AR App for Museum

Empirical Research

GROUP 12

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Introduction

1.1 Purpose

The purpose of Cognitive Walkthrough is to evaluate design early using low fidelity prototypes.

1.2 Overview of the process

Variables
Independent Variable (IV) – What is causing a change in another variable of interest
Dependent Variable (DV) – the variable of interest (what is measured)
In experimental research, the IV is the manipulated variable

Research Questions -

Q1. If error rates are kept under 2%, is reading the augmented information faster for a fixed 3D text palette than floating 3D information?

Q2. Is the accessing information about the monument faster for Landscape orientation than Portrait ?

User Study

Experiment design -

- 2 x 2 x 2 repeated-measures (within subjects) design
- Experiment with three factors, each having two levels.
- There are eight test conditions in total.
- Both factors are repeated measures, so all participants were tested on all test conditions

Dependent Variables:-

Task completion time (s) -
Time taken for fixed task : Point to a monument and View its information.
Steps of the task :

1. Open the Main screen
2. Navigate through the button layout
3. Open the camera mode
4. Point the camera to a monument
5. Wait for information to load near the monument

Reading speed (wpm) -
Time taken for reading the information about the monument

Error rate (%) -
Errors in reading or the errors in doing the task.

Independent Variables:-

Button layout - This variable has following two levels :
Grouped - encoded as G
Expanded - encoded as E

Information Mode - This variable has following two levels :
3D text palette - encoded as P
floating 3D info - encoded as F

Phone orientation - Orientation of the phone. Two levels :
Horizontal - encoded as H
Vertical - encoded as V

Data Collection

Participants details -

	Age group	Visited a Museum	AR Background	Reference for AR
Participant 1	15-20	Yes	Yes	None
Participant 2	15-20	No	Yes	Website
Participant 3	20-30	Yes	Yes	Friend
Participant 4	15-20	Yes	No	None
Participant 5	15-20	No	Yes	Website
Participant 6	15-20	Yes	No	None
Participant 7	20-30	Yes	No	None
Participant 8	15-20	Yes	Yes	Friend
Participant 9	15-20	Yes	Yes	Sony Camera
Participant 10	15-20	Yes	No	Website

Procedure followed for data collection –

- The participants were told the general objectives of our experiment
- The participants were put through some practice trials for familiarization
- Afterwards, the data collection was started
- The task under each test condition was presented to each participant on a screen.
- The latin square method was followed for ordering the conditions
- Participants instructed to perform the navigation and the reading task “as quickly as possible”
- Measurement of **Task completion time (s)** was calculated by using a stopwatch.

- Measurement of **Reading speed (wpm)** was calculated by the formula -
  Reading speed = (Number of words in the text) / (time taken to read in minutes)

Order of conditions :

Order was according to the **Latin square method** for each pair of participants
Since each factor has two levels, the latin square was applied to the pair of participants as follows -

Participant 1	L1	L2
Participant 2	L2	L1

Statistical significance testing report :

After finishing the above test conditions on each participant, following data was collected.

Data Tables -

Table for the variable “Reading Speed” :

Reading speed (wpm)									
Button layout	G	G	G	G	E	E	E	E	
Information Mode	P	P	F	F	P	P	F	F	
Orientation	H	V	H	V	H	V	H	V	Mean
Participant									
1	**213**	**169**	**185**	**220**	**220**	**175**	**166**	**178**	**190.75**
2	**231**	**178**	**151**	**214**	**223**	**208**	**153**	**177**	**191.88**
3	**201**	**208**	**206**	**199**	**247**	**150**	**218**	**190**	**202.38**
4	**186**	**172**	**216**	**189**	**211**	**168**	**192**	**211**	**193.13**
5	**227**	**157**	**164**	**178**	**187**	**182**	**157**	**194**	**180.75**
6	**210**	**177**	**178**	**172**	**218**	**161**	**211**	**197**	**190.5**
7	**243**	**150**	**220**	**179**	**185**	**173**	**167**	**195**	**189**
8	**208**	**181**	**216**	**228**	**195**	**172**	**216**	**218**	**204.25**
9	**238**	**168**	**150**	**203**	**240**	**154**	**172**	**176**	**187.63**

10	**238**	**154**	**167**	**170**	**236**	**161**	**218**	**230**	**196.75**
Mean Reading Speed	**219.5**	**171.4**	**185.3**	**195.2**	**216.2**	**170.4**	**187**	**196.6**	**192.702**

Findings for Reading Speed:

- The Mean Reading Speed is highest for the first condition(G-P-H) i.e. Grouped button layout, Palette information and Horizontal orientation.
- The mean reading speed for Horizontal orientation is faster than that for the Vertical orientation in all four cases. So the Orientation factor is considerably controlling the Reading speed.
- There is no significant effect of button layout on the reading speed. Since the speeds have less than 2% change on switching the button layout

Table for the variable “Task Completion Time” :

Task Comp. time(seconds)									
Button layout	G	G	G	G	E	E	E	E	
Information Mode	P	P	F	F	P	P	F	F	
Orientation	H	V	H	V	H	V	H	V	Mean
Participant									
1	**6.69**	**7.71**	**6.2**	**5.96**	**7.07**	**7.09**	**6.65**	**5.39**	**6.6**
2	**8.21**	**7.74**	**7.16**	**6.52**	**7.52**	**5.62**	**5.34**	**5.08**	**6.65**
3	**7.54**	**5.61**	**6.26**	**5.35**	**7.28**	**6.19**	**5.21**	**7.06**	**6.31**
4	**6.65**	**7.76**	**5.18**	**5.34**	**7.6**	**5.5**	**7.91**	**5.42**	**6.42**
5	**7.19**	**6.82**	**4.94**	**6.48**	**7.69**	**6.59**	**6.04**	**5.76**	**6.44**
6	**8.12**	**5.99**	**7.8**	**5.38**	**8.34**	**7.5**	**4.96**	**7.33**	**6.93**
7	**7.12**	**5.88**	**5.98**	**5.97**	**6.94**	**7.07**	**7.86**	**7.26**	**6.76**
8	**7.28**	**5.54**	**5.82**	**5.63**	**7.61**	**5.81**	**5.38**	**5.8**	**6.11**
9	**7.92**	**7.3**	**7.5**	**7.36**	**8.33**	**5.72**	**5.41**	**4.86**	**6.8**
10	**7.48**	**5.77**	**6.36**	**7.77**	**8.35**	**7.75**	**6.83**	**5.77**	**7.01**
Mean	7.42	6.61	6.32	6.18	7.67	6.48	6.16	5.97	6.6

Findings for Task Completion Time:

- The time taken has increased for the configurations G-P-H and E-P-H indicating the significance for Pallete mode and Horizontal configuration.
- Time taken for E is relatively lesser than that for G suggesting that the ungrouped button configuration is providing faster completion times.