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Kaleidoscopic associations between life outside home and the technological environment that shape occupational injustice as revealed through cross-sectional statistical modelling

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ABSTRACT

Background: Everyday life outside home and accessing a variety of places are central to occupation. Technology is ever more taken for granted, even outside home, and for some may culminate in occupational injustice. This study aims to explore the association between everyday technologies (ET), particularly out of home, and the number of places older adults with and without dementia go to, in rural and urban environments. **Method:** The Everyday Technology Use Questionnaire, and Participation in Activities and Places Outside Home Questionnaire, were administered with 128 people in England. Six logistic regression models explored the association between ET and the number of places people went to, with other demographic factors (i.e., rurality, diagnosis, deprivation). **Results:** The amount of out of home technologies a person perceived relevant and relative levels of neighbourhood deprivation were most persistently associated with the number of places people went to. Associations with ability to use technology, diagnosis, and education were more tentative. In no model was rurality significant. All models explained a low proportion of variance and lacked sensitivity to predict the outcome. **Conclusion:** For a minority of people, perceptions of the technological environment are associated with other personal and environmental dimensions. Viewed kaleidoscopically, these associations assemble to generate an impermanent, fragmented view of occupational injustice that may jeopardise opportunities outside home. However, there will be other influential factors not identified in this study. Greater attention to the intersections between specific environmental dimensions may deepen understanding of how modifications can be made to deliver occupational justice.

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KEYWORDS

Occupational science; Dementia; Everyday technologies; Occupational deprivation; Occupational marginalisation; Rural-urban divide

Going to a variety of physical places is central to everyday life outside home and could be indicative of independence and agency in maintaining the performance of occupations. Occupational science has challenged the notion of successful mastery over the environment and asserted

that multiple environmental dimensions can serve to narrow occupational opportunities (Hocking, 2020). The call for empirical understanding of how occupational justice issues arise and operate, demands research using different methods (Frank, 2012). Occupational

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scientists have tended to emphasise the meanings of contextually situated occupations, and without a precise measure of occupation, it has been argued that quantitative explorations are precluded (Durocher et al., 2014). However, examining differences in the number of places that individuals have access to could add further insights by revealing inequities in people's occupational opportunities, thus providing a view of occupational justice issues in everyday life.

As occupational engagement is contingent on accessing a variety of places, preventing a decline in going to places outside home should therefore be a priority. Such prevention could reduce the economic and social burden of care, anticipated as Europe's population over age 64 increases at a greater rate than the working age population, to reach 150.6 million by 2050 (European Commission, 2018). Added to the challenges of caring for an increasing ageing population are the challenges associated with increasing incidence of dementia, estimated to affect 18.7 million people in Europe by 2050 (Prince et al., 2015).

More recently, attention has turned to understanding more about how people with dementia experience life in specific places beyond the home, such as neighbourhoods (Odzakovic et al., 2018), grocery shops (Brorsson et al., 2018), and urban public art (Kelson et al., 2017). The term 'shrinking world' was introduced to describe the impact of dementia on people's outdoor lives (Duggan et al., 2008). Subsequently, a cross-sectional study found that over time, all community destinations and amenities outside home were more likely to be abandoned among people with dementia (Chaudhury et al., 2020). However, the same study found that participating older adults without cognitive impairment abandoned places for physical and recreational occupations. This suggests that a shrinking world may not only be the preserve of those living with dementia.

Occupations outside home are also increasingly contingent upon interaction with the technological environment (e.g., ticket machines to access transport, chip and PIN devices for shopping and so forth). Globally societies are located within a technological transition which is rapidly altering the nature of occupations in which humans engage. As the dominance of the technological environment increases, human

autonomy is infringed upon in relation to performing an ever-widening range of occupations. For example, the increasing ubiquity of travel ticket machines, internet banking, and automated call centres has meant that in-person services are being withdrawn. In some instances, leaving home is no longer necessary to access services, reducing the applicability of, for example, physical bank branches to everyday life. Consequently, individuals encounter barriers to occupation (e.g., travelling, managing personal finances and utilities), when it is not possible to overcome inaccessibility of the technological environment or avoid this environment altogether (Smith, 2017).

Technology development, and use, is socially driven. It serves market forces, and individuals' interactions with technologies—while seemingly autonomous—generate data, which are stored and used to predict future patterns of human occupation (Zuboff, 2015). For some, this infringement to autonomy when engaging with the technological environment coincides with increased convenience and ease—it suits their habits and capabilities and provides occupational opportunities. For example, people may be either unaware or content to sacrifice their privacy and rights over how their data are used for the perceived benefits of online browsing or feel secure through public surveillance. However, based upon anticipated efficiency improvements, and to reduce the burden on physical services, initiatives push to improve inclusion to a variety of technologised services (OECD, 2016). This is also the case within health care (e.g., self-management of long-term conditions through digital programmes and supportive applications), where evidence indicates that older adults, those in poorer health, and those living in rural areas are most likely to be excluded (NHS Digital, 2018).

For older adults with cognitive impairment, the technological environment coincides with greater complexity. This means the challenge of using technologies in public spaces may make any difficulties or disabilities a person has more visible to others (e.g., at supermarkets, ATMs, in car parks or metro stations, at doctors' surgeries and so on). So the technological environment may hinder the abilities of people with dementia to show competence and to be

like everybody else (Rosenberg & Nygård, 2017) when engaging in occupations outside home; health care, shopping, banking, travelling, and so on (Brorsson et al., 2018; Frennert & Östlund, 2018; Lindqvist et al., 2018). Such challenges could be seen as an occupational injustice, since there may be systematic reasons why interactions with the technological environment vary and consequently restrict occupation (Kottorp et al., 2016; Townsend & Wilcock, 2004).

