

# Ten simple rules for running a science-communication roadshow with a mobile research lab

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## 17   **Abstract**

18   Science communication increasingly emphasizes accessibility and participation, yet few initiatives  
19   combine rigorous research with public engagement “in the wild”. Here, we present ten simple  
20   rules for designing and operating a mobile research laboratory – a hybrid between scientific  
21   fieldwork and outreach – that enables data collection, education, and dialogue beyond  
22   conventional lab settings. Drawing on our experience developing and touring a neuroscience  
23   roadshow on circadian rhythms and light, we outline practical guidance on defining audiences,  
24   building interdisciplinary teams, managing logistics, and ensuring ethical and data protection  
25   standards. We also reflect on co-creation with the public, the challenges of working outside  
26   controlled environments, and strategies for sustainability and evaluation. Together, these lessons  
27   offer a roadmap for researchers seeking to combine high-quality science with meaningful,  
28   inclusive engagement in public spaces.

## Introduction

The role of science communication and health education is gaining more importance, emphasizing the need to make research more accessible, relevant and relatable to the public. At the same time, scientific engagement with people "in the wild" presents significant logistical and methodological challenges in field research on biology, psychology and health. In this article, we present a practical guide that illustrates a novel approach to engage broadly and widely: a mobile research lab that integrates data collection with public engagement and citizen science. Rather than serving as a prescriptive manual, this piece offers a reflective and practice-based account grounded in the experiences of a completed research road trip. Our aim is to share actionable insights, summary data and considerations for researchers seeking to combine rigorous, ethically sound scientific inquiry with meaningful outreach in the field of biology and neuroscience.

## Background: A mobile neuroscience lab on the biological clock

In 2024, we designed a mobile research laboratory in the form of a trailer designed as an interactive science communication and research tool, allowing visitors to engage with circadian science and the role of light in regulating biological rhythms (Blume et al., 2019). The central aim of the roadshow was to foster exchange between scientists and parts of the general public, that are not commonly represented in neuroscience studies (Rad et al., 2018). The roadshow consisted of multiple components: For information transfer, we prepared information presented in a museum-like format on the walls, enabling visitors to explore the exhibition semi-independently in a guided way. The researchers were always present to answer questions and engage in discussions, should questions arise spontaneously. In addition, we recreated several laboratory experiments in the trailer, allowing visitors to be researchers (on) themselves.

Visitors who chose to participate received a research badge with a unique QR code, which they scanned to provide informed consent and complete initial questionnaires. The research badge served multiple purposes. First, it allowed us to combine and track data points for each participant across different tasks, ensuring a comprehensive view of their engagement. At the same time, it functioned as a communication tool, addressing participants as collaborators contributing to the investigation rather than "passive" subjects. By scanning the QR code with their phones, participants could access the informed consent form and study information page, making the badge an essential tool for tracking agreement with the study design and highest-standard data handling procedures.

Data collection took place at two of three experimental stations within the mobile lab: (1) a stop-signal task assessing inhibitory action control (according to Verbruggen et al., 2019) and (2) a pupillometry measurement, where participants' pupillary responses to different light stimuli were recorded using an eye-tracker inside a light sphere (Martin et al., 2022). A third, non-experimental station introduced visitors to the physical properties of light, including demonstrations with spectrometers to measure different light sources, including incandescent light bulbs and LEDs. At this station, visitors could also measure the wavelengths emitted by their own phone screens and visualize them on the fly.

At the end of their visit, participants were invited to complete an additional questionnaire evaluating both the effectiveness of the roadshow as a science communication format and their overall experience. Within the first round of the tour starting in the beginning of May 2025, the roadshow successfully tested 575 diverse adult participants (age range = 18 - 85 years;  $M = 43$ ,  $SD = 15$ ) who provided consent and completed all questionnaires.

