DRITTER GLEICHSTELLUNGSBERICHT

Technology Design

Fact Sheet 2

Gender-responsive and non-discriminatory technology design

Digital products such as apps, office software and smart home systems permeate everyday life. In order for them to be widely accepted and used, they have to be technically well designed. However, oftentimes, not all future users are considered in the development of such products, and potential discrimination is neglected. For instance, Joy Buolamwini, a Black computer scientist, found that her face was only recognised by common facial recognition systems when she used a white mask. The reason: the software was programmed using data that primarily depicted white men.

Example problems in technology development are:

Lack of diversity in development teams

Vocational training and studies for digital professions as well as the digital industry are characterised by a low proportion of women and a lack of diversity. This fosters one-sided technology design. Developers are mainly guided by their own values and experiences (I-methodology).

Users not involved

When it comes to the development of assistive technologies such as software for care documentation, automatic medication dispensers or drinking support systems, people who need assistance, but also assisting people, are rarely – if ever – included.

Data bias and problematic classifications

To develop biometric face recognition systems, these have to be trained with data sets. If skin colour or gender are not fed into such data sets in a balanced way, the system will recognise the unrepresented or less represented groups poorly and/or draw wrong conclusions.

Lack of control over algorithmic decision-making

Whether and how algorithmic systems discriminate is difficult to prove. This is due to the large amount of data and the complexity of these systems. In the case of the face recognition system mentioned above, discrimination could only be proven through systematic tests with a balanced set of faces of hundreds of people of different gender and dark as well as light skin colour. Systematic testing of algorithmic systems is still lacking.

The I-methodology (Madeleine Akrich):
Technology developers draw on themselves and their world of experience as being representative of all (future) users.

IN THIS FACT SHEET

Gender Extended Research and Development Model, GERD

Many common approaches in software development, such as Scrum, Extreme Programming, Feature Driven Development or the V-model, have so far lacked a special focus on the problems mentioned above. This is despite the fact that there have been approaches to cooperative and participatory software design since the 1970s which focus on the acceptance of software by the users and their respective participation in the development. Other approaches extend common software development methods towards the inclusion of gender and diversity aspects.

One example is the Gender Extended Research and Development Model (GERD). GERD is a reflection model that supports gender-responsive and non-discriminatory software development and (computer science) research. On the one hand, it helps in detecting and recognising the perspectives and needs of different user groups already in the development phase of a digital product, and in including them in its design. On the other hand, the social impacts of the introduction of digital products, also with regard to equality and non-discrimination, are taken into account.

Drawing on the procedures commonly used in IT system development models, GERD identifies the following development steps of research and development (so-called "core phases"): project definition (goals, target group, present situation, etc.), analysis (requirements definition, users and context, risks, etc.), concept development, realisation, evaluation and dissemination of the product or results. These steps are carried out in succession, sometimes repeatedly.

