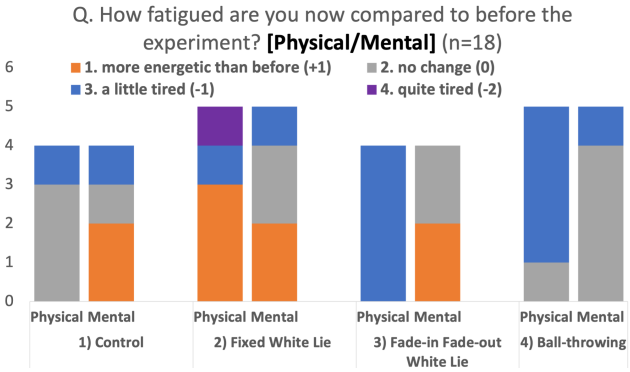

Figure 3: Results on Fatigue

to **Q4** are shown in Figure 3. We conducted Kruskal-Wallis tests to compare fatigue levels across the groups. The results revealed no significant differences in physical ($H = 2.90$, $p = 0.41$) or mental fatigue ($H = 2.87$, $p = 0.41$) among the groups. While physical fatigue was reported by more than half of the participants, mental fatigue remained low, indicating that VR exercise systems can offer a less mentally taxing workout experience. The results showed no significant differences in enjoyment or mental fatigue between the experimental groups. Participants' awareness of the white lie did not affect their experience. Since positive feelings results were obtained across all groups, indicating low mental fatigue during this VR play, future research will investigate the effects of VR play on mental well-being.

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