



Reproductibilité en neuroimagerie: état des lieux

Camille Maumet

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Réseau de la recherche reproductible

Journées Recherche reproductible: état des lieux

INSTITUT PASTEUR
8 & 9 MARS 2023

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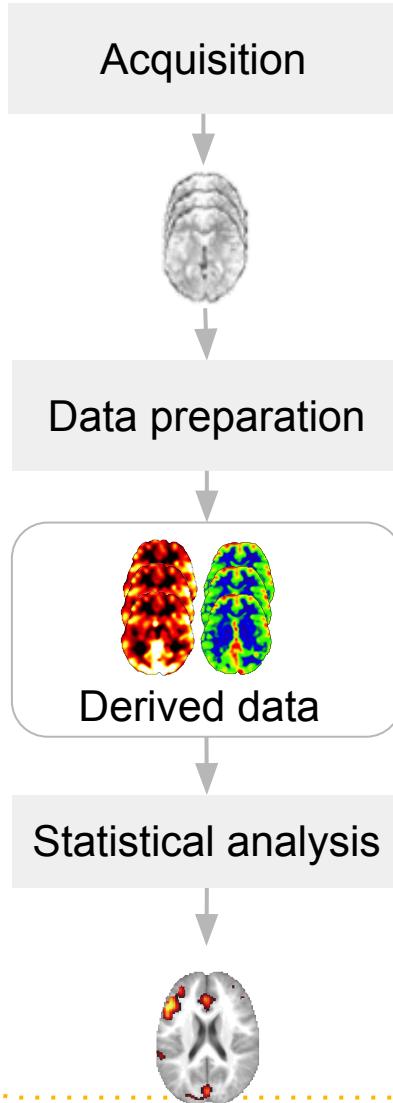
Reproductibilité en neuroimagerie: état des lieux

