

# VisMatchmaker: Cooperation of the **User** and the **Computer** in Centralized Matching Adjustment

**Po-Ming Law**

Wenchao Wu

Yixian Zheng

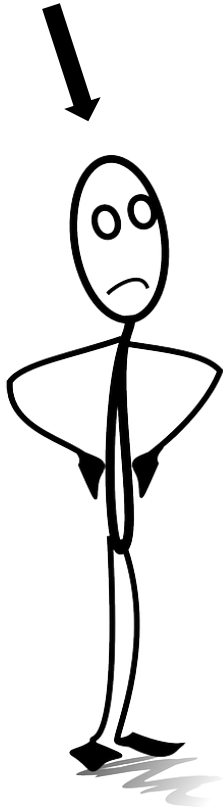
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香港科技大學  
THE HONG KONG  
UNIVERSITY OF SCIENCE  
AND TECHNOLOGY

# Mentor-Mentee Matching

A puzzled advisor  
at Georgia Tech



## Mentors

Peter  
Ken  
Betty  
Jane  
John

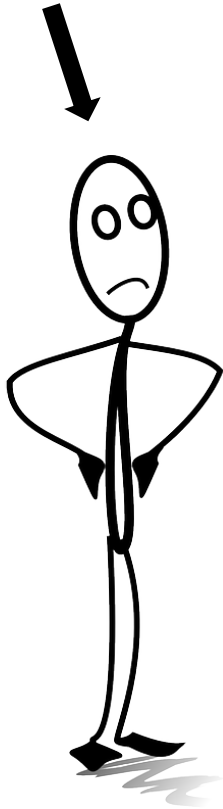
## Mentees

David  
Ben  
Jack  
Mary  
May

# Mentor-Mentee Matching

## Mentees' Preference Lists

A puzzled advisor  
at Georgia Tech

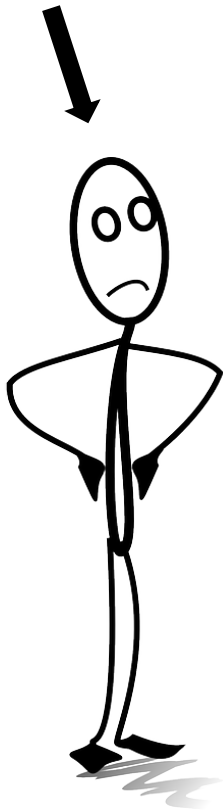


David	Ben	Jack	Mary	May
1. Jane	1. Ken	1. ...	1. ...	1. ...
2. Betty	2. Jane	2. ...	2. ...	2. ...
3. Peter	3. John	3. ...	3. ...	3. ...
4. John	4. Betty	4. ...	4. ...	4. ...

# Mentor-Mentee Matching

## Mentors' Preference Lists

A puzzled advisor  
at Georgia Tech



**Peter**  
1. David  
2. May  
3. Jack  
4. Ben

**Ken**  
1. May  
2. Mary  
3. Jack  
4. Ben

**Betty**  
1. ...  
2. ...  
3. ...  
4. ...

**Jane**  
1. ...  
2. ...  
3. ...  
4. ...

**John**  
1. ...  
2. ...  
3. ...  
4. ...

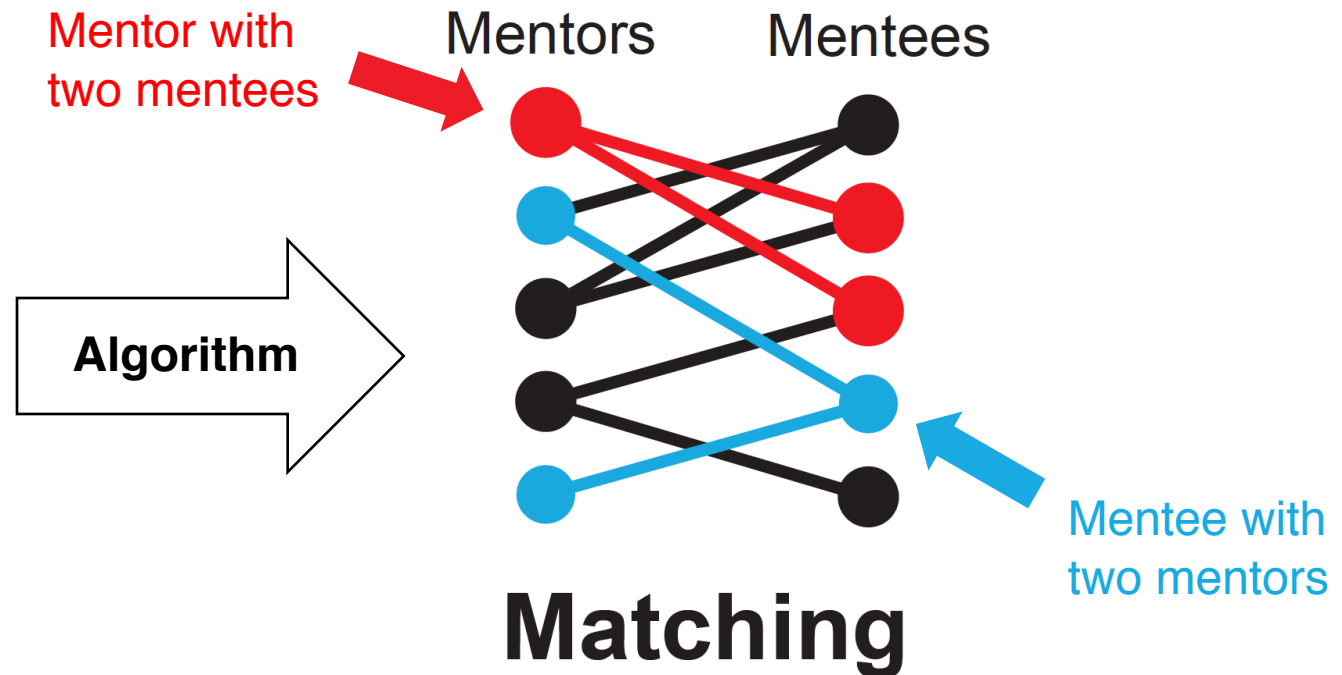
# Mentor-Mentee Matching

## Mentors' Preference Lists

Peter	Ken	Betty	Jane	John
1. David	1. May	1. ...	1. ...	1. ...
2. May	2. Mary	2. ...	2. ...	2. ...
3. Jack	3. Jack	3. ...	3. ...	3. ...
4. Ben	4. Ben	4. ...	4. ...	4. ...

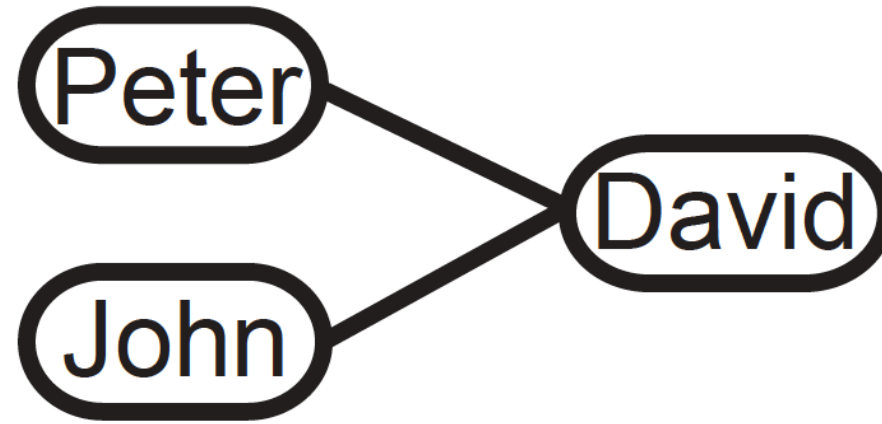
## Mentees' Preference Lists

David	Ben	Jack	Mary	May
1. Jane	1. Ken	1. ...	1. ...	1. ...
2. Betty	2. Jane	2. ...	2. ...	2. ...
3. Peter	3. John	3. ...	3. ...	3. ...
4. John	4. Betty	4. ...	4. ...	4. ...



# What if...

Mentors	Mentee
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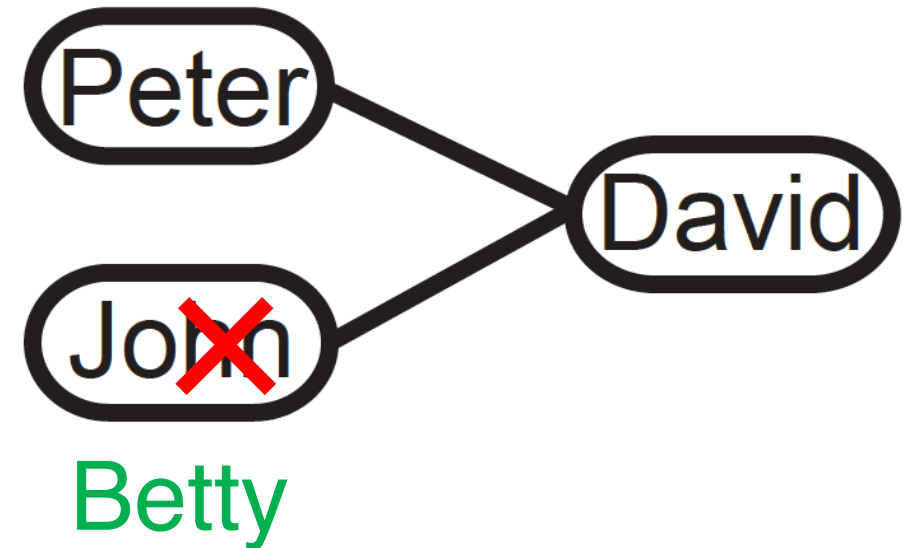
# The Cascading Nightmare

## David's Preference

1. Jane
2. Betty
3. Peter
4. John

## Mentors

## Mentee



Possible to improve?

