Exploring Personality and Game Preferences in the Younger and Older Population: A Pilot Study

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Abstract: *Aim:* Engagement in gamified applications can be increased by effectively meeting end-user preferences for game content. To design this tailored content insight in user preferences is necessary, obtained from user classification models. This pilot study aims to explore the hypothesised relation between personality traits and preference for game characteristics that is the basis for a new user classification model, deduced from the Five Domains of Play theory.
Methods: An online questionnaire consisted of the 10-item Big Five Inventory to determine personality, and five questions on the preference for game examples to determine game preference.
Results: 216 participants completed the questionnaire (M=39 years, SD=17). For the group of participants younger than 60, four out of five personality traits correlate significantly but weakly with their corresponding game preference domains (r=0,13-0,30, p<0,05). For the participants older than 60, no significant correlations were found.
Conclusion: Personality and game preferences are weakly related in persons younger than sixty years old, while no relation was found for the older participants. For the latter, this may be due to a lack of gaming experience. We therefore propose to extend research towards a field study by providing actual games to play on beforehand.

1 INTRODUCTION

Demographic changes, such as population growth and longer life expectancy, increase the burden on the healthcare system. Telemedicine can alleviate this burden by enabling professionals to provide care at distance in patients' daily environment (Jansen-Kosterink, 2014). A group that can particularly benefit from telemedicine is the older adult (Pavel et al, 2009). Telemedicine supports them in maintaining a healthier lifestyle that maintains autonomy, independence and quality of life. Adherence to telemedicine interventions is related to improved health outcomes (Huis in 't Veld et al., 2010), but is low and decreasing over time (Tabak et al., 2014, Evering et al., 2013). A possible explanation for the drop in adherence is the lack of motivation given by a professional in face-to-face contact, or plain boredom. Gamification is identified as a possible strategy to increase adherence by adding the motivational pull that (video) games inherently have, although it is unknown how to apply gamification to produce the needed long-term engagement in telemedicine. This is particularly the case for the older adult, since their preferences are not known from being an unlikely consumer of modern video games. Therefore, there is a need for methods to create gamification for telemedicine solutions, which are tailored to the end-user preferences for optimal engagement.

User engagement, which is key to adherence, is known to significantly increase when preferences of the user are effectively met (Petty et al., 1979, Bakkes et al., 2012). Our previous research showed several classifications, to categorise both younger and older users (De Vette et al, 2015), based on for example in-game behaviour or gaming motivation. Examples include Bartle (Bartle, 1996), Yee (Yee, 2005) and

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LeBlanc (Hunicke et al., 2004). These taxonomies are designed for use in a specific application, such as enterprise gamification or massive multiplayer online roleplay games (MMORPGs, for example World of Warcraft). It is unknown if these are suitable for application in gamification design for telemedicine solutions. Furthermore, we foresee that older adults demand a different approach, as we also know is the case with many exergames (Gerling et al., 2010), but none of the classifications presented target the older user specifically.

The Five Domains of Play theory (5D) (Vandenberghe, 2012) could potentially be suitable for use in telemedicine context. It stands out from the other classifications mentioned as it creates a profile of user preferences, rather than a singular label, based on personality which is an understanding applicable to all ages. According to this theory, people strive to express or satisfy their personality traits in games, whether these already are expressed in daily life or not. The 5D theory translates the five factors of the Five Factor Model of personality (FFM) into five aspects of gaming motivation i.e. game content characteristics *(table 1)*. According to the theory, the score of the personality trait should correlate positively with the score of the translated game domain: a high score on Openness to Experience would mean a preference for a game with high Novelty game content characteristics.

A negative correlation however may be expected between Neuroticism and Threat. As far as we know these relations have not been investigated.

So far, studies present inconsistent results on predicting the effectiveness of the application of personality in gaming (Orji et al., 2014, Zammitto, 2010, Teng, 2009). In one study, personality traits have been related to preference for game genres and low predictive capability was found (Zammitto, 2009), while another study shows a significant correlation between personality and game genres (Peever et al., 2012). Game genres however do not describe explicit game features and may not give an accurate indication of game preferences (Apperley, 2006).

If a classification based on the 5D theory indeed appears to be viable, it can give us insight in the user that is essential to design tailored content. Moreover, it provide us with a method to dissect games into distinctive elements. There is a need for a reliable classification of telemedicine end-users according to their preferences, to aid the development of the tailored game content that is essential for creating engaging applications through gamification. As a first step toward creating tailored game content, we investigate the hypothesised existence of a relation between personality and game preference based on the 5D theory, for the younger as well as for the older adult.

