Computers & Education 95 (2016) 63–74

Contents lists available at ScienceDirect

Computers & Education

journal homepage: www.elsevier.com/locate/compedu

See feminine – Think incompetent? The effects of a feminine outfit on the evaluation of women's computer competence

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ARTICLE INFO

Article history:
Received 1 September 2015
Received in revised form 20 December 2015
Accepted 24 December 2015
Available online 29 December 2015

Keywords:
Computer skills
Gender stereotypes
Femininity
Feminine outfit
Competence

ABSTRACT

According to common gender stereotypes, women are assumed to have lower computer skills than men. Following the interactive model of Deaux and Major (1987), target attributes or situational cues can activate stereotypes. Can the outfit of a woman elicit the stereotype of women's lower computer skills? In our study, 162 participants (105 women, 57 men) evaluated the same women competing for an IT-related student job, differing only in their outfit (neutral vs. feminine). Compared to a neutral outfit, a feminine outfit led to higher ratings of femininity, but lower ratings of computer skills, and unfavorable attributions of success and failure in a computer task (higher attribution of success to luck and of failure to lack of skills). Furthermore, women with a feminine outfit were also rated as less intelligent, less competent and less likeable. Similar to previous findings, male participants rated themselves as higher in computer skills than female participants.

1. Introduction

We undoubtedly live in a computer world. In 2013, 84% of U.S. American households owned a computer, 74% with access to the Internet (File & Ryan, 2014). Other countries such as Germany register similar numbers (Statistisches Bundesamt, 2015b). The use of computers and the Internet offers exciting new job opportunities and in many vocational domains sophisticated computer skills are already essential for a successful career. It has been argued that access to technologies at work can bring prestige, job security, more satisfying work and higher pay (Brynin, 2006). Indeed, German and U.S. American employees with computer training and advanced work-related computer skills had higher incomes compared to employees without such skills (Peacock, 2008; Peng & Eunni, 2011).

Nevertheless, women and men benefit to different degrees from this trend, as there are still fundamental gender disparities in computer use and careers in computer-related domains. Boys used computers more than girls in the context of education in 39 countries (Drabowicz, 2014); they also used the Internet more for personal and educational purposes (Durndell & Haag, 2002; Imhof, Vollmeyer, & Beierlein, 2007; Li & Kirkup, 2007; Papastergiou & Solomonidou, 2005). More importantly, men are much more likely to pursue careers in computer-related domains. In Germany, women made up only

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http://dx.doi.org/10.1016/j.compedu.2015.12.007
0360-1315/

18% of university students of computer science, computer engineering, and IT in 2014 (Statistisches Bundesamt, 2015a). In the US, female students in these subjects were even more scarce, making up only 13% of students in 2010 (Zweben, 2012).

The present study addresses one of the antecedents of the gap between men and women with regard to careers in computer-related domains: The stereotype that girls and women are less interested in and skilled with computers (Bömer & Imhof, 2011; Cheryan, Master, & Meltzoff, 2015; Cooper, 2006; Smith, Morgan, & White, 2005). Following expectancy-value theory (e.g., Wigfield & Eccles, 2000, 2002), expectation of success – both by the person choosing and relevant others – is a very important determinant of achievement-related choices, such as school or university courses. We are interested in whether this expectation of success can be manipulated by activating a female gender stereotype. More interestingly, while there is a lot of research on gender stereotypes activated by biological sex or physical appearance of stimulus persons (M. K. Ryan, Haslam, Hersby, & Bongiorno, 2011; Sczesny & Kühnen, 2004; Sczesny, Spreemann, & Stahlberg, 2006), we focus on subtle cues such as outfit, which, in contrast to biological sex or physical appearance (facial or body features), can easily be changed. Now, we will first take a closer look at the theoretical background before we consider consequences of stereotype activation.

1.1. Theoretical background

Why is it important to study stereotype activation in the domain of computer stereotypes? One theory that can explain the fact that women rarely choose careers in computer-related fields (Croasdell, McLeod, & Simkin, 2011) is the expectancy-value theory of achievement motivation (e.g., Wigfield & Eccles, 2000, 2002). It postulates that achievement related choices, for example subject selection in schools and universities, are influenced by the subjective task value and the expectation of success. The decision to study a computer-related subject is therefore affected by the value a person attributes to this subject and by the expectation of success (Dickhäuser & Stiensmeier-Pelster, 2002). Both are influenced by the stereotype that girls and women are less interested in and skilled with computers (Cooper, 2006; Smith et al., 2005) and may in turn lead to lower computer self-efficacy, less computer use, and lower participation rates of girls and women in computer courses at school (Christoph, Goldhammer, Zylka, & Hartig, 2015; Dickhäuser & Stiensmeier-Pelster, 2003; Shashaani & Khalili, 2001; Vekiri & Chronaki, 2008).

How are stereotypes activated? In their interactive model of gender-related behavior, Deaux and Major (1987) postulated that target attributes or situational cues can activate gender-related schemata. Of course, stereotypes can be triggered by the sex of a person. For example, men are seen as more self-confident, competent or intelligent (Asbrock, 2010; Fiske, Cuddy, Glick, & Xu, 2002; Sczesny et al., 2006). However, stereotypes may also be activated by gender-stereotypic appearance (e.g., length of hair and facial features), regardless of a person's sex (Sczesny & Kühnen, 2004; Sczesny et al., 2006; von Rennenkampff, 2004). In this study, we focus on the cue of a feminine outfit. While gender-stereotypic physical appearance is mostly based on unchangeable features (such as body size or facial features), the outfit (e.g., clothes and make-up) can easily be modified. In the following, we will look at the consequences of activating the gender stereotype of lower computer competence in women.

1.2. Consequences of stereotype activation

The first consequence of activating the stereotype that women have a lower computer competence than men would be a lower ascription of computer skills to women. Indeed, past studies have already demonstrated this effect, showing that women were perceived to have less computer skills (Cooper, 2006). Moreover, women also reported lower computer skills (Christoph et al., 2015; Dickhäuser & Stiensmeier-Pelster, 2003; Hargittai & Shafer, 2006; Sieverding & Koch, 2009), and lower computer self-efficacy, and indicated more negative attitudes toward computer-related domains than men (e.g., Christoph et al., 2015; Durndell & Haag, 2002; Li & Kirkup, 2007; Sun, 2008; Tømte & Hatlevik, 2011). Based on this evidence, a woman wearing a feminine outfit would likely be rated lower on computer skills.

Furthermore, the activation of gender stereotypes may lead to negative attribution patterns for women's success or failure on computer tasks. A classic study found that women who performed successfully on a “masculine” task were considered to be lucky, whereas men were considered to be skilled (Deaux & Emswiller, 1974). A later meta-analysis on gender differences in attribution of success and failure on “masculine” tasks concluded that effects were small, but still meaningful (Swim & Sanna, 1996). Thus, when a woman successfully solved a computer task, others attributed her success to luck to a greater degree than they did for men (Cooper, 2006). While the meta-analysis was conducted nearly 20 years ago, newer studies have also shown that women attribute their success in computer-related tasks less and their failure more to stable, global, internal, and uncontrollable factors (Dickhäuser & Stiensmeier-Pelster, 2002). Unfavorable attributions (e.g., to lack of skills) only emerged when people were reminded of the stereotype of women's lower computer skills (Koch, Müller, & Sieverding, 2008).

