EUROXR 2024

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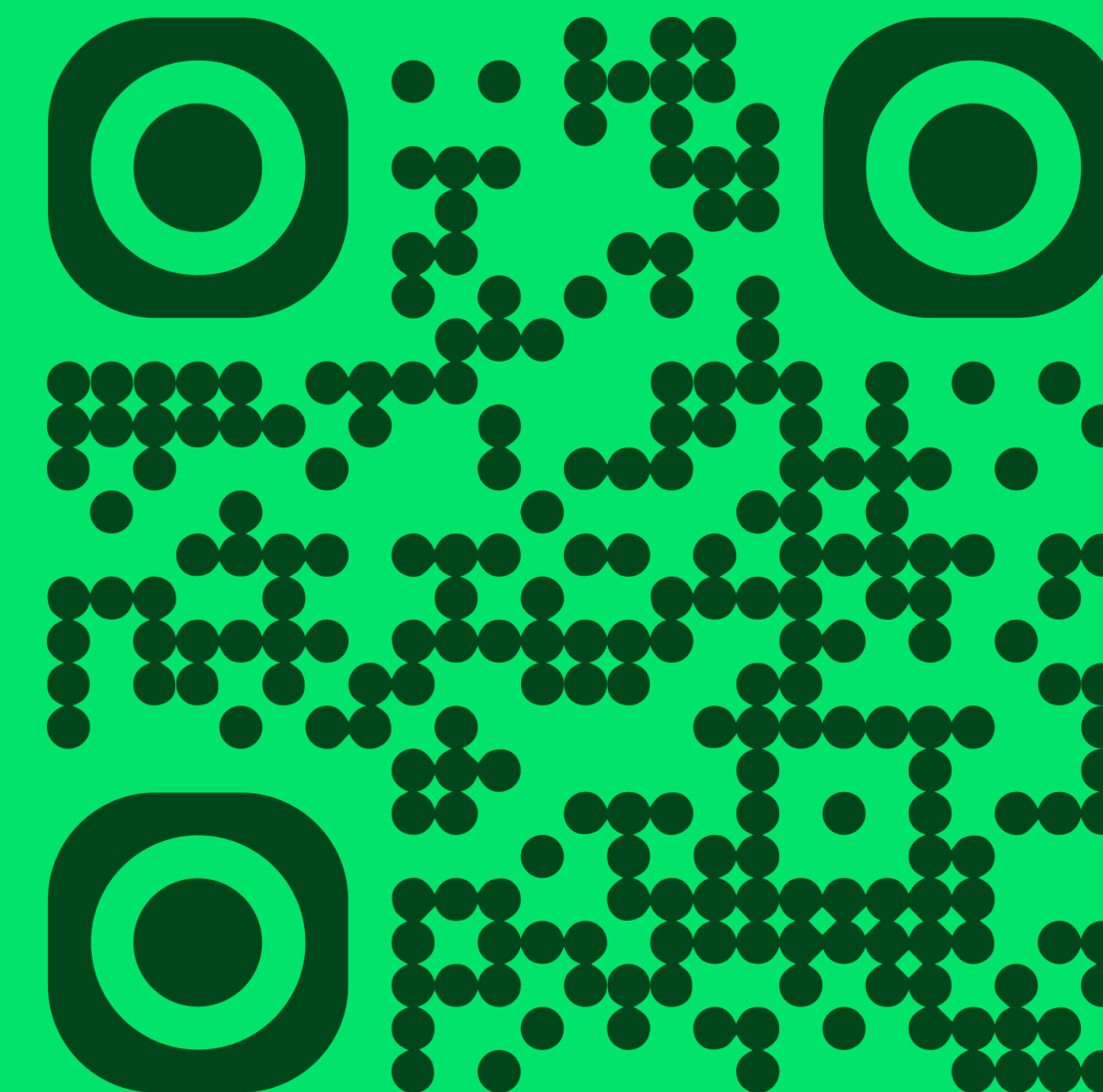
EUROXR

i-SENSE GROUP

A Mixed Reality Eye-Tracking Study on Visual Influences in Dietary Choices

Nikos Dimitrios Tantaroudas, Kostas Koukoudis, Tina Katika, Giannis Karaseitanidis, Angelos Amditis

Choice
Mainstream mitigation pathways
for a climate-conscious change
in the food chain

Introduction

Limitations of Traditional Methods

- Questionnaires and food diaries often introduce biases.

- These methods struggle to capture the complexity of food choices.

Advances in XR Technologies

- Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) enable controlled experiments in realistic environments

- Eye-tracking integrated with XR provides objective insights into cognitive and emotional food responses

Gaps in Research

- Limited comprehensive studies using MR, particularly for sustainable food practices

Innovative Approach in this study

- Combines traditional questionnaires with MR and eye-tracking.

- Simulates realistic scenarios to study demographic food preferences and sustainability behaviors

- Offers adaptable and dynamic scenarios for deeper insights into dietary habits.

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Methodology Overview

Study Objective
- Investigate the relationship between visual attention and dietary decision-making in a Mixed Reality (MR) environment

