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Gen X and Digital Games: Looking back to look forward

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Gen X and Digital Games: Looking back to look forward

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Abstract. Despite there being increased attention in recent years to older adults who actively play digital games, it seems that there has been comparatively minimal scholarly focus on the next generation of older adult gamers – Generation X gamers. Although there have been few, current audience studies that examine this population within a gaming context, a temporal perspective reveals another story. Older members of this generation were the first age cohort to be exposed to and engage in video gameplay at an early age (i.e., childhood). With the emerging popularity of video games in the 1980s, this did not escape the attention of scholars. This study provides an overview of those early studies that assessed video game use and its potential (for better or worse) among the older members Gen X. The study themes identified include: health, education, and behavior. In addition, the first studies that identified gaming characteristics of this generation in their formative years emerged in the latter half of that decade. By identifying themes in these early studies, scholars have the potential to track an entire generation's gaming history and characteristics from childhood to present day. Ultimately, this may glean richer insight into those qualities when they become the next older generation of digital game players.

Keywords: Generation X, Older Adults Gamers, Digital Games, Video Games

1   Introduction

The notion of older populations engaging and playing with digital games is not a new phenomenon and was largely spurred by the introduction of two gaming systems in 2006. First, the Nintendo DS, afforded ease of interaction through a stylus and touch screen while encompassing a variety of games across different genres, including health and casual games. Also in 2006, the Nintendo Wii was released and there was evidence soon after that it was gaining attention within older adult residential facilities, such as assisted living facilities. Other systems that were also released during that time frame that caught attention among older populations include the Xbox 360 and the PlayStation 4.

At the same time, there has been increasing attention to the rate at which the older population is growing in modernized countries. In turn, this has prompted scholars and professionals in various fields to consider how the needs of this population will be met. Although an increasing population rate is not justification for studying these age cohorts, it promotes a sense of awareness. For example, there has been growing recognition across multiple academic communities –e.g., gerontology, public health, social sciences, and computer sciences – that innovative solutions are needed to assist older populations with aspects such as ageing in place, risk-reduction with falls, cognitive maintenance, leisure

opportunities, and social connectivity, which may include intergenerational components. Since the turn of the century, there have been numerous initiatives and extensive research conducted, including those funded through national and international governments, to explore and ascertain prospective solutions. This resulted in innovative programs such as the iStoppFalls [1] and the DISCOVER Skills for Carers project [2].

ICT and digital games have the potential to benefit members of each age population within our aging society, not just the Baby Boomers – who are currently age to 54 to 72. For example, ESA's 2017 "Essential Facts" [3] reports that not only do younger populations engage in digital gameplay regularly, but also roughly a quarter of the gaming population consists of persons age 50+. While there has been increasing research conducted with the latter portion of this age cohort (those age 60 to 65+, "older adults") [4-7] exploration with other middle-aged populations (those in their 40s and 50s) is needed as a means of understanding and anticipating their future needs and ability-related requirements for ICT use, which includes digital game engagement. In turn, insight into the characteristics the *next* older adult population has the potential to prepare persons and entities, such as health care practitioners, advocacy agencies (e.g., Age UK) and government agencies to effectively serve their needs and interests.

To date, there is a limited amount of research that solely focuses on the current game-related needs, requirements, and preferences of those middle-aged adults born in the first 10 years of the Generation X cohort (those age 43 to age 53). However, if one were to consider this age segment within a temporal perspective, it may be recognized that research was conducted on this population years ago when they were children – when they were the first full generation to be born into a world of digital games. Although such technology was referred to as "video games" and "computer games" in those early years, this article will use the term "digital games" as a means to encompass all forms and platforms of electronic-based gaming. However, the term "video games" will be referenced to at times in the literature that pre-dates modern gaming.

By assessing early game studies that focused on members of Generation X during their formative years (childhood and adolescence, age 19 and younger [8]), we gain a sense of how this came to shape their current gaming characteristics [9]. A component of this involves gaining a collective insight from the studies that were conducted on this specific population over time – from childhood to current day. Currently, there is no identified publication that provides such an overview of Gen X gaming studies through a historical lens. And, although the authors would like to provide a comprehensive overview of all studies that solely focused on this population from the 1970s to current day, it would result in much larger manuscript than is represented herein. Thus, we elected to narrow our search to studies that captured some component of the older half Gen X's earliest years (pre-adulthood, pre-1990). In other words, this study focused on those who will be the first within their generation to be older adults – and for some, potentially older adult gamers. With this in mind, we pose – *What overriding themes are represented within the literature pertaining to the older members of Generation X and digital games pre-1990?*

To answer this research question, we used the following aims:

1) Provide an overview of Generation X characteristics.
2) Propose potential aspects to take into account when considering Generation X as future older adult digital gamers.
3) Identify and assess pre-1990 studies that solely focus on older members of Generation X within the context of digital games.

2   Methods

To answer the research question, Google Scholar search engine was used to identify published studies. Parameters reflecting each designated range of years were used to identify publications within that time frame. For example, 1981 and 1985 were entered when wanting to see only those studies published during that span of years. In addition,

"video games" was the primary search phrase used. However, when considering the vernacular of the time, "video games" and "arcade games" were used independently when searching for publications before 1980. Articles that were deemed as appropriate for assessment had to focus solely on the members of Gen X within the context of digital games.