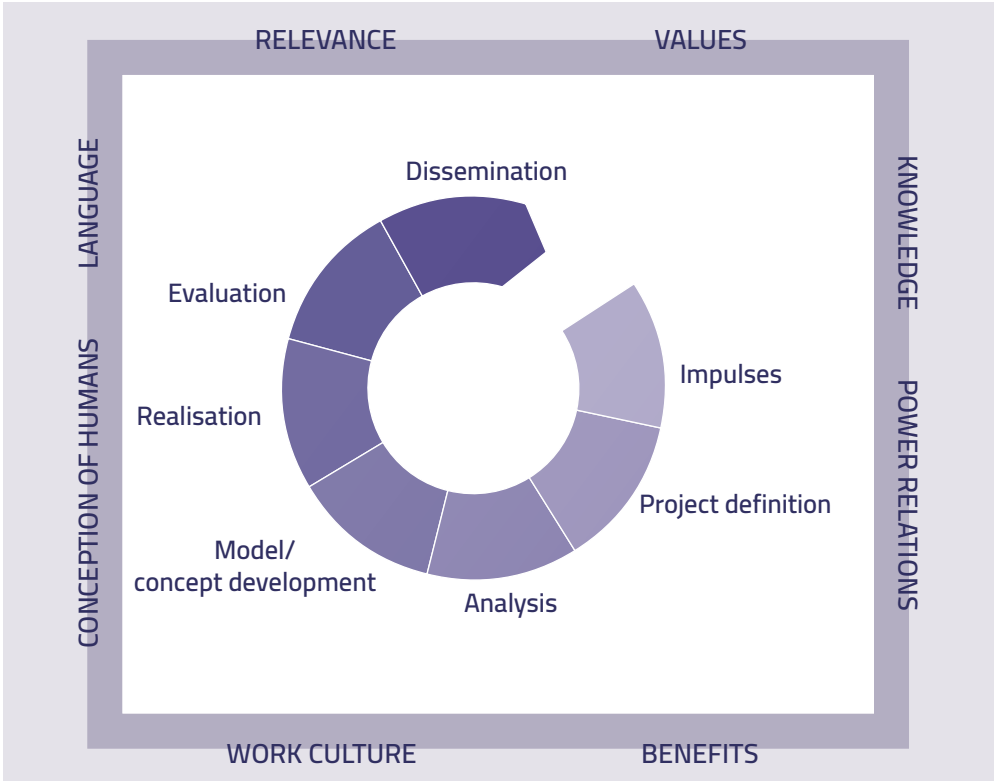
In addition, the actual impulses for a product or a research project is taken into account. This includes interests or impulses such as calls for tenders, contracts, available resources, current topics, or new technologies that are the reason for starting the development of a product or a research project.

TECHNOLOGY DESIGN

In order to design technology as close as possible to the respective contexts of use and the needs of future users, **diverse perspectives, interdisciplinary expertise and potential risks of discrimination** must be taken into account.

To do so, there are numerous **cooperative, participative and value-oriented design methods.** These follow specific procedures and phases such as requirement analysis, realisation, evaluation, dissemination.

GERD model



Graphic according to Draude/Maaß 2018, see „further reading" on p. 4

Questions oriented towards fundamental concepts of gender and diversity studies are intended to stimulate an extended consideration of research questions and development decisions.

For each phase of development, the following aspects are reflected upon (in the form of questionnaires) and incorporated into the future product or research design:

» **Relevance:** For what reasons is the development project or research topic important – and who is in the position to determine this?
» **Benefits:** Who are the future users and what exactly are the concrete application contexts of the product to be developed or of the research results? Who benefits from this? How inclusive is the development/the research? Who is excluded?
» **Knowledge:** Which knowledge is the development/research based on? Is it everyday knowledge, knowledge of future users or scientific knowledge? Which key concepts or expertise are used?
» **Values:** What values – for example about safety, equality, participation or ecological responsibility – form the basis for the product/research?
» **Power relations:** How are the working environment, the application context and the developing organisation structured? In which hierarchies are participants or future users seen, what access and information do they have to the technologies used?
» **Conception of humans:** What view do those involved in the development or research have of the people interacting with planned products/research? For instance, are they seen as a threat or as in need of protection? What assumptions are made about their gender, identity or physicality?
» **Work culture:** What is the composition of the development or research teams? In how far are different genders, social or cultural contexts and special needs represented?
» **Language:** Which metaphors and descriptions of reality are chosen in the context of development and which images of the world and people do they convey (e.g. "[male] attacker", "[female] voice assistant", "ranking", "like")?

Examples of gender and diversity aspects in different phases of technology development

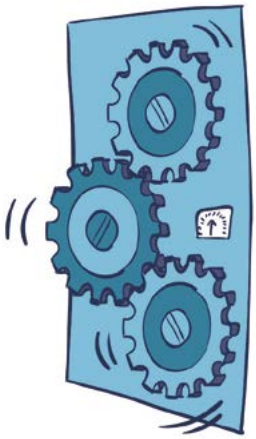
The following questions show examples of which gender and diversity aspects of digital products can become visible in different phases of technology development by applying GERD.

