

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)

Analysis 1: 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 6 / 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 & Willemse, 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
<hr/>				
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
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]

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)

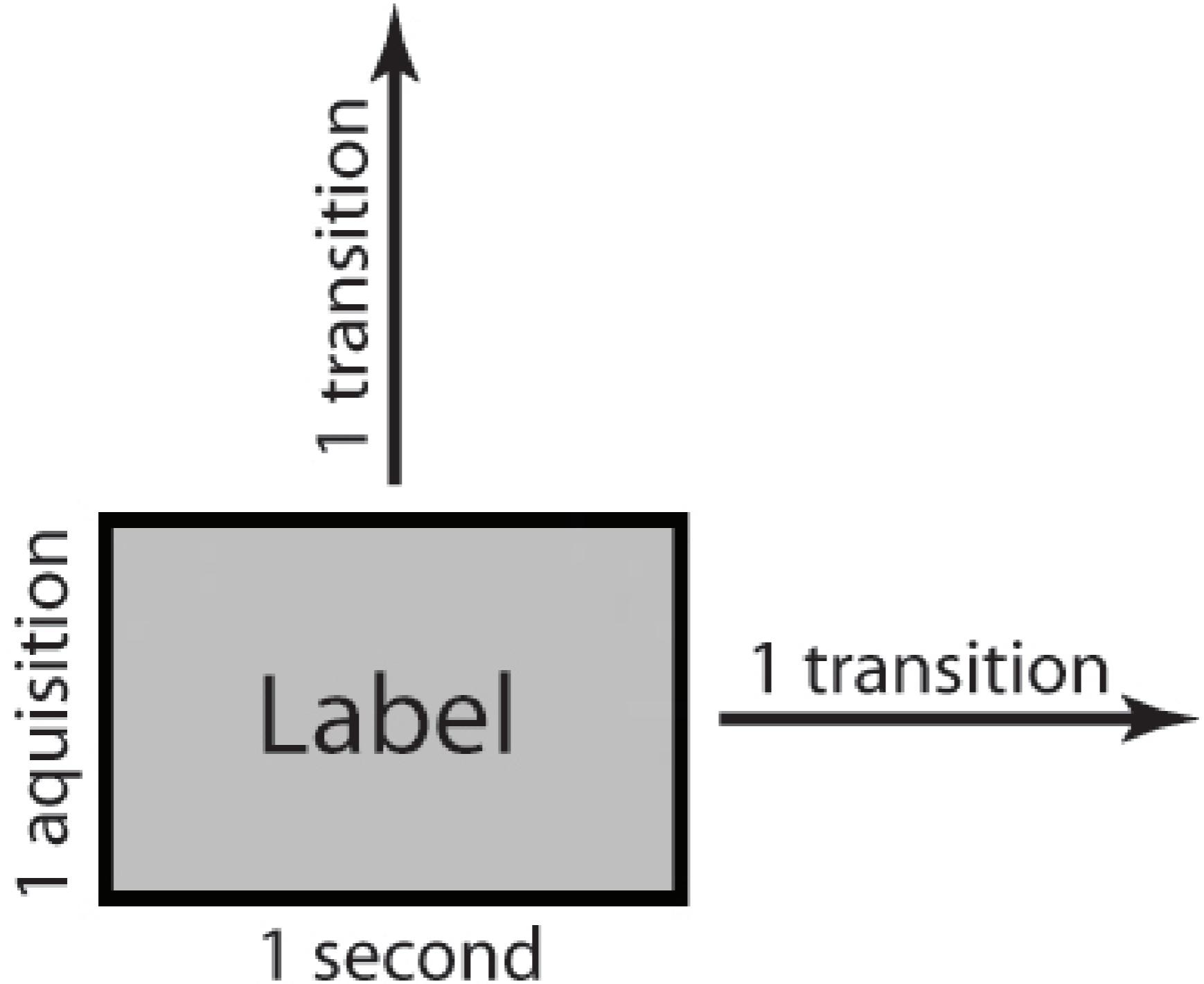
Opened boxes 26.7 times (per gamble)

	Amount to Win	Probability of that amount		Amount to Win	Probability of that amount
Gamble A:	V_{a1}	P_{a1}		\$4000	P_{a2}
Gamble B:	V_{b1}	P_{b1}		V_{b2}	P_{b2}
I choose Gamble A			I choose Gamble B		

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

Combining Clicks and Time:



READING PHASE

CHOICE PHASE

Gamble A:

1 reason

Gamble B:

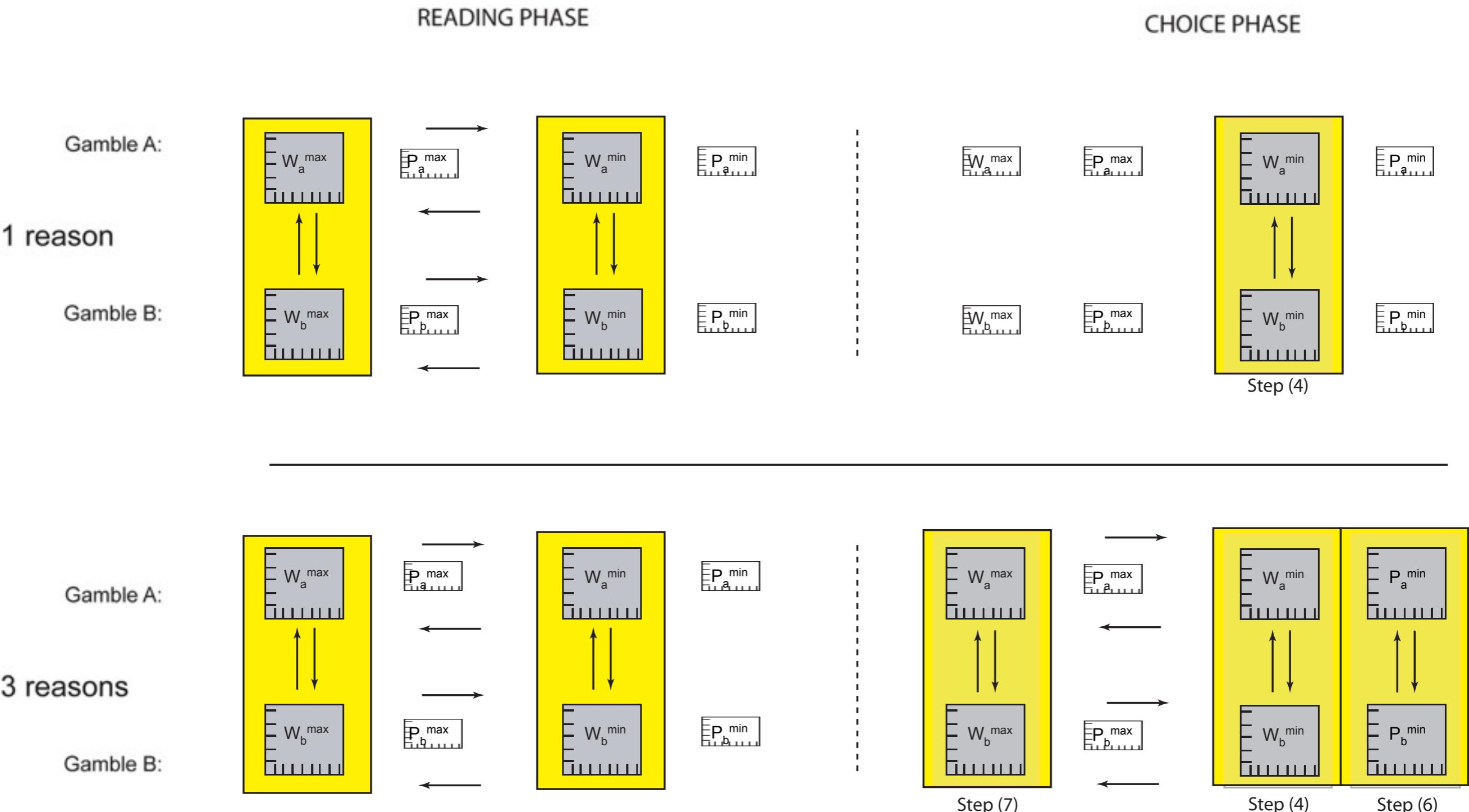


Gamble A:

3 reasons

Gamble B:

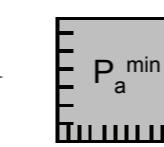
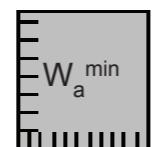
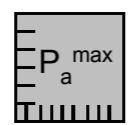
Predictions



Actual Data

READING PHASE

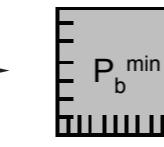
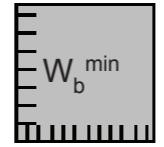
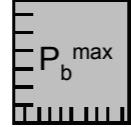
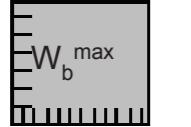
Gamble A:



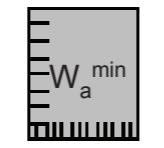
CHOICE PHASE

1 reason

Gamble B:

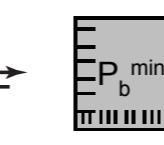
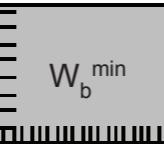
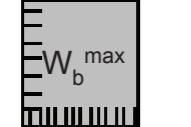


Gamble A:



3 reasons

Gamble B:



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



2000

How does food choice work?

