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The Older, the Less Digitally Fluent? The Role of Age Stereotypes and Supervisor Support

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Abstract

Over the last decades, digital technologies have progressively made their way into the workplace. Therefore, it becomes increasingly important for employees to have digital competencies, which can be measured through digital fluency, including its two sub dimensions, namely digital knowledge and digital self-efficacy. This is particularly the case for older workers, who might be affected by a digital divide that proposes younger and older employees have different prerequisites for digital fluency. Drawing from the stereotype embodiment theory, we argue that age is generally negatively related to self-perceptions of digital fluency and particularly impactful when older employees hold negative age stereotypes against older workers and therefore self-stereotype themselves. Furthermore, we argue that developmental support from the direct supervisor has the potential to either amplify or alleviate this negative relation: While a lack of supervisor support may lead to the activation of internalized negative age stereotypes, strong support by the supervisor could strengthen the employees' self-perceptions in several ways. Performing multiple regression analyses on survey data collected from 1,007 employees, we find support for our three hypotheses. Negative age stereotypes exacerbate the negative relationship between age and digital fluency, whereas the interplay of high individual stereotypes and low supervisor support is the most negative condition for the relation of age on digital fluency. On the other hand, strong supervisor support with low negative stereotypes counteract existing age differences in digital fluency. Therefore, our findings have important theoretical and practical implications.

Keywords: aging and individual differences, stereotyping and discrimination, leadership, technology use, cognitive ability and skills

Introduction And Theory

In an increasingly digitized workplace, employees rely on digital competencies, such as *digital fluency*, defined as the ability to "reliably achieve desired outcomes through the use of technology" (Briggs & Makice, 2012, p. 62). Digital fluency builds on two essential components: *digital knowledge*—e.g., when to accurately use digital technologies to create added value at the workplace—and *digital self-efficacy*—e.g., the individual's inner belief to successfully incorporate digital technologies (Wang et al., 2013; Zimmermann, 2020; Zimmermann & Kunze, 2019).

Yet, we know little about how such skills are gained, developed, and distributed among the workforces, particularly in different age groups. A widespread assumption is that digital competencies are unequally distributed among younger generations, the so-called digital natives, and the older generations, the digital immigrants leading to a digital age divide in competencies (Prensky, 2001; Wang et al., 2013). Notwithstanding, it remains unclear to which extent an actual digital divide of competencies between young and old employees exists. Extant empirical research on this relationship is inconsistent and contradictory. Guo et al. (2008), for example, do not find age to automatically relate to lower digital competencies, while Li and Ranieri (2010) find such results but only in a Chinese school context not focusing on all age groups. Recently, Hecker et al. (2021) found age differences in digital skill screening tests, but their analysis relied on a binary categorization of employees as either younger or older than 50 years in age. Still, research including all age groups in an organizational context is scarce, and it remains unclear if, and under which contextual conditions, older employees perceive high or low levels of digital fluency.

With this article, we, therefore, want to investigate how people of different ages perceive their digital fluency. Overall, we argue that older employees evaluate their digital knowledge and digital self-efficacy to be lower than younger employees. Entering a workplace that is more and more characterized by digital tools, digital natives who grew up with information and communication technologies (henceforth: ICTs) and online applications might intuitively perceive themselves as having higher digital skills. Digital immigrants, on the other hand, had to acquire digital competencies later in their working life and thus might be disadvantaged in digital knowledge and, furthermore, their digital self-efficacy (Prensky, 2001), leading to the following hypothesis:

Hypothesis 1: Chronological age is negatively related to employees' level of digital fluency.

Furthermore, we assume that individual and social contextual factors are relevant to understand the relation between age and digital fluency. First, drawing from the stereotype embodiment theory (Levy, 2009), we propose that endorsing negative age stereotypes is crucial for older employees to develop digital competencies and, therefore, negatively moderates the age-digital fluency relationship. According to Kunze et al. (2013), "work-related age stereotypes are individual beliefs and expectations about employees that are merely based on their age group membership" (p. 419). Even though such work-related age stereotypes are possible for any age group, stereotypes are predominantly expressed against older individuals (Posthuma & Campion, 2009). Holding such ageist stereotypes can affect employees of different generations differently. While for younger employees, agreeing to stereotypes about older workers' difficulties to deal with ICTs might be a cause of age-group dissociation, for older workers this should most likely imply self-stereotyping (Lagacé et al., 2016; Levy, 2009; Steele & Aronson, 1995). According to stereotype embodiment theory (Levy, 2009), the internalization of such stereotypes increases the risk of a potential "self-fulfilling prophecy". As Lagacé et al. (2016) argue, for older workers compared to younger workers, this can lead to psychological disengagement (e.g., lower self-confidence and self-esteem in one's abilities to use ICTs) and, then, to digital disengagement (e.g., investing less time in training and using ICTs). Recently, Rahn et al. (2021) as well as Weiss and Perry (2020) found similar results. Therefore, we propose the following second hypothesis:

Hypothesis 2: Negative age stereotypes moderate the negative relationship between chronological age and digital fluency, such that chronological age is more negatively related to digital fluency for employees that have high levels of negative age stereotypes than for employees that have low levels of negative age stereotypes.

Finally, we assume supervisors impact the overall relationship between age, digital fluency, and negative age stereotypes in form of a three-way interaction. Prior research indicates that developmental supervisor support matters for employees' developmental and training activities (Noe & Wilk, 1993; Van Vianen et al., 2011), employees' self-efficacy (Dvir et al., 2002) as well as their performance (Dvir et al., 2002). Further extending the stereotype embodiment theory (Levy, 2009) and integrating it with the concept of stereotype threat (Steele & Aronson, 1995), we expect that the combination of internalized negative age stereotypes and missing developmental supervisor support may affect the relationship between age and digital fluency. Older employees might understand missing support as an indication of the supervisor's lack of confidence in the employee's capabilities to gain digital skills and this may activate his/her negative age self-stereotypes as they perceive stereotype threat (Levy, 1996; Steele & Aronson, 1995). The now activated age stereotypes could aggravate the self-efficacy and one's perception of digital knowledge, in sum digital fluency. For younger employees, a lack of supervisor support might not be as detrimental as for employees of a higher age, as their levels of digital fluency are already higher and negative stereotypes do not affect them equally. On the contrary, high supervisor support could preempt existing age stereotypes of older workers and lead to higher levels of perceived digital fluency. Thus, high levels of developmental supervisor support and low levels of internalized negative age stereotypes might result in the alleviation of a prior existing digital divide, leading to Hypothesis 3:

Hypothesis 3: Developmental supervisor support weakens the existing moderating effect of negative age stereotypes on the negative relationship between chronological age and digital fluency, such that the relationship is no longer significant when employees have low negative age stereotypes and perceive high developmental supervisor support but significant and negative when employees have high negative age stereotypes and perceive low developmental supervisor support.

Figure 1 illustrates our proposed conceptual model.

Methods

Data collection and sample

To test the proposed hypotheses, we collected data in July 2020 from white-collar employees with engineering office tasks in a German industrial company operating in the automotive sector. In total, 1,007 employees fully completed the survey. The respondents' age ranged from 19 to 65 years with an average of 40 years (*SD* = 10.10). In the sample, 77.8% were males with a job tenure of 12 years (*SD* = 9.41) and a mean of 37.4 weekly working hours (*SD* = 6.11). While 66.2% of the respondents held a master's degree, 12.9% held a doctorate, 12.2% a bachelor's degree, 4.8% an apprenticeship, and 3.9% high-school education only. Overall, 21.6% indicated to be in a leadership position. The variables' descriptive statistics are displayed in Table 1.

Measures

Unless otherwise noted, 5-point Likert scales (1 = strongly disagree, 5 = strongly agree) were used for all measures. Detailed wording of all items, Cronbach's alpha-values, composite reliability (CI), and results for confirmatory factor analyses for the latent variables can be found in the Appendix. All tests and analyses showed satisfactory results.

Age.

Employees' age was measured by their chronological age in years.

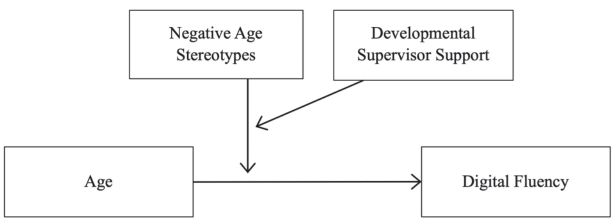

Figure 1. Conceptual model for the relationship between age and digital fluency.

