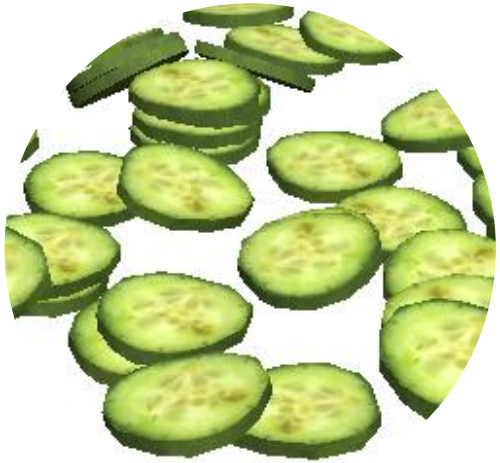
FoodXR – XR Research for Healthy Diets and Sustainable Food Choices

Nina Rosa – January 14, 2026

Future Directions in XR and User-Centred Design Workshop, Utrecht



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WANDER

PennState

Utrecht University

1. Portion size estimation

Collaboration with Human Nutrition and Health at WUR.

Prof. Alexander Klippel

Dr. Nina Rosa

Esther Kok

Els Siebelink

Michelle van Alst

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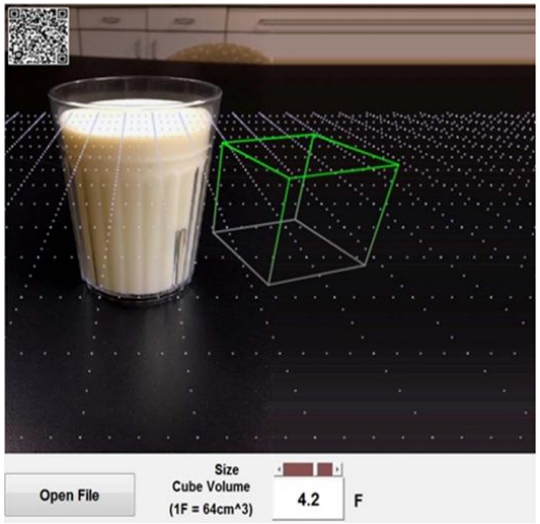
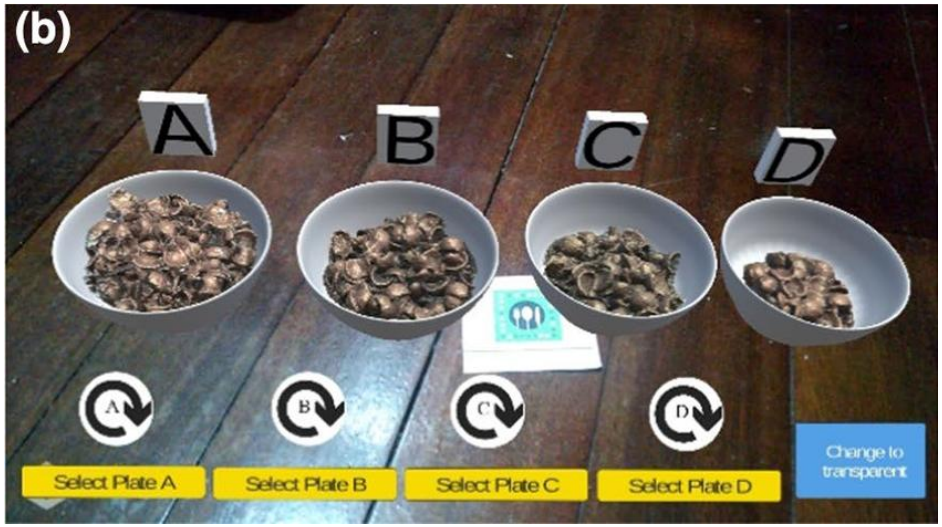
Related Work





Yang et al., M. Image-based food portion size estimation using a smartphone without a fiducial marker. Public Health Nutrition. 2019;22(7):1180-1192.
Lam et al., An evaluation of a virtual atlas of portion sizes (VAPS) mobile augmented reality for portion size estimation. Virtual Reality 25, 695–707 (2021).