To date, the amount of Everyday Technologies (ETs) reported relevant and the perceived ability to use them has been shown to overlap, but be significantly lower among groups with dementia, mild cognitive impairment, and subjective cognitive impairment, in comparison to groups with no known cognitive impairment (Malinowsky et al., 2017; Nygård et al., 2012). Additionally, ability to use ET correlated strongly with the amount of information and communication ETs (ICTs) reported relevant only among a group with mild stage dementia and not at all among the control group (Wallcook et al., 2019). Subsequently, a lesser amount of ETs used out of home (i.e., smartphones, computers, card payment machines, ticket machines, lift access, keypads) were shown to be relevant to a group of people with dementia in comparison to controls, and this coincided with going to significantly fewer places outside home (Gaber et al., 2019). These comparisons and relations highlight how the technological environment may be contributing to occupational injustice in the lives of people with dementia. However, despite the prevalence of ET used out of home little is known about its association with the places people go to, and what other factors influence that relationship.

Between rural and urban contexts, the range, patterns, and distances of places that people go to in order to carry out occupations may be differently composed. This may be expected partly because living in rural areas incurs increased distances, travel times, and costs, where public transport and communications infrastructures are lacking (Local Government Association, 2017). The rural-urban divide persists in relation to technology with inequalities in quality of infrastructure, inclusion, and diffusion of technologies (Salemink et al., 2017). So, the technological encounters on route to a

range of places may also be unequally dispersed between rural and urban locations. Consequently, the constitution of places outside home and the interactions with, and influences of technology on, occupation may be expected to vary between urban and rural environments. While the physical environment and technological environment outside home have together received attention (Brittain et al., 2010; Gaber et al., 2019; Lindqvist et al., 2018), most studies take place in urban contexts with little known about how these environments entwine in rural locations.

The characteristics of deprivation have also been shown to vary between urban and rural contexts and need to be taken into account (Fecht et al., 2017). Certain ETs (e.g., airline check-in machines) may depend upon having the personal means to reach those places where such technologies can be accessed. So, use is influenced by both personal circumstances and the context, since the costs of ET provision may be borne by the individual or by external companies. As such, the socioeconomic status of individuals and communities may also be influential to the places and ETs people access for occupation. Socioeconomic inequity and inequalities of ET access have been highlighted as culminating in an occupational justice issue (Kottorp et al., 2016). Further investigations could uncover whether this issue of occupational justice is also revealed within the physical places people access for occupation. In order to better empirically understand the contextual factors of occupational injustice, this study aimed to explore the association between (particularly out of home) ET use (amount relevant and ability to use ET), and the number of places a group of people go to, with and without dementia, in a rural versus urban environment.

Method

Design

A realist social ontological perspective, which acknowledges the coexistence of subjective and objective realities, underpins this study. This perspective embraces the totality and irreducibility of everyday life outside home, while simultaneously acknowledging that everyday life,

including occupation, is comprised of separable shifting entities (DeLanda, 2006). In order to capture a view on these entities, a quantitative, cross-sectional study was designed for rural and urban UK contexts, involving older adults with dementia and with no known cognitive impairment.

Participants

In total, 128 UK-based participants were recruited to the study between May and November 2017. Recruitment of 64 people living with dementia took place at five National Health Service (NHS) research sites; two in Cumbria, two in London, and one in Greater Manchester. A member of the person's care team screened medical records (according to inclusion criteria below), contacted people to discuss participation, and provided written information directly. Sixty four people with no known cognitive impairment were recruited by word of mouth (spoken or email) about the project and using posters displayed in public places, small businesses, and group meeting premises in Cumbria and London. Employees and volunteers of voluntary sector organisations presented the research and handed information directly to their activity group members or invited the researchers to do so. The researchers' contact details (authors one and four) were circulated, and prospective participants either made direct contact with the researcher or gave permission to be contacted by the researchers. These people with no known cognitive impairment were then invited as participants on the basis that they matched a participant with dementia in terms of gender, age, years of education, and geographical location (rural or urban). The overall number of people who received information about the research were not tracked as part of these recruitment processes.

Participants were included in the project if they were i) aged 55 and over, ii) with capacity to give informed consent to take part in the research, iii) living in their own homes in the community, iv) conversant in English, v) going to places outside their homes, and vi) using at least some ETs in daily life (e.g., a microwave). Further criteria for inclusion were that participants either had no known cognitive

impairment or had received a suspected or confirmed diagnosis of mild stage dementia (American Psychiatric Association, 2000) or mild stage major neurocognitive disorder (American Psychiatric Association, 2013) from a doctor.

Participants, whether with dementia diagnosis or no known cognitive impairment, were excluded if they had severe visual, hearing, or communication impairments not compensable by appropriate aids. Additional exclusions were the presence of other health (i.e., stroke, psychiatric diagnosis, multiple sclerosis) or psychosocial (i.e., drug and alcohol dependence) conditions that may cause cognitive deficit or inhibit the ability to participate in interviews.

Ethics

The Health Research Authority: South West - Frenchay Research Ethics Committee gave approval on 27 April 2017 (IRAS project ID: 215654, REC reference: 17/SW/0091) and the study was registered with the National Institute of Health Research Clinical Research Network Portfolio (Study ID: 33163). Ethical permission was also given by the Stockholm regional ethics board (2017/4:3).

In consideration of increased vulnerability and impaired ability to give informed consent due to dementia, participants with dementia were given repeated opportunities to consider information given about the project. Participants then gave written informed consent to participate, with ongoing capacity verbally assessed at each meeting, according to the principles of the Mental Capacity Act (2005). Participants were reminded that participation was voluntary and they had the right to withdraw at any time without giving a reason. Participant information sheets and consent forms conformed to guidelines given by the Dementia Engagement & Empowerment Project (2013). Together with detailed consent procedures, these documents were reviewed by contacts within Alzheimer Europe and the European Working Group of People with Dementia prior to recruitment.