8 mars 2023

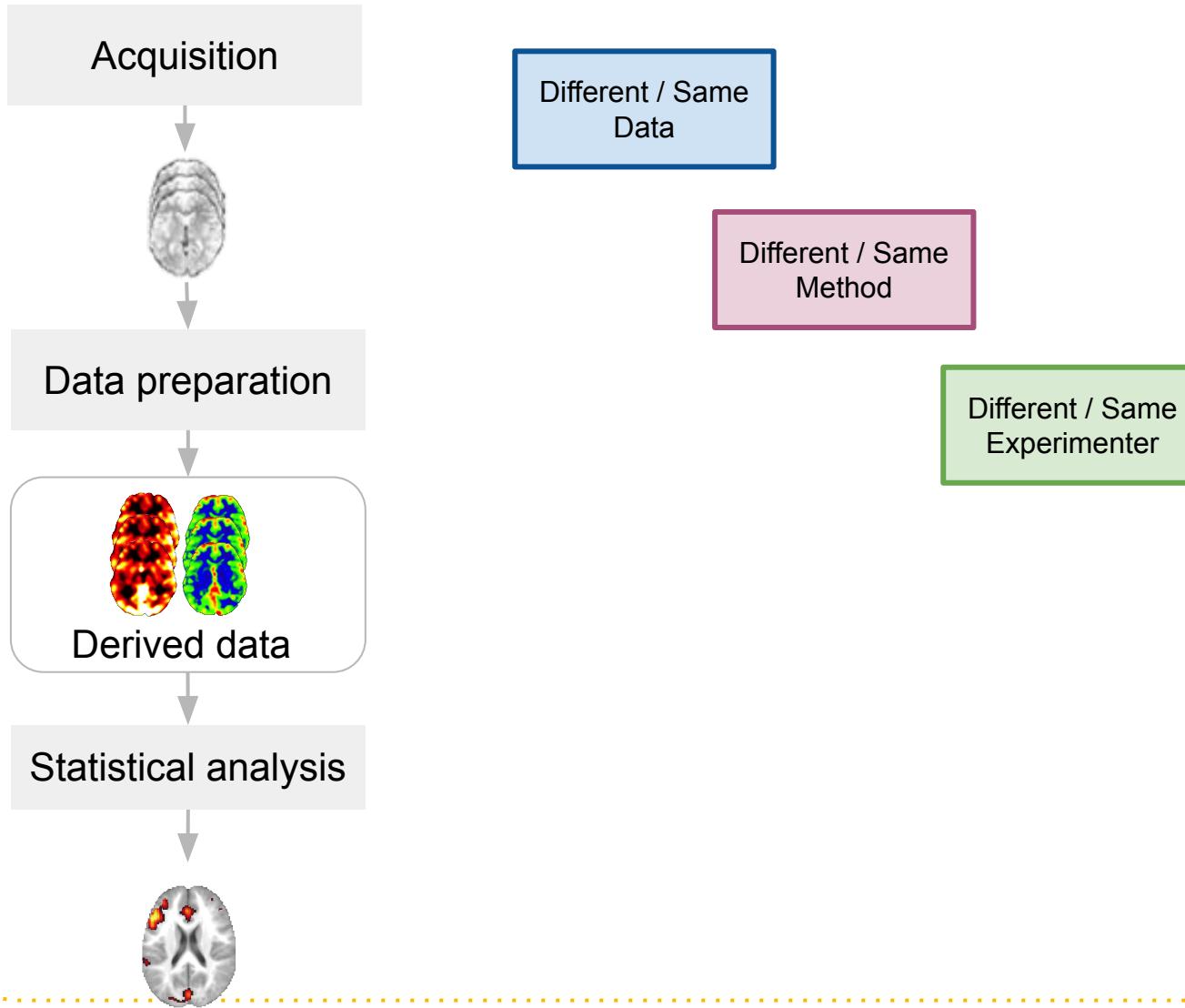
Camille Maumet

Univ Rennes, Inria, CNRS, Inserm

Reproducible brain imaging



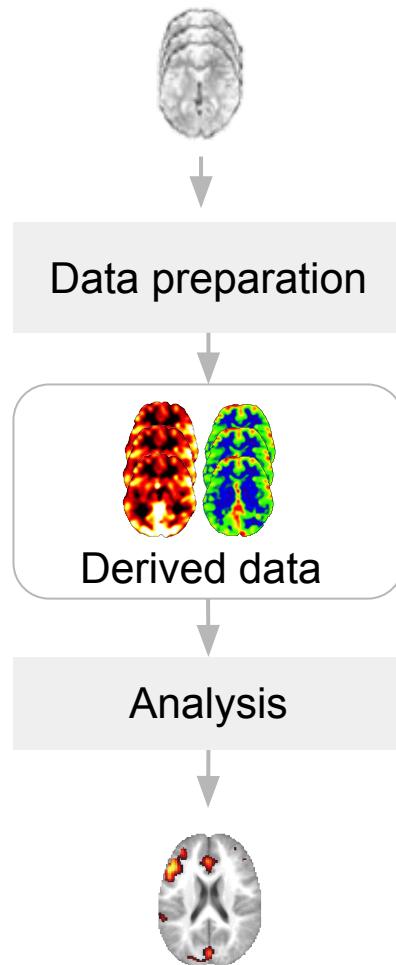
Reproducible brain imaging



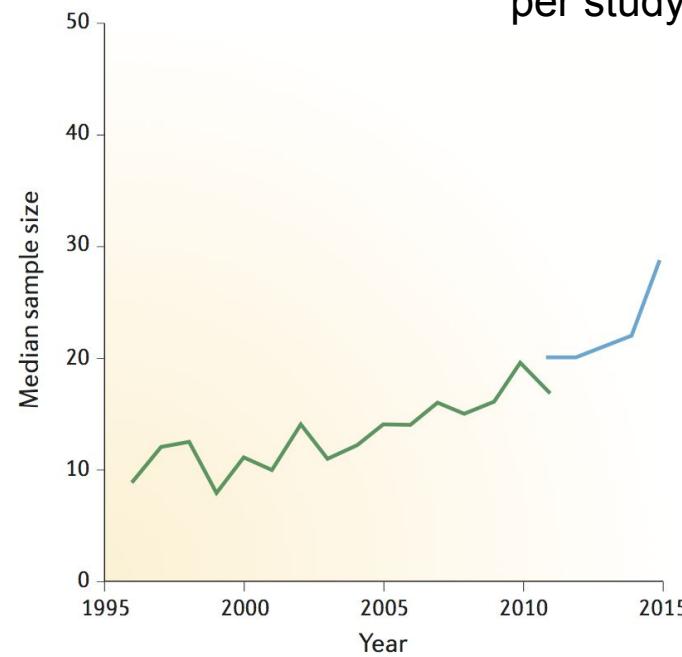
Towards **reproducible** neuroimaging

Irreproducible with...

Different Data



about 30 participants
per study



[Poldrack et. al, Nature Neuroscience 2017]

Towards **reproducible** neuroimaging

Irreproducible with...

Different Data

Towards **reproducible** neuroimaging

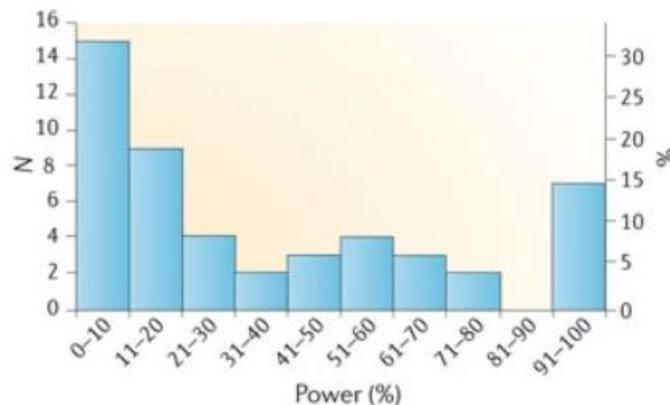
Irreproducible with...

Different Data

Lack of power

Power of neuroscience studies

Power = Prob. to correctly find a significant effect when the alternative hypothesis is true.



[Button et. al, Nat Rev Neurosci 2013]

We need bigger datasets

Towards **reproducible** neuroimaging

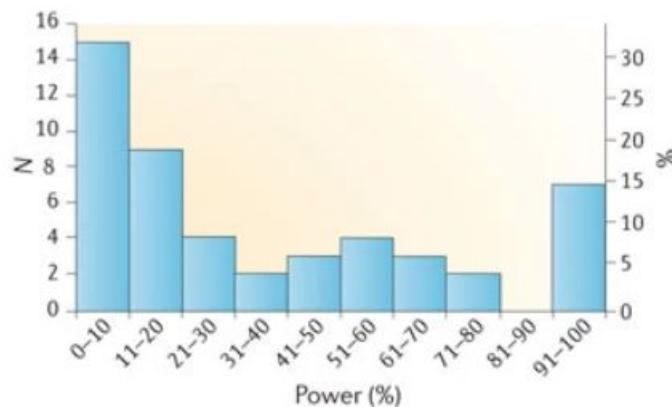
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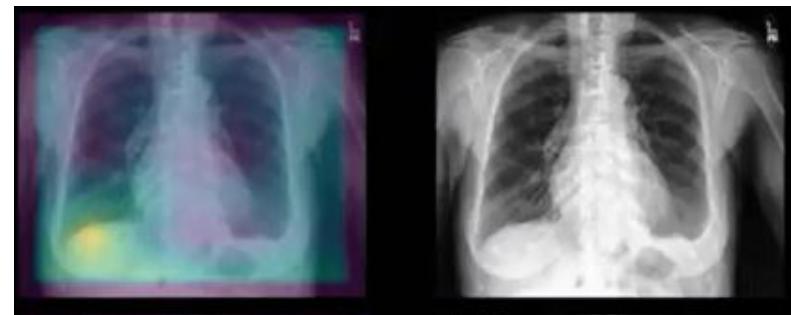
[Button et. al, Nat Rev Neurosci 2013]

We need bigger datasets

Generalizability and fairness

X-ray: Lung opacity detection

Model trained on male images, tested on female images



[Larrazabal et. al, PNAS 2020]

We need representative and diverse datasets

Open data

Unique study
30 participants



OpenNEURO

studyforrest.org



NEUROVAULT

L I E L N L F T Q K T Q R V
S M Y C O N N E C T O M E Q
G S P K K W A R R G K E H R

NITRC

OSF

- + Images
- + Homogenous
- Datasets



Open data

Unique study
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L I E L N L F T Q K T Q R V
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G S P K K W A R R G K E H R

NITRC

OSF

Consortium
1000 participants



ABIDE
Autism Brain Imaging
Data Exchange



CORR
CONSORTIUM FOR
RELIABILITY AND
REPRODUCIBILITY



- + Images
- + Homogenous
- Datasets



Open data

Unique study
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OpenNEURO

studyforrest.org



NITRC

OSF

Consortium
1000 participants



- + Images
- + Homogenous
- Datasets



Cohort
100 000 participants

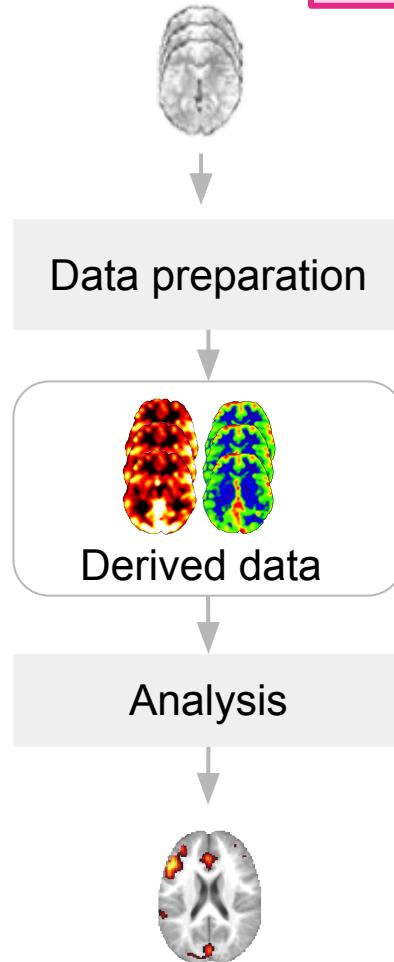


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On our way **to fix irreproducibility**

Irreproducible with...

