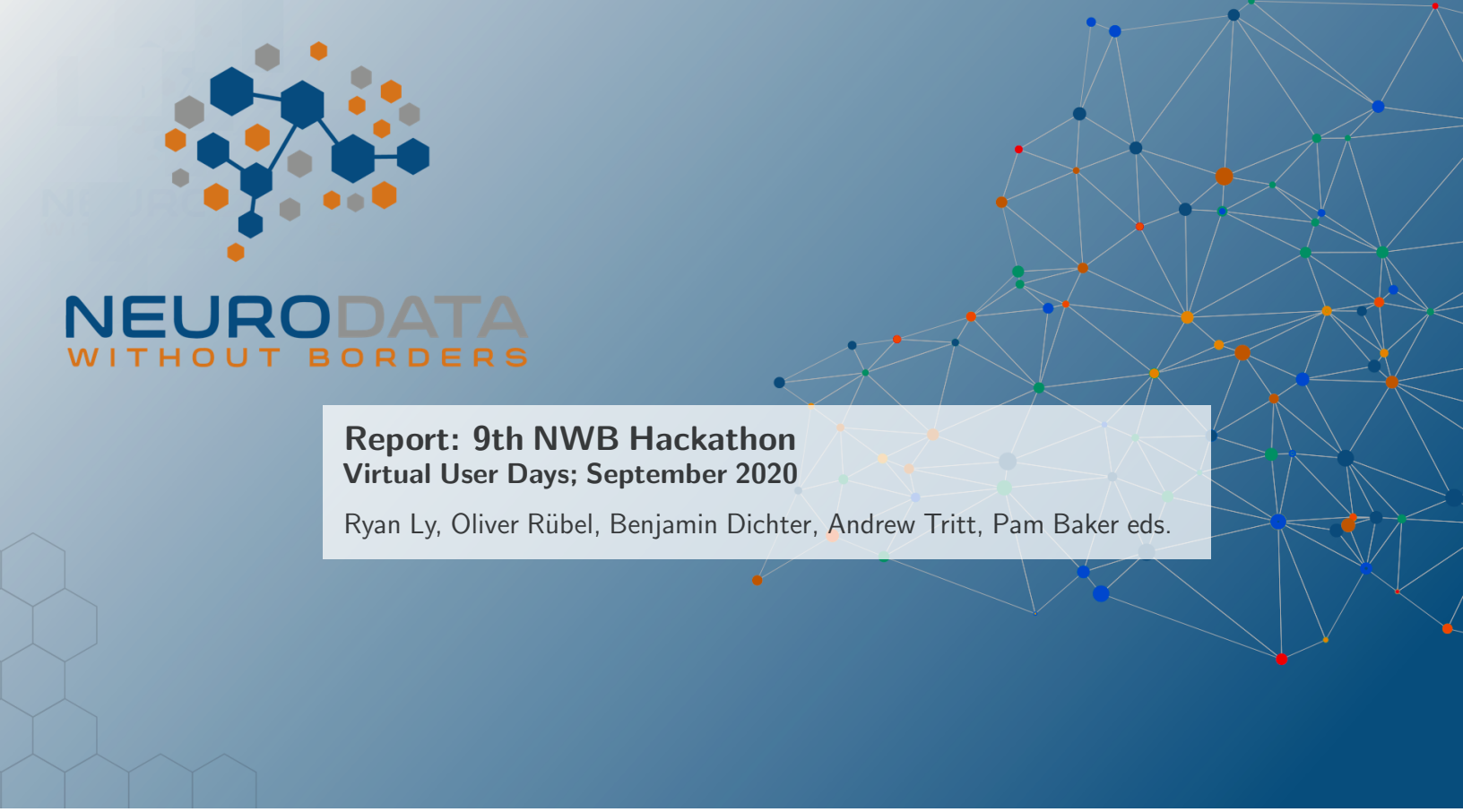

Report: 9th NWB Hackathon
Virtual User Days; September 2020

Ryan Ly, Oliver Rübel, Benjamin Dichter, Andrew Tritt, Pam Baker eds.