MR Setup for Eye-Tracking
- Participants interact with 3D Visual food options displayed on a virtual table
- Eye-tracking data is captured using Unity and the Oculus OVR Eye Gaze component
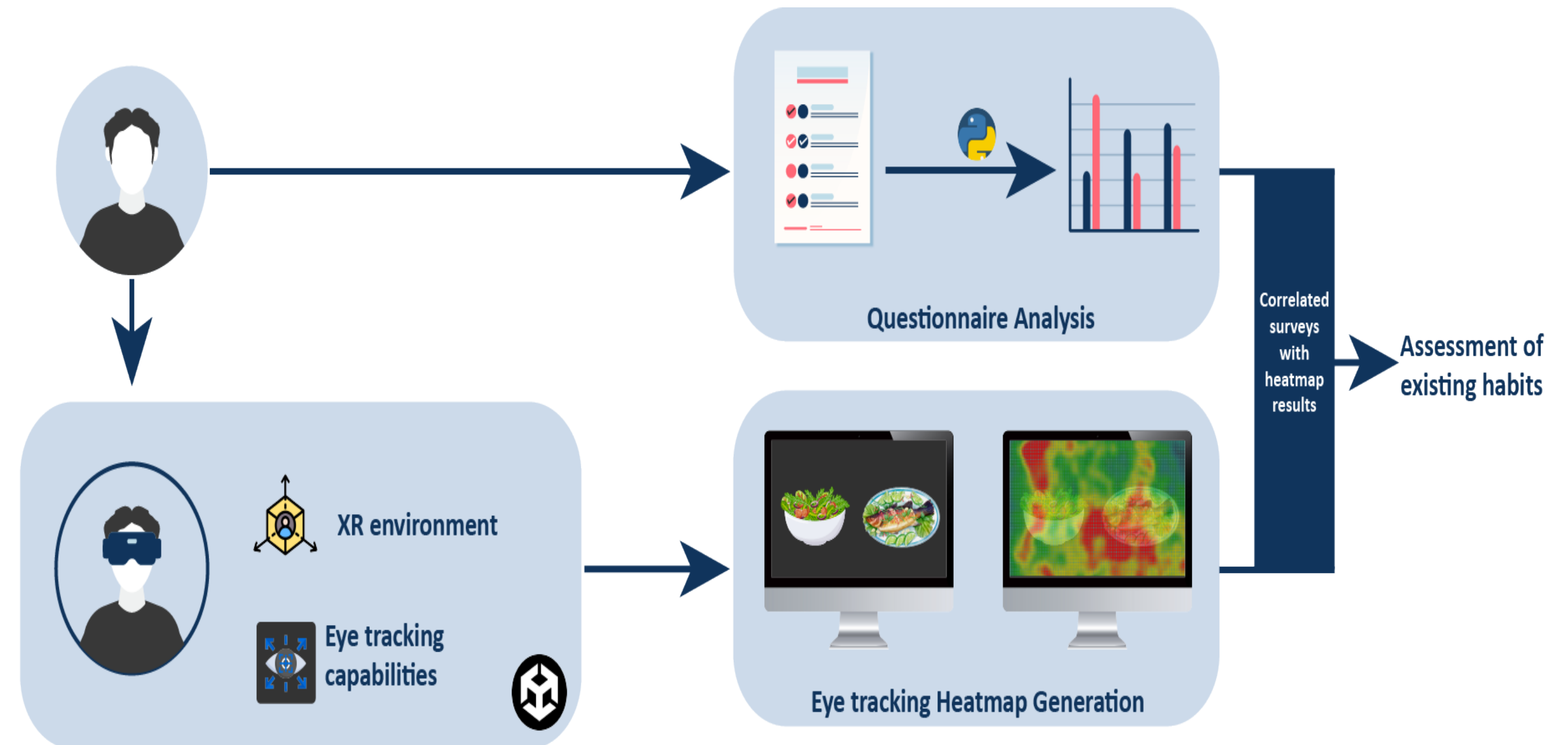
Eye-Tracking Metrics
- Gaze fixations, direction, duration, and fixation points are logged and analyzed
- Data provides insights into how participants interact with virtual food items

Data Analysis
- Quantitative eye-tracking metrics are combined with qualitative questionnaire data
- Results are visualized using **3D heatmaps** to identify areas of high visual interest and key food preferences

Comprehensive Insights
- The approach merges visual attention data and participant feedback to provide a deeper understanding of dietary habits and food choices

