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Published online: 07 Feb 2021.

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ABSTRACT
Older adults are often stereotyped as having less technological ability than younger age groups. As a result, older individuals may avoid using technology due to stereotype threat, the fear of confirming negative stereotypes about their social group. The present research examined the role of stereotype threat within the Technology Acceptance Model (TAM). Across two studies, experiencing stereotype threat in the technological domain was indirectly associated with lower levels of technology use among older adults. This was found for subjective (Study 1) and objective measures (Study 2) of use behaviour, and for technology use in general (Study 1) and computer use in particular (Study 2). In line with the predictions of the Technology Acceptance Model, this relationship was mediated by anxiety, perceived ease of use, perceived usefulness, and behavioural intention. Specifically, stereotype threat was negatively associated with perceived ease of use (Studies 1 and 2) and anxiety mediated this relationship (Study 2). These findings suggest that older adults underuse technology due to the threat of confirming ageist stereotypes targeting their age group. Stereotype threat may thus be an important barrier to technology acceptance and usage in late adulthood.

1. Introduction

Population ageing and technological innovation are two major trends of our time. Virtually every country in the world is experiencing an increase in the proportion of older adults in their population. Worldwide, the number of persons aged 60 years or older is expected to more than double by 2050 and more than triple by 2100 (United Nations [UN] 2017). Simultaneously, the rapid development of new technologies witnessed in recent decades is likely to continue, driven by the cumulative nature of technological change, the convergence of technologies into new combinations, and substantial reductions in costs (UN 2018).

Yet, older individuals and technological devices are often seen as worlds apart. Various studies suggest that older adults are stereotyped as having less technological ability than younger age groups. For instance, technology-related behaviours, such as buying a personal computer and taking a computer course, are viewed as high

competence activities that are less typical of older adults (Ryan and Heaven 1988; Ryan, Szechtman, and Bodkin 1992). An extensive body of research has shown that individuals behave in ways consistent with the stereotypes targeting their group (Levy 1996; Steele and Aronson 1995; for reviews, see Meisner 2011; Wheeler and Petty 2001). This suggests that age stereotypes about technological inability may cause older adults to underperform and underuse technology, thus contributing to maintain the existing digital divide between generations (Organisation for Economic Cooperation and Development [OECD] 2017; Ryan 2018).

The present research investigated the relationship between stereotype threat and technology use by older adults. Stereotype threat is the concern or worry about confirming negative stereotypes targeting the group to which one belongs (Steele 1997; Steele, Spencer, and Aronson 2002). Such concerns can result in performance decrements when individuals perform tasks in domains in which they are negatively stereotyped

(Spencer, Steele, and Quinn 1999; Steele and Aronson 1995). For example, when reminded of negative stereotypes about age-related memory declines, older adults perform worse on memory tests (Chasteen et al. 2005; Hess et al. 2003). Stereotype threat has been found to disrupt older adults' performance across a wide range of cognitive and physical tasks (for a review, see Lamont, Swift, and Abrams 2015).

Besides underperformance, another behavioural response to the experience of stereotype threat is domain avoidance (Steele, Spencer, and Aronson 2002). Individuals avoid situations or activities in which they risk confirming negative stereotypes about their group (Davies et al. 2002; Woodcock et al. 2012). For example, experiencing stereotype threat in the workplace has been associated with greater intentions to resign and retire among older employees (von Hippel et al. 2019; von Hippel, Kalokerinos, and Henry 2013). Similarly, concerns about confirming negative stereotypes regarding the technological competence of their age group may cause older adults to avoid interacting with technology, thus compromising its regular use in their daily lives. Supporting this argument, longitudinal evidence indicates that stereotype threat is associated with lower levels of computer use in late adulthood (Mariano et al. 2020). Nonetheless, the mechanisms through which stereotype threat impacts technology use remain unclear.

In line with previous research on age-based stereotype threat in applied settings (von Hippel et al. 2019; von Hippel, Kalokerinos, and Henry 2013), stereotype threat effects in the technology domain may be mediated by other known predictors of use behaviour. Specifically, we explore the role of stereotype threat in the context of the Technology Acceptance Model (TAM; Davis 1989; Davis, Bagozzi, and Warshaw 1989), a valid and robust framework that has been widely used to explain and predict technology use behaviour (King and He 2006). Numerous studies have applied TAM to understand acceptance and usage of a variety of technologies by older adults (Braun 2013; Ma, Chan, and Chen 2016; Vaziri et al. 2020; for a review, see Chen and Chan 2011). According to TAM, technology use behaviour is determined by behavioural intention, which is then jointly predicted by two main factors: perceived ease of use and perceived usefulness. Perceived ease of use is the degree to which an individual believes that using the technology would be free of effort. Perceived usefulness is the degree to which an individual believes that using the technology would enhance his or her performance in certain contexts, such as their job or daily life. TAM asserts that people form intentions towards using technology largely based on their cognitive appraisal of how effortless it

will be and how much it will improve their performance. Perceived usefulness is also determined by perceived ease of use, in the sense that the easier the technology is to use the more useful it can be. TAM further assumes the influence of external variables, such as system features or user characteristics, the effects of which are fully mediated by perceived usefulness and perceived ease of use.

