Why Age Is Not that Important? An Ageing Perspective on Computer Anxiety

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Abstract. We analyze the influence of age on mobile computer anxiety in a sample of 158 individuals 55+ by means of path analysis modeling. Taking as the endogenous variable a mobile computer anxiety scale (MCAS, Wang 2007), models include demographic and socioeconomic variables and a computer experience scale – based on the familiarity and frequency of use of different information and communication technologies. Results confirm a positive influence of age on mobile computer anxiety which is mediated by both socio-economic variables and computer experience. The influence of age on mobile computer anxiety is comparatively low. Age is not the relevant dimension to explain computer anxiety, as socio-economic background and computer experience have higher explanatory capacity. This result may explain the inconsistent results regarding the direct relationship between age and computer anxiety available in the literature.

Keywords: Older people · Computer anxiety · Romania · Survey · Path analysis · MCMC bayesian estimation

1 Introduction

"Some people hesitate in using computers for fear of making mistakes. Some people think they may break the machines if they do not operate them correctly" [1, p. 4].

The pervasiveness of information and communication technologies (ICT) seems to bring the assumption that individuals are comfortable when using them. Therefore, research interests on ICT-related problems are currently looking into technology anxiety that appears when it is not possible for users to check in with ICT as often as the individual would like (social network sites – SNS, e-mail, voice mail, text messages or cell phone calls) and which can be related to Internet dependence [2]. But there are other users who struggle with computers and other (mobile) ICT. Rejection and negative experiences of ICT use are approached by looking at computer anxiety, as the negative emotional tendency of an individual towards using computers [3, 4]. Even though precise and consistent definitions are lacking [5], computer anxiety is often defined as an individual's fear or apprehension of working directly with a computer or the anticipation of having to work with computers [6, p. 2338]. A person may feel

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intimidated, hostile, or worried about social embarrassment or just looking stupid in current or future use of computers, causing rejection or impacting performance. With the proliferation of mobile computers, authors (e.g. [7]) have begun discussing individual anxiety towards mobile computers, overcoming the limitations of traditional computer anxiety measures, which look at desktop computers or at wire-based Internet (see for example Computer Anxiety Rating Scale – CARS, [8]).

Nevertheless, ICT devices have become everyday tools for communication, a process that affects not only all spheres of life, for instance [9], but different generations [10] - among others, the younger elderly [11]. As (mobile) ICT are everyday tools, one may think they are well-appropriated devices which do not generate stress. However, available evidence shows that (mobile) computer anxiety is not a disappearing phenomenon. For instance, advanced users also face computer anxiety [4] and low self-efficacy [12]. Contrastingly, a common assumption is that older individuals would be among the most technology-averse [4] and experience higher computer anxiety.

In this paper we analyze the influence of age on mobile computer anxiety on a group of adults 55+ by taking into account both computer experience and socio-economic factors. Research studies on computer anxiety in the case of older people are limited [6], with [13–15] being exceptions. In addition, there are no studies on mobile computer anxiety that focus on the older segments of the population. For these reasons, this is relevant, timely research.

2 Analytical Framework

In what follows we develop the concepts that are the focus of our analysis: Firstly, (mobile) computer anxiety in relation to age; secondly, in relation to computer experience. The aim of our empirical approach is to analyze the determinants, or predictors, of mobile computer anxiety (see [6]). As mobile computer anxiety is a concept evolved from the discussions around computer anxiety, and given the current proliferation of mobile computers [7], in the subsequent sections we refer to the main concept - computer anxiety - and its correlates, with an emphasis on contextual factors.

2.1 (Mobile) Computer Anxiety and Socio-Economic Background

Computer anxiety is more commonly associated with older, less educated adults who tend to be reluctant to technology in general. Still the evidence of age predicting computer anxiety is inconsistent [16]. By means of a narrative analysis of the academic literature on older people and new communication technologies Richardson et al. [17] argue that computer anxiety reinforces the discourse that considers computers as potential dividers that marginalize seniors, as the literature sees it as a barrier to computer use. Kim [18] also develops a critical review on older people and computer learning and use: Even though older adults are found to be less confident in their computer knowledge than younger adults, for instance [19], it is not age that is the explanatory variable of these difference, but the fact that older adults have less opportunities to use computers. The way a person approaches computer mediated

communication, at any life stage, is not necessarily determined by age but by a large number of socio-economic factors, such as status, income and education, that create different opportunities for individuals [20].

