LUND UNIVERSITY

Humanities Lab

JOINT FACULTIES OF HUMANITIES AND THEOLOGY

Annual Report 2021–2022

cover picture: 3D reconstruction of Vadstena church (Lindgren)

The Director's welcome

Welcome to the Annual Report of Lund University Humanities Lab for 2021–2022. The Lab is a department for research infrastructure at Lund University open to researchers, teachers, and students across Lund University and beyond. We host technology, methodological know-how, data management and archiving expertise. Lab activities evolve around issues of culture, communication, and cognition – traditional domains of the Humanities – but many projects are also interdisciplinary and conducted in collaboration with the Social sciences, Medicine, the Natural sciences, Engineering, and e-Science. The Lab enables researchers to combine traditional and novel methods, and to interact with other disciplines. We provide training in hosted technologies and related methods through courses and tutorials, seminar series, and demo sessions. We are also an arena for contact and collaboration between academia and stakeholders in education, industry, health, and cultural institutions, and we act locally, nationally, and internationally.

Although the Lab years 2021–2022 were still affected by the Covid-19 pandemic, Lab activities still flourished, as this Annual Report will highlight. New users and projects found the Lab, and continued their research activities and creative work. The Lab offered courses, tutorials, consultations, and seminars online. In 2021 two Lab members recieved an IgNobel Prize, putting the Lab on the global map. This year also saw staff changes. Our Deputy director, Victoria Johansson, left us to take up a new exciting position after more than three years in the Lab. Victoria has been a fantastic colleague, handling all tasks with professionalism and creativity. The Lab wishes her all the best – her new colleagues are very lucky. But so is the Lab in having found a new Deputy director in Frida Splendido. She brings new skills and perspectives to the Lab and has already become an invaluable Lab member.

Other big developments in 2021 included the grant awarded by the Swedish Research Council to lead Huminfra, a national research infrastructure for the Humanities coordinating 12 units across the country. Activities in 2022 focused on setting up Huminfra, including recruiting new Lab members. The Lab was also part of two other successful national research infrastructures, INFRAVIS, dedicated to scientific visualization, and SweDigArch, dedicated to digital archeology. In 2022 the Lab was further awarded a competitive infrastructural grant from Lund University for which we are very grateful. This allowed an upgrade and re-instrumentation of facilities. A previous grant allowed us to recruit a second expert in language technology (so-called Natural Language Processing), just before CHAT-GPT became available to everyone.

This Annual Report 2021–2022 showcases a *selection* of Lab activities in 2021-22, highlighting that the Humanities Lab remains a dynamic and exciting environment where researchers can tackle scientific challenges across a range of disciplines. Welcome to taste the Lab smorgasbord.

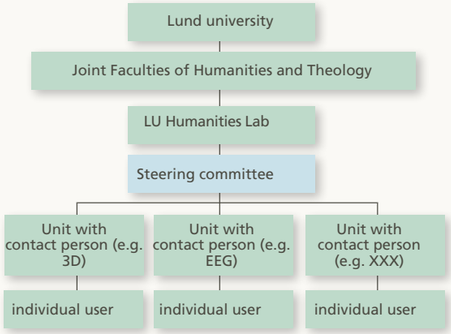
Marianne Gullberg, Director

The Dean's introduction

Since its inception in 2007, Lund University Humanities Lab has served as a resource for scholars in the fields of Humanities and Theology, encouraging them to explore new approaches and diversify their research. Today, the Lab is a vital resource for many disciplines, providing essential expertise and tools for measurements, digital technology, AI, mixed methods, and fostering and enabling interdisciplinary collaborations. In an era of rapid technological advancement, where issues such as deep fakes and CHATGPT are becoming increasingly prevalent, the skill sets and tools provided by the Humanities Lab have become ever more important to our researchers. As a leading research and training facility with users from most faculties, the Humanities Lab has become an important part of Lund University's infrastructure. In recognition of its impact, the Humanities Lab was selected to lead a Swedish national research infrastructure for the Humanities, Huminfra, in 2022. This development highlights the Lab's role and potential to lead the way in innovative research projects across the country. Collaborations between researchers from around the world are also facilitated through the Lab, further enhancing its global reach and impact. The Humanities Lab has become a vital hub for interdisciplinary research, providing a productive and collaborative environment for scholars and students alike. The Joint Faculties of Humanities and Theology are pleased to host this dynamic and innovative unit.

Johannes Persson, Dean of the Joint Faculties of Humanities and Theology

Organisation



The Humanities Lab is a university wide research infrastructure, within the Joint Faculties of Humanities and Theology. It is led by the Director, who is also the Chairman of the Steering committee.

Organisationally, research in the Lab is of two kinds. Most research in the Lab is conducted by scholars whose research grants and groups are located in their home departments. These scholars come to the Lab to conduct their empirical studies using Lab equipment and resources, and then return to their home departments. The Lab also hosts its own externally funded research projects focusing on infrastructure, as well as national infrastructures.

Steering committee 2021–2022

DIRECTOR MARIANNE GULLBERG

Marianne Gullberg is professor of Psycholinguistics at the Centre for Languages and Literature. Her fields of expertise include adult second language acquisition, bilingual acquisition and processing, and gesture production and comprehension in acquisition. Her current research targets multimodal bilingual language processing, the earliest stages of implicit language learning, bimodal discourse cohesion, and method development for studying input in second language acquisition. She leads the research platform Language Acquisition, Multilingualism and Teaching (LAMiNATE; w. J. Granfeldt), is deputy coordinator of the profile area Natural and Artificial Cognition (w. K. Åström), and Director of the national research infrastructure Huminfra. She is a Wallenberg Scholar.

DEPUTY DIRECTOR (2021) VICTORIA JOHANSSON

Victoria Johansson is senior lecturer in General Linguistics and her research focuses on language development through the lifespan, on linguistic processes in general, with special interest in cognitive aspects of writing. A particular focus is the process behind a written text. She has been involved in the development of research methods for investigating the writing process, for instance the keystroke logging program ScriptLog, also combined with eye-tracking.

DEPUTY DIRECTOR (2022) FRIDA SPLENDIDO

Frida Splendido is senior lecturer of Swedish as a Second Language at the Centre for Languages and Literature. Their research focuses on phonetics and phonology in second language acquisition and simultaneous bilingualism, with a special focus on the early stages of acquisition. They also have an interest in the teaching of pronunciation.

RESEARCH ENGINEER STEFAN LINDGREN

Stefan Lindgren is a research engineer in the Lab with special responsibility for technology and procurement. His particular expertise lies in 3D data, motion capture, and Virtual Reality. In this, he works closely with archaeologists and historians, but also cognitive scientists, and linguists.

ADMIN. COORDINATOR MAJA PETERSSON

Maja Petersson is administrative coordinator in the Lab. She is responsible for monitoring action plans, policy, and procedure to optimise project management in the Lab. She is also responsible for communicating about the Lab internally and externally.

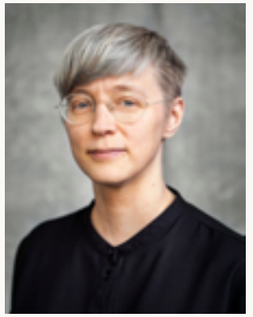
Words from the Deputy Directors 2021 and 2022

VICTORIA JOHANSSON (2021)

It is with fond memories and a rucksack full of great experiences that I leave my position as Deputy Director of the Lab after 3.5 years. During this time I have met many enthusiastic new users, had the privilege of learning about their ideas and directing them to the right facilities and people in the Lab. I've also had the pleasure and pride of presenting all the projects, large and small, new and traditional designs and more or less crazy research ideas during Lab demonstrations and tours as well as in the Annual report. In this capacity I have met internal and external visitors from universities and schools, public and private funders, and representatives from a wide range of institutions and organisations. I would like to sincerely thank all the users, visitors and not least the Lab staff for all the exciting events over the years and for the multifaceted insights into all aspects and stages of research. I leave this position as an enthusiastic ambassador for the Lab.

FRIDA SPLENDIDO (2022)

I was delighted to assume the position of Deputy Director. Having previously served as an educational developer in the Lab, I already knew what a unique place it is. Its dynamism and vitality are stimulating in ways that offer constant learning and growth.
Rejoining the team in this new capacity lets me see the Lab from a fresh and slightly different perspective, closer to our users and their projects. I meet with new and returning users through the project application process and showcase their projects through presentations and tours of the Lab. I also work to find ways to expand our reach to prospective users. Going forward, I am eager to explore opportunities for connecting my role in the Lab to my ambitions as a teacher trainer. More specifically, I hope to expand the Lab's user base to researchers in the Educational sciences and to students doing their degree projects.



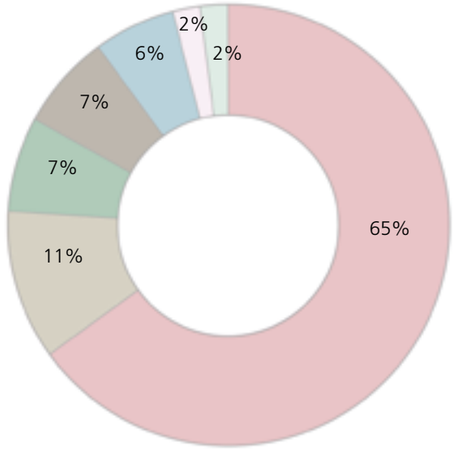
Brief facts 2021–2022

NEW PROJECTS	70
ACTIVE PROJECTS	137
CONSULTATIONS	222
DEMOS	44
OFFERED GROUP TUTORIALS	44
PHD LEVEL COURSES	11
LAB AREA M2	530

500
Lab users

28
Employees

4000
views on youtube



USERS' AFFILIATION BY FACULTY IN 2021–2022 (%)

- Joint Faculties of Humanities and Theology
- Faculty of Social Sciences
- National & international universities, private sector
- Faculty of Medicine
- Faculty of Engineering
- Faculty of Science
- Faculty of Fine and Performing Arts

The IG Nobel Prize 2021

At the 31st annual IG Nobel Prize ceremony in 2021, Lab member Susanne Schötz accepted the Ig Nobel Prize in Biology on behalf of herself, fellow Lab member Joost van de Weijer, and Robert Eklund, Linköping University. The group received the prize for their work on cat vocalisations and how humans perceive them; *for analyzing variations in purring, chirping, chattering, trilling, tweedling, murmuring, meowing, moaning, squeaking, hissing, yowling, howling, growling, and other modes of cat–human communication.*

Research

This section presents a selection of the research activities in the Humanities Lab in 2021–2022, years partly still characterised by Covid-19 and difficult conditions for experimental work. It aims to give a flavour of the scope, breadth, and interdisciplinarity of the work done in the Lab. It also highlights that research thrived despite the challenges imposed by the pandemic.

