Reading subtitles across devices:
A study into the differences in reading patterns of people watching subtitled videos on smartphone, tablet and computer screen

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About the study

- Reading across devices
  - part of the HBBTV4ALL project (Universitat Autònoma de Barcelona)
- Reading subtitles on three devices:
  - Monitor (22-inch LCD, 1920x1200)
  - iPad Air
  - iPhone (4S)
Previous eyetracking studies on mobile devices
(Al-Showarah et al. 2014)

- Influence of **age** on use of mobile devices
  - the elderly have difficulties with processing information and browsing smartphone interfaces across all screen sizes

- Influence of **screen size** of mobile devices
  - the smaller the screen – the worse the performance, irrespectively of age
Study design

- 3x2 design
  - 3 devices:
    - iPhone
    - iPad
    - monitor
  - 2 languages:
    - English
    - Norwegian

- Subtitle watching experience
  - Comprehension
  - Reading patterns
  - Preferences
Study material

- English film
  - “Joining the dots”, dir. Pablo Romero Fresco (2012)
  - 3 x 3 min. video

- Norwegian film
  - “Headhunters”, dir. Morten Tyldum (2011)
  - 3 x 3 min. videos

- Polish interlingual subtitles displayed at 15 cps
Eyetracking

- SMI Red (250 Hz)
  - Monitor
- Tobii X2 (30Hz)
  - iPhone
  - iPad

- Eyetracking measures
  - Number of fixations
  - Fixation duration

- Fixation threshold: 80 ms
Procedure

- Informed consent
- Videos in counterbalanced order
  - Calibration before each clip
  - 10 multiple choice comprehension questions after each clip
    - 5 on subtitle content (text only)
    - 5 on visual aspects
- Demographic and preference survey
- Total duration: ca. 45 minutes
Participants

- 33 people aged 20-35
  - Mean age: 24 (SD=3.4)
  - 8 men, 25 women
- Declared proficiency on 1-10 scale (1 – no knowledge, 10 – proficiency)
  - English: 8.79 (SD=1.19)
  - Norwegian: 1.36 (SD=0.55)
Participants’ background

**Education**
- MA: 67%
- PhD: 12%
- BA: 21%

**How often do you watch foreign films with subtitles?**
- Always: 55%
- Sometimes: 39%
- Rarely: 6%
Comprehension results
Comprehension – textual

Subtitle comprehension

<table>
<thead>
<tr>
<th>Device</th>
<th>No. of correct answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone</td>
<td>4.14</td>
</tr>
<tr>
<td>Tablet</td>
<td>4.32</td>
</tr>
<tr>
<td>Monitor</td>
<td>4.24</td>
</tr>
</tbody>
</table>

two-way ANOVA
(variables: device & language)
device: $p=0.4471$
Comprehension – visual

<table>
<thead>
<tr>
<th>Device</th>
<th>No. of correct answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone</td>
<td>3.55</td>
</tr>
<tr>
<td>Tablet</td>
<td>3.74</td>
</tr>
<tr>
<td>Monitor</td>
<td>3.74</td>
</tr>
</tbody>
</table>

Two-way ANOVA
(Variables: device & language)
Device: $p=0.4917$
Eyetracking results
Areas of interest on each subtitle
## Fixation count per device

<table>
<thead>
<tr>
<th>Device</th>
<th>No. of fixations per subtitle</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>iPhone</td>
<td>5.28</td>
<td>1.95</td>
</tr>
<tr>
<td>iPad</td>
<td>6.13</td>
<td>2.26</td>
</tr>
<tr>
<td>monitor</td>
<td>5.65</td>
<td>1.94</td>
</tr>
</tbody>
</table>

Two-way ANOVA (variables: device & language)

**Device**: $p=0.0647$

Bonferroni correction

The only significant difference: between iPhone and iPad ($p=0.0592$)
Mean fixation duration per device

<table>
<thead>
<tr>
<th>Device</th>
<th>Fixation duration</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>iPhone</td>
<td>250 ms</td>
<td>43.14</td>
</tr>
<tr>
<td>iPad</td>
<td>183 ms</td>
<td>20.73</td>
</tr>
<tr>
<td>Monitor</td>
<td>172 ms</td>
<td>44.59</td>
</tr>
</tbody>
</table>

two-way ANOVA (Variables: device & language)  
Device: \( p = .000 \)

Bonferroni correction:  
- iPhone vs. iPad & iPhone vs. monitor (\( p = .000 \))  
- iPad and monitor (\( p = .1173 \))
Mean fixation duration by device and language

- **iPhone**
  - Norwegian: 240 milliseconds
  - English: 250 milliseconds

- **iPad**
  - Norwegian: 178 milliseconds
  - English: 188 milliseconds

- **Monitor**
  - Norwegian: 167 milliseconds
  - English: 177 milliseconds

Two-way ANOVA (Variables: device & language)
Device: $p = .0256$
Preferences
How often do you watch subtitled videos on these devices?

- Never
- Rarely
- Sometimes
- Always

[Bar chart showing percentage of respondents for each category]
The comfort of watching subtitled videos by device

![Bar chart showing the comfort of watching subtitled videos by device. The chart compares the comfort levels between monitors, tablets, and phones. The y-axis represents the comfort level, ranging from 1 (very bad) to 5 (very good), and the x-axis shows the percentage of answers. The chart indicates that monitors generally receive the highest comfort ratings, followed by tablets and then phones.](chart.png)
Conclusions

- iPhone – the worst device to watch subtitled videos
  - Lowest comprehension results
  - Longest mean fixation duration
  - Fewest fixations – less reading
  - Nobody’s preferred device
- Habits inform preferences – other participants?
- Longer mean fixation duration in English than in Norwegian clips
  - Parallel processing of visual and audio content
  - Higher cognitive effort, but more rewarding (higher comprehension scores in English)
- Testing across eyetrackers...
So what...?

HBBTV (hybrid broadcast broadband) = digital broadcasting + Internet + mobile devices

Smartphones – secondary devices only with subtitles?
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