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 5 / 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?

Gambles

The Priority Heuristic (Brandstätter, 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, 2008)

‘The Priority Heuristic is intended to model both choice and process ... . As a consequence it can be tested on two levels: choice and process.’ (Brandstätter 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., 2008)

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

Gamble A:	$3000		.75	$7000	.25
Gamble B:	$2800	1	.80	$5000	.20

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

Gamble A:	$3000		.75		$7000	.25
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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]

Setup

Seventy-seven participants, each made 8 choices

Everything that could be counterbalanced, was counterbalanced

Horizontal and vertical formats

Trained in interface, definition of a gamble, tested for understanding

Participants studied each gamble 21 seconds (on average)

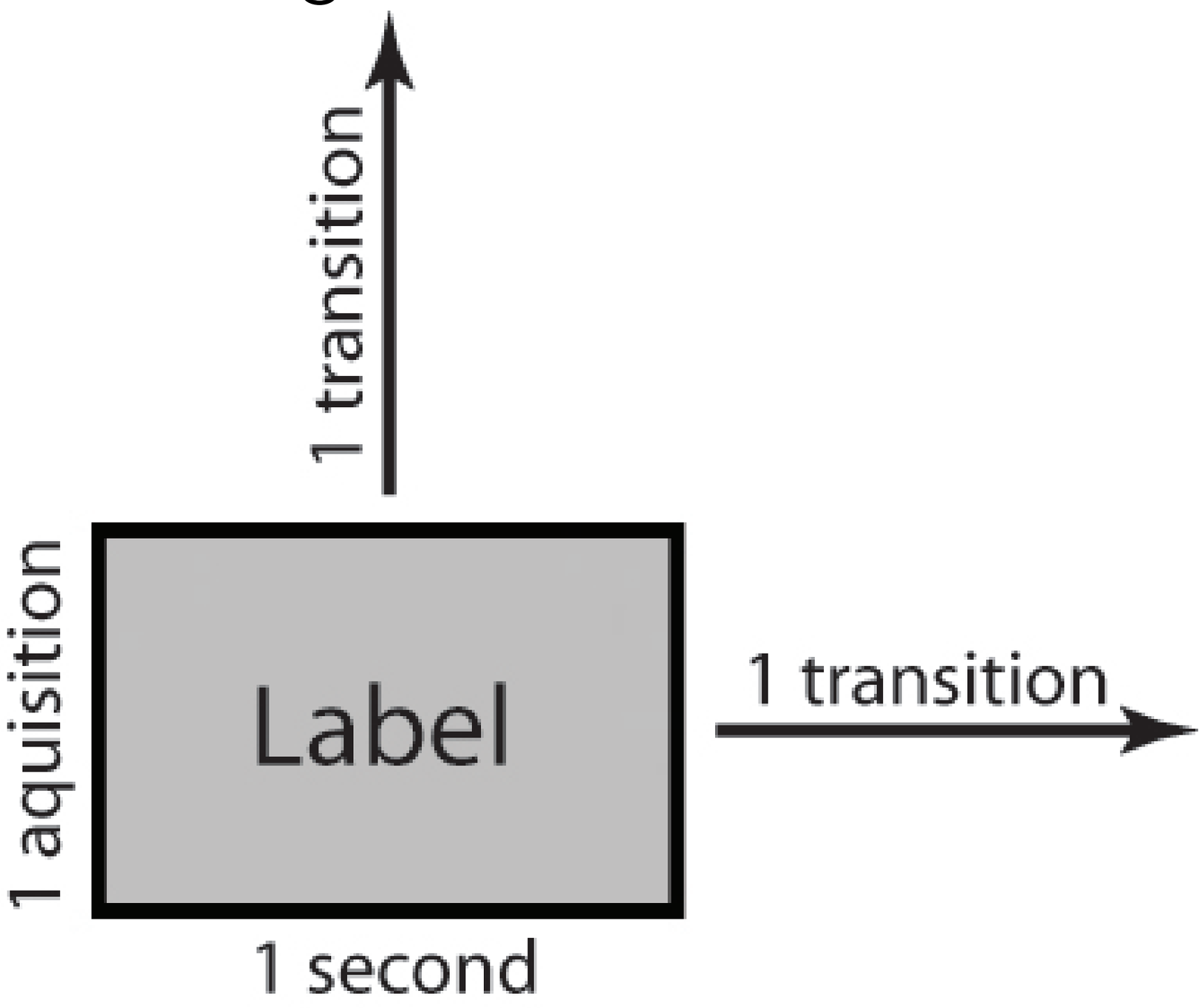
Opened boxes 26.7 times (per gamble)

	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:



Three Hypotheses

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

- Transitions
  between Ps and Ws should be rare

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

READING PHASE

CHOICE PHASE

1 reason

Gamble A:

Gamble B:

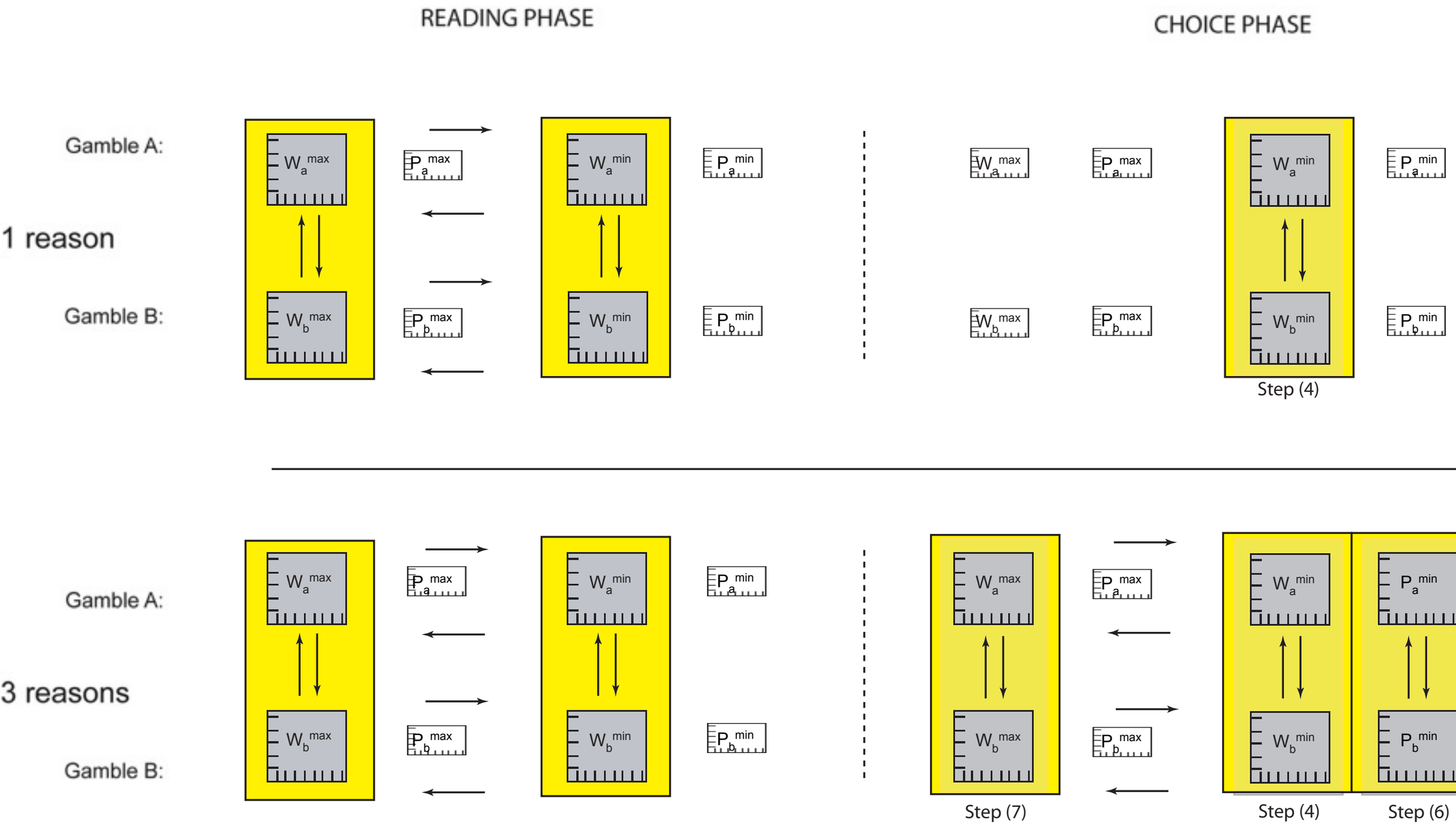
---

3 reasons

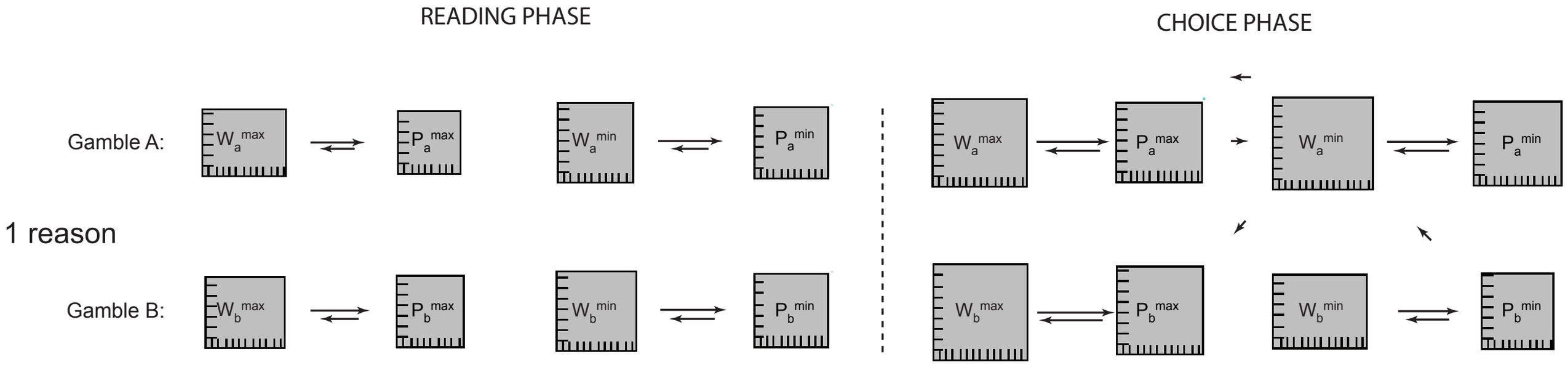
Gamble A:

Gamble B:

Predictions



Actual Data


READING PHASE
CHOICE PHASE
Gamble A:
Gamble B:
1 reason
3 reasons

Results

(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

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


200

How does food choice work?

taste

price

'through the *weighting* of various food choice motives'

Integration

sensory

of

convenience

'the decision will depend on how that food *scales on each of three* criteria:

all available

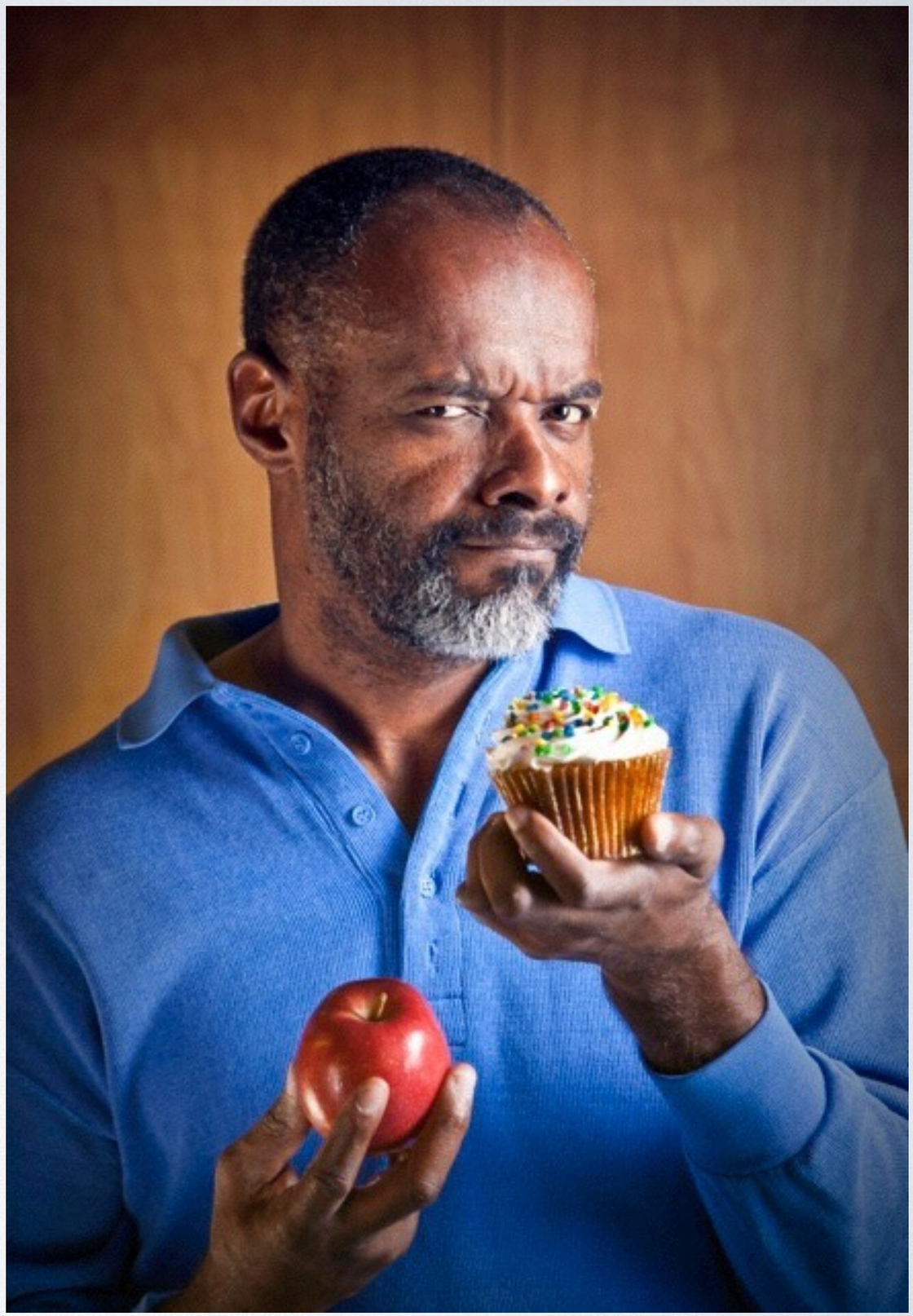
information

health

ethics

health, pleasure and weight control

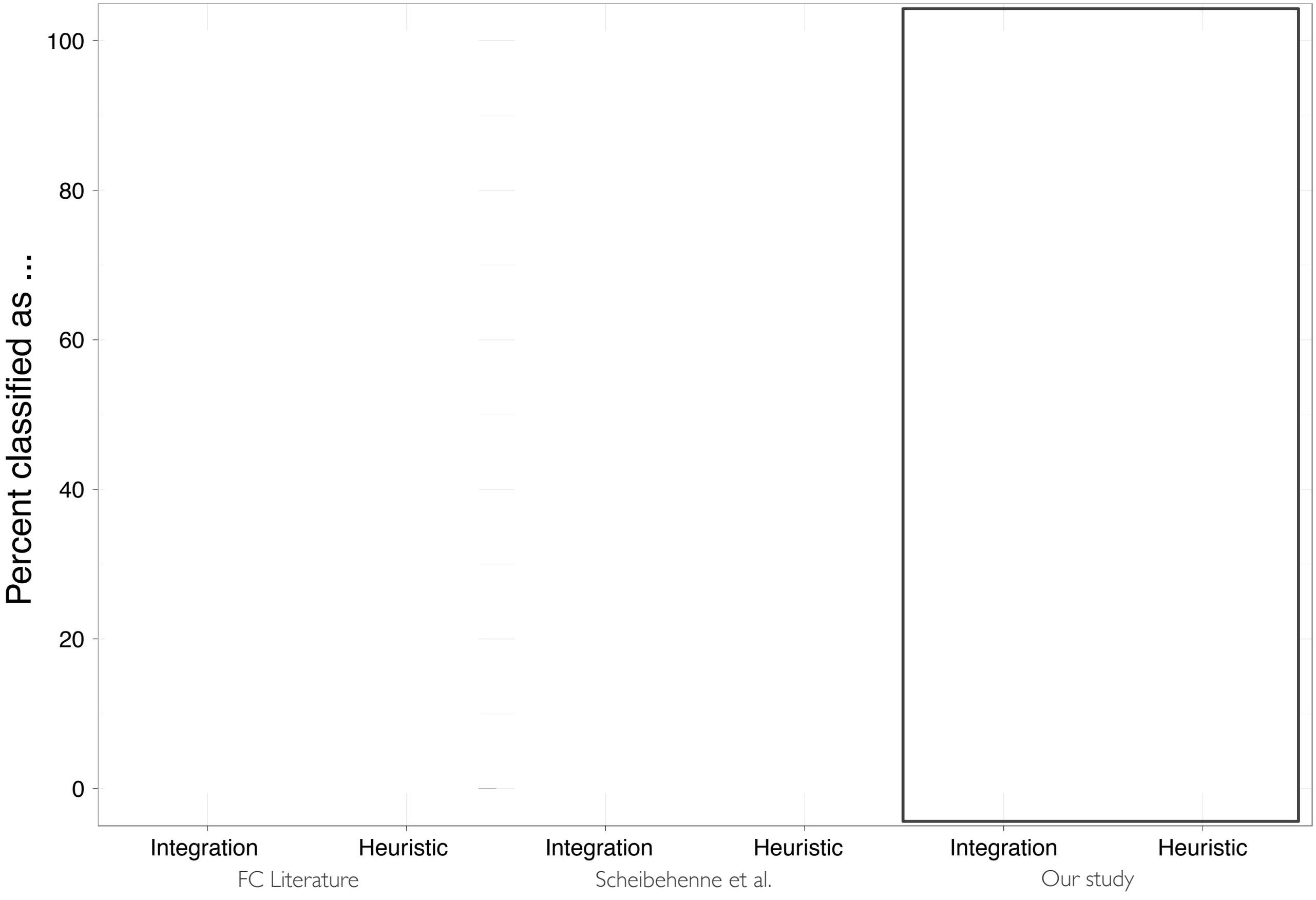
convenience



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
[b]Cognitive Science Program, Indiana University, 1101 E. 10th Street, Bloomington, IN 47405 USA

Received 16 January 2007; received in revised form 1 March 2007; accepted 26 March 2007

Output Data

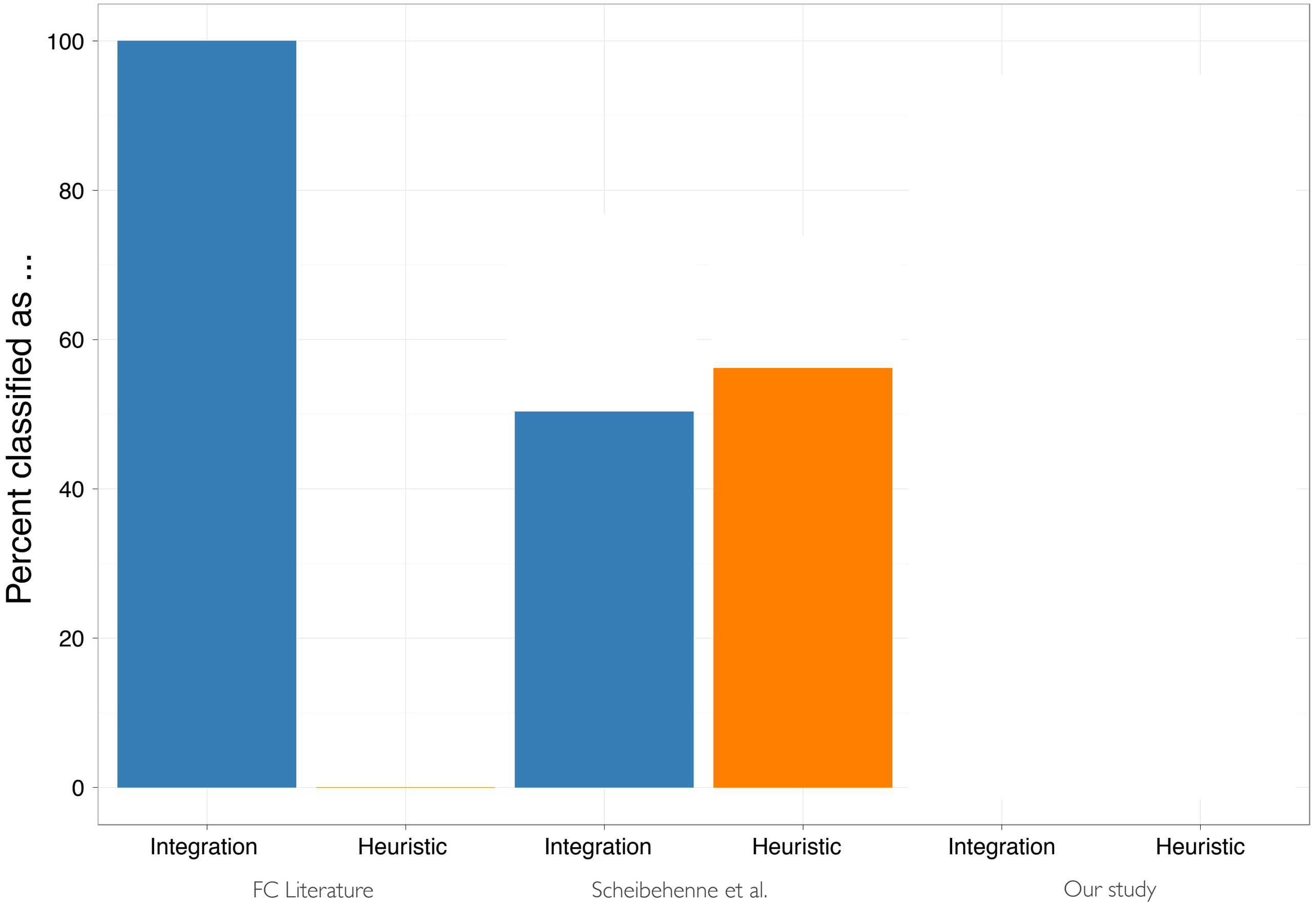
Input – Output

‘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)

