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Exploring Older Adults' Acceptance, Needs, and Design Requirements towards Applying Social Robots in a Rehabilitation Context

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***Abstract*— This paper presents a qualitative study that uses video prototypes and interviews to explore older adults' acceptance, needs, and design requirements towards a social robotic application for physical rehabilitation. Our study identified the benefits of applying social robots (SR) in physical rehabilitation. Further, we discovered participants' preference for an anthropomorphic social robot design. The data revealed a desire for social interaction could increase motivation for older adults to engage in an active lifestyle and social robot acceptance. However, participants showed low motivation for technology adoption and negatively anthropomorphize the social robot, which lowers acceptance for their application. This work complements the current user-centered explorations with SR in rehabilitation, and provides considerations for SR design for rehabilitative applications.**

I. Introduction

Keeping older adults physically healthy, especially those with rehabilitative needs, requires constant and repetitive exercise prescribed by the physiotherapist. Such self-directed training plays a vital part in the recovery and upkeep of one's physical health [13], [14]. However, compliance of older adults to prescribed training is low at 30% [16]. To tackle the issue, social robots (SR) have been proposed to improve users' engagement for self-directed training, with preliminary experiments demonstrating positive impact. A focus group study in 2018 showed positive acceptance of such an application by physiotherapists [19]. Further, strategies of SR showing goodwill and similarity while instructing exercises have been evaluated to have motivational effects on rehabilitation patients [20]. However, in general the impact of the physical rehabilitation context on SR design has not yet been researched extensively, and the rehabilitation patients, as primary end-users, have largely remained unaddressed in SR research.

Research that aims to understand context and users in SR application domains is crucial in identifying and clarifying tasks for the SR, and for providing design recommendations for optimising the SR's task success. Such studies have been conducted for certain SR applications like companion robots [5] and autism spectrum disorder (ASD) care [26], but not yet for the domain of physical rehabilitation training. The study presented in this paper explores the use of SR in rehabilitation to facilitate exercising and to provide motivational prompts. This application fundamentally differs from using SR assisting in communication (ASD care) or SR acting as extensions of animal therapy (elderly care) [23]. These differences necessitate different modalities and interaction schemes for the SR. Hence, in this study we zoom in on the context and users in a rehabilitative setting, aiming to understand users' attitudes and perceptions towards a SR trainer. The contribution of this study is in 1) clarifying SR's potential roles in self-directed rehabilitation for older adults, 2) uncovering opportunities and challenges in deploying social robots for future field and long-term deployments, and 3) informing the design of effective facilitation and motivation strategies, and social robot interactions. The current study used video prototypes to present scenarios of social robots supporting users with their rehabilitative exercises, followed by interviews to inquire participants' opinions on acceptance, needs, and preferences for applying assistive SR in the context of rehabilitation training.

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II. Related Work

A. Understanding Users of SR Applications

A literature review by Zlotowski et al. pointed out that the users' attitude and cognition undergo a complex process in interactions with social robotics [21]. Studies that aim to understand the user and application context in depth are therefore important in the design of SR applications, as they can provide crucial design guidelines and insights for the design of SR that fulfill their tasks successfully. The field of human-robot interaction (HRI) has produced a number of informative studies to understand and build empathy with users of various social robotic applications. In 2010, a study proposed the Almere Model to systematically assess older adults' acceptance of assistive social agents [7]. Later, a longer-term field study (10-30 days) explored older adults' acceptance for the assistive robot companion Nabaztag. The study proposed that area of usage, user experience, context, user traits, and domestication are important aspects to be considered when assessing and understanding older adults' acceptance for a social robot companion [5]. Specifically, a field study in 2017 discovered the importance of psychosocial functioning for social robot (companion and assistive) acceptance. Findings suggest the psychological well-being and life satisfaction are factors to be considered when assessing older adults' acceptance [1]. So far, no social robotic study investigated the user perception and use context of rehabilitation for the same purpose.

