Faculty of Agricultural and Nutritional Science

Christian-Albrechts-University Kiel
Institute of Animal Breeding and Husbandry

Comparison of two methods for developing a multicriteria evaluation system to assess animal welfare

Martín, P.[1], Buxadé, C.[2] and Krieter, J.[1]

[1]Institute of Animal Breeding and Husbandry, Christian-Albrechts University, D-24098 Kiel

[2] ETSIA, Polytechnic University, 28040 Madrid, Spain

63rd EAAP Annual Meeting - Bratislava, Slovakia
(27th August – 31st August 2012)

Introduction

Welfare : multidimensional concept

Four criteria

- Good feeding
- Good housing
- Good health
- Appropriate behaviour

Aim of study

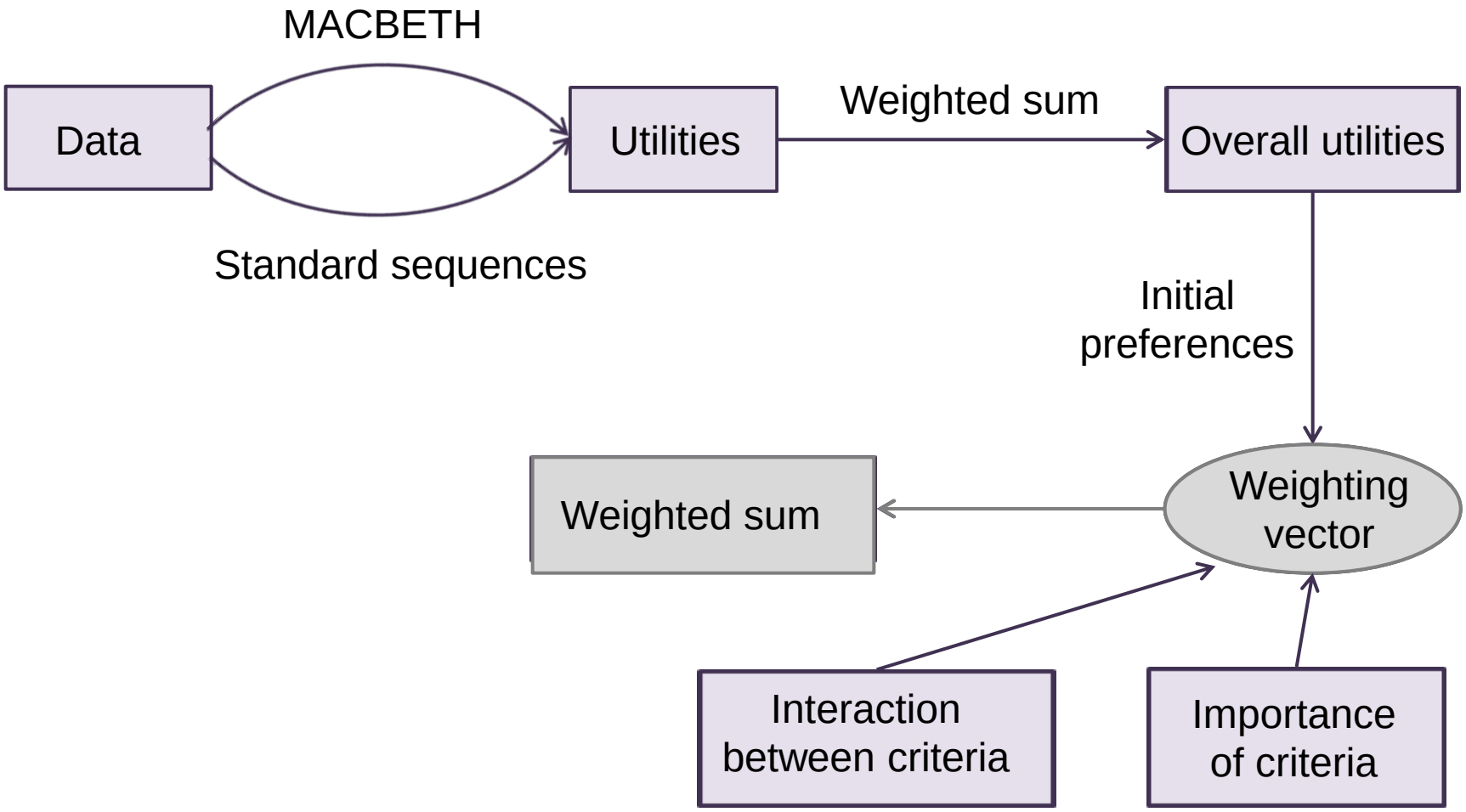
Develop a Multidimensional evaluation system for animal welfare