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

Scheibehenne, Miesler, & Todd (2007)

Predictions + Results



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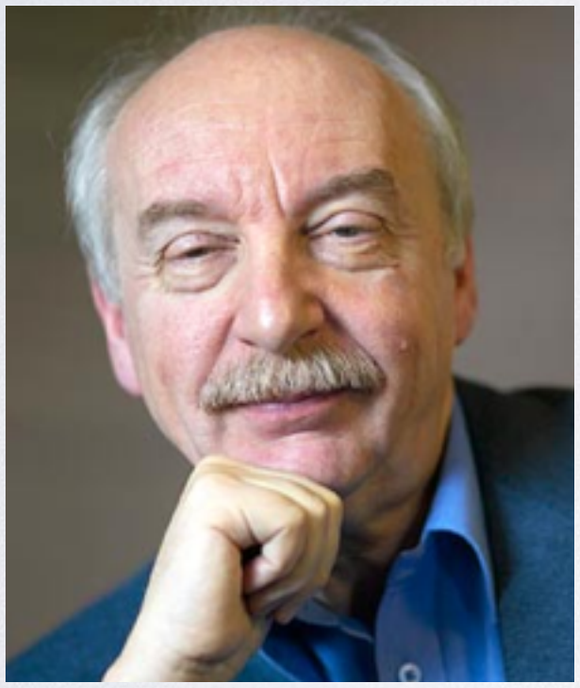
Abstract

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.

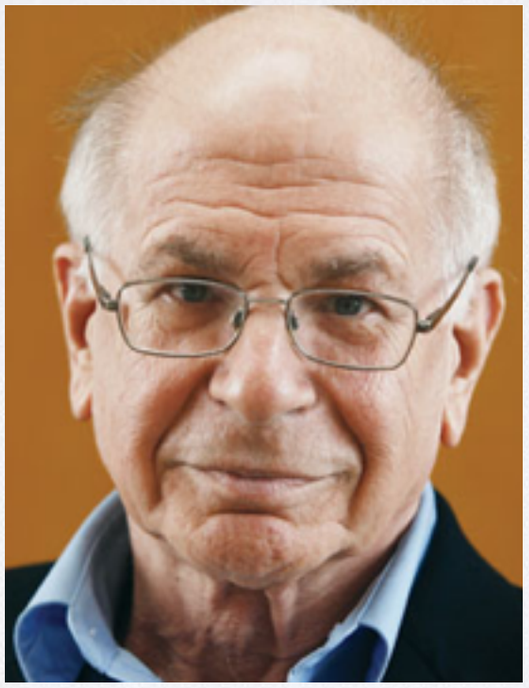
What are strategies one can find in food choice?
Comparison between LEX and WADD.

What are heuristics?

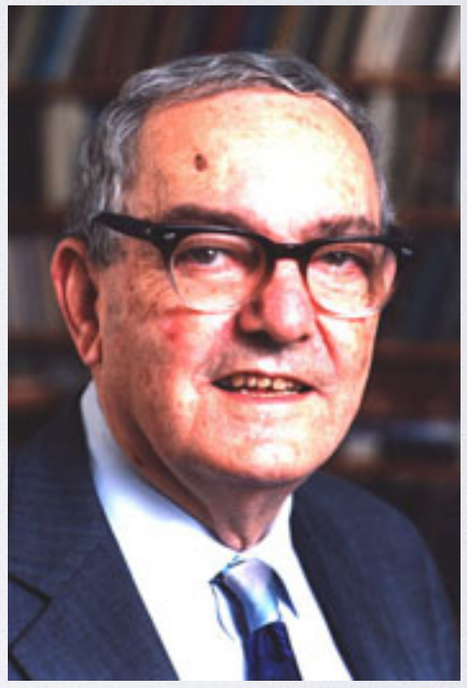
A heuristic is a strategy that ignores part of the information, with the goal of making decisions more quickly, frugally, and/or accurately than more complex models.



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

complex strategies

WADD - Weighted Additive

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

heuristic strategies

TTB – Take the Best

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

Company restaurant
~ 800 visitors every day

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 lllg	lllg	lllg	lllg	
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

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	318 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).

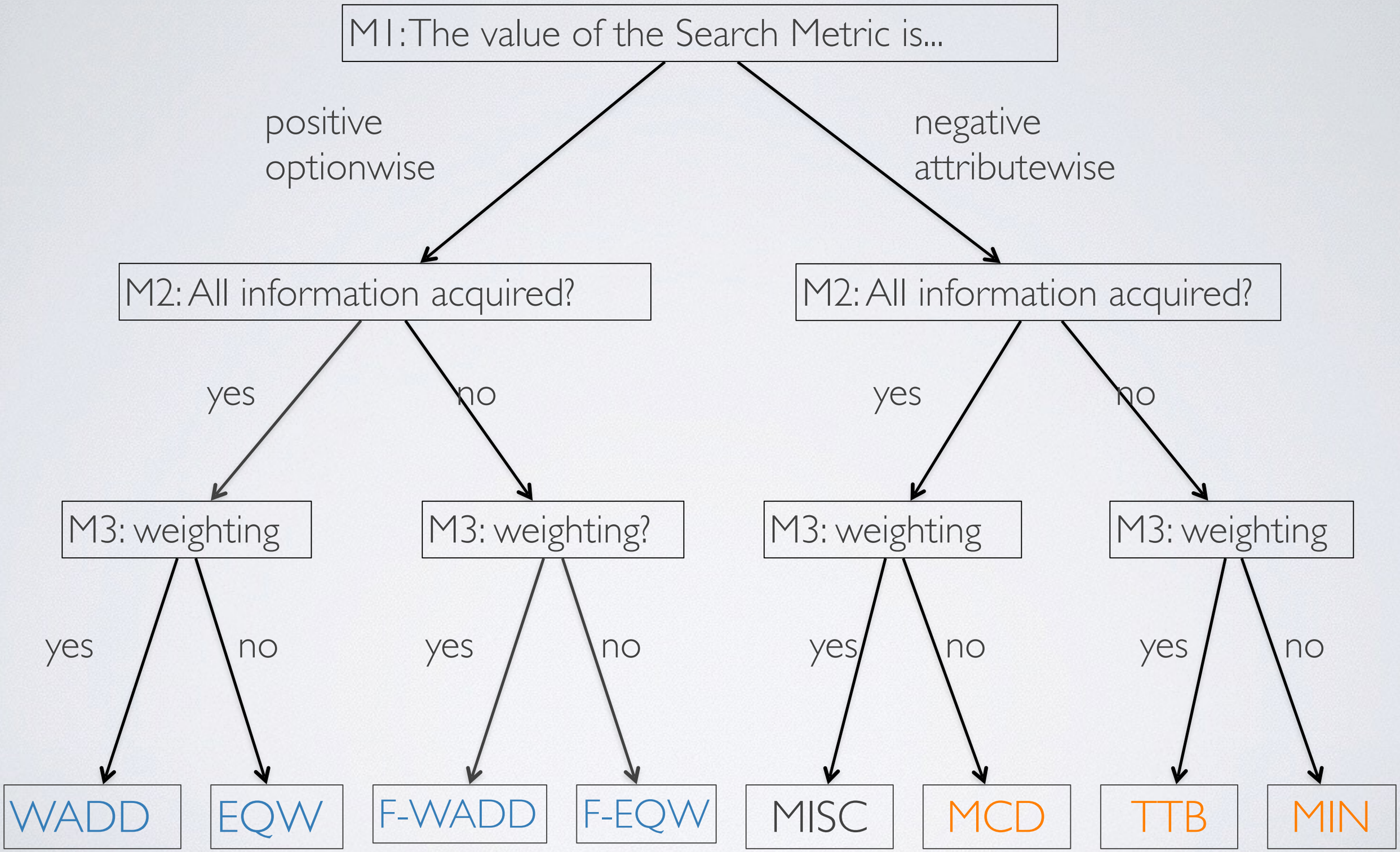
- **Equal weights (EQW)**: decision maker sums up attribute values with all attributes being equally important. Decision makers choose the option with the highest resulting sum. EQW is similar to WADD, but ignores the attributes' weights (Dawes, 1979).