B. User research in SR assisted Rehabilitation

Current research on SR application in a rehabilitative context assumes the SR to facilitate and motivate patients in repetitive self-directed training. Previous studies have assessed the feasibility of applying social robotics to assist rehabilitation[4], [9]. Further research also evaluated the robot's role as facilitator and motivator through online surveys, confirming that social robots are accepted and valuable for rehabilitation scenarios [17], [18]. A long-term evaluation published in 2020 tested a gamified SR application for post stroke rehabilitation training with an elder group (N = 4, average age = 64 ± 10 yrs). The SR was found to be enjoyable and engaging [24]. For the SR's motivational strategies, a study in 2018 found that a SR showing goodwill and similarity could motivate patients to engage in their rehabilitation exercises [20]. However, these studies are evaluative rather than explorative. End users' acceptance, preferences and potential issues of the application of SR in rehabilitation remain unclear. A qualitative study of social robotics for rehabilitation in 2018 explored the robot's acceptance, potential use, and strategies for user engagement with therapists. The research proposed design implications based on therapists' input regarding ease of access, improving motivation, and personalization of SR application in rehabilitation [19]. However, we argue that currently our understanding is incomplete without addressing the primary end-users: the rehabilitation patients.

C. Anthropomorphic Design for SR in Rehabilitation

One specific attribute of the application of SR in rehabilitation training is the preference for anthropomorphic design. As ASD interventions typically favor toy shaped SRs and elderly companions usually take inspirations from zoomorphic appearance and interaction [23], current explorations with SR in a rehabilitation context with the anthropomorphic robot Pepper have all found positive user feedback [19], [20], [24]. Previous user studies in 2018 showed a higher preference for an anthropomorphic social robot for assisting rehabilitation from a general demography, but the highly anthropomorphic appearance was rated low on self-efficacy, technology acceptance, and attitude [10], [11]. The reasons for such conflicting outcomes were not thoroughly investigated and may not be applicable for older adults specifically. A clearer understanding of user preferences is needed, as the design of the social robots concerns users' acceptance and their adherence to the assistance. Understanding users can inform the design of effective social robotic applications in a rehabilitation setting. This work takes a user-centered approach to explore end-users' attitude regarding acceptance and usage, to clarify design requirements, and to uncover potential issues and opportunities for the application of SR in rehabilitation exercises.

III. Research Questions

The current research intends to explore users' attitudes towards the application of social robots in the context of older adults' rehabilitation, to provide insights for the development and implementation of motivational strategies exercised by social robot. This research aims to:

1) Understand the context of older adults' self-directed rehabilitation training, and the tasks that a social robot is expected to offer. Specifically, it aims to answer the following questions:
   - How do older adults experience their current exercises?
   - What value could SR offer in this context, e.g., facilitation, motivation, etc.
2) Understand user acceptance for SR assisting in rehabilitation exercises.
3) Explore design requirements for SR rehabilitative application, particularly clarifying user attitudes towards anthropomorphic design.

IV. Methods and Materials

A. Participants and Procedure

We presented two video prototypes, followed by interviews with 11 older adults (average age = 81, SD = 8.46, 8 female) recruited from an elderly activity center in Eindhoven, the Netherlands. The study concluded when the interview started to acquire large percentage of repetitive data, thus determined the sample size. Participants were recruited by the management team at the activity center. During the recruiting procedure, participants were given a brief introduction about the study purpose and setup and asked for their consent. Within the sample chosen, Two of the participants were prescribed to rehabilitation exercises at the time, and the rest (N = 9) all had gone through rehabilitation treatments in the past.

First, participants were presented with the video prototypes that demonstrated how SRs could be used as a trainer for their daily exercise. Then, participants joined semi-structured interview in pairs, except for one participant who was interviewed individually. Additional slides were shown during the interview to support the discussion. The study was conducted with pairs of participants, as paired interviews can generate more data from each individual as the interaction between participants could encourage them to elaborate their opinions [8]. The pairs were suggested by participants themselves, who picked their close acquaintances from the members of the activity center.

To cover our research questions, discussions were moderated to address the following topics:

1) Participants' status about rehabilitation exercises. Specifically, their activity level, physical activities they engage in, their reflections on the current situation and their motivations for maintaining or improving their condition.
2) Thoughts and concerns about the video prototypes shown. Including general opinions about social robots, and their acceptance of the product and service.
3) How the social robots could be related to the participants' current lifestyle, the value robots could bring

in rehabilitation exercise, and what further services are needed.
4) Preferences for the robot regarding the form, interaction, and personalities.

