Studying the Impact of Virtual Reality on Sports: An Experimental Study

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Introduction

A rapidly developing technology, virtual reality (VR) has become more and more common in a variety of industries, including entertainment, education, and healthcare. Researchers have recently begun investigating VR's potential for improving athletic ability. Darts, a game that demands a high degree of accuracy and precision, is one such activity that has caught the interest of researchers.

We wanted to find out how VR affected the accuracy of dart throwing, so we conducted this research to find that out. We were particularly interested in determining whether a more immersive and realistic training setting could help a person throw darts more accurately. To accomplish this, we carried out an experimental study in which participants completed a series of dart-throwing tasks after being randomly assigned to either a VR or non-VR group.

We hope that this study will add to the increasing body of knowledge on the potential of VR in sports performance development. Our results may be useful to athletes, coaches, and trainers who are searching for cutting-edge approaches to enhance performance in a variety of sports, including archery.

Research Question

Does practicing throwing darts in a virtual reality setting cause an increase in performance (score) of throwing darts in real life?

Hypothesis

Practicing throwing darts in a virtual reality setting before throwing it in real increases performance/

Participants who practice throwing darts in virtual reality will perform better in subsequent real-world dart-throwing tests than participants who do not receive virtual reality-based training.

Methodology

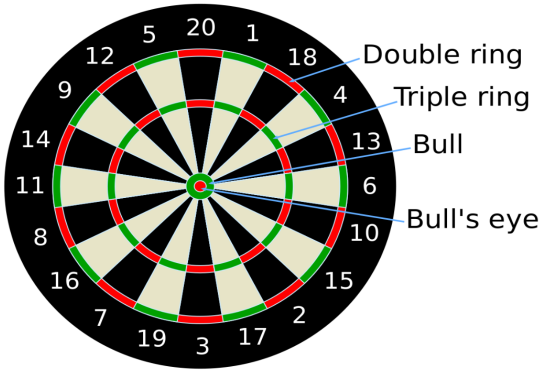
Procedure

For our experiment, we acquired a dartboard(international standard) and dart software that emulated a real-life setting on our Virtual Reality Equipment. The treatment group was subjected to the VR practice session, where they threw three darts in the virtual setting and then threw three darts on the actual dartboard. The control group only threw darts on the real dartboard with no VR exposure. Both treatment and control were conducted in the same setting and environment and conducted simultaneously to make sure no other variables could hamper the experiment. The participants were asked to aim

Participants were instructed to aim for the bullseye, and points were given according to how closely they came to hitting the target's center. Participants who hit the bullseye directly got the highest score because it was worth the most points. Using the bullseye as a gauge of accuracy made it possible to compare each participant's success in the experiment on a consistent basis.

The points scored were computed as follows:

1. If the dart landed between the double ring and the triple ring, it was deemed as one point.
2. If the dart landed between the triple ring and the bull's eye, it was considered as three points.
3. If the dart landed on the bull's eye, it was counted as ten points.
4. If the dart landed outside the double ring, it was considered as zero points.



Participants

The participants in this research were chosen and assigned to the treatment and control group at random from a large group of students and faculty in a busy common area at Questrom. Along with faculty employees, the sample included undergraduate, graduate, and PhD pupils. The degree of dart playing proficiency among the participants ranged from beginner to expert.

We classified a beginner to be a person who had never played darts before, intermediate to be someone who plays darts a few times in a month and an expert to be someone who practices darts very frequently.

Randomization

Simple and complete

We conducted our experiment in person and randomized on an individual level. In order to decide which participants would be in treatment or control we used simple randomization. We used a fair coin and tossed it for each participant. Tails was assigned to Treatment and Heads was assigned to control. Even though we did not intend to enforce complete randomization, we had an equal split of participants between treatment and control group. Therefore we had 50% in treatment and 50% in control.

Randomization check

The p-value is a probability value that is used in hypothesis testing to determine whether the observed results of a study are statistically significant, or whether they could have occurred by chance alone.

