Reasoning about quantitative data

Rhetorical argument and data visualization

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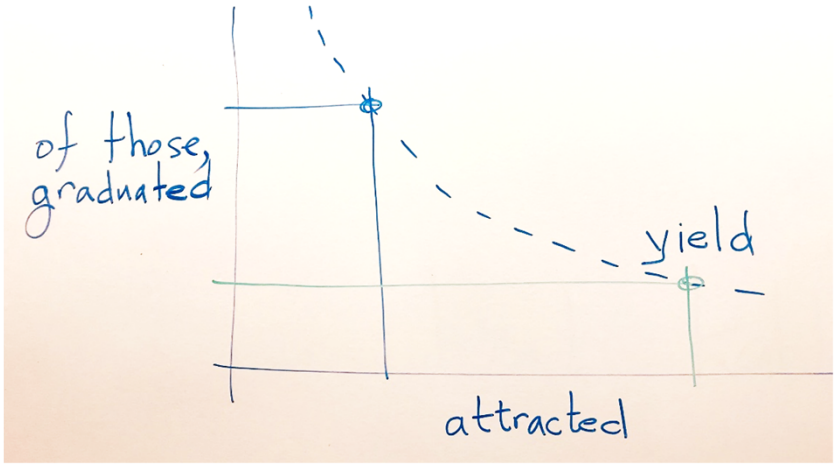
Session F4A: Special Session - Is MIDFIELD for me?
2021 FIE Conference
Wednesday, Oct. 15, 2021

MIDFIELD
Multiple-Institution Database For Investigating Engineering Longitudinal Development

Reasoning about data—and visualization—are iterative processes.

