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Still a man's world? Investigating the impact of expert gender on their perceived competence in technology communication

Noch immer eine Männerwelt? Der Einfluss des Expertengeschlechts auf die wahrgenommene Kompetenz in der Technikkommunikation

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 Studies in Communication and Media, 13. Jg., 1/2024, S. 292–316, DOI: 10.5771/2192-4007-2024-1-292

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Abstract: Experts who explain technological and complex content in the media could provoke negative responses regarding their competence due to stereotypical anticipations based on their gender. In an online experiment the impact of an expert's gender on the perceived competence in technology communication was examined, using a written interview about a technological topic with portraits of the expert as stimulus. Besides gender, the 2x2x2 design manipulated two further source characteristics, the effect of which, according to literature, interacts with gender: the expert's age and visual appearance. Contrary to the theoretical expectations, participants rated the female expert as more competent than the male expert. A higher age leads to a higher perceived competence. However, the age of the female expert did not significantly affect perceived competence, while the male expert seemed to benefit from an older appearance. The gender-neutral appearing female expert was perceived as the most competent, while a gender-neutral appearing male expert was rated as the least competent, highlighting the complex interplay between gender, visual appearance, and perceived competence.

Keywords: Gender, perceived competence, technology communication, stereotypes.

Zusammenfassung: Expert:innen, die technologische und komplexe Inhalte in den Medien erklären, könnten aufgrund geschlechtsstereotyper Antizipationen negative Reaktionen hinsichtlich ihrer Kompetenz hervorrufen. In einem Online-Experiment wurde der Einfluss des Expertengeschlechts auf die wahrgenommene Kompetenz in der Technikkommunikation untersucht, wobei ein schriftliches Interview zu einem Technikthema mit Porträts einer Expertin bzw. eines Experten als Stimulus verwendet wurde. Neben dem Geschlecht wurden im 2x2x2-Design zwei weitere Quellenmerkmale manipuliert, deren Wirkung laut Literatur mit dem Geschlecht interagiert: das Alter und das visuelle Erscheinungsbild. Entgegen der theoretischen Erwartung schätzten die Teilnehmenden die Expertin als kompetenter ein als den Experten. Ein höheres Alter führt zu einer höheren wahrgenommenen Kompetenz. Das Alter der Expertin hatte jedoch keinen signifikanten Einfluss auf die wahrgenommene Kompetenz, während der Experte von einem älteren Aussehen zu profitieren schien. Die geschlechtsneutral erscheinende Expertin wurde als am kompetentesten wahrgenommen, während ein geschlechtsneutral erscheinender Experte als am wenigsten kom-

petent eingestuft wurde, was das komplexe Zusammenspiel zwischen Geschlecht, visuellem Erscheinungsbild und wahrgenommener Kompetenz verdeutlicht.

Schlagworte: Geschlecht, wahrgenommene Kompetenz, Technikkommunikation, Stereotypen.

1. Introduction

> *"You see, man made the cars to take us over the road. Man made the trains to carry heavy loads. Man made electric light to take us out of the dark. Man made the boat for the water, like Noah made the ark. This is a man's, a man's, a man's world"*

These lines were sung by James Brown in 1966. In short: Men built cars, trains, ships and discovered electricity. Although a lot has changed since then – the number of female politicians is increasing, fathers take parental leave, and gender-sensitive language is used more and more (Magin & Stark, 2010; Maier, 2021) – the image of technology as a male domain persists (Keil & Leonhardt, 2021). The quota of women employed in technical professions in Germany was in 2023 still approximately 17 percent (Bundesagentur für Arbeit, n.d.). Keil and Leonhardt (2021) attribute this partly to the male dominance in skilled trades during the industrial revolution, and partly to the masculine rhetoric used in establishing engineering as a field of study. According to Wajcman (2007), "technologies have a masculine image, not only because they are dominated by men but because they incorporate symbols, metaphors and values that have masculine connotations" (p. 289). Gender stereotypes and the lack of female role models have proven to be particularly relevant to the low participation of women in STEM (Science, Technology, Engineering, Mathematics). A rational male image and an emotional female image are still prevalent, as is the stereotype of the mathematically and scientifically gifted male and untalented female (Heilemann et al., 2012). Research consistently confirms that men tend to be perceived as more competent and less social, while women are perceived as more social and less competent in return (Ebert et al., 2014). From a communication perspective, the media play an important role in the perception of gender and competence because, as Keil and Leonhardt (2017) state, "the images and metaphors conveyed on the Internet, in newspapers, radio, and television" influence how technology and male and female engineers are perceived (p. 27). Women in technology contexts still represent a kind of role expectation incongruence (Hu et al., 2022). When they appear in the media, e.g. in TV, magazine or newspaper interviews, as experts who explain technological and complex content, they could provoke negative responses regarding their competence due to stereotypical anticipations of the recipients. To date, however, there has been little research examining how the expert gender affects perceived competence in technology communication. Moreover, research lacks investigations about which further factors could influence the perceived competence of experts and interact with their gender. For example, when gender-stereotypes clash with age-specific expectations, literature refers to gendered ageism (Phillipson & Itzin, 1995). Since

research has shown that visual cues like clothing, facial hair or make-up can influence stereotypical attributions (e.g. Klatt et al., 2016), a more or less gender-stereotypical visual appearance could have an impact on the perceived competence of technology experts. This effect could also vary depending on the gender. Therefore, our experimental study aims to determine how the perceived competence of female and male experts in communication on technology topics differs and how the factors age and visual appearance influence this perception. Due to methodological constraints, the experiment refers to the socially constructed binary system of gender. This should not imply an absence or irrelevance of other gender identities.