Questionnaire Analysis

Correlated surveys with heatmap results

Assessment of existing habits

XR environment

Eye tracking capabilities

Eye tracking Heatmap Generation

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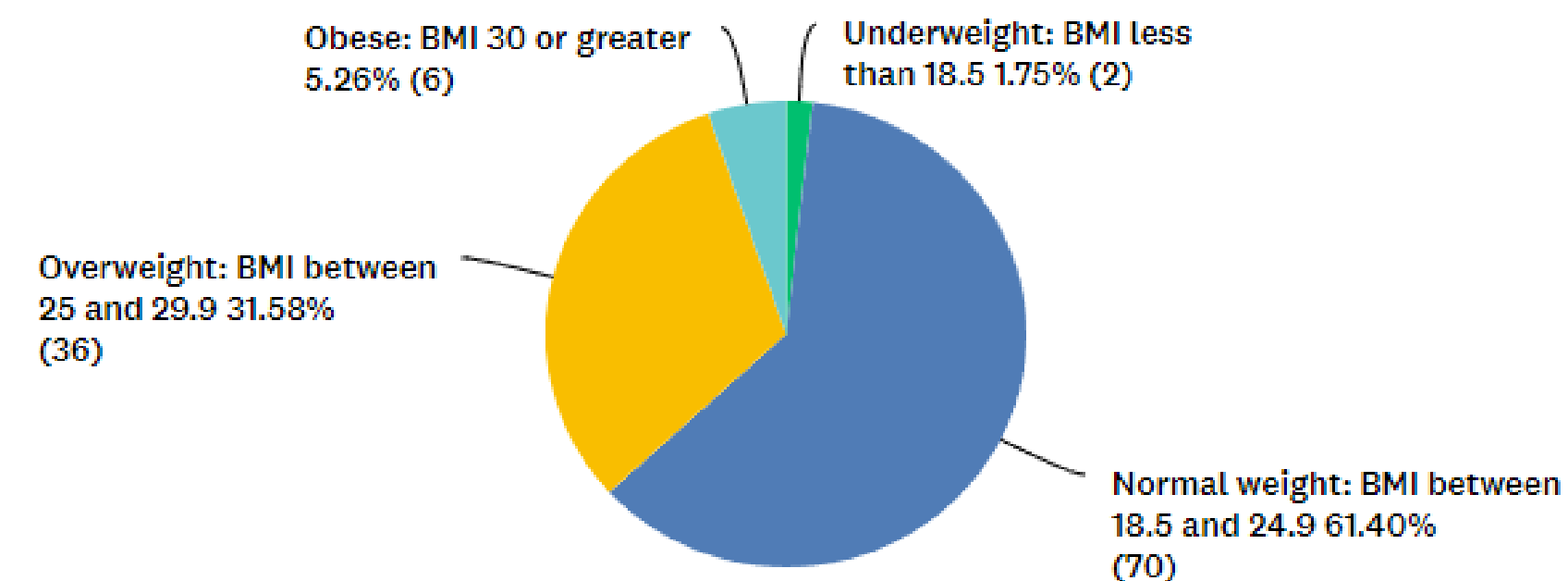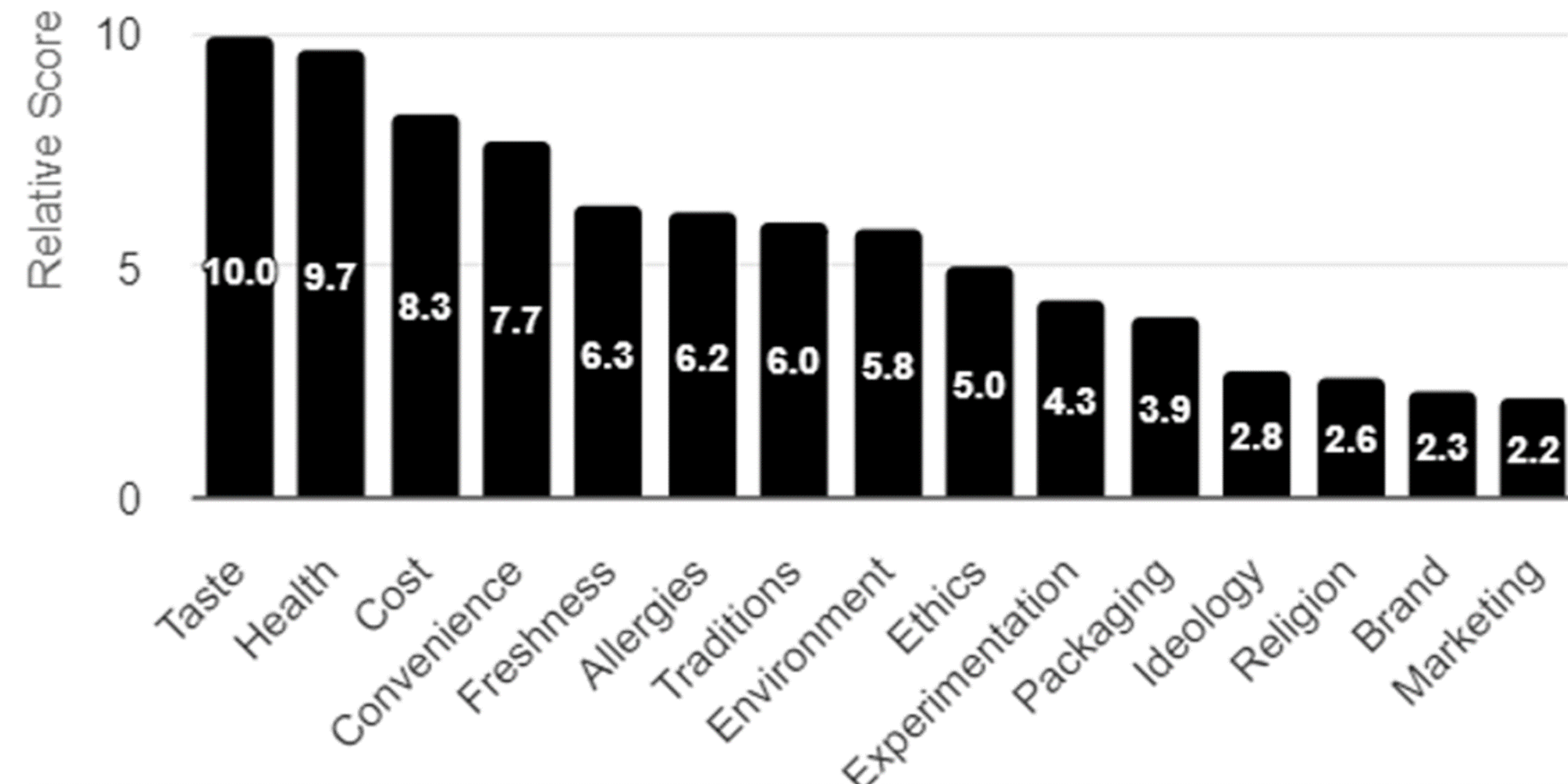# Assessment of Participants

Participant Demographics
- Survey conducted with 114 participants, encompassing diverse food preferences
- Groups include carnivores, vegetarians, and vegans

Key Observations
- **Carnivores**: Higher proportion of males and elevated obesity rates
- **Vegetarians/Vegans**: Reflect gender and cultural influences alongside health benefits of plant-based diets

Factors Influencing Food Choices
- Taste ranked as the top influencing factor followed by health, Cost Convenience and Freshness.

Assessment Highlights

Awareness and Concerns
- Vegetarians showed higher level of awareness and concerns than Omnivorous participants about the environmental impact of food choices, with significant percentages reporting "high" or "very high" concern.

