Targeting Different Demographics

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ABSTRACT
The demographics of today's users of technology must be considered when designing end-user applications and working in the field of HCI. Targeting one single demographic group when designing software results in dissatisfaction from users who may not fit within the demographic. The interaction styles, motivations for use and targeting of multiple demographics are presented as challenges through a survey of seven articles related to the field of HCI and demographics. All authors urge that extensive research be carried out to gain a better understanding of today's technology users. Surveys, interviews and empirical studies are conducted to gather information about key demographics and associated behaviours and actions. The growing influence of the minority user demographics such as the older population and the lower-income class call for a shift in perspective when designing software for today's end-user. Although some differences cannot be resolved and result in trade-offs of satisfaction between varying demographics, the importance of considering all different groups and their values and roles is emphasised.

Author Keywords
Demographics; teenagers; HCI; older population; gender; intellectual disabilities; Down Syndrome; youth; male; female; race; income; socio-economic; class; disabilities

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
User demographics categorise users of technology into groups such as age, gender, race, disabilities and income and provide a means for researchers and software developers to gain an extensive understanding of how the world uses technology. Different groups exhibit different behaviours and attitudes towards software tools. Identifying these differences helps scholars to spot gaps in research and development and create solutions to contribute toward the goal of achieving universal accessibility for all.

For any one software product, there may be millions of different users from varying backgrounds who use that software as a tool for enhancing their everyday life – whether it be for entertainment, education or productivity purposes. To reach as large an audience as possible, software developers want to ensure their software product is not biased towards any one narrow demographic group. With vast numbers of computer users around the world with varying skill levels and disabilities, the needs and capabilities of all users must be taken into account.

The need to invent and develop new products that cater towards a vast majority of the population is also crucial. The current trends towards social media technologies and cloud computing present new grounds for products and technology that was never previously in demand.

This report surveys current literature in the field of HCI and various demographics, and looks at the various challenges involved in designing software for particular demographic groups – or multiple. It then discusses authors' approaches to the challenges presented, and summarises the methods and findings obtained.

CHALLENGES
With the rapid advancement of technology and its accessibility, the target audience of today's end-user applications reaches a far more diverse spread of people than a decade or two ago. The minority populations are fast becoming major technology users [7]. The way users interact with personal, desktop and mobile technology varies between demographic groups; as does their motivation and reason for using technology as a daily tool. Below the challenges of providing for a wide range of users are highlighted, as well as the issue of designing end-user applications for more than one demographic group.

Interaction Styles
The way software applications are used and on what devices changes dramatically depending on the demographic group. Teenage users are highly likely to make use of portable and mobile devices alongside desktop computers to access their 'digital possessions' on cloud services [5]. With a rapidly ageing population [3], it is important that today's touch-screen applications and ubiquitous software is made accessible and usable by the older demographic [4]. Yardi and Bruckman [7] present statistics that 75% of American families earning annual incomes of less than $30,000 own mobile phones, highlighting the opportunity for development of mobile applications targeted towards users from lower socioeconomic backgrounds. Their study also notes how devices are more likely to be individually-owned as

opposed to 'shared'. Challenges that arise from the differences in styles of interaction include displaying information on limited screen space as well as creating solutions to address demographic-specific issues such as child safety and literacy [7]. The need for detailed surveys computer usage and methods of interaction is stressed by all authors.

Motivations for Technology Use

Varying motivations for computer use are revealed when reviewing computer use amongst demographic groups. Beckwith and Burnett [1] suggest that motivation for using software differs greatly between the sexes, with males driven to use software for a 'productising' work domain while women favour using a collaborative team-based approach. This has much impact on the user 'rewards' that a developer can incorporate into their software. The older population desire to interact with software in an increasingly computer-prevalent society [4] where touch-screens have now made their appearance in museums, libraries, transport stations and banks. Entertainment is a major motive for technology use today by users of varying ages, race, gender and socioeconomic status. Feng and Lazar [2] present results of a national survey undertaken indicating 95% of surveyed children with Down Syndrome (DS) used their computers and personal devices for entertainment purposes, while 80% use technology for education. Fulfilling various user needs and wants must be taken into consideration when designing software applications.

Designing for Multiple Demographics

It is important that a software application reach as wide an audience as possible for exposure and to be effective. Feng and Lazar's [2] study on child computer users with DS states that 'one-third of the children use computers for communication', a figure largely different to neurotypical children and the classic American teenager who uses social technology as a primary means of communication [5]. DS children typically exhibit lags in learning and cognitive development and with affected motor skills, typical applications targeted towards the youth demographic may not be usable or understandable by those suffering from disabilities. The desire to create technology that is useful and effective does not only affect those with DS; Wong et al. emphasise a need for software to be readily accessible to those with intellectual disabilities, whose motor and cognitive capabilities affect a user's response time and level of understanding [6]. Designing end-user applications for both the male and female gender also raises design issues, due to differences in learning and their perceived 'confidence' when using software [1]. In many cases it may be impossible to produce the user experience intended if the target audience includes members with contrasting ways of decision making and thinking.

