

Seniors and technology: can cognitive age and life events explain the gaps?¹

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Abstract

Purpose of the paper: this paper aims to identify good descriptors of the differences among the elderly, particularly suitable for technology use. Specifically, cognitive age and life events are compared to demographic age.

Methodology: a survey was conducted, and three cluster analyses were performed to reach three different segmentations: cohort, cognitive-age and life-event-based segmentations.

Findings: the conducted cluster analysis highlights multifaceted consumption trends also in relation to technology, both in the case of using cognitive age as a segmentation criterion and in the case of appealing to events actually lived.

Research limits: although alternative segmentation parameters to the chronological age were examined to test their validity, these criteria were used separately, while the analysis of a complex group like Seniors would require a multidimensional approach.

Practical implications: our study provides important operational indications to managers who need to understand the different consumption trends and dynamics of the use of technology by elderly consumers in order to define tailor-made offers of products and/or services. Facilitating the use of technology by the elderly has interesting implications in terms of social and economic impact, too.

Originality of the paper: although many have highlighted the need to identify effective criteria for the segmentation of such a heterogeneous target in terms of expressed needs, there are currently few studies in this field, especially concerning the use of technology.

Key words: aging population; elderly consumers; life-event; cognitive age; technology; cluster analysis

1. Introduction

Seniors and technology now appear even closer, or at least less distant, than a few years ago. Also because of the pandemic, elderlies nowadays show an increasing interest in new technologies and are more and more connected. Recent research reveals that in Europe 88% of those over the age of 60 own a PC, 81% a smartphone, 15% a device for monitoring their physical condition/health, and 8% have a home device usable as a virtual assistant (Euromonitor, 2019).

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Although these data are encouraging about the growing degree of diffusion of technology in the elderly segment, it is nevertheless evident that, compared to what happens in the younger segments, there are still many hindrances to overcome in order to favor its wider diffusion in this market (Lee and Coughlin, 2015). Not being digital natives, these consumers are certainly not as tech-friendly as the younger segments. There are several reasons for this occurrence, such as physical or health problems, the need for support and assistance, general skepticism towards technologies, and poor accessibility, even in terms of price (Euromonitor, 2015). Additionally, in relation to specific technologies, other drawbacks come to light. Regarding digital communication platforms - such as blogging, social media, and other technologies supporting communication with one's family - recent studies (Hope *et al.*, 2014) show how merging digital and physical spaces is more appealing to some older adults than exclusively acting digitally. At the same time, in relation to the adoption of social robots by older adults, concerns about deception, infantilization, and privacy are often stressed in the literature (Sharkey and Sharkey, 2012; Watchsmuth, 2018).

On the other hand, researchers from different disciplines provided extended analysis on how to use technology to support personal, community and societal engagement in later life (Waycotte *et al.*, 2019). Technologies, indeed, offer huge opportunities to the elderly who, thanks to technology, may satisfy one of the main needs that characterize this segment, namely autonomy (Kohlbacher and Herstatt, 2016). Technology today allows us not only to improve the elderlies' health by offering online services (telemedicine), but also to ensure the possibility of continuing to live in the place they have chosen - their own home, in their community - in a safe, independent, and comfortable way regardless of age, and income, thanks to assisted living technologies and integrated care services. Similarly, technologies, such as social robots, have proven to reduce loneliness for older adults (Pradhan *et al.*, 2019), as supporting functions like safeguarding, social contact, and cognitive support (Čaić *et al.*, 2018).

In order to grasp all the opportunities deriving from aging, as expected to impact future society hugely, companies need to analyze and fully understand the needs of an aging population, to develop adaptations or new strategies to align with these changes (Kohlbacher and Hang, 2011; Kohlbacher *et al.*, 2011). Even though seniority is recognized as being the combined effect of various factors and events, according to the "life course paradigm" (Moschis, 2019), elderly consumers are usually defined as those who are at least 60 years old (Jacoby, 2011). As a result, serving the entire elderly market seems to be a difficult task since people considered to fall within this target include workers and pensioners who are very different in terms of expressed needs and spending habits. The elderly market should not be considered as a single entity, but as an agglomeration of heterogeneous submarkets that require *ad hoc* approaches (Kohlbacher and Chéron, 2012; Moschis, 2012). The segment is too broad as a target and the choice of such a path would result in undifferentiated offerings, unable to meet the specific demand, thus doomed to failure.

However, the use of age as a parameter to identify an older target

audience may not be the best way to approach this problem, as people can feel more or less old than they really are, through a personal evaluation that differs from individual to individual and that can result in different perceptions and purchasing decisions, despite the same age (Barak and Schiffman, 1981). Thus, cognitive age, according to which people “see, feel, act and have interests of younger people than those of their chronological age” (Reisenwitz and Iyer, 2007) is expected to impact on elderly consumer behavior especially in relation to technology use. This is also a consequence of anti-ageism (Vincent, 2006), which leads elderlies to reject misleading stereotypes (Ng and Feldman, 2012) and thus to decline elderly’ products (Bae *et al.*, 2020).

Furthermore, since the literature on elderly consumers segmentation identified life events as strongly impacting on overall consumption behaviors (Mathur *et al.*, 2006), we might suppose that said events could impact on elderlies’ technology use, too. Since technology use in the aging population is almost always affected by social factors (Wang *et al.*, 2011; Heinz *et al.*, 2013; Lee and Coughlin, 2015), we might expect that life-event, as impacting on elderlies’ lifestyles and social relationships, could be an effective descriptor of elderly technology use.

So, based on this consideration, this paper strives to identify good descriptors of the differences across the elderly segment referring, in particular, to technology use. Specifically, cognitive age and life-event will be compared to demographic age as alternative segmentation criteria.

To this end, the paper reports a detailed literature review about elderlies’ segmentation criteria used in the studies concerning elderly consumers, and discusses how said criteria may be extended to explain the gaps emerging in elderlies’ technology use.

Thereafter, the results of three clusters analysis based on three different segmentation criteria (cohort, cognitive age, life-event segmentations) performed on a sample of elderly consumers are reported and discussed. The managerial implication, limitations of the study, and future research directions are reported in the conclusion section.

2. Segmenting elderly consumers: a literature review

Since the aging of the world population has become a consistent phenomenon that can no longer be ignored, different approaches have been followed to analyze the characteristics and behaviors of elderly consumers. At first, the most relevant data concerned the chronological age (Moschis, 1994; Hettich *et al.*, 2018; Moschis, 2019; Kuppelwieser and Klaus, 2021), considered as “a process induced by the simple passing of time after birth” (Hettich *et al.*, 2018) or as “a linear count between the moment in which a person is born and the current date” (Kuppelwieser and Klaus, 2021). Nonetheless, nowadays the range of options and visions for the study of this segment is constantly growing. Therefore, considering that chronological age is not sufficient to explain and understand the behavior of the elderly (Moschis, 2012), it is appropriate to recall the various variables that may lead to a better understanding of the behavior

of the elderly, which must be properly selected according to the purpose of the study. These methodologies are not mutually exclusive, but according to the analyzed topic, it is mandatory to select the most suitable ones. Table 1 provides a summary of the different approaches, models, and theories used in the study concerning the elderly consumer: they may be useful to understand the development of the different segmentation criteria for the elderly consumer, which are detailed below.

The fact that the elderly make up a separate group with their peculiarities does not imply that the elderly market is homogeneous. On the contrary, this segment appears highly diversified, regardless of the criterion used (Barawitzka *et al.*, 2020). This heterogeneity is the result of several factors: considering the over-sixties, it is inevitable to face different people (Barawitzka *et al.*, 2020). Consequently, marketing professionals deploy various segmentation criteria in order to cluster elderly consumers. The most popular criteria initially referred to both age groups and generations. However, they were not very useful in understanding the consumption behaviors of the elderly. According to the existing literature on the subject, no univocal criterion comes to light for the study of the segment, but an adequate mix of criteria is necessary to understand the elderly consumer fully (Moschis, 1994). Hence, it is appropriate to point out different segmentation criteria used in the literature.

