# Love as a stopping rule: an example of optimal delusion


Julien Bouvet

PhD supervisor: François-Xavier Dechaume-Moncharmont

Interns: Agnès Hivet, Lélio Belloir, Augustin d'Aboville

# Rational decision making

Rational decision making

Decision biases

*Cognitive side effects?*

Rational decision making

Decision biases

*Cognitive side effects?*

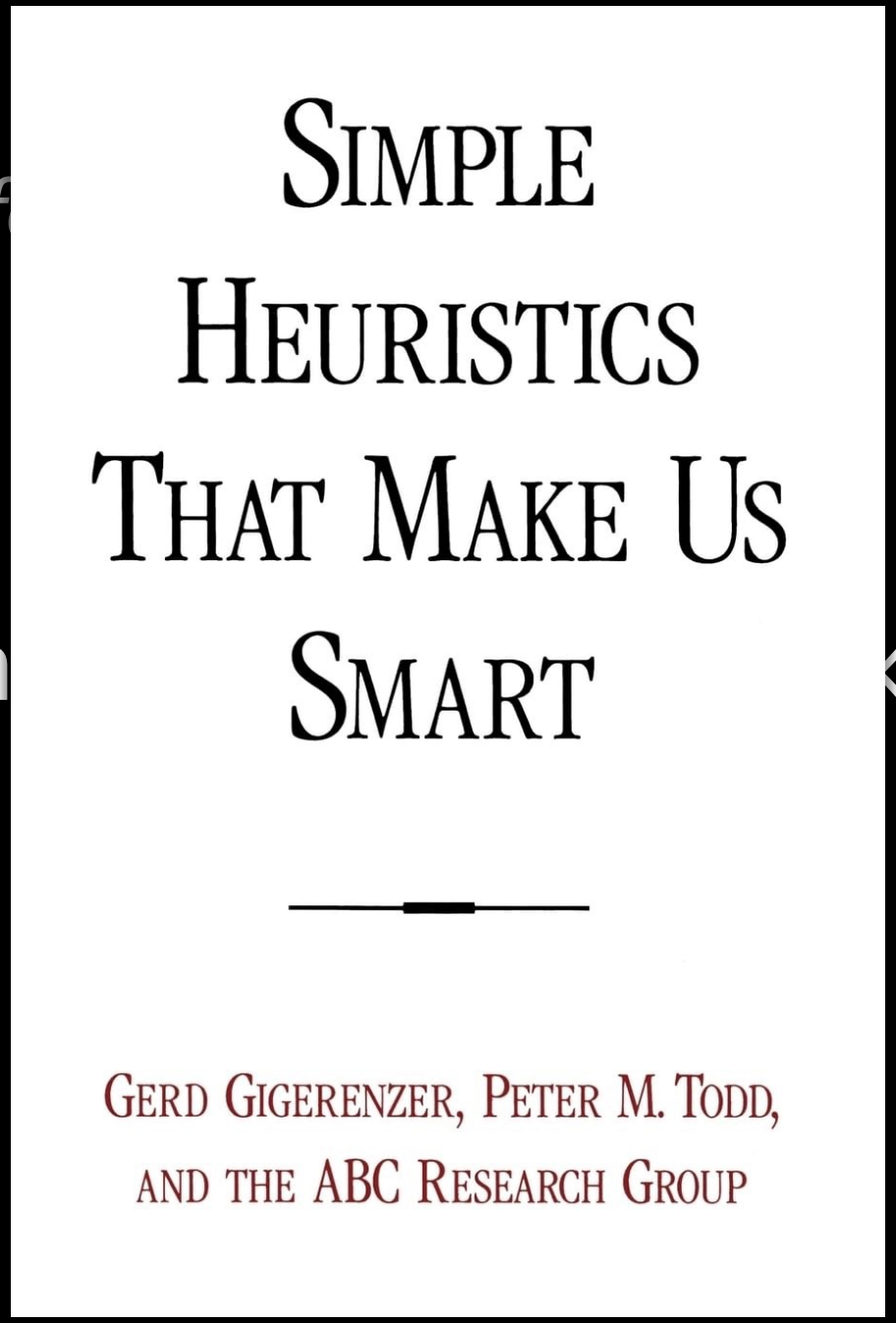
Rational decision making

Decision biases

*Adaptation?*

*Cognitive side eff*

Ra king




*Adaptation?*

FOUR DECADES OF EXCITING BIOLOGY 40 SINCE 1974
Leading Edge
Review
Cell

# A Framework for Studying Emotions across Species

**David J. Anderson**[1,3,*] **and Ralph Adolphs**[1,2,*]
[1]Division of Biology and Biological Engineering
[2]Division of Humanities and Social Sciences
[3]Howard Hughes Medical Institute
California Institute of Technology, Pasadena, CA 91125, USA
*Correspondence: wuwei@caltech.edu (D.J.A.), radolphs@caltech.edu (R.A.)
http://dx.doi.org/10.1016/j.cell.2014.03.003

# Negative emotions

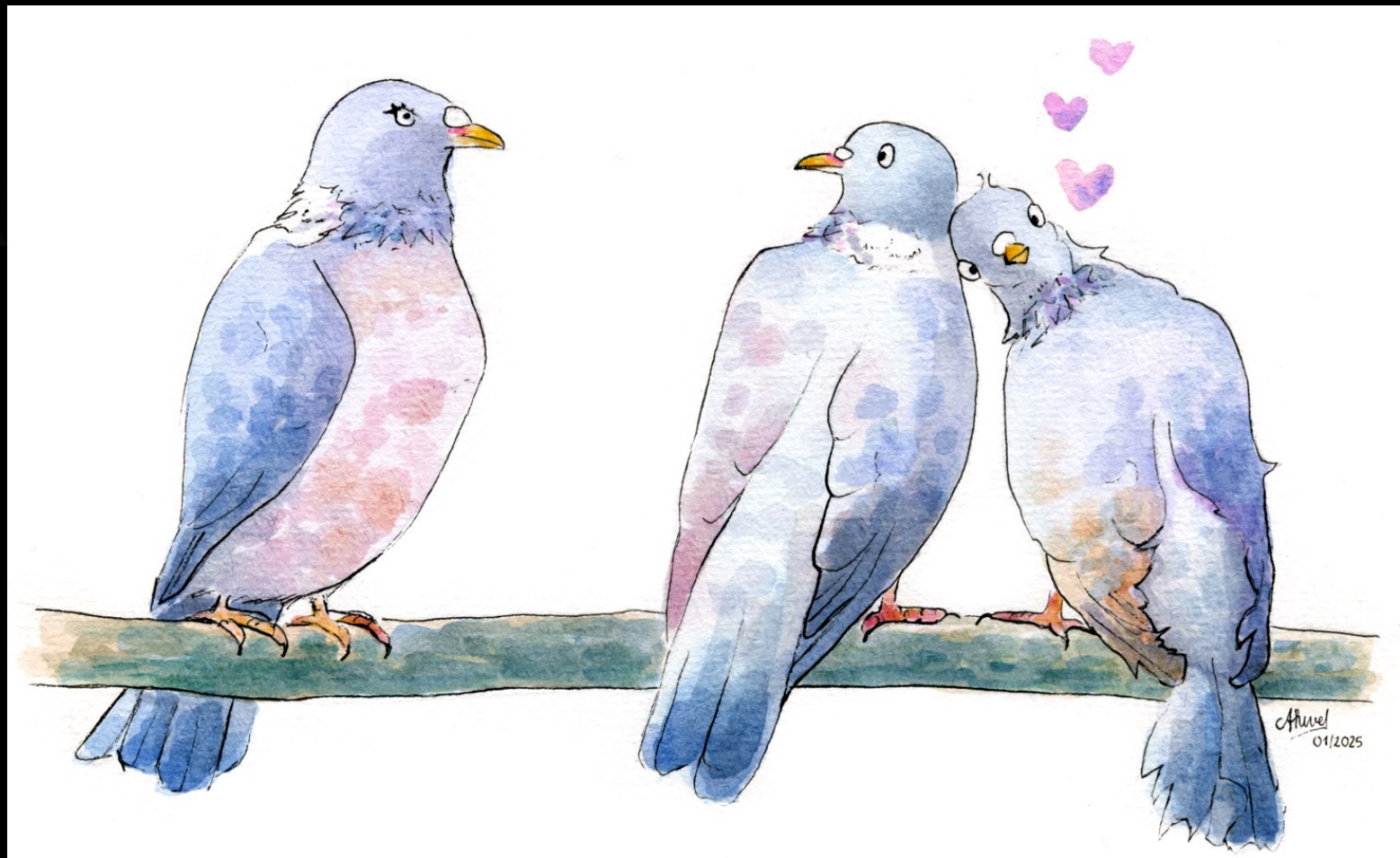
# Negative emotions

Negative emotions

Positive emotions?

# Positive emotions?

Negative emotions




*Mate choice*

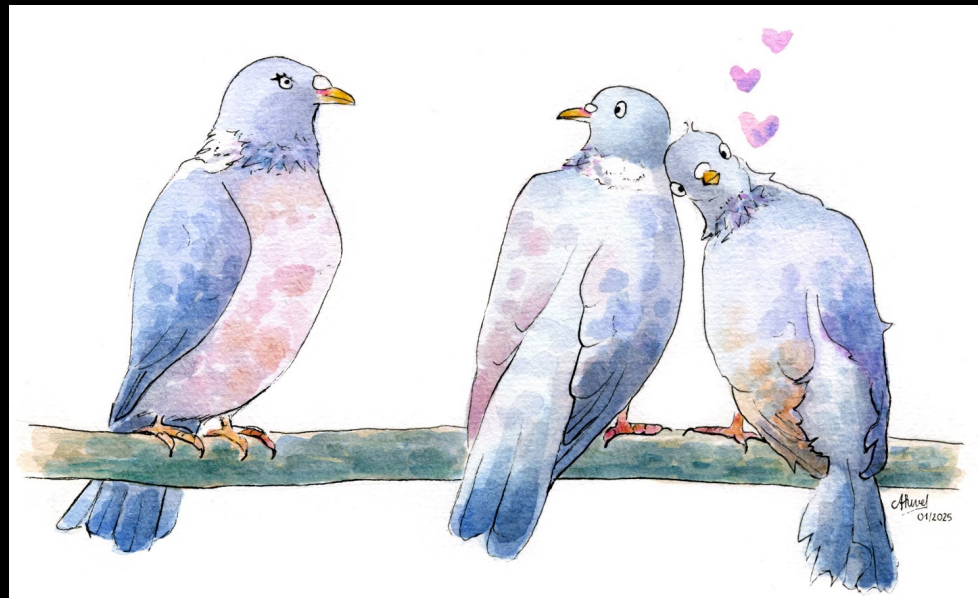
# Positive emotions

*“Does love act as a satisficing mechanism to stop further mate search?”*

Peter M. Todd

Geoffrey F. Miller

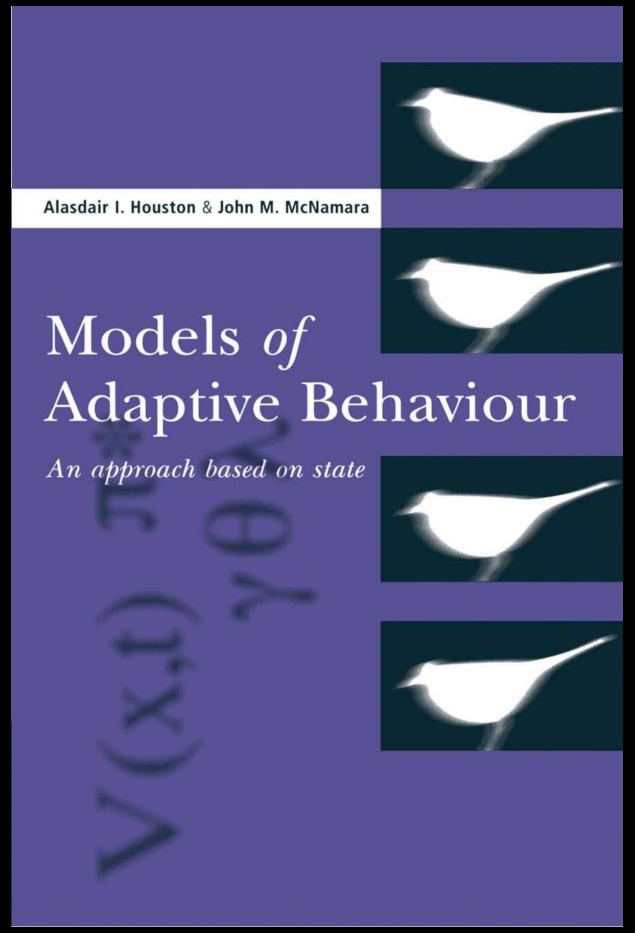
Miller, Geoffrey F, et Peter M Todd. « Mate Choice Turns Cognitive ». *Trends in Cognitive Sciences*. 1998



