

Visualization of subjective judgement challenging to verbalize by hierarchical ranking method ~ A case study of sweet potato curvature ~



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Objective

- ◆ To create a dataset that reflects continuous human perception using a newly developed ranking method.
- ◆ To uncover the viewpoint of subjective and ambiguous judgments.

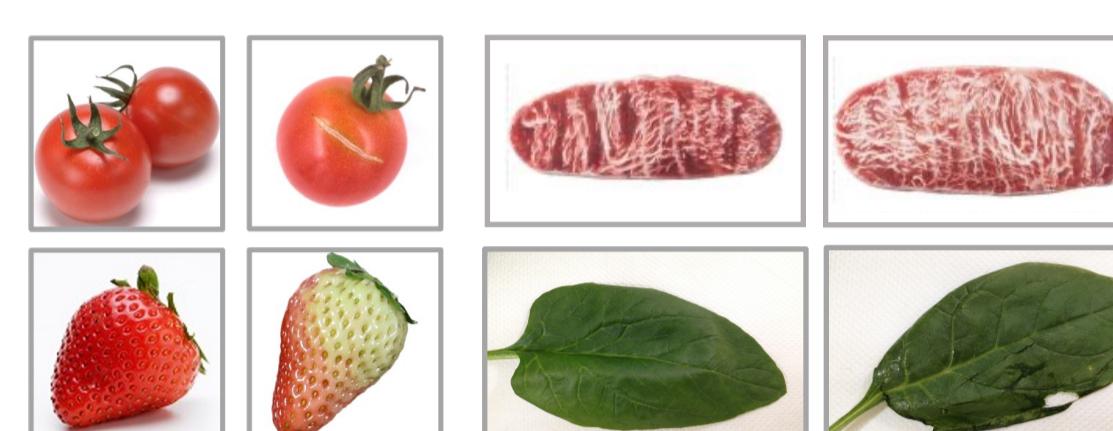
Conclusion

- ◆ A ranking scale representing continuous human evaluation was created.
- ◆ Sweet potato curvature recognition was quantified via our ranking approach.

Introduction

Sensory evaluation of product quality

- The quality of agricultural and food products is judged based on five senses.
- These evaluations are subjective and ambiguous.

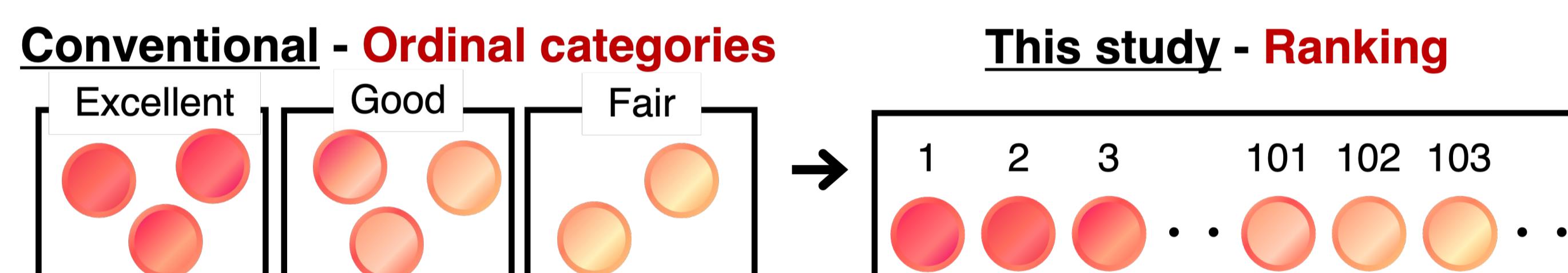


The limitation of ordinal categories

- Commonly, in the quality check, ordinal categories are used.
- Ordinal categories are generally fewer than 10.
- **Ordinal categories cannot reflect continuous human perception, making it difficult to identify what people focus on during evaluation.**

Our new ranking method

Novelty 1: Development of a new ranking method



Many ranking datasets created through repeated relative evaluations can reflect continuous human perception.

