# MouselabWeb with Food and Gambles

Michael Schulte-Mecklenbeck
@EADM Summer School 2016

# What happens today?

**Session 1: (9-10.30)**

Intro Process Tracing - Group work [Michael]

Why we think process tracing is useful (Gambles and Food) [Michael]

Why we think process tracing is useful  (Context effects) [Martijn]

**Session 2: (11-12.30)**

Repetition: Designer, counterbalancing etc. more sophisticated things [Martijn]

Intro: Datalyser, and data structure [Michael]

Import into R [Michael]

**Session 3 (13.30-15)**

Analysis1: simple analysis (task time/frequency, cell time/frequency, choices) [Michael]

Icon graphs [Martijn]

Analysis 2: first acquisition, last acquisition, all cells opened [Michael]

Analysis 3: Contrast analysis in regression [Martijn]

# Why should we care about  Processes?

**Groups of 4 / 20 Minutes**

**Outcome**: one slide - send to schultem@gmail.com

Select a presenter

- Generate 3 research questions that could be interesting to look at with process tracing methods.

- Identify for each of the questions an appropriate method and explain your choice.

- What is the one thing you want to learn today when you think about the data we collected with MouselabWeb?


200

# How does food choice work?

taste

price

‘through the *weighting* of

Integration

various food choice motives’

sensory

of

all available

convenience

‘the decision will depend

information

upon how that food *scales*

health

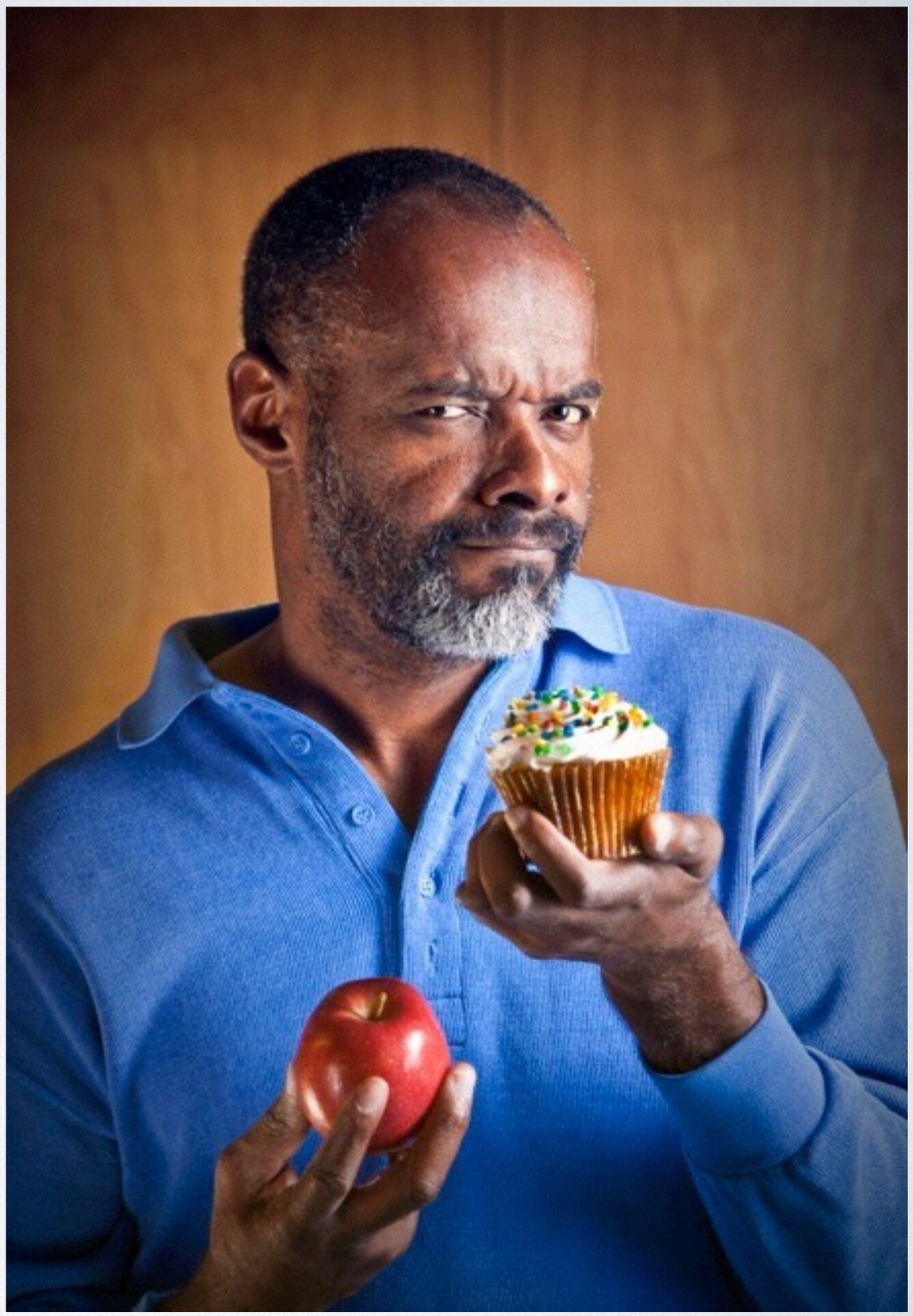
ethics

*on each of three* criteria:

health, pleasure and

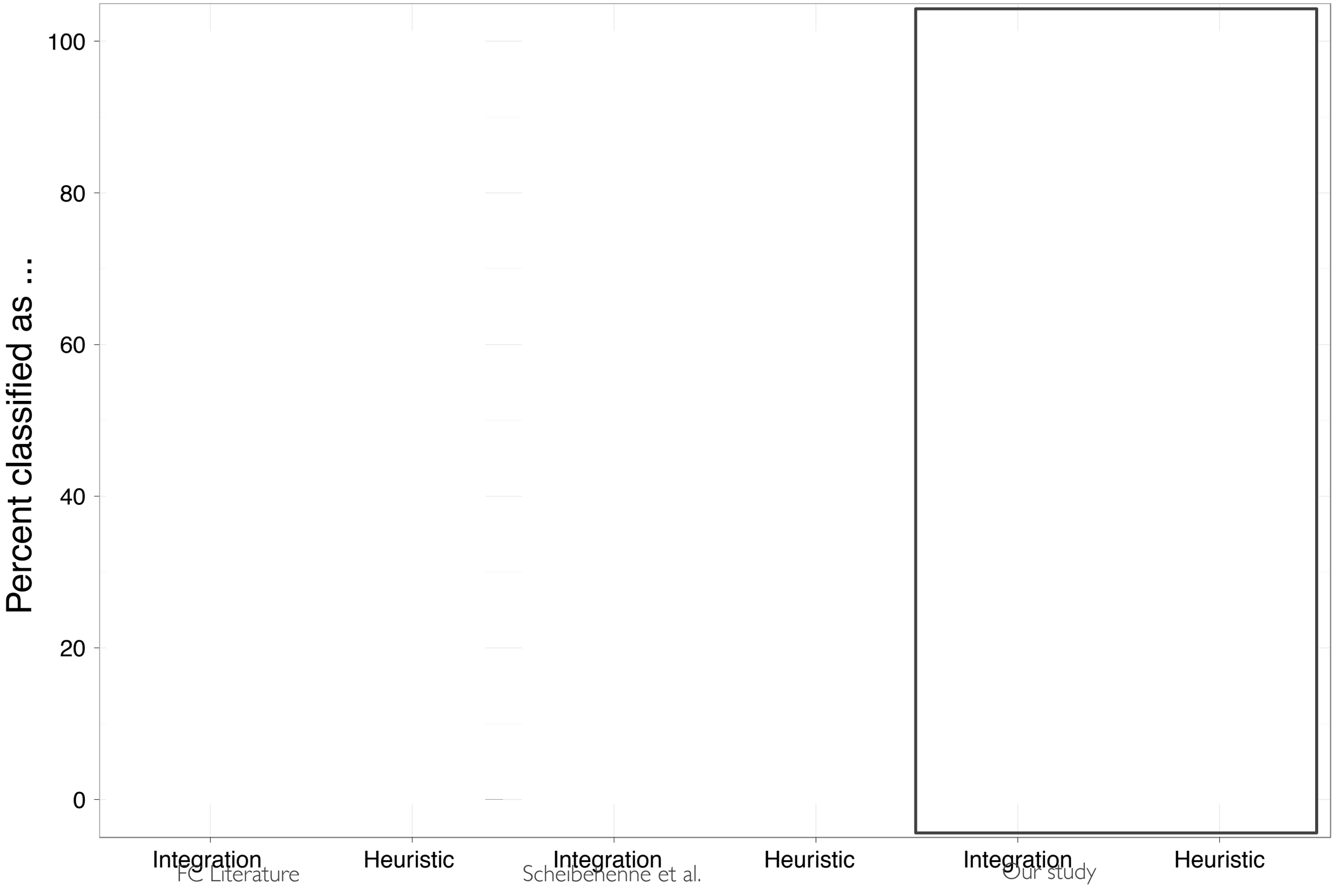
weight control

convenience



Eertmans, Victoir, Vansant, & Van den Bergh (2005)
Rappoport, Peters, Downey, McCann, & Huff-Corzine (1993)