Within TAM, stereotype threat may serve as the basis for individual beliefs about how easy or difficult it would be to use technology. Specifically, stereotype threat can be expected to negatively influence perceived ease of use. Research exploring the mediating role of anxiety on the negative effects of stereotype threat on task performance provides theoretical and empirical support for this relationship. Stereotype threat may elicit anxiety or apprehension, consequently interfering with individuals' ability to perform (Steele and Aronson 1995). Indeed, experimental manipulations of stereotype threat have been shown to induce higher levels of anxiety or negative affect in older adults (Abrams et al. 2008; Abrams, Eller, and Bryant 2006; Chasteen et al. 2005; Swift, Abrams, and Marques 2013). TAM positions anxiety as an antecedent of perceived ease of use (Venkatesh 2000). Anxiety or apprehension about the prospect of using technology is negatively related to perceived ease of use (Powell 2013), including among older adults (Phang et al. 2006; Ryu, Kim, and Lee 2009). This is consistent with Social Cognitive Theory (Bandura 1986), which asserts that situations evoking fear or anxiety may lower individuals' expectations of success. This suggests that stereotype threat is negatively associated with perceived ease of use and that anxiety mediates this relationship. Experiencing stereotype threat in the technological domain should make older adults feel more anxious or apprehensive about using technology, which in turn should lower their expectations about how easily they will use it.

Across two studies, we aimed to understand the processes through which the threat of confirming negative stereotypes about the technological ability of their age group may lead older individuals to underuse technology. In a survey study with a sample of older adults from different European countries, we explored the relationship between stereotype threat and current use of technology (Study 1). Replicating and extending this exploratory work, we examined the link between stereotype threat and actual use of computer technology in a field study where older adults were given the opportunity to freely interact with tablet computers (Study 2). Overall, we expected a negative indirect association between stereotype threat and technology use, which should be mediated by anxiety, perceived ease of use,
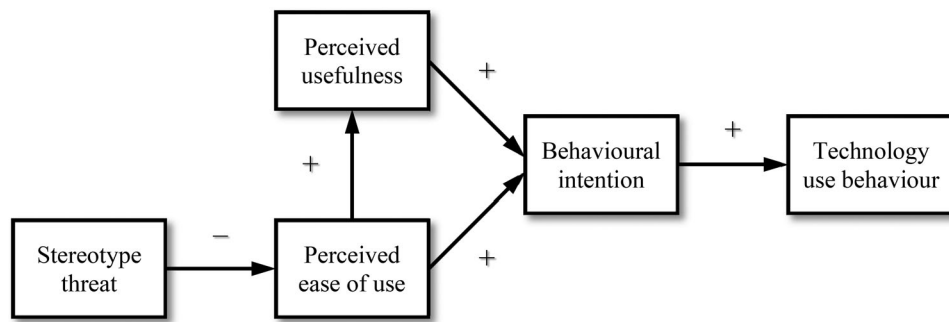
Figure 1. Hypothesised model for Study 1.

perceived usefulness, and behavioural intention, in accordance with the relationships specified by TAM.

2. Study 1

This survey study aimed to explore the relationship between stereotype threat and technology use among older adults, while also examining potential mediating mechanisms within TAM. Figure 1 presents the hypothesised model for Study 1. We predicted that stereotype threat would be negatively related to perceived ease of use (Hypothesis 1), which in turn would be positively related to perceived usefulness (Hypothesis 2). Both perceived ease of use and perceived usefulness would then be positively related to behavioural intention (Hypotheses 3 and 4, respectively), which would finally be positively related to technology use behaviour (Hypothesis 5). Based on these assumptions, we expected stereotype threat to be negatively and indirectly associated with technology use. Given the exploratory nature of this study, we focused on technology in general and targeted a broad sample of older adults from four European countries: France, Germany, Italy, and Portugal.

2.1. Method

2.1.1. Participants

In line with previous research on age stereotypes (e.g. Abrams, Eller, and Bryant 2006; Levy 1996), eligibility criteria to participate in the study included being 60 years or older, being able to read and write, living independently in the community, and having grown up in the country. Given the cultural nature of age stereotypes (Ng and Lim 2020) and the frequent exposure to these culturally shared stereotypical beliefs since early childhood (Marques et al. 2020; Mendonça, Marques, and Abrams 2018), only individuals who grew up in each country were considered eligible.

A total of 137 community-dwelling older adults (81 females, 56 males) residing in France ($n = 40$), Germany ($n = 30$), Italy ($n = 30$), and Portugal ($n = 37$) participated in the study. Their age ranged from 60 to 93 years ($M = 70.53$, $SD = 6.13$) and their education ranged from 4 to 24 years ($M = 12.36$, $SD = 3.68$). Most participants lived with their spouse (71.53%, $n = 98$), although close to one fourth lived alone (25.54%, $n = 35$). The great majority was retired (88.32%, $n = 121$) and very few were employed (3.65%, $n = 5$). Most perceived their health as average or better (91.24%, $n = 125$).