EYE-TRACKING

The Humanities Lab is equipped with several state-of-the-art eye-trackers, suitable for a wide range of experiments. An important section of the Lab's eye-tracking facilities is the digital classroom which offers the unique possibility of simultaneous recordings of eye movements of up to 16 people.

Technical upgrading continued in 2021-22. Drawing on generous continued support from the LMK Foundation, the Lab upgraded the eye-trackers in the digital classroom in 2021. Over the course of 2021 and 2022, several other upgrades were made. In the digital classroom, new chinrests (Tobii) were added, and a new server was installed to facilitate tight temporal synchronization of the experiment stations. Moreover, an invisible wearable eye-tracker was added (Pupil Labs). New, faster cameras, lenses and a frame grabber were added to the FLEX system, an (in-house-built) eye-tracker. These additions will allow for even more detailed recordings. Lab members Niehorster and M. Nyström also developed the *Titta* toolbox, used for combining Tobii eye-trackers with MatLab and Python software for data analysis. The toolbox now also provides information about how open the eyes are, in addition to data on gaze location and pupil size. Niehorster and M. Nyström also collaborated with Utrecht University (Hooge, Hessels, Benjamins) to develop a software tool for automatic determination of data quality (accuracy and precision) of wearable eye-tracker recordings.

In 2021–2022 eye-tracking was used in a range of research projects across different disciplines, in national and international collaborations. The technology was used to investigate how readers handle so-called filter bubbles in google searches (see highlight; Philosophy; E. Olsson, Ekström, Niehorster). A new doctoral project in Computer science started in 2021. The project examines the use of gaze and other sensor data to develop smarter adaptive software development tools (Peang Kuang, Söderberg, Höst, Niehorster). Another doctoral project was completed in 2021 in a collaboration between the Lab, Biomedical engineering and Clinical sciences (Rosengren, Stridh, Hammar, M. Nyström). The project improved analysis tools for the diagnosis of nystagmus, a condition in which the eyes make repetitive, uncontrolled movements, leading to reduced vision with additional effects on balance and coordination.

Several projects focused on experts' gaze and eye movements compared to those of novices. One such project looked at the so-called 'quiet eye' effect, whereby experts look longer at a target than novices just before acting in a computerized task. The research particularly focused on the eye–mouse coordination in e-sport (Dahl, M. Nyström). Another project involving researchers from Lund,

Cambridge University and Blekinge Institute of Technology explored how expert programmers experience code review. The results suggest that misalignments in the code have a negative impact on the efficiency of the review tasks (Söderberg, Church, Börstler, Niehorster, Rydenfäldt). Finally, a new doctoral project, based at the Royal College of Music in Stockholm, will investigate the relationship between eye movements, music perception and expertise (Timoshenko, Huovinen, M. Nyström).

Another series of projects focus on eye movements and memory. A collaboration between Psychology, Humanities Lab and Pupil Labs found that eye movements support episodic remembering. Replaying the scan path from when a memory was encoded helps to assemble spatio-temporal relations of the memory (R. Johansson, M. Nyström, Dewhurst, M. Johansson). A new student project in Psychology builds on these findings and explores whether differences in gaze patterns during scene encoding and scene recognition combined with differences in memory performance could be predictive of memory decline (Dilmaç). Another student project studied the pupil signal to investigate the influence of contextual information on remembering (Egan).

A new project will investigate language processing using eye-tracking with a particular focus on grammatical challenges comparing children with developmental language delay and children with Swedish as a second language (Reuterskiöld, Linköping University, M. Nyström).

Several collaborations include researchers from medical faculties both locally and beyond. A project with the Medical Faculty at Lund University and Western Norway University of Applied Sciences explores how auditory and visual noise improve cognitive performance in children

User projects

SELF-IMPOSED FILTER BUBBLES

In 2021 Ekström, Niehorster and Olsson explored how so-called filter bubbles develop. More specifically, the team examined whether filter bubbles are the result of the algorithm curating users' search results, or the consequence of individuals engaging selectively with the list of links in search engine results pages. Using eye-tracking and link selection data, the project found that participants looked longer at the links that supported their own views. In other words, filter bubbles appear to develop through users' activity rather than be imposed by the algorithms.

NOISE AND ATTENTION IN ADHD

In an ongoing project, Söderlund, Gustafsson, Nyström, and colleagues develop existing research indicating that noise can be beneficial for cognitive performance in children with ADHD. This project investigates how auditive and visual noise affect these children's performance in verbal and non-verbal memory tasks. The project is a collaboration between researchers at LU (the Humanities Lab and the Faculty of Medicine) and the Western Norway University of Applied sciences (Special education).

Collaboration

EXPERIMENTAL PSYCHOLOGY UTRECHT UNIVERSITY – LUND UNIVERSITY HUMANITIES LAB

During the past 11 years a group of researchers from Lund University and Utrecht University have collaborated and published over 25 articles together. The two groups also organise two annual eye-tracking courses (one in Lund and one in Utrecht) for professionals from the academic, non-profit and commercial sector.

The Utrecht-Lund collaboration started in 2012 when Ignace Hooge came to Lund University Humanities Lab for a ten-week visit. Ignace has visited Lund every year since then. Due to covid-19, the visit of 2021 was virtual. The Humanities Lab is the perfect place for researchers who are interested in Experimental psychology, Cognitive science, Applied topics, basic oculomotor research and eye-tracking methodology. Marcus Nyström has been the host of this collaboration since 2017. Over the years, many colleagues from Utrecht have joined Ignace Hooge in Lund and co-authored articles.

with ADHD (see highlight; M. Nyström, Gustafsson, Söderlund, p 10). In another collaboration between the Faculty of Engineering and Karolinska Institutet, researchers are working to develop new recommendations for widescreen computer monitors (M. Nyström, Hämphälä, Arvidsson, Dahlqvist, Glimne). A student project at the Department of Biomedical Engineering, co-supervised by Lab members (M. Nyström, Stridh), investigated eye diagnostics using virtual reality (Rahne, Eriksson). Nyström and Niehorster have a long-standing collaboration with the Vestibular Lab at the Skåne University Hospital where they develop a system for video head impulse testing, vHIT (M. Nyström, Niehorster, Fransson, Magnusson, A. Nyström, Tjernström).

Other collaborations included a project with The Swedish National Road and Transport Research Institute (VTI), Linköping Driving, where eye-tracking was used to investigate what drivers look at, and what is relevant in the surrounding environment (M. Nyström, Ahlström, Kircher, Wolfe). A collaboration with LU Design Sciences and LU School of Aviation designed and evaluated three user interfaces for detecting unmanned aerial vehicles (Alce, Alm, Tyllström, Smoker, Niehorster). A collaboration with Malmö University, University College West and Husqvarna AB explored how augmented reality can be used with boardgames to develop a situation awareness and attention guidance system in a multiplayer environment (Kadish, Sarkheyli-Hägele, Font Hägele, Niehorster, Pederson). A continued collaboration with Malmö University investigated tourism, advertising and racisim in Sweden and abroad (Osanami Törngren, M. Nyström).

In 2021 and 2022 the eye-tracking facility was used in several methodological projects where Lab members collaborated internationally to improve methodological robustness, data quality and reporting standards. Lab members co-authored a paper together with 47 other authors which reviewed empirical work on factors affecting the quality of eye-tracking data with a minimal flexible reporting guideline (Niehorster, M. Nyström). In collaboration with Utrecht University, Lab members also published a study about the robustness of wearable eye-trackers during slow and fast body and head movements (Hooge, Niehorster, Hessels, Benjamins, M. Nyström). In another collaboration with Utrecht University and Tobii Pro AB, Lab members published a study revealing the impact post-processing has on the output of fixation classification algorithms. Although these are given little attention in the literature, they play an important role in classifying eye-movement data into meaningful episodes (Hooge, Niehorster, Hessels, Andersson, M. Nyström). The same team published a study showing that the amplitude of small eye movements can be accurately estimated with video-based eye-trackers. In a third project, the team explored the pupil size artifact. Results showed that, for a significant part, it is dependent on the geometry of the setup, that is, the distance and the angle of the camera in relationship to the eye. Finally, a collaboration with researchers at the University of Münster in Germany investigated the latency of eye-trackers in several head worn displays (Stein, Niehorster, Watson, Steinecke, Rifai, Wahl, Lappe).

Local and national engagement include supervision of doctoral students who use eye-tracking in their PhD projects in fields such as Computer science (Niehorster), child and adolescent Psychiatry (M. Nyström), Music pedagogy (M. Nyström) and Archeology (Niehorster).

National and international engagement in the field also included participation in conferences such as the European Conference on Eye Movements (ECEM), where Lab members presented posters and talks (Niehorster, Nyström), and Eye Tracking Research & Applications (ETRA) where M. Nyström acted as a panel member during the ActiveEye Workshop discussing the future of mobile eye-tracking. Lab members were also invited to speak at seminars at international universities such as Rijksuniversiteit Groningen (the Netherlands) and University of Copenhagen (Denmark) (M. Nyström).

BIOPAC

The BioPac system measures a person's psycho-physiological reactions to events in the surroundings such as loud sounds or visual input. The current system consists of a galvanic skin response unit, a respiratory unit, and a heart rate variability unit. In 2021 an airflow transducer was added to the system through a grant from the Lund University Sound-Environment Center (Edgerton, van de Weijer). This new addition to the system will be used in 2023 in a new doctoral project at the Malmö Academy of Music that will investigate the physical mechanisms in experimental singing (Busoni, Edgerton).