The activation of stereotypes in a specific domain may transfer to an overall impression. For example, Deaux and Emswiller (1974) found that women performing well were seen as less intelligent than men performing well. Because men are seen as more self-confident, competent, or intelligent (Asbrock, 2010; Fiske et al., 2002; Sczesny et al., 2006), it is likely that when a female gender stereotype is activated by wearing a feminine outfit, a woman will not only be rated negatively in the domain of computer skills, but will also be seen as less confident, competent, and intelligent. However, women are usually seen as warmer (Asbrock, 2010; Fiske et al., 2002), which then in turn leads to higher liking (Wojciszke, Abele, & Baryla, 2009), such that a feminine woman may also be perceived as more likeable.

In addition, when a woman wears a feminine outfit, the stereotype activation may influence how people perceive themselves. For example, when students compared their own computer skills to that of a female stimulus person, they evaluated themselves as more competent than when they compared themselves to a male stimulus person (Sieverding & Koch, 2009). The results of a comparison with a woman wearing a feminine outfit (vs. a neutral outfit) may be similar. However, as the finding that women rate their computer skills lower than men do (Christoph et al., 2015; Dickhäuser & Stiensmeier-Pelster, 2003; Hargittai & Shafer, 2006; Sieverding & Koch, 2009) is quite persistent, this gender gap should also emerge in self-evaluation made in comparison to female stimulus persons.

All in all, we suggest that a gender-stereotypic outfit can activate the female gender stereotype with the respective consequences on external and self-evaluations, and test this assumption in the domain of computer skills. A feminine outfit should lead to lower ratings of computer skills and negative attribution patterns (success to luck, failure to lack of skills) in comparison to a neutral outfit. Furthermore, this negative evaluation should generalize to the competence domain (competence, intelligence and self-confidence), but the warmth domain (likeability) should be positively affected. In addition to that, participants should feel more competent regarding computers when they compare themselves to a woman with a feminine outfit, and men should generally feel more competent than women.

2. Pretest

The goal of the pretest was to test our stimulus material and to investigate whether the outfit of women can elicit the female gender stereotype. More precisely, we wanted to know whether the outfit affects the evaluations of a stimulus person's femininity (and masculinity). Our hypothesis was that women with a feminine outfit would be rated as more feminine and less masculine than the same women with a neutral outfit.

2.1. Method

119 students of a large Western German university (69 women, 48 men, 2 did not indicate) with a mean age of 22.98 ($SD = 5.37$, Range = 19–49) took part in the pretest, which was conducted in the laboratory. A 2 (applicant's outfit: feminine vs. neutral) x 2 (participant's sex: male vs. female) between-subjects design was used. That is, participants were assigned to rate either a female applicant with a feminine outfit or a female applicant with a neutral outfit. The dependent variables were ratings of masculinity and femininity of the stimulus person.

We produced pictures of four female students as stimulus persons, once with a feminine, and once with a neutral outfit (controlling for posture, gesture, facial expression, etc.). Participants were asked to rate the masculinity and femininity of these stimulus women. Each participant randomly rated only one stimulus person, which was presented with a portrait and a full-body picture. If participants were assigned to the feminine outfit condition, the stimulus person wore make-up and feminine clothes (dress or skirt with top, shoes with heels); if participants were assigned to the neutral condition, the stimulus person wore no make-up and neutral clothes (jeans and sweater, flat shoes). For an example of the pictures used, see Fig. 1. Participants were asked to rate the femininity and masculinity of the stimulus person, on scales from 1 (*not feminine/masculine*) to 7 (*very feminine/masculine*).

2.2. Results and discussion

Participants rated the stimulus women with a feminine outfit as more feminine than the same stimulus women with a neutral outfit, $M_f = 5.77$, $M_n = 4.62$, $t\ (116) = 5.36$, $p < .001$, $d = .99$. Furthermore, a neutral outfit led to higher ratings of

Fig. 1. Pictures of one of the stimulus persons used in the pretest and main study. Portrait on the left (neutral left, feminine right), whole-body picture on the right (neutral left, feminine right).

masculinity compared to the feminine outfit, $M_n = 2.43$, $M_f = 1.90$, $t\,(116) = 2.62$, $p = .01$, $d = .47$ (see Fig. 2). Therefore, our hypothesis that the feminine outfit would activate the female gender stereotype and affect femininity and masculinity ratings was supported. Thus, our stimulus material was successful in manipulating the femininity and masculinity ascribed to the female stimulus persons.

3. Main study

Our main study used the pretested stimulus material and aimed to investigate consequences of women wearing a feminine vs. a neutral outfit. Our main hypothesis was that, compared to a neutral outfit, a feminine outfit would activate the female stereotype, therefore leading to a lower attribution of computer skills for this stimulus person. Furthermore, we provided participants with additional information about the woman's performance in a complex computer task: The stimulus person allegedly solved this task either very successfully or was unsuccessful at solving the task. Then, we asked participants to give their attributions of success/failure of the stimulus person. We expected the attribution to be less favourable for women with a feminine outfit in comparison to women with a neutral outfit. Furthermore, we were interested whether the activation of the female stereotype would also influence the attribution of general competence (e.g. intelligence, competence and self-confidence), and likeability of the stimulus person. We further assessed self-evaluations of computer skills by comparing participant's own computer skills to those of the stimulus person. Participants indicated how they would perform on the same task compared to the stimulus person. Sieverding and Koch (2009) found that participants of both sexes rated their own computer skills as higher when they compared themselves with a female stimulus person than when they compared themselves with a male stimulus person. Our assumption was that not only the sex but also the outfit of a stimulus person can influence self-ratings.

We therefore tested the following four hypotheses:

Hypothesis 1. (Computer skills): Compared to women with a neutral outfit, participants will ascribe less computer skills to women with a feminine outfit.

Hypothesis 2. (Attribution): Compared to women with a neutral outfit, participants will have more negative attribution patterns regarding computer skills for women with a feminine outfit.

Hypothesis 2a. (Attribution of success): Compared to women with a neutral outfit, participants will attribute the success of women with a feminine outfit on a computer task more to luck than to skill.

Hypothesis 2b. (Attribution of failure): Compared to women with a neutral outfit, participants will attribute the failure of women with a feminine outfit on a computer task more to lack of skill than to bad luck.

Hypothesis 3. (Attribution of general competence and likeability): Compared to women with a neutral outfit, participants will rate a woman with a feminine outfit as less intelligent, competent and self-confident, but more likeable.

Hypothesis 4. (Self-evaluation of computer skills):

Hypothesis 4a. (Comparison with stimulus person): Participants will rate their own computer skills higher when comparing themselves to a woman with a feminine outfit than when comparing themselves to a woman with a neutral outfit.

Hypothesis 4b. (Comparison between participants): Male participants will rate their own computer skills higher than female participants.