The interview was conducted by the first author (R1), and for language support, a Dutch-speaking assistant (R2) with master's degree in industrial design was recruited. A thematic analysis was conducted through a combined inductive and deductive approach on the transcript [2]. An original set of codes was generated from the research questions and interview topics. The transcript was translated by R2 to English and analyzed by R1, and finally reviewed by R1 and R2 to prevent misinterpretation.

B. Materials

To 1) present application design possibilities of SR in assisting self-directed training, 2) explore design possibilities and preferences with participants, and 3) clarify older adults' attitudes towards anthropomorphic SR design, two video prototypes were prepared for the study. The videos showed scenarios with different users performing exercises with social robots with different designs. To help participants understand the breadth of the design space for SR in rehabilitation, we chose to implement the prototypes with as widely as possible varying designs. Feng's survey study on social robot design [3] proposed that a social robot design can consider aspects of form, interaction, and personality. Therefore, we chose and designed the SRs with different anthropomorphic levels on the above aspects (See Table 1). Both videos started with a SR greeting a user and introducing the current exercise plan, followed by an excerpt from an exercising session with the social robot facilitating the exercise and motivating the user, and lastly a scene where the robot summarizes the session and schedules a later session (See Fig 1).

During the interview, as we went through the participants' preferences for the robot's form, ways of interactions, and personalities, we presented additional design choices with slides. Specifically, for the robot's form, we showed a caricatured zoomorphic design (iCat by Philips), a toy-like SR (Tobbie the robot by Valleman), an anthropomorphic body with abstract face (NAO by SoftBank), a highly anthropomorphic design (Sophia by Hanson Robotics) and an abstract design (Jibo by Jibo Inc). For ways of interaction, we provided cases of human-like interactions through language and gestures, sensory interactions through touch (with variations of anthropomorphic and zoomorphic robots), and assisted interaction through a touch screen. For the discussion on personalities, we showed a collection of personality descriptions based on the Hartman Personality Profile, also known as The Color Code or The People Code. The profile is developed based on the notion that all people possess one of four driving "core motives" identified by color: Red (power), Blue (intimacy), White (peace), and Yellow (fun) [25]. The slides were used to show participants additional design possibilities beyond those portrayed in the videos, and to help participants to better describe their design preferences.

TABLE I
DESIGN DIFFERENTIATION WITHIN SOCIAL ROBOTS

Robot Platform	Pepper (By SoftBank)	SociBot Mini (By Engineered Arts)
Form	A human-like body with abstract face.	An upper torso with projected detailed human face.
Interaction	Self-equipped text-to-voice generator providing robotic voices. User interacts and input data through screen.	Natural interface with human-like vision (eye contact, counting for exercises and real time suggestions), voice (from a voice actor).
Personality	Technical and non-human-like personality.	A human-like personality with small talks, jokes, social motivational prompts, and proper timed praise.

V. FINDINGS

Our analysis revealed three themes: motivations for older adults to exercise, acceptance of a social robot, and older adults' preferences for a robot trainer.

A. Motivations for Older Adults to Exercise

All participants indicated that they feel the need to have an active lifestyle. They believe it is necessary to stay in shape and to prevent potential health issues. Apart from group exercise sessions offered at the activity center, most of their physical activities were done individually. Three of the participants, who all fell into a younger age group (in their 70's) compared to the rest of the participants, reported to have kept up very active lifestyles. They engaged in sports such as cycling, hiking, jogging, and regular gym sessions. Five participants had regular workout sessions with light exercise, such as recreational walking, stretching or small and repetitive sets of movements that focus on certain muscle groups (usually by/on the bed or couch). Less active participants consider housework as exercise or do not exercise regularly.

Participants reported several self-motivating strategies they used in the past: 1) setting a clear schedule, time, and plan, 2) setting triggers (seeing the sport equipment, having notes around the house, and turning on exercise programs on TV), 3) building a routine. However, participants also expressed that they tend to ignore familiar triggers, so the strategies did not work long-term, and that a certain level of self-discipline is needed: "*It gets easier to keep ignoring the TV program after you ignore it once.*" (P6).

