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ORIGINAL

Glass Art as Bridge: Towards Democratising MRI Sequence Development

Bianka Hofmann,[1*] Gregory Alliss[2]

[1]Fraunhofer Institute for Digital Medicine MEVIS, Max-von-Laue-Str. 2; 28359 Bremen, Germany; [2]The University of Edinburgh, Glass Studio, Edinburgh College of Art, 74 Lauriston Place, Edinburgh, EH3 9DF, United Kingdom
*Corresponding author: bianka.hofmann@mevis.fraunhofer.de

ABSTRACT

This article examines transdisciplinary co-creation in the STEAM Imaging VI residency, where glass art and the novel platform *gammaSTAR* contributed to democratised Magnetic Resonance Imaging (MRI) sequence development for upper-secondary Digital Medicine students (n=23). Adopting a "terroir" approach to science communication, the residency and STEAM workshop leveraged the institute's scanners, software, and partnerships as situated expertise, favouring context-specific interventions over scalability. In a two-day program, students, an artist-physicist, and MR researchers, controlled sequences on no-field/table-top low-field and 3T research scanner systems, scanned waste glass and water-immersed phantoms, and linked MR signals to Cathode Ray Tube (CRT) glass sculptures as epistemic tools for experiential physics. Pre-/post-Likert surveys (n = 19–22) revealed large gains in MR sequence understanding (10% to 82% positive) and understanding of artists' decision processes (10% to 77% positive), with stable art-science enabler views (65%–68%). Teacher feedback confirmed a shift in school students' engagement, from observers to active sequence controllers, facilitating curricular connections. Building on the artist's residency-based glass phantom experiments, the workshop invited students into MRI sequence control, and the resulting phantoms informed a 2026 SciArt exhibition that carried this co-creative work into a public setting. This experimental innovation strengthens digital medicine literacy and models a situated, terroir-based SciArt infrastructure for collaboration and context-specific democratisation of MRI sequence development.

Keywords: Co-creation; experimental innovation; SciArt, MRI sequence development; glass art; gammaSTAR; situated expertise; digital medicine literacy; democratizing science.

