



Interdisciplinary working

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MPI-SHH
SUMMER SCHOOL
2021

Doorway
to Human History

Definitions

integration

between disciplines

multidisciplinary

bridging disciplines

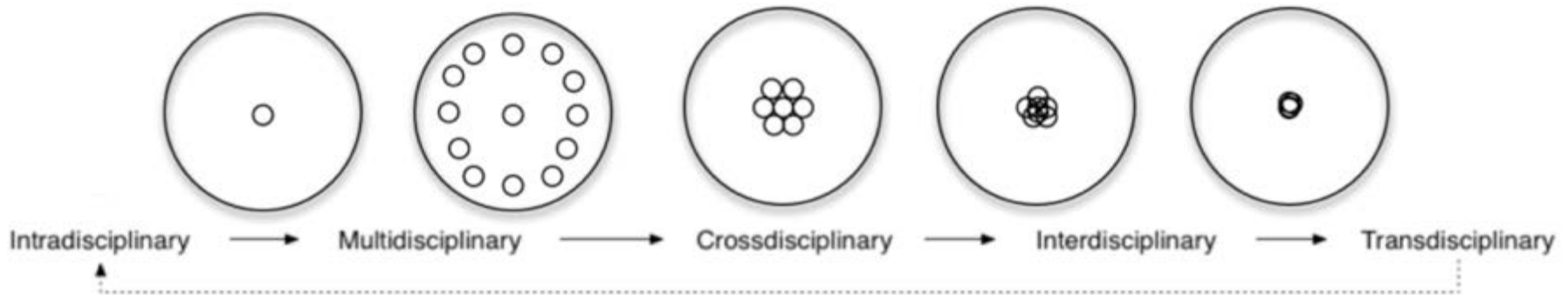
transdisciplinary

crossdisciplinary

interdisciplinary



Definitions



arj.no/2012/03/12/ disciplinaries-2/(Inspired by Zeigler (1990))

- **Intradisciplinary:** working within a single discipline (Stember, 1991)
- **Multidisciplinary:** draws on knowledge from different disciplines but stays within the boundaries of those fields (NSERC, 2004)
- **Crossdisciplinary:** a viewing of one discipline from the perspective of another (Stember, 1991)
- **Interdisciplinary:** analyses, synthesizes and harmonizes links between disciplines into a coordinated and coherent whole (CIHR, 2005)
- **Transdisciplinary:** integrates the natural, social and health sciences in a humanities context, and in so doing transcends each of their traditional boundaries (Soskolne, 2000)