# The Cascading Nightmare

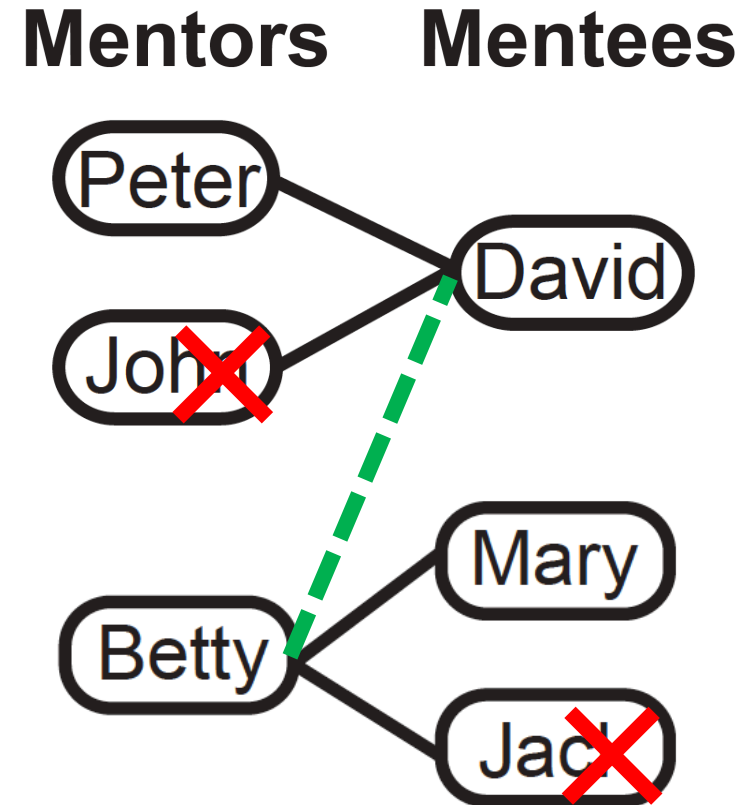
## David's Preference

1. Jane

2. Betty

3. Peter

4. John

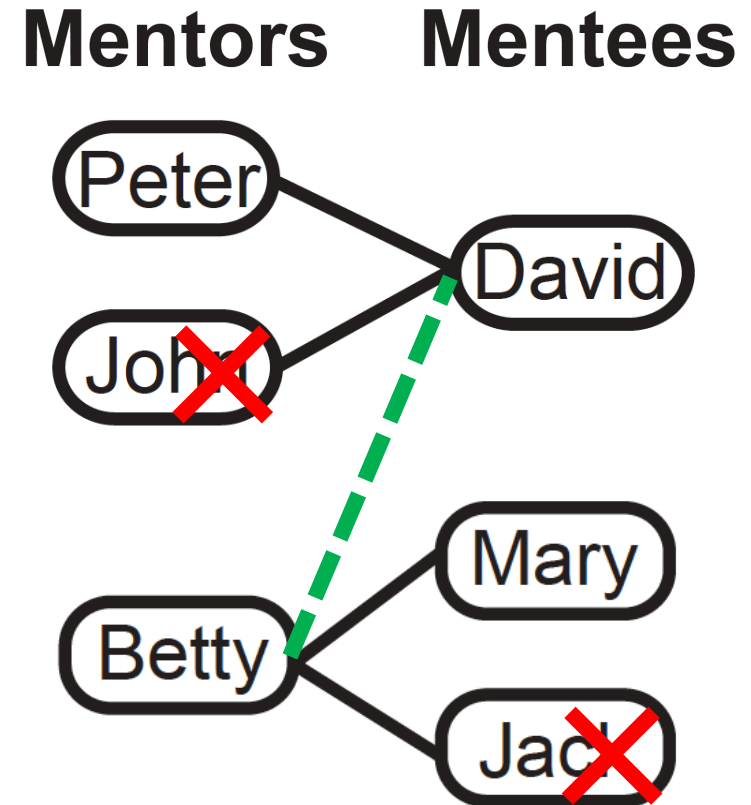


Betty can have at most two partners



# The Cascading Nightmare

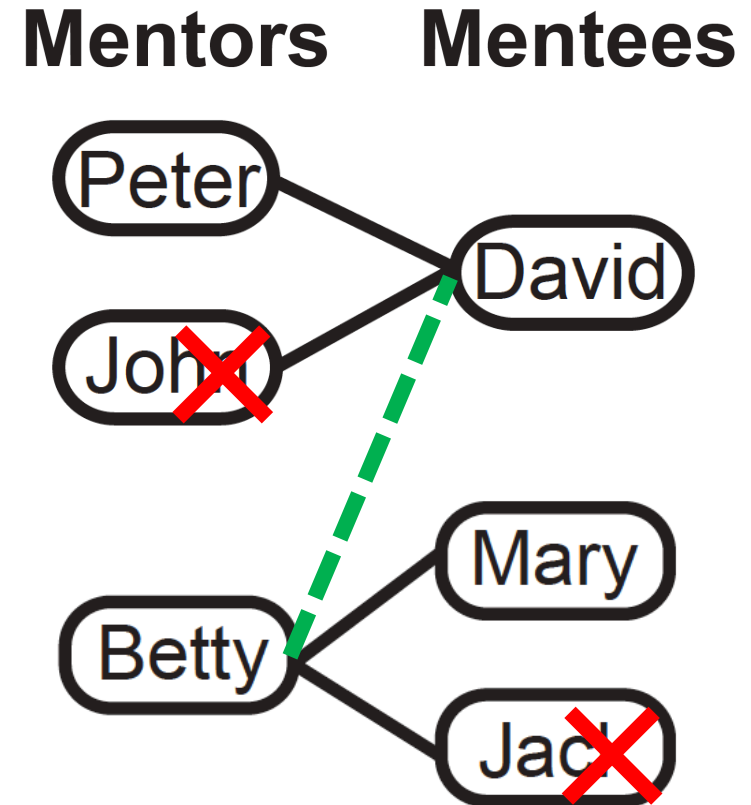
- Jack: one less mentor
- John: one less mentee
- Pair Jack with John?



Jack may not like John!

# The Cascading Nightmare

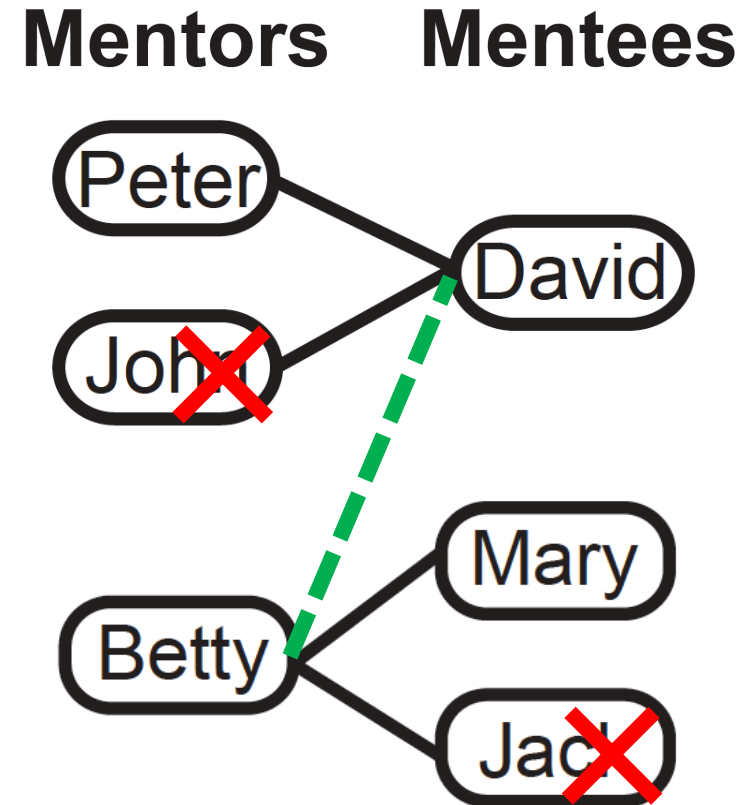
- Assign a different mentor to Jack and a different mentee to John?



The cascading nightmare continues!!

# The Cascading Nightmare

- When you change a pairing, some people become unmatched
- Match them to the others, the pairings are changed again



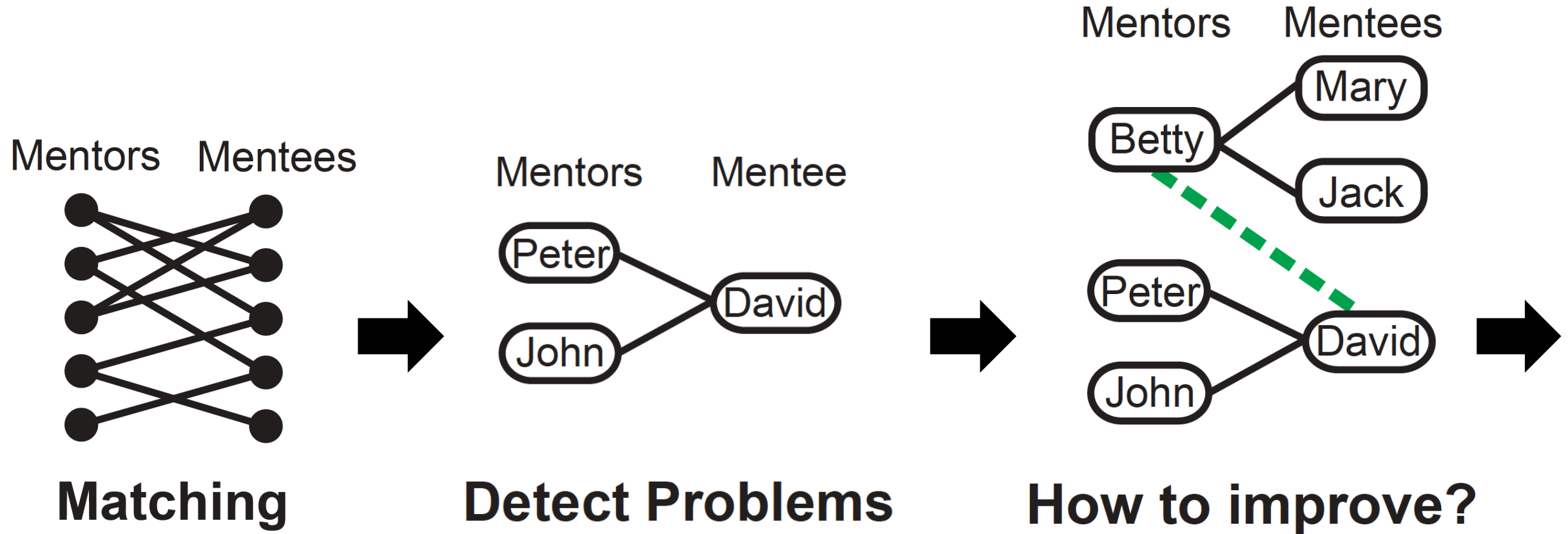
The cascading effect can go on and on!!!

Have an algorithm-generated matching  
Want to adjust it and explore matching alternatives  
**HARD** to adjust it manually!!