Educational Gap
- Potential gap in environmental impact awareness between dietary groups
- Emphasizes the need for tailored educational tools to bridge the gap and promote more sustainable food choices
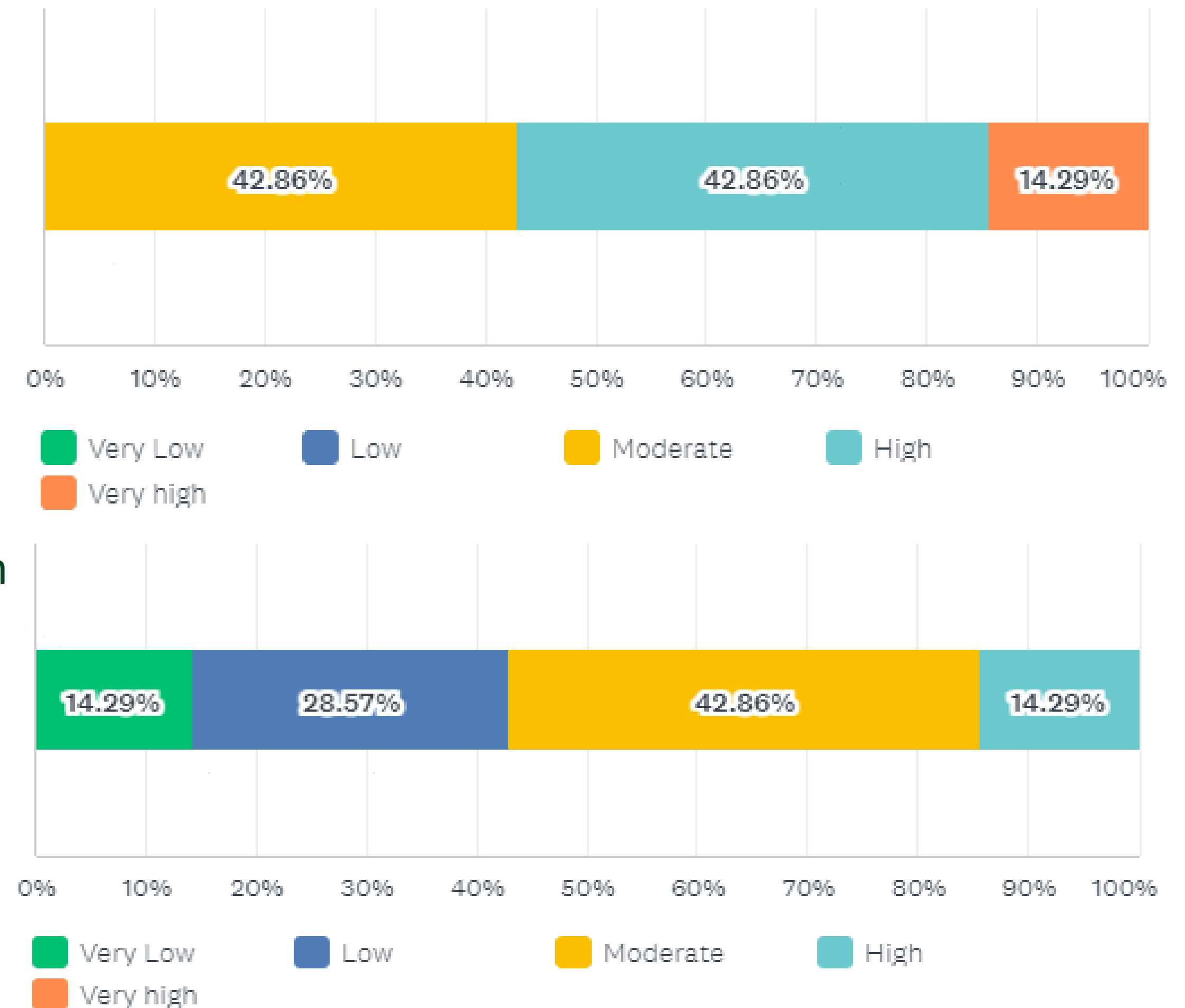
Opportunity

Role of XR in Education

- **Data Storytelling**: Use Immersive XR experiences to visually and interactively present the environmental impacts of different dietary habits

- **Personalised Learning**: Enable participants to explore and understand their food choices ecological footprint in an engaging way

- **Behavioral change**: Use of XR to promote sustainable practices by illustrating the benefits of environmentally conscious diets
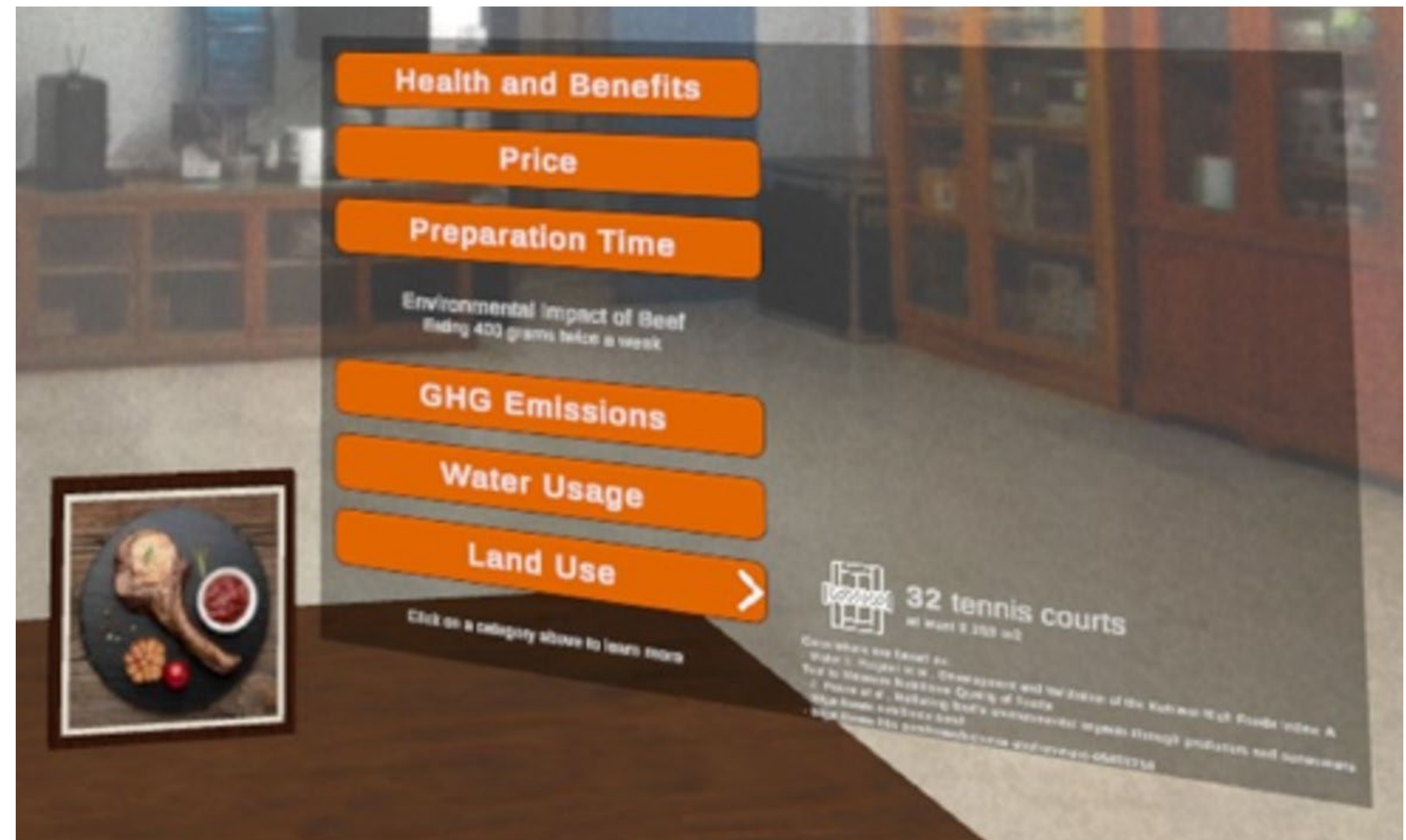
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Mixed Reality Demonstration 1/3

