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## An integrated literature review of the current discourse around universal design in the built environment – is occupation the missing link?

Valerie Watchorn<sup>a,b</sup> , Danielle Hitch<sup>a,b</sup> , Cathryn Grant<sup>c</sup>, Richard Tucker<sup>b,d</sup> , Kathryn Aedy<sup>a,b</sup>, Susan Ang<sup>b,d</sup>  and Patsie Frawley<sup>b,e</sup> 

<sup>a</sup>Occupational Therapy, School of Health and Social Development, Deakin University, Geelong, Australia; <sup>b</sup>HOME Research Hub, Deakin University, Geelong, Australia; <sup>c</sup>Architecture & Access, Parkville, Australia; <sup>d</sup>School of Architecture and Built Environment, HOME Research Centre, Deakin University, Geelong, Australia; <sup>e</sup>Disability and Inclusion, School of Health and Social Development, Deakin University, Geelong, Australia

### ABSTRACT

**Purpose:** To synthesise current literature regarding applications of universal design (UD) to built environments that promote social participation, identify areas of agreement and areas requiring further attention and development. Occupations refer to personally meaningful activities, which people need, want or must do as part of their daily life.

**Materials and methods:** Recently published literature (January 2011–December 2017) relevant to UD and built environments, and pertaining to any discipline or professional area, were identified via a systematic search of databases in the EbscoHOST platform. The person–environment–occupation (PEO) model was chosen as a theoretical framework for the review, which included a sample of 33 peer reviewed journal articles.

**Results:** The current discourse is driven more by description, discussion, and commentary than empirical approaches; although, a combination of quantitative, qualitative, and mixed methods approaches was employed. Much of the current discourse on UD and the built environment focuses on the person and the environment, with the occupations carried out in built environments and the interaction between these domains not referred to in much detail.

**Conclusions:** Including occupations, social participation, multi- and trans-disciplinary collaboration, and multicultural perspectives in the ongoing discourse around UD would enable the concept to reach its full potential as a medium for social justice.

### ARTICLE HISTORY

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### KEYWORDS

Inclusive design; design for all; ITEA process; PEO model; social participation

### ► IMPLICATIONS FOR REHABILITATION

- The universal design (UD) process must account for the occupations that people perform in the built environment.
- Multi-disciplinary research and development, using multiple methods, is the most appropriate approach to investigate the application of UD to the built environment.
- Key areas of contention within the current discourse include meaningful inclusion of non-professional stakeholders, tensions between embracing and eliminating diversity and how professional education should be delivered.

## Introduction

This is a review of recent literature on universal design (UD) in the built environment. The design of built environments is understood to influence people's health, social participation, and attainment of human rights [1]. The built environment refers to human-made surrounding that provides the setting for people to engage in meaningful activities, including physical buildings, open spaces, and their supporting infrastructure (e.g., transport, water, and energy networks) [2]. Social participation is an essential indicator of the health and wellbeing of people across the lifespan as they connect to various social entities and groups [3,4]; however, people with a disability may experience additional challenges to engaging in social and community activities [5]. UD acknowledges that people's needs and abilities are diverse and that an environment or product should

be designed in a way that is usable by the vast majority of a population without adaptation or stigma and that continues to meet users' needs throughout their lifespan [6].

The term "Universal Design" was first used in 1985 by Mace [7]. His team of architects, product designers, engineers, and environmental design researchers informed seven UD principles: equitable use; flexibility in use; simple and intuitive use; perceptible information; tolerance for error; low physical effort; and size and space for approach and use [6]. During the past 30 years, approaches to UD have emerged across disciplines, and research into their efficacy has grown steadily. The concept has, in the last few years, "acquired global significance and become orthodoxy of what is presented as the very best of design practice" [8, p. 873]. This is emphasised by the inclusion of UD as a means of overcoming inequities of access to the built environment within the

Convention on the Rights of Persons with Disabilities [9]. Steinfeld and Maisel [1] have developed eight goals of UD that focus on social participation and health and offer a way to define outcomes: (1) Body Fit; (2) Comfort; (3) Awareness; (4) Understanding; (5) Wellness; (6) Social Integration; (7) Personalization; and (8) Cultural Appropriateness. As a means of reducing discrimination and enhancing social participation, UD is increasingly being applied to policy relating to the design of built environments globally [10].

Literature relating to UD and built environments is broad. Contributions are available from the fields of policy, architecture, occupational therapy, urban design, planning, law, social studies, and advocacy. The concept itself has also expanded from its original focus on accessibility for people with disabilities, to encompass designs that address human diversity, such as body size, language, and culture that exist both within and beyond disability [1,11]. This broader understanding of diversity and the expansion of UD is also reflected in its application to education, with UD for learning approaches explicitly aspiring to meet the needs of all students [12].

Although UD in the built environment is often referenced in the literature, the research evidencing its efficacy remains emerging. Three factors contribute to the challenges of building an evidence base in this area: UD is not easily investigated by traditional scientific methods of analysis and validation; there is no clear definition of what constitutes a universally designed built environment; and there is little consensus on how UD principles should be applied or evaluated [13]. A synthesis of the peer-reviewed literature that does exist may establish what is known, and areas of future development around the evaluation of UD outcomes and efficacy.

The aim of this review was to present a synthesis of the current discourse around UD in the built environment that aims to promote social participation, and to explore the applicability of this evidence base to practice. To identify areas of consolidated evidence, and areas that require further development, a theoretical model which addresses the key components of UD – the person–environment–occupation (PEO) framework [14] – was adopted to provide structure to the integrated review (Figure 1).