In the context of our study, comparing the treatment group and a control group, a p-value would typically be calculated to assess whether there is a significant difference between the two groups in terms of the outcome being measured. .

We ran a p test and got a value of 1. Since 50% of the participants were in the control group and 50% were in the treatment group, we received a complete randomization which suggests that there is no significant difference between the treatment and control groups

Data Analysis

We can use the available data to conduct various regression analyses to examine the performance of our participants in different ways in the dart experiment. We can begin with a simple regression analysis to investigate the impact of being in the treatment group (using the virtual reality technology) on the dart-throwing score. By running the regression, we can obtain insights into the main effect we are researching and determine the significance of the treatment on the participants' performance.

Regression analysis of main effects on outcome

```{r}
model_reg <- lm(accuracy ~ test, data = dataset)
summary(model_reg)
```

```
Call:
lm(formula = accuracy ~ test, data = dataset)

Residuals:
     Min       1Q   Median       3Q      Max
-0.17870 -0.05463 -0.02130  0.05463  0.25463

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.15463    0.01581   9.783 9.87e-15 ***
test         0.02407    0.02235   1.077    0.285
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.09484 on 70 degrees of freedom
Multiple R-squared:  0.0163,    Adjusted R-squared:  0.002247
F-statistic:  1.16 on 1 and 70 DF,  p-value: 0.2852
```

From our first regression analysis we can observe that the participants in the treatment group i.e. who practiced in a VR setting had a 2.407% higher accuracy score than the participants in the control group. The standard error was 0.02235. However, the p-value we obtained was 0.285 making the result statistically insignificant.

Regression analysis of main effects on outcome plus covariates

```
Call:
lm(formula = accuracy ~ test + frequency, data = dataset)

Residuals:
      Min        1Q    Median        3Q       Max
-0.175318 -0.058090 -0.002984  0.051856  0.258012

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.156551   0.020827   7.517 1.65e-10 ***
test         0.018767   0.023787   0.789    0.433
frequency1   0.006156   0.024693   0.249    0.804
frequency2  -0.025901   0.041114  -0.630    0.531
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.09579 on 68 degrees of freedom
Multiple R-squared:  0.02504,   Adjusted R-squared:  -0.01798
F-statistic: 0.582 on 3 and 68 DF,  p-value: 0.6288
```

Regression analysis of main effects on individual throws

Throw	Coefficient	SE	P-Value
1	-0.4167	0.3868	0.285
2	0.722	0.2819	0.0126*
3	0.4167	0.4521	0.36

Power Analysis

Limitation

1) Sample Size:
   Because the sample size was only 72 it might not be representative of the entire population and it may be too small to draw meaningful conclusions or make generalizations.

2) Self-reported dart-throwing experience may not be accurate:
   The subjects were asked to self-report their knowledge of throwing darts. Individuals' perceptions of their own skill level or practice habits might not always be correct. Someone who considers themselves to be a regular player may only play once a month. This variation in self-reported experience may have an influence on the findings and make it more difficult to draw definitive conclusions about how the VR system affects dart throwing performance.

3) Equipment limitations: The VR equipment used in the experiment may not accurately simulate the weight and feel of a real dart, which could affect participants' performance in the virtual and real settings.

Conclusion

Our experiment aimed to investigate the impact of using virtual reality technology on dart-throwing performance. We considered various factors to measure performance, such as their previous dart throwing experience, and the score of their throws. We took several steps to ensure that both the control and treatment groups had similar experiences, apart for the use of virtual reality technology. We conducted the experiment at the same time, provided a standardized environment, and ensured that the participants received the same instructions. We performed various regression

analyses to explore the impact of using virtual reality technology on the participants' dart-throwing performance. The second throw had a statistically significant relationship with the test conditions, which was the only relevant finding.
However, further research with a larger sample size and varied skill levels is needed to validate these findings. Future research can explore the effects of virtual reality technology on other aspects of dart-throwing, such as consistency and precision