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P.J. White
McMaster University
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Frank Devitt
National University of Ireland, Maynooth
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The Design and Development of Novel Cooking and Heating Products for Irish Older Adults: A Real Health Need

P.J. White, National University of Ireland Maynooth, Ireland
Frank Devitt, National University of Ireland Maynooth, Ireland

Abstract: The world's population is ageing; researchers have an increasingly important role to play in innovating new products, appliances and services to allow for better everyday living conditions of this ageing demographic. Health, wellbeing and age in place needs are of particular importance in Ireland as research has revealed that as a nation we are living longer in ill health (McGill, 2009). The most fundamental domestic products to health, wellbeing and in the promotion of ageing in place are cooking and heating products, however little design research has been carried out in this area. To inquire into the context of usability in older adults, ethnographic research has been conducted within the homes of participant older adults to obtain a true insight into user needs in cooking and heating products. This involved a yearlong (Spring, Summer, Autumn and Winter) study with forty participants over the age of 70 years across Ireland and from various socio-economic groups. From this study prototypes will be created and user tested by older adults to determine appropriate design criteria for these products.

Keywords: Older Adults, Product Design, Empathy, Design Ethnography, Personas

Introduction

Older Person Populations: The World and Ireland

I**T IS NOW** well documented that the world's population is ageing, it is projected that the population of people aged 60 and older will rise from just over 7 million in 2007 (United Nations, 2007) to over 1.2 billion in 2025 (World Health Organisation, 2000). By 2050 two billion older people are projected to be alive (United Nations, 2007) which will account for one out of five persons in the world (World Health Organisation, 2000). At this stage it is predicted that older people will outnumber young people (Harper and Leeson, 2008).

There are many reasons why this is happening. Factors such as decreasing fertility together with lengthening life expectancy and mortality decline in older persons (United Nations, 2001) are the main cause for the increase. Aligned with this are improvements in sanitation, housing, nutrition, and medical innovations in the developing world (World Health Organisation, 2000). The ageing population is a major demographic event and is due to have profound effects on humanity in the 21st century, socially, economically and otherwise. Health and wellbeing aspects for older people can create serious multifaceted threats if unprepared for or underestimated. Equally and seen positively, it can produce many opportunities greatly benefiting civilization.

Ireland's older population both north and south has and will see a noted increase in the coming decades. Latest census figures from the Republic of Ireland show that 11% of the population are 65 or older (Central Statistics Office Ireland, 2007) and 14% of the population in Northern Ireland (CSO and NISRA, 2008). In total this equates to approximately one million people aged 60 and over now living in the whole of Ireland. This trend is predicted to continue with dramatic results with a projected rise to 29% of the population by the year 2041 (McGill, 2010). The largest growth will be in the older old cohort (85 years and over) which is predicted to rise fivefold, from 74,000 to 356,000 by 2041 (McGill, 2010) By this year the projected male life expectancy at birth will be 86.5 years and 88.2 years for females (Central Statistics Office, 2008). This growth in population is predicted will have profound economic effects on the Republic of Irelands recessionary future with Standard and Poor's (2010) stating that without pension and healthcare reform, the country's debt could almost quadruple.

Older Persons Health Research

The importance of healthy ageing on the world's population has both far reaching implications and opportunities for our socio-economic climate in the decades ahead. Fundamentally, health is one of the three basic pillars of a world policy framework in active ageing and quality of life in ageing (World Health Organisation, 2002). The area of older person's physical, social and mental health or healthy ageing is as complex and diverse as the older global population itself. When identifying threats to healthy ageing chronic and non communicable diseases pose the greatest risk worldwide and this will continue to rise in the years ahead.

The main chronic diseases are heart disease, stroke, cancer, chronic respiratory diseases and diabetes with the common risk factors being unhealthy diet, physical inactivity and tobacco use (World Health Organisation, 2006). The effects of these conditions on the global mortality rate are vast, contributing to 60% of the total reported deaths worldwide with most of these conditions manifesting in the later stage of life (World Health Organisation, 2003b).

