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Introduction

Two of the trends converging in the twenty-first century are that of an aging population in the US and across the globe and increases in urbanization. This century is projected to give rise to more megacities, cities and metro areas with populations in excess of ten million people. New York and Los Angeles are already considered megacities, and Chicago is expected to join their ranks by 2030 (e.g., Razvadauskas 2018). While the invention and widespread adoption of the automobile in the twentieth century gave rise to the suburbs, patterns of urban migration, an aging population and some of the negative impacts of automobiles – pollution, congestion and consumption of natural resources – suggest that there will be increasing demands on transit systems to help people remain mobile and move efficiently around their communities as they age.

Much attention around people’s mobility, particularly among older adults, is devoted to the availability of different options for people and feasibility of people’s use of different modes (e.g., Bailey 2004; DeGood 2011). In this study, however, we approach the question of keeping an aging population mobile through the lens of the accessibility of different physical environments. More specifically, we consider questions around what features of different places and spaces enhance and support the mobility of older adults – and in turn of all generations – and what opportunities exist to improve environments to increase accessibility. We focus specifically on transit, given projected growth in urban areas, as transit systems will be called upon to serve the transportation and mobility needs of these growing populations. To examine these environments through the lens of multigenerational accessibility, we explore how older adults might experience transit environments through the use of the MIT AgeLab’s AGNES (Age Gain Now Empathy System) suit with the goal of identifying which kinds of features help to facilitate the mobility of older adults accessing transit in urban metro areas.

Background

Numerous different approaches are used to explore older adults’ perspectives and experiences, from surveys to self-reports. When it comes to the design of places and spaces, however, empathy on the part of designers – the ability to put themselves in the position of actual users – is invaluable in creating end products, services, spaces or experiences that meet the capabilities, needs and aspirations of a growing market of older consumers (Bodine et al. 2013). Empathy draws on experiential learning, through which people learn “through transformative experiences” (Kolb 1984). Building on this perspective, the MIT AgeLab developed the AGNES – Age Gain Now Empathy System – suit for use by engineers, designers, researchers and other in order for them to experience the physical environment as older adults might, given some of the physical and functional limitations that often accompany older age (Dickson n.d.; Lavallière et al. 2017).

The AGNES suit uses the following to help researchers understand what it feels like to physically and functionally age (for more details, see Lavallière et al. 2016):

- A helmet, braces and bands to limit joint mobility and to simulate joint stiffness, fatigue, and slower movements;
- A weighted vest to simulate muscle loss;
- Tinted glasses to simulate vision loss or goggles that simulate particular vision conditions (e.g., diabetic retinopathy, macular degeneration, etc.);
- Earplugs to simulate difficulty with high-pitched sounds and soft tones;
- Custom shoes to simulate imbalance; and
- Gloves to simulate reduced tactile sensation.

The AGNES suit has been shown in wearers to result in functional changes that are consistent with aging (Lavallière et al. 2017). It has also been used in retail spaces to identify challenges older adults may encounter in them and to generate recommendations for design to create environments that are more accessible for older adults, which in turn supports accessibility among all generations (Coughlin 2017; Lavallière et al. 2017). Finally, designers have used AGNES to explore some of the challenges older adults may encounter when navigating the London Tube (Dickson n.d.).

The purpose of this project is to build on previous empathy research done with AGNES to develop a protocol to evaluate and assess transit environments. The protocol will help to identify what different spaces do well to support mobility among older adults, and it will provide insights into opportunities and recommendations to improve the accessibility of such environments for older adults.

Protocol Development Approach

The process for protocol development was collaborative, involving a multidisciplinary and multigenerational research team. The intent was always to include a component in which younger researchers and designers – a minimum team size of three – would wear the AGNES suit to conduct evaluations of any sites, but the process of creating the protocol resulted in the development of a richer framework that allowed not only for identifying positive features of transit environments and opportunities and recommendations for improvement, but also a more sophisticated validation of the impact of the AGNES empathy tool and broader community and user engagement in the research.

The iterative, participatory process took as its starting point a framework developed by trained designers on the research team. Following this starting point, designers and undergraduate interns at the MIT AgeLab conducted open-ended conversations with two MIT AgeLab Lifestyle Leaders – people ages 85 and older who participate in MIT AgeLab research studies – one of whom actively still uses the MBTA public transit system. Following these interviews, the framework was revised to encompass additional insights that emerged from these conversations as important, and it was decided that older adults' perspectives should explicitly be captured in the protocol.