version 1
version 2
version 3

Design of effective displays is iterative

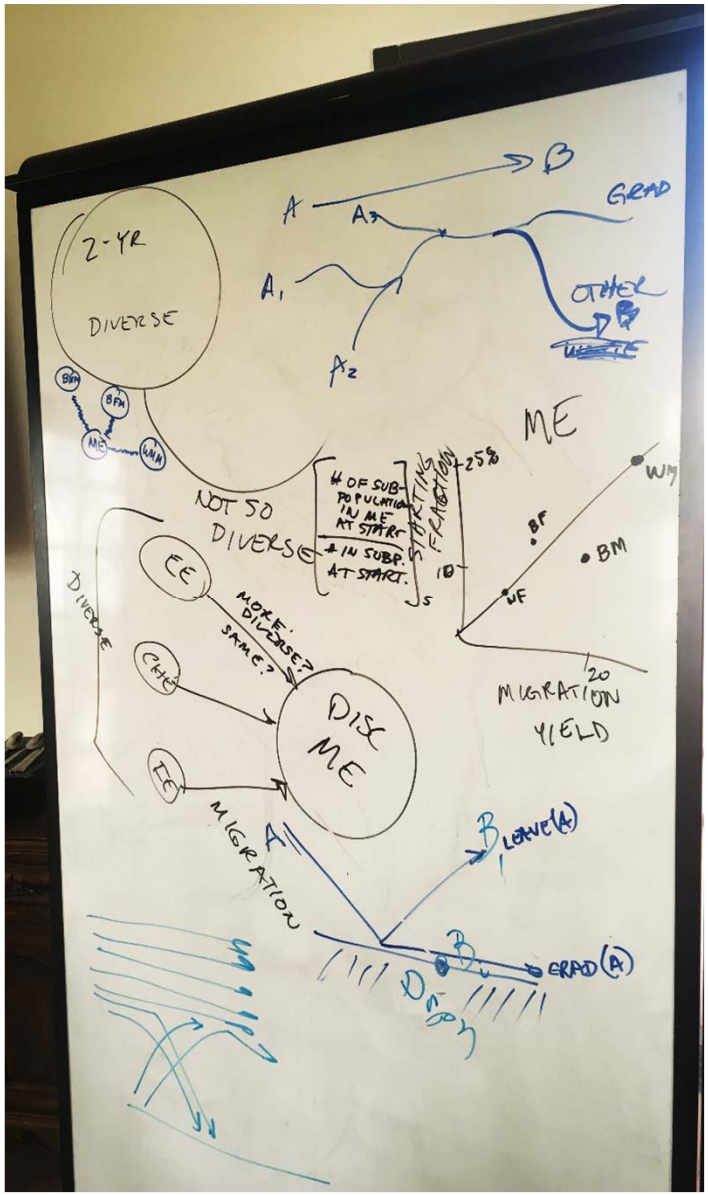


Complex displays start with simple conceptual sketches

Example

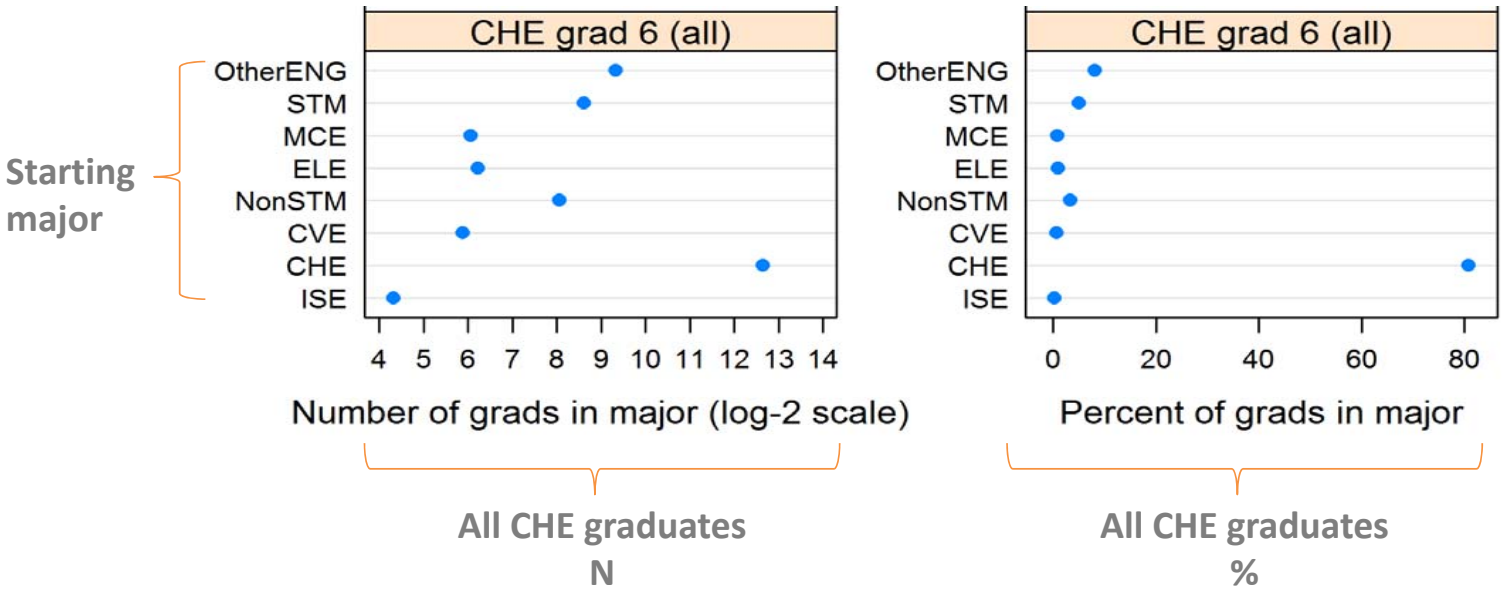
Iteratively exploring students in 5 engineering disciplines

Initially we sketched and discussed around a white board.