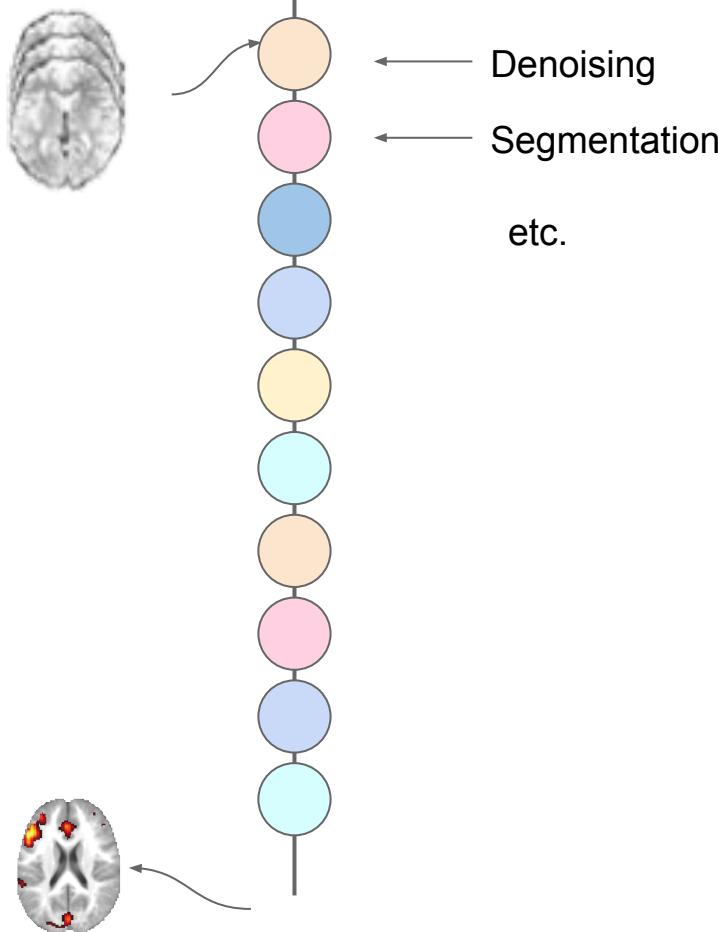
Different Post-processing Methods



On our way **to fix irreproducibility**

Irreproducible with...

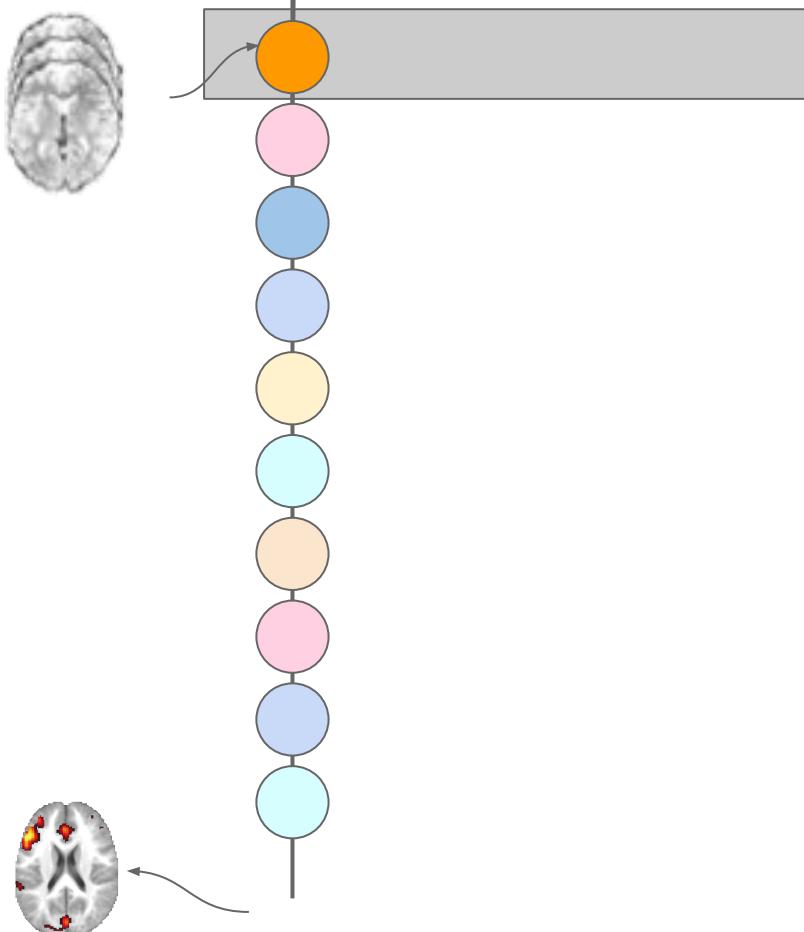
Different Post-processing Methods



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Irreproducible with...

