Inclusive and Accessible Homes for Older People: The Preparation of Guidelines for Home Design

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Abstract— **The target of this research is to create an inclusive living environment in urban houses for Indian older people through guidelines for home design. Along with the study of associated problems of older people and international concepts, an extensive literature review has been performed to understand the theoretical and methodological foundations. Preliminary diagnostic surveys are performed to study and establish the need for the creation of inclusive living environments for Indian older people for the built environment design. Field surveys were conducted to identify the challenges/ issues that older people face in the 'Activities of Daily Living' (ADLs). The surveys are performed for the upcoming urban housing typologies in India. The upcoming typologies were identified through the scientific layering of the data with a market survey. Older people in the existing urban housing typologies and in the age group of 60 to 85 years, independent elderly, frail elderly, and dependent elderly were studied using environment-behavior study tools. The data collected from interview questionnaires, audio, trace-study, and photographs, were analyzed to identify environmental issues. Analysis and synthesis are done based on these issues to identify the possibilities of interventions for the built environment in housing. It has been established through validation and testing that the gap to create inclusive living environments for Indian older people can be filled by guidelines for home design. Thus, a methodology to develop the guidelines to create 'Inclusive and Accessible Homes for the Indian Older People' is prepared. With help of these guidelines 'Inclusive and Accessible Homes' in urban residences can be designed for Indian older people.**

Keywords- Older people; Inclusive and Accessible Homes; Environment-behavior Research Tools; Guidelines

I. INTRODUCTION

In India, the increased life expectancy, decreased mortality rate, and increased birth rate, are resulting in an increasing older people population. Longevity by itself is to be celebrated, but increasing vulnerabilities of older people arising out of income insecurity, poverty, rural living, illiteracy, dependency, age-related morbidity, and decreasing support base require attention [1]-[4].

The physical environment, as it relates to the dependencies of older people, remains one of the most overlooked areas in the built-environment design. The people who are responsible for planning that environment must develop a new understanding of ways in which their influence can improve older people's physical and mental functioning [3][4].

The paper has been structured to give the background of the study in section A. The aim of the study and the objectives has been stated in section B and C. In section II, the complete methodology followed for the conduct of the field survey, identifying the issues from the transcriptions of the interviews, and the coding of statements to identify the issues has been detailed. It further explains the methods adopted to achieve the guidelines for home design, for older people. The paper concludes by stating that 'Inclusive and Accessible Homes' for Indian older people can be created following these developed guidelines.

II. BACKGROUND

As people age, certain sensory changes cause them to perceive and respond to the physical environment in different ways: a person may move more deliberately, hold reading material farther from their eyes, walk more slowly, or strain to distinguish a voice in the crowd. The person becomes more dependent on the environment for support as limitations in functioning are experienced, [3] [4]. As the sensory organs incur deprivation, strength fails, and the individual experiencing these losses reaches out to both the physical environment and the general social environment in order to continue functioning [5]. Sensory changes are usually compounded by the simultaneous occurrence of changes in several sensory systems, and it increases as people grow older. However, the rate of decline for these functions differs markedly within the various sensory systems [4][6].

The Indian situations, with the huge size of the country, diversity of political, economic, social, and cultural background, and wide variety of people with different religions, cast, etc. are very complex. [4][7]. The Indian situations are very different from the Western world because of the characteristically interdependent social scenarios, severely different demographics, religious and traditional systems, a culturally different society, a wide range of economic disparity, and beliefs [8].

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The paradigm change in the model of disability from the linear model to a model which emphasizes the role of the environment to reduce or enhance the individuals' ability to perform, specifies the role of designers, architects, and planners because it is their creation of built-environment, which makes them struggle or let them use it comfortably [4].

The aim of the research is to understand the situations of Indian older people and to generate design guidelines, that when followed will create, 'Inclusive and Accessible Homes' for the Indian older people.

