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Impact of Mixed Reality Food Labels on Product Selection: Insights from a User Study using Headset-mediated Food Labels at a Vending Machine

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AUTO–ID LABS

1   Motivation

The rise in diet-related non-communicable diseases suggests that consumers find it difficult to make healthy food-related purchases. Improving food choices via front-of-package labelling (e.g. Nutri-Score) is not yet mandated in most regions. Further, barcode scan mobile applications are impractical when purchasing. We thus applied a mixed reality (MR) wearable headset-mediated intervention (N = 61) at vending machines to explore the potential of passively activated, pervasive MR food labels in improving beverage choices.

2   Research Setup

The study was conducted at a Selecta vending machine in Zurich. 61 participants were recruited by a supervised convenience sampling process, that allowed for a random allocation into treatment (TG) and control (CG) group. Every participant wore the Hololens headset. The app showed either nutritional data (TG) or general product details (CG). Participants were then asked to select a beverage and to identify the healthiest beverage.


3   Experiment Design

Available beverages (right)

Hololens app in CG setting (below)

Hololens app in TG setting (right)

Drinks	Mean (SD)
Weight (ml)	400 (118.3)
Price (CHF)	3.18 (0.61)
Drinks in VM by Nutri-Score	**Count (%)**
A (Healthy)	4 (20%)
B	4 (20%)
C	4 (20%)
D	4 (20%)
E (Unhealthy)	4 (20%)
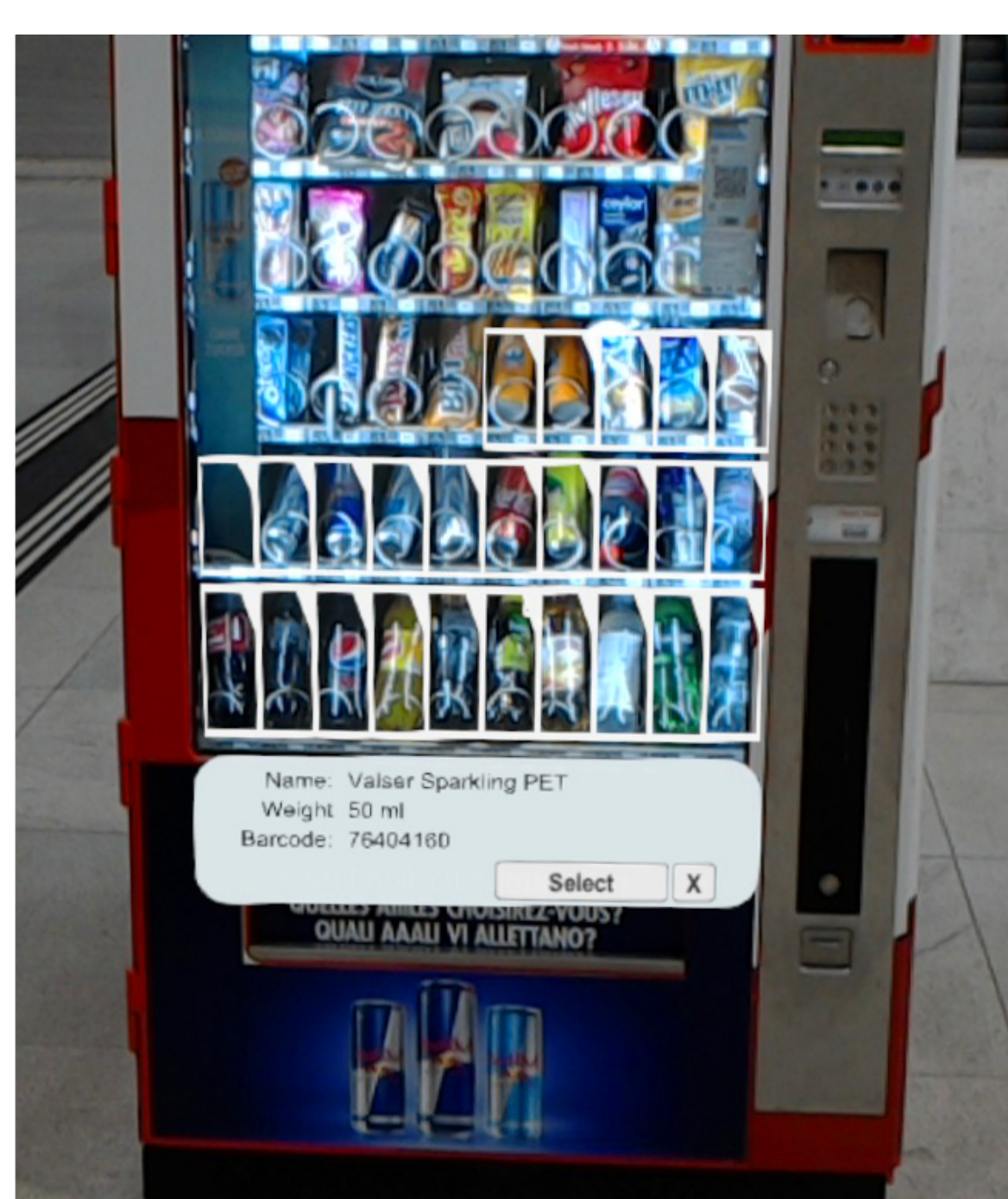
4   Mixed Reality App & Field Study

