

# Identifying the heuristics and biases in the prenegotiation preference elicitation

**Gregory Kersten**

Concordia University  
Montreal, Canada

Concordia University

— JOHN & MOLSON  
SCHOOL OF BUSINESS



**Ewa Roszkowska**

University of Białystok  
Poland



**Tomasz Wachowicz**

University of Economics in Katowice  
Poland



# Outline

- Motivation
  - Heuristic and cognitive biases in negotiation
- Experimental study
  - Negotiation case Mosico-Fado (Inspire)
  - Errors and related biases in defining scoring system
  - Scaling errors
  - Scoring system accuracy
- Results
- Conclusions and future work

# Motivation

- The results of researches in experimental economy emphasize the decision makers' (DM) **limited rationality** and common using of **intuition** and **heuristics** instead of rational decision analysis while making various managerial decisions.
- **Heuristics** are simple cognitive procedures that allow to solve the problems quickly, though not always adequately and precisely enough (*Simon 1955; Kahneman, Tversky 1975; Stanovich, West 1998; Gilovich et al., 2002; Evans 2006*).
- The role of **heuristics** in negotiation was studied in numerous works, that usually focus on analyzing the impact of the intuitive and heuristic-based thinking on the negotiation process and outcomes (*Bazerman, Neale 1994; Milburn and Isaac 1995; Gimpel 2008; McDermott 2009, Campo et al. 2016*).

# Motivation

- **Electronic negotiations** are conducted by means of software support tools which should help negotiators to focus **more analytically** on the negotiation problem. *(Kersten, Noronha 1999; Schoop et al. 2003; Brzostowski, Wachowicz 2013)*
- **Experimental results** show that participants in electronic negotiations often have problems with:
  - **proper use** of analytical tools supporting the negotiation process *(Roszkowska, Wachowicz 2014, 2015, Kersten et al.)*,
  - **map preferences** into a scoring system precisely
  - **misperception** of the system of visualization of preferential information

# Purpose

- Despite the use of negotiation support systems (analytical approach), negotiators **still use different heuristics** leading to a lack of consistency of preferences and decision-making errors.
- The research challenge is:
  - **identify and evaluate the impact of heuristic** in the prenegotiation analytical preparation of the negotiators,
  - **develop support tools** that resist these heuristics or reduce their negative effects.

# Experimental setup

## Case description- eNS Inspire

- We analyzed the occurring heuristic and biases using **Inspire**® electronic negotiation system.
- Mosico-Fado **bilateral negotiation case** - contract between a musician and an entertainment company.
- Four **issues** and **240 offers**:

Standard issues and their values for the first contract negotiation

Issues to negotiate	Issue options
Number of new songs (introduced and performed each year)	11; 12; 13; 14; or 15 songs
Royalties for CDs (in percent)	1.5; 2; 2.5 or 3 %
Contract signing bonus (in dollars)	\$125,000; \$150,000 or \$200,000
Number of promotional concerts (per year, for 1,000 or more people each)	5; 6; 7 or 8 concerts

- Each agent obtains information about the principal's preferences and uses it to negotiate a contract with the counterpart.

# Experimental setup

## The principal scoring system

- The preferences of both Mosico and Fado principals were described **verbally and graphically** and provided to the agents as private info.

Before meeting Fado you discussed the Agency's priorities and requirements with senior management. Senior managers could not give you very detailed information regarding the importance of the negotiated issues and options, but during a few short meetings they gave you many indications as to the relative importance of the issues and the agency's preferences. To help visualize the relationship between the issues you drew circles with their size indicating the issues' importance. You did the same for the options of each issue.

**Note:** The sizes of the circles are only indicative as you did not measure precisely the radius of each circle. You drew them quickly to show to the management so that they could see

Mosico	Issue				Options: Concerts				Options: Songs					Options: Royalties				Options: Contract		
	Conce.	Songs	Royalt.	Contract	5	6	7	8	11	12	13	14	15	1.5	2.0	2.5	3.0	125	150	200
Radius based system	32	28	23	17	0	21	26	32	0	7	16	28	21	13	23	16	0	17	10	0

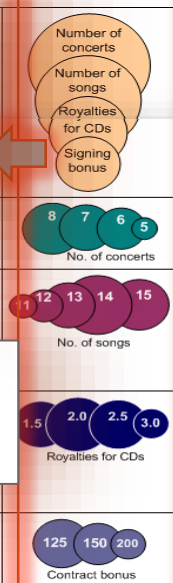
  

that 5 concerts is significantly worse than 6 and more. Less than 5 makes little sense in the entertainment business.																				
2.	<b>Number of new songs</b> It is a long established practice that too few songs are disastrous but too many are also not profitable. The best number of songs is 14; 14 songs make two full CDs. 15 songs are worse than 14 because it is considered somewhat too many. 13 songs are almost as good as 15.																			