### **Why build a mobile research lab?**

A main strength of our mobile approach lies in its ability to reach large numbers of individuals who might not typically participate in laboratory-based studies, and to do so within a relatively short time frame. While experiments in the lab often limit the rate at which we can recruit them, our walk-in lab offered rapid and uncomplicated recruitment of co-researchers. The mobile laboratory setting also poses challenges. Compared to a conventional laboratory, the environment involves more often background noise, fluctuating lighting conditions, and the presence of other visitors. Ensuring that the collected data are not artifacts of these specific circumstances but remain comparable to laboratory-based findings is therefore essential. This is why we use established paradigms and conduct a subsequent laboratory-based replication following data collection in the mobile lab. Furthermore, the feedback provided by participants yielded valuable perspectives and ideas, which may inform and inspire future research directions and follow-up research questions.

Theoretically, two complementary approaches can be distinguished in science communication. One focuses primarily on dissemination, seeking to inform, reframe, or correct public beliefs. Another approach emphasizes participation and engagement, with the dual aim of enhancing public understanding of science while also deepening scientists' understanding of societal concerns, needs, and values (Druckman et al., 2025). We believe that innovative participatory approaches, including our own research lab, are particularly well-suited to address contemporary challenges associated with uncertainty, politicized science, assumptions of value neutrality, and

the limitations of reactive rather than co-creative modes of science communication. Importantly, in a time of increased misinformation and mistrust in science and evidence, a physical space of scientists in public space as part of a mobile research lab can represent an effective antidote.

Here, we present ten simple rules as to how combining citizen science, science communication, and public engagement within a mobile research format can not only inform about but also qualitatively enhance scientific research by generating new data, perspectives, and opportunities for collaboration.

### **Rule 1: Define your target population**

Any science communication project should begin with a clear understanding of who it is intended for, and this holds true as well for a roadshow and mobile research lab. Defining your target population early on ensures that the design, equipment, and logistical setup directly align with the background and expectations of the intended visitors. Depending on whether the roadshow is meant for students, the elderly, other professionals, researchers, or members of the general public, clarity about the audience will guide decisions ranging from equipment selection to outreach strategies. Equally important is specifying the geographic and demographic scope of your population. For example, a roadshow designed for use in rural communities will face different challenges than one meant for urban environments or international deployments. Understanding these parameters helps anticipate potential barriers, including accessibility and cultural considerations. Knowing your population informs the tone and approach of communication, the style of language, from science communication materials to participant instructions. It also shapes the development of research questions, study protocols, and supporting documentation such as consent forms, information sheets, and feedback surveys. Without this groundwork, the lab risks mismatched expectations or ethical oversights. By clarifying such requirements early, research design protocols can be implemented that are both feasible and compliant with relevant regulations as well as being informative to scientific research. Involving external stakeholders (e.g., event planning personnel, researchers at geographical locations where you want to stop) already at the stage of planning can be extremely helpful (see also (3)). Conversations with community partners, potential visitors to your roadshow, and institutional collaborators can uncover expectations and requirements that might not be apparent from a scientist-only perspective. These insights help refine the project's scope and ensure the mobile research lab delivers meaningful impact for science and society.

## Rule 2: Plan your communication concept

When planning the communication concept that really engages people it is essential to move beyond traditional top-down models of science communication, within which knowledge transfer is treated as a one-way process from experts to a passive audience. Instead, design your approach as a *dialogue* that invites curiosity, critical questions, participation, and co-ownership. Be clear about your goal and start by breaking your topic down into the key messages you want to communicate. This may require thinking outside the box and stepping back from the typically narrow focus of a classic research question. Framing these key messages around relatable, everyday experiences (e.g. asking a question, such as whether someone is a “night owl” or an “early bird”) or the wider societal implications can make it easier for hesitant members of the public to engage and can help make complex scientific content more accessible and personally meaningful. A strategic use of the framing effect helps people connect with new information, lowering barriers to engagement and building trust. The more complex the topic, the more diverse focus groups should be included in the planning process right from the beginning. This helps finding a clear focus on topic, language, and design which prevents the content from being tailored too narrowly to an academically literate audience. To some degree the key messages to be conveyed should align with the expectations and needs of members of a mixed audience. To achieve this, it is important to listen to external feedback and assume that non-experts may have something interesting to contribute to a scientific problem. This may seem counterintuitive, though, as in a science communication project it is more engaging (and more fun) to assume *existing* knowledge rather than viewing them as an ‘unknowing public’ that needs to be educated.