Image courtesy of www.nwb.org

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1 Executive Summary

Overview: The Neurodata Without Borders: Neurophysiology (NWB) project is an effort to standardize the description and storage of neurophysiology data and metadata. NWB enables data sharing and reuse and reduces the energy barrier to applying data analytics both within and across labs. Following the success of the 8th NWB Hackathon: Virtual User Days, we organized a similar event with timing centered around Central European Time to provide a more convenient outlet for European participants. The program included lectures on core NWB structure and APIs, and breakout sessions on NWB-enabled tools. The NWB User Days were organized by Ryan Ly (LBNL), Oliver Rübel (LBNL), Benjamin Dichter (CatalystNeuro), Andrew Tritt (LBNL), and Pamela Baker (Allen Institute for Brain Science).

Participants: In the new virtual format, our normal space limitations did not apply, so we opened registration to anyone interested. We had a total of 300 registered participants from all over the world. As many as 61 participants were active at one time, and on average 32 participants for individual tutorials and breakout sessions. The movement of the time-slots to Central European Time facilitated international attendance, with 72% of registrations from outside the US (Figure 1).

Program: The program consisted of four main components: 1) NWB tutorials, 2) tool breakouts, 3) NWB breakouts, and 4) general session for event and project coordination. Throughout the event, users were encouraged to work on their own NWB-related coding projects and we provided forums via Slack and Zoom for users to reach NWB developers for questions and support.

The NWB tutorials were divided by data modality (intracellular electrophysiology, extracellular electrophysiology, and optical physiology) and programming language (Python and MATLAB) on Day 1 with tutorials on advanced features (e.g., advanced I/O and extensions) on Day 3. This structure was chosen to enable users to easily choose the training sessions most relevant to them, and to create space for users to work on their NWB hacking projects.

For community tools, the tool developers introduced their tools in 5-minute lightning talks as part of a session on "NWB-enabled tools" on Day 1 followed by 1-hour breakout sessions for each individual tool throughout the remainder of the program. This format was well-received, as it allowed users to get an overview of the available tools and pick the most relevant breakout sessions.

Conclusion: The NWB User Days were very well received. The remote format allows us to truly deliver of the mission of NWB by disseminating information across the entire world. Furthermore, it allows us more flexibility to provide a more modular, tailored curriculum to participants. Users were overall enthusiastic about the event, though there was consistent feedback that participants would like more hands-on training.

2 Participants

200 users registered for the event. Figure 1 and 2 provide an overview of the geographic location of attendees. The change in the timezone did appear to facilitate a more international audience, with 72% of participants registering from foreign locations and representation from each continent. In particular, we were pleasantly surprised by a large Indian audience of 39, 19.5% of the total registrants. While there were many registrations from around the CET mark, we also continued to have participants from the Americas. In particular, we had 28 registrants from the west coast, were the local start time of the meeting was midnight, likely contributing to some fall-off in attendance in particular later in the day.

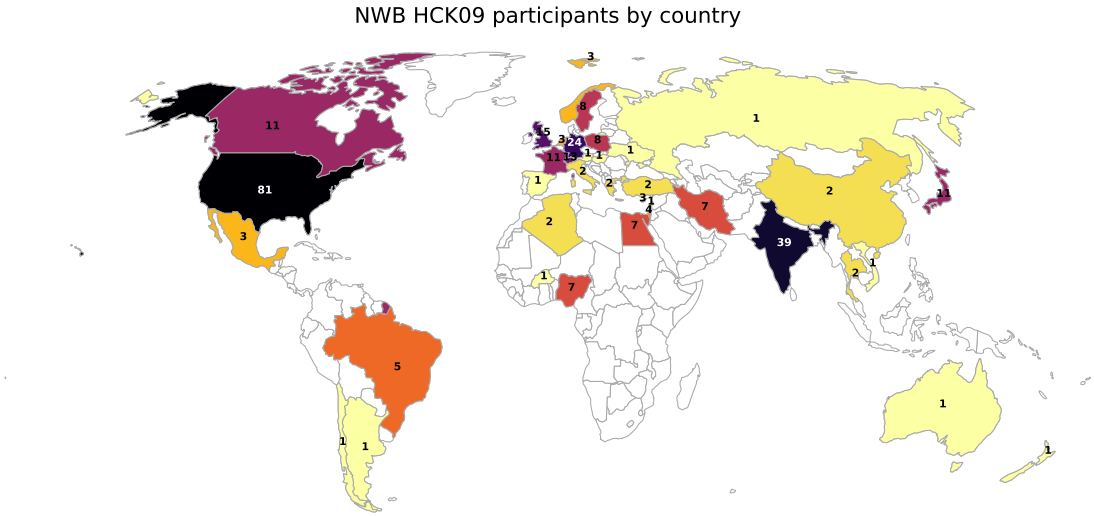

Figure 1: Map of registered participants by country.