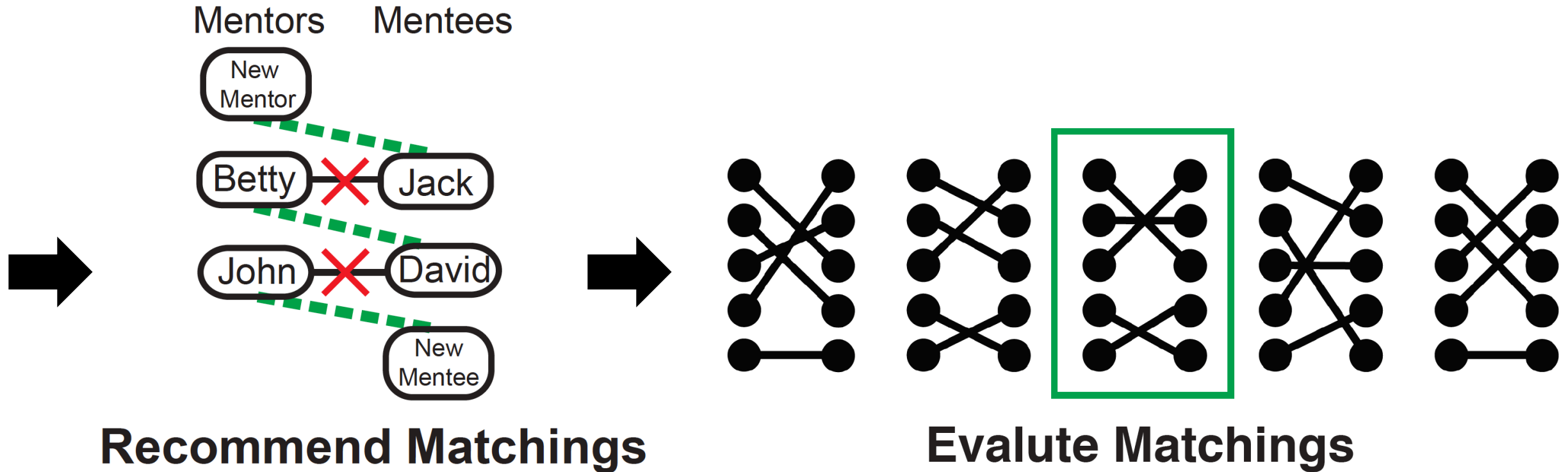
## Cooperation of user and computer

Users	→	<b>What</b> to adjust
System	→	<b>How</b> to adjust

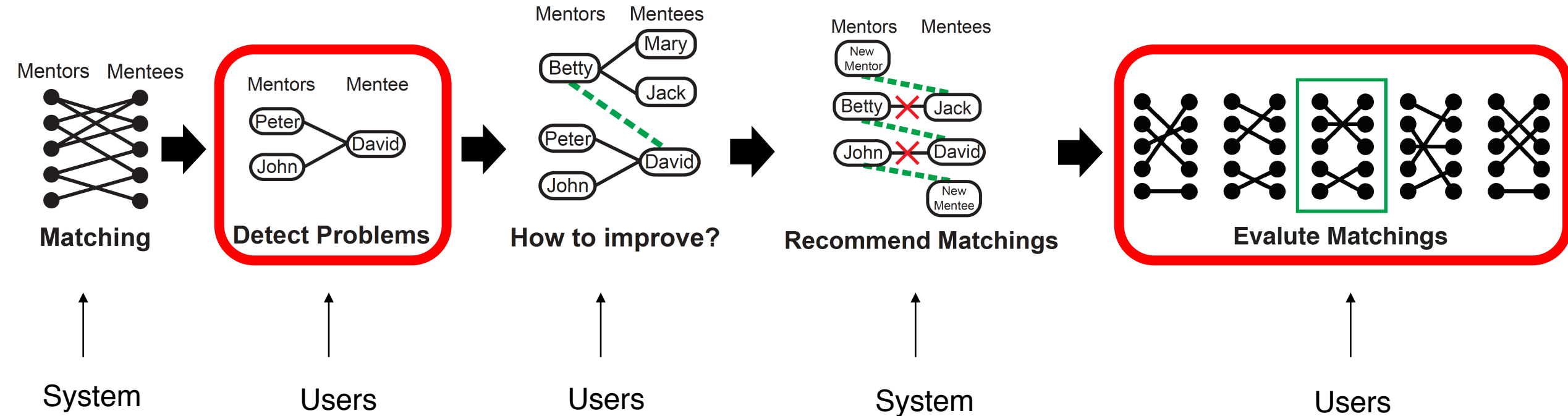
# Cooperation of User and Computer



# Cooperation of User and Computer



# Cooperation of User and Computer



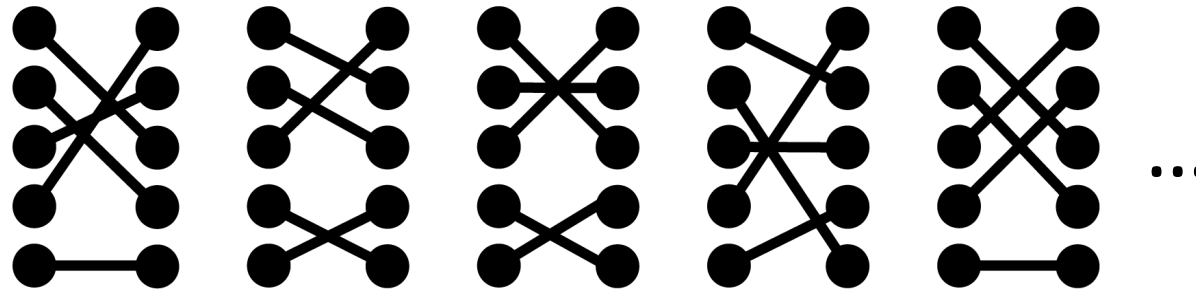
# Problem Detection

<b>Questions about allocation result</b>	<b>Questions about allocation mechanism</b>
Who are those who get poor matches?  <b>Improve their matches</b>	There is a popular person. Why pair A not B with him?  <b>Try to pair the popular person with the others</b>



# Matching Evaluation

Many matchings... How to compare them?



- Agent-level comparison
- Comparison between two matchings
- Comparison among multiple matchings

# Matching Evaluation

## Agent-level comparison

- Want to improve David's match
- Prefer matchings which give David a better match

Need to compare the quality of match of each person in multiple matchings

# Matching Evaluation

## Comparison between two matchings

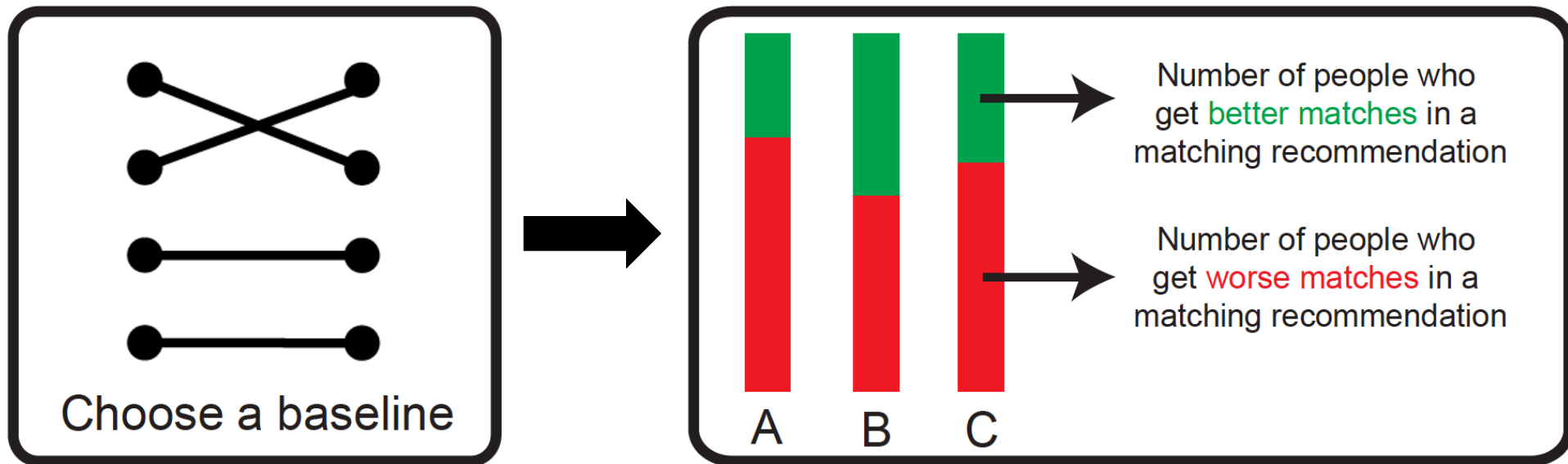
- Number of people who get better matches in matching 1 (in 2)
- Who are the people who get better matches in matching 1 (in 2)?
- By how much are their matches improved?

May prefer matching 1 if...

- Most people get better matches in matching 1

# Matching Evaluation

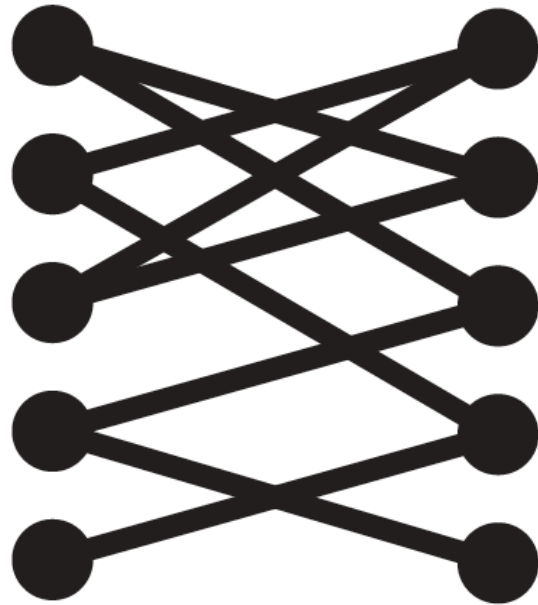
## Comparison among multiple matchings



1. Choose original matching as a baseline
2. Compute the differences between the other matchings and the baseline
3. Compare differences across many matchings

