Co-funded by the
Erasmus+ Programme
of the European Union

VI-TRAIN
VIrtual TRAINing for traditional crafts

IO6: Overcoming human restrictions

VI-TRAIN-Crafts - VIrtuell TRAINing for traditional Crafts

Reference number: 2020-1-AT01-KA226-VET-092635

Final results

Provided by:

Michael Reiner & Marco Nemetz / IMC Krems
Gerald Wagenhofer / UBW GmbH
Vienna, May 2023

Co-funded by the
Erasmus+ Programme
of the European Union

Content

1. WHAT IS THE VI-TRAIN-CRAFTS PROJECT ABOUT?

Cultural Heritage (CH) is in the focus of the European Union as motor for employment, economic drive and development. In order to guarantee longevity & usability of European Heritage it is inevitable to keep up with the requirements of society like new technology and digitisation.

The Covid19 crisis added some urgency to the issue as training organisations strongly suffered from restrictions and new rules, which were threatening traditional education and training activities. Especially in regard to hands-on-training, where instructors need to get really close to learners to teach practical skills.

The consortium of VI-TRAIN Crafts has taken the challenge of developing innovative training for traditional/threatened crafts and handling of building damages, which will boost the digitization of training in (built) Cultural Heritage. A big focus is given to crafts that are almost nowhere trained any more. Lots of those crafts do need a lot of experience and guidance by experienced craftspeople. This training in particular will be boosted by various digitisation support.

The anticipated objectives of VI-TRAIN Crafts were:

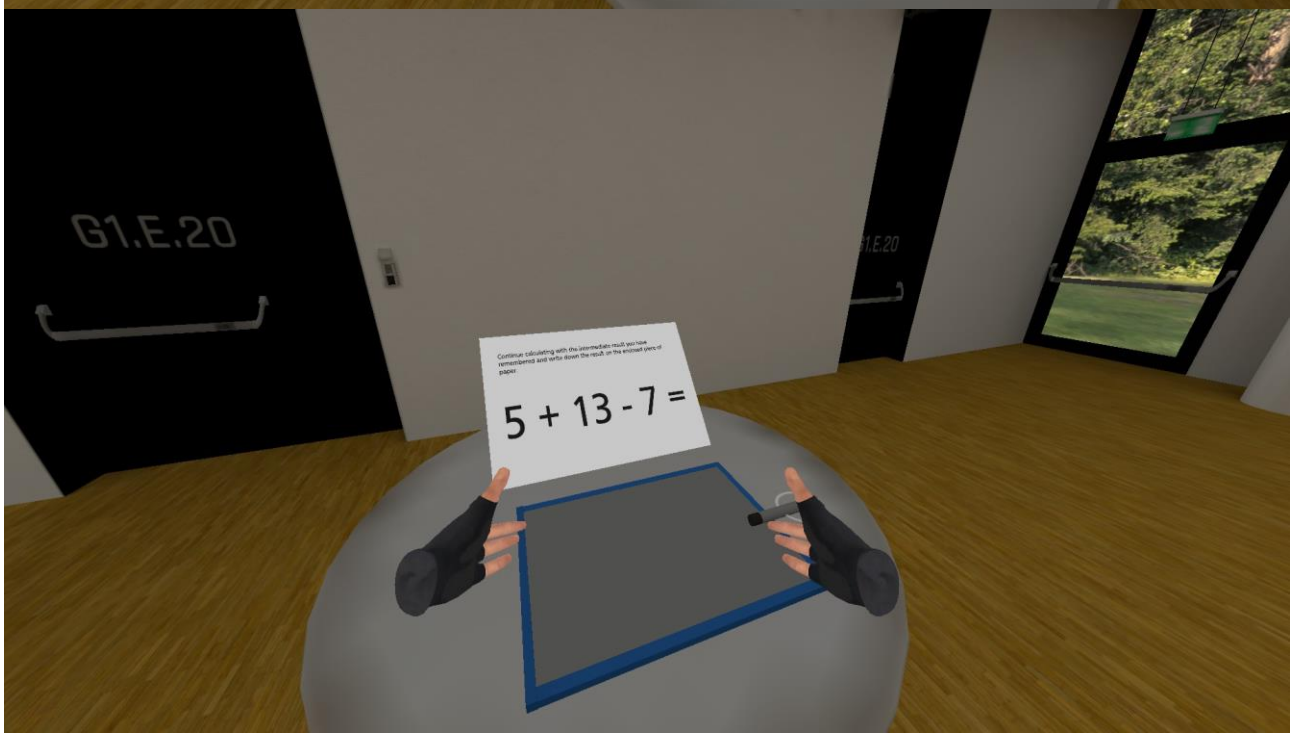
- to identify appropriate means of distance learning for the training of craftspeople (manual work),
- to identify appropriate means of online cooperation in training, regarding functionality, GDPR and data security
- to derive success criteria for highly accepted digital solutions
- to develop and test a virtual/3D-crafts training system by using sensors and VR/AR
- to develop and test a virtual/3D-buidling damage identification training system
- to investigate and test options overcoming restrictions, e.g. move sickness,
- to develop a train-the-trainer system for application of selected tools in training of traditional crafts

Participants of the courses developed in VI-TRAIN Crafts can obtain a European certificate by undergoing a certification process provided by ECQA, which is an internationally active organisation specialised in certification of skills and competences.

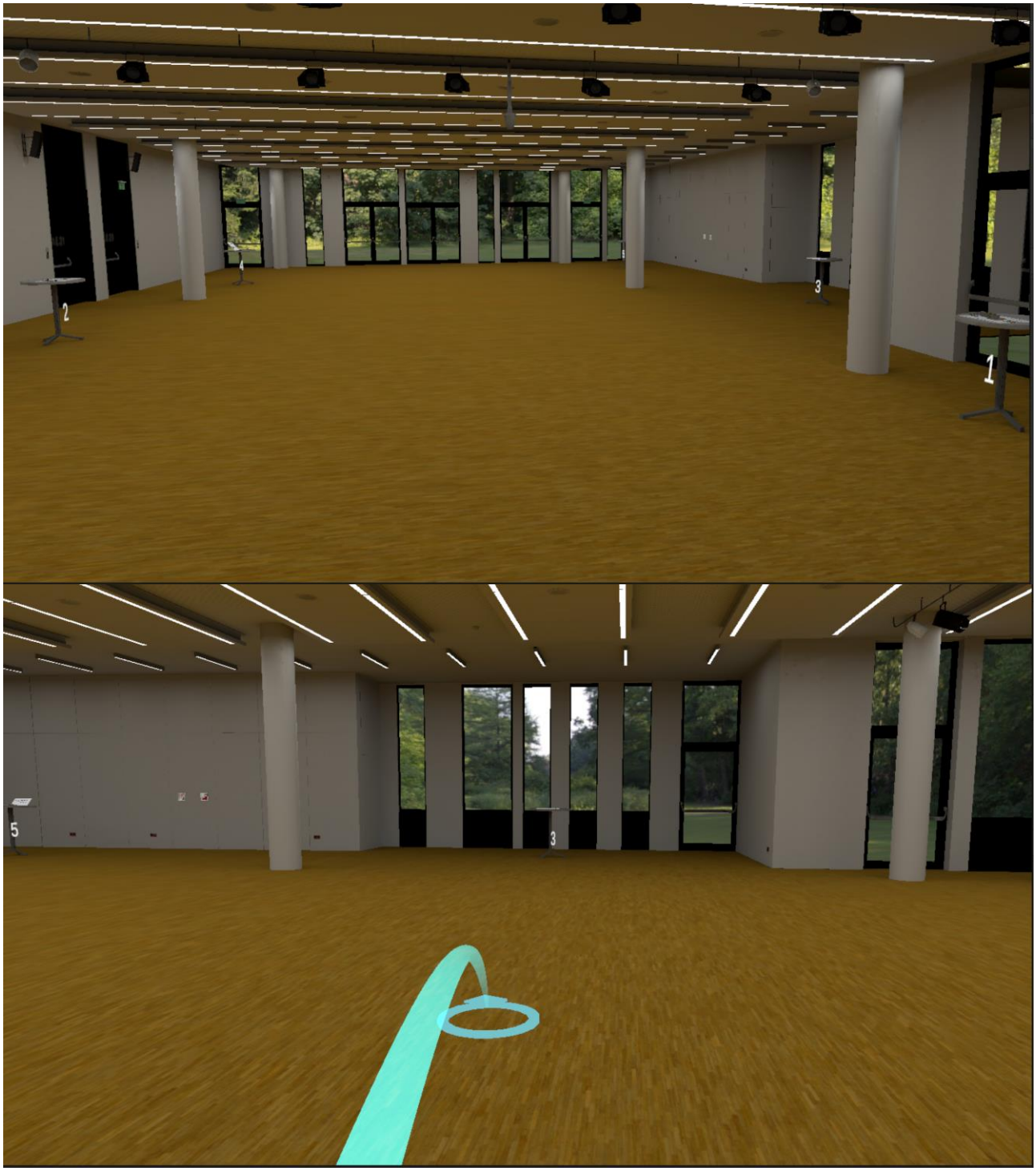
VI-TRAIN Crafts enriches the offer of The European Heritage Academy (EHA), which will be in charge of delivering VI-TRAIN Crafts training courses after completion of the project. EHA is situated at Charterhouse Mauerbach, the future EU Competence and Community Centre for Architectural Conservation, being set up during INCREAS, a Pilot project for Cultural and Creative Industries, Finance, Learning, Innovation and Patenting for Cultural and Creative Industries (FLIP for CCIs-2).