In 2021–22 the BioPac was used for an MA project in Psychology in which social fear and general fear were studied to further understand social anxiety (Turner, Kekecs, van de Weijer). In this study, skin conductance and heart rate variability were measured while participants watched video clips. The study was methodologically innovative as previous studies mostly use words or pictures as stimuli.

In 2022, the BioPac system was moved to a new location at SOL which has allowed for a more stable setup and ensures that there are no interferences with the EEG facilities.

MRI

Lund University Bioimaging Center (LBIC) hosts state-of-the-art MRI facilities to study brain anatomy and brain function. In 2021 the Lab's MRI liaison officer (Mårtensson) continued to forge stronger links between the Lab and LBIC. Research with MRI connected to the Lab consisted of projects involving the neural underpinnings of perceived language anxiety in foreign language students (Abendroth, Mårtensson), brain activity in highly suggestible individuals under hypnosis (Lindström, Cardeña) as well as two projects on how embodied learning

affects the brain (using Mocap and MRI; Mårtensson, Haake, Rumetshofer & Nilsson). New projects on the neural underpinnings of differences in the perception of self (Lindström, Cardeña) and choice blindness (P. Johansson, Vogel, Mårtensson) were also initiated. Another new project used functional and structural MRI to explore different aspects of the ego and self experience (Cardeña, Lindström, Mårtensson).

ELECTROPHYSIOLOGY

Electrophysiological measurements of brain activity (EEG, ERPs) were used in several projects during 2021–2022 despite the semi-lockdown. In two continuing projects, EEG was used to explore the influence of the first language in the acquisition of a new, artificial tone language, comparing the effect of a first language with or without tone. Both studies found benefits for the learners whose first language uses tone (Gosselke Berthelsen, Horne, Shtyrov, Roll). Another project investigated how and how quickly second language learners can use Swedish word accent to predict word endings in the same way as native speakers (Novén, Roll, Horne, Hed, Schremm). Further, a MA project using ERPs explored within-word prediction in Danish (Hjortdal, Frid, Roll). Finally, two Ph.D. dissertations drawing on ERPs acquired in the Lab were completed in 2021 (Gosselke, Berthelsen, 2021; Novén, 2021).

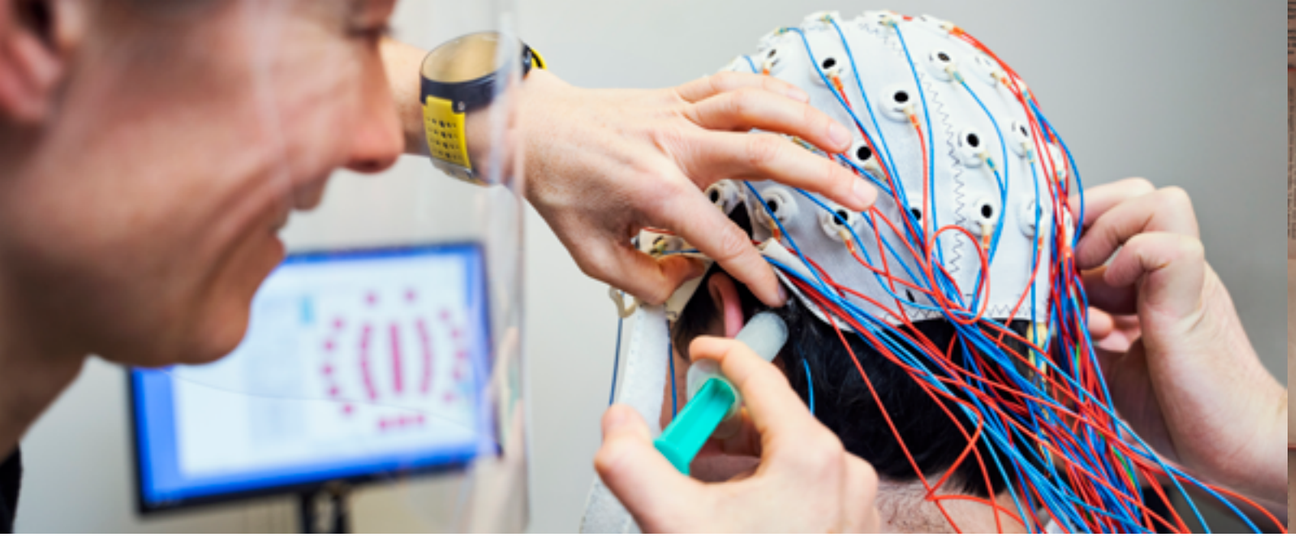
A continuing project using ERPs studied how Swedish speakers process quantified expressions such as *några studenter* 'some students' vs. *få studenter* 'few students' in a sentence like 'some/few students were studying hard' (Heinat, Klingvall). The project examines when during comprehension the meaning of 'some/few' is formed - on the noun ('students') or on the predicate ('were studying'). ERPs can shed light on that precise

User project

RIKSTEATERN COLLABORATION

In a method pilot, the Lab's Mocap/3D team made an avatar that is precise enough to capture sign language. This project is a collaboration between the Lab and *Riksteatern Crea* (Sweden's National Touring Theatre), which is the group for dramatic art in Swedish Sign Language. This pilot combined three different mocap systems, all capturing different parts of the body: (i) our general mocap system capturing the main body (torso, head, legs and arms), (ii) stretchsense gloves capturing the movement of the hands and fingers, and (iii) a mobile phone system capturing the face (where many grammatical features are signaled). The data from the three systems were synchronously mapped onto a 3D avatar, thus creating a live 3D rendering of the speaker producing fully comprehensible sign language. This project was the first step towards further methodological development for a stage production.

Photo: Magnus Göthlund



timing. Another study by the group investigated how expressions with and without quantifiers influence discourse and semantic processing.

When the Lab reopened, several student projects started, mostly examining different topics in linguistics such as the processing of subregularities in Greek morphology (D. Johansson), how Mandarin listeners deal with Scanian words in perception (Cui), and the predictive processing of Swedish word accents (Kwon). Another new student project explores the effect of listeners' mood on the processing of affective words (Kopaeva).

TEXT-LANGUAGE RESOURCES, SWE-CLARIN

Most scholars in the Humanities and Social sciences work on and with text in various formats, but interest in the use of computer-based tools for text analyses is growing very quickly beyond these disciplines. For example, there is substantial interest in OCR technology to enable the search and tagging of scanned texts, and in sophisticated tools for searching, processing, and analysing texts, or for creating corpora (structured and annotated collections of materials). The advent of CHAT-GPT at the end of 2022 has further boosted the interest in text and speech technology.

LU Humanities Lab is a member of the Swedish national consortium for language resources and technology, *Nationella Språkbanken & Swe-Clarin*. This national e-science consortium, funded by the Swedish Research Council until 2024, is itself a part of the *European Research and Infrastructure Consortium Common Language Resources and Technology Infrastructure* (ERIC CLARIN). CLARIN provides access to (contemporary and historical) language- and-text-based material, and to tools for exploring and investigating such data. Since 2020 the Lab is a C-centre, a CLARIN Metadata Providing Centre, which provides so-called CMDI metadata (Component MetaData Infrastructure) via the Archive server to CLARIN's Virtual Language Observatory (VLO).

The Humanities Lab is also a certified CLARIN K-centre (Knowledge Centre) specialising in multimodal and sensor-based language data, and serving researchers and educators with both advice and practical implementations of things such as: defining an object of study, means to extract and store information, learning or training activities, including in data-driven analysis methods. K-centres are regularly reviewed and re-certified by CLARIN's Knowledge Infrastructure Committee. The Lab underwent this procedure and was re-certified in 2021. During the process the K-centre was renamed to better reflect its activities. The new name is *CLARIN Knowledge Centre for Multimodal and Sensor-based Data* (CLARIN-MULTISENS).

The Lab supports and collaborates with many projects guided by the local coordinator (Frid). In 2021–2022 Swe-Clarin resources were involved in several ongoing projects providing data analysis and visualisation expertise. This includes continuing projects, such as PROGEST (the Royal Institute of Technology; House, Frid) which investigates the interaction of verbal and visual prosody. This project uses articulography, motion capture and acoustics to investigate the relationship between head movements, articulation and prosody, such as the synchronisation of head movements and prosodic boundaries. In 2021 a web-based environment for performing perception experiments with audiovisual stimuli was developed.

Work also continued on the RWAAI project, *Repository and Workspace for Austroasiatic Intangible Heritage* (Linguistics; Burenhult, Kruspe, Frid, Ravn, J. Larsson). RWAAI is a multimedia resource committed to the preservation of collections documenting the languages and cultures from the Austroasiatic language family of Mainland Southeast Asia and India. Swe-Clarin resources were used for developing tools for phonetic alignment and Automatic Speech Recognition (ASR) for the Aslian language family, a very challenging task. The tools use

deep learning technology in the form of Wav2vec2, which is a resource trained on a vast amount of speech material that is then fine-tuned on a specific language material. Moreover, the Archive server's new CMDI metadata standard played an important part in the RWAAI's geospatial initiative. It enabled a selection of data sets to be 'geo-tagged', which was in turn used as input to automatise the building of language maps to showcase how public (meta)data can be utilised to convey the importance of 'place' in language documentation. For example, data showing where in the landscape handwritten field notes were taken in the 1960's were presented at the International Conference on Language Documentation and Conservation. The Lab (J. Larsson) was also involved in the continuing efforts to document and archive remaining collections from the Nicobars (S.J. Singh, University of Waterloo, Canada), and Semelai language data (R. Gianno).

Another continuing project is the Swe-Clarin group Benchmarking Swedish Named-Entity Recognition and Classification (Swedish NERC) which brings together Swe-Clarin nodes at Lund, Gothenburg and Linköping. The group aims to develop a tool for finding and replacing Swedish names in written materials in order to anonymise (or 'pseudonymise') them. The project has worked on a contents report and on preparing the dataset for release.