Traditional science communication models may treat communication as the final element of the research process, once everything is done and results are published rather than as a formative process (Ziegler et al., 2021). More innovative communication concepts, however, invite the public to engage earlier in the process, allowing them to try out methods and experience for themselves the perspective of the scientist. This shift in perspective can help people understand the inherent uncertainties, provisional nature, the value and evolving character of building evidence-based knowledge. Refrain from over-hyping of results, over-simplifications of conclusions and over-generalizations, as it will be spotted. Accepting and appreciating open questions and scientific uncertainties will make the communication concept more interesting and accessible, while still remaining true to the complexities of scientific work. Incorporating interactive elements that allow visitors to contribute actively, for example through personal research badges, hands-on experimental equipment, or self-assessments foster a sense of personal investment,

amplifying engagement through the “IKEA effect”, where people value more highly what they have helped to create (Barth et al., 2017). By combining personal resonance, co-creation, and methodological soundness, a communication concept can bridge the gap between research and society and simultaneously represent a unique opportunity to collect rare data. Moreover, this dialog with the public also benefits the researchers themselves, as it allows them to align their research approaches with public interests, embed their work more firmly within societal contexts, and derive new ideas from the needs expressed by the public.

### **Rule 3: Build a competent and enthusiastic team**

A successful roadshow project relies not only on scientific expertise but also on strong administrative and technical support. Designing a lab that is both well-equipped and portable often requires acquiring items that fall outside the usual scope of laboratory procurement. This is where the experience and advice of professionals beyond the scientific sphere become invaluable. From selecting a suitable carrier (in our case a trailer) that complies with traffic regulations and can be moved and parked with ease, to sourcing portable storage for computers, screens, and research materials, specialized knowledge is invaluable. Building a reliable team with expertise in these areas helps ensure a smooth and time-efficient planning and implementation process. Because such projects are inherently interdisciplinary, researchers should remain open to collaboration with colleagues from other departments, including procurement, logistics, IT, communications, and HR. These perspectives provide critical insights and practical solutions to challenges that extend beyond academic research or “classic” laboratory work.

It is key to integrate science communication as an internal task right from the start. Clearly communicate the vision and purpose of a mobile research lab to everyone involved to create a shared understanding and ensure that the communication concept can be successfully implemented at all levels. This approach not only facilitates smooth implementation but also fosters a new quality of collaboration between researchers and administrative staff, a success that may extend far beyond the project itself. Equally important is establishing a shared understanding of project goals early on and maintaining regular check-ins. Close and open communication between researchers and supporting departments like the workshop, procurement, and administration is crucial to prevent delays and maintain efficiency. This fosters alignment, adaptability, and cohesion across the team, all of which are vital for the success of a mobile lab. Support staff are key and sufficient numbers to cover the working hours (e.g. for research / student assistant staff) need to be planned ahead.

In addition to a strong internal team, choosing the right *external* collaborators is essential for all the tasks that your institution may not be able to provide (creating a professional layout, design concept, or building a website). Aim for a low-barrier, non-clinical style that encourages openness and accessibility on all levels. That is, think carefully about how you and your science should be represented and stay in control of the key messages and design choices to ensure scientific integrity and coherence as defined in the communication concept. Align key messages between all external collaborators, being aware that different internal and external expertise involved may come with different working styles. Select external collaborators who align with your vision, and values, if possible. In developing an attractive, portable laboratory environment, we deliberately avoided working with agencies whose expertise was limited to commercial or advertising contexts. Be open to creatives, such as designers, artists, or professionals with experience in exhibitions or museum-like planning, who can bring unconventional perspectives on engagement and presentation. Nonetheless, visual and communicative styles of the website, lab, and materials should creatively align with your institution's corporate design, using appropriate elements and correct logos of the supporting organization. By combining internal expertise with carefully chosen external partners, a cohesive, efficient, and engaging mobile lab project can be created that reflects both scientific excellence and creative outreach.