Social factors have been suggested to be highly effective in providing motivation. All participants claimed that they enjoy the group exercises and, if without, they would also like or have regular sports partners. Sometimes members come to the activity center to socialize but not specifically for sports. However, by coming to the activity center "*the threshold for exercises is lowered*" (P9) and they would join the group workout eventually. Apart from group support of their peers, participants also suggested that when they are at home, encouragements and triggers from their therapists and

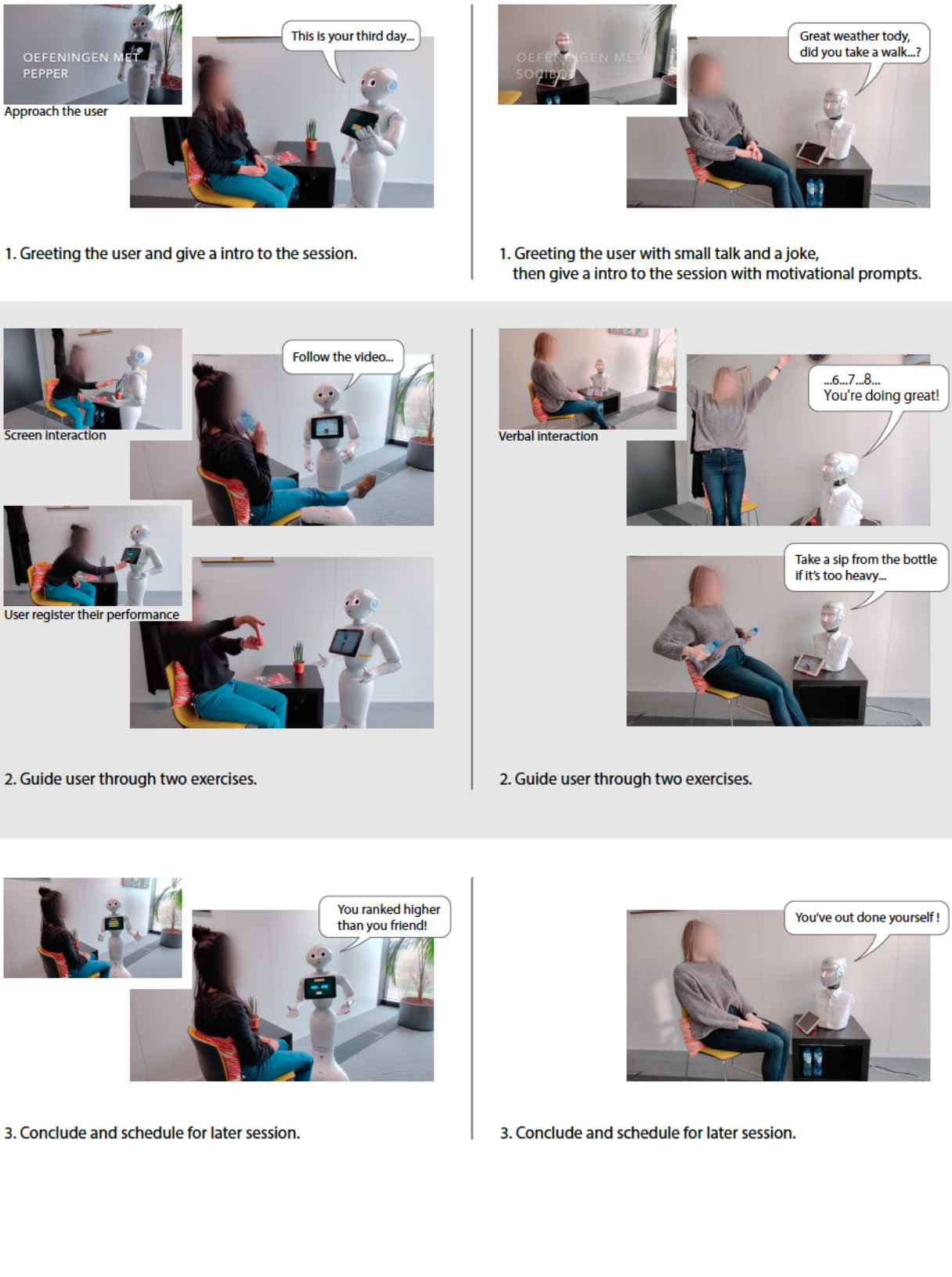

Fig. 1. Storyboard of the video prototypes varying in robot design of appearances, interaction, and personalities.