# Predictions + Results



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Research report

# Fast and frugal food choices: Uncovering individual decision heuristics

Benjamin Scheibehenne[a,*], Linda Miesler[a], Peter M. Todd[b]

[a]Center for Adaptive Behavior and Cognition, Max Planck Institute for Human Development, Lentzeallee 94, 14195 Berlin, Germany
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Received 16 January 2007; received in revised form 1 March 2007; accepted 26 March 2007

Output

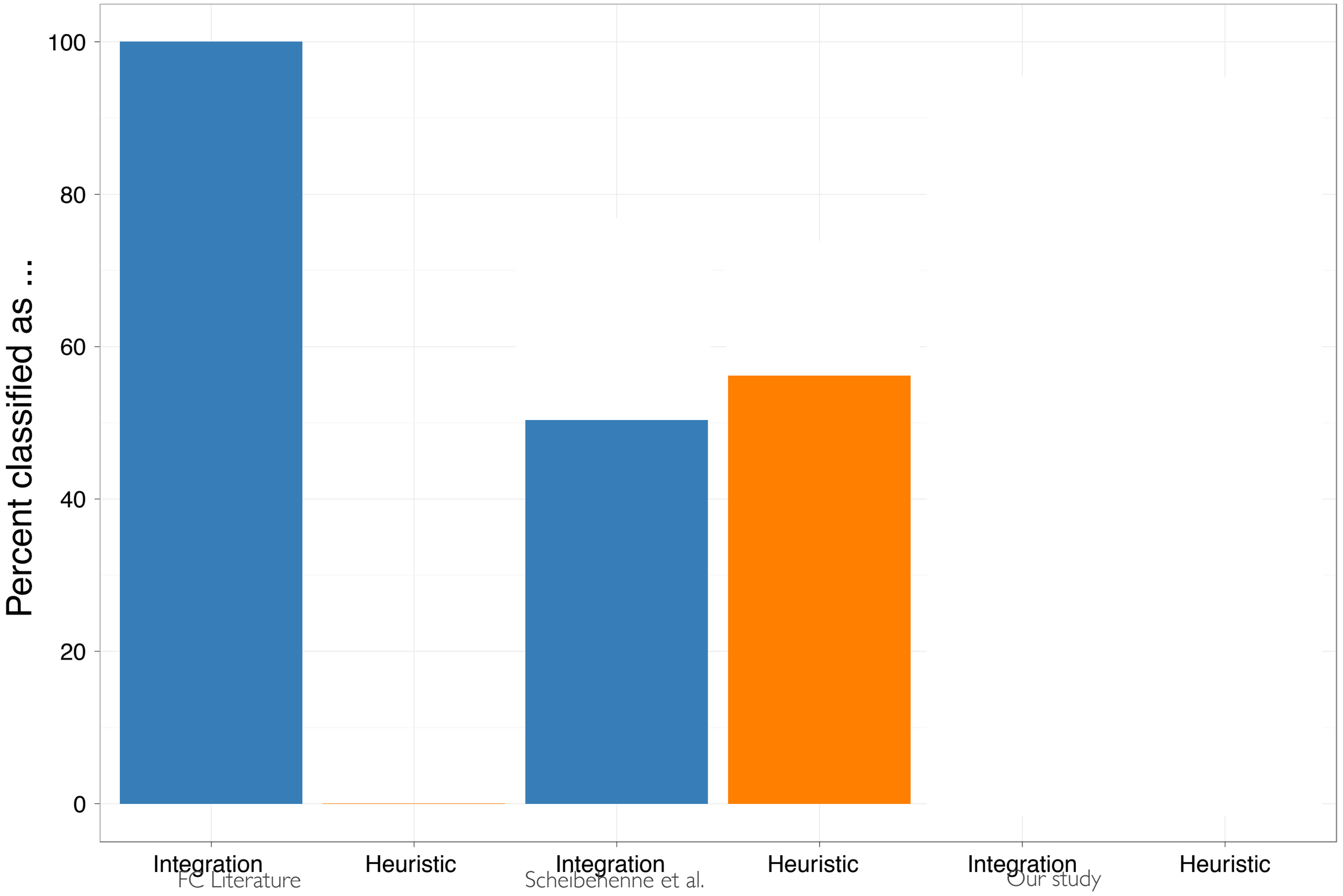
'based on our results we do not see much reason to believe that people's daily food decisions are made by the weighting and adding of several aspects.' (p. 586)

Input – Data

Weighted Additive Model (73%)
against
Lexicographic Heuristic (72%)

Scheibehenne, Miesler, & Todd (2007)

# Predictions + Results



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**Abstract**

Research on food decision making is often based on the assumption that people take many different aspects into account and weight and add them according to their personally assessed importance. Yet there is a growing body of research suggesting that people's decisions can often be better described by simple heuristics—rules of thumb that people use to make choices based on only a few important pieces of information. To test empirically whether a simple heuristic is able to account for individual food decisions, we ran a computerized experiment in which participants ($N = 50$) repeatedly chose between pairs of 20 lunch dishes that were sampled from a local food court. A questionnaire assessed individual importance weights as well as evaluation ratings of each lunch dish on nine different factors. Our results show that a simple lexicographic heuristic that only considers each participant's most important factors is as good at predicting participants' food choices as a weighted additive model that takes all factors into account. This result questions the adequacy of weighted additive models as sole descriptions of human decision making in the food domain and provides evidence that food choices may instead be based on simple heuristics.


What are strategies one can find in food choice?
Comparison between LEX and WADD.

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‘based on our results we do not see much reason to believe that people’s daily food decisions are made by the weighting and adding of several aspects.’ (p. 586)
Weighted Additive Model (73%) against Lexicographic Heuristic (72%)

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Do participants use heuristic strategies when making food choices? Which strategies can be identified?

Process data!

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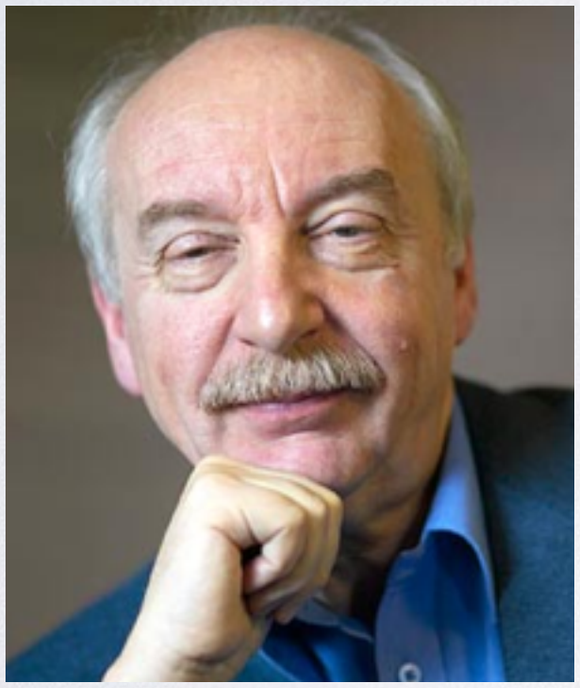
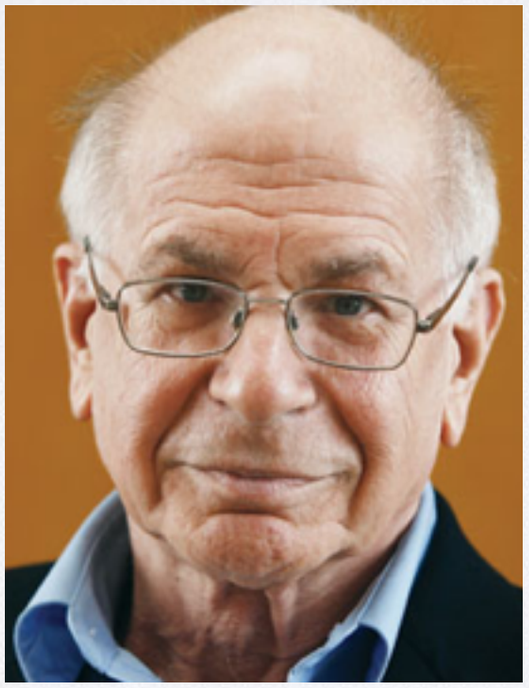
# What are heuristics?