Phase: Project definition (e.g. targets, target groups, expected outcomes)

» *Potential questions about the conception of humans: How is the category "gender" structured in the respective field? What are the important interdependent variables, e.g. level of education, physical ability, age, culture, ethnicity and sexual orientation?*
Fraunhofer IIS and the University of Bamberg are investigating how artificial intelligence can be used to support pain diagnoses in people who have difficulty providing information about the type and intensity of pain (e.g. children, dementia patients). During the preliminary definition of the project design, the interdisciplinary research team found that training data sets with pain faces, which are used to train artificial intelligence algorithms, so far mostly only portray light-skinned healthy people. Yet different skin colours, genders and ill people (e.g. dementia patients) as well as all age groups must be represented in a balanced way.

Phase: Analysis (e.g. context, risks, users, technologies)

» *Potential question about power relations: Do certain activities remain invisible and are therefore not assisted by the system?*
If a company's existing administrative software works ineffectively and inefficiently, this is often compensated for unnoticed by (mostly female) secretarial and administrative staff. Above all, informal work that takes place around accounting processes (manual categorisation and entry of paper receipts into accounting, analogue filing and searching for receipts, etc.) can only be detected and acknowledged via precise analysis of the processes by means of conversations or monitoring of the work processes and contexts.



MORE INFORMATION ABOUT THE GERD MODEL

» https://gerd-model.com

Phase: Realisation (e.g. prototype, implementation)

» *Potential questions about work culture: What does the composition of the development team look like? What roles and images are being presented?*

Many software developments nowadays follow agile methods (e.g. Scrum): The development teams are composed in an interdisciplinary way based on different expertise. However, little to no attention is paid to a balanced composition with different genders or different cultural or social backgrounds. The teams are predominantly made up of white, heterosexual men. The moderating role of, for example, the Scrum Master, who eliminates obstacles to the completion of tasks, is in turn often taken on by a woman. It is thus overlooked that with the attribution that women "naturally" have better communication skills, their possible range of tasks is severely limited as well as stereotypical.

Phase: Dissemination (e.g. documentation, support, marketing)

» *Potential question about language: What images and what language/voice are used in marketing or public relations?*

The voice assistance apps Siri, Alexa or Cortana are marketed as female assistants that receive commands and respond at any time. Despite public criticism, chatbots are still often modelled along gender stereotypes.

Recommendations for action from the Expert Opinion "Shaping digitalisation in a gender-equitable way"

Models such as GERD or similar approaches have hardly been used in practice so far. The Expert Commission for the Third Gender Equality Report therefore recommends with regard to gender-responsive technology design:

» Setting legally binding standards for gender-responsive and non-discriminatory IT systems.
» Including gender-equitable, non-discriminatory technology design in the federal government's digital strategy and take it into account when awarding public IT projects.
» Establishing gender-equitable, participation-oriented technology design in research and teaching.
» Taking gender and intersectionality into account in data-driven systems.

Furthermore, the Expert Commission recommends considering restrictions for high-risk technologies. Last but not least, work cultures in education and the digital industry have to change and development teams need to become more diverse.

Further reading:

» Chapter B.I.1 in the Expert Opinion part of the Third Gender Equality Report of the Federal Government, available (in German) at: https://www.bmfsfj.de/gleichstellungsbericht

» Agency for the Third Gender Equality Report of the German Federal Government (2021): Shaping digitalisation in a gender-equitable way. Summary of the Expert Opinion of the Third Gender Equality Report of the Federal Government. Berlin: Agency for the Third Gender Equality Report.
Download at: https://www.dritter-gleichstellungsbericht.de/de/topic/50.english.html

» Draude, Claude/Wajda, Kamila/Maaß, Susanne (2014): GERD — Ein Vorgehensmodell zur Integration von Gender/Diversity in die Informatik. In: Zeising, Anja/Draude, Claude/Schelhowe, Heidi/Maaß, Susanne (Hg.): Vielfalt der Informatik. Ein Beitrag zu Selbstverständnis und Außenwirkung. Universität Bremen, http://www.informatik.uni-bremen.de/soteg/gerd/?action=modell

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