AReplica

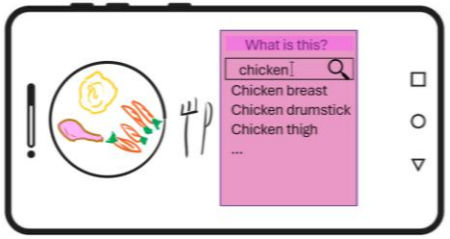
1. Meal is prepared

The user has prepared a meal. The user needs to create a food record before they start to eat.

2. QR marker is placed

The user places the marker next to the plate.

3. Input food

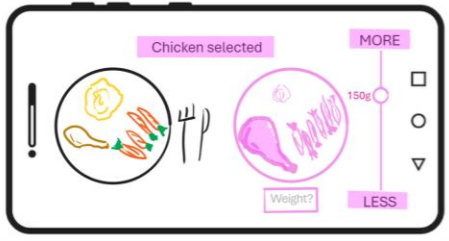


The user selects for each food on the plate which item it concerns by tapping the object, after which a searchbar appears where a food name can be typed.

4. Virtual plate is created

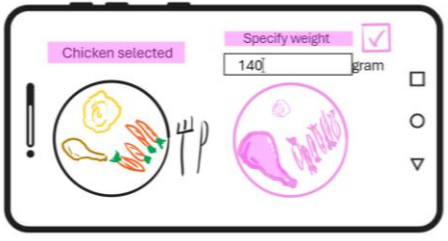
After inputting each food, a virtual plate appears next to the real plate with correct plate size, but possibly wrong portion sizes. The user taps the adjust button [+/-] to adjust portion sizes.

5. Adjust portion sizes



After selecting a virtual food, the user can adjust the portion size using a slider. If the user wants a more specific weight, then they can tap the [Weight?] button.

6. Choose portion size



The user can type a more specific weight that is otherwise not available by slider. The user can confirm the weight by tapping the confirm button [✓].

7. Confirm food record

After adjusting each portion size, the user can confirm the food record by tapping the confirm button [✓].

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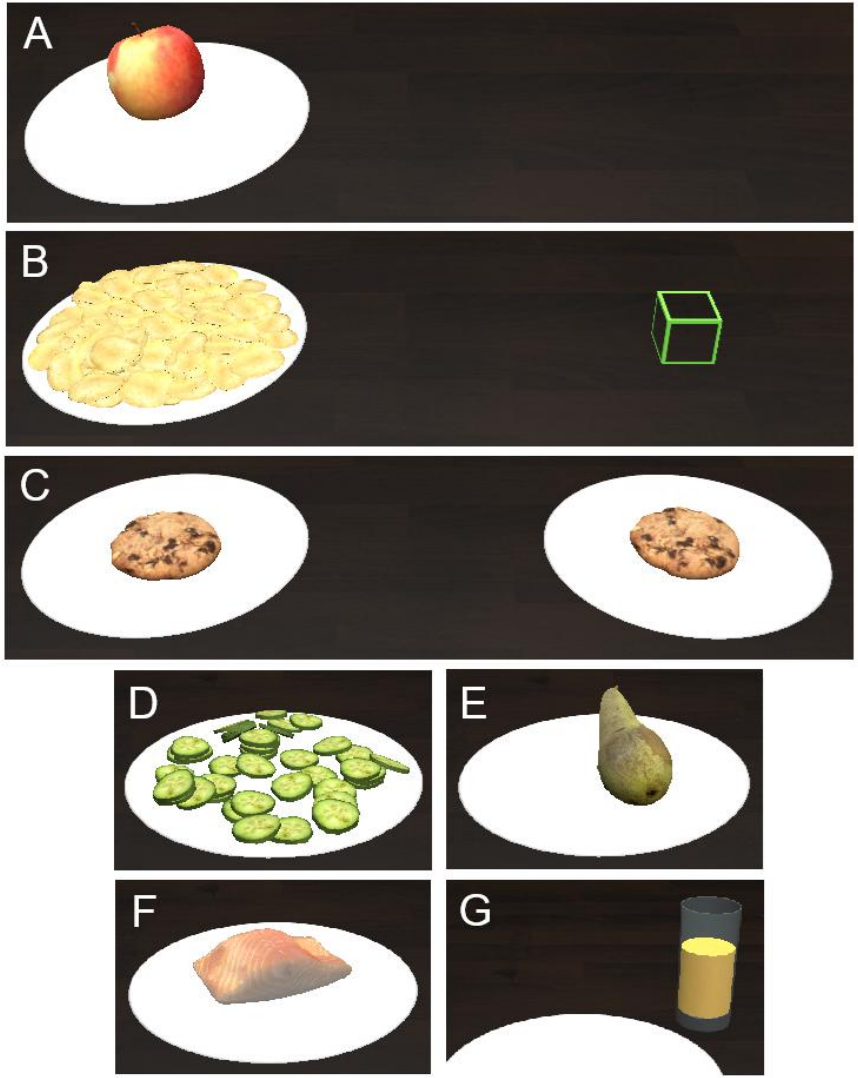
N. Rosa et al., "AReplica: User-Centered Design of an Augmented Reality Portion Size Estimation Tool for Dietary Intake Assessment," *2025 IEEE VRW*, Saint Malo, France, 2025, pp. 1462-1463, doi: 10.1109/VRW66409.2025.00377.