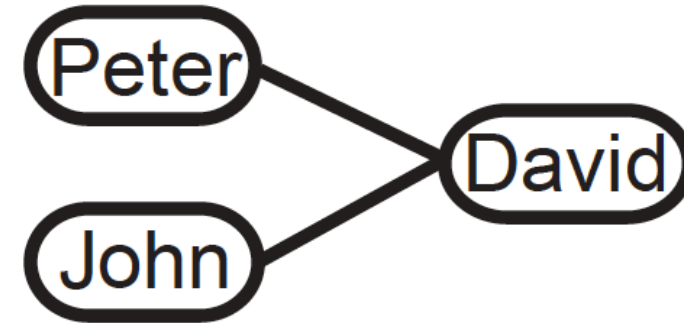
# Number Lines

Mentors      Mentees

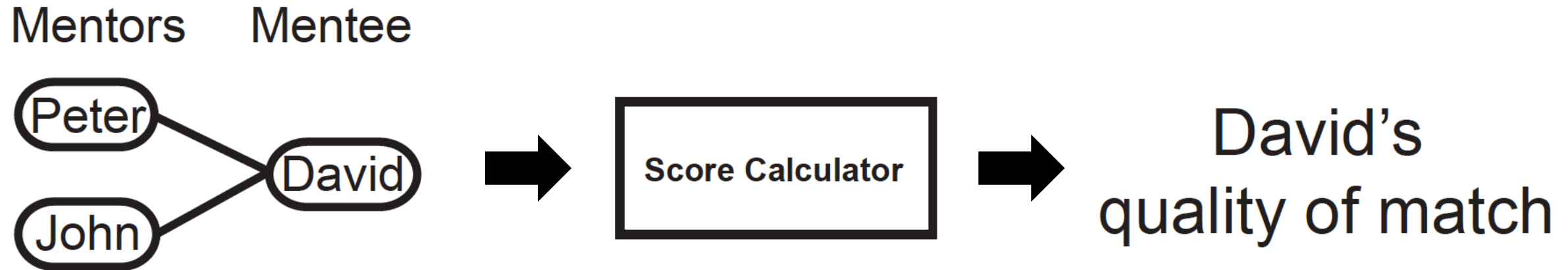


**Algorithmic Result**

Mentors      Mentee

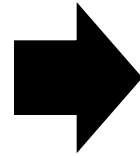


# Number Lines

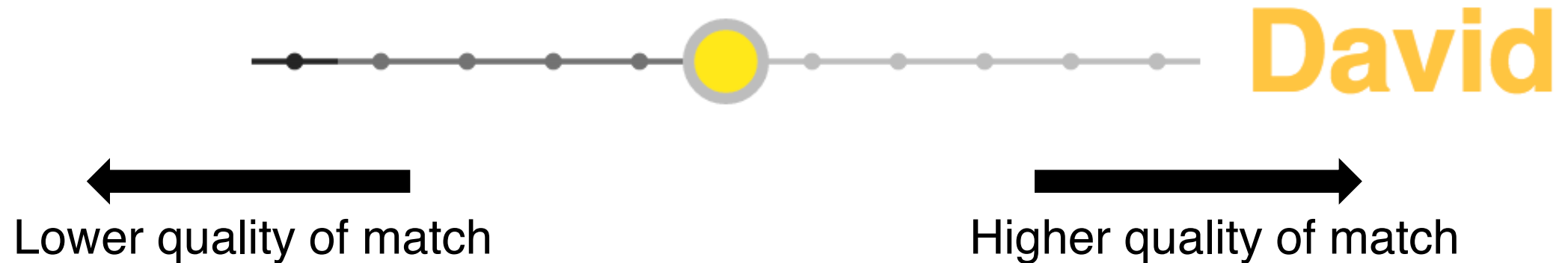


# Number Lines

David's  
quality of match

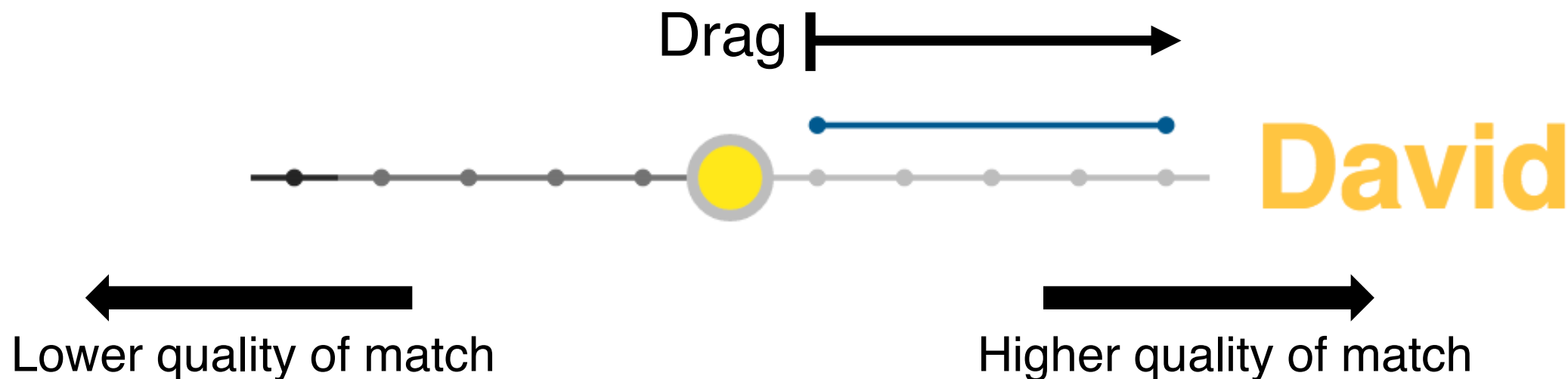


Position on  
David's number line



# Number Lines

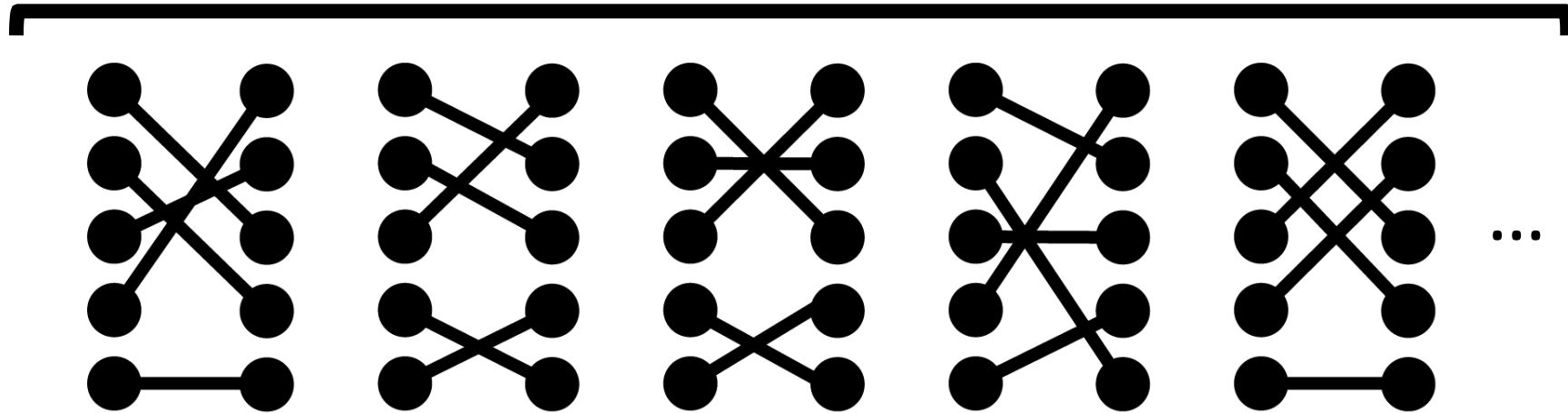
**“Find matchings in which David’s quality of match falls within this range”**





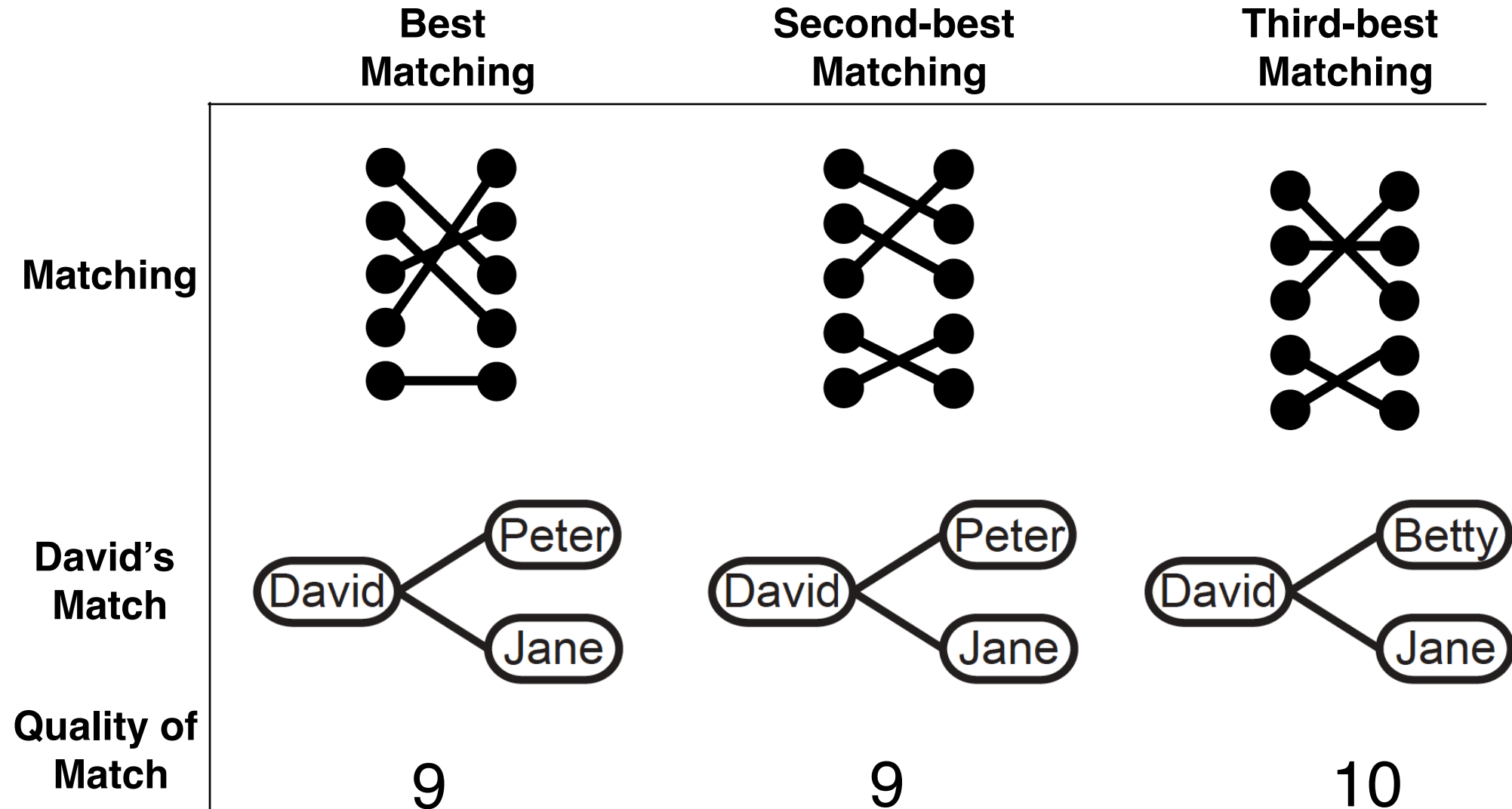
# Number Lines

System finds 100 matchings


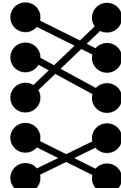
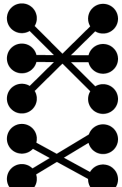
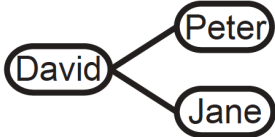
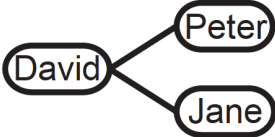
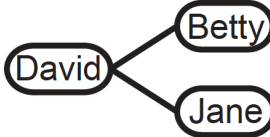