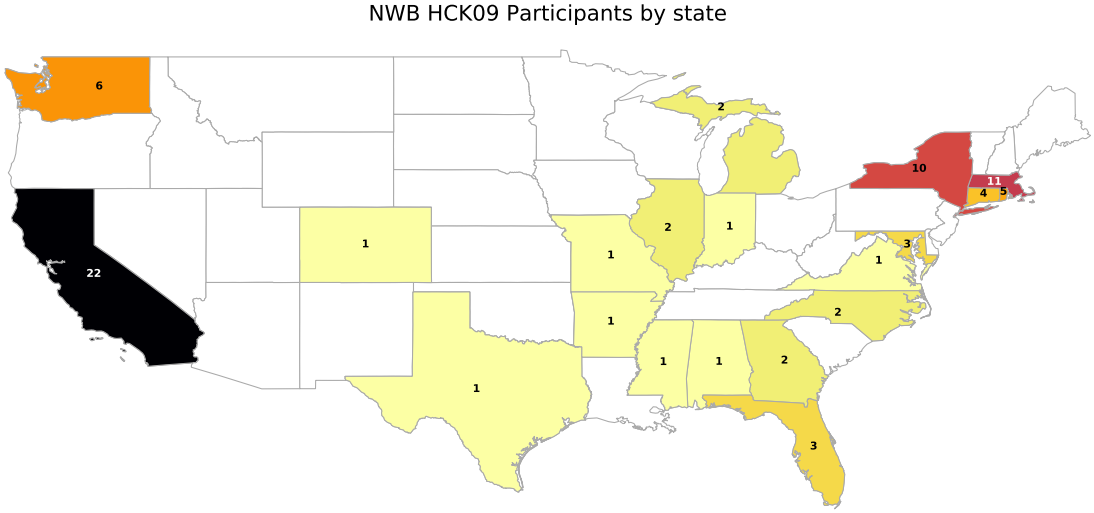

Figure 2: Map of US registered participants by state.

3 Program

Figure 3: Agenda for NWB User Days 9.

3.1 Detailed Agenda

The program for each day consisted of core NWB lessons in the morning followed by elective in-depth breakout sessions on individual tools in the afternoon. The event started on the first day with an overview of the format and ecosystem, followed by lightning talks from tools developers of top NWB-enabled tools, and a lesson in how to find and read published NWB files. On the second morning, we held specialized introductions for different recording modalities and programming languages. On the third morning, we held advanced tutorials about extensions and advanced writing options, followed by a group discussion.

Day 1	Monday, September 21
8:45 - 9am (CEST)	Call-in time, work out any technical issues
9 - 9:10am	Welcome and introduction: How to get the most out of this workshop (Ryan Ly)
9:10 - 9:55am	Overview of NWB: An ecosystem for neurophysiology data standardization (Oliver Ruebel) Recording on YouTube
10 - 11:45am	NWB tools showcase (5-7 min per tool), - MIES - calciumImagingAnalysis - CaImAn - suite2p - SpikeInterface - DataJoint - NWB Explorer / Open Source Brain - NWB Widgets - DANDI - NWB & DataJoint Integration in the Frank Lab, UCSF
12 - 1pm	Break / Virtual coffee shop - Hack on projects, do NWB exercises, ask questions to NWB developers on Zoom
1 - 2pm	Tutorial: Reading NWB data in Python and Matlab (Ben Dichter, Ryan Ly) • Python Jupyter notebook (right click link, save link to your computer) • MATLAB live script (click link, then click Download button to save file to your computer) • Recording on YouTube - Matlab Tutorial
2 - 6pm	In-depth tool breakout sessions, Day 1: 2 - 2:55pm: NWB Explorer / Open Source Brain - Padraig Gleeson, Matteo Cantarelli 3 - 3:55pm: CaImAn - Changjia Cai, Andrea Giovannucci Recording on YouTube 4 - 4:55pm: suite2p - Carsen Stringer Recording on YouTube 5 - 5:55pm: SpikeInterface - Alessio Buccino, Cole Hurwitz Recording on YouTube