In a new project, AUDEA, researchers from Cognitive science, Psychology and the Lab work with The National Agency for Special Needs Education and Schools to improve the production of audio description, that is, spoken descriptions of visual input intended for the blind. The project works specifically on information videos from authorities and government. During its initial phases, the project has used Swe-Clarin resources to develop a prototype for a web-based training tool where users can learn how to produce audio descriptions adapted to the target audience (Holsanova, Johansson, Frid).

The CHRONOS project (Linguistics; Carling) sought to explore how ancestral stages of language families can be dated. The Lab provided assistance with data analysis and visualisation (Dellert, Erben Johansson, Frid, Carling).

In a new collaboration with the Swedish Migration Agency, the Lab (Frid) is working to investigate whether speakers' first languages can be identified using machine learning based on audio samples. Initial studies have successfully replicated current state-of-the-art results of ~80% correct identification for a language sample consisting of 45 different languages using so-called transformer models.

The Lab also collaborated with the research platform Digital History@Lund (Bechmann Pedersen, Cronqvist, Snickars, Weber, cf. p 37) which uses language technology to probe historically relevant materials. One such example is the project "Presenting Parliament," that explored parliamentarians' attitudes towards the mediatisation of their proceedings over 150 years. The Lab affiliate M. Johansson participated in developing a new corpus linguistic method, 'structural collocation analysis', that targets collocations in subsets of a corpus (e.g. the utterances of a given speaker) rather than in the corpus as a whole (van Waarden, M. Johansson). Another subproject developed a computer vision-based tool to identify sections with information about successions, typically presented in tables, in estate inventories from the 18th to the 20th century (Dackling, M. Johansson).

In 2022 many projects started to use the recently developed and successful 'transformers' methods (particularly the Huggingface library) for machine learning both for text and speech data. These make heavy use of High-Performance Computing facilities, particularly Graphic Processing Units (a specialised processing unit that performs parallel computations on large datasets). To access such facilities (scarcely available locally), a collaboration was developed with the Alvis facility at Chalmers through the Swedish National Infrastructure for Computing (SNIC, as of 2023 National Academic Infrastructure for Supercomputing in Sweden, NAISS).

DATA MANAGEMENT AND ARCHIVE SERVER

Corpora are structured and often annotated collections of (mostly language) materials. The Archive server in the Lab is a facility for long-term, secure storage of such data. It functions both as an archive and as a collaborative workspace, with options for dynamic data management to upload, edit, and enrich data and metadata. Metadata are publicly visible, browsable, and searchable through the archive browser, while the actual data are password-protected. Data access is granted by data owners/depositors at four access levels. The Archive server thus enables data discovery, and serves as a means to connect and collaborate with researchers responsible for relevant collections.

THE LANG-TRACK-APP

The LANG-TRACK-APP project (Arndt, Granfeldt, M. Gullberg) investigates when, where, and how people are exposed to and use languages in everyday life, and the possible effects on the learning of second languages. Despite the importance of language exposure and use to learning, it remains very difficult to investigate, especially outside of the classroom. The LANG-TRACK-APP team therefore developed a smartphone app to collect questionnaire data from participants several times a day using push notifications (the Experience Sampling Method). The app has been used in a study examining university students' language use during study abroad to chart which languages they used, with whom, in what activities, and how patterns changed over time. A second study use the app to focus on migrants to Sweden and their exposure to, use, and learning of Swedish.

In 2021 the Lab's Archive server was upgraded. This includes both a new server back-end, in the form of a virtual server hosted by LDC (the LU IT service provider), and a new front-end, in the form of the FLAT software bundle developed by Max Planck Institute for Psycholinguistics in Nijmegen, the Netherlands. FLAT is a CLARIN-compatible repository solution based on the open source Islandora/Fedora framework. FLAT's specific CMDI profile also enables geo-coordinates to be added to data sets. Since metadata is public by design, spatialising (meta) data allows for building distribution maps of languages archived on the server, for example.

In 2021 all the data (more than 6 TB) on the old server was migrated and ingested into the new server. All metadata has been updated. The standard format for metadata is now CMDI (the official metadata standard in CLARIN). As before, the metadata is integrated with CLARIN and is harvested by the VLO, a CLARIN tool for discovering data, tools and services available in CLARIN and related communities. In 2022 the VLO indexation was adjusted so that links point to the new server. Lab work on the back-end included developing administration tools for reading and writing CMDI files, for example automatically generating CMDI files from CSV files, inspecting archived objects from the command line, and preparing archival data.

Other work on the Archive server included renewing certificates and finding ways to upload large data sets in batches (so called batch-ingests). Archive uploads will now typically be handled by researchers through the user interface, but very large data sets will need to be handled by Lab members (J. Larsson, Frid). Furthermore, each individual data record is now linked in handle.net format, which provides persistent identifiers (PIDs), or handles, to information resources. Updated links also point to the new server.

In 2021–2022, work continued on existing research projects. This included the project *Language as key to perceptual diversity* (LANG-KEY; Burenhult) which explores how languages express sensory experience with a focus on endangered languages. The project has collected data from Avatime, a Niger-Congo language spoken in Eastern Ghana (van Putten, Radboud University), Jahai, an Austroasiatic language spoken on peninsular Malaysia (Burenhult, LU), and Penan, an Austronesian language spoken on Borneo (Sercombe, Newcastle University). The project develops innovative field techniques such as the use of action cameras with built-in GPS for documenting spatial language and behaviour, and new analytical frameworks (J. Larsson, Burenhult). In 2021 the team focused on dissemination of results and archiving the project's data. In 2022 they continued developing tools and methods for data collection. Burenhult was also able to resume field trips as countries progressively opened their borders after the pandemic.

Moreover, Lab members (J. Larsson, Frid) assisted in preparation and uploads to the Archive server from individual projects documenting lesser-studied languages such as Yamdena, an Austronesian language spoken in Indonesia (Visser, University of Oslo) and Eastern Chatino, a language used in Oaxaca, Mexico (Mesh).

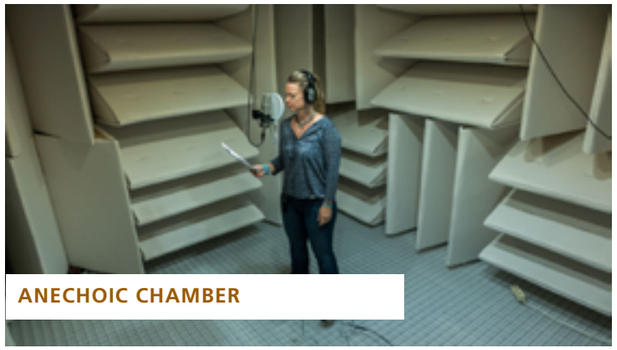
Members also developed tools and libraries for parsing various types of data in Geo ELAN, a terminal-based tool for annotating action camera GPS logs using ELAN with automatic data synchronization (J. Larsson). As of 2022 the tool supports both GoPro and Garmin's action cameras. The work also included creating libraries for parsing GoPro's GPMF format and Garmin's FIT format as well as a library for reading and writing ELAN-files.

AUDIO AND VIDEO FACILITIES

The LARM studio provides professional audio and video recording facilities as well as a set of musical instruments. Although the facility was semi-closed for most of 2021 due to the lingering pandemic, it was still able to assist with outdoor recordings and editing, for example to create elicitation films for a project comparing how people speak and write about stories they have seen versus invented (K. Gullberg, V. Johansson, R. Johansson). The LARM studio was also used for voice recordings in a collaborative project between Cognitive science and the division of Speech, Music & Hearing at the KTH Royal Institute of Technology (Nirme, Tsapos, Ekström, Almström). The project aims to investigate the relationship between the form of a message (written, auditory, or audiovisual) and the information being conveyed, and how this relationship affects communication, more specifically the reliability of the message.

The LARM studio was also used to record data for a project investigating how and why speakers adapt to each other's linguistic behaviour in dialogue by mirroring expressions (Põlvdere, V. Johansson, Paradis). The study use recordings of conversations in controlled experiments in a so-called overhearer paradigm. Another new project with Università degli Studi di Firenze (Italy) used the studio to record stimuli for an eye-tracking experiment investigating aspects of language planning during information uptake (Cacioli, Paradis). The studio was also used in a collaborative project between Lund University (M. Gullberg), Stockholm University (Schönström) and University College London (Marshall) to highlight important issues in the study and learning of sign language. The facility was further used to record stimuli for an MA thesis in Linguistics which investigated audiovisual speech comprehension in the listening of first and second language learners (Springer, V. Johansson, M. Gullberg). Another MA thesis in Linguistics used the studio for data collection in an experiment investigating word accent production in second language learners (A. Ramírez

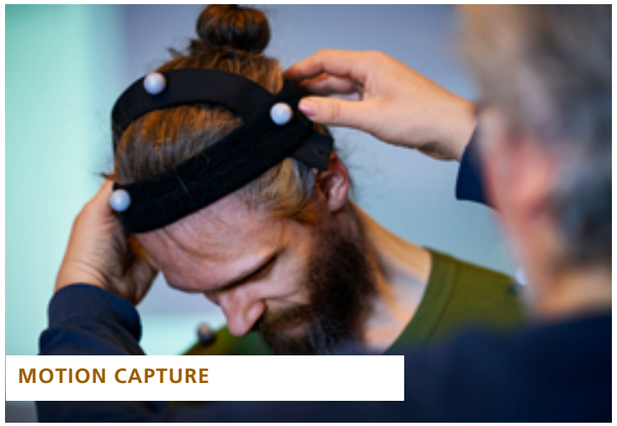
(continued on p 24)