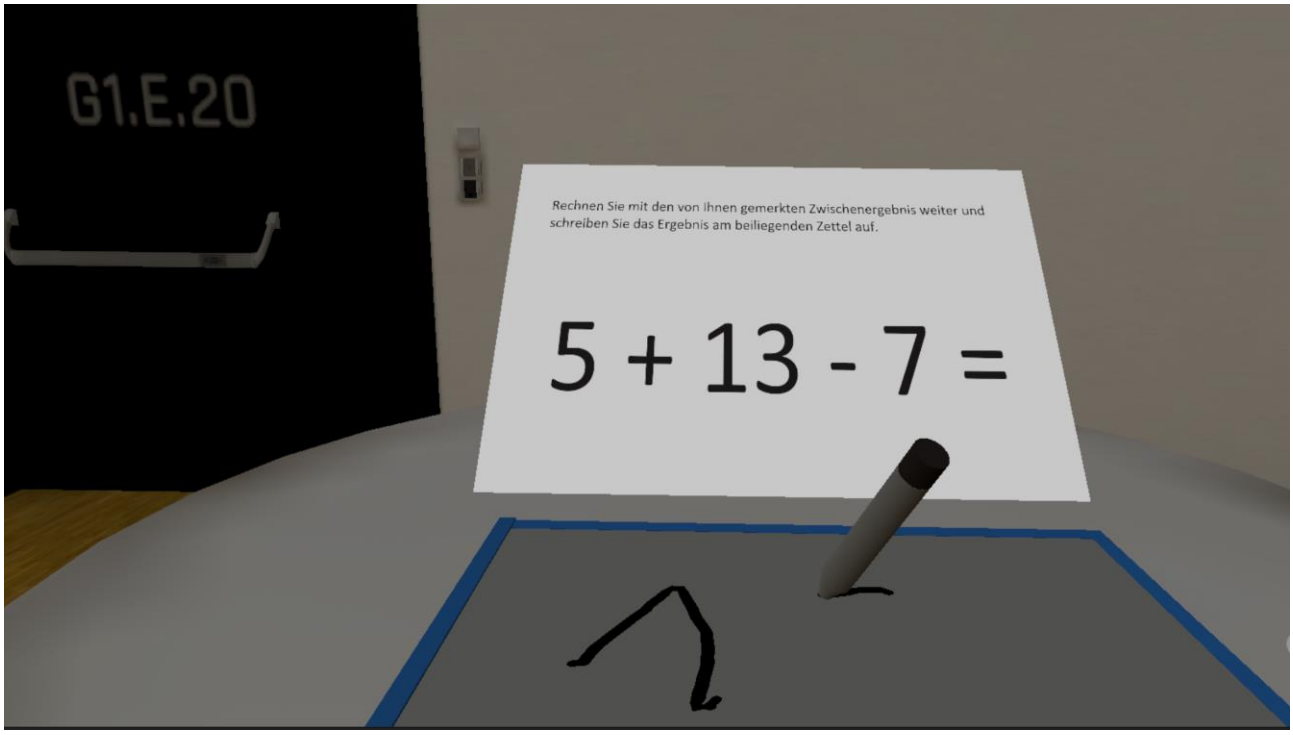
2. DESCRIPTION OF THE MOTION SICKNESS TEST

There are some pictures of the test setup:




VR WALK - STUDIE
Bitte wählen Sie die Bewegungsart aus:
0
1
2
PUSH
Hier Bild nachbauen
Nachzubauendes Bild


2
3
1
5
3



Actually, there is also available an example video:

https://secure13.nextstepit.at/f/337037

3. VRWALK QUESTIONNAIRE RESULTS MARCH 2023

The consortium performed a statistical analysis on the results of the motion sickness questionnaire carried out for the VRWalk project. This data analysis was performed using R and the tidyverse library.

The data has 41 observations for the 25 questions in the questionnaire. The majority of the questions uses a scale between 1-5 to indicate the level of difficulty of the given VR station. Additionally, two questions are open and the final questions record gender and age of the participants.

For the data preparation we selected the relevant columns, renamed them for clarity and set the factor levels when necessary.

Gender distribution: there is some imbalance between male and female participants (60% vs 40%).

```
## Warning: `stat(prop)` was deprecated in ggplot2
3.4.0. ## ℹ Please use `after_stat(prop)` instead.
```

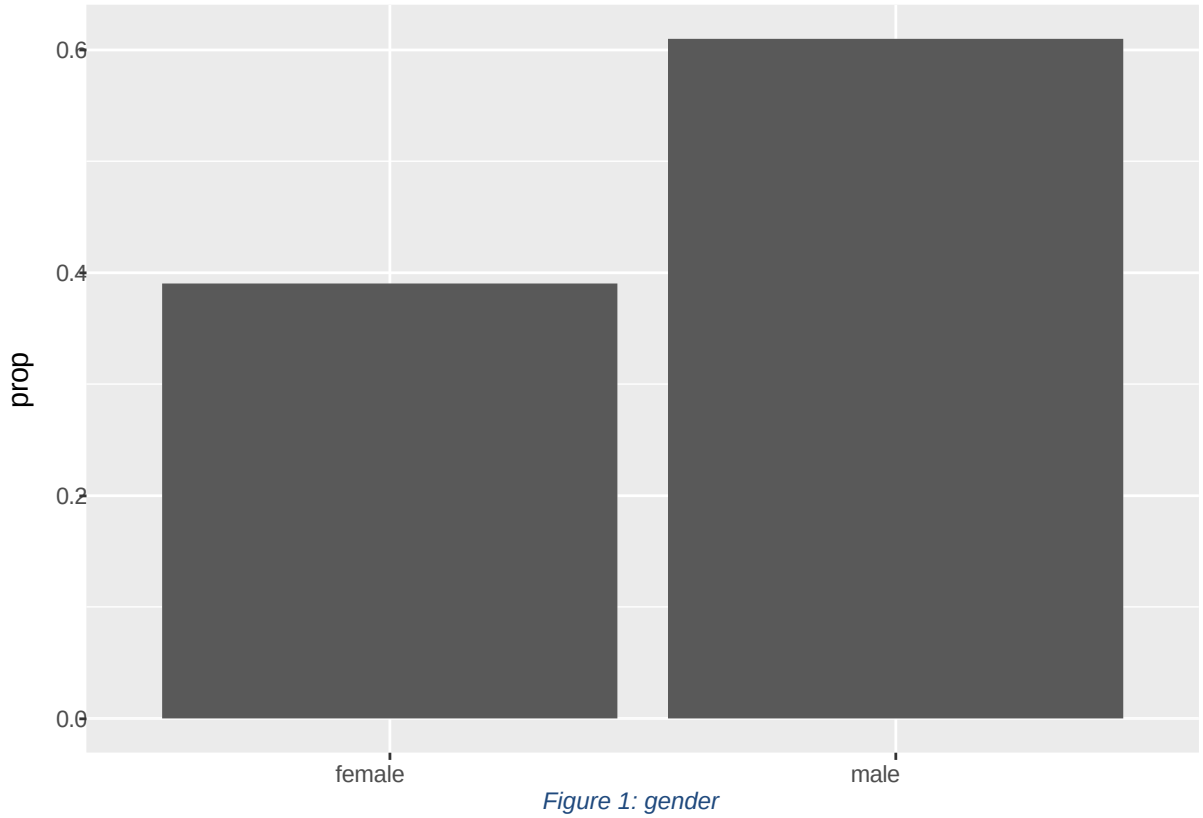


Figure 1: gender

Regarding the age distribution, the youngest participant was 16 years old, the oldest by contrast 56.

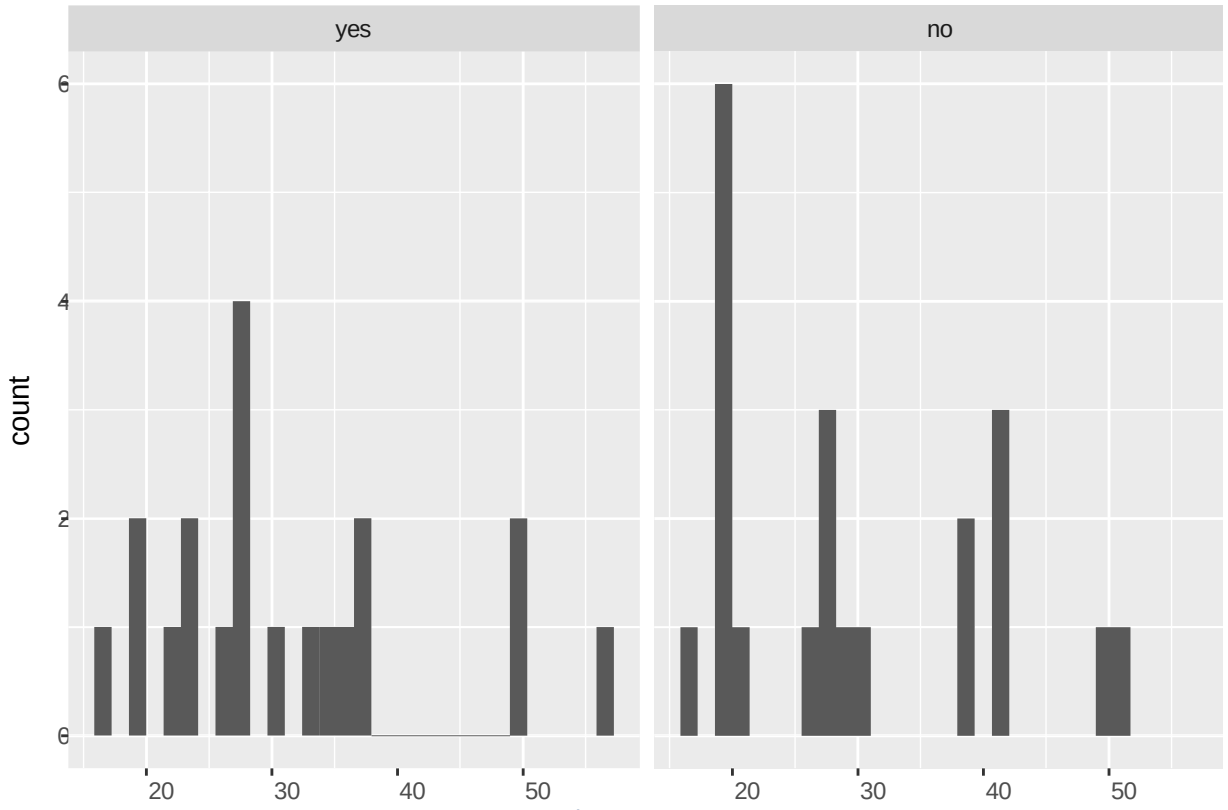


Figure 2: Age

First of all, let's take a look at which stations did the participants feel particularly unwell:

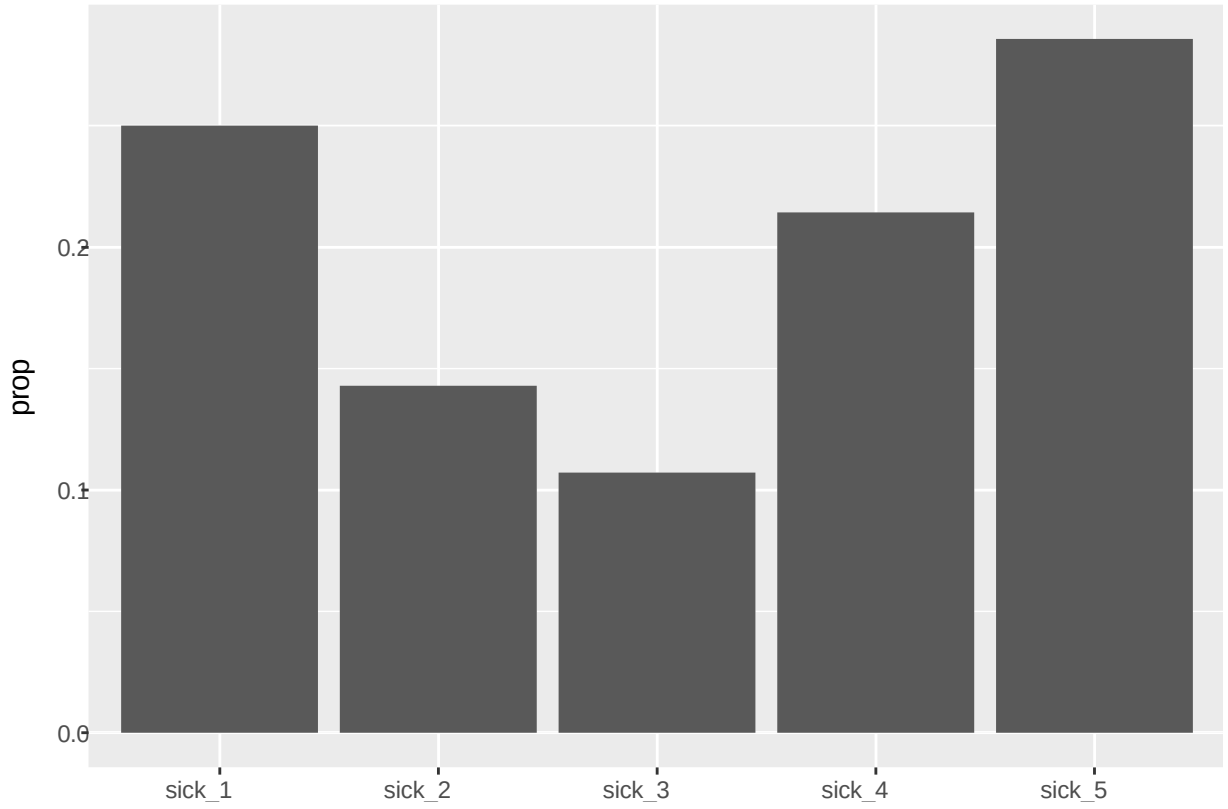


Figure 3: Sick

More than 20% of the participants felt unwell after visiting Station 1. Additionally, in Stations 4 and 5 participants felt particularly unwell.

We now plot the reported difficulty and degree of well-being of participants for all five stations.

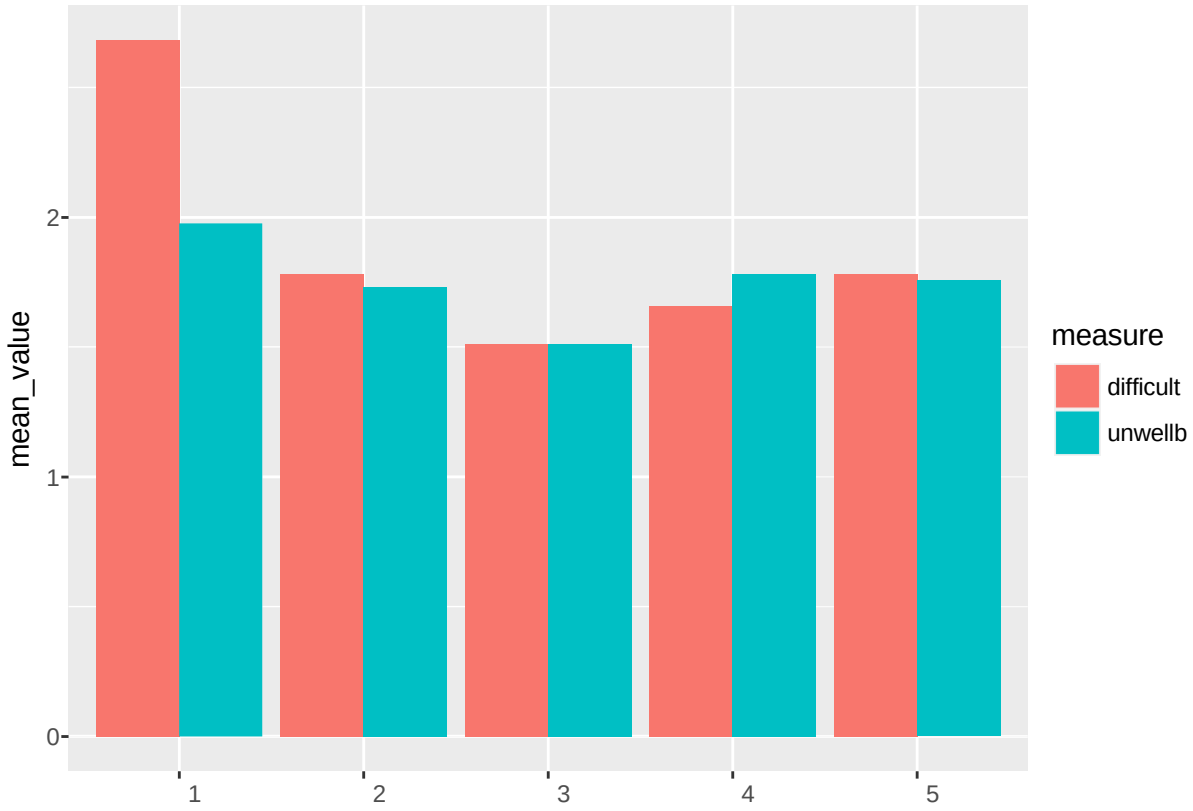


Figure 4: station

Here we plot the mean difficulty (measure = “difficult”, the higher, the more difficult) and unwell-being values (measure = “unwellb”, the higher, the more problematic from the motion sickness point of view) reported by the questionnaire participants, grouped by stations. As we can see, the greatest difficulty was again reported for Station 1, whereas the highest well-being value was reported for Station 3. There seems to be no apparent correlation between difficulty and the reported unwell-being values of the participants, although there seems to be an association between less difficult and less motion sickness, as shown in the following graph:

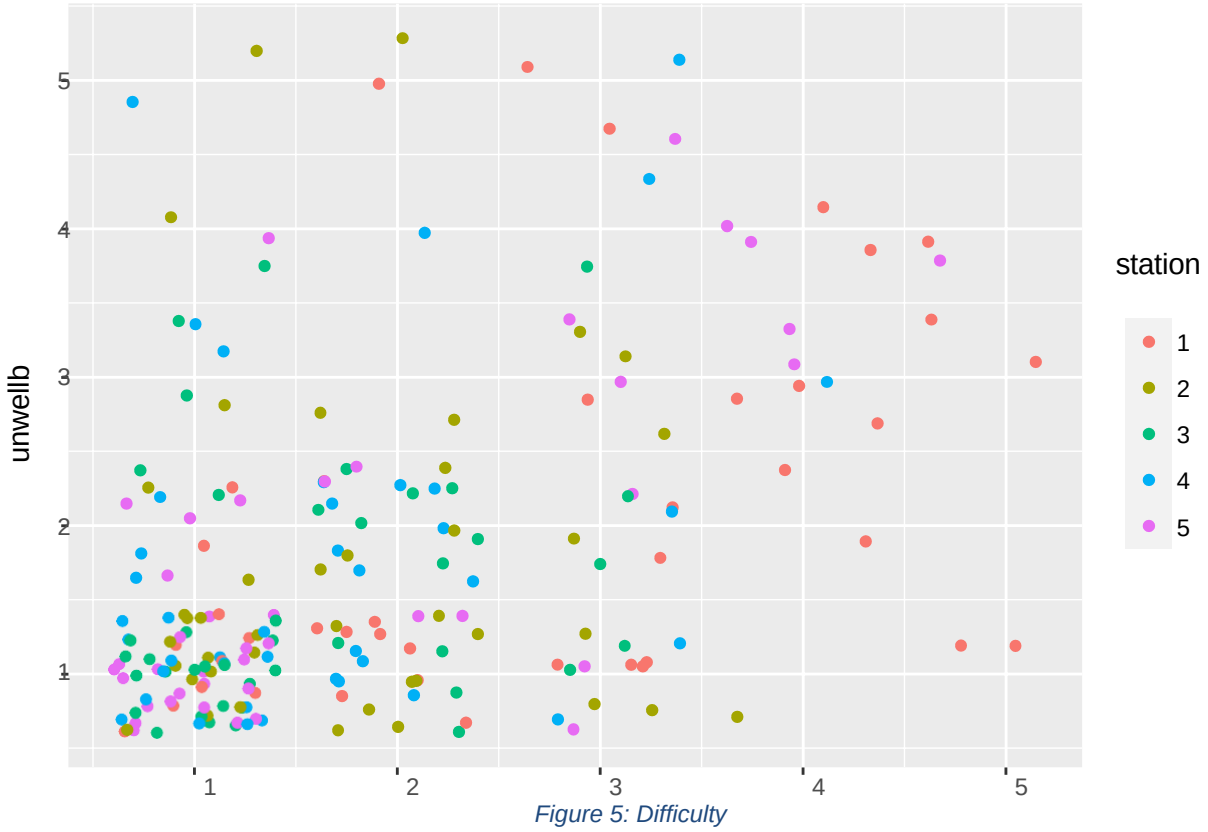


Figure 5: Difficulty

If we split difficulty and degree of unwell-being by resolution, we get the following graph:

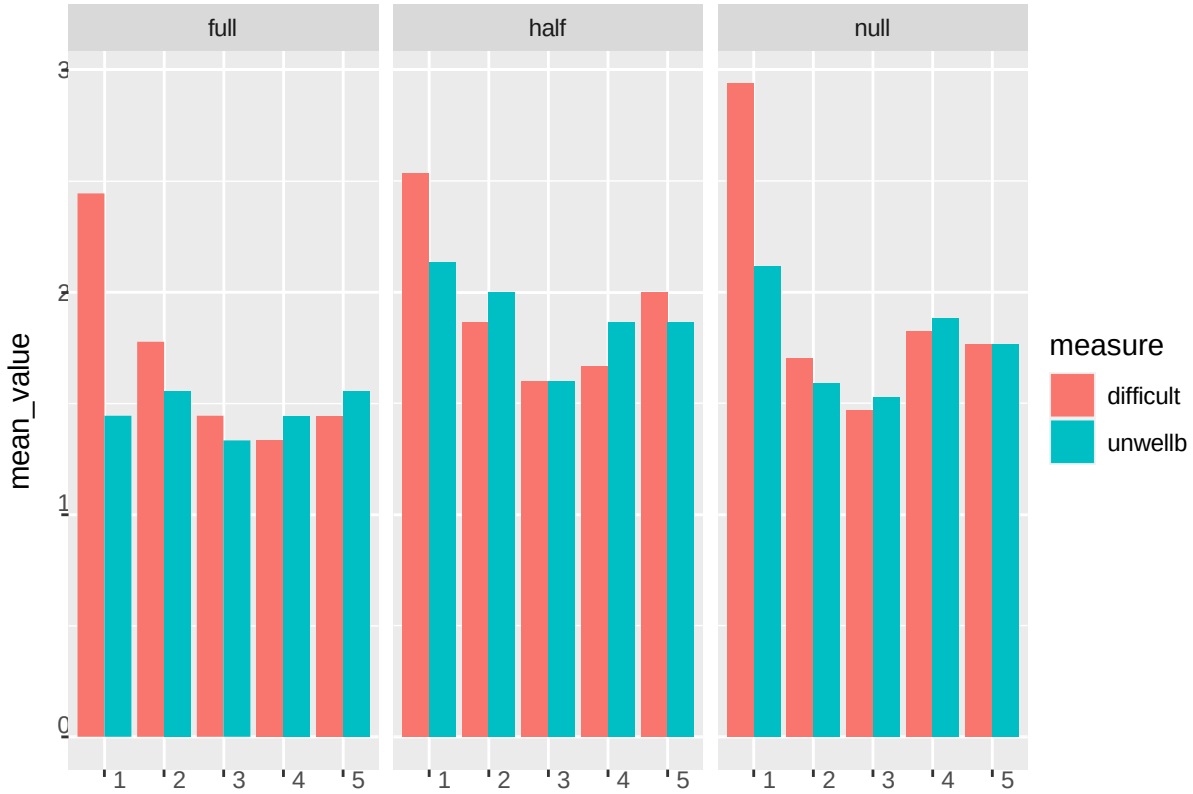


Figure 6: Station

The well-being scores seem similar across all groups, suggesting that there is no direct relationship between the resolution used and the degree of well-being. On the other side, especially on Station 1, the reported difficulty values seem to correlate with resolution: the higher the resolution, the higher the difficulty.

In the following graph we split the result by degree of VR experience:

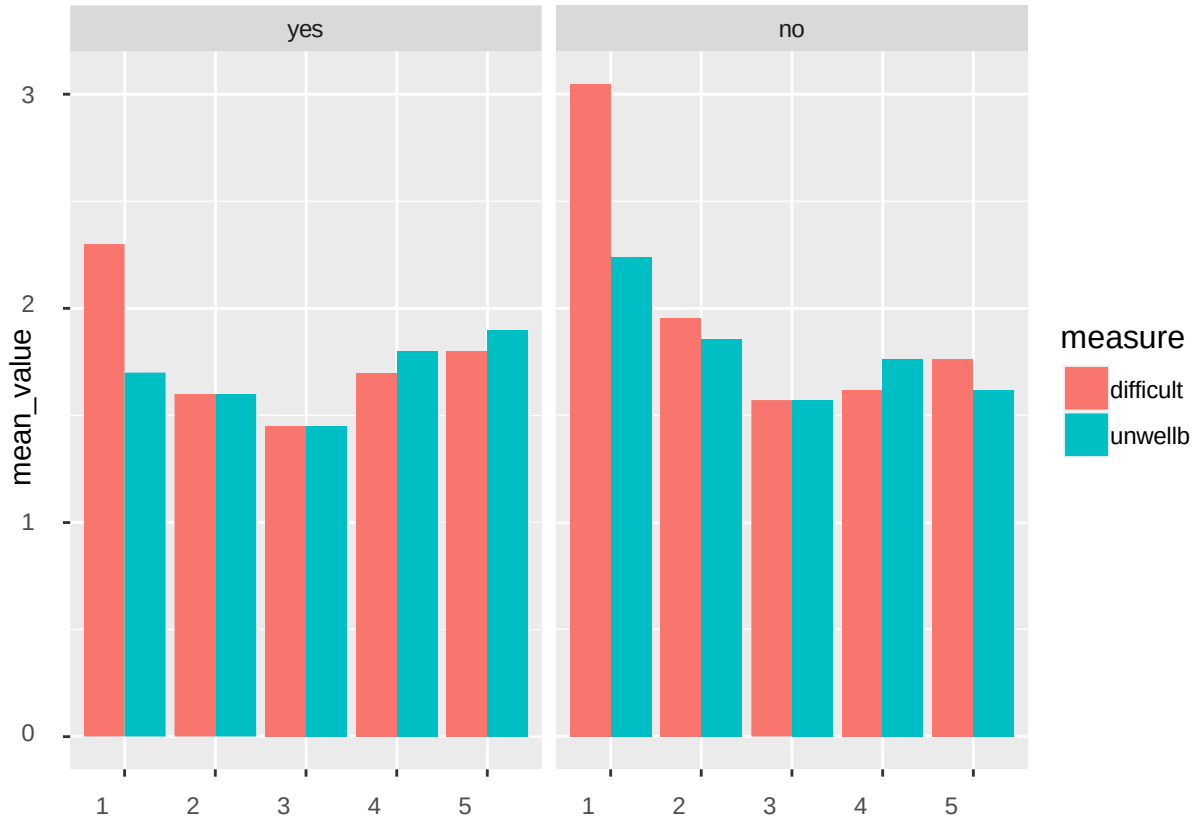


Figure 7: Station

Interestingly, there is a tendency from participants with VR experience to report higher well-being values. If we consider the distribution of the used resolution across experienced and non-experienced users, we get the following graph:

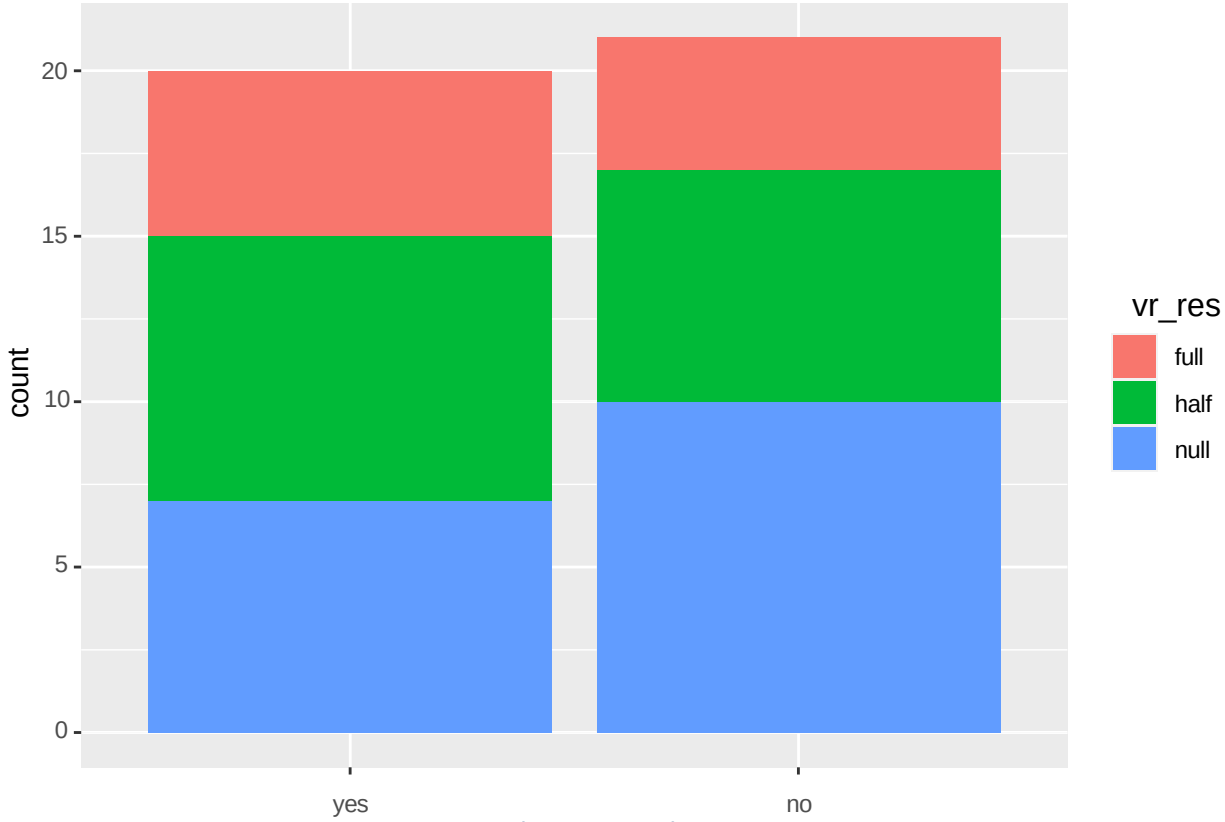


Figure 8. Experience

From this graph we can see that non-experienced users tended to use the lowest resolution more often than experienced users. Moreover, the half resolution was used by experienced users quite frequently. In the next figure we see that only moderately experienced users used the full resolution, while the most experienced users chose half and full resolution.

