TEACHING BRIGHTWAY - RIGHT AWAY

MASSIMO PIZZOL

DEPARTMENT OF PLANNING, AALBORG UNIVERSITY

massimo@plan.aau.dk

AALBORG UNIVERSITY
DENMARK

Today @ Brightcon

- Why a course in BW
- Design and implementation
- Reflections and improvements

Music

"Who knows how to make it makes it,
who knows it less teaches it,
who knows it even less organizes it,
who knows it very little criticizes it."
- *Luciano Pavarotti*

Brightway

"Who knows how to make it makes it,
who knows it less teaches it, ← ME
who knows it even less organizes it,
who knows it very little criticizes it."
- *Luciano Pavarotti*

Why teaching Brightway?

- Teaching to myself first
- Group synergy
- Steep learning curve
- Enlarge community

AALBORG UNIVERSITY
DENMARK

Brightway teaching timeline

2018 Internal pilot (7 stud)

2019 Module in PhD course (25 stud)

2020 Module in online PhD course (20 stud)

Designing the course

- Participants background
- Live and interactive
- Practical, hands-on

Guiding principles

- BW is the means to an end
- Keep it simple
- Not a course about coding

Learning objectives

Knowledge

At the end of the course you will know about: python data structures, python scientific environment, Brightway2 data structures, Brightway2 functions, key concepts of statistical analysis for LCA (error propagation, statistical testing, variance-based sensitivity indicators).

Skills

At the end of the course you will be able to: program in python at a basic level, use Brightway2 at a level comparable to other commercial LCA software, including importing foreground and background data into Brightway2, running calculations from a simple LCA to more complex simulations and comparative analyses, perform statistical analysis of LCA results, perform local and global sensitivity analysis of LCA results.

Competences

At the end of the course you will be in a position to: apply LCA modelling in Brightway2 to your research questions, by choosing the appropriate data, code, and workflow organisation that solve the case-specific challenges.

Problem Based Learning

- Group work 5-6 stud
- Theory + practice
- Case study

AALBORG UNIVERSITY
DENMARK

Practical implementation

- 4 blocks (16h)
- Lectures + exercises
- Notebooks (ipynb + html)
- Readings, Q&A, feedback

Evolution over time

```
# -*- coding: utf-8 -*-
"""
Created on Wed Jan  4 21:03:55 2017

@author: massimo
"""

from brightway2 import *

t_db = Database("testdb")

t_db.write({
    ("testdb", "Electricity production"
        'name':'Electricity production'
        'unit': 'kWh',
        'exchanges': [{
                'input': ('testdb', 'Fu
                'amount': 2,
                'unit': 'kg',
                'type': 'technosphere'
            },{
                'input': ('testdb', 'Ca
                'amount': 1,
                'unit': 'kg',
                'type': 'biosphere'
            },{
                'input': ('testdb', 'Su
                'amount': 0.1,
                'unit': 'kg',
                'type': 'biosphere'
            },{
                'input': ('testdb', 'El
```

Jupyter notebook

1. Simple LCA in Brightway2

The most important data structures of brightway are represented here a
already (e.g. Simapro). I recommend that later you read carefully this do

We again use the example product system from Heijungs & Suh (2002)

The point with tis script is to understand the dict structure of a brightwa

```
import brightway2 as bw # start with "bw." to use a f
```