Ranked by a performance metric

# Number Lines



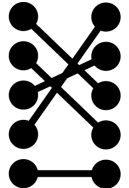
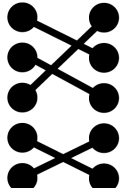
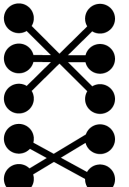
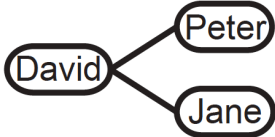
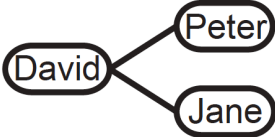
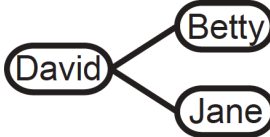
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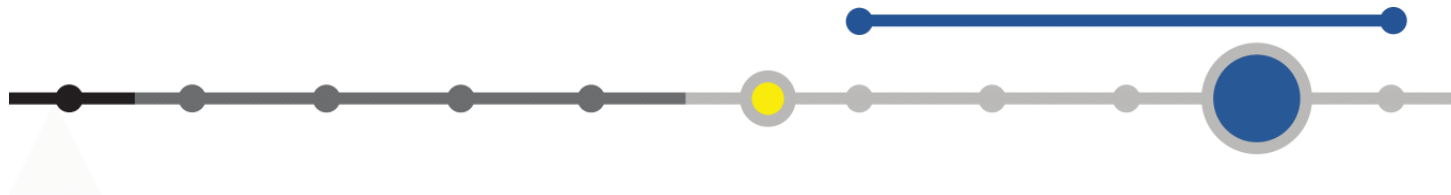
	Best Matching	Second-best Matching	Third-best Matching
Matching			
David's Match			
Quality of Match	9	9	10



David


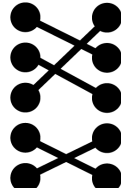
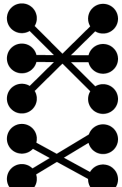
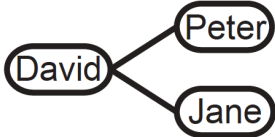
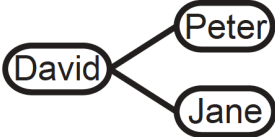
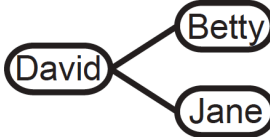
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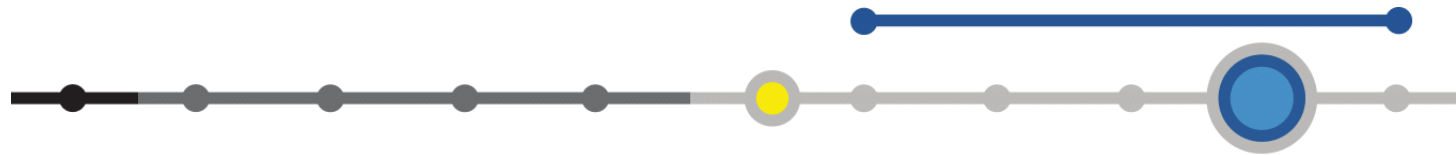
	Best Matching	Second-best Matching	Third-best Matching
Matching			
David's Match			
Quality of Match	9	9	10



David

# Number Lines

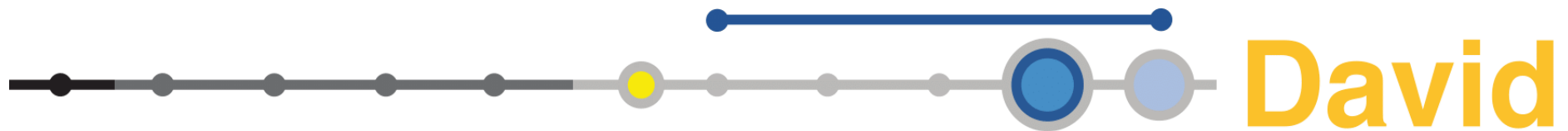
	Best Matching	Second-best Matching	Third-best Matching
Matching			
David's Match			
Quality of Match	9	9	10




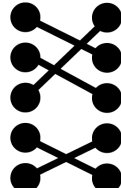
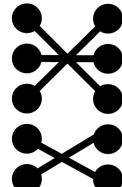
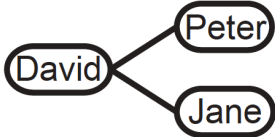
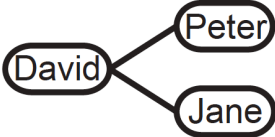
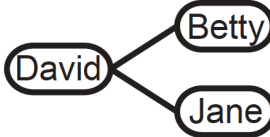
David

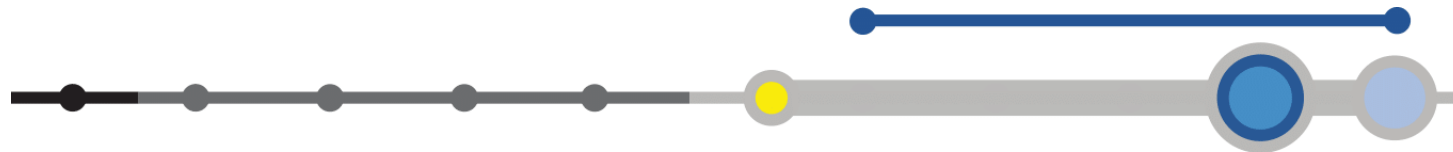
# Number Lines

	Best Matching	Second-best Matching	Third-best Matching
Matching			
David's Match			
Quality of Match	9	9	10



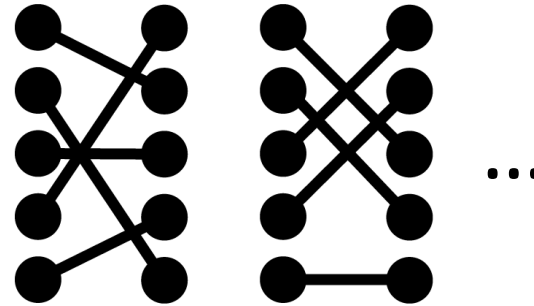
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	Best Matching	Second-best Matching	Third-best Matching
Matching			
David's Match			
Quality of Match	9	9	10