3   Defining Generation X

The Generation X age cohort follows the Baby Boomers and precedes the Millennial Generation, both of which have large population counts [10]. Generation X, referred to as "Gen Xers" in this article, is sometimes socially referred to as America's neglected 'middle child' [11]. This is a cohort of persons spanning across two decades and because there are differing beliefs of the range of birth years, this period spans 15 to 20 years. [11]. In the United States, there are approximately 77 million Baby Boomers and 83 million Millennials, yet there are approximately 65 million Gen Xers [11].

The term Generation X was coined in 1991 by author Douglas Coupland [12]. He posited that Gen Xers were sometimes thought of as slackers and, therefore, may not necessary amount to much. Contrary, Generation X has been perceived by others to be the cohort who works hard and plays hard [13]. Gen Xers are the cohort who were introduced to digital technologies at a young age, e.g., during adolescence, yet these technologies were not available to prior cohorts at such early ages. In addition, they are also the ones who made up a large base within the Dot com era in the 1990s. While Gen Xers predecessors came to adopt many of those technologies, it is the Millennials [14] those who were born into an era and exposed to digital technologies at a very young age. This includes exposure to and engagement with the Internet and its peripherals, such as smart phones, fourth generation digital game consoles, and handhelds platforms (e.g., the Nintendo DS and the PSP).

A large proportion of this cohort play digital games and will be the first generation to have been exposed to digital games from childhood to older adulthood. Yet, game scholars must first have a firm understanding of not only their present gaming characteristics, but also their past gaming characteristics so that we can more accurately prepare for their future gaming needs. Ultimately, by encompassing a lifespan and life course perspective, this has the potential to positively contribute to designing and modifying games that support their social and physical health [15].

4   Background Literature

4.1   Recent Studies: Today's Older Adults and Digital Games

To understand how Gen Xers may evolve within a gaming context in the coming years, we must first understand the scope of today's current studies pertaining to older adults. There has been a growing body of work that encompasses older adults and digital game engagement. This ranges from aspects including game genres, fun/entertainment, design, theory, health, and rehabilitation. Yet, it is important to point out that research pertaining to older populations and digital games can be divided into two camps: 1) game studies involving older adults (who are not current gamers) and 2) game studies that specifically study older adults who actively play digital games. The former typically involves the potential use of digital games as a means for health improvement. For example, there have been several systematic, scoping and narrative reviews that encompass studies that recruited older adults, in particular, those aged 85+ years [16]. One study assessed the feasibility and effectiveness of digital gaming systems to facilitate the physical activity of older adults as a means to improve health-related elements [17]. Bleakley's systematic

review [6] explored how digital games may physically and cognitively benefit adults aged 65+. Hall et al. [7] explored how digital games may have a positive impact on the lives of adults aged 65+ years with respect to improving health behaviors. Marston and Smith's [18] narrative review focused on studies that included commercial and purpose-built game technologies for both fall prevention and stroke rehabilitation. A notable aspect to highlight within related literature because it relates to game adherence among participants is the experience of flow and immersion [19-23]. Research in this area among older adult populations is still in its infancy, yet has been growing with work undertaken by Marston [24-25] and Whitelock [26]. Although research in this domain of game studies has explored younger generations, such as men in their twenties playing first-person shooter games, no study has been identified that examines the effects of flow/immersion by non-gamers from Gen X.

Additional research pertaining to game and population studies, with an eye to older adult's digital game players, has included: cognition and perception-related responses [27], motivation, usability and playability of digital games [28], intergenerational and collocated gaming, [29-33] game genre preferences, and game design and aesthetics [34-36]. While all of these studies have contributed to numerous academic fields (e.g., game studies, HCI, gerontology, gerontechnology, and health sciences) there is a considerable dearth of studies that probe the gaming characteristics of the Generation X age cohort.

4.2 The Potential to Apply Current Research to Gen X

Research reflecting a variety of methodological approaches have been conducted by Marston, De Schutter, and Brown as a means to explore gaming characteristics of older adult digital gamers. However, as of the writing of this manuscript there has not yet been a study that fully encompasses the entire age-range of Generation X. The closest studies identified are those by Brown, yet she has focused on middle-aged adults between age 40 and 59, which includes older members of Gen X and younger Baby Boomers [9, 37]. This does not capture the younger age range of that generation. When taking into account the varying methodological approaches employed by these respective researchers, it is worth considering the extent to which these approaches may be applied to the full range of Gen X. Doing so, and comparing it with findings from current older adult gamers, may glean insight into game development and design considerations that may influence future gameplay. In turn, this may also be applicable within a future health-related context, such as rehabilitation for improved mobility.

Taking an example of the iStoppFalls EU project, the aim was to design and develop purpose-built exergames [38] that integrated exercises from the Otago exercise program [39]. This included balance and strength exercises for lower extremities used in activities of daily living (ADL), such as knee extensions, knee flexion, hip abduction, calf raises and toe raises [40]. The iStoppFalls systems were then evaluated via an international, multi-centered randomized control trial. Yet, to the knowledge of the authors, there is nothing remotely similar available (with respect to an exergame) that focuses on fall prevention. In addition, this system been evaluated in terms of its effectiveness on members of younger cohorts who may also be at risk for falling. Doing so may also gauge their levels of motivations and interest, which is associated with exergame adherence.