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INTRODUCTION

Transdisciplinary co-creation practices, as demonstrated in the STEAM Imaging residency, engage diverse stakeholders (artists, scientists, students, teachers and producers) in Magnetic Resonance Imaging (MRI) research, fostering understanding, sustained involvement, and innovation. Recent case studies on transdisciplinarity, participatory research, and public engagement highlight the transformative potential of these approaches in reshaping the relationship between science and society. MRI is a non-invasive medical diagnostic technique that uses strong magnetic fields and radio waves to produce detailed images of the body's internal structures. Its flexibility enables a wide range of clinical and research applications, yet operating and programming MRI systems require advanced technical expertise due to their complex physical and computational principles. Scientists at Fraunhofer MEVIS implemented participatory, transdisciplinary science engagement initiatives within an applied research institute (Stifterverband der Deutschen Wissenschaft, 2025, pp. 50-52). At the institute, researchers and artists collaborate as co-creators, teachers, and learners, advancing shared understanding across disciplinary boundaries (Fraunhofer MEVIS, n.d.-a). These initiatives integrate methods, tools, and procedures central to the institute's mission of developing software solutions for image- and data-supported early detection, diagnosis, and therapy. They create temporary, transformative environments in which advanced technologies become approachable, experimentation is encouraged, and skill development is supported. Additionally, they promote reflection on the societal implications of scientific progress and open pathways for public participation through outreach, exhibitions, and workshops, fostering digital medicine literacy and participation. This justifies the situated use of the term democratize, understood here as making MRI tools and concepts more accessible and participatory for students and public audiences. Science engagement is embedded within the institute's R&D projects and strengthened by its lateral leadership structure and collaborative working culture. These elements provide the institutional and material conditions (time, access to MRI infrastructure, and close collaboration between artists, scientists and further stakeholders) that make the residency, workshop, and exhibition described in this paper possible. Co-creation across domains in interdisciplinary research, particularly through industry–academia collaborations such as the STEAM Imaging residency, exemplifies a structured transdisciplinary approach for making emerging technologies accessible to non-experts. This model provides practical guidance for research institutions seeking to design tailored, arts-based initiatives. The call for STEAM Imaging VI: Resonant Connections Through Design and Data, developed by Fraunhofer MEVIS in cooperation with the Institute for Design Informatics and Inspace at the University of Edinburgh (Inspace, n.d.), explicitly focused on engagement in MRI sequence development using the platform *gamma*STAR and no-field, tabletop low-field, and research-grade scanners. It raised the question of how creative, exploratory approaches can help demystify, broaden access to, and diversify engagement with resonance imaging technologies. In this context, the residency functioned as the umbrella frame within which an artist–scientist team co-held a STEAM workshop with students on MRI sequence development alongside the artist's own exploration, followed by a subsequent exhibition, treating these as linked stages of one co-creative process. Although several platforms have begun to open MR sequence development to wider audiences, little is known about how these accessible environments can most effectively support skill development, independent exploration, and reproducible outcomes. This gap offers an opportunity to investigate how embedding expert tools within co-creative, transdisciplinary formats, such as STEAM workshops, can strengthen confidence and competence, foster reproducible and innovative results, and enhance visibility for a domain traditionally inaccessible to non-experts. The STEAM Imaging VI residency exemplifies a "terroir" approach, where the research institution's local facilities and tools, participant competencies and interests, and stakeholder aims co-produce science communication (Achiam et al., 2025). This paper aims to present a practice-based case study that examines how that situated co-creative setting enabled MRI sequence control to become more accessible to non-expert participants through the combined use of glass art, hands-on software use, and collaborative experimentation. More specifically, the paper argues that the residency, workshop, and exhibition form a single co-creative arc through which MRI technologies are made more legible, discussable, and participatory for students and public audiences. It shows how a terroir-based, context-specific art–science collaboration can support digital medicine literacy. At the same time, it provides insight into how students' perspectives can enrich artists' creative processes when designing and conducting SciArt workshops in collaboration with scientists from the fields they explore for their artistic work.

THEORETICAL BACKGROUND

Across multiple fields, data science and AI, software development, STEM education, and medicine, standardised workflows and intuitive no-code or low-code interfaces have increasingly opened pathways for non-experts. These tools enable users without extensive specialisation to complete tasks that once required expert training. Examples include BlazeSQL, which allows users to query databases and generate insights through natural language by automatically producing SQL and visualisations; AppSheet, which lets users create functional applications from spreadsheets using drag-and-drop components; and Graphite Note, which provides no-code AutoML tools for novices to build predictive models and simulations. In medicine, Akhloufi et al.'s clinical decision support system (CDSS) for antibiotic therapy exemplifies this trend by addressing 51 usability issues through iterative refinement, adding calculators and auto-fetched data to help residents safely apply complex expertise. MRI sequence development, by contrast, remains a highly specialised endeavor that intersects advanced physics, clinical requirements, and hardware-specific constraints, all further complicated by limited scanner access and regulatory conditions (Bottomley, 2021). This complexity has contributed to a lack of transparency and standardisation across institutions and vendors, limiting reproducibility and collective learning. Recent tools have begun addressing these challenges through simulation and intuitive design interfaces. Treceño-Fernández et al. (2021) integrated an intelligent tutoring system (ITS) into an MR simulator to train radiographers in adjusting protocol parameters within preconfigured sequences. MRSeqStudio (Villacorta-Aylagas et al., 2022) introduced a browser-based environment for visual modification of modular sequence blocks and Bloch simulation. Loktyushin et al. (2021) advanced to genuine sequence-level manipulation via supervised machine learning, a concept extended by Hoinkiss et al. (2023) through AI-driven, domain-specific optimisation of scanner-independent MRI sequences. Recent developments like *gammaSTAR* (Konstandin et al., 2025) support such approaches as a hardware-independent platform deployable on clinical scanners, enabling modular sequence design, live validation, and hands-on experimentation to support rapid iterative development, and education (Fraunhofer MEVIS, 2024c, 2025d, 2025e). This technological democratisation mirrors no-code paradigms in other disciplines and broadens transdisciplinary co-creation and science engagement. It brings these practices into the traditionally specialised domain of MRI sequence research.