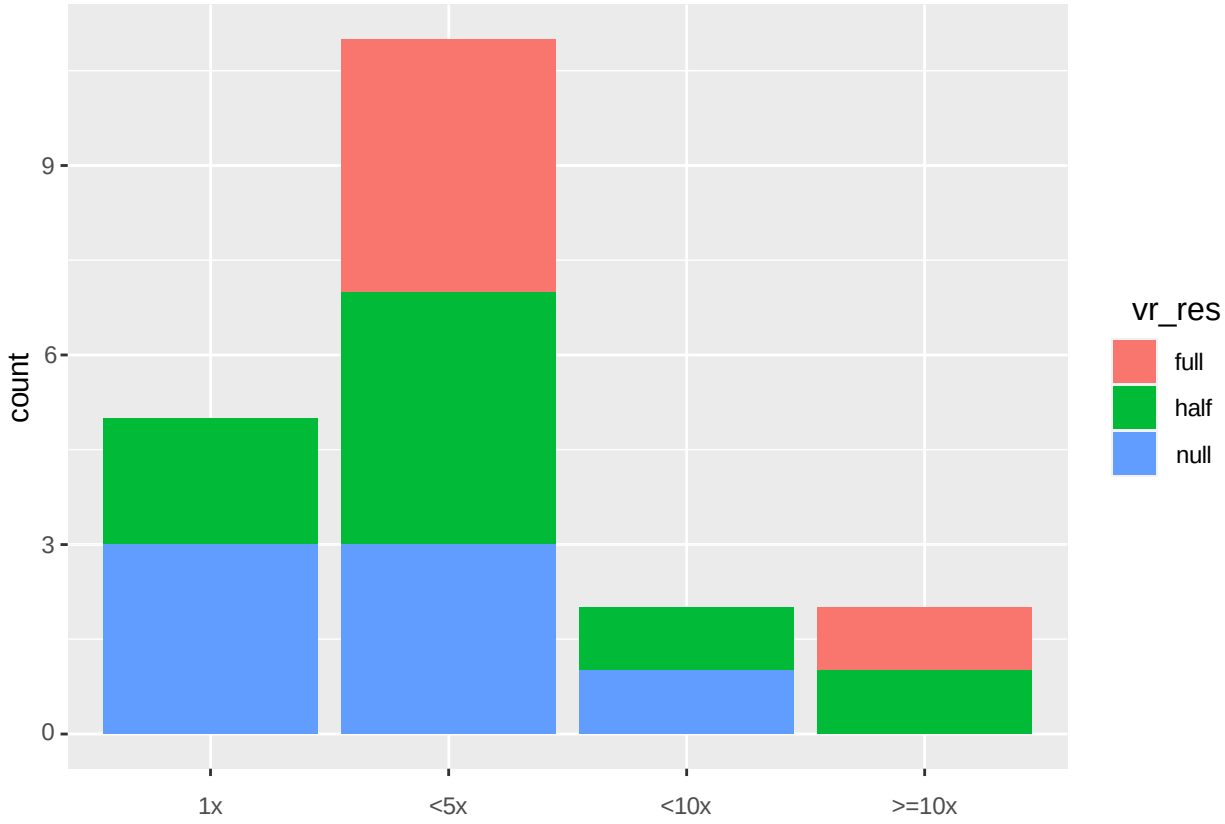


Figure 9: vr_freq

We now take a look at the reported unwell-being values from the point of view of the different resolution types in the different stations. The results seem to be highly dependent on the particular station. While clearly, in Station 1 the highest unwell-being was associated with the lowest resolution, this tendency seems quite different in Station 2. Stations 3, 4 and 5 show a similar pattern as Station 1.

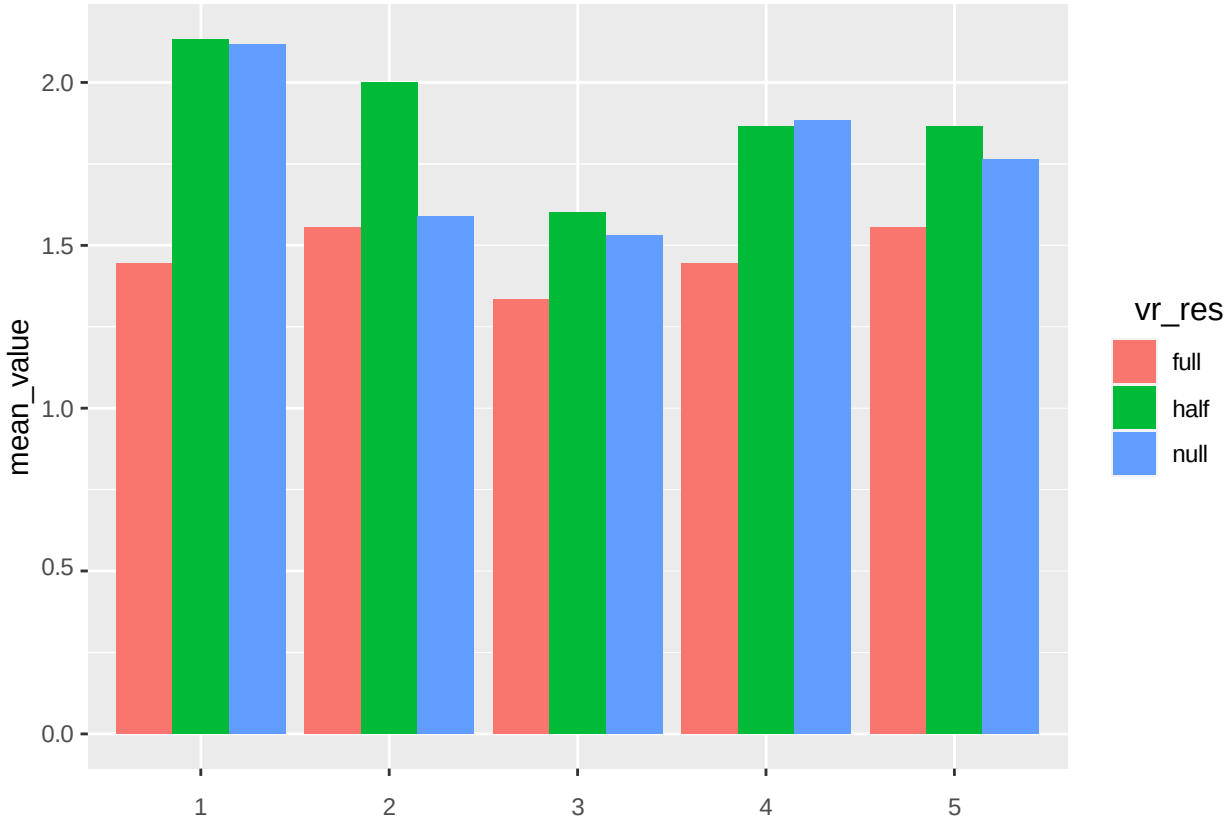


Figure 10: Station

Regarding the comments left by the participants regarding Stations 4 and 5, many reported remembering and writing as a major source of difficulty for Station 4, whereas writing and understanding was reported as the main source of difficulty for Station 5. We report the results as word clouds for both stations:

4. VRWALK QUESTIONNAIRE RESULTS

Here, the consortium performed a statistical analysis on the results of the motion sickness questionnaire carried out for the VRWalk project. This data analysis was performed using R and the tidyverse library.
The data has 105 observations for the 25 questions in the questionnaire. The majority of the questions uses a scale between 1-5 to indicate the level of difficulty of the given VR station. Additionally, two questions are open and the final questions record gender and age of the participants. After removing rows with zero duration or incomplete answers, 87 rows remain valid for the analysis.
For the data preparation we selected the relevant columns, renamed them for clarity and set the factor levels when necessary.
Gender distribution: there is a significant imbalance between male and female participants (60% vs 40%).

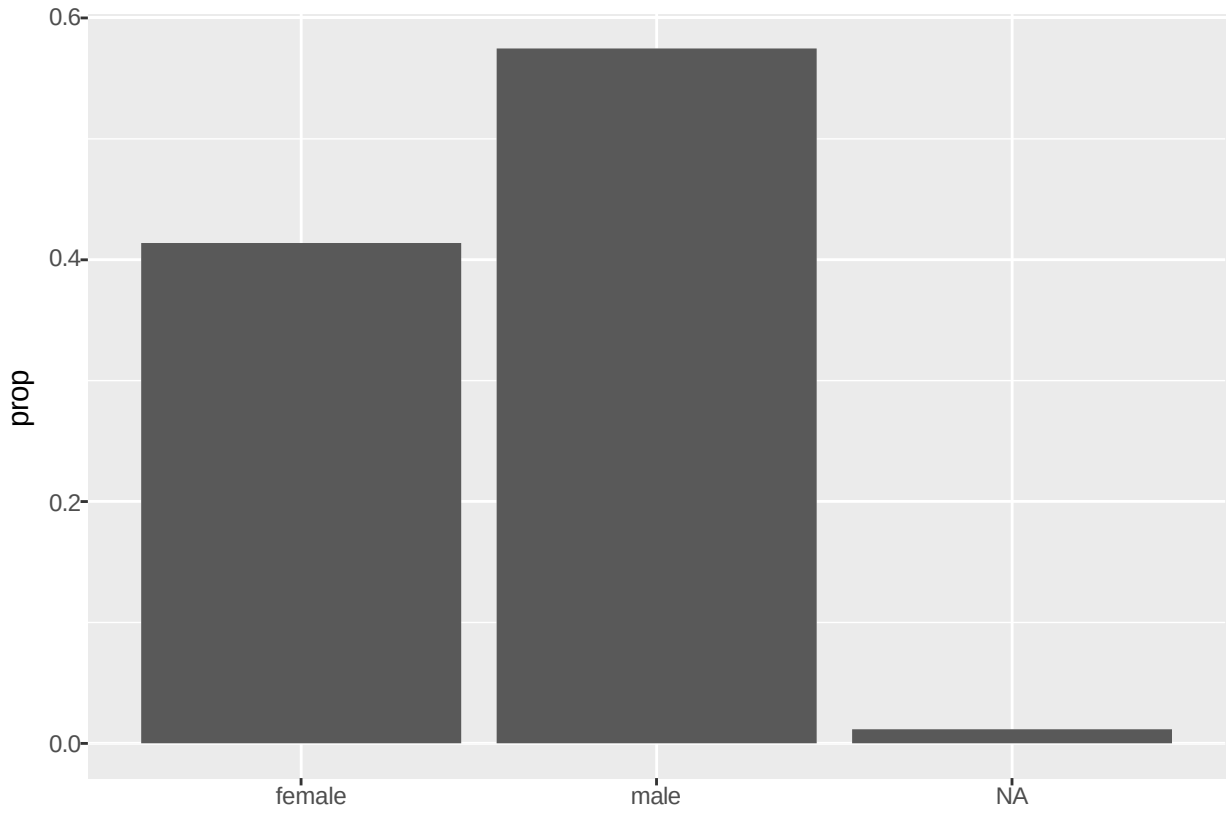


Figure 11: gender

As can be seen in the age histogram, most participants are young with even a significant part of children (33%). The youngest participant was 7 years old, the oldest by contrast 67.