5 A Temporal Perspective of Gen X

5.1 Gaming by Gen X

At first glance, it may seem as if there is not much research-based data on Gen X gamers. Although studies have been conducted with this population in recent years [40], it is essential to use a temporal lens to assess this issue. In fact, it is essential to be aware of the history of digital games and to consider those Gen Xers within specific points in time. For

example, when Pong was first released in 1972 [41], the first wave of Gen Xers were as old as age 10, and when Pac-Man was first released in 1980 [41], these same persons were as old as age 15. Likewise, when the first Nintendo Mario Brothers game was released in 1985, Gen Xers were roughly between the ages of 1 and 20. When taking this temporal aspect into consideration, it is worth noting the age-range of the Gen Xers over time, beginning from the approximate point in time when video games first became popular within the public market.

Table 1: The approximate age range of members of Generation X within the respective year indicated.

Year	Members of Gen X: Age Ranges by Year
1975	≤10
1980	≤15
1985	≈1-20
1990	≈6-25
1995	≈11-30
2000	≈16-35
2005	≈21-40
2010	≈26-45
2015	≈31-50
2017	≈33-52

So, as one can see, the Gen Xers were the first age cohort to be exposed to this mode of entertainment technology as children – albeit, primitive by today's standards – and were the first age cohort to witness its evolution to what it is today. For example, the Gen X child who may have played *Pong* in 1972 with its seemingly unsophisticated graphics, may currently play *Resident Evil 7: Biohazard*. And, this same individual who has engaged in digital game play since childhood may likely continue to play in the future – as an older adult – as the technology also advances. When taking into consideration that early, first wave of Gen X children were playing some of the first games – or were at least exposed to them via social and cultural influences– it is worth investigating the extent to which game studies focused on this population. What were the focus of these studies over time? And, what might be gleaned with respect to current and future gaming behaviors when examining this age group during their childhood years?

By broadly examining "video game" and "digital game" studies with the older half of Gen X in their childhood and adolescent years, there is the potential to identify gamer and game-playing themes that reflect current characteristics. This also has the potential to provide scholars with a richer understanding of how these first gamers were shaped over time to ultimately construct who they are now as gamers and foreshadow their gaming characteristics in the coming years as the next generation of older gamers.

5.2   Video Games: Pre-1980

It is not surprising that there is a dearth of scholarly literature on video games before 1980. This is reasonable because video games did not even begin their long climb into popularity until the late 1970's. However, there were a handful of studies conducted in the late 1970's that pertained to "computer games". These studies largely explored the potential use of computer games within a classroom setting. This varied in subjects such as history [42], chemistry [43], and civil engineering, [44]. However, it must be noted that although students were involved with these studies, they were too old to be members of Gen X; thus,

these are early game studies on Baby Boomers. Nonetheless, it is worth noting that there were indeed precursory studies conducted that examined the use of electronic platforms among a young audience.

5.3   Video Games: 1981-1985

This was truly a time when video games captured the attention of scholars who anticipated how video games could be used as a tool for beneficial purposes. In particular, the children of that era who played, early Gen Xers, also caught their attention and researchers began to assess gaming characteristics of this age cohort.

Health
Numerous studies explored how video games could be used within a health-related context. For example, this included its potential to help the distress levels of adolescents undergoing chemo [45] and increase levels of self-control and self-concept among adolescent "juvenile delinquents". Yet, there were also studies that underscored a more cautionary approach to video game engagement, as it was suggested, for example, that gameplay may be risky for adolescents who are prone to seizures [46].

Education
Similar to prior years, scholars investigated the use of electronic platforms within the classroom to aid student learning. These included students playing games to aid the acquisition of special visualization skills [47] and games as a means to motivate learning [48].

Behavior: Aggression
This identified era was when attention was first drawn to video games as a tool for managing undesired behavior among young users. Graybill et al. [49] proposed that video games may aid with aggressive impulses among children. Whereas, other scholars attempted to ascertain whether or not heavy video game engagement promoted aggression [50]. In this study, it did not. Nonetheless, the association of video games and aggressive behavior (and violence) gained momentum in the following years.

5.4   Video Games: 1986-1990

Similar to the prior period examined, scholars continued to examine how video games could be used by Gen Xers within health and educational contexts.

Health
Similar to the 1985 study discussed earlier, another study assessed the potential use of video games played by pediatric cancer patients as a means to alleviate the side-effects of chemotherapy, such as nausea [51]. It was found that playing video games helped as a distraction. Video games were also found to be an effective therapeutic tool for young burn victims, as playing aided their participation in rehabilitation [52].

Education
Although this was a time where there were promising and positive uses of video games to help young persons within a health setting, there were mixed reviews when applying video games to an educational setting. For example, one study indicated that video games did not serve as reinforcement for computer-assisted math performance among students [53]. In fact, the control group performed better. Contrary, [54] found that video games have the potential to be a catalyst for engaging students in a non-traditional means.

