A validation study on the challenges that architectural design practitioners face when designing inclusively.

Dr. Matteo Zallio
Prof. P. John Clarkson

Technical report: ENG-TR.015
March 2022
ISSN: 2633-6839

UNIVERSITY OF CAMBRIDGE
Engineering Design Centre
Inclusive Design Group

Abstract

Inclusive Design has been widely promoted in the product, engineering and user experience design fields. Notwithstanding the educational effort developed by scholars, practitioners and institutions, Inclusive Design has not flourished in architectural design practice, often being associated with design for disability.
This study, which spans the disciplines of behavioural science, ergonomics and the social sciences of architecture, validates early-stage results on the challenges that architectural design practitioners face when designing inclusively.
A questionnaire was conducted with 114 architectural design practitioners with knowledge and experience of Inclusive Design. The results highlighted the influence practitioners have in advocating for Inclusive Design among different stakeholders, and the need for tools which support the design and post-design phases for buildings that guarantee inclusion, diversity, equity and accessibility.

Keywords: Inclusive Design; Accessibility; Architectural Design; Toolkit; Data analysis; Equity; Diversity.

Introduction

Since the mid-20th century society has understood the importance of designing buildings, products and services accessible for, and usable by, people with a variety of abilities and needs (Goldsmith 2000). The concept of designing for people with disabilities evolved strongly after WWII (Gerber 1994). During the 1960s the American National Standards Institute created specifications for making buildings and facilities accessible to, and usable by, the physically handicapped which acknowledged the importance of designing accessible environments for everyone (Goldsmith 1963; American National Standards Institute, Inc 1980).
With an enhanced understanding of the concept of disability and its causes, an evolution of the design for disability approach and terminology occurred (Lifchez and Winslow 1979).
Along with several design approaches that have burgeoned in the past few decades, including Transgenerational Design (Pirkl and Babic 1988), Universal Design (Mace, Hardie, and Plaice 1991) and Design for All (EIDD 2020), Inclusive Design became an accepted overarching term amongst the product and engineering design communities. Inclusive Design (ID), originally striving to optimise the design and development of solutions which were usable by as many people as reasonably possible (Coleman 1994), evolved towards a design for people of different ages, abilities, genders, faiths, cultures and languages (Clarkson and Coleman 2015), incorporating the principles of social equity and diversity (Zallio and Clarkson 2021).
In recent years ID has become more widely acknowledged amongst architectural design practitioners, however the widespread use of ID across the building industry community can still be perceived as limited (Basnak, Tauke, and Weidemann 2015; Heylighen, Van der Linden, and Van Steenwinkel 2017; Ryhl 2014). Notwithstanding the educational efforts developed by scholars, practitioners and institutions with the creation of

guidelines, standards, career professional development courses and books (Zallio and Clarkson 2021), a number of challenges appear to still be present.
This article intends to answer the question as to which strategies can effectively allow ID to fully permeate the working routines of architectural design practitioners and bring value to building occupants and building industry stakeholders.
This study, which spans the disciplines of behavioural science, ergonomics and the social sciences of architecture, validates early-stage results on the challenges that architectural design practitioners face when designing inclusively, and identifies holistic strategies to improve the design and post-design of inclusive and accessible buildings.

Method and study design

Literature review findings highlighted that in recent years regulations and standards about accessibility and ID were more widely used amongst architectural design practitioners, creating opportunities but nonetheless limitations (Gray 2003; Van der Linden, Dong and Heylighen 2016). Amongst several challenges that manifest during the design phase, facilitating the comprehension of information from technical documentation and deploying it to answer the needs of users has acquired greater importance (Fernandez et al. 2021). In the post-design phase, the necessity to assess buildings through post-occupancy evaluation was more widely acknowledged, however there is a systemic lack of tools to assess inclusion, diversity, equity and accessibility (IDEA) in the built environment. Recent results from ethnographic studies with architectural design practitioners (Zallio and Clarkson 2021) briefly identified four major themes meriting further investigation. The first theme concerned the working routines of practitioners and their implementation of ID. The second investigated the relationship between practitioners and stakeholders. The third focused on present and future challenges when designing inclusively. The fourth discovered future opportunities to increase the uptake of ID.
This study validates the challenges of architectural design practitioners when implementing ID in the design and post-design phases through an online questionnaire undertaken in the first quarter of 2021. The questionnaire was chosen to allow participants from several countries to anonymously complete the answers in their own time, avoiding bias of the results towards influential individuals and to achieve a consensus in a reasonable timeframe (Barrett and Heale 2020; Keeney, Hasson and McKenna 2006).
Participants, including architects, access consultants and design managers with knowledge and experience of ID and accessibility, were carefully selected using the snowball sampling approach. To overcome instrumental challenges, such as the lack of expert participants, the subsequent high drop-out rates (Winkler and Moser 2016) and travel limitations brought about by the COVID-19 pandemic, panels of experts belonging to professional associations including RIBA, NRAC, AA, IAAP, NCARB, AIA and IWBI, were created after gaining ethical approval from the University of Cambridge.
A total of 209 subjects answered the questionnaire over a four week timeframe and 114 completed responses were obtained, giving a response rate of 54.5%. The number of completed responses, compared to the number of practitioners belonging to selected geographies, allowed for the consideration of non-probabilistic sampling which enabled ideas to be generated and verified without generalising the results to the entire

population thus leading to high levels of confidence in the validity of the results (Ayhan 2011).
The first version of the questionnaire was piloted amongst eight expert users and feedback was collected and informed the creation of a revised version. A second version was implemented with closed-ended questions, made readable by persons with different abilities and allowed for voice control systems to help navigate the questionnaire in about 15 to 20 minutes. It was distributed by email and comprised four main sections defined according to previous research findings. Questions were aimed at collecting data on (1) demographics (age, gender, geographical location, job title), (2) work experience (type of clients and their enquires, type of project, factors that limit the uptake of ID and source of information to keep up to date), (3) design phase (use of design tools to discover people's needs and aspirations), and (4) post-design phase (use of tools to collect building occupants' feedback on inclusion and accessibility).

