EVALUATING PRODUCT PERCEPTION USING EYE-TRACKING AND SEMANTIC SCALES:

Comparing real and virtual representations.

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Abstract

The use of 3D virtual representations is a common approach in the modern process of new product development. This work presents a preliminary study about comparing a real and a virtual representation of a product in order to use it to conduct a perception evaluation analysis with Eye-tracking technology and applying a semantic scale.

Motivation

New trends in emotional evaluation appear, integrating new technology and methods in design development to support new practices for design and test new products. Combining Semantic differential and gaze movement provide a new approach to design research.

Eye-tracking system

Eye tracking measures can provide an objective and continuous measure of the user's reactions through eye movement and gaze [1]. Eye movement provide an objective indicator of where a person's overt (and typically also their covert) attention is focused [2].

Fixations are defined as gaze patterns in which the eyes are relatively immobile, and during which the visual system is assumed to be gathering information [3].in particular, the locus of an observer's visual fixations is perhaps the single most commonly used parameter when it comes to assessing where a consumer's attention might be focused [4].

An unobtrusive eye tracker (Tobii TX300, www.tobii.com), was used to assess the participants' visual fixations. This device has a 23" flat HD screen and a sensor bar in the lower part of the screen, seated between 60-70 cm from device for calibrate system.

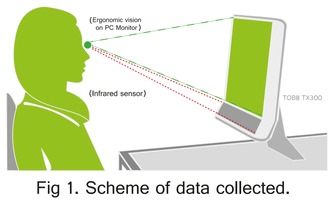

Fig 1. Scheme of data collected.

Semantic Scale

We took as a base the CPAM (Creative Product Analysis Model) [5]. In this Semantic Scale group we include an extra bipolar axis "Emotional" to improve an additional emotional result. We describe the 4 semantic axis.

NOVELTY (novedad)	RESOLUTION (resolución)	STYLE (estilo)	EMOTIONAL (emocional)
Antiquated - Fashion (anticuado - de moda)	Female - Male (femenino - masculino)	Stable - Unstable (estable - inestable)	Euphoria - Tranquility (euforia - tranquilidad)
Usual - Unusual (usual - inusual)	Robust - Thin (robusto - delgado)	Wrong-crafted - Well-crafted (mal hecho - bien hecho)	Sadness - Happiness (tristeza - felicidad)
Discreet - Revolutionary (discreto - revolucionario)	Tall - Short (alto - bajo)	Durable - fragile (Durable - fragil)	Empathy - indifference (empatía - indiferencia)

Table 1. Semantic Axes.

Test Product by Eye-tracking

One type of stimulus is presented; All of the images were set to an equal mean luminance and size edited. As a part of test, From and Back view bottle was used. Using the vision's law for workstation using in many companies, 4 angles was prepared (0°, 15°, 35°, 60°) of real and virtual bottle perspectives.

Preliminary sample took 14 Spanish (35 participants is the complete sample). 8 female and 6 male with ages range from 22 to 53 years. All participant reported normal corrected vision, and no colour-blindnesss.

Fig 2. Bottles

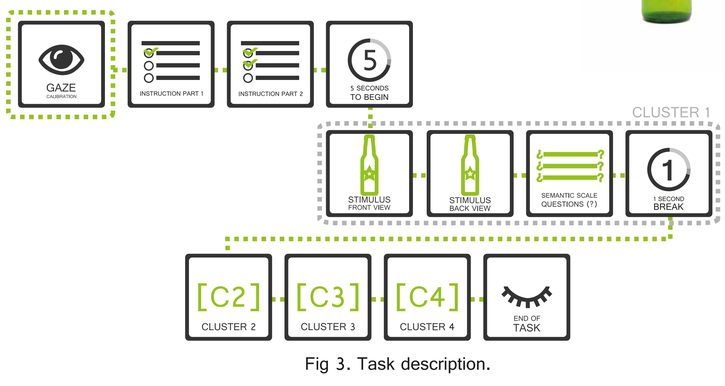

Fig 3. Task description.

Our methodology was structured follow the classic test of observation and evaluation, first watching images and then, evaluated by semantic scales. The clusters presented shows 3 blocks; 2 for display randomly the images of bottles and 1 for 3 questions based in one of the semantic axis.

Data Analyses

2 types of results are presented, statistic methods are used for interpret the data. For Semantic Scale, results for each axis show a similar behavior.