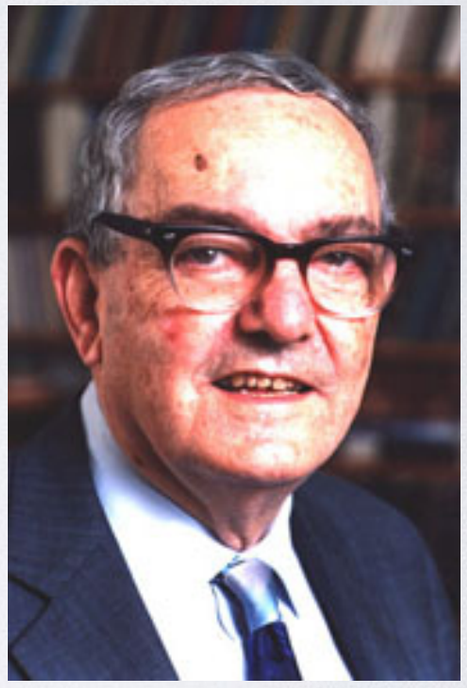
A heuristic is a strategy that ignores part of the information, with the goal of making decisions more quickly, frugally, and/or accurately than more complex models.



Gerd Gigerenzer



Daniel Kahneman
Amos Tversky



Herbert Simon

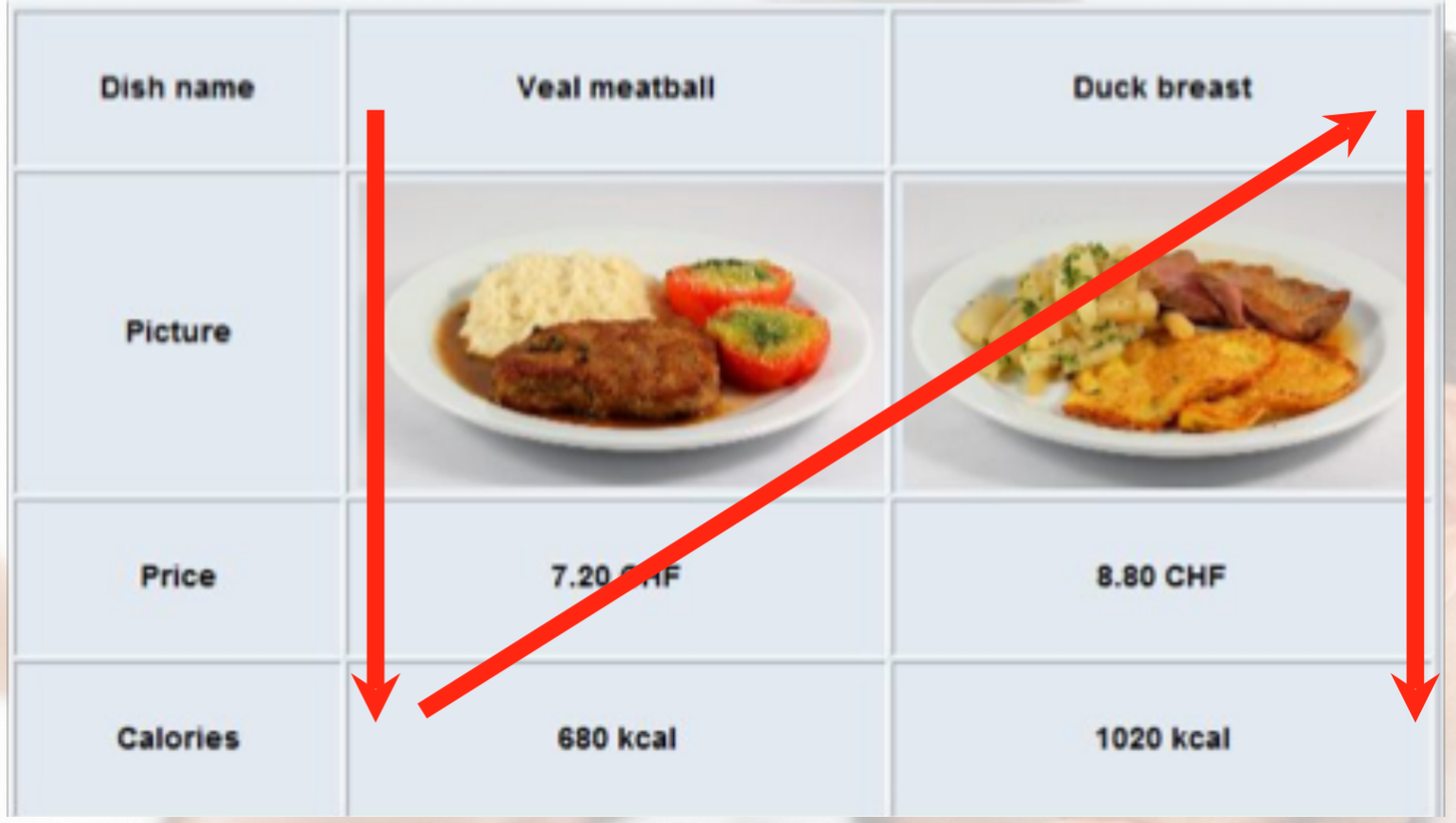
Gigerenzer & Gaissmaier (2011)

| Dish name | Veal meatball | Duck breast |
|---|---|---|
| Picture |  |  |
| Price | 7.20 CHF | 8.80 CHF |
| Calories | 680 kcal | 1020 kcal |
| Protein | 27 g | 43 g |
| Fat | 25 g | 50 g |
| Carbohydrate | 67 g | 98 g |
| Cholesterol | 10 mg | 318 mg |
| Sodium | 1205 mg | 90 mg |
| | choose this dish | choose this dish |

Willemsen & Johnson (2011)

# complex strategies

WADD - Weighted Additive




# heuristic strategies

TTB – Take the Best

## Tandoori végétarien, pot-pourri de pommes de terre végétarien

| Catégorie | Menu 3 | | | | | | Dale | | | | 08.04.20 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pour | 80 personnes | | | | | | Préparateur | | | | Jaquier P.A. |
| Mcl s1Mll rchlilldisc | **Energie** | Energie | **Protides** | L.ipides | Glucidcs | fibres | Cholester ● | Sodium | Potasiulll | **Calcium** | Eau |
| | kJ | kcal | en g | ell g | cll g | cll g | ell llllg | llllg | llllg | llllg | |
| Tandoori végétarien, avec escalope corne | 194 | 46 | 2.9 | 0.4 | 7.3 | 1.1 | 0.47 | 25.72 | 135.84 | 76.14 | 63.15 |
| Pot-pourri de pCllmes de terre végétarien | 946 | 226 | 9.3 | 1.1 | 43.9 | 12.4 | 0.00 | 135.95 | 1661.40 | 203.20 | 4 12.13 |
| Total | 1140 | 273 | 12.2 | 1.5 | 51.1 | 13.5 | 0.47 | 161.67 | 1797.24 | 27934 | 475.27 |

414 Dishes

Pairing so that distance between attributes is maximized

$$d = |\mathbf{x} - \mathbf{y}| = \sqrt{\sum_{i=1}^{n} |x_i - y_i|^2} \ .$$

Company restaurant
~ 800 visitors every day

414 dishes
picked pairs of dishes

Rapporlllu1rimcnfs

## Tandoori végétarien, pot-pourri de pommes de terre végétarien

| | | | |
|---|---|---|---|
| Catégorie | Menu 3 | Dale | 08.04.20 10 |
| Pour | 80 personnes | Préparateur | Jaquier P.A. |

| Mels1Mll rehlilldisc | Energie kJ | Energie kcal | Protides en g | Lipides ell g | Glucides cu g | fibres cu g | Cholester ell llllg | Sodium llllg | Potasiulll llllg | Calcium llllg | Eau |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tandoori végétarien, avec escalope corne | 194 | 46 | 2.9 | 0.4 | 7.3 | 1.1 | 0.47 | 25.72 | 135.84 | 76.14 | 63.15 |
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| Total | 1140 | 273 | 12.2 | 1.5 | 5 1.1 | 13. | | | | | |