Through conduction of a between subject randomized controlled trial, we find significant, strong improvements in nutritional quality of the selected products (Energy: -34% KJ/100ml, Sugar: -28% g/100ml). Our post-hoc analysis suggests that the intervention effect is especially effective with existing food literacy. This study motivates further research on MR food labels due to the promising, observed intervention effects.
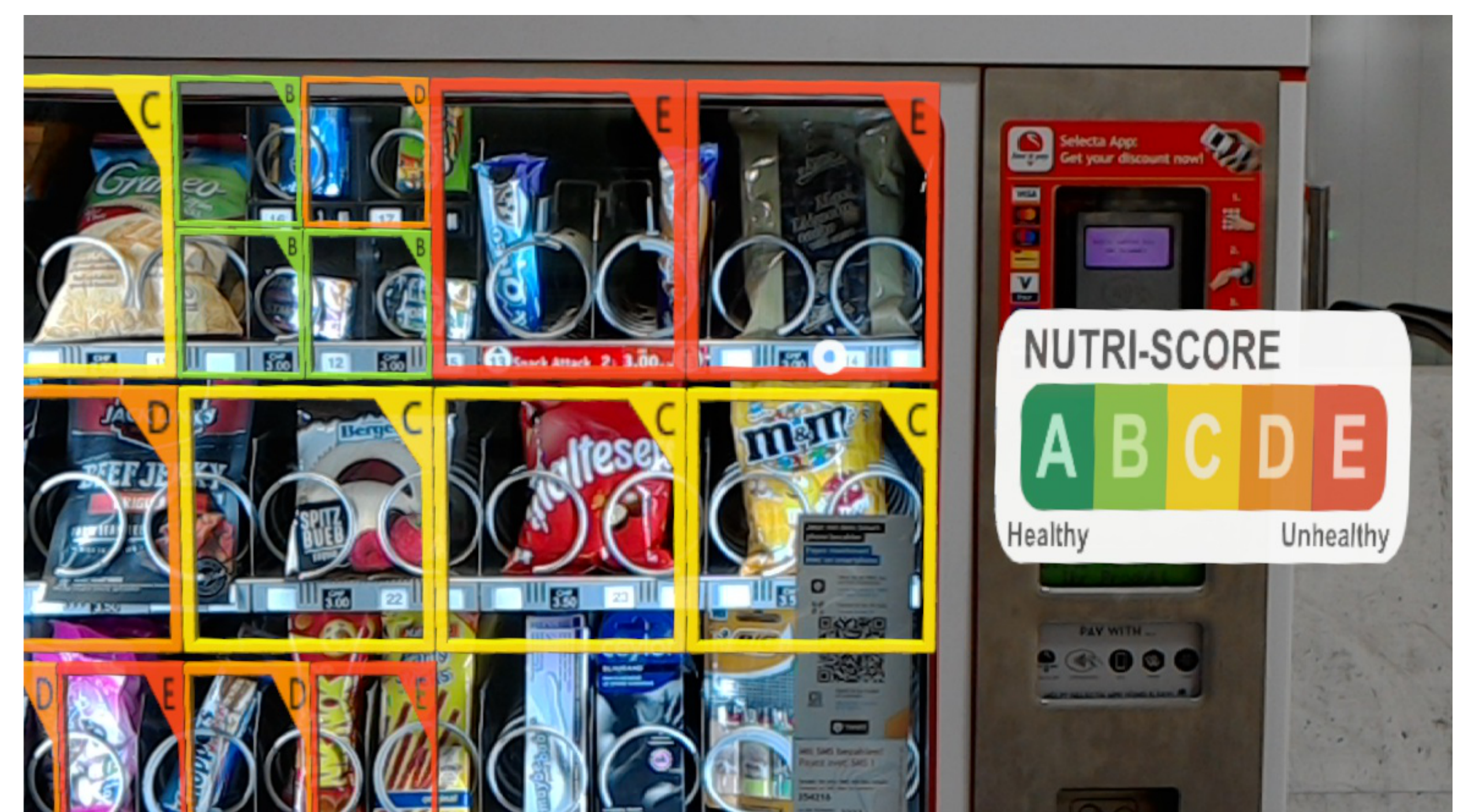
5   Detailed Results