The <b>Principal</b> rating was derived from the measurement of the radius ( <i>radius based system</i> ) or area ( <i>area based system</i> ) circle representing the strength of preferences.																				
artist's interest in cooperating with the agency. The research done convinced the management that 3.0% is too much.																				
4.	<b>Contract signing bonus</b> This issue is considered the least important, although the agency does not want to be seen as throwing money away. The management's preference is to pay less rather than more.																			

The information you obtained about the agency's top management preferences is your guide in your negotiations with Fado. It reflects WorldMusic strategic directions in the next three years and will provide guidance not only for this negotiation but also for negotiations with other artists. Therefore the ratings are quite sensitive and you were told not to discuss them with anyone.



# Experimental setup

## The agent scoring system

### Step 1. Issue ratings

Issue	Rating
Number of promotional concerts (per year)	19 ▼
Number of new songs	38 ▼
Royalties for the CDs (% of revenue)	12 ▼
Contract signing bonus (\$)	30 ▼

1 points still to be distributed.

### Step 2. Option ratings

Number of promotional concerts (per year)	5	6	7	8
Rating	19 ▼	4 ▼	15 ▼	0 ▼

Number of new songs	11	12	13	14	15
Rating	19 ▼	38 ▼	15 ▼	2 ▼	0 ▼

Royalties for the CDs (% of revenue)	1.5	2.0	2.5	3.0
Rating	12 ▼	3 ▼	5 ▼	0 ▼

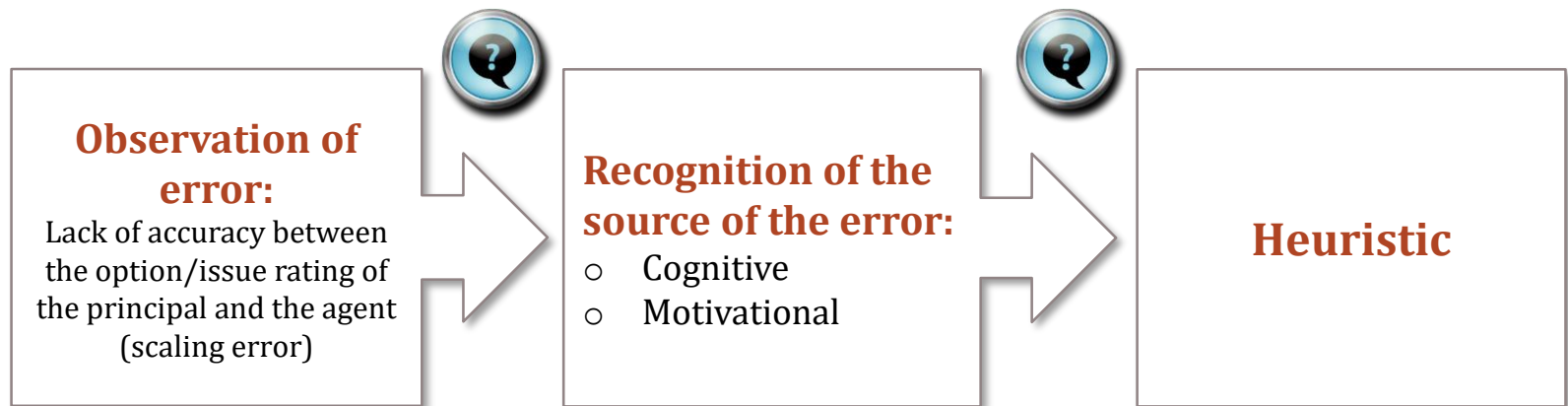
Contract signing bonus (\$)	125000	150000	200000
Rating	19 ▼	31 ▼	0 ▼

### Step 3. Package ratings

Number of new songs	Number of promotional concerts (per year)	Royalties for the CDs (% of revenue)	Contract signing bonus (\$)	Rating
12	5	2.0	150000	91
12	6	1.5	150000	85
12	6	2.0	150000	76
11	5	1.5	125000	69
12	6	2.0	125000	64
15	5	1.5	150000	62
13	6	2.5	150000	55
14	7	2.5	125000	41
14	7	3.0	125000	36
13	7	2.5	200000	35
13	7	2.0	200000	33
13	6	2.5	200000	24
14	8	3.0	125000	21



# Errors and related biases in defining scoring system



## **Cognitive Bias: Cognitive abilities:**

- Lack of or limited ability to accurately identify the preferences of the principal

## **Motivational Bias: Subjective perception negotiation situation:**

- Contradictions of Agent-Principal preferences.