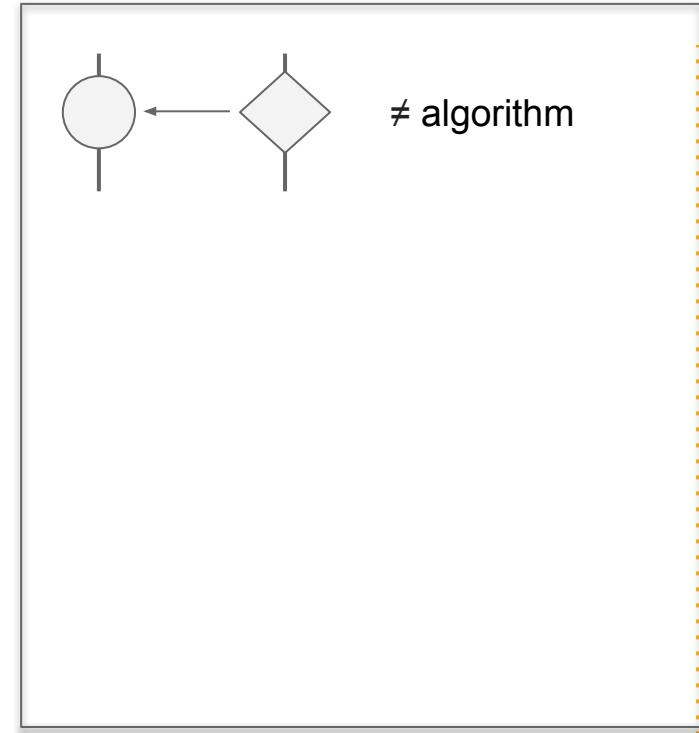
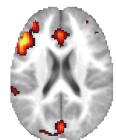
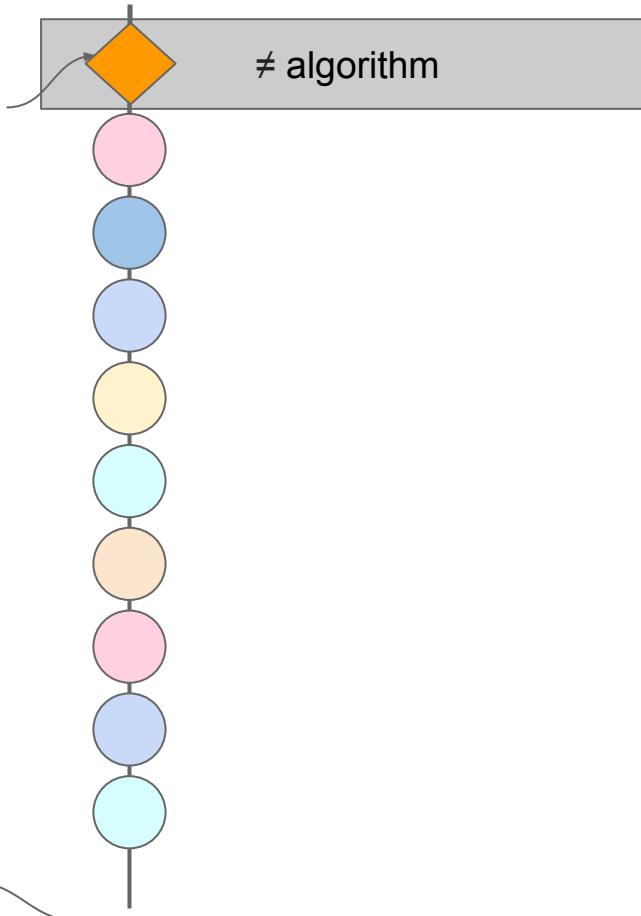
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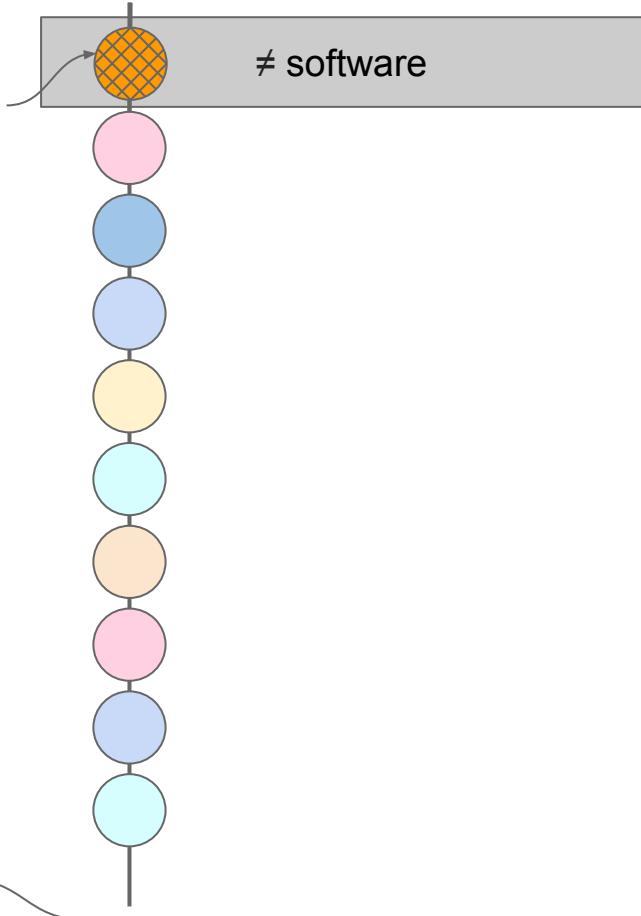
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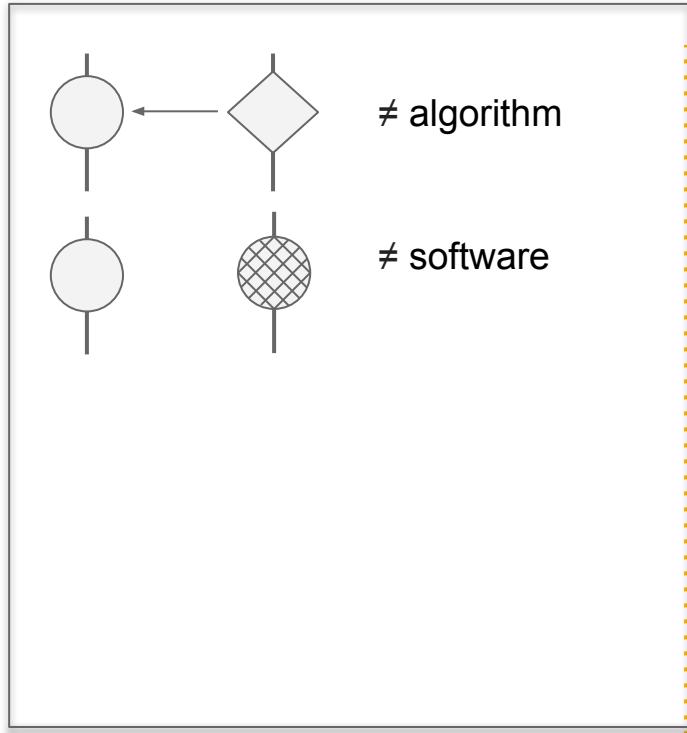
On our way **to fix irreproducibility**

Irreproducible with...

Different Post-processing Methods



≠ software



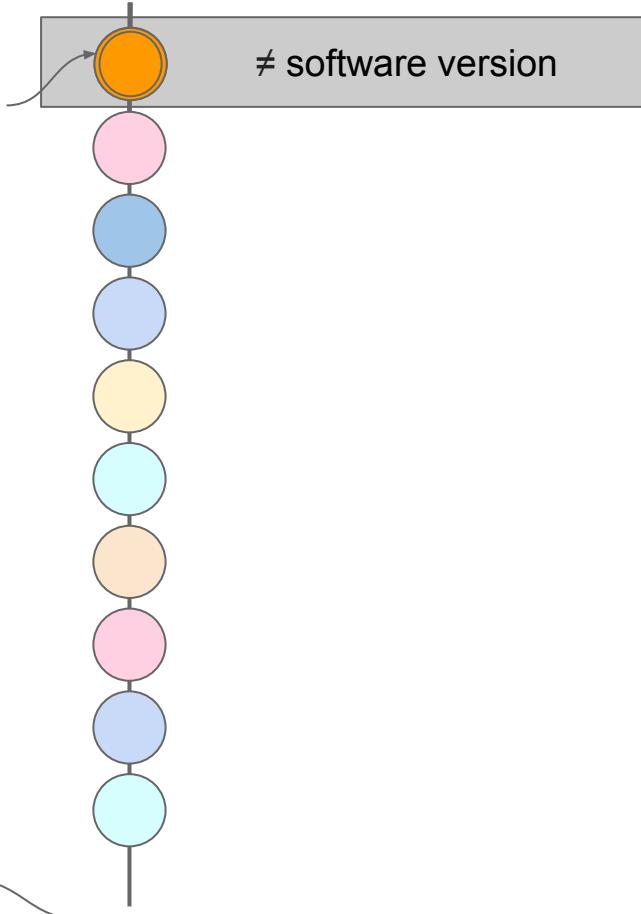
≠ algorithm

≠ software

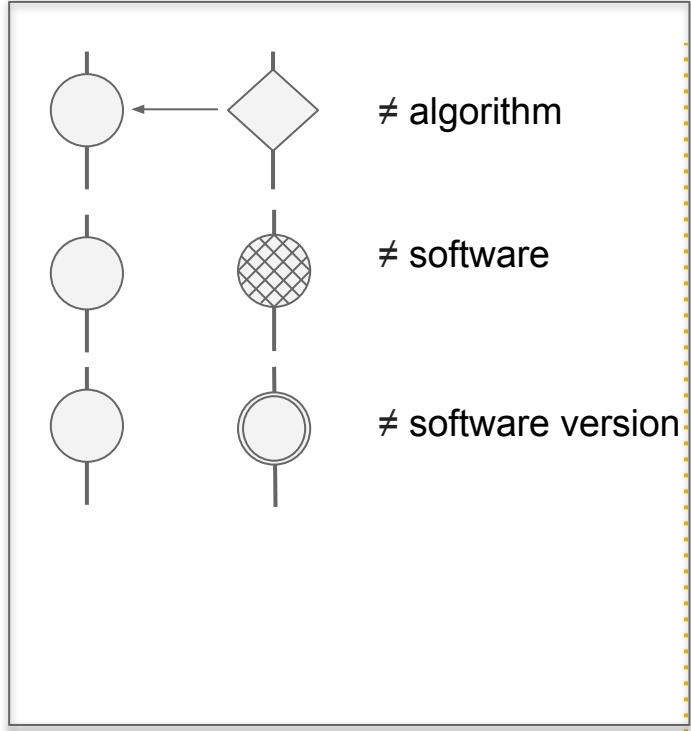
On our way **to fix irreproducibility**

Irreproducible with...