2. Media and stereotypes

Media create and convey an image of the world that recipients interpret by drawing on pre-existing cognitive schemata (Thiele, 2016). These patterns of thought were named *stereotype* by Walter Lippmann (1922/1991). Since then, it has been used to refer to generalizing statements "which, on the one hand, are applied to human groups or to individuals as members of such groups, and which, on the other hand, as generalizing statements, represent positive or negative value attributions supported by strong beliefs" (Hahn, 2016, p. 141). There are many definitions that differ in their accentuation depending on the research direction (Thiele, 2016). What they have in common is that they distinguish the stereotype from the prejudice which is more affective and often includes negative evaluations of a group (Ramasubramanian & Murphy, 2014). Stereotypes are therefore based on cognitive categorization processes that group people based on salient characteristics such as age, gender, ethnicity, political orientation, or religious affiliation. This grouping is always accompanied by the attribution of certain qualities, abilities, or motives that are considered characteristic of the group of people (Petersen & Six-Materna, 2006).

There is a significant attention of communication scholars, especially those concerned with effects, to how the media contribute to the formation and consolidation of stereotypes. Ramasubramanian and Murphy (2014) describe the mass media "along with peers, family, and co-workers, (…) as key socializing agents in shaping individuals' attitudes, perceptions, and behaviors" (p. 385). One perspective in communication science that refers to the formation of stereotypes through media consumption is the cultivation hypothesis by Gerbner (1998). He suggested that heavy viewing of media content can lead to distorted social reality perception and increased stereotypical beliefs (Ramasubramanian & Murphy, 2014). Since then, multiple studies have reported cultivation effects – e.g. regarding heavy television viewing and conventional gender-role attitudes (Shanahan & Morgan, 1999; Yamamoto & Ran, 2014).

3. Gender stereotypes and perceived competence

Gender can be a characteristic that triggers stereotypical attribution. Gender stereotypes can be defined as "overgeneralized expectations about women and men" that include both a descriptive component of how women and men *are* and a

prescriptive component of how women and men *should be* (Hernandez Bark & Hentschel, 2019, p. 624). Judith Butler questioned the separation between the biological role (sex) and the culturally shaped social role (gender), challenging the "idea of biological uniqueness" (J. Butler, 1990; Drüeke et al., 2017, p. 221). Accordingly, gender is "what people do, perform, and display in everyday life, but which is determined by social conditions and invocations by others or the symbolic order" (Maier, 2021, p. 56). In this context, gender consists of the associations attributed to male and female social categories within a culture (Lindsey, 2015; Wood & Eagly, 2015). *Doing gender*, then, is the manifestation of typical gender roles in everyday actions (Herling et al., 2020). It describes how gender is produced in communication and becomes an important social characteristic for individuals and social and professional practices (Solga & Pfahl, 2009). Research about gender stereotypes in mass media is not a new development, however. Tuchman (1978/2000) introduced the "symbolic annihilation of women by the mass media" already in the 1970s and criticized in her work the ignorance and stereotypical portrayal of women.

The Stereotype Content Model (Fiske et al., 2002) concreticizes how females and males are perceived by distinguishing between the two dimensions warmth and competence. Warmth involves more social traits such as "friendly," "well-intentioned," "trustworthy," "warm," "good natured" and "sincere," whereas competence involves more cognitive skills such as "competent," "confident," "capable," "efficient," "intelligent" and "skillful" (p. 891). The two dimensions are theoretically independent of each other. Practically, however, they are often mutually dependent, meaning that individuals who score high on one dimension score low on the other (Fiske et al., 2002). Ebert et al. (2014) showed that men are rated more competent and less warm (cold-competent), whereas women are rated opposite (warm-incompetent). This leads to an unconscious evaluation: Although we know that not every woman is automatically strong in communication, it is assumed as standard. If this characteristic is missing in women, this is perceived as a particular deficiency. In men, on the other hand, an unexpected talent for communication is evaluated positively, while an absence does not have a detrimental effect because it corresponds to the male stereotype (Herling et al., 2020). Especially in typically male fields, such as engineering, gender stereotypes may therefore also have an impact on performance assessments and evaluations (Heilemann et al., 2012).

The perceived competence of individuals in a technology context could therefore also be related to their gender. Definitions and approaches for the concept of competence have in common that it is regarded as a disposition of skills "that encompasses both a dimension of knowledge (know that) and a dimension of action (know how)" (Röhr-Sendlmeier & Käser, 2017, p. 243). Thus, competence combines expertise, responsibility and ability and is to be distinguished from intelligence (Röhr-Sendlmeier & Käser, 2017). Finally, Hatak (2018) defines competence as "matching the demands of the task on the task performer with the abilities of the task performer" (p. 120). This study will not focus on the actual competence of a person but on *perceived competence,* which refers to the individual attribution of one person over the competence of another rather than to an inherent characteristic. Since technology is still a field with masculine connotations and men are

stereotypically perceived to be more competent, while women are assessed to be more warm or social, a discrepancy in perceived competence with respect to gender in technology communication is hypothesized.

H1a: A male expert in technology communication is perceived as more competent than a female expert.

H1b: A female expert in technology communication is perceived as warmer than a male expert.