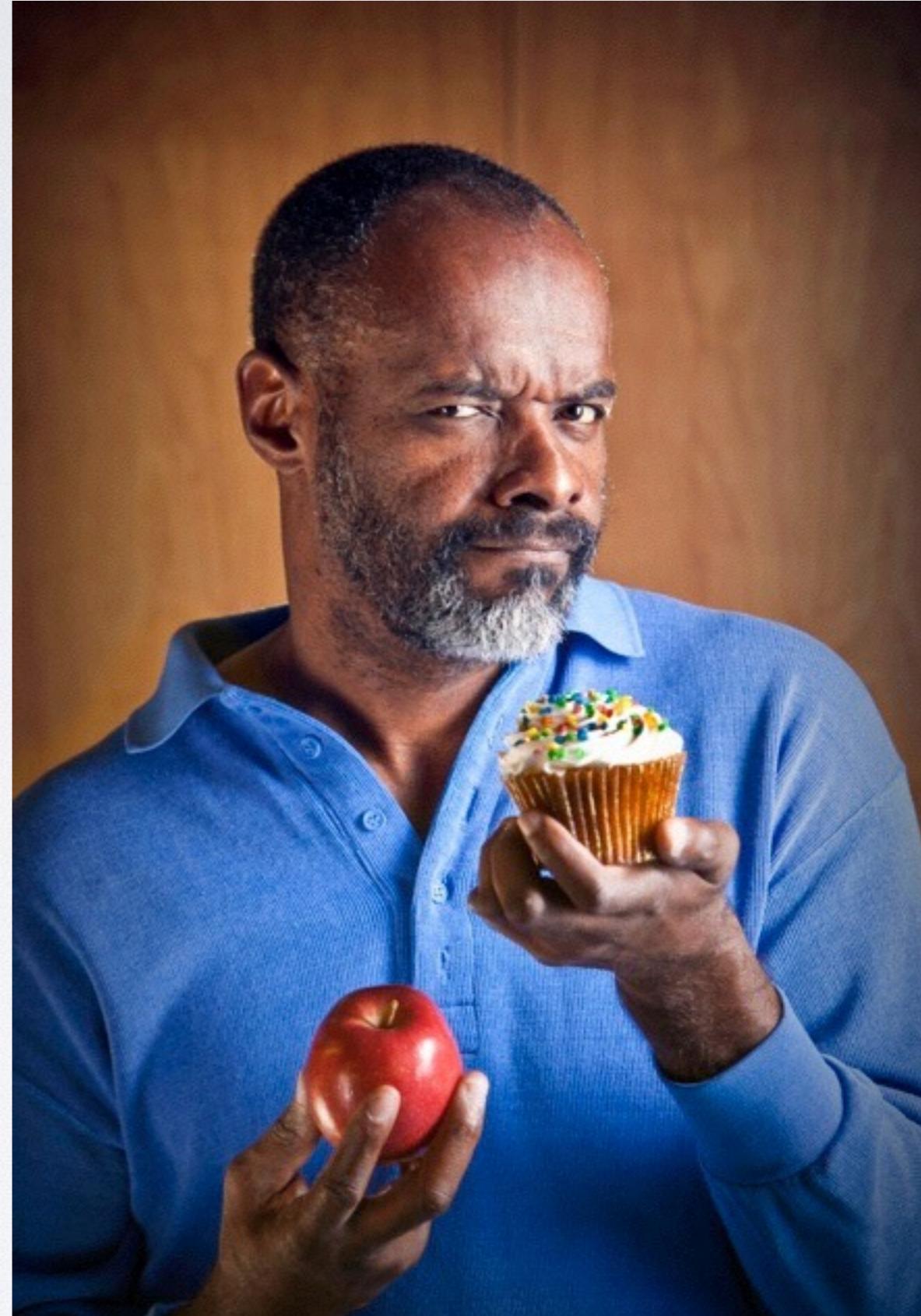
taste

price

'through the weighting of various food choice motives'

