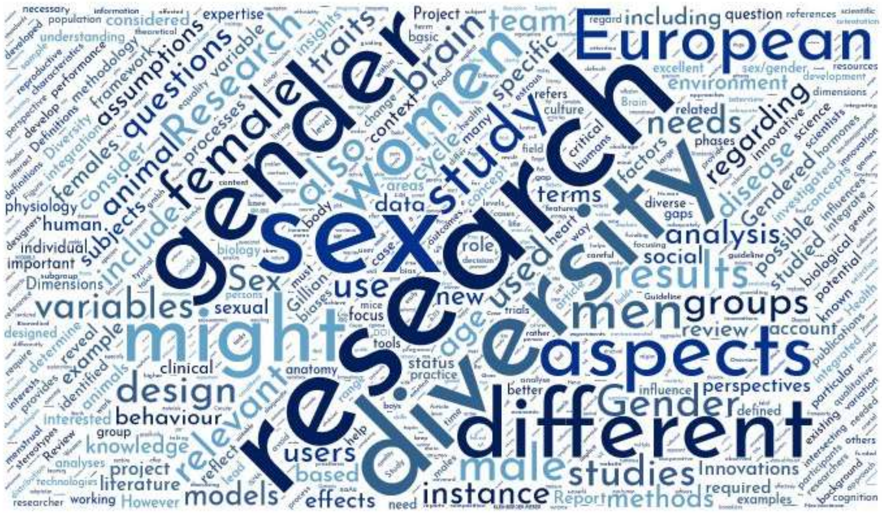
Incentives for
Best Concepts and Ideas for
Diversity in Research and Management SGA2



1. Rationale

Gender and other diversity aspects are not only important for teamwork but can also be **essential elements in scientific research projects** leading to additional insights and knowledge or far-reaching results. In line with the European Commission's RRI guidelines and the gender agenda for Horizon 2020, the HBP aims to play a pioneering role in promoting awareness and advancing gender equality in research teams and decision-making, as well as in research content and innovation.

The HBP supports researchers, especially scientists at an early career stage (Master, PhD, Post-Doc) who integrate new variables and methodological approaches accordingly sex, gender, age, specific diseases etc.). A concept might be an idea for a new research project a project that has been already carried out, or a publication, or paper described with a few paragraphs (see also H2020 Guidelines).

Differentiating variables has been recognised to be relevant in brain research, robotics, and AI alike - from the level of stem cells to avoiding the replication of stereotypes due to the use of data without reflection. For a more detailed outline see http://www.theneuroethicsblog.com/2019/09/same-same-or-different-common_10.html or the appendix of this document.

Additionally, **managers of sciences** are encouraged to contribute their observations and suggestions on how to enhance equal opportunities within teams and the overall HBP.

The most outstanding and promising ideas and concepts will gain substantial feedback from peers, be presented at the HBP Summit to a large scientific audience and representatives of the European Commission. Registration and travel expenses of award winners will be covered.

2. Terminology

- The term **gender** refers to the **social construction of women, men, and non-binary persons**: societies and cultures associate competences, behaviours and attitudes with a person's biological sex. Expectations and ascribed roles lead to further differences in persons' paths through life, for instance by influencing if and how occupational choices and achievements are recognised.
- **Sex** refers to the **biological differentiation** between "male" and "female", determined by chromosomes, genes, hormones, and anatomy. However, the idea of two discrete sexes is overly simplistic. The concept of "intersex" refers to a variety of conditions, in which the combination of sexual, anatomical, and physiological factors does not fit to the typical definition of male and female (Ainsworth 2015, ISNA 2015).
- When referring specifically to sex as a biological characteristic, the terms "**female**" and "**male**" should be used. It is recommended to use the terms "women" and "men" when both biology and culture are concerned (see European Commission 2013, p.50).

The **term diversity** comprises the manifold traits, characteristics and differences of human subjects based on various dimensions. Some of these traits are inherent (e.g. sex, ethnicity, sexual orientation, body composition, physiology, age), some are ascribed or acquired (e.g. gender, skills, knowledge, technological literacy) and others are context related (e.g. different mobility needs in private and working context, social and economic background, working and living environment, lifestyle). The European Union acts to prevent discrimination on grounds of sex, race, colour, ethnic or social origin, genetic features, language, religion or belief, political or any other opinion, membership of a national minority, property, birth, disability, age or sexual orientation (see also EU Charter of Fundamental Rights).