4. Gendered ageism

Just as with gender, the age of people can lead to stereotypes by other persons. R. N. Butler (1969) coined the term ageism to mean discrimination against people based on their age. In occupational contexts, older people may be viewed more positively due to their association with experience (Liden et al., 1996). When age-specific stereotypes clash with gender-typical expectations, the literature also refers to gendered ageism. The term builds on concept of ageism (R. N. Butler, 1969) and was introduced by Phillipson and Itzin (1995). Gendered ageism is viewed as the interaction of the two systems gender and age that together lead to increased vulnerability (Krekula et al., 2018). In discussions about gendered ageism, the emphasis is often placed on the greater impact of ageism on older women (Sánchez-Román et al., 2022). In its "Global report on ageism", the World Health Organization (WHO, 2021) states that "women are often in a situation of double jeopardy in which patriarchal norms and a preoccupation with youth result in a faster deterioration of older women's status compared with that of men" (p. 11). However, according to Krekula et al. (2018), previous research on gendered ageism focuses too much on older women, ascribing them a particularly poor status due to a dominance of patriarchal norms. Precisely because of different findings on the direction of ageism, Krekula et al. (2018) call for a more nuanced view of gendered ageism, which can vary by context and in which men can also be affected by discrimination. A clash of age- and gender-specific stereotypes could also occur when experts are portrayed in technology communication and influence their perceived communication. Due to the remarks by Krekula et al. regarding a possible variation by context, the following research question is posed:

RQ1: a) What influence does the expert's age in technology communication have on the perceived competence and b) how does it interact with the expert's gender?

5. Visual appearance

Gender stereotypes are also evident in the context of people's visual appearance. Deaux and Lewis (1984) assessed the extent to which gender and different types of component information influence the attribution of other gender-related characteristics and found that physical appearance explains more variance than a

person's gender (Klatt et al., 2016). Since competence is stereotypically attributed to men, a more masculine visual appearance could also reinforce stereotypical ascriptions and thus a higher perceived competence for men. In contrast, for women, appearing along feminine patterns could also reinforce stereotypes and thus lead to being perceived as less competent. Sczesny et al. (2006) found that persons with a typically masculine appearance were rated as having more leadership competencies.

Clothing is a key point for the evaluation of a public figure and the conformity with cultural expectations of gender (Mandziuk, 2008). Suits, for example, accentuate the shoulders, emphasizing a strong physique, and are intended to create an upright posture that marks competence and power. Above all, they symbolize the social status of the wearer. Female-coded clothing, on the other hand, is intended primarily to emphasize physical attractiveness and stand as evidence of their femininity (Sennewald, 2008).

An accentuation of masculinity or femininity can also be performed through facials cues. Different scholars have investigated how facial hair can influence the perception of men. On the one hand, literature shows that men with beards tend to be judged as more masculine (Dixson & Brooks, 2013). On the other hand, Terry and Krantz (1993) found that men's beards were associated with lessened mental competence. Make-up can be a self-chosen attribute to accentuate femininity. An experimental study by Klatt et al. (2016) shows that women wearing make-up were rated as more competent and less warm. However, in a study by von Rennenkampff et al. (2003), the feature of make-up for women lead to a lower evaluation of leadership abilities. Also in the case of hairstyle research delivers inconsistent results – but it also seems to depend on the content. Regarding the evaluation of leadership abilities, a feminine styling can be an advantage if the position is also attributed with stereotypically feminine abilities (Klatt et al., 2016; von Rennenkampff et al., 2003).

There is little research on the visual appearance of experts in STEM contexts, but there is a significant body of research on the gender-stereotypical appearance of politicians. Literature mostly agrees on female politicians facing a double bind between expressing femininity and competence (Jungblut & Haim, 2023). The authors argue that this conflict between female traits and male attributes puts female candidates in a dilemma because "distributing messages that reinforce gender stereotypes might undermine their competence" (p. 567). However, female politicians who emphasize agentic, male attributed traits, risk a backlash for violating descriptive gender stereotypes (Jungblut & Haim, 2023). Due to the lack of research regarding the visual appearance of experts in STEM and inconsistent findings for masculine and feminine appearances and competence, the following research question is formulated:

> *RQ2: a) What influence does the visual appearance of an expert in technology communication have on the perceived competence and b) how does it interact with the expert's gender?*

6. Intergroup bias

The self-concept of the recipients could also play a role in how competent they perceive an expert in the context of technology. According to Tajfel and Turner's (1979, 1986) social identity theory, people generally tend to perceive their own group in a more positive light than an outside group. This tendency stems from a desire for positive self-esteem. Social identity can therefore be made more positive by valuing the group to which one feels a sense of belonging more highly than those from whom one distances oneself. In more current research, Roth and Steffens (2014) once again confirm the preference for self-groups over other-groups (intergroup bias) as a robust phenomenon. The results of their two studies show that the interaction of implicit personal self-esteem and group identification is related to implicit intergroup bias. The authors suggest that associative self-anchoring leads to rapidly forming implicit intergroup bias and unequal valuation of different groups and discrimination. The more individuals see a trait as part of their self-concept, the more they identify with the group to which that trait is ascribed, and the more self-worth diffuses into that ingroup. Identification is therefore a prerequisite for individuals to be able to link their self-concept to a group and thereby assign themselves to an ingroup and distinguish themselves from an outgroup (Roth & Steffens, 2014).