Behavior: Pathological and Deviant

In the years leading up to 1986, there was growing public concern about there being an association between young persons (the first wave of Gen Xers) playing video games and deviant behavior. Although there were not many studies exploring this aspect at the time, there was a surge of research post-1985. A basic search of video game studies released during this era resulted in a rather large volume of published studies. Contrary to prior studies, there was evidence that gameplay among younger persons resulted in unwanted behavior, such as aggression. For example, two specific studies noted an increase in aggressive behavior among young children who watched or participated in "aggressive" video games [55-56]. A similar study was conducted and found that higher levels of aggression were evident among young girls who played video games, yet there was no effect on young boys [57]. In comparison, research assessing undesired behavior among older Gen Xers who played video games was conducted (i.e., college students). For example, one study found that engaging in video games did not result in higher levels of aggression or hostility, yet there seemed to be an increase in levels of anxiety [58]. Despite evidence that video games may produce unwanted behaviors among young persons who played them, there were just as many studies that produced evidence that suggested otherwise [59-61].

Generation X Characteristics
It did not take long after the introduction of video games to the general market that it began to attract negative attention. In fact, the U.S. Surgeon General at that time, C. Everett Koop, made statements strongly suggesting that video games were harmful to children [62], yet there was a backlash from some scholars who expressed there was no evidence to support those claims. This sentiment was supported by a small but growing body of literature to identify characteristics and associations of video games and the young persons who played them. For example, one study assessed the attitudes of young persons (age 10-20) towards video games [63]. The findings indicated that the attitudes of those surveyed did not support the popular belief that playing video games leads to poor academic performance and diminished opportunities for social development. Another study sought to identify differences, if any, between high vs. low video game use and long- vs. short-term use with respect to social withdrawal, hostility, self-esteem, and social deviancy [62]. No association was found.

With there being limited evidence to associate video game use among young persons with undesired behavior, some researchers began to explore player characteristics and motivations. Harris et al. [64] surveyed high school students to identify the motivating factors for those students who played video games. Responses ranged from it being a shared form of play with friends to being a source of excitement and escape from boredom. In addition, it was found that there was a positive correlation between video game play and financial resources. Similarly, another study indicated that those who played regularly were more inclined to master the game and to play against others [65]. With Gen X's increased exposure to video games during this era, it is no surprise that evidence emerged to suggest that they were more comfortable with interacting with this mode of technology than older populations at the time [66].

Although there was a considerable increase in the number of studies that assessed video game use among young persons (as compared to prior years), there were few that aimed to identify defining characteristics of those young Gen X video game players. Of note is a study that indicated that video game engagement was positively associated with use of other microcomputers [67]. This finding is noteworthy, as it provides further evidence that this generation was becoming more acquainted and comfortable with sophisticated technologies at a young age and laid the foundation to engaging with modern iterations in the future. Gen Xers were a cohort who was becoming increasingly familiar with information and communication technologies due to prolonged exposure and/or use within an educational and/or work setting. In addition, early members of this generation were exposed to some of the first digital games and gaming platforms, especially within a social context, during formative years – the late 1970s, 80s, and early 90s.

When the opportunity for online game became available in the 1990s, many embraced that mode of gaming and continue to rely upon it today – e.g., gaming on a smartphone [37]. While many underscored their young adulthood years with embarking on careers and/or beginning families, for those who at one time engaged in gameplay, it resulted in a reduced amount of time for gaming [9, 37]. However, over the years, free-time became available for these persons [9, 37] (e.g., their children growing up and needing less attention) and mobile gaming technologies proliferated within society. This set the stage for increased gaming opportunities, a chance to once again embrace those games that were reminiscent of those played in late childhood [9, 37]. Furthermore, this set the stage for those who not only have children, but also have grandchildren, which provided an opportunity for intergenerational gaming. [For examples, see 30-33, 68]

6.   Discussion

To understand an individual gamer, much more so gamers of a select generation, it is essential to glean insight into their personal gaming history – to explore the factors that contributed to (or hindered) their exposure to or engagement with digital games [9]. This cannot be accomplished for every digital game player of Gen X; thus, this study provided an overview of published game-related studies that pertained to the older members of that generation when they were in their formative years.

The search noted that there was a lack of studies before 1980, but the number of studies gradually increased after that point in time. Within the time frame studied, the prominent themes pertained to aspects of health, education, and behavior. And, it is worth noting that research within the realm of audience studies (i.e., gamer characteristics) did not emerge until the latter half of the 1980s.

Overall, the studies that focused on health and education indicated positive outcomes. Games within a health context were assessed as a tool to help younger persons with managing some aspect of their physical well-being, such as managing side-effects of an illness or for rehabilitation purposes. However, caution was emphasized for younger game players who were prone to seizures. Within the realm of the education-based studies conducted, there were mixed reviews with respect to the potential benefit of game use in the classroom. Video games were largely assessed for their potential for motivating student engagement, reinforcing course material, and utilizing games as a new means for teaching material. Although not all studies indicated a positive association, there was support for game use within the classroom. In short, these health and education studies were some of the earliest conducted with younger populations and in this case, their participants were the first wave of Generation X. Studies, such as these, laid the groundwork for the seemingly countless studies that followed, as health and education game research is still conducted today with a wide range of audiences.