3. Examples

1.1 Sexual dimorphism of the human brain

Compiled by Karin GRASENICK, convelop (P 121), Harald KLEINBERGER-PIERER, convelop (P 121), Javier DEFELIPE, UPM (P 68), Pilar F. ROMERO, UPM (P 68).

How sex, gender and further diversity aspects influence human brain research? To what extent do brains differ from one other? Which role play sex and gender (societal aspects)? For a better outcome and better understanding of the human brain investigating at least sex should be differentiated. Aspects like genetics, age, sex hormones, reproductive status (pre- or post-pubertal, virgin, or numerous pregnancies), body composition, comorbidities, body size, disabilities, ethnicity, nationality, geographic location, socioeconomic status, educational background, sexual orientation, religion, lifestyle, social interaction, language, family background etc. might also be of relevance, depending on the focus of brain research.

This short, certainly incomplete overview therefore list some examples of what has been discussed in brain related research:

In neurological diseases a large number of studies demonstrated differences between men and women, for example regarding Alzheimer's Disease or different forms manifestation of schizophrenia (Jackson et al. 2013, Zhang et al. 2015, Choleris 2018) which should be further investigated for therapy development.

Hormones have been identified to play an important role in regulating social behaviour, cognition, social interactions, levels of aggression and as well sexual and reproductive behaviours. For example, a common examined sex differences and hormones can be found on the level and type of aggression (Terranova 2016, Hausmann 2017 – more literature and discussion can be found Choleris et al. 2018) Studies on the influence of hormones are mainly based on animal test subjects, limiting possible conclusions for the human brain (in general on human animal test subjects, see Yartsev 2017).

Neuroanatomical differences and similarities between sexes are widely discussed at different levels of brain organization. More specifically, sexual dimorphism has been reported in the cortical volume of the Wernicke and Broca areas (Harasty et al. 1997), as well as in the frontal and medial paralimbic cortices, amygdala and hippocampus (Allen et al. 2003; Amunts et al., 2007. **At the microscopic level**, there are two levels of analysis: (1) at an intermediate resolution (mesoscopic scale), using light microscopy, which allows us to observe cells, their processes and putative connections using specific markers; (2) at an ultrastructural resolution (nanoscopic scale), which can only be studied using electron microscopy (EM) and serves to map true synaptic contacts. **At the mesoscopic scale**, sex differences have been reported in cortical cytoarchitecture. Differences have been found in the density of neurons (Pakkenberg and Gundersen 1997; Stark et al. 2007) and in the complexity of the dendritic arbors of the pyramidal cells, as well as in the density of dendritic spines in several cortical areas (Jacobs et al. 1993). At the nanoscopic level, Alonso-Nanclares et al. (2008), showed that there is significant sexual dimorphism in the density of synapses in all cortical layers of the human temporal neocortex.

It is also important to mention that these differences cannot be described as a strict dimorphism. **Intersections and overlaps** exist on a more constant basis, then sexual dimorphism regarding the human brain. According to Jänke, Carthy or Fausto-Sterling terms like "male brain" or the "female brain" are more misleading then helpful to provide a better understanding of the human brain, as well as the differences, similarities and variations of the human brain (Jäncke 2018, Carthy 2005, Fausto-Sterling 2016).

Keeping in mind that sex is not a binary variable and gender relates to social expectations, a general problem of defining **sex and gender** differences and similarities can also be found in the setup of studies on self-report questionnaires (Jäncke 2018).

A meta-analysis of publications on brain structures, brain volumes and density from 1990-2013 revealed that 5095 of 5600 identified articles, did not report on a sex comparison between individuals. The influence of sex and gender were also not combined with age (of the research subjects) in many studies. (Ruigrok 2014). Lutz Jäncke contributed 2018 a comprehensive and revealing **review on the current research status** of sex and gender related differences, sexual dimorphism in terms of brain anatomy, function, behaviour and cognition. Based on his review, he argues that sex/gender differences are relevant, however they are still difficult to assess or not as significant as argued in previous studies. Additional factors or variables need to be considered.