Segmentation by age group is the simplest type of socio-demographic segmentation to use but, at the same time, the most lacking from the point of view of the information provided (Neugarten, 1974; Mathur *et al.*, 2006). The chronological age says indeed little about consumer behavior. Mathur *et al.* (2006), echoing Neugarten (1974), point out that “age has become a bad predictor of the timing of life events, as well as a poor predictor of a person’s health, employment status and, therefore, also of a person’s interests, concerns and needs”.

The cohort-based segmentation relates to socio-demographical criteria and it is expounded through the subdivision of consumers according to the generation they belong to. The term “cohorts” refers to proposed groups of individuals who were born during the same time period and who experienced similar external events during their formative or coming-of-age years (i.e., late adolescence and early adulthood) (Schewe and Meredith, 1994; Ryder, 1985). External events, such as economic changes, wars, political ideologies, technological innovations, and social upheavals, are thought to define consumers’ values, attitudes, and preferences. However, the results of Noble and Schewe (2003) suggest the need to reassess the theory of cohorts. As Reisenwitz and Iyer (2007) underline, cohort segmentation is certainly important for evaluating different aspects of individuals (not only elderly), but it must be placed within a broader context, which includes other types of segmentation.

Tab. 1: Models in Studies concerning Elderly Consumers

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Model	Methodology	Description	Derived Research Streams	Marketing Implications	Weaknesses	Sources
Chronological age		Linear count between the moment in which a person is born and the current date		Senior needs and consumer behaviors	Age as a self-standing factor does not provide any explanation	Moschis, 1994; Hettich <i>et al.</i> , 2018; Moschis, 2019; Kuppelwieser and Klaus, 2021
Aging Models	Biological Aging	Decline of biological system due to natural changes and/or illnesses	Programmed Theories and Damage or Error Theories	New product development, promotion, customer preferences	Defined as a perspective, replaced by multi-theoretical frameworks and by studies on overall life course	Moschis, 1994; Grossman and Lange, 2006; Moschis, 2012; Jin, 2010; Goldsmith, 2014; Da Costa <i>et al.</i> , 2016; Diebel and Rockwood, 2021
	Psychological Aging	Cognitive changes, personality and identity changes	Processing-resource Framework, Phase and process models, Stage theories and cognitive age	Product positioning, advertising, reasons for rejecting products for aging people		Stephens, 1991; Moschis, 1994; Van Auken and Barry, 1995; Gwinner and Stephens, 2001; Moschis, 2012; Zniva and Weitzl, 2016; Hettich <i>et al.</i> , 2018; Bae <i>et al.</i> , 2020; Kuppelwieser and Klaus, 2021
	Social Aging	Changes in social and power relations as in the roles taken over along the person's various lifecycles	Structural functionalism, Symbolic interactionism, Exchange theory, Marxism, Social phenomenology	Segmentation, product positioning, support in role adaptation		Moschis, 1994; Grossman and Lange, 2006; Moschis, 2012; Hettich <i>et al.</i> , 2018
Life Events		Events (classified as accidental and planned) lived by the person		Senior consumers' behavior, brand preferences	Replaced by multi-theoretical frameworks and by studies on overall life course	Moschis, 2012; Zniva and Weitzl, 2016
Life Circumstances		Life circumstances a person lives or has lived (period effects and cohort effects)		Needs, consumption behaviors, purchasing habits	No methods suitable for distinguishing cohort effects, from aging effects and period effects	Moschis 2012; Zniva and Weitzl, 2016

Source: Authors' elaboration

Segmentation by cognitive age is a psychographic segmentation. Resienwitz and Iyer (2007), referring to Barak and Schiffman (1981), underline how chronological age has little relevance when compared with cognitive age in those elderly individuals who feel younger than their age. This feeling involves their behaviors and leads them to “see, feel, act and have interests of younger people than those of their chronological age” (Reisenwitz and Iyer, 2007). As Stephens (1991) points out, feeling more or less elderly has both a social and psychological impact in various ways. Some research quoted by the author highlights how those elderly consumers who feel young depart from the typical behaviors of their segment. In this perspective, the study by Stephens (1991) underlines how the adoption of the cognitive age in the analysis of the elderly consumer is fundamental, also and not only as an integration of the segmentation based on the age group.

Event-based segmentation builds upon the life-course paradigm and requires consumers to be divided according to the events they have experienced (including those anticipated) (Moschis, 2019). Based on these assumptions, Mathur *et al.* (2006) conducted a study aimed precisely at understanding the validity of this type of segmentation. In a survey,

866 respondents between the ages of 21 and 84 were asked to indicate whether they had lived certain specific experiences and equally specific consumption behaviors, indicating the moment of their occurrence (“in the last 6 months”, “between the last 6-12 months” or “more than 12 months ago”). The study revealed the existence of 4 types of segments:

- the *Unruffled*: it represents 42% of the respondents. It is made up of participants with the fewest events experienced or anticipated (Mathur *et al.*, 2005);
- the *Free Birds*: it represents 16% of the participants and includes mostly elderly people who had recently experienced events such as retirement or becoming grandparents;
- the *Chronic Strugglers* (chronic latecomers): it represents 9% of the participants, those who had experienced more events than others;
- the *Full Nesters*: it represents 33% of the respondents. They are mostly Baby Boomers, married and with children. The conclusions of this study show how life events can have a certain impact on consumption behaviors and, subsequently, how effective this segmentation is to be considered.

Afterwards, Moschis (2007) identified a criterion that he defined as “gerontographics” aimed at considering the elderly consumer in a broader perspective, simultaneously taking into account “needs, attitudes, lifestyles, and behaviors”. This kind of multidisciplinary approach looks at both the biological and the social, experiential, and psychological aspects of aging. Four groups of people over the age of 55 have therefore been identified (Moschis, 2007):

- the *Healthy Hermits*: despite their good health and participation in the labor market, they are not very active, are solitary, with few consumption needs and not very reactive about any marketing campaigns leveraging on age;
- the *Ailing Outgoers*: their compromised, but self-aware health conditions, and their retirement status do not stop this group from being very active. They are very interested in homecare products and services;
- the *Frail Recluses*: withdrawn from society, inactive and in poor health, they do not like to seek information, even if they hardly know how to admit it;
- the *Healthy Indulgents*: probably the elective segment of marketing professionals for their positive attitude towards technologies, but also shop windows and displays. They are healthy, physically and socially active but, above all, independent.

3. Segmenting elderly consumers for technology use: research questions development

While the segmentation criteria mentioned above highlight some differences in the various clusters that might affect the technology use, no studies hitherto specifically tried to apply these segmentation criteria in this field.

According to studies on technology adoption, age has been found to be a considerable barrier to the adoption of technology. Given the occurrence of problems related, for example, to hearing or eyesight that worsen with age or slower learning abilities, which modify the way older people interact with technology or acquire new information on it, age surely has a negative impact on physical abilities and, therefore, on technology use in elderly targets (Charness and Boot, 2009). Of course, the fact that younger generations will move to more advanced age groups will lead to an increase in the use of technological tools in the elderly segment, but this will not necessarily translate into a narrowing of the technological gap, as technology is always developing while cognitive and physical abilities will continue to manifest. As a result, due to his/her age, the older adult has always appeared as a problematic person to treat (Peine *et al.*, 2014), characterized by a series of handicaps that differentiate him/her from the rest of the population.

On the other hand, portraying the elderly as fragile or reluctant to change recreates misleading stereotypes contradicting the trends that nowadays characterize the elderly market. First of all, the entry into the elderly segment of the Baby Boomers' generation, the first to experience constant exposure to technology since World War II. Secondly, the improvement of living conditions compared to the past and positively impacting on physical conditions and life expectancy at the same age. Last but not least, the phenomenon of anti-ageism (Vincent, 2006; Vincent *et al.*, 2008; Vincent, 2013) as the cultural movement leading the elderly to reject misleading stereotypes (Ng and Feldman, 2012) and false convictions as the sources of social discriminations ("ageism") (Henrard, 2006). According to these prejudices, due to their physical and mental decline, the elderly are considered "weak, lonely and stubborn" (Bae *et al.*, 2020). Thus, Seniors start feeling disengaged and useless and closer to younger generations departing from Seniors' stereotypes, showing as if they were younger, and rejecting Seniors' products (Bae *et al.*, 2020). Moreover, as under the generic label of "technology" manifold types of technological tools are included, it was recently highlighted how some technologies are more appealing than others to elderly consumers as in the case of social networks adoption (Hootsuite, 2022), voice assistants (Pradhan *et al.*, 2019), and social robots (Čaić *et al.*, 2018).