*“Does love act as a satisficing mechanism to stop further mate search?”*

Laubu, Chloé, Philippe Louâpre, et François-Xavier Dechaume-Moncharmont. « Pair-bonding influences affective state in a monogamous fish species ». *Proc. B.* 2019

# *“Does love act as a satisficing mechanism to stop further mate search?”*




Houston, Alasdair I., et John M. McNamara. *Models of Adaptive Behaviour: An Approach Based on State*. Cambridge University Press, 1999.
Laubu, Chloé, Philippe Louâpre, et François-Xavier Dechaume-Moncharmont. « Pair-bonding influences affective state in a monogamous fish species ». *Proc. B.* 2019

# Model description

# Model description

Single

# Model description

Single

Courtship

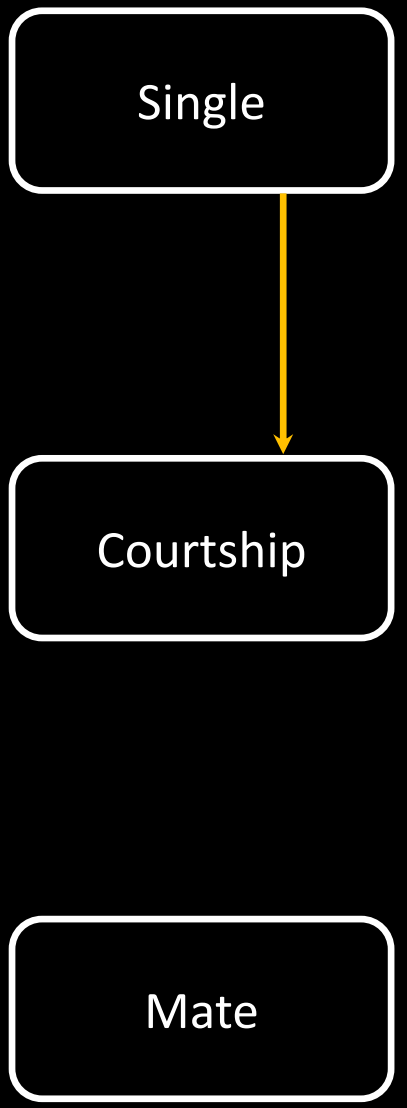
# Model description

Single

Courtship

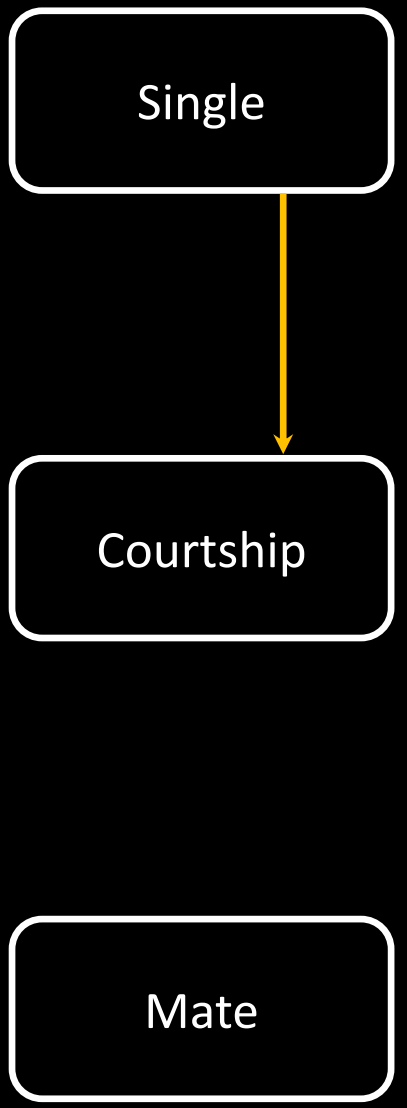
Mate

# Model description

# Model description

## *Trade-up choice*

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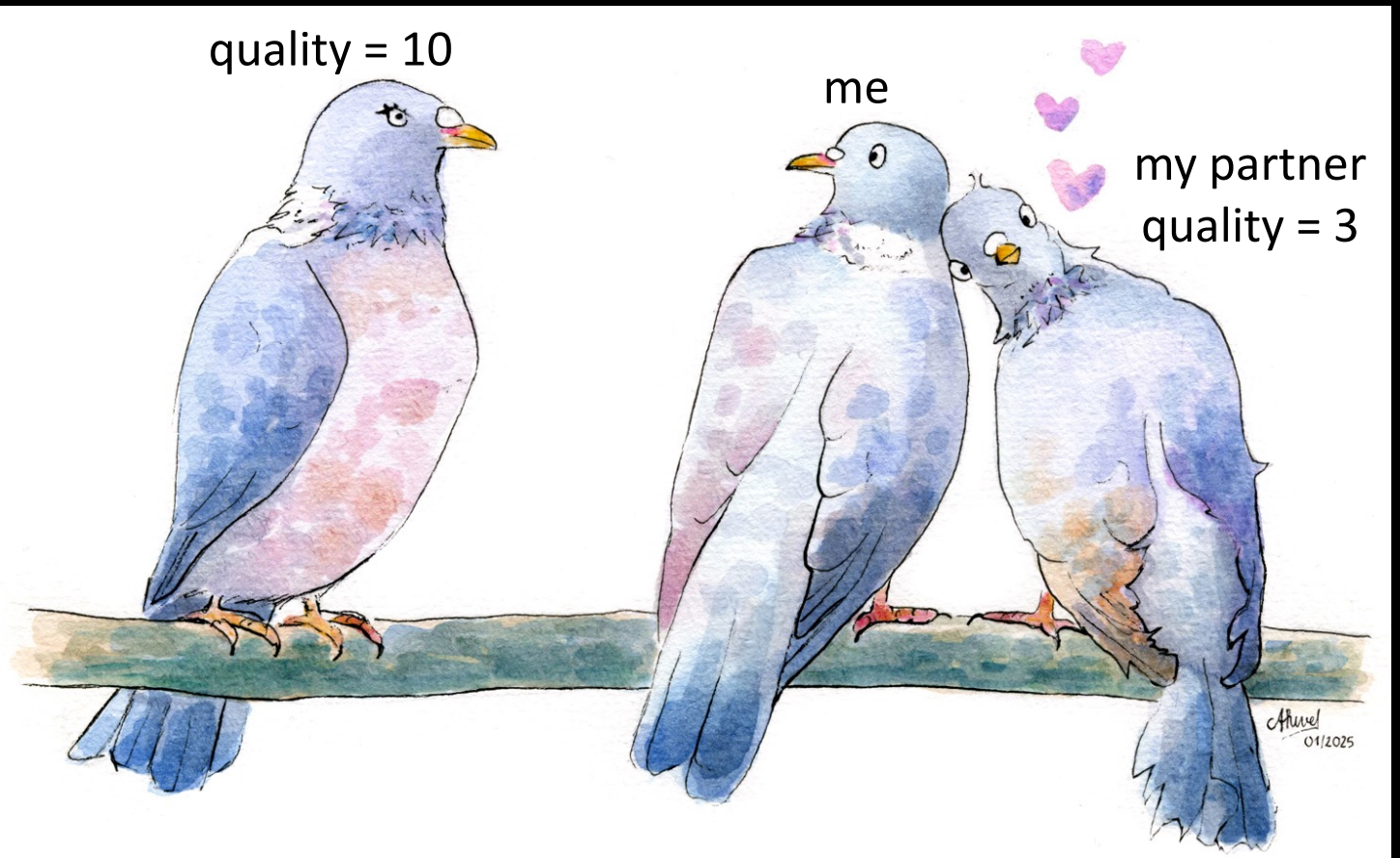


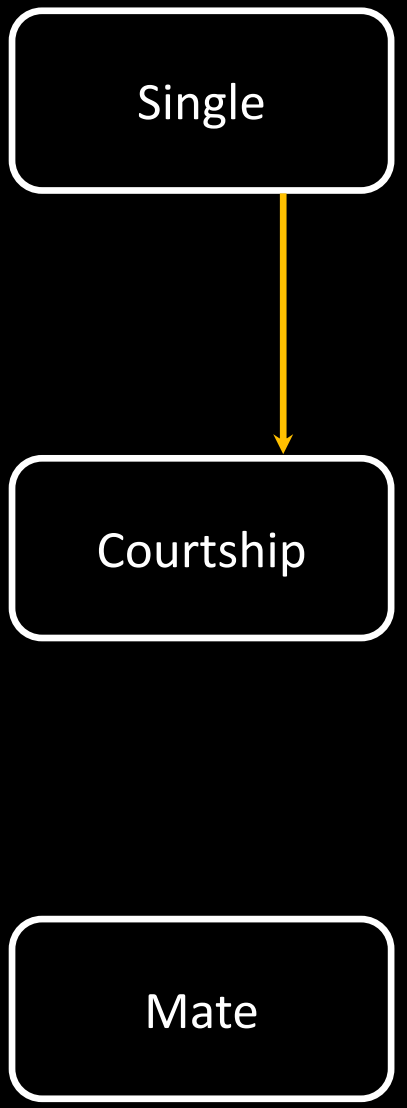

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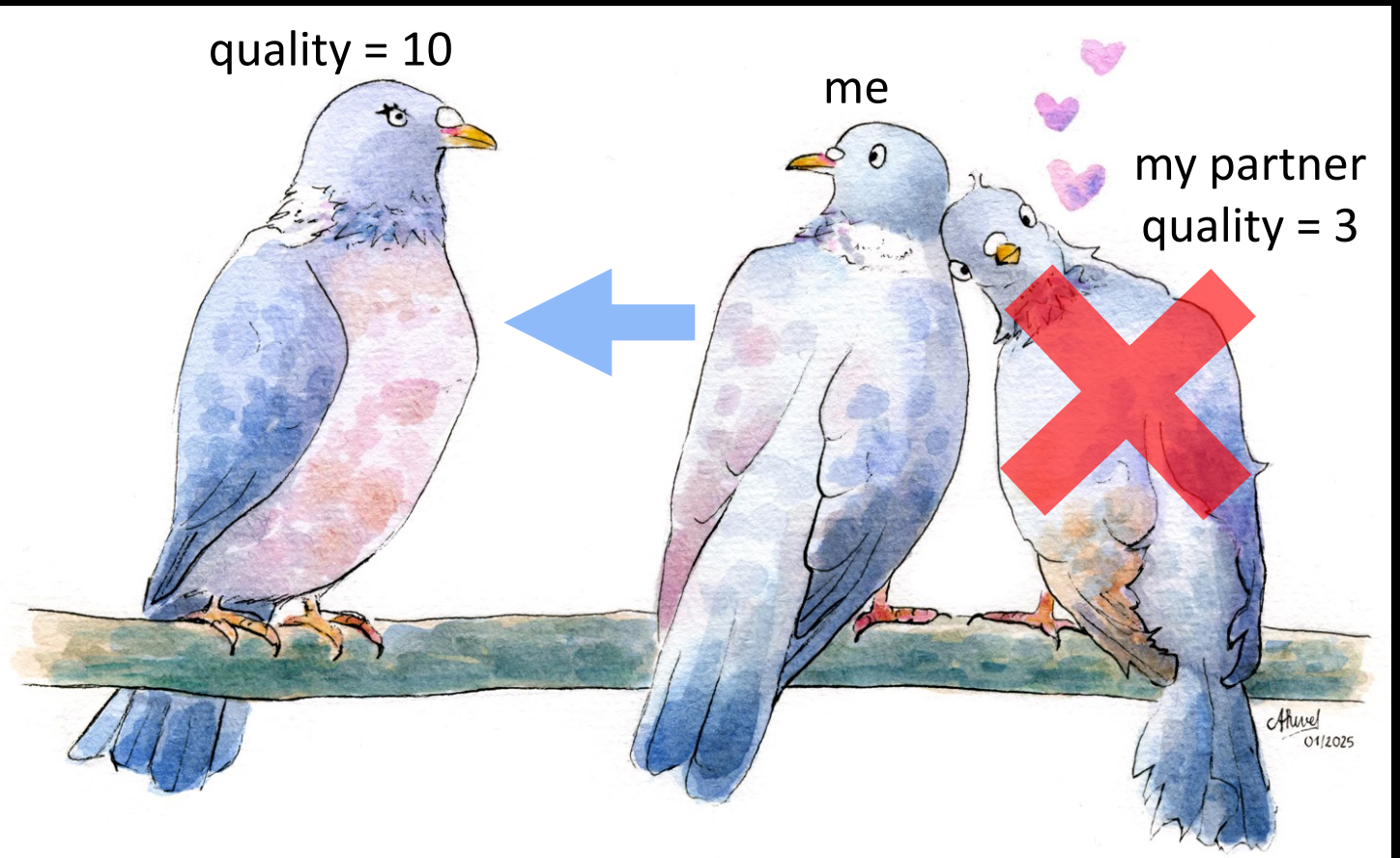


