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Personas as a user-centred design tool for the built environment

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The physical structure of a city frequently defines how people interact with each other and their environment. This paper examines the use of personas as a user-centred design tool for the re-engineering of a city to promote sustainable behaviour and social inclusion of its citizens (the Eight Eyes of Dublin Project). The research was carried out through the adoption of personas and collaboration with design partners to identify barriers to sustainability, and resulted in recommendations for the future development of Dublin city, Ireland. These recommendations are then compared with the draft Dublin development plan 2011–17 to determine the effectiveness of personas as a design tool for identifying key issues for sustainability in the built environment. The results suggest that personas may be an appropriate tool for universal design and may act as a good diagnostic tool in the early stages of the re-engineering of urban areas towards sustainability. It is concluded that personas may work most effectively when used in combination with other user-centred design tools, such as participatory design.

1. Introduction

Over 50% of the world's population now live in cities (UNFPA, 2009). Urban environments account for more than 70% of the total energy consumed by humans despite the fact that cities and towns only occupy 0.4% of the earth's surface (Filippin and Flores Larsen, 2009). Furthermore, cities and urban areas emit 75% of the world's greenhouse gases (Clinton Climate Initiative, 2009). It is argued that increased urbanisation will lead to an increase in the consumption of resources and environmental damage unless our development trajectory is substantially altered. Urban environments are clearly a driving force of global development; however, they also offer opportunities for change and are quite likely to act as the fulcrum around which sustainable development may be achieved in the future. Cities, when well-planned, can offer living conditions that facilitate socially, environmentally and economically sustainable behaviour.

A sustainable city is one that keeps its resource use and waste generation to within the limits of the planet (Chi *et al.*, 2006). For example, dense and more compact urban settlements allow for increased active travel and public transport use thus reducing

reliance on car travel, energy consumption and carbon dioxide emissions (Newman and Kenworthy, 1989). The retrofitting of existing buildings and the energy-efficient design of new buildings is also contributing to reduced energy consumption within cities. Dale and Newman (2008) argue that social capital and strong communities are also essential ingredients for the creation of a sustainable city. However, cities have traditionally been designed for cars, therefore in order to create socially sustainable cities there is a need to refocus urban design on the people who use the built environment (Randall, 2003).

It is imperative to understand the hindrances and barriers to sustainability created by the built environment in order to appreciate how the existing structure of the city needs to be re-engineered to promote sustainable behaviour among the urban population, such as reduced car use and increased public transport use and active travel, improved social cohesion and reduced energy consumption.

1.1 Universal design and urban sustainability

In order to achieve global sustainability, sustainable behaviour of urban populations, such as that outlined above, needs to be

facilitated. However, the needs and demands of urban citizens varies considerably (Afacan and Erbug, 2009), therefore the user-centred design of cities is becoming a pressing issue for global sustainability. 'Universal design' is a framework for the design of products, places, information and policy so as to be usable by the widest range of people operating in the widest range of situations (Center for Universal Design, 1997; Knecht, 2004). It seeks to design for all users rather than focusing on usability for people with disabilities or special requirements (Iwarsson and Stahl, 2003).

The universal design approach views disability as a socially constructed state due to the environmental barriers in which the user exists (Gossett *et al.*, 2009). The same could also be said for unsustainable behaviour, which is often caused by poor design of the built environment that forces the user to engage in environmentally damaging behaviour. Through careful consideration of user needs in the design of the built environment, cities can be created that allow the social inclusion of all members of society and facilitate environmentally sustainable behaviour by its citizens. However, there is a need to involve residents of the area in the design of the built environment in order for future developments to be successful in the long term (Cabe, 2007).

User-centred product design has been used to facilitate sustainable behaviour, such as in the design of Unilever's dishwasher tablet, which allows the user to use the optimum amount of powder while minimising negative environmental impacts (Lockton *et al.*, 2008). However, to date there has been little work carried out on methods for universal and sustainable design within the built environment. Afacan and Erbug (2009) developed a heuristic evaluation method to allow designers to consider universal design in the built environment, but this work does not consider the environmental sustainability of the design.