Literature

Allen JS, Damasio H, Grabowski TJ, Bruss J, Zhang W (2003) Sexual dimorphism and asymmetries in the gray-white composition of the human cerebrum. Neuroimage 18:880–894

Alonso-Nanclares L, Gonzalez-Soriano J, Rodriguez JR, DeFelipe J (2008) Gender differences in human cortical synaptic density. Proc Natl Acad Sci USA 105:14615–14619

Amunts K, Armstrong E, Malikovic A, Ho¨mke L, Mohlberg H, Schleicher A, Zilles K (2007) Gender-specific left-right asymmetries in human visual cortex. J Neurosci 27:1356–1364

Choleris E (2018), Sex differences in the brain: Implications for behavioral and biomedical research, Neuroscience and Biobehavioral Reviews 85: pp. 126–145

Joel D, Fausto-Sterling, A (2016): Beyond sex differences: new approaches for thinking about variation in brain structure and function. Philos Trans R Soc Lond B Biol Sci. Feb 19;371(1688):20150451. doi: 10.1098/rstb.2015.0451. Epub 2016 Feb 1.

Jackson D, Kirkbride J, Croudace T, Morgan C, Boydell J, Errzuriz A, Murray R, Jones P (2013) Meta-analytic approaches to determine gender differences in the age-incidence characteristics of schizophrenia and related psychoses, International J. of Methods in Psych. Research Vol. 22, Issue1 March 2013, pp. 36-45;

Jäncke L (2018), Sex/gender differences in cognition, neurophysiology, and neuroanatomy, F1000 Research 2018, 7(F1000 Faculty Rev):805

Carthy MM, Konkle AT (2005): When is a sex difference not a sex difference? Front Neuroendocrinol.; 26 (2): 85–102

Harasty J, Double KL, Halliday GM, Kril JJ, McRitchie DA (1997) Language-associated corticalregions are proportionally larger in the female brain. Arch Neurol 54:171–176

Hausmann, Why sex hormones matter for neuroscience, J Neurosci Res. 2017 Jan 2;95(1-2):40-49. doi: 10.1002/jnr.23857.

Pakkenberg B, Gundersen HJ (1997) Neocortical neuron number in humans: effect of sex and age. J Comp Neurol 384:312–320

Sowell ER, Peterson BS, Kan E, Woods RP, Yoshii J, Bansal R, Xu D, Zhu H, Thompson PM, Toga AW (2007) Sex differences in cortical thickness mapped in 176 healthy individuals between 7 and 87 years of age. Cereb Cortex 17:1550–1560

Stark AK, Toft MH, Pakkenberg H, Fabricius K, Eriksen N, Pelvig DP, Møller M, Pakkenberg B (2007) The effect of age and gender on the volume and size distribution of neocortical neurons. Neuroscience 150:121–130

Stuart JR (2018), Sex Differences in the Adult Human Brain: Evidence from 5216 UK Biobank Participants, Cerebral Cortex, Volume 28, Issue 8, 1 August 2018, pp. 2959–2975;

Terranova, J.I., et al. (2016). Serotonin and arginine-vasopressin mediate sex differences in the regulation of dominance and aggression by the social brain. Proc. Natl. Acad. Sci. U. S. A. 113 (46), pp. 13233–13238.

Yartsev M (2017), The emperor's new wardrobe: Rebalancing diversity of animal models in neuroscience research, Science 27.10.2017

1.2 Robots, Bias and Gender

Robots impact “many aspects of human life - from healthcare and law enforcement to autonomoustransportation. The development of these technologies involves design and innovation - both of which rely on personal choiceand experience. Hence, personal biases, whether intentionallyor unintentionally, tend to be embedded in the final product designs. Homogeneous teams of designers and engineers aremore likely to develop products that overlook the needs of agiven part of the population - even missing gaps for potential technological innovation” (Pereida K. and Greeff N. (2019).

Wall E. et. al. (2017) have summarised in an article that visual analytic systems rely on the feedback of users and are thereby exposed and influenced by human biases. They differentiate 4 Biases relevant to visual analytics: Bias as cognitive proceessing error, as filter for information, as perception and as a model mechanism.