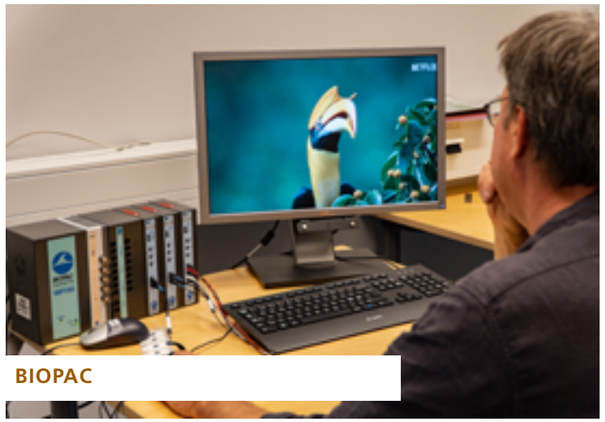
ANECHOIC CHAMBER

ARTICULOGRAPHY

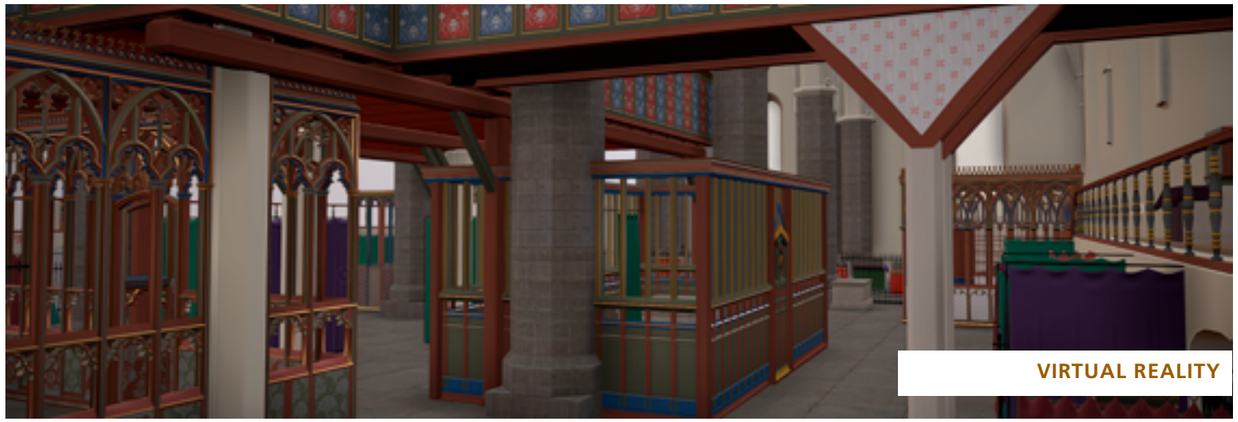
LARM STUDIO



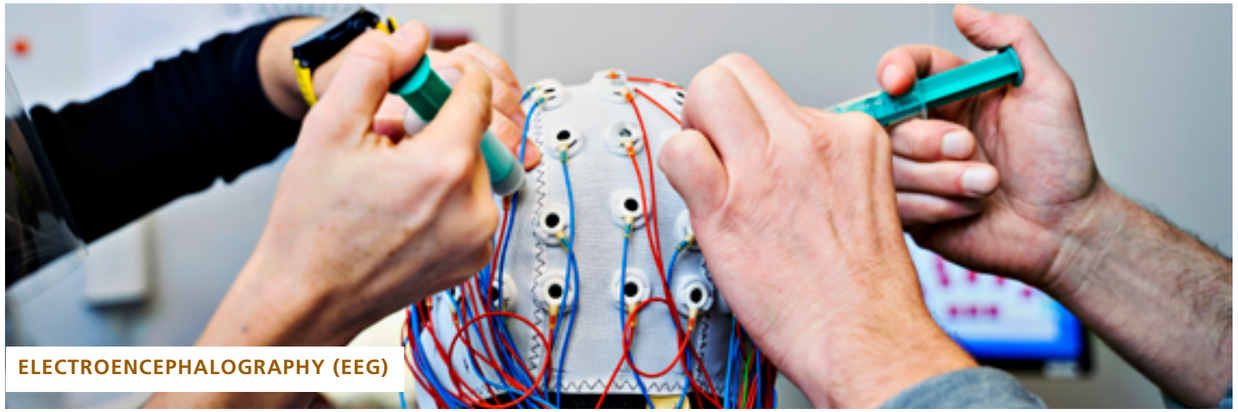
MOTION CAPTURE



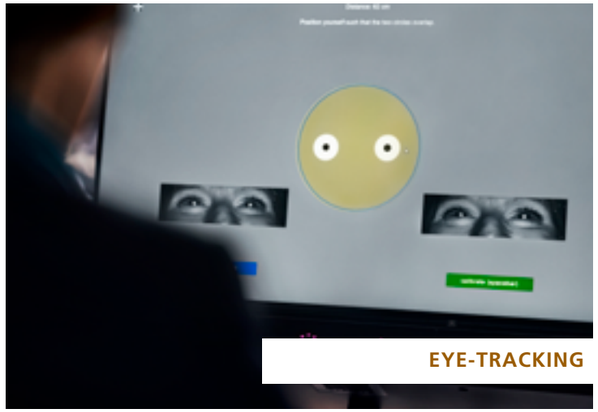
BIOPAC



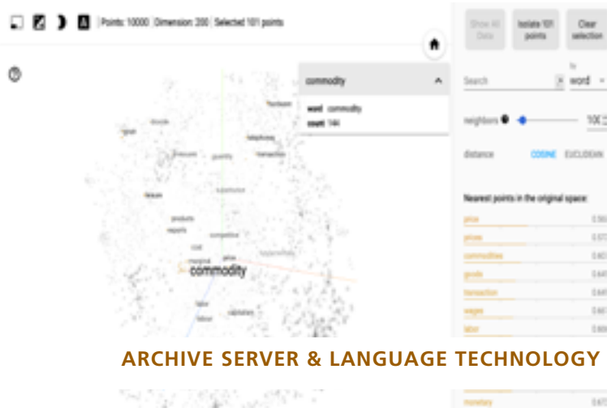
VIRTUAL REALITY



ELECTROENCEPHALOGRAPHY (EEG)



EYE-TRACKING



ARCHIVE SERVER & LANGUAGE TECHNOLOGY

Maraver). An MA project in Cognitive science (Holmer) also recorded data in the studio to investigate iconic mappings between phonetic features and movement in videos. Data collection for a project on learning with parallellograms also took place in the Lab (Ternblad). Finally, the studio assisted in a project on flexible problem solving, from the Department of Psychology (Bobrowicz).

Several scientific podcasts series made use of the studio to record episodes. This included a video podcast on the learning of sign language (Marshall, M. Gullberg) and audio podcasts such as *Bildningspodden* (Bremmer), *Om filosofers liv och tankar* (M. Jönsson), *Lüvo Leve* (Holdo). In addition, the national Swedish Radio regularly used the studio for interviews with researchers at LU (e.g., *P1 Historia*). Further, the facility was used for the recording of conference keynotes (Thormählen), an introduction to the Lab (M. Gullberg, Woxell) and a tribute video by recipients of funding from the Birgit Rausing Language Programme (Åkesson, M. Gullberg).

The research platform Language Acquisition, Multilingualism and Teaching (LAMiNATE) also produced a video podcast with professor emeritus Sven Strömqvist for the 20th Anniversary of the European Year of Language whose inauguration took place at Lund University in 2001 (M. Gullberg, J. Granfeldt).

The anechoic chamber enables top quality audio recordings, eliminating 97,5% of the echo through the use of a specific wedge-shaped foam structure covering walls, ceiling and floor.

In 2021, the anechoic chamber was used in a pilot project involving Malmö Academy of Music (Edgerton, Busoni). The facility was used for recording singing with experimental singing techniques, and the recordings were imported into speech editing software for visual inspection. One result was that the acoustic environment in the chamber had a large impact on singing performance.

A student project used the anechoic chamber to record Finnish non-words for 3D materials to be used in a study on the role of using hands, eyes and ears when learning a new language (Petersson, Jansa).

In 2022, two new projects examined music-related topics. Mauritson (Physics) recorded so called wolf tones (or wolves) on the cello. Wolf tones consist of undesired tones that accompany the played tone. These unintended tones are due to the physics of the string instrument. Magnusson (Malmö Theatre Academy) consulted with Lab members (Frid, Schötz) on the recording of voices, instruments and silence.

3D SCANNING, VIRTUAL REALITY (VR) AND GIS

The use of 3D scanners and the visualisation of the data they generate through Virtual Reality techniques continued to develop in 2021–2022 with a focus both on data acquisition and method development.

Technical upgrading of the 3D facilities in 2021–2022 included automating postprocessing, improved functionality for VR headsets and continued development of content management. Lab staff worked to automate part of the time-consuming postprocessing of data from the long-range 3D scanner. This was achieved through the development of scripts for a new python-connection to the post-processing software. The Lab also installed new computers for VR visualisations to secure compatibility with new VR (Varjo) headsets. Other equipment was acquired in collaboration with projects such as a wireless VR headset (Oculus Quest II) to test 3D models and VR interaction. Moreover, a GPS system was repaired and brought back into use. Finally, the Lab was charged with securing the local development of Omeka-S, a content management system specifically aimed at cultural heritage data (Lindgren).

Research projects involving 3D scanning during 2021–2022 included the scanning of the historical building in the open-air museum Fredriksdal and other places in Helsingborg in a collaboration between the Lab and the Department of Architecture and Built Environment. The goal of the project is to make historical architecture available to the public. The established scan procedures may be used to support more sustainable cultural tourism and to save cultural heritage (Pålsson Skarin, C. Larsson, Lindgren, Landeschi). As an expansion of the Fredriksdal project, 3D data were also acquired of the remains of the medieval castle known as Månstorps gavlar, Vellinge (Pålsson Skarin, Lindgren, Landeschi).

In collaboration with Darklab, at the Department of Archeology and Ancient History, Lab members (C. Larsson, Lindgren) assisted with 3D scanning and complex photogrammetry of the 500-year-old shipwreck *Gribshunden*, sunk outside Ronneby in Blekinge. Interesting parts of the ship were removed from the water and documented before being put back into the water, where the wood is best preserved. The documentation has been made available to the national and international research community through an online database. Some parts of the ship, for example the gun-holders, have also been 3D printed (Foley, C. Larsson, Lindgren).

