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Title Photography CERN/CH © Marion Mangelsdorf
The title page shows apparatus used in the development of the World Wide Web. These illustrate the beginnings of the comprehensive digitalization processes that were developed in a project at the research organization CERN in 1989.
"The World Wide Web is a wide-area hypermedia information retrieval initiative aiming to give universal access to a large universe of documents."

– Tim Berners-Lee, Founder of the World Wide Web

Gendering MINT digital

Actively shape Open Science

is a collaborative project financed by the Federal Ministry for Education and Research from 2018-20, involving the Albert-Ludwig-University of Freiburg, the Humboldt-University of Berlin and the University of Applied Sciences Offenburg. The project is informed by the findings of the project "Gendering MINT. Networking and exchange from a gender perspective in natural and technical sciences", that was realized with financial support from BMBF (German Federal Ministry of Education and Research at the University of Freiburg) from 2015 to 2016 (cf. Mangelsdorf 2019).

The aim of the collaborative project

is to make available in a useful visual form the natural and technical scientific insights produced by the research conducted by gender-oriented MINT and to use this knowledge to prepare Open Science Modules with the help of didactic concepts and participative and collaborative electronic tools (e-tools). The modules provide an innovative basis for discussion and promotion of critical reflection in research, teaching and equal opportunities work in the MINT field and at interdisciplinary interfaces.

Background

Gendering MINT digital does not have the primary aim of generating new scientific knowledge. There is already an impressive corpus of literature available about gender in MINT. However, the digital availability and modular processing of such Gendering-MINT subject matter has been lagging behind. Preparation, testing and sustainable distribution of gender knowledge in MINT subjects lie at the heart of *Gendering MINT digital*, with the help of digitalized and dynamic Open Science Modules.

Gendering MINT digital

- offers researchers, educators and equal opportunity protagonists dual qualification to bring gender perspectives to bear on the intertwining of natural/technical sciences and society. It also promotes their inter- and trans-disciplinary competence (Scheidewind/Singer-Brodowski 2013).
- offers students and early-stage researchers in MINT subjects the opportunity to become familiar with the inter- and trans-disciplinary theories, methods and findings of gender research in the MINT field and develop competence in critical appraisal of the meaning of gender in their fields, through the combination of digitalized content matter and informative participatory collaborative technical formats (Schmitz/Schinzel 2004).
- promotes the differentiation of knowledge transfer between research, teaching and equal opportunities policy. The collaborative project aims to provide stimuli to promote cultural evolution in MINT subjects.

Communication – Reflection – Dialogue

In order to promote cultural change *Gendering MINT digital* connects the communication of gender knowledge in MINT subjects, through initiatives that reflect on gender relevance in these disciplines, to the promotion of dialogue between gender research and MINT. This broad spectrum promotes exciting, but particularly challenging, interaction.

On the one hand the target groups of MINT should be addressed in a manner appropriate to their immediate situation. For, in the MINT field, an appreciation of gender is often informed mainly through personal experience. Students often connect their knowledge to everyday experiences that reflect stereotypical gender attributions. Here it is important to promote an initial feeling for the meaning of gender in each discipline and to motivate the target groups to investigate for themselves the gender diversity and gender constructions in the culture of their own subjects. Digitalized learning units developed by *Gendering MINT digital* offer video-based and animated formats, which introduce the terms and basics of gender research as well as offering opportunities to explore specific topics in greater depth. Starting

from a low-threshold approach, the course units lead to a thorough investigation of the way gender is inscribed in the processes of science production as addressed by MINT. This enables the participants to reflect on the way in which natural and technical science research is embedded in gender relations in society. The focus here is on making aware, motivating, communicating knowledge and furthering critical appraisal.

On the other hand the complex of approaches and terms in Gender in Science and Technology Studies (STS) should be thematized in a manner appropriate for stimulating discussion in the different target groups. It is a matter of questioning one's own contribution to the creation of knowledge, recognizing that one's own perspective is shaped by gender, cultural factors and also socialization into a particular discipline. The aim is to encourage our joint exploration and negotiation of knowledge in a dialogue between gender research and MINT. The interactive web documentation – i-Docs – and participatory mediographies offer various forms of visualisation stimulating self(reflective) exchange and further discussion.