of

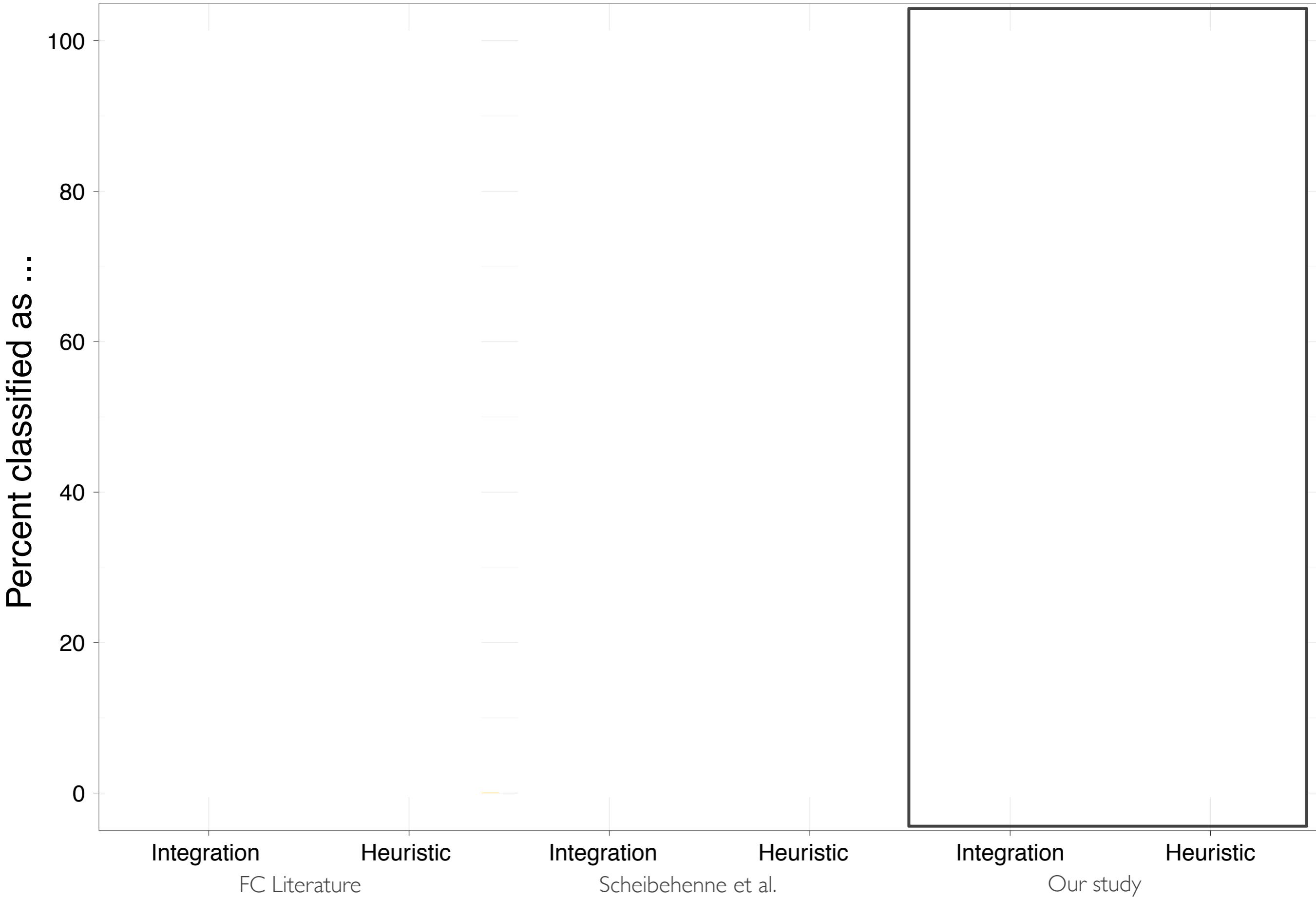
'the decision will depend on how that food scales . on each of three criteria:
information
convenience
health, pleasure and
weight control



Eertmans, Victoir, Vansant, & Van den Bergh (2005)

Rapoport, Peters, Downey, McCann, & Huff-Corzione (1993)

Predictions + Results





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, 1100 E. 10th Street, Bloomington, IN 47405 USA*