Results and discussion

This section reports the results of the questionnaire, managed through Qualtrics XM, by highlighting challenges and potential strategies to support building industry professionals with the design and maintenance of buildings that guarantee inclusion, diversity, equity and accessibility.

Demographics

Among 114 responses, 80.7% (n=92), originating from Europe, with United Kingdom (n=63), Italy (n=13) and Ireland (n=8) being the top three countries. Participants from the rest of the world totalled 19.3% (n=22), with 13.2% (n=15) from the United States of America, and the remaining from Canada and Asia Pacific. There were 57.8% (n=66) females and 39.5% (n=45) males. Three participants preferred not to respond.
The average age of participants fell within the 40-49 years of age group and those whose age was above 30 years, with relatively greater working experience than younger consultants (Smith et al. 1989; Tofan, Galster and Avgeriou 2013), were 92.1% (n=105).
Among participants, 37.7% (n=43) reported working mainly as access consultants, 34.2% (n=39) as architectural designers/engineers, whereas 28.1% (n=32) self-identified as design/project managers, surveyors, occupational therapists and housing policy officers.
The population sample and spread across countries shown in Table 1 suggested for a qualitative data analysis, rather than a purely statistical approach.

Country	Gender			Age		
	Female	Male	Prefer not to respond	Above 30 years old	Below 30 years old	Prefer not to respond
United Kingdom of Great Britain and Northern Ireland	32.2% (n=37)	21.6% (n=25)	1.8% (n=2)	53.6% (n=61)	2.6% (n=3)	-
United States of America	7% (n=8)	5.4% (n=6)	0.9% (n=1)	10.5% (n=12)	1.8% (n=2)	-
Ireland	5.4% (n=6)	1.8% (n=2)	-	7% (n=8)	-	-
Italy	5.4% (n=6)	6.2% (n=7)	-	10.5% (n=12)	0.9% (n=1)	0.9% (n=1)
Other countries	7.8% (n=9)	4.5% (n=5)	-	10.5% (n=12)	1.8% (n=2)	-
TOTAL	**57.8% (n=66)**	**39.5% (n=45)**	**2.7% (n=3)**	**92.1% (n=105)**	**7.1% (n=8)**	**0.9% (n=1)**

Table 1. Gender and age split across countries.

Work experience

This section of the questionnaire looked at practitioners' working practice and knowledge of ID.

As shown in Figure 1, approximately 61.4% of participants (n=70) work for public clients, 46.5% (n=53) for large private clients (250+ employees), 35.1% (n=40) for medium private clients (50 to 249 employees) and 36.0% (n=41) for small private clients (10 to 49 employees). A significantly high percentage (30.7%) of participants (n=35) work for not-for-profit organisations and 28.9% (n=33) for micro private clients. Practitioners are involved with a variety of consultations and the results show that 61.4% (n=70) perform access audits, which would appear to be the first step for a client in understanding the importance of accessibility and inclusion in a building (Hashim et al. 2012). Around 60.5% (n=69) were involved with new build projects with greater capacity for implementing regulations addressing accessibility and inclusion (Chrysikou 2018). Approximately 58.8% (n=67) were involved with refurbishment, which allows for space adaptations according to access audits outcomes and regulations (Van der Linden, Dong, and Heylighen 2016). Less than one third, 28.1% (n=32), reported 'others' including educational material development and best practice guidance consultancies.

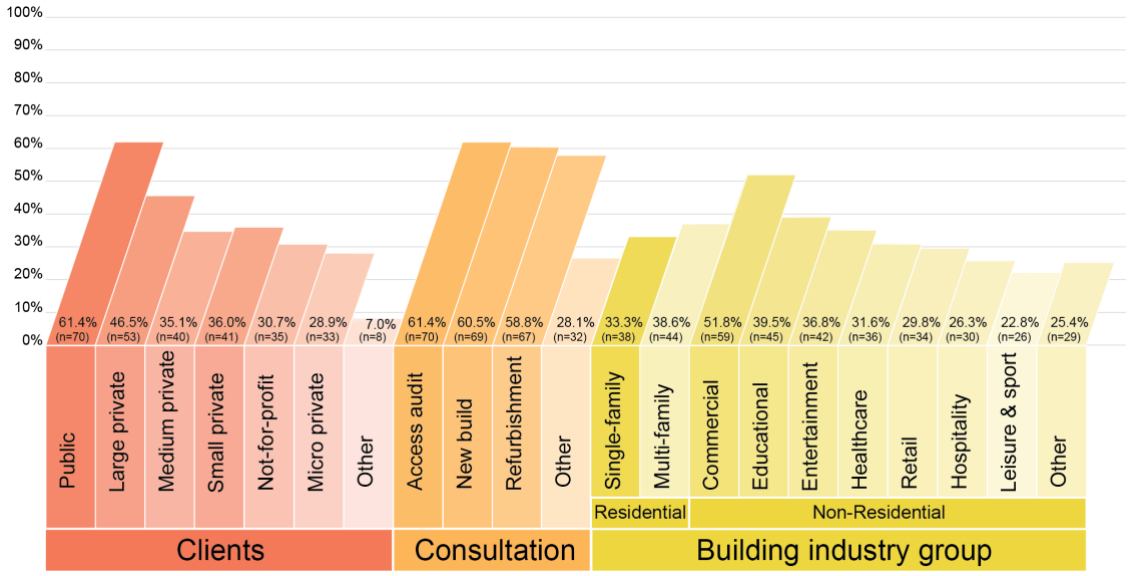

Figure 1. Infographic with details on type of clients, their enquires and the building industry group participants work for.

According to the International System of Industrial Classification (United Nations 2008) the building and construction industry is composed of three groups: non-residential, residential and engineering construction, including infrastructures and industrial facilities. This study collected data on the experience of practitioners working in the non-residential and residential groups.