The collaboration partners in *Gendering MINT digital* are developing Open Science Modules for the following two key topics:



COMMUNICATION AND REFLECTION

Learning units based on animations and collaborative electronic tools at the Humboldt-University of Berlin



DIALOGUE

Development of i-docs based on participatory mediographies by the Albert-Ludwig-University of Freiburg in cooperation with the University of Applied Sciences Offenburg

OPEN SCIENCE MODULE

Communication –
Reflection – Dialogue
Gender in MINT

FIELDS in MINT

Experimental
Fields

with Evaluation,
Elizitation &
Selfreflexion

I-DOCS

nonlinear &
modular

didactic &
artistic

PORTALS

nonlinear &
modular

Project Website
i-docs / Learning Units
Repository

LEARNING UNITS

analog, digital
& participatory

CONTENT

Basics &
subject-specific
Slots

FORMATS

with Elements like:
Video-Clips, Interviews, Fotodokus
Animation, Presentations etc.

with E-Tools like:
Concept Mapping, Cartographies etc.

What are Open Science Modules?

The Open Science Modules developed by *Gendering MINT digital* are made up of different elements that address the various focus areas of the contributing project parts in the collective. Components include the following:

Fields

The process of communication – reflection – dialogue in the following fields will be developed and tested with the help of the cooperation partners at the Universities of Freiburg and Berlin.

- Biology
- Chemistry
- Information Sciences
- Forest and Environmental Sciences
- Medecine
- Neuro Sciences
- Physics

- Gender Didactic Trainings
- Seminars in the MINT field and in the interdisciplinary course of studies
- CRC 1015 *Otium. Boundaries, Chronotopes, Practices*

Paul Walton (Chemistry) from University of York (GB) and Tomas Brage (Physics) from University Lund (Sweden) are also collaborating in the project.

More about the fields and the specificities of the development of learning units and i-docs can be found in the accompanying leaflets.

Learning units

The inclusion of gender science in the current curricular structures of MINT requires a modular system, as time for such units is often limited. Modules can be integrated into existing educational schedules in a suitable manner. According to the principle of the inverted classroom pre-prepared teaching/learning materials, so-called *Open Educational Resources* (OER) can be made available in digital form, so that students can prepare themselves and amass knowledge before the learning unit and be able to discuss when present at seminars (Schulmeister 2013). The video-based course units prepared by *Gendering MINT digital* are the equivalent of such *Open Educational Resources*. They enable study without temporal and spatial restrictions and are in accordance with the contemporary preferences of today's students for medial access to and methods of knowledge acquisition.

For *Gendering MINT digital* it is more than a matter of promoting the study of pre-prepared educational material according to the principle of the inverted classroom. By breaking down the learning units into short chapters and components it is possible to offer them in interconnected form through a navigation portal. Such a concept is based on a constructivist approach to electronically-supported teaching/learning (Schulmeister 2006, Tergan 2005). In contrast to an instructional perspective, these enable an individual entry into the material and choice of elements according to personal priorities, thus opening up different pathways to acquisition of competence. In addition, the individual sections can be linked to units for reflection.

The aim of *Gendering MINT digital's* learning modules is to move in the direction of Critical Science Literacy. The concept of Critical Literacy, based on the approaches of Antonio Gramsci and Michel Foucault, is receiving increasing attention in educational circles today as a way of supporting critical appraisal competence in social and theory of power perspectives on science and educational institutions. The concept is of

special value as Critical Science Literacy, addressing the competence to reflect on the way scientific and technological knowledge production is embedded in gender relations in society (Schmitz et al. 2014). Such ability to critically appraise is the result of intercommunication and group discussions. This in turn necessitates tools for collaborative work on terms, theories and scientific content.

E-Tools for Reflective Work: Concept Mapping

According to the concept of progressive inquiry (Muukkonen et al. 2009) students develop together relevant questions and reflections on a theme. Keys to the success of collective work in an inter- and transdisciplinary context are mutual recognition of knowledge competence and a differentiated vocabulary of terms and concepts (Reimann 2016).