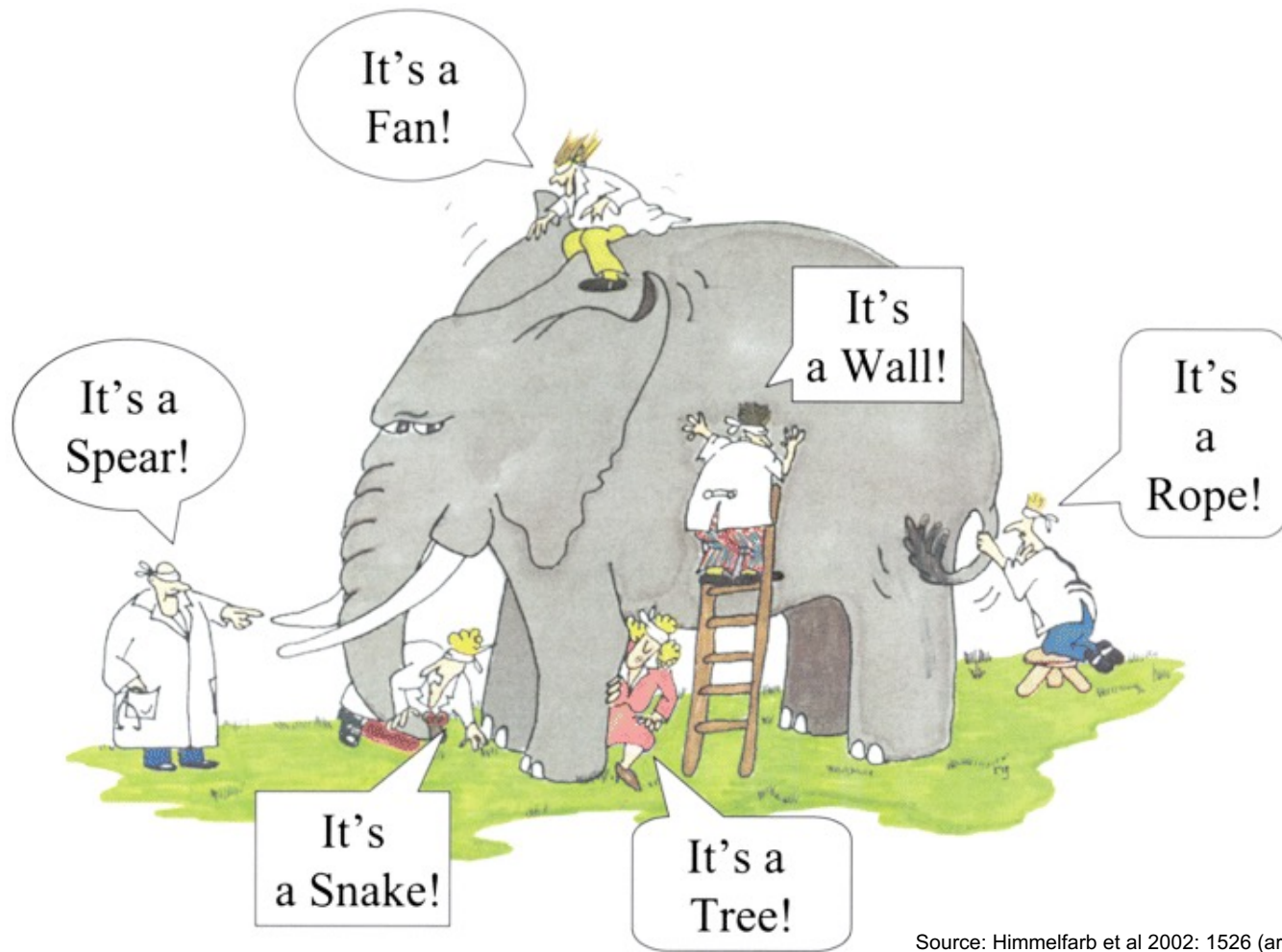
Definitions

| | <i>Multidisciplinary</i> | <i>Interdisciplinary</i> | <i>Transdisciplinary</i> |
|----------------------|--------------------------|--------------------------|--------------------------|
| Keyword | Additive | Interactive | Holistic |
| Mathematical example | $2+2=4$ | $2+2=5$ | $2+2=\text{yellow}$ |
| Food example | a salad bowl | a melting pot | a cake |

(Choi and Pak, 2006)



Why bridge disciplines?



Source: Himmelfarb et al 2002: 1526 (artist: G. Renee Guzlas).
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Why bridge disciplines?

“An interdisciplinary approach should drive people to ask questions and solve problems that have never come up before.

But it can also address old problems, especially those that have proved unwilling to yield to conventional approaches.”



Why bridge disciplines?

“Complex modern problems require many types of expertise across disciplines”

“In many endeavours, success requires collaborative, cooperative work towards a goal that is beyond the capability of any one individual, too much top talent can harm the result”



Levels of interdisciplinarity

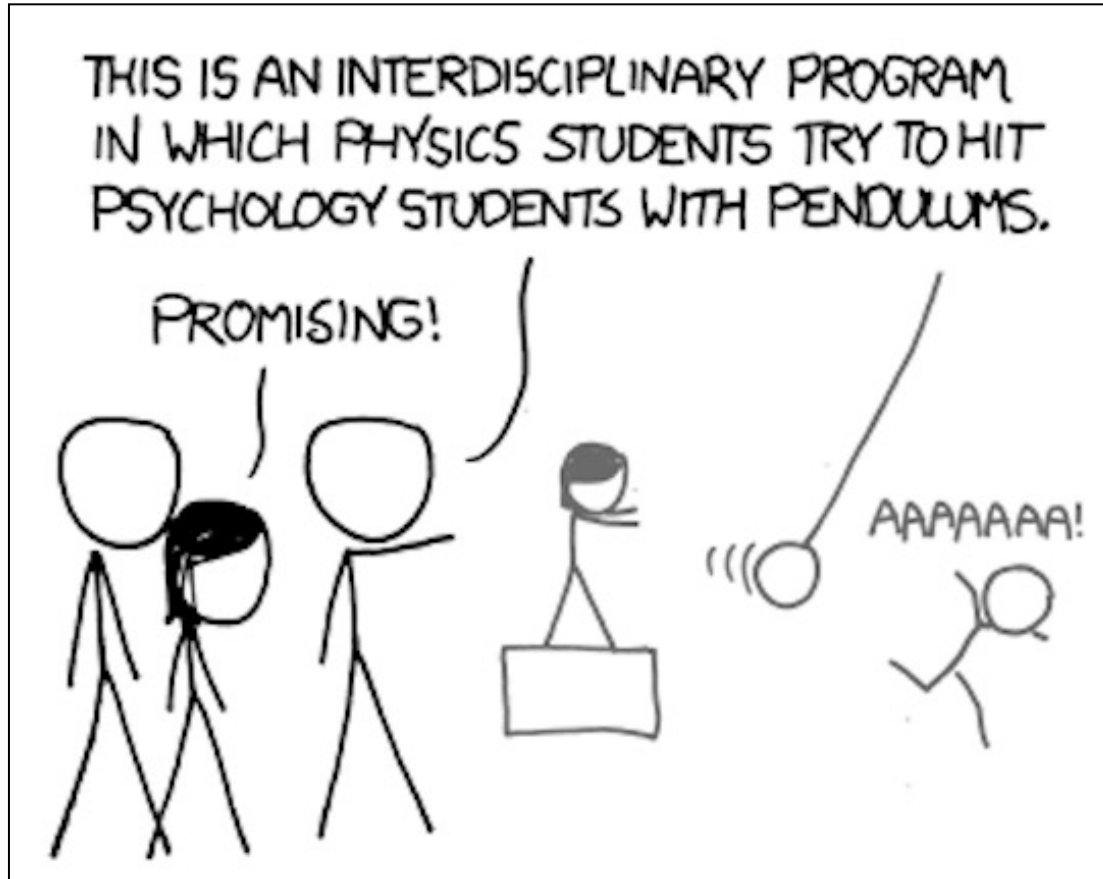


Lowest level:

- ❖ Know and cite work from other disciplines.