We observed significant improvements for i) oberweight, ii) less educated, iii) and food literate users. Furthermore, we found relative non-significant improvements for all other users as well.

Table 3: Comparison between Treatment Group (N=31) and Control Group (N=30) for task 1) Select an item of your choice, task 2) Identify the healthiest beverage available.

Item	Beverages	
Task	ΔTG-CG	*P*
1. Select		
NS	**-5.8**	**0.009***
Energy	-11.4 (-34%)	.06
Sat. Fat	+.02 (+66%)	.37
Sugar	**-1.91 (-28%)**	**0.049***
Salt	0 (0%)	.43
Protein	+ .11 (+48%)	.38
Fiber	0 (0%)	.50
2. Identify		
NS	**-0.8**	.27
Energy	**-1.26 (-67%)**	.27
Sat. Fat	0 (0%)	.16
Sugar	-0.29 (-66%)	.28
Salt	0 (0%)	.35
Protein	-0.02 (-100%)	.16
Fiber	0 (0%)	.50

*: significant at 5% level

Table 5: Survey Comparison between Treatment Group (N=31) and Control Group (N=30)

Construct (# Items)	TG (N=31) mean (SD)	CG (N=30) mean (SD)	P(X)
Usage Antecedents			
Intention (3)	5.84 (1.30)	4.98 (1.55)	.017
Perf. Expect. (5)	5.44 (1.47)	3.53 (1.74)	<.001
Social Infl. (2)	4.77 (1.51)	3.67 (1.44)	.0048
Hedonism (2)	6.35 (0.79)	6.00 (1.17)	.27
Unobserved (1)	5.23 (1.71)	4.79 (1.95)	.29
Randomization Checks			
Innovativeness (3)	5.80 (1.03)	5.60 (1.03)	.27
Food Literacy (2)	5.02 (1.45)	5.11 (1.41)	.44
Wearable Exp. (1)	0.79 (0.99)	0.55 (0.51)	.20
Duration			
Time taken (sec.)	37.2 (20.0)	31.58 (13.7)	.12

Perf. Expect.: Performance Expectancy, **Social Infl.:** Social Influence, **Wearable Exp.:** Experience w/ wearable headsets