Still, we find a limited number of papers analyzing the relationship between computer anxiety and the social context of individuals. Bozionelos [12], for example, conducted empirical research that analyzes the mechanism to explain the relationship between socio-economic background and computer use, which considers two intervening variables, computer anxiety and computer experience. He concluded that "individuals from more privileged socio-economic backgrounds are expected to demonstrate lower computer anxiety than their less socio-economically privileged counterparts" [12] p. 727. The author claims that this is the first paper connecting socio-economic background with computer anxiety. An extensive meta-analysis of the research on computer anxiety comparing the literature in the 1990 s and in the 2000 s confirms the lack of interest in this area [6]. The author identified 269 empirical articles and analyzed the issues that accounted for at least 10 hits in the corpus. She distinguished computer anxiety antecedents, correlates and outcomes. First, antecedents include personal characteristics (gender, age, other anxieties, education, personality and profession) and human-computer interaction dimensions (experience/use, training and ownership). Second, correlates correspond to self-efficacy, attitude, and perceived ease of use, usefulness and satisfaction. Finally, outcomes refer to performance and intent of use. None of these categories refer to the socio-economic background (SES) with regards to computer anxiety. In the current research, we argue that the inconsistent results regarding the relationship between age and computer anxiety can be explained by the assumed direct relation between the two concepts and the undervalued role of socio-economic variables (SES) that could play a moderating role.

With this approach, we formulate

Hypothesis 1: *The relation between age and mobile computer anxiety, for older individuals, is mediated by socio-economic variables (SES): work status, level of education, and household income.*

2.2 Computer Experience and Age

Particularly in the case of older people, experience in using computers plays an important role in individuals' attitudes towards computers [15]. Chien [1], for example, highlights lower levels of computer experience among older adults, compared to younger adults. In addition, Kim [18] explains that younger adults' computer experience may cause them higher confidence levels on their abilities to handle computers, a self-efficacy feeling that would impact their willingness to use a particular technology. Yet, social aspects should be considered to understand computer experience. Particularly, knowledge acquisition might be shaped by social dynamics, as suggested by the technology appropriation [21] and technology domestication [22] frameworks. Social dynamics, conversely, would also shape computer experience and willingness to use ICT devices.

Although most studies [23–25] found that prior experience in using the computer is associated with lower computer anxiety, some research studies (e.g. [26]) found an opposite relation between the two variables: when working with computers increases, people can become more anxious or develop negative attitudes towards computer. Certainly the way we operationalize "experience in using computers" could have some influence on the type of results we get when analyzing the impact on computer anxiety. We have noticed that most of the cross-sectional research recorded time length of computer use or self-reported measures of familiarity with different types of applications – see also [27]. Still a consistent relationship between computer experience and computer anxiety seems to be recorded in studies when experience has been operationalized as frequency of use [25, 28]. In this paper we consider the role of computer experience in mediating the relationship between age and computer anxiety. We measure computer experience by a composite measurement of self-reported measures of familiarity and frequency of use.

With this approach, we formulate

Hypothesis 2: The relation between age and mobile computer anxiety, for older individuals, is mediated by computer experience.

Hypothesis 3: The relation between age and computer experience, for older individuals, is mediated by socio-economic variables (SES): work status, level of education, and household income.

3 Method

In what follows we describe, first, the process of data collection and the sample characteristics; and second, the building of the two constructs that are part of the path analysis models.

3.1 Data Collection and Sample Characteristics

We employed a face to face questionnaire among a convenience sample (N = 158) of people 55+ living in urban and rural areas in Romania. Students enrolled in a Research Methods course voluntarily subscribed to be field operators and obtained informal consent from the participants. The second author designed and supervised the collection of data. With ages ranging from 55 to 84 years, we targeted two subgroups of participants, 55 to 64 years of age (n = 91) – most probably active on the labor market, and 65 years and above (n = 67) – at retirement age. The questionnaire included questions about the familiarity and frequency of use of different technology devices, the purposes of using specific technologies (work related/spare time activities), mobile computer use and access to internet, computer anxiety and socio-demographic characteristics: gender, residence (rural/urban), level of education, income and marital status.

With an average age of 63.9 years (SD = 7.5), there were more women (66.5 %) than men (33.5 %) among respondents (see Table 2 in the Appendix). Most

respondents reported secondary level of education (49.5 %), with 28.4 % of the participants having primary level of education (8 years of school or less) and 21.5 % graduated from college. The structure of the sample on education level is consistent with the educational structure for people in Romania having 55 years of age and above [29]. Regarding the working status, most of our respondents were retired with pensions (68.4 %), whereas 26 % were full time or part time employees. Compared to the structure of the Romanian population aged 55+, our sample is overrepresented by urban areas (76 %), reproducing the socio-demographic characteristics of older people living in large urban communities.