Irish ageing research is somewhat of a new phenomenon and is still in its infancy (CARDI, 2008). In recent times health research in older people is seen as a growing area of concern with research by McGill (2010) revealing that the Irish population is living longer in ill health. This research shows expected unhealthy years at birth averaging at 17 years for Irish females and 15 years for Irish males, a lowly 13th/14th position in a league of 15 EU countries. Similarly Fahey et al. (2007) found that only one in six older people considered their health to be 'very good', compared to that one in two of the working population (19-64 year olds) Research from Balanda et al. (2010) predicts the number of adults in Ireland with chronic conditions such as Hypertension, Stroke, Coronary Heart Disease, and Diabetes will increase dramatically between 2007 and 2020. It expects a 30% increase in Northern Ireland and a 40% increase in the Republic of Ireland with older adults in particular to be affected by the majority of these conditions.

Older Adult Heath, Nutrition and Domestic Heating

Food and heat and the adequate provision of these are basic human needs and as we get older these needs become greater in maintaining a healthy lifestyle. This was recognised in 2006

when a World Health Organisation report included the areas of Environment and Nutrition as part of ten major research areas for the promotion of healthy ageing. In this, environmental factors included the excesses of cold, excessive heat and the effects of extreme weather conditions on older people. From a nutritional perspective these were factors that influence eating habits in older adults (WHO and SNIPH, 2006).

These areas are also seen as fundamental to health and wellbeing in the Irish older adult population. In the first major study on the health, wellbeing and lifestyle of the over sixty-five population, Fahey and Murray (1994) used quality of life indicators as the provision and preparation of food and the ability to heat ones home. Of interest from a product point of view, is that in this study they use ownership of household durables as a measure of the level of deprivation in households that directly affects physical health. The report's findings called for the "complete elimination of deprivation of such basic amenities as adequate heating" (p.16)

Health and Nutrition

In older people, from a physical health perspective, one of the lifestyle characteristics most damaging to health are poor diet and nutrition. Poor nutritional intake in later life has serious implications leading to fatalities through many chronic illnesses. Included in these are heart disease, diabetes, osteoporosis, stroke and high blood pressure (World Health Organisation, 2003a). Good diet is continually proven to be a marker for good health, quality of life and lowering mortality. Barnett (1994) argues that dietary factors not only prevent chronic diseases but also delay the symptoms of ageing. Chronic nutritional based problems such as obesity and malnutrition are ongoing threats to good health in older people.

Under nutrition is seen as a high risk problem in both males and females in Ireland (FSAI, 2000). Detecting and preventing this can be difficult and delayed, in a study of Irish older people, Corish (2006) found that 15% of men and 16% of females were undernourished when admitted to hospital. According to the (Irish) Institute of Food and Health, malnutrition holds serious economic implications. In 2007 estimations show to have cost over 10% (over €1.5 billion) of Irish public spending on health (IFH and UCD, 2009).

Overweight and obesity are major modern growing health problems in all age groups throughout developed countries. It is now seen as a global epidemic with an estimated 1 billion adults overweight; at least 300 million of these considered clinically obese (World Health Organisation, 2003c). An Irish study of older adults has shown figures that are wor-ryingly high; in a nutritional assessment Corish and Kennedy (2003) found that 69% of men and 61% of women over 65 were overweight or obese. This has a significant risk to the older population; directly and indirectly being a major cause of chronic diseases such as heart disease, stroke, diabetes, and hypertension (World Health Organisation, 2003b). On the economic side, financial health costs are exceptionally high with overweight and obesity related cases estimated at €170 billion in the European Union alone (Elia, 2009).

Health and Indoor Temperature

Our physical environment and the conditions that we live in greatly influence our health and quality of life. There is increasing evidence that built environmental conditions have serious effects on physical, mental and social health. Poor environmental conditions are known to

cause chronic cardiovascular diseases, obesity and mental disorders such as chronic anxiety and depression (World Health Organisation, 2003d). There are many components in which the built environment affects health. Lavin et al. (2006) outlines these as temperature, humidity, noise, light, safety, space, accessibility, immediate surroundings, and the design, availability and maintenance of these components.