3.1. Method

We used the material from the pretest, consisting of pictures of four female students, once with a feminine, and once with a neutral outfit. Participants rated the pre-tested pictures in a scenario where the stimulus persons were competing for a student IT job. Each participant randomly rated two of the four stimulus persons, one of which allegedly solved a computer

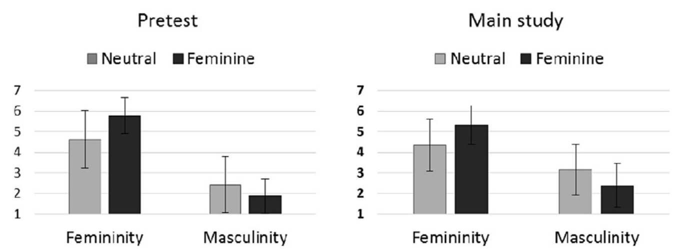

Fig. 2. Ratings of femininity and masculinity of female stimulus persons in the pretest and the main study as a function of their outfit (feminine vs. neutral). Ratings ranged from 1 to 7, error bars are standard deviations.

task very successfully, while the other one allegedly failed to solve it. Participants either saw women with a feminine outfit or women with a neutral outfit.

The study was conducted as an online study using the software SoSciSurvey (Leiner, 2014), which is free to the scientific community. Participants were recruited through social networks and psychology forums. The study was advertised as a study on computer skills. Online studies have several desirable qualities such as an anonymous setting, lower social desirability, and lower experimenter effects and demand characteristics (Joinson, 1999; Reips, 2002). These are all relevant qualities for studies on stereotypes. Besides, research shows that online and offline studies tend to produce similar results, for example for surveys, behavioral tasks, and experiments (Casler, Bickel, & Hackett, 2013; Deutskens, 2006; Krantz & Dalal, 2000; R. S. Ryan, Wilde, & Crist, 2013). We implemented recommendations for online studies such as using a warm-up technique (Reips, 2012) and asking for personal information at the beginning (Frick, Bächtiger, & Reips, 2001) to increase compliance and decrease dropout.

3.1.1. Participants

162 participants (105 women, 57 men) with a mean age of 26.70 ($SD = 7.56$, Range = 19–55) completed the study. The majority (84%) were students (55% studied psychology). Regarding academic degrees, four participants had a high school degree not qualifying them for university, 74 had one that did. Forty-eight participants held a Bachelor's degree, 22 a Master's degree, and three had a Phd.

3.1.2. Design

A 2 (stimulus person's outfit: feminine vs. neutral) x 2 (participant's sex: female vs. male) between-subjects design was used. Participants randomly rated two out of four stimulus persons. Again, participants either saw women with a feminine outfit or women with a neutral outfit. In both conditions, one of the women was allegedly very successful in solving the computer task, while the other one failed, so that the frequency of success and failure was the same for both neutral and feminine outfit. The order of success and failure of the stimulus persons was randomized. The dependent variables were attribution of computer skills, general competence and likeability, attribution of success/failure, and self-evaluations of computer skills in comparison to the stimulus persons. To rule out other influencing factors, we measured attractiveness of the stimulus persons (Sczesny & Kühnen, 2004).

3.1.3. Material

The advertised student job was presented as a job in an IT department of a university that demanded good computers skills. The stimulus persons had to solve a task to demonstrate their competence for the student job. A Word document needed to be proofread and printed, but the correct printer driver was not installed. The stimulus person had to search for the printer driver on the Internet, install it, proofread the document and then print it without any errors. The task was adapted from Sieverding and Koch (2009). Participants were told that the stimulus persons had a maximum of 30 min to solve the task. Later, they also learned that the average solving time was 24 min. The successful stimulus person was presented to have solved the task faster than the average person (in 15 min), while the unsuccessful stimulus person was presented to have taken longer than the average person and did not solve the task in time. Each of the two stimulus persons was introduced with two pictures, a portrait and a whole-body picture (see pretest for description of picture features).

3.1.4. Dependent variables and covariate

Dependent variables were computer skills, attribution of success/failure, self-evaluation, and general impression. To evaluate computer skills, participants first indicated whether they thought the stimulus person had solved the task in time (*yes*/*no*). Then, they estimated how long (in minutes) the stimulus person had taken to solve the task. They knew they could indicate a time longer than 30 min, if they thought the stimulus person did not solve the task in time. In the end, participants directly estimated the stimulus person's computer skills on a 7-point scale from 1 (*low*) to 7 (*high*). Questions were adapted from Sieverding and Koch (2009).

After that, participants were either told that the stimulus person solved the task with above- or below-average speed. For the attribution of success or failure, participants had to attribute this result to different factors. For successful stimulus persons, participants had to decide whether the solution of the task was due to luck vs. skill, on a 7-point scale from 1 (*luck*) to 7 (*ability*). For unsuccessful stimulus persons, participants had to determine whether the failure on the task was due to bad luck vs. lack of skill, on a 7-point scale from 1 (*bad luck*) to 7 (*lack of ability*). Questions were also adapted from Sieverding and Koch (2009) and extended for the unsuccessful stimulus person.

For the influence of outfit on attribution of general competence and likeability participants answered how competent, self-confident, intelligent, and likeable the stimulus person was (similar to Deaux & Emswiller, 1974), on 7-point scales from 1 (*not competent*/*self-confident*/*intelligent*/*likeable*) to 7 (*competent*/*self-confident*/*intelligent*/*likeable*).

For the self-evaluations of computer skills in comparison to the stimulus person, participants had to estimate whether they would have done better or worse on the task than the stimulus person, again on a 7-point scale from 1 (*a lot worse*) to 7 (*a lot better*). Then, they indicated how long they would have needed to solve the task (in minutes). Again, these questions were adapted from Sieverding and Koch (2009).

As a manipulation check, participants rated the stimulus person's femininity and masculinity on a 7-point scale from 1 (*not feminine*/*not masculine*) to 7 (*feminine*/*masculine*). Attractiveness may influence ratings of (leadership) competence and covary with masculine/feminine features (Sczesny & Kühnen, 2004). Participants rated the stimulus person's attractiveness on a 7-point scale from 1 (*not attractive*) to 7 (*attractive*).

3.1.5. Procedure

Participants were told that their ratings are meant to help with the selection of an applicant for a student job. At first, participants completed demographic questions. Then, they read the job advertisement and the information that all applicants had had to solve the described task in 30 min to demonstrate their computer skills. After that, participants saw the picture of the first stimulus person, allegedly her application picture, which was drawn randomly from the four pictures. They were told her name (either Antonia or Johanna), age (22 or 23) and that she was in her fourth semester of her studies to make the task more realistic. Then, they were told that the stimulus person would come to the job interview the following day, and were additionally shown the whole-body picture of this stimulus person.

Participants were first asked to describe their impression of the stimulus person. They answered the covariate question (attractiveness), manipulation check questions (femininity and masculinity), and the questions regarding general competence and likeability. Then, they completed the questions about the stimulus person's computer skills. On the next page, participants were either told that the stimulus person was successful or that she had failed to solve the task. After that, they responded to the attribution and self-evaluation questions. Next, participants were introduced to the second stimulus person, which was again randomly drawn from the pictures. The procedure for the second stimulus person was the same as for the first.