2 METHODS

2.1 Participants, Materials and Measures

Participants were recruited through Facebook and via e-mail to colleagues and other acquaintances, who forwarded the request to others as well. Furthermore, Alifa, a local social community service centre in Enschede, the Netherlands, sent requests to its older volunteers.

Table 1: The Five Factor Model of personality and the Five Domains of Play model, including personality/game preferences for both extremes (deduced by authors from Vandenberghe, 2012).

low score	FFM factor 5D domain	*high score*
Cautious, predictable Conventional experiences	Openness to Experience Novelty	Inventive, curious Open, imaginative experiences
Careless, impulsive Low difficulty, contentment	Conscientiousness Challenge	Efficient, organised High difficulty, achievement
Reserved, solitary Single-player, slow pace	Extraversion Stimulation	Energetic, outgoing Multi-player, excitement
Analytical, detached Violence, competition	Agreeableness Harmony	Friendly, compassionate Cooperation, altruism
Confident, secure Cheerful, calm	Neuroticism Threat	Nervous, sensitive Stressful, hostile

Measures were taken by means of an online questionnaire, created in SurveyMonkey and accessible through a URL. The questionnaire was available both in English and in Dutch. Age and gender were asked first. Play frequency was determined by the question 'How often do you (approximately) play games?' (answer possibilities Daily, Weekly, Monthly, Once every 6 months, Once a year or less). Play frequency was split into two groups: 1) frequent (weekly or more, answers: daily, weekly) and 2) non-frequent (montly or less, answers: montly, once every six months, once a year or less).

Game preference was determined through five questions, one for each of the five domains described by the 5D theory *(table 1)*. In each question, the game content is described through an explanation and depicted examples of a domain's extremes. The participant indicated his or her perceived level of satisfaction (nine-point scale) from the proposed game content *(fig. 1)*. Personality was measured subsequently, by means of the 10-item Big Five Inventory (percentage from 5-point scale). This short version reaches adequate levels in terms of convergence with an established instrument, test repeatability and reliability (Gosling et al., 2003, Rammstedt et al., 2007). The FFM model suggests a normal distribution of scores (ranging from 0 to 100 with an average score of 50 on each factor)

2.2 Statistical Analysis

Data analysis was performed using Statistical Package for Social Sciences (SPSS v.22). Age was partitioned in 1) younger than 60 (< 60) and 2) 60 or older (≥ 60). We define an age threshold assuming that people aged 60 and up have less affinity with technology. First, the data for each person was sorted for the five factors of the FFM model (abbreviated P, from personality) and the five domains of the 5D model (abbreviated G, from game preference), together with their gender, age and play frequency. Then, data distributions of the five factors and the five domains were analysed using the Shapiro-Wilk test, descriptives of skewness and kurtosis, boxplots and histograms. There were no outliers found in analysis of the boxplots. All factors and domains were found non-normally distributed, even after data transformation was applied (log2, log10, sqrt, x^2). Hence, correlations were explored with Spearman's Rho (rank correlation coefficient, appropriate for ordinal variables), for all groups, using a significance level of $\alpha = 0,05$. Correlations between the factors and related domains as intended by the models were studied (Openness to Experience with Novelty, Conscientiousness with Challenge, and so on). For the subgroups < 60 and ≥ 60, correlations not intended by the models, between all factors and domains, were studied as well. We consider correlation strength as the predictive value of the personality characteristic for the preference on the matching game preference domain. Correlation strength is interpreted as follows: $r < \pm 0,1$ is little or no correlation, $\pm 0,1 \leq r < \pm 0,3$ is a weak relation, $\pm 0,3 \leq r < \pm 0,5$ is a moderate relation and $r \geq \pm 0,5$ a strong relation.

3 RESULTS

3.1 Participant Characteristics

In total 243 persons filled in the questionnaire, of which 216 fully completed. The Dutch version was used in 67% of the cases. The age range was 16 to 81 years old, 66% of participants were male (n=143), 34% female (n=73). In *fig. 2*, an overview of participant characteristics is given.

Mean values of scores per age group on personality and game preference can be seen in *table 2*. Considering an expected average of 50 out of 100, the scores on Openness (72 out of 100) and Conscientiousness (66 out of 100) are relatively high. The mean values for personality scores of the different age groups are close together. Minor differences are also found between the groups of frequent and non-frequent players.