Objective of MR Content
- Developed to analyze correlations between participants' eye-gazes and factors influencing food choices
- Incorporates data storytelling to enhance user engagement and increase awareness on key factors affecting food choices

Nutritional and Environmental Data

- Nutritional values calculated using the NRF9.3 methodology
- Environmental impact metrics (CO_2 emissions, water and land use) derived from established studies

Tracking User Interactions

- Comprehensive tracking of eye-gazes, clicks, gaze duration.
- Provides detailed insights in participant behavior and preferences

Engagement
- MR setup integrates interactive elements to communicate complex data effectively, enabling users to explore the health and environmental impacts of their food choices

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EUROXR 2024, 27-29 November 2024, ATHENS
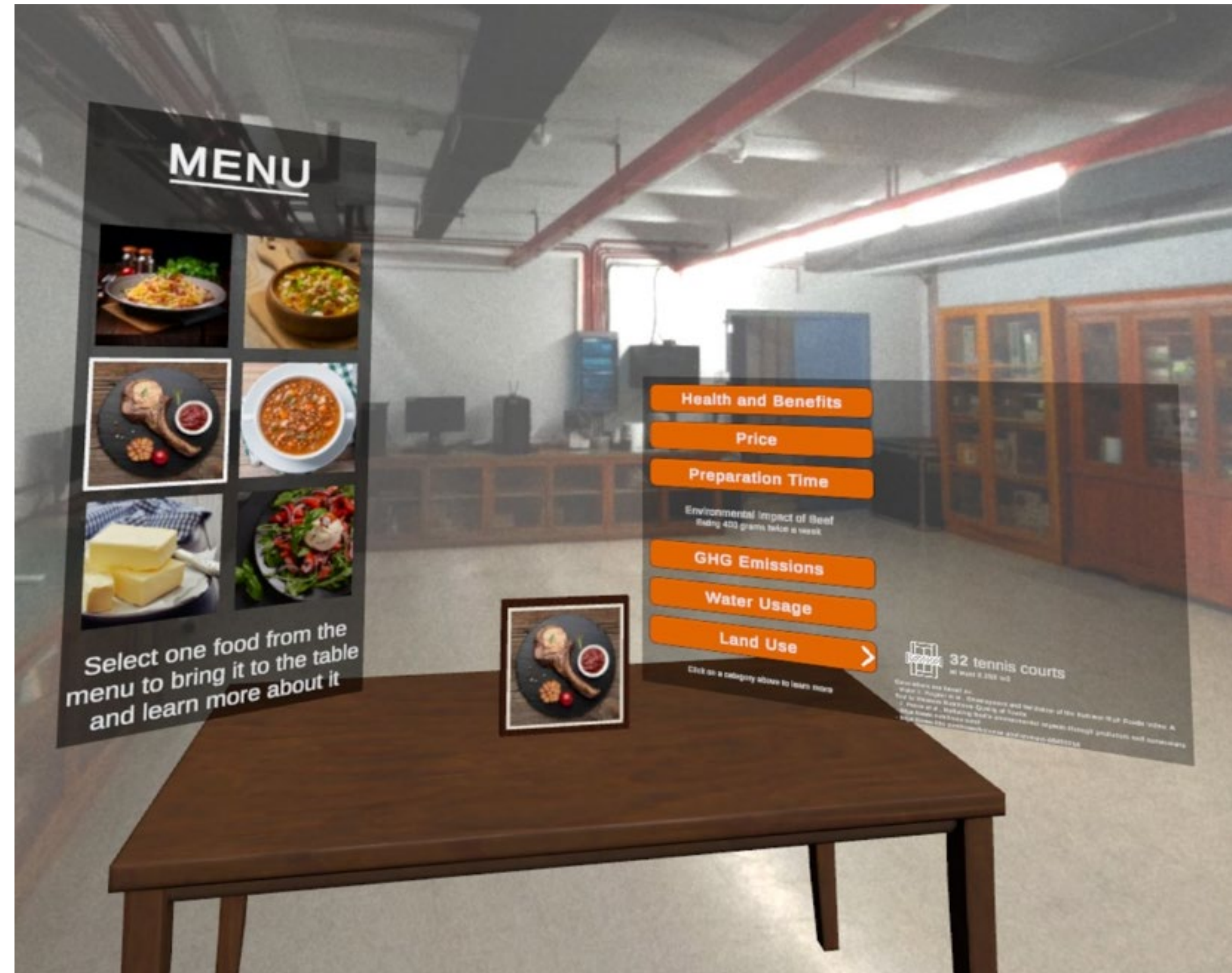
Mixed Reality Demonstration 2/3

Study Overview
- Participants' eye-gaze behavior was analyzed across various food scenarios, segmented into dietary groups: Vegetarians, Omnivores, and Carnivores.

Key Findings by Group
- Vegetarians: Highest gaze duration for salad and minimal attention to carbonara.
- Omnivores: Most attention drawn to Carbonara and distributed attention to other food options.
- Carnivores: Longest gaze for beef stake and balanced attention to other options

Insights on Preferences
- Vegetarians focus more on plant-based items, while Carnivores engage more with meat.
- Omnivores show diverse attention patterns, indicating mixed dietary preferences

Impact
- Reinforces the need for targeted education on sustainable and balanced diets through MR
- Align scenarios with user preferences to promote awareness of nutritional and environment impacts

Group	Scenario	Count	Total Gaze (s)	Avg (s)	Max (s)
Vegetarian	Carbonara	2	0.42	0.21	0.26
	Lentil Soup	24	9.26	0.39	1.36
	Butter	10	3.72	0.37	0.88
	Beef Stake	13	8.06	0.62	1.44
	Bean Soup	5	1.62	0.32	0.52
	Buratta Salad	31	17.06	0.55	3.48
Omnivorous	Carbonara	39	26.54	0.68	4.22
	Lentil Soup	17	21.10	1.24	5.28
	Butter	14	8.76	0.63	2.14
	Beef Stake	21	12.68	0.60	1.78
	Bean Soup	17	8.76	0.52	2.24
	Buratta Salad	22	17.94	0.82	3.46
Carnivorous	Carbonara	29	14.16	0.48	1.80
	Lentil Soup	21	11.24	0.54	2.42
	Butter	24	7.60	0.32	1.02
	Beef Stake	41	19.28	0.47	1.76
	Bean Soup	25	12.24	0.49	1.20
	Buratta Salad	38	17.66	0.46	1.76

