Using 360 VR Video to Improve the Learning Experience in Veterinary Medicine University Degree

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360 VR Video for Veterinary Medicine University Degree
Project Objectives

• 360VR video for practical lessons on horse surgical pathology and surgery
  • 4th year undergrads
  • Help in the retention of content → difficult to access the hospital outside lesson times
  • Part of the regular course → students are evaluated of those contents

• Analyze the QoE reported by students
  • Impact of presence factors on passive VR (videos) for education
  • Understand student satisfaction
  • Validate the use of compact questionnaires
University Veterinary Hospital
Content Preparation and Delivery

Rico Theta V
4K monoscopic equirectangular

HEVC Encoder

Packager

HTTP SERVER

Private YouTube Channel

MPEG DASH
Content evaluation

Questionnaires

• Temple Presence Inventory (TPI)
• Simplified Simulator Sickness Questionnaire (sSSQ)
• Distributed Reality Experience Questionnaire (DREQ), including
  • Net Promoter Score (NPS)
Temple Presence Inventory

- By Lombard & Ditton & Weinstein,
  - Based on analysis of existing presence questionnaires + experimentation
- 42 items (questions) in 8 categories (presence factors)
- Covering spatial and social presence
- Easy to adapt (remove some sections)
- Mostly 7-point Likert scale
- We represent it normalized into (-1, 1)

Presence factors:
- Spatial (“being there”)
- Social presence-actor (“interact to people”)
- Passive social (“observe people voices, etc”)
- Active social (“smile/talk to people”)
- Engagement (“mental immersion”)
- Social richness (e.g. “remote” vs “immediate”)
- Social realism (“would occur in real world”)
- Perceptual realism (“feel, touch, temperature”)

Simplified Simulator Sickness Questionnaire

• Questions to cover globally the main SSQ elements:

• Are you experimenting now any of these symptoms?:
  • Headache, eyestrain, difficulty focusing (OCULOMOTOR)
  • Vertigo, dizziness (DISORIENTATION)
  • Stomach awareness, nausea (NAUSEA)
Distributed Reality Experience Questionnaire

- Bell Labs tool to evaluate interactive video-based XR experiences (“Distributed Reality”).
- Removed questions that don’t apply

<table>
<thead>
<tr>
<th>Factor</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence</td>
<td>I felt like I was actually there in the remote environment</td>
</tr>
<tr>
<td></td>
<td>I was aware of the events occurring in the real world around me</td>
</tr>
<tr>
<td></td>
<td>I was able to complete the task as if it happened in the real world</td>
</tr>
<tr>
<td></td>
<td>I was able to interact normally with the elements of the remote environment</td>
</tr>
<tr>
<td></td>
<td>I was able to interact normally with the objects of the real world</td>
</tr>
<tr>
<td>AV Quality</td>
<td>Please rate the perceived quality of the remote environment</td>
</tr>
<tr>
<td></td>
<td>Please rate the perceived quality of your local reality (your hands, etc.)</td>
</tr>
<tr>
<td>Sickness</td>
<td>Did you feel any sickness or discomfort during the experience? Please rate it</td>
</tr>
<tr>
<td></td>
<td>Are you feeling any sickness or discomfort now (after the experience)? Please rate it</td>
</tr>
<tr>
<td>QoE</td>
<td>How would you rate the quality of the experience globally?</td>
</tr>
<tr>
<td></td>
<td>How likely is that you would recommend this experience to a friend or colleague?</td>
</tr>
</tbody>
</table>

Content evaluation
Experimental setup

Experiment evaluation:
• 100 students (75% female, 25% male)
• Watch the videos → answer questionnaires
• Samsung Galaxy 8+, Samsung Gear VR, noise-cancelling headphones
**Results**

TPI and DREQ, by gender

- 78% rate the experience as good or excellent
- MOS > 4 for all categories
- Female slightly better opinions (< CI)
- High social realism
- Moderately high spatial presence
- Inter-gender difference in social active
Results
Cybersickness

- Small cybersickness (35% of light oculomotor discomfort)
- Low correlation between cybersickness factors

| Correlation between mSSQ and DREQ cybersickness factors. |
|-----------------|-----|------|-----|-----|-----|
|                 | IECS| PECS | OCUL| DISO| NAUS|
| IECS            | 1.00|      | -0.52| -0.49| -0.13|
| PECS            |  0.72| 1.00 | -0.57| -0.60| -0.30|
| OCUL            | -0.52| -0.57| 1.00 |  0.53|  0.34|
| DISO            | -0.49| -0.60|  0.53|  1.00|  0.36|
| NAUS            | -0.13| -0.30|  0.34|  0.36| 1.00 |
Results
Net Promoter Score

“How probable is that you would recommend this to a friend or colleague?”

- Classify into
  - Promoters (9-10)
  - Neutral (7-8)
  - Detractors (0-6)

\[
NPS = 100\% \frac{P - D}{P + D + N}
\]

- NPS = 14% (not bad)

Results
Net Promoter Score

• But... classification into P,N,D (as per the original paper) was based on a clustering of the people under test

• Here 8-raters are clearly supporters → we use a modified NPS
  • D = (0-5), N = (6-7), P = (8-10)
  • NPS = 44%
Results
TPI and DREQ by (modified) NPS

- **Effective clustering of users**
- Strongest differences in VQ/QoE
- Smallest differences in CS

- Strongest effect: social active, engagement, social richness
Conclusions

- Successfully integrated VR content into actual practical lessons
- Good acceptance and quality for this kind of experiences / contents
- Net Promoter Score
  - Useful clustering tool
  - Need additional questions for calibration (standard partitioning may be misleading)
- Slightly better responses in females (including cybersickness)
- Social presence has better discriminative factor than spatial presence in terms of user satisfaction
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