2.1.2. Procedure

This study was conducted in accordance with the ethical principles and code of conduct of the American Psychological Association (2017). Participants were invited to complete a questionnaire about technology. After providing their informed consent, participants completed the questionnaire in their native language.

2.1.3. Measures

All measures were originally translated from English to French, German, Italian, and Portuguese. Unless otherwise indicated, participants responded using a seven-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Item ratings were averaged for each measure, with higher scores indicating greater levels of the corresponding construct. Reliability was assessed with the Spearman-Brown coefficient (ρ) for two-item measures and Cronbach's alpha (α) for three-item measures (Eisinga, Grotenhuis, and Pelzer 2013).

2.1.3.1. Stereotype threat. Three items ($\alpha = .80$) were used to assess stereotype threat based on the measures developed by Marx and Goff (2005) and Steele and Aronson (1995): 'I worry that my ability to perform well using technology is affected by my age', 'I worry that if I perform poorly using technology, people will attribute my poor performance to my age', 'Some people

feel I am less able to use technology because of my age'. All items were adapted to refer to age stereotypes about technological ability.

2.1.3.2. Perceived ease of use, perceived usefulness, and behavioural intention.
The scales developed by Davis and colleagues (Davis 1989; Venkatesh and Davis 2000) were used to assess perceived ease of use (three items, $\alpha = .84$; e.g. 'My interaction with technology is clear and understandable'), perceived usefulness (two items, $\rho = .82$; e.g. 'Using technology improves my performance in my daily life'), and behavioural intention (two items, $\rho = .90$; e.g. 'Assuming I have access to technology, I intend to use it'). All items were adapted to refer to technology use in everyday life.

2.1.3.3. Technology use behaviour.
Technology use was assessed based on internet and computer use. For each technology, participants reported their frequency of use using a five-point scale (1 = *never*, 2 = *a few times a year*, 3 = *at least once a month*, 4 = *at least once a week*, 5 = *everyday*; $\rho = .87$). Internet and computers were chosen based on the consistent finding that older adults are less likely than younger age groups to use them (Czaja et al. 2006; OECD 2017; Ryan 2018).

2.1.3.4. Demographics.
Participants reported their age, education, sex, living arrangements, occupational status, and health status. Health status was rated on a seven-point scale ranging from 1 (*terrible*) to 7 (*excellent*).

2.1.4. Data analysis
To test the hypothesised model, we conducted structural equation modelling (SEM) using Mplus 8 (Muthén and Muthén 1998–2017) with robust maximum likelihood estimation (MLR). Model fit was examined based on the Chi-Square Test (χ^2), the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). CFI and TLI values of .95 or above and RMSEA values of .06 or below indicate good model fit (Hu and Bentler 1999). We also compared the hypothesised model to other plausible competing models to determine whether the proposed causal patterns provided better fit to the data. The Bayesian Information Criterion (BIC) was used to assess the relative fit of the models. BIC differences greater than 10 provide very strong evidence that the model with the lowest BIC is better (Raftery 1995). Age (in years), education (in years), sex (1 = *female*), living arrangements (1 = *alone*), occupational status (1 = *retired*), health status, and country were introduced as control variables.

Table 1. Means, standard deviations, and correlations in Study 1.

Variables	M	SD	1	2	3	4
1. Stereotype threat	3.68	1.63	–			
2. Perceived ease of use	4.63	1.29	−.32***	–		
3. Perceived usefulness	5.81	1.23	−.14**	.47***	–	
4. Behavioural intention	5.84	1.30	−.16**	.46***	.60***	–
5. Technology use behaviour	4.19	1.28	−.08*	.14*	.22***	.40***

*$p < .05$. **$p < .01$. ***$p < .001$.

2.2. Results

2.2.1. Descriptive analysis
Table 1 presents the means, standard deviations, and correlations for all variables in Study 1. Stereotype threat scores approached the midpoint of the scale, suggesting that participants experience some level of stereotype threat in the technology domain. Importantly, stereotype threat was negatively correlated with technology use, as well as with all TAM variables, although more strongly with perceived ease of use. Consistently with TAM predictions, perceived ease of use, perceived usefulness, and behavioural intention were significantly intercorrelated in the anticipated directions. These measures were also positively correlated with technology use. A one-way analysis of variance (ANOVA) revealed no significant differences between countries in stereotype threat, $F (3, 133) = 0.51$, $p = .677$, nor technology use, $F (3, 132) = 1.57$, $p = .200$.