In the non-residential group, more than half of participants, 51.8% (n= 59), consult for commercial and office spaces, whereas 39.5% (n=45) and 36.8% (n=42), work respectively on educational and entertainment facilities. A significant number of participants, 31.6% (n= 36), reported consulting for healthcare facilities, 29.8% (n=34) for retail, 26.3% (n=30) for hospitality and 22.8% (n=26) for leisure and sport facilities. Almost 25.4% (n=29) reported others, such as public realm improvements, master planning and mixed/playground areas. With regard to residential buildings, most enquires are for multi-family residential, 38.6% (n=44), and slightly less for single-family residential, 33.3% (n=38).

To fully comprehend the relationships between clients and building groups Fisher's Exact Test was chosen to evaluate whether variables are statistically related within the current sample size (Kim 2017). A p value less than 0.05 suggests a statistically significant relationship.

As reported in Table 2, there are statistically significant relationships between public bodies and educational (p=0.0487) and entertainment facilities (p=0.0468). Not-for-profit organisations have a correlation with entertainment (p=0.00352) and healthcare facilities (p=0.00412). These relationships suggest that consulting for these clients can lead to greater impact when designing these types of facilities. Working for large private clients appears to be beneficial in delivering impactful designs for commercial/office facilities (p<0.00001), educational (p=0.00764), entertainment (p=0.0000131), retail facilities (p=0.0140), hospitality (p=0.0114) and leisure (p=0.0130). Consulting for medium private clients provides similar opportunities as those afforded by working for large private clients, with the addition of potentially consulting on healthcare facilities (p=0.0029). Small private clients were seen to be involved with similar types of building groups, excluding educational facilities and with the addition of multi-family residential buildings (p=0.0166). Micro private clients have a strong correlation with single-family residential buildings (p=0.00084). These

correlations suggest that in order to have greater chances when designing multi-family buildings it is beneficial to connect with small private clients, whereas when designing or redesigning single-family buildings, micro private clients may offer more opportunities.

	p Value	Clients					
		Public	**Non-for-profit**	**Large private**	**Medium private**	**Small private**	**Micro private**
Non-Residential	**Commercial** (*p* Value)	1	0.543	<0.00001	0.000011	0.0110	0.536
	Educational (*p* Value)	0.0487	0.0986	0.00764	0.0013	0.0724	0.679
	Entertainment (*p* Value)	0.0468	0.00352	0.0000131	<0.00001	0.00223	0.285
	Healthcare (*p* Value)	0.0618	0.00412	0.227	0.0029	0.0385	0.125
	Retail (*p* Value)	0.679	0.827	0.0140	0.000030	0.00548	0.370
	Hospitality (*p* Value)	0.0517	0.107	0.0114	0.00001	0.0272	0.818
	Leisure & sport (*p* Value)	0.0713	0.0884	0.0130	0.000101	0.00451	0.470
Residential	**Single-family** (*p* Value)	1	0.832	0.167	0.407	0.409	0.00084
	Multi-family (*p* Value)	0.554	0.838	0.342	0.164	0.0166	1

Table 2. Relationships between clients and buildings groups according to Fisher's Exact Test data analysis. A *p* value less than 0.05 (in grey) suggests a statistically significant relationship.

Designing buildings for public or large private clients can impact how thousands or even millions of individuals experience their spaces (Kuitert, Volker, and Hermans 2019), whereas working for smaller clients may have an impact at a different scale. Maintaining relationships with different clients allows for the development of different opportunities to design or redesign more inclusive spaces. Data regarding the involvement of practitioners with different clients and the correlations with building groups creates a baseline of knowledge upon which to develop optimal strategies to promote the future uptake of ID.

The relationship between practitioner and client appears to be essential in order to foster the uptake of ID. Approximately 41.6% of participants (n=47) reported that clients request only legal and regulation compliancy, with the goal being to achieve minimum accessibility standards. Around 36.3% (n=42) reported that clients request best practice compliancy, going beyond minimum accessibility standards and only 10.6% (n=12) reported that clients are well informed about ID and are seeking future-proof inclusive projects targeting sensory and cognitive inclusion over and above just physical accessibility. This data validates early-stage findings from previous ethnographic studies (Zallio and Clarkson 2021).

To gain insight into the factors that practitioners perceive to limit the uptake of ID during the design and post-design phases, a five-point Likert scale questionnaire, ranging between one (strongly disagree) and five (strongly agree), was distributed to participants.

Approximately 74.5% of respondents (n=85) agreed that project budgets were a constraining factor (M=4.02, SD=1.66).
Roughly 73.7% of respondents (n=84) reported clients failing to perceive the value of ID with the view of respondents tending towards somewhat agree (M=3.90, SD=1.85).
A limited awareness from clients with regard to ID was reported by 72.8% of respondents (n=83), with responses of somewhat agree (M=3.90, SD=2.12).
Other factors such as few requests from clients for ID projects (M=3.61, SD=2.32), lack of mandatory laws and regulations (M=3.61, SD=2.12) and project time constraints (M=3.31, SD=2.33) were also reported as contextual factors preventing practitioners from designing inclusively and these are represented in Figure 2.