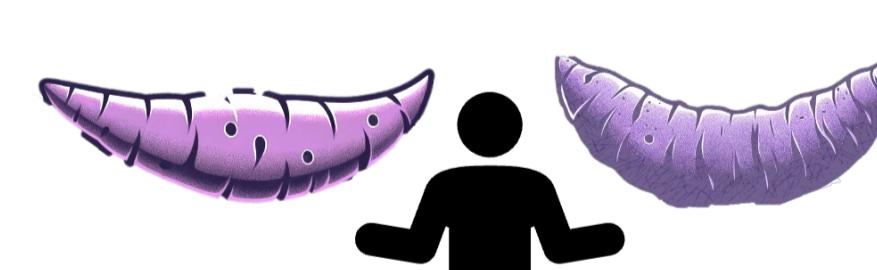
Novelty 2 : Development of a web application for ranking evaluations



- It enables efficient handling of large numbers of evaluations.
- It allows ranking evaluation anytime, anywhere.

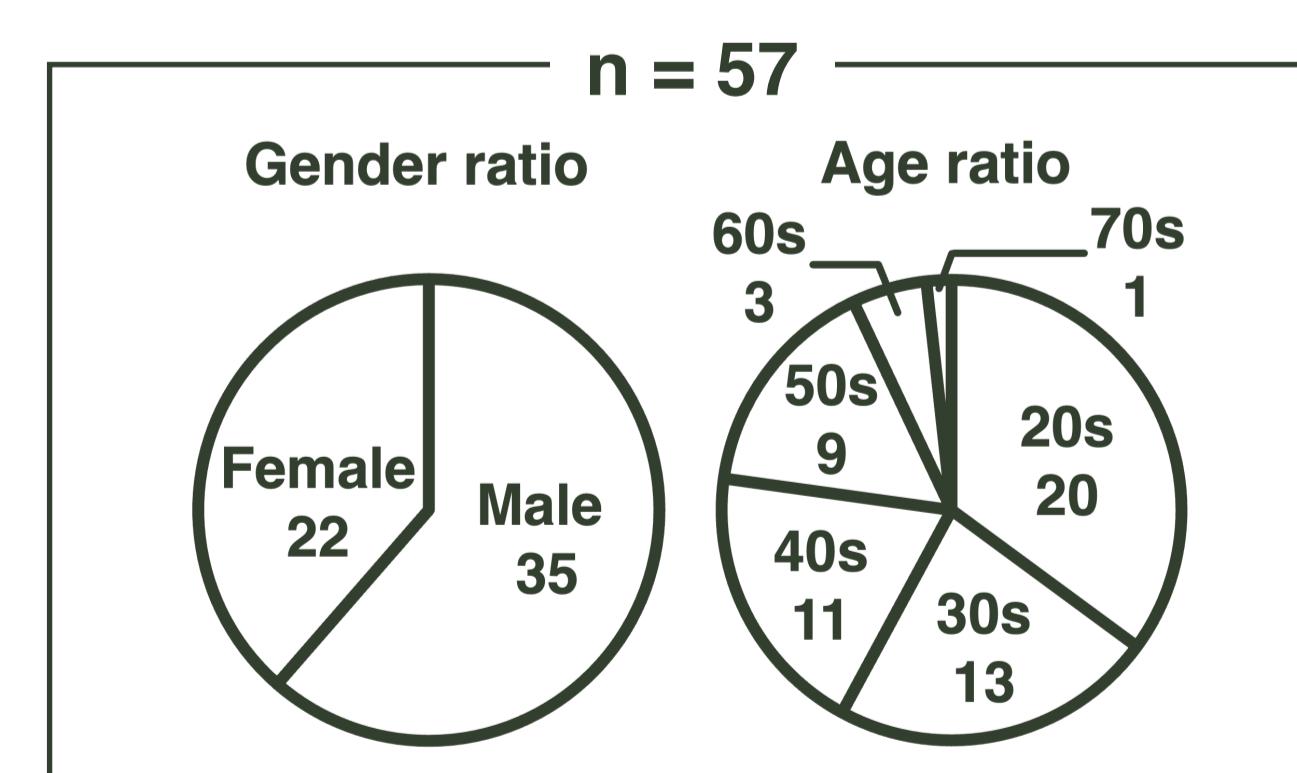
Methods

What visual features people actually focus on when evaluating curvature were investigated.