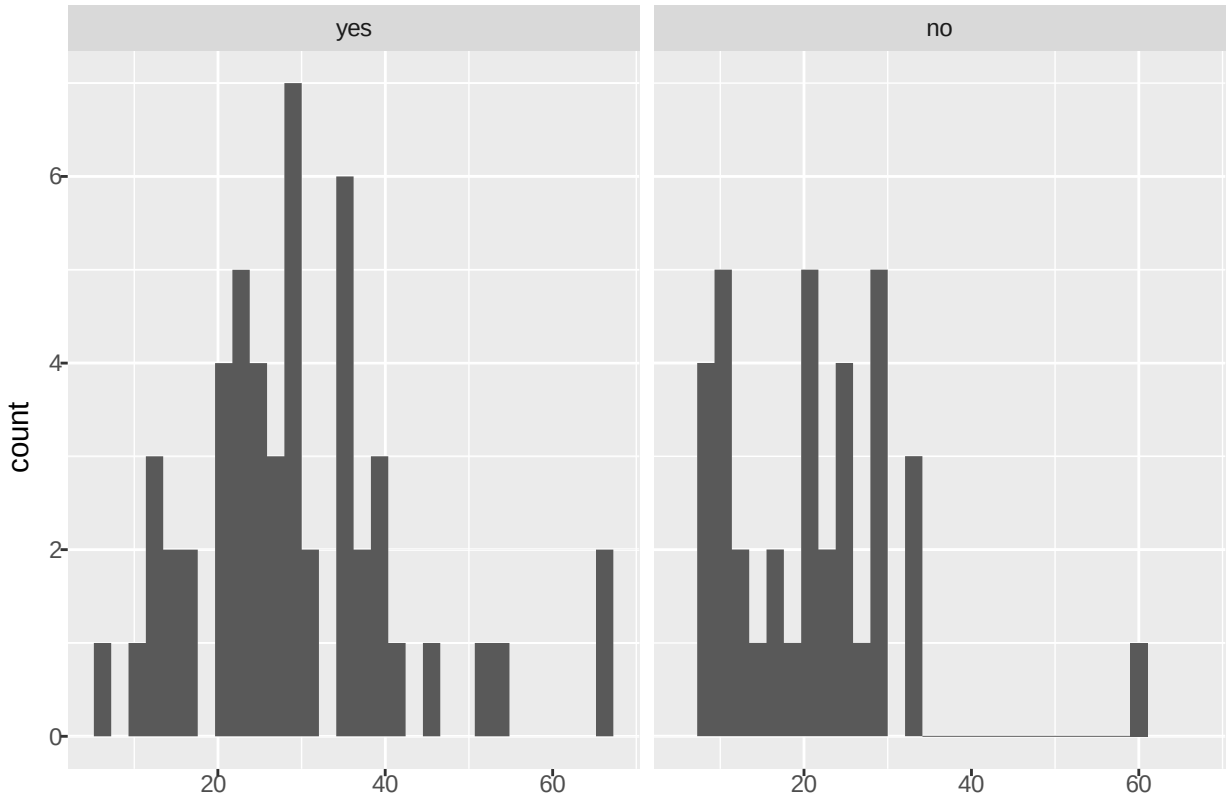


Figure 12:age

First of all, let's take a look at which stations did the participants feel particularly unwell:

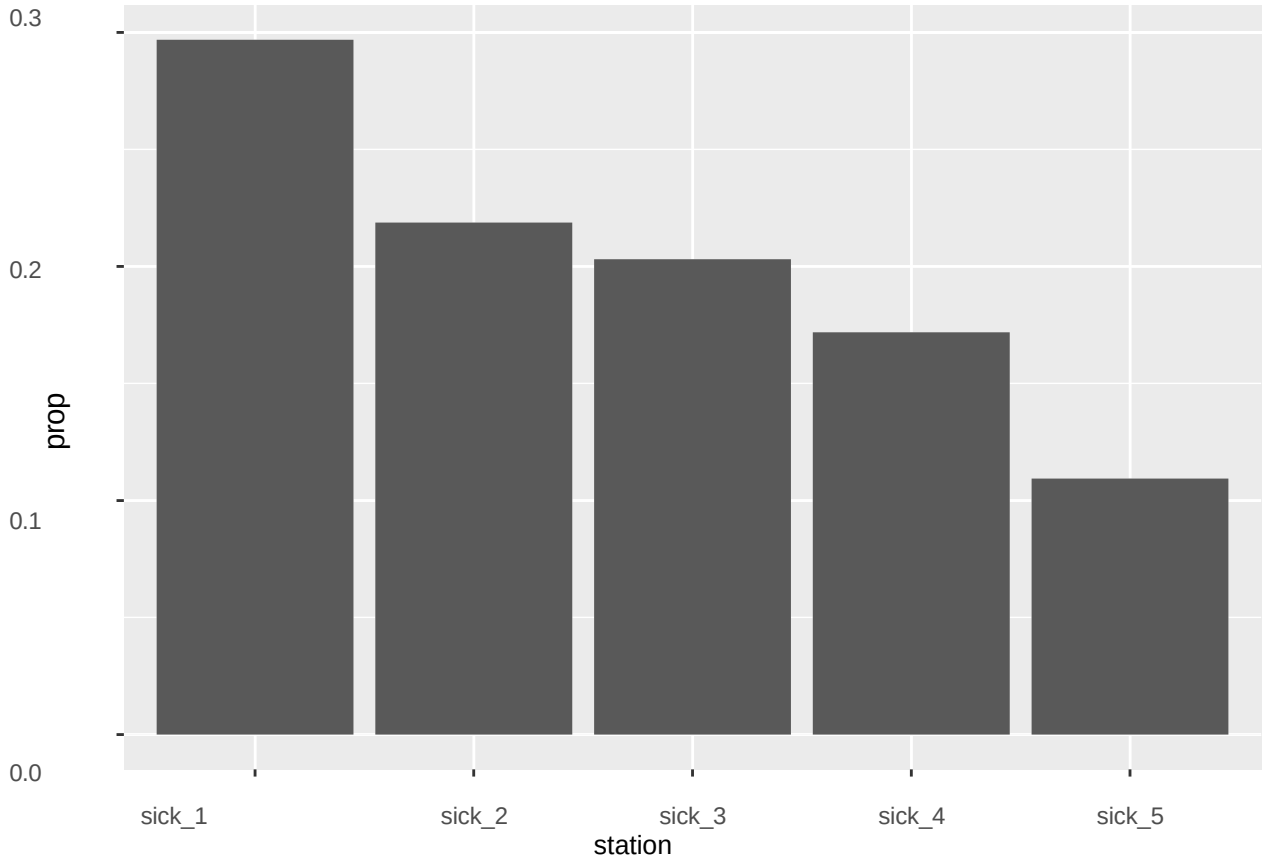


Figure 13: sick

Almost 30% of the participants felt unwell after visiting Station 1. Stations 4 and 5 were the stations with the smallest proportion of participants that felt particularly unwell.
We now plot the reported difficulty and degree of well-being of participants for all five stations.

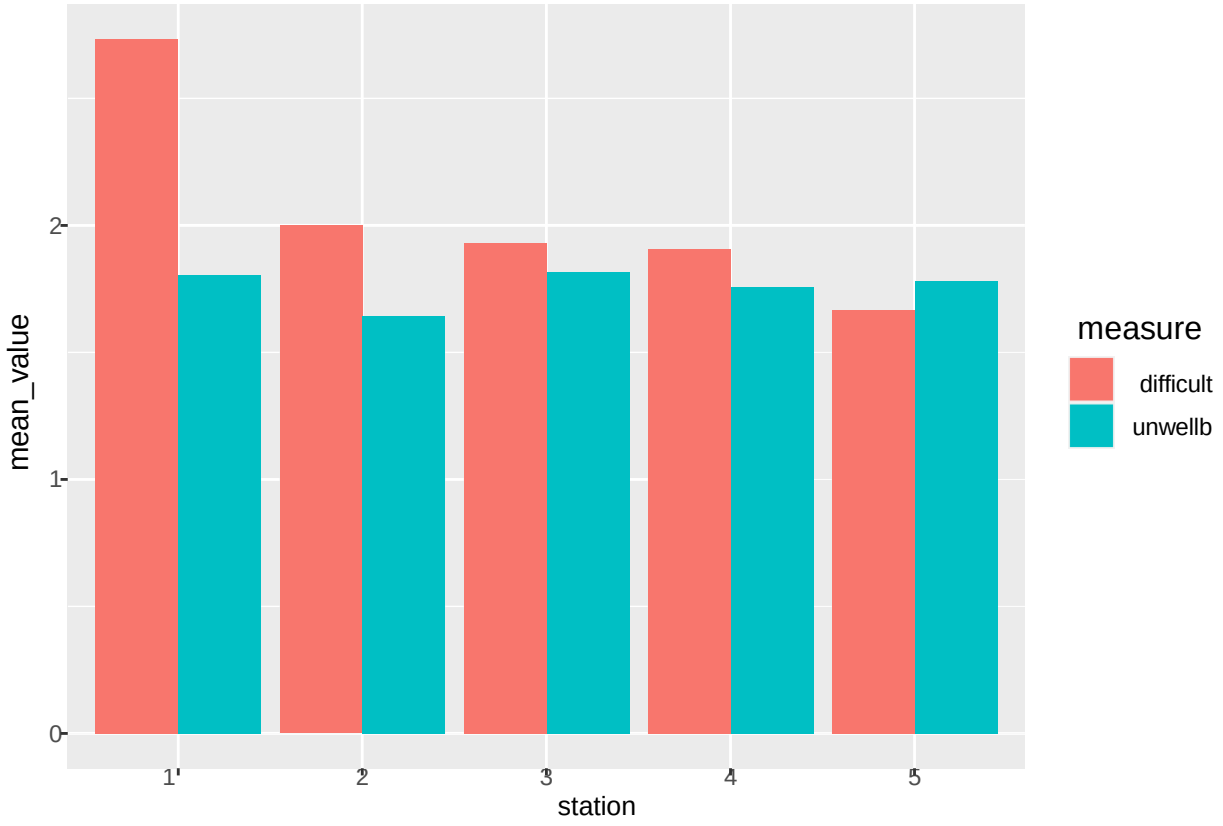


Figure 14: difficulty and unwellbeing per station

Here we plot the mean difficulty (measure = “difficult”, the higher, the more difficult) and unwell-being values (measure = “unwellb”, the higher, the more problematic from the motion sickness point of view) reported by the questionnaire participants, grouped by stations. As we can see, the greatest difficulty was again reported for Station 1, whereas the highest well-being value was reported for Station 2. There seems to be no apparent correlation between difficulty and the reported unwell-being values of the participants, as shown in the following graph:

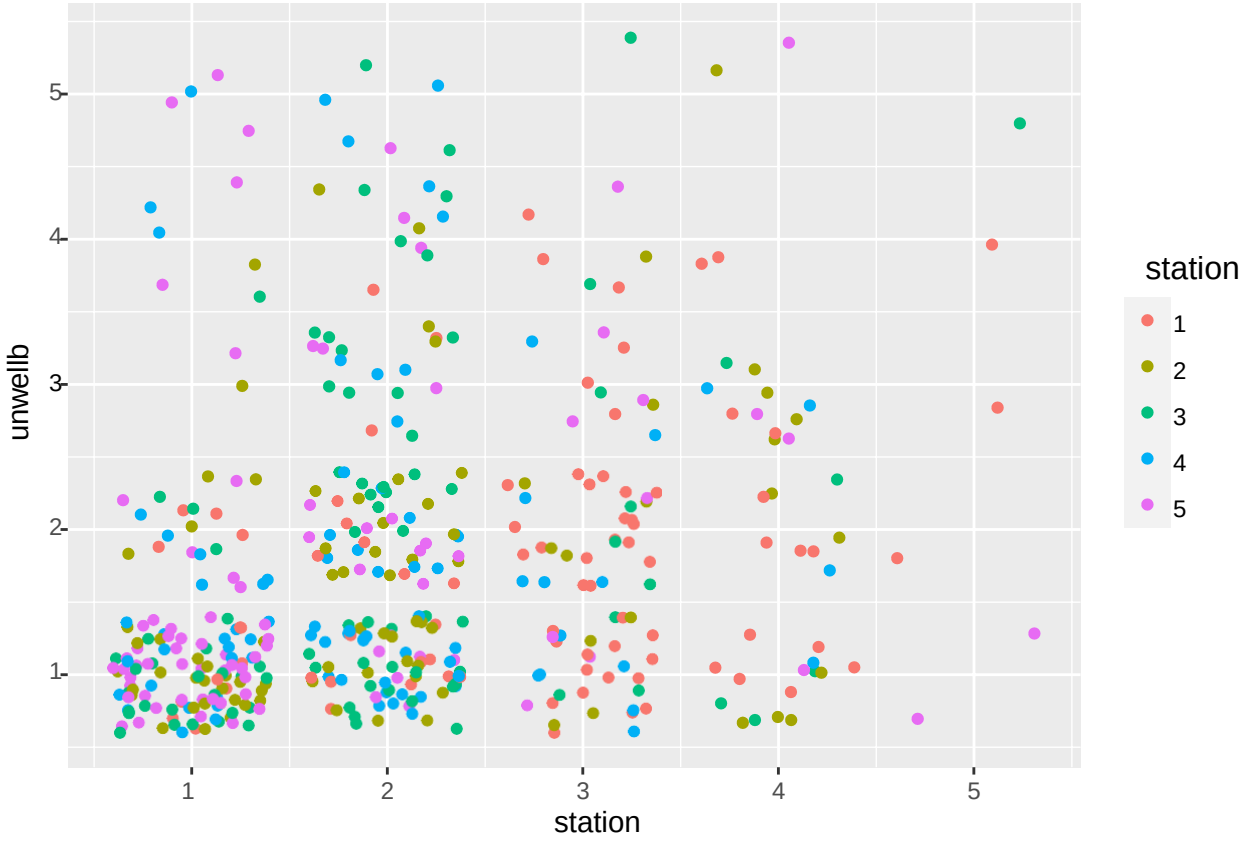


Figure 15:difficult

If we split difficulty and degree of unwell-being by type of movement, we get the following graph:

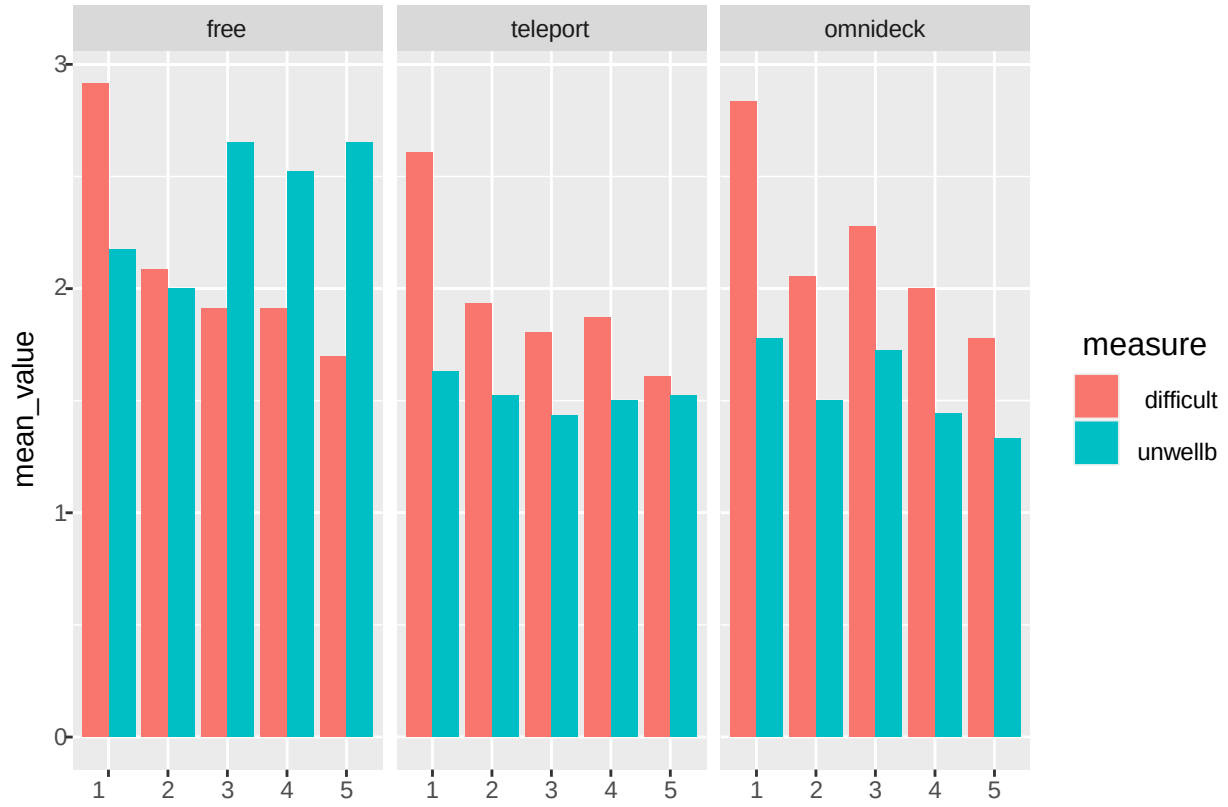


Figure 16: difficulty and unwellbeing per movement

We can see here that in general, free movement is related to the highest degrees of motion sickness. By contrast, teleportation and omnideck report the highest well-being values, suggesting that these types of movement are less frequently associated with motion sickness. Remarkably, the participants using omnideck reported the highest difficulty values. In the following graph we split the result by degree of VR experience:

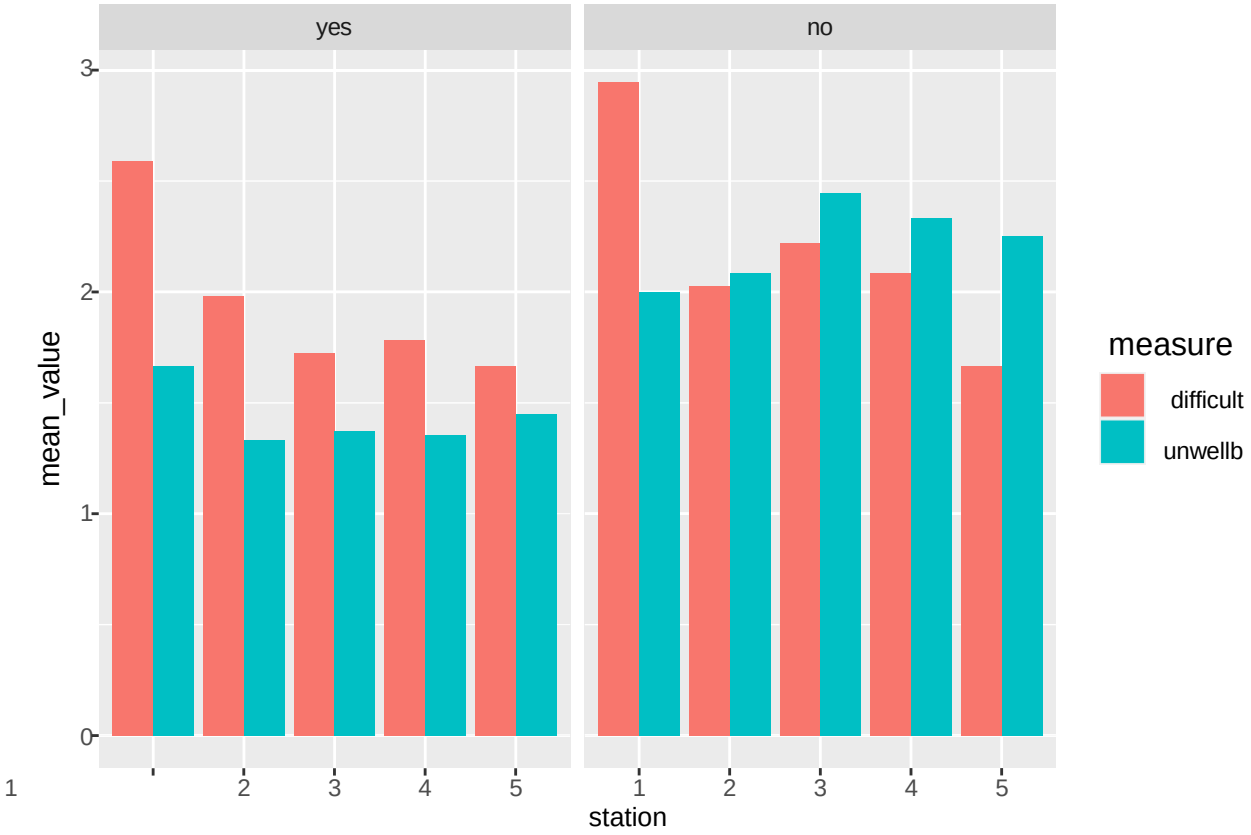


Figure 17: difficulty and unwellbeing by experience

Interestingly, there is a tendency from participants with VR experience to report higher well-being values. If we consider the distribution of movement types across experienced and non-experienced users, we get the following graph:

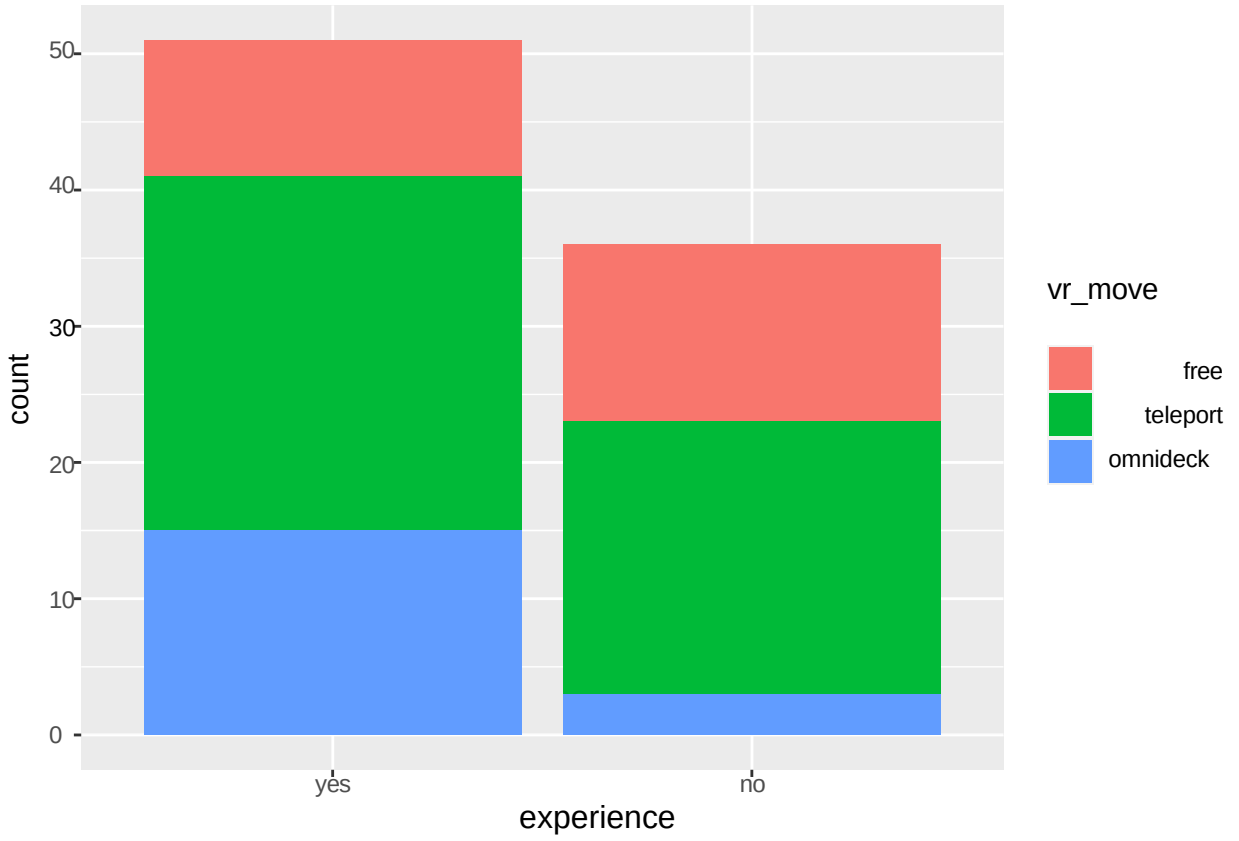


Figure 18: Movement versus experience

This graph explains this tendency by showing that non-experienced users used free movement more frequently than the experienced users, which is more frequently associated with lower reported well-being values. In the next graph we show that the most experienced users chose omnideck and teleportation much more frequently than free movement.

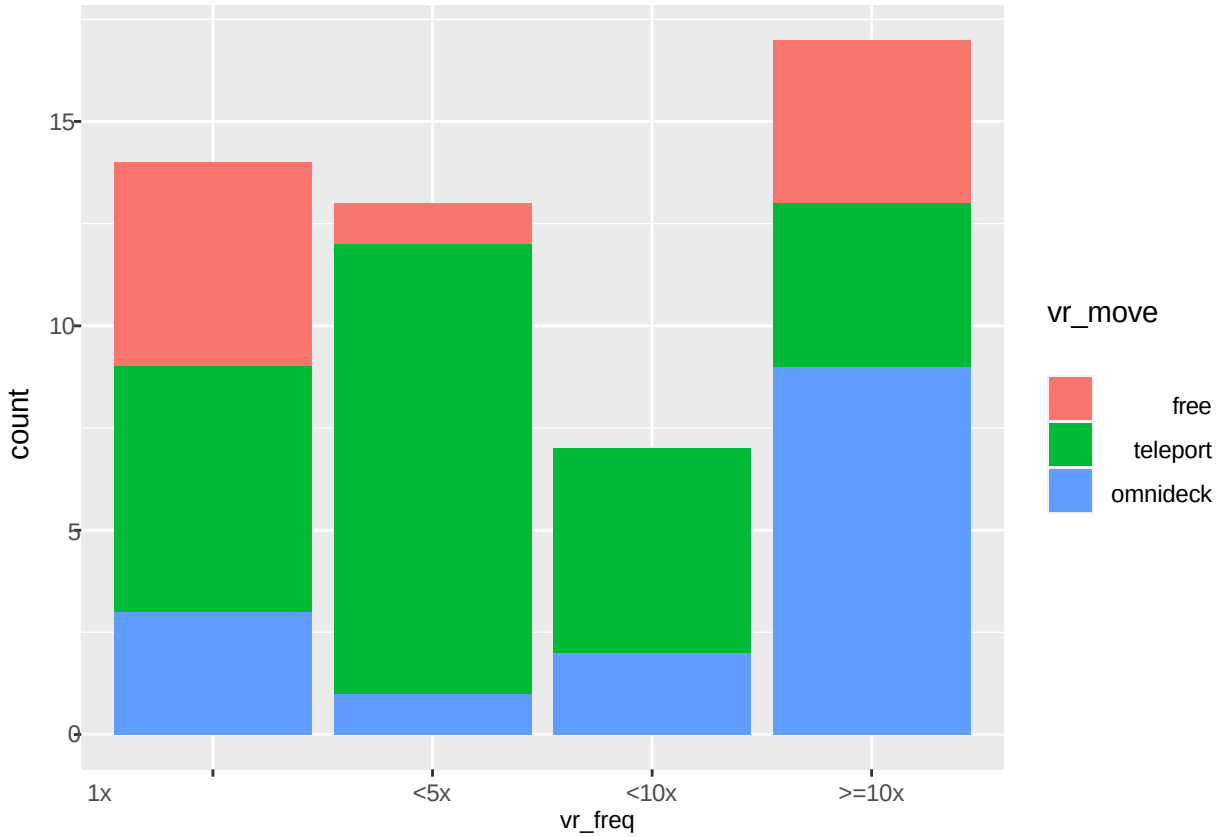


Figure 19: type of movement selected by experience

We now take a look at the reported unwell-being values from the point of view of the different movement types in the different stations. As can be seen, the lowest well-being values are being reported on average by participants using free movement across all stations. Teleportation and omnideck seem less problematic: in Stations 1 and 3, teleportation is associated with higher well-being values than omnideck, whereas in the other stations the values are comparable.

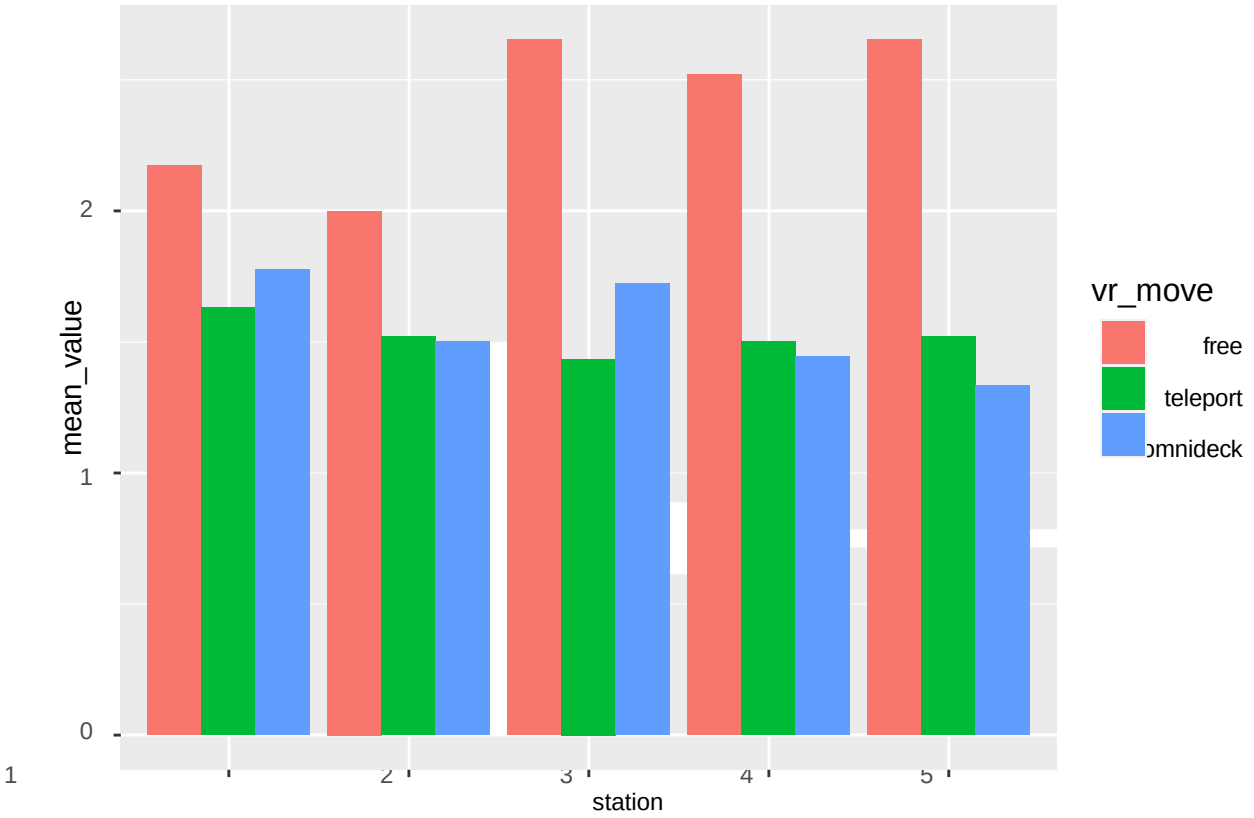


Figure 20: difficulty and unwellbeing by movement and station

Regarding the comments left by the participants regarding Stations 4 and 5, many reported remembering as a major source of difficulty for Station 4, whereas writing was reported as the main source of difficulty for Station 5. We report the results as word clouds for both stations:

5. ASSESSMENT OF THE SELECTED APPROACH

- The intensity of motion sickness depends on the transportation mode. Moving by walking in the virtual world.
- Moving by jumping has a lower impact on motion sickness.
- Walking on the Omnideck has the lowest impact on motion sickness.
- Concentrating on manual work has a significant influence on the intensity of motion sickness.
- Main conclusion the consortium draw from this motion sickness test is that manual work can be trained virtually with a lower probability of motion sickness.
- However, there are some design elements like offering a smooth way of transportation, clear resolution and an eye-friendly colour-code needs to be considered.

6. CONCLUSIONS

6.1. Summary of achievements

The consortium conducted motion sickness test with a diverse group of testers. Their task was to solve some manual and thinking (calculation) task. Main conclusion is that manual work is combined with a lower probability of motion sickness. This is caused that concentrating on manual work avoid that the users are open for the causes of motion sickness. Proper virtual applications need to respect some design elements like offering a smooth way of transportation, clear resolution and an eye-friendly colour-code to ensure a low occurrence of motion sickness.

6.2. Contact to the Coordinator´s Data Protect Officer

DPO Christian Gepp
Head of the Staff Office for Public Relations and Communication
Hofburg-Schweizerhof
A-1010 Vienna
Phone: +43 (1) 53649-814619
Mail: datenschutz@burghauptmannschaft.at