Sensory analysis performed within an immersive mixed reality system

Impact on hedonic scores and engagement

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BACKGROUND

Increasing the ecological validity (balance between scientific control and the components of natural environment of sensory evaluation methods is one the greatest challenges in sensory and consumer studies. Virtual reality may increase contextual effects, but its application still faces several restrictions when evaluating real products.
The main goal of this study was to evaluate an immersive mixed reality system, where a real product and the participant are placed into a virtual environment.

METHODS

- A panel of 102 young adult consumers (aged 18-45 years) evaluated five different samples of commercial peach nectars.
- Evaluation occurred during three sessions, in three different environments (Figure 1): dining room, school cafeteria (virtual environments) and laboratory (sensory booth), following a balanced design with a one-week interval between sessions.
- Consumers rated overall liking on a 9-point hedonic scale, followed by open comments. At each session, participants tasted the five samples following a balanced sequential monadic presentation.
- After each session, consumers answered a 10-item Engagement Questionnaire and a 6-item Presence Questionnaire, specific for virtual environments.

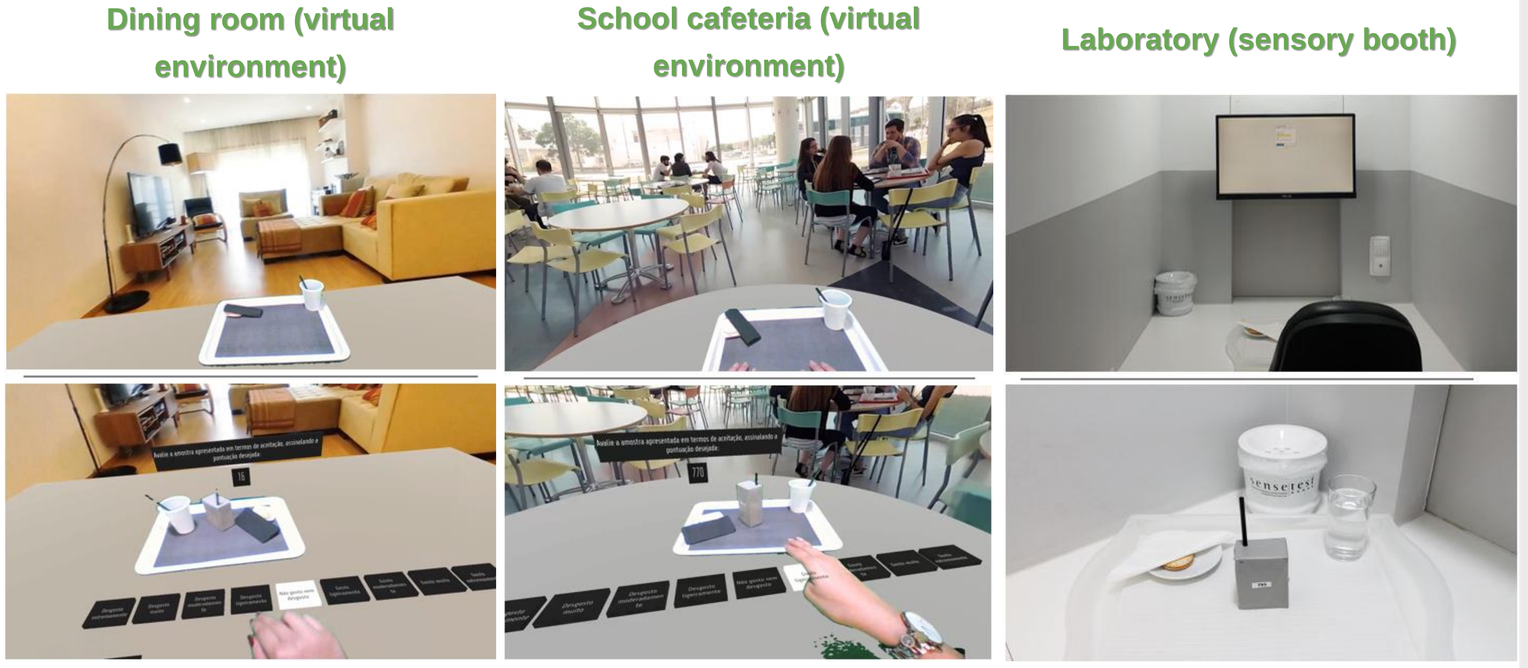

Figure 1. Testing environments used in the study

RESULTS

HEDONIC RATINGS

The type of environment affected the hedonic discrimination between samples, with laboratory (sensory booth) promoting a higher discrimination between samples than in the Virtual Environments (Table 1). Furthermore, there were no significant differences in the evaluations of the same samples across different environments (Table 1).

Table 1. Mean overall liking (± S.D) of the peach nectar samples in each environment. *p* values from 3-Way ANOVA (environment/sample and order as fixed factors, participants as random factors) on overall liking. a,b - homogeneous groups in each environment in accordance with the Tukey's test ($p < 0.050$), at each environment.

Samples	Laboratory	School cafeteria	Dining room	*p-value*
Brand A	7.2 (± 1.6)[a]	7.1 (± 1.6)[a]	7.2 (± 1.6)[a]	$p = 0.791$
Brand B	7.0 (± 1.4)[a,b]	7.0 (± 1.4)[a]	7.0 (± 1.4)[a]	$p = 0.938$
Brand C	7.2 (± 1.5)[a]	6.9 (± 1.6)[a]	7.0 (± 1.5)[a]	$p = 0.136$
Brand D	6.8 (± 1.8)[ab]	6.9 (± 1.4)[a]	6.8 (± 1.3)[a]	$p = 0.745$
Brand E	6.6 (± 1.5)[b]	6.9 (± 1.3)[a]	7.0 (± 1.5)[a]	$p = 0.105$
***p*-value**	**$p = 0.009$**	$p = 0.621$	$p = 0.282$	----

ENGAGEMENT

The type of environment significantly affected the engagement levels, with values of affective value being higher in either mixed reality environment than in the laboratory (Table 2).

Table 2. Mean scores (± S.D) of each EQ factor for each environment. p values from 3-way ANOVA (environment and order as fixed factors and participants as random factors) for each EQ factor. a,b - homogeneous groups between environments in accordance with the Tukey's test ($p < 0.050$)

EQ Factor	Laboratory	School cafeteria	Dining room	*p value*
Active Involvement	17.3 (± 3.7)[a]	17.2 (± 3.6)[a]	16.5 (± 3.9)[a]	$p = 0.191$
Purposeful Intent	25.6 (± 2.4)[a]	26.0 (± 2.1)[a]	25.7 (± 2.4)[a]	$p = 0.158$
Affective Value	16.4 (± 3.1)[b]	18.5 (± 2.8)[a]	18.0 (± 3.0)[a]	$p \leq 0.001$

PRESENCE LEVEL

Presence level in the virtual environments was significantly different between environments, being higher in the scenery with most contextual cues (e.g. sound and social environment) (Table 3).

Table 3. Mean scores (± S.D) of Presence for each Mixed Reality environment. F values from for Presence scores. a,b – significant different results between environments ($p < 0.050$) according to 3-Way ANOVA (environment and order as fixed factors, participants as random factor).

Environment	Presence level
School cafeteria	31.4 ± (6.2)[a]
Dining room	27.6 ± (6.6)[b]

CONCLUSION

In this study we were able to successfully develop a mixed reality system for sensory analysis with untrained consumers. This system improved the participants' engagement with the task but diminished hedonic discrimination, probably the tested product (peach nectar) was not context-sensitive.

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