Recruitment materials briefly listed inclusion criteria and participants with no known cognitive impairment were informed of the matching process and updated on recruitment progress.

As needed, they were held on a waiting list to ensure a match to a participant with dementia before participating or were politely declined. These participants were referred to as having no *known* cognitive impairment, since it can be common that people are unaware they have an impairment. The risk that participants could become aware of cognitive difficulties during interview was therefore anticipated. Researchers were sensitive to this, and prepared to reassure participants about the purpose of the interview and to signpost participants to appropriate NHS services as required.

Data collection

Structured interviews were carried out in each participant's own home or at another place of their choosing between May and November 2017. The mean duration of interviews was 1 hour 45 minutes, staged between one and three occasions (mean 1.3) according to the preference and comfort of each interviewee, with an average of 3 days between occasions. All participants were interviewed directly (not by proxy), and for any reason, if they wished, had another person in attendance (i.e., support, comfort, normalcy). Interviews requested demographic information and the Montreal Cognitive Assessment (MoCA), and also comprised of two questionnaires; the Everyday Technology Use Questionnaire (ETUQ) and the participation in ACTivities and places OUTside home questionnaire (ACT-OUT).

Occupational therapists can administer the ETUQ, which examines the relevance of 90 commonplace ETs, after a 1-day training course delivered in person or via the web. An ET is reported not relevant; or relevant if that ET is available to the person and the person uses the ET, has used it in the past, or intends to use it in the future (Nygård & Rosenberg, 2016). Once an ET is reported as relevant, the rater records the person's perceived ability to use that ET, on a 5-step scale from 'used with no hesitation or difficulties' to 'not used anymore or has not yet come into use'. A total of 90 ETs are segregated into seven categories in the ETUQ; home, information/communication, self-care, maintenance and repair, accessibility, economy and purchasing, and travel. Derived

from five of these categories were 45 out of home ETs, some of which are provided within the public realm (i.e., petrol pump) and some of which would more likely be privately owned (i.e., push-button mobile phone). This derivation excluded domestic ETs (from home, and maintenance and repair categories; i.e., microwave, lawnmower) and included all ETs from accessibility, economy and purchasing, and travel (i.e., lift, ATM, chip and PIN, ticket machine, automatic gate); a majority from information/communication (i.e., camera, GPS, call functions on a smartphone, laptop computer for word processing or searching for information) and pedometer from self-care.

The ETUQ has shown validity in different countries among groups of people with and without cognitive impairments; inter-rater and test-retest reliability in Denmark (Kaptain et al., 2019), rating scale function, internal scale validity and person response validity in Sweden (Nygård et al., 2012; Patomella et al., 2017), Japan (Malinowsky et al., 2015) and Portugal (Patomella et al., 2017), with no evidence of testing bias between Sweden, the United States, and England (Wallcook et al., 2020).

The ACT-OUT was developed using a transactional perspective on the shifting relations between person-place-activity, in response to a lack of instruments designed to capture respondent views on participation outside home (Margot-Cattin et al., 2019). The tool is intended for cross-cultural use with older adults with dementia and is divided into three parts. Part one maps the applicability of four categorised clusters of (maximum 24) places ascertaining whether the person goes there now, in comparison to past or future intentions. The four clusters are: 1) six places for purchasing, administration, and self-care (e.g., grocery shop, supermarket, bank/post office), 2) five places for medical care (e.g., doctor's surgery, hospital), 3) six social, spiritual, and cultural places (e.g., friend or family member's house, place of worship, cemetery), and 4) seven places of recreation and physical occupations (e.g., garden, forest/lake/mountains/seaside, transportation centre).

The questionnaire content, including place categorisations, was identified from previous research and constructed by an expert group of nine interdisciplinary professionals with

expertise in dementia (including researchers, clinicians, and charity representatives). The content and categorisations were subsequently revised in three successive rounds of cognitive interviews with 26 older adults and aligned to participants with dementia by implementing feedback from five interviews conducted with people living with dementia (Margot-Cattin et al., 2019). Information from parts two and three of the ACT-OUT, which enquire about the occupations and circumstances surrounding two places in each cluster and self-perceptions of, for example, risk, were not intended for use in this study. The utility of the questionnaire is currently under evaluation, and so the results from this study can be used for future power analyses for studies using the ACT-OUT.

The MoCA was used for its sensitivity in detecting early cognitive deficits in order to describe differences between the cognitive abilities of the participants (Nasreddine et al., 2005). A non-standardised demographic questionnaire was designed to collect information about a range of contextual factors that might reasonably influence ET use and the number of places people go to. These included age, gender, co-morbidities and functional impairments, driving, education, and co-habitation. Postcodes were used to obtain an urban or rural categorisation for the small geographical output area each participant lived in (Bibby & Brindley, 2013) and an index of multiple deprivation (IMD) decile. Decile 1 represents the most deprived 10 per cent of areas nationally and decile 10, the least deprived 10 per cent of areas nationally, with England divided into 32,844 small areas (Department for Communities and Local Government, 2015).

Data analysis

Preparatory analysis

Summed scores from the ETUQ raw data comprised the explanatory variables ‘number of out of home ETs relevant’ and ‘number of total ETs relevant’. A Rasch model produced in WINSTEPS® converted the raw ordinal scores from the ETUQ into calibrated, linear measures using a logarithmic transformation (logits) based upon the probability odds related to each response (Bond & Fox, 2007; Linacre,

2017). This, and subsequent procedures, follow Rasch model assertions (Bond & Fox, 2007; Linacre, 2019) and are explained in greater detail elsewhere (Malinowsky et al., 2015; Nygård et al., 2012). These measures form one of the explanatory variables, labelled ‘Perceived ability to use ET’. From the ACT-OUT data, the places each person reported going to were summed to generate the outcome variable ‘number of places’. Together with the demographic data, the distribution of these variables was checked for normality using the Shapiro Wilks test, rejecting the null hypothesis that the data are normally distributed if $p < 0.05$, and further visual inspection with Q-Q plots.