**Bounded Awareness** affects the information selection process of individuals; in order to avoid information overload people often filter information unconsciously and automatically. This could lead to ignore or neglect useful, observable, and relevant data (*Bazerman and Chung, 2005*);

# Experimental setup

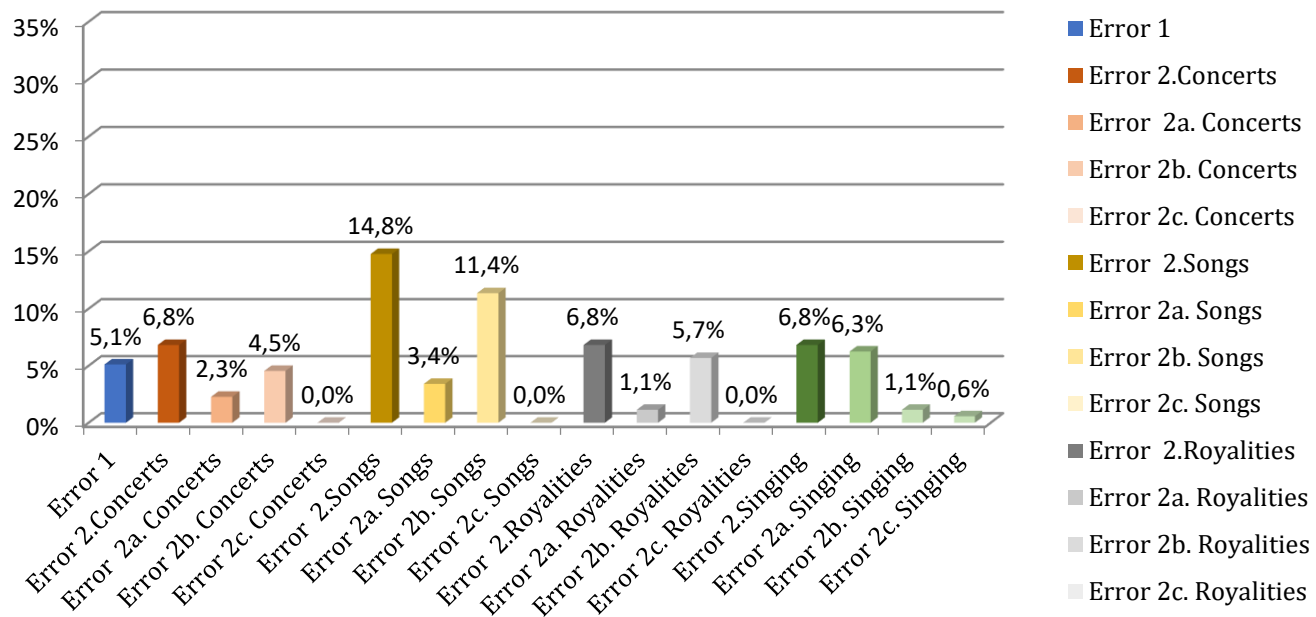
## Errors in defining scoring system

- **Scaling errors** (*Montibeller G, von Winterfeldt D. 2015*)
- **Error 1.** The agent's rating of one issue is at most 5, while other is rated at least 50; or the issue weight is equal to 1 (marginalized).
- **Error 2.** The not-worst option from reference system is rated as 0 by the agent.
- This Error may be broken down into three others:
  - **Error 2a.** The worst option from reference system is not rated as 0.
  - **Error 2b.** At least two options are rated as 0.
  - **Error 2c.** The worst option from reference system is not rated as 0 and at least two other options are rated as 0.
  - Error 2a → Error 2, Error 2b → Error 2, Error 2c = Error 2a & Error 2b
  - $N(\text{Error 2}) = N(\text{Error 2a}) + N(\text{Error 2b}) - N(\text{Error 2c})$

# Results

## Scalining errors

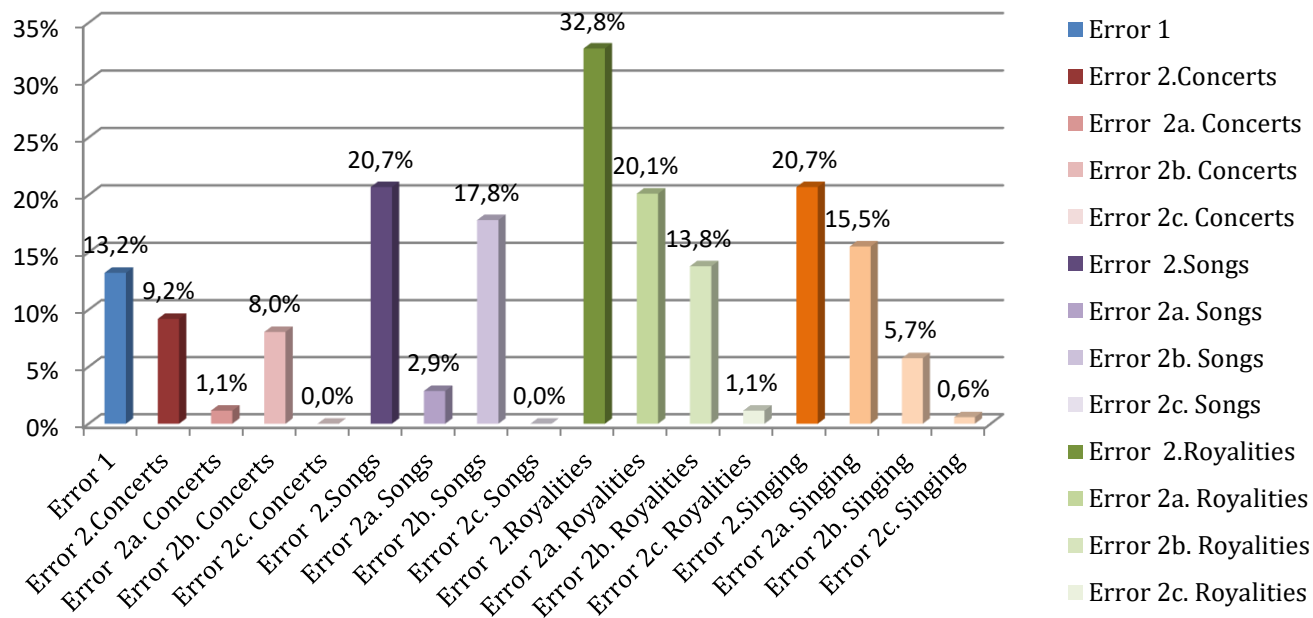
### Structure of errors made by Fado agents