These new trends and the studies revealing how the elderly are today well prepared to use technology (Peine *et al.*, 2014), support the idea that age cannot always be a good predictor of technology use. Furthermore, the anti-ageism movement, like recent studies investigating the impact of cognitive age on technology adoption (Keng-Chieh and Po-Hong, 2020), point out how cognitive age, on the other hand, may be a good proxy.

RQ1: Is cognitive age a good predictor of technology use in elderly consumers?

At the same, the literature identified various variables affecting technology use and adoption by elderly consumers that might be useful to identify other segmentation criteria suitable for this aim.

Kampmeijer *et al.* (2016) have identified inadequate skills for the use of new technologies, insufficient support and feedback, lack of motivation and cost as the main obstacles to technology adoption among older adults. On the other hand, the main facilitators in the use of these tools were motivation and the ability of self-regulation through goal setting, together with the support and feedback provided by professionals, especially the remote help at home (Kampmeijer *et al.*, 2016). By extending the TAM model, the Unified Theory of Acceptance and Use of Technology (UTAUT) incorporated, in addition to performance and ease of use, two new elements, namely social influences, the degree to which an individual considers the pressures by important others towards the use of the system and facilitating conditions, or the degree to which an individual perceives to be supported by infrastructures and organizations in the use of the system (Venkatesh *et al.*, 2003). Regardless of problems that come to the fore as people age and the presence of facilitators and barriers to adoption, it is estimated that more than 50% of older people's problems with technology can be solved either through a more appropriate design or through education (Hermann *et al.*, 2012). Training and familiar interaction may overcome the anxiety and the lack of comfort in using technology, typically associated with older people (Nikou, 2015).

Recent studies on the older adults' use of voice assistants (Pradhan *et al.*, 2019), while supporting benefits as controversial aspects related to the use of these tools by the elderly, shed light on the role that one person's life might play in this context. The study by Pradhan *et al.* (2019), indeed, points out how the experiences that a person has built up over a lifetime, such as the specific living conditions, lead him/her to have more or less a desire for social contact.

Despite some Authors' attempts in the field of Gerontechnology to connect technology to the existing theories of life-span development (Schulz *et al.*, 2014), no explicit reference is made to life-events in the studies on technology adoption by aging adults. At any rate, life-events are commonly recognized to affect consumer behavior (Mathur *et al.*, 2006). Specifically, according to life-course research, behaviour at a given point in time modifies according to changing life conditions (Mayer *et al.*, 1990) owing to various reasons. First of all, as behaviors are influenced by personal resources, we might expect that people exposed to different events over the course of their life are likely to access different personal resources and, consequently, to act differently (John and Cole, 1998). Secondly, based on stress theory and research, major life events act as "stressors" that create a generalized demand for readjustment to restore balance and remove frustrations and tensions thus resulting in initiation, intensification or changes in consumption habits (Andreasen, 1984; O'Guinn and Faber, 1989). Lastly, according to the normative perspective, certain life events surely favor the transitions into new roles (i.e., the birth of a firstborn into "parenthood" or death of spouse into "widowhood"). As a result, as people acquire new roles and relinquish old ones, their behaviours change accordingly (Andreasen, 1984; Hagestad and Neugarten, 1985).

As all the reasons supporting life-course research behavior refer to factors that are widely recognized as affecting elderly technology adoption,

too - especially, psychological, sociological, and age-specific factors (Nikou, 2015) - we might expect that life-events could be an effective descriptor of Senior use of technology.

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RQ2: Is Life-event a good predictor of technology use in elderly consumers?

4. Methodology

A survey was conducted to provide an answer to the identified research questions - that is, whether life events and cognitive age are good predictors of the consumption behavior of the elderly segment with particular reference to the use of technology. Consistent with the definition of elderly consumers provided by Jacoby (2011), the target was a population aged 60 and over, using a universally recognized threshold for the definition of the elderly segment to include both young old (60-74 years old), middle old (75-84 years old) and oldest old (over 85) age segments (Forman *et al.*, 1992). A non-probabilistic sample was drawn from this population (Table 2).

Tab. 2: Socio-demographic characteristics of the sample

Variables		Percentage of respondents
Age	GI Generation	2,46%
	Depression Generation	17,21%
	War Generation	11,48%
	Baby Boomers	68,85%
Gender	Males	39,34%
	Females	60,66%
Marital status	Married	58,20%
	Widows/Widowers	29,51%
	Unmarried	6,56%
	Divorced	5,74%
Work status	Retired	65,57%
	Homemakers	21,31%
	Full-time employees	6,56%
	Part-time employees	2,46%
	Other (unemployed, disabled)	4,10%
Living conditions	Alone, at home	23,77%
	With other people, at home	67,21%
	In a nursing home	9,02%

Source: Authors' elaboration

Therefore, among the survey participants, we find both people belonging to all the three groups identified in the literature - that is to say, young old, middle old and oldest old. Due to the unbalanced distribution of respondents, we can say that our analysis focused mainly on the young old category (68,85% of the sample). The questionnaire was provided anonymously both online, through a link to Google Form, and in paper form. The surveys were carried out between October and November 2021. An amount of 89 paper questionnaires were collected (11 acquired via

direct interview and the remainder via self-compilation) and 112 online. Of the questionnaires in paper form, 72 (80,9%) were found to be usable, while 17 (19,1%) were discarded due to missing answers. Of the 112 online questionnaires, only 50 (44,6%) were found to be usable. In total, 122 questionnaires were used (60,7% of the total number of questionnaires received). The respondents were all Italian (60,66% women). Most of them were married (58,20%), followed by widows/widowers (29,51%), unmarried (6,56%), and divorced (5,74%). 65,57% were retired, 21,31% were homemakers, and the remaining full-time (6,6%), part-time employees (2,46%), and others (4,1% unemployed or disabled). Regarding living conditions, 67,21% of the sample said they were living with other people at home, 23,77% alone at home, and 9,02% in a nursing home.

The questionnaire consisted in 18 questions, divided into 4 main blocks. The first block concerns 5 multiple choice questions about habits and adopted lifestyles mainly aimed at understanding the degree of autonomy and activism of the respondent, as well as the main barriers, which limit this autonomy. For these questions, surveys recently conducted on the elderly segment (Pivotal Research, 2019) worked as a reference.

The second block of questions referred to the events experienced by Seniors, drawing inspiration from the life-course paradigm and event-based segmentation (Mathur *et al.*, 2006). With a single question we asked participants to say if they ever experienced the listed events (answering “yes” or “no”): moved to a different place, marriage, birth or adoption of a child, divorce or separation, the last child moved out of household, death of a parent or close family member, birth of first grandchild, major conflict with family member, retirement (of one’s own will), lost job/business or forced to retire, started work for the first time or after not working for a long time, reduction in working hours or giving up employment (of one’s own will), significant success at work or personal life, change jobs, same or different type, major improvement in financial status, financial status a lot worse than usual, family member’s health a lot worse, more responsibility for an aged relative, gained a lot of weight, chronic illness or condition diagnosed, serious injury, illness or major surgery, community crisis or disaster (hurricane crime, fire, flood, earthquake, etc. ...), death or loss of a pet (dog or cat), stopped smoking.

The third block contained one question aimed at reconstructing the actual consumption behaviors of the interviewed segment, and three questions about the use of technology as digital devices, also connected to the Internet. Questions of this block were phrased by referring to various sources (Mathur *et al.*, 2006 for the question on consumer behaviour; Pivotal Research, 2019, and Consumer Market Monitoring Survey, 2021 for the questions on technology). Specifically, we first asked respondents to indicate the connected products/services bought or used in the last year, selecting from a list which included: connecting devices controlling energy consumption in the household, connected devices for house safety, connected household appliances, wearable connected devices, connected devices for health monitoring, connected entertainment devices, and connected car. Afterwards, with explicit reference to the usage of “digital devices” identified as a smartphone, or a personal computer, or a tablet, or a

smartwatch or an e-reader tool, we asked respondents to say how frequently they use digital devices during a week (multiple choice question), and the main reasons why they use them, specifying the time related to each reason (last year, in the past, never). The various reasons listed in the question were the following: for generic/entertainment purposes (news, driving, reading), to keep in touch with family, friends, community, for professional scopes (work-related activities), for health reasons (telemedicine services), to search for information, for e-mail checking and transmission, for financial transactions, to play, shopping, to access social media.