Indoor and household temperatures have major affects on health and mortality with a report by the World Health Organisation stating that "Extreme high and low temperatures [are] an underestimated cause of ill health and premature death in many countries" (World Health Organisation, 2001 p.12). It is commonly considered that older people stay indoors for longer due to factors such as poor mobility and as humans get older indoor temperatures have serious implications on health and mortality. One example of this being from a personal injury perspective with temperature extremes known to lead to more accidents within the home (World Health Organisation, 2001). In the United Kingdom indoor temperatures were shown to cause an additional 40,000 deaths in winter months than other months of the year (Wilkinson et al., 2001). Furthermore, the probability of the occurrence of damp and mould rises with poorly heated dwellings. This can cause physical ill health side effects such as increasing the risk of stroke, heart attack, hypertension and respiratory problems. Safe indoor temperatures recommended by the British Geriatrics Society are 21°C in winter and 18°C for a comfort level for most people (Lowry, 1989). The control of this indoor temperature could have serious implications on the health of older people. Bhaskaran K. et al. (2010) discovered that a 1°C reduction in temperature can equate to approximately 200 extra heart attacks, with older people most vulnerable to this effect of temperature reduction.

Methodology

To inquire into the holistic context of cooking, heating and health in Irish older adults inductive analysis research was used. Primary inquiry using ethnographic methods was conducted within the homes and the domestic environments of participant older adult stakeholders. The study was conducted over a period of one year in Spring, Summer, Autumn and Winter with ethical approval gained from the university prior to the study. Recruitment of participants was initially gained through email, telephone, and written letter correspondence. This recruitment was mainly through trusted gatekeepers such as occupational therapists, care homes and carers. Further recruitment was obtained within the field through word of mouth and participant friend and family referral. Forty participants were interviewed in total within their own domestic setting, the sample participants consisted of 10 male, 10 female and 5 male/female married and cohabitating couples. Each participant was over the age of 70 years of varying health status, and varying independence. The sample was spread over urban and rural locations in Ireland with participants from differing socio-economic backgrounds. Participants from eight counties were interviewed including Dublin, Kildare, Waterford, Kilkenny, Tipperary, Carlow, Laois and Wexford.

Ethnographic methods in this instance were used as a means of finding insights and product opportunity within the older adult population whist maintaining human centricity as a fundamental approach. The interviews were intended as a means of immersion in the older adult culture, to develop meaning and to tap into tacit knowledge of older adults. Furthermore this approach was used to demystify cultural differences and to prevent assumptive decision making early in the research process. These methods were utilised to provide both under-

standing and discovery in the research participant's natural setting and as a means "humanising stereotypes" (Agar, 1986 p.44). The ethnographic inquiry consisted of:

(i) Informal conversational interviews: This was used to build confidence and rapport from the participant from an early stage; interviews were based in an informal loosely structured format. Informality eased the participant into a relaxed discussion and built informant confidence allowing for flow of narrative inquiry. Outcomes of this consisted of rich collected data of lifestyle, past/present experiences and future product requirements.

(ii) Observation : The purpose of observation in this study was to visually collect data relating to and between domestic environments, artifacts and humans. In addition, observation was used to understand the arrangement, schematic and perceived affordances of products, usability and interactions in context. Of particular interest was the discovery of latent functionality within cooking and heating products for future design consideration and to observe and to learn from possible lead user adaptation.

(iii) Participation: The participation in using products informed and provided empathic insight to the study. This was achieved by reenacting steps of using products under natural conditions in the domestic environment with the intent of exploring barriers to which a user finds difficulty or fails to use a product. Examples of this included product controls such as the operation thermostats.

Field source data consisted of tape recordings, photographs, sketches and to a lesser extent the collection of artefacts. This source data was edited and organised in a single profile document per participant, recordings were transcribed verbatim and photographs were positioned in sequence with relative text within the transcripts. Transcripts were edited versions of the audio recordings and placed in a loose thematic narrative structure. Photographs were organised accordingly to coincide with this narrative. This resulted in a concise textual and visual documentation of all source data. This source data was manually coded in two ways open coding and focused coding.