The Article of Nomura T. (2017) “[…] provides an overview of the current research on gender in human–robot interaction (HRI) includinga discussion of the effects of gender characteristics in robotics design (robot gender), gender differences oninteraction with robots (human gender), and some interaction effects between the two. The article also reviewsresearch that examined the impact of the interaction between humans and robots with regard to robot ap-pearance and behaviors, and situational factors, such as tasks and roles. Although the current state of researchfindings is complicated, it appears that even simple gendering of robots by manipulation of voice and name can affect humans’ feelings and behaviors toward robots. These effects vary and are dependent on other factors, including human gender. Future research should focus on gender stereotypes, cultural influences, and roboticapplications in various fields. At the same time, we should consider if gendering of robots, for given roles, is really necessary to encourage interactions between humans and robots.”

Literature

Nomura, T. (2017). Robots and Gender. *Gender and the Genome*, 18–26. https://doi.org/10.1089/gg.2016.29002.nom

Pereida K. and Greeff M. (2019). Bias in, Bias Out – Diversity In, Diversity Out. http://roboticsdebates.org

Wall E. Blaha L., Paul C.L. Cook K. Endert E. (2017). Four Perspectives on Human Bias in Visual Analytics. https://www.cc.gatech.edu/~ewall9/media/papers/BiasDECISIVe17.pdf

1.3 Gender and Artificial Intelligence

Machine learning does not sufficiently take gender and other diversity aspects into account in data sets and algorithms, which limits the application potential (cf. Zou & Schiebinger 2018). A study (cf. Buolamwini & Gebru 2018) showed that commercial applications of facial recognition programs show very different results, even for simple tasks such as the automatic recognition of a person's gender in a photo: Women were detected worse than men, and the sex of darker skin types was classified much less correctly than that of lighter skin types. This results are related with the data used to train the programmes. The over- or under-representation of certain groups in a data set can lead to unintended biases, e.g. with regard to gender, ethnicity or culture. For example, 45% of the images in the much-used "ImageNet" platform come from the USA, where only 4% of the world's population live. (cf. Zou & Schiebinger 2018, see also the MIT initiative for transparency and standardisation of datasets for AI training: http://datanutrition.media.mit.edu/ and the AI Now 2017 Report https://ainowinstitute.org/AI_Now_2017_Report.pdf)

"Word embeddings" are basic components of many machine learning applications in natural language processing. For the application in algorithms it is essential to represent words mathematically. Word embeddings are vectors that represent a word and its meaning in the context of other words. Words that are often used in similar contexts have similar vectors.

However, this also makes explicit implicit gender biases and biases that are present in the training data. The widespread use of word embeddings bears the danger of further reinforcing these stereotypes. At the same time, however, there is also enough information available to reduce distortions and prejudices. Bolukbasi et al. (2016) propose a methodology to modify word embeddings in such a way that gender-specific stereotypes are removed but desired associations are retained. Gender-specific words are distinguished from gender-neutral words and the gender dimension in the vector is removed from the latter.

Literature

Buolamwini, Joy & Gebru, Timnit (2018). Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification, Proceedings of Machine Learning Research 81:1–15, 2018;

Bolukbasi, Tolga; Chang, Kai-Wei; Zou, James; Saligrama, Venkatesh; & Kalai, Adam (2016). Man is to Computer Programmer as Woman is to Homemaker? Debiasing Word Embeddings. 30th Conference on Neural Information Processing Systems (NIPS 2016), Barcelona, Spain., 9p. https://papers.nips.cc/paper/6228-man-is-to-computer-programmer-as-woman-is-to-homemaker-debiasing-word-embeddings.pdf

Zou, James & Schiebinger, Londa (2018). AI can be sexist and racist — it's time to make it fair, Nature 559, 324-326; https://www.nature.com/articles/d41586-018-05707-8

1.4 Equal Opportunities in Science

Diverse ways to express ourselves, to learn, create and collaborate influence our collaboration in teams. Family background also plays a role on how easy or hard it might be to become familiar and navigate university practices and scientific communities.

These are some of the driving factors influencing career development in science. They describe different starting positions for a career which might even become personal challenges. They also fuel unconcious biases and different perceptions of similar achievements leading to measurable disadvantages for women and minorities: Without noticing it we judge someone not only by his/her performance but also by his/her affiliation to a group.

Measures have been undertaken on university and project level to counteract biases and enhance equal opportunities. These measures include among others mentoring systems, peer groups, training for scientific leaders and juries, support for parents and dual career couples.