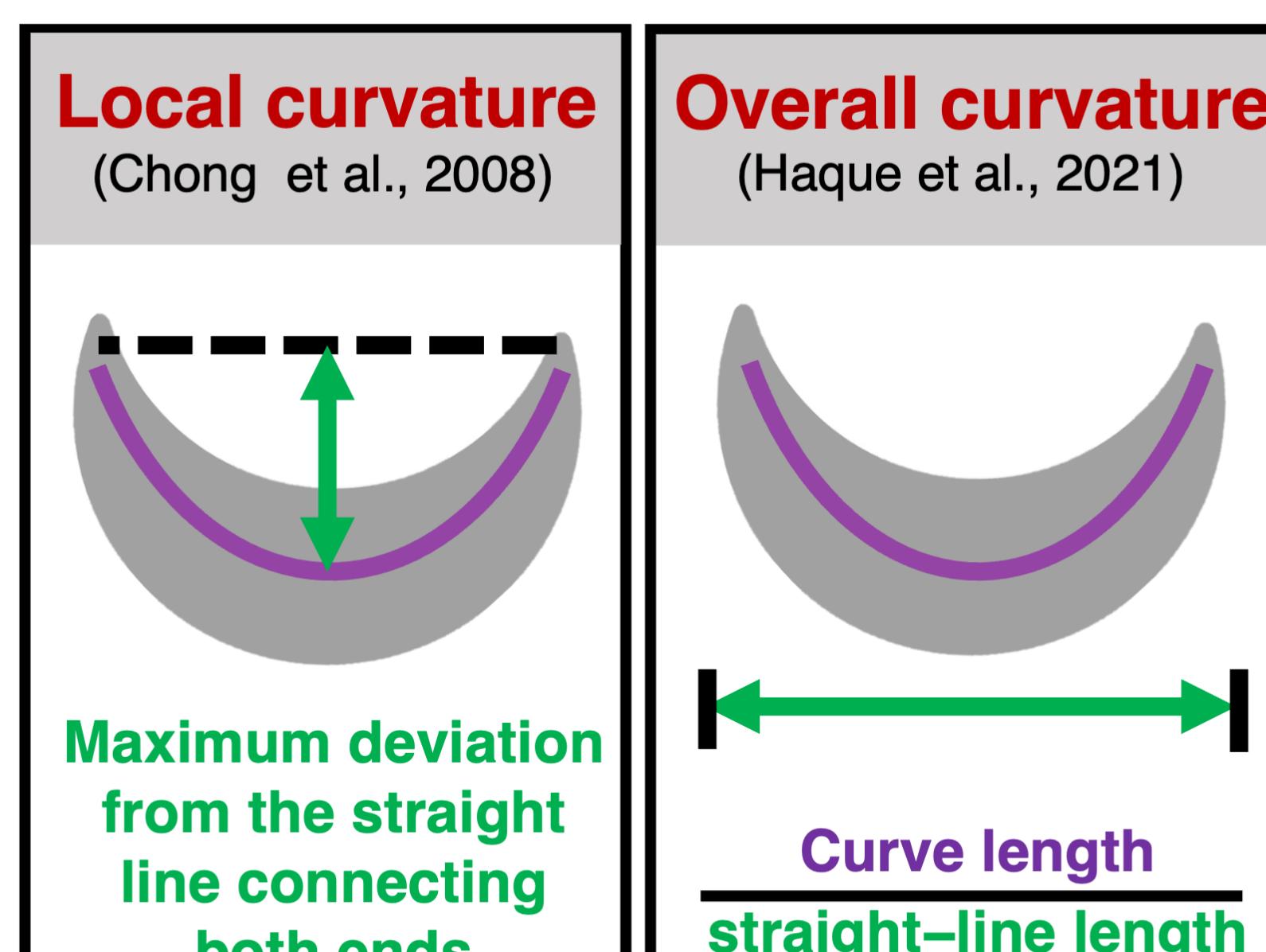
1. Hierarchical ranking sensory evaluation