Levels of interdisciplinarity



<https://imgs.xkcd.com/comics/interdisciplinary.png>

Middle level:
❖ Use tools or
methods from
other disciplines.



Levels of interdisciplinarity



Children going to school,
Lebak, Indonesia
Photo: Reuters

<http://www.boredpanda.com/dangerous-journey-to-school/>

Highest level:
❖ Two-way
collaboration
(bridge).



Flash Survey:

Have you worked interdisciplinary before,
or been involved in such a project?

Use the "raise hand" function



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Natalie Uomini profile

Neuroscience, Animal Behaviour

Researcher
Liverpool, Leipzig, Jena

- brain function
- brain evolution
- animal minds
- language
- tool-making

- laterality
- tool-making
- cognitive evolution

Anthropology Archaeology

M.Sc., Durham
Ph.D., Southampton

- animal communication
- language evolution

Cognitive Science

B.A., San Diego

Linguistics

B.A., San Diego
M.A., Grenoble

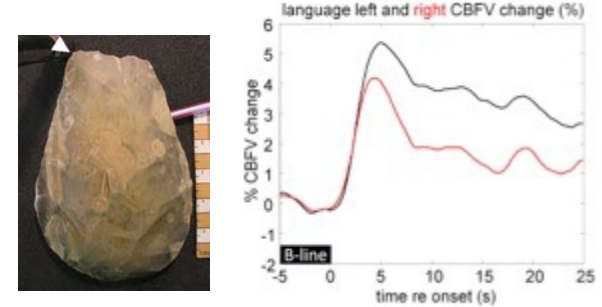


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Examples

- archaeology & evolutionary biology
- linguistics & primatology
- archaeology & neuroscience
- linguistics & animal behaviour
- archaeology & animal behaviour



Uomini & Meyer 2013, *PlosONE*

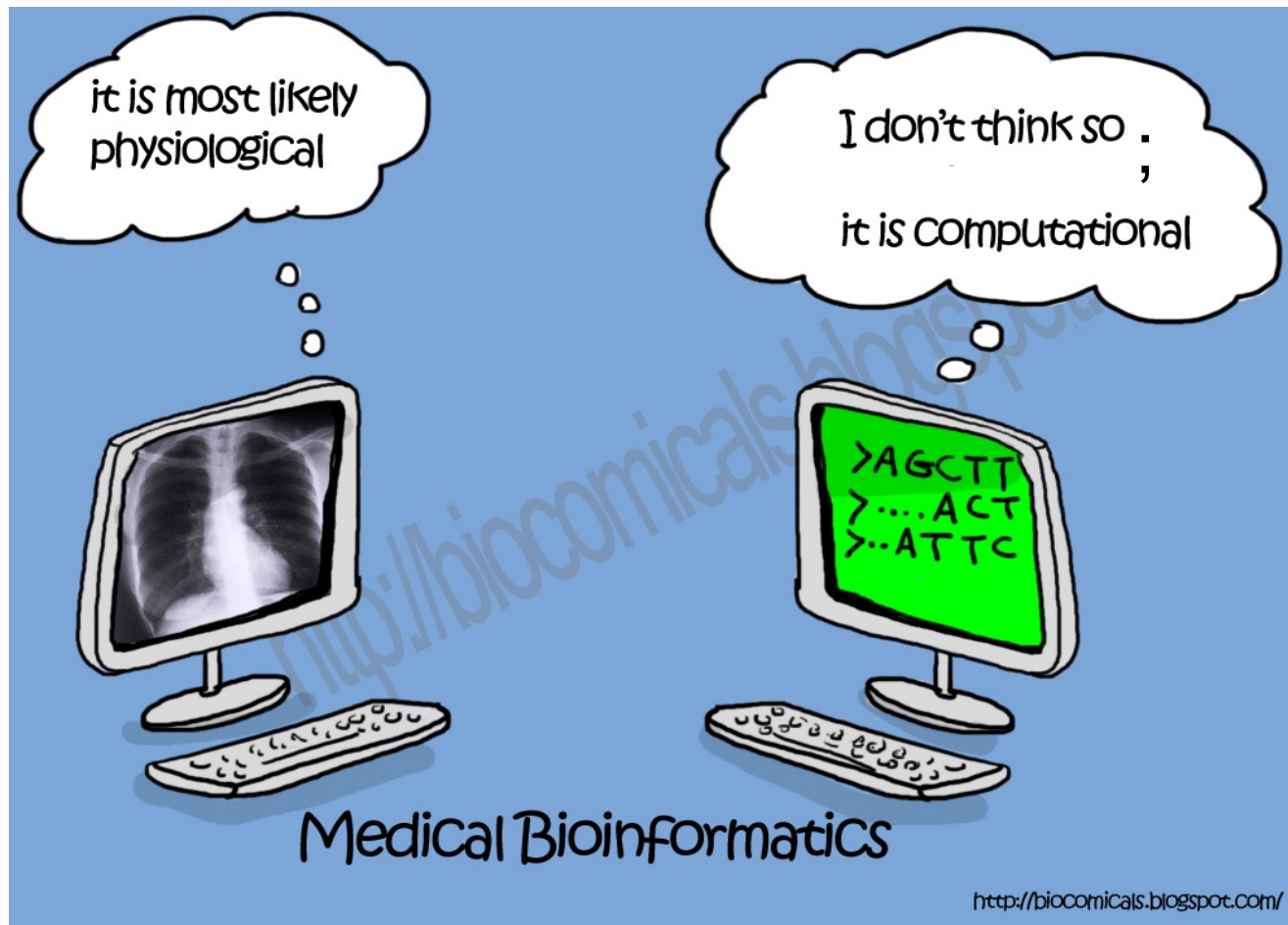
Morgan, Uomini, et al. 2015,
Nature Communications