In our first attempt we asked where grads in a major started

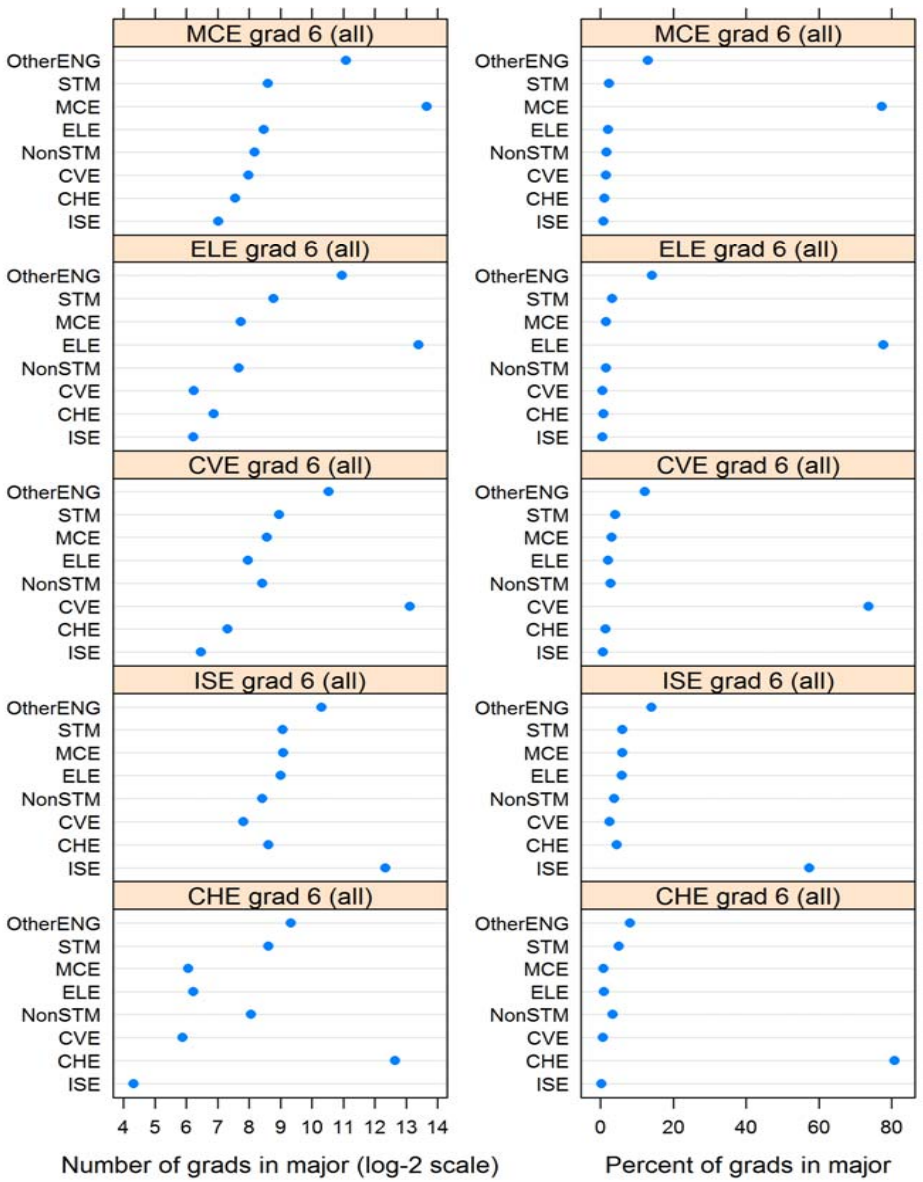
version 1



Same graph, 5 majors

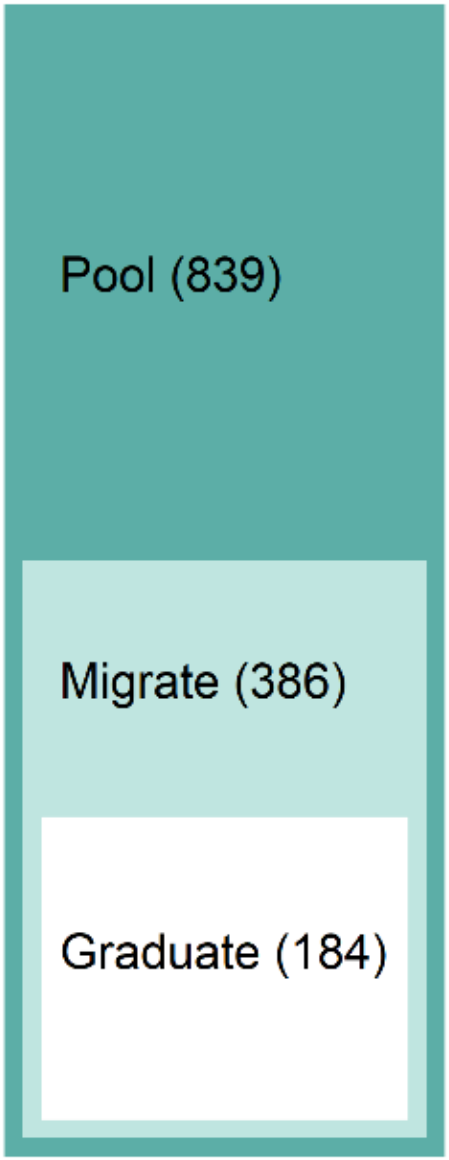
version 1

The visual story didn't seem meaningful



We constructed a new metric

A new metric, migration yield, was hinted at in our initial brainstorming.



Consider Black male students

Black Male students

839 potential migrators to EE

Of those, 386 migrated to EE

Fraction of migrators attracted = 386 / 839 = 0.460

Of those, 184 graduated in EE

Fraction attracted that graduate = 184 / 386 = 0.477

Migration yield is computed in one of two ways:

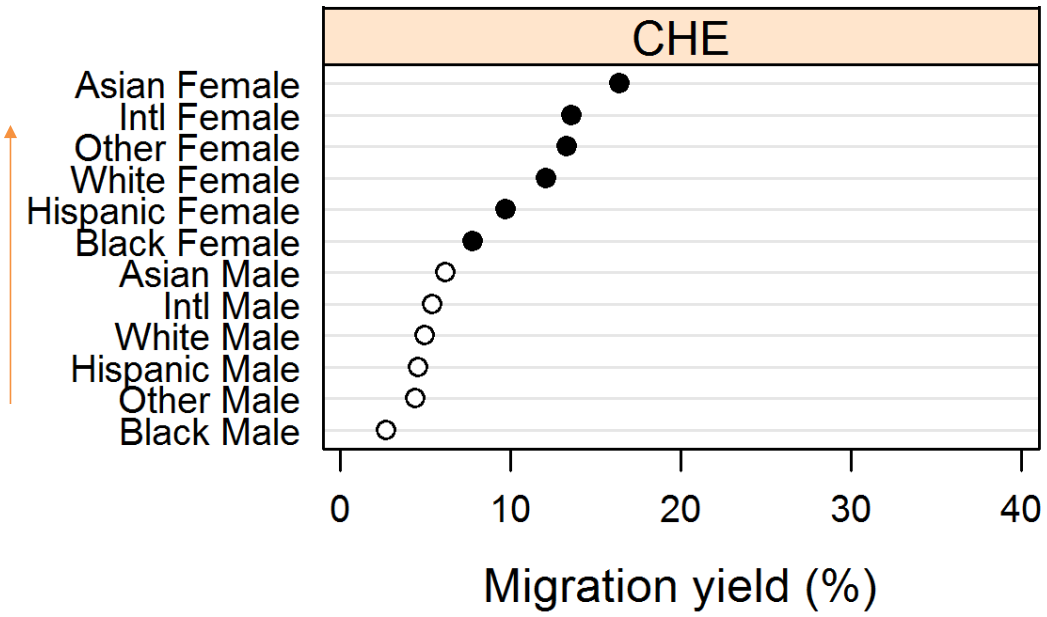
Product of the two fractions: 0.460 x 0.477 = 22%