Fig. 2. A group training session in the study location. (Image source: https://www.ontmoet-en-groet.nl/ouderen/)

family members have shown to be effectively motivating, but only to a certain extent, "*My children do it (notify) for me. I am trying not to forget, but yeah...*" (P2). Participants were asked to propose the ideal scenario for the use of a robot in the context of rehabilitation exercises, and all suggested that the best way is to exercise with the social robot in a group setting, similar to their current arrangement in the activity center that offers group training sessions using sporting equipment (see Fig 2).

B. Attitudes Towards a Social Robot for Rehabilitation

1) Technology Acceptance: Generally, participants showed low acceptance towards SR, relating to their perceptions and motivation towards new technology, and with some expressing concerns for self image.

a) Expectations & belief in technology: Participants think that robots are not capable enough to perform some of the tasks in being a trainer. In their assessments, they compared the social robot to a physical therapist, even when they were not suggested to do so. They doubted the robot would understand their real-time feedback and be able to pick up important social and subtle cues, or feared that the robot would possibly misunderstand or misinterpret the situation and therefore complicate the process. Also, participants think feedback or suggestions should be given from a source with emotions and empathy, since it takes these qualities to understand what they are going through, and a robot is not able to equip these qualities. Three participants showed willingness to accept a social robot, however, they would only consider using it when their therapists are not available, or when they are alone.

b) Willingness to adopt technology: Generally (9 out of 11), participants showed reluctance in accepting new technology. Most participants expressed negative attitudes towards smart phones. Six participants owned smart phones, but have not adopted smart phones after using them for a while. Participants also expressed frustrations towards the current technology-advanced society in general: "*Everything is automated... everything is...*" (P8).

c) Self-esteem: Two of the participants feared that being a user of the social robot might portray them as being "weak and unwanted". They considered it a sign of weakness having to use assistive technology, and the fact that a robot is novel and attracts attention, could amplify such a message. "*People will think that I cannot handle myself, so I have to have one of these (robots).*" (P1). Additionally, the robot was viewed as a replacement for a therapist, therefore having to use a social robot instead of human assistance could make the participants feel like they might be not worthy of the therapist's attention. "*It's like they (therapist) just don't have time for you anymore.*" (P5).

2) Value of SR in rehabilitative context: Despite a generally negative attitude towards technology, participants acknowledged that a social robot could bring value into exercise routines. Especially when the SR was imagined to help someone else who would be more willing to accept new technology, participants started to confirm and suggest the value a SR can bring. Six participants showed positive acceptance for the functional aspects and actual services the SR can bring. "*But maybe you can see it as a tool. When you are alone, you will not start exercising. It could be used as a stimulus.*" (P1). Below we provide a list of potential services participants expected from a social robot:

1) **Triggering**. The social robot could serve as a trigger for initiating the training. The presence of the robot is believed to add motivation to initiate the exercises, participants also suggested that the robot can approach them with motivational prompts.
2) **Facilitation**. Participants would like to be provided with information regarding the task, their progress, and real-time monitoring and suggestions.
3) **Motivation**. The social robot could provide motivational prompts, such as timing-appropriate compliments, but participants explicitly mentioned the robot's compliments should not be "*over the top*" (P5).
4) **Connection**. Participants suggested that the social robot could help them to stay connected with their therapist, possibly providing the therapist with their detailed exercise record and receiving their therapists' feedback.
5) **Personalisation**. During rehabilitation, older adults would have their prescribed training plan, and in their daily exercises, they also have certain goals for their exercises. Participants required the social robot to provide training programs and difficulty levels that match their capabilities and goals.
6) **Entertainment**. Participants expected that the robot can be a source of entertainment. Specifically, one participant suggested that the mere novelty of the robot can be a source of entertainment. They expected their interactions with the robot to be playful and joyful. "*Someone brought this red balloon to my mother's care home, and they just played with that for almost an hour, a robot should keep them busy for longer*" (P3).

As participants identified the benefits of social robots for

their rehabilitation, they also showed concerns. Apart from their low willingness for adopting technology, participants considered rehabilitation and sports to be sources of social interaction. On top of which, as the study was conducted during the COVID-19 pandemic, participants suggested that their need for social contact is stronger during the lockdown periods. Participants worried that a social robot would reduce their amount of social interaction by replacing their contact with their therapists, friends, etc.