The following list of ressouces is taken from the HBP Talent Guideline "I don't care who they are, I just want the best Person" and contains some inspiration at what might be an interesting idea or proposal for your team, Subproject or even the overall HBP to enhance equal opportunities.

Title	Short Description
Bacock, L., Laschever, S. (2003). Women don't ask: Negotiation and the gender divide. Princeton, New Jersey: Princeton University Press.	*"Women Don't Ask shows women how to reframe their interactions and more accurately evaluate their opportunities. It teaches them how to ask for what they want in ways that feel comfortable and possible, taking into account the impact of asking on their relationships."*
Bohnet, I. (2016). What Works: Gender Equality by Design. Harvard University Press.	"Gender equality is a moral and a business imperative". To overcome unconscious bias, Bohnet presents research-based solutions and tools to improve diversity and equality in teaching, workplace, HR management, governments, etc.

Cooke N. J., Hilton M. L. (2015). Enhancing Effectiveness of Team Science, National Research Council. Washington, DC: The National Academies Press.	The report focuses on challenges related to the complexity of modern science, which can be challenged by teamwork and teambuilding. It discusses and integrates the available research to provide guidance for practice to assembling a team, improving leadership, education and professional development for science teams.
European Union (2015). REPORT of the WORKING GROUP of the STEERING GROUP OF HUMAN RESOURCES MANAGEMENT under the EUROPEAN RESEARCH AREA on Open, Transparent and Merit-based Recruitment of Researchers (OTM~R), March 2015 https://cdn1.euraxess.org/sites/default/files/policy_library/otm-r-finaldoc_0.pdf	This Report and Guideline give suggestions for improvements in the recruitment and job advertisement for researchers, institutions, a country's research system, etc. The goal is to guarantee equal opportunities and access for all, developing an international portfolio (cooperation, competition, mobility) and make research careers more attractive.
Harvard Business Review (2016), THE LATEST RESEARCH DIVERSITY. https://hbr.org/product/the-latest-research-diversity/DIVRES-PDF-ENG	Diversity on different views and levels is discussed with this collection of articles, including gender, race, institutional factors, HR management and diversity, LGBT, etc.
Hill C., Corbett C., Rose A. St. (2010). Why So Few? Women in Science, Technology, Engineering and Mathematics, AAUW https://www.aauw.org/research/why-so-few/	"This study tackles this puzzling question and presents a picture of what we know—and what is still to be understood—about girls and women in scientific fields." Providing a lot of data for women in STEM.
Koch A. J., D'Mello S. D., Sackett P. R. (2015). A Meta-Analysis of Gender Stereotypes and Bias in Experimental Simulations of Employment Decision Making, in: Journal of Applied Psychology 2015, Vol. 100, No. 1, 128-161. http://dx.doi.org/10.1037/a0036734	Meta-Analysis especially analysing studies for working and recruitment and bias. Giving also practical implications based on research including diversity management, educational models for diversity as well as organizational tools.
Martinez, E. D. et al. (2007). Falling off the academic bandwagon. Women are more likely to quit at the postdoc to principal investigator transition. In: EMBO reports. Vol. 8 (11). p. 977-981. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2247379/	Report on the ratio of women and men in scientific careers on different levels. It is argued that women often quit their scientific career between postdoc and tenure-tracks position. Listing support options that are likely to help especially women to stay on track, underpinned with data.
Nielsen M. W., Alegria S., Börjeson L., Etzkowitz H., Falk-Krzesinski H. J., Joshi A., Leahey E., Smith-Doerr L., Woolley A. W., Schiebinger L (2017). Gender diversity leads to better science, in: PNAS, issue 8, February 21, 2017 114:1740-1742 10.1073/pnas.1700616114	Paper showing that under the right conditions and circumstances, teams benefit from various types of diversity, including scientific discipline, work experience, gender, ethnicity, and nationality. Showing "mechanisms for innovation" specifying why gender diversity matters for scientific discovery and how to manage diversity to maximize benefits.
Ross, H. (2008). Proven Strategies for Addressing Unconscious Bias in the Workplace. In: CDO Insights, Vol. 2, Issue 5. http://www.cookross.com/docs/UnconsciousBias.pdf	Short introduction on unconscious bias on different levels and 10 ways to combat Hidden Bias in companies.