Research Question

Use VR to test basic concept:

How well do humans perform in terms of **resizing solid virtual foods and drinks** to match the size of a virtual reference food or drink of equal type and shape, and does this performance differ from performance by **resizing virtual wireframes** or from performance by **free estimation?”**

Experiment



N = 18, within-subjects
Counterbalanced order of 3 conditions

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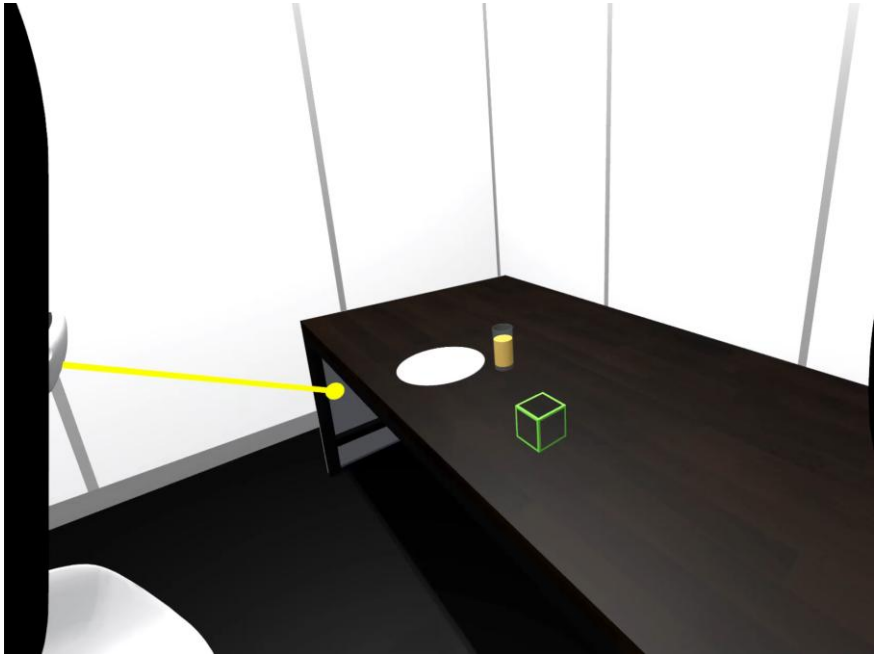
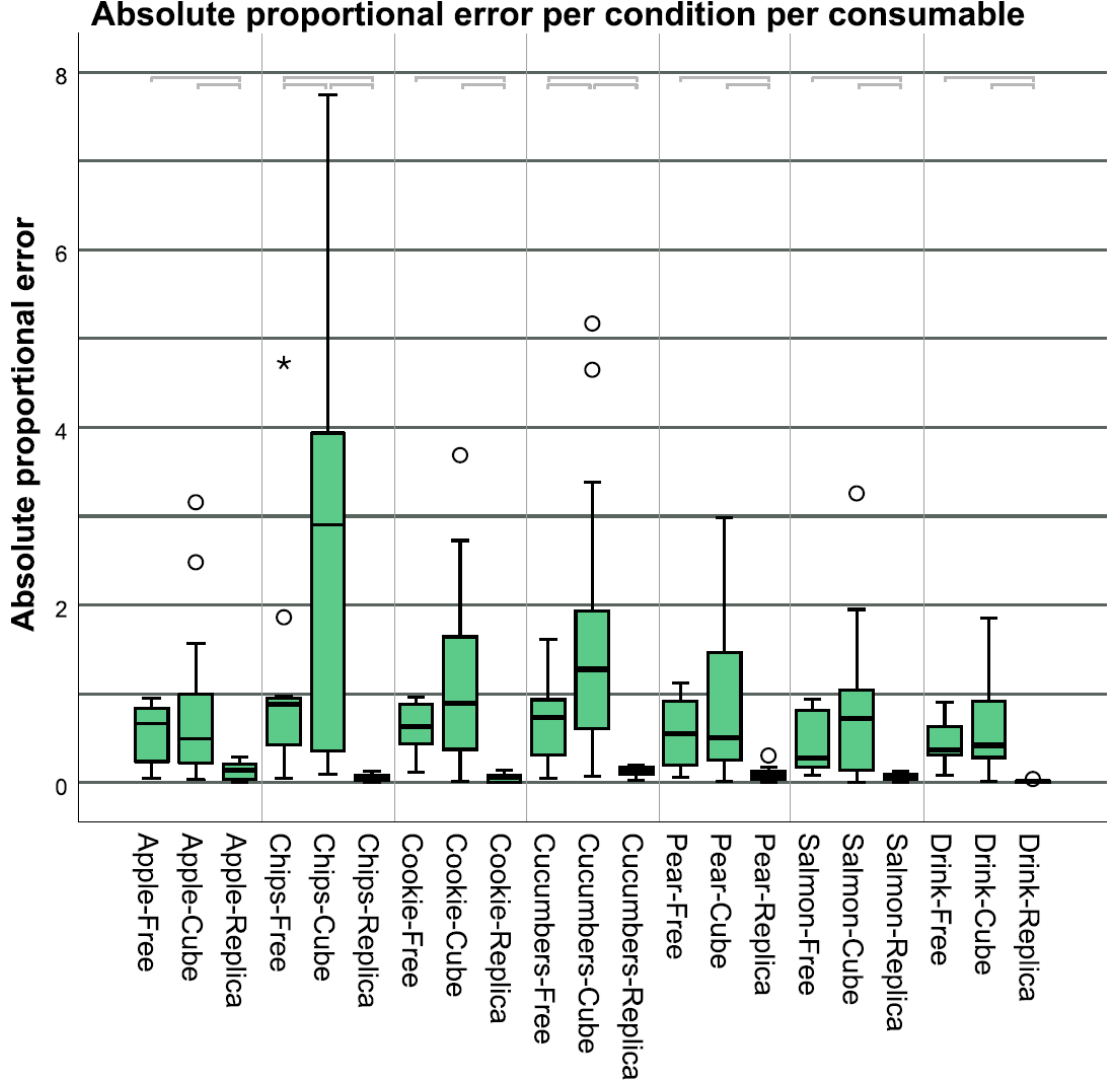
Cube and Replica



Absolute proportional error

N. Rosa, M. van Alst, E. Siebelink, E. Kok, J.O. Wallgrün, T. Masterson and A. Klippel (2025) Portion Size Estimation Performance when Using Resizable Visual Aids of Matching Shape and Type in Virtual Reality. In *Proceedings of the IEEE 2025 11th International Conference on Virtual Reality (ICVR)*, Wageningen, Netherlands, 2025, pp. 144-152, doi: 10.1109/ICVR66534.2025.11172552.



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Conclusion and next steps: eyetracking

- Continue with development and investigation of AReplica.

- Compare difficulty of different conditions.
- Compare difficulty of different foods.

2. Biodiversity and Farming

Collaboration with Marketing and Consumer Behaviour at WUR.