Frequency (30570)
Length
Sequence

Decision (1625)

# Definition and Selection of Strategies

# Metric 1: Searchtype (SM)

| Dish name | Veal meatball | Duck breast |
|---|---|---|
| Picture |  |  |
| Price | 7.20 CHF | 8.80 CHF |
| Calories | 680 kcal | 1020 kcal |

AT

OT

# Metric 2: Completeness

| Dish name | Veal meatball | Duck breast |
|---|---|---|
| Picture | | |
| Price | 7.20 CHF | 8.80 CHF |
| Calories | 680 kcal | 1020 kcal |
| Protein | 27 g | 43 g |
| Fat | 35 g | 90 g |
| Carbohydrate | 67 g | 99 g |
| Cholesterol | 10 mg | 218 mg |
| Sodium | 1205 mg | 90 mg |

# Metric 3: Weighting (CV)

Name
Picture
Price
Fat
Carbohydrates
Salt
Energy
Cholesterol
Protein

- Weighted additive linear model (WADD): decision maker has to multiply each attribute value with its subjective weight, then the decision maker sums up these weighted attribute values. This process is repeated for each option. Finally the decision makers chooses the option with the highest resulting sum (Payne et al., 1993).

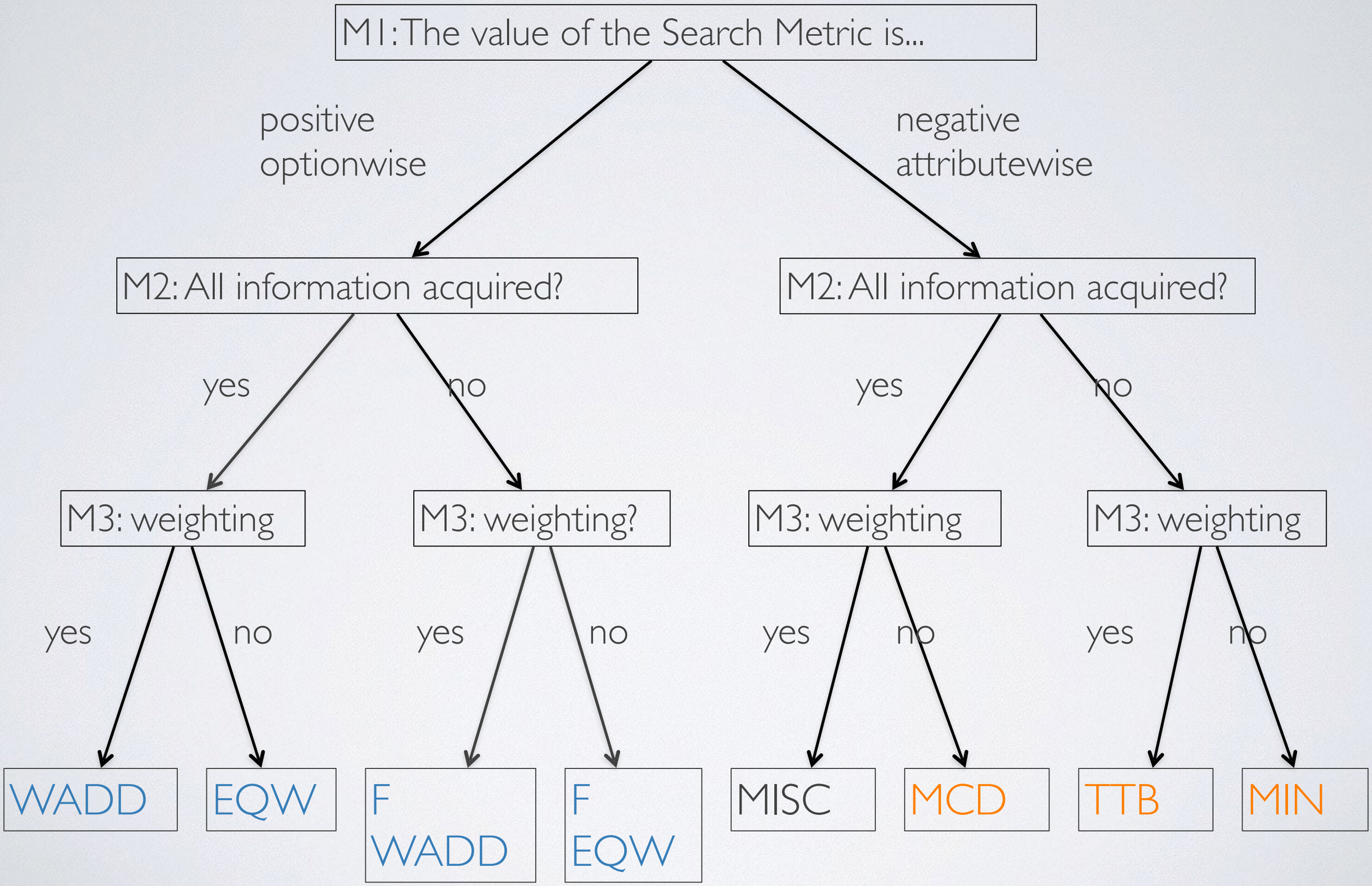
- Equal weights (EQW): decision maker sums up attribute values with all attributes being equally important. Decision makers choose the option with the highest resulting sum. EQW is similar to WADD, but ignores the attributes' weights (Dawes, 1979).

- FrugalWADD / FrugalEQW same as WADD/EQW but without looking at all available information

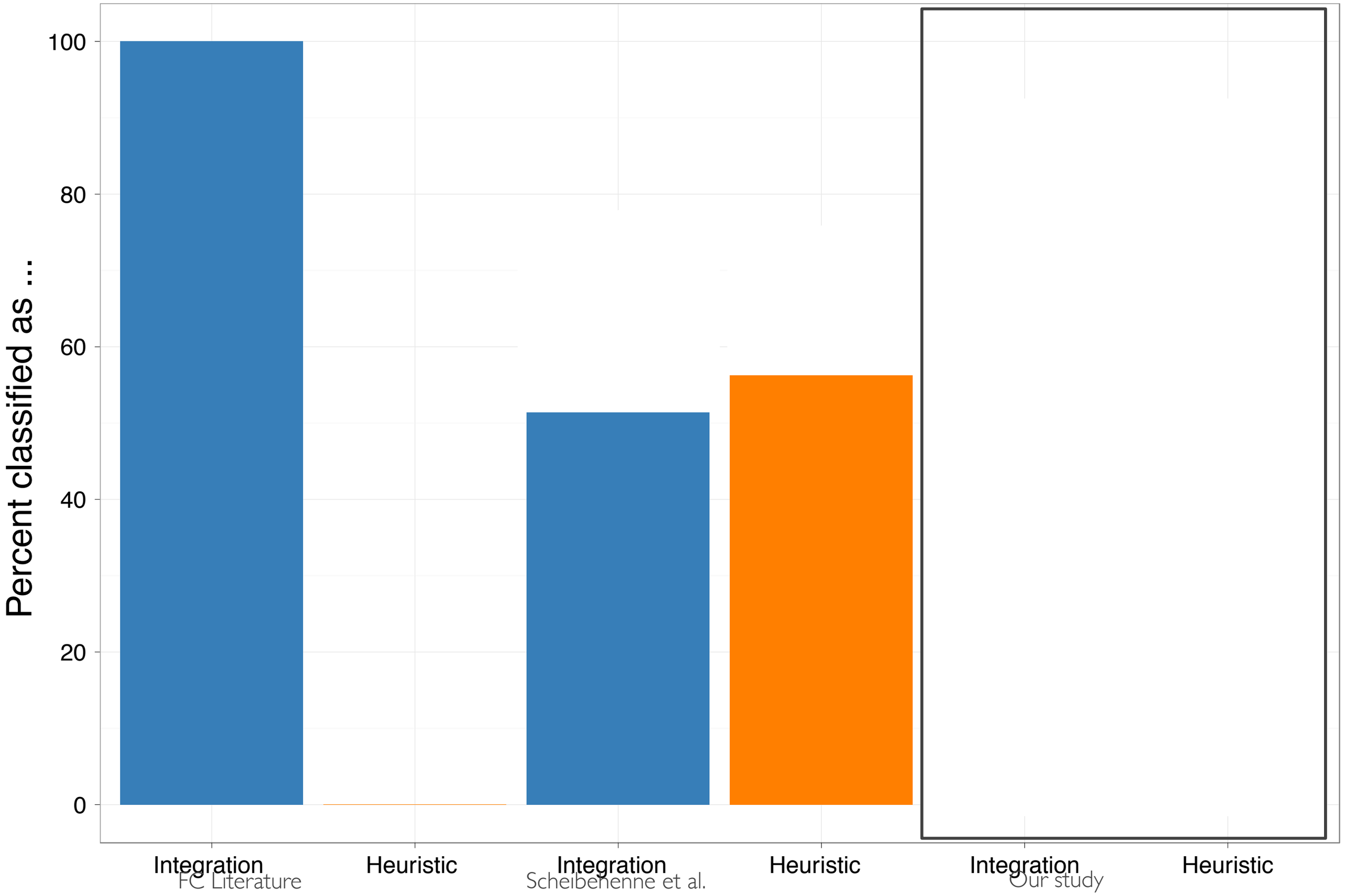
- Take the Best (TTB): decision maker has to multiply each attribute value with its subjective weight. Then the decision maker chooses the option with the highest value on the most important attribute. When the values on the most important attribute do not differ, decision makers switch to the second most important attribute and so on (Gigerenzer & Goldstein, 1996).