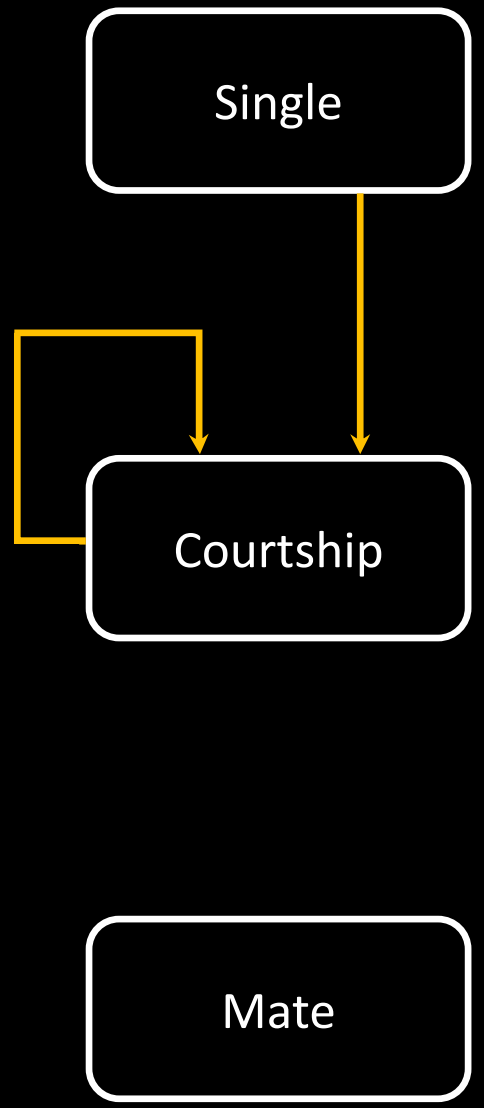

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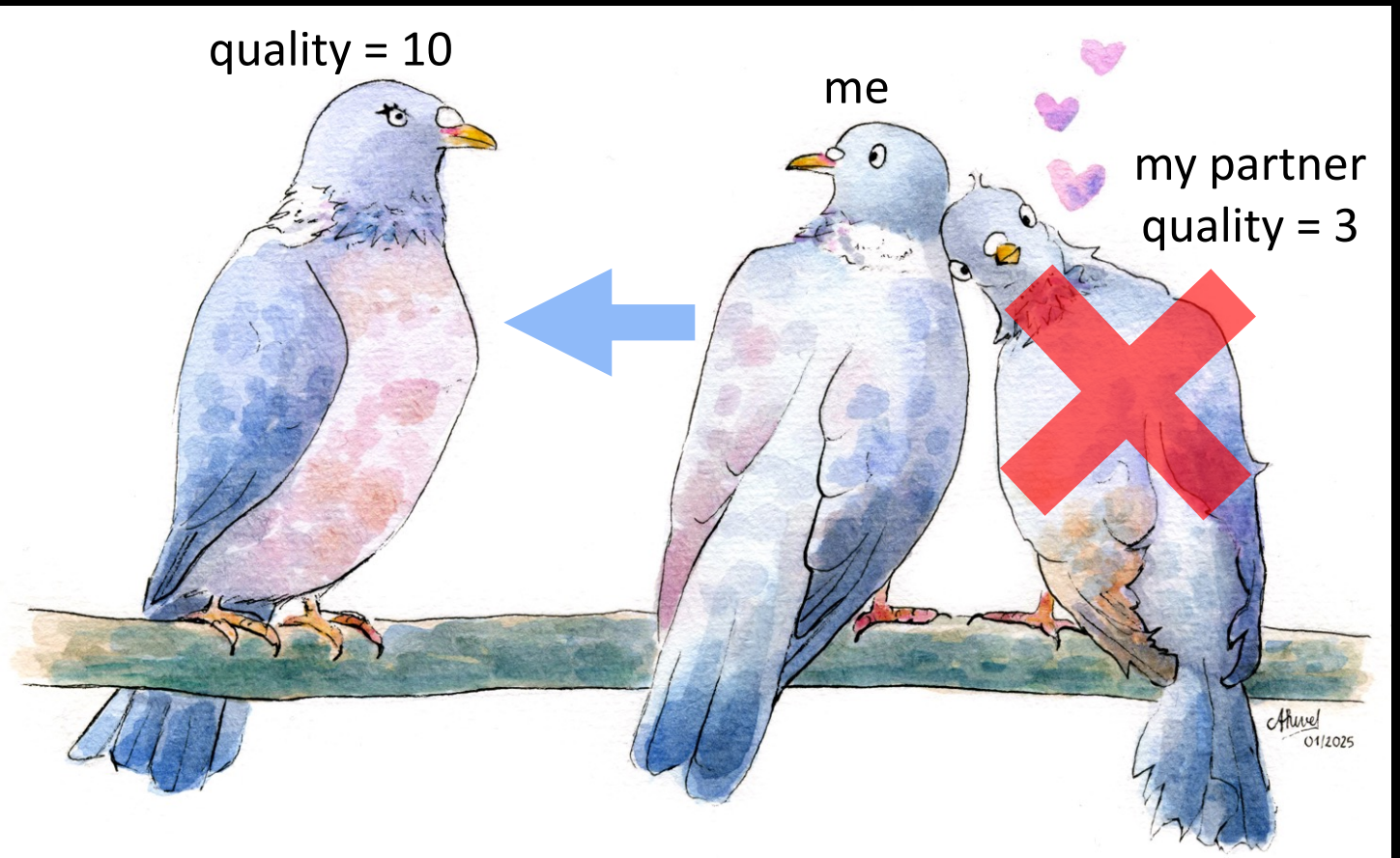


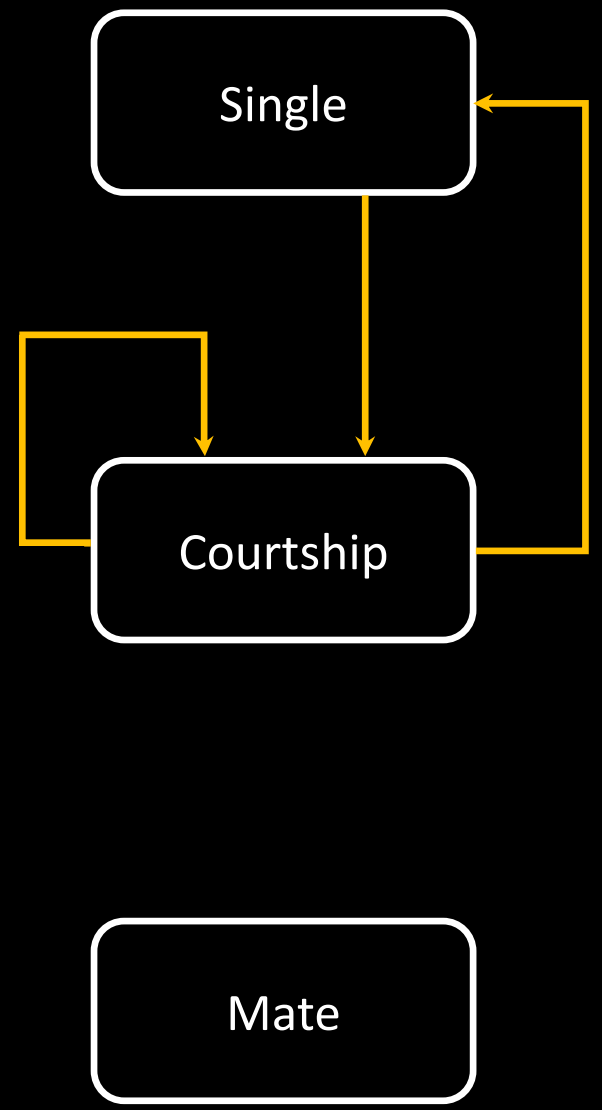

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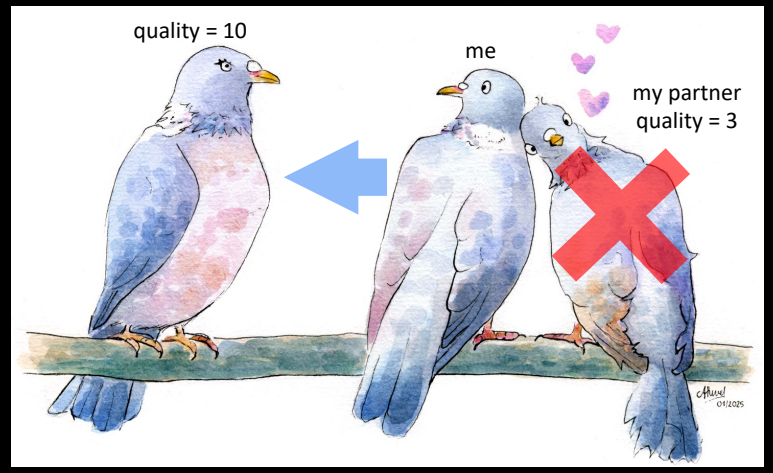