In conclusion, the last section reported three questions aimed at investigating the cognitive age (Van Auken and Barry, 1995; Barawitzka *et al.*, 2020). In this context, one question was included to analyze the Ageism phenomenon (Pivotal Research, 2019). The study carried out by Van Auken and Barry (1995) was a reference point especially regarding the reasons behind the choice of a semantic differential scale for cognitive age. Among the scales used for the measurement of cognitive age adopting a direct approach, the semantic differential scale was therefore considered one of the most valid compared to ratio scale and Likert scale (Van Auken and Barry, 1995). In comparison with other widely recognized multiple items scales measuring cognitive age (see for instance Barak and Schiffman, 1981 scale), Van Hauken and Barry semantic scale was preferred in our study for its simplicity in relation to the target. As a result, to investigate cognitive age, respondents were asked to assign a score from 1 to 5 to the question asking them how young (score 1) or old (score 5) they felt. In order to enrich the collected information, two additional questions were included: one asking people assigning at least 3 to the previous question to detail when they started feeling old (retirement, reaching the age of 60, physical troubles, becoming a grandpa/ma, one's spouse's demise, a parent's death), and one asking to what extent the others see them as old (not at all, a little, quite, so much).

Then, the end of the questionnaire reported some questions to identify different demographic data of the elderly, as well as gender, year of birth, marital and employment status.

The data collected through the questionnaires were entered into an Excel spreadsheet. Three cluster analyses were then conducted to reach three different segmentations:

- cohort segmentation;
- cognitive segmentation based on age;
- life-events-based segmentation.

The first two belong to the category of descriptive a priori segmentation because the segments were predetermined according to the research conducted through the questionnaires. Specifically, in cohort segmentation, respondents were clustered into four groups according to their date of birth: GI Generation (born in 1929 or before); Depression Generation (born between 1930 and 1939); War Generation (born between 1940 and 1945), and Baby Boomers (born between 1946 and 1964). In the cognitive-based segmentation, respondents were instead clustered according to their answers to the cognitive age scale (5 clusters according to the score ranging from 1 "I feel young" to 5 "I feel old"). For these two segmentations,

analyzing the answers to the questions about demographics, habits, adopted lifestyles, and the degree of autonomy and activism of the respondent in each cluster allowed us to identify similarities and assign different labels.

As regards the segmentation referred to life events, this is a descriptive a posteriori segmentation. In particular, cluster analysis was the approach, through the Two-step method using SPSS.

Therefore, in the segmentation based on life-events, since the events are qualitative variables, in particular dichotomous (the answers were “Yes” or “No”), it was not possible to use cluster analysis techniques, such as the k-mean algorithm or hierarchical methods, for which the use of the Two-step cluster analysis was selected. The dataset contained in Excel was therefore transferred to SPSS and clustering was performed, using the 21 events experienced by the Seniors as variables. The information criterion used is the AIC, while the distance measurement is the Logarithm of the likelihood (all being categorical variables). Although Twostep allows for the automatic identification of the number of clusters (in this case the solution would have been two clusters), it was deemed necessary to specify the number of clusters to compare different options.

The analysis was initially launched with two clusters. However, since the Silhouette had two clusters equal to 0.2 (therefore scarce), the use of three clusters was decided. In this case, the Silhouette worsened (0.1) and out of the three clusters obtained two were very similar, especially for the first four most important predictors. Therefore, four clusters were analyzed: the Silhouette returned equal to 0.2, but in the first four predictors the situation was varied for the four obtained segments. Despite a reduced Silhouette, however, the condition of these clusters seemed satisfactory. Afterward, a Twostep cluster analysis based on four segments was conducted. The main events that led to the determination of the segments were four in order of importance: “the last child left home”, “birth of the first grandchild”, “death of the spouse” and “birth or adoption of a child”.

Crossing the differences in life-events with demographics, habits, adopted lifestyles, and degree of autonomy and activism of the respondents in each cluster, we were then able to assign labels to the clusters.

5. Results

This section will report the main results from the analysis of the collected data. For every segmentation depicted, the leading trends in the use of technology will be subsequently described to understand whether the segmentation criteria used can be considered effective in identifying homogeneity among elderly consumers.

5.1 Cohort segmentation

Cohort segmentation allowed for the identification of four segments (Table 3):

- *GI Generation* (GI stands for “General Issue”, known as the Greatest Generation shaped by the Great Depression and including the primary

- participants in World War II born in 1929 or before) 2,46% of the sample;
- *Depression Generation* (often included in the previous category as devoted to recovery, including people born between 1930 and 1939) 17,21% of the sample;
 - *War Generation* (including those born at the time of the Second World War between 1940 and 1945) 11,48% of the sample;
 - *Baby Boomers* (born in the demographic and economic boom between 1946 and 1964) 68,85% of the sample.

Tab. 3: Cohort-based clusters' profiles

Variables		GI Generation	Depression Generation	War Generation	Baby Boomers
Gender	Males	66.67%	23.81%	21.43%	45.24%
	Females	33.33%	76.19%	78.57%	54.76%
Marital status	Married	0.00%	23.81%	42.86%	71.43%
	Widows/Widowers	100.00%	71.43%	50.00%	13.10%
	Unmarried	0.00%	4.76%	7.14%	7.14%
	Divorced	0.00%	0.00%	0.00%	8.33%
Work status	Retired	66.67%	80.95%	85.71%	58.33%
	Homemakers	33.33%	19.05%	14.29%	22.62%
	Full-time employees	0.00%	0.00%	0.00%	9.52%
	Part-time employees	0.00%	0.00%	0.00%	3.57%
	Other (unemployed, disabled)	0.00%	0.00%	0.00%	5.95%
Living conditions	Alone, at home	33.33%	38.10%	42.86%	79.76%
	With other people, at home	0.00%	33.33%	42.86%	19.05%
	In a nursing home	66.67%	28.57%	14.29%	1.19%

Source: Authors' elaboration

In order to better depict the characteristics of the clusters identified on the basis of the cohort the respondents belonged to, the socio-demographic data collected during the administration of the questionnaire were analyzed.

Most Baby Boomers live alone, while 2 out of 3 people part of the GI Generation are in a care facility, and one lives alone at home. The (numerical) gender gap intensifies in the median generations, while the situation is more balanced for Baby Boomers. As regards marital status, widowers and widows prevail clearly in the first two generations, while the situation changes for the War Generation and the Baby Boomers, in which married couples re-emerge. Speaking of the level of activity, recreational and spiritual ones are outnumbering. Hence, it is evident that daily activities, probably practiced by children, relatives, or acquaintances, take a back seat, such as expenses. For the Depression Generation, on the podium, two types of activities mentioned above are found, in addition to daily activities. In the War Generation, spiritual activities are the most popular, followed by daily activities. Of great significance is the cohort of Baby Boomers, very active from the point of view of daily tasks. Being the youngest cohort, it is probably also the most active from this point of view. More than 40% also love exercising and delving into recreational and leisure activities.

As far as the difficulties encountered are concerned, it is useful to point out how in the passage from one generation to another the percentage of people who have faced obstacles is lower and the number of people who have never encountered any increases. If, however, the age obstacle arises as the main reason leading the GI Generation to inactivity, this does not apply to subsequent cohorts. For Baby Boomers, a crucial reason for inactivity is given by the lack of motivation/laziness. With reference to the difficulties encountered, it is evident that the GI Generation does not seem to show any kind of difficulty.