3.2. Results

First, we analyzed whether the outfit manipulation was effective in our online sample as well. Then, we looked at the ratings of the stimulus person's skills, attribution ratings, comparison, and general impression. While the outfit did not influence attractiveness for the first or the second stimulus person shown, $F(1,154) = 2.22$, $p = .139$, $F(1,154) = .41$, $p = .524$, the stimulus persons themselves varied in attractiveness, $F(3,154) = 3.51$, $p = .017$, $\eta^2 = .06$, $F(3,154) = 12.78$, $p < .001$, $\eta^2 = .20$. Therefore, attractiveness of stimulus person was used as a covariate, where it influenced ratings.

As in the pretest, participants evaluated stimulus persons as more feminine in the feminine condition than in the neutral condition, $M_f = 5.32$, $M_n = 4.33$, $t(160) = 5.66$, $p < .001$, Cohen's $d = .89$ (see Fig. 2). They also rated stimulus persons in the neutral condition as more masculine than stimulus persons in the feminine condition, $M_f = 2.38$, $M_n = 3.14$, $t(160) = 4.21$, $p < .001$, Cohen's $d = .66$ (see Fig. 2). Similar to the pretest results in the lab, the online survey supported the hypothesis that the outfit affected the femininity and masculinity ratings of the stimulus persons. In both studies, the effect sizes were substantial (a medium to big effect following Cohen's 1988 categorization), indicating that we were successful in eliciting the female stereotype with the outfit. Table 1 contains all means, and standard deviations of the main dependent variables and the covariate separated by conditions, Table 2 contains all correlations.

3.2.1. Ratings of stimulus person's computer skills

Hypothesis 1 predicted that participants would rate the computer skills of women higher when they wore a neutral outfit compared to a feminine outfit. We analyzed computer skill ratings for the stimulus persons (success, minutes to solve the task

Table 1
Means and standard deviations of dependant variables and covariate.

	Feminine outfit		Neutral outfit		Overall	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*
Stimulus person ratings						
Success[a]	.70	0.34	.83	0.31	.76	0.33
Minutes stimulus person[b]	31.64	16.72	27.06	10.12	29.35	13.97
Computer skills	4.35	1.15	4.82	0.95	4.59	1.07
Attribution success	5.40	1.34	5.84	1.09	5.62	1.24
Attribution failure	2.79	1.37	3.27	1.41	3.03	1.41
Intelligence	4.69	0.99	5.23	0.96	4.96	1.01
Competence	4.34	1.03	4.74	1.00	4.54	1.03
Self-Confidence	4.67	0.94	4.42	1.17	4.55	1.07
Likeability	4.71	0.99	5.36	1.01	5.04	1.05
Attractiveness	4.29	1.11	4.07	1.20	4.18	1.16
Participant's self-ratings						
Computer skills participant	4.65	1.22	4.18	1.41	4.41	1.34
Minutes participant[b]	24.20	11.39	28.48	23.84	26.34	18.74

Note. Ratings ranged from 1 to 7, higher numbers indicate success, more minutes to solve the task, higher computer skills, attribution of success to skill and failure to bad luck, higher intelligence, attractiveness, self-confidence, likeability and attractiveness for stimulus person, participant's belief of their better solution and participant's higher minutes to solve the task.

$^{*}p < .05$. $^{**}p < .01$.

[a] 1 = yes, 0 = no.

[b] In minutes.

and computer skills) with a 2 (stimulus person's outfit: feminine vs. neutral) × 2 (participant's sex: female vs. male) MANCOVA with attractiveness as the covariate. Participants rated stimulus persons with a feminine and neutral outfit differently, $F(3,155) = 2.88$, $p = .038$, $\eta^2 = .05$. Men and women evaluated stimulus persons similarly, $F(3,155) = .40$, $p = .754$. There was a significant interaction between stimulus person's outfit and participant's sex, $F(3,155) = 4.08$, $p = .008$, $\eta^2 = .07$. To further explore these effects, we looked at analyses for each dependent variable separately.

In accordance with Hypothesis 1, univariate analyses showed that outfit had a marginal significant effect on success ratings, $F(1,157) = 3.76$, $p = .054$, $\eta^2 = .02$, and a significant effect on estimated minutes to solve the task, $F(1,157) = 5.00$, $p = .027$, $\eta^2 = .03$, and ratings of computer skills, $F(1,157) = 8.01$, $p = .005$, $\eta^2 = .05$. Participants thought that women with a neutral outfit would be more successful in solving the task than women with a feminine outfit ($M_n = .83$, $M_f = .70$), would take less minutes to solve the task ($M_n = 27.06$, $M_f = 31.64$), and would have higher computer skills ($M_n = 4.82$, $M_f = 4.35$, see Fig. 3). There was no main effect of participant's sex on any of these ratings (all Fs < 1). The interaction of participant's sex and stimulus person's outfit was not significant for estimated minutes to solve the task ($F < 1$), or ratings of computer skills, $F(1,157) = 1.57$, $p = .213$. However, the interaction was significant for success ratings, $F(1,157) = 6.51$, $p = .012$, $\eta^2 = .04$. Simple mean tests showed that female participants thought women with a neutral outfit would be more successful than women with a feminine outfit, $M_n = .87$, $M_f = .64$, $F(1,157) = 14.71$, $p < .001$, $\eta^2 = .09$. This was not the case for male participants, $M_n = .71$, $M_f = .76$, $F(1,157) = .14$, $p = .712$.

3.2.2. *Attribution for success and failure*

Hypothesis 2 stated that participants would have more negative attribution patterns for women with a feminine than for women with a neutral outfit. Success would be attributed more to luck; failure more to lack of skills. We first recoded the attribution for failure, so that a higher value indicated a more favourable attribution to bad luck. Then, we tested the hypothesis with a 2 (stimulus person's outfit: feminine vs. neutral) × 2 (participant's sex: female vs. male) MANCOVA for attribution of success and failure with attractiveness as the covariate. Participants attributed the success of stimulus persons with a feminine and neutral outfit differently, $F(2,156) = 6.90$, $p = .001$, $\eta^2 = .08$. Men and women rated stimulus persons similarly, $F(2,156) = .31$, $p = .734$, and the interaction was also not significant, $F(2,156) = .01$, $p = .995$.

Supporting Hypothesis 2, univariate analyses showed that participants attributed the success of a woman with a neutral outfit more pronouncedly to skill than the success of a woman with a feminine outfit, $M_n = 5.84$, $M_f = 5.40$, $F(1,157) = 5.10$, $p = .025$, $\eta^2 = .03$ (see Fig. 3). Similarly, participants attributed the failure of a woman with a feminine outfit more pronouncedly to lack of skill than the failure of a woman with a neutral outfit, $M_n = 3.27$, $M_f = 2.79$, $F(1,157) = 5.57$, $p = .020$, $\eta^2 = .03$ (see Fig. 3).