Protocol

In order to focus on the transit environments rather than the journeys themselves, the research team decided to focus on people's journeys from the time they leave a public street/enter a transit station or waiting space to the point at which they would step on to a transit vehicle. The travel on any vehicle was not considered as part of the journey for this particular research project. To make the research process more tractable, the team determined that each unit of analysis for the research should consist of a journey: a navigation of a user from one space to another. Sample journeys could be, for example, entering a transit station to get on a subway, transferring from one subway line to another within a station, or transferring from one bus to another.

The final protocol the team developed consists of seven stages, with the expectation that the researchers would complete field notes following each stage:

1. *Personal, individual typical experience of a transit journey without stopping to narrate the journey or to make observations (no AGNES suit)*

In this stage individual researchers independently proceed through the given journey in their usual manner and at their typical speed. There are no stops and no narration. Following this typical journey, each research records their individual reactions to the journey, responding to a set of prompts around the journey, including: How did that feel? Did anything make you pause/hesitate/stand out?

2. *Personal narrated experience of a transit journey, stopping to narrate the journey and to make observations at pre-determined stopping points (no AGNES suit)*

In this stage individual researchers independently complete the journey a second time with a voice recorder. During this journey, each researcher narrates his or her experience along the journey at each pre-determined stopping point using the voice recorder (stopping points are selected based on the particular selected but could include points such as descending into a station, purchasing a ticket, waiting at a platform, etc.). In addition to any independent observations the researchers have, they also respond to a series of prompts, including: How did that make you feel (for each of the five senses – sight, hearing, sound, touch and smell)? What about your typical experience was challenging? What about your typical experience was easy? Did the environment make your experience more challenging? Did the environment make your experience easier? How/what about it?

3. *Personal narrated AGNES empathy suit experience of a transit journey, stopping to narrate the journey and to make observations at pre-determined points*

In this stage individual researchers independently complete the journey a third time with a voice recorder and while wearing the AGNES empathy suit. During this journey, each researcher narrates his or her experience along the journey at each of the same pre-determined stopping points using the voice recorder as in the second stage. In addition to any independent observations the researchers have, they also respond to a series of

prompts, including: How did that make you feel (for each of the five senses – sight, hearing, sound, touch and smell)? What about your AGNES experience was challenging? What about your AGNES experience was easy? Did the environment make your experience more challenging? Did the environment make your experience easier? How/what about it?

4. *Older adult typical experience of a transit journey without stopping to narrate the journey or to make observations*

In this stage, researchers accompany but do not interact with the older adult participating in the research. The older adult conducts the same journey without any narration and moving at his or her typical speed. Following the journey, researcher prompt the participant to respond to the following prompts about the journey: How did that feel? Did anything make you pause/hesitate/standout?

5. *Older adult narrated walkthrough of a transit journey stopping to narrate the journey and to make observations at pre-determined points*

In this stage, the older adult participant narrates his or her typical experience along the transit journey at pre-determined stopping points, responding to prompts from the researchers, including: How did that make you feel (for each of the five senses – sight, hearing, sound, touch and smell)? What about your typical experience was challenging? What about your typical experience was easy? Did the environment make your experience more challenging? Did the environment make your experience easier?

Following this walkthrough, the research team engages in a more detailed interview with the older adult participant to capture their more general experiences with and reactions to the broader transit system in which the particular journey is embedded. Key questions for the interview include inquiries about their particular experiences with the transit system, such as: What are the top things, aspects, etc. of this transit system that could be changed or improved? What are some essential and nonessential changes that could be made to the transit station? Of the things you experienced and found easier to navigate in the station, what was necessary to have and what was just nice to have (nonessential)? Do you feel welcome when you use transit? Do you feel any societal pressures, as an older adult, in this transit station? What could be improved to make your journey a more comfortable/safe experience? A second set of questions focused on the individual's lifestyle and activity level, including items such as: What do you like to do in your free time? What do you like about living in this area? What is difficult about living in this area? How often would you say you go out in this area for fun?

6. *AGNES design review with a trained designer completing the prescribed journey wearing the AGNES empathy suit*

In this stage the researcher designer completes the transit journey, stopping at pre-determined points to narrate the journey and to provide any observations.

7. *Design observations based on the AGNES walkthrough*

In this stage the researcher designer completes a design review, guided by a series of prompts.