Crockford, Grawunder, Uomini,
et al. 2021, *Phil Trans Royal Soc*

Haslam, Uomini, et al. 2019,
Scientific Reports



Points of conflict... then compromise



Archaeology vs. Psychology



Photo: www.transportscotland.gov.uk



Photo: <http://illustrationrevealed.wordpress.com>



Points of conflict... then compromise

Project planning, experimental design:

- what are considered **valid data** (e.g. number of subjects; qualitative vs. quantitative data collection)
- naturalistic environment vs. control of variables

Publication:

- **theoretical framing of the study:** how you explain the motivation and importance of results, to be attractive to each discipline (e.g. big open questions are different in each field)
- where and how to **publish** (find suitable journal & reviewers; cite relevant literature for each discipline)



Eleftheria Orfanou profile

- Age at death
- Sex estimation
- Social organization
- Paleopathology

Archaeogenetics

Doctoral Researcher
Leipzig, Jena

Osteoarchaeology

M.Sc., Leiden

- Migration patterns
- Biological kinship
- Social organization



- Diet reconstruction
- Mobility patterns
- Social organization

Archaeology

B.A., Vancouver

Isotopes

Doctoral Researcher,
Jena



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Archaeology vs. Archaeogenetics



Opinion:

What do you think are the main challenges
of interdisciplinary research?

Type in the chat



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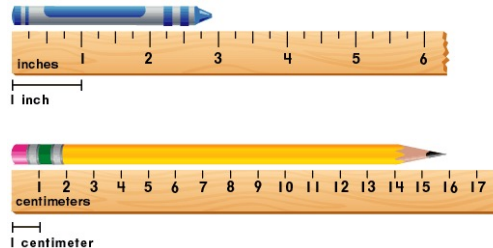
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Challenges



- ◆ Arrogance
- ◆ Terminology
- ◆ Lack of knowledge of current issues
 - ◆ Time commitment
- ◆ Ideas of what is a “proper” study / publication
 - ◆ Scale differences
 - ◆ Fear of the unknown



Challenges: Arrogance

Remember!

Each discipline has its own established methods & standards for conducting research, that have been validated and are accepted by that community.

>> empirical-experimental vs. social, conceptual <<

Neuron

NeuroView

2010

**Humans, Brains, and Their Environment:
Marriage between Neuroscience and Anthropology?**

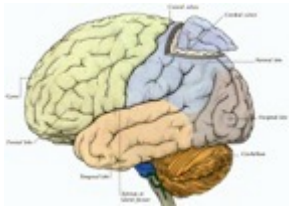
Georg Northoff^{1,*}



Challenges: Terminology



Challenges: Terminology



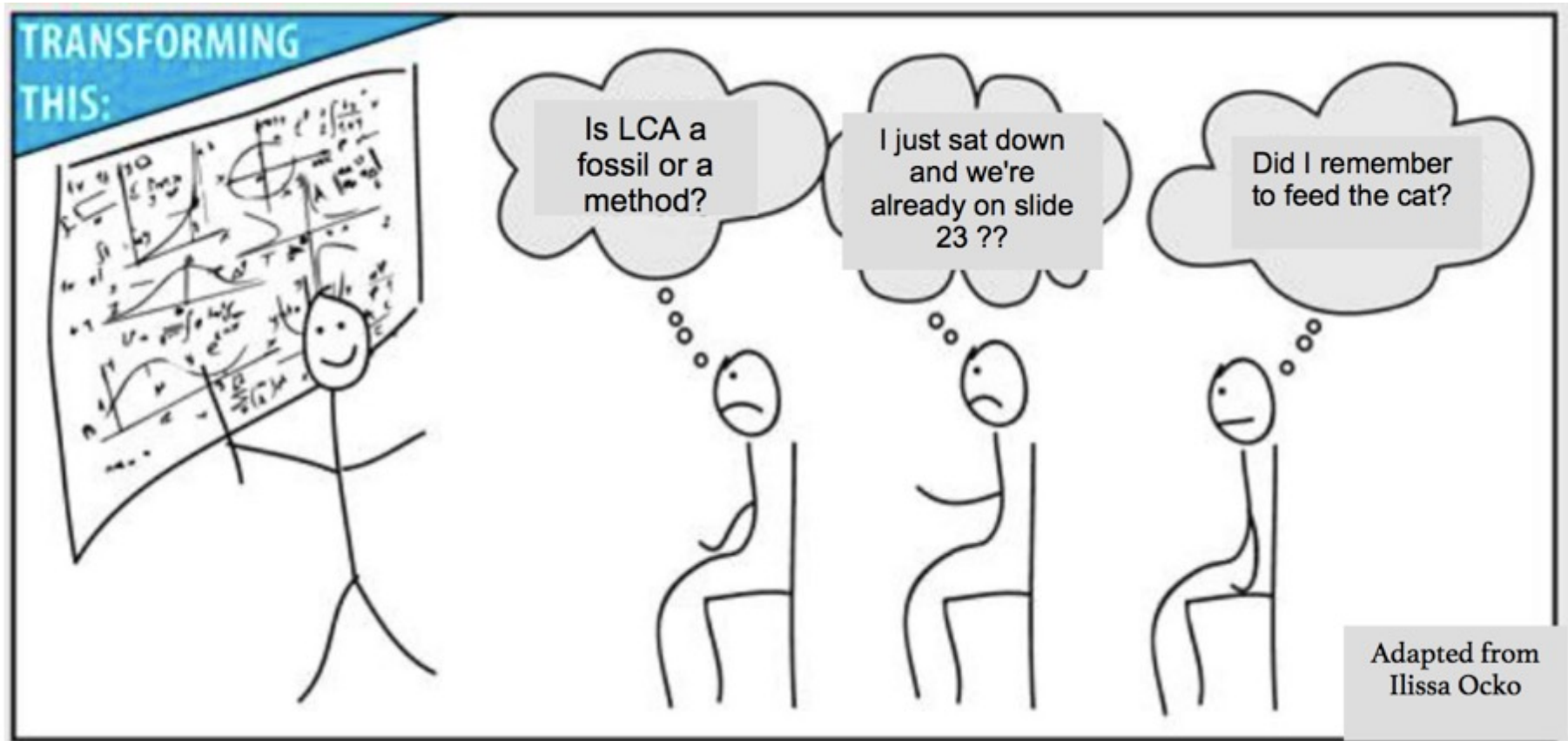
...is crucial! Discuss terminology...
before
during
after
your study