3.2.3. *General competence and likeability*

Hypothesis 3 stated that a woman with a feminine outfit would be rated as more likeable, but less competent, intelligent or self-confident. A 2 (stimulus person's outfit: feminine vs. neutral) × 2 (participant's sex: female vs. male) MANOVA on competence, intelligence, self-confidence, and likeability showed a significant effect for outfit, $F(4,155) = 9.96$, $p < .001$, $\eta^2 = .21$, but not for participant's sex, $F(4,155) = 1.73$, $p = .146$, or the interaction, $F(4,155) = 1.22$, $p = .305$. As expected in Hypothesis 3, univariate analyzes showed that participants rated women with a neutral outfit as more intelligent, $M_n = 5.23$, $M_f = 4.69$, $F(1,158) = 10.80$, $p = .001$, $\eta^2 = .06$, and marginally more competent, $M_n = 4.74$, $M_f = 4.34$, $F(1,158) = 3.35$, $p = .069$, $\eta^2 = .02$. However, they also evaluated them as marginally less self-confident, $M_n = 4.42$, $M_f = 4.67$, $F(1,158) = 3.74$, $p = .055$, $\eta^2 = .02$, and more likeable, $M_n = 5.36$, $M_f = 4.71$, $F(1,158) = 12.95$, $p < .001$, $\eta^2 = .08$ (see Fig. 4).

3.2.4. *Self-evaluation: Comparisons of own computer skills to stimulus person*

Hypothesis 4 stated that participants comparing themselves to a woman with a feminine outfit (vs. a neutral outfit) were expected to rate their own computer skills higher. Furthermore, men were expected to generally judge their own computer

Table 2
Inter-correlations of dependant variables and covariate.

Variable	1	2	3	4	5	6	7
Stimulus person ratings							
Success[a]	–						
Minutes stimulus person[b]	–.68**	–					
Computer skills	.63**	–.56**	–				
Attribution success	.38**	–.30**	.46**	–			
Attribution failure	.22**	–.18*	.23**	–.17*	–		
Attractiveness	.20	–.13	.36**	.14	.12	–	
Participant's self-ratings							
Computer skills participant	–.03	.01	–.15	–.11	–.11	–.13	–
Minutes participant[b]	-.04	.12	.06	.04	.03	.11	–.70**

Note. Ratings ranged from 1 to 7, higher numbers indicate success, more minutes to solve the task, higher computer skills, attribution of success to skill and failure to bad luck, higher attractiveness for stimulus person, participant's belief of their better solution and participant's higher minutes to solve the task. *p < .05. **p < .01.
[a] 1 = yes, 0 = no.
[b] In minutes.

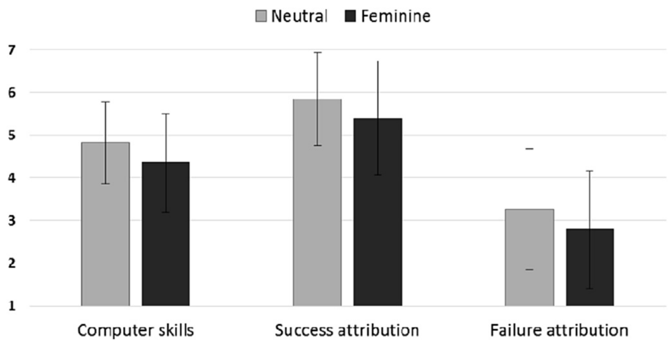

Fig. 3. Ratings of computer skills, attribution of success to skill, and attribution of failure to bad luck as a function of outfit (feminine vs. neutral) of the female stimulus persons in the main study. Ratings ranged from 1 to 7, error bars are standard deviations.

skills higher than women. We analyzed Hypothesis 4 with a 2 (stimulus person's outfit: feminine vs. neutral) x 2 (participant's sex: female vs. male) MANOVA for computer skills and minutes comparisons. The main effect of stimulus person's outfit was not significant. Participants evaluated themselves similarly, regardless of the outfit of the stimulus person, F (2,157) = .58, p = .563. However, the main effect of participants' sex was significant; women and men judged their own computer skills differently, F (2,157) = 13.54, p < .001, η^2 = .15. The interaction of stimulus person's outfit and participant's sex was not significant, F (2,157) = .85, p = .431.

Univariate analyses showed that Hypothesis 4a could not be supported. Participants rated their own computer skills similarly, regardless of the stimulus person's outfit, F (1,158) = .95, p = .332. The same was true for the rating of one's minutes to solve the task, F (1,158) = .09, p = .771. However, according to Hypothesis 4b, men rated their own computer skills higher than women, M_m = 5.13, M_w = 4.06, F (1,158) = 26.34, p < .001, η^2 = .14, and estimated that they would need less time to solve the task than women, M_m = 17.96, M_w = 30.34, F (1,158) = 16.81, p < .001, η^2 = .10.

4. Discussion

Previous work has shown that women are thought to be less skilled with computers than men (Cooper, 2006; Smith et al., 2005). The goal of this study was to test whether this stereotype could be activated by a stimulus person's attributes (Deaux & Major, 1987). We decided to test this assumption in the area of outfits, because these can be easily changed and results can therefore impact recommendations concerning outfits for job interviews or similar important (professional) situations. We compared the ratings of the same stimulus persons with either a neutral or a feminine outfit allegedly applying for a computer-related student job.

In sum, the outfit of the evaluated women played an important role in the judgment of their computer skills. It influenced the ratings of their computer skills, and the attribution of success or failure in solving a computer task. Furthermore, it affected the ascription of general competence and likeability. We first discuss these results, then turn to strengths and limitations of our research, and finally consider the implications.

4.1. Consequences of gender-stereotypic outfits

Deaux and Major (1987) postulated that gender-related schemata can be activated by a person's attributes. For example, gender-stereotypic appearance can activate stereotypes (Sczesny & Kühnen, 2004; Sczesny et al., 2006). The results of our

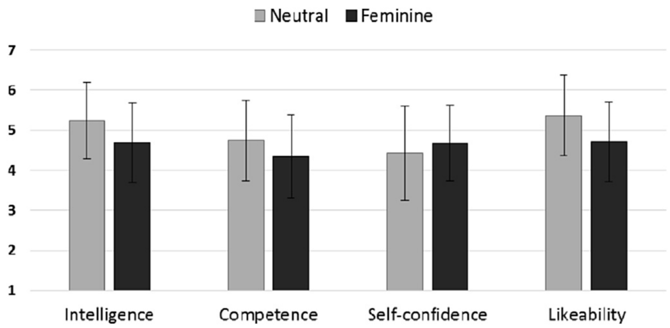

Fig. 4. Ratings of intelligence, competence, self-confidence, and likeability as a function of outfit (feminine vs. neutral) of female stimulus persons in the main study. Ratings ranged from 1 to 7, error bars are standard deviations.

pretest and our main study supported the assumption that a feminine outfit would indeed activate the female gender stereotype. Both studies using the same stimulus material found that a woman with a feminine outfit was rated as much higher in femininity and lower in masculinity than the same woman with a neutral outfit ($d = .99$ and $d = .89$ for femininity in the pretest and the main study, respectively, $d = .47$ and $d = .66$ for masculinity in the pretest and the main study, respectively).

The female stereotype includes women's lower computer skills (Cooper, 2006; Smith et al., 2005). The results of our main study are a first indication that a feminine outfit can be used to activate gender stereotypes in the computer domain. Participants believed that a woman with a feminine outfit – in comparison to the same woman with a neutral outfit – would be less successful in solving a computer task. They also estimated that women with a feminine outfit would take longer to solve the task, and even directly rated the computer skills of women with a feminine outfit as lower than those of women with a neutral outfit.