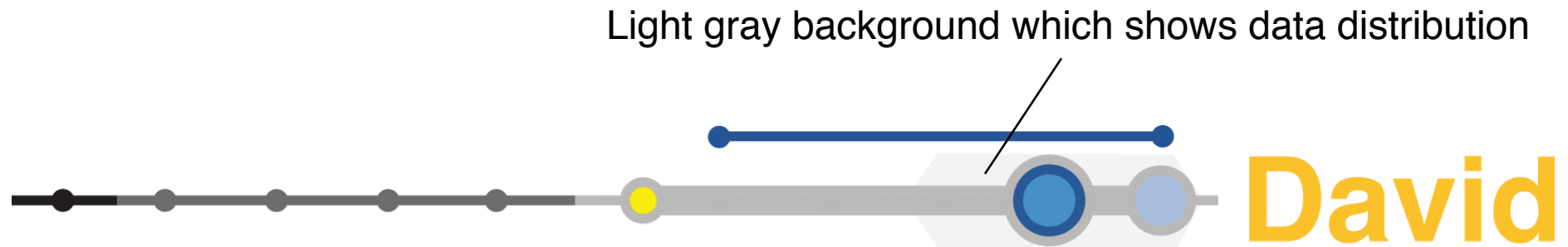


David

# Number Lines

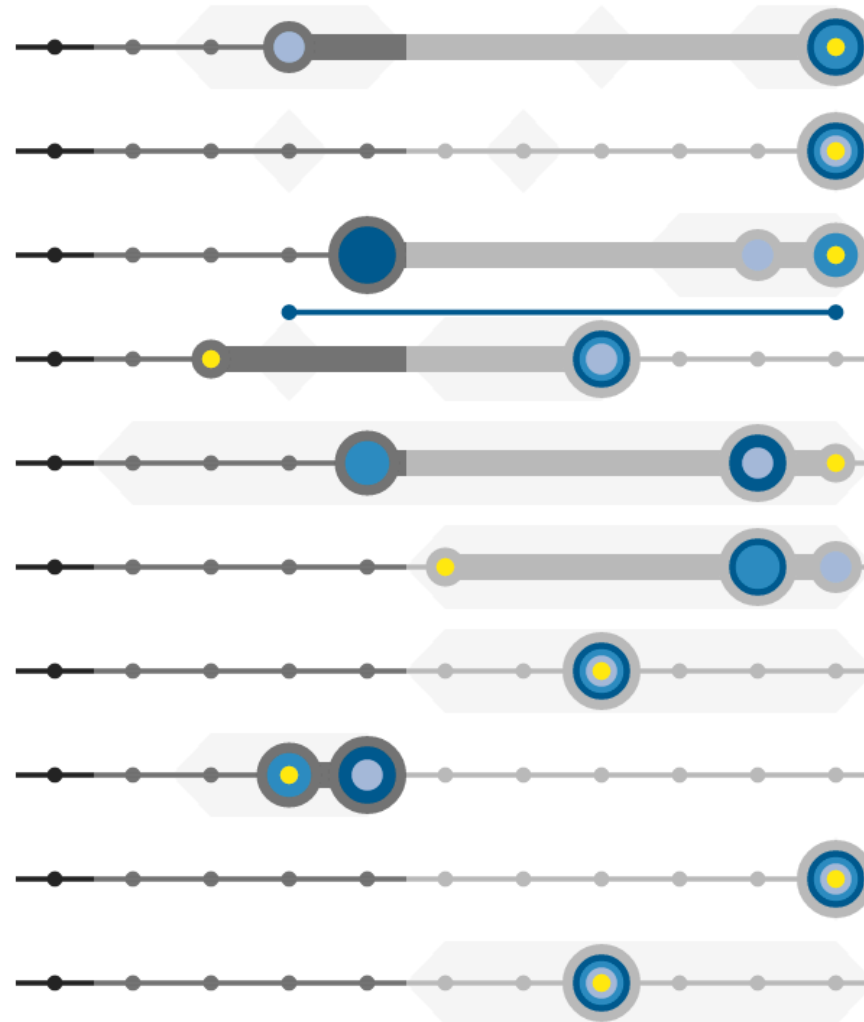


Matchings with lower rankings





# Visual Preference List



Peter

Ken

Betty

Jane

John  
David

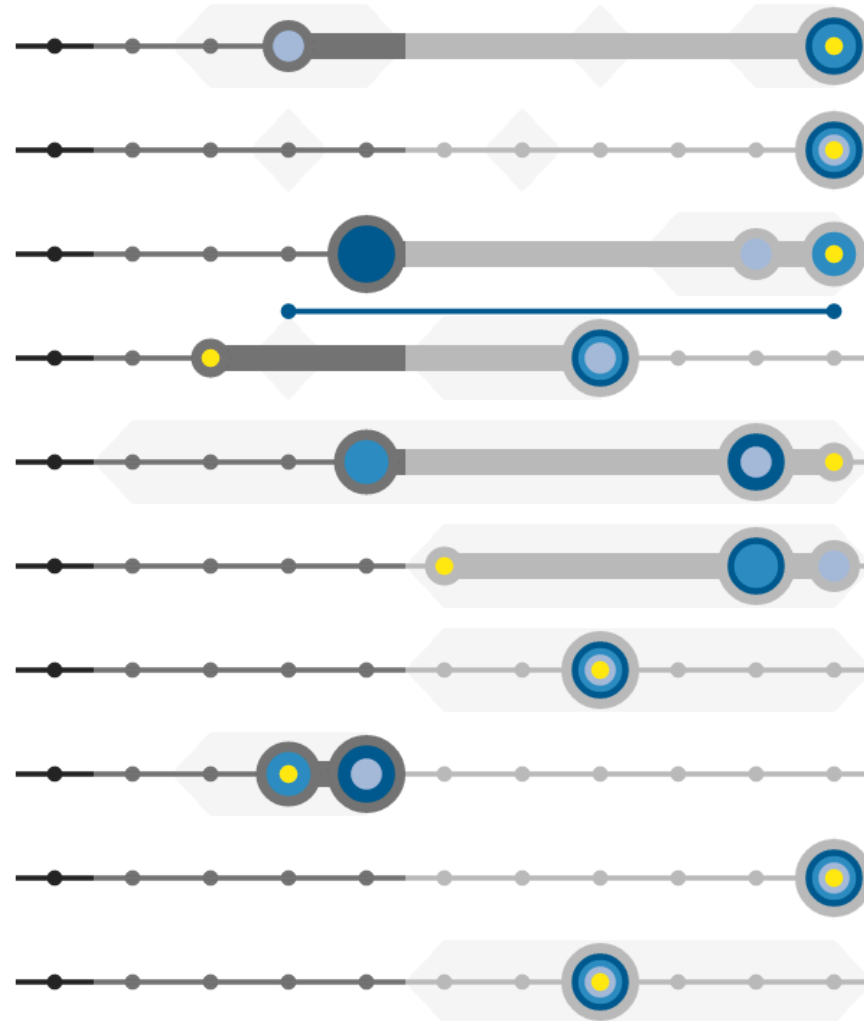
Ben

Jack

Mary

May

# Visual Preference List



Peter	
Ken	
Betty	
Jane	
John	
David	
Ben	
Jack	
Mary	
May	

# Visual Preference List

Label size: popularity

Can have at most 2 partners

Jack

First choice

Fourth choice

- Not matched
- Matched
- Not chosen by that person

# Visual Preference List



“John and Jack work well together.  
Match them together.”



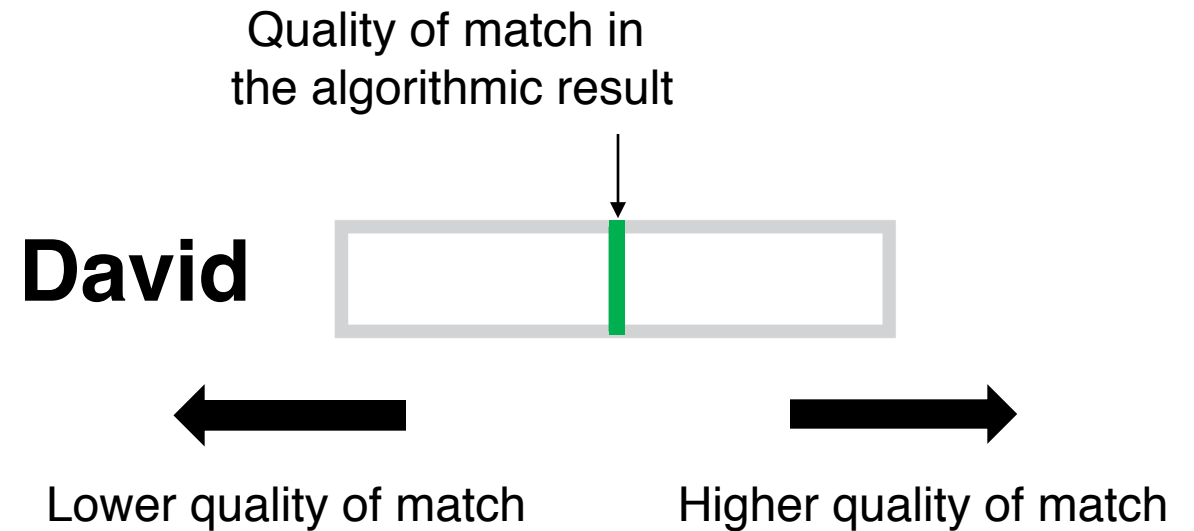
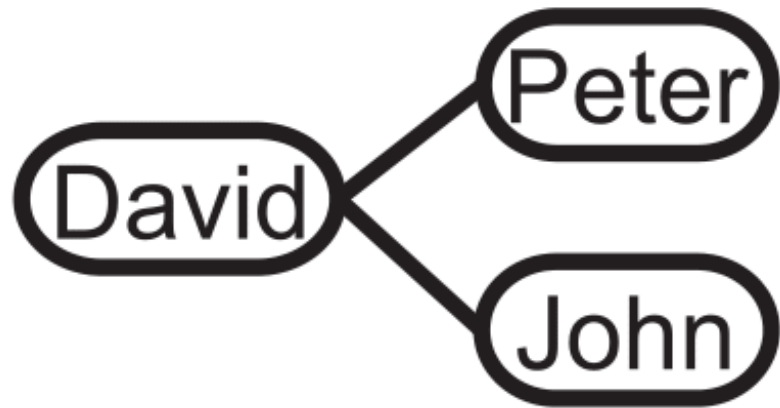
Jack



May

# Stacked Graph

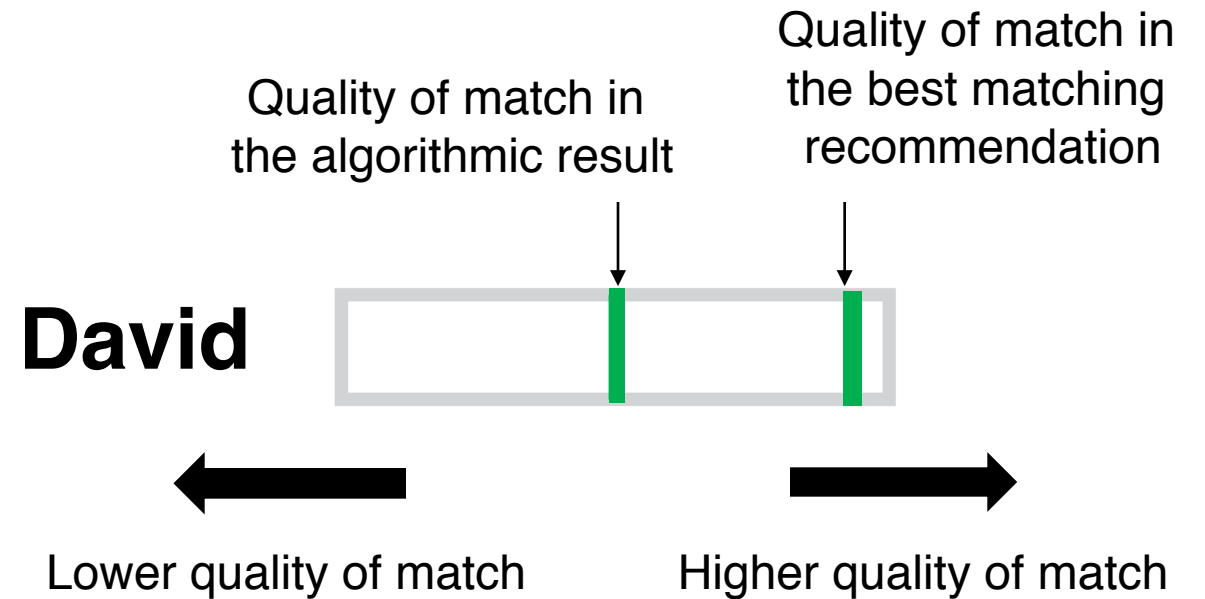
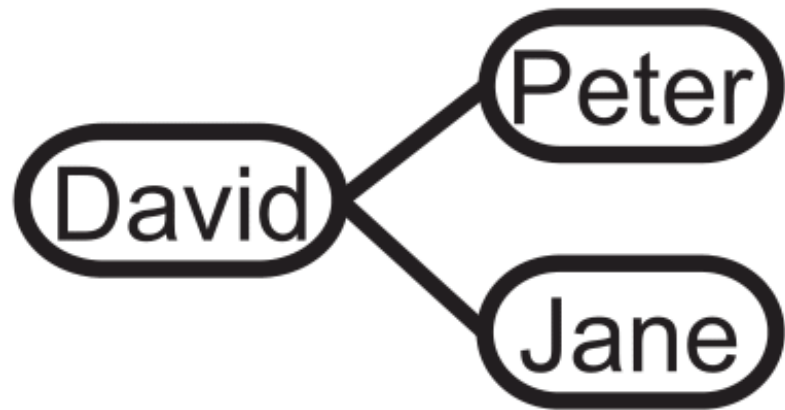
Consider the algorithmic result and the best matching recommendation