3) Anthropomorphizing: All participants showed signs of anthropomorphizing the social robots. For example, they showed interest in the robot's gender ("*Is it a boy or a girl?*" (P2)) and laughed when the robot told a joke. However, the interviews also captured negative opinions in relation to anthropomorphizing the social robot. In particular, the nine participants who showed low willingness to adopt new technologies also projected negative feelings onto the robots. They felt judged and commanded by something that is "*less than a human*" (P1). The anthropomorphic appearance and interaction of the social robot also led to a comparison of capabilities between robots and humans. Participants evaluated the robots negatively when they were showing emotions, empathy or were talking about food, as these are considered human traits. Participants felt the robots were "*pretending to be human and seem creepy*" (P1). Participants insisted that the robots cannot replace humans, even when the social robots were not introduced by the researchers as a replacement for human interaction.

4) Trust: Though participants doubted whether the robot would understand their performance enough to give live suggestions, they still showed trust towards robots, specifically when receiving and sharing information with the robot. The trust for the social robot is associated with the supposed operating party: "*It's not that the robot understands the information, I trust the people behind it*"(P4). Participants considered the robot to be a delivery device for information between them and the operator behind the robotic service, therefore participants suggested that if the robot's information system was supported by a credible source, they could trust the information given by the social robot. In the case of the robot acting as a connection between participants and therapists, no concern was expressed.

C. User Preferences for Rehabilitative Social Robot

Participants showed general preferences for the SR assisting their rehabilitation exercises. Figure 3 shows keywords that participants mentioned as preferences, larger fonts show words mentioned with higher frequencies.

1) Appearance: For appearance, participants expressed their interest in 1) more anthropomorphic forms, and 2) familiarity. Aesthetically, a social robot should portray "*a nice and welcoming feeling*"(P9), which participants believed that a human-like appearance represents. Anthropomorphic form also suggested more advanced capabilities to participants, as they believed a robot with human-like body "*has more action*" and "*can do more stuff*"(P2). Participants preferred the robot to be able to physically demonstrate the exercises and to perform the workout with them. On the other hand, four of the participants suggested that they have seen robots before and preferred the one they were shown already (in their case, it was the NAO robot by SoftBank). "*Yes, we are more used to looking at number 4 (NAO by SoftBank).*" (P2). The size of the robot was also suggested to be a factor in their preferences. Most participants preferred a smaller sized robot for domestic use due to the size of their living space.

2) Modes of Interaction: In ways of interaction, participants preferred to interact through a natural language interface (voice and gesture recognition, and interaction) rather than through buttons or touch screens. Participants expressed that they prefer a human-like, verbal interaction experience with the social robot. "*TomTom (car navigation) also has a voice but it's horrible, it has no tones, and you can't understand what it says half of the time.*" (P7). However, a screen was still highly favored as a complementary device for clarity while interacting with the robot.

3) Personality: Participants tended to prefer a personality that resembles their perception of a therapist or peer. A social robot for rehabilitation exercises should be friendly, professional, and mature. They preferred straightforward conversations and guidance for the training. The social robot should give appropriate suggestions, so the participants wouldn't feel pushed. Compliments should be given at a deserving moment in moderate amounts, so the robot does not seem overbearing. "*That woman in the video was doing the bare minimum and the robot just drowned her with compliments, I don't want that.*" (P1). Participants also looked forward to a pleasant social interaction with the social robot. Their ideal social robot for assisting exercises is described as optimistic and energetic, with a sense of humor. However, being professional and effective in facilitating the exercises should be the priority in their opinion. Three participants also suggested a dynamic personality experience in accordance with their mood and the stage of rehabilitation. "*It's like a switch to change the mode, one minute you're making jokes, but next we will start to work out and let's be serious.*" (P7). Participants did not show a strong preference for the robot portraying a certain gender.

As discussed above, participants generally tended to look for humanness in the appearance, interaction, and personality of a social robot. However, anthropomorphic robots also elicited negative reactions: "*A robot should just be a robot. I don't want to talk to a robot about what I'll have for dinner, that's crazy.*" (P2), "*It's really creepy when a robot is pretending that it cares about my pain, because I know well that it does not even understand pain.*" (P5). Participants suggested that a robot should acknowledge its self-identity and capability as a robot instead of trying to impose as human.

VI. Discussion

A. Social Motivation

Participants were very motivated by social interaction. Based on the findings, mixing social interaction with activities is a very effective approach for getting older adults to be

Fig. 3. Word cloud of participants' preferences for social robots (Font size indicates the frequencies of the keywords mentioned)

active. During our study, participants suggested social robots to facilitate social interaction with their peers or therapists. Hence, group exercising and tele-communication could be effective social robot use cases for motivating older adults to exercise regularly.

