

### **Glass boundaries:** difference in interdisciplinarity between men and women

#### Presented by Lili Miao

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# 1) Is there gender difference in interdisciplinary research?

### 2) Where is the difference?



#### Any idea about INTERDISCIPLINARITY ?

Approaches integrate separate disciplines to create a holistic view to understand complex issue. ——[Wagner et al. 2011]



### Break down the boundaries of disciplines, integrating different bodies of knowledge.

Wagner, Caroline S., et al. "Approaches to understanding and measuring interdisciplinary scientific research (IDR): A review of the literature." Journal of informetrics 5.1 (2011): 14-26.

National Academies (2005) Facilitating Interdisciplinary Research, Washington, D.C.: National Academies Press.



Indicators for process and output
Diversity of disciplines: Variety, Balance and Disparity

 Higher impact: variety has positive effect on impact, balance and disparity have negative effect on citation impact.

Yegros-Yegros, Alfredo, Ismael Rafols, and Pablo D'Este. "Does interdisciplinary research lead to higher citation impact? The different effect of proximal and distal interdisciplinarity." *PloS one* 10.8 (2015): e0135095.

### 1)There is no solid evidence to show the relationship between interdisciplinarity and scientific impact.

2) Relationship between interdisciplinarity and scientific impact is highly determined by the citation characteristics of the disciplines involved. ——[Vincent *et al.* 2010]

Larivière V, Gingras Y. On the relationship between interdisciplinarity and scientific impact[J]. Journal of the Association for Information Science and Technology, 2010, 61(1): 126-131.

## 1)Interdisciplinary researches increase scientists' visibility in scientific community

### 2)Women are slightly more likely than men to engage in interdisciplinary research

Leahey E, Beckman C, Stanko T. The impact of interdisciplinarity on scientists' careers[C]//annual meeting of the American Sociological Association, Denver, CO. 2012.

Academic Analytics (AA2014): Researchers from universities and institutes in United States

demographic: name, gender, degree year...

information

Data

\_ research achievements: publication...

Gender: Genderize.io, visual inspection Sample size : 143,001 (87.25%) 44,482 female and 98,519 male researchers



# Discipline: researchers are assigned to one or more disciplinary classifications (National Center for Education Statistic)

#### Example: Cassidy R. Sugimoto

Data

Institution Name	L1Name	Person name	articlecount Citation count	
	Information			
Indiana University	Science/Stu	SUGIMOTO, CASSIDY ROSE	39 44	443
	dies			
	Social		20	440
Indiana University	Sciences, various	SUGIMOTO, CASSIDY ROSE	39	443

Three-tiered taxonomy: **Biological and Biomedical** Level-3 (11) Sciences Biomedical Level-2 (25) Sciences Cell Level-1 (171)

Biochemistry

Biophysics

Biological Sciences

Biology

#### Data

#### Results – Proportion of women by discipline



#### Results – Ratio of interdisciplinarity

#### Ratio at Level-3:

 $R_{inter} = \frac{N_{inter}}{N_{total}} \quad \text{Example: } R_{Bio \text{ and } Bio \text{ medical}} = \frac{N_{inter, Bio \text{ and } Bio \text{ medical}}}{N_{total, Bio \text{ and } Bio \text{ medical}}}$ 

 $N_{inter,Bio\ and\ Bio\ medical} = N_{Bio\ and\ Bio\ medical,Bussiness} + N_{Bio\ and\ Bio\ medical,Engineering} + \cdots$ 

#### Ratio at Level-1:

 $R_{inter} = \frac{N_{inter}}{N_{total}} \qquad \text{Example:} \quad R_{Biochemistry} = \frac{N_{inter,Biochemistry}}{N_{total,Biochemistry}}$  $N_{inter,Biochemistry} = N_{Biochemistry,Biophysics} + N_{Biochemistry,Cell Biology} + \cdots$ 

#### Results – Ratio of interdisciplinarity

### 1) Gender difference is insignificant

2) Subject matters

Subjects	Total	Male	Female
Biological and Biomedical Sciences	86%	s 87%	
Natural Resources and Conservation	85%	85%	<i>б</i> 85%
Engineering	79%	5 79%	<b>6 80%</b>
Agricultural Sciences	73%	5 73%	6 74%
Physical and Mathematical Sciences	62%	62%	65%
Family Consumer and Human Sciences	56%	58%	<i>б</i> 54%
Education	55%	57% b	<b>53%</b>
Health Professions Sciences	50%	62%	<b>39%</b>
Humanities	48%	5	б <u>50</u> %
Social and Behavioral Sciences	47%	5	<i>б</i> 47%
Business	44%	<b>44%</b>	<b>42%</b>

#### Results – Ratio distribution in Level-3 discipline



#### Results – Disciplinary composition



#### Results – Disciplinary composition



#### Results – Disciplinary composition

Subject Name **Agricultural Sciences Biological and Biomedical Sciences** Business Education Engineering Family Consumer and Human Sciences **Health Professions Sciences** Humanities Natural Resources and Conservation Physical and Mathematical Sciences Social and Behavioral Sciences

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P-value ( "***' P< 0.001)
3.93E-293 ***
0 ***
2.21E-163 ***
1.99E-14 ***
0 ***
7.62E-134 ***
3.53E-169 ***
1.10E-44 ***
0 ***
0 ***
2.53E-295 ***
```

#### Results – Physical and Mathematical Sciences



#### Results – Physical and Mathematical Sciences



#### Results – Humanities



#### Results – Humanities





1) Gender difference in rates of interdisciplinarity is insignificant

2) Disciplinary compositions are significantly different

3) Move beyond mere counting of the number of disciplines to the ways in which disciplines are combined

## Thank you