Fig. 1. Artwork, *Lenses,* kiln cast glass and steel. Copyright Chris Scott.

Making glass art occupies a unique position at the intersection of material science and creative expression (Alliss, 2025). This interdisciplinary intersection is core to the artist's practice. The artist's glassmaking process employs kiln-casting to create sculptures combining conventional art glass with contaminated waste glass, materials not traditionally used by glass artists. This process challenges conventional limitations to expand aesthetic and conceptual possibilities in contemporary glass casting (Alliss, 2026). The artist's waste glass of choice is Cathode Ray Tube (CRT) glass sourced from old-style tube televisions. The kiln-cast objects made from the CRT glass had an unconventional aesthetic and a unique colour. (Alliss, 2022). This innovative approach aims to guide viewers on a perceptual journey inside the glass, revealing internal striations, veiling patterns, and material impurities. Glass art functions here as an epistemic tool, making MR physics tangible through material and visual exploration. This aligns with calls to value arts-based science communication methods that surface emotional, sensory, and contextual dimensions of situated knowledge (Achiam et al., 2025). The concept of terroir describes how access emerges from the specific combination of local tools, institutional practices, artistic materials, and participant constellations that shape what kinds of science engagement become possible, rather than from generic toolkits.

METHOD AND DATA

Participants

Upper-secondary Digital Medicine students (n = 23).

Materials

- Phantoms (test objects, here glass-based, used to explore how material properties and water immersion affect MR visibility and signal behaviour); plant samples; human volunteer.
- *gammaSTAR*. Hardware-independent platform deployable on clinical scanners, enabling modular sequence design, live validation, and hands-on experimentation to support rapid iterative development and education (Konstandin et al., 2025; Fraunhofer MEVIS, 2024c, 2025d, 2025e).
- 3D-printed, non-functional "no field" models of MR scanners with *gammaSTAR* drag-and-drop programming and coil sound/light simulation, integrated LEDs/sound feedback, clinical image library;
- MRI-Scanners: Tabletop low-field systems and 3-T research MRI;
- Surveys. Pre: 11-item Likert scale; post: 10-item Likert scale (n = 19-22).

Procedure

STEAM Imaging VI Context

The international creator-in-residence program STEAM Imaging (Hofmann, 2021), initiated in 2016 in collaboration with SPACE, London (SPACE Studios, n.d.), reached its sixth iteration in 2025. This program promotes contextualisation, self-efficacy, and diversity in STEM and digital medicine through research-informed artistic production, with a jointly held artists-scientists STEAM workshop for school students at its core. The workshop adhered to six core principles: (1) theme-driven partnerships with innovation-enabling stakeholders; (2) art–design–academic collaborations for topic-specific calls; (3) early engagement of target users and experts in co-design to address accessibility; (4) hands-on "making" sessions to elicit tacit knowledge; (5) joint facilitation by artists, producers, and scientists; and (6) minimal pre- and post-workshop questionnaires for experiential evaluation. Within this framework, the residency provided the artistic and institutional context, the workshop served as the main empirical setting of the paper, and the exhibition functioned as a public-facing experiential setting of the co-creative process. The workshop emerged out of the artist's residency-based experimentation with glass, MRI visibility, and sequence design.