Mixed Reality Demonstration 3/3

Heatmaps in MR Environment
- Highlight areas of concentrated visual attention for omnivorous participants
- Offer insights into individual engagement with specific food scenarios

Participant Behavior
- Carnivorous participants showed higher engagement with less healthy and less sustainable food scenarios
- Significant interest observed in health, GHG emissions, and water use metrics

Educational Potential
- Findings suggest opportunities to educate participants on the environmental impacts of food choices through targeted interventions
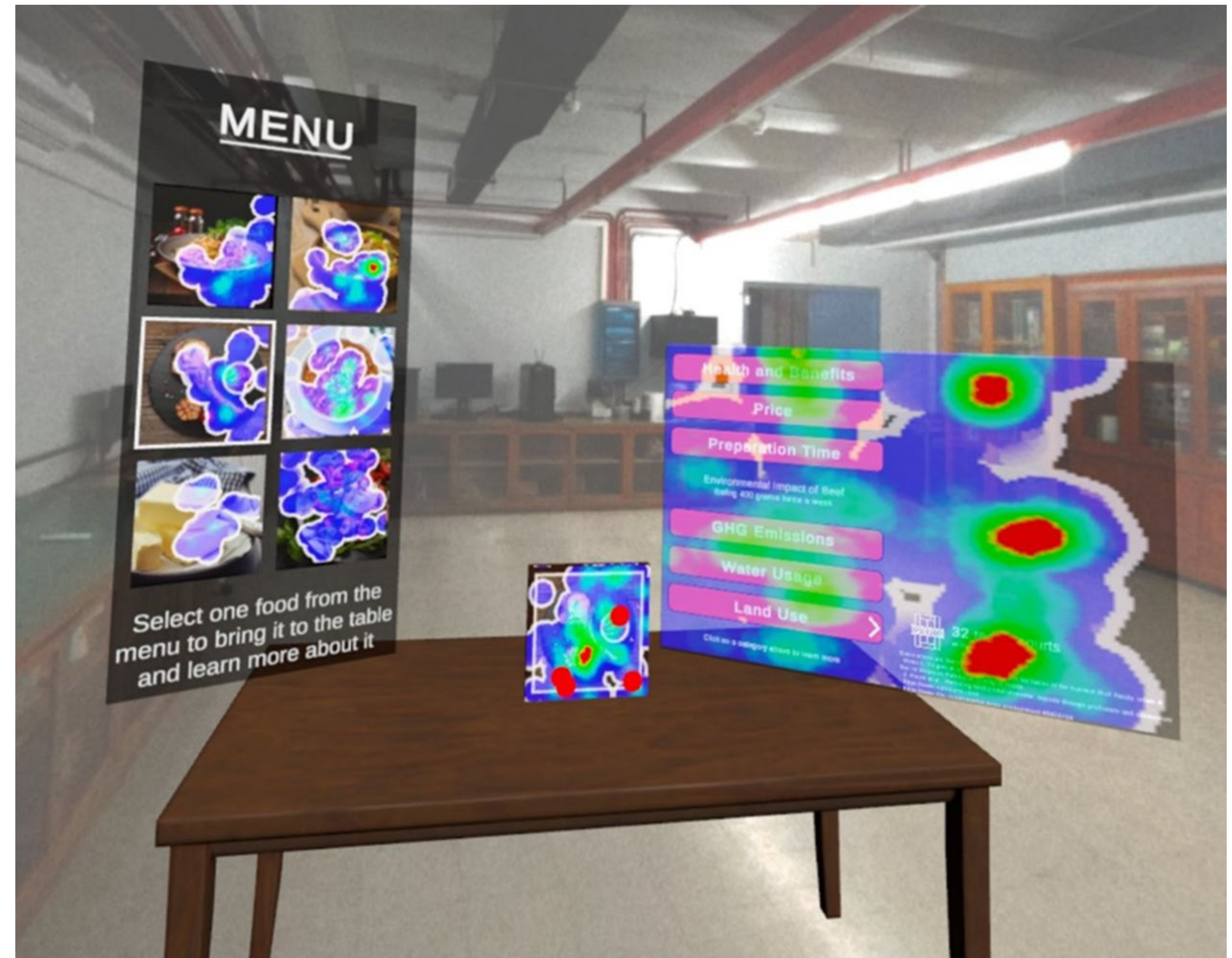
# Conclusion and Future studies

Key Findings
- Participants with sustainable dietary preferences engaged more with sustainable food options, while carnivorous participants focused on meat scenarios
- The MR tool provides valuable insights into behavioral patterns related to food choices

Future Research Directions
- Incorporate additional metrics such as selection patterns, pupil dilation, and heart rate to deepen behavioral analysis.
- Develop new MR scenarios addressing broader consumer behaviors, including circular economy and climate resilience.
- Use findings to design targeted campaigns promoting sustainable practices and inform policies to enhance societal acceptance of sustainable habits.

