



DPZ 


## Data Sharing: Monkey multi-electrode array recordings and Neo

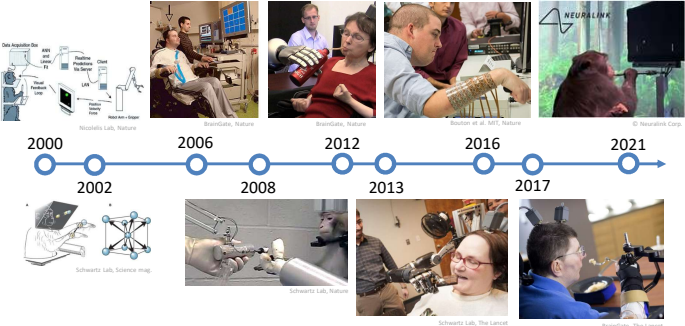
Andres Agudelo-Toro and Hans Scherberger

**NFDI Neuro 5th Community Workshop:  
Integrating the Neuroscience Community  
July 2021**


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## Impressive progress of Brain Computer Interfaces


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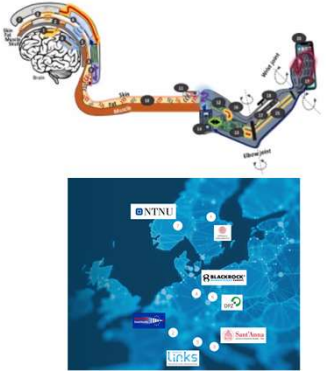
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## Project B-CRATOS (2021-2025)


DPZ 

- Wireless **Brain-Connect** interRfAce **TO** machineS
- Large multi-site EU project (€ 4.6 m.)
- Aim: wireless **bidirectional** communication between the brain and a robotic device
- More info: [b-cratos.eu](http://b-cratos.eu)

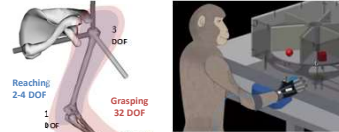



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## Multi-lab Big-Data sharing challenge

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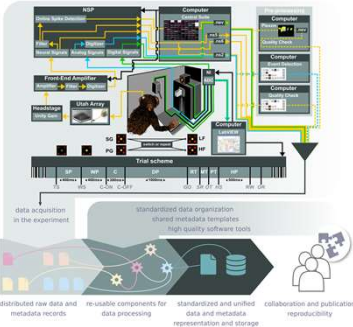
- Preparation for real-time experimental phase requires simulation with existing data
- EU working groups focused on different levels:
  - Neural decoding
  - Robotic grasping
  - Neural stimulation, etc.




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### Preventing a data sharing “perfect storm”

- Complex data set where details matter
- Sharing to non-electrophysiologists
- Until now customized formats (Lab’s own protocols)
- Ideal case: automated tools before the experiment (not always possible)





distributed raw data and metadata records    re-usable components for data processing    standardized and unified data and metadata representation and storage    collaboration and publication reproducibility

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### Requirements



- Open data formats
- Ideally open and freely accessible tools
- Compatible with collaborator’s workflows (De facto Python)
  - But consider existing Matlab code
- Reusable
  - Training of Master’s and PhD students
  - Future collaborations
- Good performance/low storage footprint




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### Considered formats


- Neuroshare (defunct)
- NWB: Neurodata Without Borders
  - HDF5 Based. Python, Matlab support
  - Complex specs, more rigid
  - Relatively new, toolset still limited
- NIX/Neo ecosystem:
  - HDF5 Based. Python, Matlab, Java support
  - Simpler specs, more flexible
  - Actively maintained, more available tools





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### Experience so far with Neo

- Fitted the project well:
  - Version 1.0: Use the Python tools but save as Matlab files
  - Version 2.0: Neo structure can be also produced in Matlab using struct(...) and cell(...)
- Related tools (e.g. Elephant) can be easily used for common routines (binning, PETHs)
- Well documented (still lacks richer code examples)




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### Some metrics



- **Half a day** to write the code for basic translation of existing behavioral data
- **Two days** to add neural information
- Rough code length:
  - Version 1.0: .m **80 loc** ,.py **40 loc**
  - Version 2.0: .m **160 loc**
- Spikes and behavioral data stored in .mat files in very manageable sizes (**1 GB per session**)

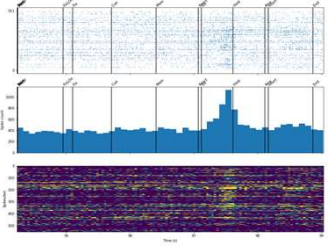
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### Code: a lot in very few lines




```

1 """ settings: set it here """
2
3 Load recording from the Neurobiology Lab (DPZ) saved in the neo structure
4 using the Neural Forum (11/2017 from: neuroforum.com)
5
6 V.A. 23.04.2021 Anders Aggleto here first version
7
8
9 import numpy as np
10 import matplotlib.pyplot as plt
11
12 from neo.io.neomatlabio import NeuroLabIO
13 from elephant.conversion import Conversion
14
15 from vizphant_rasterplot import exampleplot
16 from vizphant_events import add_event
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18 from elephant import MWGAP
19 from elephant import get_sessions_from_neo_segment, compare_sessions_from_sessions
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### Interaction with collaborators




- So far neural data shared with the Swedish and Italian team
- Required Python modules shared to collaborators as a **conda** recipe
- Setting up the Python environment was possible in **10's of minutes**
- Collaborators could plot basic binned data from **day zero** using elephant
- Data shared with 1 Master's student, successful machine learning project completed in **8 weeks**

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### Summary



- Ecosystem keeps evolving with standard formats and tools
- Python and Conda greatly facilitate sharing work environments
- More than the storage format (e.g. nix vs nwb): it is important to agree upon a **data structure**
- That is what you will deal with 90% of the time!
- If there is a common structure, community tools will develop around it

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