The mean values for game preference show more variety, particularly the scores of the ≥ 60 group (range 24-62). While it seems that personality has not changed much for the older adult, game preferences show differences compared to the younger group. For example the score on the Novelty domain, which would imply that the older player prefers games that resemble the real world or are otherwise familiar. Although not statistically convincing, the older adult seems to prefer a somewhat lower amount of Challenge than the younger group, while being more Conscientious. Also, a lower level of Stimulation and Threat are preferred by the older adult, as well as a slightly higher level of Harmony.

3.2 Correlations between Personality and Game Preference

When exploring the intended correlations between personality (P) and game preference (G), we find the following correlations, presented in *table 3*. No strong

Figure 1: Question 1 on game preferences (excerpt: Novelty).

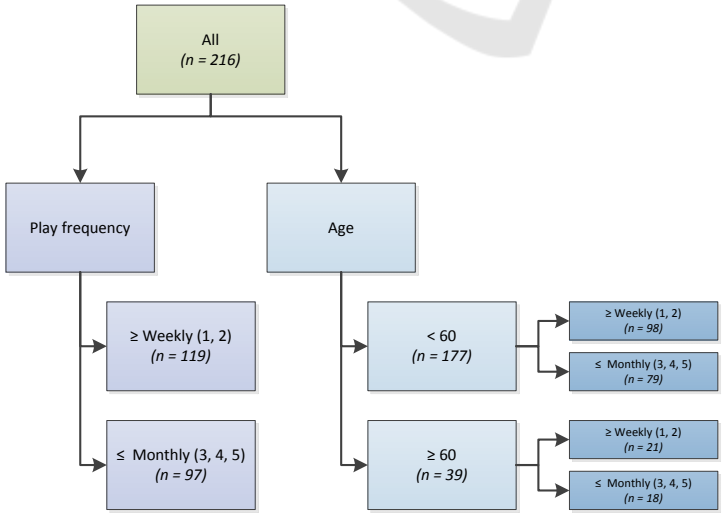

Figure 2: Overview of participants.

Table 2: Mean values of personality and game preference scores (M = mean value, SE = standard error), all n = 216, < 60 n = 177, ≥ 60 n = 39.

Personality	All				Age < 60			Age ≥ 60		
	M	*SE*	Frequent *(M)*	Non-frequent *(M)*	All *(M)*	Frequent *(M)*	Non-frequent *(M)*	All *(M)*	Frequent *(M)*	Non-frequent *(M)*
Openness	72	1,645	76	66	73	78	66	66	66	66
Conscientiousness	66	1,481	60	72	64	59	71	71	65	78
Extraversion	55	1,661	53	57	55	53	58	55	55	54
Agreeableness	57	1,492	54	59	57	55	61	53	52	53
Neuroticism	42	1,763	40	44	43	41	45	39	38	40

Game preference	All				Age < 60			Age ≥ 60		
	M	*SE*	Frequent *(M)*	Non-frequent *(M)*	All *(M)*	Frequent *(M)*	Non-frequent *(M)*	All *(M)*	Frequent *(M)*	Non-frequent *(M)*
Novelty	60	2,347	67	53	65	73	55	38	36	41
Challenge	46	2,243	57	32	48	61	32	35	39	31
Stimulation	44	2,054	44	43	47	49	45	27	18	38
Harmony	59	2,054	54	65	59	53	66	62	60	63
Threat	31	2,026	38	24	33	40	24	24	24	24

correlations were found (r ≥ ± .5), correlations range from little or none at all to moderate. For all participants as well as in both subgroups, a significant correlation between Agreeableness and Harmony is absent.

From the overview of correlations between personality and game preference *(table 3)*, we notice weak significant correlations between three out of five personality factors and their antagonist in the game preference model for all participants, and four for the group < 60 years old. In these two groups, we find a negative significant correlation for Conscientiousness with Challenge, which is contradictory to the theory. For frequent players, the preference for Novelty is significantly correlated to Openness but not for non-frequent players. For non-frequent players, Extraversion and Stimulation are significantly correlated, which is not the case for frequent players.