With respect to the theme of behavior, there was a steady increase in the amount of attention (i.e., research) given within the 1980s, as this was a reflection of the concerns of there potentially being a relationship between violence in video games and negative behavior of those young persons who played. Studies [9, 69] have shown how many aging gamers, including older members of Gen X, had their first experience with video games in childhood or adolescence, such as playing on an early generation console in the home or in arcades, some of which may been considered "violent" at the time. Violence and video games have been a topic of debate for decades, and while some video games of yesteryear were perceived to be inappropriate for young audiences, these genres are still played and enjoyed by many older Gen Xers today [9]. For example, in one study reviewed above, a video game on karate was considered violent and the authors posed that exposure to such violence may result in aggressive behavior. Contrary, by today's standards, a karate game may be considered rather mild when compared to the how "fighting" is depicted in current games.

In addition, some Gen Xers gamers who played action-based games in their earlier years are a part of the broader audience who currently play game series such as *Grand Theft Auto* and *Call of Duty* [70]. This lends to discussing how one generation may have differing perceptions of what constitutes violence. Furthermore, it begs discussion to consider how a gamer of a particular generation, such as Gen X may perceive a gaming aspect, such as violence, and to what extent that perception changes over time. It may be too early to determine, yet generation-specific attitudes towards game characteristics may modify over time just as games modify. This will be useful to examine in the future, as many Gen Xers may still be playing similar games when in older adulthood.

Similarly, further consideration should be taken when exploring the extent to which game preferences may change over time for Gen Xers. This includes examining games from their younger years to what is currently being played. For example, why the change in genre(s)? Is it a natural result of gaming evolution, or, was there a personal shift in preferences? Future research may assess Gen X perceptions of how games have developed and the extent to which it shaped their gameplay. This could provide insight into how future game developments could (further) shift their gameplay in the future.

Additionally, future work should also explore the meaning that Gen Xers ascribe to video gaming, as for many it was not a mere distraction in their day but a focal point in what they considered "play". For those who have continued to play over the years, it is also telling that the games they played in the early days are reminiscent to what they play now [9, 37, 69]. Meaning, there is no indication that they will give up their progressive and action-based games to play "senior friendly" games like *Candy Crush* or *Solitaire*. This is notable, as it is contrary to what is often regarded as older adult appropriate games by the gaming industry and some gaming scholars.

Although every generation bleeds into the next, certain characteristics tend to surface with each. As such, it is essential for the research community to become familiar with the range of game-related aspects that are reflective of each age cohort. This pertains not only to those associated with those who actively play digital games, but also those elements that may influence members of a specified cohort who do not play. This does not suggest that all persons should play digital games, but such information may be useful for those who wish to design games to meet a specific need, such as games aimed at improving an aspect of health or learning.

Although it is noteworthy how much the literature base has grown in recent years with respect to studies that solely focus on active older adult digital game players, it must not be assumed that the following (i.e., younger) generation of gamers will have the same (or similar) game-related characteristics. Thus, it is erroneous to use the phrase "digital games for older adults" if there is some level of assumption that those games are for persons of a specified age. Rather, we propose that one must keep in mind that such games are "digital games for older adults of a particular generation". However, it is also erroneous to state that a member of a particular generation would like or not like, or, engage or not engage in a game because of qualities identified with their generation. For example, that would be akin to stating that an older adult gamer would not like a first-person shooter game.

Moreover, the authors propose scholars who focus their research on game studies, such as those within the fields of gerontology and communications, to explore the literature in greater depth. This includes a systematic review of the literature that encompasses both the older and younger age cohorts within Generation X. This also may also provide the opportunity to explore and define the meaning of "play" for this generation, as it has the potential to assist scholars across health and education domains, HCI, and game design to better prepare for the next older adult generation. Based on prior studies [9, 69], it is likely that older members of Gen X will have a very different set of leisure needs and requirements from their predecessors – the Baby Boomers.

This line of inquiry is also important because academic communities across several disciplines are working together in a bid to ascertain a variety of options for our current ageing populations to maintain or enhance quality of life and well-being. Yet, to the knowledge of the authors, there has been limited exploration with this next older generation

who comprise a very different set of attitudes, needs, and requirements. Therefore, to prepare for our future ageing population scholars need to understand underpinning influences that shaped them over time, from childhood to current day.

7.   Conclusions and Limitations

This paper provided an overview of Generation X characteristics and an assessment of literature that pertained the older members of Generation X in their formative years (childhood and adolescence) within the context of digital games. It resulted in identifying themes that emerged from studies published before 1990: health, education, behavior, and early gaming characteristics.

Limitations of the work presented here include the paucity of papers identified via Google Scholar and the time frame in which the authors have presented the respective papers (e.g. pre-1980-1990). Although the limited range of years assessed was reflective of a specified developmental period, this did not include younger members of Generation X. This authors of this study aim to add to this line of inquiry in the future by extending the search timeframe to include studies conducted and published in the mid-to-late 1990s and beyond, which in turn may identify similar and/or different themes. In addition, a similar assessment may yield comparable findings that pertain to the younger members of Generation X.