Primary analysis

Across the whole sample ($n=128$), the outcome variable ‘number of places’ was artificially categorised into two groups using the median (16.5), to create a group that ‘goes to 16 or less places’ and a group that ‘goes to 17 or more places’. Statistical division of the outcome variable based on the median has explorative utility in situations where there is not yet any theoretical justification for assuming a cut-point that lies elsewhere in the data (Altman & Royston, 2006). To mitigate for the compromised power and the inflated risk of generating false positives associated with an analysis which uses a median split, the outcome variable was also split at the 25th and 75th percentiles. This approach enables exploration of greater extremes in the data, the variation across groups, and inconsistencies in the magnitude of the associations with explanatory variables (DeCoster et al., 2011).

The participants’ characteristics are shown in Table 1, according to the quartile number of places participants reported they went to. Accounting for the type and distribution of the variables, these are presented and compared for differences between groups using the corresponding χ^2 and Kruskal-Wallis tests with a significance level of $p < 0.05$.

Bivariate correlation analyses assessed collinearity between all variables prior, using $r < 0.7$ to determine which could be included as explanatory variables in each model. Therefore, diagnosis and driving a car were retained in preference to MoCA score and driving license, which were considered redundant variables in the analysis (Midi

Table 1. Participant characteristics shown for each quartile of the number of places participants go to.

		Goes to <13 places (1 st quartile) (n=22)	Goes to 13-16 places (2 nd quartile) (n=42)	Goes to 17-18 places (3 rd quartile) (n=35)	Goes to >18 places (4 th quartile) (n=29)	Comparison test
Diagnosis	People with dementia	15 (68.2%)	25 (59.5%)	15 (42.9%)	9 (22.7%)	$\chi^2 p<0.05$
	People with no known cognitive impairment	7 (31.8%)	17 (40.5%)	20 (57.1%)	20 (69%)	
MoCA* score (adjusted)	Median	22	23	25	25	Kruskal Wallis Test NS
	(IQR)	(19.5-25)	(20-26.25)	(22-27)	(21-28)	
	Min-Max	14-27	12-29	12-30	14-29	
Geography [^]	Urban	18 (81.8%)	36 (85.7%)	23 (65.7%)	21 (72.4%)	$\chi^2 p<0.05$
	Rural	4 (18.2%)	6 (14.3%)	12 (34.3%)	8 (27.6%)	
Gender	Male	12 (54.5%)	17 (40.5%)	18 (51.4%)	18 (62.1%)	$\chi^2 NS$
	Female	10 (45.5%)	25 (59.5%)	17 (48.6%)	11 (37.9%)	
Ethnicity ^α	White British	16 (72.7%)	30 (71.4%)	26 (74.3%)	21 (72.4%)	$\chi^2 NS$
	Other [~]	6 (27.3%)	12 (28.6%)	9 (25.7%)	8 (27.6%)	
Age	Median	78.5	78.5	75	72	Kruskal Wallis Test NS
	(IQR)	(73.5-84.25)	(71.5-83.25)	(68-82)	(66.5-78.5)	
	Min-Max	62-96	57-90	55-90	61-87	
Health condition ^γ	No physical impairment	12 (54.5%)	29 (69%)	22 (62.9%)	20 (69%)	$\chi^2 NS$
	Physical impairment	10 (45.5%)	13 (31%)	13 (37.1%)	9 (31%)	
Index of Multiple Deprivation (IMD) Decile ^δ	Median	4.5	5.5	6	7	Kruskal Wallis Test p<0.05
	(IQR)	(3-6)	(3.75-5.5)	(5-9)	(4-9)	
	Min-Max	2-10	1-10	1-10	1-10	
Living situation	Alone	10 (45.5%)	18 (42.9%)	11 (31.4%)	10 (34.5%)	$\chi^2 NS$
	Co-habiting	12 (54.5%)	24 (57.1%)	24 (68.6%)	19 (65.5%)	
Years spent in education	Median	12	12	13	13	Kruskal Wallis Test NS
	(IQR)	(10.75-13)	(11-13)	(11-16)	(11-17)	
	Min-Max	9-15	7-21	9-20	10-20	
Has a driver's license	No	10 (45.5%)	14 (33.3%)	9 (25.7%)	6 (20.7%)	$\chi^2 NS$
	Yes	12 (54.5%)	28 (66.7%)	26 (74.3%)	23 (79.3%)	
Driving	Not driving a car	14 (63.6%)	21 (50%)	14 (40%)	7 (24.1%)	$\chi^2 NS$
	Driving a car	8 (36.4%)	21 (50%)	21 (60%)	22 (75.9%)	
Ability to use ET (logits)	Median	49.47	51.63	52.59	53.88	Kruskal Wallis Test p<0.01
	(IQR)	(48.42-52.99)	(49.20-51.63)	(50.07-55.60)	(52.09-56.41)	
	Min-Max	45.63-54.34	45.51-60.59	46.26-61.24	46.23-74.76 ^l	
Relevant number of total ETs (max. 90)	Median	37	42	46	48	Kruskal Wallis Test p<0.05
	(IQR)	(31.75-44.25)	(36.75-49)	(37-55)	(37.5-59.5)	
	Min-Max	20-70	23-64	22-66	28-67	
Relevant number of out of home ETs (max. 49)	Median	15	20	23	23	Kruskal Wallis Test p<0.001
	(IQR)	(11.5-19)	(14-25)	(18-28)	(17.5-33)	
	Min-Max	4-38	4-36	9-39	12-39	

* Montreal Cognitive Assessment (Nasreddine et al., 2005) lower scores indicate increased cognitive impairment. Adjusted scores given with additional point for <12 years of education.