- Compensation
- Importance
- Interactions

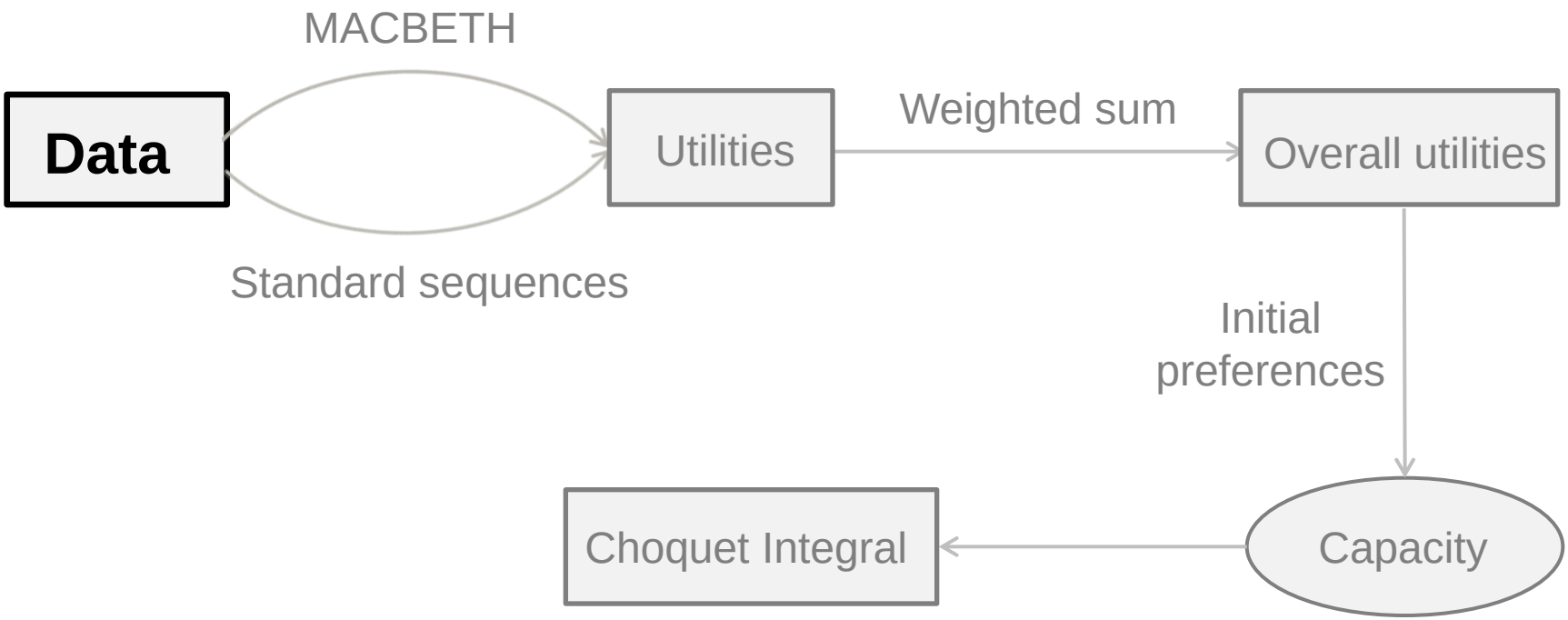
Choquet Integral

Labreuche and Grabisch (2003)