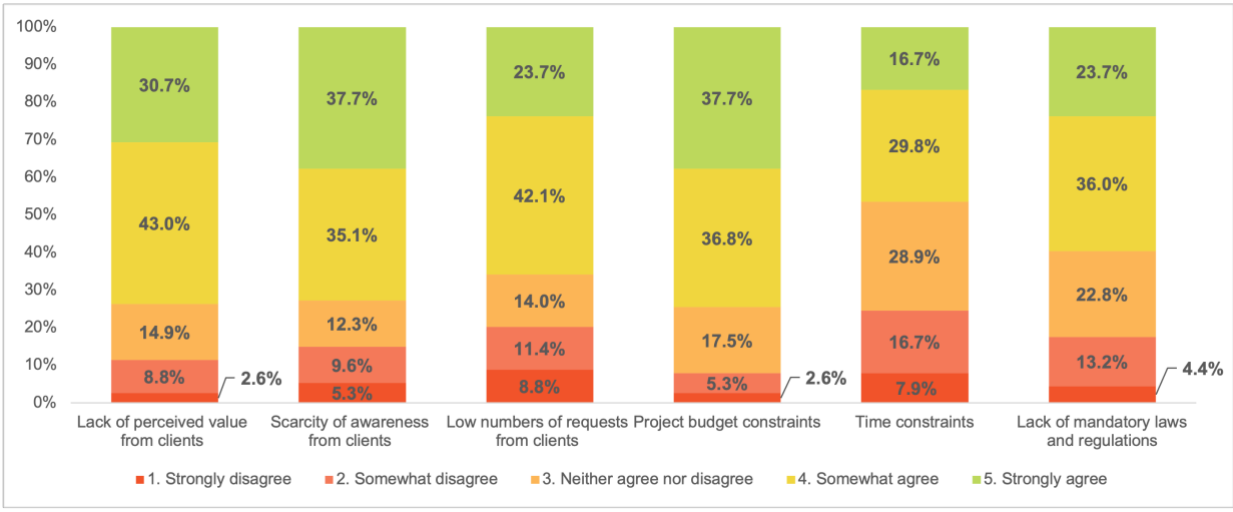

Figure 2. Factors that limit the uptake of Inclusive Design among architectural design practitioners.

In order to understand the relationships between paired factors explaining the lack of uptake of ID a correlation test was performed. The Pearson Correlation Coefficient (PCC) was used to measure the correlation between couples of data as no outliers were present in the dataset.
The limited awareness from clients with regard to ID was positively correlated with a lack of perceived value in ID (p<0.00001, Effect Size (Pearson's r)=0.497). This correlation suggests that limited awareness of ID leads to a reduced perception of value in an inclusively designed building. As a result of this biased perception, the proportion of difference between variables, calculated by using the coefficient of R-squared, suggests that limited client awareness was emphasised as the dominant driver for the low numbers of requests from clients for ID projects (p<0.00001, R-squared=46.5%). A positive correlation was also noted between project budget and time constraints (p<0.0000136, Effect Size (Pearson's r)=0.395).
It would seem that most of these factors influence the abilities of practitioners to design inclusively and to positively influence the decisions of clients by building the business case for ID. The practitioner would appear to play a key role as advocate for the value of ID at different stages of the design process.
The continuous education of practitioners is fundamental in influencing clients to design inclusively, and a series of instruments to support this process were identified through a five-point Likert scale questionnaire, ranging between one (not important at all) and five (strongly important).

Figure 3 shows that continuing professional development (CPD), identified with formal and informal learning (Daniel, Fleischmann, and Welters 2017), was considered important by 93.8% of participants (n=107), (M=4.55, SD=0.82). Technical documentation such as standards, regulations and best practices were identified as important by 89.5% of participants (n=102), (M=4.53, SD=0.79), as well as evidence-based literature including scientific literature and market research, by 88.6% (n=101), (M=4.41, SD=0.81).
As reported by 75.4% of participants (n=86), (M=3.92, SD=0.91), four additional instruments of relevance were grey literature (identified with reports), government documents and White Papers (Pappas and Williams 2011). Internet content, including blogs, podcasts and newsletters were reported by 71.9% of participants (n=82), (M=3.81, SD=0.89). Other literature, such as newspapers and magazines, were reported by 62.3% of participants (n=70), (M=3.55, SD=0.97), together with social media content and platforms to connect people (e.g. LinkedIn, Twitter, WhatsApp, etc) by 46.5% (n=53), (M=3.30, SD=1.7).

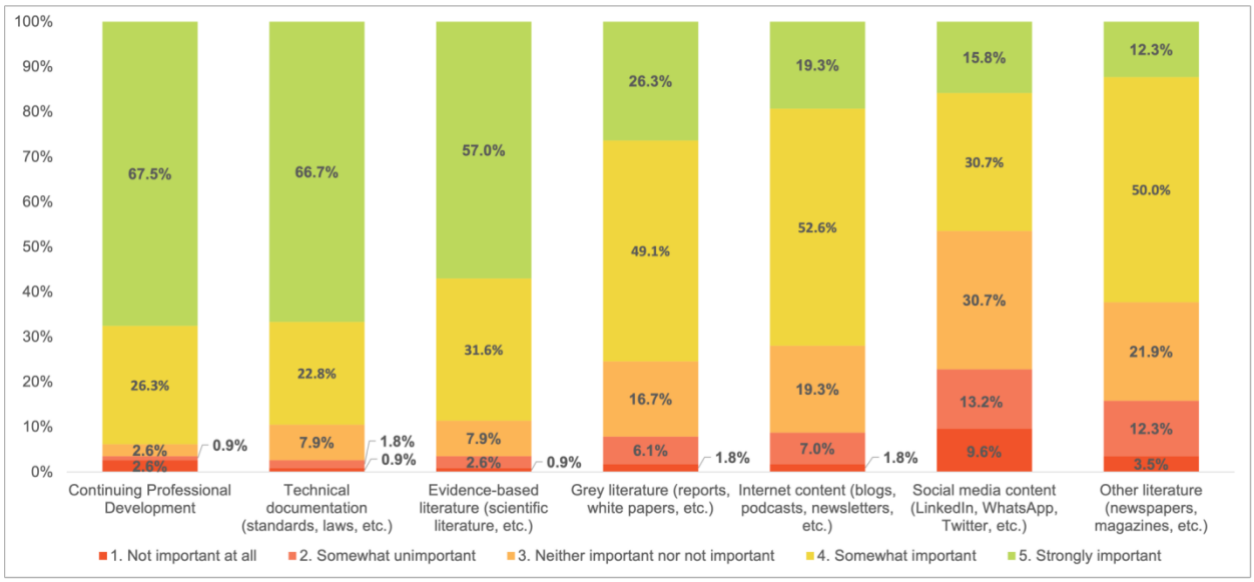

Figure 3. Importance of instruments to facilitate the development of knowledge of Inclusive Design among architectural design practitioners.