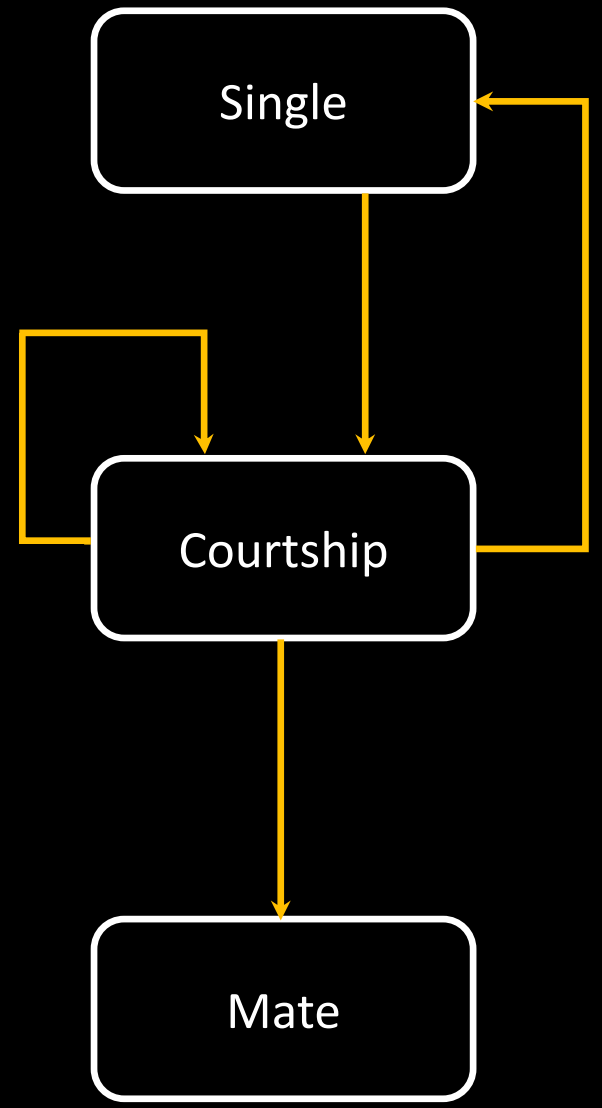

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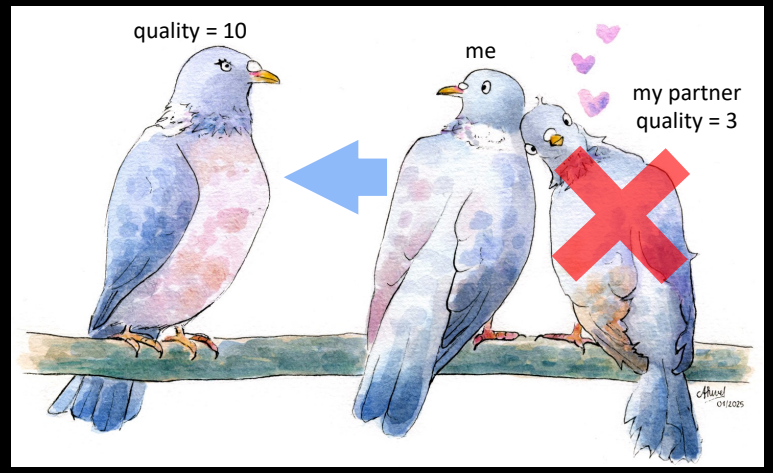
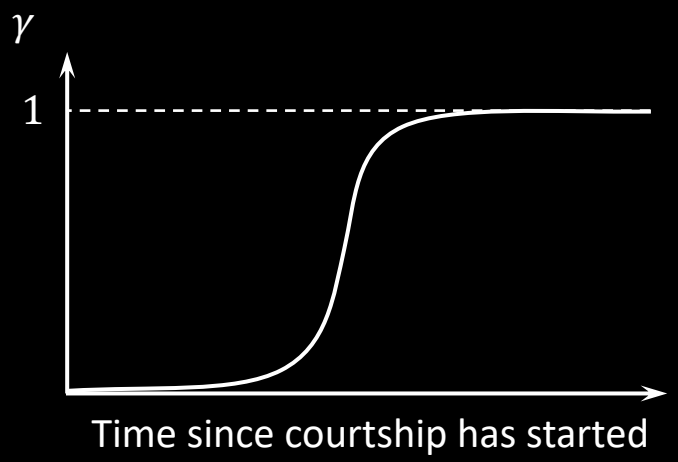
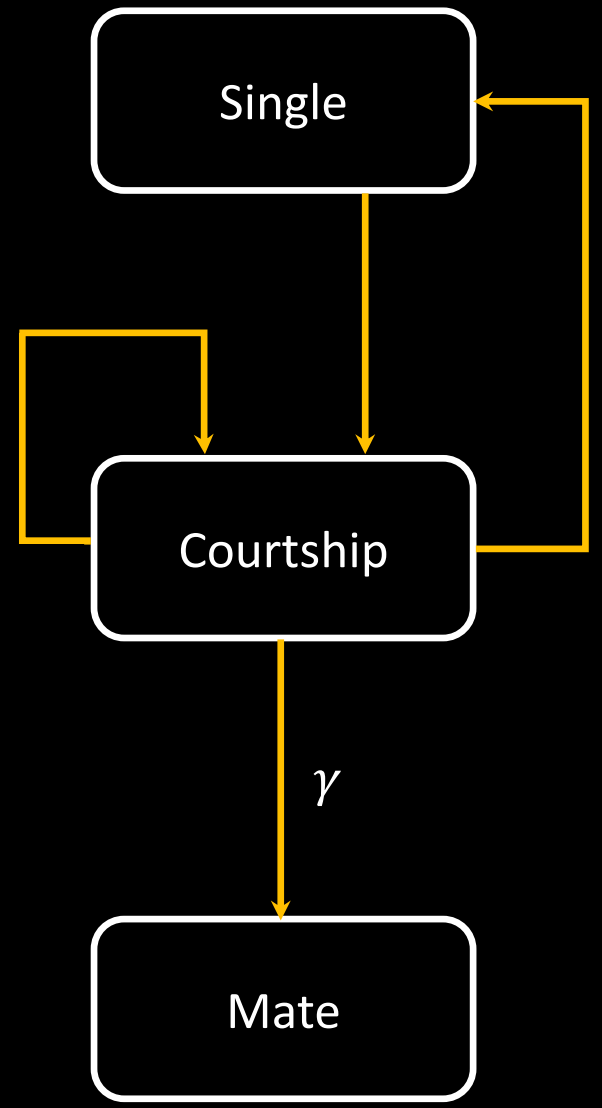
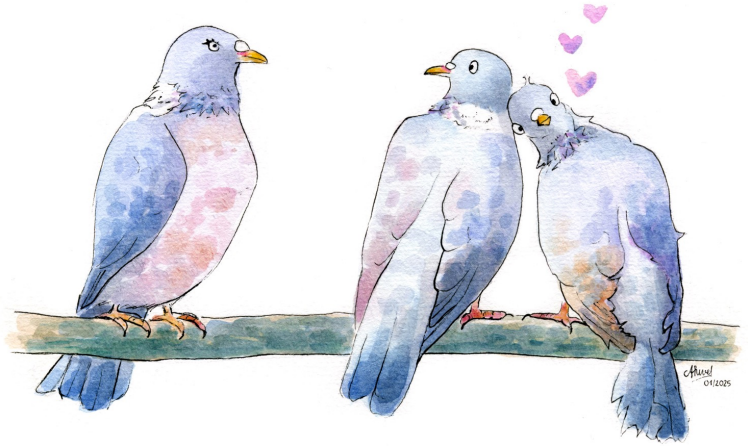


# Model description

## *Love bias*



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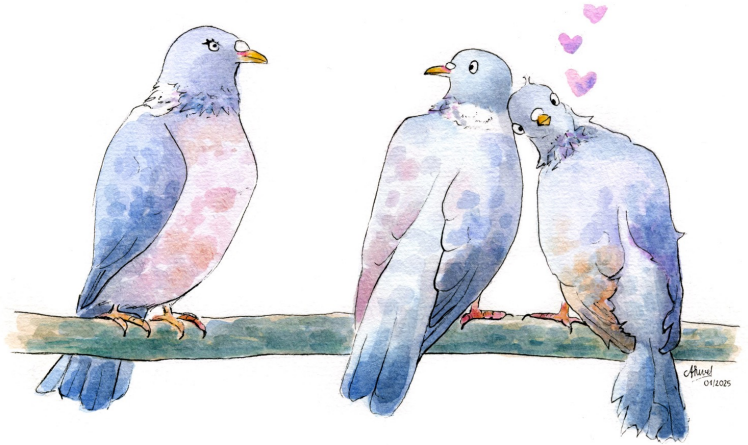
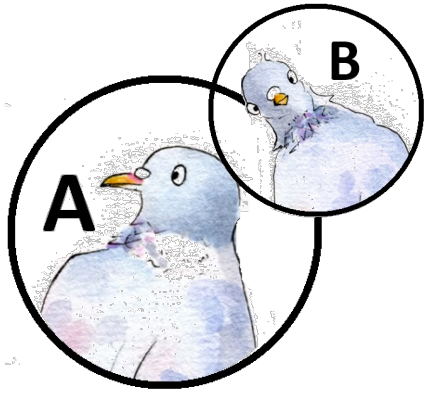
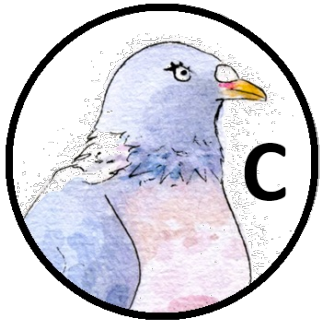
## *Love bias*






A accepts to leave B for C only if:

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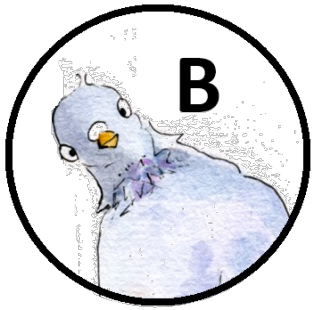

# Model description

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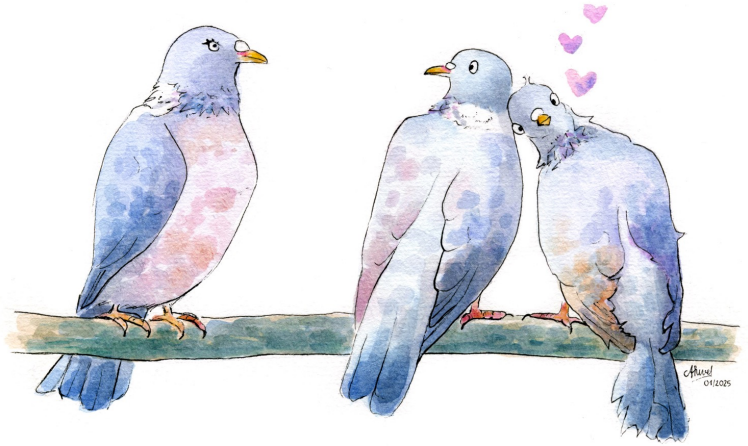

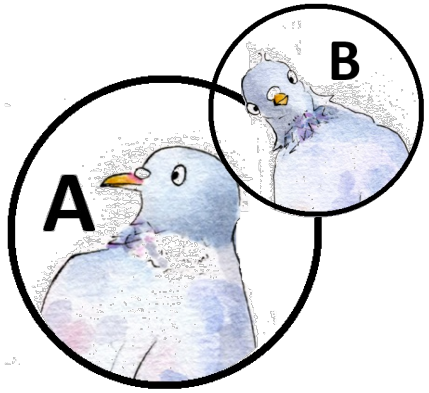


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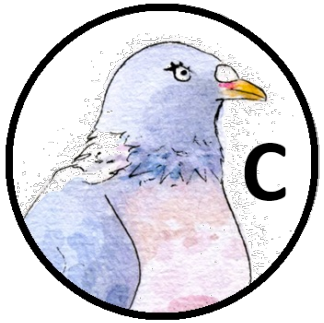


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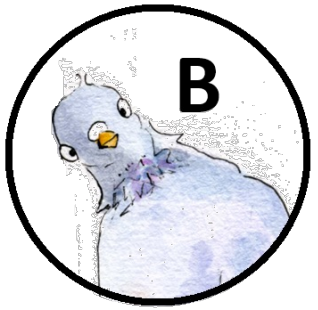