Electronic tools for Concept Mapping support collaborative and interdisciplinary work on terminology, the analysis of complex scientific matter and conceptual and critical discussions. They also offer the possibility of visualising, storing and distributing the interlinked results of the analytical work, in order to work further on these by oneself or with others (Novak/Cañas 2006). Concept Mapping tools prove to be especially helpful in addressing gendered terminology in scientific-technical contexts (Schmitz/Grunau 2009). Open access and online Concept Mapping-Tools (e.g. *Cmap* or *Mind Master*) can be implemented without difficulty by users.



i-docs

interactive web documentations

offer information in different formats including texts, audio and animated visuals. They were developed as long ago as 1997 by the *Korsakow Insitute* of nonlinear narrations. In 2011 this led to the founding of the network for interactive documentation formats, with the name *i-docs*, while at the same time the software *klynt* came onto the market. The use of the latter is widespread, as a user-friendly tool for the development of i-docs. For that reason it is used in this project. To date, the opportunities opened up by this computer-based narrative form have mainly been exploited by NGO's or in journalism, by the television channel *Arte* for example. The co-founder of *i-docs* Sandra Gauzendi has shown that this form of communication of knowledge is also useful for processes of dialogue and negotiation in academic research (Gauzendi 2013). By enabling interactive interlinking of video, audio, photo and text formats the i-docs provide stimulation for individual knowledge exploration and collaborative discussions (Fetzner & Dornberg 2016).

Participative mediographies

The concept of participative mediographies is based on approaches taken from Gender Media Studies (Lüneborg/Maier 2013) and the gender research in the MINT field – drawing here in particular on the treatment of situated knowledge by Donna Haraway (1988), the concept of cadrage as discussed by Trinh T. Minh-ha (2001) and the agential cut proposed by Karen Barad (1999). For, in order to enable a trans-disciplinary dialogue of equals crossing over between different scientific disciplines, it is necessary to think critically about the camera as one of the actors affecting what happens, in the sense advanced by Feminist Science and Technology Studies (FSTS). The question is how a camera can be regarded as a means to achieve a collaborative act of speaking nearby, instead speaking about (Minh-ha 1992).

The following three aspects are important for participatory mediography i-docs that have been developed in the MINT fields:

Embodiment theories

Based on the thesis that cognitive, affective and behavioural processes embody their respective environments and are embedded in them, embodiment theories informed by philosophy and cognition and media sciences (Fingerhut et al. 2013) throw up new questions for media-ethnographic work in the form of participatory mediographies: How is knowledge experienced, learned and communicated by the participants – in the case of *Gendering MINT digital* in the fields of the various target groups? In what way is knowledge experienced as being embedded in different environments and how do its structures affect behaviour and interactions? This approach also critically considers the medial and aesthetic opportunities and limitations that make these embodiment processes visible (Corsten et al. 2010): what role can interactive animated visuals play in order to make cognitive, emotive and interactional processes apparent and open to discussion? What perspectival regime are we following? How much power of influence and action (agency) do the media (e.g. visual) representatives gain for their part (Burri 2008; Borer et al. 2011)?

Participatory approaches

in the framework of ethnographic-documentary debates falling within the remit of Participatory Action Research (PAR) make it possible to examine the interrelationship of the body and its specific environment through cognitive and emotive processes. The description and investigation of this entanglement means that ethnography can be understood as a form of interaction and as a constellation of interrelationships (Chevalier/Buckles 2013; Milne et al. 2012). Within these settings it is possible to promote the participation of those involved in the mediographic process through the inclusion of ethno-fictional elements, among other aspects (Minh-ha 1992; Klöpping 2004). It is essential to appreciate the participatory moments as having an influence on the

result and as liable to be problematic and conflict-laden. For there will be opportunities for and limits to participation in a given environmental context, subject to specific structural conditions, and these should be given appropriate consideration. Customary questions referring to categories such as status, education, age, sex, species or ethnicity play a large role in this respect (Walgenbach et al. 2012). However, it is only through reflecting on these categories and their connection with the respective embodiment of scientific practices and their outward form that it is possible to achieve deeper understanding and adopt participatory structures.