Ratio of graduates to pool: 184 / 839 = 22%

In the first attempt, we graphed migration yield directly

version 2

Order rows by the data values



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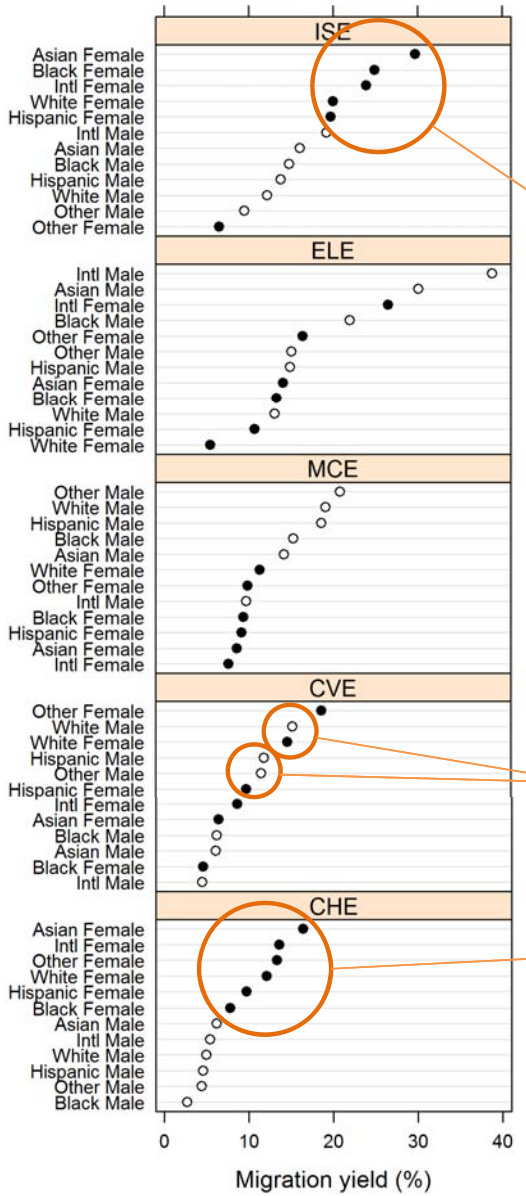