Exploring all possible correlations between personality and game preferences for the group of age < 60 *(table 4)*, we notice multiple significant correlations outside the factors as intended *(shaded)*. A moderate, significant correlation exists for Openness to Experience and Challenge. Agreeableness was not found to be related to preference within the Harmony domain and also does not show any (significant) correlations with other game preference aspects. Other factors, Openness to Experience, Conscientiousness and Extraversion, do seem to influence the preference for content within this domain. Stimulation correlates only with Extraversion. Lastly, there is a significant positive correlation for Neuroticism with Threat.

Exploring all correlations for the group of ≥ 60 years old *(table 5)*, we only find a moderate, significant correlation for Agreeableness and Stimulation.

4 DISCUSSION

In this study, the relations between personality factors and the preference for game content based on the Five Domains of Play model were examined, in search for methods to use in the tailoring of game content to the user for the effective use of gamification. Our most important findings are the presence of weak significant correlations between personality and game preference for people younger than 60 years old, and the absence of significant correlations for people aged 60 and up as intended by the model. Two moderate significant correlations were found outside the supposedly related traits (< 60 Challenge – Openness and ≥ 60 Stimulation – Agreeableness), but we are uncertain how to interpret these.

Personality seems to give an indication of game preferences according to the theory for participants younger than sixty years old, but the numbers are not convincing. Four out of five relations as they were intended by the original models correlate significantly, although weakly for this group. This could mean that the model can be used to determine game content for certain user groups, but a refinement of the game preference domains should be made in order to deal with ambiguity and increase internal consistency. For example, Agreeableness was not found to be predictive for preference within the Harmony domain as the model suggested which is possibly due to the ambiguity of the Harmony domain, seemingly showing contradictory traits for scores on both sides of the domain spectrum. Also, both competition and violence are supposed to correspond with a low score on Agreeableness. Among the findings is a negative relation between Conscientiousness and Challenge. This is inconsistent to the model and may imply that a highly

Table 3: Correlation coefficients and significance between personality and game preferences.

					Age < 60			Age ≥ 60		
Correlations		All	Frequent	Non-freq.	All	Frequent	Non-freq.	All	Frequent	Non-freq.
Personality	**Game pref.**	df = 216	df = 119	df = 97	df = 177	df = 98	df = 79	df = 39	df = 21	df = 18
Openn.	Novelty	,254**	,270**	,114	,299**	,280**	,143	-,059	-,035	-,050
Consc.	Challenge	-,194**	-,137	-,042	-,191**	-,092	-,050	-,085	-,137	,008
Extrav.	Stimulation	,097	-,010	,215*	,129*	,021	,259*	-,038	,066	-,078
Agreeabl.	Harmony	,061	,037	,042	,059	,056	-,006	,072	-,035	,210
Neurot.	Threat	,146*	,186*	,127	,187**	,181*	,229*	-,153	,010	-,359

* = Correlation is significant at the 0.05 level (1-tailed)

** = Correlation is significant at the 0.01 level (1-tailed)

Table 4: Overview of all correlations between personality (P) and game preference (G) for participants < 60.

Correlations

< 60			P_openness	P_conscientiousness	P_extraversion	P_agreeableness	P_neuroticism
Spearman's rho	G_novelty	Correlation Coefficient	,299**	-,156*	-,132*	-,015	,217**
		Sig. (1-tailed)	,000	,019	,040	,422	,002
	G_challenge	Correlation Coefficient	,318**	-,191**	-,093	,026	,253**
		Sig. (1-tailed)	,000	,006	,110	,366	,000
	G_stimulation	Correlation Coefficient	,092	,003	,129*	-,033	-,003
		Sig. (1-tailed)	,113	,485	,043	,332	,484
	G_harmony	Correlation Coefficient	-,150*	,157*	,129*	,059	,013
		Sig. (1-tailed)	,023	,019	,044	,217	,430
	G_threat	Correlation Coefficient	,276**	-,255**	-,095	,015	,187**
		Sig. (1-tailed)	,000	,000	,104	,421	,006

* = Correlation is significant at the 0.05 level (1-tailed)

** = Correlation is significant at the 0.01 level (1-tailed)

Intended relation G and P

Table 5: Overview of all correlations between personality (P) and game preference (G) for participants ≥ 60.