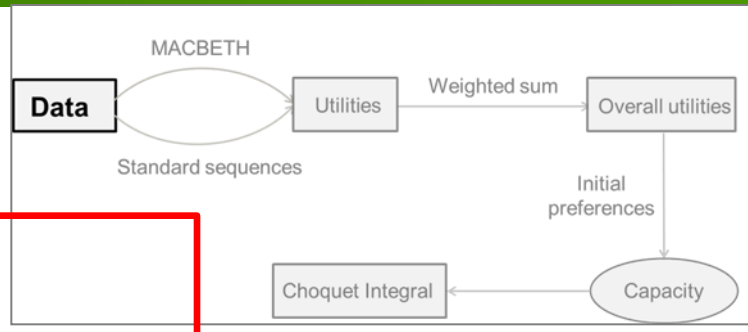
Outline- Model



Outline

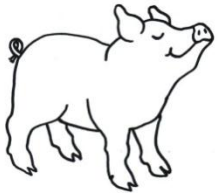

MACBETH
Data
Utilities
Weighted sum
Overall utilities
Standard sequences
Initial
preferences
Choquet Integral
Capacity

Material and methods - Measures

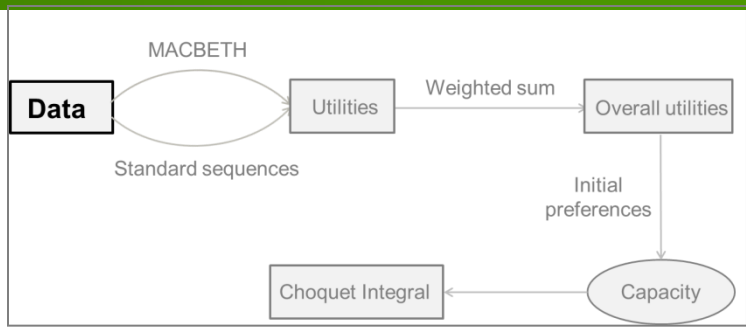


Absence of prolonged hungry
Absence of prolonged thirst
Comfort around resting
Thermal comfort
Ease of movement
Absence of injuries
Absence of disease
Absence of pain
Expression of social behaviour
Expression of other behaviours
Good human-animal relationship
Absence of fear