Gender can be such a trait and is, as argued by Steiner et al. (2022), part of most people's self-concept due to its social meaningfulness, early socialization, and the pervasiveness of gender roles. Thus, when people see gender as part of the self-concept, they might identify with people who appear to assign themselves to the same gender. A study by Ebert et al. (2014) shows that both men and women tend to implicitly attribute competence to their own gender. This is consistent with other studies finding an overall attribution of positive characteristics to the own gender (e.g. Rudman et al., 2001; Vonk & Olde-Monnikhof, 1998).

> *H2: Recipients perceive an expert as more competent when they feel they belong to the same gender.*

7. Recipients' characteristics as moderators

This different perception of men and women is accompanied by different expectations of the respective gender. Gender roles comprise "the general, socially accepted expectations of the behavior of men and women in certain life situations such as family and work, in social interaction and in political action" (Böttcher, 2020). Discrepancies can arise between the expected behavior and the gender role actually lived out. These can be rooted in societal framework conditions but also in personal values and norms of individuals (Böttcher, 2020). This means that people of different genders can move within a certain framework without coming up against social acceptance limits, which, however, is always changing due to changes in attitudes, values, and norms.

In a traditional perception of gender roles, the woman is primarily responsible for internal family activities, while the man is responsible for external activities and

primarily for providing for the family's finances. In an egalitarian gender role understanding, tasks are divided between men and women on a largely equal basis, and a gender-specific assignment of tasks is not found here, as a result of which both genders are economically independent of each other to the greatest possible extent. The egalitarian gender role understanding thus represents an emancipated image of the societal role of women (Böttcher, 2020). The understanding of gender roles is changing over time. The generations Y and Z, for example, grew up in a time when equality was already an important and much discussed topic. Correspondingly, Adriaans et al. (2020) found that younger people (23-33 y.) evaluate equal earnings of women and men as fair, while middle-aged (34-41 y.) and older (42-63 y.) find it fairer when men earn more than women. Comparing genders, Eilers (2019) found that in generation Z, males still agree with the traditional family role model significantly more than young women do (similar results in Hofmann et al., 2023).

RQ3: How is the effect of an expert's gender on the perceived competence moderated by the recipient's age?

RQ4: How is the effect of an expert's gender on the perceived competence moderated by the recipient's gender role attitude?

Petty and Cacioppo's (1986) *Elaboration Likelihood Model* postulates that, depending on the individual and situational involvement, attitude change can occur through two different routes since "modifying people's attitudes or other judgements can be done within a high degree of thought or a relatively low degree of thought" (Petty & Briñol, 2012, p. 226). Via the central route of information processing, the message is intensively processed cognitively and related to prior knowledge – in this process, the strength and quality of the arguments are especially crucial for a possible attitude change. The other route is the peripheral route, in which the recipients make only a small cognitive effort and deal less intensively with the arguments. Here, heuristics and vivid cues play a greater role. The personal relevance of a message can be one crucial factor affecting how a message is elaborated, since a high involvement could lead to a higher motivation and ability to process an information on the central route (Petty & Cacioppo, 1986). In a STEM context, people with a high personal involvement, e.g. because they work or study in this sector or because of specific personal interest, could engage more intensively with the quality of the arguments presented in media content while people with a low involvement may tend to rely on heuristics such as gender, age or visual appearance of the communicators. The gender of a communicator is easily perceived and may function as a heuristic cue (Gierl & Bambauer, 2002).

H3: The effect of an expert's gender on the perceived competence is moderated by the recipients' involvement.

8. Method

The hypotheses and research questions were examined using data from an 2x2x2 online experiment with the factors (1) expert gender, (2) age and (3) visual appearance which was conducted in July and August 2022.

Treatment

For the experiment, participants were presented an interview article in which an expert explains the topic of the *Internet of Things* in an industrial context. This topic was chosen because it has an industrial and technological component but is also comprehensible for laypersons. The stimulus text (see appendix on https://osf.io/85j27) was identical for all versions and was based on an interview originally published on the website of a German technology venture (Engelhardt, 2019). Next to the text, a photograph depicted the expert cited whose gender, age and gender-stereotypical visual appearance were manipulated. The source material of this photo were two different pictures of a woman, once as a portrait (see Table 1) and once in a presentation situation (see appendix on https://osf.io/85j27). The original pictures and the person depicted there were not used as stimuli. New images of eight different people in the two situations were created using a face-modification app and further processing, changing the three factors in each case. These images were embedded in the interview article, which differed for the eight groups only in linguistic gender-related features such as the expert's name and the corresponding personal pronouns (see appendix on https://osf.io/85j27 for the whole treatment).

The first factor, gender, was varied in the dimensions female expert and male expert. The second factor, age, was divided into the categories younger and older. In the younger category, an attempt was made to represent a person between the ages of 20 and 30, and in the older category, a person between the ages of 50 and 60. This division was intended to create a visible but also realistic age difference between the various experts. The third factor consisted to gender-neutral versus gender-stereotypical visual appearance. The latter means a gender-typical look, according to the cues described in chapter 4, which accentuates either femininity or masculinity. The male expert with a gender-stereotypical visual appearance was depicted stereotypically masculine, i.e. in a suit, rather muscular, with short hair and beard. The gender-stereotypical female expert was depicted with long hair, tailored clothing and make-up. The gender-neutral expert was depicted as neutral as possible for both genders: no bodyhugging clothing, no make-up or beard, mid-length hair.