1.2 User-centred design tools

Typically, user-centered approaches agree design goals between users and designers; these designs are then developed and tested with users until the goals are met (Blomquist and Arvola, 2002). There is a wide variety of methods to assess the needs of the user in the design of products and environments. These include field studies, iterative design, focus groups, user interviews (Mao *et al.*, 2005) and contextual and participatory design (Blomquist and Arvola, 2002). Scenario planning has been used by architects and planners to introduce potential future needs into the design of the built environment (Brand, 1994); however, this frequently focuses on a very small group of users. In order to engage citizens in the design of their built environment, methods such as public meetings, consultation events, special interest forums, exhibitions and interactive websites have also been used (Wates, 2000). Nevertheless, not all members of a community engage with the design process.

Despite the plethora of design tools, universal design is still a challenging process. Pruitt and Adlin (2005) argue that the reasons for this are threefold. First, it is frequently difficult for the designer to understand truly the users' needs; second, users' needs are complex and varied and frequently the needs of different users contradict one another; finally, there is a need for methods that maintain the user at the centre of the design teams' efforts. In addition to these issues, when attempting to include the community in the design of the built environment it is difficult to engage all citizens and users, therefore there is a risk that not all users' needs will be considered by the tools outlined above and by Wates (2000). Pruitt and Adlin (2005) suggest that the use of fictional personas may offer an engaging and focused embodiment of the user to which design teams can refer to ensure that their designs remain user focused. This tool also offers a method through which the needs of users who do not engage in the participatory process can be considered in the design plans.

1.3 Personas as a design tool

Cooper (1999) developed the concept of personas as a goal-directed design tool for software design. When attempting to design user-friendly products the needs of the user may be ill-defined leading to a design that fulfils no user's needs fully; however, using personas in the design process forces the designer to deal with specific user needs (Cooper, 1999).

A persona is a precise description of the user and what they wish to achieve (Blomkvist, 2002). They are normally constructed from data gathered from interviews, questionnaires, focus groups and work with design partners (Bichard *et al.*, 2005), and offer a narrative of the user's experience with a product or system. In order to be effective personas need to be goal orientated as the goal gives direction to the design (Jacobs *et al.*, 2008). Blomkvist (2002) noted that the more specific the persona the more effective it is as a design tool. As a critical design tool, personas allow for greater understanding of users, their goals and behaviours within a specific environment. They provide a snapshot of user needs, are an engaging reference for professionals (Bichard *et al.*, 2006), and serve as a communication tool that keeps the user at the centre of the design process (Blomquist and Arvola, 2002). In addition, the use of personas facilitates universal design as a design solution can be matched to a number of seemingly disparate user groups, through identifying similarities of need between different personas (Bichard *et al.*, 2006).

1.4 The use of personas in the design of a sustainable built environment

In order to enable environmentally sustainable behaviour and social inclusion within a built environment it is necessary to develop physical structures that facilitate rather than hinder the population. This research sought to use personas to

identify aspects of the built environment of Ireland's capital city, Dublin, which hinders sustainable behaviour and social inclusion of its citizens, and to recommend ways in which the city could be retrofitted in order to facilitate both environmental and social sustainability.

The use of personas as a design tool for product design can be transferred to the design of a user-centred built environment. Personas can be used to create accounts of a particular citizen experience within a given built environment, to describe how the user interacts with the physical environment of the city, and how this enables or prohibits their desired behaviour. Personas have been used to voice how the failing of product design restricts certain users and to identify future design solutions that can meet user needs better (Richard *et al.*, 2006). Through the application of personas to the design of the built environment similar conclusions can be drawn, as aspects of the city that restrict use by certain personas can be identified and recommendations for retrofitting and re-engineering to provide a more user-centered and sustainable design can be made. In keeping with the philosophy of universal design this research seeks to identify common needs within the built environment across many personas in order to make recommendations for future development scenarios for Dublin city, which could serve to improve sustainability for all citizens.