3D scanning was further used during an excavation in Västra Vång in Blekinge, in a collaboration between the Lab, the Department of Archaeology and Ancient History, Darklab and the interdisciplinary platform for the development and application of autonomous drone systems,

UAV@LU. The purpose was to compare a 3D scanning of an environment with a LIDAR scanning made from a drone. LIDAR (Light Detection and Ranging) is a laser-based remote sensing technology widely used in the domain of geographical information systems (GIS) for surveying and mapping natural resources and infrastructures. The project aimed to establish guidelines for what research questions can be answered with a drone flight and what research questions require more extensive 3D data acquisition (Lindgren, B. Nilsson, dell'Unto).

The continuing project of reconstructing the monastery church at Vadstena, a collaboration with Uppsala University and the Department of Technical Geology at LU among others (Lindgren, Lindqvist Sandgren, Ask, Rossi), was completed in 2022. By 3D scanning the church, this project has been able to reconstruct the monastery church in VR. The reconstruction has involved developing methods for combining 3D models and sound, yielding 360 auralisation videos illustrating what could be seen and heard from different parts of the church. This is particularly interesting as monks, nuns and visiting pilgrims did not have access to the same parts of the church.

New collaborations included several international projects. A collaboration between the Lab, the Department of Archaeology and Ancient History and archaeologists in Raqqa, Syria, aimed to conduct 3D documentation of damaged cultural heritage (al Khabour, Landeschi, Lindgren). In a collaboration with the Swedish Institute in Athens, the Lab assisted in making a 3D recording of an ancient well at an archeological site at Poros (Lindgren). Finally, in new project *3D documentation of Crinkill Barracks in Ireland* the Lab assisted in scanning the ruins of the military barracks in Crinkill, Ireland. The Lab also assists in post-processing this particularly large data set (C. Larsson).

The Lab also participated in the launch of a new national Infrastructure, SweDigArch (see also "Infrastructures", p. 33), aiming to aggregate and harmonise sets in a database for digital archaeology. Lab expertise will be used to ensure compatibility with new types of data (Lindgren).

Research projects in 2021 and 2022 continued to develop the use of eye-tracking in combination with VR models. One continuing project aimed to develop the use of the software *Cognitive 3D* for the analysis of human interaction and eye-tracking data in virtual environments (Campanaro, Landeschi). Another project, in collaboration with Cyprus University, used VR-based eye-tracking to investigate historical reconstructions of ancient theatres based on sound recordings (Manzetti, Lindgren, Landeschi).

The GPS-system was used in the MOSS (Management strategies for tree colonized peatland ecOSyStems) project at the Department of Geology for mapping interesting areas (Edvardsson). The GIS system was further used in a project at the Department of Arts and Cultural Sciences, about GIS mapping historical maps (Vorminder).

Lab staff was also consulted regarding the use of GIS systems in the on-going *Hermione* project. This project is a collaboration between the Lab (Lindgren, Landeschi), the Department of Archaeology and Ancient History, and the Swedish Institute in Athens with the purpose to create a plan of the ancient city of Hermione, Greece. In 2021, the project investigated how mapping and GIS data georeferencing worked (Klingborg).

Two student projects in archaeology also made use of the Lab: a project which 3D scanned bones (M. Andersson), and a project which used photogrammetry to perform 3D documentation of a rune stone and then presented the results online (A. Larsson).

MOTION CAPTURE

Motion capture is a technology that enables the recording of human bodily movements in 3D with high spatial and temporal resolution. The Lab's current setup consists of a Qualisys system with twelve high-speed infrared cameras and three high-speed video cameras. The infrared cameras detect and record the 3D position of reflective markers strategically located on a moving individual's body.

Technical upgrading in 2021–2022 included a major update on various workflows (Garde), and in addition different techniques for facial motion capture using video were tested (Garde, C. Larsson, Lindgren). Also, Lab staff evaluated the possibility to simultaneously stream data from different systems, video and motion capture data, into the game engine Unity. This process also involves the rigging of avatars (Garde, C. Larsson).

In 2021–2022 motion capture was used in several research projects. Two projects were initiated by researchers from the Medical Faculty. In a project on quantitative assessment tools for Attention Deficit Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD), the Lab assisted in creating an avatar (Rasmussen). In future assessment situations the avatar might help clinicians avoid spoken instructions in that children could instead imitate the avatar in a play-like situation. A continuing PhD project in Speech and language pathology examined the training of Mandarin vocabulary in immersive virtual environments (Langensee, Mårtensson, M. Gullberg, Garde). The facility was also used in artistic

projects. Lab staff (C. Larsson, Garde, Lindgren) worked with Riksteatern Crea to explore the use of motion capture in theater productions with sign language (highlight p. 14; Drapsa, Kankkonen, Ouahid, Rosengren). In a continuing project with Malmö Academy of Music, motion capture was used to capture hand movements during guitar playing (Chavarria-Aldrete). A new collaboration with KU Leuven, Belgium, used motion capture to record natural gestures which can then be used to create virtual gesturers (Oben, Prové, Garde, M. Gullberg; see also *Multimodality*).

The facility was also used in projects for methodological development. A pilot for the research project *Meowsic* tested the use of marker-less motion capture on cats, using different kinds of depth sensors (Schötz). Another project aimed to set up multiple synchronised systems for position detection (Yaman, Garde).

ARTICULOGRAPHY

The Lab hosts two devices for electromagnetic articulography (EMA; AG500 and AG501). This technique records the movement of the tongue, the lips, the jaws (so-called speech articulators) in 3D with high spatial and temporal resolution through sensor coils in an electromagnetic field.

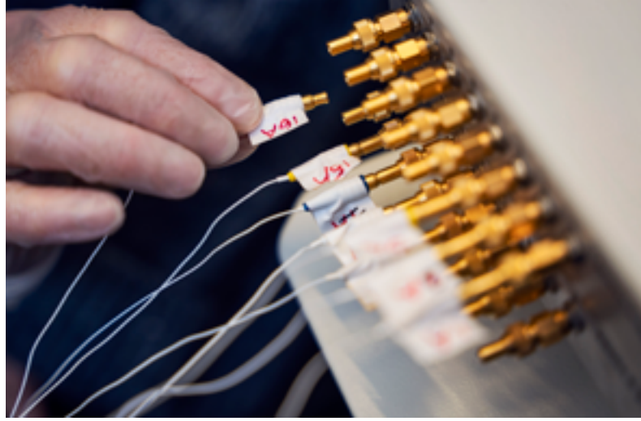
The facility was closed for most of 2021, but continuing projects in Linguistics and Phonetics used data recorded prior to the pandemic. This included a study on consonant-vowel coordination which explored the effects of the Swedish word accents on word-initial consonant–vowel coarticulation (Svensson Lundmark, Frid, Ambrazaitis, Schötz). Another study by Svensson Lundmark examined the relationship between articulation and acoustics. More specifically, the study focused on the potential alignment of boundaries between speech sounds ('segments') and articulatory events such as maximum acceleration and deceleration of the lips and tongue.
In a new method project Frid tested a method for automatically segmenting EMA data. This new method uses so-called forced alignment with a pre-trained model. Results show an improvement compared to previous similar methods.

During 2021, Lab members updated the user guides (according to the new Lab server standard) for the AG500 as well as the AG501 (Frid, Schötz). In 2022 method development included using a bite plane to control for the position of the head during recordings (Svensson Lundmark, Niebuhr).

KEYSTROKE LOGGING

Keystroke logging is a technique that enables the recording of a writer's keyboard and mouse activities during text production keystroke by keystroke. The writing session can be replayed and analysed in detail to show how the process of writing may differ from the final text. The keystroke logging program ScriptLog has partly been developed by Lab members (Frid, V. Johansson). In 2021, keystroke logging was used in a new project which compares writing processes (e.g. pauses and revisions) to speaking processes (e.g., pauses and repetitions) in narrative accounts (V. Johansson, R. Johansson, K. Gullberg). The aim is to examine how the processes may differ between spoken and written accounts, as well as between accounts of self-experienced and invented events. Further, a MA thesis in Linguistics examined pauses and revisions during writing in a second language (R. Ramírez Maraver). The study examined how speakers of Brazilian Portuguese and Spanish used so-called null objects (e.g., *I am reading*, where the object, for instance "a book" is missing) in their first languages and in English as a second language. Results showed that participants treated null objects differently depending on their first language. A new project is developing an integration of ScriptLog and contemporary eye-trackers to allow for simultaneous recording of the writing process and eye movements (K. Gullberg, Frid).

Keystroke logging was also used in external collaborations. A project with the University of Gothenburg worked with keystroke logging in a picture naming-task to investigate writing processes in patients with writing difficulties (Johansson-Malmeling, Henriksson, Frid).



MULTIMODALITY

Multimodal analysis of human behaviour (e.g., speech, gesture, head movements) continued to flourish in 2021–2022.

Some studies examined crosslinguistic and cross-cultural aspects of speech and gestures. For example, in 2021 a Marie Skłodowska-Curie Individual Postdoctoral Fellowship continued to examine how speakers of Eastern Chatino, Mexico organise lip pointing while also respecting politeness requirements of gaze avoidance (Mesh, Cruz, M. Gullberg). Another ongoing project compared Swedish and Italian speakers' use of gesture in storytelling (Graziano, M. Gullberg). New projects include a collaborative study with Kiel University which examines how phonetic properties and manual gestures contribute to a sense of alignment in Swedish conversation (Rossi, Zellers, Graziano).

Other projects focused on multimodality in language acquisition or bilingualism. Two MA projects in 2021 dealt with gestures. One study examined how Greek speakers gesture when they agree with their interlocutors and what role gender and familiarity plays for this behaviour (Rozou, M. Gullberg, Graziano). Another

study with Humboldt University Berlin investigated gestures in relation to grammatical aspect and so-called progressive markers in German and Swedish (Barth, Graziano). M. Gullberg's Wallenberg Scholar project *Embodied bilingualism* also continued to investigate a range of language-gesture pairings, including Swedish, German, English, French, Turkish (Christensen). A project with the University of Concordia continued to probe the effect of gesture on language learners' ability to understand native Italian speakers by manipulating the presence/absence of gestures (Graziano, Trofimovich). Work also continued on a joint project with University College London examining whether adults can break into sign language after only a few minutes of exposure and with no training (Marshall, Janke, Hofweber, Aumônier, M. Gullberg). Results show that adults can indeed recognise signs from a continuous stream of signing, and that they are helped by the frequency of signs and the resemblance between a sign and the thing it refers to in the world. Final data collection was completed in 2022.