Descriptive statistics data showed that more than half of practitioners (65%) between 50 and 70+ years of age preferred to use more traditional learning tools including CPD, technical documentation and evidence-based literature. More than one third of participants (35%), between 40-49 years of age, strongly believed it was important to use the Internet and social media content for inspiration and to learn more about ID. Overall it appeared that senior practitioners preferred using traditional learning tools, whereas junior practitioners were more willing to engage with contemporary and new methods of learning.

Design phase

The educational role of practitioners along with their ability to influence the decisions of clients are two important factors in improving the uptake of ID. The design phase represents a fundamental stage in the building development process where practitioners can explore the user journey (Følstad and Kvale 2018) and tailor a design according to the capabilities, needs and desires of the occupants of the building (Zallio and Clarkson 2021).

Most participants (64%, n=73) reported having no prior knowledge of toolkits or frameworks to help explore the user journey and describe user needs. The remaining 36% (n=41) reported knowledge of Soft Landings from BSRIA, a process to ensure all decisions are based on improving the performance of a building by meeting the expectations of clients (BSRIA 2015); the BUS methodology, a process to capture the complexity of the features of a building, highlighting building performance indicators (Usable Buildings Trust 2017); or customised and not necessarily scientifically validated toolkits. The toolkits mentioned above are more focused on performance and sustainability, rather than on inclusion and accessibility.

Different thematic areas within ID were briefly explored in previous research (Fernandez et al. 2021; Zallio and Clarkson 2021) and should be part of the design process. On a five-point Likert scale questionnaire, ranging between one (strongly disagree) and five (strongly agree), 78.9% of participants (n=90) agreed (M=4.63, SD=0.90) that physical accessibility, including dimensions, access, circulation and wayfinding should be considered. Sensory inclusion, such as use of light, colours and materials and cognitive inclusion, including perception of space, neurodiversity and psychosocial safety, were strongly recommended by 74.6% of participants (n=85), (M=4.61, SD=0.85) and (M=4.57, SD=0.92). Data from the three groups of variables was selected and analysed with a Chi-squared test which showed a statistically significant relationship between physical accessibility, cognitive inclusion ($p<0.00001$, Effect Size=0.729) and sensory inclusion ($p<0.00001$, Effect Size=0.710). While physical accessibility is perceived as slightly more important than sensory and cognitive inclusion, the significant relationship between the three thematic areas suggests that they all support an ID process.

To understand more about the thematic areas and how ID could be implemented during the design phase, four major components were rated by participants through a five-point Likert scale questionnaire, ranging between one (strongly disagree) and five (strongly agree), and this is illustrated in Figure 4.

Approximately 87.7% of participants (n=100) agreed overall that the use of prompt questions were an effective way for them to better identifying physical, sensory and cognitive user needs (M=4.51, SD=0.84). Participants reported slightly less agreement, 84.2% (n=96), (M=4.37, SD=0.82), when it came to receiving help to identify and organise design requirements. Nearly 82.5% of participants (n=94), (M=4.2, SD=0.85), were in agreement with the use of a framework to organise user needs. Around 81.6% (n=93), (M=4.32, SD=0.82), agreed positively with using a framework to recognise and organise key aspects in the user journey.

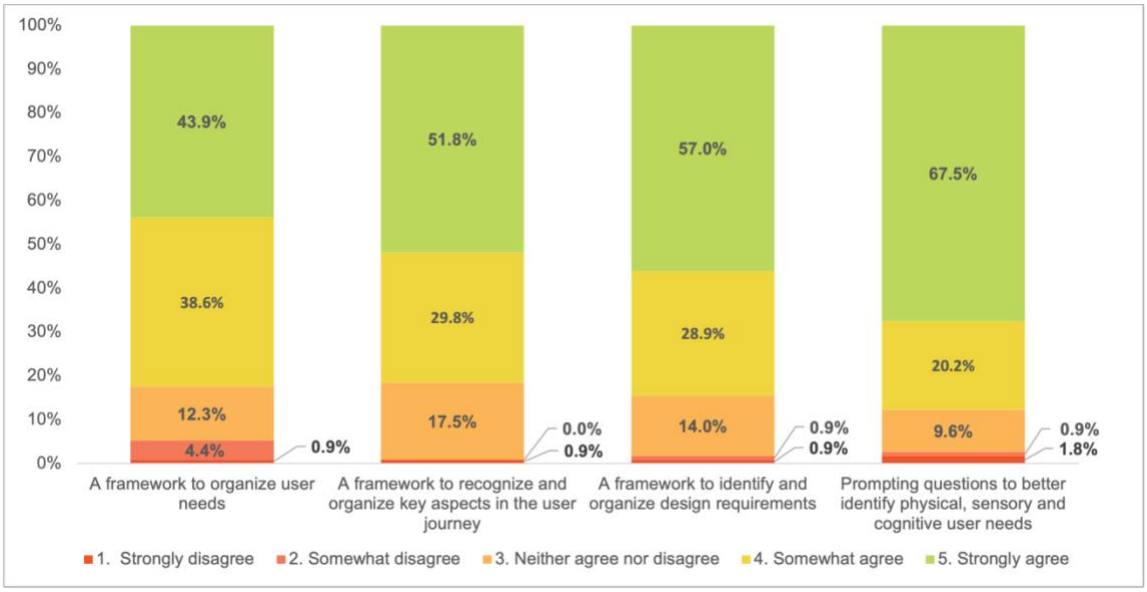

Figure 4. Four major components helpful in improving an Inclusive Design process for practitioners.