The population of Dublin city is just over 500 000 (Central Statistics Office, 2010) and the city covers 115 km². Dublin is at sea level, and is naturally divided into north and south by the River Liffey and is ringed by the Royal Canal to the north and the Grand Canal to the south. The city centre is served by rail, tram and bus networks. In the recent European green city index report (Siemens, 2009), Dublin ranked 21 out of the 30 European cities examined in terms of environmental sustainability, and last in terms of its transport options.

The draft Dublin city development plan 2011–17 (DCC, 2010), hereafter referred to as the draft development plan or the plan, seeks to ensure that Dublin becomes a sustainable, accessible city with thriving neighbourhoods. Dublin's citizens were engaged in the development of the plan through consultation events and an online comments forum. The plan places the creation of a low carbon sustainable Dublin as its top priority and recognises the need to put the user at the centre of future development if this goal is to be achieved. This paper investigates the degree to which personas can be used to further this goal and the extent to which the draft development plan already recognises the needs of Dublin's citizens.

The remainder of this paper will outline the methodology used for the creation of the personas, and will discuss how these personas were used to assess the effect of Dublin's built environment on the sustainable behaviour and social inclusion

of its citizens. The personas' recommendations for the improvement of Dublin's built environment will be compared with the objectives of the draft development plan (DCC, 2010), and a tangible example of barriers to footpath accessibility is discussed. Finally, the suitability of personas as a design tool for the re-engineering of the built environment is discussed.

2. Methodology

2.1 Development of the personas

Personas were developed and adopted by the researchers in order to identify the barriers to sustainable behaviour and social inclusion. Pruitt and Adlin (2005) outlined the stages of persona development as: the identification of representative users; data collection; persona creation; persona development and validation of the personas. This method was followed in the development of the personas for this current project. Initially, Central Statistics Office (2010) data were consulted to determine the demographics of Dublin's population; using these data a brainstorming session identified 20 potential personas. Blomquist and Arvola (2002) recommend that when the needs of two personas overlap they should be merged into one; this was the case with many of the personas in the initial list of 20, such as a wheelchair user and an elderly person, both of whom have limited mobility and as a result may be socially excluded from many aspects of urban living. A cast of between three and seven personas has been suggested as reasonable when conducting work of this nature (Blomquist and Arvola, 2002). When the personas with overlapping needs were eliminated eight personas remained; these personas and how they represent Dublin's population are detailed in Table 1. The choice of the personas will always affect the results from work of this nature; however, it was felt that the personas chosen for this research were representative of the needs of the Dublin population. In particular the wheelchair user was appropriate as their needs represented those of anyone with limited mobility. The urban food grower also considered the potential impacts of future threats to food security, especially for an island nation such as Ireland, which relies heavily on imported food.

In the next stage, the behaviour, expectations and motivations of these personas were identified through several sources, which included interviews and questionnaires delivered to relevant stakeholders in addition to work with specific design partners. Central Statistics Office (2010) data were also consulted to provide additional details on the interaction of each persona with Dublin's built environment. The personas were then developed and in the final stage they were validated with the design partners to ensure that they were representative of typical citizen behaviour.

Once the initial stage of stakeholder engagement has been completed and the personas have been developed they can be