^α Ethnicity classifications follow the Office for National Statistics (2012).

[~] Other ethnicities, 35 (27.3%): Asian/Asian British - 9 (7%); Black/African/Caribbean/Black British - 8 (6.3%); Mixed/multiple ethnic groups - 2 (1.6%); White - Irish 4 (3.1%), Gypsy or Irish Traveler 1 (0.8%), Any other white background 9 (7%); Other ethnic group - 2 (1.6%).

[^] Rural-Urban Classification given by Bibby & Brindley (2013) using www.ukpostcodecheck.com

^γ Participants designated 'No physical impairment' if no diagnosis was given, or if reported diagnoses or impairments to hearing or vision did not coincide with a deficit of physical functioning. The designation 'physical impairment' was given where reduced walking ability and/or reduced upper limb function was reported or observed.

^δ English Indices of Deprivation (Department for Communities and Local Government, 2015) using <http://imd-by-postcode.opendatacommunities.org/>

Table 2. Univariate analysis results for variable selection at each quartile of places. All variables whose Odds Ratio (OR) met the statistical significance threshold of $p < .25$, denoted by *, were put into the corresponding regression model.

Independent variables	25 th %ile, OR, <i>p</i> value		50 th %ile OR, <i>p</i> value		75 th %ile OR, <i>p</i> value	
	Diagnosis	2.493	.066*	2.778	.005*	2.778
Geography	0.684	.524	0.407	.040*	0.750	.550
Gender	1.200	.698	0.644	.217*	0.552	.170*
Ethnicity	1.654	.384	1.784	.237*	1.296	.666
Age	0.954	.102*	0.951	.019*	0.954	.054*
Health conditions	2.118	.114*	3.355	.002*	3.254	.027*
IMD decile	1.321	.011*	1.197	.017*	1.118	.201*
Living situation	0.699	.448	0.628	.204*	0.633	.810
Years spent in education	1.288	.027*	1.199	.010*	1.171	.035*
Driving a car	0.375	.043*	0.405	.013*	0.325	.019*
Ability to use ET	1.234	.006*	1.181	.002*	1.190	.005*
Number of relevant out of home ETs	1.132	.001*	1.094	.000*	1.074	.007*
Number of relevant total ETs	1.066	.008*	1.047	.006*	1.043	.029*

et al., 2010) (refer to Table 2 for a complete list of included variables). The amount of relevant out of home ETs (maximum 45) and the amount of relevant total ETs (maximum 90) were intended for separate regression models (see models presented in Tables 3 and 4) as these variables were collinear but of independent interest to the study.

Possible predictor variables related to the outcome of ‘goes to less’ or ‘goes to more’ than the median 16.5 places were then selected in a univariate analysis using a predetermined beta coefficient significance threshold of $p < 0.25$ (Hosmer & Lemeshow, 2004) (refer to Table 2). Assumptions

of linearity relating to IMD decile and amounts of relevant ETs were checked using a quadratic term. As no evidence of departure from linearity was found, these variables were treated as continuous. Variables which met the significance threshold were subsequently entered into a multi-way binary logistic regression model using a backwards, block procedure with beta coefficient significance set to $p < 0.25$ for inclusion in the model, and $p < 0.05$ for exclusion. The unconditional binary logistic model has been shown to be an appropriate approach to use when the data are loosely matched (Kuo et al., 2018). All potential predictor demographic variables were entered at block one. Ability to use ET and either the amount of relevant out of home ETs (Table 3a), or the amount of total ETs (Table 4a), was entered at block two. This backwards, block procedure was repeated to produce additional models based upon the outcome of ‘going to least’ or ‘going to more than or equal to’ the 25th percentile of 13 places, and ‘going to most’ or ‘going to less than or equal to’ than the 75th percentile of 18 places.

Cook’s distance plots were visually inspected, using the guide that substantially large distances were identifiable through observations exceeding three times the mean Cook’s *d* of each model (Cook, 1977). These large distances indicated that the observations could be considered potentially influential to the coefficients given for each model. As no explanations were found for these outlying points within the datasheet,

Table 3a. Binary logistic regression results for the models including the amount of Relevant Out of Home ETs (maximum 45). Outcome split at going to least places (< 13, 25th percentile), median places (16.5, 50th percentile) and most places (≥ 18, 75th percentile), identified using the ACT-OUT.

	Least places (< 13, 25%ile)			Median places (16.5, 50%ile)			Most places (≥ 18, 75%ile)			
	OR, <i>p</i>	95% CI		OR, <i>p</i>	95% CI		OR, <i>p</i>	95% CI		
Decile of deprivation	1.283	.023	1.035-1.590		1.195	.025	1.022-1.396			
Amount of relevant out of home ETs*	1.802	.002	1.228-2.626		1.560	<.001	1.217-1.994		NS	-
Perceived ability to use ET [#]	NS	-			NS	-			2.154	.005
Omnibus test	$\chi^2 = 19.213, df = 2, p < .001$			$\chi^2 = 20.313, df = 2, p < 0.001$			$\chi^2 = 9.840, df = 1, p < 0.01$			
Nagelkerke R ²	.232			.196			.113			
Hosmer & Lemeshow Test	$\chi^2 = 4.666, df = 8, p = 0.793$			$\chi^2 = 4.295, df = 8, p = 0.830$			$\chi^2 = 9.659, df = 8, p = 0.290$			
Classification accuracy	84.4%			69.5%			76.6%			

NS. Non-significant.

* OR/CI are shown for a difference of 5 relevant ETs as indicating a more meaningful contrast in amounts between participants. # OR/CI for perceived ability to use ET are shown for the median difference of 4.41 logits between participants in the lowest and highest quartile of places.