Day 1: Glass Art Context and MRI Fundamentals

Glass Art Context

This session introduced participants to glass art processes, material properties, and aesthetic challenges, supporting the artist's development of MRI-responsive objects for a 2026 Edinburgh Science Festival exhibition. Participants handled raw glass and artworks, then followed the artist's journey, exploring the hypothesis of

MRI visibility of glass objects. This early introduction to the artist's process was intended to give participants a material and conceptual frame for later work with phantoms, sequence controlling, and scan interpretation.

MRI Fundamentals

Participants received instruction on MRI principles (magnetism, radio waves, nuclear spin dynamics, and Maxwell's equations) via demonstrations linking physics to clinical image formation. Key concepts (excitation, precession, relaxation) were illustrated through visualisations.

Sequence Programming

3D-printed models of MR scanners connected to *gamma*STAR software enabled hands-on sequence programming. Participants analysed MR sequences as parameter-controlled "recipes" that affect RF pulses, gradients, and timing.

Glass Imaging Configurations

Low-Field Testing. Small groups imaged glass objects (with/without water) using tabletop scanners, observing signal behaviours and system artifacts.

Sequence Optimisation

Participants adjusted MR parameters to optimize contrast and clarity.

Day 2: Presentations and Applications

Following the sequence presentations, participants rotated into two groups:

3T MRI Scanner

MR Lab orientation included field visualisation, protocol adjustments, and scanning of glass–water phantoms, human volunteers, and test objects.

Low-Field Measurements

Participants documented experiment in a lab diary format, tested parameters, and established protocols for a shared measurement database.

Exhibition Preparation

During the artist's stay at the institute, the exhibition space's creative producer joined meetings with scientists, and after the stay, the residency lead participated in exhibition realisation meetings, with the goals of transparency and knowledge transfer. The approach is deliberately tailored to the specific tools and facilities available, the competencies and interests of all participants, and the aims and logics of involved stakeholders, requiring freedom to design context-specific interventions rather than pursuing general scalability. This reflects context-specific situated expertise and co-creation over scalability, cultivating resonance within specific ecosystems (Achiam et al., 2025).

Note. Workshop Agenda and Workshop Exercise available in the Supplementary Materials (Workshop Agenda; Workshop Exercise).

Note. See Table S2 in the Supplementary Materials (Evolved MR Phantom Scans).

RESULTS

Workshop Activities

The artist's STEAM Imaging VI workshop adopted a co-creative model in which MR researchers, an artist-physicist who is also a doctoral student at a college of art, and upper-secondary school students jointly explored MRI imaging and sequence development as intertwined scientific and artistic practices. Together, they negotiated both technical parameters and aesthetic intentions through a shared experimental space where boundaries between expert domains and between experts and novices were deliberately blurred. Questions, methods, and outcomes emerged iteratively within a co-designed framework aimed at advancing both artistic inquiry and accessibility of MRI research tools. The STEAM Imaging VI workshop was integrated into the school's Digital Medicine specialisation. Building on participation in STEAM Imaging workshops since 2017, the teacher reported that students subsequently displayed greater confidence, broader scientific thinking, and an increased willingness to engage actively with complex questions, for example, composing music based on the structure of DNA sequences. A key pedagogical insight was that high-achieving female students were initially reluctant to participate because they feared that artistic formats would not be taken seriously, would lack academic legitimacy, and would resemble activities designed for younger pupils "who do not understand real science." The credibility gained through collaboration with a renowned research institute, where artists and scientists visibly worked together, enabled these students to trust that creating an artistic product within an advanced biology course would not disadvantage them in terms of grades or content coverage but would instead enhance learning. Within this protected yet high-level setting, students later produced outputs that exceeded typical expectations, adding to conventional project reports, such as on polymerase chain reaction (PCR) tests, genuinely creative works, including a music piece accompanied by a video (Schaak et al., 2022a, pp. 17–18; see Supplementary Material; Schaak et al., 2022b). These experiences demonstrate that creative approaches can yield high-quality outcomes valued within authentic scientific and medical research contexts. Note: Translation from DNA into Music in the Supplementary Materials (Translation from DNA into Music).