**In the algorithmic result**

# Stacked Graph

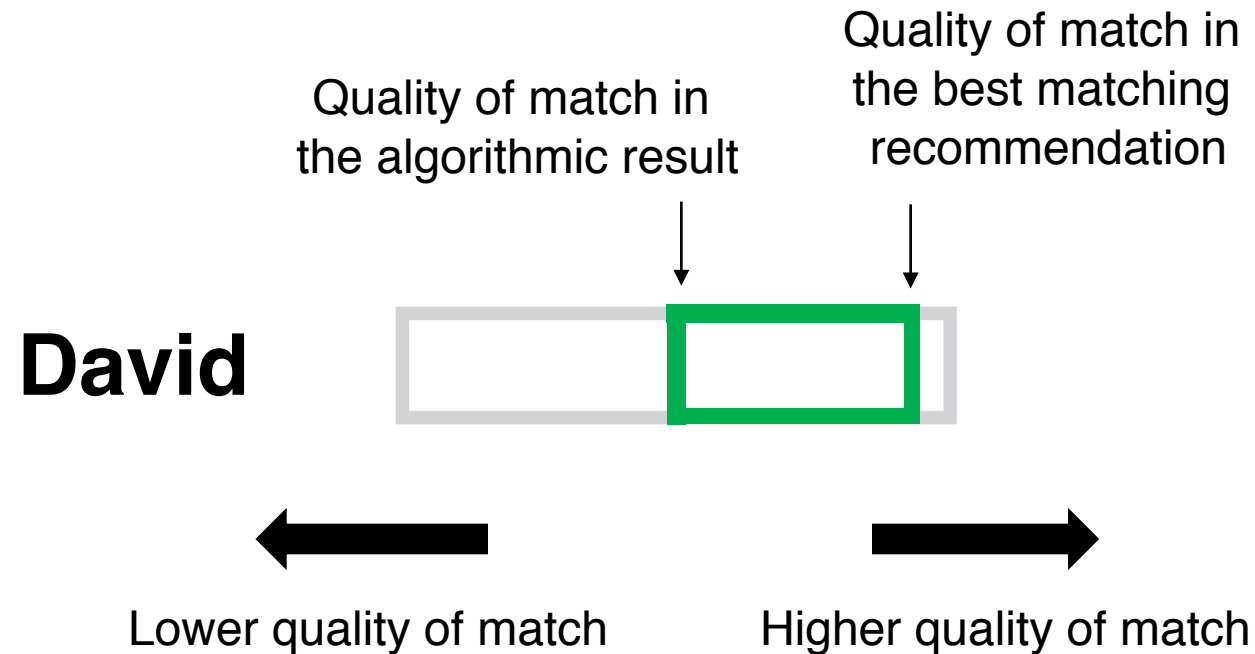
Consider the algorithmic result and the best matching recommendation