Interestingly, for one of the three computer skills variables (the success of the stimulus person), the main effect was qualified by an interaction with the participant's sex. While male participants did not make a difference between stimulus persons with a neutral or feminine outfit, female participants did. This outcome may be due to several different causes. First of all, the results may be based on the fact that we did not have as many men as women in our sample, making it harder to find an effect. Second, as women tend to consistently rate their own computer skills lower than men (Christoph et al., 2015; Dickhäuser & Stiensmeier-Pelster, 2003; Hargittai & Shafer, 2006; Sieverding & Koch, 2009), they may be more prone to self-stereotyping. Third, women may be less likely to give social desirable answers because people would not expect them to discriminate their own in-group. Nevertheless, there were no interactions for the other two measures of computer skills (minutes to solve the task and direct rating of computer skills), so that we can conclude that male participants also use the activated stereotype in rating the stimulus persons.

The activation of a female stereotype also influenced attributions of success and failure. As shown by previous studies, when tasks are stereotyped as male, attribution patterns for women are more negative (Deaux & Emswiller, 1974; Dickhäuser & Stiensmeier-Pelster, 2002; Koch et al., 2008). Similar attribution patterns were found for both the success and the failure of a woman with a feminine outfit. In comparison to a woman with a neutral outfit, her success was attributed more to luck (vs. skill), and her failure was attributed more to lack of skill (than bad luck).

Furthermore, participants rated a woman with a neutral outfit as more intelligent and competent, and – unexpectedly – also as more likeable, but tend to rate them as less self-confident. As women are thought to be less competent than men (Asbrock, 2010; Fiske et al., 2002; Sczesny et al., 2006), the activation of the female stereotype could explain the lower ratings on competence and intelligence. However, the results for self-confidence are unexpected, as are the results for lower likeability, as women are usually liked more because they are considered as warmer (Asbrock, 2010; Fiske et al., 2002; Wojciszke et al., 2009). Possibly, these results are based on different popularity estimates, as participants may have thought that the women with feminine outfits were "party queens", who are more self-confident, while they believed the women with neutral outfits were "wallflowers", who they liked more. This would be partly in line with research from Naumann, Vazire, Rentfrow, and Gosling (2009), who found that students with a "stylish" appearance were rated as having a higher self-esteem, but also more likeable.

In addition to that, male participants expected to be much more successful with computers than female participants. This finding supports existing evidence on gender differences in self-rated computer skills (Christoph et al., 2015; Dickhäuser & Stiensmeier-Pelster, 2002, 2003; Hargittai & Shafer, 2006; Sieverding & Koch, 2009). However, it is unclear whether men actually have higher computer skills than women. Another interpretation may be that men are overconfident or that women underestimate their actual skills (Hargittai & Shafer, 2006; Sieverding, 2003), as the evidence on gender differences in computer performance is mixed (Aesaert & van Braak, 2015; Christoph et al., 2015; Hargittai & Shafer, 2006; Rubio, Romero-Zaliz, Mañoso, & de Madrid, 2015; Sieverding & Koch, 2009). However, self-perception of skills and success (in contrast to actual skills and success) may play an important role in explaining why women rarely choose computer-related professions (Christoph et al., 2015; Dickhäuser & Stiensmeier-Pelster, 2002, 2003; Wigfield & Eccles, 2000).

4.2. Limitations and strengths

One limitation of our research concerns our sample. As the majority were students, who are a very specific group (young, high education, etc., Middendorff, Apolinarski, Poskowsky, Kandulla, & Netz, 2013), our findings cannot be generalized to the general population. However, students should perceive men and women as more similar than the older generations and hold more egalitarian views than less educated people, because people perceived men and women becoming more similar (Wilde & Diekman, 2005) and educated people tend to be more egalitarian (Peng & Eunni, 2011). Therefore, it is likely that the effect will also be present in the general population to at least the same or even a higher degree. Further research needs to test this prediction with a bigger, more sex-balanced and more diverse sample, especially concerning age, socioeconomic status and educational background.

In our study, participants only saw two pictures of young women who allegedly applied for a student's job, and received little other information. People resort to stereotyping in the absence of relevant information, but tend to stereotype less if information is available (Tosi & Einbender, 1985). Therefore, the lack of information may have elicited stereotyping that may not have been present in a real-life setting. However, the appearance and outfit of a person may be the first information one often has about a person, for example, through an application photo or the appearance of a speaker at a conference. However, our experimental design also has several strengths. Due to the experimental manipulation, confounding factors are not very likely to play a role, so that the manipulation of the outfits most likely accounts for the obtained effects. Importantly, participants saw the same four women in both conditions, so that differences in attractiveness, sympathy, general appearance, or other characteristics were held constant. Furthermore, by using four different pictures we made sure that the effect was not due to a specific stimulus.

Moreover, we refrained from examining differences of general physical appearance such as facial or body features, because they cannot be changed easily. Rather, we tested how feminine and neutral clothes and make-up affected the stereotype about women's computer skills. Of course, our study only provides first hints at the negative evaluations that are connected to feminine outfits; further research needs to test these effects in a more ecologically valid setting. For example, it would be interesting to study what influence a feminine outfit has on the success of real applicants, for example as an application picture or in a job interview. Then, it may be possible to derive suggestions for women applying for a job in an area where computer skills are relevant.

Another strength of the present study is that we tested attributions of both success and failure. We were thus able to show that attribution patterns for women with a feminine outfit in comparison to a neutral outfit were unfavorable in both cases: When a woman with a feminine outfit was successful, she was just lucky, when she failed, it was due to her lack of skills.

4.3. Implications

The results of our study indicate that – when the female stereotype is activated through an applicant's outfit – people may rate women with a feminine outfit as having lower computer skills, and as less competent and intelligent, than women with a neutral outfit. They may also tend to attribute success and failure more in the classic gender-stereotyped pattern described by Deaux and Emswiller (1974). When solving a computer problem, the success of a women with a feminine outfit may be attributed more strongly to luck, an external factor. In contrast, the failure to solve the task may be attributed more pronouncedly to lack of skills, an internal factor.

Consequently, there are two problems that may keep women from entering computer-related fields. The first one, as found in several previous studies (Dickhäuser & Stiensmeier-Pelster, 2002, 2003; Sieverding & Koch, 2009), is that women themselves expect to be less successful with computers than men, and therefore may voluntarily avoid jobs that involve advanced computers skills (many women use computers at work but more for routine tasks like typing. This kind of computer work is not rewarded by higher prestige or income, see Brynin, 2006 or Peacock, 2008). Consequences may be that women use computers and the Internet less than men and are more anxious about it (Chou, Wu, & Chen, 2011; Dickhäuser & Stiensmeier-Pelster, 2002; Drabowicz, 2014; Durndell & Haag, 2002; Huang, Hood, & Yoo, 2013; Imhof et al., 2007; Li & Kirkup, 2007; Papastergiou & Solomonidou, 2005). This can disadvantage women, because computer skills bring professional assets, such as higher wages (Peacock, 2008; Peng & Eunni, 2011) and more secure and satisfying jobs (Brynin, 2006). The other problem is that feminine outfits appear to activate the stereotype of women's lower computer skills. In this case, people would judge the computer skills of woman with a feminine outfit and make-up to be as lower than that of women with a neutral outfit.