Correlations

≥ 60			P_openness	P_conscientiousness	P_extraversion	P_agreeableness	P_neuroticism
Spearman's rho	G_novelty	Correlation Coefficient	-,059	-,152	-,020	,049	-,147
		Sig. (1-tailed)	,361	,179	,453	,384	,185
	G_challenge	Correlation Coefficient	,055	-,085	,135	-,001	-,146
		Sig. (1-tailed)	,371	,303	,207	,497	,187
	G_stimulation	Correlation Coefficient	,091	,180	-,038	,370*	-,089
		Sig. (1-tailed)	,291	,137	,409	,010	,295
	G_harmony	Correlation Coefficient	-,064	-,016	-,098	,072	,167
		Sig. (1-tailed)	,350	,462	,277	,332	,155
	G_threat	Correlation Coefficient	-,016	,154	,030	,009	-,153
		Sig. (1-tailed)	,462	,175	,428	,479	,176

* = Correlation is significant at the 0.05 level (1-tailed)

** = Correlation is significant at the 0.01 level (1-tailed)

Intended relation G and P

conscientious person would prefer an unchallenging game rather than the opposite. Our findings suggest that a more elaborate questionnaire is needed in future studies to deeper examine the underlying facets that both personality traits and game preference domains consist of, so that these details are not covered by an overall domain score.

No relations between personality and game preference were found for participants of sixty years and older. Although the smaller sample size may be of influence, we expect that the older participants were not able to relate to the game content in the questionnaire to the same extent as the younger group. Older adults, although increasingly interested in video games, have a much different frame of reference than people of later generations (Nap et al., 2014) from being inexperienced or unaware of the variety of games currently existing. There is a possibility that preferences of the older group are somewhat more uniform because of this awareness.

The mean on the Novelty domain for this group is much lower than expected when compared to the Openness to Experience score. This would indicate that the older player prefers games that resemble the real world or possibly more traditional games as these are familiar for this target group, such as card and board games. The older participants score lower on Openness and higher on Conscientiousness than the overall average, which is according to expected change in personality from ageing (Lucas, 2009, Mroczek et al., 2006).

This study provided a first exploration of using personality as a method to tailor game content for the effective use of gamification. In comparison to previous studies (as mentioned in the introduction), our study can neither offer solid statements on the usefulness of applying personality in gaming. The correlations we have found between personality traits and game preferences, expressed in five domains, are not convincing enough to do so. A limitation of this study is that both models were assessed in a simplified form; the used BFI-10 provides less in-depth information on psychometric measures than a full FFM inventory.

For future studies we would therefore recommend to investigate personality and game preference using a more detailed questionnaire, looking deeper into the six facets for each FFM factor and possibly corresponding factors for each 5D domain to gain a better understanding of both. We see a particular need to investigate and refine the model in the domain Harmony, in which both violence and competition are captured. Furthermore, it is unknown if the correlating factors also determine the choice for certain games, and which factors play the most important role in effectively tailoring game content to the user. We would recommend a different study setup to evaluate the older user, in which the frame of reference is presented to the user by means of actual games previous to analysing their game preferences.

5 CONCLUSIONS

This study investigated the relations between personality and game preference by means of an online questionnaire, in order to tailor game content to the needs of individuals or user groups. Results show that several weak significant correlations exist for persons younger than sixty years old. For participants of sixty years and older, no significant relations have been found. We cautiously conclude that personality may give an indication of game preferences but, working towards practical use of this knowledge, research should be extended to 1) deeper examine the models used to determine personality and game preference, 2) gain insight in how to assign content corresponding to preference of the user for effective use in gamification and 3) further explore and refine the models used in a field study towards focused on the older adult user.

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REFERENCES

Jansen-Kosterink S. The added value of telemedicine services for physical rehabilitation. University of Twente. 2014. [ISBN:9789082319606] [PMID:17725187]

Pavel M, Jimison H, Hayes T, Cooper R a, Marottoli R. Technologies for an Aging Population. *Bridg Natl Acad Eng. 2009;*39(1):68.

Huis in 't Veld RMHA, Kosterink SM, Barbe T, Lindegård A, Marecek T, Vollenbroek-Hutten MMR. Relation between patient satisfaction, compliance and the clinical benefit of a teletreatment application for chronic pain. *J Telemed Telecare*. 2010;16(6):322–8. [DOI:10.1258/jtt.2010.006006] [ISBN:1758-1109 (Electronic)r1357-633X (Linking)] [PMID:20798426]

Tabak M, Brusse-Keizer M, Valk P Van Der, Hermens H, Vollenbroek-Hutten M. A telehealth program for self-management of COPD exacerbations and promotion of an active lifestyle: a pilot randomized controlled trial. *International journal of COPD. DovePress*; 2014. p. 935–44. [DOI:10.2147/COPD.S60179]

Evering RMH. Ambulatory Feedback at Daily Physical Activity Patterns: A Treatment for the Chronic Fatigue Syndrome in the Home Environment? *University of Twente; 2013*. [DOI:10.3990/1.9789036535120]

Petty RE, Cacioppo JT. Issue involvement can increase or decrease persuasion by enhancing message-relevant cognitive responses. J Pers Soc Psychol.