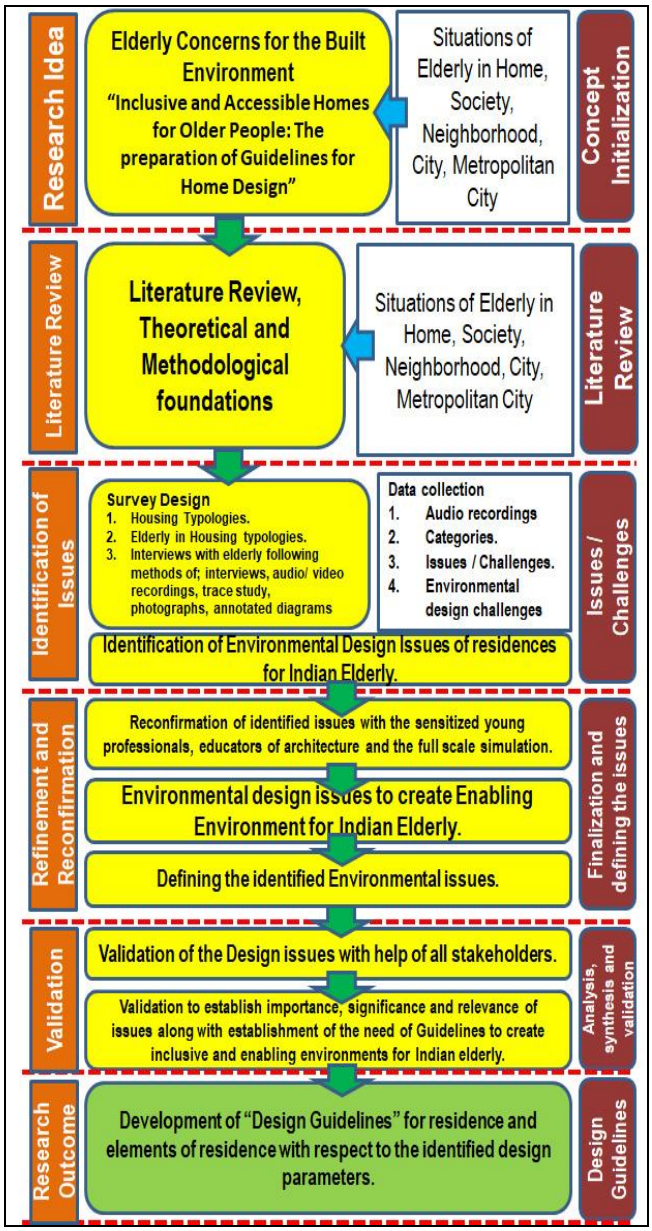
The objectives of the study are:

- To study and understand Indian older people, their residences, and residential neighborhood environment.
- To study the 'Activities of Daily Living' of Indian older people in their residential environment.
- To conduct a field survey to identify the issues, based on the 'Activities of Daily Living', which the Indian older people face while interacting with their residential environment.
- Based on the identified issues, and the elements of residence, develop guidelines for the creation of an 'Inclusive and Accessible Homes' with the help of identified and validated list of enabling environmental issues for Indian older people.

III. METHODOLOGY

The study investigates the problems and issues, Indian older people face with their built environment and attempts to identify the issues to enumerate, analyze and synthesize them, to develop a set of guidelines, to create inclusive, and accessible homes for Indian older people [4]. Refer the methodology diagram as shown in Figure 1.

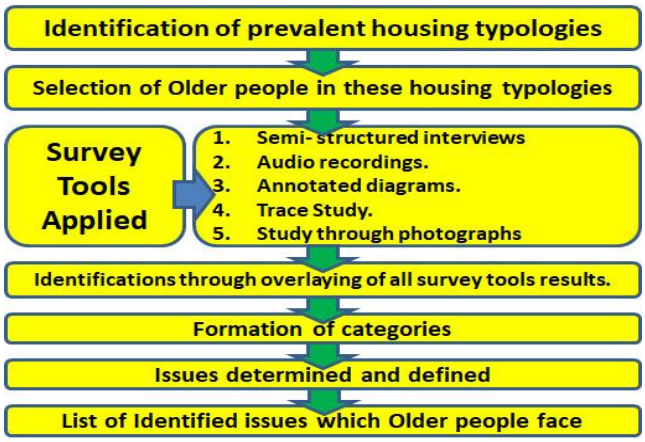
Initially, preliminary diagnostic surveys are done to study and establish the need for the creation of inclusive and accessible homes for Indian older people. Then a field survey is performed to identify the challenges that older people face in their 'Activities of Daily Living' (ADLs) in the Indian context. The survey is done for the upcoming urban housing typologies in India. These upcoming typologies are identified with market surveys and scientific layering of the data. Then older people in the age group of 60 to 85 years representing independent older people, frail older people, and dependent older people are studied using environment-behavior research tools, living in joint and nuclear families, in identified urban housing typologies [4]. The collected data from interview questionnaires, audio recordings of interviews, trace-study, and study of photographs, is analyzed in layers to identify twenty environmental issues. Based on these identified issues, analysis and synthesis are done to identify the possibilities of interventions at the architecture design level for the built environment in housing. It has been established through testing and validation that the gap can be filled by guidelines to create, Inclusive and Accessible Homes for Indian older people [4]. Thus, a methodology to develop the guidelines has been prepared. Following the developed guidelines, inclusive and accessible homes in urban residences can be designed for Indian older people [4].