Work with motion capture and virtual reality also continued. A continuing project examined the synchronisation of head movements and speech using articulography data, motion capture, and acoustic analysis (Frid, Svensson Lundmark, Ambrazaitis, Schötz, House; see also *Text-language resources, Swe-Clarin, Articulography*). A new collaboration was initiated with KU Leuven, Belgium, in 2022 which uses motion capture to capture natural gestures to create virtual gesturers whose gestures can then be manipulated. The procedure is used to create experimental materials to examine experimentally how first language speakers adapt to conversational partners who are second language speakers (Oben, Prové, Garde, M. Gullberg).

Multimodality also featured in teaching and training. Lab members contributed to instruction on methodology for multimodal data analysis through tutorials on ELAN, a tool for annotating speech and gesture data (Graziano). Lab members also supervised international MA and PhD students working on multimodality (Belgium, Germany, South Africa, Switserland; Graziano, M. Gullberg), and acted as external examiners of PhD theses on multimodality (M. Gullberg). Furthermore, the online seminar series on multimodality, the Gesture seminar (M. Gullberg organiser), continued in 2021–2022. Twelve seminars were held in 2021 and 13 in 2022 with international scholars regularly attending, and several Lab members in regular attendance (Frid, Garde, Graziano). In addition, Lab members (M. Gullberg, Graziano, Frid) presented multimodal work at several international conferences, such as the *6th Hong Kong Conference of the Asia-Pacific Languages for Specific Purposes and Professional Communication* in 2021, *Eurosla* in 2021 and 2022, the *International Symposium on Bilingualism* in 2021, and the annual conference of the *International Society of Gesture Studies,* Chicago, USA, in 2022. Moreover, M. Gullberg was elected President of the Society in 2022 for the period of 2022-2025. She also gave the so-called *Einar Haugen Lecture* 2022 at the University of Oslo on the topic of gestures in bilingualism.

An international network dedicated to the study of Gestures and Head Movement in Language (GEHM), led from the University of Copenhagen, also held monthly online meetings in the period with Lab members as active participants and presenters (M. Gullberg in the steering committee; Graziano, Frid; see *Collaborations*).

The research platforms

In 2021 the Joint Faculties of Humanities and Theology provided two-year funding for five so-called 'research platforms' – long-term interdisciplinary research environments. Three of the funded platforms are connected to the Humanities Lab: DIAD, Digital History @Lund and LAMiNATE.

DIAD (Digital Integration Across Principles; Burenhult, Dell'Unto) combines digital archaeology and language documentation to document cultural heritage in new and ground-breaking ways.

Digital History @Lund (Bechmann-Pedersen, Cronqvist, Snickars, Weber) aims to promote digital history at Lund University. It specialises in historical reflections on the digital turn and the historical development of new media.

LAMiNATE (Language Acquisition, Multilingualism and Teaching; M. Gullberg, Granfeldt) builds on the long tradition of research in these three areas at Lund University. The platform brings together some 40 researchers at LU and beyond.

National infrastructures

THE SWEDISH RESEARCH COUNCIL (*VETENSKAPSRÅDET*) FUNDS RESEARCH INFRASTRUCTURES OF BROAD NATIONAL INTEREST THAT ENABLE RESEARCH OF THE HIGHEST SCIENTIFIC QUALITY. THE LAB IS A PARTNER IN FOUR SUCH INFRASTRUCTURES.

Swedish Research Council

HUM INFRA

HUMINFRA

Huminfra is a national research infrastructure, supporting digital and experimental research in the Humanities. It brings together 11 Swedish universities and organisations led by Lund University Humanities Lab. Huminfra hosts the web-based information platform huminfra.se which compiles and links to existing digital/e-scientific data sets, tools, expertise and training opportunities spread across Sweden – resources that the individual researcher previously had to spend a lot of time identifying and learning to use. Huminfra also hosts national training events in different techniques.

INFRAVIS

InfraVis provides national support for data analysis and scientific visualisation across all disciplines. The infrastructure provides access to state-of-the-art visualisation competence, support, equipment, training and methods.

InfraVis

SWE-CLARIN

Swe-Clarin is a national e-science consortium dedicated to language technology. It is itself a part of the European Research and Infrastructure Consortium Common Language Resources and Technology Infrastructure (ERIC CLARIN). CLARIN provides access to (contemporary and historical) language- and-text-based material, and to tools for exploring and investigating such data. Since 2020 the Lab is a CLARIN Metadata Providing Centre which provides so-called CMDI metadata via the Archive server to CLARIN's Virtual Language Observatory (VLO). (See also p. 17.)

SWE-CLARIN

SWEDIGARCH

The Swedish National Infrastructure for Digital Archeology (SweDigArch), aims to provide the full range of archaeological, palaeoecological and eventually heritage science data, to aggregate and harmonise existing databases to make them compatible with advanced search tools and integrate new types of data (e.g. 3D scannings, satellite and drone images).

Swedigarch

Collaborations

Lund University Humanities Lab and its members have thriving local, national, and international collaborations and networks. Those linked to individual scholars are too numerous to list here, but the Lab also has many institutional collaborations.

LOCAL. The Lab has numerous local collaborations across Lund University. Many are longstanding such as with the departments of Linguistics, Archeology, Cognitive science, Design sciences, Biomedical engineering, Biology (cf. *Research*), Lund University School of Aviation and UAV@LU, the Strategic Research Area for e-Science eSSENCE, LU Center for Scientific and Technical Computing (LUNARC), Lund Bioimaging Centre, the network AI Lund, etc. Continuing initiatives in 2021–2022 included the engagement in a LU Thematic Collaboration Initiative, *Intelligent intelligence* (Political science, Petterson) where linguistic analyses of how people talk, write, read, and listen were provided by Lab members (V. Johansson, van de Weijer). An Advanced Study Group at the Pufendorf Institute for Advanced Studies, *Interspecific communication (Intercom),* focused on how humans and other animal species communicate across species boundaries. The ASG brought together experts from the Lab, Psychology, Speech and language pathology, Evolutionary ecology, and Cognitive science (Schötz, van de Weijer, Graziano, Mårtensson). Other local activities in 2021–2022 included engagement with the Science Village Scandinavia (SVS) enterprise. Lab member Petersson collaborated with the project team of the SVS Science Centre. Lab members were also engaged in a project at the Swedish National Data Service under the leadership of Lund University Library investigating how to best take care of digital research data and databases (M. Gullberg on the steering committee).

In the domain of e-Science, local collaborations continued (see also under National collaborations), both in terms of projects and training. The collaboration with Lund University Bioimaging Centre continued through the liaison officer (Mårtensson) whose task was to facilitate and boost the use of and training in brain imaging techniques. In 2021-22 Mårtensson offered a course on MRI for participants without a background in medicine, to recruit new users and forge stronger connections between the Humanities Lab and other groups at LU interested in the brain.

The Lab and its members were also engaged in the exploratory and collaborative work initiated in 2021 for identifying so-called profile areas at Lund University. Following an application procedure, one of the successful initiatives was *Natural and Artificial Cognition – 1, 2, many* (Åström, M. Gullberg, Bäck, Davies), granted in June 2022 with funding until 2024. This profile area brings together researchers from five faculties (Engineering, Humanities and Theology, Social sciences, Medicine, Science) to study connections between animals, humans, and robots. A launching workshop in Oct. 2022 showcased the breadth of domains relevant in the area and kickstarted ideas for new collaborations. The Lab is one of the key infrastructures for the profile area.

NATIONAL collaborations were numerous. The Lab is a node in the national consortium *Nationella Språkbanken and Swe-Clarin*, itself part of *CLARIN*, the European Common Language Resources and Technology Infrastructure. Swe-Clarin links nine Swedish institutions around issues of language technology, including the *Swedish National Data Service (SND)*. As a national node and an accredited *Knowledge Centre*, the Lab provides tools and expertise related to language archiving, corpus and (meta-)data management, assistance with sensor-based methods, and speech and language technology. The local coordinator (Frid) was involved in a range of projects in 2021-22 (see *Research*) in addition to consulting on issues of language technology. A new Lab member recruited in 2022 (Berck) now also contributes to this work.

The Lab also continued its partnership with *eSSENCE*, the national Strategic Research Area and programme in e-Science, involving the universities of Uppsala, Lund, and Umeå. The overall enterprise focuses on the development of tools for handling, storing and retrieving research data in digital form. M. Gullberg is a member of the Lund steering committee. Core elements are data flows, large databases, heavy data computation, and data visualisation, achieved with the assistance of *LUNARC*, the Lund University Center for Scientific and Technical Computing (M. Gullberg member of the executive board). Lab members regularly contributed to *COMPILE*, a common web site for research, education, and infrastructure related to Science and e-Infrastructure at Lund University. The collaboration with the Strategic Research Area *ELLIIT* on information technology and mobile communications continued with M. Gullberg as a member of the steering committee. ELLIIT is a partnership between Linköping, Lund, Halmstad and Blekinge Universities.

Important developments on the national level also concern national research infrastructures. The Lab took the lead on a bid to the Swedish Research Council for a national research infrastructure for the Humanities called Huminfra. The bid was granted in 2021 and started in 2022. Huminfra supports digital and experimental research in the Humanities by providing users with a single entry point for finding existing Swedish materials

and research tools, as well as by developing national method courses. The Huminfra consortium consists of 12 nodes across 11 universities and organisations, and is coordinated by Lund University Humanities Lab (M. Gullberg director of the infrastructure; cf. p. 32). In 2022 two further Huminfra staff members were recruited in Lund (Björck, Blåder) to build the Huminfra web platform and to structure the infrastructure's organisation and communication.