at coffee break
in the lunch room
over dinner

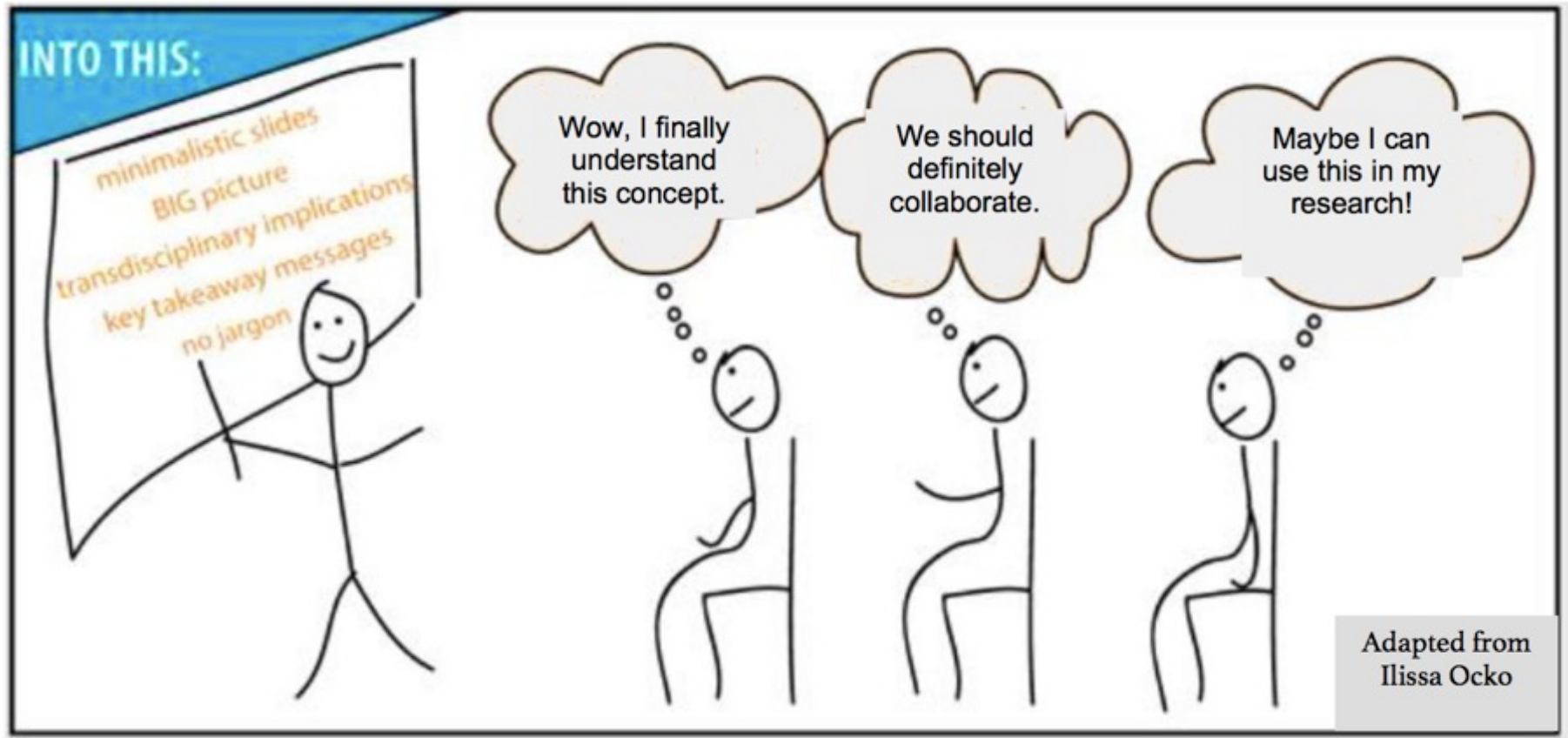
➤ Differing technical vocabularies (field specific jargon) and communication cultures



Challenges: Terminology



Challenges: Terminology



Challenges: Lack of knowledge

- ...of the major debates in another field
- ...of the big questions that inspire the other field
- ...of what is known, what is not yet known
- ...of what is relevant to that field
- ...of the history of another field's research



Challenges: Time commitment

...is necessary.