Liam Dwyer

Dr. Anke Janssen

Dr. Rene de Wijk

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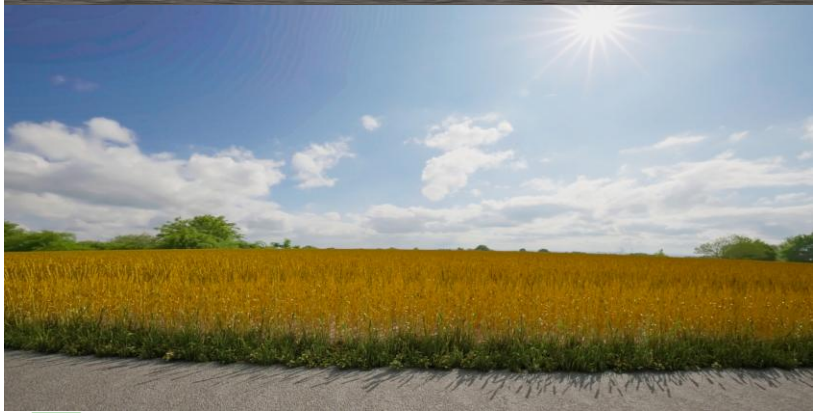
VR-mediated consumer journey

- Consumer perception influenced throughout **consumer journey**
- VR → awareness and pro-environmental behavior
- Context: stripcropping and biodiversity
- Aim: gain insight into consumer acceptance of biodiversity+ bread when the wheat field is experienced immersively

The consumer journey: A new methodology to study the effects of store and product information on consumers' responses to sustainable foods and clothing fabrics. René A. de Wijk; Anke M. Janssen; Liam Dwyer, *Food Quality and Preference,* Vol. 126, May 2025, 105381
L. Dwyer, N. Rosa, O. Tekeli, T. Ginn, A. Klippel, A. Janssen, R. de Wijk (2025) A Virtual Reality Experience on the Relation between Biodiversity and Local Wheat Farming Methods. In Proceedings of the 2025 11th International Conference on Virtual Reality (ICVR), Wageningen, Netherlands, 2025, pp. 42-49, doi: 10.1109/ICVR66534.2025.11172418.

Stelt u zich voor:
u gaat brood kopen,
namelijk een heel bruin tarwebrood

Multisensory VR experience



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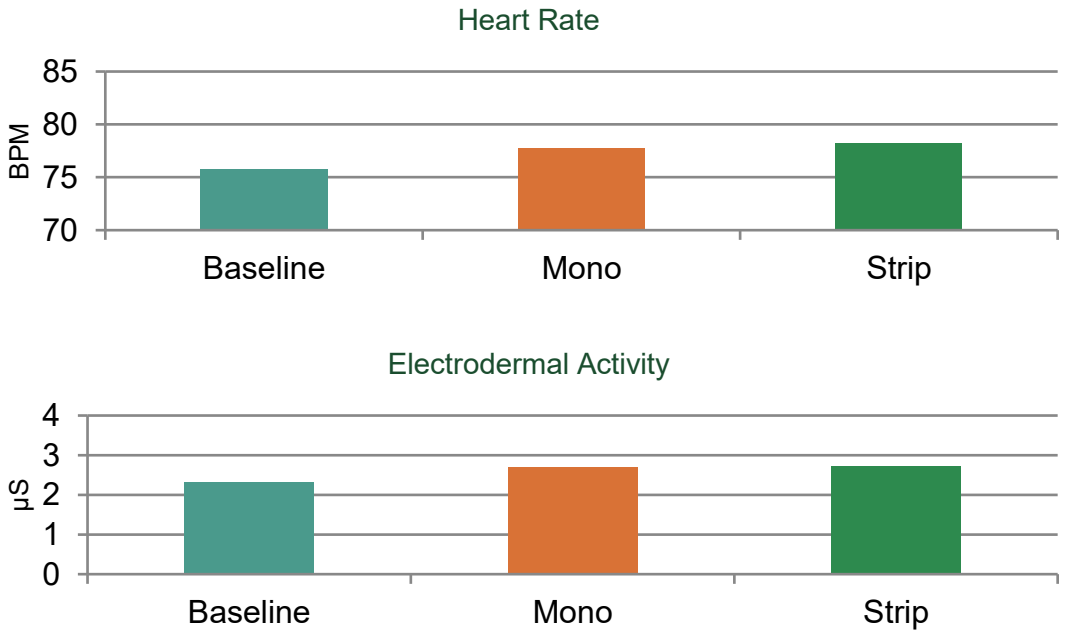
L. Dwyer, N. Rosa, O. Tekeli, T. Ginn, A. Klippel, A. Janssen, R. de Wijk (2025) A Virtual Reality Experience on the Relation between Biodiversity and Local Wheat Farming Methods. In Proceedings of the 2025 11th International Conference on Virtual Reality (ICVR), Wageningen, Netherlands, 2025, pp. 42-49, doi: 10.1109/ICVR66534.2025.11172418.

