

## Impact of Virtual Reality to the Public in Brno

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### Abstract

The main topic of this article is analysis and impact of virtual reality device HTC Vive to the public in Brno, Czech Republic. The first part deals with a theoretical description of virtual reality itself, namely device HTC Vive. Following part is about the research that examines different areas of influence virtual reality to human, also the opinion of public in Brno about this innovative new technology. There is also a discussion and an evaluation as the result of my research.

**Keywords:** Virtual reality, HTC Vive, modern technology, other dimensions, impact to the human, emotion, coordination

### INTRODUCTION

The paper deals with virtual reality device HTC Vive, its features, the functions of individual components and mainly with the impact on people in different areas. The research was conducted with Brno's public during March 2017. The student organization Studium zivota v Zline, which is a part of the Faculty of Applied Informatics at Tomas Bata University in Zlin, offered possibility to try virtual reality (referred to as VR) for free twice a week every Monday and Wednesday. The research examined the impact of VR on human and his psychological and physical aspects, as well as exploring public's view of modern technology and its use in various sectors.

### HTC VIVE

#### Description of HTC Vive components

The view of the device is shown in Figure. 1. HTC Vive consists of several components. The main one is a headset designed to be used on the head and is the main component, which creates the 3D image itself. The headphone is connected to the headset to improve the experience in the more realistic way and move to a different dimension. There are also two controllers, each for one hand, used for general application control and space movement. Each controller includes a set of

buttons for wide control variability. The set also includes two base stations that need to be placed in the space or room. These stations capture user's movement and transform it to the virtual world. There are also included cables in the package; some of them are used for charging controllers and another are used for plugged base stations to the electricity. [1]



**Figure 1.** Device HTC Vive

A well-functioning computer with powerful graphics card is necessary for fluent VR experience. Our test computer consisted of Intel Core i5 7400 Kaby Lake 3.5GHz, Intel B150, RAM 16GB DDR4, NVIDIA GeForce GTX1060 6GB, SSD 240GB + HDD 1000GB, Windows 10 64-bit.

## HTC Vive Features and Parameters

### Headset

With HTC Vive, you dive into a world full of surprises and new experiences where you can move freely and explore everything. However, the guidance system keeps the user within the limits of the motion field. The player feels real and at the same time superlative thanks to high quality graphics.

The front camera mixes elements from the real world into the imaginary one by displaying surrounding objects in outline to avoid them. [2] These contours can only be seen at the beginning, and the image is not disturbed when the application is started. The adjustable headband ensures balanced comfort even with longer use. It also balances the weight of the front of the headset.

A 110° field of view produces captivating immersion to the image and 32 headset sensors allow 360° motion tracking, 2160 x 1200 dpi resolution together with 90 Hz refresh rate provides incredible graphics and smooth action. Also included in the package there is a replaceable foam pad designed for user comfort. [1]

### Controllers

The wireless controller in each hand, combined with the precision SteamVR™ Meter, allows the user to freely explore and work with virtual objects, characters, and environments. HTC Vive controllers are designed specifically for VR with intuitive control and realistic HD tactile reaction. The multifunctional controllers allow accurate and natural smooth navigation. It includes 24 sensors for accurate tracking. Also included are two-stage starters with an HD tactile reaction that moved the VR experience to a new level.

### Base station

Two base stations provide 360° motion tracking. The stations are connected to other parts wirelessly, the only cable which is required is power one.

Stations produce infrared radiation; the rays of radiation also rotate and illuminate the scene in both the horizontal and the vertical directions. The headset sensors then calculate the ray delay and determine your position using triangulation calculations. The stations must be at least 2 meters across from each other with direct visibility. If there is an obstacle in the way, it is necessary to connect the station with the synchronization cable. You will be informed by the status diode about the connection. [2]

## RESEARCH

In this part, we focused on a sample of inhabitants of Brno as you can see in Figure 2.



**Figure 2:** People during testing virtual reality device HTC Vive

## BACKGROUND OF THE RESEARCH

The inhabitants of Brno had a unique opportunity to try virtual reality free of charge. Information about the event could be found on the Internet or in the form of Facebook event. The information was also disseminated by recommendations among various students in Brno. There is also a small survey about which media is the best for dissemination of this information among the population in these days.