Analysis

Open Coding: Developing a Thematic Framework

The transcribed profile documents were analysed using a grounded theory analysis to develop broad and detailed themes, patterns and theories from the data firstly through open coding. Text and images within each document were colour coded and assigned categories and sub categories in a thematic framework. As coding of theses profile documents progressed from #1 through to #40, four revisions of the coding thematic framework were evolved providing a detailed and concise record of themes and phenomena within each category. The final revision of the thematic framework consisted of two overarching categories: Person data and Product data.

- Person data consisted of personal profile data, environment and health data.
- Product data included cooking products, heating products and other product data.

Focused Coding and Persona Building

The second phase of coding consisted of a process of focused coding to uncover broad archetypal profile groups. To commence this, main insights from each participant were pulled into focus and interpreted. This consisted of drawing out a list of main insights including phenomena and or causal conditions where appropriate in each interview. These were then collated and categorised into three files; first 'Male' second 'Female' and third 'Couples'. To refine and compress this focused coding further, all insights were compared and contrasted to identify similar character traits in participants and grouped accordingly. Seven main themes emerged; these were archetypal profiles representative of the 40 participant's interviewed. Categorised into the following profile codes and descriptions:

- Persona#1: Couple: Couple with dependant partner profile (See fig1.)
- Persona#2: Female: Housebound profile
- Persona#3: Female: Capable female profile
- Persona#4: Female: Affluent profile
- Persona#5: Male: Capable male profile
- Persona#6: Male: Socially isolated profile
- Persona#7: Male: Rural profile

Following focused coding, data displays were built for peer analysis, validation and reliability purposes. In qualitative analysis Miles and Huberman (1994) states that a "Data display is an organised, compressed assembly of information that permits conclusion drawing and action" p.11. By categorising participant profiles into one of the seven predominant categories it was noted that 'persona' data displays could be collated. If certain codes clashed in terms of characteristics it was stored and assigned to an appropriate persona. This method enabled all codes from the ethnographic inquiry to be displayed as seven 'fictional' but representative personas and acted as a succinct method to visually share and communicate data for validity and reliability purposes. The use of personas in this instance is of particular interest to design research as it can be re-used in later stages of design processes such as ideation, conceptualisation and user testing phases.

Analysis and interpretation of persona data displays was conducted through memoing (Glaser, 1998). Peer analysis was conducted by introducing personas to three peers unfamiliar with the coded data; personas were introduced as fictional characters that represented a category of older adult and peers were asked to interpret meaning from each display. Each display was narrated and short theoretical memos were documented on the phenomena. Each memo was categorised and grouped under an assigned heading, these classified memos resulted in a framework for ideation of product solutions.
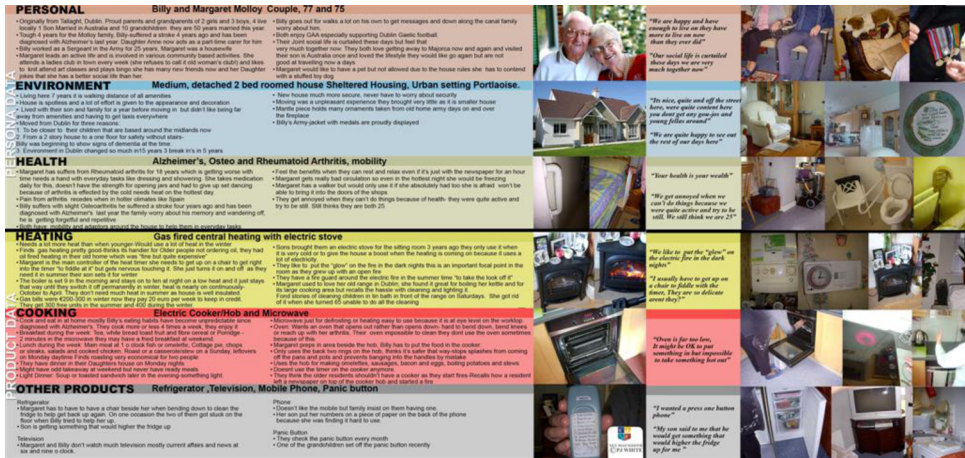
Fig.1: #1 Couple with Dependant Partner Persona Display: Billy and Margaret Molloy aged 77 and 75. © P.J. White