2.2.2. Hypothesised model
A comparison of all fit indices with their corresponding recommended values provided evidence of good model fit: $\chi^2 (5) = 3.76$, $p = .584$, CFI = 1.00, TLI = 1.00, RMSEA = 0.00 (90% Confidence Interval (CI) [0.00, 0.10]). Standardised path coefficients of the structural equation model are shown in Figure 2. Overall, results supported all the hypothesised relationships. Stereotype threat was negatively associated with perceived ease of use ($\beta = −.27$, $p = .001$), which in turn was positively related to perceived usefulness ($\beta = .44$, $p < .001$), supporting Hypotheses 1 and 2. Both perceived ease of use and perceived usefulness had positive relationships with behavioural intention ($\beta = .20$, $p = .023$ and $\beta = .46$, $p < .001$, respectively), which supported Hypotheses 3 and 4. Finally, supporting Hypothesis 5, behavioural intention was positively linked with technology use behaviour ($\beta = .33$, $p = .002$).

Providing further support for these hypotheses, the total indirect effect of stereotype threat on technology use behaviour was significant and negative ($\beta = −.04$, $p = .023$). Similarly, the total indirect effects of stereotype threat on behavioural intention and on perceived
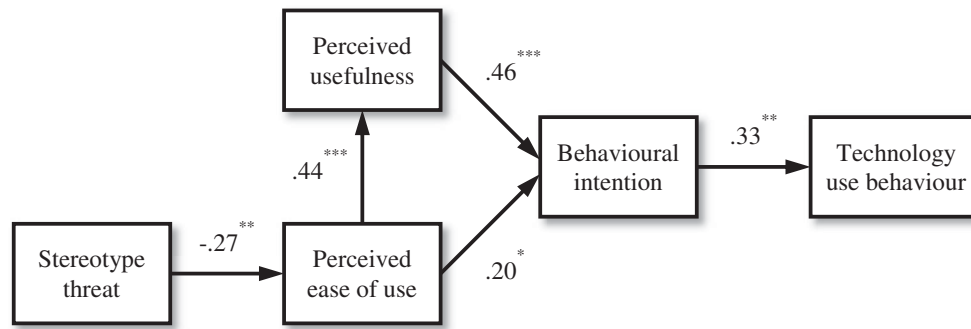
Figure 2. Results for the hypothesised model in Study 1. Path coefficients are standardised. Age, education, sex, living arrangements, occupational status, health status, and country were included as control variables (omitted for clarity). *$p < .05$. **$p < .01$. ***$p < .001$.

usefulness were both significant and negative ($\beta = -.11$, $p = .003$ and $\beta = -.12$, $p = .009$, respectively). Also supporting the relationships proposed by TAM, the total indirect effects of perceived ease of use and perceived usefulness on technology use behaviour were both significant and positive ($\beta = .13$, $p = .007$ and $\beta = .15$, $p = .002$, respectively).

2.2.3. Alternative models

The hypothesised model (BIC = 5335.66) was compared to alternative models in which stereotype threat was modelled as a direct predictor of perceived usefulness (BIC = 5347.88), behavioural intention (BIC = 5347.49), and technology use behaviour (BIC = 5346.17). Overall, BIC differences between the hypothesised and alternative models were greater than 10 and the proposed model had the lowest BIC, suggesting that the hypothesised model provides the best fit to the data.

2.3. Discussion

Study 1 suggests that the threat of confirming negative stereotypes in the technological domain is related to technology avoidance among older adults. As predicted, stereotype threat was indirectly associated with lower levels of technology use. Consistently with the relationships posited by TAM, perceived ease of use, perceived usefulness, and behavioural intention mediated this negative association.

Nonetheless, some limitations should be noted. First, although some studies have followed a similar approach (Chen and Chan 2014), we targeted technologies in general rather than a particular type of technology. Second, we relied on a self-report measure of current use rather than actual use. Although this is common practice in technology acceptance research, subjective measures of use behaviour have higher correlations with TAM variables than objective measures (Yousafzai, Foxall, and

Pallister 2007a, 2007b). These shortcomings may limit the generalizability of our findings, as they may not extend to more specific types of technology and more objective measures of use. In Study 2 we addressed these limitations while also extending the results of Study 1.