This paper is timely, as there is a lack of research that reflects a collective, historical perspective of an entire generation within a gaming context over time from childhood to current age. The work presented here is a critical component in establishing a foundation for understanding digital game related aspects of Generation X. It highlights the need to start thinking, discussing and exploring the varied characteristics, needs and preferences of both older and younger cohorts of the Generation X through not only a lifespan lens, but also through a life course lens, as they will be the next generation of older adult gamers. Thus, when this generation reaches older adulthood, academic communities and game developers are prepared, and ideally, have research-based approaches and solutions to promote quality of life.

References

1.   iStoppFalls (2011-14) iStoppFalls EU Project. Grant Agreement 287361 http://www.istoppfalls.eu/cms/front_content.php
2.   DISOVERSkills for Carers (2012-15) DISCOVER Skills for Carers EU project. Grant Agreement 297268. http://www.discover4carers.eu/
3.   Entertainment Software Association, Essential Facts About the Computer and Video Game Industry, 2017, http://www.theesa.com/wp-content/uploads/2017/04/EF2017_FinalDigital.pdf
4.   Marston HR, Freeman S, Bishop KA, Beech CL (2016) Utilization of digital games for older adults aged 85+ years: A scoping review. Games Health J; 5(3), 157-174. doi: 10.1089/g4h.2015.0087.
5.   Miller KJ, Adair BS, Pearce AJ, et al. (2014) Effectiveness and feasibility of virtual reality and gaming system use at home by older adults for enabling physical activity to improve health related domains: A systematic review. Age Ageing; 43:188–195.
6.   Bleakley CM, Charles D, Porter-Armstrong A, McNeil MD, McDonough, SM, and McCormack B (2015) Gaming for health: A systematic review of the physical and

cognitive effects of interactive computer games in older adults. J Appl Gerontol; 34:NP166–NP189.

7. Hall AK, Chavarria E, Maneeratana V, Chaney BH, Bernhardt JM (2012) Health benefits of digital videogames for older adults: A systematic review of the literature. Games Health J; 1:402–410.

8. L'Abate L (2009) The Praeger handbook of play across the life cycle: fun from infancy to old age. Santa Barbara, Calif.: Praeger/ABC-CLIO.

9. Brown, JA (2014) Let's play: understanding the role and significance of digital gaming in old age. Dissertation at the University of Kentucky. https://uknowledge.uky.edu/gerontol_etds/6/

10. Klara R (2016) 5 Reasons Marketers Have Largely Overlooked Generation X. Adweek.com. Retrieved from http://www.adweek.com/brand-marketing/5-reasons-marketers-have-largely-overlooked-generation-x-170539/

11. Taylor P, Gao G (2014) Generation X: America's neglected 'middle child'. Pewresearch center, USA. http://www.pewresearch.org/fact-tank/2014/06/05/generation-x-americas-neglected-middle-child/

12. Coupland D (2009) Generation A. Random House Canada. ISBN 978-0-307-35772-4.

13. Barnett D (2017) In the war between Millennials and Baby Boomers we have forgotten about the work-hard, play-hard generation X. Independent Newspaper, UK, http://www.independent.co.uk/life-style/health-and-families/millenials-generation-x-baby-boomers-a7570326.html

14. Prensky M (2001) Digital Natives, Digital Immigrants. From On the Horizon (MCB University Press), 9(5), October 2001.

15. Loos EF, Kaufman D: Positive Impact of Exergamin on Older Adult's mental and Social Well-being: In Search of Evidence. In Zhou J, Salvendy G, (eds.) Human Aspects of IT for the Aged Population. Healthy and Active Aging, Second International Conference, ITAP 2018, Held as Part of HCI International 2018 Las Vegas, July 15-20, 2016, Proceedings. Springer, Cham (2016).

16. Marston HR, Freeman S, Bishop KA, Beech CL (2016) Utilization of digital games for older adults aged 85+ years: A scoping review. Games Health J; 5(3), 157-174. doi: 10.1089/g4h.2015.0087.

17. Miller KJ, Adair BS, Pearce AJ, et al. (2014) Effectiveness and feasibility of virtual reality and gaming system use at home by older adults for enabling physical activity to improve health related domains: A systematic review. Age Ageing; 43:188–195.

18. Marston HR, & Smith ST (2013) Understanding the digital game classification system: A review of the current classification system & its implications for use within games for health. Human Factors in Computing & Informatics, LNCS, 7946, pp. 314-331. http://link.springer.com/chapter/10.1007/978-3-642-39062-3_20.

19. Brox E, Luque LF, Eversten, GJ, Hernandez, JEG: Exergames for elderly: Social exergames to persuade seniors to increase physical activity. In Pervasive Computing Technologies for Healthcare (PervasiveHealth), 2011 5th International Conference on, pp. 546-549, IEEE (2011, May)

20. Larsen LH, Shou, L, Lund HH, Langberg H: The physical effect of exergames in healthy elderly—a systematic review. Games for Health Research, Development, and Clinical Applications 2(4), 205-212 (2013).