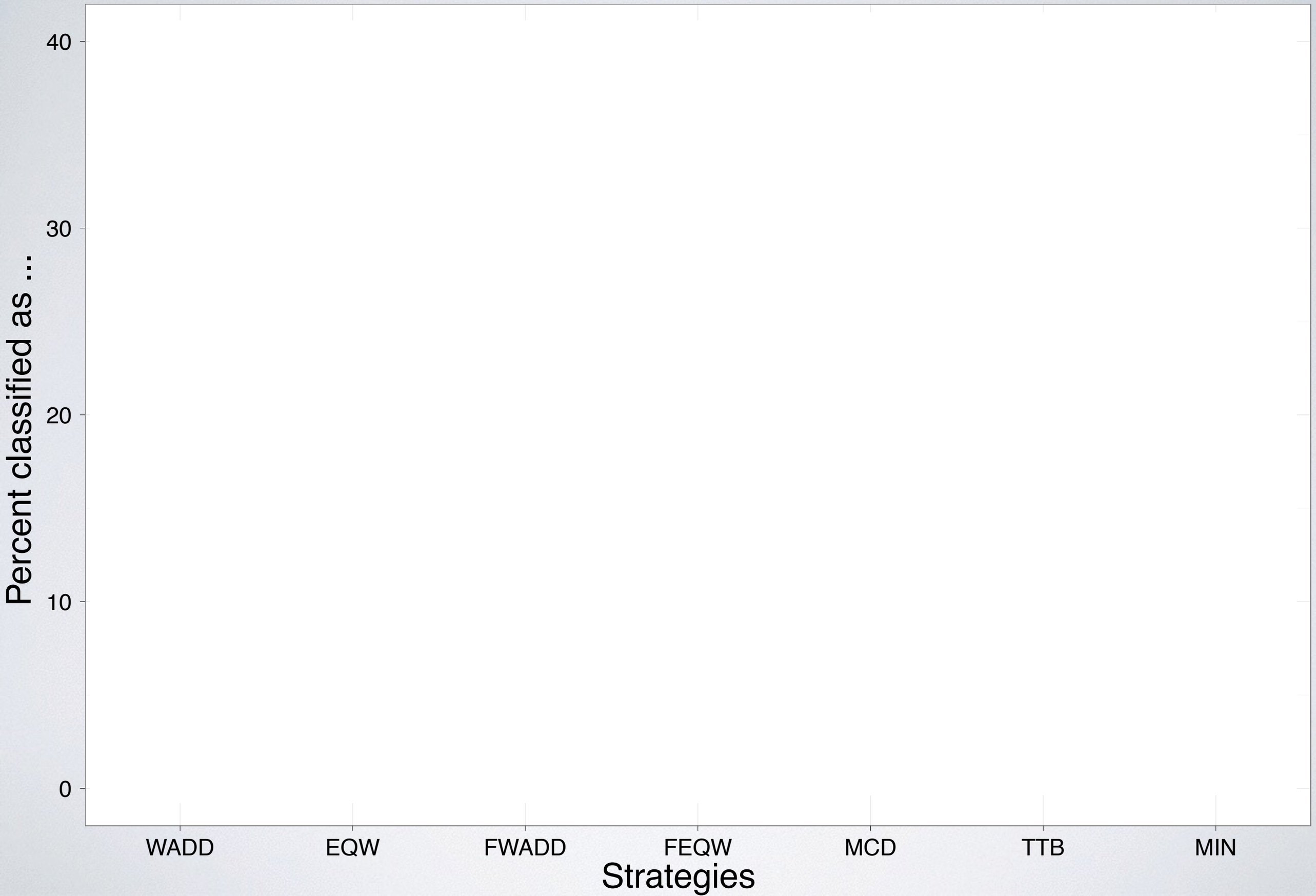
- Minimalist (MIN): decision maker selects one attribute randomly and chooses the option with the highest value on this attribute. When the values on the selected attribute do not differ, decision makers randomly switch to the next attribute and so on. MIN is similar to TTB but ignores the attributes' ranking (Gigerenzer & Goldstein, 1996).

- Majority of conforming dimensions (MCD): decision maker counts the number of superior attributes on each alternative, chooses the winner (Russo & Dosher, 1983)


M1: The value of the Search Metric is...
positive
optionwise
negative
attributewise
M2: All information acquired?
M2: All information acquired?
yes
no
yes
no
M3: weighting
M3: weighting?
M3: weighting
M3: weighting
yes
no
yes
no
yes
no
yes
no
WADD
EQW
F
WADD
F
EQW
MISC
MCD
TTB
MIN

# Predictions + Results




Percent classified as ...
40
30
20
10
0
WADD
EQW
FWADD
FEQW
MCD
TTB
MIN
Strategies