Whether the manipulation was perceived by the respondents as intended was checked with a manipulation check and could be confirmed for all three factors (see appendix on https://osf.io/85j27). The recipients' attention on the interview text has been controlled with multiple choice questions to measure the recall of content. Also the duration of exposure was measured by automatically registering each subject's time spent on the stimulus page in seconds. However, no significant differences were found between the recall of content or the duration of exposure for the three manipulated factors.

Table 1. Expert photo in eight versions

	Younger	Older
	Female	
Gender-neutral		
	n = 29	*n* = 32
Gender-stereo-typical		
	n = 25	*n* = 28
	Male	
Gender-neutral		
	n = 28	*n* = 32
Gender-stereo-typical		
	n = 29	*n* = 27

Sample

The online experiment was conducted in SoSciSurvey. The non-representative sample of $N = 246$ persons was recruited via social networks, forums, and university e-mail distribution lists. The sampling method is biased towards young and highly educated people due to the young and academic environment of the recruiting researcher. Individuals who completed the questionnaire in a conspicuously short time (< 2.5 minutes) were excluded ($n = 14$). Since the gender of the respondents plays an important role in the analysis, two respondents were excluded who classified their gender as "diverse" and therefore could not be assigned to an ingroup due to the experimental design. The subsequent analyses were thus conducted with $n = 230$ individuals. The power analysis that was conducted in G*Power determined a sufficient statistical power (α error probability = .05) of the sample for detecting large (99%) and medium effects (96%). Due to the small sample size it is possible that not all small effects can be found (statistical power for small effects: 33%). Respondents ranged in age from 17 to 93 years ($M = 32.9$, $SD = 15$). 67 percent of the respondents identified themselves as female. Seventy-five percent of the respondents had a university degree. Twenty-seven percent were professionally employed in the STEM sector or are studying a STEM subject. Participants were randomly assigned to one of eight experimental groups and thus exposed to only one of the experts. In preparation for hypothesis testing, the eight experimental groups were tested for differences and significant differences were found in terms of the respondents' age and their relation to the STEM sector. However, the demographics of the respondents and their relation to the STEM sector have been controlled during the data analysis to neutralize their effects.

Measures

Perceived competence, the dependent variable, was measured using a scale by Kanning and Heilen (2016), which operationalizes the construct competence via the eight items eloquent, confident, self-assured, sovereign, competent, experienced, expert, and professional. Respondents were asked to indicate their disagreement or agreement with the items on a five-point Likert scale from 1 (= "disagree") to 5 (= "agree") with respect to the expert shown. A mean index was calculated for the item battery ($M = 4.11$, $SD = 0.58$, $\alpha = .89$).

Perceived warmth, as another dimension of the *Stereotype Content Model,* was also captured using a scale from Kanning and Heilen (2016). How socially competent the respondents perceived the expert to be was queried via the eight items polite, friendly, attentive, open, approachable, trustworthy, sympathetic, and patient. Again, the five-point Likert scale was used and condensed to a mean index ($M = 3.79$, $SD = 0.60$, $\alpha = .90$).

Gender role attitude was examined using a translated scale by Behm-Morawitz and Mastro (2009), which conceptualizes attitudes and beliefs across the three dimensions of appearance, occupation/household, and cognitive abilities. The appearance subscale contains five items (e.g., "Compared to men, it is more important for women to look good when appearing in public"), the occupation/household

subscale seven items (e.g., "Women should hold the same occupational positions as men" or "Women should be responsible for cooking at home, men should not"), and the cognitive abilities subscale three items (e.g., "Men can handle mental challenges better than women"). A five-point Likert scale from 1 (= "disagree") to 5 (= "agree") was applied and condensed to three mean indexes: appearance (M = 1.84, SD = 0.88, α = .83); occupation/household (M = 1.67, SD = 0.68, α = .78), and cognitive skills (M = 1.84, SD = 0.97, α = .86). Finally, a mean index was formed across the three dimensions where a low mean value represents an egalitarian role model, a high value a traditional one. Overall, the sample showed more egalitarian gender role attitude (M = 1.76, SD = 0.72, α = .91).

Involvement was measured by asking respondents whether they worked in the STEM sector or study a STEM subject themselves (27 %) or not.

Data analysis

To investigate H1a and H1b as well as RQ1 and RQ2, two ANCOVAs were performed for perceived competence and perceived warmth as dependent variables. Each model includes the three experimental factors as independent variables and the recipients' characteristics (gender, age, education, involvement and gender role attitude) as covariates to control their effects. For H2, an ANCOVA was calculated with the expert and recipient gender as independent variables, while the other characteristics of the recipients were again used as covariates. The same procedure was carried out for H3 with expert gender and recipients' involvement as independent variables. To investigate RQ3 and RQ4, moderation analyses were calculated since both the recipients' age and their gender role attitude were measured as metric scales.