Experiment

- 37 participants, within subjects
- Collect heart rate, skin conductance, self-reported responses

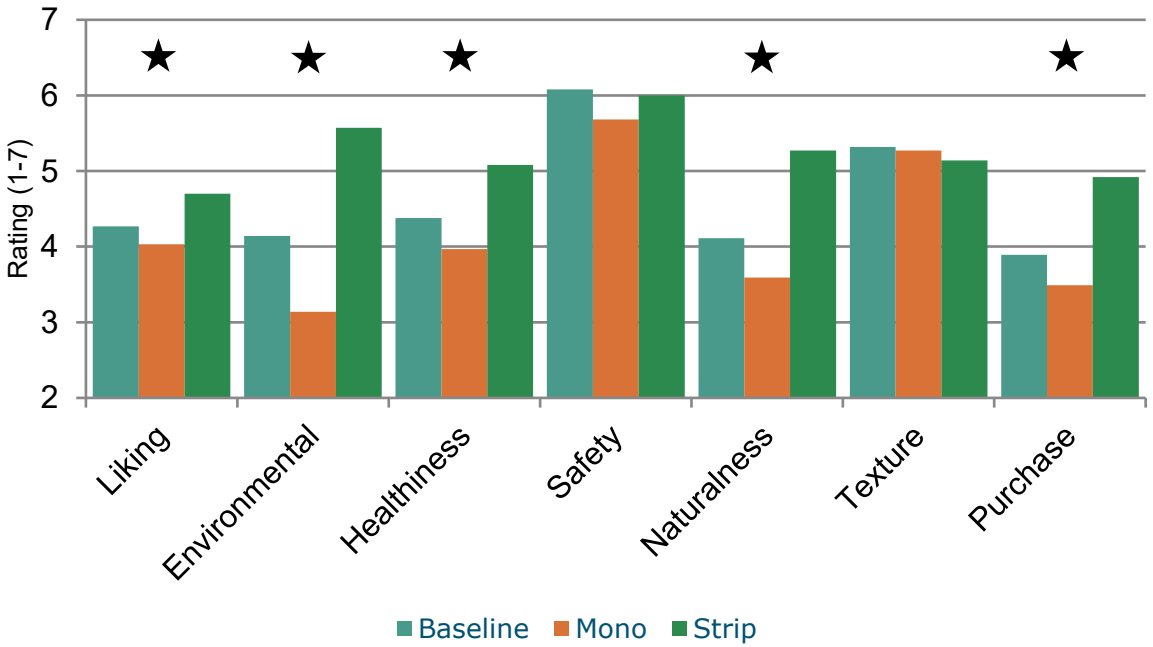
Results

- Both farming VR contexts evoke stronger physiological responses than a neutral supermarket setting.



Results

- Strip higher for Liking, Environmental, Healthiness, Naturalness, Purchase Intent
- Effects consistent across ages and environmental concern.