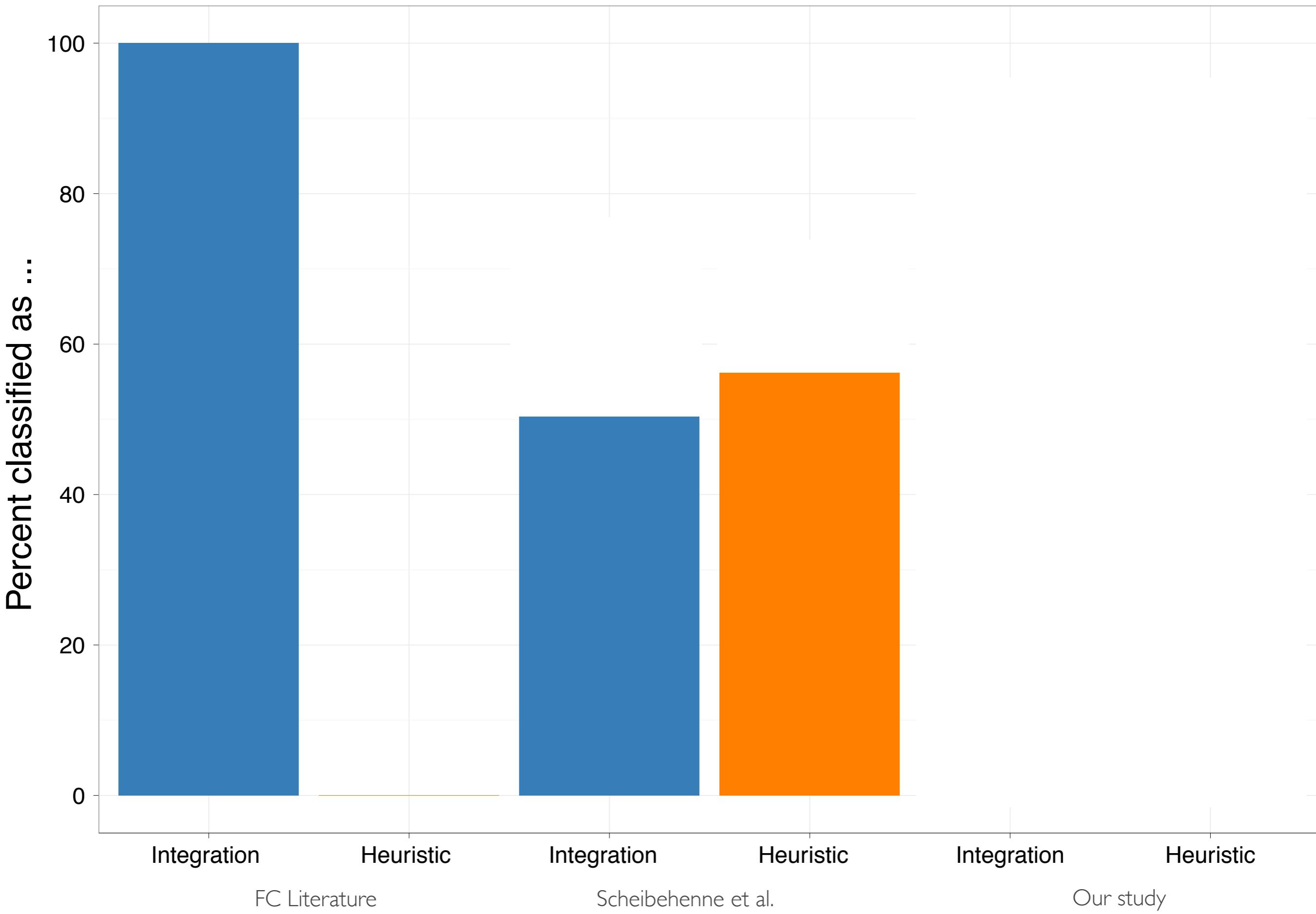
Received 16 January 2007; received in revised form 1 March 2007; accepted 26 March 2007

'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 –

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

Predictions + Results





Available online at www.sciencedirect.com



Appetite 49 (2007) 578–589

Appetite

www.elsevier.com/locate/appet

Research report

Fast and frugal food choices: Uncovering individual decision heuristics

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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.

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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 A. Simon

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				08.04.2010			
Pour	80 personnes				Préparateur				Jaquier P.A.			
Mets	Mets	Energie	Energie	Protides	Lipides	Glucides	fibres	Cholester	Sodium	Potassium	Calcium	Eau
		kJ	kcal	en g	en g	en g	en g	en mg	mg	mg	mg	mg
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 pommes de terre végétarien		946	226	9.3	1.1	43.9	12.4	0.00	135.95	1661.40	203.20	412.13
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



Decision 1

Nom du Plat

	
Lipides	
Glucides	
Prix	
Sodium	
Energie	
Cholesterol	
Protides	

[choisir ce plat](#)

[choisir ce plat](#)

Frequency (30570)
Length
Sequence

Decision (1625)

Definition and Selection of Strategies



Metric I: Searchtype (SM)

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

OT

Dish name	Veal meatball	Duck breast
Picture		
Calories	680 kcal	1020 kcal
Protein	27 g	42 g
Fat	25 g	50 g
Carbohydrate	87 g	98 g
Cholesterol	110 mg	218 mg
Sodium	1200 mg	90 mg

Name

Picture

Price

Fat

Carbohydrates

Salt

Energy

Cholesterol

Protein



Metric 3: Weighting (CV)

- **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)

MI: The value of the Search Metric is...

positive
optionwise

negative
attributewise

M2: All information acquired?