Clustered by **sex**

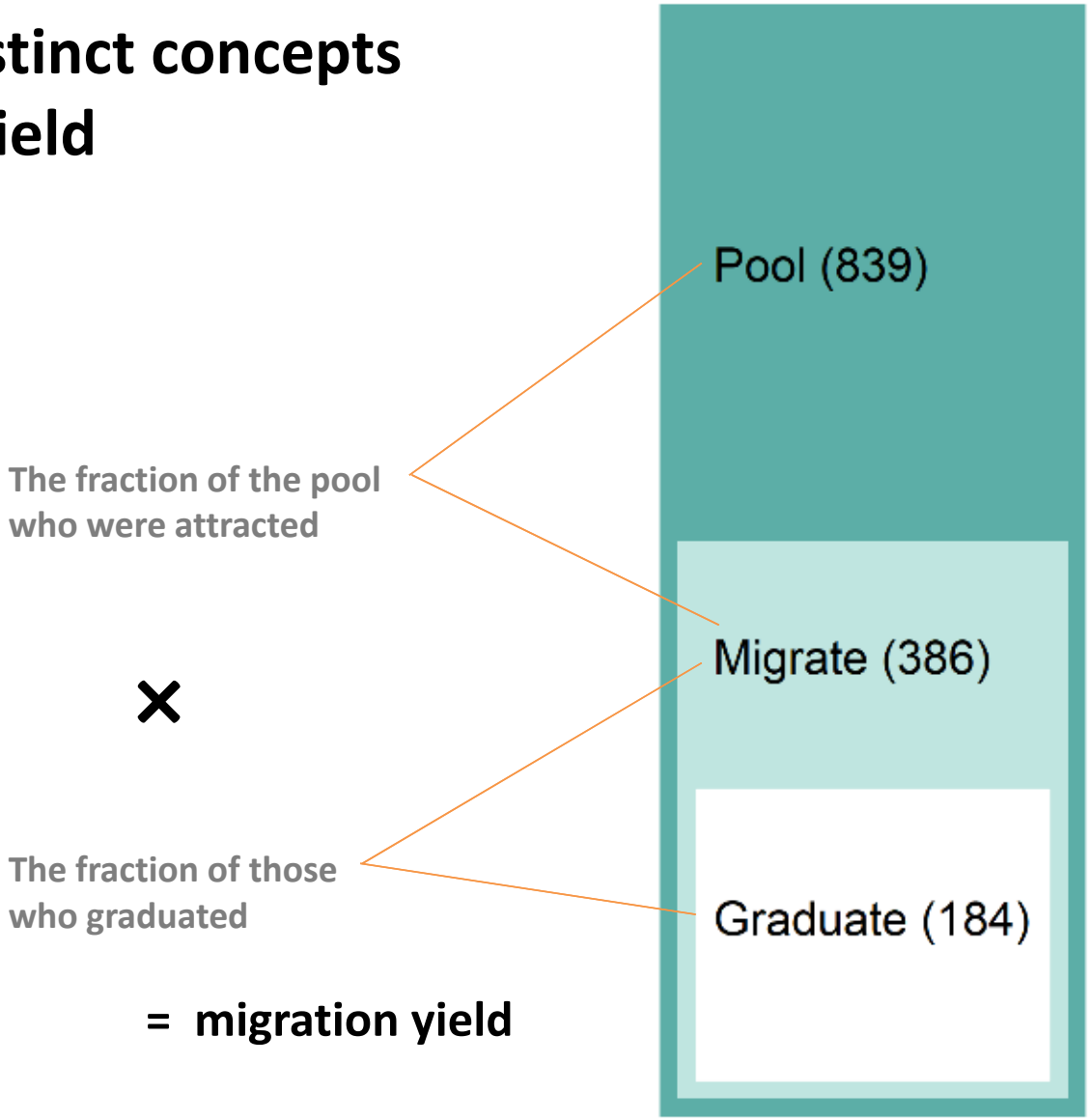
Order rows by the **data values**

Here, row order is unique to each panel

Clustered by **race**

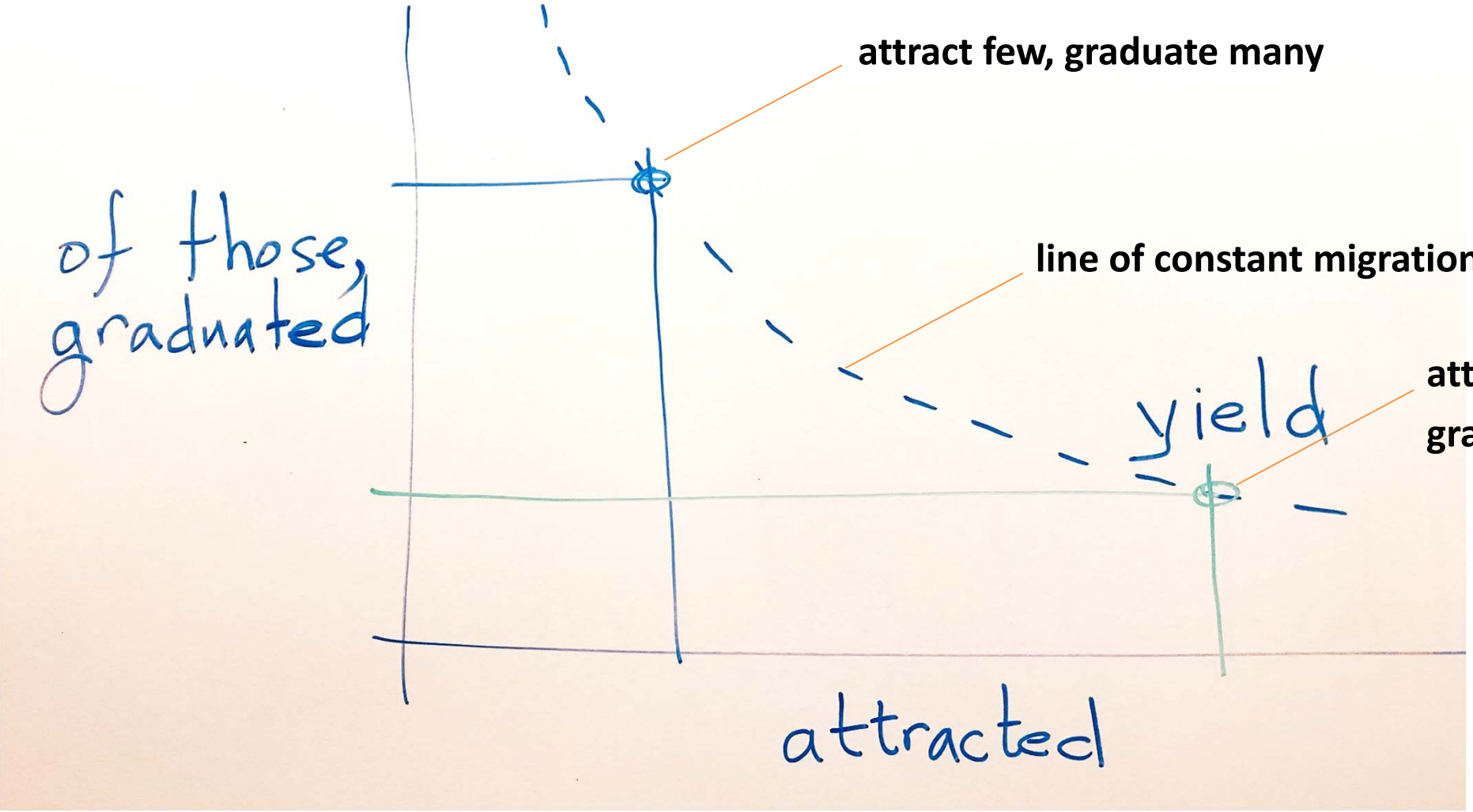
Clustered by **sex**