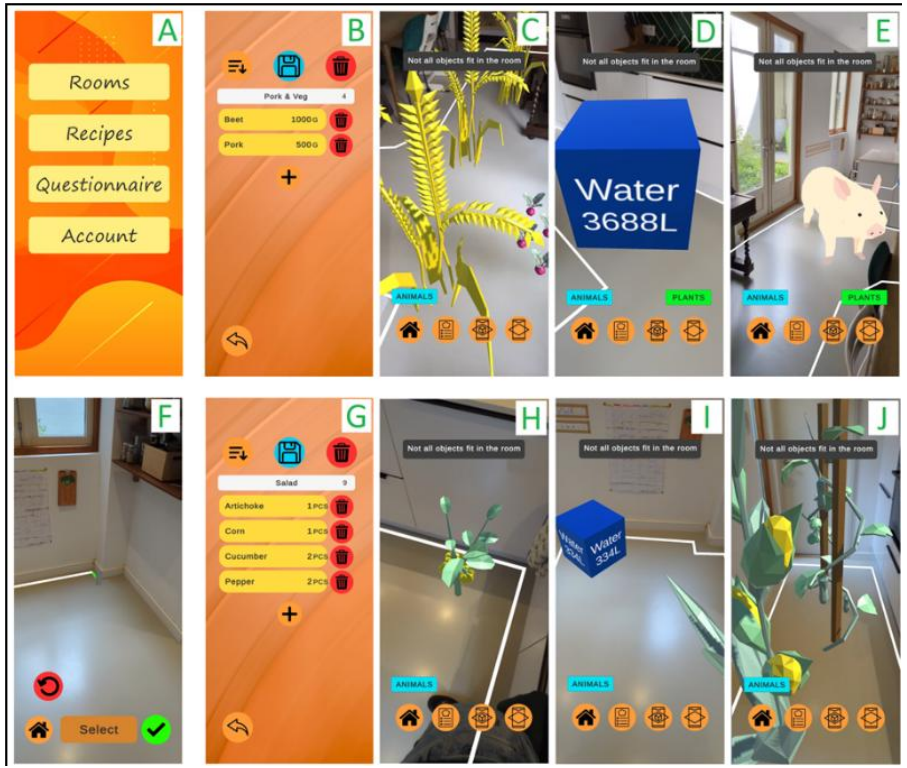
Conclusion

- Landscape communication
- Marketing and packaging
- Biodiversity support

3. Food resources

- Student project UU

N. Rosa, "AwARe: Using handheld augmented reality for researching the potential of food resource information visualization," 2024 IEEE VIS Workshop on Visualization for Climate Action and Sustainability (Viz4Climate + Sustainability), St. Pete Beach, FL, USA, 2024, pp. 10-16, doi: 10.1109/Viz4Climate-Sustainability64680.2024.00006.



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Augmented Reality for Food Production

Crops in the Kitchen: Exploring AR Visualisations as a Stimulus for Proximising Food Production and Reinforcing Motivations to Avoid Food Waste

- Jordi Pen

- Food waste in households, consumers struggle to prevent waste
- Psychological distance from food production, disconnection from resources
- Use AR to reduce distance
- *To what extent can AR visualisation of food resources reduce consumers' psychological distance and thereby increase their motivation to avoid food waste?*

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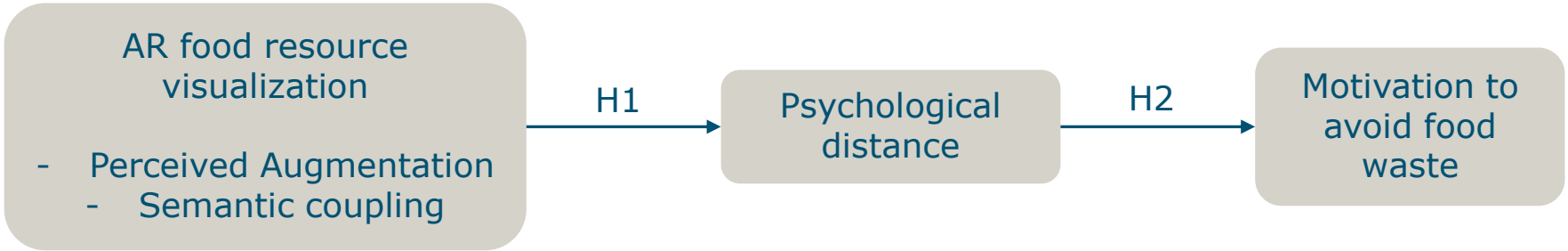
Model


AR food resource visualization
- Perceived Augmentation
- Semantic coupling
H1
Psychological distance
H2
Motivation to avoid food waste

Experiment

AR condition

Control

Results

- Not ready yet ☺

Thank you!

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