#### **Rule 4: Prioritize co-creation over control**

When developing the format and concept for a mobile research lab, it is important to resist the instinct to control every detail as if designing a tightly managed in-laboratory experiment. Instead, adopting a more open and collaborative approach can generate more interesting and valuable outcomes. By letting go of traditional hierarchies and power dynamics, the project can be shaped not only by the scientific team but also by the public. This openness may influence everything from the lab's content and design to text, dress codes (e.g. the white coat effect (Gerin et al., 2006) and modes of interaction (top-down versus bottom-up language (Jensen, 2014). Inviting the public to participate the process from the very beginning fosters creativity and relevance. By conducting focus groups or co-design sessions, for example, the different steps of the planning process can be influenced by members of the public. Allowing the public to co-create in this way cultivates a sense of shared ownership and strengthens trust in the science communication as well as the research project.

Equally important is the willingness to experiment, to try things out and to be surprised by unexpected input. Creating space for flexibility allows researchers to adapt both the content and the experience in ways that keep the lab dynamic, engaging, and grounded in real-world



perspectives. In our project, the co-design phase was a key to making sure our roadshow is relevant. This also includes designing for accessibility and inclusion from the outset. For example, offering inclusive opening hours which may include weekends. Further, ensuring physical accessibility (wheelchair access), keeping participation free of charge, using broad inclusion criteria for study participation, providing information in multiple languages, and having back-up tablets available for people who do not own smartphones or don't want to use their private device. Our experience has shown that negotiating with event organizers and explaining the importance of accessibility and public ownership of research has led to arrangements being made so that access to the mobile research lab remains free of charge for visitors, even when the overall event itself is not free.

#### **Rule 5: Keep it simple and adapt flexibly**

Mobile research labs open the door to unique opportunities, but they also come with distinct limitations and challenges. To succeed from a scientific point of view and still be feasible, research designs must be both realistic and flexible. Rather than striving for laboratory-level control, focus on formulating clear and straightforward research questions that can yield robust data despite the unpredictability of field settings. One great advantage of mobile labs is the ability to access study populations that are difficult or even impossible to recruit at a larger scale for traditional laboratory environments (e.g., sun sneezers, colour blind people, synesthetes, people who had laser eye surgery, or the elderly). This creates opportunities to investigate questions or designs that a standard lab context may not allow for, and to reach rare or diverse participant groups in their "natural" environments.

Leveraging these possibilities requires researchers to balance strictly controlled ambition with informative practicality: prioritize verifying the reliability of measures, identifying large-scale effects, and reserving more nuanced or complex investigations for follow-up studies in more controlled lab settings or finer methodology. In the interest of inclusion, diversity, and equality, avoid harsh pre-study exclusion criteria. Instead, allow for *broader* participation and refine your dataset during or pre-analysis, ideally in a pre-registered fashion (Nosek et al., 2018). This approach increases representativeness while still safeguarding rigor. Consider factors such as randomization, order effects, environmental noise, and potential confounds (e.g., alcohol intake at festivals or fatigue in public spaces). Addressing these challenges up front ensures that your methodology remains robust while still responsive to real-world conditions

## **Rule 6: Consider ethics and data protection**

When collecting data in the context of a mobile research lab, it is essential to uphold the highest ethical and legal standards, as you would in a classic lab-based design. Clearly communicate to participants what data are being collected, for what purpose, and how data will be stored, processed, and used. Participation is to be voluntary, with informed consent obtained in a transparent and comprehensible way. In general, not more data should be collected than necessary (particularly identifying data). Apply the principle of data minimization and avoid gathering sensitive data unless it is essential to answer the research questions. The aim and the central research questions should be formulated in advance and ideally, preregistered on an open repository. Ensure that all data are handled in compliance with relevant data protection regulations and that storage systems are secure and access is limited to personnel that is directly involved with the project. Consider how anonymisation or pseudonymisation can help protect participants' identities.