+ BIAS

Depends on:
- A's quality
- time in the season
- time in A & B courtship

Can be negative or positive

# Model description

*Dynamic programming*

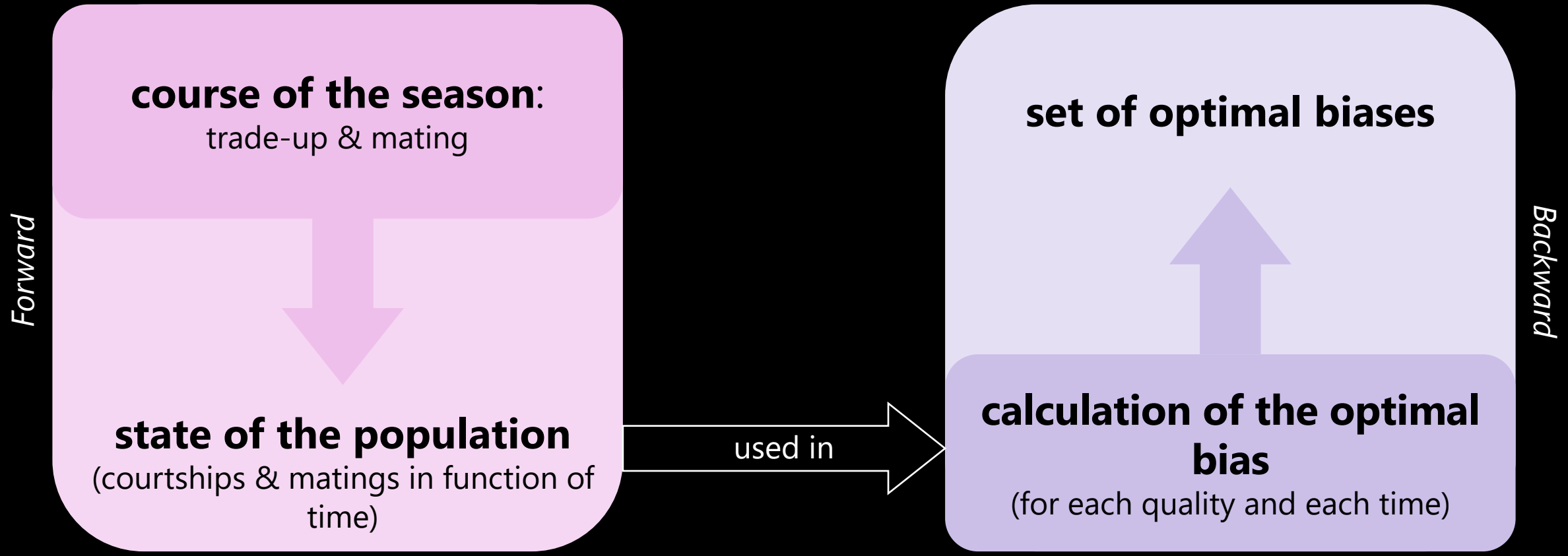
*Forward*

**course of the season**:
trade-up & mating

**state of the population**
(courtships & matings in function of time)

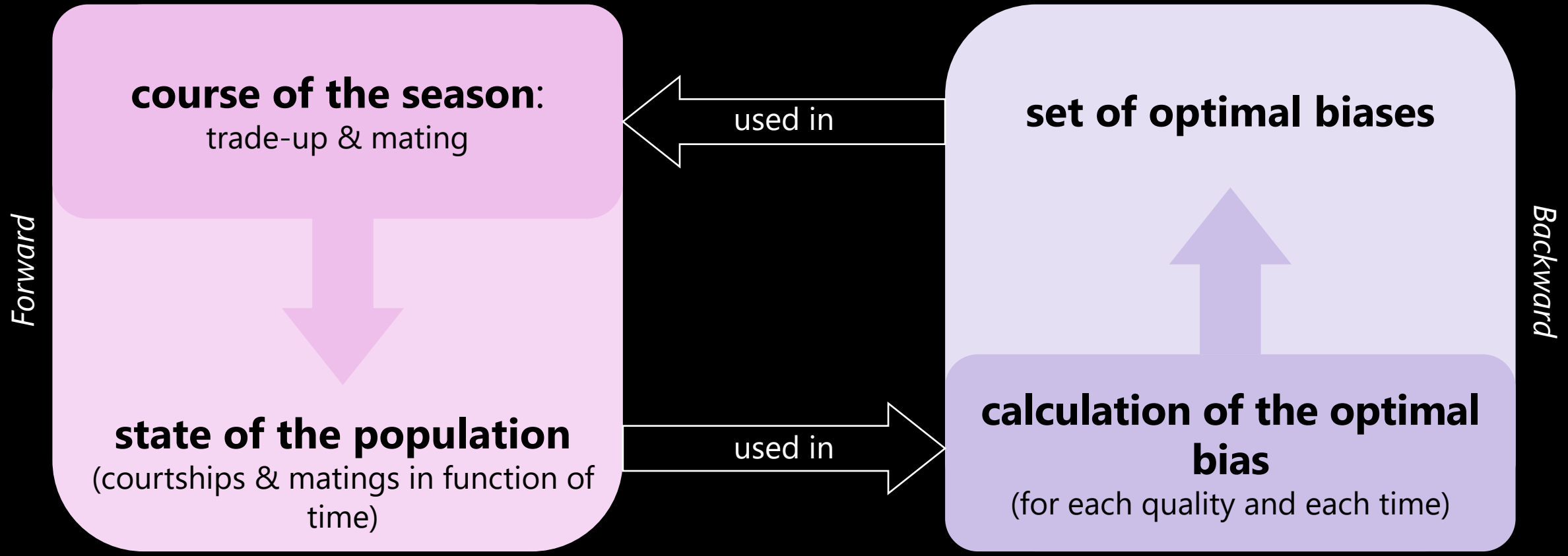
# Model description

*Dynamic programming*



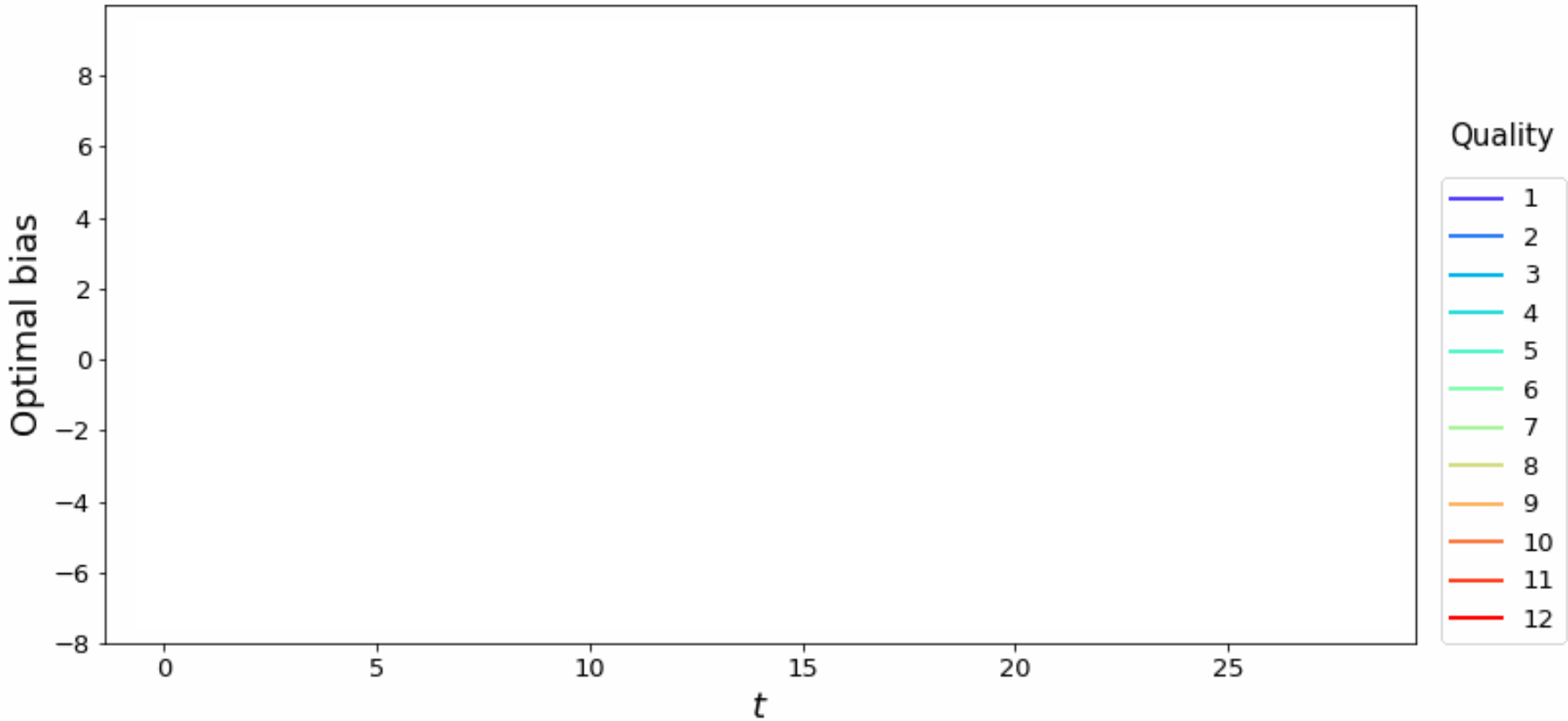
# Model description

*Dynamic programming*




Iterations of the model until convergence = **evolutionarily stable strategy** (ESS)

# Results


Optimal bias
8
6
4
2
0
−2
−4
−6
−8
0
5
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25
t
Quality
1
2
3
4
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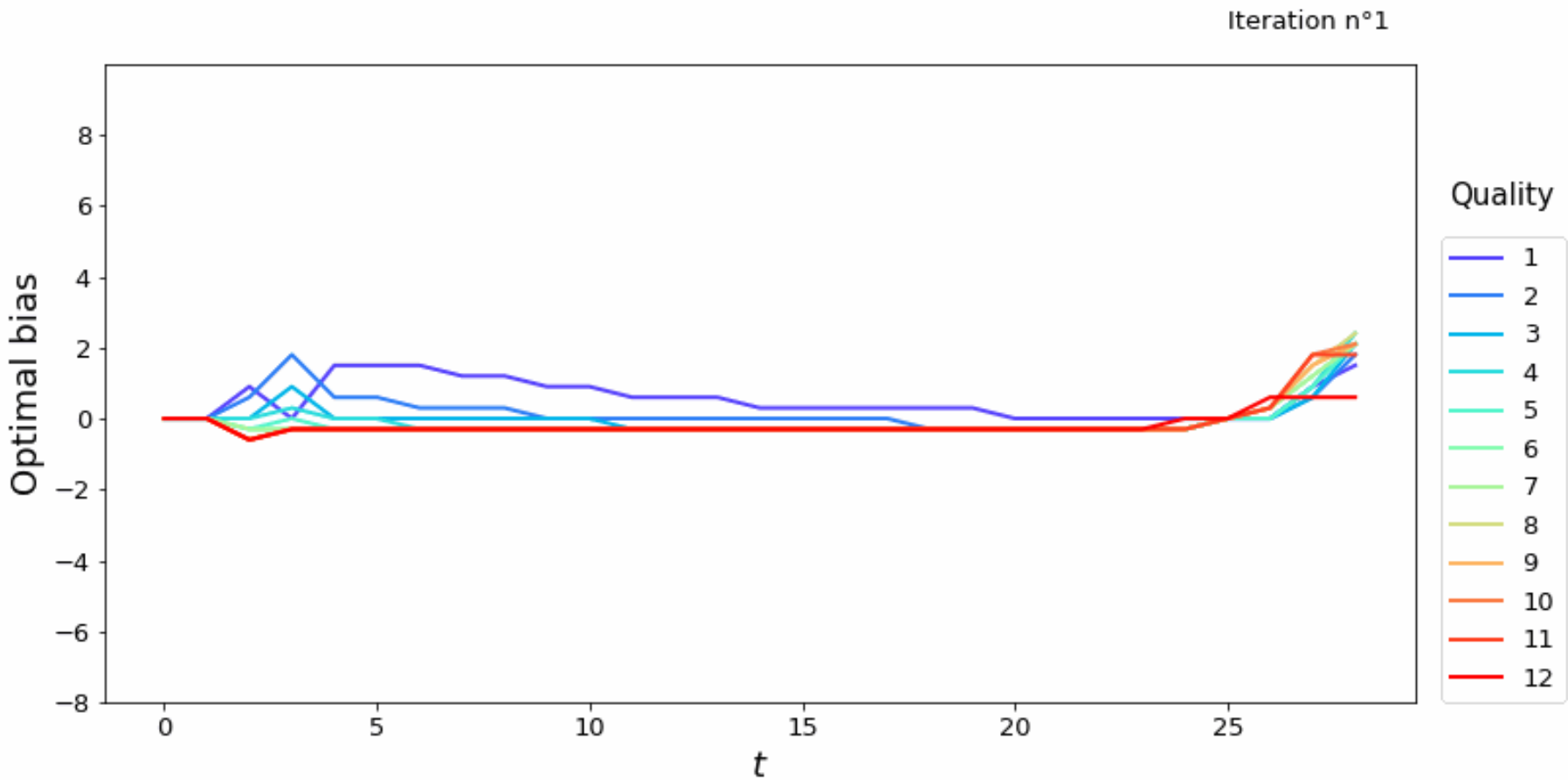
6
7
8
9
10
11
12