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

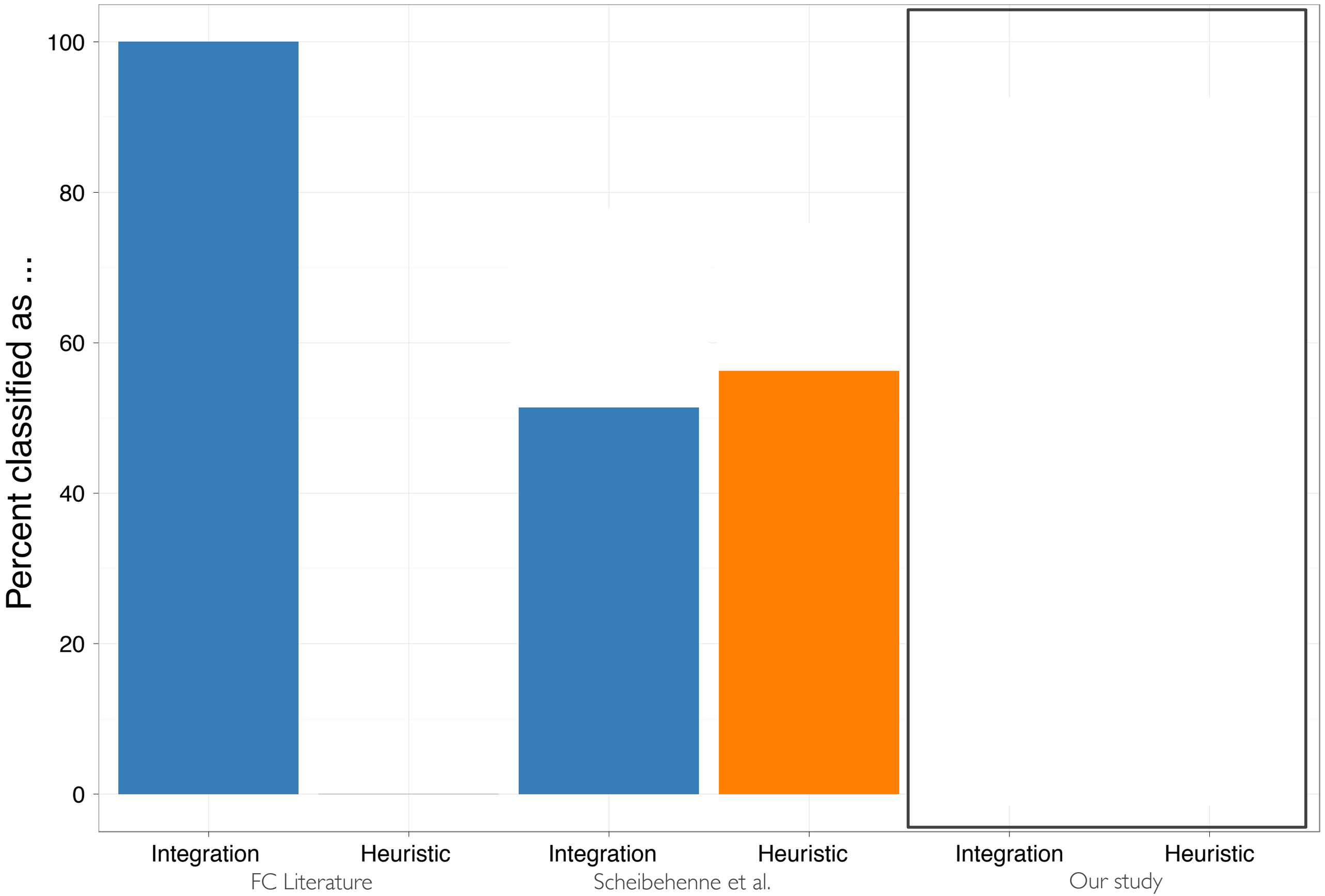
- **Take the Best (TTB)**: decision maker has to multiply each attribute value with its subjective weight. Then the decision maker chooses the option with the highest value on the most important attribute. When the values on the most important attribute do not differ, decision makers switch to the second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