21. Chao YY, Scherer YK, Montgomery CA: Effects of using Ninendo Wii exergames in older adults: a review of the literature. Journal of aging and health, 27(3), 379-402 (2015)

22. Loos EF, Zonnevald A: Silver Gaming: Serious Fun for Seniors? In Zhou, J., G. Salvendy, G. (eds.), Human Aspects of IT for the Aged Population. Healthy and Active Aging, Second International Conference, ITAP 2016, Held as Part of HCI International

2016 Toronto, ON, Canada, July 17-22, 2016, Proceedings, Part II, pp. 330-341. Springer, Cham (2016).

23.   Loos EF: Exergaming: Meaningful Play for Older Adults? In Zhou, J. & Salvendy, G. (eds.), Human Aspects of IT for the Aged Population. Healthy and Active Aging, Second International Conference, ITAP 2017, Held as Part of HCI International 2017 Vancouver, acnada, July 9-14, 2017, Proceedings, Part II Applications, Services and Contexts, vol. 10298 (pp. 254-265). Springer, Cham (2016).

24.   Marston HR, Kroll M, Fink D, Gschwind YJ (2016) Flow experience of older adults using the iStoppFalls exergames. Special edition: Digital Gaming & Ageing; Games & Culture Journal; 11(1-2); 201-222. doi: 10.1177/1555412015605219.

25.   Marston HR (2013) Digital Gaming Perspectives of Older Adults: Content vs Interaction. Educational Gerontology, 39(3), 14-208, doi: 10.1080/03601277.2012.70081.

26.   Whitelock LA, McLaughlin AC, Leidheiser W, Gandy W, Allaire JC (2014) Know before you go: feelings of flow for older players depends on game and player characteristics. In Proceedings of the first ACM SIGCHI annual symposium on Computerhuman interaction in play (pp. 277–286). doi:10.1145/2658537.2658703.

27.   Basak C, Boot WR, Voss MW, Kramer AF (2008) Can training in a real-time strategy video game attenuate cognitive decline in older adults Psychology and Aging, 23, 765-777.

28.   Aison C, Davis G, Milner J, Targum E (2002) Appeal and interest of video game use among the elderly. Harvard Graduate School of Education (working paper) i-28Clark, Lanphear, Riddick, 1987;

29.   Voida A, Greenberg S (2009) Wii all play: The console game as a computational meeting place. In Proceedings of the ACM SIGCHI Conference on Human Factors in Computing Systems (CHI 2009) Boston, Massachusetts, April 4-9. New York: ACM Press, pp. 1559-1568.

30.   Voida A, Greenberg S (2012) Console gaming across generations: Exploring intergenerational interactions in collocated console gaming. In Universal Access in the Information Society, 12(1), 45-56.

31.   Loos EF: Designing meaningful intergenerational digital games. Proceedings of the International Conference on Communication, Media, Technology and Design, Istanbul, 46-51. April 24-26 (2014)

32.   Costa L, Veloso A: Being (grand) players: Review of digital games and their potential to enhance intergenerational interactions. Journal of Intergenerational Relationships, 14(1), 43-59 (2016)

33.   Zhang F, Kaufman D: A review of intergenerational play for facilitating interactions and learning. Gerontology, 14(3), 127-138 (2016)

34.   Marston HR (2012) Older Adults as 21st Century Game Designers. The Computer Games Journal, Whitsun, 1(1): 90-102.

35.   Marston HR (2013) Design recommendations for digital game design within an aging society. Educational Gerontology, 39(2), 103-118, doi: 10.1080/03601277.2012.689936.
        http://www.tandfonline.com/doi/abs/10.1080/03601277.2012.689936.

36.   Marston HR, Kroll M, Fink D, Eichberg S (2014) Digital Game Aesthetics of the iStoppFalls Exergame. In B. Schouten et al. (Eds). p. 89- 100. Games for Health, 2014. Springer Fachmedien Wiesbaden. Doi: 10.1007/978-3-658-07141_12. http://link.springer.com/chapter/10.1007%2F978-3-658-07141-7_12.

37.   Brown JA (2016) Exploring the next generation of older gamers: Middle-aged gamers. In: Zhou J., Salvendy G. (Eds) Human Aspects of IT for the Aged Population. Healthy and Active Aging. ITAP 2016. Lecture Notes in Computer Science, Vol 9755. Springer, Cham.

38. Marston HR, Woodbury A, Kroll M, Fink D, Eichberg S, Gschwind YJ, Delbaere K (2015) The design of a purpose built Exergame for fall prediction and prevention amongst older adults. European Review of Aging and Physical Activity (EURAPA), 12:13; doi:10.1186/s11556-015-0157-4.

39. Campbell JA, Robertson MC (2003) Otago exercise program to prevent falls in older adults. http://www.acc.co.nz/PRD_EXT_CSMP/groups/external_providers/documents/ publications_promotion/prd_ctrb118334.pdf.

40. Gschwind YJ, Eichberg S, Marston HR, de Rosario H, Aal K, Ejupi A, Kroll M, Drobics M, Annegam J, Wieching R, Lord SR, Delbaere K (2014) ICT-based system to predict and prevent falls (iStoppFalls): study protocol for an international multicenter randomized controlled trial. BMC Geriatrics. doi:10.1186/1471-2318-14-91.

41. Kent S (2001) "And Then There Was Pong". Ultimate History of Video Games. Three Rivers Press. pp. 40–43. ISBN 0-7615-3643-4.