Day 2	Tuesday, September 22
9 - 9:55am	Introduction to NWB for intracellular electrophysiology (Oliver Ruebel, Pam Baker) • Python Jupyter notebook (right click link, save link to your computer) • MATLAB live script (click link, then click Download button to save file to your computer) • Recording on YouTube - Tutorial • Recording on YouTube - Intracellular Electrophysiology Experiment Metadata
10 - 10:55am	Introduction to NWB for extracellular electrophysiology in Python (Ryan Ly) • Python Jupyter notebook (right click link, save link to your computer) • Recording on YouTube
11 - 11:55am	Introduction to NWB for extracellular electrophysiology in MATLAB (Ben Dichter) • MATLAB live script (click link, then click Download button to save file to your computer) • Recording on YouTube
12pm - 12:55pm	Introduction to NWB for optical physiology in Python (Ryan Ly) • Python Jupyter notebook (right click link, save link to your computer) • Recording on YouTube
1pm - 1:55pm	Introduction to NWB for optical physiology in MATLAB (Ben Dichter) • MATLAB live script (click link, then click Download button to save file to your computer) • Recording on YouTube
2 - 3pm	Break / Virtual coffee shop - Hack on projects, do NWB exercises, ask questions to NWB developers on Zoom
3 - 6pm	In-depth tool breakout sessions, Day 2: 3 - 3:55pm: DANDI - Yaroslav Halchenko, Satrajit Ghosh 4 - 4:55pm: NWB Widgets - Ben Dichter, Recording on YouTube 5 - 5:55pm: calciumImagingAnalysis - Biafra Ahanonu, Recording on YouTube

Day 3	Wednesday, September 23
9 - 9:45am	NWB extensions: How to store and share non-standardized data types in NWB (Ryan Ly) Recording on YouTube
9:50 - 10:20am	Advanced write in PyNWB (compression, chunking, iterative write, and parallel access) (Andrew Tritt) Recording on YouTube
10:20 - 10:40am	Advanced write in MatNWB (compression, chunking, and iterative write) (Ben Dichter) Recording on YouTube
10:40 - 10:55am	Review of workshop projects
11 - 11:55am	Discussion: The current state of NWB and data standardization in neurophysiology • What is the future of NWB? • What would you like to see in NWB that is not yet supported? • What hardware and software tools would you like to see integrated with NWB? • How can we make NWB easier for you to use?
12 - 3pm	Break / Virtual coffee shop - Hack on projects, do NWB exercises, ask questions to NWB developers on Zoom
3 - 6pm	In-depth tool breakout sessions, Day 3: 3 - 3:55pm: MIES - Thomas Braun Recording on YouTube 4 - 4:55pm: DataJoint - Thinh Nguyen, Dimitri Yatsenko Link to Jupyter notebooks Recording on YouTube 5 - 5:55pm: NWB & DataJoint Integration in the Frank Lab, UCSF - Loren Frank • Link to Jupyter notebooks • Recording on YouTube

3.2 Attendance

Figure 4 shows the attendance on Zoom for the different sessions. The agenda was designed to enable users to select the sessions in their specific science area (i.e., extracellular electrophysiology, intracellular electrophysiology, and optical physiology) as well as main programming language (i.e., Python or MATLAB).