- 57 panelists.
- 100 sweet potato images were ranked in order of straightness using a web application.
- Inter-panelist consistency was calculated using Kendall's coefficient of concordance (W).



2. Curvature feature calculation

- Curvature of sweet potatoes, in two types, were calculated using image analysis.

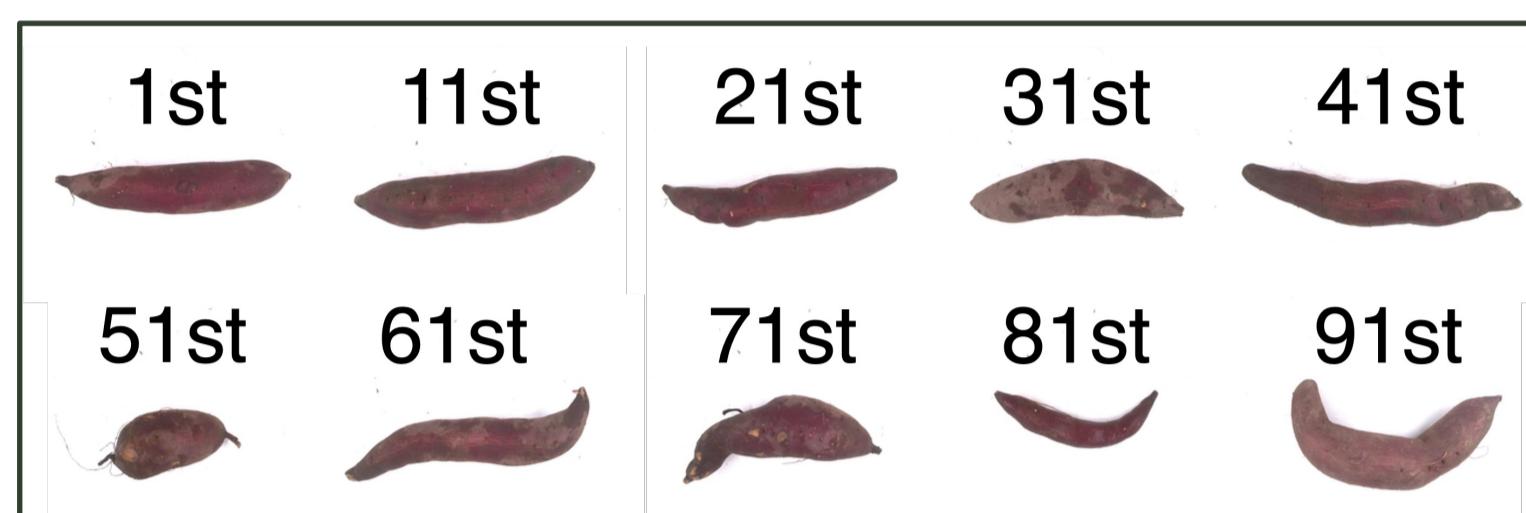


3. Clarification of evaluation focus

- The correlation coefficient between the sensory evaluation ranking and each curvature ranking was calculated.

Results

Inter-panelist consistency of evaluation results



Kendall's coefficient of concordance
 $W = 0.85$

The rankings were largely consistent across panelists.