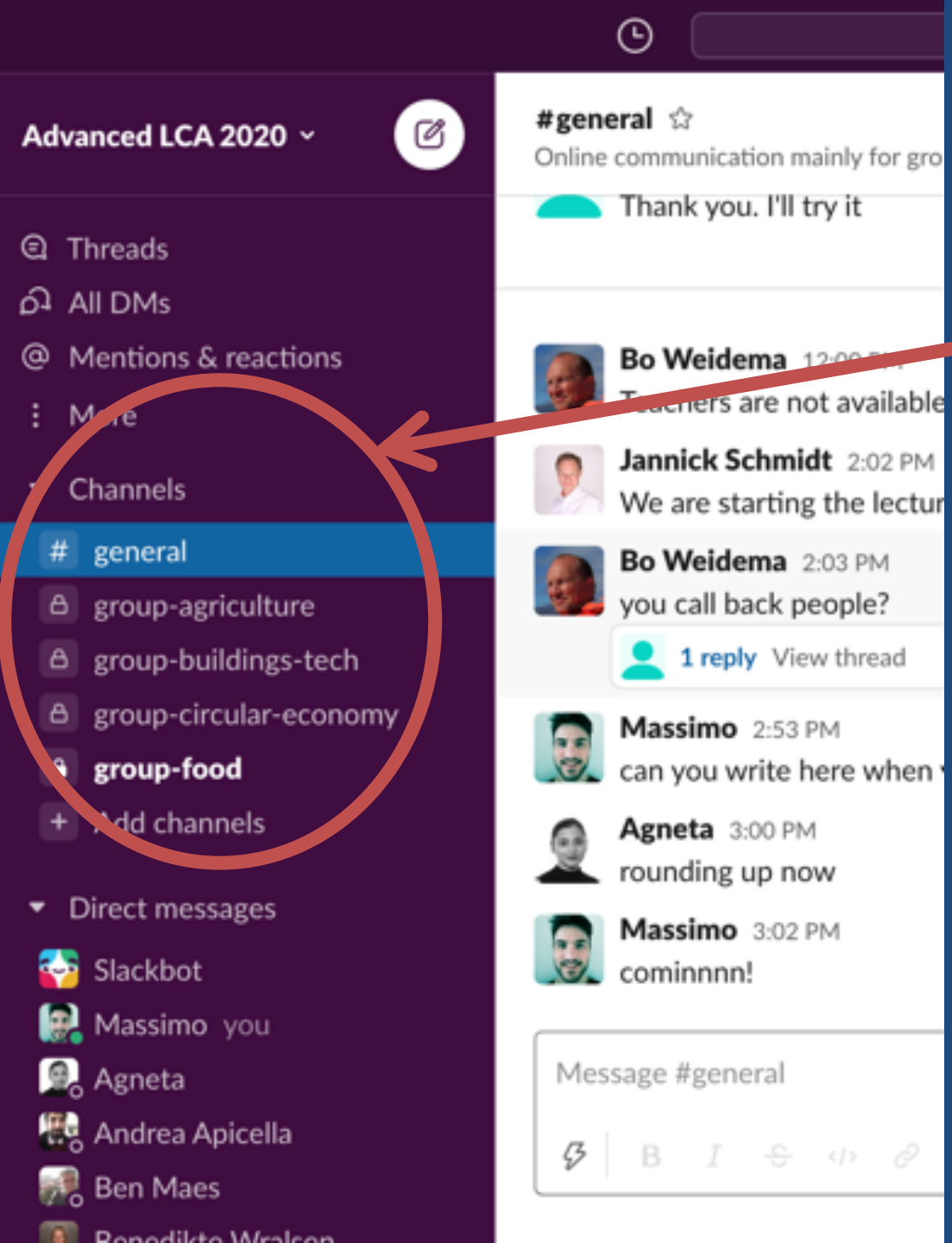
```
bw.projects.set_current('advlca20' # cf. notebook "F
```

```
bw.databases.clear() # line to use in case you had al
bw.databases # lists all databases. We start from an
```

```
Databases dictionary with 0 objects
```

```
t_db = bw.Database("testdb" # creates an instance of
```

```
# this is the most important cell in this notebook, r
t_db.write({
    ("testdb", "Electricity production"): # note tha
        'name':'Electricity production',
        'unit': 'kWh',
        'exchanges': [{
```



Online vs physical

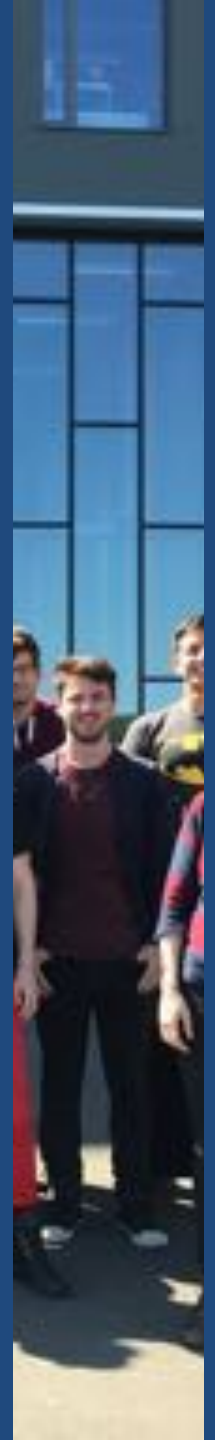
- Groups in slack + zoom
- *"Large screen all for myself"*
- No travel
- Unpractical for discussions

AALBORG UNIVERSITY
DENMARK

Teacher reflections

- Module integration challenging
- High pace → consider spread
- Share the code?
- Add external elements

More here:
https://github.com/massimopizzol/B4B
https://moutreach.science/2018/04/10/Teaching-experiment.html



Student feedback

- *Primary motivation was to learn Brightway2*
- *Challenging, but appropriate for PhD level*
- *Assignments were a lot of work - but crucial to really understand the material*
- *For the Brightway part I felt well prepared also because of the pre-material provided*
- *Truly one of the best courses I have taken*
- *Thank you for providing lunch*

AALBORG UNIVERSITY
DENMARK

More student feedback

“I found it difficult to keep pace with Brightway due to lack of experience with programming but I was able to understand what we covered when I revised / reflected in my own time.”

“Something that I could have wished for is a little bit more on Brightway2 and why it is better/more smart than other LCA software. Because many of the exercises we did in Brightway2 could have been done also and maybe also faster (depending on your coding skills) in LCA software”

Wrapping up

- BW as the means to an end
- Teach BW for yourself and others
- Continuous improvement

Looking forward

“I would like to have seen more on Brightway2.

I have had some time to get used to it, but it would be better if its applicability and capability could be explored in more detail.

What we did was great, but very much a whirlwind tour, and I feel like I have a long way to go to incorporate it fully”

THANK YOU

MASSIMO PIZZOL

DEPARTMENT OF PLANNING, AALBORG UNIVERSITY

massimo@plan.aau.dk

AALBORG UNIVERSITY
DENMARK