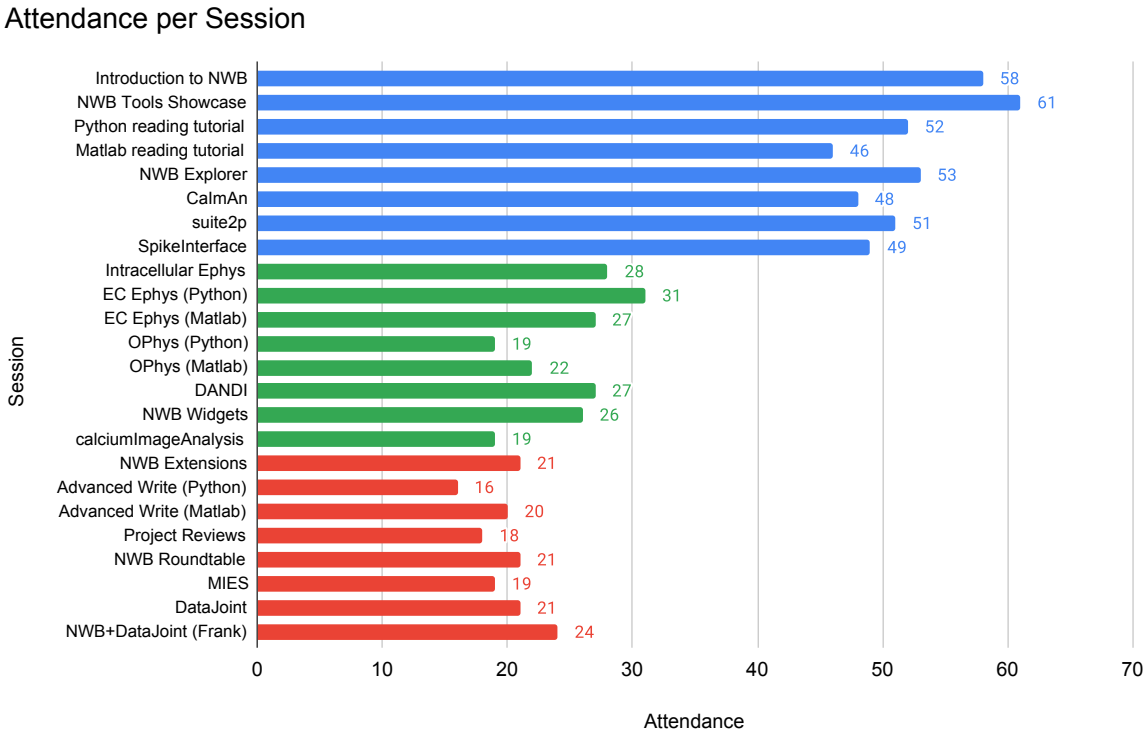

Figure 4: Number of attendees via Zoom per session. Sessions are ordered in time, first to last. Color of bars is used to indicate the different days of the event.

3.3 Polls

During the NWB tutorial sessions, the NWB team used Zoom polls to ask participants to rate the usefulness and appropriateness of the expected skill level.

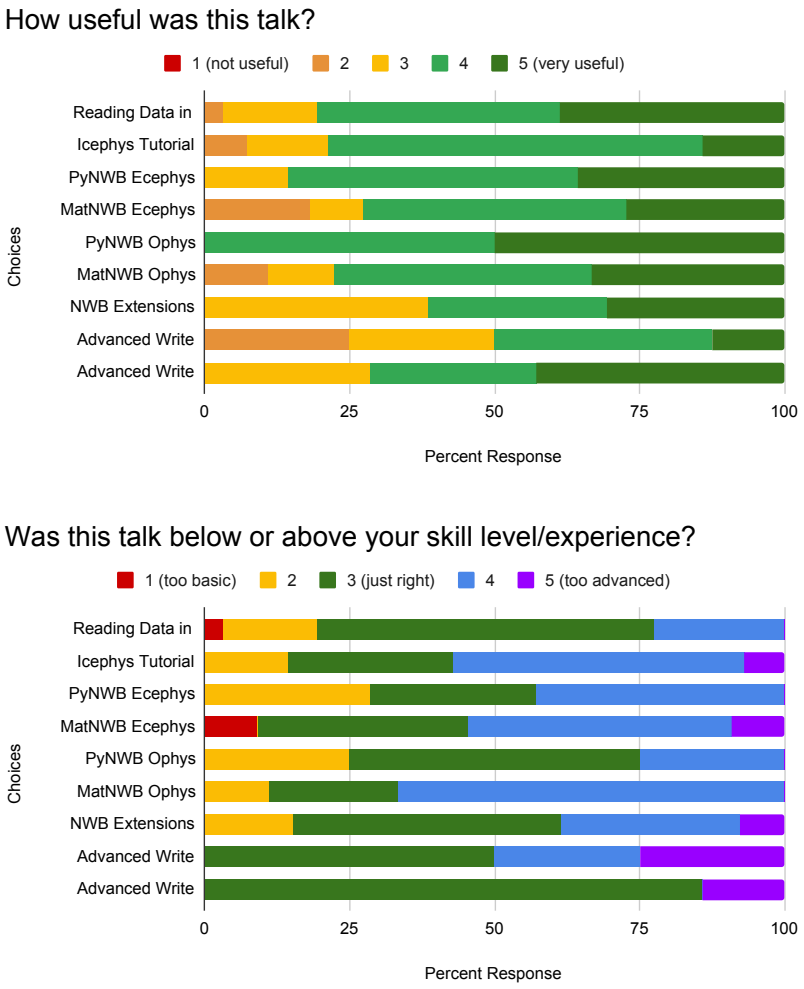

Figure 5: Polls in Zoom meetings.