# Results

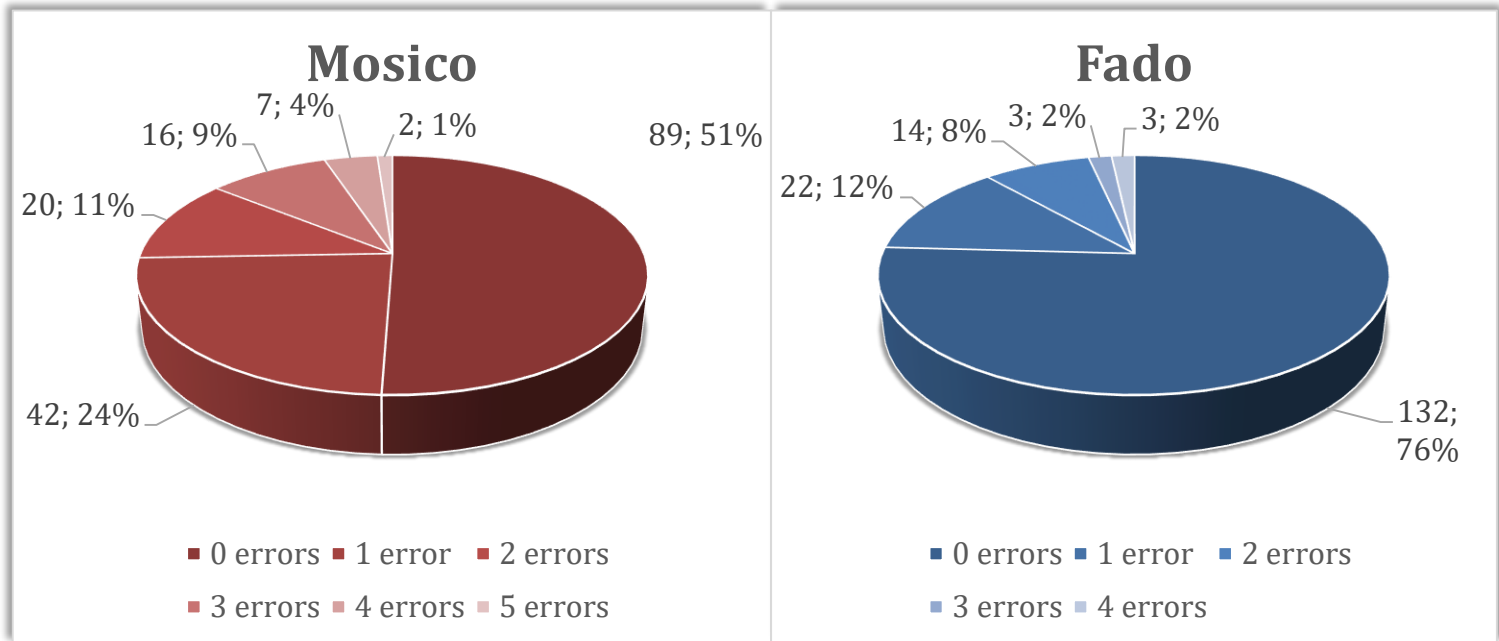
## Scalining errors

### Structure of errors made by Mosico agents



# Results

## Coincidence of scaling errors

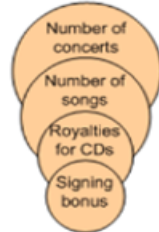


# Results

## Error 1 - Mosico

Structure of principal preferences:

**Weights of issue**



Cognitive or motivational bias ?

