The Brain Imaging Data Structure (BIDS) for Data Sharing

1st Oldenburger Open Science Conference
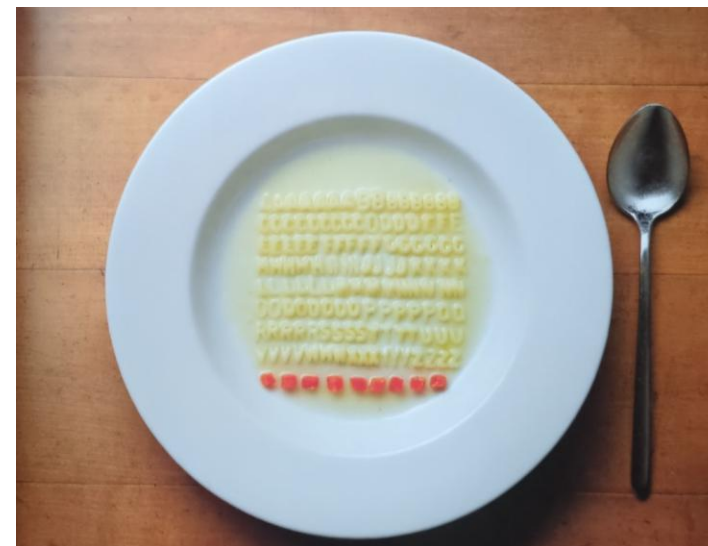Julius Welzel

Motivation

- **Many, many, many subjects** are recorded for research purposes each year

- **Lack of consensus** of how data should be organized

What is BIDS?

Dataset info

Motion

Aims of BIDS

→ **Makes data FAIR**

DATA STRUCTURE

- BIDS is based on simple file formats and folder structures

- Provides a "easy-to-understand" folder structure

- Provides a naming convention for files and directories

METADATA

- Separate data and metadata

- Some metadata is better than no metadata

Brain Imaging Data Structure v1.9.0

Brain Imaging Data Structure v1.9.0

The BIDS Specification

Introduction

Common principles

Modality agnostic files

Modality specific files ›

Derivatives ›

Longitudinal and multi-site studies

Glossary

BIDS Extension Proposals

Appendix ›

Changelog

The BIDS Starter Kit

Website

Tutorials

GitHub repository

The Brain Imaging Data Structure

The Brain Imaging Data Structure (BIDS) is a simple and intuitive way to organize and describe data.
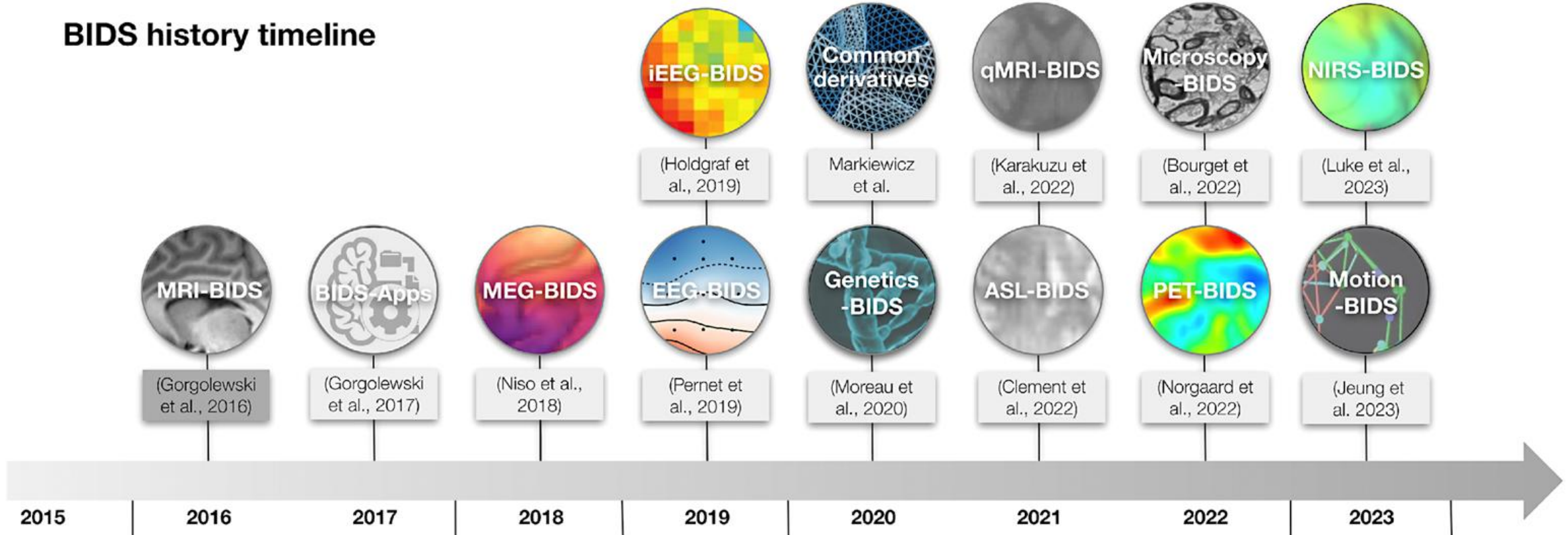
This document defines the BIDS specification, which provides many details to help implement the standard. It includes the core specification as well as many extensions to specific brain imaging modalities, and increasingly also to other kinds of data.