Regarding technologies, it is the Baby Boomer segment that once again stands out both in the use of digital devices (80 out of 84 subjects use them) and various appliances connected to the Internet (42 out of 84). Rates fall when passing to the “older” generations. More than half of the younger cohort uses social media. Regarding the use of digital devices, excluding GI Generation, all the other generations use digital devices. The rate of non-users decreases as they move from one cohort to another, while the percentage of users increases. Regarding how frequently Seniors in the three cohorts, excluding the GI generation, use digital devices, the most intense use of these devices is by Baby Boomers. In addition, in respect of the methods of use that Seniors make of digital devices, some differences come to light between generations. As for the Depression Generation, the main underlying reason for the use of digital devices is the ability to stay in touch with family/friends/communities and to send and receive e-mails. People belonging to the War Generation, on the other hand, use these tools mainly to contact family members, but also for general and entertainment purposes and to find information. The reasons behind the use of these devices are instead multifaceted for Baby Boomers. For these latter, the desire to stay in touch with both family members and acquaintances prevails and, besides general purposes and the ability to search for information, the use of e-mail and social media emerges. As regards the devices connected to the Internet, the prevalent use is by Baby Boomers, while both the Depression Generation and the War Generation make little use of them. In particular, the Baby Boomers show an extensive use of entertainment devices, such as smart TVs, smart speakers, and game consoles. Other tools are appliances connected to the Internet, those for monitoring health, and wearable devices.

At the conclusion of this focus on technologies, it appears quite clearly that the cohort most accustomed to the use of technologies, be they digital devices or other devices connected to the Internet, is certainly that of Baby Boomers. Within this cohort, however, the varied behaviors that come to light cannot be easily explained, revealing some typical shortcomings of segmentation by cohorts.

5.2 Cognitive-age segmentation

According to cognitive age, the following groups were identified (Table 4):

- the *Peter Pan* (individuals who rated 1 on the cognitive age scale) represent 8,20% of the sample;

- the *Young but not too young* (those who rated 2 on the cognitive age scale) represent 16,39% of the sample;
- the *No longer young, but not old yet* (those who rated 3 on the cognitive age scale) represent 44,26% of the sample;
- the *Old but not too old* (those who rated 4 on the cognitive age scale) represent 20,49% of the sample;
- the *Old in word and deed* (those who rated 5 on the cognitive age scale) represent 10,66% of the sample.

Tab. 4: Cognitive-age-based clusters' profiles

Variables		Peter Pan	Young but not too young	No longer young, but not old yet	Old but not too old	Old in word and deed
Gender	Males	40.00%	50.00%	48.15%	20.00%	23.08%
	Females	60.00%	50.00%	51.85%	80.00%	76.92%
Marital status	Married	80.00%	75.00%	55.56%	56.00%	30.77%
	Widows/Widowers	0.00%	10.00%	27.78%	44.00%	61.54%
	Unmarried	10.00%	10.00%	9.26%	0.00%	0.00%
	Divorced	10.00%	5.00%	7.41%	0.00%	7.69%
Work status	Retired	40.00%	45.00%	66.67%	76.00%	92.31%
	Homemakers	50.00%	30.00%	18.52%	16.00%	7.69%
	Full-time employees	0.00%	15.00%	5.56%	8.00%	0.00%
	Part-time employees	0.00%	5.00%	3.70%	0.00%	0.00%
	Other (unemployed, disabled)	10.00%	5.55%	0.00%	5.95%	0.00%
Living conditions	Alone, at home	10.00%	15.00%	20.37%	28.00%	53.85%
	With other people, at home	80.00%	85.00%	66.67%	60.00%	46.15%
	In a nursing home	10.00%	0.00%	12.96%	12.00%	0.00%

Source: Authors' elaboration

With regard to the segmentation based on cognitive age, it should be recalled that respondents were asked to first indicate how young or old they felt and, thereafter, to clarify the reasons for that perception. As for the people who assigned a score of 3 to the first question on cognitive age, the prevailing reasons were: the onset of physical problems (29,63%), reaching the age of 60 (25,93%), and retirement (16,67%). For the individuals who assigned a score of 4: the main reason (44%) was once again related to physical issues. The same can be said for the people who assigned a score of 5 to the first question: almost half of them (46,15%) indicated the onset of physical problems as their reason.

A further question investigated, instead, how other people saw them. The emerging data allow us to state that a person's cognitive age influences the way they feel they are seen from the outside. Those who gave a score of 1 in the question on cognitive age, think indeed that others do not see them as elderly at all or slightly old, in line with their perception; therefore, as the perceived cognitive age increases, the perception of the age assigned by others increases, too.

Regarding technology, the use of digital devices decreases in the transition from reduced cognitive age segments to cognitively older segments (Table 5). The "Peter Pan" people qualify as one of the six most "technological" segments as well as the most "social" one. The older

categories who use these devices, as well as for reasons shared with other segments, such as searching for information or keeping in touch with family and friends, often also employ them to find information about their health, also making use of telemedicine. Online shopping is a matter for the “Young but not too young” category. Even in the use of devices connected to the Internet, individuals who feel cognitively younger prevail. Therefore, the comparison between cognitive age and the use of technology shows how the mental obstacle of feeling “elderly” often represents a barrier. As regards the segmentation based on cognitive age, data highlight a marked use of digital devices in all segments, in particular for the “Young but not too young” group. However, the observable trend emerging from the second segment is a progressive reduction in the number of digital devices users from one segment to another. This is consistent with the cognitive age referred to the different segments. Indeed, people who consider themselves older use to a lesser extent these types of devices. The reasons behind the use of digital devices are also interesting. As for the “Peter Pans”, they use these tools for general purposes, to communicate with their family, to search for information, and to access social media. In particular, regarding the use of social media, a greater inclination is evident in the “Peter Pan” segment. The “Young but not too young” people use digital devices mostly for general purposes, to stay in touch with family and friends, to search for information, to send and receive e-mails. The same goes for the last three segments. Regarding telemedicine services, the highest percentages concern “Old but not too old” and “Old in name and deed” individuals. This tool is mainly used to find health information. The use of devices for financial transactions is also notable. A high percentage of “Young but not too young” individuals shop online. This percentage is lower in the “Old in name and deed” people. Moving from one segment to another, the rate of digital devices users who check and send e-mails grows, as does the use of games available in the app stores of smartphones. Concerning devices other than just smartphones, tablets, etcetera, taking into consideration all the devices connected to the Internet, it is evident how the “Peter Pan”, “Young but not too much” and “Not young but not yet elderly” groups are inclined to use various devices. The data collected, therefore, hold on a good level in the use of different devices and subsequently of technologies. Feeling young certainly affects this trend. This also concerns the use of social media.

Tab. 5: Cognitive-age-based clusters' use of technology

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	Peter Pan	Young but not too young	No longer young, but not old yet	Old but not too old	Old in word and deed
Digital Devices users	80%	85%	74%	60%	54%
Digital Devices types (prevailing in the last year)	1. Connected household appliances (57%); Connected entertainment devices (57%) 2. Wearable connected devices (43%)	1. Connected entertainment devices (64%) 2. Connected devices for health monitoring (36%) 3. Wearable connected devices (27%)	1. Connected entertainment devices (56%) 2. Connected devices for health monitoring (33%); Connected household appliances (33%)	1. Connected household appliances (40%) 2. Connected entertainment devices (20%); Connected devices for health monitoring (20%); Wearable connected devices (20%); Connecting devices controlling energy consumption in households (20%)	1. Connected entertainment devices (100%) 2. Connected household appliances (67%) 3. Connected devices for health monitoring (33%)
Digital Devices reasons to use (prevailing in the last year)	1. For generic/entertainment purposes (news, driving, reading) 2. To keep in touch with family, friends, community 3. To search for information	1. For generic/entertainment purposes (news, driving, reading) 2. To search for information 3. To keep in touch with family, friends, community	1. To keep in touch with family, friends, community 2. To search for information 3. For generic/entertainment purposes (news, driving, reading)	1. For generic/entertainment purposes (news, driving, reading) 2. To search for information 3. To keep in touch with family, friends, community	1. To keep in touch with family, friends, community 2. For generic/entertainment purposes (news, driving, reading) 3. To search for information

Source: Authors' elaboration

5.3. Life-events-based segmentation

The following segments were identified according to life events (Tables 6-7). In order to provide a better description of the clusters, profiling information about lived events was combined with data collected on socio-demographic features, habits, and adopted lifestyles as impacting on the autonomy and activism of the clusters:

- *Proactive people* (persons who lived more events compared to other people, with an average of experienced events of 12,9. They are married, with grown-up children who left home), 30,33% of the sample;
- *Shy Seniors* (persons with a low average of experienced events in comparison with other clusters. They are mainly unmarried), 34,43% of the sample;
- *Old-fashioned widows/widowers* (persons once married and now widows/widowers with children, who lived the standard events expected by the society of the past, without special features), 16,39% of the sample;

- *Footloose Seniors* (married persons with children with the highest rate of divorces or breakups compared to other clusters), 18,85% of the sample.