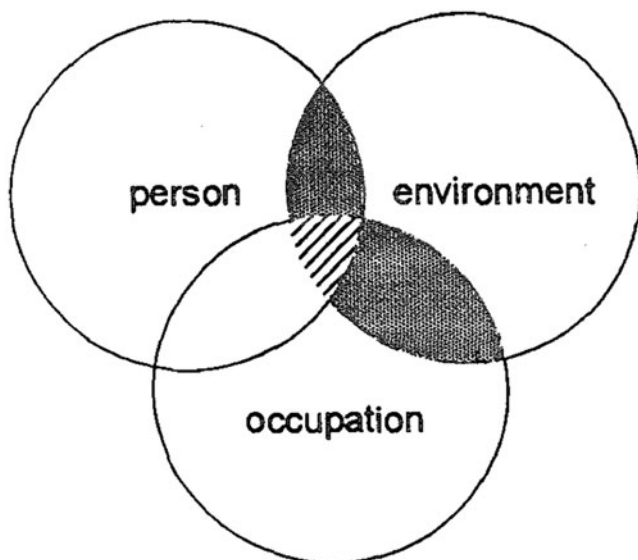


Figure 1. The PEO model. Reprinted from “The person–environment–occupation model: a transactive approach to occupational performance,” by Law M, Cooper B, Strong S, et al., 1996, *Canadian Journal of Occupational Therapy*, 63, p. 18. Copyright 1996 by SAGE Publishing. Reprinted with permission.

## Methods

Ethical approval was not required for this study as it drew upon previously published material, and does not involve human subjects, medical records, or human tissues [15]. This integrative review was conducted using the integrating evidence and action (ITEA) process, which is designed to make explicit links between theory, evidence, and future plans for knowledge translation and action [16]. While initially developed for the use of health clinicians, this process has also been found effective in conducting research in other disciplines [12]. The ITEA process includes seven steps, which will be described with specific reference to their application to this study.

### Step one: determining a critical question

The critical question guiding this study was “How is social participation represented in recent discourse around universal design in the built environment?”

### Step two: determining a theoretical framework

The PEO model is a theoretical model that describes the dynamic interaction that occurs between a person, their environment and their occupations [14]. Occupations in this context refer to personally meaningful activities which people need, want, or must do as part of their daily life [17]. Occupations enable the social participation targeted by the goals of UD. While not all occupations explicitly involve participation in social activities, occupations are multidimensional and interdependent [16]. For example, the occupation of shopping can require and enable social participation, but is also related to the performance of personal and domestic occupations. Participation in a range of occupations (personal, domestic, and social/community), across a range of built environments, is interrelated with health and wellness [18].

The PEO model has been used at both individual and macro levels to analyse, and better understand factors that may act as barriers or facilitators to people’s performance of meaningful occupations [19–21]. Given that the goals of UD in the built environment are premised on the aim to “enable and empower a diverse population by improving human performance, health and wellness and social participation” [1], the PEO model is an appropriate choice to highlight how its application to the environment impacts upon the humans who use it, and the social participation they seek to engage in (Figure 1).

### Step three: identifying the required evidence

An integrated literature review was selected as the method for this study. Integrative reviews complement the ITEA process by explicitly including all forms of evidence, in contrast to systematic reviews which privilege quantitative ways of knowing over others [22]. Integrated reviews follow similar procedures as systematic reviews, but pursue a more flexible analytic approach [23]. Integrative reviews are recommended for addressing complex and uncertain topics, which is appropriate to the inherent complexity of UD and the built environment.

The inclusion criteria for this review were articles: (1) published in a peer-reviewed academic journal between January 2011 and December 2017; (2) published in English; and (3) pertaining to any discipline or professional area. The exclusion criteria were (1) articles relating to the UD of learning, technology, and products and (2) published conference proceedings. This period of time

was chosen to ensure the analysis reflected recent discourse around this topic.

While this study focused on UD, other related terms are also in current use, including usability, accessibility, visitability, and barrier-free design. Two of these terms are closely aligned with UD, and were therefore included in the methodology for this study. Inclusive design caters for specific populations but remains of benefit to everyone [24–26], and is the preferred term in the UK [1]. Design for all is the term used more frequently in Europe, and is defined as “design for human diversity, social inclusion and equality” [27].

A total of 52 databases from health, science, education, humanities, and the arts on the EbscoHOST platform, along with the Scopus database, were searched by two authors (DH, VW) to ensure the inclusion of diverse perspectives. This search was repeated three times over two years by the same author as new evidence became available, and the most recent iteration of the search strategy is provided as [Supplementary Material](#). The search terms (“universal design” OR “inclusive design” OR “design for all”) AND “built environment” were utilised. Publications were excluded if they related to UD of “products,” “technology,” “education,” “teaching,” or “learning.”

After the removal of duplicates, a total of 47 articles were identified for independent full text review by two authors (VW, DH). Thirteen of these articles were subsequently excluded for not meeting the inclusion criteria, while the full text of a further article could not be located. Therefore, a final sample of 33 articles met the criteria for this integrated review.

Measures were embedded throughout this study’s design to ensure the findings are rigorous and credible. The inclusion of global publications from all disciplines ensures the review provides a comprehensive overview of UD discourse. Triangulation occurred as three researchers (VW, DH, CG) independently reviewed articles, compared findings, and reached consensus where differences in interpretation occurred. All three of these authors are experienced occupational therapists, who have utilised the PEO model throughout their careers and are very familiar with its concepts. All of these members of the study team have participated in UD research in the past, and/or have a detailed understanding of its practice in the field. Their background knowledge, along with that possessed by the rest of the study team, enabled an informed analysis that focused on translation of the synthesis into practice.