Results

Continually seen in the study was the intrinsic value of cooking and heating products in the health of the older adult. This supports the hypothesis that nutrition and environmental conditions are essential to older adult's health. Aside from health factors, insights pertaining to the design of these products were gained from diverse areas. Areas included social and emotional wellbeing, usability, ergonomics, cost and safety factors, all demonstrating the breath of necessity in these products. Deep and far reaching themes and insights were discovered in the form of previously unthought-of correlations to older person product interactions and usability. The following are the accumulation of these insights into two significant health themes.

Healthy Environments – Physical, Emotive and Social Spaces

Older adults require products that go beyond mere functionality namely products that enhance emotive, social, and physical spaces. Poor physical environmental conditions linked with social and economical issues were seen to have huge impacts on health and wellbeing. It was found that Irish older adults coping with poor mobility and or financial pressures are in particular finding difficulty paying for or are physically unable to heat their entire home. As a result a proportion of this demographic live in a small area of their dwelling, usually in the corner of a room beside a localised heat source such as a radiator. In many cases the remaining house is left in disrepair due to lack of use and open to health hazards through damp and deterioration. This phenomenon; recently cited as "Spatial Shrink" (McAvoy, 2007) is seen as a growing concern within cohorts open to impoverished conditions or susceptible to fuel poverty. To design products that prevent spatial shrink; cost mobility and ability factors come to the fore. Integrating a means of measuring efficiency and encouraging heat conservation will be considered together with the appropriate distribution of heat throughout the home. Considering this, it is intended to induce healthier environmental living conditions

with a built in flexibility that empowers older adults with reduced mobility and financial issues.

From a physical and personal health perspective, heat and heating products are used as a central means of comfort and a source to alleviate pain. Participants were observed using portable heating products to relieve pain associated with arthritis and poor circulation. Placing affected areas such as fingers or hands on a warm or cool surface meant gradual relief of pain. Comfort from heating products can also be enhanced in the aesthetic sense; the 'Open fire aesthetic' is seen as a preference in this case. Having a fireside light or 'a glow' emanating in a room provides a sense of heightened comfort even when a fire is not in operation. This provides comfort to relax, induces environments for activities and offers a sense of companionship.

The fire place, heating source and cooking products are domestic artefacts that encourage and foster social interaction in older people. These products in particular were continually seen to be used as social gathering points for informal meetings with friends and family. Cooking and heating products were also seen as the main focal point for display in the home. These products act as congregation points for important and sentimental material goods such as photographs, awards, mementos and religious artefacts (fig.2). This gathering of important artefacts assumes an emotive function for the older adult considered almost as a reminiscent focal point in the home. Developing these emotive functions further is of particular topical interest with recent research showing the positive effects of remembered experiences, improving wellbeing, communication and social contact (Woods, 2010). The display of material artefacts on and in cooking and heating products provides affordance for personalisation, designing future products with elements of personalisation will promote positive mental health through the act of reminiscence. This act of personalisation extends to the users comfort and familiarity within the domestic environment. This is seen as distinctly important at transitional periods in later life for instance moving home or when a spouse passes away.

Fig.2: A Female Research Participant's use of her Redundant Fireplace as a Gathering point for her Important and Sentimental Artefacts. © P.J. White

Health: Synthesising Sociality, Independence and Safety

Older adults were seen to view products as a balance between independence and social interaction, and new products developed should enhance this. Specific examples were seen in cooking and heating controls and the safe usability of these products. Also evident was a strong social bond in peripheral control products such as thermostats and temperature switches. In one respect the use of controls (for example on off switches on heating devices) are necessary for independence however in another it is seen that family, friend or carer interaction and involvement in these provide peace of mind and social contact. These controls also provide a sense of security and safety both for the user and the family/carer. Prioritising product safety and eliminating danger from the task of cooking food and heating their homes is of upmost importance. In designing future heating products it is proposed that this be a shared stakeholder concern. These controls should work with and not hinder the daily routine

of the older adult strengthening independence and self sufficiency. By providing levels of shared control over products this self sufficiency could be made available regardless of the level of ability of the user so it is viewed as manageable or as perceived independence. A significant aspect of designing these shared user products is the prevention of negative stigma by means of aesthetic or function. Examples of this would be in the design of appropriate user interfaces in products, providing approachable interaction with technology.