We realized we had two distinct concepts contributing to migration yield



In a Cartesian graph, a constant product is a contour

version 3



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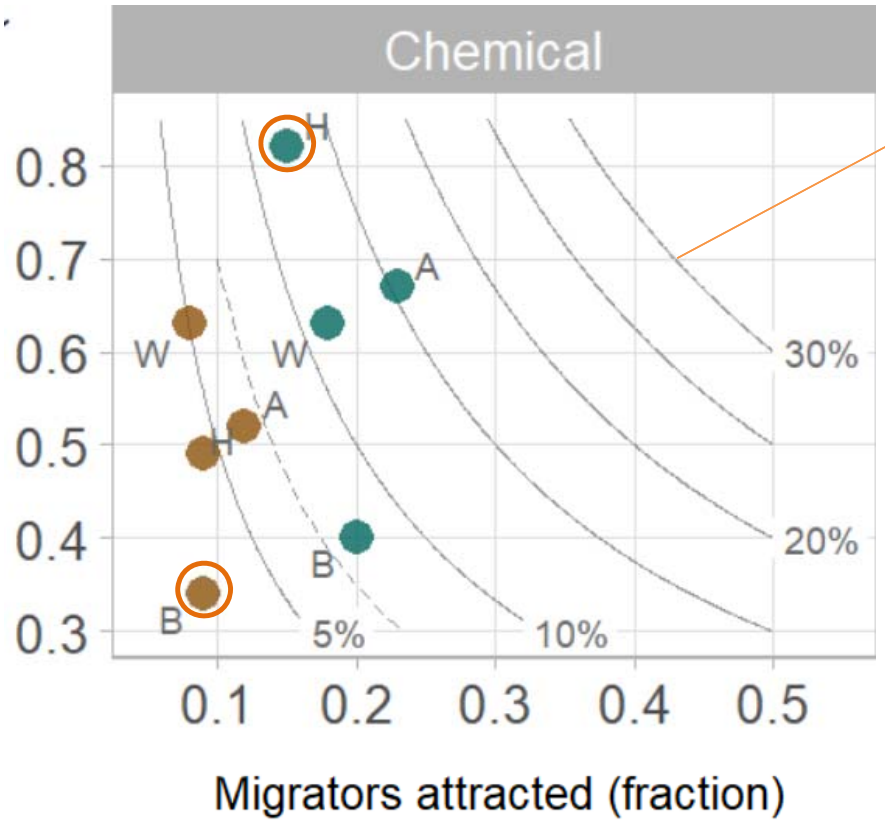
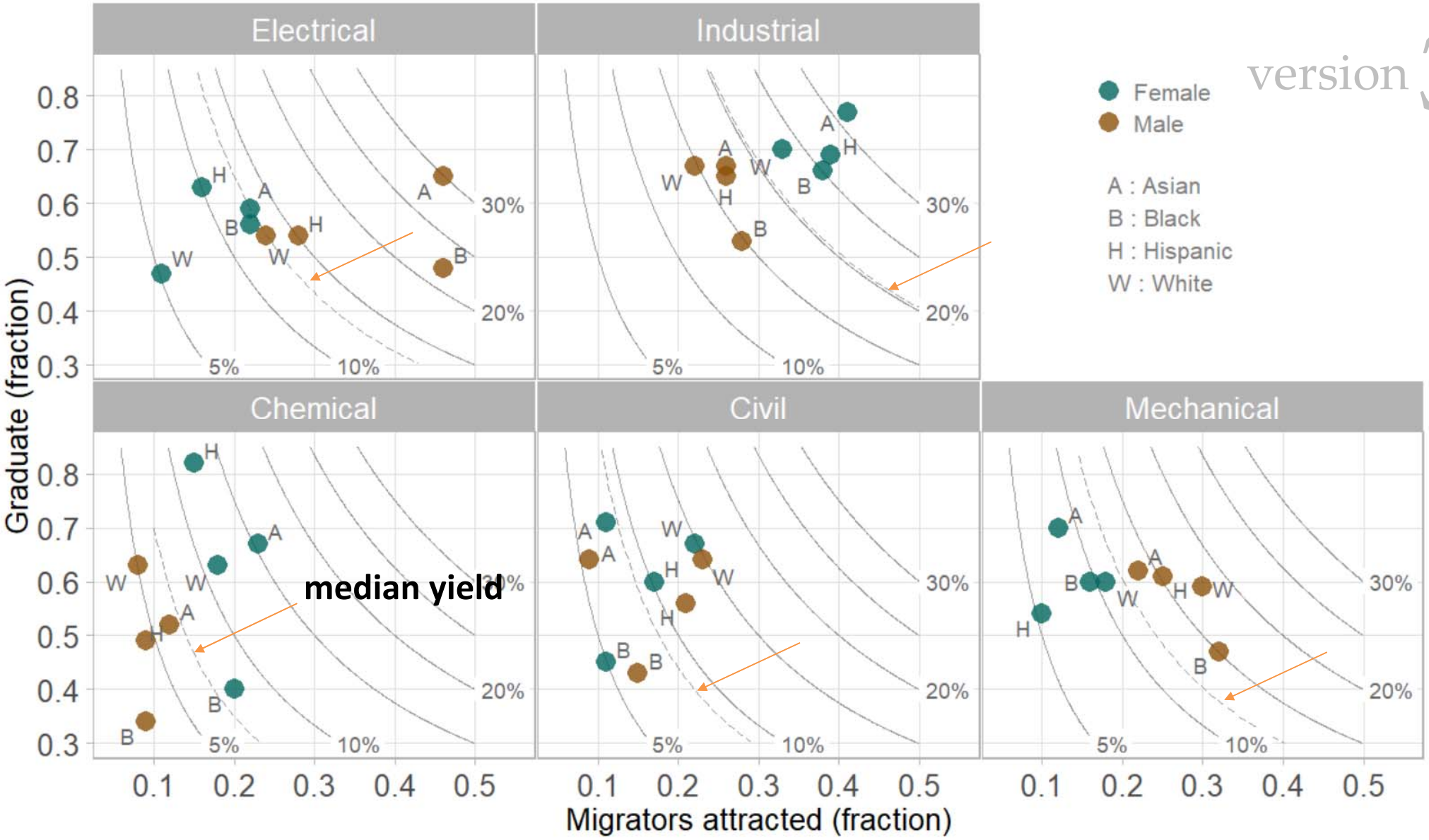