9. Results

Perceived competence and warmth by gender

For H1a and H1b, which assumed that a male expert would be perceived as more competent than a female expert while a female expert would be perceived as socially warmer, the results in Table 2 show significant effects for both. Contrary to H1, the female expert (M = 4.27; SD = 0.55; n = 114) was perceived more competent than the male expert (M = 3.96; SD = 0.58; n = 116). H1b can be confirmed, since the female expert was also perceived more socially competent than the male expert (M_{female} = 3.92; SD = 0.60; M_{male} = 3.67; SD = 0.58). How can both results be explained? The previously described underrepresentation of women in the tech industry could lead to *tokenism*, being seen as special as an expert in the field (Herling et al., 2020). Therefore, one reason for the overall more positive evaluation of the female expert could be that it is seen as a special achievement that the interviewed tech expert is a woman. While men do not stand out when talking professionally about technology since it fits the male stereotype, women do. This could lead to them being seen as having a special competence (Herling et al., 2020). The results for H1b again confirm the previous findings, in which women are more

likely to be attributed with social and communal traits such as "good-natured," "trustworthy," and "sympathetic" than men based on biological traits such as the ability to bear children (Fiske et al., 2002; Hernandez Bark & Hentschel, 2019). However, considering H1a and H1b together, no interdependence (cold-competent vs. warm-incompetent) can be confirmed in this study.

Table 2. ANCOVA results for perceived competence and warmth of experts

	Perceived competence		Perceived warmth	
	F	η^2_p	F	η^2_p
Expert gender	17.98***	0.08	7.09**	0.05
Expert age	8.49**	0.04	0.00	0.01
Expert visual appearance	0.03	0.00	0.07	0.00
Interactions with expert gender				
Expert gender * expert age	3.09	0.01	1.42	0.01
Expert gender * expert visual appearance	6.43*	0.03	0.02	0.00
Covariates				
Recipients' gender	0.37	0.00	0.03	0.00
Recipients' age	0.04	0.00	0.48	0.00
Recipients' education	2.33	0.01	0.34	0.00
Recipients' involvement	2.68	0.01	4.15*	0.02
Recipients' gender role attitude	5.38*	0.02	3.43	0.02
$R^2_{adj.}$	0.15		0.05	

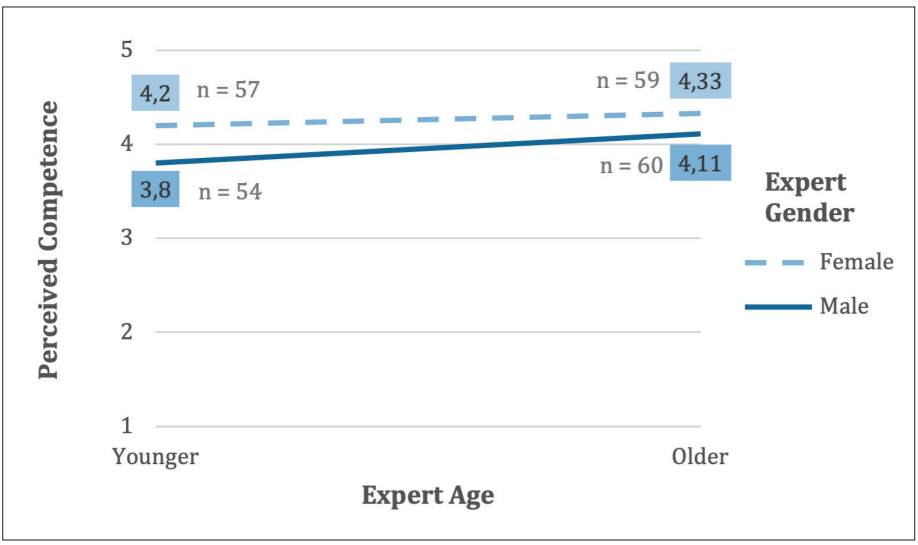
Note. N = 230. Scale 1-5 (low-high competence/cold-warm). *** $p < .001$; ** $p < .01$; * $p < .05$.

The impact of age and visual appearance

RQ1a aims to investigate the main effect of the expert age on the perceived competence. The results of the ANCOVA (see Table 2) show a significant effect for the expert age. Older experts were evaluated as more competent (M_{older} = 4.22; SD = 0.50; $M_{younger}$ = 3.99; SD = 0.64). This is in line with research that finds older people being judged more positively in occupational settings. However, "older" in this study was represented by experts who aimed to be evaluated as being between 50 and 60 years old. An even older age might lead to different results, as for them the dimension of warmth is perceived as more pronounced (Fiske et al., 2002). RQ1b then referred to the interaction between experts' age and experts'gender. No significant effect was found for the interaction of both factors (p = 0.08). Thus, the study confirms that a higher age can lead to a higher perceived competence, not necesseraly depending on the gender. However, an exploratively conducted Tukey HSD post hoc test with pairwise comparisons shows that the young male expert was perceived signicantly less competent than all other experts. While it had almost