1979;37(10):1915–26. [DOI:10.1037/0022-3514.37.10.1915] [ISBN:0022-3514]

Bakkes S, Tan CT, Pisan Y. Personalised Gaming: A Motivation and Overview of Literature. *Proc 8th Australas Conf Interact Entertain* Play Syst '12. 2012;4. [DOI:10.1145/2336727.2336731] [ISBN:9781450314107]

Vette AFA de, Tabak M, Dekker-van Weering MGH, Vollenbroek-Hutten MMR. Engaging elderly people in telemedicine through gamification. *In Press. JMIR Serious Games*. [DOI:10.2196/games.4561]

Bartle RA. Hearts, clubs, diamonds, spades: Players who suit MUDs. 1996. [URL: http://mud.co.uk/richard/hcds.htm Archived at: http://www.webcitation.org/6XvZlirzF]

Yee N. Motivations of play in MMORPGs. Proc DiGRA 2005 Conf Chang Views - Worlds Play. 2005;

Hunicke R, LeBlanc M, Zubek R. MDA: A Formal Approach to Game Design and Game Research. Work Challenges Game AI. 2004;1–4. [DOI:10.1.1.79.4561]

Gerling KM, Schild J, Masuch M. Exergame design for elderly users: the case study of SilverBalance. Proc 7th *Int Conf Adv Comput Entertain Technol - ACE '10*. 2010;66–9. [DOI:10.1145/1971630.1971650] [ISBN:9781605588636] [PMID:15123609]

Vandenberghe J. The 5 Domains of Play: Applying Psychology's Big 5 Motivation Domains to. 2012 [URL: http://www.gdcvault.com/play/1015364/The-5-Domains-of-Play Archived at: http://www.webcitation.org/6Xva2AWDK]

Orji R, Vassileva J, Mandryk RL. Modeling the efficacy of persuasive strategies for different gamer types in serious games for health. *User Model User-adapt Interact. 2014*; [DOI:10.1007/s11257-014-9149-8]

Zammitto VL. Gamers' Personality and their Gaming Preferences. Sch Interact Arts Technol. 2010;M.Sc Thesi:147.

Teng C. Online Game Player Personality and Real-life Need Fulfillment. Int J Cyber Soc Educ. 2009;2(2):39–50.

Zammitto V. Game research, measuring gaming preferences. Appl Artif Intell. 2009;(May):15–6. [DOI:10.1145/1639601.1639611] [ISBN:9781605586854]

Peever N, Johnson D, Gardner J. Personality & video game genre preferences. Proc 8th Australas Conf Interact Entertain Play Syst - IE '12. 2012;1–3. [ISBN:9781450314107]

Apperley TH. Genre and game studies: Toward a critical approach to video game genres. Simul Gaming. 2006;37(1):6–23. [DOI:10.1177/1046878105282278]

Gosling SD, Rentfrow PJ, Swann WB. A very brief measure of the Big-Five personality domains. *J Res Pers. 2003;37*(6):504–28. [DOI:10.1016/S0092-6566(03)00046-1] [ISBN:1512471593] [PMID:6406]

Rammstedt B, John OP. Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. *J Res Pers. 2007;41(1):203–12*. [DOI:10.1016/j.jrp.2006.02.001] [ISBN:0092-6566]

Nap HH, Diaz-Orueta U, González MF, Lozar-Manfreda K, Facal D, Dolničar V, et al. Older people's perceptions and experiences of a digital learning game. *Gerontechnology*. 2014;13(3):322–31. [DOI:10.4017/gt.2015.13.3.002.00]

Lucas RE. NIH Public Access. 2009;23(3):558–66. [DOI:10.1037/a0012897.Age]

Mroczek DK, Spiro A, Griffin PW. Handbook of the Psychology of Aging. Handbook of the Psychology of Aging. Elsevier; 2006. 363-377 p. [DOI:10.1016/B978-012101264-9/50019-7] [ISBN:9780121012649]