The positive agreement on different components emphasises the relevance of receiving a structured, evidence-based foundation of support to help identify user needs, highlight key aspects in the user journey and organise design requirements. In confirmation of this view, participants had a positive perception of the creation of a toolkit that embraces these components. Through a five-point Likert scale questionnaire, ranging between one (extremely unlikely) and five (extremely likely), 79% of participants (n=90), (M=4.02, SD=0.91), would be likely to use a toolkit to implement ID in their design process.

This toolkit could prove to be an agent in fostering understanding of ID, using a structured method that listens to different stakeholders in order to tease out meaningful feedback with regard to the design of buildings that guarantee inclusion, diversity, equity and accessibility. Notwithstanding that it is focused primarily on the design phase, practitioners in other fields could benefit from it. Architects and architectural technologists were selected by 91.2% of participants (n=104), design and project managers by 82.5% (n=94), access consultants and interior/product designers by 75.4% (n=86), landscape and urban architects by 74.6% (n=85) and engineers by 61.4% (n=70).

Post-design phase

The post-design phase constitutes a significant stage where users can fully experience a building or facility (Durosaiye, Hadjri, and Liyanage 2019). In many cases the design process starts with learning from past experiences through analysis of occupancy data from an existing facility (Hostetler 2010) to further improve a new building. However, studies reported (Zallio and Clarkson 2021) that sometimes practitioners are not keen to explore post-design feedback.

In this study we ascertained that most participants, 78.1% (n=89), have limited knowledge of existing post-occupancy evaluation (POE) tools to gauge accessibility and inclusion within buildings. Only 21.9% (n=25) of participants had previous experience with other tools such as the Occupant Survey Toolkit (Graham, Parkinson, and Schiavon 2021), the BUS methodology (Usable Buildings Trust 2017) and Soft Landings (BSRIA 2015). These tools mostly assess sustainability, comfort and

efficiency, with little focus on accessibility and inclusion. These findings validate previous research (Zallio and Clarkson 2021), where it was evidenced that there was a low uptake of post-design feedback and a generalised lack of POE tools targeting inclusion, diversity, equity and accessibility in the built environment.
In similarity to the design phase, eight components that should constitute a POE tool targeting inclusion and accessibility were explored and displayed in Figure 5.

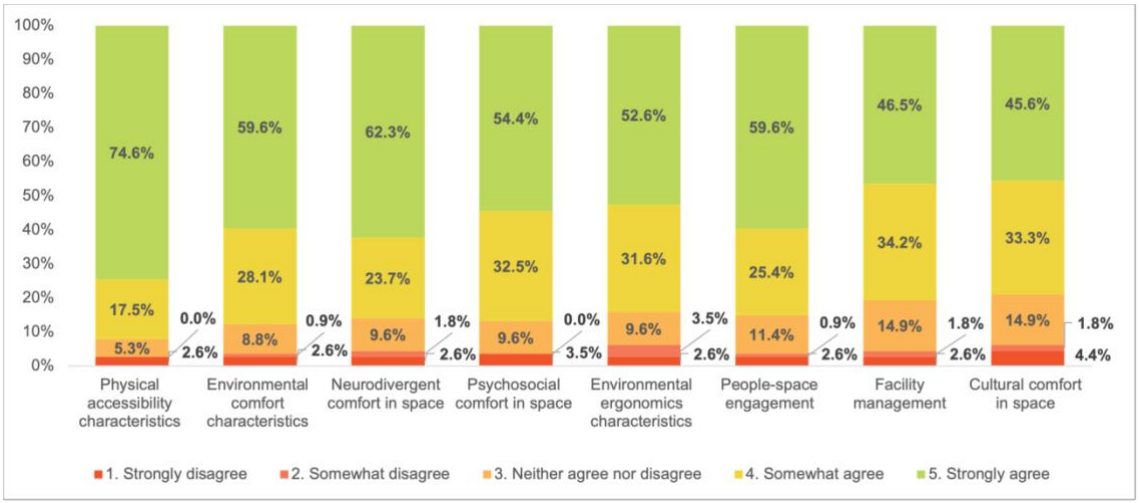

Figure 5. Components to consider for a POE tool targeting inclusion, diversity, equity and accessibility.

Through a five-point Likert scale questionnaire, ranging between one (strongly disagree) and five (strongly agree), positive agreement was established for physical accessibility characteristics (e.g. access, circulation, wayfinding, interaction, etc) from 92.1% of participants (n=105), (M=4.61, SD=0.81). Approximately 87.7% of participants (n=100), (M=4.41, SD=0.89), agreed with including environmental comfort characteristics (e.g. air quality, thermal, lighting, sound comfort, etc).
Similarly, 86% of participants (n= 98), (M=4.41, SD=0.93), agreed with including neurodivergent comfort within spaces (e.g. behavioural dynamics, neuroinclusion, people diversity, engagement, etc) and psychosocial comfort in space (e.g. gender safety, mental health awareness, anxiety and stress coping, etc), (M=4.34, SD=0.92).
Roughly 84% of participants (n=96), (M=4.28, SD=0.96), agreed with including environmental ergonomics characteristics (e.g. space dimensions, use of materials, use of colours, furniture comfort, space adaptability, etc) and people-space engagement (M=4.39, SD=0.91) (e.g. spatial aesthetics, person-space dynamics, space configuration, privacy comfort, etc).
An aspect that is not so often taken into consideration in POE tools is facility management (e.g. maintenance, cleanliness, updating building features, etc) and the importance of this was agreed by 81.2% of participants (n=92), (M=4.20, SD=0.94).
Finally, cultural comfort in space (e.g. sense of belonging, cultural shift, language and terminology, etc) received a preference from 78.9% participants (n=90), (M=4.14, SD=1.02).
The robust agreement expressed for characteristics such as physical accessibility, neurodivergent comfort in space, people-space engagement and environmental comfort suggests these components should be included in a POE tool with an increased weighting to impact the overall rating. However, further investigation with pilots and practical experiences is recommended in order to appropriately gauge different aspects of inclusion and accessibility.

