

**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

Psuedonyms	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		✓		✓		
Patricia	Female (94)	Caucasian	Condo (Couple)	✓		✓		
Albert	Male (71)	Caucasian		✓	✓			
Betty	Female (71)	Asian	Condo (Couple)	✓	✓			
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					✓

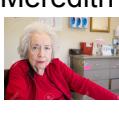
B. SEMI-STRUCTURED INTERVIEWS

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	MEDICIAL 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	Frequency
Inability to keep up with activity group/partner	7
Fear of Public Embarrassment	6
TECHNICAL ACCESSIBILITY	
Frequency	Frequency
Trouble using technology	3
GENERAL ATTITUDE	
Frequency	Frequency
General Attitude	5
"What can I do with the time I have left"	2
MOBILITY	
Frequency	Frequency
Fall Risk	5
Mobility Issues	11
PAIN	
Frequency	Frequency
Pain while engaging in PA	10
Longer Recovery Times	2
MENTAL ILLNESS	
Frequency	Frequency
Mental Health Issues	7
Attitude towards Death	2
FINANCIAL	
ACCESSIBILITY	Frequency
Expenses	11
Availability of PA Facility	9
SOCIAL ACCESSIBILITY	
Frequency	Frequency
Lack of Information	6
Inability to make friends	2
Lack of Social Life	5
COMMITMENTS	
Frequency	Frequency
HOME COMMITMENTS	Family Dynamics
	Home Maintenance
WORK COMMITMENTS	Work commitments
	Irregular Schedule
MEDICINAL ISSUES	
Frequency	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	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	MENTAL/ EMOTIONAL HEALTH BENEFITS	Frequency
Safe Activities	2	Interacting with pets	4
Ease of Access	5	Changing Instructors	4
PROGRESSION	Frequency	Independence	6
Progression	7	Feels Good	9
Set Schedule	6	Prevent/Decrease	2
Goal Setting	6	Boredom	
Smart Watch	3	Enjoyable Physical Activity	15
Motivations		Enjoyment of Nature	10
Frequent Check-ins	3	Enjoyment of Culture	6
Tracking of Progress	7	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		MENTAL STATE	
BENEFITS	Frequency		Frequency
Relief from physical conditions	7	Encouragement	9
Improved recovery	5	"What can I do with the time I have left"	2
Reverse aging	1	Prevent/Decrease Depression	2
Get excercises and benefits explained	4	Physchological Counselling	1
To keep active and engaged	2		
Better Health	3		
To keep up and improve fitness levels	12		
To build an appetite	2		

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

H. OUTPUT OF WORKSHOPS

H.1 mindmaps from PT workshop

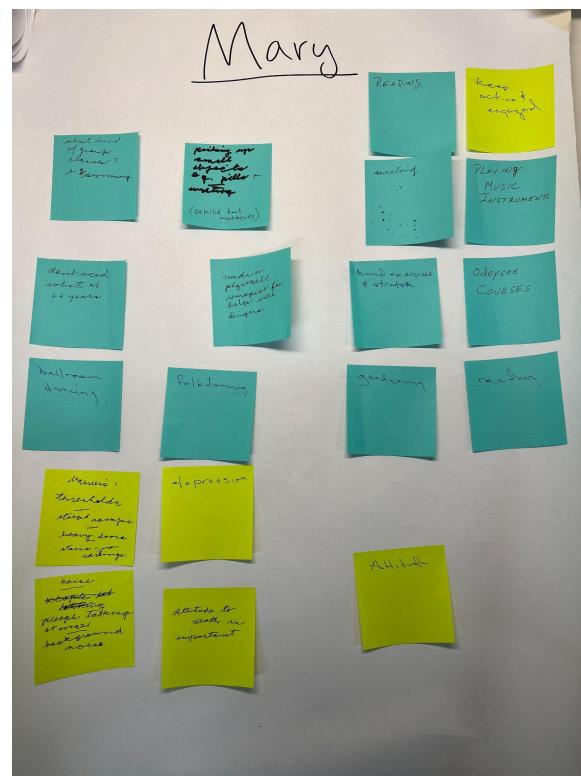
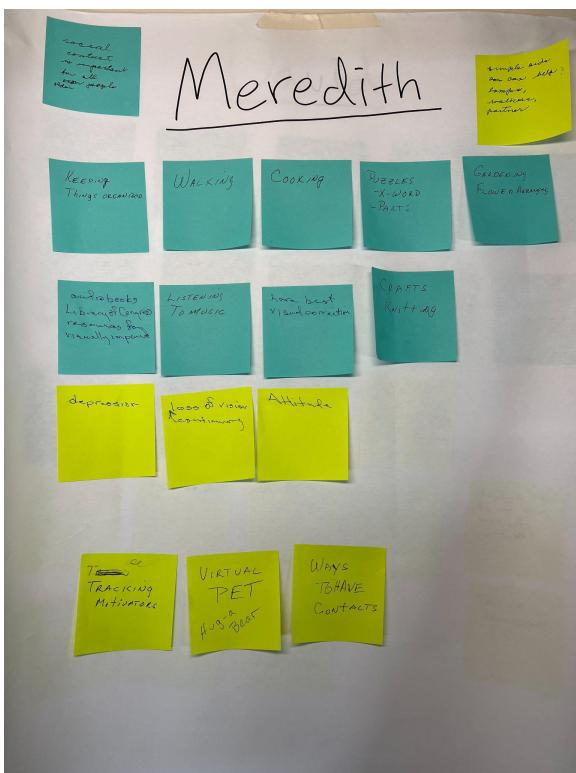


H.2 mindmaps from older adult workshop #1





H.3 mindmaps from older adult workshop #2



H.4 mindmap from older adult workshop #3