If BIDS is new to you, and you would like to learn more about how to adapt your own datasets to match the BIDS specification, we recommend exploring the BIDS Starter Kit. Alternatively, to get started please read the introduction to the specification.

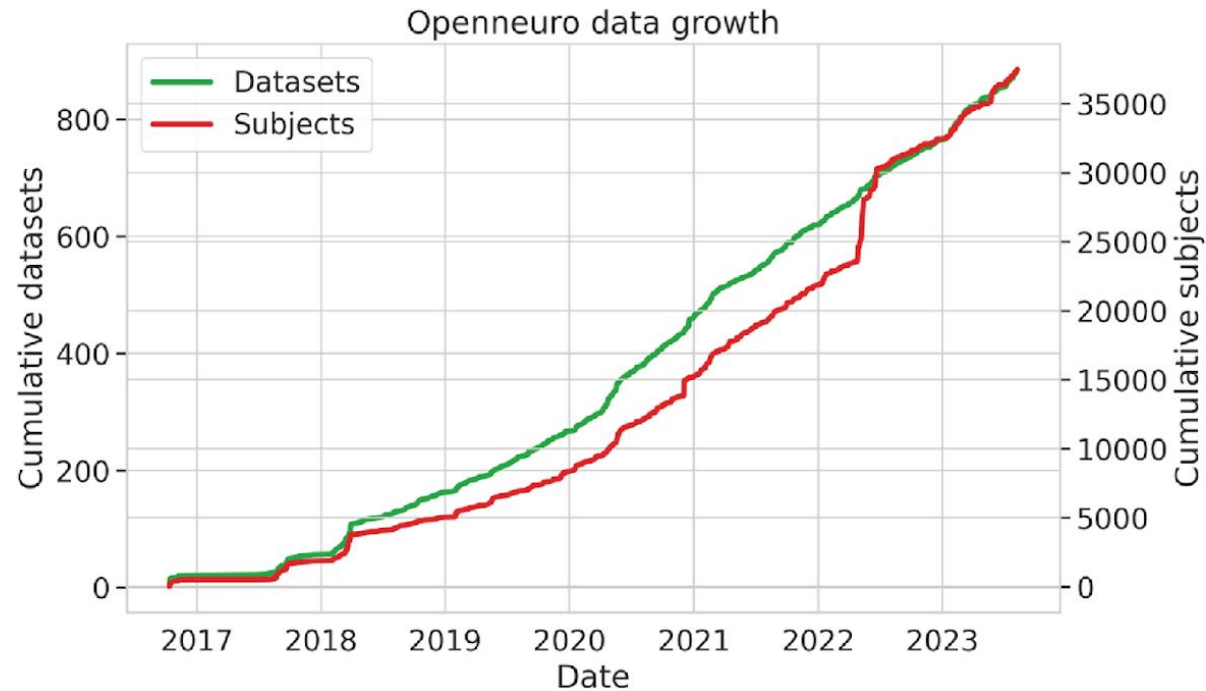For an overview of the BIDS ecosystem, visit the BIDS homepage. The entire specification can also be downloaded as PDF.

https://bids-specification.readthedocs.io/en/stable/

The Past, Present, and Future of BIDS

BIDS history timeline

iEEG-BIDS (Holdgraf et al., 2019)
Common derivatives Markiewicz et al.
qMRI-BIDS (Karakuzu et al., 2022)
Microscopy BIDS (Bourget et al., 2022)
NIRS-BIDS (Luke et al., 2023)