Feeding
Housing
Health
Behaviour



Material and methods - Data

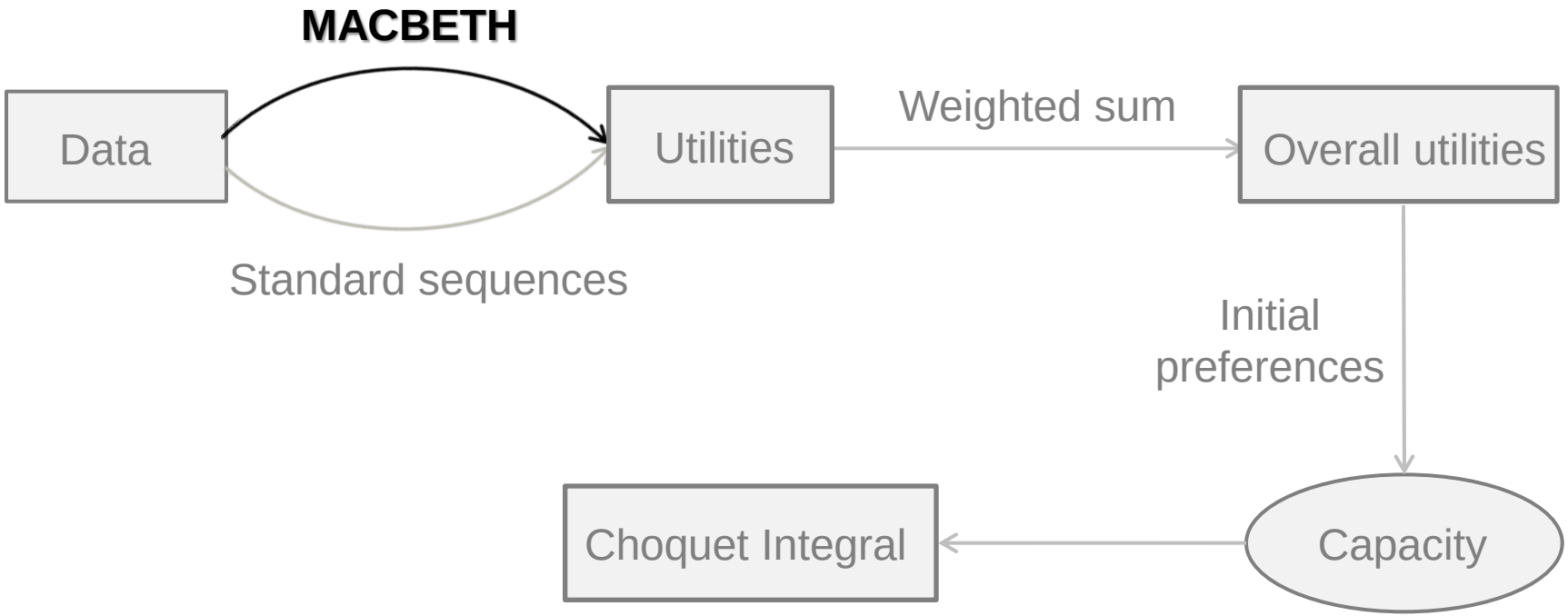


Example: 9 farms

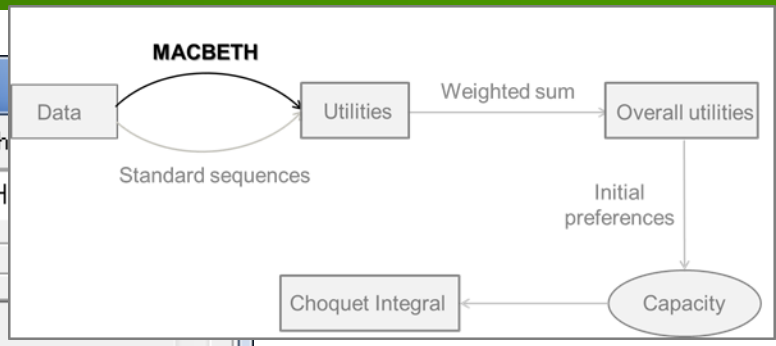
Farm	Feeding	Housing	Health	Behaviour
a	3	6	13	2
b	3	6	13	1
c	3	6	13	0
d	3	6	8	2
e	3	6	7	2
f	3	6	4	2
g	2	4	8	2
h	1	4	11	2
i	1	2	13	2

Criterion	Range
Feeding	0-3
Housing	0-6
Health	0-13
Behaviour	0-2

Outline


MACBETH
Data
Utilities
Weighted sum
Overall utilities
Standard sequences
Initial
preferences
Choquet Integral
Capacity

Material and methods - MACBETH



Properties of Housing

Name : Housing

Comments :

Basis for comparison :
- the options
- the options + 2 references
- qualitative performance levels :
- quantitative performance levels :

criterion

Performance levels :

	Quantitative level
1	6
2	5
3	4
4	3
5	2
6	1
7	0

Indicator :

Short :

1. Define quantitative performances

Reference scores

[all upper] 1

[all lower] 0

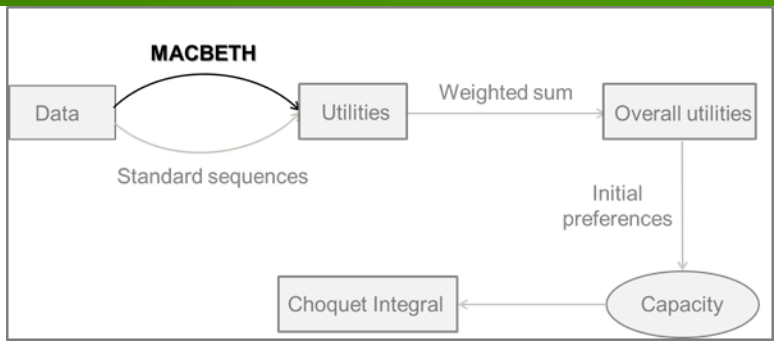
OK

Cancel

2. Define reference scores

Material and methods - MACBETH

Qualitative judgements



Housing

	6	5	4	3	2	1	0	Current scale
6	no	very weak	weak	strong	strg-vstr	vstrg-extr	extreme	1.00
5		no	very weak	strong	strg-vstr	v. strong	extreme	0.93
4			no	strong	strg-vstr	strg-vstr	v. strong	0.86
3				no	moderate	mod-strg	strg-vstr	0.57
2					no	moderate	strong	0.36
1						no	weak	0.14
0							no	0.00

