SUBJEKTIVNO ODREĐIVANJE RAZINE NELAGODE U VIRTUALNOM I 2D OKRUŽENJU

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Sažetak

Danas u industriji igara sve veći dio ponude zauzimaju igre namijenjene za sustave virtualne stvarnosti. Ciljevi kojima se teži sa napretkom tehnologije virtualne stvarnosti je veći stupanj interaktivnosti, realističniji prikaz sadržaja, mogućnost za istovremeno igranje više igrača i dostupnost većem broju ljudi. Jedan od problema s kojim se susreću dizajneri i programeri prilikom izrade igara je kretanje i interakcija korisnika u virtualnoj stvarnosti. Sa većom razinom interakcije i prirodnijim načinom kretanja podiže se stupanj imerzije i postiže bolje korisničko iskustvo te smanjuje negativna posljedica virtualne stvarnosti (eng. cybersickness). Osjet nelagode u virtualnoj stvarnosti se može objasniti kao sličan osjećaj mučnine kod vožnje na vlakovima u zabavnim parkovima, sa glavoboljom, nelagodom, vrtoglavicom i slično. U ovom radu dana je usporedba između subjektivnog doživljaja simulacije vožnje auta u smislu procjene imerzije i nelagode u sustavu virtualne stvarnosti i klasičnim oblikom igranja (iste simulacije vožnje auta) na monitoru. Sa različitim istraživanjima korisničkog iskustva, i prilagodbom interakcije može se podići razina i kvaliteta samog iskustva u virtualnoj stvarnosti.

Ključne riječi: virtualna stvarnost, imerzija, simulacija vožnje auta.

SUBJECTIVE DETERMINATION OF CYBERSICKNESS IN VIRTUAL AND 2D ENVIRONMENT

Abstract

Gaming industry today offers increased number of games and experiences for virtual reality systems. Goals pursued by the advancement of virtual reality technology are greater degree of interactivity, the more realistic presentation of content, the possibility of multiplayer and availability to greater number of people. One of the problems encountered by the designers and programmers in game development is character's movement and interaction within virtual reality system. With a higher level of interaction and more natural way of movement, the degree of immersion increases and achieves better user experience and reduces the negative effect of virtual reality, which is cybersickness. Cybersickness in virtual reality can be explained as sensation similar to nausea while driving on rollercoasters in theme and amusement parks, alongside with headache, discomfort, dizziness and so on. In this paper a comparison between subjective car driving simulation experience in terms of estimating immersion and cybersickness in virtual reality system and classic form of playing (the same car driving simulation) on the monitor is given. With variety of research of user experience and interaction adjustment, the quality of experience in virtual reality can be raised.

Key words: virtual reality, immersion, car driving simulation.

1. Uvod

Virtual reality is very popular nowadays and this term was first proposed by Jaron Lanier in 1989 [1]. He is the inventor of the "Data Glove" and "EyePhone", the first modern-like virtual reality devices. The term virtual reality (or environment)has many definitions, and one of them states that it is "Simulated or artificial model of reality with which a human can interact, getting information from the model by ordinary human senses such as sight, sound, and touch and/or control- ling the model using ordinary human actions such as position and/or motion of body parts and voice." [2]. There are many applications of this newly renewed technology, and currently most popular is gaming industry. Popular are also

medicinal visualizations of human bodies, vascular system and bones, also in research associated in phobias and other psychological problems, and it can provide experiences for physically disabled people. Architectural visualizations of buildings, apartments and projects are also one of applications of virtual technology. Even though this is an outstanding technology, it has some limitations. Many research has been conducted over years considering one of mayor problems in VR, and that is cybersickness caused by these devices. It can be defined as a negative side-effect which manifests as nausea, headache, vertigo, blurred vision, focus difficulties, sweating etc. [3]. There are many factors contributing to this side-effect, and most common are previous experience with VR, people who experience motion sickness in cars and other vehicles, sex, age and more. Several hardware limitations include, but not limited to, display resolution and size, lag and speed of movement [4]. Cybersickness can be affected and/or induced by different locomotion techniques, most common is "teleportation" technique, also "flying" and "point to walk" methods can be encountered [5][6][7].

2. Eksperimentalni dio

In this paper, experimental part consists of three parts, and participants were volunteers. Prior to experiment it was explained to them the process of experiment and they were free to stop the experiment at any time if they felt too nauseated, or if they had any other reason to quit.

1) Participants first drove a car simulation with Steam controller in "classic way", i.e. by looking to monitor.

2) Participants then drove the same car simulation with Steam controller in virtual reality.

3) Participants were given a questionnaire which consists of several questions that point out their subjective level of user experience in both driving simulation cases.

Equipment used: personal computer with Intel i7 4690k processor, Nvidia GTX 1070 graphic card, 16 GB RAM, 27" monitor, HTC Vive VR headset, Steam controller, game used: car driving available for PC and VR. Figure x shows a screenshot of in-game above-mentioned car driving simulation.

Figure x: Screenshot of in-game above-mentioned car driving simulation.