Different Post-processing Methods



≠ software version



≠ algorithm

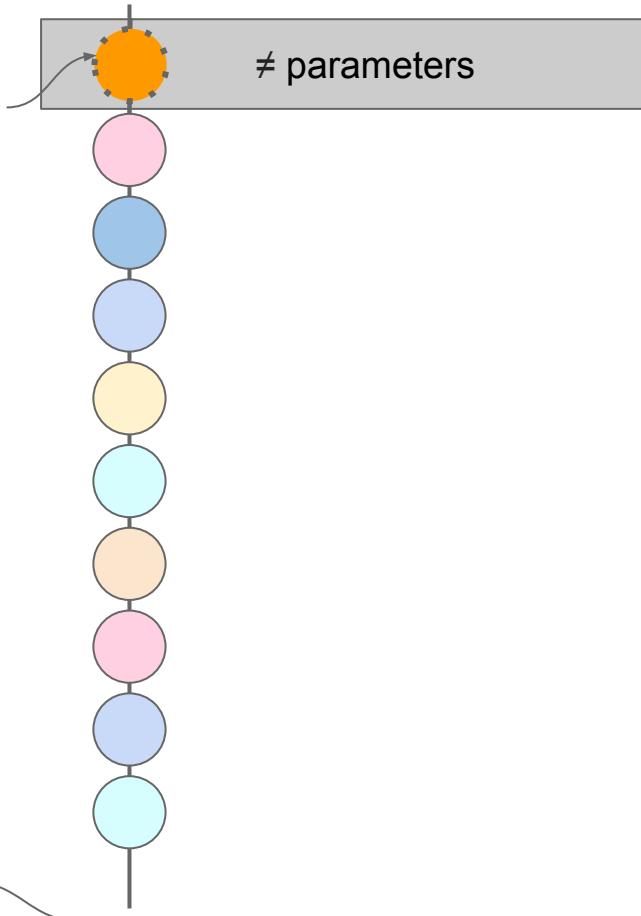
≠ software

≠ software version

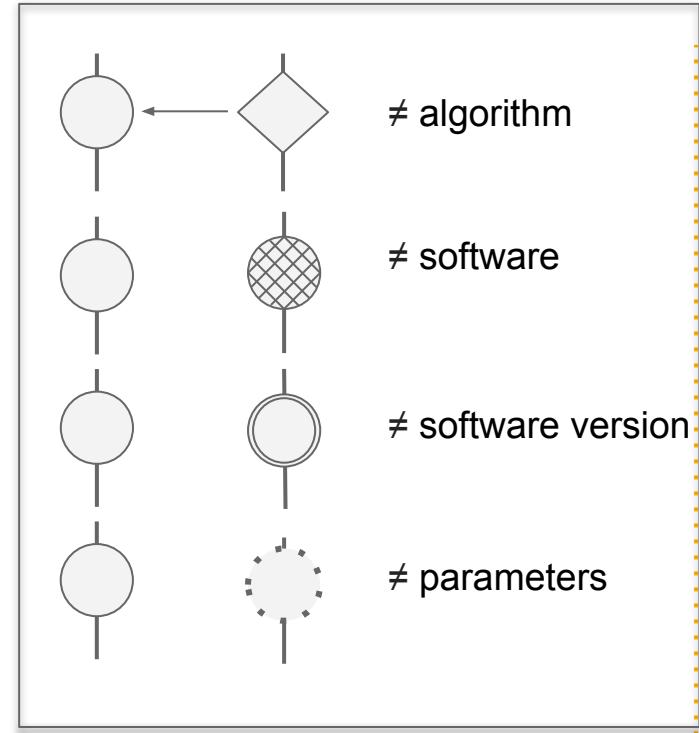
On our way **to fix irreproducibility**

Irreproducible with...

Different Post-processing Methods



≠ parameters



≠ algorithm

≠ software

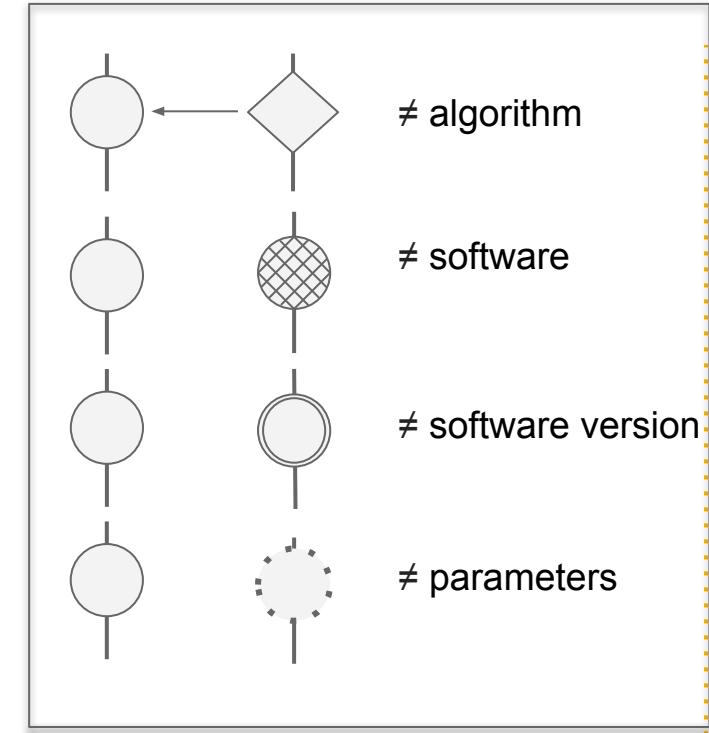
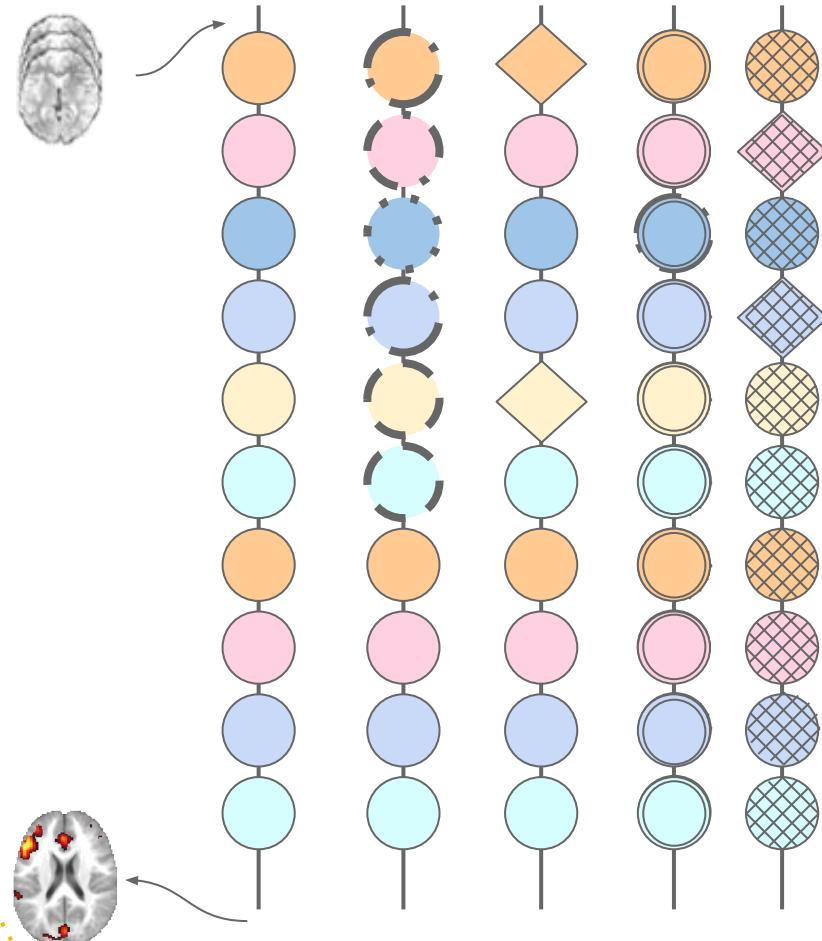
≠ software version