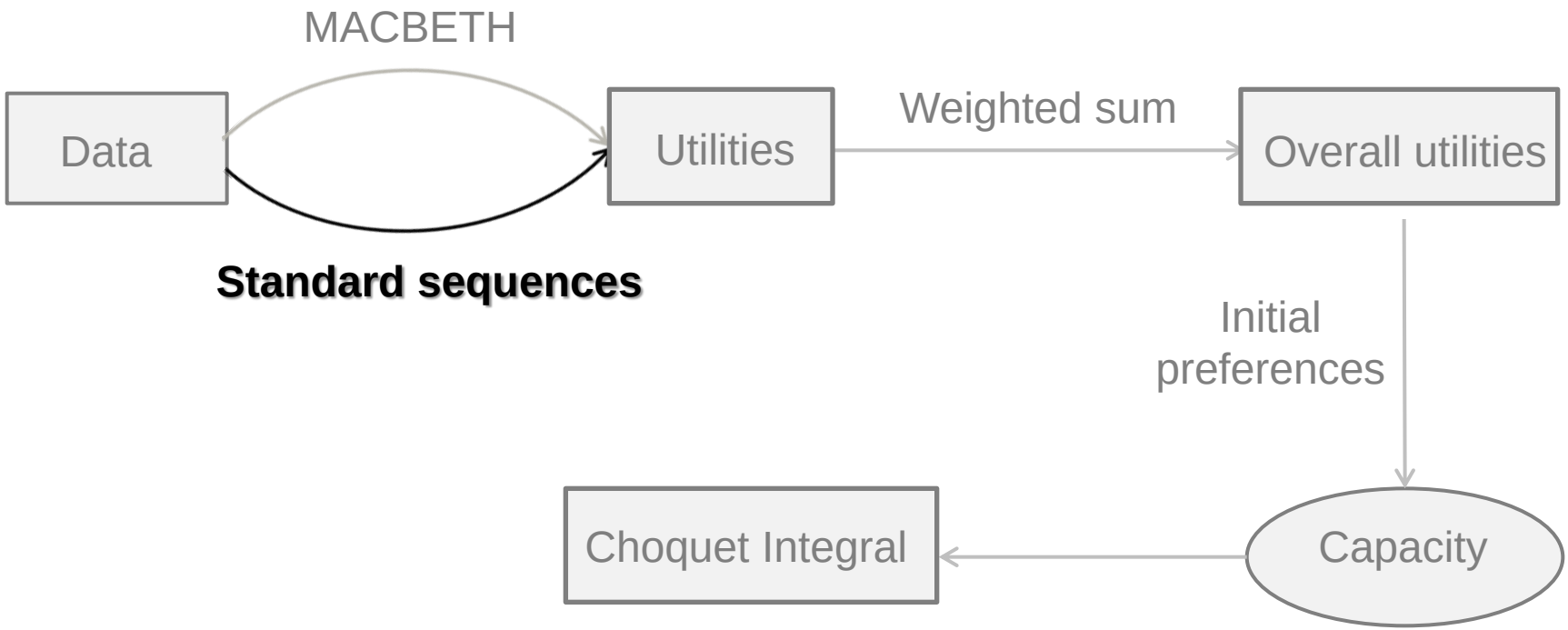
extreme
v. strong
strong
moderate
weak
very weak
no

Consistent judgements

OK?

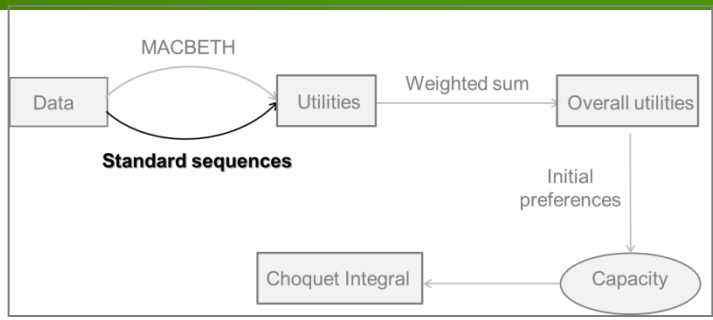
3. Qualify the strength of difference between criteria levels