Survey Results

Pre- and post-workshop surveys (pre: n=20; post: n=22) used 11- and 10-item Likert scales, respectively. Most items were fully answered (pre: 19/20; post: 21/22). These scales measured shifts across core items, revealing significant gains in participants' understanding of MR sequence development, SciArt relevance, art–science synergies, and creative data use.Pre-workshop responses featured high rates of "keine Ahnung" (no idea), "stimmt weniger" (somewhat disagree), and “stimmt nicht” (disagree) for experiences in software-based image creation (pre Q1 & Q2), MR sequences (pre Q7), and glass art (pre Q8), reflecting baseline gaps. Post-workshop responses shifted toward "stimmt etwas/genau" (somewhat/strongly agree), with the strongest gains in interdisciplinary synergies (post Q4 & Q5), creative data use (post Q9 & Q10), and tool usage motivation (after Q1–Q3). Key results included MR Sequence Understanding (from 10% to 82% positive, large effect), Decision Process of Artists (from 10% to 77% positive, large effect), and Art as Science Enabler (pre Q9, post Q8: from 65% to 68% positive, marginal increase, over half of students assumed a positive art-science link, which remained stable). Anonymity prevented individual analysis, but aggregate gains validate low-barrier research tools like no-field/table-top low-field scanners and *gamma*STAR software for SciArt competence-building. Results highlight the value of hands-on glass phantoms, despite marginal gains in explicit art-science enabler perception. See also (pre-workshop questionnaire) and (post-workshop questionnaire) in the Supplementary Materials. These results suggest that the workshop was particularly effective in helping participants understand MRI sequence development and the decision-making processes behind artistic practice, while broader claims about art as a general enabler for science remained more stable because many students already entered the workshop with positive expectations. This pattern supports the argument that creative hands-on, co-created engagement can strengthen specific forms of technical and conceptual access even when broader attitudes change less dramatically.

Artwork Development

The artist's transdisciplinary background in art, engineering, and MR physics positioned the residency in Bremen as a unique opportunity to extend this journey through MRI. Traveling to the MR Lab with pre-existing glass sculptures and a kit of parts for potential MR phantoms, the artist hypothesised that waste glass contaminants would generate visible MR artifacts. Initial scans using *gammaSTAR*-developed sequences revealed no discernible MR signal from waste glass contamination. The artist rapidly adapted, assembling kit components with water to create glass-based MR phantoms where glass appeared as negative space (signal voids) against water-based positive signals. In sharing this adaptation with workshop participants through demonstrations, discussion, and subsequent sequence testing, the development of the phantoms and artworks became part of the co-creative learning process. These water-immersed MR phantom designs evolved across the two-week residency, achieving greater structural complexity and MR visibility. This adaptive process, from contamination hypothesis to negative-space realisation, demonstrates transdisciplinary method iteration characteristic of co-creative art-science practice. In support of the installation development (discussed below), the artist created more technically sophisticated glass phantoms, which also were MR-scanned at the institute in Bremen, Germany. The original pre-existing glass artworks also underwent complementary ultrasound and C-arm X-ray scanning, yielding limited but diagnostically useful images of internal structures. These multimodal datasets informed phantom refinement.

Note. For details of the glass objects scanned, MR sequences used, and the scan outcome of the scanning performed during the residency, see Table S1 (Initial Glass MR Scans) and Table S2 (Evolved MR Phantom MR Scans) in the Supplementary Materials.