**What kind of heuristics?**

- Information selection
- Inattentional blindness
- Change blindness
- Focalism

Mosico	Weights			
	Concerts	Songs	Royalties	Contract
Radius bases system	32	28	23	17
Area based system	39	30	20	11
Mosico_1	85	14	1	1
Mosico_2	65	20	10	5
Mosico_3	61	27	7	5
Mosico_4	60	25	10	5
Mosico_5	60	30	6	4
Mosico_6	60	25	10	5
Mosico_7	60	25	10	5
Mosico_8	53	35	7	5
Mosico_9	52	34	10	4
Mosico_10	50	35	10	5
Mosico_11	50	35	10	5
Mosico_12	50	30	15	5
Mosico_13	50	25	20	5
Mosico_14	50	35	10	5
Mosico_15	50	30	15	5
Mosico_16	50	30	15	5
Mosico_17	50	30	15	5
Mosico_18	50	35	10	5
Mosico_19	50	30	15	5
Mosico_20	50	25	20	5
Mosico_21	49	20	30	1
Mosico_22	20	20	1	59
Mosico_23	17	14	2	67

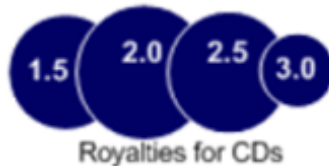
# Results

## Error 2: Royalties - Mosico

Structure of principal

preferences:

**Royalties**



Cognitive or  
motivational bias ?

**What kind of heuristics?**

- Information selection
- Inattentional blindness
- Change blindness
- Focalism

Royalties	1,5	2	2,5	3
<b>Mosico (Radius bases system)</b>	13	23	16	0
<b>Mosico (Area based system)</b>	10	20	13	0
<b>Mosico_1</b>	0	30	20	10
<b>Mosico_2</b>	0	25	20	15
<b>Mosico_3</b>	0	25	20	15
<b>Mosico_4</b>	0	24	10	3
...	...	...	...	...
<b>Mosico_15</b>	0	15	20	9
<b>Mosico_16</b>	0	15	20	10
...	...	...	...	...
<b>Mosico_26</b>	0	10	15	29
<b>Mosico_27</b>	0	6	9	20
...	...	...	...	...
<b>Mosico_39</b>	0	20	10	0
<b>Mosico_40</b>	0	19	30	0
<b>Mosico_46</b>	0	0	15	15

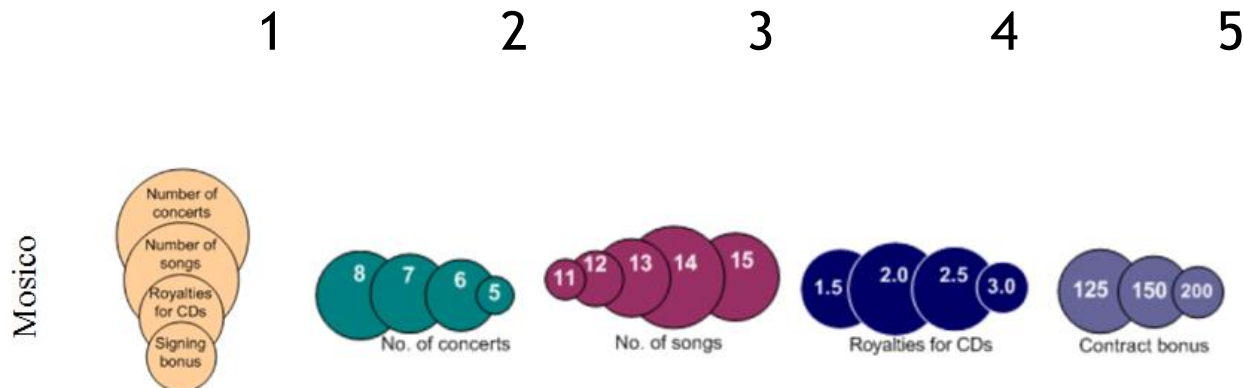
# Scoring system accuracy

## Ordinal accuracy index

- Ordinal accuracy index is the ratio of (1) the **number of correct rankings** by  $i$ th negotiator ( $n_i^{\text{cor}}$ ) and (2) the total **number of all rankings** in a negotiation template:

$$OAI_i = \frac{n_i^{\text{cor}}}{n}$$

- In Inspire experiment  $n = 5$





# Results

## Errors 1 and 2 vs ordinary accuracy

- Number of Mosico agents with regard to scoring system accuracy and errors made.

Mosico	Ordinary inaccurate	Ordinary accurate	Sum
Error s 1 or Error 2	85	2	87
No errors	60	29	89
Sum	145	31	176

$$\chi^2 = 27.807, df = 1, p = 0.000.$$

- Number of Fado agents with regard to scoring system accuracy and errors made.

