A Theoretical Framework for Environmental Design

Interventions to Support Neurodegenerative Disease Management

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Facts and Futures

- U.S. Population: 311,000,000
- U.S. Population age 45-64: 82,800,000
- U.S. Population age 65 and over: 41,400,000

Age 45 and over represents 40% of the U.S. population

census.gov 2010

Every day more than 10,000 will reach the age of 65
Projected to occur every single day for the next 20 years

endoftheamericandream.com
Falls: 
Leading Cause of Injuries Among Older Adults

- direct costs to the U.S. health care system $30 billion per year

- indirect costs include long-term disability, dependence on others, lost time from work, reduced quality of life, risk management, legal fees, and settlement awards

- average cost per fall
  $13,797 - $20,450

Centers for Disease Control and Prevention
National Center for Injury Prevention and Control
Core competencies in professional education and practice grounded in an artistic tradition
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Adapted from S. Caan, 2014
Essential elements of design programming

1. Review of literature on the building type and analysis of plans of existing projects
2. Organizational, aesthetic, function, economic, schedule, and management goals
3. Based upon the goals, relevant information is determined and researched, i.e., users, activities, and schedules
4. Ways to accomplish goals within constraints
5. Reconciliation of budget with design intentions desired within the project time frame
6. Information to be integrated into the design process
Environmental design intervention strategy to support neurodegenerative disease management

ANTECEDENT HUMAN FACTORS

ANTECEDENT PHYSICAL ENVIRONMENTAL FACTORS

ANTECEDENT SOCIAL ENVIRONMENTAL FACTORS

KNOWLEDGE TRANSFER AND TRANSLATION

PROBLEM BEHAVIOR

NEW KNOWLEDGE, DESIGN PREMISE AND STRATEGY

INFORMED DESIGN INTERVENTION

BEHAVIORAL and/or PHARMACOLOGIC INTERVENTION

REQUISITE BEHAVIOR
DEMENETIA

1. Delusions
2. Hallucinations
3. Agitation/Aggression
4. Depression/ Dysphoria
5. Anxiety
6. Elation/Euphoria
7. Apathy/Indifference
8. Disinhibition
9. Irritability/Lability
10. Aberrant Motor Activity
11. Sleeping And Nighttime Behavior Disorders
12. Eating Disorders

Adapted from The Neuropsychiatric Inventory
Jeffrey L. Cummings, MD
1. Aberrant Motor Behavior

1.1 PROBLEM BEHAVIOR
• agitation and irritability
• lack of concentration
• difficulty with balance management and falls, postural instability
• restlessness
• wandering
• night wandering and confusion
• slips and falls (common cause of injury and death among the elderly)

1.2 ANTECEDENT HUMAN FACTORS
• aging process
• diminished physical functions
• muscle tension, stiffness or rigidity of the arms, legs, or trunk
• diminished psychological functions
• retinal dysfunction (the increase of both contrast and brightness occurs in the image projected onto their retina)
• psychoactive drugs

1.3 ANTECEDENT PHYSICAL ENVIRONMENTAL FACTORS
• lighting inappropriate to spatial function
• confusing surroundings
• excessive sensory stimulation

1.4 ANTECEDENT SOCIAL ENVIRONMENTAL FACTORS
• excessive demands from family, friends, etc.
• distressing behavior of others
• loneliness/boredom and social isolation
1. **Aberrant Motor Behavior**

1.5 **DESIGN PREMISE**
- under daylight condition older adults take more confident steps
- under nightlight condition adults take more cautious steps
- daylight equivalent lighting may help decrease risk of falling

1.6 **DESIGN STRATEGY**
- design fall preventive milieu that supports balance recovery
- specify high intensity lighting with a highly correlated color temperature emitted by ceiling-mounted luminaires to positively influence restless behavior
- specify floor surfaces to support traction
- specify transitional floor surfaces to avoid abrupt changes in surface friction or surface heights
- integrate clear sight lines to spatial destinations
- specify contrasting colors to enhance depth perception
  - integrate combinations of daylight equivalent lighting (fluorescents) to generate diffused light and incandescent single point spot and flood lighting to enhance color, texture and form
Conclusion

- *we spend approximately 90% of our time inside buildings*

- building interiors constitute a multisensory experience from which the brain acquires and uses new and retained information to direct behaviors**

- neuroscience identifies and explains brain functions relevant to multisensory experience

* Environmental Protection Agency  
** Thomas Albright, Salk Institute
- interior design interfaces building performance with human performance

- design intervention (vs. design interference) to support neurodegenerative disease management requires the transfer and translation of current knowledge to advance toward a health care responsive methodological paradigm