Correlation between sensory evaluation results and curvature ranking

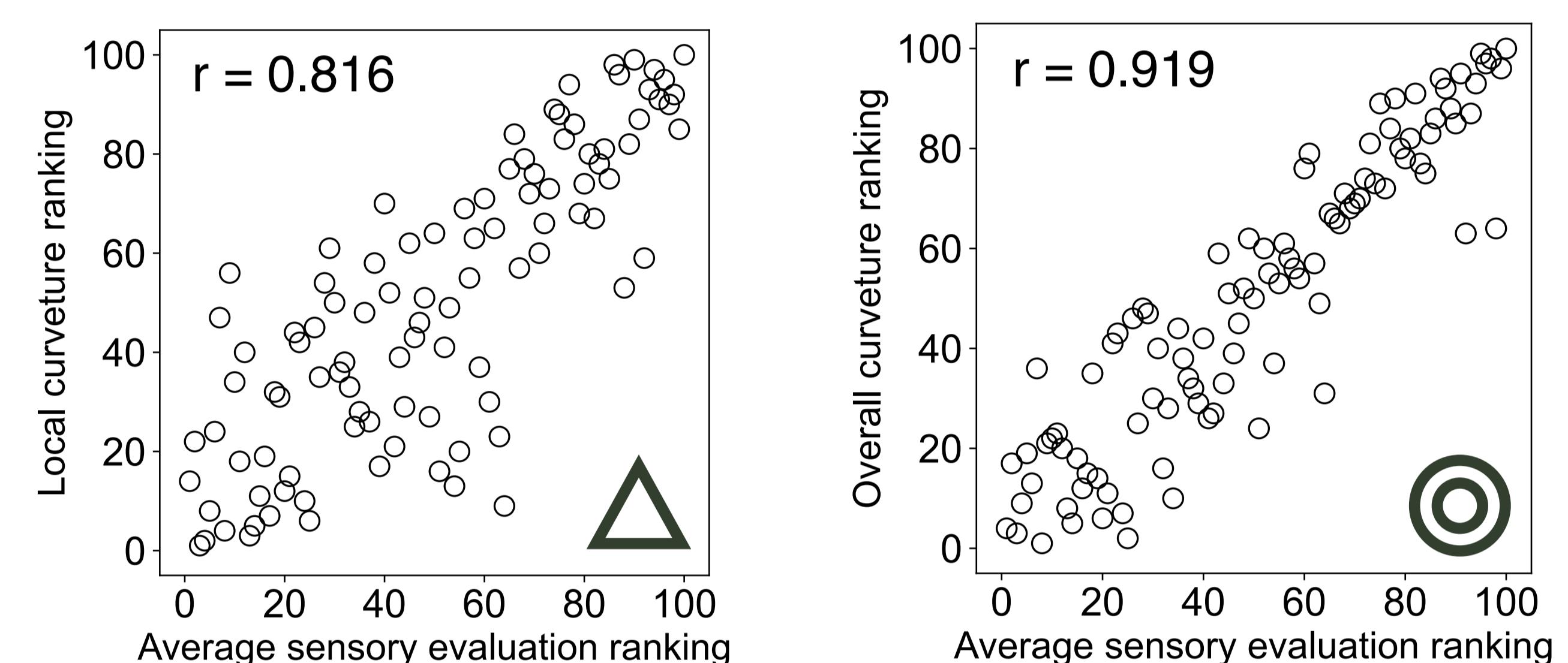
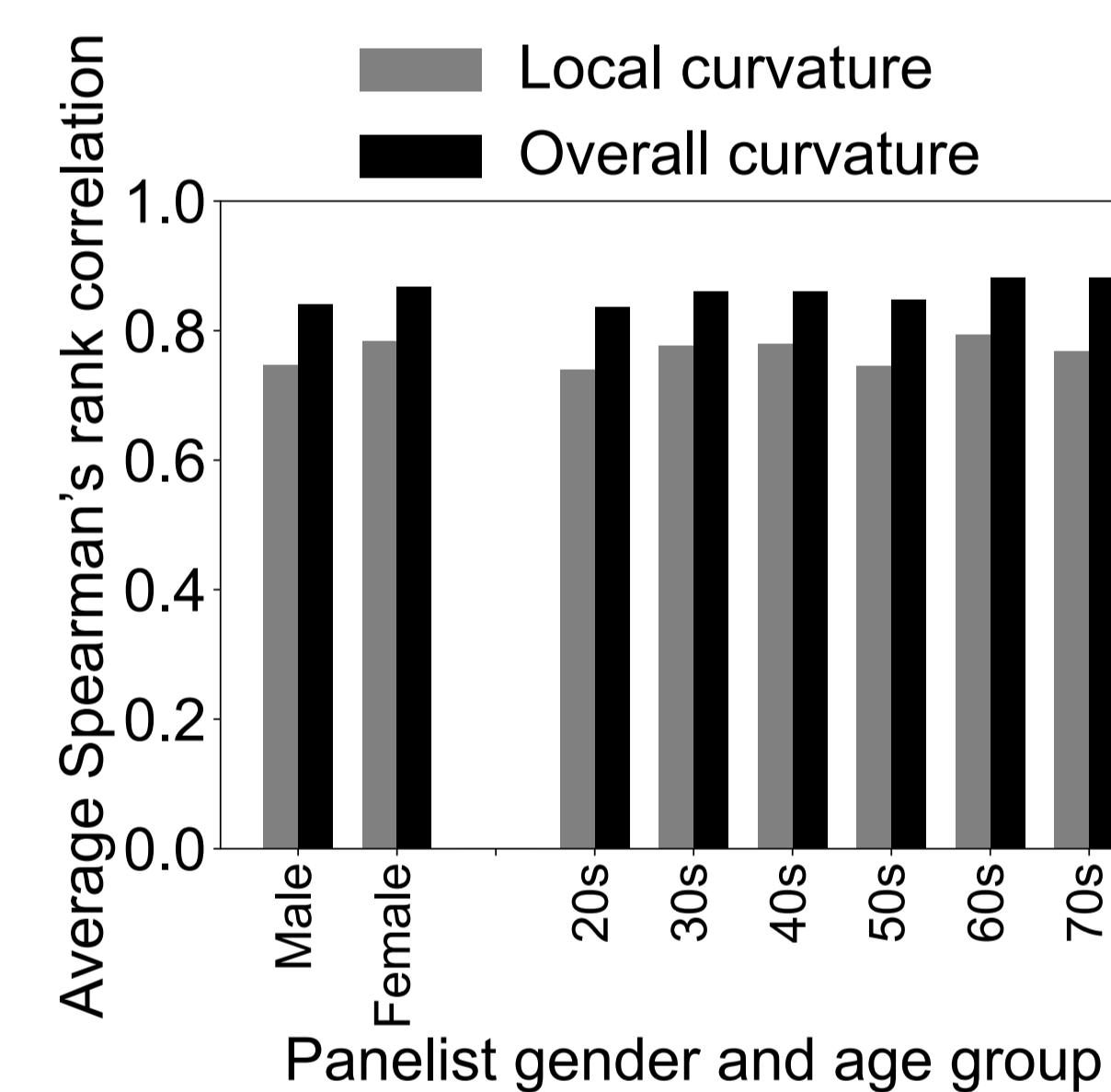