If the person wanted to try the VR, all he/she had to do was to come during our specific time in which it was possible to try VR. To the visitor it is explained how the VR works, what everything is included in the box and how to use VR. Then organizers helped to put on individual components to the examiner and run a suitable application for VR.

## THE RESEARCH

The research was conducted by asking questions and by observation during testing of VR. It was focused on a few areas.

### Statistical area

The possibility to try virtual reality was offered to around 100 people. Most of them came in groups consisting of family

members or friends. They could share their experiences from the “other world” immediately. Most of the people have been informed about the event via facebook and friends’ recommendations. The most powerful media has become facebook, which currently has the major influence on human.

To the “other world”, both children and adults have been transferred by VR. Most of the visitors were adults, often accompanied by their children. They had a choice of dozens of various applications to choose according to their interests. In the list of applications, there were action, fantasy, sports, and logic games, creative applications for 3D or different educational programs.

Ninety-eight people came to try virtual reality during March 2017 in Brno.

**Table 1.** Participation of individual age categories

Categories	Childre n	High School	Colleg e	Adul t	Pensioner s
Age [years]	< 15	15-19	19-26	26-55	55 ->
Participation [%]	18	17	28	25	12

People could try VR alone or in groups.

**Table 2.** Number of people in the group and percentage of groups

Number of people in the group	1	2	3	4	5	6
Representation [%]	32,3	35,7	17,2	13,2	1,1	0,5

Information about the opportunity to try the VR has been disseminated through different media.

**Table 3.** Sources of information about the VR testing possibility

Source of information	Facebook	Friends	Other
Representation [%]	58	8	34

People had a possibility to try different applications.

**Table 4.** Genre of the application and their interest among the public in Brno

Genre of application	Creativity Creation	Actions Fantasy	Sport Movement	Education Art History	Others
Representation [%]	21	24	31	22	2

### Area examining the impact of VR on humans

#### Impact on the physiological aspect of humans

Modern technologies have greater or lesser influence on some more sensitive individuals. It was the same with VR. 84% of people did not experience any physiological changes, the remaining 16% responded after experiencing that they experienced various negative symptoms, such as headache, eye pain or disorientation after removing the headset. Some of them felt tiny fatigue or nausea. These difficulties are associated with a brain that is not used to such a function. [3] Symptoms usually did not last long and the person was all right within 20 minutes after removing HTC Vive.

**Table 5.** Percentage of people with physiological problems / no problems after VR testing

People without problems	84%
People with problems	16%

**Table 6.** Negative impact on humans; the percentage is based on the total number of people = max. 16%. Some of the people are with more than one problem.

eye pain	15%
headache	5%
disorientation	6%
nausea	2%
fatigue	11%

The positive impact was the increased physical activity that caused blood circulation in the whole body. Performed physical activity during you are in VR does not reach the same values as full-fledged sport, but it can be a good start for people who avoid sports and general movements. [4] They may not perceive sport as negative and boring activity when they are in flow.

#### How was a person using VR able to coordinate its movements?

From all incoming people, 95% of them have tried VR for the first time. This was reflected in the ability to coordinate their movements in many different ways. Most of the visitors did not have any problems with coordination. This group of people was especially younger generation. The second part of the people was unable to properly manipulate with controllers and they had problems with coordinating of movement and orientation in a space. However, in about 5 minutes they were able to use VR in a standard way.

**Table 7.** Coordination of movement during VR testing

Coordination	No problems	Adaptation within 5 minutes	Apathy / Dislike
Participation [%]	82	15	3

The last part of people were unable to get used to the VR and after they removed it, they showed apathy for possible further VR testing. This group was mostly created by the older generation.



**Figure 3:** People during testing virtual reality device HTC Vive

*What was the impact of VR on the psychic/mental aspect?*

The environment of VR influences in many different ways on the psychic and mental aspects of people. [5] Approximately 95% of people were so enthusiastic about the new environment that they lost the idea of time and the real world. In this situation, people's emotions were as real as they were. If the people were in danger, they felt fear or anxiety. In other situations, they felt tension or joy. Only 5% of participants were able to perceive the difference between real reality and virtual reality. In this case, their emotions did not show up to such an extent as most people.