| Dish name | Veal meatball | Duck breast |
| --- | --- | --- |
| Picture |  |  |
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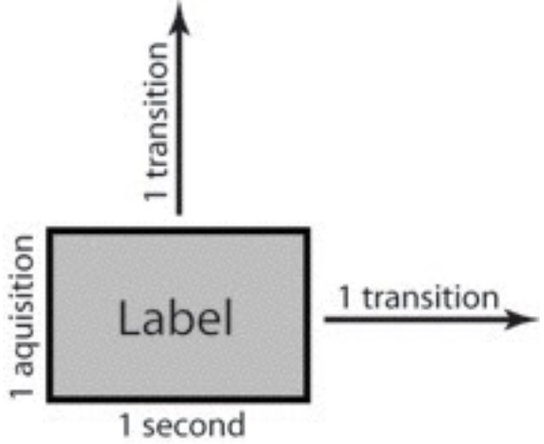
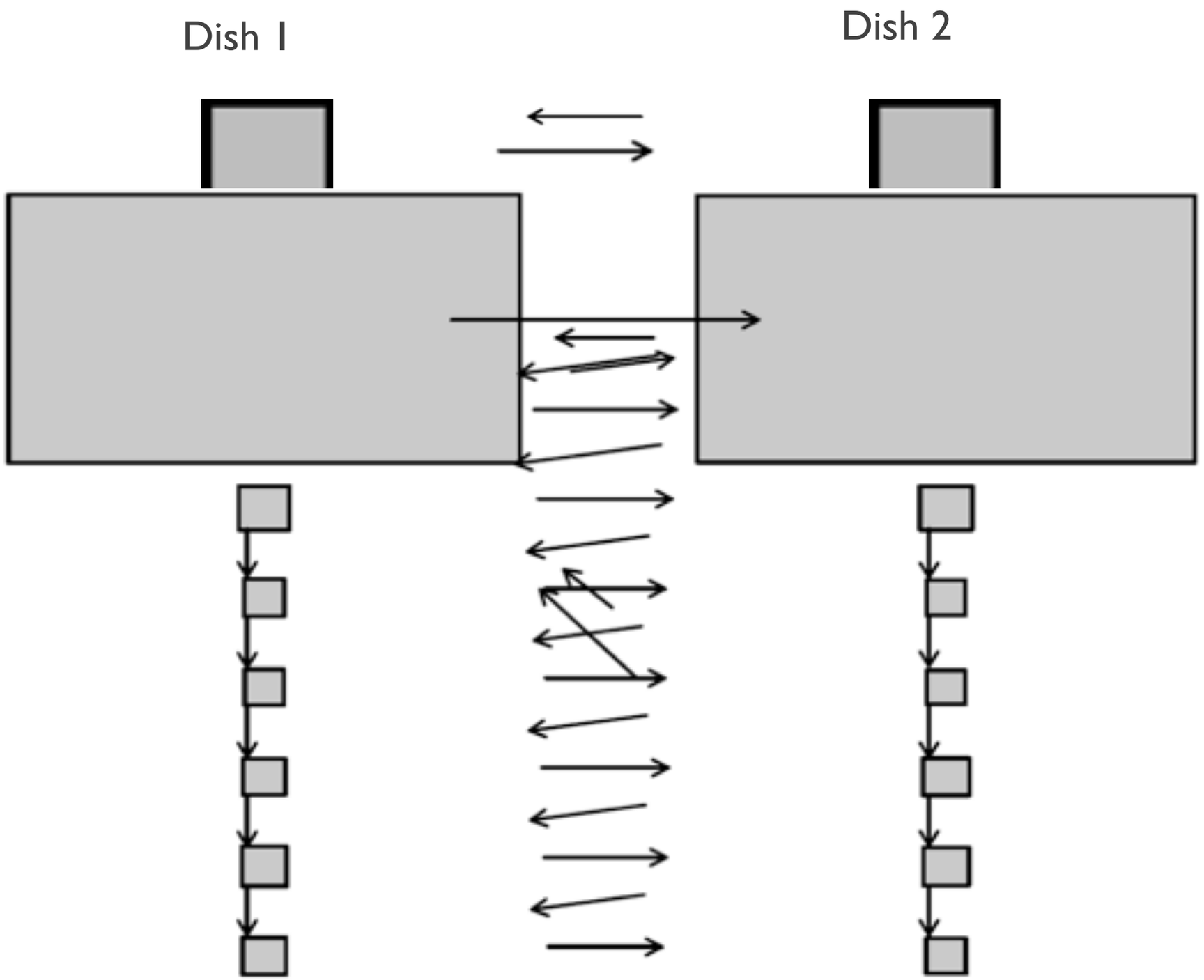
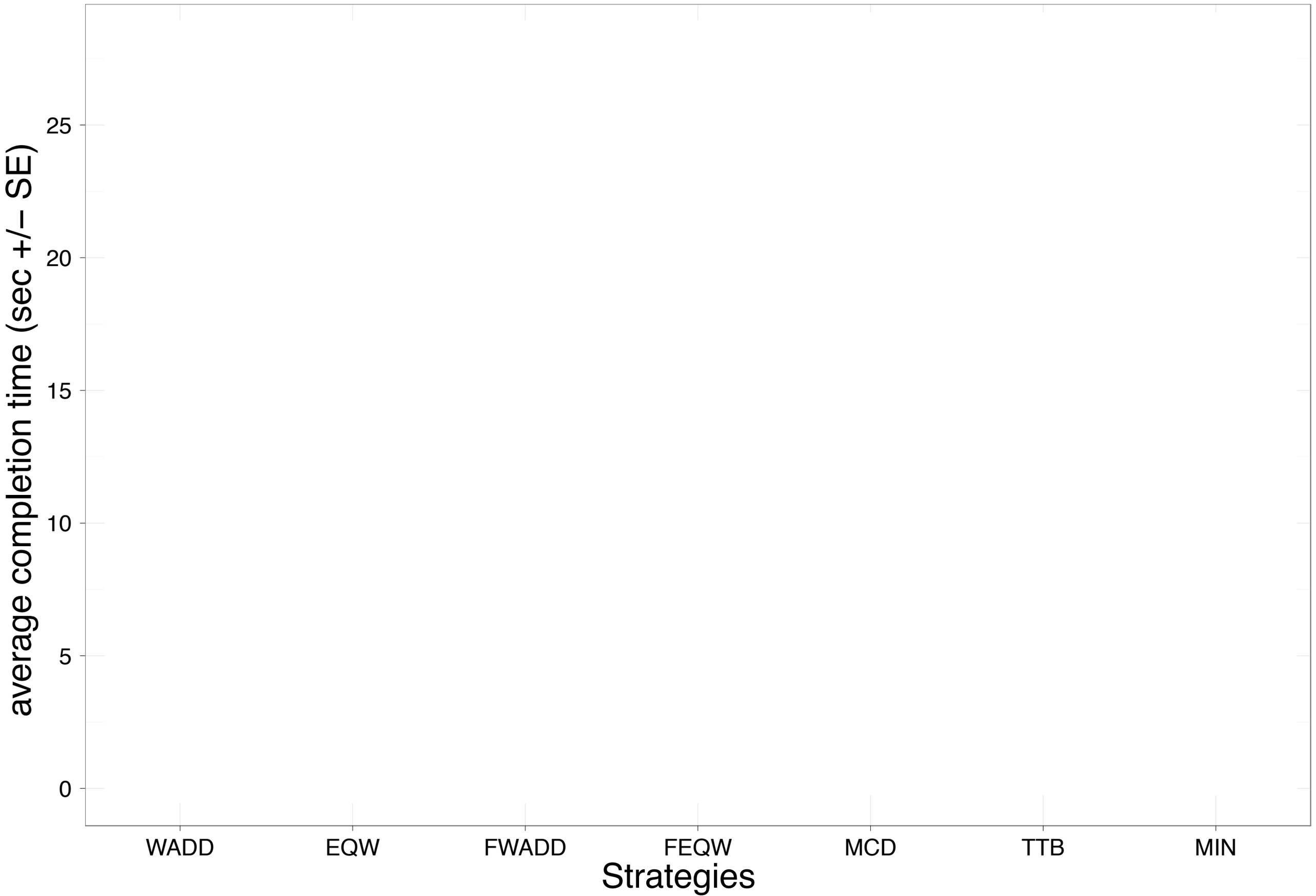
# Process data




| | |
|---|---|
| Name | 26% |
| Picture | 52% |
| Price | 9% |
| Fat | |
| Carbohydrates | |
| Salt | |
| Energy | |
| Cholesterol | |
| Protein | |


average completion time (sec +/– SE)
0
5
10
15
20
25
WADD
EQW
FWADD
FEQW
MCD
TTB
MIN
Strategies

Emanuel de Bellis

Ralph Hertwig

Matthias Sohn

Schulte-Mecklenbeck, M., Sohn, M., de Bellis, E., & Hertwig, R. (2013). A lack of appetite for information and computation. Simple heuristics in food choice.

# Gambles

The Priority Heuristic (Brandst¨atter, Hertwig & Gigerenzer, 2006) describes a set of rules to solve two-(multiple) option gambles

Additionally a detailed description of a process model is provided.

We ran a Mouselab study to test the predictions of this process model (Johnson, Schulte-Mecklenbeck & Willemsen, in press)

‘The Priority Heuristic is intended to model both choice and process ... . As a consequence it can be tested on two levels: choice and process.’ (Brandst¨atter et al., 2006)

‘We need to open the black box of decision making and come up with some completely new and fresh modeling devices.’ (Rubinstein, 2003)

‘We believe that process models of heuristics are key to opening up this black box.’ (Johnson, et al., 2007)

Priority rule: Consider reasons in the order: minimum gain, probability of minimum gain, maximum gain

| | | | | |
|---|---|---|---|---|
| **Gamble A:** | **$3000** | **.75** | **$7000** | **.25** |
| **Gamble B:** | **$2800** | **.80** | **$5000** | **.20** |

Priority rule: Consider reasons in the order: minimum gain, probability of minimum gain, maximum gain

| | | | | | |
|---|---|---|---|---|---|
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|---|---|---|---|---|---|---|
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| **Gamble B:** | $2800 | 1 | .80 | 2 | $5000 | .20 |

Priority rule: Consider reasons in the order: minimum gain, probability of minimum gain, maximum gain

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gamble A:** | $3000 | | .75 | | $7000 | 3 | .25 |
| **Gamble B:** | $2800 | 1 | .80 | 2 | $5000 | | .20 |

1. CALCULATE $\frac{1}{10} * W_a^{max}$

[aspiration level]

2. ESTIMATE DIFFERENCE $W_a^{min}, W_b^{min}$

[1 reason]

3. IF (2) $\geq$ (1) THEN stop ELSE

[stopping rule]