# Results


Iteration n°1
Optimal bias
8
6
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0
−2
−4
−6
−8
0
5
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Quality
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2
3
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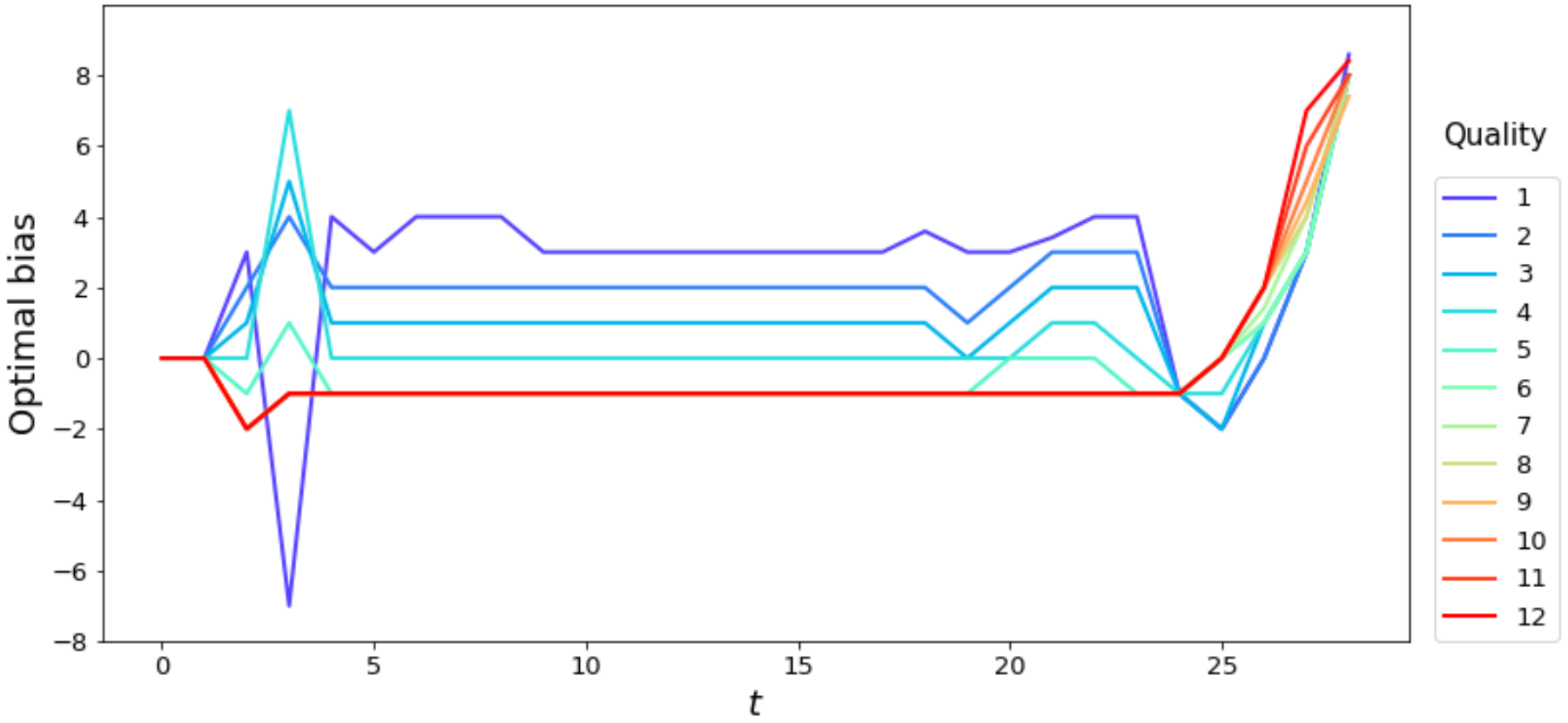
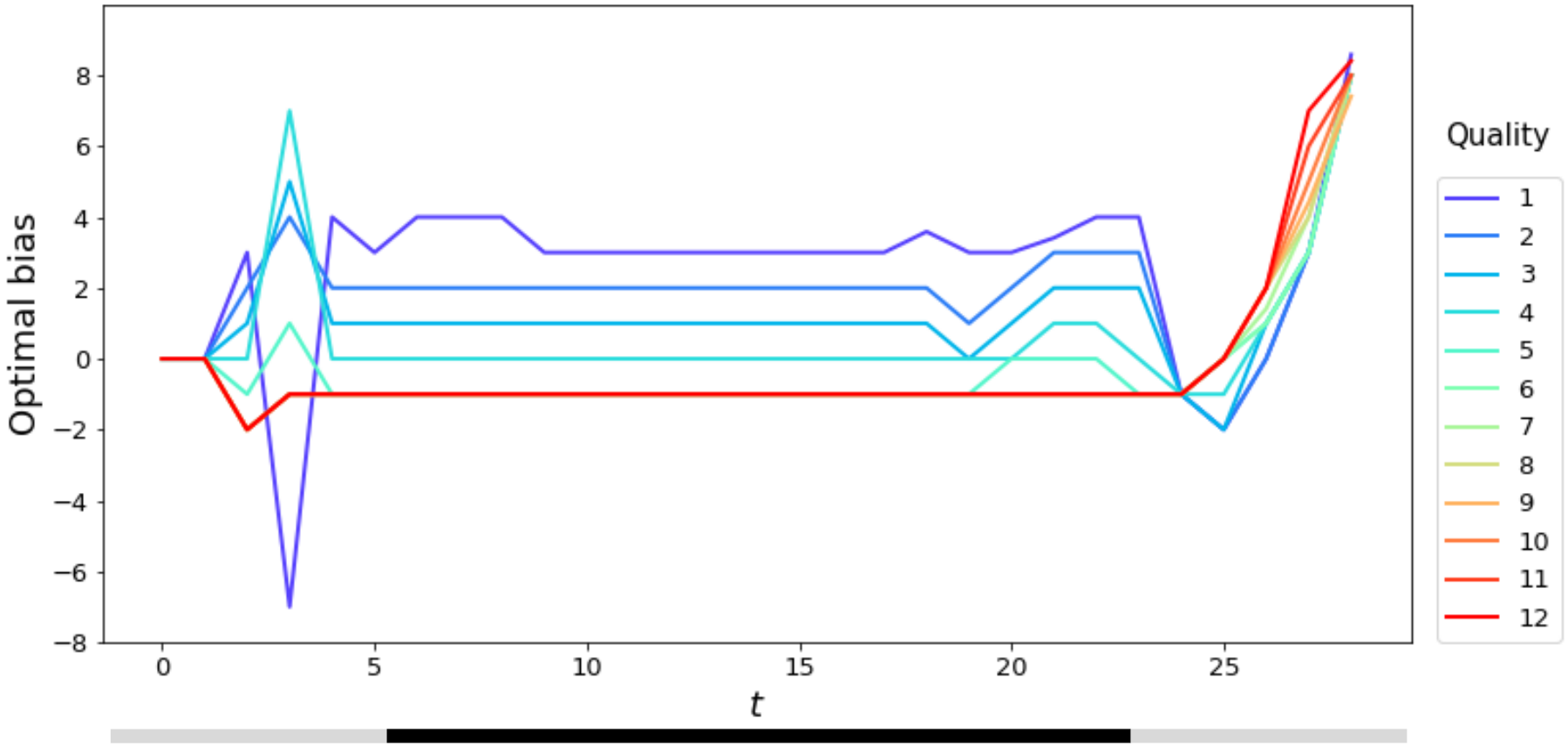
12

# Results




In a season, the optimal bias depends on:

# Results




In a season, the optimal bias depends on:

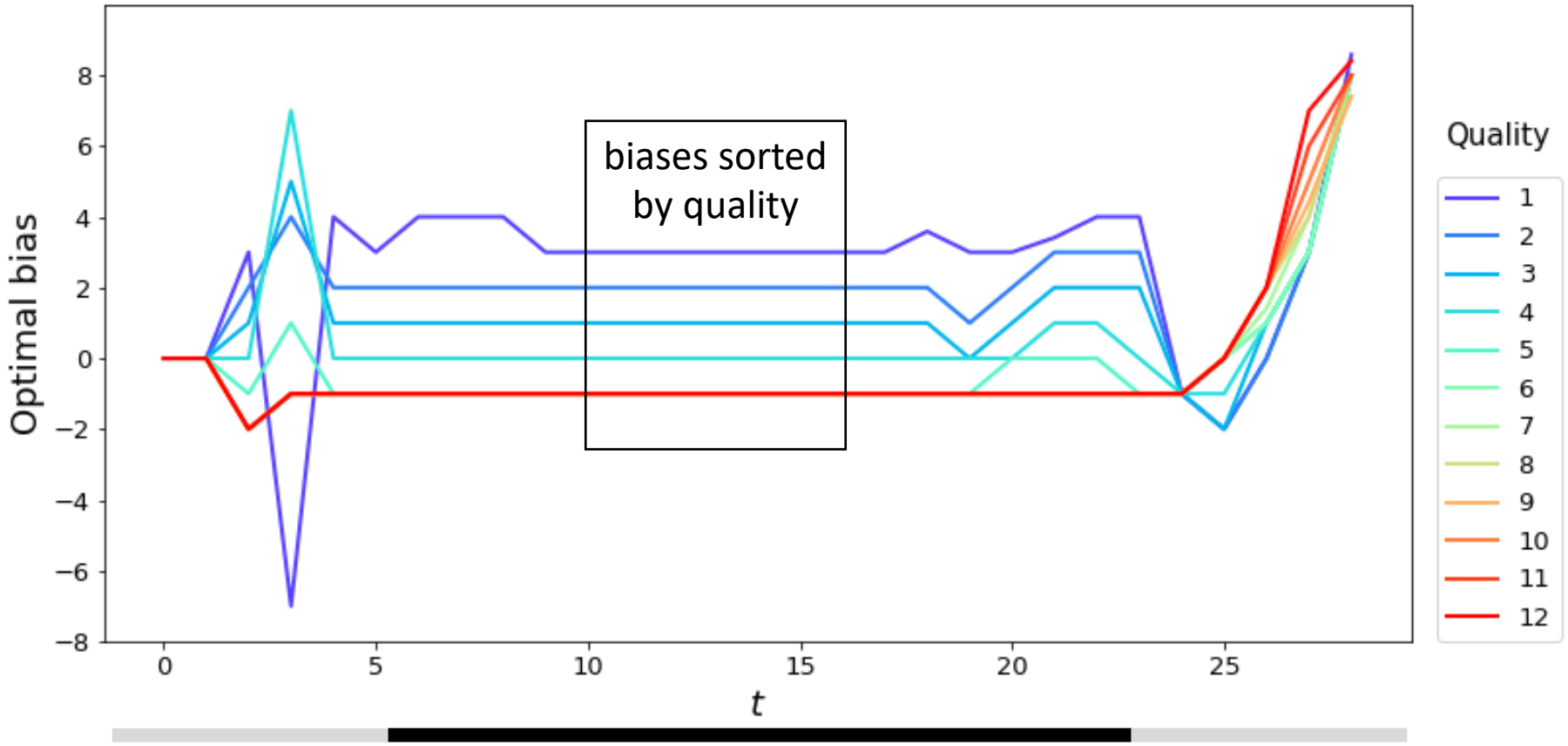
— **Time**

**Start**:
Effect of random pairs

**Middle**:
Constant biases

**End**:
Last chance to mate

# Results




**Start**:
Effect of
random pairs

**Middle**:
Constant biases

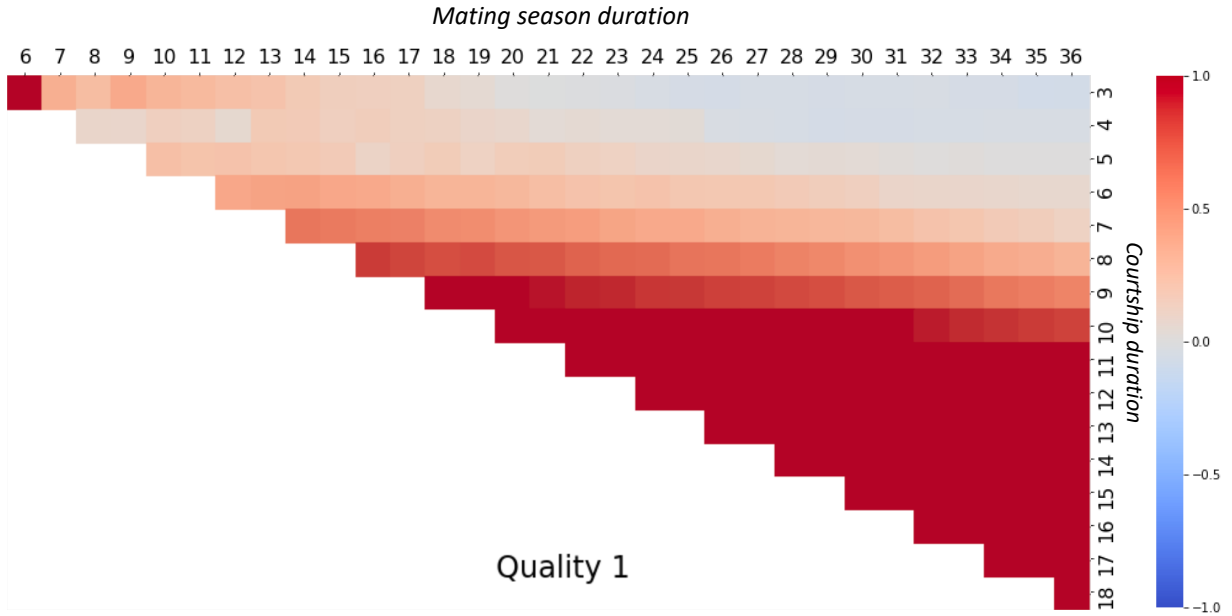
**End**:
Last chance
to mate

In a season, the optimal bias depends on:

- **Time**
- **Quality**

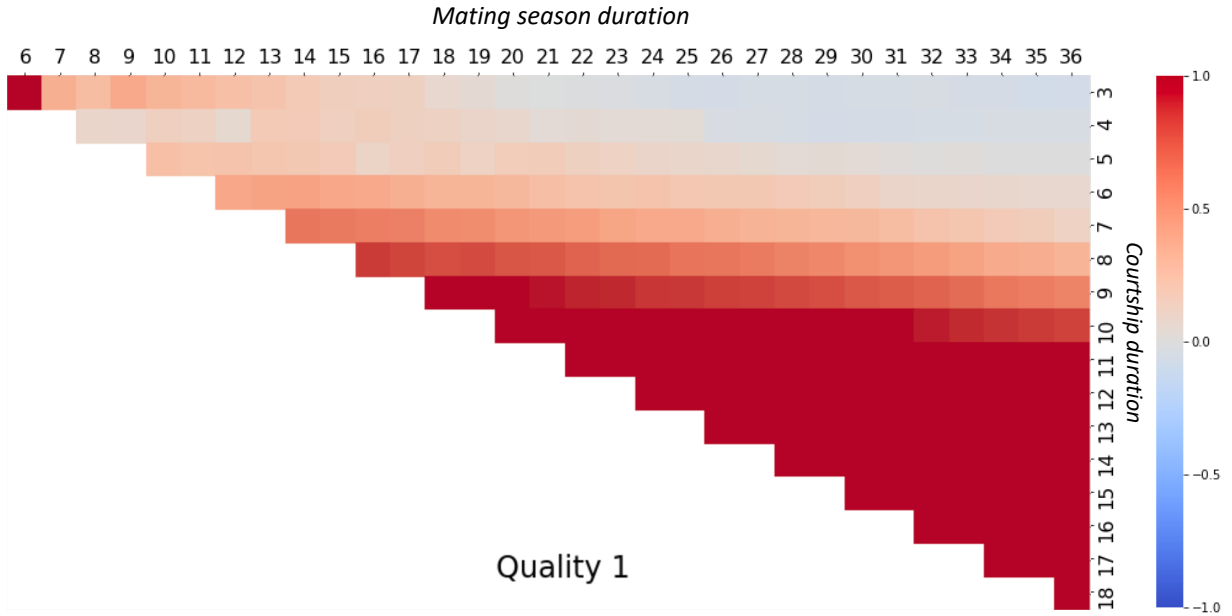
# Results

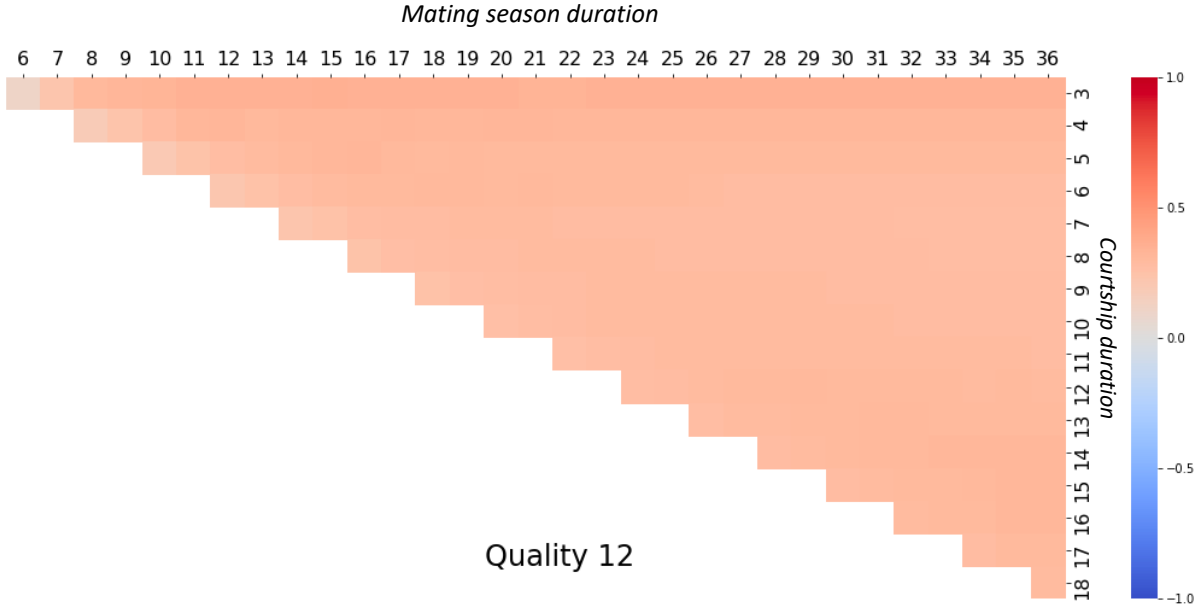
## *Biased vs unbiased populations*



# Results

## *Biased vs unbiased populations*



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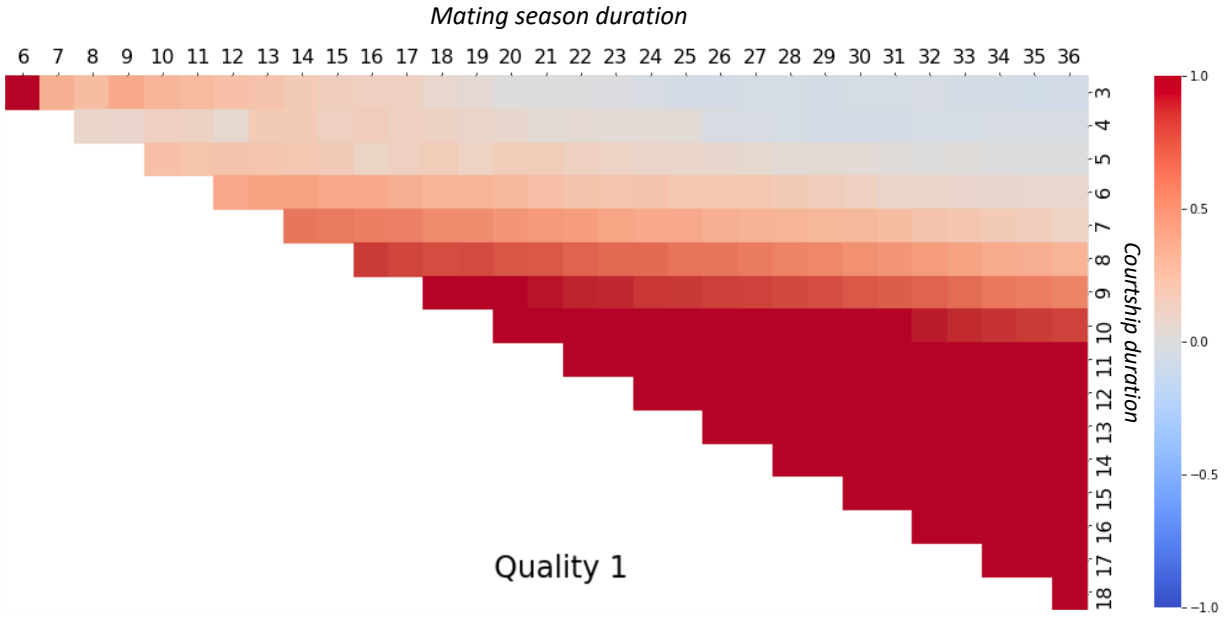