Table 1. Means, standard deviations, and intercorrelations of study variables.

Variable	*M*	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1. Age	39.94	10.10									
2. Negative age stereotypes	3.13	0.88	–0.19**								
3. Developmental supervisor support	3.35	0.97	–0.04	–0.07*							
4. Digital fluency	4.16	0.67	–0.27**	–0.08*	–0.15**						
5. Tenure	11.70	9.42	0.79**	–0.10**	–0.03	–0.29**					
6. Agility	0.48	0.50	–0.10**	–0.01	0.02	0.13**	–0.10**				
7. Educational background	8.68	1.24	0.01	–0.06*	–0.02	0.12**	–0.16**	–0.04			
8. Remote work in %	14.09	17.75	0.04	–0.07*	0.01	0.00	0.00	0.06*	–0.05		
9. Training participation internal	5.41	4.20	–0.03	–0.03	0.00	0.03	–0.01	–0.01	–0.04	0.02	
10. Training participation external	7.99	4.83	–0.01	0.07*	0.00	–0.03	0.02	–0.06	0.00	0.01	0.12**

Note. * $p < 0.05$; ** $p < 0.01$.

Negative age stereotypes.

Employees' own negative stereotypes against older workers were captured by a three-item-scale further developed by Kunze et al. (2013) and previously based on the age stereotype scale by Chiu et al. (2001). To measure age stereotypes in a digital work context, the items were slightly adjusted to stereotypes against older workers' adaptability to digital technologies and the speed of the digital change.

Developmental supervisor support.

Perceived supervisory support was measured using the scale developed by Greenhaus et al. (1990). To reduce participant fatigue, we used a shortened and slightly adapted version.

Digital fluency.

To measure employees' level of digital fluency, the digital fluency scale developed by Zimmermann (2020) was used, which is comprised of two subdimensions, digital knowledge and digital self-efficacy, each consisting of three items.

Controls.

To avoid running the risk of disregarding a potential omitted variable bias, we controlled for several factors that may influence employees' levels of digital fluency, such as tenure in years (Ragu-Nathan et al., 2008), working in an agile team (Booth et al., 2016), educational background (Van Deursen & Van Dijk, 2010), working remotely (Vuori et al., 2019), as well as participation in company-internal or external trainings (Mohammadyari & Singh, 2015).

Results

Descriptive statistics

Descriptive statistics and correlations are illustrated in Table 1. As expected, employees' age was negatively related to the level of digital fluency ($r = –0.27$, $p < 0.01$). Age was also negatively related to negative age stereotypes ($r = –0.19$, $p < 0.01$) and agility ($r = –0.10$, $p < 0.01$). Digital fluency was negatively related to negative age stereotypes ($r = –0.08$, $p < 0.05$), supervisor support ($r = –0.15$, $p < 0.01$), and tenure ($r = –0.29$, $p < 0.01$).

Measurement model

Table 2 displays the measurement model, which consisted of the three latent constructs negative age stereotypes, developmental supervisor support, and digital fluency measured with 14 items and, additionally, the manifest single-item variable of age. To evaluate the model fit, we followed the recommendations by Bentler (2007) and Hoyle (1995). The hypothesized model of this study showed sufficient values for all indices (CFI = .95, IFI = .95, TLI = .94, RMSEA = .07) and was also superior to further alternative models, as described in Table 2.

Hypotheses testing

Table 3 contains the results of the multiple linear regression analyses. Model 1 indicates negative and statistically significant relation of age on digital fluency ($\beta = –0.13$, $p < 0.001$) supporting Hypothesis 1.[1]

In Model 2, the interaction term of negative age stereotypes and chronological age was negative and significant ($\beta = –0.07$, $p < 0.001$). We plotted the interaction effect in Figure 2 and simple slopes showed that the high negative age stereotypes condition was strong statistically significant ($\beta = –0.23$, $t = –5.85$, $p < 0.001$) compared to the slope for low negative age stereotypes ($\beta = –0.09$, $t = –2.32$, $p < 0.05$), supporting Hypothesis 2.