Educational Potential
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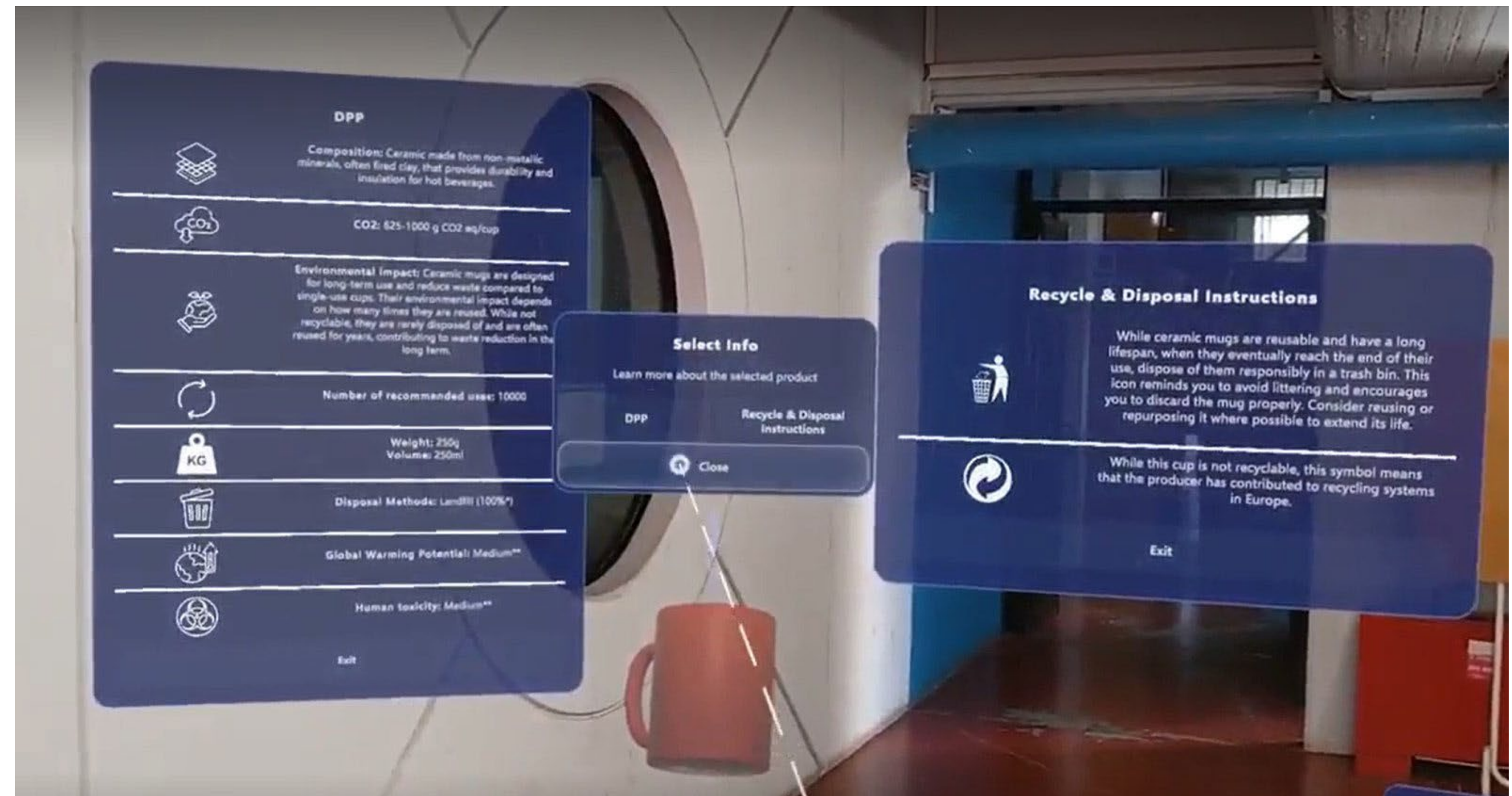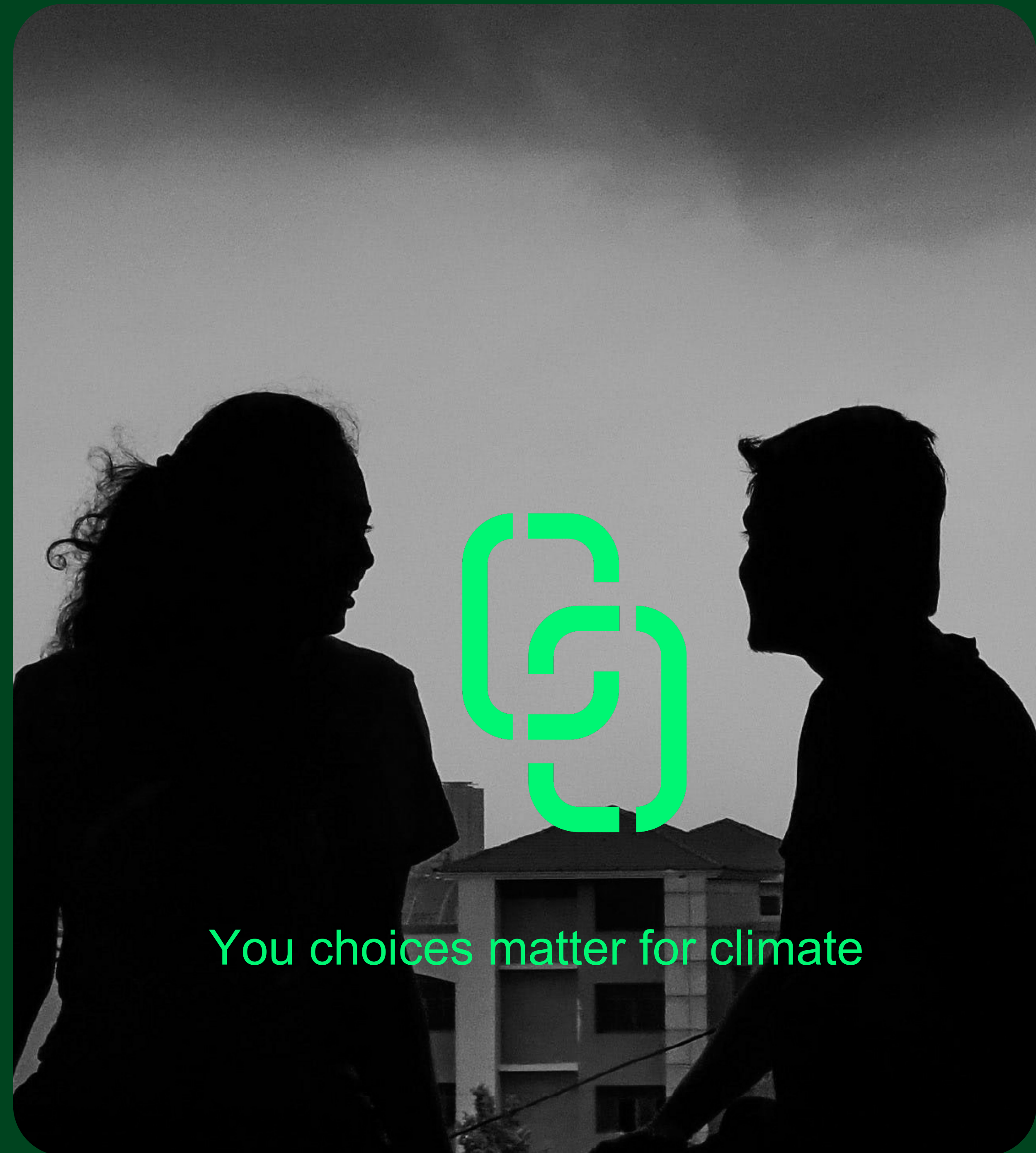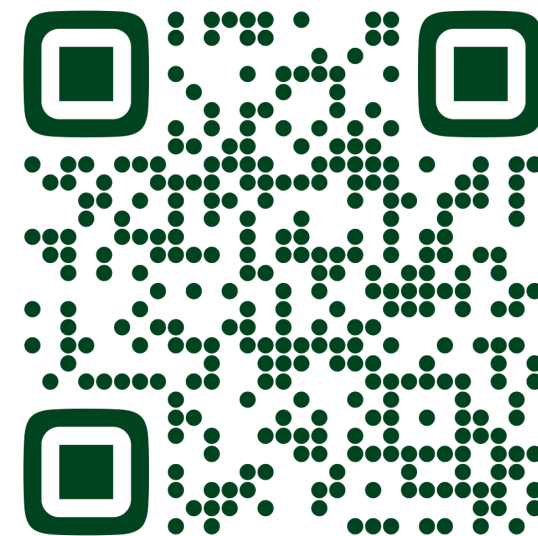
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