		Name							
		Leah	Jennifer	Owen	Dylan	Anna	Brian	James	Aoife
Persona type	Urban food grower	Artist	Wheelchair user	Child	Suburban dweller	Tourist	University student	Expectant mother	
Age (years)	24	38	28	11	32	42	21	30	
Gender	Female	Female	Male	Male	Female	Male	Male	Female	
Employment	Young professional	Self-employed artist	Civil servant	Primary school student	Young professional	Accountant	University student	Engineer	
Place of residence	Rented apartment just outside the city centre	Small rented house in the north inner city	Semi-detached house in a north Dublin suburb	Detached house in a south Dublin suburb	Semi-detached house in a newly built north Dublin suburb	Hotel in the city centre	Rented apartment in a north Dublin suburb	Semi-detached house in a south Dublin suburb	
Goals	To be able to grow a percentage of her own food	To be able to live a sustainable lifestyle in Dublin while working as an artist	To be able to live in the city centre and engage in normal social activities	To be able to travel to and from school and extracurricular activities using active or public transport	To be able to engage in active travel and leisure activities in her newly developed neighbourhood	To be able to visit Dublin in a sustainable manner	To reduce his energy consumption	To be able to engage in normal social activities despite her pregnancy	
Persona's representation of Dublin's population	Dublin is experiencing increasing demand for allotment space and a limited supply from county and city councils (Healy, 2006)	The needs of artists and an unwaged person were deemed to be similar. In November 2009 425 000 people were unemployed in Ireland (Central Statistics Office, 2009)	Over 36 000 people in Ireland have a disability, the majority of whom have limited mobility (Central Statistics Office, 2006a)	There are over 110 000 children of primary school age in Dublin (Central Statistics Office, 2006c)	33% of Ireland's housing stock has been built since 1996, and many housing estates are currently unfinished or vacant (Department of Environment, 2007)	5 600 000 tourists visit Dublin every year (Failte Ireland, 2008)	There are over 53 000 university and college students in Dublin (Central Statistics Office, 2006c)	In 2006 there were 18 000 births in Dublin (Central Statistics Office, 2006b)	

Table 1. Details of the eight personas adopted in the project

integrated into the design process, therefore making this method less labour intensive for the stakeholder than methods such as participatory design. Personas do not necessarily require direct engagement with stakeholders as statistical data can be used to develop the personas, therefore allowing consideration of the needs of users who do not readily engage with typical stakeholder engagement processes such as public meetings.

2.2 Description of the scenarios and field studies

Typically when using personas as part of the design process the personas are placed into a scenario that describes the contexts in which a user interacts with the product or system in question (Blomkvist, 2002). These scenarios identify gaps that frustrate the achievement of the personas' goals and identify opportunities for improved design and recommendations for future development (Langwald *et al.*, 2007). In this current project, once the development of the personas was complete the researchers created scenarios for each of the persona's interactions with the built environment. These scenarios were conducted through field studies during which the researchers adopted a selected persona and experienced a typical journey through the eyes of their persona. These journeys involved a 'day in the life' experience for the chosen persona in Dublin's built environment. The journeys involved taking public transport, engaging in active travel, shopping, leisure activities and consideration of energy consumption and the environmental impact of behaviour. Props such as a wheelchair, an empathy pregnancy belly and a chest-mounted camera were used to help the researchers identify with their personas more fully and record their experiences. Their experiences were related back to the individual goals of the personas as outlined in Table 1, and were recorded using field notes and digital photography. In order to ensure the personas accurately represented the experience of real users, the design partners for each of the personas were also observed interacting with various aspects of the built environment. The scenarios

identified barriers within Dublin's built environment for each of the personas and recommendations were made as to how these barriers could be overcome. These recommendations were then compared with the draft development plan (DCC, 2010) to determine whether the diverse needs of the personas could be met by the plan and to assess the suitability of personas as a user-centred design tool for the built environment.

3. Results

3.1 Barriers within the built environment

Each of the eight personas had a unique experience of Dublin's built environment as they each had different goals that they hoped to achieve. However, the barriers that they encountered were frequently similar, as detailed in Table 2, and therefore the recommendations for the re-engineering of Dublin towards a more sustainable and universally designed city are a result of the convergence of the needs of all of the personas, as outlined in Table 3.

As shown in Table 3, a total of 28 barriers were recorded by the eight personas along with 31 recommendations for changes to Dublin's built environment. The barriers and associated recommendations can be grouped into five categories

- (a) the need for better local amenities
- (b) the need for improved transport networks
- (c) a greater provision of green spaces
- (d) accessible and universally designed streets
- (e) more energy-efficient buildings.