Tab. 6: *Life-events-based clusters' profiles*

		Proactive People	Shy Seniors	Old fashion Widows/ Widowers	Footloose Seniors
Moved to a different place	Yes	40.54%	30.95%	45.00%	47.83%
	No	59.46%	69.05%	55.00%	52.17%
Marriage	Yes	100.00%	80.95%	100.00%	100.00%
	No	0.00%	19.05%	0.00%	100.00%
Birth or adoption of a child	Yes	100.00%	57.14%	100.00%	100.00%
	No	0.00%	42.86%	0.00%	0.00%
Divorce or separation	Yes	5.41%	2.38%	0.00%	26.09%
	No	94.59%	97.62%	100.00%	73.91%
The last child moved out of the family household	Yes	89.19%	11.90%	95.00%	82.61%
	No	10.81%	88.10%	5.00%	17.39%
Death of spouse	Yes	24.32%	9.52%	100.00%	21.74%
	No	75.68%	90.48%	0.00%	78.68%
Death of a parent or close family member	Yes	100.00%	78.57%	100.00%	95.65%
	No	0.00%	21.43%	0.00%	4.53%
Birth of first grandchild	Yes	91.89%	19.05%	100.00%	100.00%
	No	8.11%	80.95%	0.00%	0.00%
Retirement (out of one's will)	Yes	70.27%	66.67%	70.00%	60.87%
	No	29.73%	33.33%	30.00%	39.13%
Lost job/business or forced to retire	Yes	8.11%	11.90%	10.00%	13.04%
	No	91.89%	88.10%	90.00%	86.96%
Significant success at work or personal life	Yes	86.49%	59.52%	50.00%	60.87%
	No	13.51%	40.48%	50.00%	39.13%
Change jobs, same or different type	Yes	59.46%	40.48%	20.00%	21.74%
	No	40.54%	59.52%	80.00%	78.26%
Major improvement in financial status	Yes	48.65%	38.10%	50.00%	39.13%
	No	51.35%	61.90%	50.00%	60.87%
Financial status a lot worse than usual	Yes	45.95%	11.90%	0.00%	17.39%
	No	54.05%	88.10%	100.00%	82.61%
Family member's health a lot worse	Yes	86.49%	76.19%	100.00%	30.43%
	No	13.51%	23.81%	0.00%	69.57%
More responsibility for aged relative	Yes	72.97%	73.81%	45.00%	78.26%
	No	27.03%	26.19%	55.00%	21.74%
Gained a lot of weight	Yes	37.84%	38.10%	15.00%	17.39%
	No	37.84%	38.10%	15.00%	17.39%
Chronic illness or condition diagnosed	Yes	72.97%	33.33%	25.00%	34.78%
	No	27.03%	66.67%	75.00%	65.22%
Serious injury, illness or major surgery	Yes	75.68%	38.10%	75.00%	13.04%
	No	24.32%	61.90%	25.00%	86.96%
Death or loss of a pet (dog or cat)	Yes	35.14%	47.26%	45.00%	39.13%
	No	64.86%	52.38%	55.00%	60.87%
Stopped smoking	Yes	43.24%	38.10%	5.00%	0.00%
	No	56.76%	61.90%	95.00%	100.00%
Average number of lived events		12.9	8.6	11.5	10

Source: Authors' elaboration

Cluster 1 was called “Proactive Seniors”, considering that they are the individuals who have experienced more life events than the others, with a number of experienced events averaging 12,9. This cluster consists of 100% happily married individuals (only 2 individuals are divorced and 9 are widows or widowers, out of 37 subjects belonging to the cluster) and with children, who are now adults and left home. Of all 4 segments, Cluster 2 has the lowest average of experienced events. They are mostly married, but in this group unmarried single men and women of the sample (8 individuals) can be found; this is not to be underestimated, as well as the data relating to children’s birth or adoption. Unlike the other segments, which show a 100% positive answer in relation to this event, in this case the situation changes for this cluster: 24 Yes and 18 No are collected as answers, which shows that celibates and even some married people have no children. As regards the event “The last child left home”, the data show that only 5 out of 37 individuals experienced this step. As there are 24 persons with children in this cluster, it can be said that only 5 Seniors out of 24 no longer have children at home: a high percentage of them still have so-called “dependent children”, who are teenagers or adults currently living in the parental home. Given a low average of experienced events compared to the other clusters, these subjects were called “Shy Seniors”, specifying that this label only refers to the low propensity of these individuals to experience numerous events compared to the other segments. Cluster 3 has been called “Traditionalist widows/widowers”: they were all once married and are now widows or widowers, with children, who have experienced the classic events that society once expected, without peculiarities. None of them is divorced and has experienced any worsening of their financial condition. Cluster 4 consists of individuals who experienced marriage and children, but this segment shows the highest percentage of divorced or separated people considering all 4 clusters. In addition, almost 83% have experienced the last child leaving home. Given these peculiarities, it was decided to call this cluster “No longer constrained Seniors”.

In the field of technologies, the least technological segment is represented by the “Old fashioned widows/widowers”. Mostly, they do not use any digital devices, but if they do, the main reason is to stay in touch with loved ones. The most technological is, instead, the “Shy Seniors” category. High percentages of “Proactive”, “Shy Seniors” and “Footloose Seniors” use these tools, while the data change for the “Old fashioned widows/widowers”: most of them do not use any digital devices, indeed. In the use of technologies, on the other hand, the “Shy Seniors” dominate: the reason may be traced back to their still cohabiting with young models or to the fact that they are unmarried, which, therefore, leads these Seniors to become familiar with technological devices. In the case of digital device use, this is generally frequent. Regarding the reasons for the use of these types of devices, there is a strong dualism between users and non-users. Speaking of “Proactive” subjects, the main reason for using general devices is to keep in touch with family and friends, followed by general purposes and the search for information. As for the “Shy Seniors” and the “Footloose Seniors”, the reasons behind the use of these devices are very comparable to those of the first segment. In this case, however, a good percentage also use

them for e-mails. The “Old fashioned widows/widowers” who use digital devices all agree in indicating as the main reason of use the possibility of keeping in touch with their family, friends, and the community to which they belong. Regarding the data on the use of devices connected to the Internet by the different segments identified based on life-events, non-use dominates, especially in “Old fashioned widows/widowers”. As regards “Proactive” people, different types of devices connected to the Internet are used. In the “Shy Seniors” group, the use of entertainment devices prevails clearly.

In conclusion, it is therefore possible to state that “Old fashioned widows/widowers” are the “least technological” segment while “Shy Seniors” are the most accustomed to technologies. This is because this segment tends to be inspired and influenced by youth models (both for having children who live with them and for feeling young based on their condition).

Tab. 7: Life event-based clusters’ use of technology

	Proactive People	Shy Seniors	Old fashion Widows/ Widowers	Footloose Seniors
Digital devices users	73%	90%	20%	86%
Digital devices types (prevailing in the last year)	1. Connected entertainment devices (64%) 2. Connected devices for health monitoring (50%) 3. Connected household appliances (36%); Wearable connected devices (36%)	1. Connected entertainment devices (61%) 2. Wearable connected devices (33%) 3. Connected household appliances (28%)	1. Connected devices for house safety (100%)	1. Connected household appliances (54%) 2. Connected entertainment devices (45%) 3. Connected devices for health monitoring (27%)
Digital devices reasons to use (prevailing in the last year)	1. To keep in touch with family, friends, community 2. For generic/ entertainment purposes (news, driving, reading) 3. To search for information	1. To search for information 2. For generic/ entertainment purposes (news, driving, reading) 3. To keep in touch with family, friends, community	1. To keep in touch with family, friends, community 2. For generic/ entertainment purposes (news, driving, reading) 3. To search for information	1. For generic/ entertainment purposes (news, driving, reading) 2. To keep in touch with family, friends, community 3. To search for information

Source: Authors’ elaboration

6. Discussion

This study aimed to compare different segmentation criteria in order to identify the most suitable ones for describing the elderly market, particularly referring to technology use. The cluster analysis we performed confirmed the existence of various facets in this market in terms of needs, and, as a result, in terms of consumer behavior. This asks for effective segmentation criteria.

