

Co-Designing with Older Adults, for Older Adults: Robots to Promote Physical Activity

Supplementary Materials

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A. PARTICIPANT DATA

Table A: Detailed Information On Older Adult Participants

Pseudonyms	Gender(Age)	Ethnicity	Living Condition	Interview	WS #1	WS #2	WS #3	WS #4
Joe	Male (75)	Caucasian	Condo (Solo)	✓	✓			✓
Lois	Female (74)	Caucasian	Condo (Solo)			✓		✓
Alfred	Male (67)	Caucasian	Condo (Couple)	✓		✓		
Patricia	Female (94)	Caucasian		✓		✓		
Albert	Male (71)	Caucasian	Condo (Couple)	✓	✓			
Betty	Female (71)	Asian		✓	✓			
Dolores	Female (74)	African-American	House (Solo)	✓				
Clement	Male (79)	Caucasian	House (Solo)	✓				
Eileen	Female (77)	Caucasian	House (Solo)	✓				
Sidney	Female (69)	Caucasian	House (with Family)	✓				
Gloria	Female (80)	Caucasian	Condo (Solo)					✓
Eugene	Male (65)	African-American	Rehabilitation Center				✓	
Roger	Male (75)	African-American	Rehabilitation Center				✓	
Abraham	Male (70)	African-American	Rehabilitation Center				✓	






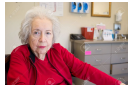
B. SEMI-STRUCTURED INTERVIEWS

Table B: Questions Used To Steer Stage 1: Semi-Structured Interview, Organized By Goal

Understanding Current Physical Activity Domain
What does your day look like?
What kinds of physical activity do you engage in or would like to or used to?
How does engaging in physical activity make you feel?
What are the barriers to and motivators for physical activity?
Do you have physical rehabilitation experience? If so, how was it?
Understanding Preferences (Hopes and Fears) for Robotic Support
How can you see an assistive robot help promote physical activity in your life?
What would your physical preferences for such a robot be?
What would your concerns be when using such a robot?
Understanding Relationship with Technology
Would you say using technology makes your life easier?
Have you ever wanted to try a gadget but couldn't? If so, when and why?

C. PERSONAS

Table C: Description Of The Personas Used In Older Adult Workshops #1 & #2

Workshop	Persona	Name	Age	Gender	Note 1	Note 2
1	Persona 1	Mary 	68	Female	Mary has started developing knee Arthritis and back pain.	Mary likes to hang out with her friends. Mary loves spending time with her grandkids.
	Persona 2	David 	75	Male	David struggles with his balance due to recent surgery on his ears.	David is new to the city, so he does not have many acquaintances yet.
	Persona 3	James 	82	Male	James' vision has been deteriorating significantly in the past few years	James currently lives with his grandkids.
2	Persona 4	Mary 	65	Female	Mary has started developing Arthritis in her fingers	Mary likes to hang out with her friends. Mary loves spending time with her 2 grandkids.
	Persona 5	David 	72	Male	David struggles with his balance due to recent surgery on his ears.	David likes trying new things but loses interest quickly
	Persona 6	Meredith 	84	Female	Meredith's vision has been deteriorating significantly in the past few years	Meredith currently lives with her partner.

D. DESIGN GUIDELINES

The following characteristics were provided to participants in the design workshop to guide their work as they built upon the ideas provided by older adults in previous workshops.

Interactive

Task appropriate verbal and non-verbal communication

- Universal translator
- Adjustable volume
- Realistic lip movements
- Informative body cues, eye movement, face color

Friendly voice

Adaptive to users preferences and abilities

Easy to use

Mindful towards privacy

Size - not intimidating, appropriate for its task

E. CODE OCCURRENCES FOR ROBOT PREFERENCES

Table E: Frequency of thematic code occurrences regarding robot preferences from transcribed interview and workshop data

Robot Preferences	Frequency
Helping Out With Tasks	8
Mobility	7
Open To Robotic Support	6
Provide Information On Physical Activity Opportunities	2
Incorporate Other Applications	7
Joint Movements	6
Informative Feedback	13
Mobility Augmentation	2
Wearability	1
Functional Facial Features	3
Nonverbal Communication	2
Verbal Communication	6
Volume Change	2
Virtual	3
Group Activity Leader	6
Personal Trainer	4
Companionship	17
Privacy Concerns	17
Adaptability	11
Physiological Monitoring	7
Visual Monitoring	6
Universal Translator	1
Facilitates Social Interaction	8
Interactivity	5
Usability (Easy To Use)	11
Customizability	11
Reminders	2
Encouragement	3

Functional Size	2
Progression	5
Small Stature/Compact	10
Not Intimidating	3
Friendly Voice	6
Humanoid	7
Cute	3