Exhibition

The exhibition united glassmaking, scientific experimentation, and digital imaging into a reciprocal framework. Artistic form translated MR sequence logic, expanding the aesthetic and epistemological scope of magnetic resonance as a medium of inquiry. The refined artistic concept integrated the production of glass objects with video installations to explore magnetic resonance (MR) and the development of MR sequences through aesthetic form. This project interpreted scientific imaging processes as an experiential “journey through the glass”, translating phenomena such as interference patterns, Fourier transforms, and signal responses into physical and visual artworks. The exhibition's set up allowed visitors to follow the co-creative process during the workshop. The conceptual development of the exhibited works was shaped by the artist’s residency experiments, exchanges with MRI scientists, and insights gained from the student workshop, including how participants understood, questioned, and interacted with the phantoms and scanning processes. In this sense, the exhibition extends the project’s co-creative logic into a public setting.

Fig. 2. Artwork, *Resonance*, illuminated kiln cast glass and bioplastic. Copyright Chris Scott.

During the residency at the Institute in Bremen, the artist examined how MR imaging reveals internal structures and imperfections in glass objects. Glass functioned as both subject and metaphor: Its transparency, refraction, and structural irregularities paralleled the layered, reconstructive nature of MR imaging. Contaminants, veiling (i.e., delicate striations), and optical variations in glass mirrored noise, signal, and resolution properties in MR images, creating intersections between material and computational aesthetics.

Visitors to the final exhibition first encountered a video wall displaying animated titles and low-resolution conceptual visualisations video ("pixel wall"). The lower exhibition space presented two central glass objects: *Interference,* a vertical 140 ˣ 50 cm glass sculptural form that visualizes Fourier transform patterning, and *Resonance,* a hybrid glass and bioplastic object made using a 3D file of the no-field mini-MR scanners.

Visitors were able to trigger a simulated sequence on the glass object using a tablet. The object anchored a live MR scanning event, held jointly with school students from the workshop, streamed from the MR laboratory in in Bremen to the gallery in Edinburgh.

Fig. 3. Artwork, *Interference,* kiln cast glass and steel. Copyright Chris Scott.

Subsequently, interviews with the artists and a scientist in the venue space, and impressions of a recording of the interactive opening event was replayed in this space every 30 minutes during the following exhibition period (Digital Informatics, 2026). This exhibition design is also central to the paper's situated use of democratisation. It seeks to make aspects of MRI logic and image production accessible to festival audiences by encounter physical glass objects and videos of their scans with their MR representations and joining live scans or even control a sequence interacting with *Resonance*. The aim is to reduce opacity and invite participation to explore the topic. See also Video of the *Exterior of the exhibition,* Alliss (2026).

Fig. 4. At the opening: interactive talk, reception, and live-streamed MR scanning. Copyright Chris Scott.

The upper gallery space featured a glasswork titled *Lenses*, a set of 7 square glass lenses in a line, each 20 x 20 cm, installed against a large window with natural backlighting to evoke cross-sectional anatomy in medical imaging. Originating from the artist's prior body of work, *Lenses* was the first artwork to connect his worlds of art and medical physics. An additional glass-based object in that space, *Precession*, 186 x 10 x 15 cm, referenced the core physics concept behind MRI.

Fig. 5. Artworks, *Precession* (left); *Lenses* (right). Kiln cast glass and steel. Copyright Chris Scott.

The video installation consisted of seven projections onto screens along one whole side of the gallery space, plus one projection onto a screen at right-angles at the end of the space. Each screen displayed MR scans corresponding to plinth-mounted glass “Negatives”, made using the first and second visits in Bremen.

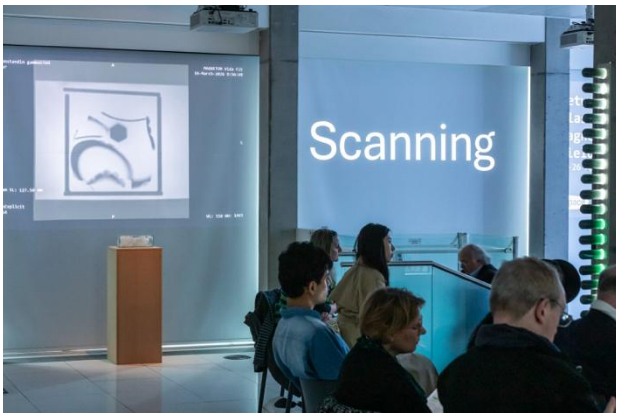

Fig 6. Artwork, *Negatives,* fabricated glass. Shown with MR scan of glass artwork. Copyright Chris Scott.