Questionnaire:

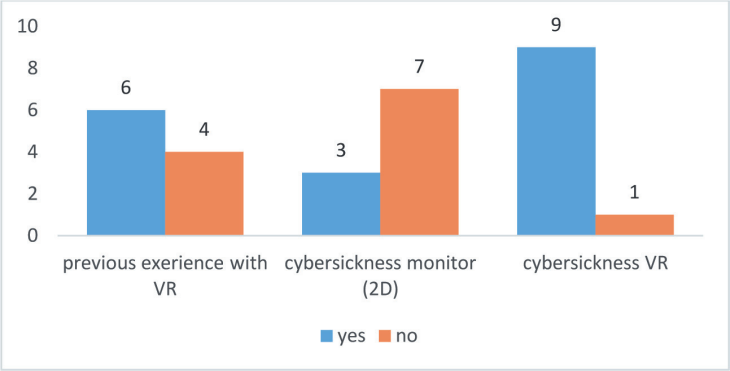
Question:	**possible answer:**	
Do you have any previous experience with VR?	yes	no
Did you feel any of cybersickness symptoms during car driving simulation (2D)?	yes	no
*if yes, can you state which? vertigo? general discomfort? blurred vision? focus difficulties? other?		
Did you feel any of cybersickness symptoms during car driving simulation (3D)?	yes	no

*if yes, can you state which? vertigo? general discomfort? blurred vision? focus difficulties? other?		
I find it was easier for me to drive a car...?	without VR?	with VR?
I felt more immersed in driving simulation...?	without VR?	with VR?
Which experience would you estimate as more comfortable?	without VR?	with VR?

3. Rezultati i diskusija

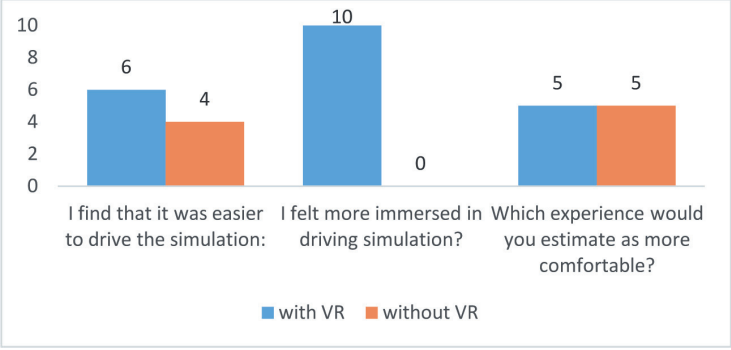
In this section, the results of questionnaire survey are presented, also with survey participants' comments, which they gave regarding the overall experience. In this survey, 10 participants were included, of which 6 females and 4 males. Average age was 27.9 years. In tables 1-3 below are shown results of the survey.

Table 1: General experience with VR and cybersickness experienced in both 2D and VR car driving simulation



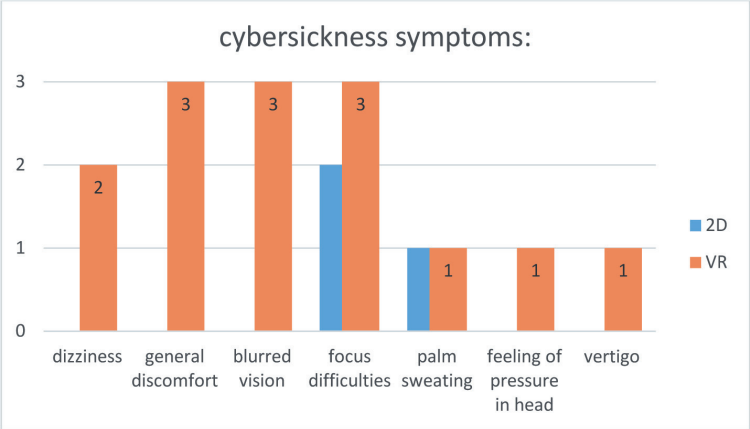
In the Table 1. above, can be seen from the chart that even though 6 participants had previous experience with virtual reality technology, 9 had feel some form of cybersickness in VR and 3 felt while driving in classic form (2D).

Table 2: Ease of driving in simulation, immersion and comfort estimation



In the Table 2. is shown how did participants feel during driving simulation in 2D and VR surrounding compared, did they feel more immersed and which experience did they estimate as more comfortable. All participants felt more immersed in driving simulation in VR, which can be explained as logical, due to fact that VR offers 360 degrees of computer generated scene which user can see around himself, and that increases sense of presence, while in classic desktop mode user can see other real items around himself.

Table 3: Other cybersickness symptoms recorded by survey participants



Some of the comments given from the participants were:

1) "Image is sharp only in the center of screen." (in VR)

2) "During car driving simulation, my hands were intensively sweating."

3) "I feel excitement similar as during plane take-off." (in VR)

In Table 3. are shown some cybersickness symptoms which were noted in survey. Most common in virtual reality were general discomfort (3 participants), blurred vision (3 participants) and focusing difficulties (3 participants). Noted was also dizziness (2 participants), palm sweating (1 participant), feeling of pressure in the head and vertigo (1 participant). In 2D car simulation environment two participants noted focusing difficulties and one noted palm sweating.

4. Zaključak

This paper shows a simple research in which a car driving simulation game was used as a test for determination of cybersickness in virtual reality compared to classic gaming in 2D environment (monitor watching). Cybersickness is a relatively common side effect of virtual reality systems, and can be manifested as a series of symptoms such as vertigo, dizziness, blurred vision, upset stomach, sweaty palms etc. From the result and discussion section in this paper can be seen that even though 6 participants had previous experience with virtual reality, overall 9 /10 participants had felt some cybersickness effects while driving in VR and 3 felt some symptoms while driving the same simulation in 2D environment. It is also visible from the results that VR provides absolutely greater sense of immersion then classic 2D environment. Further researches are necessary for better understanding and mitigation of cybersickness.

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