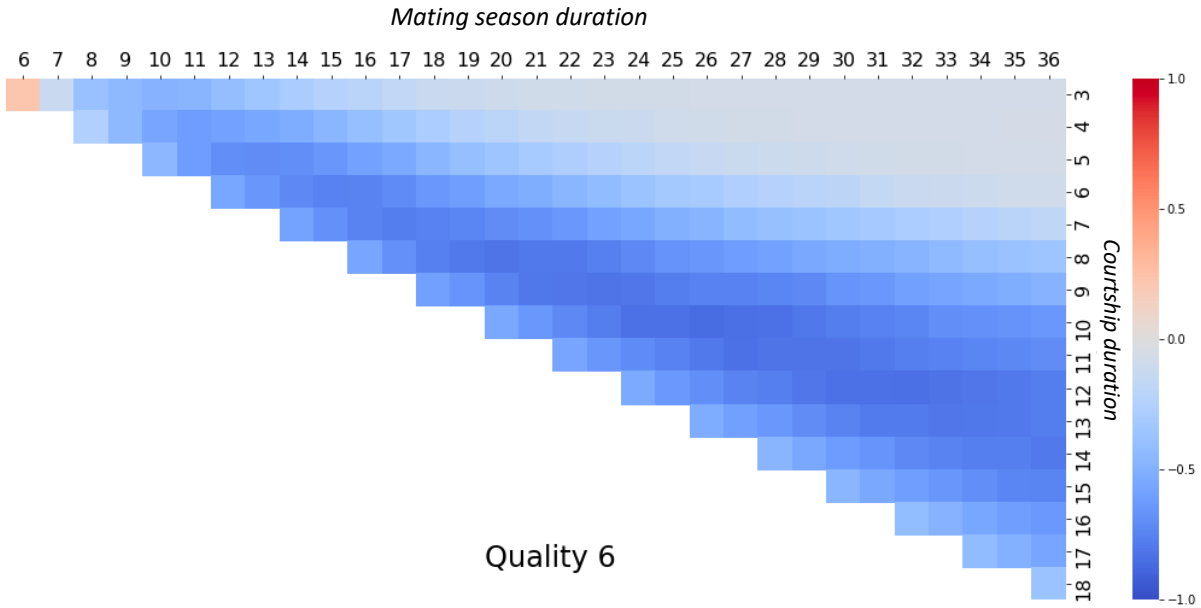


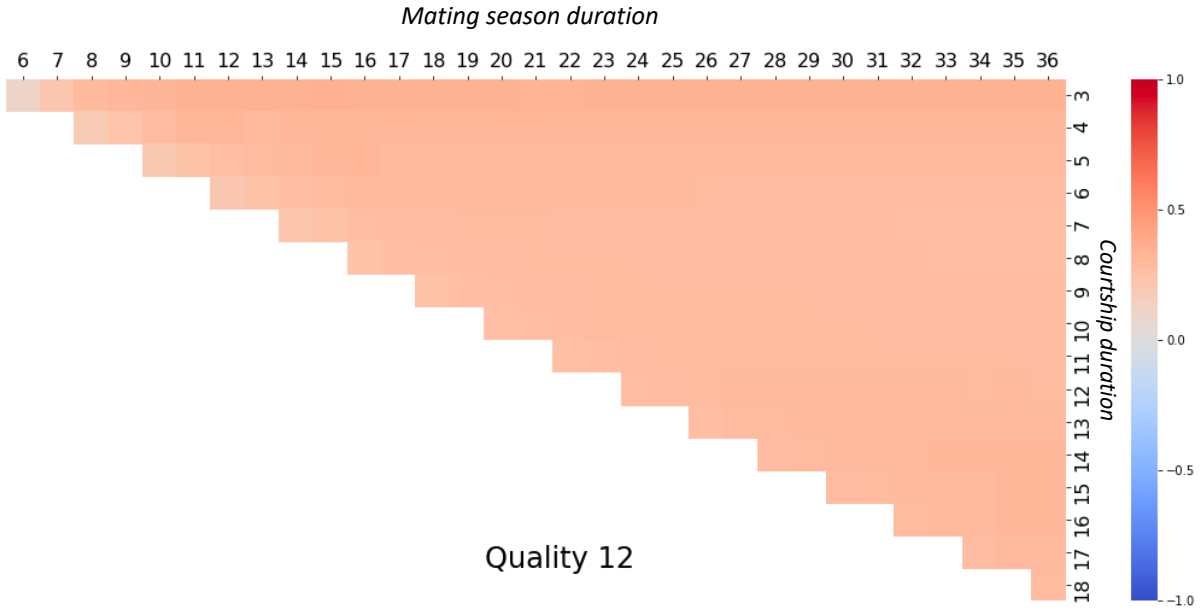

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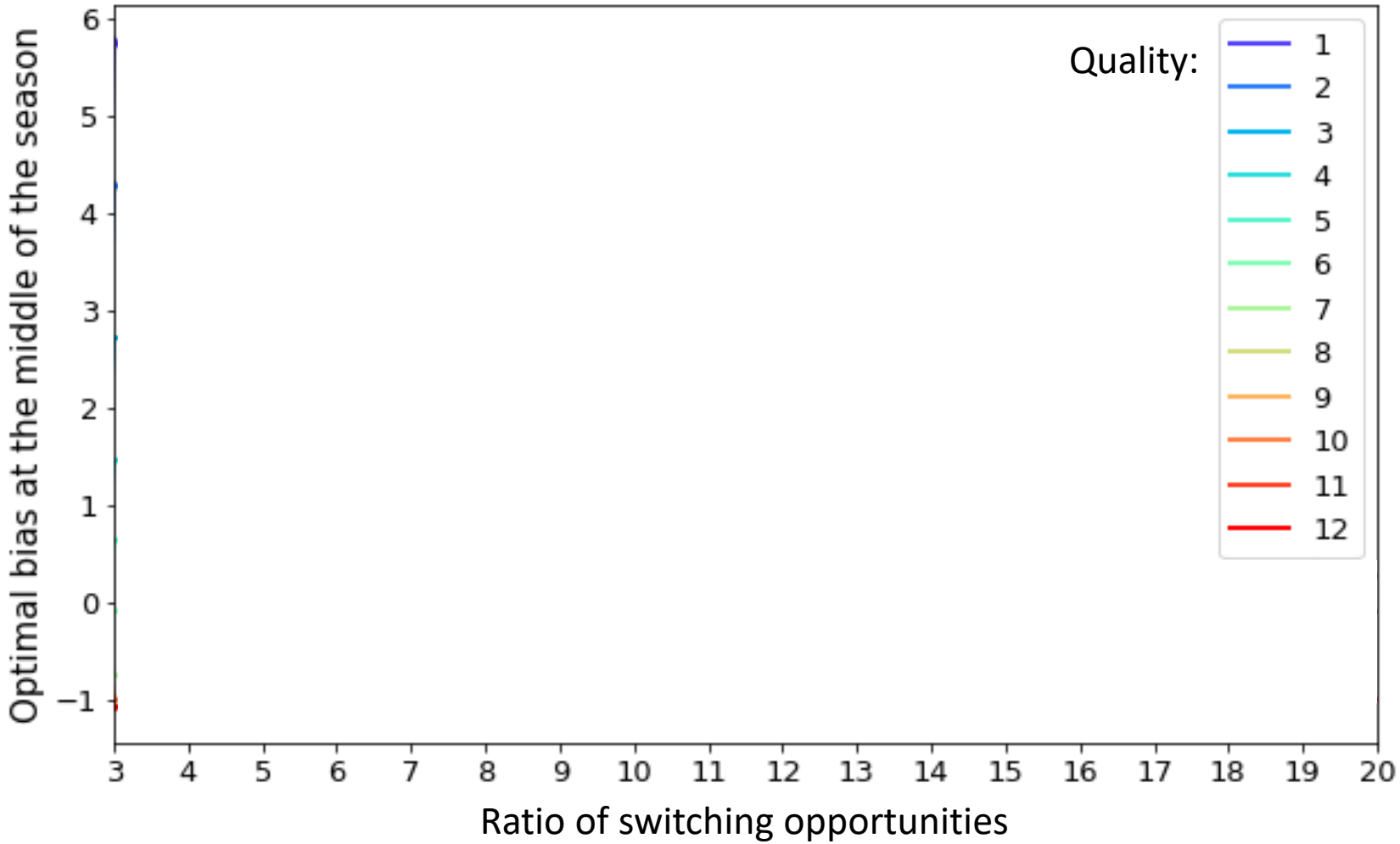
Optimal bias at the middle of the season
6
5
4
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−1
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Ratio of switching opportunities
Quality:
1
2
3
4
5
6
7
8
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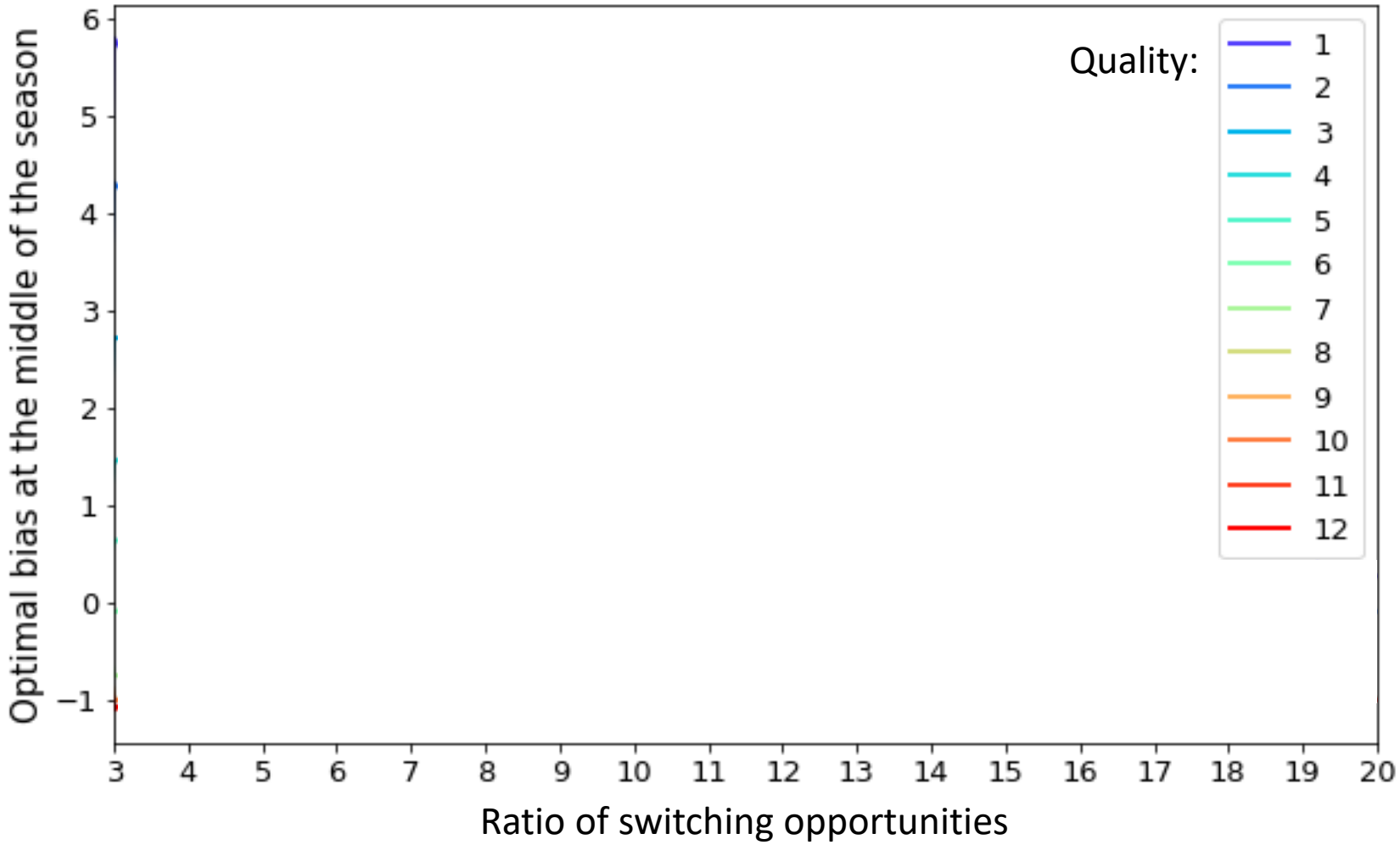
12

# Results




**Ratio of switching opportunities**:

number of individuals met during **the season**

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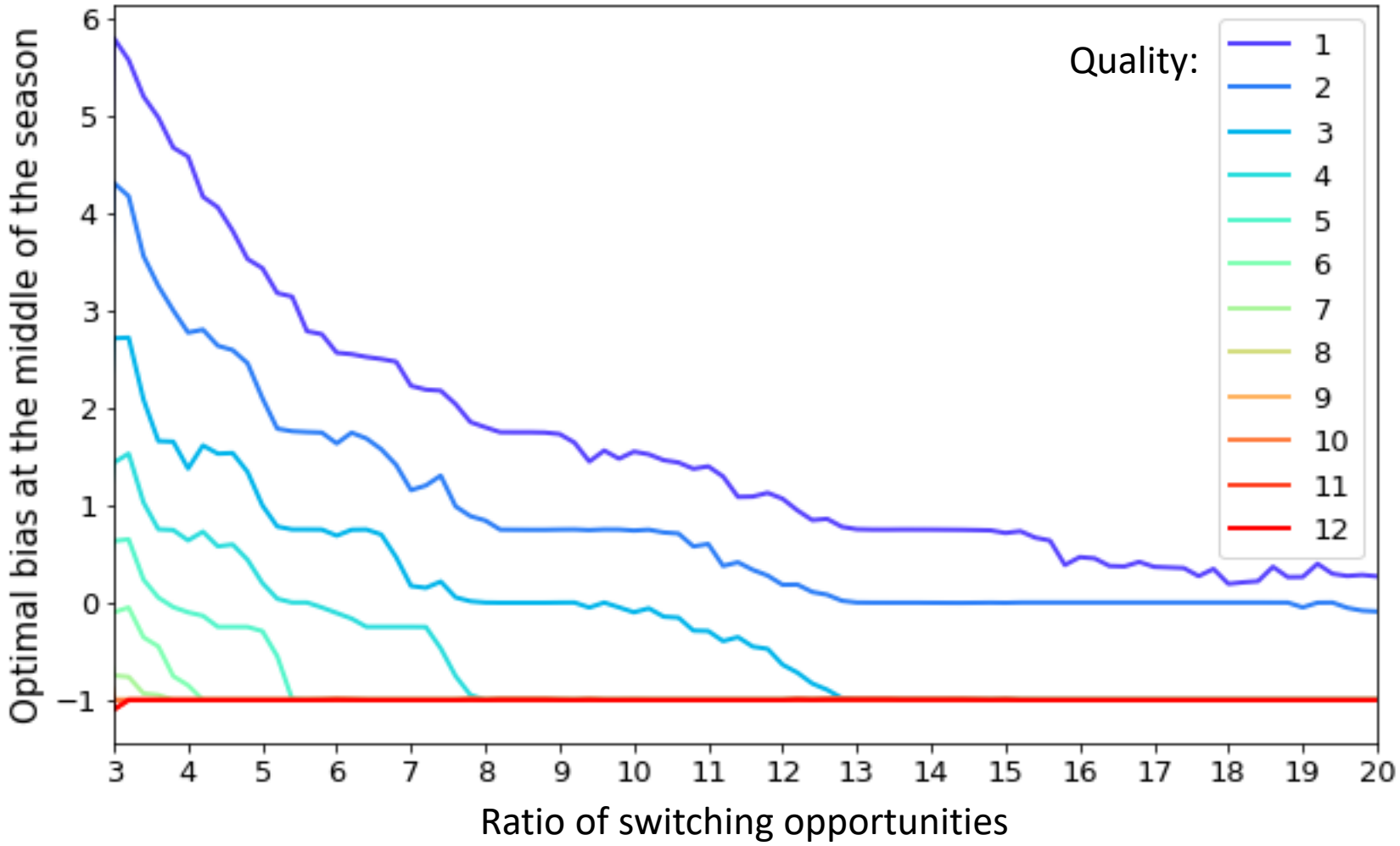
number of individuals met during **a courtship**

# Results




**Ratio of switching opportunities**:

number of individuals met during **the season**

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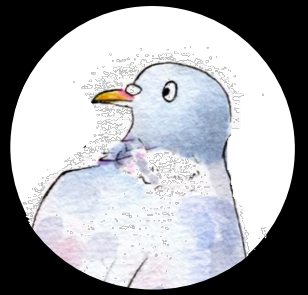
number of individuals met during **a courtship**

# Conclusion

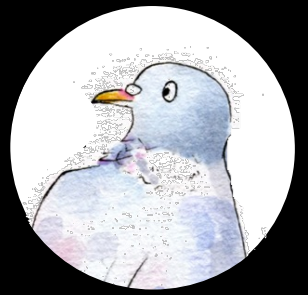




—Being biased can be an adaptive strategy in mate choice.

—The biased strategy leads to contrasted fitness outcomes depending on individual qualities.

—The optimal biased strategy depends on the available opportunities.

# Perspectives



—Eco-evo feedback loops

—Effects of different mating systems

—Consequences on homogamy pattern

# Acknowledgments

FX Dechaume-Moncharmont
Agnès Hivet
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Chaire MMB