Table 3b. Classification tables showing the sensitivity and specificity of the results of the models in table 3a.

	Predicted goes to < 13 places	Predicted goes to ≥ 13 places	Percentage correct
Observed goes to <13 places	4	18	18.2%
Observed goes to ≥13 places	2	104	98.1%
	Predicted goes to ≤ 16 places	Predicted goes to > 16 places	Percentage correct
Observed goes to ≤16 places	44	20	68.8%
Observed goes to >16 places	19	45	70.3%
	Predicted goes to < 18 places	Predicted goes to ≥ 18 places	Percentage correct
Observed goes to <18 places	97	2	98.0%
Observed goes to ≥18 places	28	1	3.4%

the analyses were re-run without these potentially influential observations to check results for consistency.

Primary analyses were conducted using IBM SPSS Statistics for Windows, version 26 (IBM Corporation, 2019).

Results

Table 1 describes and shows the differences between participants grouped at each quartile based upon the number of places they were going to; whether within the first quartile (least, <13 places), second quartile (less, 13-16 places), third quartile (more, 17-18 places), or fourth quartile (most, >18 places). The logistic regression models aimed to explore the association between these different grouped numbers of places that people go to, and amounts of relevant ETs, ability to use ET, diagnosis, and rurality.

Table 3a presents the models, which included the amount of relevant out of home ETs (maximum 45); and shows that this variable was significantly and most strongly associated with

the number of places, together with IMD decile at the 25th percentile split. Reporting a lower amount of out of relevant home ETs increased the odds of going to least places (less than 13) by a factor of 1.802 for every five ETs. These odds were reduced to 1.560 when the data were split at the median amount of 16.5 places. For each decile decrease in deprivation (indicating a higher relative level of deprivation) the odds of going to least places also increased by a factor of 1.283. This odds ratio also decreased at the median split to 1.195 and no other variables, including diagnosis and rurality, were found to be significant in these two models. At the 75th percentile, only ability to use ET was significant with the odds of going to most places (more than 18) increased by a factor of 2.154 for a 4.41 logit higher ability measure (the median difference between the four groups). The classification accuracy of each model varied slightly, being highest (84.4%) and explaining the greatest proportion of variation (Nagelkerke R²) in the outcome variable (23.2%) when the model predicted based upon the 25th percentile. The specificity of this model was high (98.1%),

Table 4a. Binary logistic regression results for models including the amount of Relevant Total ETs (maximum 90). Outcome split at going to least places (< 13, 25th percentile), median places (16.5, 50th percentile) and most places (≥ 18, 75th percentile), identified using the ACT-OUT.

	Least places (< 13, 25%ile)		Median places (16.5, 50%ile)		Most places (≥18, 75%ile)	
	OR, p	95% CI	OR, p	95% CI	OR, p	95% CI
Decile of deprivation	1.283, .023	1.036-1.589	1.232, .01	1.052-1.443	NS	-
Diagnosis	NS	-	2.619, .014	1.211-5.666	NS	-
Years of education	NS	-	1.160, .043	1.005-1.339	NS	-
Amount of relevant total ETs	NS	-	NS	-	NS	-
Perceived ability to use ET [#]	2.404, .012	1.214-4.738	NS	-	2.154, .005	1.261-3.683
Omnibus test	$\chi^2 = 14.795, df = 2, p < .01$		$\chi^2 = 19.463, df = 3, p < .001$		$\chi^2 = 9.840, df = 1, p < .01$	
Nagelkerke R ²	.182		.188		.113	
Hosmer & Lemeshow Test	$\chi^2 = 9.843, df = 8, p = .276$		$\chi^2 = 10.828, df = 7, p = .146$		$\chi^2 = 9.659, df = 8, p = .290$	
Classification accuracy	82.8%		64.8%		76.6%	

NS. Non-significant

OR/CI for perceived ability to use ET are shown for the median difference of 4.41 logits between participants in the lowest and highest quartile of places

however, the sensitivity was low (18.2%). This indicates that the model correctly predicted the outcome for only 4 participants from the group of 22 who were going to less than 13 places (refer to Table 3b). Cook's distance outliers were found for the models split at the 25th and 75th percentiles, and the ORs increased when these outlying observations were removed from the analyses.

For the models that included the total amount of relevant ETs (refer to Table 4a), this variable was shown not to have a significant association with the number of places people go to, whether the dichotomisation was made at the 25th, 50th, or 75th percentile. Ability to use ET was significant at the 25th percentile, with a 4.41 logit lower ability to use ET increasing the odds of going to less than 13 places by a factor of 2.404. Diagnosis and years of education were additional explanatory factors to the IMD decile at the 50th percentile. The overall classification for these models, shown in Table 4a (and in detail in Table 4b), was slightly less and explained a lower proportion of the variation in the outcome variable than the model results in Table 3a. These models (Tables 4a and 4b) appeared to fit less well when comparing Hosmer Lemeshow statistics and the Cook's distance plots identified outlying observations in all three models. The ORs increased when these observations were removed, except for diagnosis, where the OR marginally decreased.

Discussion

The results shown in these models highlight people's interactions with several environmental dimensions. Together with various aspects of personal capacity, these dimensions shape people's engagement in occupation. The discussion begins with the result regarding the

technological environment, and how that environment might interact with physical places people go to outside home. Then, the results pertaining to diagnosis, rurality, and other personal and environmental socio-economic dimensions are discussed. Finally, the kaleidoscopic nature of the intersections between all these factors are highlighted. With each shifting juxtaposition, an altered view on the impact of environmental dimensions and personal factors to occupational opportunities is implied. While occupation itself is never directly viewable, the underlying perspective is that person-place relations are vital and inseparable from occupation.