Ultimately, the regression results from Model 3 also support Hypothesis 3 and the assumed three-way-interaction effect of age, negative age stereotypes, and developmental supervisor support on digital fluency ($\beta = –0.04$, $p < 0.05$). In Figure 3, we graphically plotted the effects. Slope 2—high negative age stereotypes and low developmental supervisor support—provokes a negative significant slope ($\beta = –0.20$ $t = –4.37$, $p < 0.001$). In contrast, slope 3—low negative age stereotypes and high developmental supervisor support—turns out to be non-significant ($\beta = –0.05$, $t = –1.18$, p = ns). Also, the slope difference test between Slope 2 and 3 is statistically significant ($\beta = –0.15$, $t = –2.87$, $p < 0.01$[2]).

[1]We also tested our three hypotheses without controlling for covariates. Results remained similar and can be found in the Appendix.

[2]All coefficients and slope difference tests can be found in the Appendix.

Table 2. Measurement model comparison.

Model	χ^2	df	χ^2/df	$\Delta\chi^2$	Δdf	CFI²	IFI	TLI	RMSEA
Hypothesized model	502	84	5.98	***		0.95	0.95	0.94	0.07
Alternative model 1[a]	2,144	88	24.36	1,642 ***	4	0.76	0.76	0.72	0.15
Alternative model 2[b]	5,379	90	59.77	4,877 ***	6	0.39	0.39	0.29	0.24
Alternative model 3[c]	8,315	91	91.37	7,813 ***	7	0.05	0.05	-0.01	0.30

Note. CFI = Comparative Fit Index; IFI = Incremental Fit Index; TLI = Tucker-Lewis-Index; RMSEA = Root Mean Squared Error of Approximation. All measurement models are compared to the hypothesized model.
[a] Negative age stereotypes and digital fluency on one common factor.
[b] Negative age stereotypes, digital fluency, and developmental supervisor support on one common factor.
[c] Negative age stereotypes, digital fluency, developmental supervisor support, and age on one common factor.

Table 3. Regression analysis.

Digital fluency	Model 1		Model 2		Model 3	
Age (H1)	**–0.13*****	(0.03)	–0.16 ***	(0.03)	–0.17 ***	(0.03)
Negative Age Stereotypes			0.07 ***	(0.02)	–0.07 ***	(0.02)
Developmental Supervisor Support					0.08 ***	(0.02)
// Interaction Effects						
Age × negative age stereotypes (H2)			**–0.07** ***	(0.02)		
Age x Negative Age Stereotypes					–0.07***	(0.02)
Age × developmental supervisor support					0.01	(0.02)
Negative age stereotypes × developmental supervisor support					0.01	(0.02)
Age × negative age stereotypes × developmental supervisor support (H3)					**–0.04***	(0.02)
// Controls						
Tenure	–0.08*	(0.03)	–0.06	(0.03)	–0.06	(0.03)
Agility	0.09***	(0.02)	0.07***	(0.02)	0.07***	(0.02)
Educational background	0.08***	(0.02)	0.08***	(0.02)	0.08***	(0.02)
Remote work	0.01	(0.02)	0.01	(0.02)	0.01	(0.02)
Training participation internal	0.02	(0.02)	0.02	(0.02)	0.02	(0.02)
Training participation external	0.02	(0.02)	–0.01	(0.02)	–0.01	(0.02)
Constant	4.17 ***	(0.02)	4.15 ***	(0.02)	–4.15 ***	(0.02)
N	1,007		1,003		997	
Adjusted R^2	0.11		0.14		0.15	
ΔR^2			0.03		0.01	

Note. Standard errors in parentheses. All effects are standardized regression coefficients. *$p < .05$; **$p < .01$; ***$p < .001$.

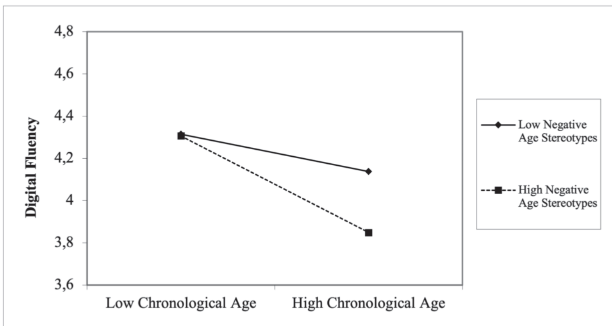

Figure 2. Moderating effect of negative age stereotypes on the negative relationship between employees' age and digital fluency (Hypothesis 2).