4 Exit Survey

All participants were asked to participate in an exit survey. 16 participants responded to the survey.

4.1 NWB User Days Overall

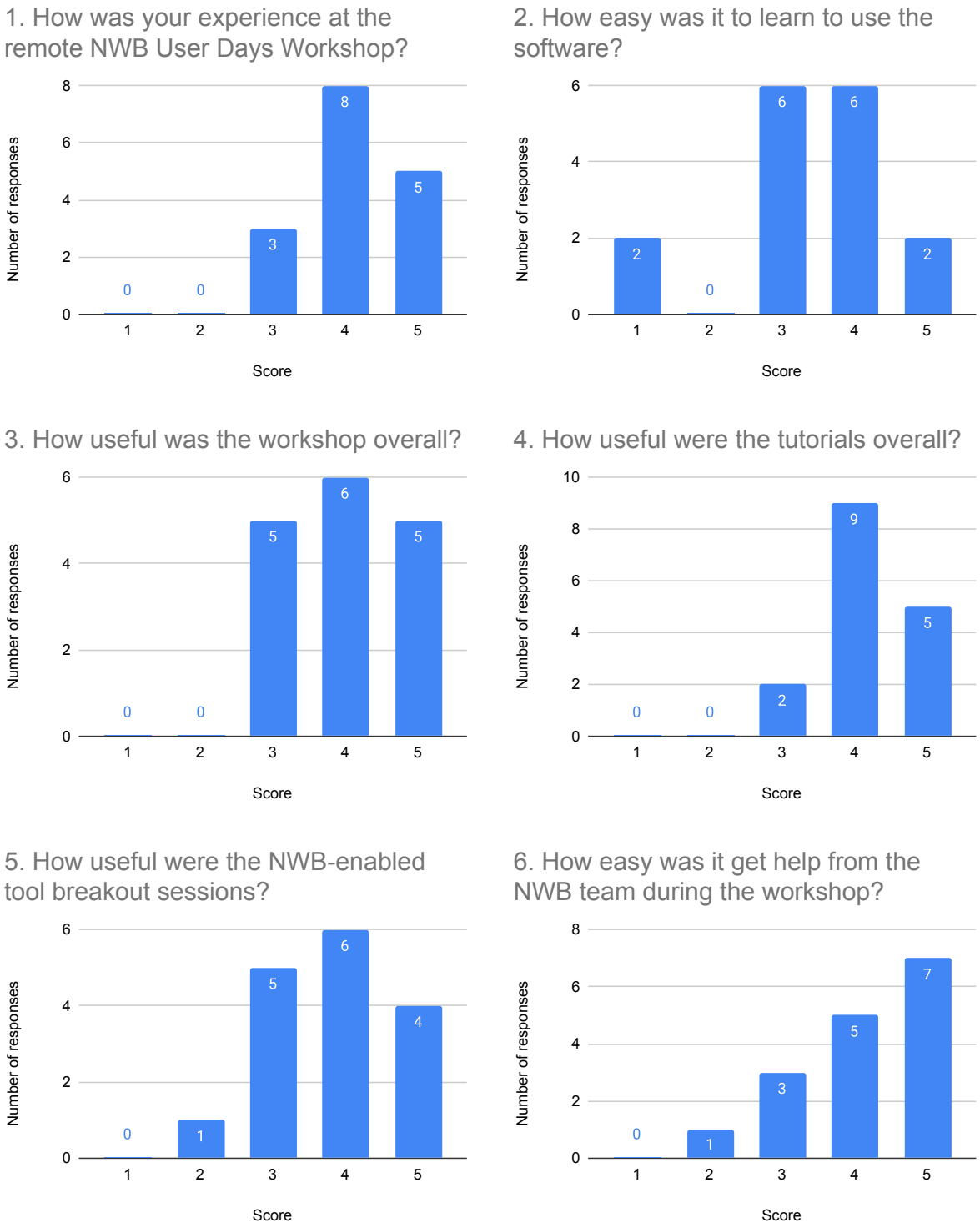

Figure 6: Exit survey responses ranking the overall experience at the NWB User Days 2020 on a scale of 1 (worst) to 5 (best).