The Lab was also part of two other successful bids, a National Research Infrastructure for Visualisation of Data (*InfraVis*) led by Chalmers University of Technology (M. Gullberg, Garde), and the Swedish National Infrastructure for Digital Archeology (*SweDigArch*), led by Uppsala University (Lindgren; cf. p. 33).

A new collaboration was also initiated in 2021 with Riksteatern Crea (cf. *Research*), the national theatre of Sweden's unit for theatre in Swedish Sign Language (Rosengren, Lindgren, Garde, C. Larsson).

INTERNATIONAL. The Lab has several longstanding international collaborations. For example, in the field of 3D scanning, the Lab has several collaborations through its members (Lindgren, C. Larsson, Landeschi). These networks include the *Swedish Institute in Athens, CNR-ISTI* in Pisa, and *Institute of Heritage Science* in Rome. For example, 3D and GIS documentation at the archeological site of Poros is part of the collaboration with the Swedish Institute in Athens. In the domain of eye-tracking, long-standing collaborations with universities in the Netherlands, Germany, and Finland continued to flourish and involved training and research activities in 2021–2022, both online and in situ in Lund (cf. p. 11). In the area of language documentation, data management and corpora, the long-standing collaboration continued with the *Max Planck Institute for Psycholinguistics and The Language Archive (TLA)* hosted there. The Language Archive develops software and archiving solutions for the Humanities and languages in particular. In the domain of multimodality, the international network *Gesture and Head Movements in Language (GeHM)*, funded by the Independent Research Fund Denmark (Paggio), continued its work with online working meetings linking the Universities of Copenhagen, Lund, Linnaeus, KTH, Leuven, Kiel, Barcelona, and Trinity College Dublin.

In the time period the Lab also became responsible for a software and hardware solution for management of digital research data, OMEKA-S, in a collaboration with the IT-unit at the Joint Faculties of Humanities and Theology (Lindgren). This work also links the Lab to the international network for OMEKA-S.

Moreover, the Humanities Lab is a partner in a number of international centres such as the *Centre for Multilingualism in Society across the Lifespan*, Oslo; and *DigHumLab* Denmark, the Danish national consortium for digital humanities. Annual meetings were held both online and on site in the time period.

Normally, the Humanities Lab hosts many visiting scholars from all over the world for both short- and long-term stays. Lab members normally also visit other institutions and give invited talks about their own research both within and outside Lund University. In 2021 these activities resumed gradually but online forms of exchange continued to complement physical visits.

New Lab members

Anna Blåder

I am a communications officer with a background in visual communication and illustration. At the Humanities Lab I work specifically with the research infrastructure Huminfra where I assist the operative management team in administrative issues, and work on communication activities. This includes the internal communication within Huminfra's twelve nodes, as well as the external communication, covering everything from producing strategic documents, newsletters, and printed materials to administrating social media accounts and outreach events.

Stephan Björck

I work at the Humanities Lab as a systems developer in mobile and web applications and my task in Huminfra is to structure and develop the web-based information platform (huminfra.se). It is always a lot of fun and challenging to take something complicated, with multiple components and participants, and make it easy to use and appealing at the same time.

Peter Berck

I am a research engineer at the Humanities Lab, specialising in natural language processing (NLP). I am fascinated by machine learning, AI, and language models, and I enjoy not only research but also developing practical applications from these technologies. At the Humanities Lab I will continue to explore this exciting intersection between technology and language.

Training, teaching & consultations

Training constitutes an important part of the Lab's activities. Training activities include PhD courses, group tutorials, individual and group consultations, and guest lectures. These are adjusted according to topics, needs, and audiences. The goal is to facilitate and increase users' access to the technological resources that require advanced methodological skills, and to enable interdisciplinary work within and across faculties. The Lab offers a range of training activities in areas such as eye-tracking, visualisation of 3D data, programming, audio and video recording, statistics for the behavioural sciences, and data geo-referencing. Lab members also participate in training organised by other units at LU and elsewhere. In 2021, training activities initially continued in the virtual modality due to the pandemic but during part of the year the Lab was able to welcome participants on campus for some courses and tutorials. In 2022, some training activities continued to be virtual but now it was because they benefited from it. However, most activities were conducted at campus.

PhD courses in the Lab typically run over a number of weeks, and focus both on broad methodological approaches such as programming or statistics, and on specific research technologies, such as eye-tracking. Courses normally include practical hands-on elements as well as theoretical and methodological components. In 2021–2022, the Lab offered 11 courses of this type; *Statistics I & II* (van de Weijer), *Eye-tracking* (Niehorster and M. Nyström), *Functional and structural brain imaging* (Mårtensson) and *Programming for the behavioural sciences* (M. Nyström and Garde). The participants represented a wide range of subjects such as General linguistics, English, Cognitive science, Psychology, Computer science, Media and communication, Cultural studies, Agricultural sciences, Economics and Medical science at LU. Group tutorials were offered on several topics, both online and on campus. The 44 tutorials included topics such as *Practical text mining* (Frid), *PsychoPy* (M. Nyström and Garde), *ELAN* (Graziano), *GIS for historians* (M. Johansson), *R Studio, BioPac* (van de Weijer), *GPS systems* (Landeschi), *Video and sound editing* (Roslund), and *Transcribus, working with databases* (M. Johansson). The tutorials had participants from Media and communication studies, Cognitive science, English, Arts and cultural sciences, Cognitive semiotics, Gender studies, Psychology and History.

Individual and group consultations are also important training activities. They offer Lab users targeted advice on specific research problems and are often related to the use of specific software, technologies or analysis methods. In 2021–2022 Lab members provided 222 such consultations. Areas covered included statistical and methodological advice (van de Weijer), BioPac (van de Weijer), GPS and GIS data (Landeschi), data post processing (Landeschi), Motion capture, VR and 3D techniques (Larsson, Lindgren, Garde), EEG set up and recording (Garde), text analysis tools (Frid), data visualisation (Frid), Sentiment analysis (Frid), EMA (Schötz and Frid), sound and video recording and editing (Roslund). Consultations were also provided on the softwares *ScriptLog* (Frid), *Praat* (Frid), *MATLAB* (Frid) and *Psychopy* (Garde).

The Lab was also consulted on strategic and practical issues concerning the building of infrastructures, for example by the Medical faculty at LU and the Forum Medicum *Movement and Reality Lab* (MoReLab).

Visibility, access, outreach

Every year, the Humanities Lab hosts multiple events for local, national and international visitors across a range of domains. The continued pandemic changed the nature of the regular engagements 2021–2022, and many tours and demos were thus transformed into online events. In 2021–2022 a total of **43** demos were organized, **11** of which were online. These gave an overview of the research facilities and the on-going research, often adapted for the targeted audiences and purposes. Visitors included national and international students and researchers as well as the Swedish Minister of Education, the Royal Swedish Academy of Sciences and a cohort of Wallenberg Academy Fellows. Lab members also gave virtual demos for students from upper secondary schools.

The Humanities Lab further participated in events in both academic and popular contexts. Many of the talks demonstrated technologies and activities in the Lab, as well as research. For instance, the Lab participated with Youtube-films at the annual event Future week (*Framtidsveckan*) organised by LU in 2021. This included the films "Eye tracking - examples and breakthroughs" (M. Nyström) and "Groundbreaking insights without breaking ground" about archeology (Lindgren).

Lab members also gave invited talks at local, national and international venues on various topics, for example "Event classification - from hand coding to deep learning" (M. Nyström), "Measuring affective polarization" (Frid), "Multimodal communication and motion capture" (Garde), cat phonetics and how to study cat articulation (Schötz), and language use in internationalisation and mobility (M. Gullberg).

Lab members also appeared in the media, (cf. page 41)

Finally, the Lab conveyed information about activities on its website and social media (Facebook, Twitter, LinkedIn) with regular updates on research, events, grants, and awards. The Lab's Youtube channel had more than **4,000** views of video material during 2021–2022. The Lab's website is continuously updated and re-organised to follow rules for web accessibility. Information about policies, access, user agreements, etc., are available on the web. The Lab also has a newsletter sent to all users on a regular basis.

IN THE MEDIA

July, 13, 2021
Swedish National Television
Är det möjligt att snabba på sin lästakt?
Marcus Nyström

September 18, 2021
National newspaper Sydsvenskan
De får IgNobelpris
Susanne Schötz

November 16, 2021
Swedish National Radio
Kan katter prata dialekt?
Susanne Schötz

January 11, 2022
Swedish National Agency for Education
Gester gynnar språkinlärning och talproduktion
Marianne Gullberg

January 12, 2022
Curie
Fler HS-forskare vill använda infrastrukturer
Marianne Gullberg

February 15, 2022
Sveriges säkerhet
Människors kroppsrörelser in i globala positionssystem
Marianne Gullberg

February 17, 2022
Forskning.se
Mikroryckningar i ögonen kan avslöja undvikande beteende
Elia Psouni

March 24, 2022
International newspaper Haaretz
Ancient Roman 'Feng Shui' Revealed in Pompeii
Giacomo Landeschi, Danilo Marco Campanaro

March 24, 2022
International newspaper Daily Mail
Step inside an ancient Pompeian home!
Giacomo Landeschi, Danilo Marco Campanaro

April 28, 2022
Forskning och Framsteg
Här avslöjas klotter i kyrkan – skrivet på medeltida latin

June 1, 2022
The Conversation
Eye movements could be the missing link in our understanding of memory
Roger Johansson, Mikael Johansson

September 6, 2022
Swedish National Radio
Våga vara nybörjare
Johan Mårtensson

October 15
Forskning och framsteg
3D fördjupar arkeologin
Giacomo Landeschi, Danilo Marco Campanaro

October 23, 2022
Swedish National Radio
Tecknande scenkonstavatar snart verklighet
Riksteatern Crea

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Funders

The Crafoord Foundation
FORMAS
The Joint Faculties of Humanities and Theology
LU Innovation
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LMK Foundation
Lund University Research Board
The Bank of Sweden Tercentenary Foundation
The Swedish Research Council

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The PDF version contains hyperlinks to resources.

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