4. ESTIMATE DIFFERENCE $P_a^{min}, P_b^{min}$

[2 reasons]

5. IF (4) $\geq$ .10 THEN stop ELSE (6)

[stopping rule]

6. CHOOSE based on attractiveness $(W_a^{max}, W_b^{max})$

[3 reasons]

# Our sample

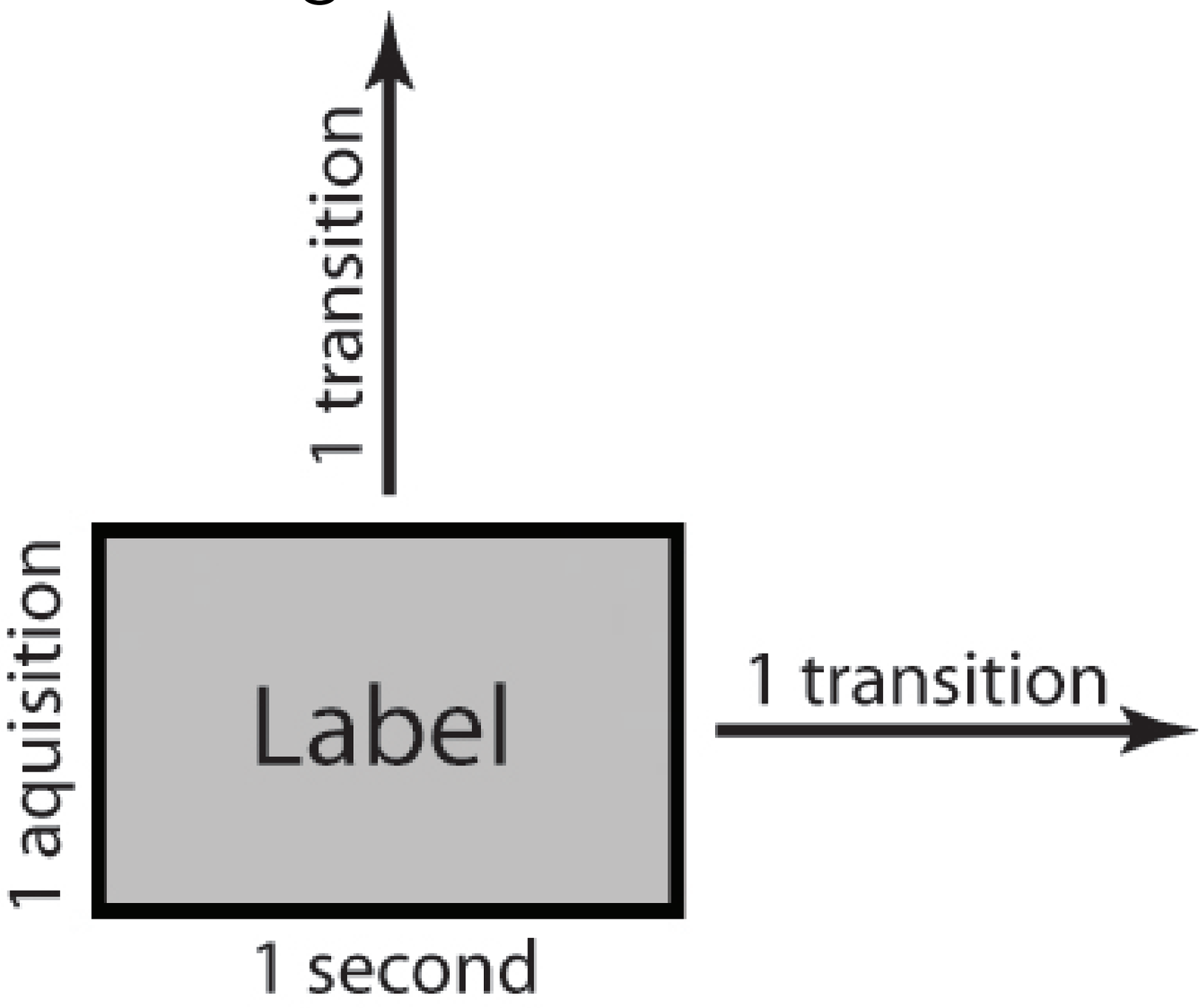
Seventy-seven participants, each made 8 choices
Everything that could be counterbalanced, was
Horizontal and vertical formats
Trained in interface, definition of a gamble, tested for understanding
Participants studied each gamble 21 seconds (on average)
Opened boxes 26.7 times (per gamble)

| | Amount to Win | Probability of that amount | Amount to Win | Probability of that amount |
|---|---|---|---|---|
| **Gamble A:** | $Wa_1$ | $Pa_1$ | $4000 | $Pa_2$ |
| **Gamble B:** | $Wb_1$ | $Pb_1$ | $Wb_2$ | $Pb_2$ |

I choose Gamble A

I choose Gamble B

# Combining Clicks and Time:



READING PHASE

CHOICE PHASE

1 reason

Gamble A:

Gamble B:

---

3 reasons

Gamble A:

Gamble B:

# Three Hypotheses

- . 1 Reasons
  (a) For 1 reason choices: W mins should receive more attention, more comparisons
  (b) For 3 reason choices: Pmin, Wmax should receive more attention than in (a)

- . 2 Transitions
  between Ps and Ws should be rare

- . 3 Reading
  more attention to Ws (number, time); more transitions comparing Ws

READING PHASE

CHOICE PHASE

1 reason

Gamble A:

Gamble B:

---

3 reasons

Gamble A:

Gamble B:

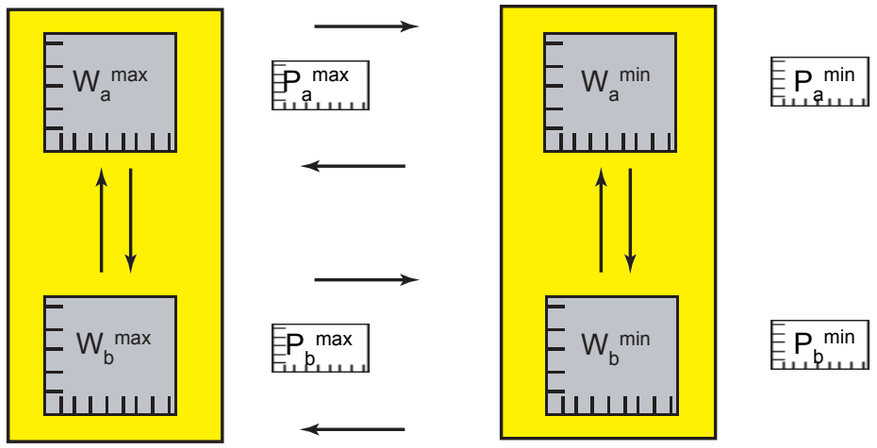
READING PHASE

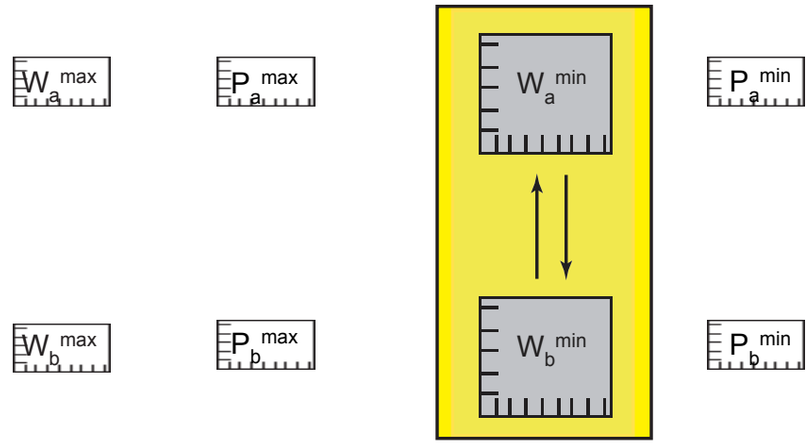
CHOICE PHASE

Gamble A:

Gamble B:

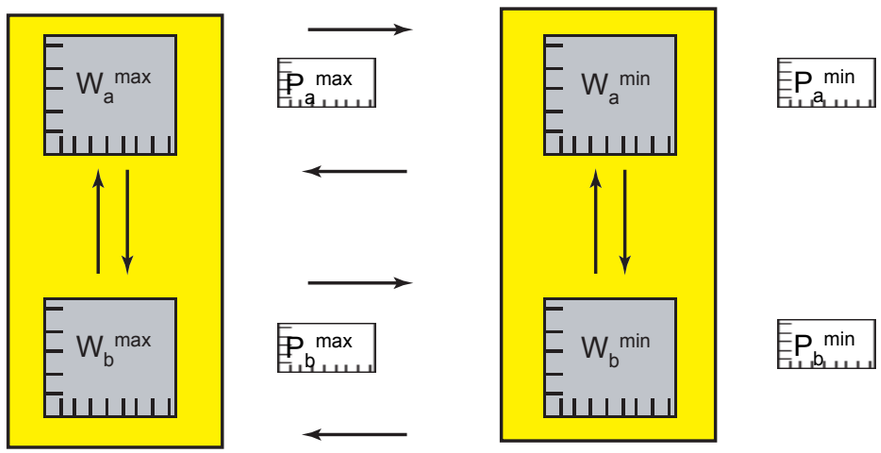
1 reason

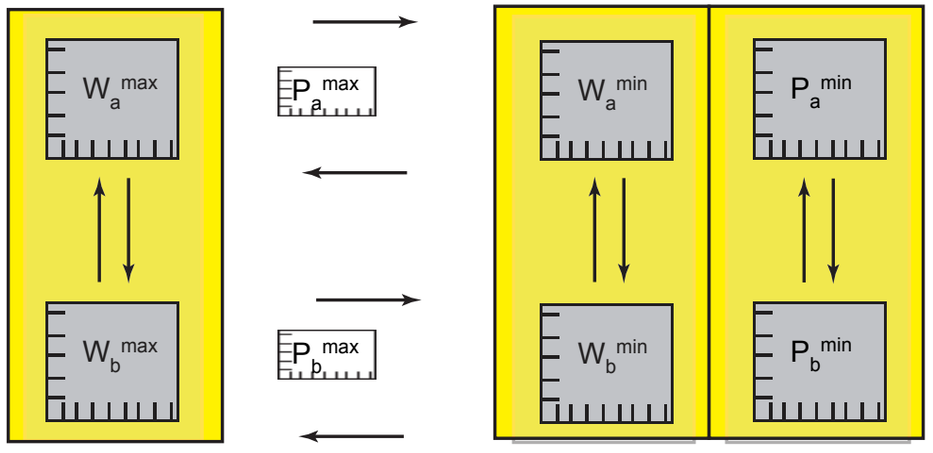



Step (4)

3 reasons




Step (7)

Step (4)

Step (6)

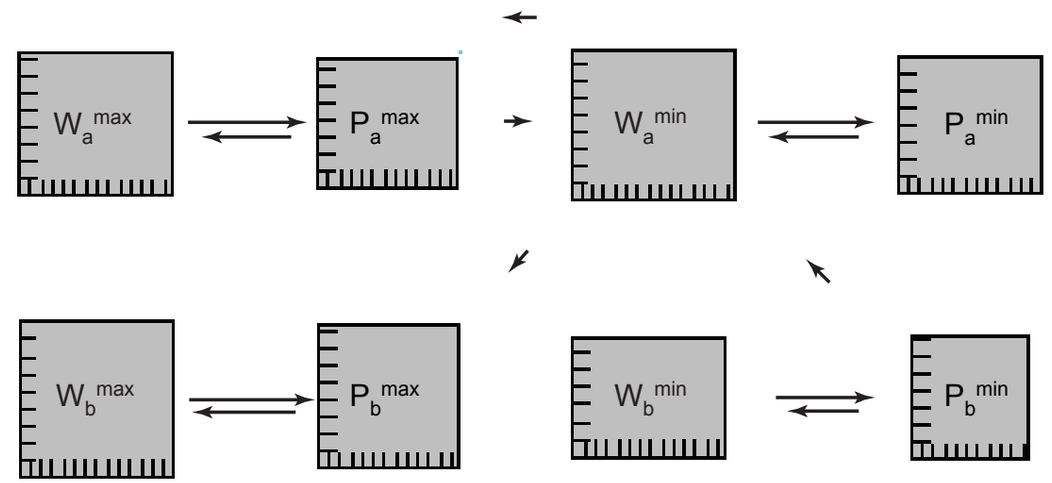
READING PHASE

CHOICE PHASE

1 reason

Gamble A:

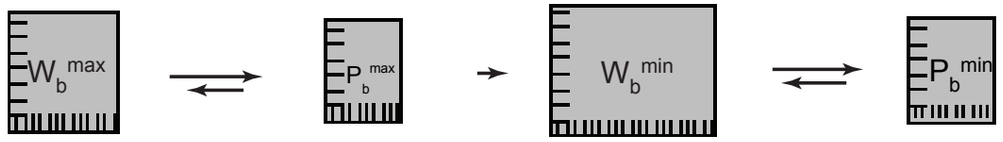

Gamble B:

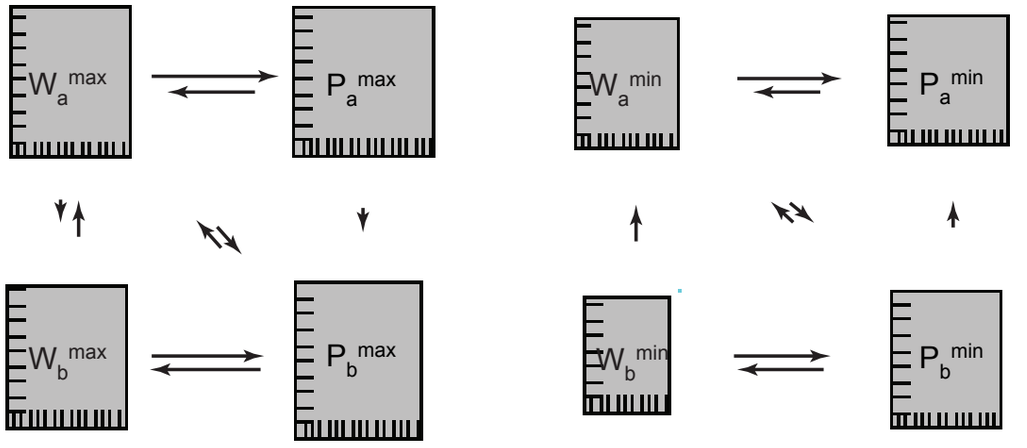




3 reasons

Gamble A:


Gamble B:



Reasons

(a) For 1 reason choices, W mins should receive more attention: no support

(b) For 3 reason choices, Pmin, Wmax should receive more attention: supported

Transitions: no support

3 Reading

More attention to Wins (number, time): supported

More transitions comparing Wins: no support

The probability-payoff transition is the single strongest feature of this data

The priority heuristic posits a process model for choice and suggests specific steps - we find mixed evidence for this model

Process tracing methods enables us to get a better understanding of human decision making and build better models

# Datalyser

# MouselabWEB Datalyser

**Part of MouselabWEB, version 1.00beta**

This screen enables you to download data in CSV (comma separated values) format. This is a textfile format in which each field is enclosed in brackets (") and separated by commas. Such a file can be read by most statistical programs. If the **unpack events** box is checked, the program will unpack the process data (whether it is in XML or CSV format in the database) into a list of events.

The **download and process selected** button allows to download processed data that can be analyzed directly. It will delete acquisitions below the threshold, will calculate time and frequency columns for each box on the screen, and will summarize data in divisions.

**Disclaimer: The processing module has not been checked extensively for the 1.00beta version! Check whether the output is consistent with the event files.**

The **Show Table** button allows you to look at the data in one table, either unpacked or as is. The **Playback** allows for playback of participants in one of the experiments. This button wil open a new page in which you can select a participant from the list.

**Password:** For any action you do on this page, a password is required. Type the password before pressing a button. This prevents unauthorized users that browse to this page from actually reading your data!

| Experiment name | Download | Show data | Play back |
|---|---|---|---|
| Lego | ☑ | Show Table | Replay |
| | sel all Reset sel Invert sel | | |
| Password: ••••• | download selected<br>☑ Unpack events | | |
| | download and process selected<br>Threshold (ms) 0<br>divisions (1=all, 2=halfs ect.): 1 | | |

| Experiment name | Download | Show data | Play back |
| --- | --- | --- | --- |
| Lego | ☑ | Show Table | Replay |
| | sel all Reset sel Invert sel | | |
| Password: ••••• | download selected<br>☑ Unpack events | | |
| | download and process selected<br>Threshold (ms) 0<br>divisions (1=all, 2=halfs ect.): 1 | | |