VR can help in this area with various mental problems or illnesses. People can learn to get rid of for example lighter phobias or tensions in different situations. It can also be released by acting / playing appropriate chosen applications so people can relax for a moment from life-threatening situations. This can lead to addiction, but if this method is managed by a specialist, it can generate a positive effect. [6]

**Area examining reactions and evaluation by people**

The last area was focused on people's views on different aspects of VR.

*Evaluation of VR*

Visitors came with some expectation, and for most of them expectations were met or even exceeded. Only a small group of people was disappointed by VR. People mainly appreciated the realistic view of the environment and the variability of applications. The group of people who were disappointed by graphics, which according to some of them was still not perfect. They were people who were involved in technology so they were more focused on details than ordinary people.

**Table 8.** Virtual reality in the eyes of public in Brno and their expectations

Expectation	Overcome	Completed	Disappointed
Participation [%]	45	50	5

*Reactions of people a few moments after starting testing of VR*

Visitors were also asked how quickly they got used to the new situation.

**Table 9.** Speed of adaptation to new situation and reality

Adaptation	Fast, within 5 minutes	Within 10 minutes	None
Participation [%]	65	33	2

*Opinion about the use in education*

The last topic was about the use of VR in education. It has been determined what people think about using VR and general modern technologies in education. Up to 85% of people were positively introduced VR into schools because of the better imagination of the subject matter, bigger interest of school children and the creativity of the lessons. Approximately 12% with this opinion disagreed because they believe that modern technologies have negative impact on people, especially children who can become addicted on these technologies. About 3% of people did not have a clear understanding of this situation.

**Table 10.** People's opinion about the use of VR in education

Use in education	Agree	Disagree	Not clear
Participation [%]	85	12	3

## DISCUSSION

This research follows similar research, which we realized in Zlin. Zlin is much more smaller town in the Czech Republic compare to Brno. We were curious how the size of the city can affect interest of people in VR. After the research we can say that there is almost no significant different between the size of the city. We can say that virtual reality has big potential everywhere. It can be interesting for both, people from 1 million city or small town. It can be used for a small school somewhere in the middle of nowhere and also in huge university in big metropolitan cities.

## CONCLUSION

The aim of the paper was to make a research of the effects of virtual reality on people in Brno. During March 2017, the data needed to generate the research was collected. Methods such as polling and observation were used for this. Research covered 10 areas in 3 themes. The first area provided information about general statistical data like the number of people, their attendance by number of people in the group, etc. The second area dealt with the possibilities of how virtual reality affects a person mainly its mental and physical aspects. The last area mentioned the opinions and reactions of people in relation to virtual reality.

The result was that virtual reality generally has a more positive response than negative. It can be predicted that it could be used in the future in various sectors, such as schools, quality of education or healthcare. It is certain that this advanced technology will continue to evolve and improve and its use will become wider.

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## REFERENCES

- [1] Vive - Product, VIVE [online]. 2011 - 2017 [Retrieved 2017-04-06]. Available from: <https://www.vive.com/eu/product/>
- [2] Recenze HTC Vive: Virtuální realita s novým rozměrem, 2014. Svět androida [online]. [Retrieved 2017-04-15]. Available from: <https://www.svetandroida.cz/recenze-htc-vive-vr-steam-hry-201606>
- [3] KERN, Hans, 2006. Přehled psychologie. Vyd. 3. Praha: Portál. ISBN 80-736-7121-2.
- [4] FAIRBURN, Christopher a Vikram PATEL. The impact of digital technology on psychological treatments and their dissemination. Behaviour Research and Therapy [online]. Elsevier, 2016 [Retrieved 2017-04-21].
- [5] HUANG, Youliang, Qian HUANG, Sajid ALI, Xing ZHAI, Xiaoming BI a Renquan LIU. Rehabilitation using virtual reality technology: a bibliometric analysis. Scientometrics [online]. Budapest: Springer, 2016 [Retrieved 2017-04-25]. DOI: 10.1007/s11192-016-2117-9.
- [6] NAKONEČNÝ, Milan, 2009. Sociální psychologie. Vyd. 2., rozš. a přeprac. Praha: Academia. ISBN 978-80-200-1679-9.