Older people require a platform to demonstrate ability rather than disability. The act of cooking for the older Irish population is seen as many things other than the provision of personal daily nutrition. Cooking is seen as an outward gesture of ability, a statement of independence and in addition, a central means of socialising. Cooking products should be designed to enhance a show of ability, independence and sociality in all older people. However evidence suggested that there was no allowance for the vast diversity of usability 'extremes' in the experience of cooking in older adult users. Extremes observed in the field ranged from experienced users with lifetime cooking skills to inexperienced users. Inexperienced user insights showed the struggles of older men learning to cook for the first time after their spouse passed away and how this has health and social implications on their life. This inability to cook or to provide meals for themselves was shown to lead to issues such as malnutrition or obesity and in some cases social exclusion. Also noted was the need for a healthy and approachable means to cooking for individuals living independently, specifically older men learning to cook for the first time. Health and nutritional empowerment within products can be achieved by providing adequate dietary information, allowing users to meet complex dietary needs through a usable, healthy means of cooking.

This design for extremes follows through to ergonomic, usability and ultimately safety of the user in their own environment. The challenge in these factors is to create products with a low learning curve allowing for decline in cognitive and physical ability associated with ageing. Most evident are audibility and visibility of controls and interfaces.

Conclusion

The products older people use, directly and indirectly influence health and wellbeing. This presents designers with vast opportunities to improve future product offerings. Cooking and heating products transcend the physical functionality and output of cooking food and heating environments. These products, fundamental in their nature and conventional in their domestic presence, assume holistic healthcare roles that can enhance emotive experiences, strengthen social bonds, purvey independence and sustain age in place.

New knowledge and insights from this study can lead to many new innovation streams for the design of fundamental products for older adults. The human centric, ethnographic approach of this research has uncovered many unforeseen possibilities improving stakeholder usability, independence and domesticity. From this research it is intended to proceed with a human centric approach in future stages of the design process through conceptualisation, prototyping, user testing and validation of products in the field.

Product specification from the study can be structured into three product areas, first being 'Cooking Products- ovens and hobs' second 'Heating Products- Space heating and stationary household heating products' and third 'Cooking and heating controls'.

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About the Authors

P.J. White

PJ has eight years experience as a Product Designer innovating for small to multi-national businesses and directing a design consultancy. His work at Schivo group Waterford included designing new products and project management from sketch to fully operational assemblies, liaison with clients and working with all departments throughout the product life cycle. Products range from the consumer, industrial solutions, computer and medical sectors. His work at Waterford Stanley/ AGA Food services group included generation of concepts for new stove and cooker products, liaising with marketing departments on consumer needs and requirements, developing concepts to fully working prototypes and creating final 3D parametric models and 2D detailed drawings for suppliers. He began his academic career as an Assistant Lecturer of Industrial Design and Product Design Innovation at the Institute of Technology Carlow. He joined the National University of Ireland Maynooth as a PhD Researcher and Associate Lecturer in October 2008 and became an Assistant Lecturer in September 2010. Here he teaches modules in Usability, Ergonomics and Aesthetics, Universal Design, Conceptualisation and Model-making, History of Design and Design Processes to Undergraduate Product Design students.

Dr. Frank Devitt
Dr. Frank Devitt is Head of the Department of Design and Innovation, in the School of Business at NUI Maynooth. Frank previously has been Head of Dept of Electronic Engineering and, prior to joining NUIM, he worked in technology industries doing international business for over 23 years. His various roles were CEO, Founder, Business Manager and Engineering Manager in a number of multi-national and indigenous firms.