#### **Step four: deconstructing data**

All articles were read by two members of the study team, with contents relevant to each domain of the PEO model extracted into a specifically designed Excel spreadsheet. This spreadsheet commenced with a worksheet with information about the characteristics of the included studies (including aim, location, method, and sample). A series of further worksheets were designated locations for article content related to each domain of the model (i.e., person, environment, and occupation) and for the interactions between them (i.e., person/environment, environment/occupation, person/occupation, and person/environment/occupation), which was extracted verbatim. This content took the form of sentences or short passages that were considered to address a specific domain or interaction with the PEO model. Article content identified by both reviewing team members went on to the next phase of analysis, while those extracted by only one team member were discarded. A high degree of agreement was found between the

researchers regarding what was considered relevant content in reference to the PEO model.

The classification of content was then independently reviewed by a third team member as to their relevance to each PEO model element and their interactions. Definitions and interpretations of these elements available from the PEO model’s developers were used to support this process [14,21]. The few instances of uncertainty that existed were collaboratively resolved.

#### **Step five: critical analysis of data in relation to theoretical framework**

All data were then critically analysed in relation to the individual elements of the PEO model in the first instance. Critical analysis for each of the interactions between these elements was then undertaken via an iterative process of comparison and contrast. Comparison occurred when content related to the similar or related aspects of a PEO element was identified and consolidated (i.e., similar findings across different settings or populations), whilst contrast occurred when content was contradictory or dissonance was identified (i.e., alternative perspectives on concept or issue). Further columns added to the Excel worksheet that highlighted how the different aspects of the discourse related to each other enabled this process of analysis, and a deep understanding of the relationship between the discourse and the theoretical framework.

#### **Step six: reconstruction of data**

Once the content had been identified and understood in relation to elements of the PEO model, it was reconstructed into prose statements that describe how the peer reviewed discourse published between 2011 and 2017 addresses person, environment, occupation, and their interactions. The outcomes of this step of the ITEA process are reported in the findings section of this paper.

#### **Step seven: dissemination and transfer of findings**

The findings of this study are being disseminated through this paper and have also been presented at professional forums. Measures taken by this research team to translate findings into future practice and research will be reported in the Discussion section of this article, along with recommendations for further development.

## **Results**

### **Evidence characteristics**

As shown in [Table 1](#), the sample of articles included in this review ( $n=33$ ) is varied in regard to both disciplinary background, and approach to the concept of UD. The research team is aware of additional resources with relevance to this topic which did not meet the inclusion criteria for this review, and as highlighted by Heylighen et al. [41], the diversity inherent within the concept and practice of UD poses challenges to anyone seeking to obtain a comprehensive overview.

The majority of articles in this review originated from Europe ( $n=18$ , 55%) or North America ( $n=10$ , 30%), with the remaining evidence arising from Turkey, Saudi Arabia, Egypt, and Australia. While built environment disciplines, such as architecture, planning, landscaping, and engineering had a strong presence within this literature ( $n=18$ , 55%), health disciplines ( $n=6$ , 18%), and

Table 1. Characteristics of articles included in this review.

Author	Origin	Aims	Sample	Discipline	Methods	Key findings
Ahmed and Sungur Ergenođlu [28]	Egypt/Turkey	(1) Examine urban public spaces from the UD perspective (2) Find requirements for high-quality, accessible and legible streets (3) Provide leadership around attractive and inclusive streets (4) Highlight concept of UD for a range of stakeholders	<i>n</i> = 330 Visitors, shop owners, architects, planners, and officials	Not specified	Case study – quantitative surveys of participants, and qualitative observations by research team	UD application ensures equal democratic rights for all and full social participation. UD streets include access and linkages, comfort and image, uses and activities, and sociability.
Carr et al. [29]	Canada	Conceptualize how UD can support the active engagement of older adults, and provide examples of UD implementation with this population	N/A	Kinesiology/ Architecture	Literature review	UD is desirable for active engagement by older adults, due to broad benefits, lack of stigma and activity of daily living support. Increased attention from planners, evidence for application and greater acceptance to develop UD beyond a promising voluntary philosophy are needed.
Christensen [30]	USA	Explore how the built environment accommodates people with disabilities during emergency evacuation	<i>n</i> = 5000. Simulated individuals	Landscape Architecture and Environmental Planning	Quantitative modelling	Fewer emergency exits available for people with mobility issues than for general population. However, provision reduces evacuation time disparity. Wayfinding support needed for people with disability unfamiliar with environment.
Clarkson and Coleman [31]	UK	Describe the development of UD in the UK as a practice, topic of research, framework and toolkit	N/A	Engineering and Design	Descriptive history	Increased knowledge translation approaches from industry, universities and schools observed. Few UD applications are truly inclusive, with some becoming less inclusive. Accelerated research and development needed to facilitate UD goals.
Edwards and Harold [32]	Ireland	Discuss the architectural paradigm of DeafSpace, and its relationship to UD	N/A	Social Studies	Commentary	DeafSpace is a user centred approach, based on lived experience. It highlights the tension between universalism and particularism, and the potential of reflexive design practices.
Erkiliç [33]	Turkey	Scrutinise the aim of UD to “design for all,” in relation to underlying conceptual and strategic challenges and disability discourse	N/A	Architecture	Conceptual discussion	Universality in UD is a strength and potential oversimplification. Unresolved duality in UD between socio-political and design issues. Disability and impairment are distinct concepts. UD is not a “one size fits all” concept.
Frattari et al. [34]	Europe	Highlight awareness of UD adoption, and create e-learning tool which enables solution development	N/A	Civil and Environmental Engineering	Description of tool development	AWARD tool enables the identification of critical environmental barriers, and promotes an “inclusive” design approach. May be suitable for educational settings and industry.
Gray et al. [35]	USA	Review applicability of instruments measuring built environment and physical activity to people with disability	<i>n</i> = 95 instruments	Nursing and Psychology	Review of available instruments	Only UD principles 1–3 (tolerance for error, equitable use, and low physical effort) were represented significantly. Future instruments should integrate UD principles into design.
Hall [36]	USA	Discuss laws around access to residential homes, and benefits of ageing in place	N/A	Law	Commentary	Current domestic design standards are insufficient to enable aging in place. Local, state, and federal laws reform needed to encourage UD.
Hamraie [37]	USA	Present a feminist disability theory of UD, which produces physical environments and symbolic meaning	N/A	Medicine, Health and Society	Theoretical discussion	Design is value laden, and further work is needed to understand who is included/excluded by UD at national and international levels. This theory of UD can be interpreted as activism within design professions.