The first cluster analysis, based on chronological age, highlighted some relevant diversities in elderly consumer behavior, also in technology use. As expected, chronological age leads to specific consumer trends related to aging. Likewise, regarding technology use, as ageing increases, technological devices use decreases. These pieces of evidence are consistent with the contributions identifying age as a key factor impacting on technology adoption because of the consequent progressive worsening of physical and cognitive abilities (Charness and Boot, 2009). Despite this, chronological age appears lacking when it comes to studying in-depth the reasons behind specific behaviors.

To this end, cognitive age seems to represent a good criterion to segment the elderly market. Our analysis shows how, in conjunction with the different clusters of consumers identified according to cognitive age, different uses of technology come to light. Similarly, as regards chronological age, the perception of being younger than one's true age (low cognitive age) goes with more active behaviors and this, inevitably, goes with more intense technology use. This, indeed, is in line with the anti-ageism phenomenon (Vincent, 2006) that, leading Seniors to reject the ageing stereotypes, pushed them to disregard elderly *ad hoc* products (Bae *et al.*, 2020), and to prefer products, such as those technology-based, conceived for a younger target. As stated in the literature, a low cognitive age positively affects innovative consumer behavior (Szmigin and Carrigan, 2000). Similarly, a high cognitive age creates a barrier to technology use. This is consistent with the well-known concept of technophobia, which can emerge if the person, through a self-evaluation, does not feel able to use such tools (Dogruel *et al.*, 2015).

Cognitive age-based segmentation also provides interesting insights for technology developers. Based on the results of the cluster analysis we performed, "Peter Pan" and "Young but not too young" clusters do not require an *ad hoc* investment in order to encourage the use of technology. These are the clusters that already use digital devices and are technology friendly, even though for different scopes - more "social network" users the Peter Pan and more "online shopper" the "Young but not too young". Because of their attitude to feeling younger, these categories probably would reject technologies developed for elderly users. This is the reason why, for these categories, universal design approaches (Gassmann and Reepmeyer, 2011) - as the development of solutions that may be desired by any consumer, regardless of their differences, integrating customer groups and offering larger target markets - may be more suitable than *ad hoc* approaches. The opposite goes for the clusters feeling older that tend to use digital devices less frequently. For these categories, probably investing in developing more user-friendly technologies could be a viable solution. As these categories show a higher propensity to use specific devices for health monitoring and to use technology also to find health information, promoting *ad hoc* technology solutions may represent a good strategy to reach this target. As these consumers do not feel the need to distance themselves from their actual age, they are probably more willing to accept technologies developed according to their values, ideas and aspirations (Boerema *et al.*, 2016). So, technologies addressing the physical and psychological needs of the elderly

could be suitable for this target as welfare technologies helping older people to perform tasks they used to pursue in their previous daily living, such as exercises, housekeeping and medication and reduce healthcare costs (Hofmann, 2012).

Lastly, using lived events for segmenting the elderly market seems to be truly intriguing. Our analysis shows how life events are very good descriptors of elderly consumer behavior also in relation to technology use. Similarly, as for the previous segmentation, in addition to the reasons to use digital devices in the four live-event-based clusters, also types of digital devices differ, suggesting interesting insights. Usually, on the basis of lived events, Seniors tend to adopt different consumer behaviors, also in relation to technology. Regarding technology use, some inspiring insights come to the fore, supporting the pieces of evidence of some studies, and opening up new interesting avenues for future research. Lived events in the elderly target not only discriminate between more or less technology-friendly targets, but also provide additional insights into the reasons that lie behind these behaviors. The results of our cluster analysis indicate that life-events contribute to shaping the social groups Seniors belong to, thus supporting their technology use. This is in line with the literature stressing social factors as essential for training elderly target to technology use (Wang *et al.*, 2011; Heinz *et al.*, 2013; Lee and Coughlin, 2015).

Moreover, regarding this cluster analysis, inspiring suggestions could be provided to technology developers. It is evident that, for many elderly consumers, lived events impacted on the social group they belonged to, and this favored or hampered technology adoption. As a result, “Shy Seniors”, as the most technological category among the life event-based clusters, do not need any specific support in the use of technology, as the group they belong to acts as a trainer. Advanced technological solutions, maybe developed by co-creation procedures (Östlund *et al.*, 2014) may therefore suit this category. On the contrary, the least technological “Old fashion widows/widowers” surely need user friendly technologies. The simpler the technology with which the person has to interact, the less physical and mental energy is spent (Bong *et al.*, 2018). This certainly stimulates purchases also among people with no previous knowledge and narrows the digital divide for the elderly (Spreicer, 2011). Furthermore, due to the role that social influences play in technology acceptance (Venkatesh *et al.*, 2003), technical support is essential when it comes to developing technologies addressed to “Shy Seniors”. Lastly, as by nature older people are used to maintaining previous behaviours and lifestyles (Deng *et al.*, 2014), product adaptations rather than completely new products could be recommended for this target (Zhang *et al.*, 2016). On the other hand, “Footloose Seniors” and “Proactive people”, despite their stronger attitude to using technology, might be attracted by different solutions according to their backgrounds. “Footloose Seniors”, mostly living alone and feeling no more constraints, are likely to be more sensitive to “social” technologies supporting them in developing new social relationships. Technologies designed to be easily usable, and able to emotionally engage the user (Harte *et al.*, 2017) may be fitting for this target. On the other hand, this doesn't does not seem to be a specific need for “Proactive people”.

7. Conclusion

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This research, albeit of an exploratory nature, contributes to the enrichment of the studies about the consumption behavior of the elderly segment, with specific reference to technology use. Although many have highlighted the need to identify effective criteria for the segmentation of such a heterogeneous target in terms of expressed needs, there are currently few studies in this field, especially in relation to the use of technology.

Therefore, by analyzing the elderly target, cognitive age and lived events are good predictors of the consumption behavior of these subjects, as an alternative to age. The conducted cluster analysis highlights multifaceted consumption trends, both in the case of using cognitive age as a segmentation criterion and in the case of appealing to lived events.

As far as technology is concerned, our study states that segmentation based on age is not very effective, especially when certain dynamics of the use of the technology need explanation. On the one hand, it is evident that the use of technologies changes according to the age group (greater use for the youngest and lower use for the oldest). On the other hand, cognitive age and lived events provide additional information regarding the reasons for such discrepancies in the use of technological tools.

This provides important operational indications to managers who need to understand the different dynamics of the use of technology by elderly consumers in order to define offers of products and/or services suited to the several needs of the different segments into which this target is divided. The gaps emerging in our clusters show that some digital devices are perceived as more user-friendly than others by elderly consumers. Others, on the contrary, are less familiar to the elderly, but probably in the different reasons to use technologies as well as in the different cluster profiles, the producers of technological devices and services can find the basis for designing or redesigning their offerings to better fit elderly's needs.

Producing and selling their products or providing services allows companies to leverage the purchasing power of the elderly, triggering economic growth. Seniors' innovations to boost autonomy offer opportunities that are not restricted to medical devices, but include various products and services, such as transportation, housing and communications.

Promoting and facilitating the use of technology by the elderly segment has interesting implications in terms of social and economic impact, too. This is because the use of technology by this segment would lead to its greater autonomy with relevant effects on several fronts. Technology adoption might help older people to live independently in their comfort zone, improving their life quality and satisfaction, reducing pressure on the healthcare system and society as a whole.

Despite its theoretical and practical contribution, the present work is not exempt from limitations.

The first certainly deals with the method used for the segmentation of the elderly. Although alternative segmentation parameters to the chronological age were examined, to test their validity, these criteria were used separately. Homogeneity in terms of number of lived events seems to

affect cognitive age in our analysis, stressing the importance of adopting multicriteria approaches, capable of integrating the different perspectives for segmenting the elderly market.