Ethical approval from an institutional review board or ethics committee should be obtained before launching the project, particularly if personal or physiological data are involved. Equally important are health and safety considerations in mobile and laboratory settings, for participants as well as all staff involved. All equipment should be operated according to safety guidelines, with clear procedures for handling, calibration, and sanitation, especially for devices that are in direct contact with participants. Sensitive equipment must be securely stored and transported using appropriate protective cases and environmental controls to prevent damage or data loss. Regular maintenance and safety checks help ensure reliable operation and protect both participants and researchers. Fire protection measures must always be in place (during the data collection as well as when transitioning between tour stops), including the safe storage and handling of lithium batteries, which should be transported in compliance with relevant hazardous goods regulations and using certified fireproof containers.

Just as important is the way data collection is *experienced* by participants: maintain sensitivity to privacy, avoid intrusive methods or questioning, and make sure people feel respected and in control of their contribution. Ethical rigour, safety, and transparency not only protect participants and researchers but also strengthen trust and credibility.

## **Rule 7: Make the most of on-site events**

Before attending any event, gather information about the expected conditions: who the typical audience will be, how many people are likely to attend, and what other activities will be taking

place (e.g. bands, other exhibitors). Some events can also provide a detailed analysis of their visitors and target audiences, such as typical age, gender, and education distribution and are often happy to share this information if you ask. An important question to ask here is whether that event or sites are in line with the projects intend and the values of the science communication project itself. The audience that can be reached there should fit the project, and ideally would go beyond the classic academically literate audience that are most often engaged with science. Understanding potential sites, geographical and social conditions help anticipate the setting and plan the lab's positioning. In our experience, it is useful to take as much control over the location as possible and most organizers are happy to learn about the intent of a communication project in detail in advance and will support your needs if they understand them.

It is also ideal to be formally incorporated into the program of each event. This may be the case through a complementary lecture, panel discussion, or workshop related to the mobile research lab. Be creative in finding ways to connect your research topic and the science presented in the lab to the broader theme of the event, and be open to exploring opportunities to position the scientific perspective within wider societal debates. Be explicit about the conceptual as well as practical requirements of your mobile lab: for example, if it is not designed for children, make sure it is not accidentally placed in or next to a children's area. Consider specific safety measures for the location as well as general safety measures for all staff including clear emergency contacts and procedures for fires (including lithium fires), break downs and for handling uncooperative visitors. Avoid locating the mobile research lab in areas where alcohol is likely to be consumed, as this can compromise both safety and the quality of interactions.

Prepare staff thoroughly, as staffing a mobile research lab can be demanding: it involves constant conversations, answering questions, and representing their research to a wide range of people. While this is a valuable opportunity for scientists to gain visibility, practice communication skills, and engage with a wide range of stakeholders, they should be equipped to respond confidently to a variety of social situations outside their usual lab context. Plan shifts, breaks, and resting hours to avoid exhaustion. Crowd control is also crucial: set clear limits on how many people can enter the lab at once, and provide nearby seating or waiting areas. Offer engaging materials such as reading or short activities for people who are waiting, so that interested visitors remain motivated and do not feel let down if they cannot enter immediately.

#### **Rule 8: Think about sustainability and follow-up**

A mobile research lab should be more than a one-off event it should be strategically designed with both immediate reach and long-term value in mind. Consider whether your goal is to move through communities to maximize visibility or to reach specific populations for deeper engagement, and plan accordingly. Build in mechanisms for evaluation and feedback from the outset to assess both scientific outcomes and public impact. Sustainability and follow-up are also key: think ahead about how relationships, data, and insights will be maintained or developed after the project concludes. A well-planned project anticipates these dimensions from the beginning, setting the foundation for both trust and future collaboration.