(continued)

Table 1. Continued.

Author	Origin	Aims	Sample	Discipline	Methods	Key findings
Hamraie [38]	USA	Discuss “post disability” narratives and historical “ideologies of ability,” in relation to critical disability theory and UD practice	N/A	Medicine, Health and Society	Theoretical discussion	UD discourse informed by critical disability theory, rather than ideology of ability, would better respect building users as lived experience experts, understand accessibility as a resource and highlight the value of disability embodiment UD understands disability as the interaction between person and environment. Challenges associated with designing for all relevant to every area of design.
Heylighen [39]	Belgium	Examine how UD relates to general design, and explore scepticism towards this approach	N/A	Architecture	Commentary	Further promotion needed for built environment professionals to value consulting with people with disability
Heylighen et al. [40]	Belgium	Describe consultant service provided by people with disability about their experience of built environment	N = 53 Architectural professionals (n = 34), people with disability (n = 7), expert organisations (n = 12)	Architecture	Qualitative – interviews	
Heylighen et al. [41]	Belgium	Address common questions about UD in the built environment	N/A	Architecture	Discussion/question and answer	Adoption of UD remains limited, and misconceptions prevalent. Promising future developments include greater user involvement in integration of UD into educational curricula. UD must include designers and users. Evaluation of UD is not the sole preserve of any stakeholder group, but arises from collaborative deliberation.
Heylighen and Bianchin [42]	Belgium	Present an argument for design as a deliberative enterprise, which integrates inclusivity and normative objectivity	N/A	Architecture	Commentary	Both professions bring unique strengths and skills design. All stakeholders must actively collaborate with others for multidisciplinary UD.
Hitch et al. [43]	Australia	Explore key stakeholder perspectives on how occupational therapists and architects collaborate on UD	n = 28 Occupational therapists, architects, service managers, access consultants, legal practitioners, higher education professionals, other health professionals	Occupational Therapy & Architecture	Qualitative – interviews	
Imrie [8]	UK	Critique the theoretical and conceptual underpinnings of UD	N/A	Geography	Commentary	UD usually presented from a reductive and functionalist perspective, focusing on technical or management solutions. Universalism is ill defined, therefore provides partial understandings of overcoming inequality in built environments. UD can support architects to design less hostile built environments, however, power differentials between professionals and citizens must be addressed to enable this (i.e., inadequate handrails, excessive flight lengths, low visual contrasts)
Jones [44]	UK	Provide a sociological – theoretical critique of UD, drawing from other transformatory architectural movements	N/A	Sociology	Commentary	61% of stairways had at least one design hazard
Kim and Steinfield [45]	USA	Evaluate stairway designs features in a leading architectural journal from 2000 to 2013	N = 578 stairways	Architecture	Cross sectional review	
Koutsogeorgou et al. [46]	Europe	Demonstrate the relevance of items in the COURAGE in Europe Built Environment instrument to health and disability assessment	N/A	Health	Cross sectional mapping	Most items linked to few International Classification of Functioning, Disability and Health for Children and Youth categories, with some not linked at all

*(continued)*

Table 1. Continued.

Author	Origin	Aims	Sample	Discipline	Methods	Key findings
Lid [47]	Norway	Utilise an empirical study of an urban design project to interpret the "right to the city"	Not stated	Rehabilitation	Commentary	The "right to the city" includes rights to participate in public places and political processes. Policy documents would have more influence if related to human rights, discrimination and accessibility legislation.
Meshur [48]	Turkey	Identify the problems that people with disabilities encountered in urban areas	N/A	Urban and Regional Planning	Spatial field survey	UD need to encompass all urban spaces, and should be multidisciplinary. A lack of awareness of the needs of people with disabilities, and how UD can benefit all people.
Mulazadeh and Al-Harbi [49]	Saudi Arabia/ South Africa	Survey the influence of disability policy in Saudi Arabia on the creation of accessible built environments	$n = 13$ public buildings and $n = 6$ public roads	Engineering	Field observations	Very few buildings achieved >50% compliance, and no roads met this benchmark. Policy has not translated into accessible environments in real life.
Nasar and Elmer [50]	USA	Explore developer and builder perceived barriers to visitability in new housing	$n = 203$ Homeowners ( $n = 96$ ), homebuyers ( $n = 107$ )	City and Regional Planning	Cross sectional survey	Houses with visitable features were preferred by both groups, but perceived to cost more
O'Shea et al. [13]	Ireland	Review of building evaluation from the perspective of UD	N/A	Civil Structural and Environmental Engineering	Literature review	Current UD evaluations rely upon checklists, value-driven, or invisible evaluation. Future evaluation should include validated design standards and guidelines, contextual evaluation criteria and multiple methodologies.
Pionke [51]	USA	Discuss the UD aspects of public libraries	N/A	Library and Information Studies	Commentary	Legislation to support UD not widely enforced. Libraries can draw on their leadership of social change to ensure inclusive spaces and services.
Pritchard [52]	UK	Discuss how spaces are disabling for different body sizes, and how UD may address this issue	N/A	Geography	Commentary	UD is applicable to the geography of different body sizes, and beyond specific functional impairments
Pritchard [53]	UK	Explore issues that people with short stature have when accessing the build environment	$n = 22$ ( $n = 20$ female)	Geography	Qualitative – interviews and photo elicitation	Specially adapted spaces can be both enabling and disabling. UD may enable participation by people with dwarfism, but a relatively small population means their needs are overlooked.
Purcaru [54]	Romania	Offer an architectural perspective on special education, including phenomenology and environmental psychology	N/A	Architecture and Urban Planning	Commentary	Best practice UD includes perspectives of users of that environment. UD may support more creative architecture, rather than restrictions and limitations.
Quintas et al. [55]	Italy	Review current built environment assessment tools, and identify common key items	$n = 31$ instruments	Health	Review of available instruments	Checklist and self-report questionnaire of items addressing the built environment structure and its interaction with users were generated
Siddal et al. [56]	Ireland	Explore use of personas in design as part of city re-development to promote sustainable behaviour and social inclusion	$n = 8$ personas created	Engineering	Description of field observations	Personas may be an appropriate approach to UD, particularly in early design stages and in conjunction with other user centred approaches (like participatory design)
Simmons and Kroffors [57]	Finland	Present four case studies highlighting common factors leading to excellence in housing design	N/A	Architecture	Commentary	Inclusive public environments can encourage wider participation by all members of a community
Watson et al. [58]	USA	Describe the introduction of UD principles into multiple facets of campus life	N/A	Higher Education	Summary of a design method	Institutional UD policies and guidelines can support university accessibility. UD adoption may also encourage new student groups to access higher education.