M2: All information acquired?

yes

no

M3: weighting

M3: weighting?

M3: weighting

M3: weighting

yes

no

yes

no

yes

no

yes

no

WADD

EQW

F-WADD

F-EQW

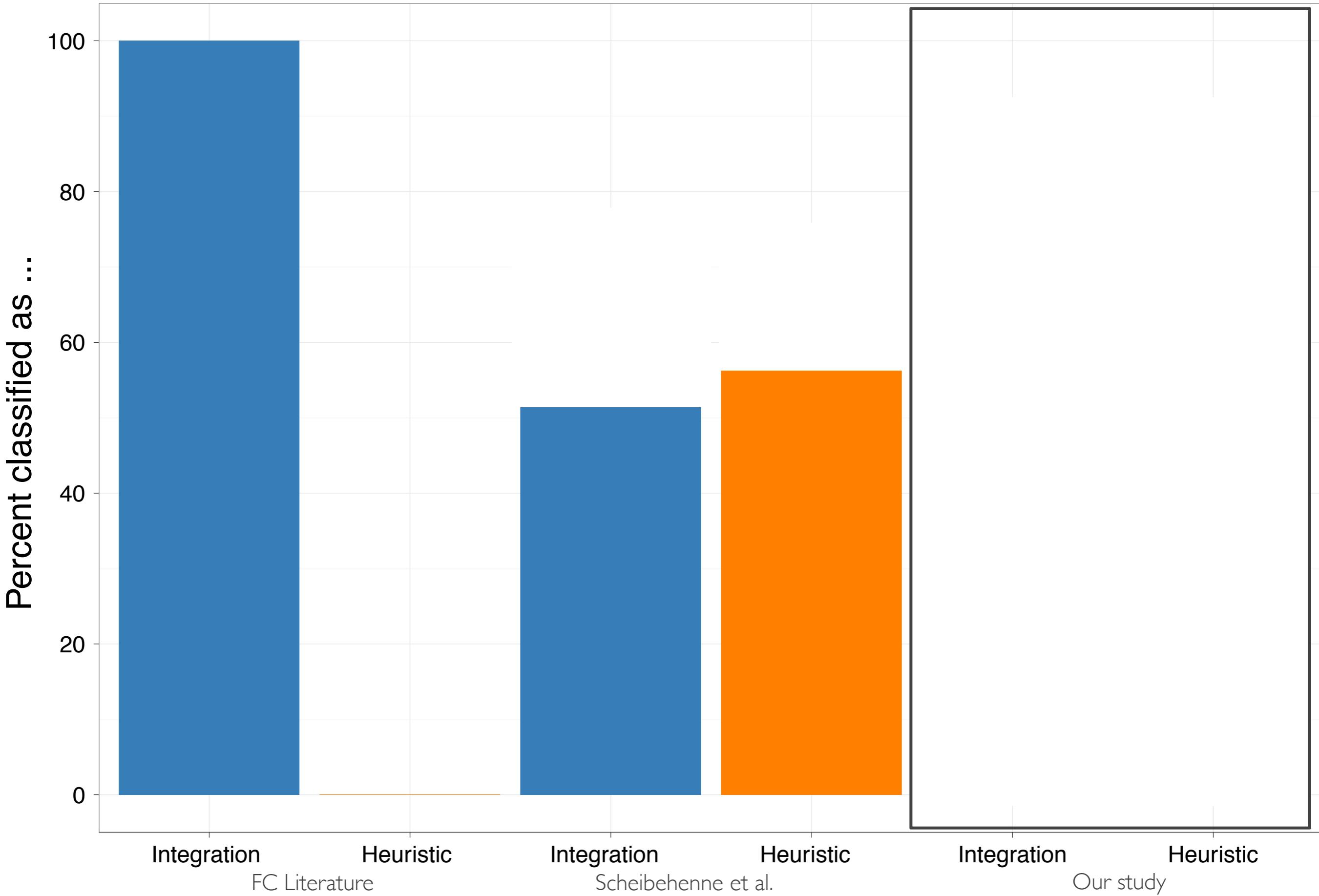
MISC

MCD

TTB

MIN

Predictions + Results



Percent classified as ...