#### **Rule 9: Document, share, and amplify your impact**

To maximize sustainability of a mobile research lab, it is important to systematically document the activities, interactions, and outcomes of each event. Give visitor the opportunity to ask questions afterward, or leave feedback right after their visit. Collect both qualitative insights such as participant feedback, experience reviews, questions asked, and observations of engagement and quantitative data, including attendance numbers, demographic details of whom you have reached (age, gender, educational background, prior knowledge of your field or topic). It is known that particularly or science engagement and participation rates. Sharing these findings with your team and external stakeholders helps reflect on what worked well and what could be improved, while also demonstrating the broader impact of your work. Amplify your efforts by using multiple communication channels, from social media and blogs to newsletters and institutional reports, highlighting key moments, insights, and participant contributions. Engage in wider conversations beyond your lab: connect your research and outreach activities to societal debates, public policy discussions, and interdisciplinary networks. By doing so, you not only increase visibility but also position your project within larger conversations, fostering collaboration, influence, and sustained engagement with both scientific and non-scientific audiences.

#### **Rule 10: Evaluate and learn from feedback**

One of the greatest challenges for any science communication project is to collect and interpret meaningful impact measures (Jensen, 2014). Straightforward metrics such as clicks, follows, attendance numbers, or social media engagement may provide some insight into the initial engagement. However, real impact of a science communication project, as to whether participants actually took on the information provided, understood and engaged with the implications, or applied the knowledge after their attendance is difficult to infer in this way. Particularly, when it comes to science health information, the most valuable impact is often seen in how participants

are able to employ or implement what they have learned in their everyday lives. Truly innovative projects go beyond counting visitors and instead design evaluation methods that capture deeper outcomes on participants' thinking, decisions, or behavioral change. Structured evaluation and feedback loops should be integrated into the project from the very beginning, as they can significantly distinguish a science communication initiative from more traditional approaches by embedding success evaluation as a core element rather than an afterthought.

Particularly for a mobile research lab, where it may be possible to reach groups that are not normally represented in these measures, collecting engagement data in "difficult-to-reach" individuals during and after the visit will be insightful and data that most science communication project fail to collect. Think of ways to collect data even from early dropouts if possible, to gain information about possible skepticism, or reasons for not feeling welcome. Collect feedback from multiple perspectives: visitors, staff, collaborating partners, and event organizers. This can include short surveys, informal interviews, debrief sessions after events, or simple comment boards that allow people to share their impressions and suggestions. If you conduct focus groups at early planning stages, one option is to re-invite members of those focus groups when the project has progressed. This way they can give feedback throughout and compare the outcome with what they envisaged early on. Where possible, consider follow-up evaluation after the roadshow or events have finished to understand what (knowledge/messages) participants remembered, applied in their everyday lives, or what they got inspired by. Feed those insights back into planning meetings and design iterations so that lessons learned become visible in the future stages of the project or new project ideas.

## **Conclusion**

Mobile research laboratories blur the boundaries between research, outreach, and education. By stepping outside the controlled environment of traditional laboratories, they invite dialogue with communities that science often overlooks. This approach transforms data collection into participation, where participants become co-researchers rather than subjects, and demonstrates how scientific inquiry can coexist with public learning, trust building and co-creation.

Looking ahead, mobile laboratories could become key infrastructures for inclusive, field-based research across disciplines. They offer a powerful platform for investigating variability in natural environments, testing interventions in real-world settings, and translating scientific findings into

380 experiential learning. Their flexibility also supports partnerships with local stakeholders and  
381 educational institutions extending the reach and relevance of scientific work.

382 For these benefits to be sustained, mobile lab initiatives should be embedded within institutional  
383 strategies for outreach, data management, and ethics. Establishing shared frameworks for  
384 documentation, evaluation, and long-term maintenance can ensure that such projects evolve from  
385 one-time experiments into scalable, replicable models of open, participatory science. By  
386 combining methodological rigor with creative engagement, mobile research laboratories  
387 exemplify how science can move, literally and figuratively, toward the public.

388

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