F. HIERARCHICAL CODE OCCURRENCES FOR BARRIERS TO PHYSICAL ACTIVITY

Table F: Frequency of physical activity barriers codes organized thematically from transcribed interview and workshop data

	Barriers to PA	Frequency
A11Y (accessibility)	INFRASTRUCTURE ACCESSIBILITY	27
	ENVIRONMENTAL ACCESSIBILITY	22
	FINANCIAL ACCESSIBILITY	20
	TECHNICAL ACCESSIBILITY	3
	SOCIAL ACCESSIBILITY	13
MENTAL STATE	EMBARASSMENT	13
	MENTAL ILLNESS	9
	RELATIONSHIP WITH PA	23
	GENERAL ATTITUDE	7
PHYSICAL LIMITATIONS	MEDICAL ISSUES	35
	MOBILITY	16
	PAIN	12
COMMITMENTS	HOME COMMITMENTS	5
	WORK COMMITMENTS	5

Note: see codes for each theme along with frequencies on the next page

INFRASTRUCTURE ACCESSIBILITY	
	Frequency
Physical Accessibility (stairs, heavy doors)	12
Challenging Terrain	2
Transportation Issues	7
Lack of private space	2
Inability to drive	4

ENVIRONMENTAL ACCESSIBILITY	
	Frequency
Fear of COVID	9
Noise	3
Climate Factors	10

SHAME OF SELF	
	Frequency
Inability to keep up with activity group/partner	7
Fear of Public Embarrasment	6

TECHNICAL ACCESSIBILITY	
	Frequency
Trouble using technology	3

GENERAL ATTITUDE	
	Frequency
General Attitude	5
"What can I do with the time I have left"	2

MOBILITY	
	Frequency
Fall Risk	5
Mobility Issues	11

PAIN	
	Frequency
Pain while engaging in PA	10
Longer Recovery Times	2

MENTAL ILLNESS	
	Frequency
Mental Health Issues	7
Attitude towards Death	2

FINANCIAL ACCESSIBILITY	
	Frequency
Expenses	11
Availability of PA Facility	9

SOCIAL ACCESSIBILITY	
	Frequency
Lack of Information	6
Inability to make friends	2
Lack of Social Life	5

COMMITMENTS		Frequency
HOME COMMITMENTS	Family Dynamics	4
	Home Maintenance	1
WORK COMMITMENTS	Work commitments	1
	Irregular Schedule	4

MEDICIAL ISSUES	
	Frequency
Surgeries	1
Car sickness	3
Numb Legs	1
Frequent Urination	2
Arthritis	11
Back Pain	2
Injuries	5
Vision Issues	10

RELATIONSHIP WITH PA	
	Frequency
Unenjoyable Activities	10
Initiation Inertia	2
Loss Of Interest	2
Relationship with Trainer	6
Lack of prior experience	3

G. HIERARCHICAL CODE OCCURRENCES FOR MOTIVATORS OF PHYSICAL ACTIVITY

Table G: Frequency of physical activity motivators codes organized thematically from transcribed interview and workshop data

Motivators for PA	Frequency
COMMUNITY FACTORS	7
MENTAL/ EMOTIONAL HEALTH BENEFITS	56
PROGRESSION	32
MENTAL STATE	14
ACTIVE LIFESTYLE	21
PHYSICAL HEALTH BENEFITS	36
SOCIAL CONTACT	38

Note: see codes for each theme along with frequencies below

COMMUNITY FACTORS	Frequency
Safe Activities	2
Ease of Access	5

PROGRESSION	Frequency
Progression	7
Set Schedule	6
Goal Setting	6
Smart Watch Motivations	3
Frequent Check-ins	3
Tracking of Progress	7

MENTAL/ EMOTIONAL HEALTH BENEFITS	Frequency
Interacting with pets	4
Changing Instructors	4
Independence	6
Feels Good	9
Prevent/Decrease Boredom	2
Enjoyable Physical Activity	15
Enjoyment of Nature	10
Enjoyment of Culture	6

ACTIVE LIFESTYLE	Frequency
Learn new skills	1
To understand various world views	1
Find things to do within your abilities	11
Increase number of hobbies	3

PHYSICAL HEALTH BENEFITS	Frequency
Relief from physical conditions	7
Improved recovery	5
Reverse aging	1
Get exercises and benefits explained	4
To keep active and engaged	2
Better Health	3
To keep up and improve fitness levels	12
To build an appetite	2

MENTAL STATE	Frequency
Encouragement	9
"What can I do with the time I have left"	2
Prevent/Decrease Depression	2
Psychological Counselling	1

SOCIAL CONTACT	Frequency
Expand social network	5
Social Activity/Experience/Contact	24
Connect/Interact with grandkids/family	9
To understand whats happening in the world	4
Use and Develop Brain	1

NOTE: please contact vantony1@jhu.edu for questions