Table 4: Nutrients of Selected Beverages for users differing in BMI, Education and Food Literacy

BMI

		BMI >25kg/m²			BMI ≤ 25kg/m²	
	P	TG N=7	CG N=3	P	TG N=22	CG N=26
		M (SD)	M (SD)		M (SD)	M (SD)
NS	0.010*	-12.7(6.1)	3.7(3.5)	.068	2.9(8.1)	5.0(8.1)
EN	0.005*	0.4 (1.1)	41.3(23.6)	.41	28.8(20.6)	33.2(29.8)
SF	0.017*	0.0(0.0)	0.2(0.3)	.07	0.1(0.2)	0.0(0.0)
SU	0.003*	0.0(0.0)	7.8(3.0)	.28	6.4(4.3)	6.8(4.6)
SO	.101	0.0(0.0)	0.0(0.0)	.28	0.0(0.0)	0.0(0.0)
PR	0.017*	0.0(0.0)	1.7(2.5)	.23	0.5(1.3)	0.1(0.2)
DF	0.5	0.0(0.0)	0.0(0.0)	0.5	0.0(0.0)	0.0(0.0)
FNV	.10	0.0(0.0)	0.0(0.1)	.40	0.0(0.0)	4.6(16.3)

Education

		Education high			Education low	
	P	TG N=17	CG N=15	P	TG N=12	CG N=14
		M (SD)	M (SD)		M (SD)	M (SD)
NS	.07	-3.3(10.5)	2.7(8.2)	0.049*	1.0(10.2)	6.6(6.7)
EN	.29	21.2(24.0)	26.8(31.7)	.07	21.6(20.0)	39.4(25.2)
SF	.24	0.1(0.2)	0.1(0.2)	.34	0.0(0.0)	0.0(0.0)
SU	.31	4.4(4.7)	5.0(4.6)	.07	5.1(5.0)	8.4(3.4)
SO	.45	0.0(0.0)	0.0(0.0)	.47	0.0(0.0)	0.0(0.0)
PR	.40	0.6(1.5)	0.4(1.2)	.19	0.0(0.1)	0.1(0.2)
DF	.50	0.0(0.0)	0.0(0.0)	.50	0.0(0.0)	0.0(0.0)
FNV	.43	0.0(0.0)	4.0(15.5)	.18	0.0(0.0)	4.3(16.0)

Food Literacy (FL)

		FL >3.5			FL ≤ 3.5	
	P	TG N=25	CG N=25	P	TG N=6	CG N=4
		M (SD)	M (SD)		M (SD)	M (SD)
NS	0.025*	-0.8(10.5)	4.6(8.1)	.13	-1.8(10.3)	6.0(4.9)
EN	.17	23.5(23.2)	32.7(30.3)	.052	16.0(14.6)	42.3(20.1)
SF	.31	0.1(0.2)	0.0(0.0)	.38	0.0(0.0)	0.2(0.3)
SU	.14	5.2(5.0)	6.5(4.6)	.052	3.7(3.4)	9.0(3.2)
SO	.30	0.0(0.0)	0.0(0.0)	0.033*	0.0(0.0)	0.0(0.0)
PR	.42	0.4(1.2)	0.1(0.2)	.38	0.0(0.0)	1.1(2.3)
DF	.50	0.0(0.0)	0.0(0.0)	.50	0.0(0.0)	0.0(0.0)
FNV	.10	0.0(0.0)	4.8(16.6)	.27	0.0(0.0)	0.0(0.0)

*: significant at 5% level, N varies as answers were skippable
NS: Nutri-Score, EN: Energy in KJ/100ml, SF: Saturated Fat, SU: Sugar, SO: Sodium, PR: Protein, DF: Dietary fiber, FNV: Share of fruit/vegetable/nuts
P: P value, M: Mean, SD: Standard deviation
Healthiest mean values for each nutrient in **bold**

Partners

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