Table 2 represents the common barriers encountered by the different personas and where overlaps between the personas occurred. As Table 3 provides detail as to the barriers experienced by the personas it will not be repeated here. Therefore, the remainder of this section will discuss the recommendations made for the re-engineering of Dublin's

Persona/category	Local amenities	Transport	Green space	Inaccessible streets	Energy-inefficient buildings
Urban food grower					
Artist					
Wheelchair user					
Child					
Suburban dweller					
Tourist					
University student					
Expectant mother					

Table 2. The category of barriers experienced by each persona. Grey indicates experience of the barrier

Category	Common barriers	Recommendations for improvement
Local amenities	Access to basic amenities such as leisure and social activities, school, doctors and grocery shopping required travel by car Lack of access to public leisure space, which eroded social cohesion	Improved local amenities in the neighbourhood accessible within a walkable or cyclable distance
		Improved public space
Transport	Public transport is inaccessible and unreliable Lack of real-time information on public transport Out-of-order lifts and insufficient or inaccessible ramps at public transport stations Lack of sufficient priority seating on public transport Lack of access to toilets on public transport Many locations are not served by adequate public transport Walking and cycling routes are unconnected, unsafe, incoherent and inaccessible to many personas	Better real-time information on public transport
		Functioning lifts on all forms of public transport
		Self-service ramps
		More priority seating for a wider variety of users on public transport
		Better access to public toilets on all public transport routes
		Better reliability and frequency of public transport
		More locations served by public transport
		Faster, cheaper and safer public transport
		Improved walking and off-road cycling routes that include routes connected to public transport networks
		Improve the provision of city centre green space for recreation and urban food growing
Green spaces	Poor access to public green space for recreational use Lack of access to space for food growing within the city Poor-quality public realm Many green spaces in Dublin city centre are inaccessible or have restricted public access	Create green spaces on unused sites within the city
		Retrofit roof gardens and balconies to apartment buildings to provide more private open space
		Provide communal composters or wormeries in apartment buildings or housing estates
		Create green corridors that would function as pedestrian and cycle routes as well as a recreational space that connects the city
		Creation of leisure facilities in parks such as outdoor gyms
Inaccessible streets	Barriers on pavements such as lampposts and bins Poor signage and lack of street furniture Narrow pavements Cobbled streets and uneven pavements Lack of kerb cuts Steep steps into many buildings Lack of public toilets Lack of connectivity for pedestrians and cyclists	Removal of barriers on pavements
		Retrofitting of pavements to improve surfaces and create a cohesive network of kerb cuts
		Improved and cohesive street signage and street furniture
		Provision of a network of public toilets
		Smooth sections on cobbled streets
		A cohesive network of cycle paths
		More efficient heating systems in buildings
Energy-inefficient buildings	Insufficient thermal insulation, which leads to higher heating bills Lack of information on energy consumption Lack of ability to control energy consumption Energy-inefficient heating systems Energy-inefficient appliances Inaccessible buildings increases energy usage Inability for a tenant to improve the sustainability of their home	Better thermal insulation in buildings
		Improved information for residents and provision of building energy management systems
		Automation of energy use within buildings
		Energy-efficient appliances
		Universal design and improved accessibility in buildings
		Change to the Tenancy Act to allow tenants to improve the sustainability of their homes
		Provide loans to renters from utility companies for the retrofitting of buildings; these loans would then be paid back through utility bill payments

Light grey signifies recommendations included in the draft development plan, dark grey identifies recommendations that are not considered by the plan.

Table 3. Common barriers encountered by the personas and recommendations for improvements to the built environment

built environment and how this relates to the objectives of the draft development plan (DCC, 2010).

3.2 Persona recommendations and the Dublin city development plan

The recommendations for the re-engineering of Dublin’s built environment made by the personas (Table 3) were compared with the policies and objectives outlined in the draft development plan (DCC, 2010). The plan addressed the majority of the recommendations made by the personas; however, it was noted that the personas’ recommendations not addressed by the plan tended to be focused on specific aspects of universal design, see Table 4.