**In the best matching recommendation**

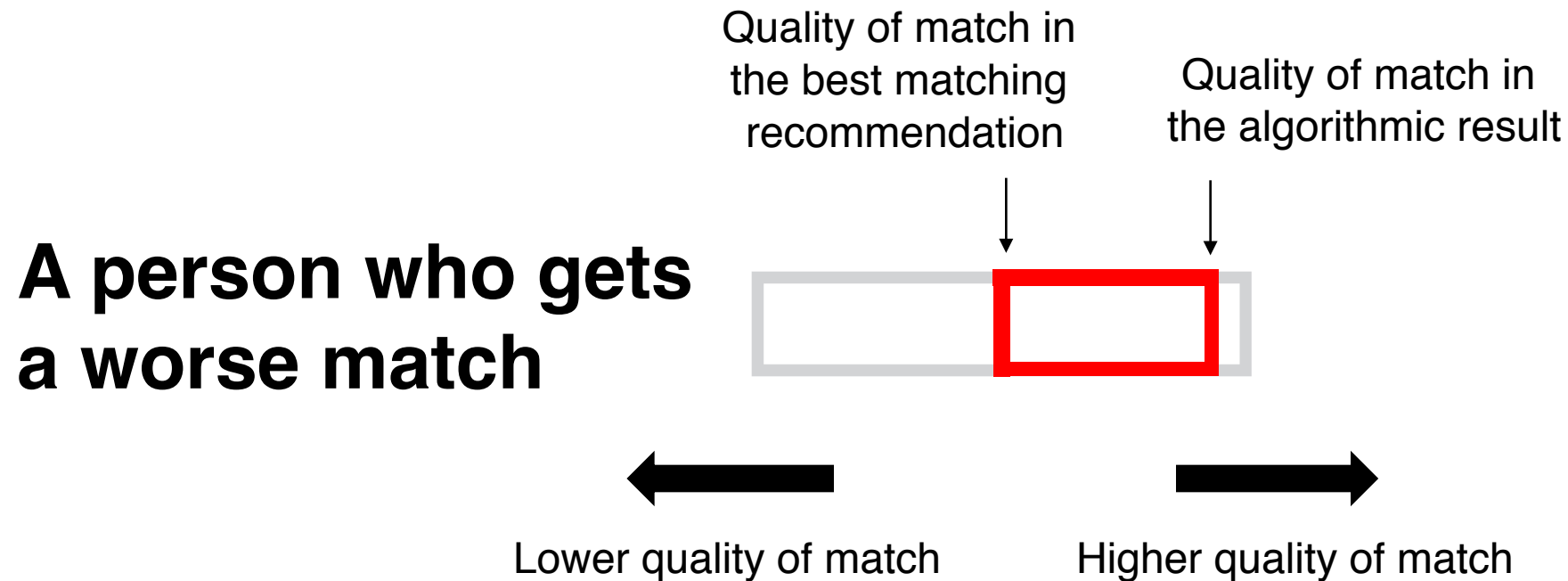
# Stacked Graph

Consider the algorithmic result and the best matching recommendation



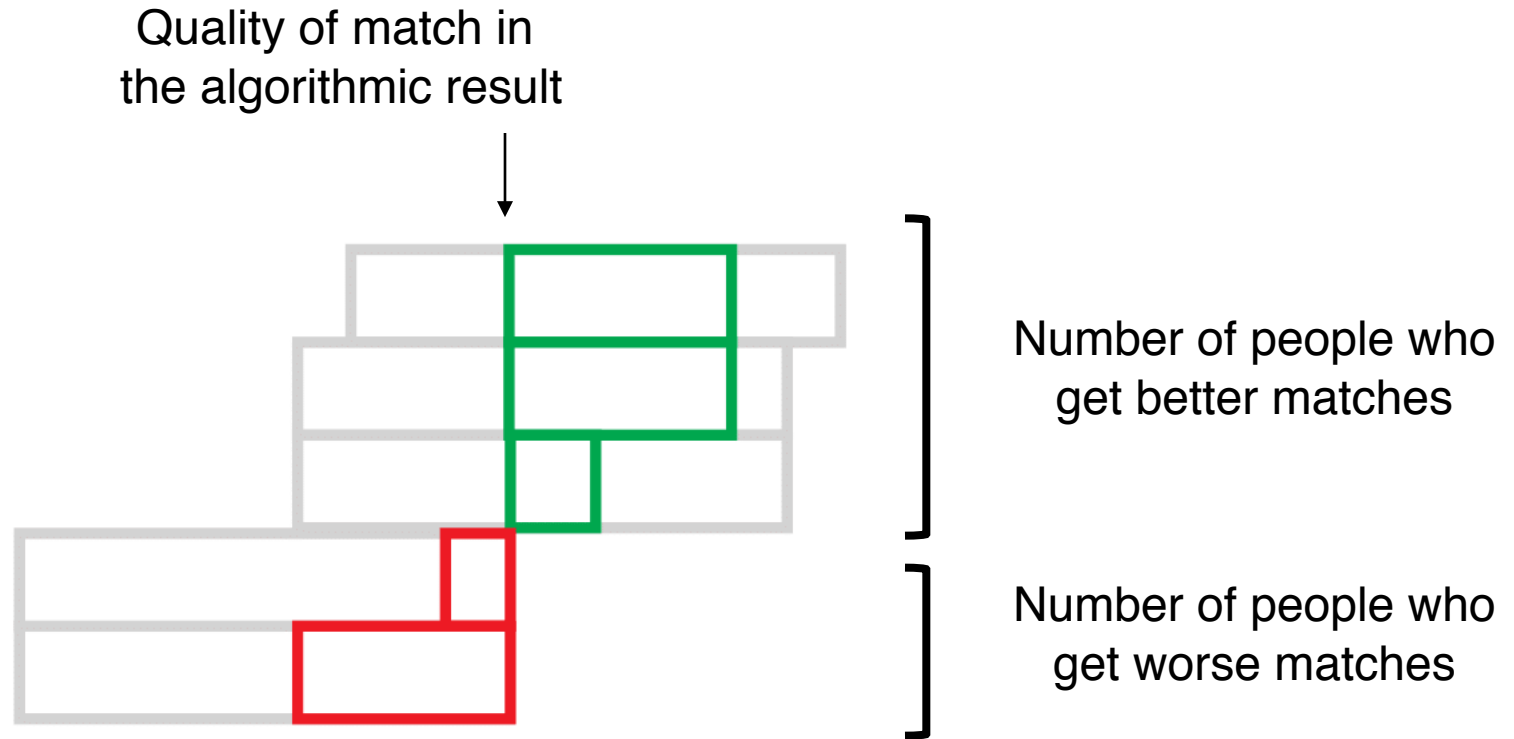
# Stacked Graph

Consider the algorithmic result and the best matching recommendation





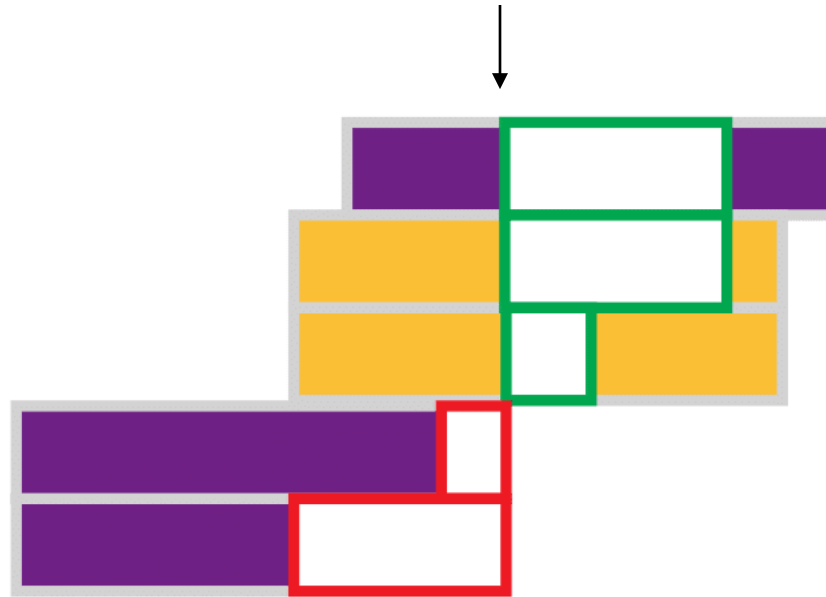
# Stacked Graph



# Stacked Graph

● **Mentor**  
● **Mentee**

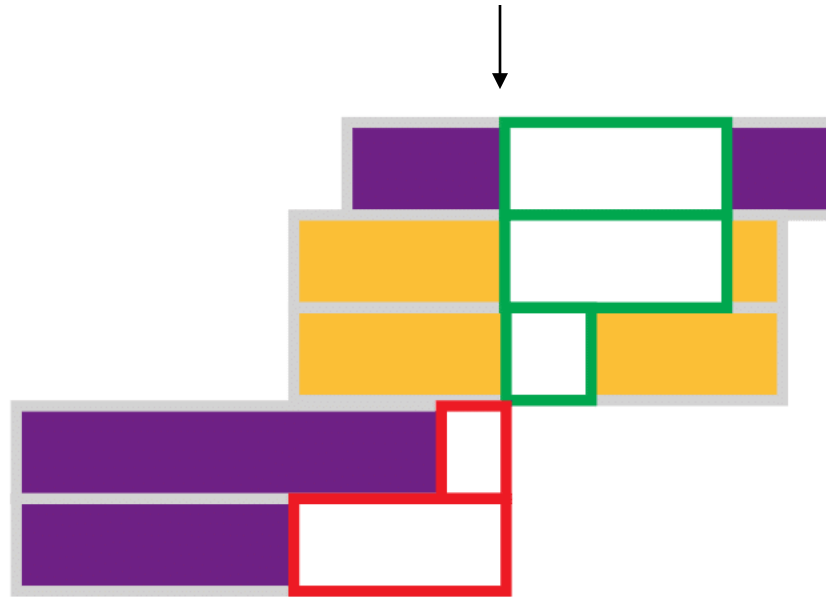
Quality of match in  
the algorithmic result



# Stacked Graph

● Mentor  
● Mentee

Quality of match in  
the algorithmic result



Comparing the algorithmic result  
(yellow) and the best matching  
recommendation (blue)



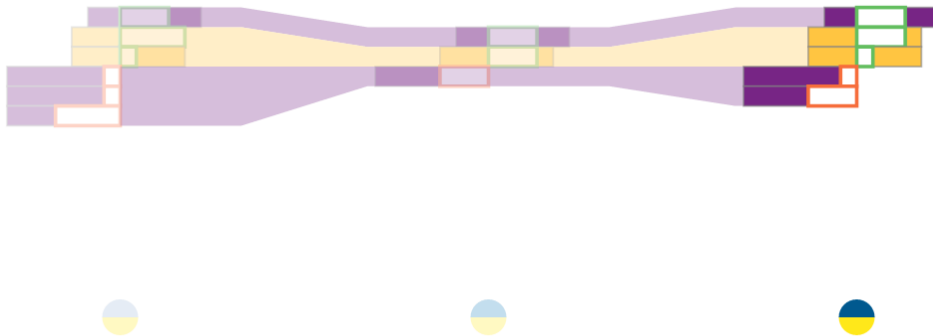
# Stacked Graph

● Mentor  
● Mentee

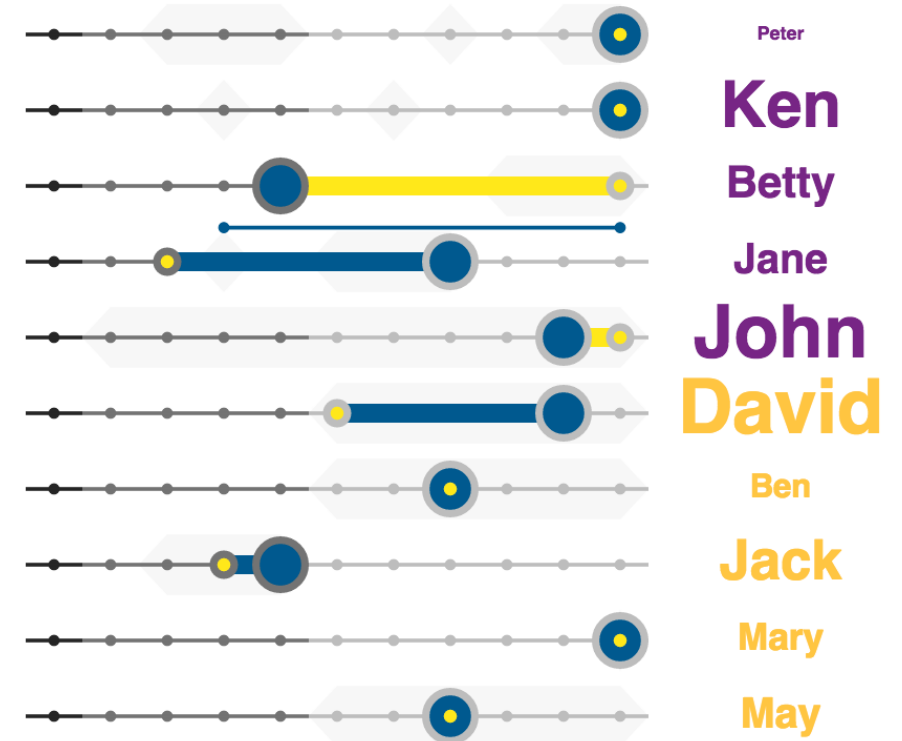


# Stacked Graph

● Mentor  
● Mentee

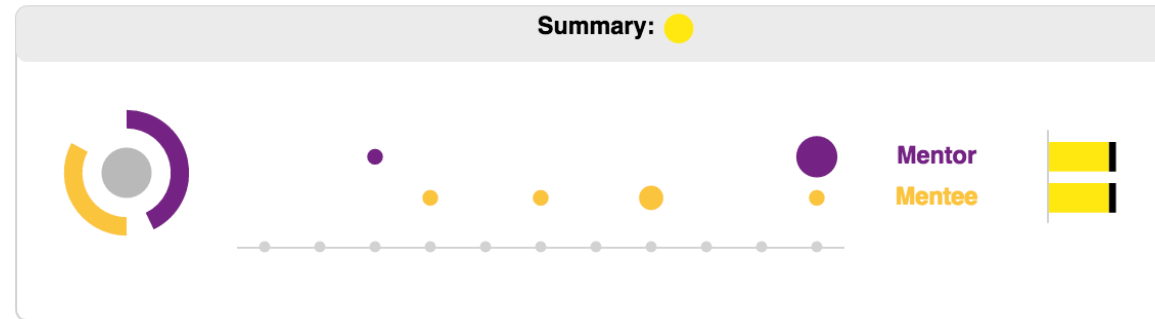


Hover  
(detail on demand)

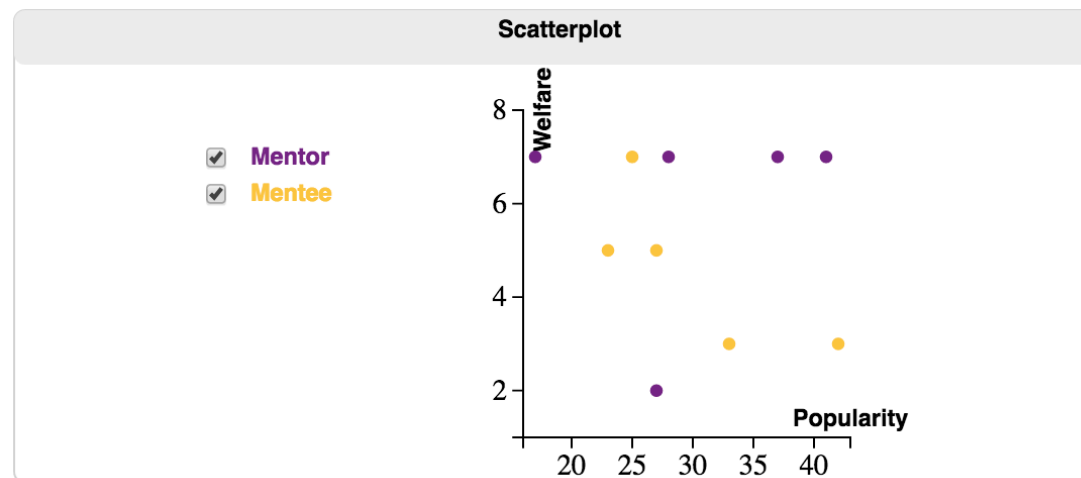


# Other Views

## Glyphs for summary statistics



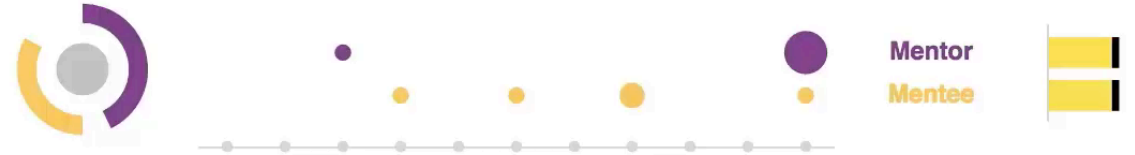
## A scatterplot for filtering the number lines



Stacked Graph View



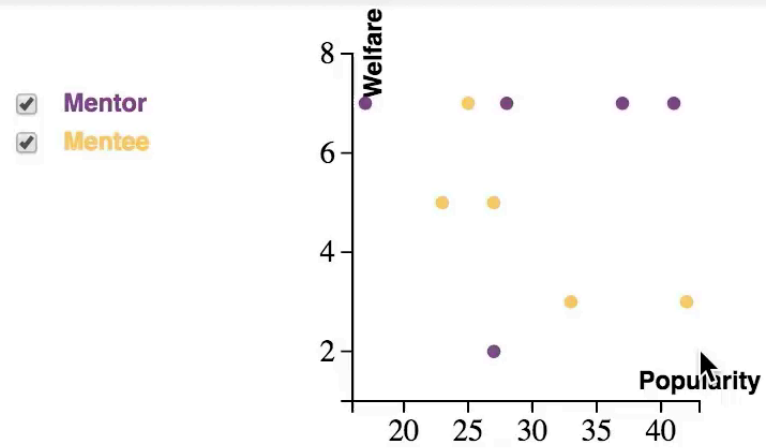
Summary: ●



Number Line View



Scatterplot



# Expert Interview

Better than spreadsheet for assignment

More confident in assignment

Learning curve may be steep



# Conclusion and Future Work

- Developed a way for users and the system to co-create a matching
- Designed visualizations for matching comparison
- Steep learning curve
  - Improve the usability of the system
- Slow and non-optimal matching recommendation algorithm
  - More efficient algorithm to prune the huge matching search space

# Thank You!

Po-Ming Law

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Yixian Zheng

Huamin Qu