The development of POE tools with ID as their focus appears to be an emergent priority for more than 83.4% of participants (n=95) and can help a variety of architectural design practitioners to collect feedback from occupants. Architects and architectural technologists constitute major beneficiaries, reported by 58.3% of participants (n=91), followed by access consultants and facility managers, reported by 55.8% (n=87), design and project managers, stated by 53.2% (n=83), and Diversity, Equity and Inclusion human resource managers, indicated by 50.6% (n=79). Building maintenance staff were reported by 35.9% of participants (n=56) and it appears they hold a stronger position when it comes to guaranteeing inclusive and accessible building features.

Conclusions and implications

The age spread across participants suggested that practitioners who have an understanding and knowledge of ID may have received previous training and been practicing ID for a considerable number of years.
The perceptions of practitioners highlighted that some clients scarcely acknowledge the added value of an inclusive project, and this is mainly due to lack of awareness. This systematic challenge is one of the major drivers for the low numbers of requests from clients for ID projects across different building groups.
It emerged that practitioners play a fundamental role in influencing clients and building the business case for ID.
Considering the educational role of practitioners, the projects they engage with and the variety of their clients, there is at present a willingness to acquire new knowledge of inclusive and accessible design through different learning tools, with the aim to develop more design and post-design phases for ID.
This study emphasises the strength of aspiration amongst practitioners to advance the design process with a tool offering a structured methodology, in order to identify the variety of user needs, organise design requirements and to highlight key aspects in the user journey and in accordance with an ID approach.
To comprehensively inform the prospective architectural design of an inclusive and accessible building, the data demonstrates positive reinforcement of the use of POE tools to gauge the perception of inclusion, diversity, equity and accessibility in the built environment.

Acknowledgements:
This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement N°846284. The authors kindly thank all participants for their availability. Dr. Matteo Zallio conducted the research, analysed data, wrote the introduction, method and study design, results and discussion, conclusions and implications and developed the infographics. Prof. P. John Clarskon co-wrote conclusions and supervised the study.

References

American National Standards Institute, Inc. 1980. *American national standard specifications for making buildings and facilities accessible to, and usable by, the physically handicapped*. New York: American National Standards Institute, Inc.

Ayhan, H. Ö. (2011). “Non-probability sampling survey methods.” In *International Encyclopedia of Statistical Science*, edited by M. Lovric. Berlin: Springer. doi: 10.1007/978-3-642-04898-2_41.
Barrett, D., and R. Heale. 2020. What are Delphi studies?. *Evidence-based Nursing* 23 (3): 68-69. doi:10.1136/ebnurs-2020-103303.
Basnak, M. B., B. Tauke, and S. Weidemann. 2015. “Universal design in architectural education: who is doing It? How is it being done?” In *Proceedings of the Future of Architectural Research: The Architectural Research Centers Consortium (ARCC)*. Chicago, Illinois.
BSRIA. 2015. “Soft Landings.”
Chrysikou, E. 2018. “Why we need new architectural and design paradigms to meet the needs of vulnerable people.” *Palgrave Communications* 4 (116). doi:10.1057/s41599-018-0171-z.
Clarkson, P.J., and R. Coleman. 2015. “History of inclusive design in the UK.” *Applied Ergonomics* 46 (Pt B): 235-247. doi:10.1016/j.apergo.2013.03.002.
Coleman, R. 1994. “The case for Inclusive Design - an overview.” In *Proceedings of the 12th Triennial Congress of the International Ergonomics Association*. Mississauga, Ontario: Human Factors Association of Canada.
Daniel, R., K. Fleischmann, and R. Welters. 2017. “Professional development in the creative industries: Methods and insights from regional practitioners.” *Australian Journal of Career Development* 26 (3): 113-123. doi:10.1177/1038416217720780.
Durosaiye, I. O., K. Hadjri, and C. L. Liyanage. 2019. “A critique of post-occupancy evaluation in the UK.” *Journal of Housing and the Built Environment* 34 (1): 345-352. doi:10.1007/s10901-019-09646-2.
EIDD. 2020. “Design for All Europe: Stockholm Declaration.” Accessed November 12, 2020. https://www.designforalleurope.org.
Fernandez, C., M. Zallio, D. Berry, and J. McGrory. 2021. “Towards a people-first engineering design approach. A comprehensive ontology for designing inclusive environments.” In *Proceedings of the International Conference on Engineering Design (ICED21)*. Gothenburg, Sweden. doi:10.1017/pds.2021.579.
Følstad, A., and K. Kvale. 2018. “Customer journeys: A systematic literature review.” *Journal of Service Theory and Practice* 28 (2): 196-227. doi:10.1108/JSTP-11-2014-0261.
Franke, N., and F. Piller. 2004. “Value creation by toolkits for user innovation and design: The case of the watch market.” *Journal of Product Innovation Management* 21 (6): 401-415. doi:10.1111/j.0737-6782.2004.00094.x.
Gerber, D. A. 1994. “Heroes and Misfits: The Troubled Social Reintegration of Disabled Veterans in ‘The Best Years of Our Lives’.” *American Quarterly* 46 (4): 545-574. doi:10.2307/2713383.
Goldsmith, S. 1963. *Designing for the Disabled: A Manual of Technical Information*. London: Royal Institute of British Architects.
Goldsmith, S. 2000. *Universal Design: A Manual of Practical Guidance for Architects.* London: The Architectural Press.
Graham, L. T., T. Parkinson, and S. Schiavon. 2021. “Lessons learned from 20 years of CBE’s occupant surveys.” *Buildings and Cities* 2 (1): 166-184. doi:10.5334/bc.76.
Gray, D. B., M. Gould, and J. E. Bickenbach. 2003. “Environmental barriers and disability.” *Journal of Architectural and Planning Research* 20 (1): 29-37.
Hamilton, R., and L. L. Price. 2019. “Consumer journeys: Developing consumer-based strategy.” *Journal of the Academy of Marketing Science* 47 (2): 187-191. doi:10.1007/s11747-019-00636-y.