(it takes time to build a true relationship)



Challenges: Ideas of what is "proper"

e.g. the standard way to give a talk:

- handouts - read aloud (Linguistics)
- talking with slides (Archaeology, Palaeoanth, Primatology)
- start with a hypothesis (Primatology, Evol. Biology)
- start with presenting data (Anthropology, Archaeology)
- ...



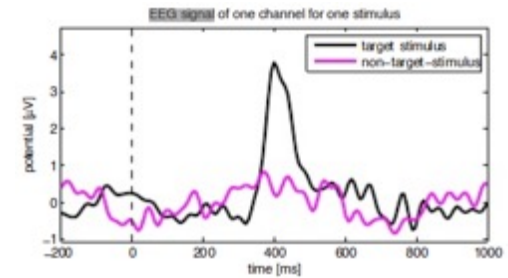
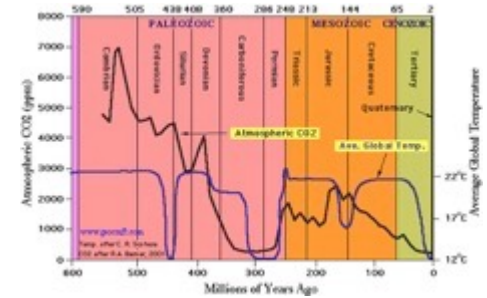
e.g. publication type:

- book
- journal article
- video, audio recordings
- ...



Challenges: Scale differences

- Measurement time scales:
 - millions of years vs. milliseconds
- Time scales of doing the project:
 - years vs. months
- How and when you work & publish:
 - one at a time, single author (Cultural Anthro.)
 - vs.
 - several projects at once, teams (Biology)



Challenges: Fear of the unknown



Challenges

- Doing actual interdisciplinary research and not using the term as a fashionable label
- Organizational and interpersonal communication
- Intellectual and authority relationships, unequal power among disciplines
- Difficulty to get interdisciplinary papers into top-tier disciplinary journals



Challenges

- Poor selection of disciplines (or even poor decision to go interdisciplinary)
- Lack of proper measures to evaluate success of interdisciplinary work
- Lack of guidelines for multiple authorship in research publications
- Limitations imposed by grant agencies & institutions



(Choi and Pak, 2007)



Recommendations

The person: Educate yourself in several disciplines

The team: Create links with experts in other disciplines



EDITORIAL

Ten Simple Rules for a Successful Cross-Disciplinary Collaboration

Bernhard Knapp^{1*}, Rémi Bardenet¹, Miguel O. Bernabeu^{2,3}, Rafel Bordas⁴, Maria Bruna^{4,5}, Ben Calderhead⁶, Jonathan Cooper⁴, Alexander G. Fletcher⁵, Derek Groen², Bram Kuijper^{3,7}, Joanna Lewis³, Greg McInerny⁴, Timo Minssen^{8,9,10}, James Osborne⁴, Verena Paulitschke¹¹, Joe Pitt-Francis⁴, Jelena Todoric¹², Christian A. Yates¹³, David Gavaghan⁴, Charlotte M. Deane¹