3. Study 2

This field study aimed to further explore the association between stereotype threat and technology use in a real-world context where older adults were given the opportunity to freely interact with computer technology. Following the introduction of tablet computers in several senior centres, the actual use of these devices by older attendees was recorded for one full month. We predicted that older adults who reported greater concerns about confirming negative stereotypes regarding the computer ability of their age group would use tablet computers less frequently during this one-month period. Furthermore, we expected this relationship to be mediated by computer anxiety, perceived ease of use, perceived usefulness, and behavioural intention in line with the assumptions defined by TAM. Figure 3 presents the hypothesised model for Study 2. We predicted that stereotype threat would be positively related to computer anxiety (Hypothesis 1a), which in turn would be negatively related to perceived ease of use (Hypothesis 1b). Perceived ease of use would then be positively related to perceived usefulness (Hypothesis 2) and both perceptions would be positively related to behavioural intention (Hypothesis 3 and Hypothesis 4, respectively). Behavioural intention would then be positively related to tablet computer use behaviour (Hypothesis 5). Thus, Study 2 replicates and extends Study 1 by using an objective measure of use behaviour, focusing more specifically on computer technology, and examining anxiety as an additional mediator of the relationship between stereotype threat and technology use.
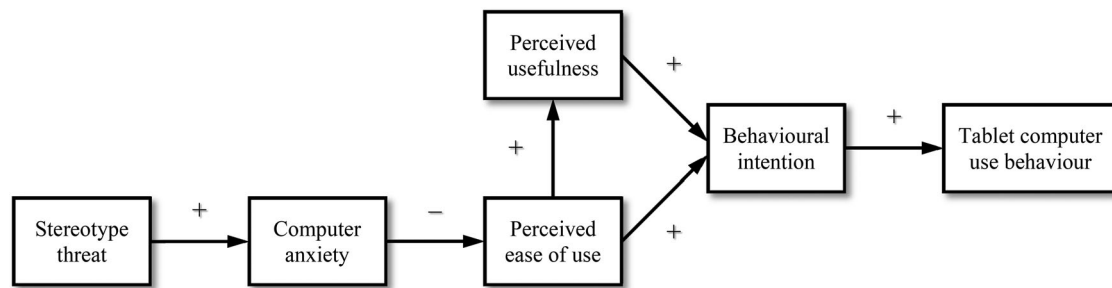
Figure 3. Hypothesised model for Study 2.

3.1. Method

3.1.1. Participants

Similarly to Study 1, eligibility criteria included being 60 years or older, being able to read and write, living independently in the community, and having grown up in the country. A total of 109 community-dwelling older adults (81 females and 28 males) attending six senior centres in Portugal participated in the study, ranging from 9 to 31 participants per centre ($M = 18.17$, $SD = 7.11$). Their age ranged from 62 to 95 years ($M = 78.51$, $SD = 7.59$) and their education ranged from 1 to 19 years ($M = 5.06$, $SD = 2.81$). Most participants lived alone (58.72%, $n = 64$) or with their spouse (25.69%, $n = 28$). Almost all were retired (97.25%, $n = 106$). Most perceived their health as average or better (75.23%, $n = 82$). Very few (4.59%, $n = 5$) reported having prior experience with tablet computers.

3.1.2. Procedure

This study was conducted in accordance with the ethical principles and code of conduct of the American Psychological Association (2017). Data collection was carried out in six senior centres (i.e. community centres attended by local older adults for social, leisure, and other activities) located in the same city and belonging to the same institution, thus having similar characteristics. All procedures were maintained identical across senior centres. Older adults attending these centres were invited to participate in a study about computer technology. Participants provided their informed consent before completing the baseline questionnaire.

In each centre, after all participants completed the questionnaire, two tablet computers were made available for public use for one month. During this period, usage sessions were periodically delivered by trained centre personnel, so that participants could become familiar with the tablet computers until being able to use them by themselves. Participants were free to attend these sessions and to use the tablet computers whenever they wanted. Prior to the study, centre personnel participated in a training session to learn research-based guidelines on how to train and assist older adults in using computer technology (Beisgen and Kraitchman 2003; Jones and Bayen 1998). The number of days each participant used the tablet computers during that month were registered by the centre personnel. This record was made on calendar-like sheets where they marked the days of the month when each participant used the tablet computers. To ensure anonymity and confidentiality, the match between questionnaire and usage data was based on participants' birthdates. Each tablet computer contained two games designed for cognitive training (Vasconcelos et al. 2012). In one game, players formed as many words as possible with a group of letters presented onscreen, until all possible words were identified. In the other game, players turned two of several playing cards presented onscreen facing down, until all pairs of matching cards were found. Besides these two readily available games, participants were free to use the tablet computers for other purposes.

3.1.3. Measures

Unless otherwise indicated, participants responded using a five-point scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, 5 = *strongly agree*). Item ratings were averaged for each measure, with higher scores indicating greater levels of the corresponding construct. Given the lower education levels expected and observed among the participants of Study 2, slight adaptations were made to the measures used in Study 1, such as decreasing the number of response options and changing the wording of some items to make them as clear and understandable as possible.

3.1.3.1. Stereotype threat. Three items ($\alpha = .80$) were adapted from Marx and Goff (2005) and Steele and Aronson (1995) to assess stereotype threat in the computer domain: 'I worry that my ability to perform well using computers is affected by my age', 'I worry that people feel I am less able to use computers because of

my age', 'I worry that I am unable to use computers because of my age'.

3.1.3.2. Computer anxiety.
Two items ($\rho = .75$) from the corresponding subscale of the Computer Attitude Scale (Loyd and Gressard 1984a, 1984b) were used to measure computer anxiety (e.g. 'Working with a computer would make me very nervous').

3.1.3.3. Perceived ease of use, perceived usefulness, and behavioural intention.
The scales from Davis and colleagues (Davis 1989; Venkatesh and Davis 2000) were adapted to reflect computer use in everyday life to assess perceived ease of use (three items, $\alpha = .87$; e.g. 'I would find computers easy to use'), perceived usefulness (three items, $\alpha = .94$; e.g. 'I would find computers useful in my daily life'), and behavioural intention (two items, $\rho = .96$; e.g. 'Given that I have access to a computer, I predict that I would use it').