"Figure 1. The Methodology"

A. The Field Survey

The field survey was conducted to identify the challenges/ issues Indian older people face in the residential environment, using multiple environmental-behavior tools as shown in Figure 2 [10][13]. The focus of this survey was to understand the situations of Indian older people in their residential environment. And it aimed to identify the issues that older people face in their 'Activities of Daily Living'. Based on these identifications a comprehensive list of issues for the challenges that older people face was identified [4].



"Figure 2. The Field Survey"

B. Housing Typologies and Selection of Older People

The prevalent upcoming typologies are identified with a market survey of the new housings in the city of Bhopal, India. A system of scientific layering of the data was adopted to identify the prevalent newer housing typologies. The overlapping of various floor plans of apartments, row houses, single houses, detached and semi-detached houses was done to select the sample of housing typologies [4].

Older people residing in these housing typologies were identified based on age and type of family settings. Total 48 elderly were selected as sample. Table I shows the sample of older people as per the age groups and distribution in the housing typologies. The sample of these 48 older people was then interviewed for the identification of issues based on their 'Activities of Daily Living'. Out of these 48 samples, in 7 cases the answers and the interview talk seemed to be biased because of the influence and presence of the other family members or due to non-interest or being in hurry due to some other work, etc. These cases of biased opinion were not considered for the analysis and removed from the list of samples. This resulted in the sample size of 41 older people of which 34 were from the newer housing typologies and 7 were from the existing old age homes. The interview started appearing repetitive after almost 30 interviews. Therefore, the overall number of older people interviewed has not increased beyond a total number of 48 samples.

TABLE I THE OLDER PEOPLE IN HOUSING TYPOLOGY

S.no	Age Group	Elderly (nos)	Elderly Living in Row House (nos)	Elderly Living in Apartment (nos)	Elderly Living in Individual houses (Detached or semi detached) (nos)	Elderly Living in Old Age Home (nos)
1	60-65	13	5	6	2	-
2	65-70	8	3	2	2	1
3	70-75	10	2	4	3	1
4	75-80	9	2	2	2	3
5	80-85	6	2	2	-	2
6	85-above	2	-	2	-	-
	Total	48	14	18	9	7

C. Research Tools

The field survey was an attempt to collect qualitative data by understanding the 'Activities of Daily Living' of Indian older people. Multiple layering of the below-mentioned tools was applied for the collection of data [4].

- Interviews with a semi-structured questionnaires.
- Audio recordings of the interviews.
- Annotated diagrams.
- Trace study.
- Photographs and observations.

D. Semi-structured Interviews

The interviews aimed to identify 'Activities of Daily Living' to understand the complete daily routine of older people. It is focused to identify the activities in terms of early morning activities, using the toilet, bowel/ bladder control, oral hygiene, grooming, pooja (prayer), dressing, cooking, meal planning, eating, mobility inside the residence, using stairs, mobility outside the residence, daily job/ work, driving, household chores, doing laundry, using phone, money management, managing own medications, etc. in detail [4].

E. Audio Recordings

The audio of each interview is transcribed to identify the statements. From these statements of the samples, the categories were derived and then from these categories, the built environment design issues have been identified and ascertained as shown in Table II.