Outline

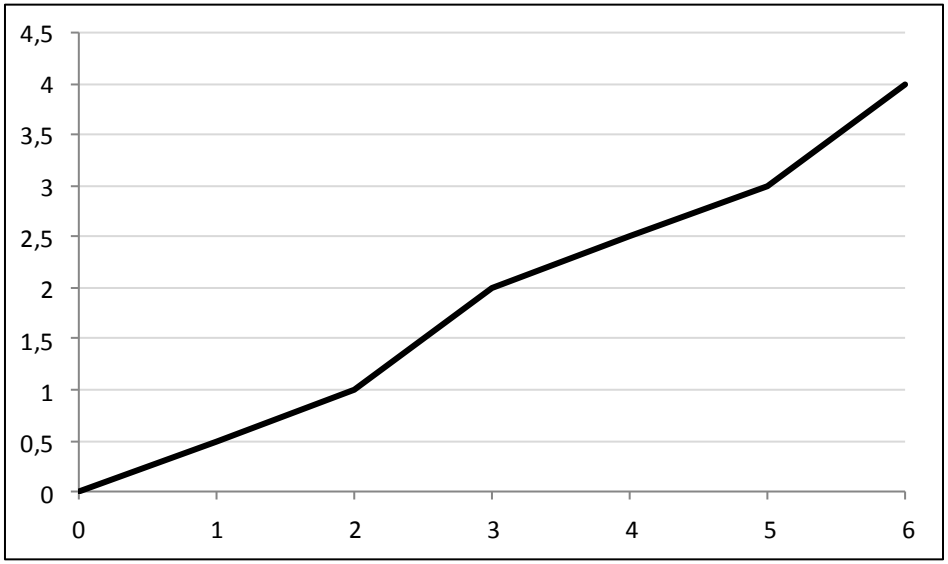

MACBETH
Data
Utilities
Weighted sum
Overall utilities
Standard sequences
Initial
preferences
Choquet Integral
Capacity

Material and methods – STANDARD SEQUENCES

MACBETH	STANDARD SEQUENCES
Qualitative judgements	Quantitative judgements
Qualify the strength of difference between criteria levels	Quantify the increase in the value of a criterion that would compensate the decrease of one unit in other criterion