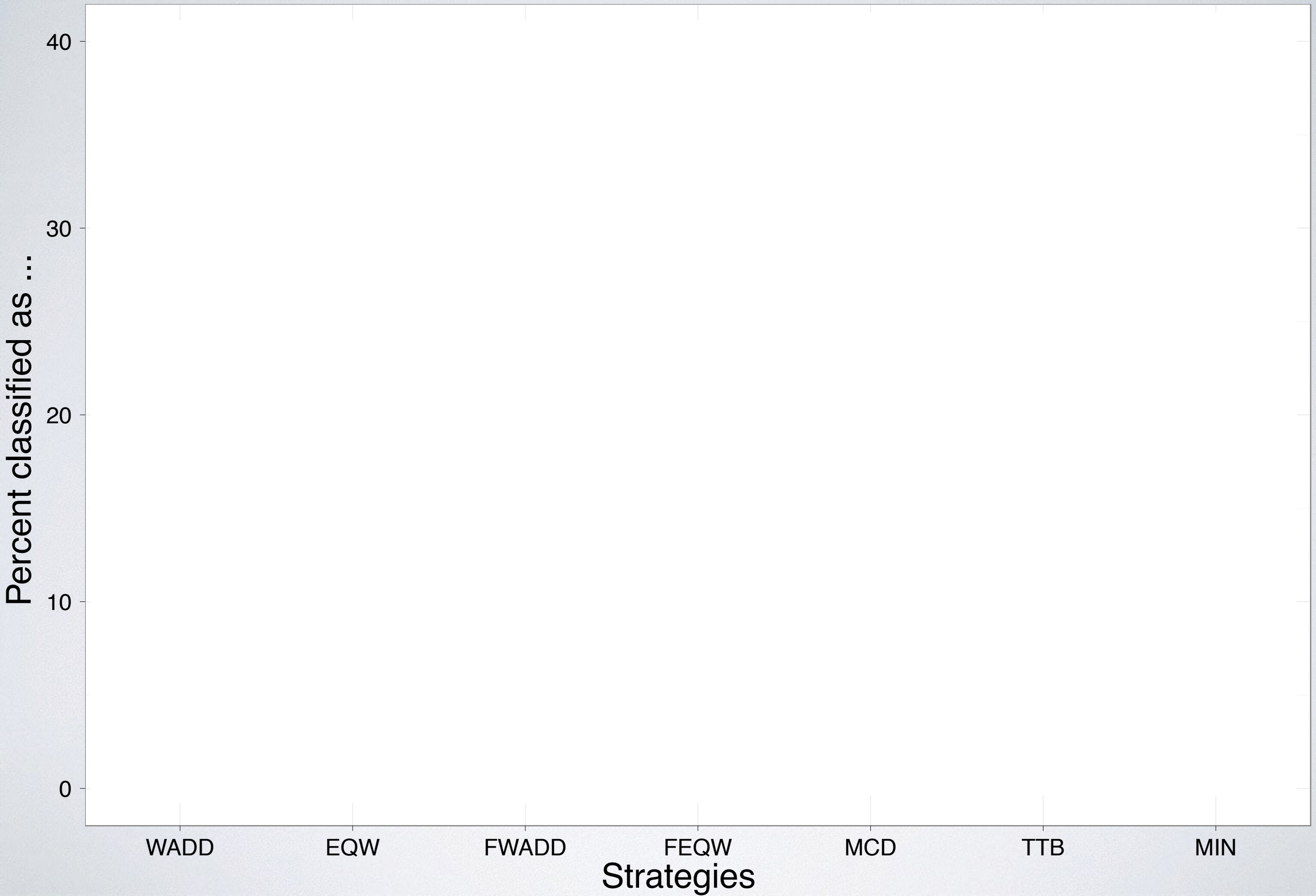
- **Minimalist (MIN)**: decision maker selects one attribute randomly and chooses the option with the highest value on this attribute. When the values on the selected attribute do not differ, decision makers randomly switch to the next attribute and so on. MIN is similar to TTB but ignores the attributes' 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		
Price	7.20 CHF	8.80 CHF
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Protein	27 g	43 g
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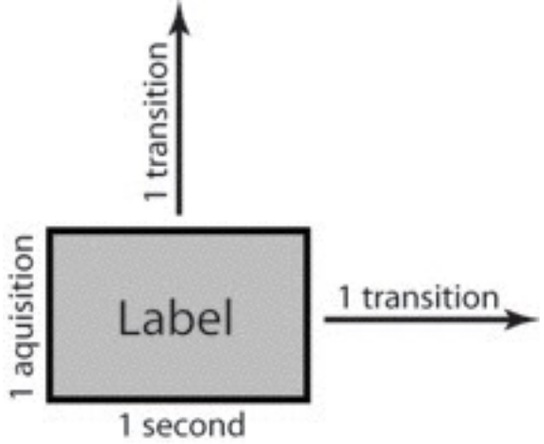
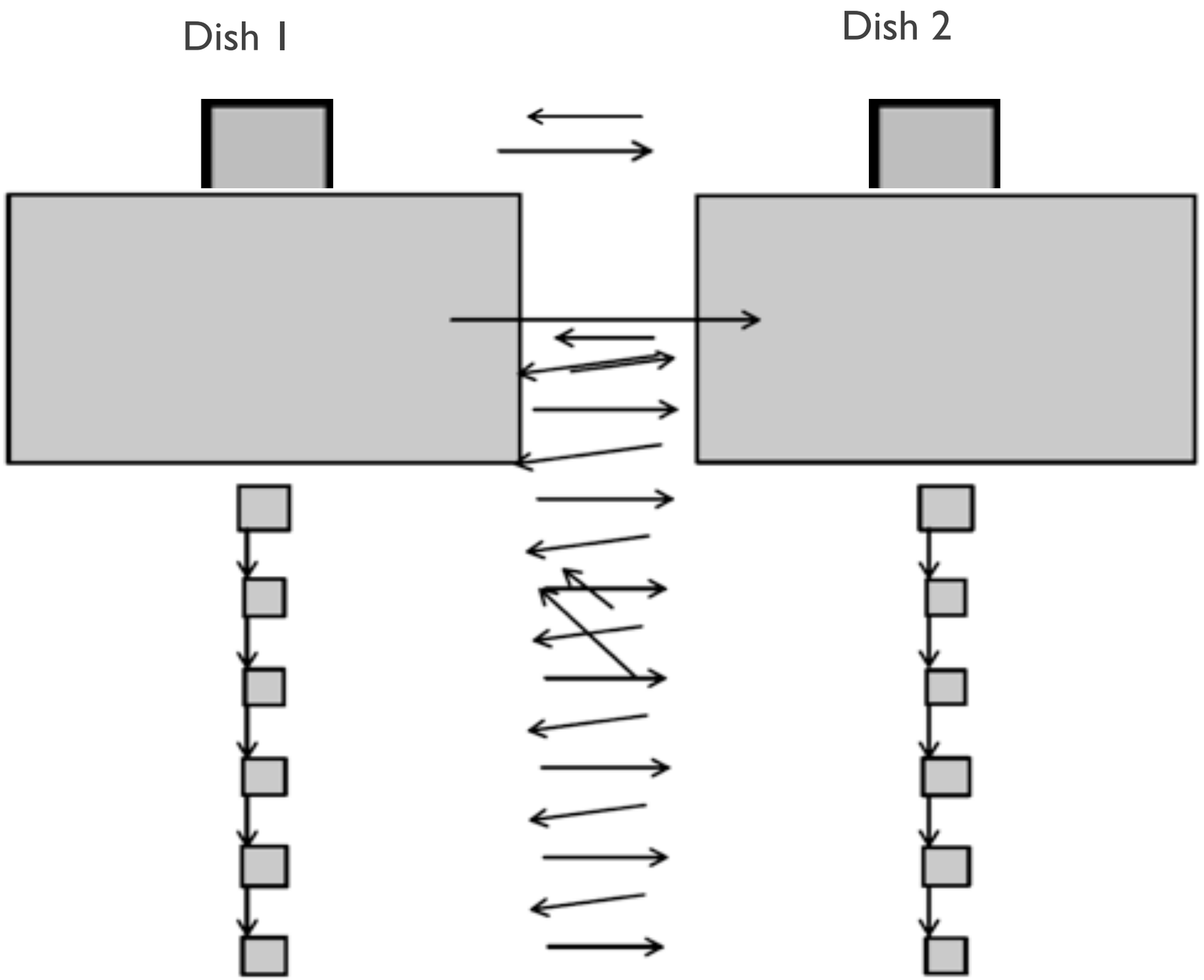
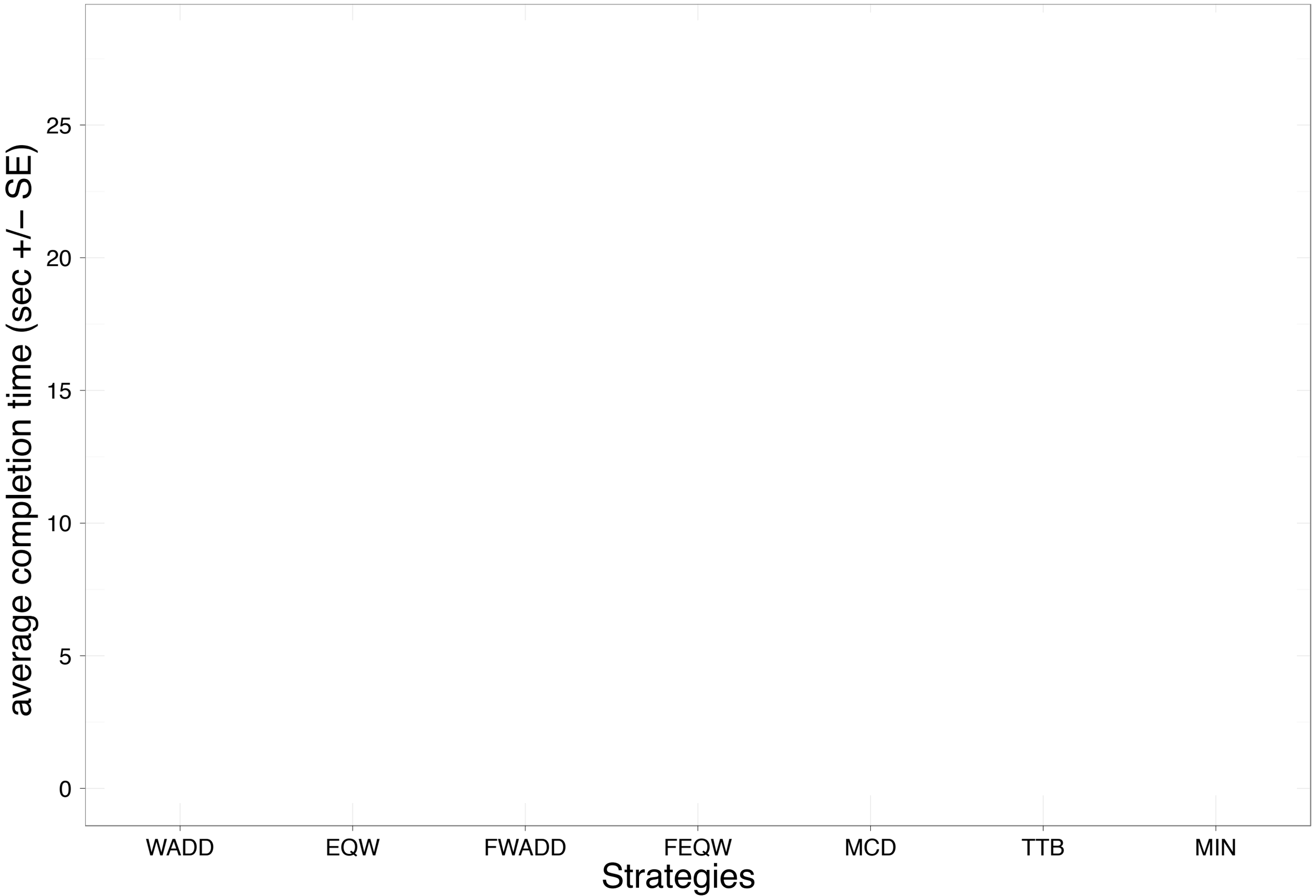
Carbohydrate	67 g	98 g
Cholesterol	10 mg	318 mg
Sodium	1205 mg	90 mg
	choose this dish	choose this dish