TABLE II. IDENTIFICATION OF ISSUES OLDER PEOPLE FACE

S. No.	Category	Environmental issue	Definition of Environmental issue
1.	Indoor areas: • Safety from falls. • Non-slippery floors. • Uneven, unstable Surfaces. • Safety from projections and protruding objects. • Wet areas in the toilet. • Holding toilet accessories for support. • Safety while climbing stairs. • Safety while working in the kitchen. • Safety from burns. • Safety within home. Out doors: • Safety from uneven, unstable surfaces. • No walking space on roads. • Safety from vehicles while waking. • Fear of fall.	**Safety**	"Need for providing safety in the residential indoor and outdoor areas while using all elements of residence, specially kitchen, toilet, stairs, ramps, etc. along with outdoor areas in terms of their use to improve the physical environment with design and appropriate use of material."

F. Annotated Diagrams

After each interview, rough annotated diagrams were prepared to understand the pattern of spatial usage. Findings

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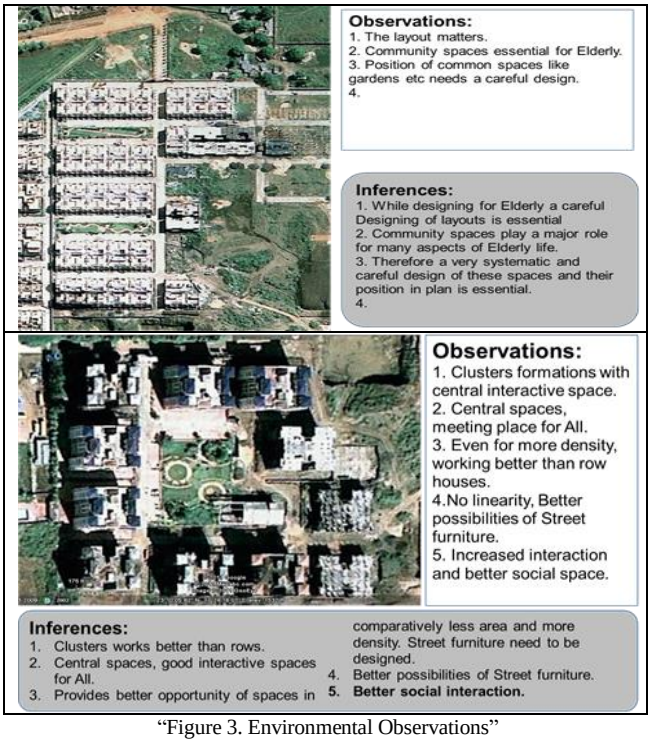
from these documented diagrams are then analyzed to understand the issues faced by older people [4].

G. Environmental Observations and Trace- Study

The environment of older people is also analyzed through environmental observation and trace study to further identify the challenges as shown in Figure 3.



"Figure 3. Environmental Observations"

H. Method of Identification of Issues

The identified issues through all tools are then overlaid to formulate a common list of issues faced by older people. Every issue is rated for its level of importance and the Table III below lists these issues in random order.

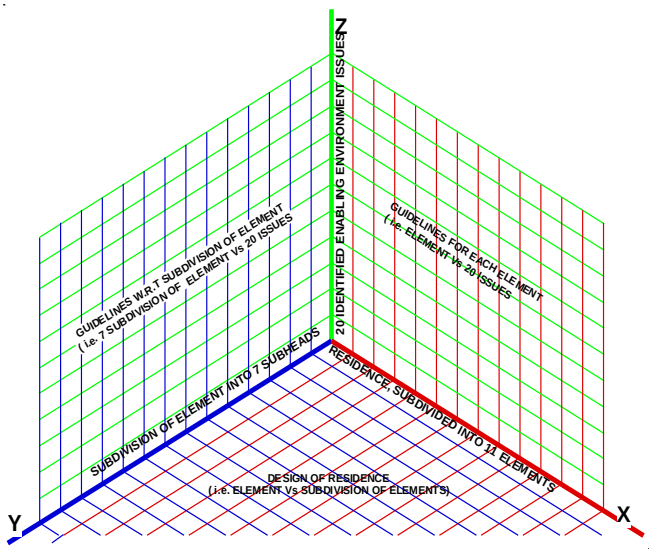
TABLE III. IDENTIFIED ENVIRONMENTAL ISSUES

Identified environmental issues			
1	Safety	11	Socio-cultural disconnect
2	Environmental Support for mobility, balance, and slow movement	12	Affordability
3	Environmental support for better vision	13	Leisure and recreation
4	Environmental support for better hearing	14	Security
5	Light Ventilation	15	Live with nature
6	Health	16	Spiritual connect
7	Memory	17	Technology Disconnect
8	Privacy and Personalization	18	Usable
9	Degree of Independence	19	Emotional comfort
10	Interdependence	20	Loneliness

IV. DEVELOPMENT OF GUIDELINES

The methodology followed to develop the guidelines investigates each element of residence for its design to be inclusive for older people with respect to the identified enabling environmental design issues.