However, as stated in the discussion of limitations, this study provides simply first data that there may be unfavourable evaluations of women connected to a feminine outfit. In the light of our effect sizes, it is yet unclear whether a feminine outfit can have implications in real-world applications or job interviews. Field research on bigger, more diverse samples in future studies will show whether one should avoid gender-stereotypic outfits when going to a job interview, a conference, or a team meeting, as well as in other situations when computer skills are important.

Conflict of interest

The authors declare that there is no conflict of interest.

References

Aesaert, K., & van Braak, J. (2015). Gender and socioeconomic related differences in performance based ICT competences. *Computers & Education, 84*, 8–25. http://dx.doi.org/10.1016/j.compedu.2014.12.017.

Asbrock, F. (2010). Stereotypes of social groups in Germany in terms of warmth and competence. *Social Psychology, 41*(2), 76–81. http://dx.doi.org/10.1027/1864-9335/a000011.

Bömer, A.-T., & Imhof, M. (2011). "Computer sind doch nichts für Mädchen!?" Computer-bezogene Geschlechterstereotypen bei Grundschülerinnen und Grundschülern ['Computers are not for girls!?' Gender stereotypes of elementary school students]. *Psychologie in Erziehung und Unterricht, 58*, 189–197.

Brynin, M. (2006). Gender, technology and jobs. *British Journal of Sociology, 57*, 437–453. http://dx.doi.org/10.1111/j.1468-4446.2006.00119.x.

Casler, K., Bickel, L., & Hackett, E. (2013). Separate but equal? A comparison of participants and data gathered via Amazon's MTurk, social media, and face-to-face behavioral testing. *Computers in Human Behavior, 29*, 2156–2160. http://dx.doi.org/10.1016/j.chb.2013.05.009.

Cheryan, S., Master, A., & Meltzoff, A. N. (2015). Cultural stereotypes as gatekeepers: increasing girls' interest in computer science and engineering by diversifying stereotypes. *Frontiers in Psychology, 6*. http://dx.doi.org/10.3389/fpsyg.2015.00049.

Chou, C., Wu, H.-C., & Chen, C.-H. (2011). Re-visiting college students' attitudes toward the Internet-based on a 6-T model: gender and grade level difference. *Computers & Education, 56*, 939–947. http://dx.doi.org/10.1016/j.compedu.2010.11.004.

Christoph, G., Goldhammer, F., Zylka, J., & Hartig, J. (2015). Adolescents' computer performance: the role of self-concept and motivational aspects. *Computers & Education, 81*, 1–12. http://dx.doi.org/10.1016/j.compedu.2014.09.004.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum.

Cooper, J. (2006). The digital divide: the special case of gender. *Journal of Computer Assisted Learning, 22*, 320–334. http://dx.doi.org/10.1111/j.1365-2729.2006.00185.x.

Croasdell, D., McLeod, A., & Simkin, M. G. (2011). Why don't more women major in information systems? *Information Technology & People, 24*, 158–183. http://dx.doi.org/10.1108/09593841111137340.

Deaux, K., & Emswiller, T. (1974). Explanations of successful performance on sex-linked tasks: what is skill for the male is luck for the female. *Journal of Personality and Social Psychology, 29*, 80–85. http://dx.doi.org/10.1037/h0035733.

Deaux, K., & Major, B. (1987). Putting gender into context: an interactive model of gender-related behavior. *Psychological Review, 94*, 369–389. http://dx.doi.org/10.1037/0033-295X.94.3.369.

Deutskens, E. (2006). An assessment of equivalence between online and mail surveys in service research. *Journal of Service Research, 8*, 346–355. http://dx.doi.org/10.1177/1094670506286323.

Dickhäuser, O., & Stiensmeier-Pelster, J. (2002). Gender differences in computer work: evidence for the model of achievement-related choices. *Contemporary Educational Psychology, 27*, 486–496. http://dx.doi.org/10.1006/ceps.2001.1106.

Dickhäuser, O., & Stiensmeier-Pelster, J. (2003). Gender differences in the choice of computer courses: applying an expectancy-value model. *Social Psychology of Education, 6*, 173–189. http://dx.doi.org/10.1023/A:1024735227657.

Drabowicz, T. (2014). Gender and digital usage inequality among adolescents: a comparative study of 39 countries. *Computers & Education, 74*, 98–111. http://dx.doi.org/10.1016/j.compedu.2014.01.016.

Durndell, A., & Haag, Z. (2002). Computer self efficacy, computer anxiety, attitudes towards the Internet and reported experience with the Internet, by gender, in an East European sample. *Computers in Human Behavior, 18*, 521–535. http://dx.doi.org/10.1016/S0747-5632(02)00006-7.

File, T., & Ryan, C. (2014). *Computer and internet use in the United States: 2013: American community survey reports*. Suitland, Md: United States Census Bureau.

Fiske, S. T., Cuddy, A. J., Glick, P., & Xu, J. (2002). A model of (often mixed) stereotype content: competence and warmth respectively follow from perceived status and competition. *Journal of Personality and Social Psychology, 82*, 878.

Frick, A., Bächtiger, M.-T., & Reips, U.-D. (2001). Financial incentives, personal information and drop out in online studies. In U.-D. Reips, & M. Bosnjak (Eds.), *Dimensions of Internet science* (pp. 209–219). Lengerich: Pabst.

Hargittai, E., & Shafer, S. (2006). Differences in actual and perceived online skills: the role of gender. *Social Science Quarterly, 87*, 432–448. http://dx.doi.org/10.1111/j.1540-6237.2006.00389.x.

Huang, W. H. D., Hood, D. W., & Yoo, S. J. (2013). Gender divide and acceptance of collaborative Web 2.0 applications for learning in higher education. *The Internet and Higher Education, 16*, 57–65. http://dx.doi.org/10.1016/j.iheduc.2012.02.001.

Imhof, M., Vollmeyer, R., & Beierlein, C. (2007). Computer use and the gender gap: the issue of access, use, motivation, and performance. *Computers in Human Behavior, 23*, 2823–2837. http://dx.doi.org/10.1016/j.chb.2006.05.007.

Joinson, A. (1999). Social desirability, anonymity, and Internet-based questionnaires. *Behavior Research Methods, Instruments, & Computers, 31*, 433–438. http://dx.doi.org/10.3758/BF03200723.

Koch, S. C., Müller, S. M., & Sieverding, M. (2008). Women and computers. Effects of stereotype threat on attribution of failure. *Computers & Education, 51*, 1795–1803. http://dx.doi.org/10.1016/j.compedu.2008.05.007.

Krantz, J. H., & Dalal, R. (2000). Validity of web-based psychological research. In M. H. Birnbaum (Ed.), *Psychological experiments on the Internet* (pp. 35–60). San Diego, California: Academic Press.

Leiner, D. J. (2014). *SoSciSurvey (Version 2.4.00-i). [Computer software]*. Available from: http://www.soscisurvey.de.

Li, N., & Kirkup, G. (2007). Gender and cultural differences in Internet use: a study of China and the UK. *Computers & Education, 48*, 301–317. http://dx.doi.org/10.1016/j.compedu.2005.01.007.

Middendorff, E., Apolinarski, B., Poskowsky, J., Kandulla, M., & Netz, N. (2013). *Die wirtschaftliche und soziale Lage der Studierenden in Deutschland 2012* [*The economic and social situation of students in Germany 2012*]. Berlin: Bundesministerium für Bildung und Forschung.