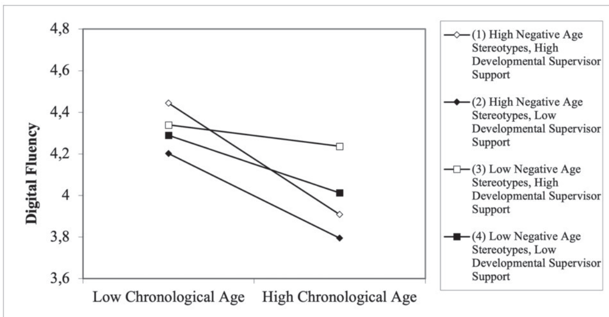

Figure 3. Moderating effects of negative age stereotypes and developmental supervisor support on the negative relationship between age and digital fluency (Hypothesis 3).

Discussion

The goal of our study was to shed light on the relationship between employees' age and digital fluency. Using a sample of 1,007 employees from a German company, we found older employees to perceive themselves as having lower levels of digital fluency. Nevertheless, we argued that this effect is contingent upon personal and situational factors. First, drawing from stereotype embodiment theory (Levy, 2009), we proposed and found that ageist stereotypes held by the employees moderate the age-digital fluency relationship, with older employees with high negative age stereotypes display even lower levels of digital fluency. Importantly, younger employees' digital fluency levels were not affected by holding such stereotypes. Furthermore, we argued and showed that developmental supervisor support contextualizes this existing moderating effect. In particular, our results indicated that older employees with strong negative age stereotypes and low supervisor support perceived the lowest levels of digital fluency. Additionally, age differences in digital fluency perceptions diminished when employees disagreed with such stereotypes and experienced strong supervisor support.

Theoretical and practical implications

Our research has numerous implications. First, we find empirical support for the disputed digital divide hypothesis among the workforce (Prensky, 2001; Wang et al., 2013). By using digital fluency as an outcome variable, we incorporate a new holistic approach and do not only focus on digital knowledge but also on digital self-efficacy, which is necessary for employees to satisfactory adopt ICTs at work (Briggs & Makice, 2012; Zimmermann, 2020). We, therefore, encourage companies to assess levels of digital fluency among their workforce and to observe and countervail potential age differences.

Furthermore, we present that digital fluency perceptions with inclining age depends on important personal and situational factors: So far, to our knowledge, the moderating role of internalized age stereotypes was only shown by Tougas et al. (2008) for retired seniors but not in a workplace context for digital work-related skills. Our moderation effect suggests that ageist stereotypes are detrimental and should not be underestimated. Specific training and diversity-friendly HR-policies could help to counteract such psychological tendencies (see Kunze et al., 2013; Wegge et al., 2012 for further HR-related suggestions).

Most importantly, this research highlights the essential role supervisors play in older employees' digital fluency development. Our results suggest that a lack of developmental supervisor support together with strong negative age stereotypes is most detrimental for employees and creates the biggest age differences in digital fluency levels. In contrast, strong supervisor support together with low negative age stereotypes seem to nullify the effect of age on digital fluency and lead to strong perceptions of digital fluency among all age groups. Interestingly, our results indicate that age differences in digital fluency perceptions only diminish with the condition of low negative age stereotypes. Managers should, therefore, increasingly focus on employees' potential self-stereotyping to strengthen digital competencies at the workplace.

Limitations and suggestions for future research

This study has several limitations that might be addressed in future studies. First, our cross-sectional and self-reported data does not allow for causal claims. While we see the self-perception measurement of digital fluency, particularly of digital self-efficacy, as a strength, one could include alternative, objective data sources of digital knowledge. Nevertheless, we also tested alternative models following the procedure described by Shaver (2005) and Antonakis et al. (2010) and did not find endogeneity nor multicollinearity to bias our results. Second, it may also be interesting to include supervisors' actual beliefs about older workers' adaptability to digitalization to analyze whether this impacts employees' self-stereotyping and digital fluency. Third, we assume that older employees who agree with negative age stereotypes internalized these stereotypes and self-stereotype themselves (Levy, 2009). Our results clearly indicate that for older employees, internalization is rather the case than dissociation from the stereotypes. Nevertheless, future research may want to further investigate the exact mechanisms underlying self-stereotyping and stereotype dissociation.

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