Figure 2. The PEO model including articles reviewed.

humanities scholars ( $n=8$ , 24%) also made a contribution. The majority of the articles reviewed here were uni-disciplinary, although three (9%) included a multidisciplinary approach to their topic.

A common approach across articles was to examine UD from the perspective of evaluation or reviews of built environments [13,30,35,46,48,49,53,55]. Many other articles adopted a theoretical stance, often comparing UD to other theoretical frameworks or historical and contextual factors [8,31–33,36–38,42,44,52,54]. Some examples of the UD implementation process in practice were also provided [29,57,58], with the participation of building users in this process highlighted in two studies [40,56]. Several studies also explicitly sought to raise awareness or understanding of UD as a concept [28,34,41], or explore the comparative perception of stakeholder groups [43,50]. Generally, the discourse around UD in the articles included in this review is driven more by description, discussion, and commentary than empirical approaches; although, a combination of quantitative, qualitative, and mixed methods approaches has been employed.

### Relationship to the PEO model

While references were found in the literature that relate to all domains of the PEO model, the “person” and the “environment” are the main focal points of current discourse about UD in the built environment. This finding is illustrated in Figure 2, which displays the number of articles in the reviews that included content related to each of the domains of the PEO model.

#### Person

Discourse around the person in UD currently focuses on specific attributes (usually related to disability), and the personnel involved in the UD application process. While other examples of human diversity were presented in these articles, such as people with obesity [52], much of the identified diversity focused on physical or mobility impairments, potentially overlooking the needs of people with sensory and cognitive needs [51]. The diversity of human capabilities (physical, mental, social, cultural) and anthropometrics that occurs across the lifespan and across a

population was highlighted in several of the articles reviewed. However, using these aspects of personhood as a basis for UD has also been critiqued, given the lack of data available about some segments of the population [38,44,47]. To more effectively address diversity, Clarkson and Coleman [31] propose that user populations include a series of overlapping bell curves representing different capabilities or measures, with the central area encompassing the population average. An individual could therefore be in a range of locations on these curves depending on the capability or measures, due to the multiple aspects of their personal identity [37]. This highlights that UD is unlikely to ever be inclusive of all aspects of all persons.

In regards to planning, designing, and evaluating UD, a strong theme in the current discourse is the need for built environment users to play a meaningful role in this process [37,42]. Ideally, such collaboration or co-production with professionals should be facilitated from the beginning of the design process, to enable people’s lived experience and non-professional “design authority” to be fully embedded at all stages [8,43,44,47,57]. Several methods for facilitating this involvement have been proposed, including collaboration with specialist advocacy or representative organisations, the development of best practice guidelines for user involvement and the use of personas (i.e., case studies based on real lived experience) to promote empathy and mutual understanding [29,48,56].

While collaboration and co-production were broadly presented as valuable and sought after, elements of the discourse also framed the interpersonal relationships required as potentially problematic. Built environment professionals receive relatively little training or education in UD and generally do not have access to the subjective lived experience of people with diverse needs to draw upon during the design process [13,29]. Potential tensions between professionals and their clients were also identified, as the latter may be more driven by financial considerations than the broader mission of UD [29,31]. Champions and advocates for UD are noted to play an important role in its implementation in the built environment, and they may belong to any stakeholder group [31].

The ability of built environment users to articulate their needs to professionals has also been questioned, given the terminological differences between professional and community settings [39,42]. People with disability have reported that during previous experiences, they needed to persuade professionals of their value to the design process, and barriers to these working relationships are proposed to occur more often due to ignorance and/or fear than pervasive negative attitudes [40]. Currently, UD is primarily focused upon the role of professional expertise and knowledge (which is assumed to come from the perspective of people without a disability), which can lead to built environment users being “acted on” rather than included as equal partners. This highlights the continuation of historical power disparities between people with, and people without a disability, and between professionals and non-professionals, and may lead to the breakdown of collaborative projects due to perceptions of tokenism and discrimination [32,44].