These 12 x 22 x 12 cm glass objects, *Negatives*, are fabricated from various types of glass some of which are water-jetted or cut to replicate veiling and interference patterns. The glass elements were used to create composite objects, immersed in water during scanning to create negative space and depth contrast. This method improved on the glass kit of parts phantoms produced and scanned during the residency.

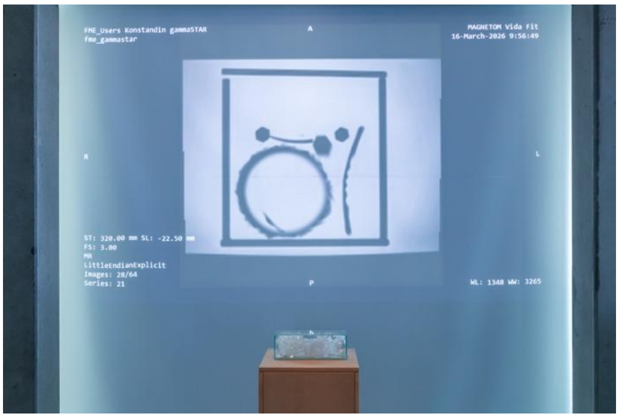

Fig 7. Artwork, *Negatives,* fabricated glass. Shown with MR scan of glass artwork. Copyright Chris Scott.

These new glass phantoms were more refined and technically sophisticated, achieving greater precision aligned with MR signal behaviour.

