

The Earth under the Microscope

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Background and Goals

Global challenges, particularly a warming climate, dominate public discourse. Agriculture, a significant contributor to greenhouse gas emissions, is already suffering from the climate crisis and will face increasing pressure. Without transformation, ongoing intensive agriculture threatens global food security.

This science communication experiment aimed to bridge the gap between society and science by building and creating mutual trust and benefit, addressing the agricultural crisis by making food (in)security and global challenges tangible and understandable and raising awareness of the current situation as well as necessary actions. The goal was further to empower individuals and provide avenues for action, communicating the scientific process of drawing conclusions about Planetary Health from Earth observation data in an engaging way, and fostering networking and dialogue among stakeholders, including the public, scientists, farmers, politicians, and industry representatives.

SciComm Format and Evaluation

The exhibition was designed for the Deutsches Museum's target groups, especially families and interested adults (see figure 1). Its pop-up design makes it suitable for various venues, such as public spaces, university halls, informal settings, science areas at music festivals, and climate camps, serving as both an information base and networking opportunity. The experiment comprises three components: the pop-up exhibition, the Earth observation microscope, and direct interaction between visitors and scientists, which are described in more detail below.

The pop-up exhibition consisted of 23 information panels, two computer screens, and an optional microscope integrated into a table. The panels balanced text, infographics, citations, and Earth observation images, designed to convey maximum information efficiently in both German and English language. The content included an introduction that provided general context about agriculture, food growth, intensive farming versus diversification, food waste, and natural resource requirements. Another section titled "Agriculture Seen from Space" highlighted the benefits of satellite Earth observation for monitoring global agricultural trends. Information about the microscope was also provided, explaining the data stories shown through the device. Finally, an "Interpretation and Context" section put introductory information into the context of food security, discussing challenges and opportunities for individual action. Two looping videos complement the exhibition. The first explained the importance of satellites for global agricultural monitoring, using footage from the German Aerospace Centre. The second video showcased the Earth observation data and AI algorithm insights visitors could explore with the microscope.

The Earth Observation Microscope, constructed from layer-glued wooden panels, used a modified VR headset and knobs for navigation. The content included three data stories activated by selecting specimen plates: high-resolution satellite data of Brandenburg showing crop changes over time, AI algorithm's crop-type detection in Brandenburg, and an overview of dominant crop-types in Europe. Visitors were also able to engage directly with scientists specializing in food security, AI, and Earth observations that were present at the exhibition.

The exhibition, which ran from January 14 to mid-February 2023, was evaluated over four weekends. Four groups tested different setups: Control group 1 experienced the pop-up exhibition only, group 2 (ExSci) the exhibition plus dialogue with scientists, group 3 (ExSciMi) the exhibition, dialogue with scientists, and the microscope exploration, and group 4 (ExMi) the exhibition and the microscope exploration. Visitors were asked questions about their interest in science, exhibition experience, emotional state, and demographics after the visit. Scientists documented visitor questions to assess depth of understanding, and the scientists' attitude towards science communication was evaluated before and after the exhibition.

Results and Discussion

During the evaluation period, 148 participants engaged with a thread-board for feedback (see figure 2), and 35 discussions were documented by scientists. The estimated total number of visitors was higher, with 250 QR code scans leading to the project website.

During the four weekends of evaluation, a diverse group of visitors interacted with the exhibit. A broad audience across various age groups was reached, with a general shift towards younger visitors. The overall age distribution remained roughly constant up to 30 years, peaked between 30 and 40 years, and then declined at older ages. High levels of interest and trust in science were observed across all groups, irrespective of whether visitors only read the information panels or interacted with the supporting staff and microscope. Visitors aged 20 to 40 showed the most interest and trust in science. Those below 20 years old tended to be less convinced, with fewer agreeing "a lot" and the majority agreeing "somewhat" or "about 50/50". A wide range of emotions was reported, with about 50 % of visitors feeling happy and jittery, 40 % feeling satisfied and tired, and around 30 % feeling delighted, hopeful, excited, relaxed, and enthusiastic. Few visitors felt dissatisfied, angry, unhappy, or sluggish, and only about 15 % felt awake.

The following insights can be drawn based on the proposed hypotheses and the collected data: Engagement was higher when visitors interacted with scientists or used the microscope, resulting in better information retention. More questions were asked and the questions were more advanced when scientists were present. Additionally, visitors were more likely to ask questions and engage in discussions when scientists were present, with longer and deeper conversations observed. While visitors who interacted with scientists or used the microscope did exhibit a more excited emotional state, and emotional experiences correlated with better retention, the evidence was not uniformly strong across all measures of retention. The scientists showed varied willingness for future science communication activities. After the intervention, an increase in proactive communication efforts was noted, although overall willingness did not significantly change.

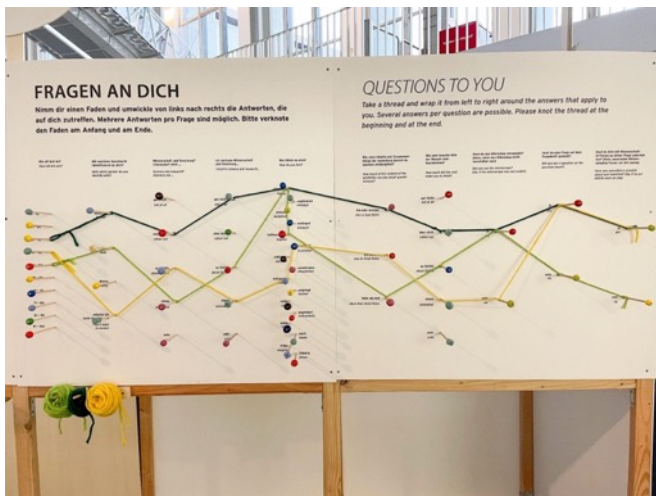
In conclusion, the exhibition faced several challenges. Its location in the Science Communication Lab (SCL) at the Deutsches Museum was initially hidden behind a prominent exhibition and a construction site. Visitor guidance to the SCL was unclear, relying heavily on the proactivity of the staff. Online publicity and cross-promotion efforts were not fully realized. Visitor feedback indicated that the microscope alone did not significantly increase interest or trust in science unless supported by experts. Technical issues with the microscope and its lack of intuitiveness were noted. Positive framing of challenges related to food security and climate change received favorable feedback. Furthermore, changes in scientists' willingness to engage in science communication were observed. The intervention prompted a shift towards more proactive communication efforts. The qualitative evaluation highlighted the benefits of diverse audience engagement and the importance of personal interaction in science communication. Room for improvement relates to technical issues with the microscope. Incorporating a real microscope or a special children's activity could further enhance engagement. Recognition from employers for science communication efforts could boost motivation and sustainability of such projects. Additionally, displaying the same exhibition at

Klimacamp Munich demonstrated further successful engagement with a different target audience keen on discussions and information exchange. The pop-up exhibition facilitated fruitful interactions among activists, scientists, and the public, confirming the effectiveness of the exhibit's design for such settings.

Figure 1: Exhibition at the Deutsches Museum on the topic of the agricultural crisis and its connection to food.



Figure 2: Feedback from visitors at the Deutsches Museum via an innovative thread-board method.



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