APPROACHES

There is a common thread to all of the literature surrounding the subject of HCI and demographics – a critical need to perform more research around the behaviours and motivations of today's users, and the importance designing for universal accessibility.

Calls for Research

Beckwith and Burnett [1] appeal for more research to be carried out concerning gender and designing end-user applications – with differing levels of 'risk avoidance' and confidence in performing tasks, differences between male and female end-users need to be examined and distinguished to ensure high levels of user satisfaction.

Goodman-Deane et al. [3] justify the need to shed light on how the older demographic use, and interact with, technology. With today's population gradually ageing and making up a larger percentage of the computer users in society, they suggest that new technologies be designed with the older demographic in mind in terms of response to information, accessibility, and as a support and tool for daily living.

Feng and Lazar [2] discuss the lack of empirical research conducted comparing computer usage between neurotypical and DS children. With technological and societal advancements enabling DS children to live and perform well alongside neurotypical youth in everyday lives, there is a considerable lack of development in the field of end-user applications and technology. There is a significant opportunity for technology to be developed to aid the education and entertainment of DS children, who can suffer from affected motor skills as well as cognitive, intellectual, learning, memory and sensory disabilities.

Designing for Accessibility

Yardi and Bruckman [7] explore 'broadening the vision' of the everyday end-user to one not of a middle-class white American family but to those belonging to the lower socioeconomic groups, of different races and family structures. They argue that the minority users are steadily becoming the majority and with a change in values, goals and relationship/family dynamics, should be a principle focus when designing end-user applications.

Murata and Iwase [4] highlight the importance of designing touch-screen interfaces in an accessible manner for the senior demographic. With the rise of touch-screen devices and portable technologies, the use of a heavyweight keyboard and mouse is slowly declining as older users begin to favour the accuracy and rapid-learning curve of touch-panels.

Odom et al. [5] recognise the teenage demographic as heavy users of social media and technology. Teenagers are quick to adopt new trends in technology and their constantly-adapting interests make them a key target audience for software developers. Odom et al. define the 'virtual possession' that teenagers hold meaning and value

to, and see technology as a tool to store, share, access and transport their possessions as well as gather 'social metadata' and create meaning to both material and virtual objects.

Wong et al. [6] also stress the cognitive, societal and software issues faced by those suffering intellectual disabilities when using end-user applications. They advocate the use of software in encouraging independence for the disabled demographic, as well as a tool for 'error-less' learning at the user's own pace.

METHODOLOGIES

Methods taken to produce and come up with solutions to the challenges faced in the literature ranged from face-to-face approaches to passive data collection.

On one side of the scale, [1] devised a taxonomy of the current literature written surrounding the subject of HCI and gender. They highlighted three key areas where male and female usage differed – 'confidence' in using software, 'support' involved when handling end-user applications, and the 'motivation' for using technology that affected a user's method of use and perception of 'reward'.

[2] designed a 56-question survey that was distributed digitally and in hard-copy to approximately 600 participants with DS. The parents of the children were required to complete the survey as it was decided the participants themselves may have difficulty in comprehending the survey questions. The surveys involved multi-choice questions, Likert scales and open questions. Feng and Lazar surveyed the group's general computer use, how they interacted with various devices, interaction with personal devices such as mobile phones, music players and gaming systems, as well as gathering background information for gathering accurate conclusions.

Other authors used a more active approach in gathering data by conducting experiments and meeting participants face-to-face. [6] gathered 57 participants from a 'computer technology training program' between the ages of 14 and 17 where participants were required to use Internet Explorer to complete common tasks in a competence test. Participants performed tasks such as opening and closing web browsers, using search engines, making use of 'language functions' and interacting with bookmarks.

[4] designed two experiments with 45 participants from three different age groups, including 19 participants from the senior population. Using a personal computer and a 'touch panel' participants were required to point to a specific location on the screen using their index fingers. The accuracy and speed of the pointing was measured.

[7] conducted interviews amongst 16 parents from middle/upper-class families and low-income African American families. Interviews lasted 15 minutes to 1 hour, and findings on the family dynamics and use of technology were made. Details on rules and safety enforced in the use of technology at home were gauged from the interviewees.

Similarly, [5] conducted a field study with 21 American teens, heavy digital and social media users. Interviews were held in the participants' bedrooms and the teens gave the authors a tour of their personal bedroom, as well as material and virtual possessions that their bedroom contained.

FINDINGS

The findings described highlight key areas of weakness and lack of development within the field of HCI when designing for a range of audiences. Within demographics behavioural differences can be seen. Many minority user groups express difficulty when performing basic tasks on current end-user applications on cognitive and physical levels. Results obtained from experiments and empirical studies show where various user groups excel and do not perform well. Interviews and reviews of current literature reveal differences in values and ideals amongst users.