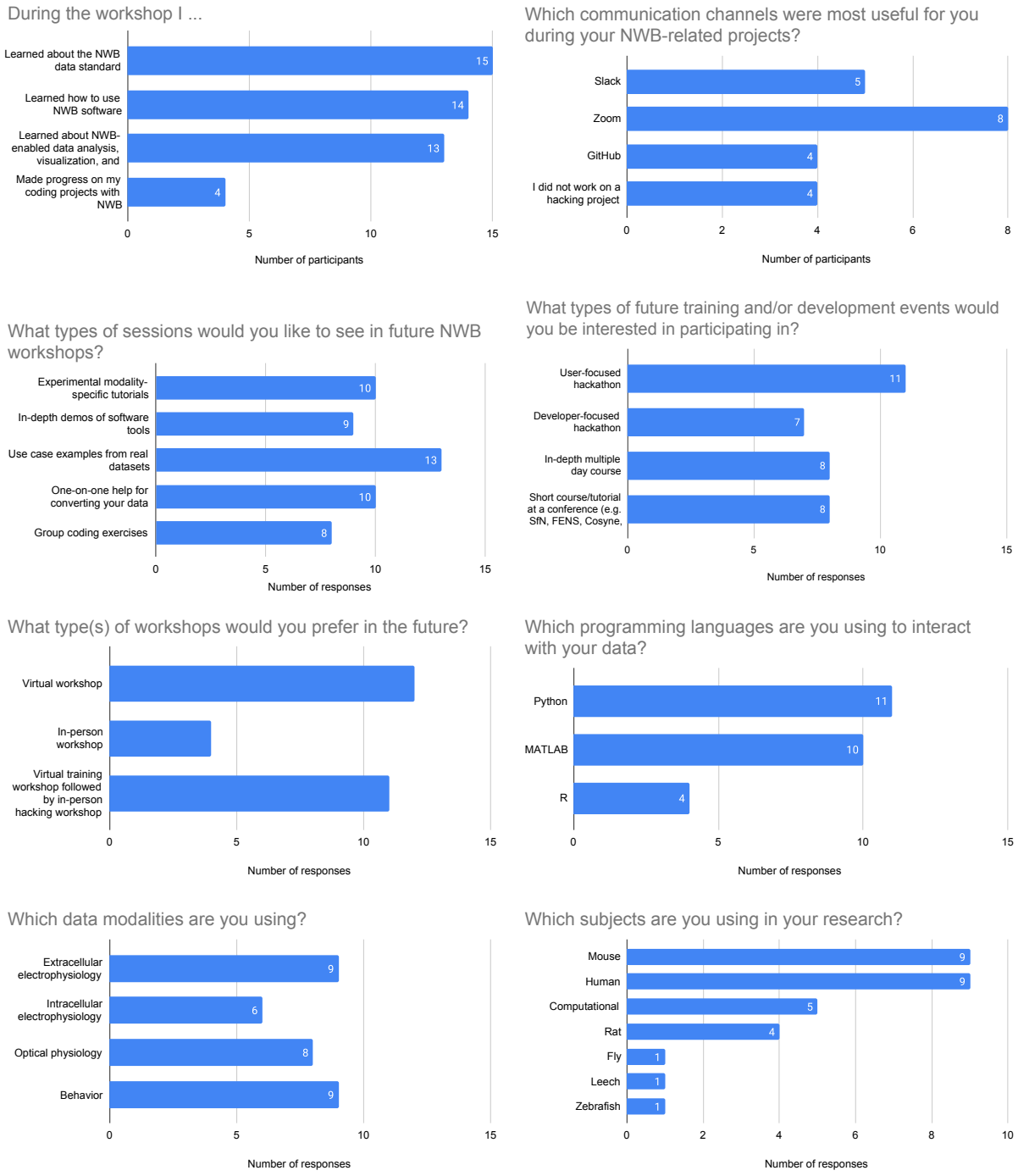

Figure 7: Survey questions. Users could select multiple answers for each question.

What were the most helpful parts of the workshop?

10 (of 16) respondents answered the question. Responses did not present a clear trend.