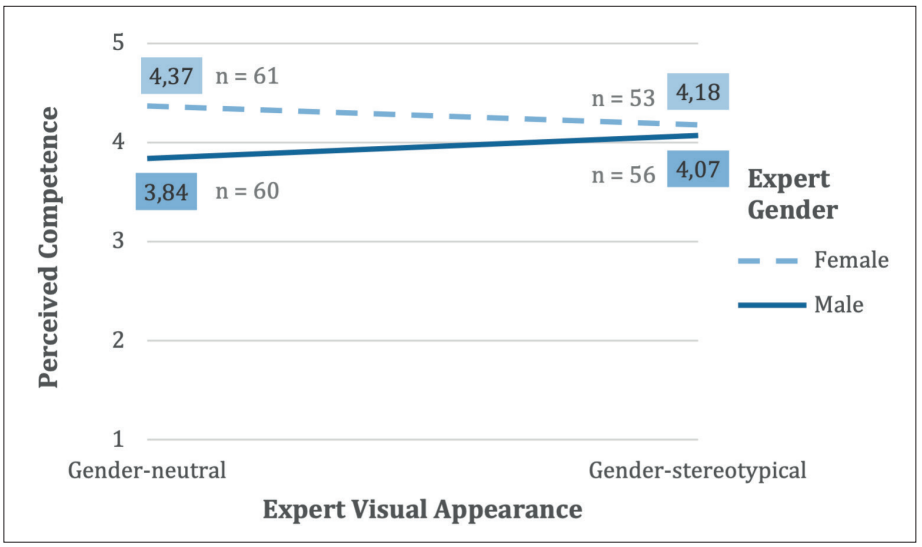
no impact on the perceived competence of the female expert (ΔM = 0.13, n.s.), for the male expert it makes a difference how old he is and being young leads to being perceived less competent (ΔM = 0.31, p < .05; see figure 1). Considering this, there is a positive effect of age on the perceived competence of technology experts in a media context – whether this impact is also influenced by their gender should be investigated in further research to confirm the found differences between younger and older male and female experts.

Figure 1. Interaction of expert gender and expert age on perceived competence



RQ2a asked for the effect of gender-stereotypical visual appearance on perceived competence. The conducted ANCOVA does not show a significant main effect for the visual appearance alone. Thus, gender-stereotypically appearing experts, regardless their gender, are not perceived differently than gender-neutral appearing experts. The results demonstrate that visual appearance affects the perceived competence differently depending on the expert gender. There is a significant difference between a gender-neutral appearing female versus male expert (see figure 2; $p < .001$) while the gender-stereotypical appearing female and male expert are not perceived differently regarding their competence. When a female expert adopts a gender-neutral visual appearance, stereotypical ascriptions might be reduced. This is in line with the research on politicians who are in a double bind between expressing femininity and competence (Jungblut & Haim, 2023). In contrast, a male expert adopting a gender-neutral visual appearance may be seen as deviating from the traditional male appearance associated with competence, resulting in decreased perceived competence. A lessened association with competence for bearded men, as found by Terry and Krantz (1993), could not be confirmed.

Figure 2. Interaction of expert gender and expert visual appearance on perceived competence



The impact of the recipients' characteristics

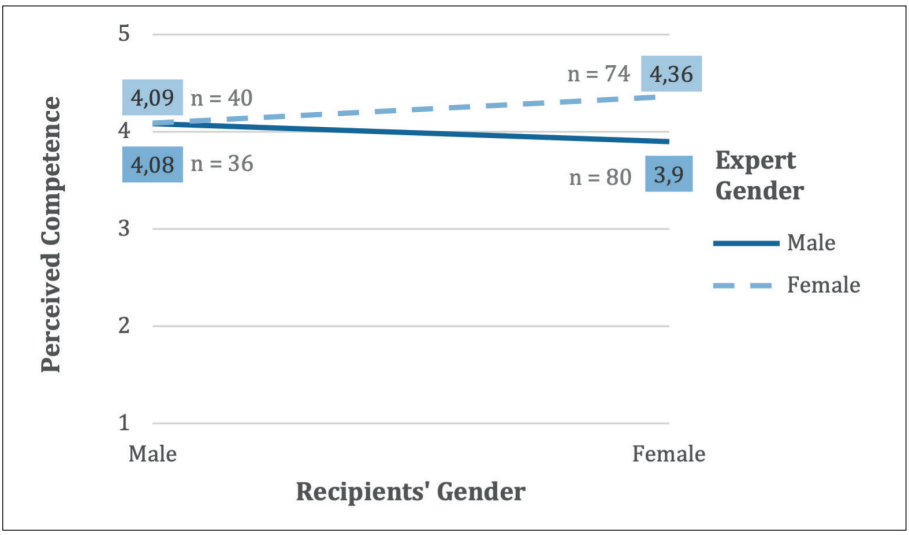
H2 assumed that the recipients' gender has an influence on how competent they perceive the male and female expert. Table 3 (see appendix on https://osf.io/85j27) reveals a significant interaction between the respondents' and expert gender. Figure 3 shows that the male respondents did not rate the female and male expert differently in terms of their competence ($\Delta M = 0.01$, n.s.), while the female respondents rated the female expert significantly more competent than the male expert ($\Delta M = 0.46$, $p < .001$). Therefore, a clear ingroup favoritism is evident among female respondents, whereas this does not occur among the male respondents.

One reason for this could be the perception of necessity: According to the social identity theory, individuals strive to build or maintain a positive self-worth, which is why they distinguish their own group from others and evaluate it more positively. Maybe male respondents' self-worth is greater in this case because it is an issue that is also consistent with the male stereotype – especially in an experimental and thus somewhat artificial setting. Therefore, they might feel less of a desire or urge to evaluate their own group more positively, whereas women have a lower self-worth due to established stereotypes (e.g. "women can not handle technology"), so they might be more likely to feel they can or should increase it by evaluating their ingroup more positively.

The aim of RQ3 was to investigate whether the influence of the expert gender on the perceived competence is moderated by the recipients' age. The results of the moderation analysis show that the recipients' age has no influence on how competent they perceive the expert depending on the gender since neither the main

effect of the recipients' age (β = -.02, n.s.) nor the interaction effect of the recipients' age and the expert gender are significant (β = -.01, n.s.).