A systematic sequential process has been followed to achieve the enabling environmental design guidelines for the residences. All the identified enabling environmental issues were considered to generate guidelines for each element of residence design. Combining all the guidelines generated with respect to each element gave the final guidelines for the whole residence. Figure 4 below defines the pattern of development of guidelines.



"Figure 4. Pattern of the Development of Guidelines"

The pattern of development of guidelines is a simultaneous considerations of three major components namely;

- The Residence, subdivided into 11 elements.
- The subdivision of the element into 7 subheads.
- The twenty identified enabling environmental issues.

A. The Residence, subdivided into 11 elements

The Residence is subdivided into 11 elements (the elements of residence) taken along the X axis as shown in Figure 4 and listed in Table IV. The elements of the residence are the various spaces of a residence. The residences under consideration are the urban residences having typologies of;

- Detached and semi-detached houses
- Row Houses
- Apartments
- Bungalows.

These typologies are the upcoming, prevalent housing typologies identified for the urban areas. The common elements of all the above-mentioned typologies are listed below in Table IV.

TABLE IV. LIST OF ELEMENTS OF RESIDENCE

Elements of Residence			
1	Entrance and Porch	7	Bath rooms
2	Garden	8	Balconies and Terraces
3	Verandah/ Lobby	9	Stairs
4	Drawing room Living room and Dining room	10	Ramps
5	Kitchen	11	Lifts
6	Bedroom		

B. The subdivision of seven elements into 7 subheads

The subdivision of the element into 7 subheads is seen with respect to the design of the element as the major component and under design the subheads are;

- Furniture,
- Circulation,
- Openings
- Surfaces
- Light and ventilation
- Miscellaneous
- Material characteristics,

These 7 subheads are shown along the Y-axis in Figure 4. For this the major components of an element of residence are considered with respect to ***Design****:* The design of the elements of the residence. The design is the main head and its 7 subdivisions considered are:

- ***Furniture:*** The furniture of the elements of the residence and all accessories of the spaces such as; furniture, street furniture, lamp posts, post boxes, etc. in case of outdoor spaces, and carpets, scatter rugs, sculpture painting, and products, etc. in case of indoor spaces.
- ***Circulation****:* The circulation space of the residence and its element with clearances.
- ***Openings:*** All the openings in the form of doors, windows, and ventilators in the indoor areas, and entries, gates, etc. in the outdoor areas.
- ***Surfaces:*** All surfaces of the elements of residence, the ground, vertical, and ceiling surfaces.
- ***Light and ventilation****:* The provision of light and ventilation in the whole residence and its elements, whether it is natural or artificial.
- ***Miscellaneous:*** Anything not covered in the above-stated components of the residence design or need to be highlighted as an important guideline.
- ***Material characteristics:*** The characteristic features of the material required for residence and its element.

C. The Twenty Identified Enabling Environmental Issues

The twenty identified enabling environmental issues taken along the Z axis are listed in Figure 4. Below mentioned is the list of identified enabling environmental issues. The guidelines were developed considering each of these issues.

TABLE V. LIST OF IDENTIFIED ENABLING ENVIRONMENTAL ISSUES

List of Identified Enabling Environmental Issues			
1	Safety in environment	11	Environmental support for sociocultural connect
2	Environmental Support for mobility, balance, and slow movement	12	Affordable environments
3	Environmental support for better vision	13	Environment to support leisure and recreation
4	Environmental support for better hearing	14	Environment to support security
5	Light and ventilation in the environment	15	Environment to live with nature
6	Environment to support better health	16	Environment to support spiritual connect
7	Environment to support memory loss	17	Technology connect in the environment
8	Privacy and personalization in the environment	18	Usable environment
9	Degree of independence in the environment	19	Environment to provide emotional comfort
10	Environmental support for interdependence	20	Environment to address loneliness