MRI-BIDS (Gorgolewski et al., 2016)
BIDS-Apps (Gorgolewski et al., 2017)
MEG-BIDS (Niso et al., 2018)
EEG-BIDS (Pernet et al., 2019)
Genetics-BIDS (Moreau et al., 2020)
ASL-BIDS (Clement et al., 2022)
PET-BIDS (Norgaard et al., 2022)
Motion-BIDS (Jeung et al. 2023)

2015 2016 2017 2018 2019 2020 2021 2022 2023

Poldrack ea., Imaging Neuroscience, 2024

The Past, Present, and Future of BIDS

My favourite two BIDS principles

Requirement levels

Level of requirement **for** files and **within** files:

1. **REQUIRED**
2. **RECOMMENDED**
3. **OPTIONAL**

```
├── README.md
├── dataset_description.json
├── participants.tsv
├── sub-001
│   ├── ses-01
│   │   ├── eeg/
│   │   └── motion/
│   └── ses-02
└── sub-002
```

| participant_id	age	group
sub-001	34	C
sub-002	12	P
sub-003	33	M

Directories and file naming structure

- Data for each subject are organized in subdirectories labeled **"sub-<label>**

- Each subject contains subdirectories for different data (food) types

- For a data file that was collected from a given **subject**, the file name **MUST** begin with the string sub-<label> and **MUST** contain a task-<label>

```
├── README.md

├── dataset_description.json

├── participants.json

├── participants.tsv

└── sub-001
    └── eeg/
        └── sub-001_task-GoNoGo.eeg
```

Dataset info

EEG
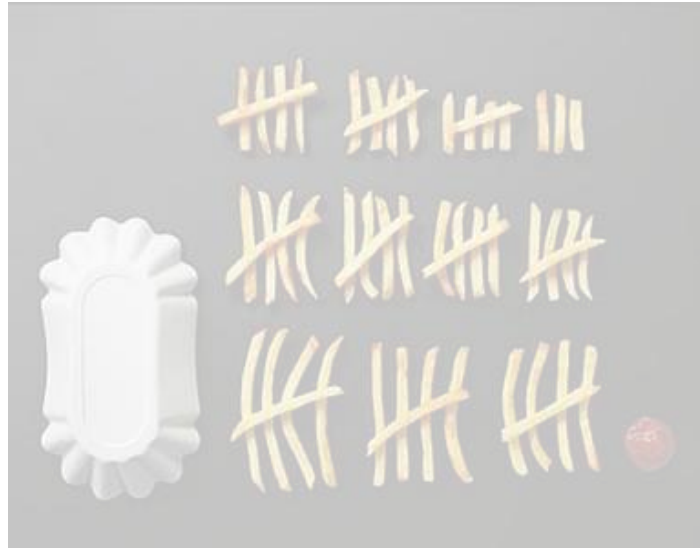
```
├── README.md
├── dataset_description.json
├── participants.json
├── participants.tsv
└── sub-001
    ├── ses-01
    │   ├── eeg/
    │   └── motion/
    └── ses-02
└── sub-002
```

Modality agnostic data

dataset_description.json

```
├── README.md
├── dataset_description.json  ───────────→
├── participants.json
├── participants.tsv
└── sub-001
    ├── ses-01
    └── ses-02
└── sub-002
```

{
"Name": "The mother of all experiments",
"BIDSVersion": "1.4.0",
"DatasetType": "raw",
"License": "CC0",
"Authors": ["Paul Broca", "Carl Wernicke"],
"Funding": [„NIH F37823MFH1"],
"EthicsApprovals": [„HRPO (Protocol AR0928"],
"DatasetDOI": "10.0.2.3/dfjj.10"
}

participants

```
├── README.md

├── dataset_description.json

├── participants.tsv

├── participants.json

└── sub-001
    ├── ses-01
    └── ses-02
└── sub-002
```

participants.tsv

participant_id	age	group
sub-001	34	C
sub-002	12	P
sub-003	33	M

participants.json

```
"age": {
   "Description": "age of the
   participant",  "Units": "years"
   },
 „group": {
   "Description": „assigned group",
   "Levels": {
      „C": „control",
      „M": „medication",
      „P": „placebo",
      }
```
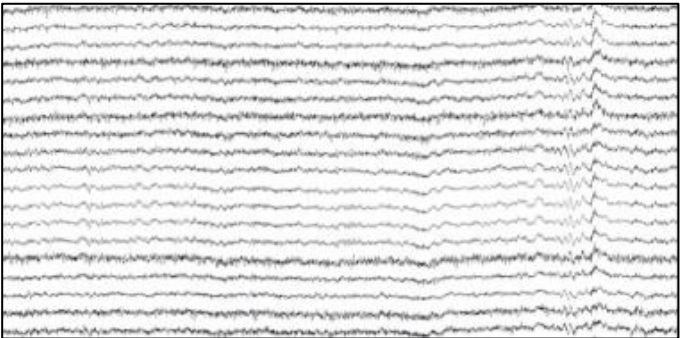
Modality specific data