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

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.

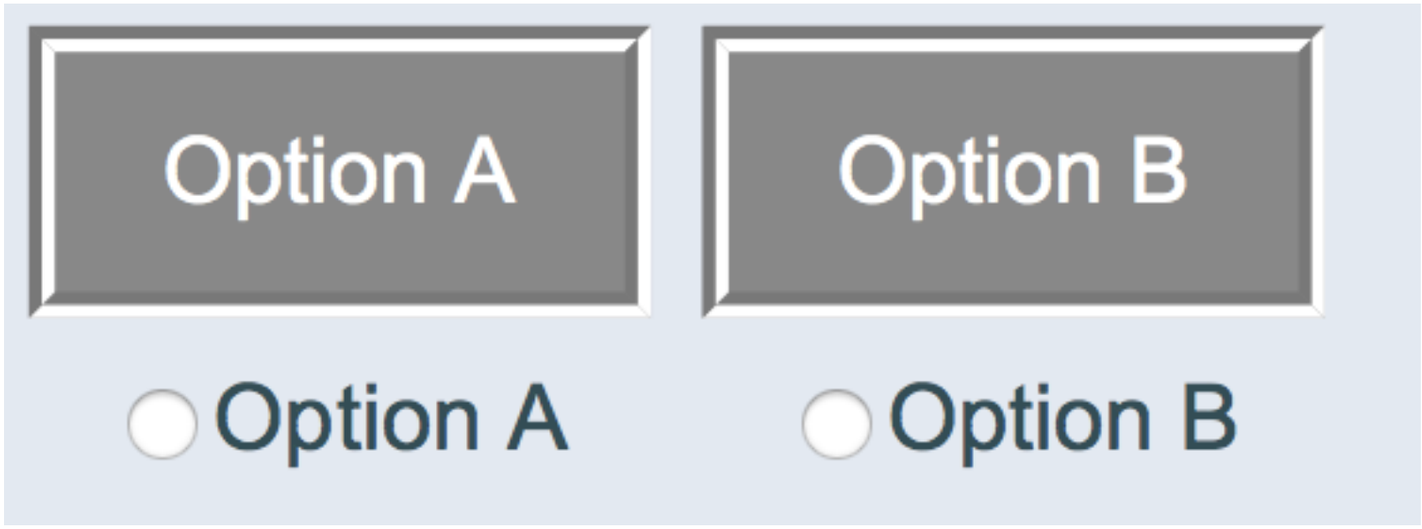
Disclaimer: The processing module has not been checked extensively for the 1.00beta version! Check whether the output is consistent with the event files.

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 ☑ Unpack events		
	download and process selected Threshold (ms) 0 divisions (1=all, 2=halfs ect.): 1		

