REAL DECISION MAKERS AND REAL ALTERNATIVES ARE IMPORTANT INGREDIENTS FOR EXPERIMENTAL DECISION RESEARCH



MM1

□ MW1

Grains/ ear

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Background: Wheat Variety Selection is a Bad-Structured Inference Problem

Selecting wheat varieties is a decision task farmers are familiar with.

Due to...

- **complexity**: diverse interactions between plant, soil and production system,
- **uncertainty:** huge influence by poorly predictable annual weathering,
- multitude of available information: 160 varieties x 20 attributes = 3.200

...variety selection is a-bad structured inference problem.

Heuristic strategies to solve this inference task

- **Model-based:** evaluation of alternatives based on (some) variety characteristics (1)applying different heuristic principles
- Memory-based: variety names can be used to recall memories about varieties' (2)performance in the past
- Combinations of **both strategies mentioned before** (3)

Objectives: Identification of heuristic strategies in (familiar) decision situations.

Examination of key factors for the application of different strategies.

Method: Incentivized Lab Experiment 2.

- **Real decision makers:** 145 operative managers (farmers) and reference group (43 agricultural students)
- **Real-world problem:** selection of wheat varieties for 7 specific production systems \bullet

| | Production system (you can open the covered information by mouse clicks) | | | | | | | |
|---|--|---------------------------|------------------------|-------------------|--|--|--|--|
| > | Production side | Yield potential (max 120) | Cultivation area | Soil-climate-area | | | | |
| | Previous crop | Topsoil thickness (cm) | Altitude (m) | Soil type | | | | |
| | Sowing date | Humus content | Annual temperature (C) | Geological origin | | | | |
| | Field size (ha) | Cultural condition (soil) | Precipitation (mm) | Soil character | | | | |

- **Real alternatives:** wheat varieties available on the market
- **Information search tracing** via information-display-matrix
- **Incentive:** monetary pay-off based on varieties' performance in reality
- **Participants' characterization** through accompanying survey



3. Results

20

140

15

120

(I) Convenience samples lead to biases in experimental decision research

(III) Memories are a key factor for the application of heuristics



In comparison to the reference group, farmers ...

- use cues (variety names) to apply memory-based and combined decision strategies.
- assess significantly less and different attributes.

Share in % (farmers: n=145) The more participants are Task (production system) HR1 HW1 HW5 KR5 GR5 MW1 MM1 experienced with alternatives the Experience with at least one 60,7 12,4 58,6 63,4 28,3 more participants evaluate "variety 51,0 61,4 alternative in realty Variety name used 88,3 85,5 89.0 90.3 89,7 names" non-compensatory Take the best heuristic¹ 5,5 8,3 6,9 9,0 2,1 4.8 with "variety name" → Availability of internal Non-compensatory evaluation 11,0 6,9 13,1 9.0 5,5 7,6 7,6 of "variety name" information determines 18,6 16,6 19,3 13,8 9,7 Total 10,3 16,6 application of heuristics Share (%) of farmers using... (IV) Mental models² are a key factor for the application of heuristic strategies Variety name Year of market launch **Task variation and decision effort** (farmers, n=145; Ear emergence Maturitv (Wilcoxon signed-rank test: *p < 0,05; **p < 0,01; ***p < 0,001) Plant height Frost damage Task (production system) MW1 p value **MM1** lodged grain Wheat Corn Previous crop Eyespot** Yield potential rating (max. = 120) 75 75 Mildew** 190 190 Altitude (m) Septoria*** Temperature (°C) 8.4 8.4 **PTR***** Precipitation (mm) 605 605 Yellow rust** Field size (ha) (pay-off multiplying factor) Brown rust*** 0,000*** Average number of used information 47,0 56,9 Fusarium head blight** 171,2 0,000*** 143,8 Average decision time (seconds) Glume blotch*** Stand density

Significant differences in decision effort and used

| take the same decision tir are significantly more suc | ne. cessful. | | | | → Mental models explain decision effort and application of heuristic principles Thousand grain weight Yield potential (extensive) Yield potential (intensive) 0 20 40 60 80 100 | |
|--|-----------------|---------|----------|--|--|--|
| (II) Decision scope is not a key factor for heuristic application Decision scope and decision effort (farmers, n=145; | | | | | 4. Conclusion | |
| (Wilcoxon signed-rank test: *p < 0,05; **p < 0,01; ***p < 0,001) | | | | | Farmers' significant heavy use of memory-based decision making shows the | |
| Task (production system) | HW1 | HW5 | p value | No significant difference in decision effort | on effort | |
| Yield potential rating (max. = 120) | 57 | 52 | | hotwoon tooke with different desision | importance of using real decision problems, real alternatives and samples of real | |
| Altitiue (m) | 206 | 206 | | between tasks with unlerent decision | decision makers in experimental decision research. → Otherwise it is just observing someone's lain decision effort. behavior in some situation. | |
| Temperature (°C) | 8,1 | 8,1 | | scope. | | |
| Precipitation (mm) | 670 | 670 | | | | |
| Field size (ha) (➔ pay-off multiplying factor) | 1 | 5 | | Accuracy effort considerations can | | |
| Average number of used information | 52,3 | 56,8 | 0,068 | not explain decision effort | | |
| Average decision time (seconds) | 154,4 | 183,4 | 0,059 | | | |
| Contact: Jörg Müller • Departm | nent for A | aribusi | iness Ma | anagement and Food Economics • | References: ¹ Gigerenzer, Gerd; Goldstein, Daniel G. (1996): Reasoning the fast and frugal way: Models of bounded | |

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rationality. In: Psychological Review 104 (4), S. 650–669. ²Johnson-Laird, Philip N. (1983): Mental models: Towards a cognitive science of language, inference, and consciousness. Cambridge Mass.: Harvard University Press.