3.2 Constructs

Computer Anxiety Measurement. Computer anxiety was assessed by Wang's [7] *Mobile Computer Anxiety Scale* (MCAS). Participants answer using a 7 point scale, from 1 - not anxious at all - to 7 - very anxious, about how they would feel when a series of mobile computer interactions would happen in the following days. MCAS comprises 38 items divided on seven subscales: (1) anxiety about *learning* activities (i.e. "taking a class about the use of mobile computer"; identified as FL in what follows); (2) anxiety about *internet use* (i.e. "browsing web pages using a mobile computer"; FI); (3) anxiety about *the equipment limitation* (i.e. "using a mobile computer with a limited memory"; FE); (4) anxiety about *job replacement* (i.e. "mobile computers would replace someone's job"; FJ); (5) anxiety about computer use (i.e. "working on mobile computer"; FU); (6) anxiety about *computer configuration* (i.e. "disassembling hardware components, such as memory card, battery"; FC); and (7) anxiety about *Internet stability* (i.e. "using a mobile computer in the context of less stable wireless network"; FS). A Romanian back-translated version of MCAS (38 items instrument) was used in the current research study. The overall internal consistency was high (Cronbach's $\alpha = .97$) and reliability was good for all seven components (Cronbach's α ranging from .81 to .96). We conducted a CPA (Component Principal Analysis) for each subscale, all of them loading a unique factor with eigenvalue over 1 that explained between 62 % and 84 % of the corresponding dependent variance.

Computer Experience Measurement. We assess participants' experience with information and communication technologies using an *ICT experience index* that comprises: (a) familiarity with ICT - measured by the years of using a given communication technology; and (b) frequency of use, measured by the number of hours spent in using the device. We conducted a CPA with the 12 variables that gathered this information, obtaining 5 factors that explained 86.2 % of the variance. While this construct could be improved (for instance, by adding information on the kind of use of the device) it proved to have an acceptable internal consistency in the context of the current research (Cronbach's $\alpha = .79$) and the reduction of the dimension was appropriate.

First factor, ICT1, gathered information of experience in using smart phones and other mobile devices that go online; second, ICT2, experience with laptops; Third,

ICT3, experience with desktop computers and Internet ownership at home; fourth, ICT4, experience with tablet pc; and fifth, ICT5, experience with mobile phones. These factors will serve as observed indicators of the construct 'ICT experience' in the model.

4 Results

We analyzed the relationship age has with MCAS and ICT experience. On the one hand, age positively correlates with six of the seven factors that summarize the MCAS subscales. In the case of not significant correlation (Internet stability or FS) the parameter is also positive.[1] On the other hand, age shows a negative relationship with the factors that summarize ICT experience.[2] We question whether this relationship is mediated by individual characteristics and computer experience; thus we took a path analysis approach. Model specification followed the literature review. Figure 1 gathers the main characteristics of the initial model (Model 1) after adjusting its specification. Particularly, the model includes direct effects from Age to ICT experience and to MCAS. The illustration does not include covariances or error terms while for dichotomous variables the category under analysis is depicted. For statistical methodology aspects we follow [30–32].

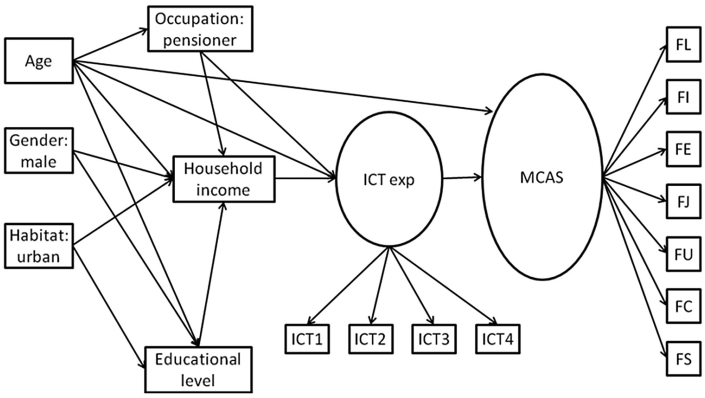

Fig. 1 Model 1, specification.