Film aesthetics and narrative questions

Narration and authorship are being scrutinized from new angles in the context of theories of embodiment and the use of participatory methods in i-docs. Interaction and participation necessitate an influence on content and form with respect to narration. These should not only become accessible to experience, but also be subject to active construction by the participating person. It is important to thematize the co-construction of reality. People, machines/technology and medium in the communicative space of i-docs are all interrelated dynamically (cf. the term technography in Burri 2008). During the active construction of the narration the component elements constantly change along with their interdependences, as is evident in the montage practices of Harun Farocki (Baumgärtel 2002). The question arises of how this structure alters as it is being experienced and constructed. How and to what extent do the dynamic relationships of the users, authors, the narrations and also the technical elements change that are interlinked in the system (Gaudenzi 2013)? The concept of authorship is also central with regard to interactive documentation and participation. According to the communication space as elucidated, it is not possible for the authors to maintain a complete overview of the construction or keep it totally under their control. Its structures will change in response to individual intentions. The behaviour and functions of the users are to be seen as both explorative and at the same time configurative, leading to the dissolution of the dichotomy between author and recipient.

Portals

Project Website

Albert-Ludwigs-University of Freiburg

The continuous documentation of the whole project and further distribution is effected through the project website. This offers access to the navigation interfaces of the i-docs and learning units. It affords links to the media repository of the Humboldt University of Berlin. Here there are also reference points to the presentations and publications developed by the project and links to events in the national MINT-Forum framework as well as *Komm mach MINT* (Join in and make MINT), the *national PAKT for women in MINT professions*.

www.genderingMINT.uni-freiburg.de

i-docs

University of Applied Sciences Offenburg

The i-docs created using klynt are linked at this project website

www.genderingMINT.uni-freiburg.de

Media Repository

Humboldt University of Berlin

The media repository has been working on the basis of Open Source Software since 2014. Via the repository it is possible to provide open access for the use and compilation of the Open Science Modules, the materials and didactic concepts on a sustainable basis.

<https://rs.cms.hu-berlin.de/gemintdig>

Experimental fields

With its innovative initiatives the collaborative project *Gendering MINT digital* incorporates into the digital turn the communication and acquisition of competence in critical appraisal of natural and technical scientific gender-oriented research, as Wiesner et al. (2004) recommended. It makes use here of the contemporary formats online developed by experts linked to innovative information–technical formats for the development and adaptation of the Open Science Module to achieve testing and evaluation in parallel. The trial procedures carried out in comparable scientific-technical target groups at the Albert-Ludwig-University of Freiburg and the Humboldt-University of Berlin are evaluated using videographic documentation, video-elicitation, questionnaires, interviews and online assessments. The results lead to modifications in the Open Science Modules and their further development.

Distribution

Gendering MINT digital makes a substantial contribution to the strengthening of gender competences in the MINT fields and to inter- and transdisciplinary dialogue. The Open Science Modules that have been developed and evaluated will be made available via the open access media repository of the Humboldt-University of Berlin. Open Science Modules that have already been tried out can be offered and used in the future, and can also be made available in a new combinations. Thus a modular system can be evolved with instructions and key words so that in future, researchers, educators and equal opportunity activists can put together their own Open Science Modules and use them for their own events. The transfer knowledge that has been developed and packaged by the collaborative project can thus be made available for nationwide research and teaching. Furthermore, it is possible to connect up with other academic fields in MINT. The approach is also suitable for use in schools, in further education by educational institutions beyond the universities and for political education. The project results flow through presentations, publications and innovative media formats into the scientific discourse.

Collaborative Team

Albert-Ludwigs-University of Freiburg

Marion Mangelsdorf did her doctorate in Cultural Sciences with a focus on Science and Technology Studies (STS). She is managing director of the Centre of Anthropology and Gender Studies (ZAG). She is the director of the collaborative project as a whole and of the section in Freiburg.