NOVELTY Paired simple test

	Mean	N	Std. Deviation	Std. Error Mean	95% Confidence Interval of Difference	T	P
Antiquated /Fashion							
Real	4.929	14	1.774	0.474			
Virtual	3.786	14	1.968	0.526			
Differences	1.143		3.009	0.804	(-0.595, 2.880)	1.42	0.179
Usual - Unusual							
Real	2.571	14	0.938	0.251			
Virtual	4.000	14	1.754	0.469			
Differences	-1.429		2.277	0.609	(-2.744, -0.114)	-2.35	0.035
Discreet - Revolutionary							
Real	3.714	14	1.069	0.286			
Virtual	4.357	14	1.646	0.440			
Differences	-0.643		1.598	0.427	(-1.566, 0.280)	-1.50	0.156

RESOLUTION Paired simple test

	Mean	N	Std. Deviation	Std. Error Mean	95% Confidence Interval of Difference	T	P
Female/Male							
Real	3.214	14	1.311	0.350			
Virtual	3.929	14	1.592	0.425			
Differences	-0.714		2.016	0.539	(-1.879, 0.450)	-1.33	0.208
Robust / Thin							
Real	5.500	14	1.286	0.344			
Virtual	5.143	14	1.292	0.345			
Differences	0.357		1.646	0.440	(-0.593, 1.307)	0.81	0.431
Tall /Short							
Real	3.429	14	1.604	0.429			
Virtual	3.429	14	1.828	0.488			
Differences	-0.000		1.301	0.348	(-0.751, 0.751)	0.00	1.000

STYLE Paired simple test

	Mean	N	Std. Deviation	Std. Error Mean	95% Confidence Interval of Difference	T	P
Stable/Unstable							
Real	2.786	14	1.718	0.459			
Virtual	3.000	14	1.468	0.392			
Differences	-0.214		2.082	0.556	(-1.416, 0.988)	-0.39	0.706
Wrong-crafted / Well-crafted							
Real	5.857	14	1.167	0.312			
Virtual	4.643	14	1.865	0.498			
Differences	1.214		2.259	0.604	(-0.090, 2.519)	2.01	0.066
Durable/fragile							
Real	3.714	14	1.858	0.496			
Virtual	3.500	14	1.743	0.466			
Differences	0.214		1.805	0.482	(-0.828, 1.256)	0.44	0.664

EMOTIONAL Paired simple test

	Mean	N	Std. Deviation	Std. Error Mean	95% Confidence Interval of Difference	T	P
Euphoria/ Tranquility							
Real	4.714	14	1.684	0.450			
Virtual	4.857	14	1.512	0.404			
Differences	-0.143		0.949	0.254	(-0.691, 0.405)	-0.56	0.583
Sadness/ Happiness							
Real	5.000	14	1.754	0.469			
Virtual	4.929	14	1.269	0.339			
Differences	0.071		2.269	0.606	(-1.239, 1.382)	0.12	0.908
Empathy/ indifference							
Real	3.786	14	1.888	0.505			
Virtual	4.214	14	1.672	0.447			
Differences	-0.429		1.651	0.441	(-1.382, 0.525)	-0.97	0.349

Table 2. Semantic Axes.

A paired-samples t-test was conducted to compare each attribute in the four semantic axes. Descriptive statistics and t-test results are reported in Table 2.
A tendency is been marked. There was not a significant difference (α= ,05) in the scores for each semantic axis except for the pair "usual – unusual" in the Novelty axis.

Heat maps are a quick alternative to understand highlights. Results for frontal and back views are presented in Fig. 4. The used color gradation (aqua=low fixation time, red=high fixation time). AOI analysis gives quantitative information about the amount of time that gaze is focused on a specific area. Four areas of interest were defined according to Fig. 5. Sum time to see what area showed more attention, "Principal Logo" (27.00 vs 16. 52 sec). "Vertical Logo" (9.07 vs 12.98 sec).

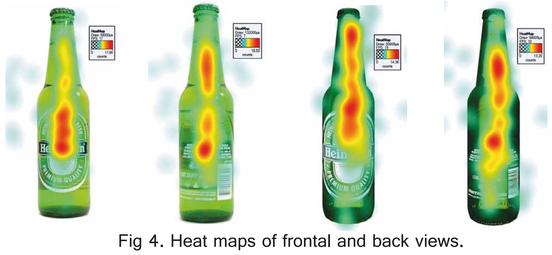

Fig 4. Heat maps of frontal and back views.

Fig 5. Areas of interest.

Conclusions

As result of last statistical analysis, variable "total fixation duration" has been used to conduct a one-way ANOVA analysis. For a small sample analysis this metric measures the sum of the duration for all fixations in AOI. ANOVA results for front and back showed a "Bottle Cap" unattracted and "Transparent Logo" catches more attention in back views.

A semantic scale has been designed that extends Besemer's CPAM model with an additional emotional dimension. Experimental results show that the user responses are very similar, and there is only one case with a statistically significant difference (one in twelve attributes). A design bottle needs to be tested to find more elements to dictate more design elements and complementary test must be used.

Eye tracking results show some different gaze patterns when using images from computer renderings or real photos. Analyzing the stimuli some differences can be observed. Results suggest for a bigger sample can justify a different gaze pattern. In this case, the quality of the computer render perhaps simplify the representation (it does not simulates transparency perfectly) and give more emphasis to some design features that are less salient in the real objects.

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Acknowledgments

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