40

30

20

10

0

WADD

EQW

FWADD

FEQW

MCD

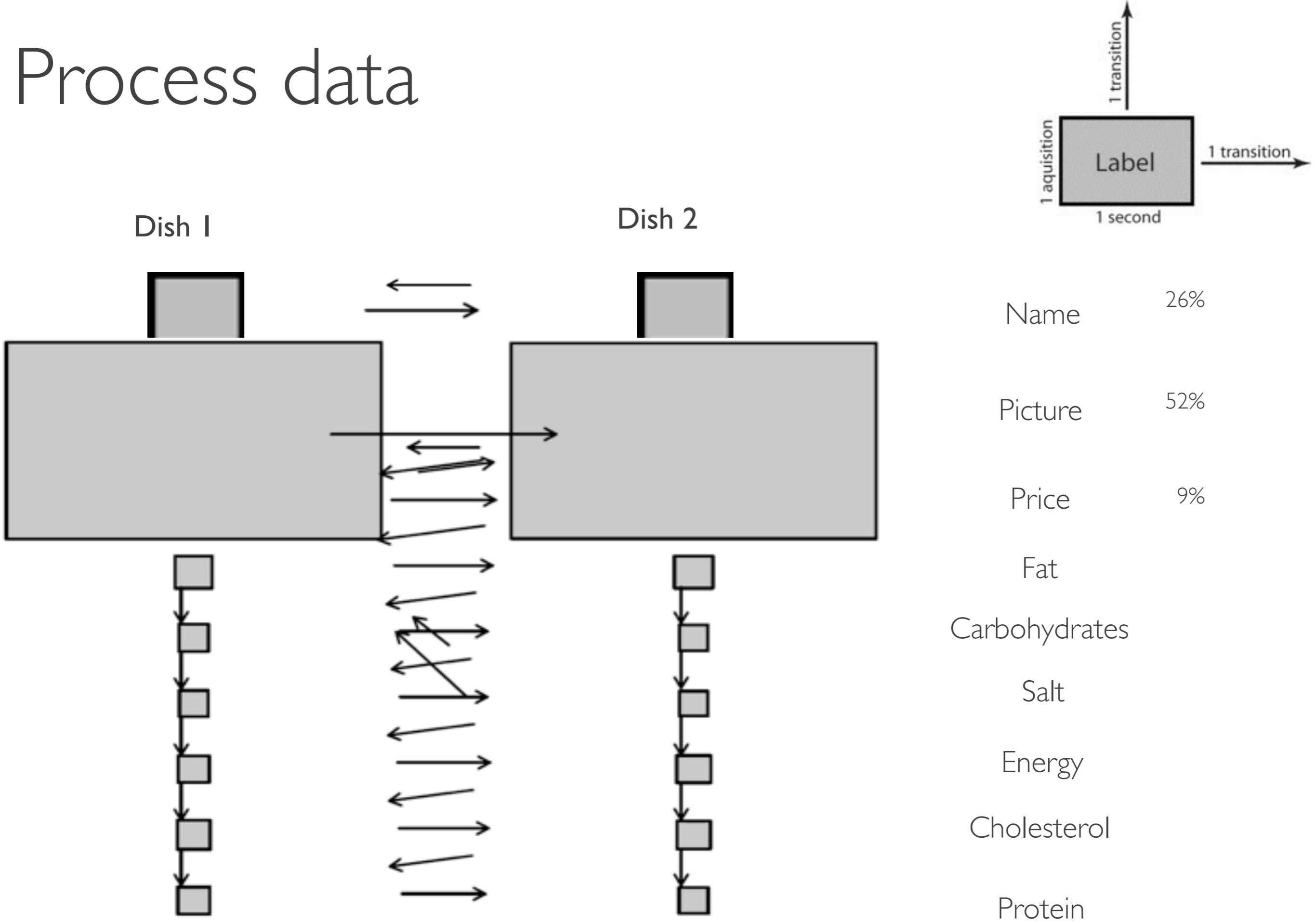
TTB

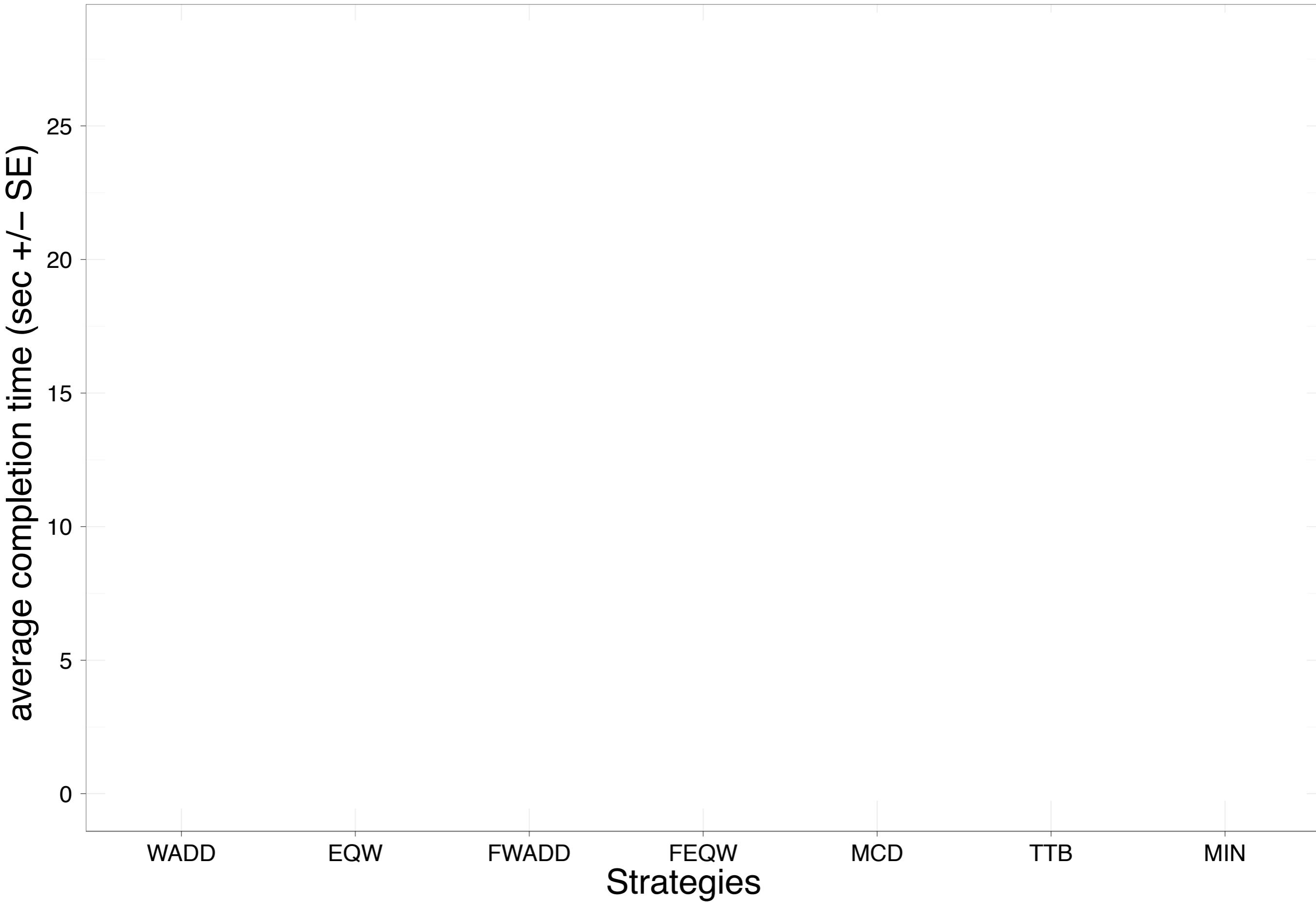
MIN

Strategies

Dish name	Veal meatball	Duck breast
Picture		
Price	7.20 CHF	8.80 CHF
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

Process data





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	<input checked="" type="checkbox"/>	Show Table	Replay
	<input type="button" value="sel all"/> <input type="button" value="Reset sel"/> <input type="button" value="Invert sel"/>		
Password:	<input type="button" value="download selected"/> <input checked="" type="checkbox"/> Unpack events <input type="button" value="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	<input checked="" type="checkbox"/>	Show Table	Replay
	sel all Reset sel Invert sel		
	download selected <input checked="" type="checkbox"/> Unpack events download and process selected Threshold (ms) <input type="text" value="200"/> divisions (1=all, 2=halfs ect.): <input type="text" value="1"/>		

Experiment name	Download	Show data	Play back
Demo2Boxes	<input checked="" type="checkbox"/>	Show Table	Replay
	sel all	Reset sel	
	Invert sel		
	download selected		
	<input checked="" type="checkbox"/> Unpack events		
Password:	download and process selected		
	Threshold (ms) 200		
	divisions (1=all, 2=halves 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

Experiment name	Download	Show data	Play back
Demo2Boxes	<input checked="" type="checkbox"/>	Show Table	Replay
	<input type="button" value="sel all"/> <input type="button" value="Reset sel"/> <input type="button" value="Invert sel"/>		
	<input type="button" value="download selected"/> <input checked="" type="checkbox"/> Unpack events		
Password:	<input type="button" value="download and process selected"/>		
	Threshold (ms) 200		
	divisions (1=all, 2=halves ect.): 1		

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

reward: 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	evtttype	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!)

evtttype:

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
26622	1195	6	btn2	0.20000000

boxin: timestamp when cell was opened

boxtime: length of acquisition

counter: sequential count of acquisitions

relcount: percentage of acquisition

Analysis of demo
experiment

Based on DataImport_2Boxed.R

Groups of 3

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.

data is on

<https://github.com/michaelschulte/EADMSummerSchool2016>