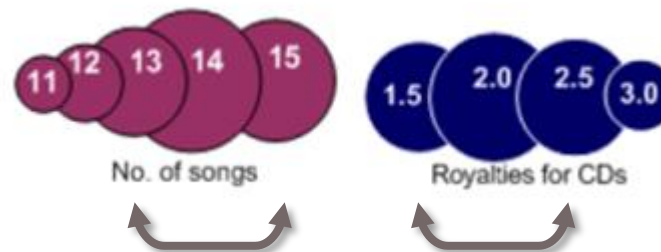
Fado	Ordinary inaccurate	Ordinary accurate	Sum
Error s 1 or Error 2	42	0	42
No errors	94	38	132
Sum	136	38	174

$$\chi^2 = 15.46, df = 1, p = 0.000.$$

# Results

## Specific scaling errors

- Error 3M (Mosico) –Error of monotonicity:



$$u(\text{Songs}13) \geq u(\text{Songs } 15) \text{ or } u(\text{Royalties } 1.5) \geq u(\text{Royalties } 2.5)$$

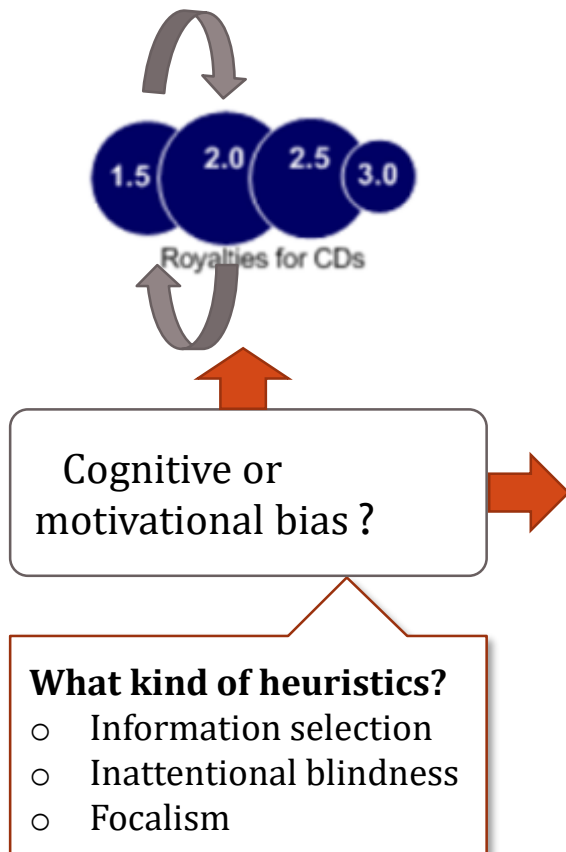
- $N(u(\text{Royalties}1.5) \geq u(\text{Royalties}2.5)) = 65$
- $N(u(\text{Songs } 13) \geq u(\text{Songs } 15)) = 105$
- $N\left(\begin{matrix} (u(\text{Royalties}1.5) \geq u(\text{Royalties}2.5)) \\ \wedge (u(\text{Songs}13) \geq u(\text{Songs}15)) \end{matrix}\right) = 45$

Mosico	Error 3M
Error 1 or error 2	68
No errors	57
Sum	125

# Results

## Specific scaling errors

$u(\text{Royalties}_{1.5}) \geq u(\text{Royalties}_{2.0})$ :

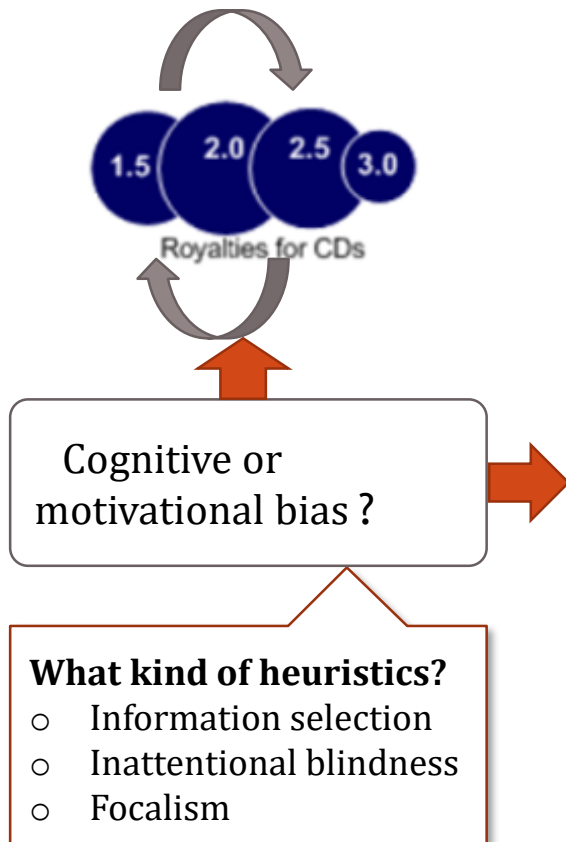


Royalties	1,5	2	2,5	3
Mosico_1	40	30	25	0
Mosico_2	40	30	10	0
Mosico_3	38	23	3	0
Mosico_4	30	30	10	0
Mosico_5	30	30	20	0
Mosico_6	25	25	25	0
Mosico_7	21	21	16	0
Mosico_8	20	10	5	0
Mosico_9	20	15	12	0
Mosico_10	20	20	15	0
Mosico_11	19	19	15	0
Mosico_12	19	19	19	0
Mosico_13	18	14	6	0
Mosico_14	15	10	5	0
Mosico_15	15	10	5	0
Mosico_16	15	10	5	0
Mosico_17	15	15	10	0
...	...	...	...	...