Further, participants' low acceptance towards social robots as a technology could partly be explained by 1) a generally low technology acceptance amongst the participants, and 2) negative perceptions towards users of assistive technology. We suggest that older adults' desire for social interaction may add motivation for adopting the SR application and that the group use scenarios could be used to create a positive social norm and alter older adults' self-image as an assistive technology user.

B. Fun as Engagement Strategy

Participants suggested the mere presence of the social robot is already interesting and has the potential to spark engagement. We also observed positive reactions towards the robot giving a funny comment, with participants smiling, laughing, and repeating the robot's line to their fellow participant. Previous research reported similar responses from participants interacting with an assistant social robot for older adults, children and customers [12], [15], [5], [6]. We hypothesize that the element of fun in HRI has the effect of increasing likability, promoting engagement and acceptance. Future studies should measure and explore the effect of fun and develop design guidelines for more engaging SR user experiences.

Nevertheless, in the context of rehabilitation exercises participants suggested that a social robot should treat the training seriously and professionally. To achieve a balance between professionalism and playfulness, we suggest the design could draw inspiration from real-life patient-therapist interactions, so the robot could combine the two characters (fun and professional) in a more appropriate and sensible manner.

C. Acceptable Anthropomorphic Design

In previous studies, rehabilitation patients showed positive acceptance for anthropomorphic SR [17], [18], [20], [24]. However, the current study uncovered a mixed perception towards anthropomorphic SR design. We wish to discuss the participants' attitudes to provide clearer design indications.

On the positive side, in the context of older adults' rehabilitation, an anthropomorphic robot design and interaction suggests warmness and human touch. Also, the human-like design suggests advanced capabilities and ease of interactions. In the current study, we observed general sociability of the robot triggering positive responses. For example, participants reacted positively to the robots' jokes and social motivational prompts. Participants preferred an anthropomorphic robot that is easy to operate, acknowledges itself as an assistive robot and not *"pretending to be a human"* (P4).

On the other hand, we also uncovered the negative perceptions triggered by anthropomorphic design. It was clear that older adults did not appreciate social robots portraying themselves as human, and did not intend to interact with the robots as if they were human. The current study also suggests that participants with low technology acceptance show stronger negative attitudes towards social robots.To further explain the participants' negative attitude towards human-like behaviour of SR, previous research has shown that negative perceptions of anthropomorphic robots relate to feeling a threat for human-distinctiveness, and possibly, experiencing the uncanny valley effect [21]. Other possible causes also include unfamiliarity with the robot's social features, low self-efficacy [17], [18], and interacting with a robot socially conflicting with one's social and self-norms [22]. The current study observed participants' concerns for human-distinctiveness and social/self-norm. Social robots discussing what are believed to be human-specific topics, such as food or showing related understanding of human-specific issues (e.g. pain or emotions), elicited negative reactions. Further, the current study observed a low technology acceptance from older adults. which hints on participants' high expectations and self-efficacy towards the SR.

VII. Limitations

The above work is conducted during the COVID-19 pandemic, therefore, due to local regulations and to be responsible towards the safety and well-being of all participants, the number of participants recruited was limited. The current study was not able to recruit an adequate number of participants from different genders, to be able to evaluate the potential effect of gender differences on the issues discussed above. Due to the futuristic nature of the intended robotic application, we chose to use video prototypes over actual robots. Future research should evaluate the actual use of social robots in realistic and long-term settings.

VIII. Conclusion

This work presents a user-centered exploration on older adults' acceptance, needs, and design requirements for applying social robotics in rehabilitation exercises. Using semi-structured interviews and video prototypes of SR application in the context of rehabilitation exercises, we confirmed and

further identified the value of social robots in this context, and we discovered current issues with such application: 1) low technology acceptance from older adults, 2) concerns of negative self-image, and 3) negative perceptions of anthropomorphic robot design. Our participants still showed interest for anthropomorphic design, and proposed guidelines for the design to be more acceptable. While clarifying the above aspects, our study also provided detailed explanations for such attitudes, and insights towards the challenges in applying social robotics in the context of older adults' rehabilitation exercises.

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