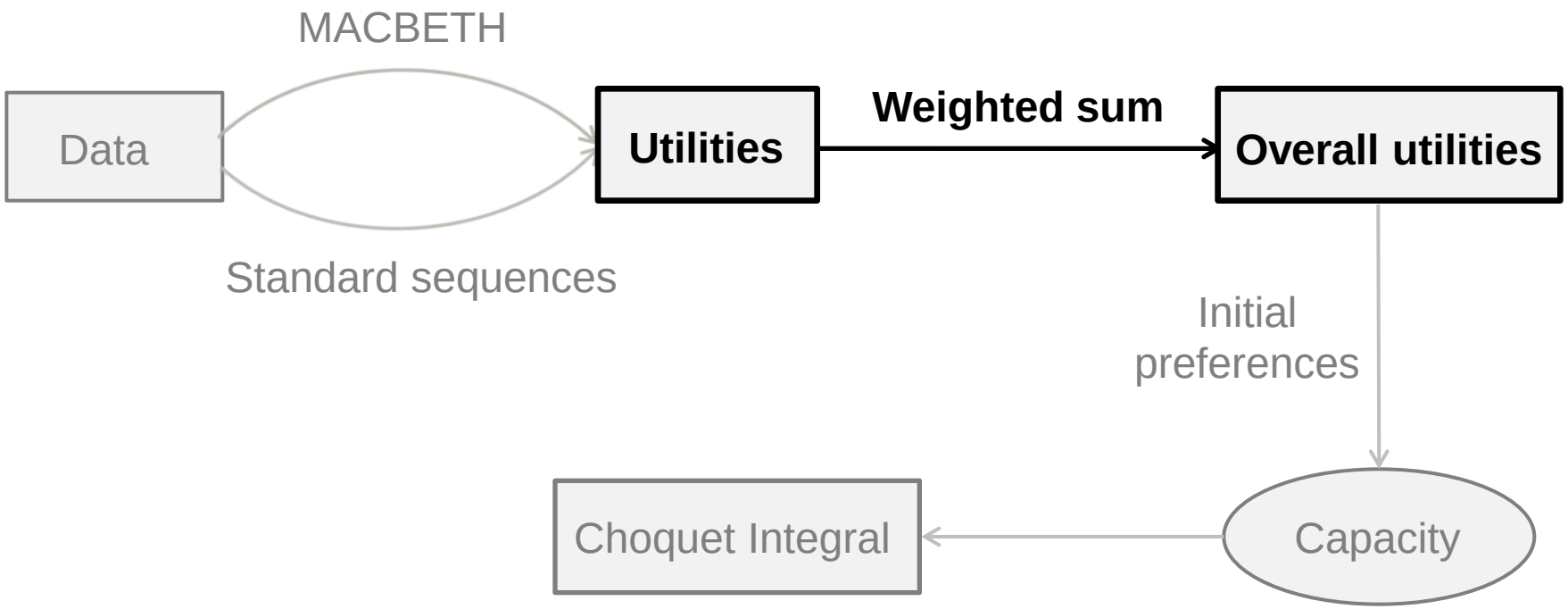


Feeding



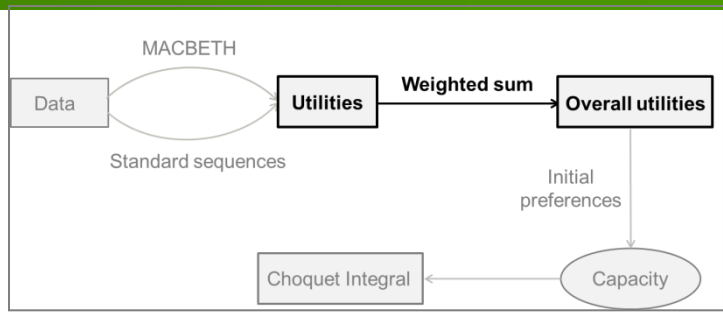
Housing

Outline


MACBETH
Data
Utilities
Weighted sum
Overall utilities
Standard sequences
Initial
preferences
Choquet Integral
Capacity