#### Environment

The discourse around the environmental aspects of UD has focused on its relationship to related theories and constructs, and the features that promote accessibility for particular population groups. The embedding of UD into local regulations, standards, codes, and legislation that inform built environments is seen as a key strategy for supporting its implementation into practice [32,34–37,40,42–44,48,49,59]. As highlighted by Imrie [8], global

organisations, such as the United Nations and World Health Organization, have accepted the principles of UD. Despite this, built environments may demonstrate only loosely applied principles, due to their broad nature [13,44], and Gray et al. [35] found that only the first four principles of UD are regularly addressed in evaluation tools. Frameworks such as the aging principles of the World Health Organization, and trans-generational design, have been identified as complementary to and facilitative of UD for older people [29,55]. Links between the environmental aspects of UD and broader concepts (such as health and disability, or socio-political contexts) have been explored in some studies, but are noted to be poorly understood at the current time [38,46].

In regards to specific features that promote accessibility, current UD discourse has been critiqued for focusing on outcomes rather than processes [44]; although, the introduction of UD into professional and trades curricula offers an opportunity for procedural influence [34]. Walkability and pedestrian access was an area of consolidation in the articles reviewed [30,46,47], as were universally designed environments for older people. For example, the installation of automatic doors has been cited as an example of good UD practice for older people, as has wall blocking to enable the installation of future adaptive equipment and the implementation of visitability standards in housing [29,36,58].

### *Occupation*

The discourse around occupation in relation to UD is currently very sparse. Universal design is recognised to have the potential to support participation in occupations identified as “cherished,” including education, religious observance, commercial activities, family life, and recreation [37]. As most of the UD discourse focuses on public buildings, public spaces and facilities, social participation (such as shopping and commuting) were particularly highlighted [28,29,47]. However, the nature of these activities, and what people require from their built environment to participate in them, are rarely addressed in more than passing.

### *Person–environment*

The discourse around the relationship between person and environment highlights the role of environment in the experience of disability. It also explores the evaluation of universally designed built environments and acknowledges the education professionals need in order to understand its application to real life. Traditionally, built environment design has privileged average or normative capacities over divergent or alternative ones, while acknowledging that people experience spaces very differently. Universal design is said to be based on the assumption that a poorly defined space is disabling, rather than the medical or psychosocial condition experienced by a person [31,52]. For example, a poorly designed stairway can make people reluctant to or unable to use this feature and therefore exclude them from part of a building [45]. However, Jones [44] noted that access problems in the built environment are often still located with the users in the discourse, with barriers represented by technical representations of an individual’s body and mobility needs. This is despite these personal attributes frequently being presented as fixed and unchanging, in contrast to the potential for the built environment to be modified via UD [46].

The human right of all people to equal citizenship is also a theme in this discourse, particularly the right to access and experience safety, security and comfort in public environments [28,47]. Frattari et al. [34] assert that people with disabilities are no longer “guests of society,” but an integral part of it. Therefore, the right to inclusion (potentially enabled by UD) should not be

conditional on resource availability, or on the tolerance and permission of the general population [38,51].

The inclusion of all people in the built environment as equals is the stated goal of UD, which aspires for all users to be able to use the same space without special modifications or attention being drawn to their diversity [33,41,48]. However, the development of UD itself has also increased attention on the diversity inherent in the population, contributing to the development of specific environmental designs for identified groups and cultures (such as DeafSpace, dementia friendly environments, and autism friendly architecture) and the accommodation of assistive devices [8,32,37,41,58]. While these specialisations may be seen as contrary to the universal aspirations of UD, a generalised or “one size fits all” notion of disability or diversity has also been critiqued for disregarding the diversity this approach is attempting to meet [33]. The tension between the foregrounding of disability as a personal attribute and holding UD distinct from this form of personal diversity (either entirely, or in favour of a focus on marginalisation in broader terms), remains present, with ambivalence between embracing diversity on the one hand and attempting to eliminate it through design [38,54].

The relationship between person and environment has also been explored through discourse around the evaluation of universally designed built environments. There is no current consensus around a standardised approach to evaluation, and the process of the development reported for the COURAGE tool [46,55] illustrates the complexity involved in assessing how people relate to their environment. A reliance on standardised approaches may also obscure why particular building features are problematic, by reducing the person element to a series of indicators or averages without explanation or focusing on potential demands on the person rather than actual demands experienced in that space [13,36,41,59].

It has been proposed that subjective evaluation tools with lower specificity may contribute greater insight from people with disability, and that multiple methods of assessment and tools are likely to be required for each built environment [13,35,56]. However, the adoption of multidisciplinary, multi-method approaches to exploring the relationship between person and environment introduces increased complexity into an already complex phenomenon [48], and designers may be tempted to focus on the challenges of the “extreme user” rather than a more prevalent capability profile [31]. Simulation or accompanied building site visits has been recommended as a way for designers to get a better sense of the lived experience of the relationship between person and environment from the perspective of a different user [31,40,43]. Beyond the features of the built environment, the economic, social and health consequences of not implementing UD are not often evaluated and assumptions that UD may facilitate economies of scale and decrease longer-term health costs remain untested [37,43,50,58].

The education of design professionals who design and build public environments has also been discussed, but the inclusion of UD in professional education is not unanimously advocated. Reasons provided not to include UD training focus on its lack of supporting evidence, lack of space in professional curricula, and its poor investment-value when authorities do not support implementation [39]. The alignment of UD with political instruments (such as disability discrimination legislation) is often implied but not explicitly addressed in professional education [44,58], although governing bodies, such as the Council of Europe Committee of Ministers, have mandated that UD be part of the

curricula for all design professionals despite the presence of ambivalence about its value [34].