DISCUSSION AND CONCLUSIONS

Velasco and Nieto (2024) frame arts and sciences as entailing complementary yet distinct ways of knowing, each with its own approach to inquiry, material engagement, and meaning-making, and argue that their encounter forms a productive site of tension and creativity in art–science practice. They propose that art–science synthesis is not merely additive (science + art) but transformative, producing novel forms of inquiry, communication, and cultural meaning that invigorate both domains. In this sense, the workshop results demonstrate that artistic approaches—particularly (glass) art frameworks—enhanced non-experts’ access to STEM tools by fostering conceptual translation from abstract MR physics and data workflows to tangible experiences, thereby increasing MR sequence understanding and software readiness despite residual artistic uncertainty. This coupling of low-code MR tools with artistic inquiry appears to lower barriers to participation in complex domains and to advance transdisciplinary SciArt approaches. According to the teacher (Wicke, J. transcribed interview, 2025), students observed the artist’s working processes, interacted with him, and simultaneously witnessed how scientists invested time in acquiring and optimizing MR images, moving from a purely observational stance into an active role as they were gradually introduced to sequence programming and allowed to run their own sequences on the scanners. The teacher further emphasised the importance of connecting these experiences sustainably to the curriculum by enabling colleagues in biology and art to reference the workshop and cultivate interdisciplinary connections, particularly in units where MRI and CT (computer tomography) technologies are explicitly addressed within upper-secondary neuroscience and diagnostic imaging topics such as oncology. The residency results demonstrate glass art's capacity to operationalize MRI sequence logic through material metaphor. The material properties of glass and the artist's manipulation of the patterns and contamination within the art object allow it to embody complex abstract concepts, in this case, making the MR physics more tangible and accessible. During the residency, the artist's initial hypothesis—that waste glass contaminants would yield visible MR artifacts—gave way to the creation of water immersed phantoms in which glass appeared as negative space against the water signal, a shift that directly informed the development of the artworks *Resonance* and *Interference.* Using the "journey through glass" as a motivation for experimentation and discussion, the artist drew conceptual parallels between how MRI scans reveal internal structures and how light unveils the inside of a glass object through transmission and refraction. Workshop co-creation transformed the artist's initial waste glass contamination hypothesis into water-immersed negative-space phantoms, where signal voids directly visualised pulse/gradient interactions that students manipulated via *gammaSTAR*. This reciprocal process—novice questions ("invisible glass") prompting expert adaptation—informed resulting artworks: glass objects: *Resonance* mirrored no-field workshop simulations, while *Interference* addresses student-optimised Fourier patterning into vertical glass form. The terroir approach prioritised context-specific co-creation over scalable best practices, cultivating resonance through situated glass-art expertise (Achiam et al., 2025). Survey gains in sequence understanding validate this perceptual bridge: Glass striations and veiling paralleled noise/signal challenges, which participants encountered hands-on. Installation layout replicated workshop progression from simulation to clinical scanners, making abstract reconstruction perceptible, for public audiences. Large "glass art and artists' decision understanding" gains, but marginal "art as an enabler for experts' tools" indicates veiling metaphors require contextual mediation or hands-on glass-making experience beyond visual form or touching glass examples. Actual glass-making practice was absent, limiting hands-on equivalence. Teacher observation (Wicke, J. transcribed interview, 2025) confirms that students progressed from observers to programme controllers through witnessed iteration. This trust could extend further if students could have created glass art work beyond the presented unprocessed raw glass, pre-existing glass art works and glass phantoms were feasible, despite challenges with workshop tools and space requirements. Glass art succeeds as an enabler, making MR sequence development more accessible when embedded in co-witnessed processes; public installations, therefore, ideally require equivalent narrative framing, like labels, videos, or contextual panels, to achieve parity in comprehension. The residency, workshop, and exhibition can be understood as three connected moments within one co-creative process, and established the artistic journey that students followed from insights into glass making and conceptual thoughts of the artist, into scanner-based exploration: the residency generated the material and conceptual conditions for experimentation, the workshop provided the paper's main pedagogical and empirical focus, and the exhibition translated these insights into a public-facing form of engagement. Context-specific art–science co-creation can make complex imaging technologies more accessible through material, procedural, and aesthetic translation. This exemplifies the "terroir" of R&D engagement and shows, where it becomes useful: material (glass), technological (*gammaSTAR*) and data (MR imaging), as well as human (artist-scientist-student-teachers-producers) factors yielding contextually unique outcomes rather than universal methods (Achiam et al., 2025). Note: Teacher interview transcript available in the Supplementary Materials (Transcript Interview JanWicke 19.12.25).

Fig. 8, 9. A version of *Resonance* in the making (left). Alliss with *Interference* in the making (right). Kiln cast glass (both). Copyright Bianka Hofmann and Gregory Alliss.

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- Fraunhofer MEVIS. (2024, April 4). *MRI measurements on a desk: Fraunhofer MEVIS aims to utilize compact MRI devices for research and education*, at the Institute for Design Informatics (IDI), University of Edinburgh
- Fraunhofer MEVIS. (2025, January 20–21). *Workshop on the basics of MR physics and MR sequence development with gammaSTAR,* at the Institute, in collaboration with the University of Bremen
- Fraunhofer MEVIS (2025, May 27-29). *Magnetic Resonance Imaging: A Hands-on Course of Core Concepts, Protocol and Sequence Design,* at the University of Auckland, New Zealand

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STATEMENT ABOUT AI TOOLS USAGE

This manuscript received language-editing assistance from Perplexity AI (free version, December 2025) to improve clarity and style. All analysis, interpretations, and factual claims are the authors' own and are based on independently verified sources.

CONFLICTS OF INTEREST

BH is affiliated with the Fraunhofer Institute for Digital Medicine MEVIS, a non-profit research organisation where the gammaSTAR platform described in this article was developed. GA declares no competing interests. Neither author derives any personal or financial benefit from this publication.

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