≠ parameters

On our way to fix irreproducibility

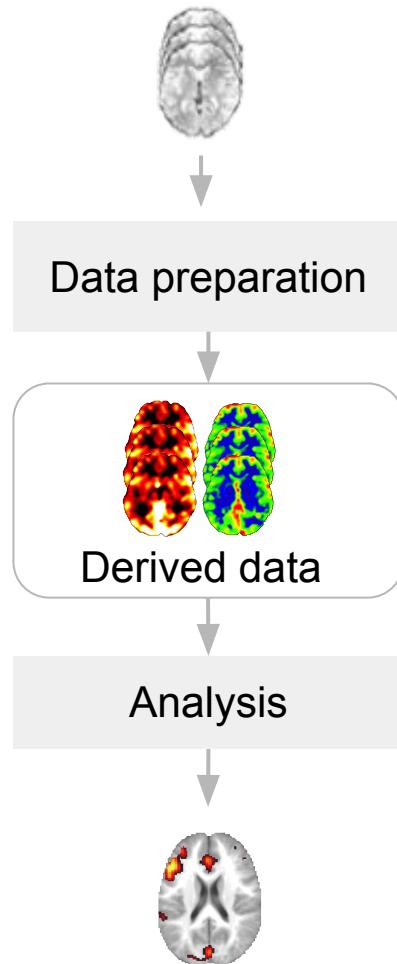
Irreproducible with...

Different Post-processing Methods

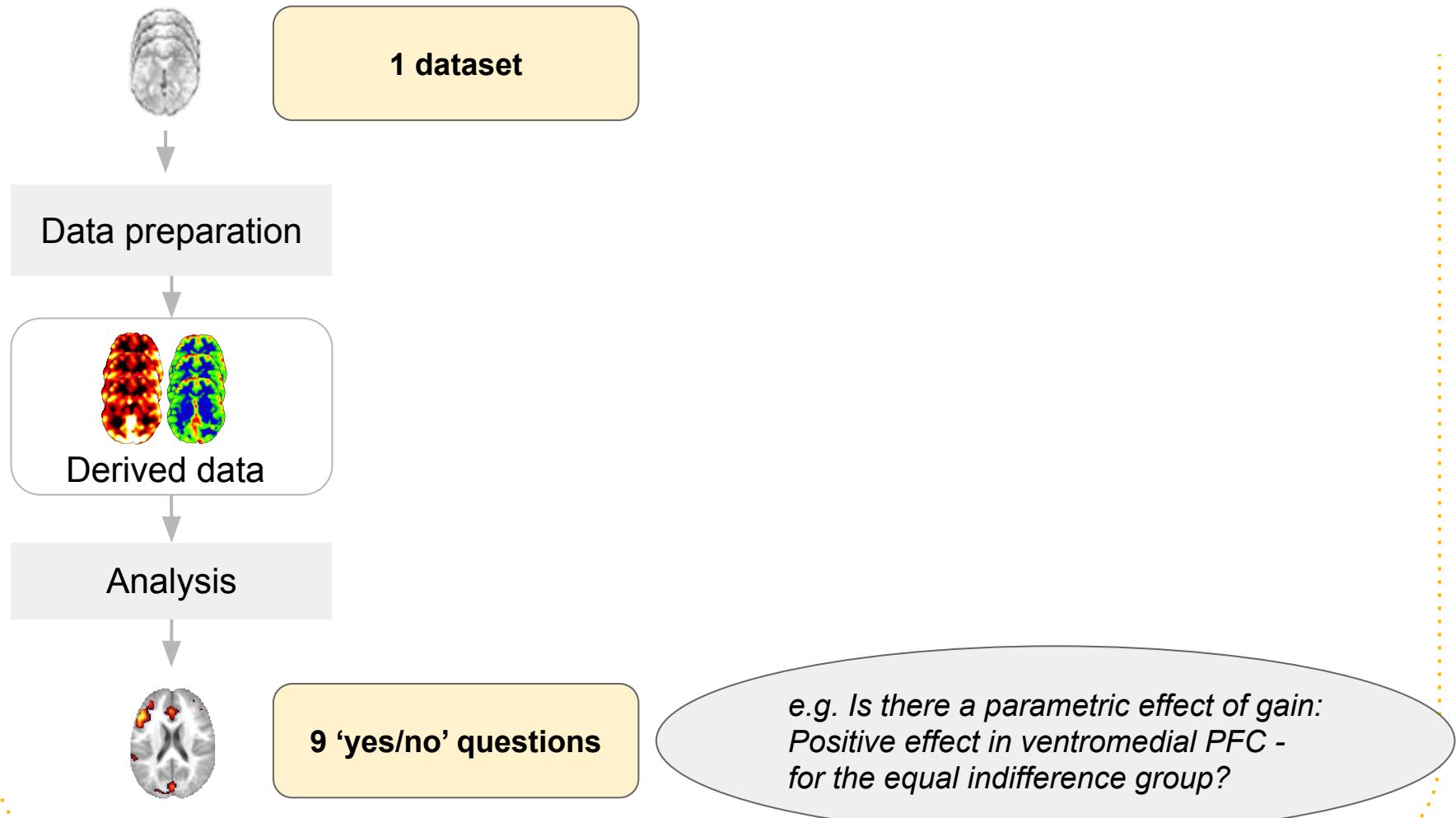


A family of acceptable pipelines
over 10^{30} combinations...