comes as part of the MouselabWeb package - datalyser.php


Option A
Option B
Option A
Option B

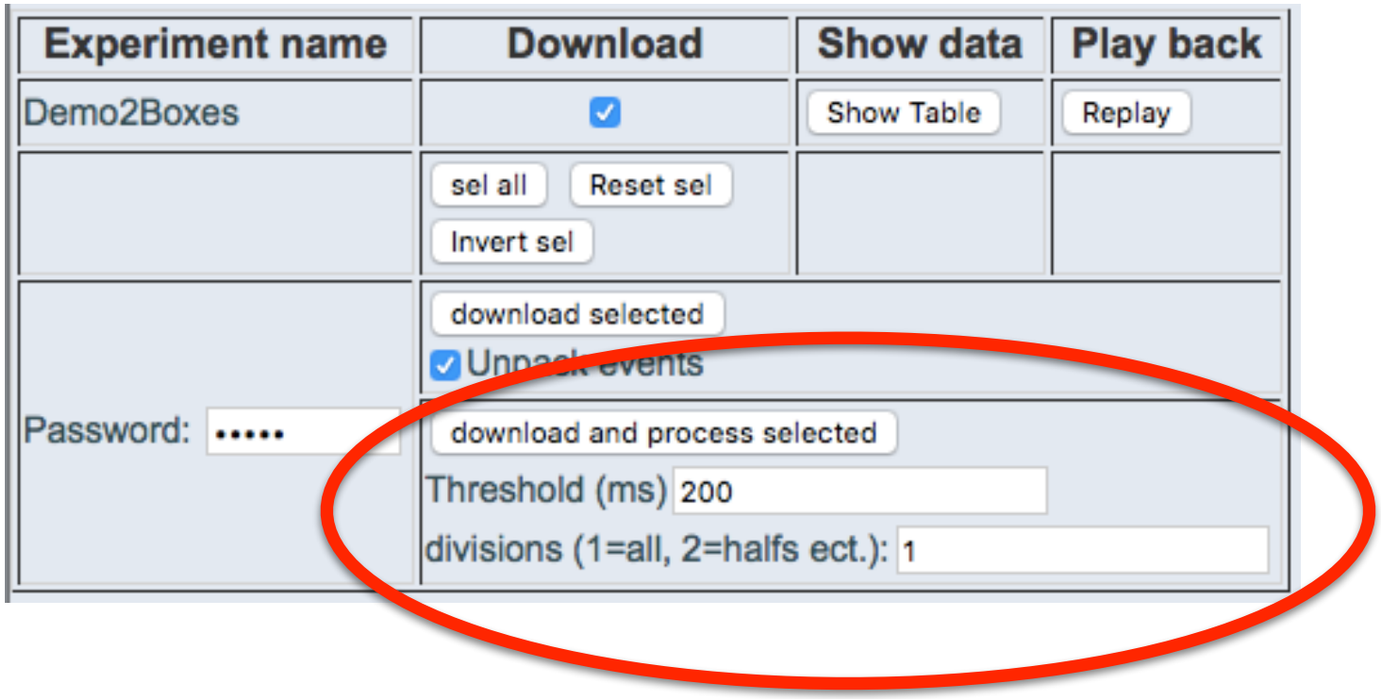
Experiment name	Download	Show data	Play back
Demo2Boxes	☑	Show Table	Replay
	sel all Reset sel Invert sel		
Password: •••••	download selected ☑ Unpack events		
	download and process selected Threshold (ms) 200 divisions (1=all, 2=halfs ect.): 1		

Experiment name	Download	Show data	Play back
Demo2Boxes	☑	Show Table	Replay
	sel all Reset sel Invert sel		
Password: •••••	download selected ☑ Unpack events		
	download and process selected Threshold (ms) 200 divisions (1=all, 2=halfs ect.): 1		

Results of Experiment Demo2Boxes

id	expname	subject	ip	condnum	choice	submitted	event	name	value	time	mlchoice
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	onload	body	body	34	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	subject	header	0	35	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	order	col	0_1	35	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	order	row	0	35	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	events	open_close	0_0	35	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	mouseover	a0	Rain	17478	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	mouseout	a0		18102	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	mouseover	a1	Snow	18102	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	mouseout	a1		19161	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	mouseover	a0	Rain	19177	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	mouseout	a0		20943	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	mouseover	a1	Snow	20961	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	mouseout	a1		22216	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	mouseover	btn2	Option B	22387	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	mouseout	btn2	Option B	22439	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	mouseover	btn2	Option B	22959	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	onclick	btn2	Option B	23374	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	mouseout	btn2	Option B	23740	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	submit	submit	submit	24326	btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	submit	submit	succeeded	24331	btn2

Summary version



id	expname	subject	ip	condnum	choice	submitted	roword	colord	div	mlchoice	maxcount	f_a0	f_a1	f_btn2	t_a0	t_a1	t_btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	0	0_1	1	btn2	6	2	2	2	2390	2314	467

id	expname	subject	ip	condnum
1	Demo2Boxes	anonymous	::1	-1

id: subject identifier (counting up)
expname: name provided in designer
subject: independent subject identifier
ip: IP address of submitting computer
condnum: condition order

id	expname	subject	ip	condnum	choice	submitted	roword	colord	div	mlchoice	maxcount	f_a0	f_a1	f_btn2	t_a0	t_a1	t_btn2
1	Demo2Boxes	anonymous	::1	-1	btn2	2016-07-13 18:50:43	0	0_1	1	btn2	6	2	2	2	2390	2314	467

choice	submitted	roword	colord	div
btn2	2016-07-13 18:50:43	0	0_1	1

choice: which button (btn1 or btn2) was pressed at the end of the search process
submitted: time stamp when task was submitted
reword: counterbalancing order of rows - 0 means that there is only one row
colord: counterbalancing order of columns - in this case 0_1 means that cell 0 is presented in the first column, cell 1 in the second
div: division of data into, e.g., halves, thirds … (can be set in datalyser)

mlchoice	maxcount	f_a0	f_a1	f_btn2
btn2	6	2	2	2

mlchoice: which button (btn1 or btn2) was pressed at the end of the search process (redundant with choice)
maxcount: frequency of acquisitions in task
f_a0, f_a1, f_btn2: for opened cell(s) and button(s) this variable shows the frequency of acquisitions

t_a0	t_a1	t_btn2
2390	2314	467

t_a0, t_a1, t_btn2: for opened cell(s) and button(s) this variable shows the length of acquisitions

Detailed version: _proc

event	roword	colord	evttype	boxname	boxin	boxtime	counter	mlchoice	relcount
mouseout	0	0_1	0_0	a0	17444	624	1	btn2	0.20000000
mouseout	0	0_1	0_0	a1	18068	1059	2	btn2	0.40000000
mouseout	0	0_1	0_0	a0	19143	1766	3	btn2	0.60000000
mouseout	0	0_1	0_0	a1	20927	1255	4	btn2	0.80000000
onclick	0	0_1	0_0	btn2	22925	415	5	btn2	1.00000000
mouseout	0	0_1	0_0	a1	2662	1195	1	btn1	0.33333333
mouseout	0	0_1	0_0	a0	3857	659	2	btn1	0.66666667
onclick	0	0_1	0_0	btn1	4746	392	3	btn1	1.00000000
mouseout	0	0_1	0_0	a1	1259	5447	1	btn2	0.25000000
mouseout	0	0_1	0_0	a0	6722	5961	2	btn2	0.50000000
mouseout	0	0_1	0_0	a1	12683	3512	3	btn2	0.75000000
onclick	0	0_1	0_0	btn2	16555	366	4	btn2	1.00000000

event	roword	colord	evttype	boxname
mouseout	0	0_1	0_0	a0
mouseout	0	0_1	0_0	a1
mouseout	0	0_1	0_0	a0
mouseout	0	0_1	0_0	a1
onclick	0	0_1	0_0	btn2

event: mouseout, onclick (result mouseout - mousein!)
evttype:
boxname: cell and button names

boxin	boxtime	counter	mlchoice	relcount
17444	624	1	btn2	0.20000000
18068	1059	2	btn2	0.40000000
19143	1766	3	btn2	0.60000000
20927	1255	4	btn2	0.80000000
22925	415	5	btn2	1.00000000

boxin: timestamp when cell was opened
boxtime: length of acquisition
counter: sequential count of acquisitions
relcount: percentage of acquisition

Analysis example 1

Based on DataImport_2Boxed.R:

1. Import the data of the experiment we ran yesterday
2. Select one of the conditions/tasks: food, context effect, WTP versus choice
3. How many participants are in this condition?
4. Plot how many acquisition each participant made.
5. Plot how long each participant took for the task.
6. Plot how long each cell was opened.