We distinguish between observed and unobserved variables. Among the observed variables in the model (see Table 2, Appendix) there are three exogenous variables of the model (Age, Sex and Habitat: urban); and three intermediate variables (Occupation: pensioner, Household income in the last month, and Educational level). The model

[1] Pearson's correlation with Age: FL, .369*; FI, .363*; FE, 0.178**; FJ, .257*; FU, .253*; FC, .242*; and FS, .088 (* significant at least at 99% level, ** significant at 95%).

[2] Pearson's correlation with Age: ICT_1, −.223*; ICT_2, −.321*; ICT_3, −.334*; ICT_4, .010; ICT_5, −.212* (* significant at least at 99% level, ** significant at 95%).

includes two unobserved variables: ICT experience and MCAS. The observed indicators of the ICT experience construct are all the obtained PCA factors except one.[3] The observed indicators of MCAS are the unique PCA factors obtained for each of the 7 subscales.

We conducted Markov Chain Monte Carlo (MCMC) Bayesian estimations because the model includes qualitative variables as intermediate variables. In MCMC Bayesian estimations, goodness of fit is assessed by means of two elements: First, CS or convergence statistic – which must take a value of 1.002 or lower in all the estimated parameters of the model; second, the posterior predictive p-value (PPP) – which must reach a value around .50. Model 1 did not achieve convergence. Even though PPP equaled .50, we discarded Model 1 for not meeting the goodness of fit criteria.

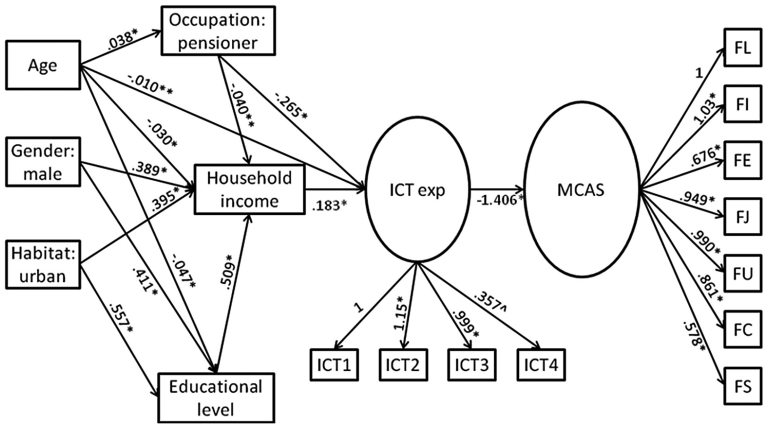

Fig. 2 Model 2, specification and estimated parameters

Model 2 includes a direct path connecting Age and ICT experience but no path connecting Age and MCAS. It converged in less than 500,000 iterations and PPP equaled to .50, thus goodness of fit is acceptable. As shown in Fig. 2, all the regression weights have the expected sign. While most parameters are significant at a 95 % level, the direct path from Age to ICT experience is significant at a 90 % level. There is one non-significant parameter, but we decided to keep it because it is one indicator of ICT experience (ICT4) and its deletion did not impact other elements of the model.

Total effects are the addition of direct effects - represented by arrows directly connecting two variables - and indirect effects - represented by arrows connecting two variables through other variables. Table 1 shows that total effects keep the same sign as direct effects in all cases.

[3] We arbitrarily excluded the last one, as PCA returns orthogonal factors.

Table 1. Total effects over intermediate and endogenous variables. Model 2

	Age	Habitat: urban	Gender: man	Occupation: pensioner	Household income	Educational level	ICT exp
Pensioner	.038[a]	0	0	0	0	0	0
Income	–.069[a]	.679[a]	.598[a]	–.400[b]	0	.509[a]	0
Education	-–0.47[a]	.557[a]	.411[a]	0	0	0	0
ICTexp	–.033[a]	.124[a]	.109[a]	–.338[a]	.183[a]	.093[a]	0
MCAS	.044[a]	–.167[a]	–.147[a]	.450[a]	–.246[a]	–.125[a]	–1.406[a]

Total effects of variables in columns over those in rows. Significance level: [a]95%; [b]90%.