- Coding
- Ben is Always great although he was sleepy due to the early morning
- I'm noob and slow, so only the few first session were relevant.
- Compatible with Python and MATLAB users
- The presentations that focused on how to get NWB working in a real life lab situation.
- Breakout sessions.
- I am new to NWB, and it was very helpful to get an overview of the entire NWB ecosystem.
- overview, tools showcase, tutorials, datajoint and integration
- Introduction to NWB in Python
- the NWB-enabled tool breakout sessions

How can we improve the workshop?

9 (of 16) respondents answered the question. Several wanted access to the lesson materials ahead of time.

- Can do a minor projects with availay data
- Cloud base computing big data so We can speed things up
- Have initial tutorials that participants need to learn, so the starting point will be more homogenous.
- Due to CEST timing little confused about the starting time
- Perhaps with the implementation of smaller, parallel breakout rooms where an experienced user could have a discussion/workshop with new/potential users.
- I think a "flipped classroom" format would be great for making more progress on personal projects in a workshop-type setting. As it was there was so much time on talks etc, and it wasn't always entirely clear the best way to get help and work on projects. A more flipped setting where you first have people do a tutorial and work on their project, and *then* meet to discuss with the experts. (And then the teachers come in knowing people are prepared). In terms of how to get help, I would suggest be really specific: tell people what slack channel to go to first thing.
- Please make all the jupyter notebooks, including linked images, easily downloadable from the web site by the beginning of the session.
- Being completely new to NWB, I would have liked to get a better overview of the standard before diving into coding issues. I would make the first day just about NWB, talk about the big idea, the architecture of the format, how it is typically used (like one NWB object is usually one experimental session), that the idea is to have a hierarchy of containers that are linked to each other. For most part, I wouldn't use coding but just work with visualisations (diagrams showing containers and their relationships). Show several examples from labs/researchers how they designed their data structure. For people who want to translate their data into NWB, I would probably make a separate break out session where everybody should design there NWB structure, again just using diagrams. With the help of the experts, these diagrams can be made very specific: which containers to use, how to link them, ... This would also give you as developers the chance to shape good standards in using the NWB format. I would minimize showing coding examples. Some are good, to get an idea. But I mostly wanted to get an idea about NWB and existing tools; I will not remember how exactly to use these tools in terms of programming (I'll look it up when needed). I understand that these suggestions do not fit with a typical "Hackathon". So, maybe there should be different workshops: high-level for people who don't know anything yet, and detailed with coding practicals for people who know the basics and now want to start/deepen their coding skills.
- The time was limited, this made presenters to be very fast

How can we improve the workshop?

8 (of 16) respondents answered the question. Several wanted more hands-on teaching with real data.

- Lab based and handson
- Concentrate on a specific part of brain We only Have 2 days If You concentrate on substantia nigra We could actually in 2 days do something innovative about it so If You Have MWB hackathon Every second month We can cover up most of the brain during 6 hackathon sessions

- Experiment specific sessions
- I would have liked to see a more practical totorial on how a lab can transition from non-NWB to NWB.
- 0 session for begginers, and slower the inroducing session withe more time for simple questions
- A bit more hands on. Give notebooks in advance, more focused on particular topic. I realize this will severely curtail attendance so might not be a good idea.
- NWB architecture (standard containers and how to use them; good resources for this session: https://nwb-schema.readthedocs.io/en/latest/format_description.html, https://www.nwb.org/nwb-software/); Designing your own NWB structure that fits your data
- All sessions were useful

What types of future training and/or development events would you be interested in participating in?

4.2 Testimonials

As part of the exit survey attendees were asked: *"If you would like to help us inspire new users to join the NWB community, then please leave here your testimonial (including your name and affiliation) for us to include in the workshop report."* Below are the individual responses:

> The workshop was great for quickly getting up to speed on how to transform our data to the NWB standard. Also, it was exciting to learn about the amazing array of tools that are available, or in active development, for those who make this transition.
>
> Eric Thomson
> Bioinformatics Scientist, NIEHS/NIH

> This is one of the important workshop for budding neuroscience and vision science students. Can explore and learn many things that will be useful in our carrier and Research. Thank you NWB community.
>
> Shiva Ram M.
> PhD scholar, School of Medical Sciences, University of Hyderabad

Acknowledgements

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