Figure 3. Interaction of expert gender and recipients' gender on perceived competence



RQ4 aimed to find out whether the relationship between the expert's gender and their perceived competence is influenced by the recipients' gender role attitude. The moderation analysis confirms this assumption (β = -.14; $p < .05$). Thus, a more traditional attitude towards the role of men and women in society leads to the female expert being perceived less competent than it is perceived by people with less traditional attitudes. It is interesting to mention that women reject traditional gender roles significantly more than men ($M_{Women} = 1.60$; $M_{Men} = 2.09$; $t(120) = -5$; $p < .001$, $d = 0.72$). This rejection could reinforce the ingroup favoritism that was previously found for women.

H3 predicted that the relationship between the expert gender and the perceived competence is influenced by the recipients' involvement due to their activity in the STEM sector. The sample includes $n = 61$ respondents who were active in STEM, $n = 169$ did not work or study in the sector. There is a weak, significant interaction between the expert gender and the involvement (see table 4). Respondents who are not studying or working in the STEM sector, and thus have a low involvement, rated the female expert as significantly more competent than the male expert ($\Delta M = 0.40$, $p < .001$). Recipients who are highly involved due to a closer relationship to STEM did not show such a differentiation ($\Delta M = 0.09$, n.s.).

Thus, it still seems to matter whether respondents are themselves involved in the STEM industry. Those respondents may have received the stimulus more via the central information processing route and focused on the content of the interview, whereas respondents who are not in STEM industries may have paid more attention to gender as a peripheral stimulus. In addition, since before it was already shown that

male recipients did not rate male and female experts differently the gender distribution in the STEM group has been controlled, since theory has shown that the STEM industry consists of only about 15 percent women. In this sample, 56 percent of the recipients who had a closer relationship to STEM were male. The ANCOVA was therefore repeated separately for male (n = 76) and female (n = 154) respondents, but did not find significant effects in either group. Hence, the found effect is actually caused by the respondents' involvement. Gender-sensitive technology communication is therefore particularly important when it is used to address people outside the STEM sector, as they have internalized the stereotype of masculinity and technology even more strongly than people who deal with technology every day.

10. Discussion

The aim of this study was to empirically investigate the effects of the gender of an expert in technology communication. It was shown that a female and a male expert are perceived differently regarding their competence. In contrast to the predictions, the female expert was generally assessed as more competent. Furthermore, in line with prior research, the results once again confirm that being young in professional settings may result in lower perceived competence, while middle-aged individuals may benefit from probably being associated with more experience. However, the results also indicate that while the experts' age did not matter for the perceived competence of the female expert, the male expert may have to prove himself through older age, which is associated with experience, in order to stand out from other men in the industry. While the gender-stereotypical appearing male and female experts are perceived as almost equally competent, a gender-neutral visual appearance leads to a more polarized perception, since the gender-neutral appearing female expert is perceived as most competent and the gender-neutral appearing male expert as least competent. In addition, this study has shown that gender stereotypes are still prevalent by demonstrating that men were perceived to be less warm than women. The fact that women are still poorly represented in the STEM sector and lack comparative persons in technology communication can be seen in the ingroup favoritism observed. One possible explanation is that women could try to increase their self-worth in the technology context by better assessing their own group due to the assumption of a negative image of women and technology in society.

For gender-appropriate technology communication, in which men and women are perceived as equally competent and have the same opportunities, two aspects must therefore be taken into account: On the one hand, more female role models need to be shown so that women see technology as part of their self-concept and have no inhibitions about being active in this field. They should be able to see through the presence of role models that the image of women and technology is not as bad as they think. More female presence in the media could also reduce tokenism, so that women are not being seen as something special when they embody experts for technology topics (Herling et al., 2020). On the other hand, as already stated by Keil and Leonhardt (2017), stereotypes of the connection between masculinity and technology must be broken down, as both genders suffer from this.

Thus, these structural barriers need to be broken down by changing the image of masculinity in society. Technology communication needs a careful approach to stereotypes so that the competence of an expert is not judged on the basis of gender, age or appearance, but on ideas and arguments. It should convey that all people with appropriate knowledge can build cars, trains or ships and develop new technologies.

One limitation of this study is the image manipulation for the treatment. The study attempted to manipulate gender-typical visual appearance for both men and women identically, but it is uncertain whether an identical manipulation is possible. Make-up on women, for example, could have different effects than facial hair on men. Another limitation is the statistical power for small effects and the predominantly female, young and highly educated sample. Although the results are therefore not representative, they show that even in a sample like this, female and male experts are still perceived differently. This emphasizes the relevance of further initiatives for equality – in both directions. It is not only the pictures in people's heads about femininity, that still withhold equality, but also the ideas of masculinity. Since a strong ingroup favoritism could be identified among the female respondents, presumably due to a low self-esteem on technology topics, future research could investigate whether this phenomenon occurs among male respondents when using experts on social, educational or domestic topics. In terms of the skills shortage, it might be worth investigating the extent to which an increased presence of women in, for example, corporate blogs, job advertisements, or social media posts by tech companies leads to higher self-worth among women in relation to technology, and whether this in turn has an impact on more women venturing into the tech industry. Moreover, it could be interesting to see what differences there are in terms of communication success when either researchers, management, or, for example, press spokespersons communicate on technology topics. Since technology communication is often about creating acceptance, it could also be interesting to see what role perceived competence plays in the development of acceptance.

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