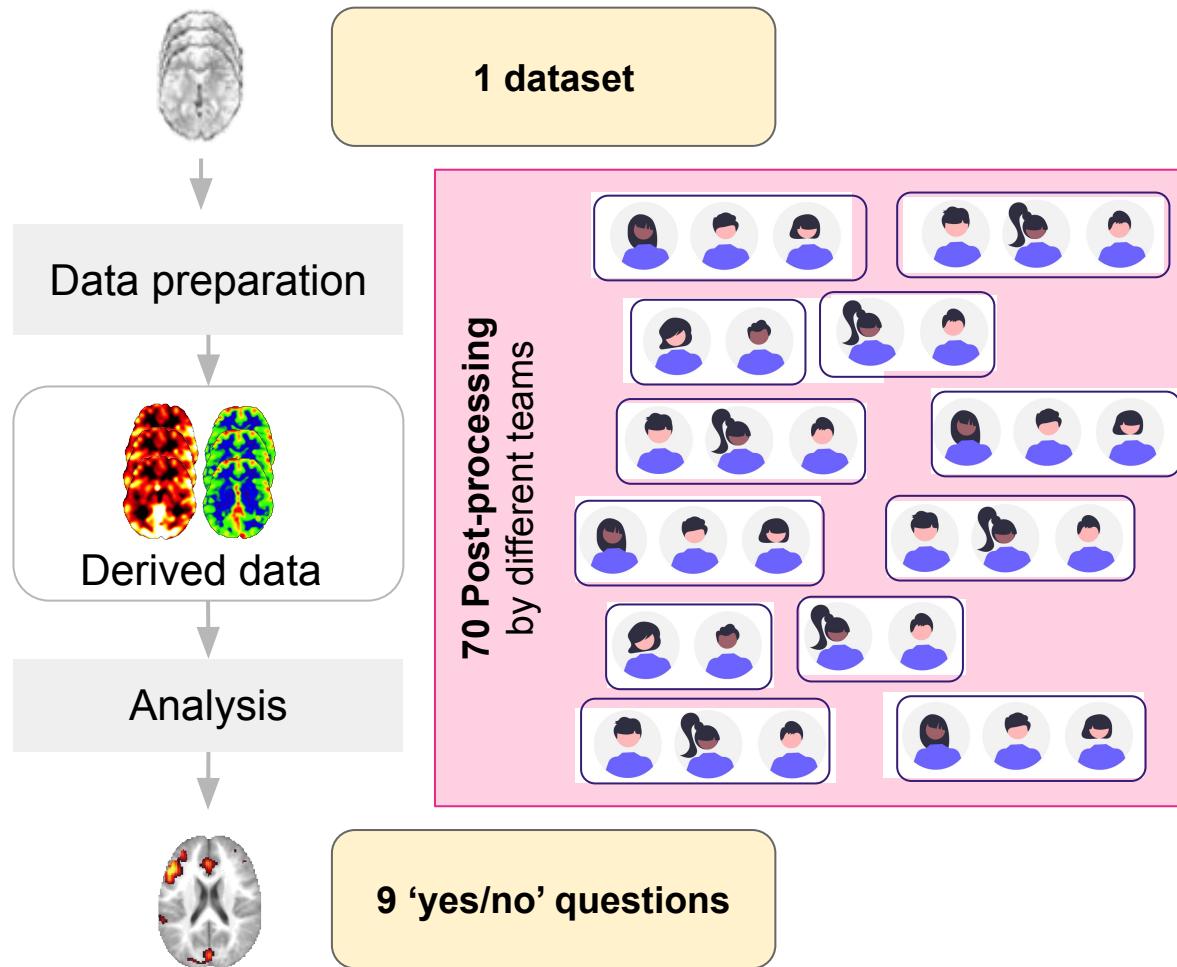
Many analysts project : NARPS



Many analysts project : NARPS

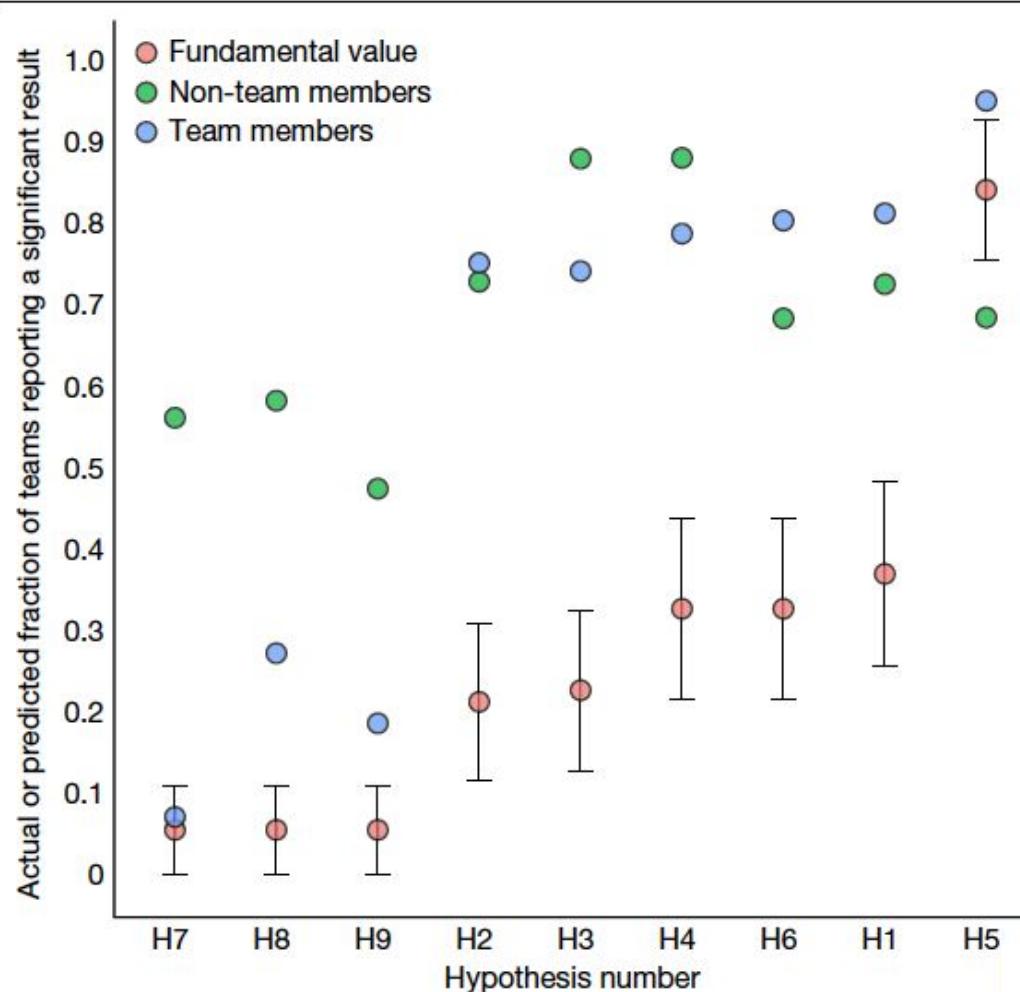


Many analysts project : NARPS



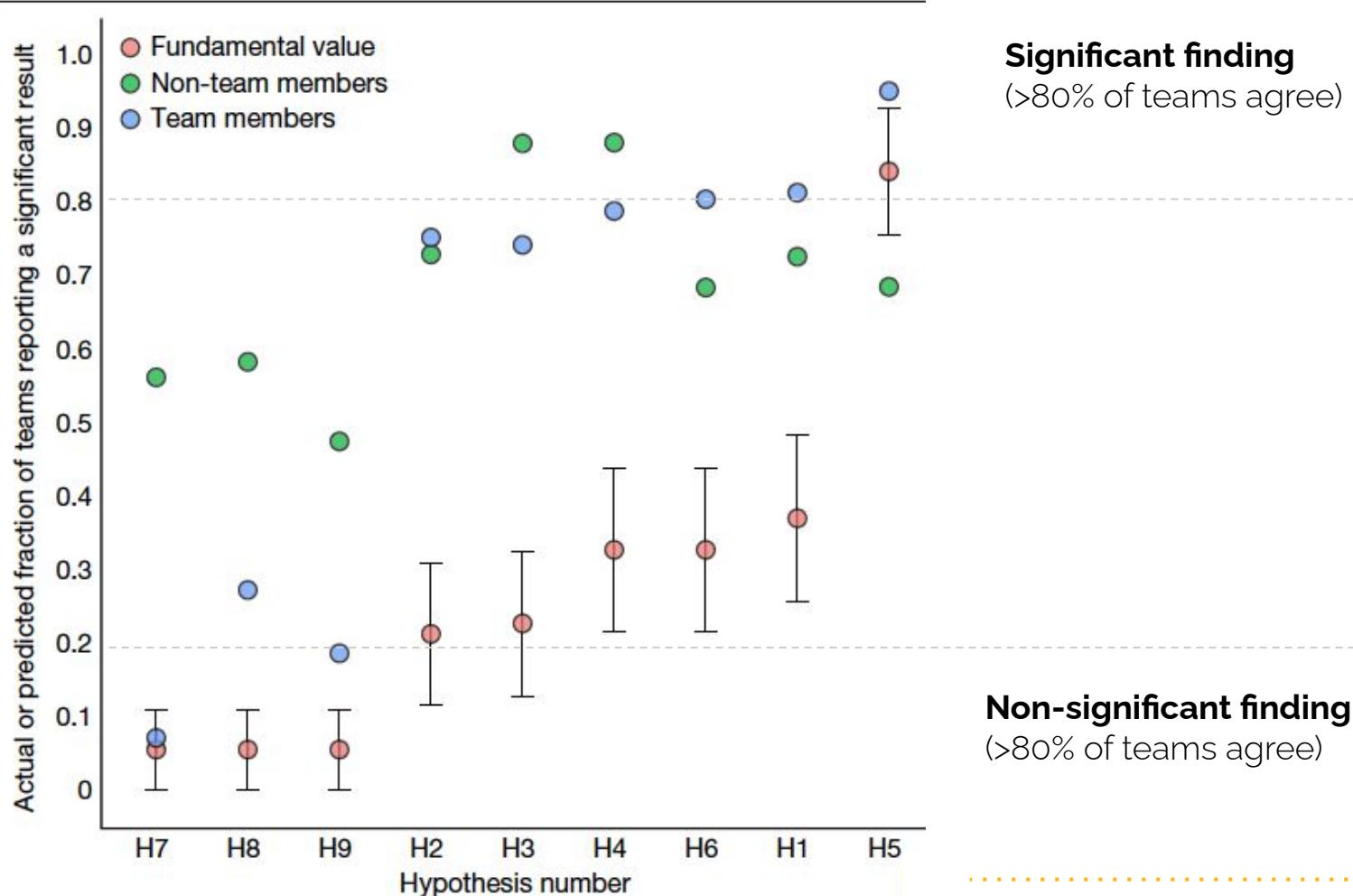
Many analysts project : NARPS

Results over the **70 post-processing pipelines**:



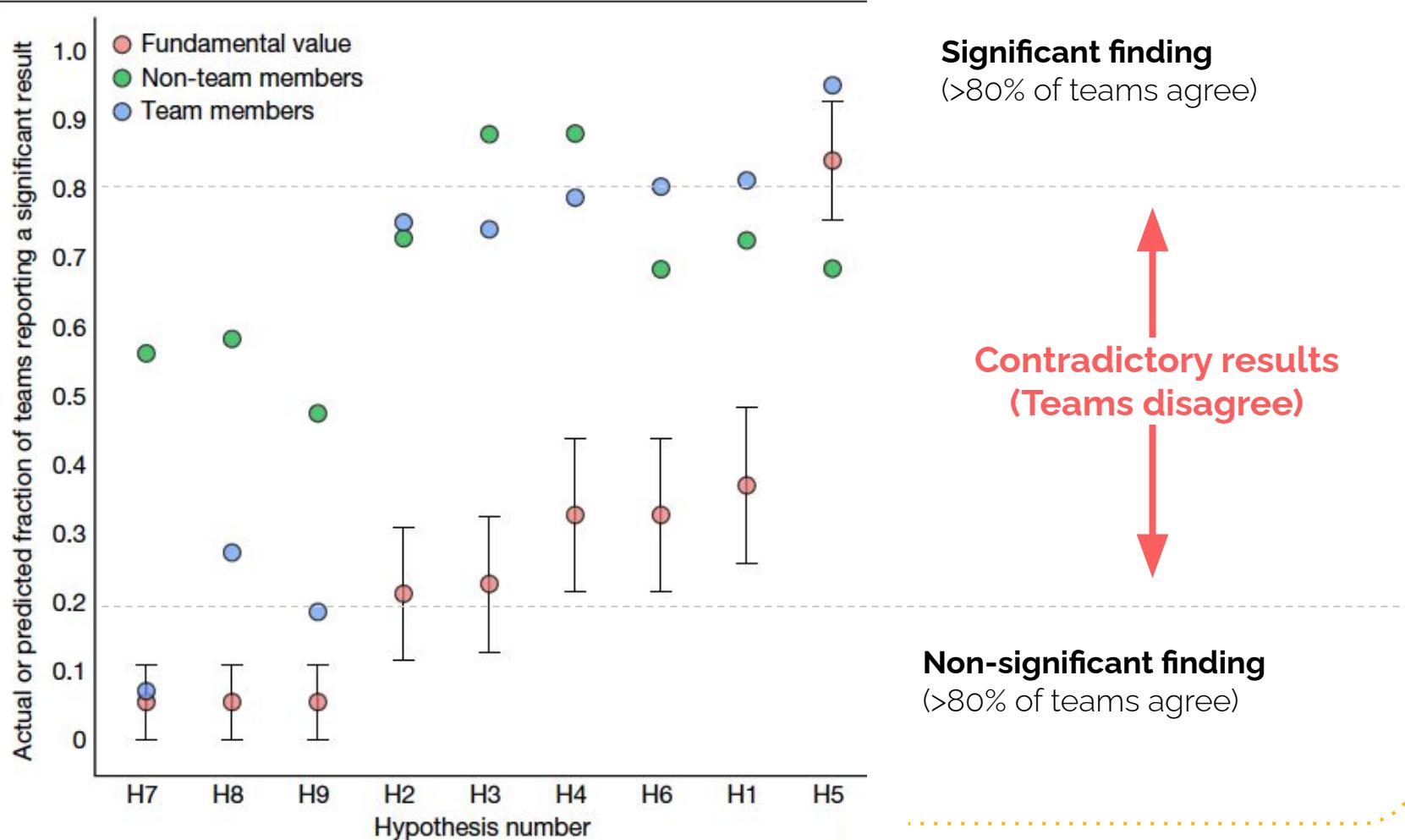
Many analysts project : NARPS

Results over the **70 post-processing pipelines**:



Many analysts project : NARPS

Results over the **70 post-processing pipelines**:



Different levels of variability in post-processing pipelines

- Different end-to-end pipelines [Carp 2013]
- Different Software Version [Gronenschild 2012]
- Different operating system [Glatard 2015]
- Different **post-processing software packages** [Bowring 2019, 2021]

Open questions

Stratégie adoptée par votre communauté

- **sur le plan technique**
 - Partage de code
- **pour les carrières**
 - Data papers
- **en terme d'Animation**
 - Open science community (OHBM open science SIG, Brainhack)
 - Hackathons collaboratifs "Brainhack"

Exemple de problèmes techniques et scientifiques

- Open data in Europe (GDPR, infrastructures)
- Causes of analytical variability (different methods) not well understood

Réseau de la recherche reproductible Journées Recherche reproductible: état des lieux

March 8, 2023

Reproductibilité computationnelle en **neuroimagerie**: *état des lieux*



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Merci



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