# Results

## Specific scaling errors

$u(\text{Royalties } 1.5) \geq u(\text{Royalties } 2.5)$ :

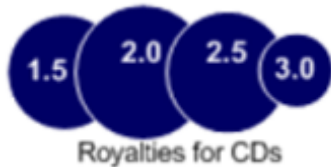


Royalties	1,5	2	2,5	3
Mosico_22	17	19	12	0
Mosico_23	15	18	12	0
Mosico_24	15	18	12	0
Mosico_25	15	20	15	0
Mosico_26	15	20	10	0
Mosico_27	15	20	15	0
Mosico_28	15	20	15	0
Mosico_29	15	20	12	0
Mosico_30	15	20	15	0
Mosico_31	15	24	15	0
Mosico_32	15	25	15	0
Mosico_33	14	20	10	0
Mosico_34	12	15	6	0
Mosico_35	12	17	11	0
Mosico_36	10	15	5	0
Mosico_37	10	15	0	0
Mosico_38	10	15	5	0
...	...	...	...	...

# Results

## Specific scaling errors

$u(\text{Royalties } 1.5) = u(\text{Royalties } 2.5) =$   
 $= u(\text{Royalties } 3.0) = 0:$



Cognitive or  
motivational bias ?

### What kind of heuristics?

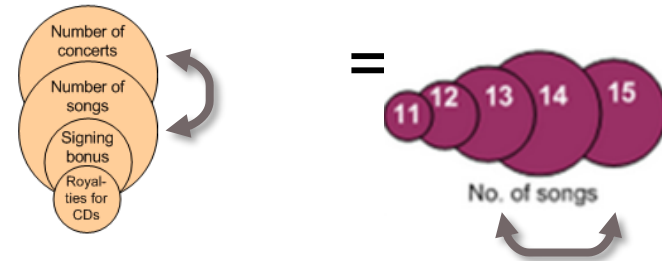
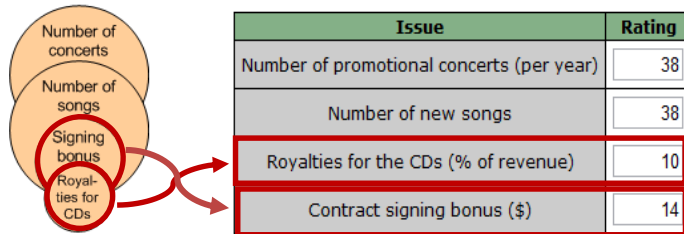
- Information selection
- Inattentional blindness
- Focalism

Royalties	1,5	2	2,5	3
Mosico_54	0	1	0	0
Mosico_55	0	10	0	0
Mosico_56	0	15	0	0
Mosico_57	0	18	0	0
Mosico_58	0	18	0	0
Mosico_59	0	18	0	0
Mosico_60	0	19	0	0
Mosico_61	0	20	0	0
Mosico_62	0	20	0	0
Mosico_63	0	20	0	0
...	...	...	...	...

# Results

## Specific scaling errors

### ○ Error 3F (Fado):



$$u(\text{Royalties}) \geq u(\text{Contract}) \text{ or } u(\text{Songs}) \neq u(\text{Concerts}) \text{ or } u(\text{Songs}_{13}) \geq u(\text{Songs}_{15})$$

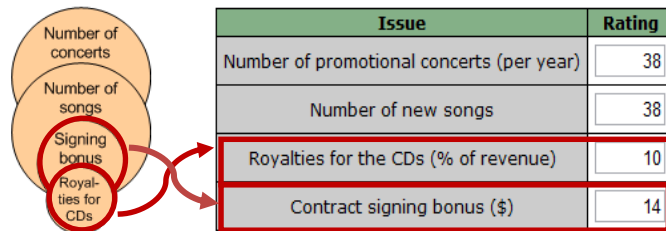
- $N(u(\text{Royalties}) \geq u(\text{Contract})) = 70$
- $N(u(\text{Songs}) \neq u(\text{Concerts})) = 86$
- $N(u(\text{Songs}_{13}) \geq u(\text{Songs}_{15})) = 57$

Fado	Error 3F
Error 1 or error 2	38
No errors	86
Sum	124

# Results

## Specific scaling errors

- $u(\text{Royalties}) > u(\text{Contract})$ :



Issue	Rating
Number of promotional concerts (per year)	38
Number of new songs	38
Royalties for the CDs (% of revenue)	10
Contract signing bonus (\$)	14

Cognitive or  
motivational bias ?

What kind of heuristics?