Recommendations

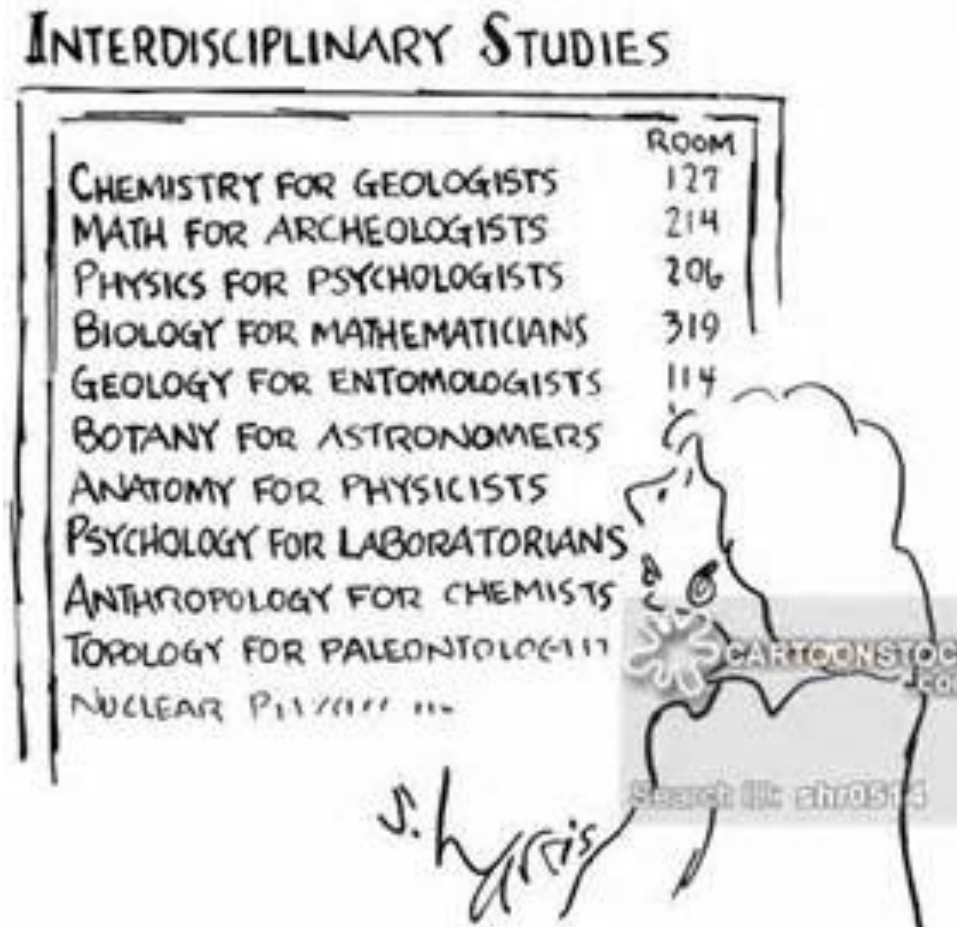
- **Enjoy Entering a Completely New Field of Research**
 - No one expects you to know everything about the new field
 - Ask the “stupid” questions
 - Don’t pretend to know everything already
 - Learn the vocabulary and the key ideas of the new field
 - Discuss your work with scientists from complementary fields



(Knapp et al., 2015)



Recommendations: The person



Educate yourself:

- Attend conferences outside your topic
- Question everything you read
 - Make friends
 - Read review papers
- Attend lectures, seminars, courses



Recommendations

➤ Go to the Wet Lab

- Understand where datasets come from
- Understand the process of data collection, cost, time frame, in- build assumptions



➤ Learn the Language: Different Fields Have Different Terminologies

- Fully understand your collaboration partners, mutually understandable communication
- Learn the other field's jargon and ask questions about meaning of words
- Build a technical vocabulary
- Agree on a joint nomenclature with your collaborators early in the project



(Knapp et al., 2015)



Recommendations

- **Different Fields Move at Different Speeds:
Do not Become Impatient**
- Accept the different pace of different fields
- Do not make assumptions about how hard fellow collaborators are working
- Communicate early with your collaborators how long your part of the work is likely to take and why



(Knapp et al., 2015)



Recommendations

➤ Different Fields Have Different Reward Models: Know What You Can Expect

- Recognise that the publication culture in the life sciences differs from that of the theoretical sciences. This includes:
 - ❖ Publication speed
 - ❖ Different impact factor scales
 - ❖ The preferred ordering of authors on a manuscript
 - ❖ The definition of a “significant” contribution to a manuscript might differ markedly
- Develop a well-planned publication strategy



(Knapp et al., 2015)



Recommendations

$$S(\omega) = \frac{\alpha g^2}{\omega^5} e^{[-0.74 \left\{ \frac{\omega U_{\omega} 19.5}{g} \right\}^{-4}]} \\ = \frac{\alpha g^2}{\omega^5} \exp \left[-0.74 \left\{ \frac{\omega U_{\omega} 19.5}{g} \right\}^{-4} \right]$$

➤ What Different Fields Mean by “Data”

- Ask your collaboration partner for a standardized data format
- Favour electronic forms of data and always keep a copy of the original file
- Write minutes about meetings and data specifications to avoid later misunderstandings
- Do not blindly trust experimental data, perform “sanity” checks

➤ Assess the Advantages and Disadvantages of Service Work

- Service work is also risky, as it may take more time than you anticipated
- Make sure to evaluate the amount of service work on a regular basis and be clear with your collaborators about what you expect in return before engaging in service work

(Knapp et al., 2015)



Recommendations

➤ Create and Manage Structural Bonds

- ❖ Establish a proper framework for scientific exchange
 - Regular meetings
 - Workshops, Symposia
 - Attendance of each other's group meetings
 - Co-teaching of courses
 - Apply collaboratively for grants
 - Shared PhD students and postdocs, shared supervision, shared publications, constant knowledge exchange, interdisciplinary training
 - Protect junior scientists from “getting lost in cross-disciplinary collaboration”