3.1.3.4. Tablet computer use behaviour.
The behavioural measure of tablet computer use was computed by dividing the total number of days each participant used the tablet computers, ranging from 0 to 18 days ($M = 6.55$, $SD = 4.32$), by the total number of working days the tablet computers were available in their senior centre during that month, ranging from 18 to 22 days ($M = 20.00$, $SD = 1.79$).

3.1.3.5. Demographics.
Besides age, education, sex, living arrangements, occupational status, and health status, participants also reported their prior experience with tablet computers on a six-point scale adapted from Czaja et al. (2006): $1 = never$, $2 = less\ than\ 6\ months$, $3 = more\ than\ 6\ months,\ but\ less\ than\ 1\ year$, $4 = more\ than\ 1\ year,\ but\ less\ than\ 3\ years$, $5 = more\ than\ 3\ years,\ but\ less\ than\ 5\ years$, $6 = more\ than\ 5\ years$.

3.1.4. Data analysis
We followed the same analytical approach outlined in Study 1. Age (in years), education (in years), sex ($1 = female$), living arrangements ($1 = alone$), occupational status ($1 = retired$), health status, and prior experience with tablet computers were introduced as control variables. Effects on tablet computer use behaviour were further controlled for senior centre.

3.2. Results

3.2.1. Descriptive analysis
Table 2 presents the means, standard deviations, and correlations for all variables in Study 2. On average, participants used the tablet computers nearly one third of the days they were available in their senior centre. Stereotype threat scores reached the midpoint of the scale, suggesting that participants experience stereotype threat in the computer domain. The correlation between stereotype threat and tablet computer use was negative, despite being marginally significant. Stereotype threat was positively correlated with computer anxiety, which in turn was negatively correlated with perceived ease of use. Perceived ease of use, perceived usefulness, and behavioural intention were intercorrelated in the directions predicted by TAM, while also being positively correlated with tablet computer use.

3.2.2. Hypothesised model
An examination of all fit indices suggested good model fit: $\chi^2 (34) = 38.51$, $p = .273$, CFI = 0.99, TLI = 0.97, RMSEA = 0.04 (90% CI [0.00, 0.08]). Standardised path coefficients of the structural equation model are shown in Figure 4. The results supported all hypotheses. Stereotype threat was significantly and positively related to computer anxiety ($\beta = .52$, $p < .001$), which in turn was negatively associated with perceived ease of use ($\beta = -.38$, $p < .001$), supporting Hypotheses 1a and 1b. Perceived ease of use had a positive relationship with perceived usefulness ($\beta = .62$, $p < .001$), which supported Hypothesis 2. Both perceived ease of use and perceived usefulness were positively associated with behavioural intention ($\beta = .33$, $p = .001$ and $\beta = .39$, $p < .001$, respectively), supporting Hypotheses 3 and 4. Finally, supporting Hypothesis 5, behavioural intention had a positive association with tablet computer use behaviour ($\beta = .23$, $p = .003$).

Providing general support for these hypotheses, the total indirect effect of stereotype threat on tablet computer use behaviour was significant and negative ($\beta = -.03$,

Table 2. Means, standard deviations, and correlations in Study 2.

Variables	M	SD	1	2	3	4	5
1. Stereotype threat	3.07	1.23	–				
2. Computer anxiety	3.03	1.27	.58***	–			
3. Perceived ease of use	2.81	1.31	−.33***	−.47***	–		
4. Perceived usefulness	3.20	1.39	−.27***	−.35***	.70***	–	
5. Behavioural intention	3.25	1.57	−.27***	−.35***	.65***	.64***	–
6. Tablet computer use behaviour	0.33	0.21	−.08[†]	−.06	.16*	.15*	.23**

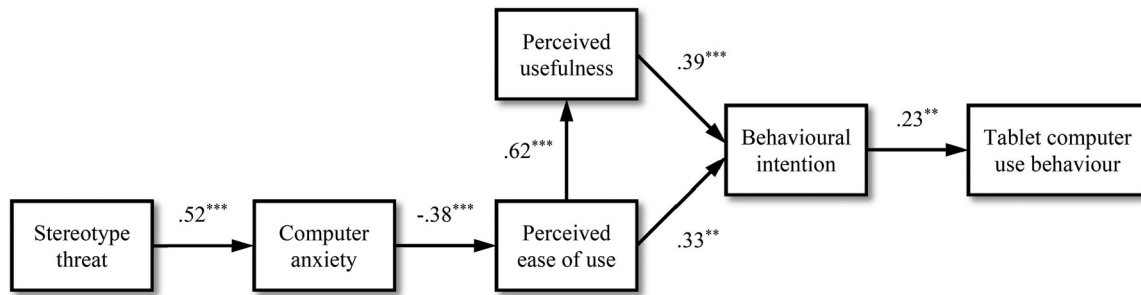[†]$p < .06$. *$p < .05$. **$p < .01$. ***$p < .001$.