Dataset info

EEG

README.md
dataset_description.json
participants.json
participants.tsv
sub-001
  ses-01
    eeg/
    motion/
  ses-02
sub-002

Overview | eeg

```
{
    "TaskName": "TASKNAME",
    "SamplingFrequency": 1000,
    "SoftwareFilters": "n/a",
    "EEGChannelCount": 4,
    "EOGChannelCount": 1,
    "EEGReference": "placed on Cz",
    "PowerLineFrequency": 50
}
```

```
└── sub-001
    └── ses-01
        └── eeg/
            ├── sub-001_ses-01_task-<label>_eeg.<extension>
            ├── sub-001_ses-01_task-<label>_eeg.json
            ├── sub-001_ses-01_task-<label>_channels.tsv
            ├── sub-001_ses-01_task-<label>_electrodes.tsv
            ├── sub-001_ses-01_task-<label>_electrodes.tsv
```

name	type	units	status	status_description
CP5	EEG	microV	good	n/a
FC5	EEG	microV	bad	high freq noise
FC1	EEG	microV	good	n/a
C3	EEG	microV	good	n/a
VEOG	EOG	microV	good	n/a

name	x	y	z	impedance
CP5	−0.77	−0.30	0.57	8
FC5	−0.77	0.30	0.57	12
FC1	−0.29	0.31	0.91	2
C3	−0.59	0.00	0.81	5
VEOG	n/a	n/a	n/a	n/a

```
{
    "EEGCoordinateSystem": "T1w",
    "EEGCoordinateUnits": "mm",
    "AnatomicalLandmarkCoordinates": {
        "LPA": [−0.067, 1.736e−09, −3.844e−09],
        "NAS": [−4.11e−09, 0.091, −4.541e−10],
        "RPA": [0.064, −6.435e−09, −4.566e−09]
    },
    "AnatomicalLandmarkCoordinateSystem": "T1w",
    "AnatomicalLandmarkCoordinateUnits": "mm",
    "IntendedFor": "sub−01_T1w.nii.gz"
}
```

BIDS Starterpack

Website

[https://bids-specification.readthedocs.io/en/stable/]

Tutorials

[MNE, fieldtrip, EEGLab]

Validator

[https://bids-standard.github.io/bids-validator/]

Community

[https://bids-standard.github.io/bids-validator/]

IGOR BIDS consultations hour   Meetings   Materials

On this page
- It's a match!
- What is the IGOR BIDS Consultation Hour?
- What can I expect?
- How can I participate?
- Upcoming Session:

IGOR BIDS consultations hour

It's a match!

What is the IGOR BIDS Consultation Hour?

We're are happy to offer the IGOR BIDS Consultation Hour, a monthly forum designed to help researchers like you navigate the Brain Imaging Data Structure (BIDS) format. During these sessions, you can connect with experienced BIDS users to get individualized feedback and solutions for your specific BIDS data conversion challenges.

What can I expect?

- **Personalized guidance**: Our experienced researchers, Julius (EEG & motion data expertise) and Lennart (MRI expertise), will be available to answer your questions and provide tailored advice on converting your datasets to the BIDS format.

- **Open forum**: Feel free to bring any BIDS-related questions you have, big or small. We're here to help you overcome conversion hurdles and ensure your data adheres to BIDS best practices.

- **Recurring sessions**: The IGOR BIDS Consultation Hour takes place on the 4th Friday of each month at 12:00 PM (noon) CET.

