



International Fraunhofer Talent School Bremen: STEAM Imaging VI Resonant Connections through Design and Data

17./18. November 2025

Day 1:

Ways to make glass visible: A multisensory simulation space for MR sequence development

09:30 – 10:00		Welcome & Evaluation	
10:00 – 11:00 two groups	Station 1a Gregory works with glass because it presents a challenging puzzle of making and invites viewers to look into the material rather than merely through it. Today's purpose is to explore glass art and MRI sequence design in order to help Gregory develop ideas and objects for an artwork to be shown at the 2026 Edinburgh Science Festival. The exhibition will integrate glass sculptures, representations of digital medicine (MRI sequences), and immersive installations, using the unique transparency and depth of glass to reveal what lies beyond its surface.	Station 1b MRI (Magnetic Resonance Imaging) is a method for visualizing the inside of objects, most often the human body, using magnetism, radio waves, and physics principles. At this station, participants learn how MRI can offer Gregory a new way of looking at glass in a new way by understanding the underlying mechanisms. The session introduces the basics: what MRI is, what the name means, and how an MRI scanner creates images. Through hands-on demonstrations, participants explore magnetism, spin motion, and electric currents, and how these interconnected phenomena (described by Maxwell's equations) enable MRI to transform fundamental physics into real images.	material properties, puzzle solving, visual aesthetics, making process, MRI, spins, magnet, experiments
11:00 – 11:15		Break	
11:15 – 11:30 entire group	Station 2 Introduces the basic science behind MRI, exploring how it allows us to make objects visible. Participants explore the dynamics of magnetization in a strong magnetic field and how these dynamics generate measurable signals. Key concepts, such as excitation, precession, coordinate transformation, and relaxation, are visualized to make the principles of magnetic resonance imaging accessible and understandable, connecting physics to the creation of images.		acrosopic magnetization, relaxation, T1, T2
11:30 – 12:30 two groups	Station 3a Introduces a portable, 3D-printed no-field MRI scanner combined with the gammaSTAR software, making MRI technology and sequence programming tangible and experiential. Participants explore MR sequences, the "recipes" that control radiofrequency pulses, magnetic field gradients, and timing to generate images, and see how these sequences drive specific hardware components. LEDs, sounds, and color-coded visualizations make the sequences multisensory, showing both the timing and effects of RF pulses and gradient switching.	Station 3b Introduces a portable, 3D-printed no-field MRI scanner combined with the gammaSTAR software, making MRI technology and sequence programming tangible and experiential. Participants explore MR sequences, the "recipes" that control radiofrequency pulses, magnetic field gradients, and timing to generate images and see how these sequences drive specific hardware components. LEDs, sounds, and color-coded visualizations make the sequences multisensory, showing both the timing and effects of RF pulses and gradient switching.	MR sequence programming, creating image contrast, no-field MRI, gammaSTAR, simulated MR images, hear and see how an MRI machine works, multisensory learning, LEDs and sound feedback, experiential learning
12:30 – 13:00		Lunch Break	

13:00 - 14:00 entire group	Station 4: Testing Configurations 1/2: The station focuses on exploring how to look inside glass using low-field MRI scanners and gammaSTAR sequence programming. Participants probe glass objects with and without water, observing how MRI signals vary and learning that not all MRI systems behave the same.	
14:00 – 15:00 work in small groups	Hands on Testing Configurations 2/2 Participants explore how to look inside glass by controlling and experimenting with their own MR sequences. They try different sequences and observe how changes in parameters, such as TR, resolution, and flip angle dramatically affect image contrast. Exercises include selecting sequences and parameters that would make the artist, Greg, satisfied, and testing them on a 3T MRI system. For example, adjusting the flip angle in a FLASH sequence can make CSF, and NaCl solutions appear bright, while the default setting would render CSF dark. Participants learn how physical properties like T1 relaxation times interact with sequence settings, and how careful tuning of parameters is essential for producing meaningful images.	MR sequences, RARE, FLASH, Ernst angle, control your own MR sequence protocol
15:00 - 15:45	Break and Wrap Up	



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Day 2:

Hands-On with the MRI: exploring MR sequences, scanning glass objects, and revealing the invisible.

09:30 – 10:00	Welcome	
10:30 - 10:45	Participants present their own MR sequence ideas	presentation
10:45 - 12:45 two groups	Group 1 - at the MRI Lab This session gives participants a hands-on experience applying their learned skills to explore glass using MRI. The session introduces the “inverted problem,” showing that even negative or unusual images are valid artistic viewpoints. Participants explore the MR lab, experience the clinical scanner environment, and experiment with metals to see how materials interact with magnetic fields. They learn about phantoms, MR sequences, and protocol parameters, and how adjustments at the console affect image contrast. Activities include scanning test subjects, Gregory’s glass phantoms, and testing their own ideas while discussing results with Greg. Participants discover how MRI can reveal normally invisible structures, like the skull or glass objects made visible with water.	3T MRI Machine, MRI Laboratory, subject scanning, creating Art with MRI
	Group 2 - At the Institute Record Keeping and Sketch Books highlights the importance of documenting experiments, comparing it to an artist’s sketchbook as a journal of what has been done. The group engages in low-field MRI measurements of various probes, such as onion slices, chili, and plant parts. Participants collect and document data, experiment with different sequences and parameters, and observe how these choices affect image quality. The session emphasizes creating a standardized method for recording results, tracking what works best, and discussing a school database to store and share all measurement outcomes.	data collection, standardized low-field experiments for school students’ use
13:00 – 13:30	Lunch Break	
13:30 - 15:30	Group 1 - at the Institute Group 2 - at the MRI Lab	
15:30 - 16:00 At the Institute	Wrap Up & Evaluation	

STEAM Imaging VI, hosted by Fraunhofer MEVIS, Germany, in collaboration with the Institute for Design Informatics, University of Edinburgh, United Kingdom, creates a unique opportunity to explore the potential for application of creative multi- and transdisciplinary approaches in digital medicine. The collaboration involves the International Fraunhofer Talent School Bremen, and the Oberschule am Waller Ring in Bremen, and is supported by Ars Electronica, Austria.