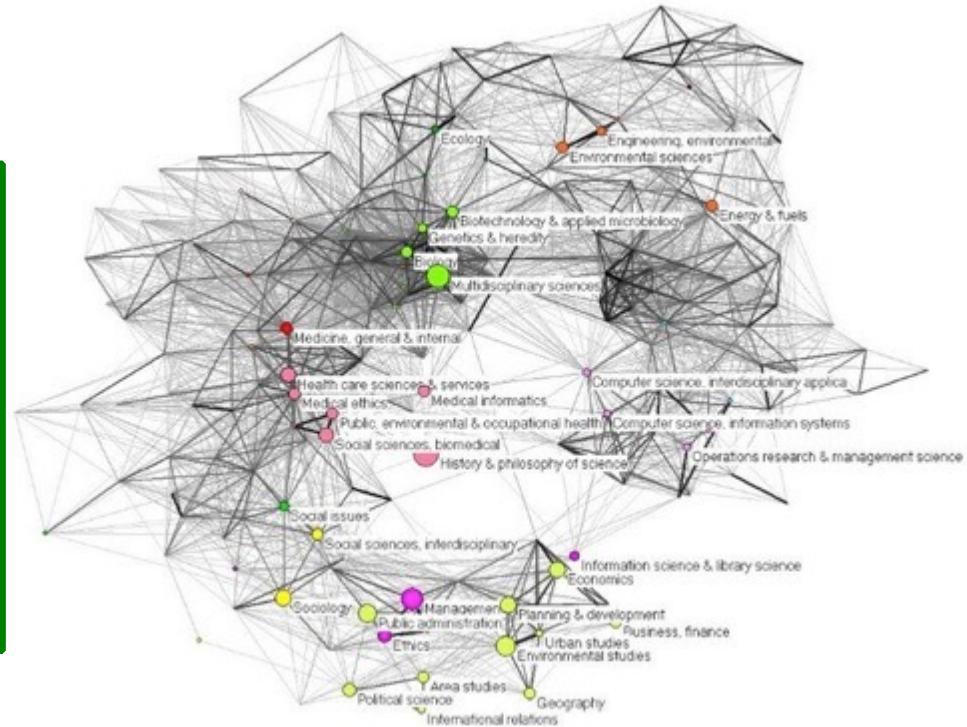
(Knapp et al., 2015)



Recommendations

It's impossible to have all the skills yourself, so you need an expert!

- Attend conferences
- Contact random names at your university
 - Joint journal clubs
 - Share work often



ISSTI, Univ. Edinburgh -
[http://www.interdisciplinaryscience.net/
maps/all_ind.html](http://www.interdisciplinaryscience.net/maps/all_ind.html)

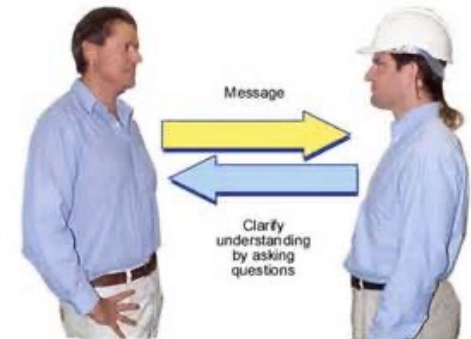


Recommendations

➤ Recognise When Things Are Not Working Well

❖ Possible approaches

- Pretend that nothing has happened
- Pause the collaboration
- Search for alternatives
- End a collaboration



➤ Be synergistic

- Combine contributions from both sides
- Focus on mutual gain
- Give enough credit to partners
- Care for the interests of all parties as if they were your own

(Knapp et al., 2015)



Qualities needed

“Interdisciplinary work requires particular skills, mindsets and attention to establishing common ground”

(Rylance, 2015)

“Brilliance and wit are not enough for interdisciplinary progress”

(Stember, 1991)

- ✓ Understanding, Respect
- ✓ Commitment to common interests
- ✓ Exceptional patience, compromise
- ✓ Don't be afraid to ask "stupid" questions
- ✓ We still need deep experts in topics
- ✓ Expect the unexpected!



Qualities needed

- ✓ Good selection of team members
- ✓ Good team leaders
- ✓ Maturity and flexibility of team members
- ✓ Personal commitment
- ✓ Incentives
- ✓ Institutional support and changes in the workplace
- ✓ A common goal and shared vision
- ✓ Communication
- ✓ Constructive comments among team members



Meaningful exchange

“Dialectic” occurs when the participants have subordinated the demands of their egos and have a paramount desire for discerning what is meaningful and true in what the other says, if meaning and truth exists there and can be coaxed out.

“On the other hand, the “eristic” type of exchange includes the consuming desire to be persuasive to one’s own view, philosophy, theory, or method-to overwhelm the other and to secure what must appear at the time to be a victory of wits and argumentative skill.

(Stember, 1991)



I don't know
who I am
anymore



I have
real identity
crisis



Look!
How many
affiliations I have!



www.biocomicals.com



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"We are not students of some subject matter, but students of problems. And problems may cut right across the borders of any subject matter or discipline."

(Karl Popper, 1963)



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Team Challenge

- 10 minutes
- Groups of 5 (randomly assigned)
- Prepare a list to share with class



You are a research team on an interdisciplinary project...

- ◆ (1) How did the human gut microbiome adapt to population migrations?
- ◆ (2) When and where did the Indo-European language family originate?
- ◆ (3) Why did megafauna go extinct?
- ◆ (4) Any other topic of your choice!



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Prepare 1 slide to present to class:

- ✓ Your assigned 3 disciplines & your chosen topic
- ✓ List 2 likely pitfalls to avoid
- ✓ List 3 strategies you could use to successfully bridge the disciplines
- ✓ (Optional: examples of projects/methods/activities)



Groups

1. biology, theology, music
2. chemistry, anthropology(ethnology), business
3. genetics, sociology, architecture
4. astronomy, geography, history
5. physics, economics, archaeology
6. computer science, political science, linguistics
7. mathematics, psychology, literature
8. geology, cognitive science, law
9. engineering, paleontology, philosophy
10. medicine, education, museum studies