Figure 4. Results for the hypothesised model in Study 2. Path coefficients are standardised. Age, education, sex, living arrangements, occupational status, health status, and prior experience with tablet computers were included as control variables. Effects on tablet computer use behaviour were further controlled for senior centre (omitted for clarity). *$p < .05$. **$p < .01$. ***$p < .001$.

$p = .043$). Likewise, the total indirect effects of stereotype threat on behavioural intention ($\beta = -.11$, $p = .001$), perceived usefulness ($\beta = -.12$, $p = .001$), and perceived ease of use ($\beta = -.20$, $p < .001$) were all significant and negative. Supporting the relationships posited by TAM, the total indirect effect of computer anxiety on tablet computer use behaviour was significant and negative ($\beta = -.05$, $p = .036$), while the total indirect effects of perceived ease of use and perceived usefulness on tablet computer use behaviour were both significant and positive ($\beta = .13$, $p = .008$ and $\beta = .09$, $p = .016$, respectively).

3.2.3. Alternative models

The hypothesised model (BIC = 1771.37) was compared to alternative models in which stereotype threat directly predicted perceived ease of use (BIC = 1806.36), perceived usefulness (BIC = 1802.38), behavioural intention (BIC = 1800.61), and tablet computer use behaviour (BIC = 1803.39). BIC differences between the hypothesised and alternative models were greater than 10. The proposed model had the lowest BIC, indicating that the hypothesised model fits the data better than the alternatives.

3.3. Discussion

Study 2 provides further support for the link between stereotype threat and technology use by older adults. Stereotype threat was negatively and indirectly associated with tablet computer use behaviour for one month. Consistently with TAM, computer anxiety, perceived ease of use, perceived usefulness, and behavioural intention mediated this relationship. By extending the results of Study 1 to computer technology and an objective measure, Study 2 confirms the robustness of its findings while also addressing its shortcomings.

4. General discussion

The present research aimed to explore the relationship between stereotype threat and technology use in late adulthood by examining its role within the Technology Acceptance Model (TAM; Davis 1989). Across two studies, older adults reported concerns about behaviourally confirming age stereotypes about technological inability. Importantly, the experience of stereotype threat was indirectly associated with less frequent technology use in this age group. Confirming the robustness of this relationship, this was observed with subjective (Study 1) and objective measures (Study 2) of use behaviour, and with technology in general (Study 1) and computers in particular (Study 2). Besides being in line with longitudinal evidence that stereotype threat precedes lower levels of computer use among older adults (Mariano et al. 2020), our work extends this relationship to other types of technological devices and more objective measures of use behaviour, while also identifying its underlying mechanisms.

Findings from both studies consistently revealed that stereotype threat was associated with lower expectations about how easily one will use technology. This is congruent with research indicating that performance expectations mediate stereotype threat effects on task performance. Experimental inductions of stereotype threat have been found to lower older adults' expectations about how well they would perform in memory tests (Desrichard and Köpetz 2005; Hess, Hinson, and Hodges 2009). The mediating role of anxiety observed in Study 2 provides further support for this relationship. Matching experimental evidence showing that stereotype threat raises anxiety levels among older adults (Abrams et al. 2008; Abrams, Eller, and Bryant 2006), experiencing stereotype threat in the technological domain was associated with greater anxiety about using technology. Increased anxiety was then related to decreased perceptions about the ease of using technology. This is in line with the prediction that anxiety

is an antecedent of perceived ease of use within TAM (Venkatesh 2000) and with studies demonstrating a negative association between anxiety and perceived ease of use among older adults (Phang et al. 2006; Ryu, Kim, and Lee 2009).

Additionally, stereotype threat was negatively and indirectly associated with perceived usefulness and technology use intention and behaviour. Previous studies also found stereotype threat to be indirectly related to behavioural intentions in stereotype-relevant domains (von Hippel et al. 2019; von Hippel, Kalokerinos, and Henry 2013). Perceived ease was positively associated with perceived usefulness and both perceptions were positively linked with behavioural intention, which was then positively related to use behaviour. Taken together, these results confirm the interrelationships between anxiety, perceived ease of use, perceived usefulness, behavioural intention, and use behaviour as proposed by TAM (Davis 1989; Venkatesh 2000). Although some studies investigating technology acceptance and usage by older adults found inconsistent evidence for TAM relationships (Chen and Chan 2014; Ma, Chan, and Chen 2016), our findings provide full support for its assumptions.