As shown in Table 2, five of the eight personas made recommendations for improved provision of local amenities; this is addressed by the draft development plan as it aims to create a range of local amenities and public spaces in all neighbourhoods, especially new developments. The access to these amenities will also be improved through the creation of walking and cycling routes. Transport routes were highlighted as a barrier by seven of the eight personas, and most of the personas’ recommendations are addressed by the draft development plan. The plan sets out objectives to increase the use of public and active transport through the creation of a cohesive network of walking and cycling paths within the city, and aims to make the cycle network accessible to more vulnerable users through the separation of cyclists from other road users. There are also plans to extend the public transport network and provide real-time information on all routes. Whereas the draft development plan mentions the need for universal design it does not include some of the specific recommendations that

were made by the personas, such as improved lift and ramp facilities, more priority seating on all forms of public transport and increased access to toilet facilities (Table 4).

The draft development plan recognises the need for increased provision of green space and therefore addresses many of the personas’ recommendations in terms of ensuring there is sufficient green space in all new developments and providing green roofs for new apartment buildings. It also recognises the need to create new green spaces for existing developments and suggests using derelict sites for recreational sites and allotments. There are also plans to create a network of green corridors within the city that connect existing green spaces in order to create a cohesive green infrastructure. While the plan recognises the lack of access to green space for apartment dwellers, it makes no recommendations as to how this could be overcome for existing buildings or how urban food growing could be promoted. Therefore the personas’ recommendations of retrofitting balconies and roof gardens to existing apartment buildings and providing communal composters and wormeries (Table 4) may further improve the draft development plan’s goals and help to meet the needs of a wider range of Dublin’s residents.

Features of Dublin’s built environment that made its streets inaccessible were noted as barriers by five of the eight personas used in the project (see Table 2). These included unconnected and unfinished pavements (Figure 1), which made it difficult for the suburban dweller to access their neighbourhood on foot, and a lack of kerb cuts on pavements (Figure 2), which acted as a barrier to the wheelchair user. Congested (Figure 3) and narrow pavements (Figure 4) were barriers for the wheelchair user,

Category	Recommendation not considered by the development plan
Transport	Functioning lifts on all forms of public transport Self-service ramps More priority seating for a wider variety of users on public transport Better access to public toilets on all public transport routes
Green spaces	Retrofit roof gardens and balconies to apartment buildings to provide more private open space and space for growing food Provide communal composters or wormeries in apartment buildings or housing estates
Inaccessible streets	Provision of a network of public toilets Smooth sections on cobbled streets
Energy-inefficient buildings	Improved information for residents and provision of building energy management systems Automation of energy use within buildings Energy-efficient appliances Change to the Tenancy Act to allow tenants to improve the sustainability of their homes Provide loans to renters from utility companies for the retrofitting of buildings; these loans would then be paid back through utility bill payments

Table 4. Recommendations made by the personas not considered by the draft Dublin city development plan

tourist, expectant mother and child. The draft development plan addresses some of these barriers insofar as it aims to reduce obstructions on pavements such as unnecessary street furniture and signage. There are also plans to create a cohesive wayfinding system that makes Dublin's streets more legible and connected for both residents of and visitors to the city. The plan mentions the need to create a universally designed streetscape and has objectives such as the widening of pavements and increasing the number of kerb cuts and ramps. However, it does not outline the specific user-centred tools that will be used to achieve this goal other than stating that Dublin City Council plans to work with the relevant universal design agencies (DCC, 2010). The personas used in this project identified the need for greater access to public toilets and the creation of smooth sections of cobbled streets (Table 4); however, these needs are not specifically addressed by the draft development plan.

The personas made recommendations for energy-efficient buildings, some of which are also contained in the development plan, such as improved energy efficiency and heating systems for future building developments. However, several recommendations were made by the personas that were not considered in the development plan, such as improved information on energy consumption for occupants and automation of energy usage in residential and large-scale buildings (Table 4).