Hashim, A. E., S. A. Samikon, F. Ismail, H. Kamarudin, M. N. M. Jalil, and N. M. Arrif. 2012. “Access and Accessibility Audit in Commercial Complex: Effectiveness in Respect to People with Disabilities (PWDs).” *Procedia - Social and Behavioral Sciences* 50: 452-461. doi:10.1016/j.sbspro.2012.08.049.
Hay, R., F. Samuel, K. J. Watson, and S. Bradbury. 2018. “Post-occupancy evaluation in architecture: Experiences and perspectives from UK practice.” *Building Research & Information* 46 (6): 698-710. doi:10.1080/09613218.2017.1314692.
Heylighen, A., Van der Linden, V., & Van Steenwinkel, I. (2017). Ten questions concerning inclusive design of the built environment. *Building and Environment, 114*, 507-517. https://doi.org/ 10.1016/j.buildenv.2016.12.008Hostetler, M. 2010. “Beyond Design: The Importance of Construction and Post-Construction Phases in Green Developments.” *Sustainability* 2 (4): 1128-1137. doi:10.3390/su2041128.
Imrie, R., and P. Hall. 2001. *Inclusive Design: Designing and Developing Accessible Environments.* London: Spon Press.
Keeney, S., F. Hasson, and H. McKenna. 2006. Consulting the oracle: Ten lessons from using the Delphi technique in nursing research. *Journal of advanced nursing* 53 (2): 205-212. doi:10.1111/j.1365-2648.2006.03716.x.
Kim, H-Y. 2017. “Statistical notes for clinical researchers: Chi-squared test and Fisher’s exact test.” *Restorative dentistry & endodontics* 42 (2): 152-155. doi:10.5395/rde.2017.42.2.152.
Kuitert, L., L. Volker, and M. H. Hermans. 2019. “Taking on a wider view: Public value interests of construction clients in a changing construction industry.” *Construction Management and Economics* 37 (5): 257-277. doi:10.1080/01446193.2018.1515496.
Lifchez, R., and B. Winslow. 1979. *Design for Independent Living: The Environment for Physically Disabled People*. New York: Whitney Library of Design.
Mace, R. L., G.J., Hardie, and J. P. Plaice. (1991). “Accessible environments: Toward universal design.” In *Design Interventions: Toward a More Human Architecture*, edited by W. Preiser, J. Vischer, and E. White. New York: Van Nostrand Reinhold.
Mari, M., and P. Poggesi. 2014. “Facility management: Current trends and future perspectives.” *International Journal of Globalisation and Small Business* 6 (3/4): 177 - 192.
Osterwalder, A., and Y. Pigneur. 2010. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. Hoboken, NJ: John Wiley and Sons, Inc.
Pappas, C., and I. Williams. 2011. “Grey literature: Its emerging importance.” *Journal of Hospital Librarianship* 11 (3): 228-234. doi:10.1080/15323269.2011.587100.
Persad, U., Langdon, P., & Clarkson, J. (2007). Characterising user capabilities to support inclusive design evaluation. *Universal Access in the Information Society,* 6(2), 119-135. https://doi.org/10.1007/s10209-007-0083-y.
Pirkl, J. J., and A. L. Babic. 1988. *Guidelines and Strategies for Designing Transgenerational Products: A Resource Manual for Industrial Design Professionals*. Acton, MA: Copley Publishing Group.
Ryhl, C. (2014). The missing link in implementation of universal design: The barrier between legislative framework and architectural practice. In H. A. Caltenco, A. Larsson, P.-O. Hedvall, K. Rassmus-Gröhn, & B. Rydeman. *Assistive Technology Research Series: Vol. 35. Universal Design 2014: Three Days of Creativity and Diversity* (pp. 433-434). IOS Press. https://doi.org/10.3233/978-1-61499-403-9-433.
Schelings, C., and C. Elsen. 2017. “A Method for Architectural Inclusive Design: the Case of Users Experiencing Down Syndrome.” *International Journal on Advances in Life Sciences* 9 (3/4): 151-162.

Smith, B. N., J. S. Hornsby, P. G. Benson, and M. Wesolowski. 1989. “What is in a name: The impact of job titles on job evaluation results.” *Journal of Business and Psychology* 3 (3): 341-351. doi:10.2307/25092192.
Tofan, D., M. Galster, and P. Avgeriou. 2013. “Difficulty of architectural decisions. A survey with professional architects.” In *Proceedings of the 7th European conference on Software Architecture (ECSA’13)*. Springer-Verlag, Berlin, Heidelberg. doi: 10.1007/978-3-642-39031-9_17.
Usable Buildings Trust. 2017. “BUS Methodology.” Accessed June 15, 2021. https://busmethodology.org.uk/.
United Nations. 2008. “International Standard Industrial Classification of All Economic Activities (ISIC).” In *Series M No.4/Rev.4*. New York: United Nations.
Van der Linden, V., H. Dong, and A. Heylighen. 2016. “From accessibility to experience: opportunities for inclusive design in architectural practice.” *Nordic Journal of Architectural Research* 28 (2): 33-58.
Winkler, J., and R. Moser. 2016. Biases in future-oriented Delphi studies: A cognitive perspective. *Technological Forecast and Social Change* 105: 63-76. doi:10.1016/j.techfore.2016.01.021.
Zallio, M., and Clarkson P.J. 2021. “On Inclusion, Diversity, Equity, and Accessibility in civil engineering and architectural design. A review of assessment tools.” In *Proceedings of the International Conference on Engineering Design (ICED21)*. Gothenburg, Sweden. doi:10.1017/pds.2021.491.
Zallio, M., and Clarkson P.J. 2021. "*Inclusion, diversity, equity and accessibility in the built environment: A study of architectural design practice*". Building and Environment, 2021,108352, ISSN 0360-1323, https://doi.org/10.1016/j.buildenv.2021.108352.