The second limitation concerns the sample, which is surely limited and therefore expandable to be more representative of all age groups included in the elderly segment.

The third and final limitation concerns the moment of detection. The data were gathered during the period of the pandemic and, especially for those concerning the use of technology, they certainly appear to be influenced by this phenomenon. Therefore, although the information collected does not allow for a comparison with the period prior to the pandemic, it is also true that the pandemic has certainly contributed to accelerating the process of adoption of technology by the elderly and to making this process irreversible.

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Appendix 1

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Tab. 1a: Reasons to adopt technologies in the different cohort-based clusters

		<i>Cluster 2 Depression Generation</i>	<i>Cluster 3 War generation</i>	<i>Cluster 4 Baby Boomers</i>
For generic / entertainment purposes (news, driving, reading)	Yes, in the last year	50,00%	80,00%	85,00%
	Yes, in the past	25,00%	0,00%	2,50%
	Never	25,00%	20,00%	12,50%
To keep in touch with family, friends, community	Yes, in the last year	100,00%	100,00%	86,25%
	Yes, in the past	0,00%	0,00%	3,75%
	Never	0,00%	0,00%	10,00%
For professional scopes (work related activities)	Yes, in the last year	25,00%	0,00%	23,75%
	Yes, in the past	25,00%	20,00%	16,25%
	Never	50,00%	80,00%	60,00%
For health reasons (telemedicine services)	Yes, in the last year	50,00%	0,00%	33,75%
	Yes, in the past	0,00%	0,00%	3,75%
	Never	50,00%	100,00%	62,50%
To search for information	Yes, in the last year	75,00%	80,00%	82,50%
	Yes, in the past	0,00%	0,00%	3,75%
	Never	25,00%	20,00%	13,75%
For email checking and sending	Yes, in the last year	100,00%	20,00%	55,00%
	Yes, in the past	0,00%	0,00%	1,25%
	Never	0,00%	80,00%	43,75%
For financial transactions	Yes, in the last year	25,00%	0,00%	30,00%
	Yes, in the past	0,00%	0,00%	0,00%
	Never	75,00%	100,00%	70,00%
To play	Yes, in the last year	25,00%	0,00%	26,25%
	Yes, in the past	0,00%	20,00%	2,50%
	Never	75,00%	80,00%	71,25%
To do shopping	Yes, in the last year	50,00%	0,00%	31,25%
	Yes, in the past	0,00%	0,00%	1,25%
	Never	50,00%	100,00%	67,50%
To access social media	Yes, in the last year	50,00%	40,00%	53,75%
	Yes, in the past	0,00%	0,00%	2,50%
	Never	50,00%	60,00%	43,75%

Tab. 2a: Reasons to adopt technologies in the different cognitive age-based clusters

		<i>Cluster 1 Peter Pan</i>	<i>Cluster 2 Young but not too young</i>	<i>Cluster 3 No longer young, but not old yet</i>	<i>Cluster 4 Old but not too old</i>	<i>Cluster 5 Old in name and deed</i>
For generic / entertainment purposes (news, driving, reading)	Yes, in the last year	100,00%	94,47%	80,00%	73,33%	71,43%
	Yes, in the past	0,00%	0,00%	2,50%	6,67%	14,29%
	Never	0,00%	5,53%	17,50%	20,00%	14,28%
To keep in touch with family, friends, community	Yes, in the last year	100,00%	84,21%	92,50%	66,67%	100,00%
	Yes, in the past	0,00%	0,00%	5,00%	6,67%	0,00%
	Never	0,00%	15,79%	2,50%	26,66%	0,00%
For professional scopes (work related activities)	Yes, in the last year	12,50%	21,05%	25,00%	26,67%	14,29%
	Yes, in the past	12,50%	21,05%	15,00%	20,00%	14,29%
	Never	75,00%	57,90%	60,00%	53,33%	71,42%
For health reasons (telemedicine services)	Yes, in the last year	37,50%	31,58%	27,50%	40,00%	42,86%
	Yes, in the past	12,50%	5,26%	0,00%	6,67%	0,00%
	Never	50,00%	63,16%	72,50%	53,33%	57,14%
To search for information	Yes, in the last year	100,00%	89,47%	80,00%	73,33%	71,43%
	Yes, in the past	0,00%	0,00%	2,50%	13,33%	0,00%
	Never	0,00%	10,53%	17,50%	13,34%	28,57%
For email checking and sending	Yes, in the last year	37,50%	68,42%	52,50%	46,67%	71,43%
	Yes, in the past	0,00%	0,00%	0,00%	6,67%	0,00%
	Never	62,50%	31,58%	47,50%	46,66%	28,57%
For financial transactions	Yes, in the last year	12,50%	47,37%	20,00%	33,33%	28,57%
	Yes, in the past	0,00%	0,00%	0,00%	0,00%	0,00%
	Never	87,50%	52,63%	80,00%	66,67%	71,43%
To play	Yes, in the last year	25,00%	10,53%	35,00%	13,33%	28,57%
	Yes, in the past	0,00%	10,53%	0,00%	6,67%	0,00%
	Never	75,00%	78,94%	65,00%	80,00%	71,43%
To do shopping	Yes, in the last year	25,00%	42,11%	30,00%	26,67%	14,29%
	Yes, in the past	0,00%	0,00%	0,00%	6,67%	0,00%
	Never	75,00%	57,89%	70,00%	66,66%	85,71%
To access social media	Yes, in the last year	62,50%	47,37%	57,50%	46,67%	42,86%
	Yes, in the past	0,00%	0,00%	2,50%	6,67%	0,00%
	Never	37,50%	52,63%	40,00%	46,66%	57,14%

Tab. 3a: Reasons to adopt technologies in the different life event-based clusters

		Cluster 1 Proactive people	Cluster 2 Shy Seniors	Cluster 3 Old- fashioned widowers	Cluster 4 Footloose Seniors
For generic / entertainment purposes (news, driving, reading)	Yes, in the last year	77,78%	89,47%	50,00%	85,00%
	Yes, in the past	11,11%	0,00%	0,00%	0,00%
	Never	11,11%	10,53%	50,00%	15,00%
To keep in touch with family, friends, community	Yes, in the last year	88,89%	86,84%	100,00%	85,00%
	Yes, in the past	7,41%	0,00%	0,00%	5,00%
	Never	3,70%	13,16%	0,00%	10,00%
For professional scopes (work related activities)	Yes, in the last year	14,81%	26,32%	25,00%	25,00%
	Yes, in the past	18,52%	18,42%	0,00%	15,00%
	Never	66,67%	55,26%	75,00%	60,00%
For health reasons (telemedicine services)	Yes, in the last year	29,63%	34,21%	25,00%	35,00%
	Yes, in the past	3,70%	2,63%	0,00%	5,00%
	Never	33,33%	63,16%	75,00%	60,00%
To search for information	Yes, in the last year	77,78%	89,47%	50,00%	80,00%
	Yes, in the past	3,70%	2,63%	0,00%	5,00%
	Never	18,52%	7,9%	50,00%	15,00%
For email checking and sending	Yes, in the last year	48,15%	63,16%	50,00%	50,00%
	Yes, in the past	3,70%	0,00%	0,00%	0,00%
	Never	48,15%	36,84%	50,00%	50,00%
For financial transactions	Yes, in the last year	33,33%	31,58%	0,00%	20,00%
	Yes, in the past	0,00%	0,00%	0,00%	0,00%
	Never	66,67%	68,42%	100,00%	80,00%
To play	Yes, in the last year	18,52%	26,32%	0,00%	35,00%
	Yes, in the past	3,70%	5,26%	0,00%	0,00%
	Never	77,78%	31,58%	100,00%	65,00%
To do shopping	Yes, in the last year	22,22%	42,11%	0,00%	25,00%
	Yes, in the past	3,70%	0,00%	0,00%	0,00%
	Never	74,08%	57,89%	100,00%	75,00%
To access social media	Yes, in the last year	55,56%	55,26%	25,00%	50,00%
	Yes, in the past	3,70%	2,63%	0,00%	0,00%
	Never	40,74%	42,11%	75,00%	50,00%

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