4. Discussion

The personas used in the Eight Eyes of Dublin Project identified a variety of barriers in Dublin's built environment to the sustainable behaviour and social inclusion of the city's citizens. Once the scenarios had been completed the recommendations made by the personas were compared with the objectives of the draft Dublin city development plan 2011–17 (DCC, 2010). Many of the recommendations made by the

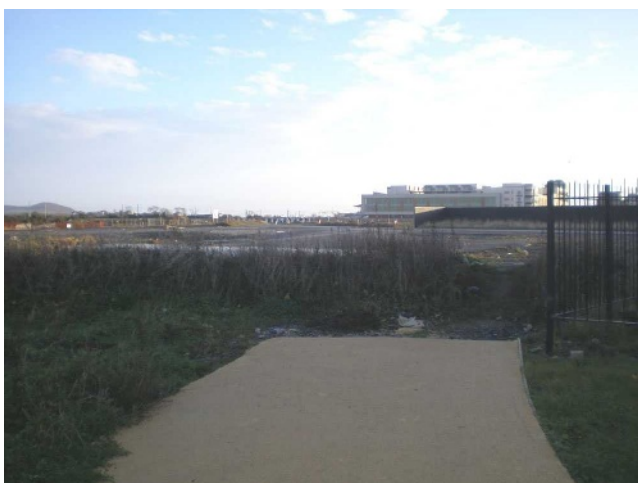


Figure 1. Unfinished pavement in Clongriffin, Co. Dublin



Figure 2. Wheelchair user trying to mount a pavement without a kerb cut

personas were included in the plan, which suggests that personas are a useful tool for correctly identifying the key barriers to sustainability and the necessary changes for



Figure 3. Congested pavements in Dublin's city centre



Figure 4. Narrow pavements beside the River Liffey, Dublin

re-engineering the built environment. In addition, the personas made several recommendations that were not considered in the draft development plan. These recommendations tended to focus on specific user needs such as access to toilets at public transport stations and retrofitting of roof gardens and balcony space to existing apartment buildings. This suggests that personas are also a valuable tool for identifying barriers that may be overlooked when development plans are created using methods of user-centred design with which certain citizens do not engage, such as public meetings and consultation events.

The draft development plan aims to create a two-way dialogue with Dublin's residents and the relevant stakeholders about the future development of the city, and recognises the need to foster a collaborative approach in order to ensure the success of future development projects. Methods to create this dialogue outlined in the plan include the use of the internet to obtain feedback on future development projects. The plan also recognises the importance of universal design in the future development of the city; however, it does not outline specific ways in which this will be achieved other than through communication with relevant agencies who have an interest in universal design. The results from this current project suggest that personas may be a useful tool to keep the user at the centre of the re-engineering process for Dublin city and to identify diverse user needs in the built environment. For example, several personas recommended the need for access to public

toilets in order to make streets and public transport more accessible. This recommendation serves the needs of many users as it was suggested by the wheelchair user, expectant mother, child and tourist, and therefore highlights the fact that by designing for the extremes of user needs a more inclusive design for all users is achieved (Gossett *et al.*, 2009).

It has been suggested that personas cannot be used as the sole design tool for user-centred design (Blomquist and Arvola, 2002) and that they may be most useful when used in conjunction with other design tools such as contextual and participatory design (Grudin and Pruitt, 2002). Blomquist and Arvola (2002) argue that personas should be seen as an additional tool in the design process rather than as a replacement for other forms of user-centred design. Personas may be particularly useful as a means of considering the needs of residents who do not typically engage in the design process, but as a tool it does not give residents a sense of ownership over the plans. However, as discussed, in order to be successful, development plans need to include residents in the design process (Cabe, 2007). Therefore, there may be an advantage to using personas in addition to other more participatory design tools outlined earlier in this paper and by Wates (2000). This combined approach could use personas in the initial stages of the design process coupled with stakeholder engagement and participatory design tools at the later stages of the development process.

5. Conclusions

The Eight Eyes of Dublin Project found that the use of personas successfully identified some of the most pressing design issues in terms of the sustainability of Dublin's built environment, as highlighted by the draft Dublin city development plan (DCC, 2010). The use of personas as a design tool also made several recommendations for universal design that were not considered in the development plan, suggesting that personas may be a good tool for the consideration of specific user needs within the built environment. Personas may also offer a way of considering the needs of citizens who do not typically engage with the more traditional methods of stakeholder engagement. However, it is argued that personas could be used in conjunction with other user-centred design tools such as participatory design, to ensure that the true needs of the city's population are being met and that the citizens feel engaged with the creation of a sense of place.

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