Preliminary Findings

While the initial intent of the project was to conduct evaluations at one or more sites, more time was used to develop and to refine the protocol so that it could form the basis for an approach that could be used widely to assess different environments. Further, the research team encountered some challenges in communicating with local transit partners around securing permission to conduct the research. As a result, we ultimately conducted only a pilot trial of the protocol at the Kendall Square MBTA T station, with the journey for the pilot going from the street/sidewalk to the subway platform at the primary outbound station.

Stage 1:

In this stage neither of the researchers noted significant challenges around navigating the journey. Field note comments included, "I'm feeling totally fine, the steps were easy, nothing about that was particularly challenging. In my body nothing was that difficult."

Stage 2:

In this stage researchers were more attentive to some of the challenges of navigating the journey. Around the descent into the station, one noted: "Appreciate the yellow on every step.... The stairs were not too bad because I could easily see them." Some issues were identified around a landing at the stairs' midpoint: "This landing is fine for me but I'm noticing it's uneven, which might be an issue for certain people.... There's not much space here [on the landing]." The researchers noted that the overall station lighting was poor. The sensual experience of the journey was mixed: "I hear the train going by, I would hear more people going by if it were busier, I don't really smell anything, I taste nothing that's good, the air is heavier and not awesome. I see markers but I don't see when the next train is coming."

Stage 3:

In this phase wearing the AGNES suit, the researchers experienced some challenges around their physical movement through the space. Feedback in the field notes included: "Those two steps [in the descent] that were different [heights] from the other ones definitely made a difference for me with the goggles." "If someone were to pass me, that would maybe put me off balance.... Whenever someone walks by me it makes me a little bit nervous." "The [signage] had really good contrast..." They also noted some more significant challenges around purchasing a ticket for the subway using the installed machines. Comments included "Putting in the credit card was not great" and "buying a ticket was easy until I had to pay." Despite this challenge, the "Touchscreen worked well. Directions were simple and easy."

Stages 4 and 5:

In this phase the older adult participant in particular reported similar difficulties as those encountered by the researchers around ticket purchase. This participant had extensive experience with the transit system and had been taking various subway and bus lines within the system for decades.

Stage 6:

The researcher designers completed their AGNES walkthrough of the journey.

Stage 7:

Recommendations from the design review are preliminary in light of the pilot nature of the data collection and as a result of subsequent upgrades that the MBTA has undertaken to the Kendall Square MBTA station (most notably improved lighting). One key issue that emerged from the analysis and design review reflected some concerns around uneven flooring and changes in flooring from one area of the station during the prescribed transit journey to the next. There were also challenges identifying some signage around availability of next trains, as well as purchasing tickets using the installed ticket machines.

Recommendations

The completed pilot protocol is a systematic tool that leverages the MIT AgeLab's AGNES suit to evaluate specified transit journeys, but it also could be extended to evaluate and generate design recommendations for other journey segments and public and private spaces. Further testing of the tool is required. The results of additional testing and the application of the protocol to additional environments will yield a variety of benefits. First, this holistic, participatory approach to the research should yield more valid design recommendations for improving older adults' experiences with different spaces. The process should also help to identify which recommendations may be more urgent or central to the experience of the space, and which ones are less so. This may help public agencies and other owners and designers of spaces to prioritize these features in design as well as to target any resources around any renovations of spaces.

A second benefit of the research and use of the protocol will be to generate a unique method to validate AGNES as an empathy tool and suggest any revisions that may result in the tool more closely mimicking the experiences of older adults. The multi-stage review process enables researchers to compare their experiences wearing the AGNES suit with those of older adults navigating the same spaces. This process can be used to identify where the experience of wearing AGNES overlap with the experiences of older adults, and where these diverge. These overlaps increase our confidence in the use of AGNES as a tool generally, and points of difference highlight potential future improvements to the AGNES tool.

Conclusions

As a result of the project, the research team, including AgeLab researchers and students, developed a protocol to assess environments tailored to older adults' use of transit spaces. The goal of the research was to leverage the MIT AgeLab's AGNES tool to identify challenges around navigating spaces as well as to provide insights into how spaces currently support older adults' mobility and access. The protocol represents an extension of the AGNES tool that represents a more consistent, reliable and valid approach to measuring people's interactions with an environment and to identifying the impact of environments on people's behaviors.

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