### *Environment–occupation*

Despite the relative lack of discourse around the relationship between environment and occupation in this review, the evidence available presents a consistent message. When considered in conjunction with occupational participation, several authors have highlighted that simply being able to access or visit an environment is not enough – users must also be enabled to engage in their preferred occupations within that space, because equity is embodied through this participation [8,29,47,48,50,56]. Watson et al. [58] cites examples where student accommodation met minimum criteria or UD guidelines, but still did not enable residents to function in their student role. However, only two of the instruments for evaluating UD identified by Gray et al. [35] included items which assessed the occupations that a person wanted to engage in within that environment. Koutsogeorgou et al. [46] also found that it was difficult for people to evaluate a built environment without them also commenting on the occupations they normally performed there. Some approaches to UD have begun to incorporate aspects of the environment–occupation relationship, such as Froyen’s approach which includes activities and patterns of interaction [13], but this is yet to become common practice.

Culture is a key determinant of the occupations people engage in and is recognised as an influence on the needs which must be met by built environments [43,55]. Historically, UD originates from a Western socio-political context and is based on inherently Western ideals around disability, equity and the participation of people with a disability and its transferability to other cultures is yet to be determined [8]. A UD approach to built environments may not be sensitive to local culture and populations [8]. The repertoire of occupations that may be required in public built environments, such as a streetscape, will depend on factors such as cultural practices and neighbourhood demographics [28]. Universal design may also need to accommodate other aspects of cultural expression (e.g., such as decorative features); although, their relationship to safety and accessibility is currently unknown [45].

### *Person–occupation*

Beyond individual engagement in occupation, UD may also enable social activism by supporting the social and economic participation of people in their communities [8,47,48,51]. If public built environments enable inclusion, and also choice around when and how to engage in occupations, people may be encouraged to socially participate more actively [47,57]. Hamraie [37] proposed this could be achieved by promoting UD explicitly as a method for social change, rather than as a commercial marketing strategy.

The design of built environments themselves could also be considered as an avenue for social participation, in and of itself. Siddal et al. [56] constructed personas based on statistical information representing the needs of a range of people with diverse needs, and then simulated them engaging in a range of occupations within the built environment. However, real life building users with the diverse needs identified were not involved in the process, as this had been assessed too labour intensive. This approach stands in contrast with Heylighen and Bianchin’s [42] assertion that people should not take the role of judge in relation to UD, but rather adopt the role of collaborator with the people who are in the best position to collect information relevant to

their occupational needs in an environment. Jones [44] also urges UD practitioners to follow Wijk’s recommendation [60] to “not think in terms of people, but to look at every aspect of human functioning.”

### *Person–occupation–environment*

The integrated consideration of person, occupation, and environment for UD was identified within the discourse in several examples, despite the relative lack of discourse around occupation and its relationship to person and environment. For example, a low bank counter could enable a wheelchair user or a person of short stature to independently engage in the meaningful community occupation of financial management [52]; the practice of Deaf people choosing open plan living arrangements to facilitate clear lines of sight for communication [32]; or the use of visitability guidelines to enable a person with mobility impairments to socialise with friends and family in the home [50]. Occupational therapists have been identified as a discipline who already possess an integrated view of the person, occupation, and environment; although, this could also be contributed to by collaboration with a range of disciplines beyond those traditionally involved in the design of the built environment [43]. However, all of the content that addressed PEO was brief (often a single sentence), and presented as self-contained examples.

## **Discussion**

Recent discourse around UD in the built environment primarily addresses the person and environment components of the PEO framework. This is perhaps unsurprising, as the interaction between people and environment has been identified as the key focus of UD and the source of its leverage for social change [41]. It is also understandable on the basis that aspects of the person and the environment are amongst the most tangible, and a reasonable way to engage with a complex phenomenon is to start with the simplest aspects of it. However, it is noteworthy that the discourse reviewed here comes from a wide range of settings, disciplines, and contexts, and yet, as noted above, the themes addressing each aspect of the PEO model were remarkably coherent.

### *Areas of ambivalence in the discourse*

There remains ambivalence in the discourse around the involvement of built environment users in the UD process, both in terms of their identity and the value of their inclusion. Current discourse around the person in UD is located mostly at the population level [21], with people who experience disability (particularly those with physical and mobility impairments) broadly represented as an “identified” group of built environment users. The multiple, inter-related, and inter-dependent nature of aspects of diversity is beginning to gain recognition, mainly regarding the challenge this presents to the aspiration of “design for all.” The discourse around the meaningful inclusion of built environment users in the UD process has also focused more on the potential problems this may present, rather than the often-assumed benefits of this approach.

There are several particular areas of tension in the discourse around the relationship between the person and environment. While the environment is acknowledged to contribute to the experience of disability for some built environment users, the problem remains located with the person, and the capacity for recovery or change over time in a person’s ability to engage with

the environment is rarely acknowledged. While the notion of equal citizenship is invariably supported, there remains significant discord around whether UD should accommodate or eliminate the experience of disability in the built environment. The strong focus on people with a disability as the target population of UD is also a source of ambivalence, as this may appear to narrow its application to a specialist area. The current discourse highlights significant uncertainty around what UD is trying to achieve in the relationships between person and environment.

A sense of ambivalence was also evident in the discourse around educating built environment professionals about UD. While the introduction of UD into professional curriculum is mandated in some cases, challenges associated with its implementation have discouraged its broader introduction, until its actual impact is better understood. Contributing to this ambivalence are the challenges inherent in evaluating a complex phenomenon across multiple populations, contexts and built environments. Currently available assessment methods and tools require further development, particularly in regard to the adoption of mixed and multiple methods to gather diverse perspectives on outcomes.