1. Summarising the models with respect to ET

The regression models highlight the statistical significance and the nature of the associations between the number of places people go to and ET use. It seems that the amount of out of home ETs a person perceives as relevant is the most influential variable to consider. This variable was present in two of the models, however, the magnitude of this association was shown to be inconsistent when making comparisons at the extreme ranges in the data. It was strongest when the data were separated at the 25th percentile, and not present when the separation was made at the 75th percentile. Comparing the varying magnitudes in each model may indicate that the amount of relevant out of home ETs is most consequential to the group going to the lowest number of places. However, the low sensitivity could suggest that the consequences of the association impact only a minority of people in that group.

Creating additional models gives clarity that the amount of domestic ETs a person reports

Table 4b. Classification tables showing the sensitivity and specificity of the results of the models in table 4a.

	Predicted goes to < 13 places	Predicted goes to ≥ 13 places	Percentage correct
Observed goes to <13 places	1	21	4.5%
Observed goes to ≥13 places	1	105	99.1%
	Predicted goes to ≤ 16 places	Predicted goes to > 16 places	Percentage correct
Observed goes to ≤16 places	40	24	62.5%
Observed goes to >16 places	21	43	67.2%
	Predicted goes to < 18 places	Predicted goes to ≥ 18 places	Percentage correct
Observed goes to <18 places	97	2	98.0%
Observed goes to ≥18 places	28	1	3.4%

relevant is not associated with the number of places people go to, since the variable 'total amount of relevant ETs' was not significant in any model. However, these additional models provide insight into the association with perceived ability to use ET. Once again, the association is clearest at the data extremes and strongest at the 25th percentile division, with the low sensitivity (also at the 75th percentile) similarly suggesting an impact to a minority of people.

The findings from these models highlight a connection between the breadth of the physical and technological environments outside home. This connection infers a match between the perceived scope of places participants went to, and the scope of the ETs they encountered, particularly among those reporting lesser amounts relevant. Furthermore, the models highlight a second connection which infers a similar match between the scope of the physical environment outside home and the scale of a person's perception of their ability to use ET. This time, it was particularly evident among those participants who reported going to greater numbers of places and having higher perceived ability.

This association between amounts of out of home technology and places may seem logical and expected, since perhaps encountering a complete range of technologies is contingent upon going to a more complete range of places. However, many of the places counted may not immediately suggest a technological encounter at all (i.e., garden, cemetery, neighbourhood, park), whereas other places may suggest multiple encounters (i.e., transportation centre, supermarket). Additionally, since a person is never without place (Bennett & Agarwal, 2007), the destination itself may not hold the technological demands or encounters (e.g., friend or family member's house), but the places between destinations do (e.g., bus) (Lindqvist et al., 2018). From this perspective, it becomes quite striking then, that the complexity of this connection between the physical and technological environments outside home is made visible by these models based upon amounts of each. A low amount of technologies could still relate to some kind of ability, but rather than ability to use the technologies, it

may reflect a systematically hampered ability to keep up with rapid technological transitions. Such a structural inability to keep up with developments in the technological environment when outside the control of the individual could be viewed as occupational deprivation (Kottorp et al., 2016; Townsend & Wilcock, 2004).

The consequences of personal ability are sharpened at the upper quartile, where the overall relevance of technology seems less influential and a better match between person and environment is grasped. Here, ability to use ET, which captures the person's perceptions of their interaction with the technological environment in consideration of their own personal capacities, becomes the predictor of going to more places. A person's ability to use technology may be directly related to their ability to navigate streets, to drive a car, to negotiate complex situations like 'being a customer', or attending an appointment on time. Higher abilities could then explain a person's going to a greater number of places, which aligns with findings that a person's technological ability may predict their need for assistance in daily life (Ryd et al., 2016).

2. Considering other influential personal and environmental factors

Diagnosis was shown to associate with the number of places people go to in only one model, together with years of education. However, there may be a methodological reason for this since the choice of an unconditional regression model may have led to an underestimation of the influence of dementia on the outcome (Kuo et al., 2018). Several studies have explored the impact of dementia upon people's perceptions of life outside their homes and the interplay with technology (Brittain et al., 2010; Gaber et al., 2019; Lindqvist et al., 2018), suggesting that this is an important consideration. Fewer years of education have been linked to incidence of dementia in many studies (Sharp & Gatz, 2011) however, education also relates to socioeconomic status (Sirin, 2005), and the educational attainment of a localised population is bound within the IMD (Department for Communities and

Local Government, 2015). Therefore, the potential influence of both diagnosis and education on the number of places that individual older adults go to should not be ruled out, even if these factors may tend to shape patterns of places, rather than the amount (Gaber et al., 2019).

The rurality of the context was not significant in any model, however IMD decile showed a significant association in four out of six models. The magnitude of the association was greater in the 25th percentile model compared to the 50th percentile and absent at the 75th percentile. This deprivation decile encapsulates multiple characteristics of a small neighbourhood area with seven unequally weighted domains in total. These domains include income and health deprivation, incidences of crime, feelings of safety, quality of the environment, proximity to amenities and services, among other considerations (Department for Communities and Local Government, 2015). Furthermore, the quality and quantity of leisure facilities, transport, food shopping opportunities, health care services, and levels of ICT engagement are known to be lower in more deprived areas of England (Longley & Singleton, 2009; Macintyre et al., 2002). Therefore, it seems reasonable that this association with going to a number of places is more prominently discernible with an analysis focussed at the lower IMD deciles—where the range of places may not be available or passage between places is thwarted—becoming less perceptible at the higher deciles.