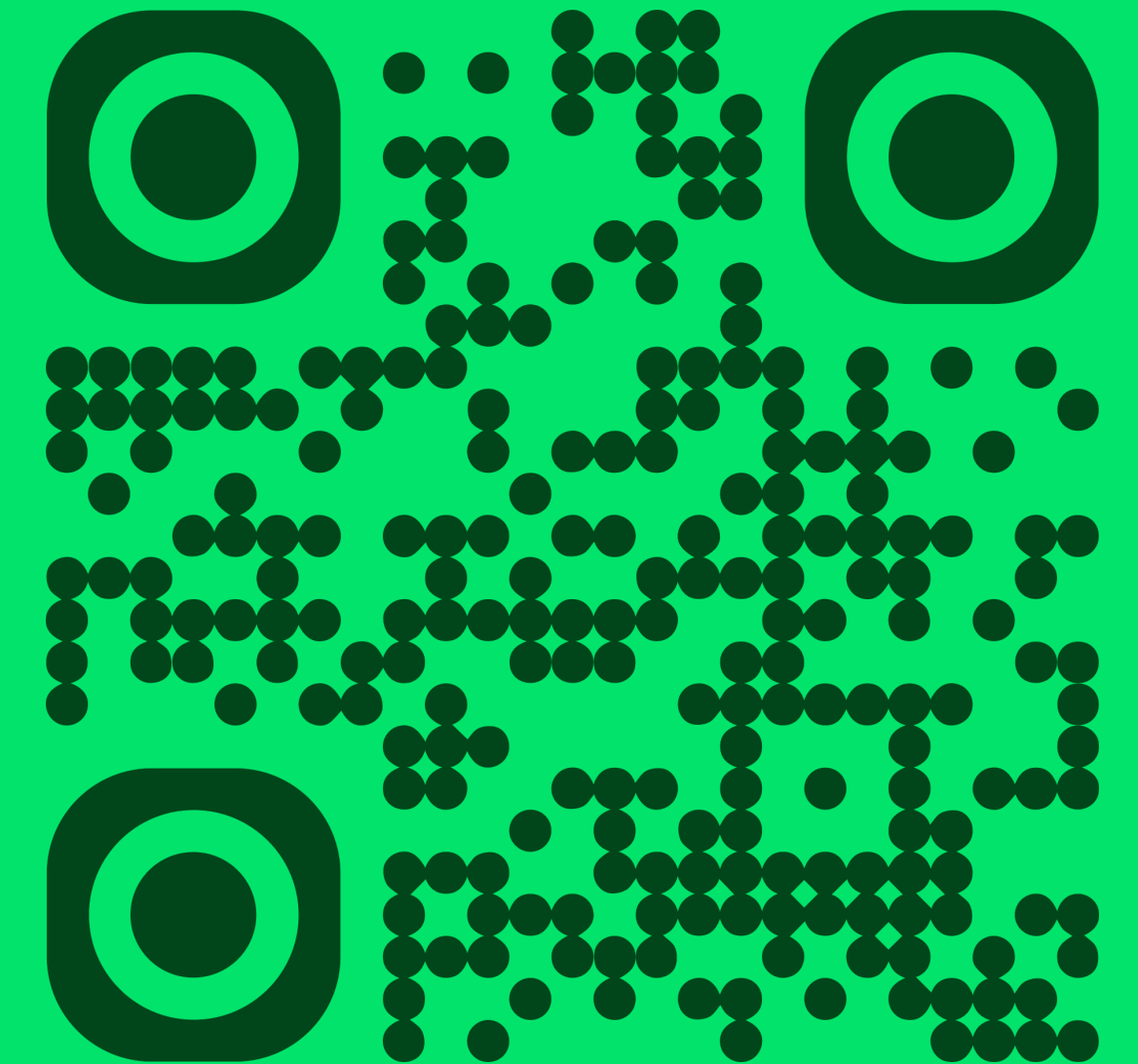
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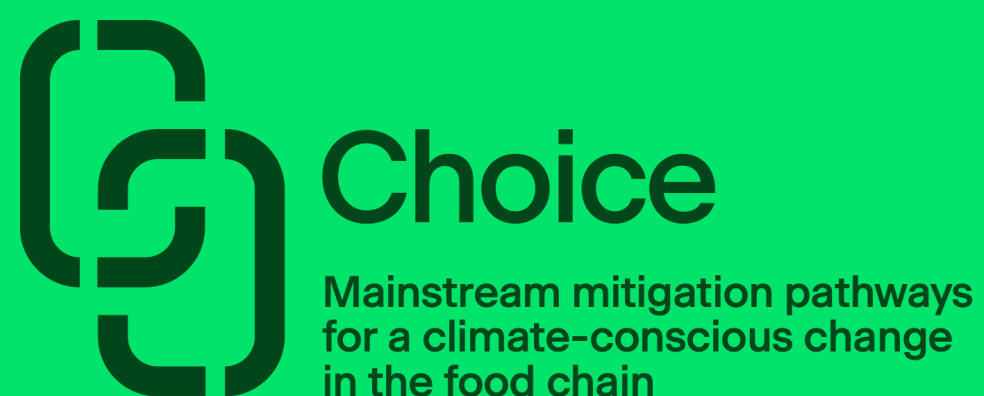
You choices matter for climate

Thank You!

Any Questions?

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