BIDS in the bigger picture

- Building a sustainable research environment

Wagner ea., Scientific Data, 2022
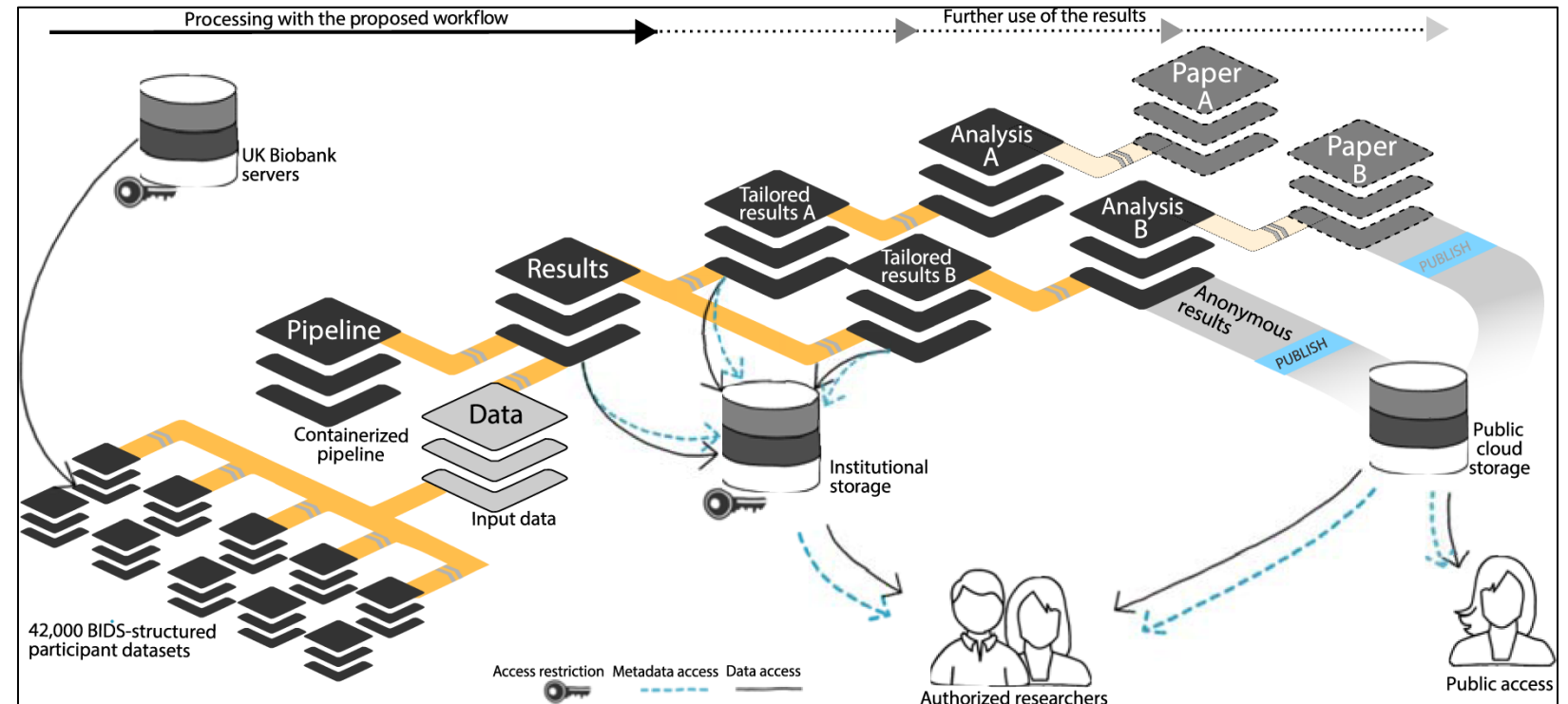
Conclusions
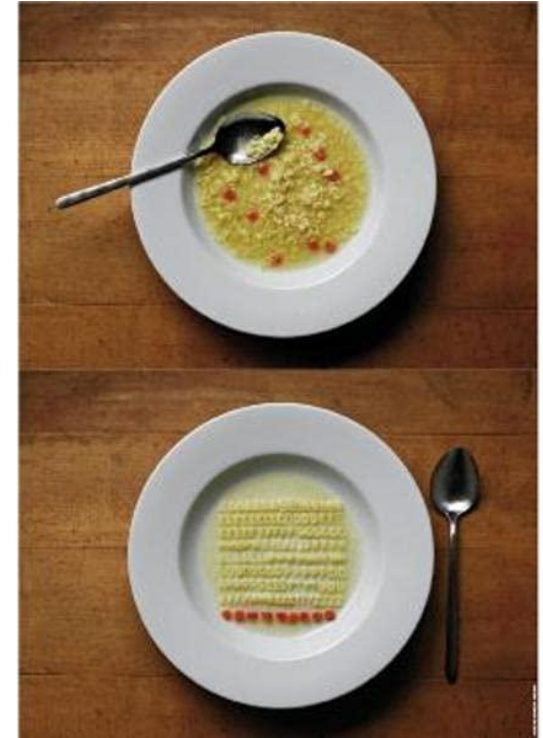
Thank you for listening carefully

Thanks to all **participants** who ever provided data which is now in BIDS
Thanks to all **people who ever used BIDS** to make data FAIR
Thanks to **all BIDS contributors** <3