While it seems that rurality is of no consequence in the models, some contrasting aspects of rural and urban dwelling, such as proximity to amenities, are already bound up within the IMD, which could mask any influence of these two environmental characteristics. Also, the shortcomings of the IMD for capturing the nature of deprivation in rural places (neglecting digital services access, for example) have recently been uncovered (Fecht et al., 2017). These shortcomings suggest that the context of rural deprivation in comparison to urban deprivation is more important to look at than rurality per se. If the underlying IMD scale measuring that deprivation is not sensitive to the specific characteristics of rural deprivation, then this goes some way to explaining why geographic

area appears to have no influence on the number of places people go to. Furthermore, the subsample of people from a rural location ($n=30$) is simply too small to draw a conclusion that the rural and urban context is an irrelevant factor affecting the number of places that people go to.

3. Assembling a kaleidoscopic picture of alliances

These combined results from the two sets of models can be assembled to kaleidoscopically visualise the non-uniformity of relations between the component parts. For some people, the smaller scope of their perceived accessible environment outside home (as far as this can be understood as a number of places an older person goes to) is allied with a smaller technology ‘room’, that is the subset of ETs from the wider technological environment that a person perceives to be relevant (Hagberg, 2008), and relatively more neighbourhood deprivation. Perceptions of relevance relating to ET can be seen as nested within broader ideas of material disadvantage. Inequalities between physical environments mean a neighbourhood may not have a complete range of public space ETs installed within it. Also, for reasons of personal socioeconomic and material disadvantage, a person may not have access to a full range of ICTs. For other people, higher ability is more allied with a greater breadth of access to places out of home, and access to technology does not seem to be linked, which could relate to a lack of deprivation.

More broadly, a picture emerges from these models that internal, individual personal factors (diagnosis, socioeconomic status, ability to use ET) seem less influential than external environmental factors in explaining the number of places people go to. These external factors include not only the technological environment, but also those considerations that are bound in the IMD; social, economic, built, and green environments. The finding that removal of potentially influential (Cook’s distant) observations inflates that association further in each model serves to confirm rather than question those influences. This implies that the picture is predominantly one of

occupational deprivation and issues of occupational marginalisation are less influential, but still apparent.

However, the mixed picture of consistency across all models, together with the result that each model explains a low proportion of variability in the outcome, highlights the complexity encapsulated within a person's going to a number of places. As a possible indicator of participation and engagement in occupation, there will be many other factors that influence a person's total number of places. For example, traffic safety and the aesthetics of the environment (Van Cauwenberg et al., 2012), a person's self-efficacy and social support (Kim et al., 2012), their level of functional independence (Ryd et al., 2016), access to free public transport and personal concerns about falling (Gaber et al., 2020). So, this study does not conflate going to a higher quantity of places with participating to a higher degree, nor does it infer a quality judgement, that more or less going is better or worse. Furthermore, demarcating the environment as an external factor is not to suggest a dualism, since the conditions of the external are also constructed and perpetuated internally; within neighbourhoods, households, and individuals. This makes it challenging to discern whether the issue at stake in this picture is either occupational marginalisation or occupational deprivation. The difference is that marginalisation infringes upon autonomy because of informal norms and expectations within a sociocultural structure, whereas deprivation relates to exclusion resulting from structures which are beyond individual control and have lengthy effects (Durocher et al., 2014). Indeed, the findings of the present study bring into question the idea that there is a clear demarcation between occupational marginalisation and occupational deprivation; that the boundaries are perhaps more permeable. To return to the kaleidoscope analogy, with each new view on the intersections between environmental factors it is not always apparent when, or in which circumstances, informal expectations versus structural concerns are produced. Rather, it seems that both can coexist for the same factor since, for example, transitions within the technological environment are a product of

both social expectations and structured policy, with each operating as an engine for the other.

Models based on prediction techniques are often criticised for inconsistency when replicated with a different sample. However, this study has embraced both the recurrence of variables and the inconsistencies of the results between models, even within this same sample of participants. This comparative approach is grounded in the data, using the suggestions revealed by small proportions of people in each analysis to explore theoretical possibilities (Holton & Walsh, 2017). These possibilities may or may not extend to other people in the population, and further studies with larger sample sizes are recommended to confirm the presence and direction of these associations. With low sensitivity, the outcome selected—number of places a person goes to—has made occupational justice a visible issue among a minority, and perhaps other ACT-OUT outcomes may be more sensitive. Future research may derive insights from the patterns of places across clusters, a person's subjective perception of the meaning of places frequented, or stability and change related to going to places across time points. Furthermore, since the technological environment and society are in continual transition, the alliances revealed in this study may assemble, disassemble, and reassemble, in a state of temporal impermanence (DeLanda, 2006). In light of this potential impermanence, study of this evolving picture could spotlight how occupational injustices are being shaped by environmental dimensions and intersections over time and at future time points.

Conclusion

These different data explorations have generated empirical evidence highlighting the factors that may intersect and form alliances to culminate in occupational injustice for older adults. The factors include the technological environment and other environmental dimensions, which may be inseparable from some personal capacities. While occupation itself is not directly in view, it can be appreciated that these dimensions assemble to influence the places people to go to and consequently the occupations they access.

The low sensitivity of these explorations indicates that for many people, no occupational injustice is evident. Their opportunities to go to places outside home seem free from the limiting influence of the dimensions identified. And indeed, the low explanation of proportional variance indicates that the set of personal and environmental factors given attention in this study are insufficient to explain the places people go to. Yet, by paying attention to the minority of people at the margins of these models, it can be appreciated that these dimensions—of having fewer out of home ETs, having lower abilities with ETs, living in more deprived locations, being less educated, living with a cognitive impairment—may jeopardise occupational opportunities outside home. Such jeopardy could lead to occupational marginalisation and deprivation, as possibly inseparable entities. Deeper attention to the modifiability of environmental influences, that is, which influences coalesce, how, for whom, and in what circumstances is needed, in order to understand how occupational justice can be delivered.

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