Naumann, L. P., Vazire, S., Rentfrow, P. J., & Gosling, S. D. (2009). Personality judgments based on physical appearance. *Personality and Social Psychology Bulletin*. http://dx.doi.org/10.1177/0146167209346309.

Papastergiou, M., & Solomonidou, C. (2005). Gender issues in Internet access and favourite Internet activities among Greek high school pupils inside and outside school. *Computers & Education, 44*, 377–393. http://dx.doi.org/10.1016/j.compedu.2004.04.002.

Peacock, S. E. (2008). The historical influence of computer use at work on income in the late twentieth century. *Social Science Computer Review, 26*, 334–349. http://dx.doi.org/10.1177/0894439307309285.

Peng, G., & Eunni, R. V. (2011). Computer skills, non-routine tasks, and wage premium: a longitudinal study. *Journal of Strategic Information Systems, 20*, 449–460. http://dx.doi.org/10.1016/j.jsis.2011.09.002.

Reips, U.-D. (2002). Standards for Internet-based experimenting. *Experimental Psychology, 49*, 243–256. http://dx.doi.org/10.1026//1618-3169.49.4.243.

Reips, U.-D. (2012). Using the Internet to collect data. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *Research designs: Quantitative, qualitative, neuropsychological, and biological: Vol. 2. APA handbook of research methods in psychology* (pp. 291–310). Washington: American Psychological Association.

von Rennenkampff, A. (2004). *Aktivierung und Auswirkungen geschlechtsstereotyper Wahrnehmung von Führungskompetenz im Bewerbungskontext*. Doctoral dissertation. Mannheim, Germany: Universität Mannheim. Retrieved from https://ub-madoc.bib.uni-mannheim.de/.

Rubio, M. A., Romero-Zaliz, R., Mañoso, C., & de Madrid, A. P. (2015). Closing the gender gap in an introductory programming course. *Computers & Education, 82*, 409–420. http://dx.doi.org/10.1016/j.compedu.2014.12.003.

Ryan, M. K., Haslam, S. A., Hersby, M. D., & Bongiorno, R. (2011). Think crisis–think female: the glass cliff and contextual variation in the think manager–think male stereotype. *Journal of Applied Psychology, 96*(3), 470–484. http://dx.doi.org/10.1037/a0022133.

Ryan, R. S., Wilde, M., & Crist, S. (2013). Compared to a small, supervised lab experiment, a large, unsupervised web-based experiment on a previously unknown effect has benefits that outweigh its potential costs. *Computers in Human Behavior, 29*, 1295–1301. http://dx.doi.org/10.1016/j.chb.2013.01.024.

Sczesny, S., & Kühnen, U. (2004). Meta-cognition about biological sex and gender-stereotypic physical appearance: consequences for the assessment of leadership competence. *Personality and Social Psychology Bulletin, 30*, 13–21. http://dx.doi.org/10.1177/0146167203258831.

Sczesny, S., Spreemann, S., & Stahlberg, D. (2006). Masculine = Competent? Physical appearance and sex as sources of gender-stereotypic attributions. *Swiss Journal of Psychology, 65*, 15–23. http://dx.doi.org/10.1024/1421-0185.65.1.15.

Shashaani, L., & Khalili, A. (2001). Gender and computers: similarities and differences in Iranian college students' attitudes toward computers. *Computers & Education, 37*, 363–375. http://dx.doi.org/10.1016/S0360-1315(01)00059-8.

Sieverding, M. (2003). Frauen unterschätzen sich: Selbstbeurteilungs-Biases in einer simulierten Bewerbungssituation [Women underevaluate themselves: self-evaluation-biases in a simulated job interview]. *Zeitschrift für Sozialpsychologie, 34*, 147–160. http://dx.doi.org/10.1024//0044-3514.34.3.147.

Sieverding, M., & Koch, S. C. (2009). (Self-)Evaluation of computer competence: how gender matters. *Computers & Education, 52*, 696–701. http://dx.doi.org/10.1016/j.compedu.2008.11.016.

Smith, J. L., Morgan, C. L., & White, P. H. (2005). Investigating a measure of computer technology domain identification: a tool for understanding gender differences and stereotypes. *Educational and Psychological Measurement, 65*, 336–355. http://dx.doi.org/10.1177/0013164404272486.

Statistisches Bundesamt. (2015a). *Bildung und Kultur - Studierende an Hochschulen* [*Education and culture - Students at universities*]. Wiesbaden: Statistisches Bundesamt.

Statistisches Bundesamt. (2015b). *Private Haushalte in der Informationsgesellschaft -Nutzung von Informations- und Kommunikationstechnologien 2014*. Wiesbaden: Statistisches Bundesamt.

Sun, S. (2008). An examination of disposition, motivation, and involvement in the new technology context computers in human behavior. *Computers in Human Behavior, 24*, 2723–2740. http://dx.doi.org/10.1016/j.chb.2008.03.016.

Swim, J. K., & Sanna, L. J. (1996). He's skilled, she's lucky: a meta-analysis of observers' attributions for women's and men's successes and failures. *Personality and Social Psychology Bulletin, 22*, 507–519. http://dx.doi.org/10.1177/0146167296225008.

Tømte, C., & Hatlevik, O. E. (2011). Gender-differences in self-efficacy ICT related to various ICT-user profiles in Finland and Norway. How do self-efficacy, gender and ICT-user profiles relate to findings from PISA 2006. *Computers & Education, 57*, 1416–1424. http://dx.doi.org/10.1016/j.compedu.2010.12.011.
Tosi, H. L., & Einbender, S. W. (1985). The effects of the type and amount of information in sex discrimination research: a meta-analysis. *Academy of Management Journal, 28*, 712–723. http://dx.doi.org/10.2307/256127.
Vekiri, I., & Chronaki, A. (2008). Gender issues in technology use: perceived social support, computer self-efficacy and value beliefs, and computer use beyond school. *Computers & Education, 51*, 1392–1404. http://dx.doi.org/10.1016/j.compedu.2008.01.003.
Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology, 25*, 68–81. http://dx.doi.org/10.1006/ceps.1999.1015.
Wigfield, A., & Eccles, J. S. (2002). The development of competence beliefs, expectancies for success, and achievement values from childhood through adolescence. In A. Wigfield, & J. S. Eccles (Eds.), *Development of achievement motivation* (pp. 91–120). San Diego: Academic Press.
Wilde, A., & Diekman, A. B. (2005). Cross-cultural similarities and differences in dynamic stereotypes: a comparison between Germany and the United States. *Psychology of Women Quarterly, 29*, 188–196. http://dx.doi.org/10.1111/j.1471-6402.2005.00181.x.
Wojciszke, B., Abele, A. E., & Baryla, W. (2009). Two dimensions of interpersonal attitudes: liking depends on communion, respect depends on agency. *European Journal of Social Psychology, 39*, 973–990. http://dx.doi.org/10.1002/ejsp.595.
Zweben, S. (2012). *Computing degree and enrollment trends: Undergraduate degree production in computer science rises while enrollment grows for fourth straight year.* Washington, D.C.: Computing Research Association.