Victoria Vonau studied Philosophy, Neurological Science, Cognition and Interdisciplinary Anthropology. As a research assistant she is involved in the organization of the project, content and the development of the i-docs.

Simon Schwab studied Conceptual Media Studies at the Hochschule Furtwangen, and Time-based Media at the University of the Arts in Linz. He is an academic assistant in the fields of media concepts– media design–media production.

Student assistants: **Mona Kraus, Lioba Martin, Isabell Schaub** provide support to the project organization and ad communication between the subsections of the project.

University of Applied Arts Offenburg

Daniel Fetzner became Professor of Media Design and Art Research at the Hochschule Offenburg in 2014. He is director of the Laboratory for Media Ecology. He is director of the Offenburg section of the project.

Stefan Salm studied Media Production and Media Communication at the Hochschule Offenburg. He is an academic assistant in the fields of media concepts–media design–media production.

Student assistants: **Zaid Ghasib, Adrian Schwartz** provide support with Media Production.

Humboldt University of Berlin

Sigrid Schmitz had a doctorate and postdoc. degrees in biology and is a feminist STS researcher. She has been Senior Lecturer at the University of Freiburg, Professor of Gender Studies at the University of Vienna and at the HU Berlin. She is director of the Berlin project section at the Centre of Trans-disciplinary Gender Studies (ZtG).

Göde Both is a qualified information scientist. He did his doctorate in trans-disciplinary Science and Technology Studies (STS). He has worked at the TU Braunschweig and at the University of Paderborn and the University of Copenhagen. As a research assistant he develops and tests learning modules and the application of e-tools in the field of information science.

Smilla Ebeling is a biologist. She did her doctorate in the History of Science. Her focus is on Feminist Science Studies, Animal Studies and Museum Research. As a research assistant she develops and tests digital learning units for scientific discipline-related didactics and Workshops on Equal Opportunity work in MINT.

Student assistants: **Felicitas Günther, Simon Herchenbach** help with video production, the application of e-tools and the Media Repository.

Events for Distribution of knowledge

Gendering MINT digital runs three workshops in which the Know How of experts is brought together on the application of digitalization for Communication – Reflection – Dialogue about Gender in MINT. The Open Science Modules are critically appraised in a Feedback Workshop with the cooperation partners. A symposium that is open to the public delves deeper in a discussion of the potential and challenges of *Gendering MINT digital*.



WORKSHOP

Gender Research in MINT
Albert-Ludwigs-University of Freiburg



WORKSHOP

Gender responsive digitalization
Albert-Ludwigs-University of Freiburg



WORKSHOP

Cultural change in MINT
Albert-Ludwigs-University of Freiburg



FEEDBACK WORKSHOP & SYMPOSIUM

Humboldt University of Berlin

More information about the events and interviews with the speakers can be found at the project website www.genderingMINT.uni-freiburg.de.

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Open Science active participation

Director Sector I

Dr. Marion
Mangelsdorf
Managing Director
Centre of Anthro-
pology and Gender
Studies

Team

Mona Kraus
Lioba Martin
Isabell Schaub
Simon Schwab
Victoria Vonau

Albert-Ludwigs- University of Freiburg

Belfortstr. 20
D-79098 Freiburg
genderingMINT@
uni freiburg.de
+49 761 203 4216

Director Sector II

Dr. habil. Sigrid
Schmitz
Centre of Trans-
disciplinary Gender
Studies,
Faculty of Huma-
nities and Social
Sciences

Team

Dr. Smilla Ebeling
Göde Both
Felicitas Günther
Simon Herchenbach

Humboldt University of Berlin

Georgenstr. 47
D- 10117 Berlin
sigrid.schmitz@
hu-berlin.de
+49 30 2093 46210

Director Sector III

Prof. Daniel Fetzner
Professorship for
Media Design and
Art Based Research,
Media Design Depart-
ment

Team

Stefan Salm
Zaid Ghasib
Adrian Schwartz

University of Applied Sciences Offenburg

Badstraße 24
D-77652 Offenburg
daniel.fetzner@hs-
offenburg.de
+49 0781 205 4751

Colophon

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