lines of constant migration yield

Female
Male

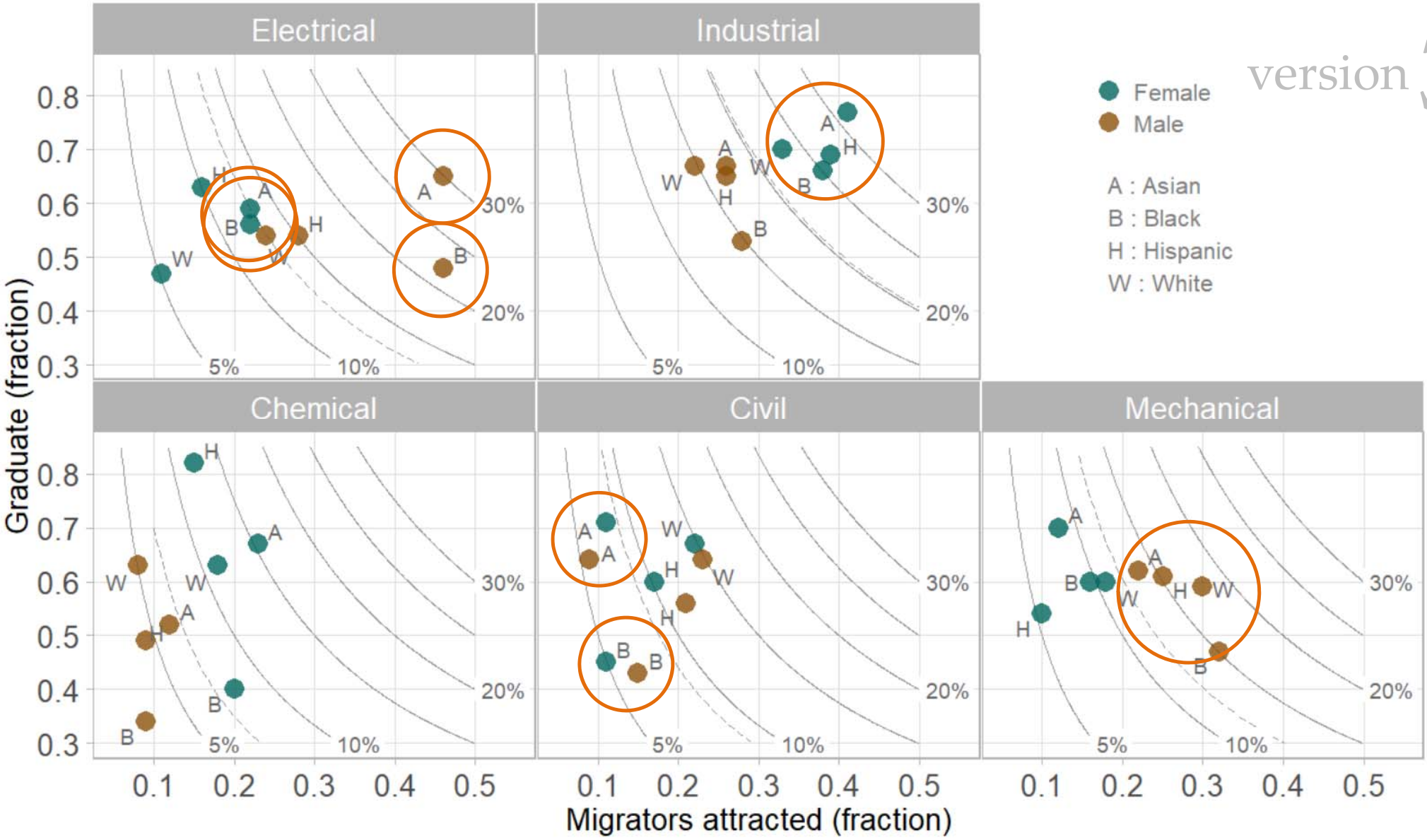
two legends required

A : Asian
B : Black
H : Hispanic
W : White


Electrical
Industrial
Chemical
Civil
Mechanical
Female
Male
A : Asian
B : Black
H : Hispanic
W : White
30%
20%
10%
5%
median yield
Graduate (fraction)
Migrators attracted (fraction)
0.3
0.4
0.5
0.6
0.7
0.8
0.1
0.2
0.3
0.4
0.5