By integrating stereotype threat and technology acceptance literature, this work contributes to existing research in several important ways. Firstly, we focused on domain avoidance, an underexplored behavioural consequence of stereotype threat that has received considerably less theoretical and empirical attention compared to its detrimental effects on task performance. Secondly, while most studies examining domain avoidance rely on self-report measures of behavioural intention as a proxy for actual behaviour (von Hippel, Kalokerinos, and Henry 2013; Woodcock et al. 2012), we used an objective measure of use behaviour. Besides being negatively linked with behavioural intention to use technology, stereotype threat was also negatively related to actual behaviour. Lastly, despite the argument that stereotype threat effects may not generalise from laboratory settings to applied contexts (Cullen, Hardison, and Sackett 2004), findings from our field study in which older adults could freely interact with computer technology suggest that stereotype threat does play an important role in real-world situations.

Our findings also contribute to technology acceptance research. Studies testing TAM overwhelmingly rely on self-report measures of technology use (Chen and Chan 2011; Yousafzai, Foxall, and Pallister 2007a), which are more susceptible to reporting biases (Collopy 1996) and have higher correlations with TAM variables (Yousafzai, Foxall, and Pallister 2007b) than objective measures. In our field study, we focused on an objective measure of actual use of computer technology which was significantly determined by behavioural intention, thus supporting TAM predictions. Finally, we identified an antecedent of perceived ease of use that is specific to older adults. As members of a negatively stereotyped group in the technology domain, older individuals are susceptible to the experience of stereotype threat, unlike younger age groups who are not targeted by such stereotypes. Chen and Chan (2011) suggest that TAM research should consider age-specific factors to better understand technology acceptance and usage in late adulthood. Moreover, a recent meta-analysis concluded that perceived ease of use is lower among older age groups, suggesting that interventions aiming to promote technology acceptance and usage by older adults should prioritise perceived ease of use (Hauk, Hüffmeier, and Krumm 2018). By identifying stereotype threat as a correlate of technology-related anxiety and perceived ease of use that is specific to older age groups, we hope to contribute to TAM research by pointing out new ways for intervention.

Researchers have identified various strategies to reduce stereotype threat effects on task performance, which may serve as the basis for intervention development. For instance, exposure to ingroup role models who are successful in the stereotyped domain can lessen stereotype threat effects (Marx and Goff 2005; Marx and Roman 2002). Likewise, informing members of stereotyped groups about the effects of stereotype threat may improve their performance on stereotype-relevant tasks (Johns, Schmader, and Martens 2005; Mazerolle et al. 2016). Positive intergenerational contact, either experienced or imagined, can lower older adults' vulnerability to stereotype threat effects by reducing anxiety (Abrams et al. 2008; Abrams, Eller, and Bryant 2006). Future studies should investigate how to minimize age-based stereotype threat effects specifically in the technological domain.

Some limitations should be acknowledged and addressed in future research. First, cross-country comparisons were not possible in Study 1 given the insufficient sample size in each country. Future research should examine the potential cross-cultural generalizability of these findings. Second, the applied nature of Study 2 may have implicated confounders that were difficult to control. For example, the usage sessions delivered during the month when tablet computers were available in the senior centres may have influenced the factors previously assessed through the questionnaire. We believe this limitation is partly offset by the added value of conferring greater ecological validity to our findings, which were nevertheless consistent across

studies. Third, given the cross-sectional nature of these studies, we were unable to infer causality between variables. Future longitudinal and experimental studies should address this shortcoming. Fourth, the effect size of the relationships between stereotype threat and technology use were relatively small. Given the cultural nature of age stereotypes (Ng and Lim 2020), their influence may be more distal, primarily shaping more proximal predictors of use behaviour. Consistently, our findings suggest that stereotype threat exerts its influence through important determinants of technology use intention and behaviour among older adults, namely anxiety and perceived ease of use (Czaja et al. 2006; Hauk, Hüffmeier, and Krumm 2018). Lastly, both studies focused solely on general frequency of technology use. While frequency of use may be an appropriate indicator of avoidance, it would also be interesting to explore more specific behavioural outcomes. For instance, stereotype threat may limit the range of activities older adults perform when using technology. Rather than avoiding a technology completely, they may stick to more familiar tasks and avoid exploring new ones. This would be consistent with findings suggesting that older adults use the internet and computers for fewer activities than younger adults (Czaja et al. 2006).

Future studies should identify other potential mediators of the relationship between stereotype threat and technology use. For example, self-efficacy has been found to mediate the negative impact of stereotype threat on older adults' memory performance (Bouazzaoui et al. 2016). Interestingly, self-efficacy is an important predictor of technology use by older adults (Mitzner et al. 2019; Wild et al. 2012) and an antecedent of perceived ease of use within TAM (Venkatesh 2000). Similarly to anxiety, stereotype threat may undermine older adults' beliefs about their ability to use technology successfully, which in turn may lower their perceptions about how easily they will use it and ultimately compromise technology use intention and behaviour.

Overall, our findings suggest that age stereotypes may undermine technology adoption among older adults by generating concerns about the possibility of confirming the widespread belief that older age groups are less technologically competent. The processes through which stereotype threat impacts technology acceptance and usage should therefore be better understood in order to combat the digital inequalities between younger and older generations.

Acknowledgements

Disclosure statement

Funding

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