5 Discussion and Conclusion

In terms of direct effects, which are equal to regression weights, Model 2 indicates that age has a positive influence on being a pensioner but negative influence on the rest of the socio-demographic indicators: household income and educational level (see Fig. 2). Being male increases household income and educational level but has no effect on the individual's occupation. The same is valid when participants live in urban areas, compared to rural ones. Being a pensioner reduces ICT experience while the higher the household income, the higher the ICT experience; Besides, educational level was found to have only an indirect effect on ICT experience. In addition, the higher the ICT experience the lower the MCA. This result is in line with the findings in the literature regarding computer anxiety [12, 19, 20]. Thus, socio-economic dimensions, which can be interpreted as indicators of the opportunities individuals had along their life for interacting with different ICT, are relevant for understanding mobile computer anxiety in the case of 55+ individuals.

The total effect of Age over MCAS is statistically significant (see Table 1), showing a positive influence of age on mobile computer anxiety in the sample of 55+ individuals under study. Yet, this influence is not direct, as the goodness of fit of Model 1 was not acceptable. Variables acting as intermediaries are occupational status, pensioner; household income; educational level; and ICT experience. The magnitude of the total effect of Age over MCAS is the smallest one in the model (.044). Similarly, it is neither the most important factor explaining ICT experience, as Age total effect (.033) is the lowest one. These results reinforce the idea that age should not be considered the main explanatory variable of mobile computer anxiety.

In fact, the individual characteristic with the greatest impact on MCAS is occupational status, pensioner (total effect = .450), followed by household income (–.246). In addition, being a pensioner increases mobile computer anxiety, while higher household incomes reduce it. The role of ICT experience is key to explain this relationship, as these are precisely the two variables with higher total effects on ICT experience (–.338 and .183 respectively).

Therefore, the three hypotheses are accepted.

Hypothesis 1. The relation between age and *mobile* computer anxiety, among older individuals, is mediated by socio-economic variables (SES): work status, level of education, and household income.

Hypothesis 2. The relation between age and *mobile* computer anxiety, among older individuals, is mediated by computer experience.

We confirmed the mediated relationship of SES and computer experience. Particularly, we found a positive influence of age on mobile computer anxiety but it was the predictor with the lowest explanatory capacity.

Hypothesis 3. The relation between age and computer experience, for older individuals, is mediated by socio-economic variables (SES): work status, level of education, and household income.

We found a negative relationship between age and computer experience. In this case it was partly direct and partly indirect, showing that socio-economic background could better explain this relationship than age. This evidence supports the idea that inconsistent results regarding the relationship between age and computer anxiety can be explained by the assumed direct relation between the two concepts and the undervalued role of socio-economic variables (SES) that could play a moderating role.

Yet, the empirical analysis could be improved by incorporating other variables that go beyond the narrow scenario in which computer experience is the only aspect that directly impacts mobile computer anxiety. Aspects related to learning processes or to perceived computer self-efficacy would be relevant. In addition, a comparison between the mobile computer anxiety scale [7] we use here and more traditional computer anxiety scales (as [33]) would bring nuances of the specific characteristics of the fast-evolving landscape of mobile ICT devices. Finally, it would be of most interest to validate the hypotheses from a broader perspective, to replicate the study in other countries, as cultural differences might play a role.

All in all, our empirical analysis individuals 55+ living in Romania validates that the influence of age on mobile computer anxiety happens through two different intermediate channels. One corresponds to social and economic personal context, and the other corresponds to familiarity and frequency of ICT use. The influence of age is positive but comparatively low. Other factors, as socio-economic background, have higher explanatory capacity. Our analysis also confirms that the influence of age on computer experience is mediated by socio-economic variables and, again, is the predictor with the lower influence on computer experience in the sample under study. We can conclude that while age could be used as a proxy of other individual characteristics in the study of the relationship of (older) individuals with ICT, it should not be considered the main explanatory variable. That is, age is not that important for explaining mobile computer anxiety.

Appendix: Characteristics of the Sample

Table 2. Characteristics of the sample (N = 158)

Age		**Education**	
Mean	63.91	Primary school (4 classes) (4 years)	10.2%
St. Dev.	7.51		
Median	63,5	Secondary School (8 years)	18.5%
Min - Max.	55 - 84		
N	158	High school/ professional high school	49.7%
Gender			
Female	66.5%	Faculty/master/PhD	21.7%
Male	33.5%	N	157
N	158		
Habitat		**Household monthly income**	
Urban	75.9%	Up to 700 lei	10.8%
Rural	24.1%	701 - 1500 lei	37.3%
N	158	1501 - 2500 lei	27.8%
Occupation		2501-3500 lei	11.4%
Pensioner	68.4%	3501 - 4500 lei	3.8%
Other	31.6%	More than 4500 lei	7.0%
N	157	N	155

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