version 3

version 3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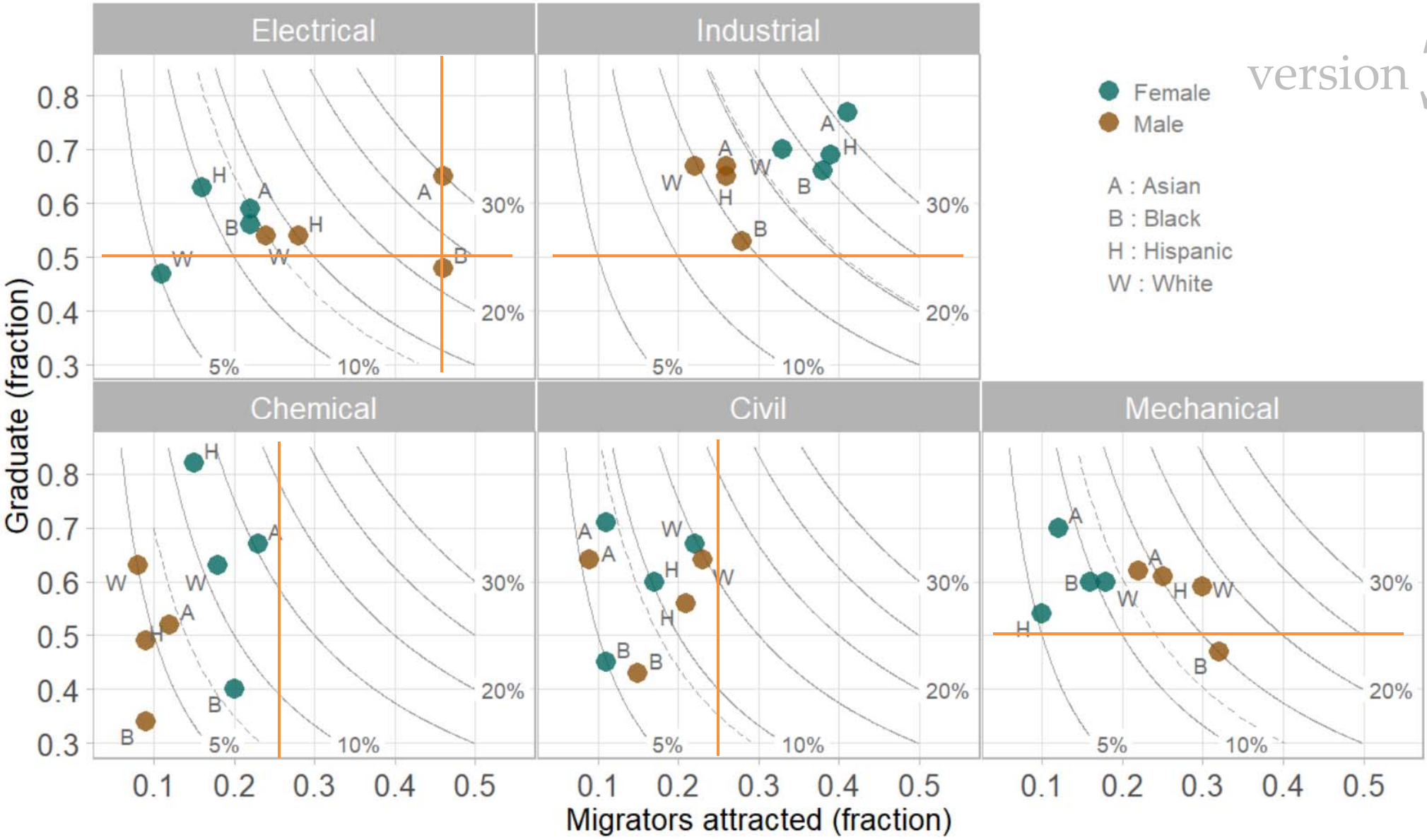
20%
30%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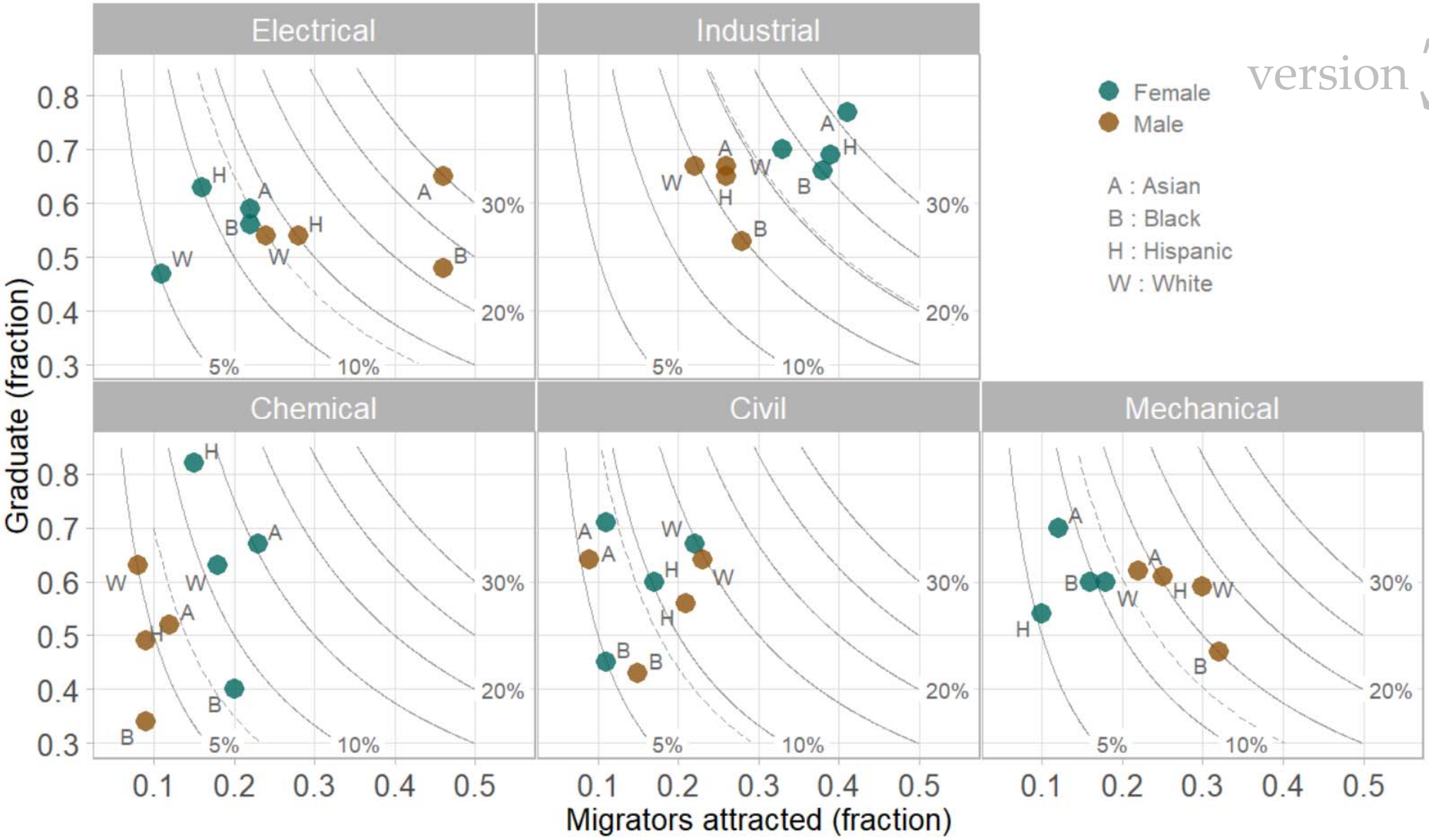
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version 3