Thus, the hierarchy followed to subdivide the residence into its components for in-depth and detailed development of guidelines is mentioned below;

TABLE VI. RESIDENCE AND ITS ELEMENTS

Residenc e	11 Elements of residence (as mentioned in table III)	7 subdivisions (as mentioned in above)

Thus, the formula for the preparation of the guideline for each element of residence is mentioned below;

Guidelines for Z = X1Y1, X1Z1, Y1Z1

Where Z = Guidelines for the elements of the residence. For example Z1 = Guideline for the element of residence, "Entrance and Porch".

The combinations along all three axes generated the guidelines as mention-below;

X1 Y1 = Residence (subdivided into 11 elements) and subdivisions of elements (i.e. 7 subdivisions)

This explains the hierarchy as, residence → 11 Elements of residence → 7 Subdivisions (i.e. Subdivision of element

of residence into 7 subheads, under the main heading design).

X1 Z1 = Elements of residence and 20 identified enabling environmental issues

This will generate guidelines for each element with respect to the 20 issues.

Y1 Z1 = Subdivision of elements (i.e., 7 subdivisions under design) and 20 identified enabling environment issues

This will generate guidelines for each element (when the element is seen as a spatial subdivision into seven subheads) with respect to twenty enabling environmental issues under the main heading design.

Similarly, for all the remaining 20 enabling environmental issues, the guidelines were developed.

Following the pattern of development of guideline as explained in the methodology above the guidelines for each element of residence is developed.

Explanation of development of guidelines for elements of residence:

A systematic stepwise process is adopted for the preparation of guidelines for each element of residence design based on the above-mentioned pattern of development of guidelines.

Step 1: Sequentially, an element is selected for the preparation of guidelines from the list of the elements of the residence.

Step 2: The element is subdivided into 7 subdivisions under the main heading design.

Step 3: Guidelines with respect to each subdivision and the main heading design were developed for twenty enabling environmental issues.

This process gave the guidelines for each element of the residence design (listed in Table III) these are the separate detailed guideline for all 11 elements of the residence. (The detailed guidelines for all 11 elements of the residence with respect to twenty enabling environmental issues is not part of this paper due to a large number of pages).

D. Final Guidelines to Create Inclusive and Accessible Environment in Urban Residences for the Indian Older People

The guidelines for each element of the residence were prepared separately with respect to the twenty enabling environmental issues. Due to the reoccurrence of the spatial and material characteristics for the issues, there was a lot of repetition and overlap. To remove this overlap and repetition, the guidelines for urban residences are prepared by combining the guidelines of all elements of the residence. The development of these guidelines was based on the concept that, "with the solution of the twenty identified enabling environmental issues, inclusive living environments can be created for the older people in urban residences. Thus, following the methodology and pattern of development of guidelines, first the guidelines for each element of residence, (as listed in Table IV) is prepared. Then the separately developed guidelines for each element of residence are combined with respect to each enabling environmental issue to finalize the guidelines for the urban residences.

V. CONCLUSION

The situations of demography, a characteristically interdependent social scenario, a culturally different society, a wide range of economic disparity, religious and traditional systems, and beliefs, the Indian situations are entirely different from the other countries [14]. This research study focused on the 'Activities of Daily Living' of older people and investigates and identifies the issues faced by older people while using their built environment. Improvements in the built environment with respect to the needs of older people can improve the situation of Indian older people. Thus, the construction of urban residences following the developed guidelines will result in the inclusion of older people and ultimately result in 'Inclusive and Accessible Homes for Older People in India'.

The outcome in the form of guidelines is the reference and guide for the creation of an inclusive built environment for Indian older people but, the same has opened newer avenues as mentioned below;

- The developed guidelines are qualitative, but the area has the potential to develop quantitative guidelines and developing standards specific to older people.
- The guidelines developed can be applied to the upcoming typologies of residences and followed for home modification for Indian older people.
- The identified issues and the guidelines can be collectively pursued to create smart homes for the ease and comfort of older people. The same has the potential to be the background and initiation for the design of assistive devices required in the homes of older people.
- Developing designs focused on vernacular and indigenous solutions based on these findings can be another area for future design research.

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