Experimental Results

The survey held in [2] gathered significant data that highlighted the major difficulties faced by children with DS in performing tasks on software designed for the neuro-typical youth. Children with DS typically lag in reading and writing development and their reading skills were a hindrance when using the Internet to gather information. A significant majority of DS children showed 'signs of frustration' when navigating their way around the Web space, encountering errors and when experiencing slow loading time. An overload of information on a website made for unnecessary complexity which made many sites hard to comprehend. Websites that lacked fluidity and uniformity were also a hurdle for children with DS. Many children with DS also suffer from memory loss and their inability to concentrate for long periods of time was another source of difficulty when using sites designed for the neuro-typical child.

In the competence test performed in [6], Wong et al. found that users with intellectual disabilities found difficulties in performing the 'use customised bookmark' task which required a higher level of cognitive thinking as well as finer motor skills.

A speed and accuracy test designed in[4] found that as the age of the computer user increased, the time taken to hit a target onscreen using a mouse significantly increased, while the average time taken using a touch panel was dramatically shorter, highlighting the benefits of using touch panels for users of the older demographic.

Design Opportunities

[1] gathered findings on the confidence, support and motivation for using technology through a review of the current literature on the subject. It can be seen that females are more likely to exhibit 'risk avoidance' and show less confidence when performing tasks on end-user applications in comparison to males. The difference in learning styles between the genders was highlighted and Beckwith and Burnett advocate different styles of support for helping

males and females process data in different ways. It was shown that females enjoy working with applications that involve a collaborative aspect while males favour competition and independence in learning.

[7] recognised differences in the use of technology and rules surrounding its use between the different socioeconomic classes in their study. Both the middle/upper-class and lower-income parents used mobile phones to communicate with their children concerning transport and after-school activities. Both groups monitored Internet usage by setting a time limit or cut-off on certain days of the week. Parents recognised that their children were hiding the websites that they visited via private browsing or erasing their history and this indicated a lack of ability to monitor what content their children were viewing. Higher socio-economic families typically used individual, separate devices while 'shared devices' were more commonly seen in lower-income households. Key differences in responsibility, values and views of economic status were highlighted between the two socioeconomic levels.

[5] expressed opportunity for designing tools to support and enhance social media and technology use in teenage lives. Using features such as 'tagging' photos allows teens to associate virtual possessions with 'social metadata' and hence create value around virtual objects. The use of cloud-computing services to store and transport data allows possessions to exhibit 'placelessness'. Filtering how users present themselves to various social groups allows teens to curate the 'presentation of self' and tailor their online personalities to fit within certain groups.

SUMMARY

Dealing with the multitude of varying demographics who are quickly becoming major users of computing technology presents many challenges. Age and socio-economic status play a large part in determining how users interact with technology, be it via portable devices or desktop computers. Within demographics such as gender, users can have highly contrasting behavioural patterns and motivations for using an end-user application, which greatly affects their satisfaction of use. Attempting to cater an end-user application for users with varying skill levels and cognitive/intellectual capabilities can present many challenges to the software developer. All authors mentioned agree that opposing viewpoints within demographics and minority groups must be taken into consideration when designing for accessible and satisfying end-user applications. A plea for more research and development in the area of HCI and demographics is emphasised by many. Murata and Iwase [4] and Wong et al. [6] conduct empirical studies and experiments with statistical findings that relate increased accessibility to activities with a lower cognitive-load and higher physical tolerance. Beckwith and Burnett [1] and Goodman-Deane et al. survey current research literature and highlight key design opportunities in their fields. Odom et al. and Yardi and Bruckman use interviews to gather research on the values and responsibilities held by media-savvy teenagers and lower-income households alike. There are clear opportunities for research and design of new technology solutions to achieve universal accessibility and enhance the lives of millions of computer users around the globe, by pinpointing key needs and wants of the diverse demographic groups that computer users are made up of.

FUTURE WORK

All authors express a need for extra research into the various demographics and their computer usage. Gathering more in-depth data with larger numbers of participants would enable researchers and developers alike to ascertain areas of opportunity and areas of weakness amongst different user groups.

Feng and Lazar [2] and Wong et al. [6] performed studies using mainly the Web to gather data. Similarly, Murata and Iwase [4] conducted an experiment using a basic experimental design. Gathering information about computer usage via social media and offline programs as well as mobile applications would broaden the scope for the HCI and demographics field.

The demographics of users can be divided into many sub-categories, as Beckwith and Burnett [1] deduce with the taxonomy that they present. There are still large numbers of participants who were not considered in the described articles whose computer usage information would contribute towards the studies – teenagers who are light users of social media, for example, as well as subdividing the genders by family dynamics and employment status. The overlap between various demographics would be a highly interesting field of research to get involved in.

Studying applications, websites and end-user applications that attract a wide number of participants from varying demographic backgrounds could draw conclusions about values commonly shared and behavioural characteristics exhibited by different demographic groups. For example, the Android app 'Angry Birds' attracts users from all ages, economic status and location – analysis of popular applications would help to distinguish common features to contribute towards universal accessibility and increased user satisfaction among users.

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