42. Schafer RG (1977) Computer in the (History) Classroom. AHA Newsletter, 15(7) Oct 1977.

43. Smith SG, Chabay R (1977) Computer games in chemistry. J. Chem. Educ; 54 (11), 688

44. Cullingford G, MJ Mawdesley, MJ, Davies P (1979) Some experience with computer based games in civil engineering teaching. Computers & Education; 3(3), 159-164.

45. Kolko DJ, Rickard-Figueroa JL (1985) Effects of video games on the adverse corollaries of chemotherapy in pediatric oncology patients: A single-case analysis. Journal of Consulting and Clinical Psychology, 53(2), 223-228.

46. Glen Glista GG, Helge G, Frank MD, Tracy FW (1983) Video Games and Seizures, Archives of Neurology, 40(9):588.

47. Lowery BR, Knirk FG (1982) Micro-Computer Video Games and Spatial Visualization Acquisition Journal of Educational Technology Systems; 11(2), 155-166. First Published December 1, 1982.

48. Long SM, Winston LH (1984) Rethinking Video Games: A New Challenge. Futurist, 18(6), 35-37.

49. Graybill D, Kirsch JR, Esselman ED (1985) Effects of playing violent versus nonviolent video games on the aggressive ideation of aggressive and nonaggressive children. Child Study Journal, 15(3), 199-205.

50. Kestenbaum GI, Weinstein L (1985) Personality, Psychopathology, and Developmental Issues in male Adolescent Video Game Use. Journal of the American Academy of Child Psychiatry. 24(3), 329-333.

51. Redd WH, Jacobsen PB, Die-Trill M, Dermatis H, McEvoy M, Holland JC (1987) Cognitive/attentional distraction in the control of conditioned nausea in pediatric cancer patients receiving chemotherapy. Journal of Consulting and Clinical Psychology, 55(3), 391-395.

52. Adriaenssens P, Eggermont K, Pyck W, BB Gilles (1988) The video invasion of rehabilitation, Burns, 14(5), 417-419.

53. Axelrod S, McGregor G, Sherman J, Hamlet C (1987) Effects of Video Games as Reinforcers for Computerized Addition Performance. Journal of Special Education Technology. 9(1), 1-8.

54. Silvern SB (1986) Classroom Use of Videogames. Educational Research Quarterly, 10(1), 10-16.

55. Silvern S, Williamson P (1987) The effects of video game play on young chldren's aggression, fantasy, and prosocial behavior. Journal of Applied Developmental Pshychology. 8(4), 453-462.

56. Schutte NS, Malouff JM, Post-Gorden J, Rodasta AL (1988) Effects of playing videogames on children's aggressive and other behaviors. Journal of Applied Social Psychology. 18(5), 454–460.
57. Cooper J, Mackie D (1986) Video Games and Aggression in Children. Journal of Applied Social Psychology. 16(8), 726–744.
58. Anderson CA, Ford CM (1986) Affect of the Game Player: Short-Term Effects of Highly and Mildly Aggressive Video Games. Personality and Social Psychology Bulletin 12(4), 390 – 402.
59. Creasey G, Myers B (1986) Video Games and Children: Effects on Leisure Activities, Schoolwork, and Peer Involvement. Merrill-Palmer Quarterly, 32(3), 251-262.
60. Graybill D, Strawniak M, Hunter T, O'Leary M (1987) Effects of playing versus observing violent versus nonviolent video games on children's aggression. Psychology: A Journal of Human Behavior, 24(3), 1-8.
61. Winkle M, Novak DM, Hopson H (1987) Personality factors, subject gender, and the effects of aggressive video games on aggression in adolescents. Journal of Research in Personality. 21(2), 211-223.
62. Gibb GD, Bailey JR, Lambirth TT, Wilson WP (1983) Personality differences between high and low electronic video game users. The Journal of Psychology: Interdisciplinary and Applied, 114(2), 159-165. http://dx.doi.org/10.1080/00223980.1983.9915409.
63. Egli EA, Meyers LS (1984) The role of video game playing in adolescent life: Is there reason to be concerned? Bulletin of the Psychonomic Society, 22(4), 309–312.
64. Harris MB, Williams R (1985) Video Games And School Performance. Education. Spring 1985, 105(3), 306-10.
65. Morlock H, Yando T, Nigolean K (1985) Motivation of Video Game Players, Psychological Reports 57(1), 247 – 250.
66. McClure RF, Mears G (1984) Video Game Players: Personality Characteristics and Demographic Variables. Psychological Reports, 55(1), 271 – 276.
67. Lin S, Lepper MR (1987) Correlates of children's useage of videogames and computers. Journal of Applied Social Psychology; 17(1), 72-93.
68. de la Hera Conde-Pumpido T, Loos EF, Simons M, Blom J: Benefits and Factors Influencing the Design of Intergenerational Digital Games: A Systematic Literature Review. Societies, 7(18) 2017

69. Brown JA, De Schutter B (2016) Game design for older adults: Lessons from a life course perspective. International Journal of Gaming and Computer-Mediated Simulations. 8(1), 1-12
70. McKay SM, Maki BE (2010) Attitudes of older adults toward shooter video games: An initial study to select an acceptable game for training visual processing. Gerontechnology. 9, 5-17.