### ***An incomplete or uneven approach to the principles of universal design***

Much of the discourse around the environment focused on specific building features appropriate to meet the needs of sections of the population, leading to an uneven or incomplete representation of the principles of UD. This was also prominent when UD was considered in relation to other theories and constructs, as guidance around the features was often the main content of influential regulations, standards, codes, and legislation. Given that the application of UD in the environment is the most tangible aspect of its practice, it is perhaps unsurprising that the environmental aspect of the PEO model is clearly and explicitly addressed. However, once the discourse moves beyond the micro level of specific building features, the broad nature of the principles of UD introduces significant diversity. The uneven representation of the principles in current evaluation tools may indicate they are considered to have variable influence on UD. As the key guidance available to practitioners, the impact of the principles on the development of built environments requires further exploration.

The remaining four components of the PEO model (environment–occupation, occupation, person–occupation, person–occupation–environment) were clearly the least prevalent in the current discourse, both in terms of numerical references and depth of content. It was widely recognised that social participation (as opposed to simple access) was crucial to the meaningful achievement of equity and social inclusion, and that what people do in a built environment is just as important to its evaluation as how they get there. Accessibility remains emphasised as an end rather than a means, indicating that UD is still largely conceptualised from an accessibility, rather than an outcomes point of view.

### ***Occupation as a means to social participation***

The current focus in the discourse on person and environment means that a crucial aspect of the interaction that occurs between a person, their environment and their occupations is missed. There are indications that this gap in understanding is recognised on some level [38] in the frequently made assertion that accessibility is not sufficient, and in references to the social justice and

equity aspirations of UD. However, one of the consequences of diversity being mainly confined to disability (as opposed to, for example, social and cultural diversity) appears to have been a focus on physical capacity and function, rather than on the roles people play in life. Thus, identifying a built environment user as a person with a lower limb amputation highlights questions of mobility; whereas identifying them as the parent of a young child highlights their need to undertake feeding, changing, play, and supervision duties. The many areas of ambiguity and tensions within the discourse identified in this review (i.e., the universality of design versus the valuing of diversity) may also be obscuring.

The missing link of social and occupational participation is beginning to emerge in discussions around what constitutes “good” design. Several authors have indicated they believe that UD and good design are one and the same [31,38,54]. The UK Design Council [61] states that good design is about aesthetic improvement of the environment, along with improved quality of life, equality of opportunity and economic growth. The Principles of Good Design adopted by the Office of Design and Architecture in South Australia [62] specifically include the creation of built environments for everyone to use and enjoy. In specific regards to UD, Heylighen and Bianchin [42] believe that excellent design is not about appreciation from both designers and users, but its co-production by professionals and built environment users around what is done in the space. If UD is synonymous with good design, then social participation through occupation should be an essential part of the discourse.

Given the key role that regulations, standards, and legislation are considered to play in the enactment of UD, the inclusion of social participation and activity in these documents would support its greater presence in the discourse. There is also a clear need to incorporate occupation into the methods of assessment and evaluation tools used to understand the impact of UD in the real work. Universal design advocates from all disciplines assert that its adoption and application will benefit all people, and create a more just and inclusive world [31,38]. The only way to provide evidence for this aspiration is to evaluate person, environment, and occupation factors, and the ways in which they interact with each other.

### ***Limitations***

While this review has been conducted in a systematic and rigorous way, it has several acknowledged limitations. The selection of peer reviewed literature as the primary source of the review means its conclusions are drawn from single genre, and the authors acknowledge that conference proceedings, grey literature, and social media posts may contain perspectives and findings which challenge the evidence presented here. The original database search was conducted by a single author, although all screening of abstracts included independent work by members of the research team. While having all three abstracts reviewed by those well versed in the PEO model increased the consistency of thematic analysis, it may also have introduced bias from that particular disciplinary perspective. Limiting the review to a period of six years has also excluded older evidence that could inform a more historically embedded understanding of this discourse. The use of electronic databases to search for evidence may also be a limitation, as UD (and related terms) are not commonly found in the subject headings and taxonomies on which they are based.

## Conclusions

The recent discourse around UD in the built environment in peer reviewed journal articles reflects a dominance of person and environmental factors over considerations of occupational and social participation within these spaces. If UD is intended as a means for increasing social inclusion and wellness, it cannot be limited to only personal and environment determinants. Economic, educational, and cultural participation in community life is predicated on the occupations people perform in the built environment. To reach its stated goals, the discourse around UD must be more inclusive of the occupations people participate in to live, work, and recreate in their daily lives.

The discourse reviewed here also indicates the ways in which UD is currently practiced, and areas of contention within the community of stakeholders. The meaningful inclusion of non-professionals in the process of UD remains an aspiration, rather than a regular achievement. However, an overall lack of collaborative practice is reflected in the finding that the vast majority of evidence is uni-disciplinary. The discourse is also notably uni-cultural, with all but four of the articles originating in European cultures. While a range of disciplines and perspectives are present in the body of evidence as a whole, the current discourse around UD tends towards uniformity in its focus on the relationship between the person and environment, single discipline research and cultural origin. This could be interpreted as the results of a consolidated understanding of UD, but it has implications for the ongoing development of the practice.

Enlarging the discourse around UD to include a focus on occupational and social participation, multi- and trans-disciplinary collaboration (both within and outside the professional realm), and multicultural perspectives (beyond Western and disability based understandings) will enable the concept to reach its full potential as a medium for social justice. Balancing this call for expansion is a recommendation for the consistent use of “universal design” in titles or keywords as a strategy to manage and promote the synthesis of a more diverse discourse. As a concept that straddles multiple boundaries, the accelerating collective knowledge of UD should be accessible to all stakeholders.

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## ORCID

Valerie Watchorn  <http://orcid.org/0000-0003-4726-2414>

Danielle Hitch  <http://orcid.org/0000-0003-2798-2246>

Richard Tucker  <http://orcid.org/0000-0001-9989-251X>

Susan Ang  <http://orcid.org/0000-0003-0180-584X>

Patsie Frawley  <http://orcid.org/0000-0002-7643-4935>

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