- Change blindness

Fado	Concerts	Songs	Royalites	Contract
Radius bases system	32	32	16	20
Area based system	38	38	9	15
Fado_1	40	40	20	5
Fado_2	40	40	12	8
Fado_3	38	38	13	11
Fado_4	35	35	20	10
Fado_5	35	35	20	10
Fado_6	35	35	20	10
Fado_7	35	35	20	10
Fado_8	35	35	20	10
Fado_9	35	35	20	10
Fado_10	35	35	20	10
Fado_11	35	35	20	10
Fado_12	35	35	16	14
Fado_13	34	34	22	10
Fado_14	32	32	20	16
Fado_15	30	30	25	15
...	...	...	...	...

# Conclusions and future work

## ○ Conclusions

- **Scaling errors** occur when evaluating offers via the rating method (SMARTS / SAW).
- It is difficult without additional research to clearly assess the source of these errors.
- In-depth interviews and negotiation reports from the participants indicate the source of the error in: **Cognitive errors? Motivational errors? Maybe in others** (*question how to study it?*)

## ○ Future work

- **Identify and evaluate the impact of** errors/biases in the prenegotiation analytical preparation of the negotiators for the negotiation process and agreement.
- **Develop support tools** that resist these heuristics or reduce their negative effects.



***Thanks you for your attention***

# Identifying the heuristics and biases in the prenegotiation preference elicitation

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SCHOOL OF BUSINESS



**Ewa Roszkowska**

University of Białystok  
Poland



**Tomasz Wachowicz**

University of Economics in Katowice  
Poland



# Methodology

## Examples of heuristic and biases

**Bounded Awareness** affects the information selection process of individuals; in order to avoid information overload people often filter information unconsciously and automatically. This could lead to ignore or neglect useful, observable, and relevant data (*Bazerman and Chung, 2005*);

- **Information selection:** Individuals tend to ignore accessible, perceivable, and important information, while paying attention to other equally accessible but irrelevant information.
- **Inattentional blindness:** Individuals fail to see the obvious because it violates common assumptions about our visual awareness. People have the tendency not to see what they are not looking for, even when they are looking directly at it.
- **Change blindness:** Individuals tend to fail to notice visual change in their physical environments.
- **Focalism:** Individuals tend to focus too much on a particular event and too little on other events that are just as likely to occur.

# Methodology

## Errors in defining scoring system

- **Scaling errors** (Montibeller G, von Winterfeldt D. 2015)

*Evaluation of the important of negotiation issues:*

- **Error 1.** The agent's rating of one issue is at most 5, while other is rated at least 50; or the issue weight is equal to 1 (marginalized).

*Evaluation of the issue options.*

- **Error 2.** The not-worst option from reference system is rated as 0 by the agent. This Error may be broken down into three others:
  - **Error 2a.** The worst option from reference system is not rated as 0.
  - **Error 2b.** At least two options are rated as 0.
  - **Error 2c.** The worst option from reference system is not rated as 0 and at least two other options are rated as 0.
- Error 2a → Error 2, Error 2b → Error 2, Error 2c = Error 2a & Error 2b
- $N(\text{Error 2}) = N(\text{Error 2a}) + N(\text{Error 2b}) - N(\text{Error 2c})$

# Results

## Statistical analysys

Stat.	Option															
	Concerts				Songs				Royalties				Contract			
	5	6	7	8	11	12	13	14	15	1.5	2.0	2.5	3.0	125	150	200
Mosico																
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max	30	50	80	85	23	35	40	50	40	40	30	30	40	59	67	40
Av.	<b>0.2</b>	<b>17.9</b>	<b>29.9</b>	<b>36.9</b>	<b>0.34</b>	<b>9.9</b>	<b>18.6</b>	<b>28.2</b>	<b>17.8</b>	<b>7.7</b>	<b>15.5</b>	<b>10.8</b>	<b>2.5</b>	<b>9.5</b>	<b>8.1</b>	<b>1.9</b>
Fado																
Min	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Max	42	38	40	34	30	45	58	70	65	28	30	35	40	40	81	74
Av.	<b>31.3</b>	<b>24.7</b>	<b>17.2</b>	<b>0.6</b>	<b>0.5</b>	<b>11.8</b>	<b>22.1</b>	<b>32.8</b>	<b>23.8</b>	<b>0.2</b>	<b>7.6</b>	<b>12.0</b>	<b>13.7</b>	<b>1.13</b>	<b>14.1</b>	<b>17.2</b>

Stat.	Fado weights				Mosico weights			
	Concerts	Songs	Royalties	Contract	Concerts	Songs	Royalties	Contract
Min	5	1	1	5	8	12	1	1
Max	42	70	40	81	85	50	40	67
Av.	<b>32.67</b>	<b>33.63</b>	<b>14.75</b>	<b>19.00</b>	<b>39.90</b>	<b>29.9</b>	<b>17.48</b>	<b>12.57</b>