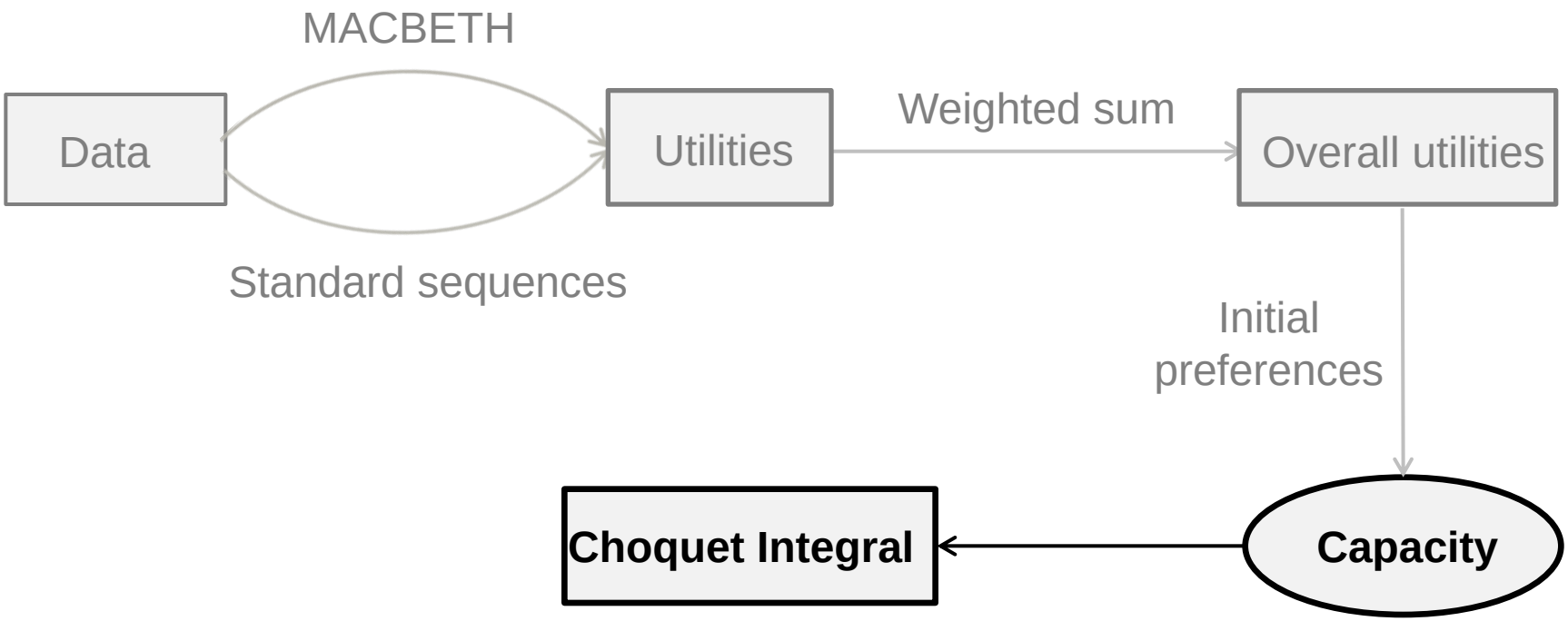
Results and discussion

Overall utilities and rankings for the 9 farms calculated by the Standard Sequences (SS) and by MACBETH

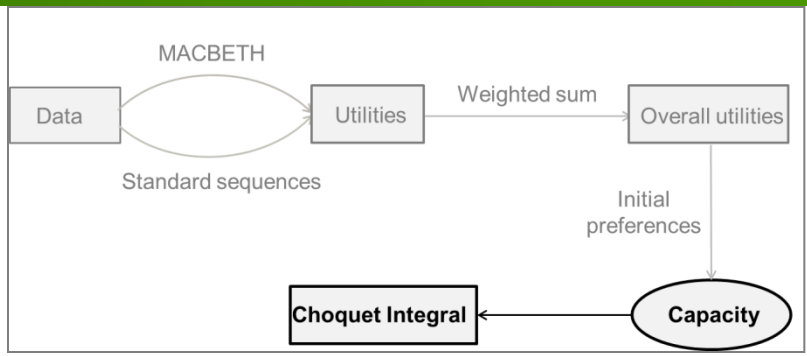


Farm	SS Utility Value	SS Ranking	MACBETH Utility value	MACBETH Ranking
a	1	1	1	1
b	0.818	4	0.873	4
c	0.636	9	0.667	9
d	0.860	2	0.933	2
e	0.832	3	0.877	3
f	0.748	8	0.790	7
g	0.762	7	0.869	5
h	0.815	5	0.868	6
i	0.803	6	0.780	8

Outline


MACBETH
Data
Utilities
Weighted sum
Overall utilities
Standard sequences
Initial
preferences
Choquet Integral
Capacity

Material and methods – Capacity and Choquet integral



- Least squares based approaches were implemented within the Kappalab R package following the method described by Grabisch et al. (2008).

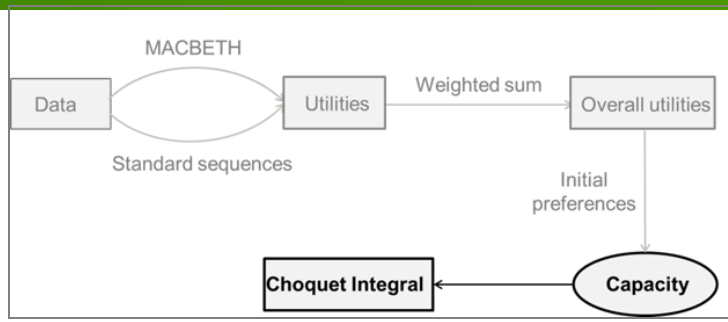
- Interactions indices constraints were imposed → criteria regarded as complementary → no compensation allowed between them.

- Importance values constraints were imposed → importance of the criteria follows the next order:

Health = Behaviour > Housing > Feeding

Results and discussion

Choquet Integral (CI) results



Farm	CI (SS)	CI (SS) Ranking	CI (MACBETH)	CI (MACBETH) Ranking
a	1	1	1	1
b	0.789	4	0.799	4
c	0.578	9	0.597	9
d	0.835	2	0.849	2
e	0.802	3	0.819	3
f	0.704	8	0.728	7
g	0.735	6	0.730	6
h	0.766	5	0.753	5
i	0.733	7	0.697	8

Conclusion

- **Utilities** aggregated with the **weighted sum** → do not reflect DM preferences and several ranking reversals between results through different methods are obtained

- **Choquet integral** results → in accordance with the DM preferences and few ranking reversal between results are obtained through different methods

- Outlook → use of **MACBETH** preferable, simpler than standard sequences and no significant differences between results

Thank you for your attention!