Figure 2. Spearman's rank correlation coefficient between average sensory evaluation rankings and curvature ranking



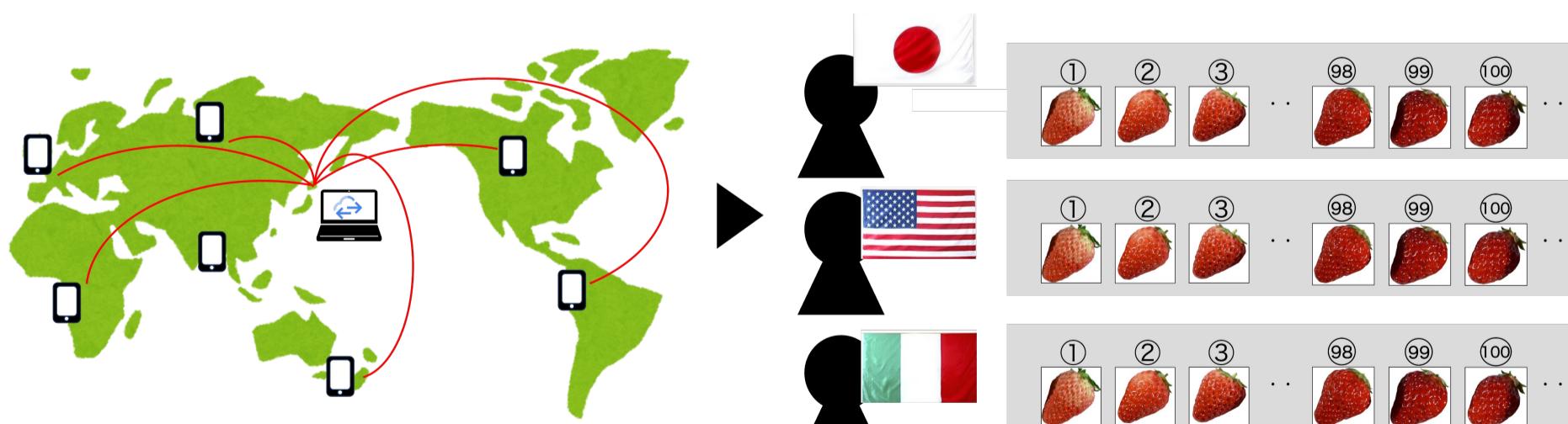
All panelists focused on the overall curvature when making their results.

The same trend was observed regardless of gender and age.

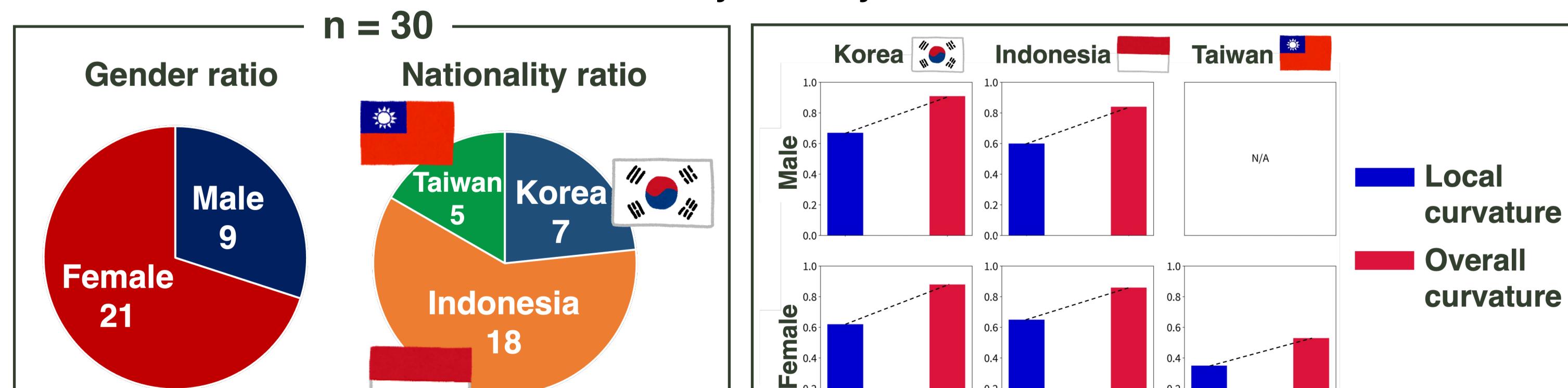
Analysis of rankings from a hierarchical ranking method uncovered common human focus points, which are difficult to verbalize.

What is the potential of our ranking method?

Our new method enables the investigation of international differences in perception.



Preliminary survey results



Acknowledgements

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